



PRODUCT CATALOGUE

- » Engine & Gen-set Controls
- » Marine Bridge Instrumentation
- » Switchboard Instrumentation
- » Renewable Energy Controls

10/2-2011

Table of content

Engine & Gen-set Controls				6
Engine starters, mains failure units				7
Table of Products		4921240159	B	7
Key Starter	KSE72-1N	4921240029	C	8
Stop Relay	SR-1	4921240041	C	12
Multi-line 2, Engines and Gen-set Controls				14
Table of Products		4921240209	T	14
Advanced Gen-set Controller	AGC 232	4921240362	F	24
Advanced Gen-set Controller	AGC 223	4921240362	F	see page 24
Advanced Gen-set Controller	AGC 212	4921240362	F	see page 24
Advanced Gen-set Controller	AGC 242	4921240362	F	see page 24
Advanced Gen-set Controller	AGC 243	4921240362	F	see page 24
Advanced Gen-set Controller	AGC 244	4921240362	F	see page 24
Advanced Gen-set Controller	AGC 245	4921240362	F	see page 24
Advanced Gen-set Controller	AGC 246	4921240362	F	see page 24
Advanced Gen-set Controller	AGC 213	4921240362	F	see page 24
Multi Differential Relay	MDR-2	4921240275	G	37
Generator Protection Unit	GPU-2	4921240312	E	40
Generator Paralleling and Protection Unit	PPU-2	4921240313	E	50
Generator Protection Unit	GPU-3	4921240352	B	60
Paralleling and Protection Unit	PPU-3	4921240354	B	71
PPU Power Management	PPM-2	4921240291	H	82
Protection and Power Management	PPM-3	4921240337	D	93
Engine Controller, marine version	EC-1M	4921240308	D	117
Generator Controller, marine version	GC-1M	4921240309	D	124
Generator Controller	GC-1F	4921240310	H	133
Automatic Gen-set Controller	AGC-3	4921240295	M	145
Advanced Gen-set Controller	AGC 200	4921240362	F	see page 24
Generator Paralleling Controller	GPC-3	4921240351	B	161
Basic Gen-set Controller	BGC-2	4921240273	H	172
Generator Paralleling Controller	GPC-2	4921240311	F	182
Automatic Gen-set Controller	AGC-2	4921240257	I	192
Engine Controller	EC-1	4921240292	E	203
Generator Controller	GC-1	4921240293	F	209
Advanced Graphical Interface	AGI 107	4921240387	A	217
Synchronising equipment Electr. Pot. Meters				224
Table of Products		4921240160	M	224
Electronic Potentiometer	EPQ96-2	4921240364	B	227
Read synchroscope	RSQ-3	4921240265	E	233
Check synchronising relay	CSQ-3	4921240263	G	235
Phase Sequence Meter	PHQ	4921240014	D	237
Phase Sequence Relay	RMT-111Q96	4921240131	F	239
Lamp Synchroscope	LSQ	4921240073	D	241
Double Frequency Meter	2FQ	4921240005	K	243
Double Frequency Meter	2FTQ	4921240005	K	see page 243
Zero Voltage Meter	NEQ	4921210049	D	246
Double voltmeter	2EVQ	4921240005	K	see page 243
Double voltmeter	2EQ	4921240005	K	see page 243



-power in control

Uni-line relays, synchronisers, load sharing units			248
Table of Products		4921240130 N	248
Voltage Relay	RMV-112D	4921240096 G	254
Voltage Relay	RMV-122D	4921240096 G	see page 254
Voltage Relay	RMV-132D	4921240096 G	see page 254
Voltage Relay	RMV-142D	4921240128 F	256
Short circuit relay	RMC-111D	4921240102 E	258
Short circuit relay	RMC-121D	4921240260 B	260
Current Relay	RMC-122D	4921240102 E	see page 258
Differential Current Relay	RMC-131D	4921240104 H	262
Current Relay	RMC-132D	4921240102 E	see page 258
Stator Earth Fault Relay	RMC-142D	4921240148 E	264
Overload (Power) Relay	RMP-111D	4921240108 F	266
Overload/Reverse Power Relay	RMP-112D	4921240110 F	268
Reverse Power Relay	RMP-121D	4921240106 H	270
Excitation Relay	RMQ-111D	4921240112 F	272
Excitation Relay	RMQ-121D	4921240112 F	see page 272
Frequency Relay	RMF-112D	4921240223 C	274
Loss Of Mains relay	LMR-111D	4921240214 D	276
Loss Of Mains relay	LMR-122D	4921240220 C	278
Protection Relay Package	G59	4921240217 D	280
Synchroniser	FAS-113DG	4921240114 G	283
Synchroniser	FAS-115DG	4921240116 G	287
Paralleling Relay (Synchroniser)	HAS-111DG	4921240144 G	291
Electronic Potentiometer	EPN-110DN	4921240126 G	295
Load Sharing Unit	LSU-112DG	4921240118 F	297
Load Sharing Unit	LSU-113DG	4921240120 H	301
Load Sharing Unit	LSU-114DG	4921240122 F	305
var Load Sharing Unit	LSU-122DG	4921240124 F	309

Marine Bridge Instrumentation **313**

Illuminated indicators, Anemometers			314
Table of Products		4921240143 U	314
Illuminated indicators	XL	4921250057 N	317
Illuminated indicators	BRW-2	4921250057 N	see page 317
Illuminated indicators	BW	4921250057 N	see page 317
Rudder Angle Indicator, Panoramic	TRI-2	4921250043 F	330
Rudder Angle Transmitter	RT-2	4921250052 C	332
Anemometer	WSS	4921250059 D	334
Anemometer	WSS-L	4921250059 D	see page 334
Wind display	WSDI-2	4921250062 C	339
Indicator	WSDI	4921250063 A	348
Interface box	WSI	4921250063 A	see page 348

Other Products **355**

Audio-Visual equipment			356
Table of Products		4921240162 D	356
Sirens	212, 208	4921200002 E	358
Bells	117, 118R, 124	4921200005 D	360
Diaphragm Horns	172, 173	4921200008 D	362



-power in control

Renewable Energy Controls 364

Renewable Energy Controls			365
Table of Products		4921240338 B	365
Renewable Energy Control System	DM-4 REC-1 Wind	4921240315 C	368
Generator Protection Unit	GPU-2	4921240312 E	see page 40
Thyristor Control Module	TCM-2	4921240329 A	378
Generator Protection Unit, GPU Hydro	GPU Hydro	4921240335 A	384
Generator Protection Unit, GPU Hydro	GPU-3 Hydro	4921240353 B	391
Generator Paralleling Controller	GPC-2	4921240311 F	see page 182

Switchboard Instrumentation 402

Battery chargers			403
Table of Products		4921240286 C	403
Battery charger	DCP2	4921210105 H	405
Current transformers			409
Table of Products		4921240331 A	409
Measuring current transformers	ASR/ASK/EASR/EASK	4921210111 E	410
Split core current transformers	KBU	4921210112 B	504
Summation current transformers	KSU/SUSK	4921210113 B	511
Primary winding current transformers	WSK	4921210115 B	524
Protection current transformers	SASR/SASK	4921210114 B	534
Energy Meters			561
Table of Products		4921240252 A	561
Energy Meter, Panel Mount	WQ2R96	4921210083 D	562
Energy Meter, Panel Mount	WQR96-x	4921210083 D	see page 562
Energy Meter, Panel Mount	WQR96-c	4921210083 D	see page 562
Energy Meter, Panel Mount	WQR96	4921210083 D	see page 562
Energy Meter, DIN Rail Mount	TAE-2	4921220030 D	566
DC Integrator, Pulse Transmitter	DCF-Q96	4921220014 D	570
Panel meters, Accessories			572
Table of Products		4921240140 ZJ	572
Panel Meter, Moving Coil, DC Current/Voltage	DQ	4921210012 O	578
Panel Meter, Moving Coil, AC Current/Voltage	VDQ	4921210012 O	see page 578
Panel Meter, Moving Iron, AC Current And Voltages	EQ	4921210012 O	see page 578
Panel Meter, Moving Coil, Edgewise, DC Current/Voltage	DPR	4921210012 O	see page 578
Panel Meter, Moving Coil, Edgewise, DC Current/Voltages	DSM	4921210012 O	see page 578
Panel Meter, AC Current, Built In Switch	VDQ96-sw	4921210077 I	586
Panel Meter, AC Voltage, Built In Switch	EQ96-sw7	4921210077 I	see page 586
Panel Meter, AC Voltage, Built In Switch	EQ96-sw4	4921210077 I	see page 586
Panel Meter, Bimetallic, Currents	BQ	4921210015 D	588
Panel Meter, Combined Bimetallic And Moving Iron, Ammeter	BEQ	4921210018 D	590
Panel Meter, Watt or var	WQ	4921210005 H	592
Panel Meter, Power factor	PFQ	4921210002 F	596
Panel Meter, Temperature pt100	PTQ	4921210021 F	598
Panel meter, Frequency, Pointer	FQ	4921210047 K	600
Panel Meter, Frequency, Reed	FTQ	4921210047 K	see page 600
Shunt Resistors	Shunts	4921210042 G	602
Multi-instrument	MIB	4921210109 D	604
Multi-instrument	MIC	4921210107 E	609
Multi-instrument	MIC-2	4921210130 B	614
Multi-instrument	MIQ96-2	4921210108 D	620
Insulation monitor	ADL-111Q96	4921230021 A	622
Selectable insulation monitor	SIM-Q	4921230020 E	627
Insulation Monitors	AAL-111Q96	4921230011 J	632
Remote Position Indicator	PIR25-1	4921210033 E	636
Remote Position Indicator	PIR25-2	4921210033 E	see page 636
Running Hours Counters	HC48	4921210090 D	638
Running Hours Counters	HC36/24	4921210080 B	640
Panel Meter, Moving Coil, DIN Rail Mounting	D45	4921210027 G	642
Panel Meter, Moving Iron, DIN Rail Mounting	E45	4921210027 G	see page 642
Panel Meter, Bimetallic Instrument, max. reading pointer, DIN Rail	B45	4921210027 G	see page 642
Alarm Panels	AL8-2	4921230002 D	644



-power in control

Transducers				652
Table of Products		4921240158	R	652
Transducer, Current	TAC-311DG	4921220034	G	655
Transducer, Current	TAC-321DG	4921220034	G	see page 655
Transducer, Voltage	TAV-311DG	4921220032	G	659
Transducer, Voltage	TAV-321DG	4921220032	G	see page 659
Transducer, Selectable, Watt, var	TAS-331DG	4921220036	G	663
Transducer, Selectable, Voltage, Current, Frequency, Phase Angle	TAS-311DG	4921220038	G	667
Selectable AC-transducer, bi-directional current measurements,	TAS-321DG	4921220040	F	671
Transducer, Temperature	TEMAX-3	4921220022	C	675
Transducer, DC/DC Insulation Amplifier	TDG-210DG/2	4921220011	F	679
Multi-transducer	MTR-2	4921220046	F	683
Panel Meter, Moving Coil, DC Current/Voltage	DQ	4921210012	O	see page 578
Panel Meter, Moving Coil, AC Current/Voltage	VDQ	4921210012	O	see page 578
Panel Meter, Moving Iron, AC Current And Voltages	EQ	4921210012	O	see page 578
Panel Meter, Moving Coil, Edgewise, DC Current/Voltage	DPR	4921210012	O	see page 578
Panel Meter, Moving Coil, Edgewise, DC Current/Voltages	DSM	4921210012	O	see page 578
Panel Meter, AC Current, Built In Switch	VDQ96-sw	4921210077	I	see page 586
Panel Meter, AC Voltage, Built In Switch	EQ96-sw7	4921210077	I	see page 586
Panel Meter, AC Voltage, Built In Switch	EQ96-sw4	4921210077	I	see page 586
Panel Meter, Bimetallic, Currents	BQ	4921210015	D	see page 588
Panel Meter, Combined Bimetallic And Moving Iron, Ammeter	BEQ	4921210018	D	see page 590
Panel Meter, Watt or var	WQ	4921210005	H	see page 592
Panel Meter, Power factor	PFQ	4921210002	F	see page 596
Panel Meter, Temperature pt100	PTQ	4921210021	F	see page 598
Panel meter, Frequency, Pointer	FQ	4921210047	K	see page 600
Panel Meter, Frequency, Reed	FTQ	4921210047	K	see page 600
Shunt Resistors	Shunts	4921210042	G	see page 602
Multi-instrument	MIB	4921210109	D	see page 604
Multi-instrument	MIC	4921210107	E	see page 609
Multi-instrument	MIC-2	4921210130	B	see page 614
Multi-instrument	MIQ96-2	4921210108	D	see page 620
Insulation monitor	ADL-111Q96	4921230021	A	see page 622
Selectable insulation monitor	SIM-Q	4921230020	E	see page 627
Remote Position Indicator	PIR25-1	4921210033	E	see page 636
Remote Position Indicator	PIR25-2	4921210033	E	see page 636
Running Hours Counters	HC48	4921210090	D	see page 638
Running Hours Counters	HC36/24	4921210080	B	see page 640
Panel Meter, Moving Coil, DIN Rail Mounting	D45	4921210027	G	see page 642
Panel Meter, Moving Iron, DIN Rail Mounting	E45	4921210027	G	see page 642
Panel Meter, Bimetallic Instrument, max. reading pointer, DIN Rail	B45	4921210027	G	see page 642
Alarm Panels	AL8-2	4921230002	D	see page 644

Engine & Gen-set Controls

Key Starters, KSE72-1N



Stop Relays, SR-1



Main functions:

Manual start/stop and automatic supervision / emergency shutdown of smaller engines. Suitable for both 12V and 24V starting batteries.

For diesel engines with ""stop coil"" a separate stop relay type SR-1 is applied.

The *Key switch* can be set in 3 positions: "START", "RUN", "STOP"

4 inputs:
Oil pressure, temperature and A & B (customisable alarm inputs)

Protection:
IP41

Aux. voltage: 12 and 24V DC

Stop relay designed for internal combustion engines fitted with a stop solenoid. The relay is for use with the key starter KSE72-1N and is designed for 35 mm DIN rail mounting.

Activation time: appr. 20 s

Output: relay output (change-over switch) for connection of stop solenoid)

Aux. voltage: 9...30V DC

Protection: IP53

Key starter

Type KSE72-1N

4921240029C



- *2 standard alarm inputs*
- *2 customer selectable alarm inputs*
- *Charge circuit indicator*
- *Inhibit of alarms during start sequence*
- *Automatic emergency shutdown of engine*

Application

KSE72-1N is a compact, generally applicable unit for manual start/stop and automatic supervision/emergency shutdown of smaller diesel or petrol engines. For diesel engines with "stop coil" a separate stop relay type SR-1 (see specific data sheet) is applied. The KSE72-1N is CE classified for residential, commercial and light industry plus industrial environment.

The KSE72-1N is without adjustment suitable for both 12V and 24V starting batteries.

A maximum of 4 alarm devices can be connected to the key starter. In case of failure, the LED indicator for the relevant alarm input is lit, the engine is stopped and a signal is transmitted to an external alarm device.

The alarms remain inhibited for 10 s. after start of the engine, to allow e.g. normal oil pressure to be established during this period of time. A pre-exciting current is fed to the charging generator and an LED is lit in case of insufficient charging voltage.

Mechanical construction

KSE72-1N is housed in a robust plastic housing for flush mounting. The key switch is mounted in a solid aluminium plate. The front plate and the 5 red LEDs are covered by a hard-wearing polycarbonate film provided with text on the inside. The rear consists of an epoxy plate with spade plugs (6.3 x 0.8 mm) for electrical connections, provided with text (terminal No./designation).

Key switch

The key switch can be set in 3 positions:

"START"	Starts the engine. When the engine starts the key is released which then returns to the "RUN" position (spring loaded).
"RUN"	Normal position when the engine is running.
"STOP"	Manually stops the engine. Reset of alarm after automatic shutdown of the engine upon detection of a failure. The key can only be removed when set to this position.

Inputs

KSE72-1N is provided with 4 inputs for connection of the following alarm contacts:

"OIL SW."	Oil pressure sensor (too low oil pressure).
"TEMP. SW."	Thermostat (too high engine temperature).
"A and "B"	Other alarm contacts, e.g. overspeed, low coolant level, etc. Descriptive texts can be filled in using black marking pen.

Activation of alarm inputs

The alarm inputs are activated at either N/O or N/C contact function - determined by the position of the jumper marked "J1" on the rear of the unit. The setting is COMMON to all 4 inputs. See detailed instruction (in English/German) on the side panel of the unit. NOTE: "J1" is mounted (CLOSED) on delivery.

"J1" closed:	An alarm is registered when the first external alarm contact OPENS (N/C). NB: unused inputs should be short-circuited !
"J1" open:	An alarm is registered when the first external alarm contact CLOSES (N/O). NB: unused inputs should be left open!

Outputs

The unit is provided with 4 outputs for connection of the following external components:

"START"	Relay for starting motor (max. 10A DC).
"FUEL/IGN."	Fuel solenoid or ignition coil (max. 10A DC). For stop coils use external stop relay type SR-1 (See specific data sheet).
"ALTERNATOR"	Charging generator (pre-exciting current: 120mA through internal resistor).
"HORN"	For connection of alarm device (max. 10A DC).

Alarm inhibit during start sequence

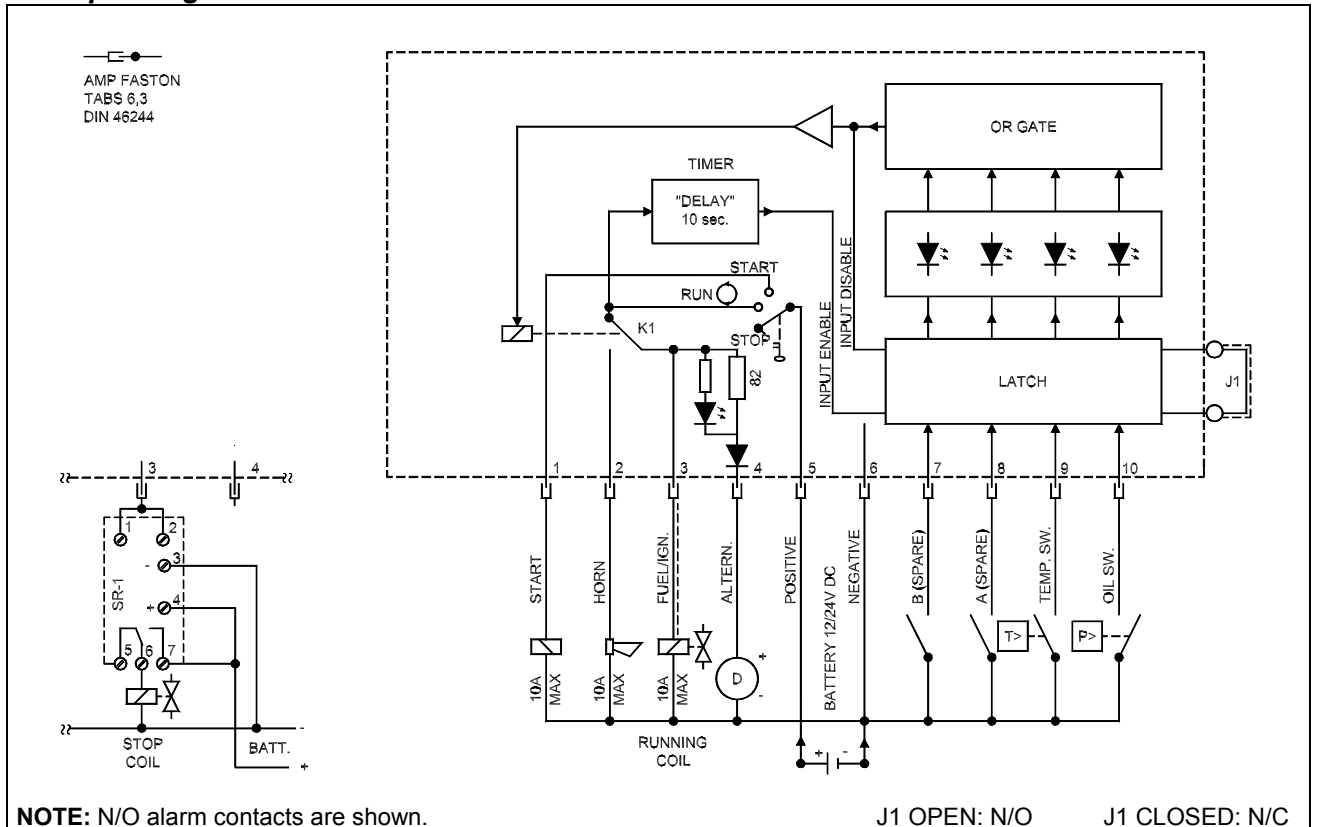
When the key is set to the "START" or "RUN" position, all alarm inputs remain inhibited for the next 10 secs. Unwanted stop of the engine, e.g. due to low oil pressure during the start sequence, is thus prevented.

Emergency shutdown of the engine

If an alarm condition is detected after the above period of time, the LED indicator for the first received alarm signal is lit, the engine is stopped and the alarm horn is activated.

The horn may then be reset by turning the key to the "STOP" position.

Principle diagram



Function

Pre-glowing of the diesel engine (if required) must be carried out before the key is turned from the "STOP" position!

To start the engine, turn the key to the "START" position. This results in:

- 1) Activation of the starting motor through an external starter relay.
- 2) Activation of the fuel starting coil and/or the ignition coil.
- 3) Connection of a pre-exciting current (ca. 120mA) for the charging generator.
- 4) Inhibit of all alarm channels.
- 5) Start of the "DELAY" timer.
If the engine starts, the key is released. It returns to the "RUN" position which results in:
- 6) Disconnection of the starting motor.
- 7) Switch off of the LED indicator for the charge circuit, if the generator works normally.
- 8) Release of all alarm channels after the time delay ("DELAY").

In case of failure in one of the supervised functions, the following steps are carried out:

- 1) Illumination of the relevant LED indicator.
- 2) Inhibit of remaining alarm channels (i.e. indication of the first alarm only).
- 3) Activation of the internal relay ("K1"). The relay contact changes position.
- 4) Activation of the alarm horn (or the like).
- 5) Disconnection of the fuel starting coil and/or the ignition coil.
- 6) Disconnection of the pre-exciting current for the charging generator.
- 7) Shutdown of the engine.

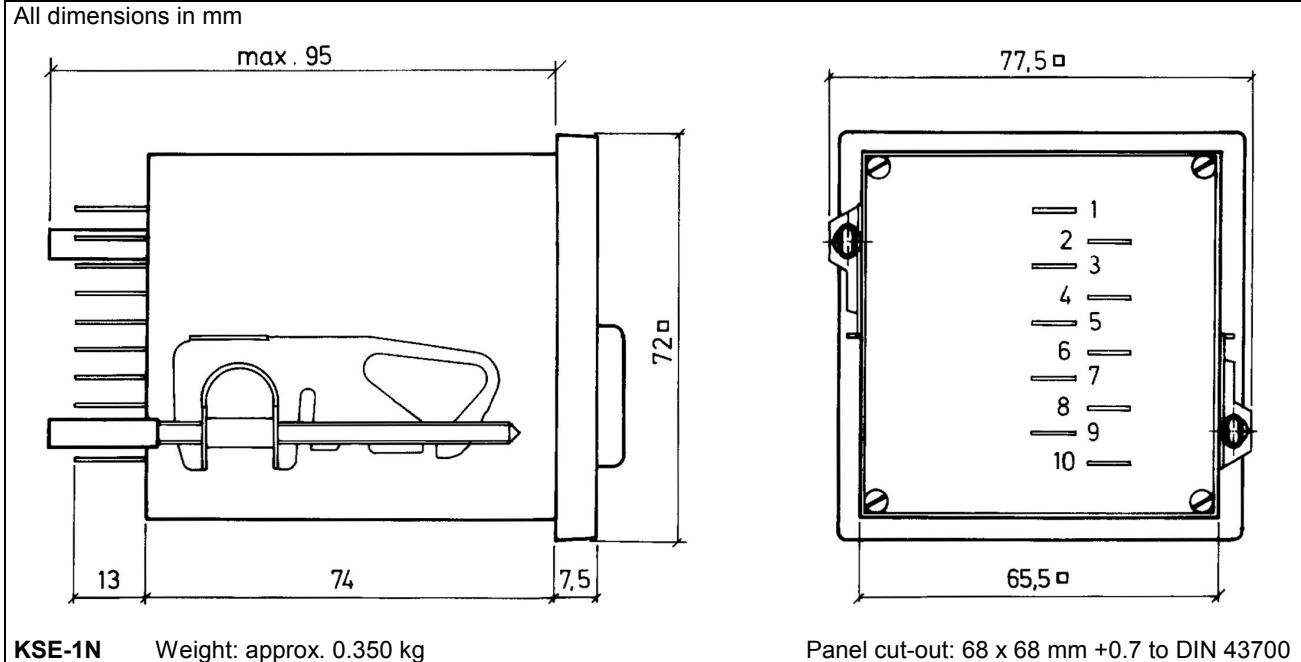
The alarm is reset by turning the key to the "STOP" position.

To stop the engine manually, turn the key to the "STOP" position, i.e. steps 5-8 are carried out.

Technical specifications

Auxiliary voltage:	Suitable for both 12V DC and 24V DC. Protected against polarization errors. Functional range: 0..30V DC during start sequence. 9..30V DC after the engine has been started.
Consumption:	Max. 20mA DC (no alarm). Max. 120mA DC (at alarm).
Alarm contacts:	Open contact: 6V DC. Closed contact: 12mA DC.
Outputs:	"START", "FUEL/IGN." and "HORN": Max. 10A DC. "ALTERNATOR": 120mA for pre-excitation of charger circuit. Short-circuit protection, max. 420mA.
Alarm inhibit:	10 s Tolerance: ± 2 s.
Key system:	Standard: All units identically coded. 2 keys supplied with each unit. Individually coded key/lock available on request.
Ambient temperature:	-10...55°C (nominal), -25...+70 C (operating), -40...+70 C (storage).
Climate:	Class HSE, to DIN 40040.
Vibration:	3..30Hz: 100 mm/s, 30..100Hz: 1.9 g, to GL + LR: Test 1 and DNV: Class B.
Shock:	15 g, tested 6 times in 3 directions, to IEC 68-2-27, Test: Ea.
EMC:	To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4), IEC 255-22-1 (class 3).
Plastic materials:	Self-extinguishing, to UL94 (V0).
Connections:	Standard spade plug, 6.3 x 0.8 mm.
Protection:	IP41, to IEC 529 and EN 60529.

Dimensions



Order specifications

KSE72-1N

Individually coded keys/lock and front panel to customer design – on request

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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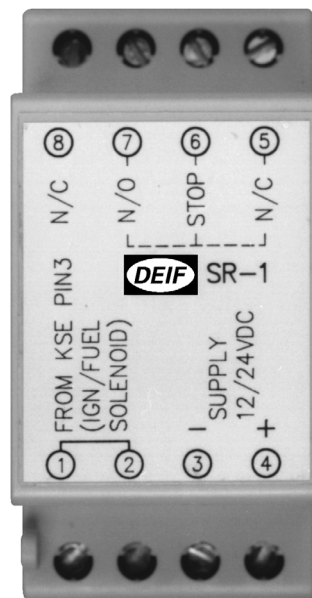
Tel.: +45 9614 9614, Fax: +45 9614 9615
E-mail: deif@deif.com, URL: www.deif.com



Stop relay

Type SR-1

4921240041C



- *For internal combustion engines*
- *For use with key starter type KSE72*
- *Activation time: approx. 20 s*
- *For DIN rail mounting*

Application

The stop relay type SR-1 is designed for internal combustion engines fitted with a stop solenoid.

The relay is for use with the key starter **KSE72-1N** and is CE classified for residential, commercial and light industry plus industrial environment.

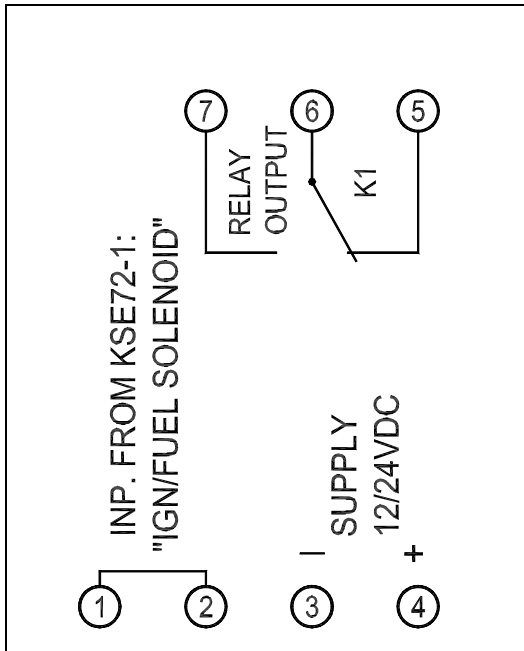
The SR-1 is provided with a built-in relay, which is activated for approx. 20 s. when the unit receives a signal from the key starter.

The SR-1 is housed in a plastic housing complete with screw terminals for connection of stop solenoid, auxiliary voltage and key starter.

Technical specifications

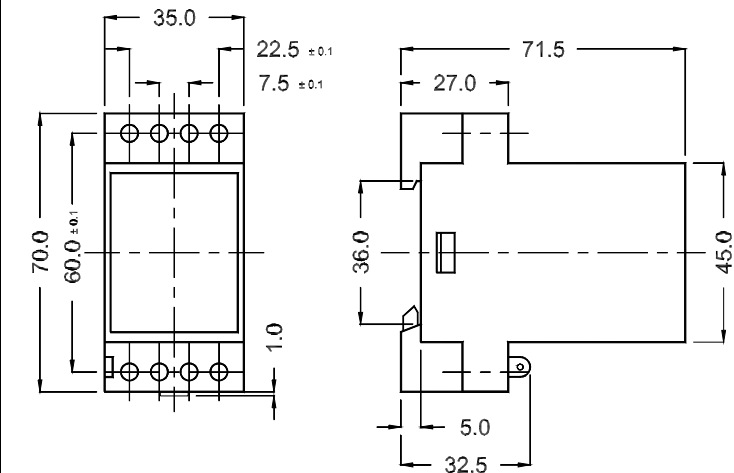
Input:	Connection to KSE72-1N (terminal marked "IGN./FUEL").
Output:	Relay output (change-over switch) for connection of stop solenoid. Max. load: 30V/10A DC.
Auxiliary voltage:	9...30V DC (protected against incorrect polarity).
Consumption:	Activated: max. 120mA. De-activated: max. 20mA.
Temperature:	-10...55°C (nominal), -25...65°C (operating). -25...65°C (storage).
EMC:	To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-22-1 (class 3).
Climate:	Class HSE, to DIN 40040.
Vibration:	To DNV: Class B.
Materials:	Polystyrene HSF 13.
Connections:	Screw terminal, max. 1 x 4 mm ² .
Protection:	Case: IP53, terminals: IP20, to IEC 529 and EN 60529.
Mounting:	35 mm DIN rail.

Connections



Dimensions

All dimensions in mm



Weight: approx. 0.010 kg
SR-1

Order specifications

Type




Due to our continuous development we reserve the right to supply equipment which may vary from the described.





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	Multi Differential Relay, MDR-2	Generator protection Unit, GPU-2	Paralleling and Protection Unit, PPU-2
			
Main function	Multi Differential Relay for protection against short circuits and currents	Engine and generator control and protection unit for single operation	Engine and generator control and protection unit for single and parallel operation
Auxiliary voltage	8-36V DC	8-36V DC	8-36V DC
Measuring voltage	–	100-690V	100-690V
Current transformer	-/1A or -/5A	-/1A or -/5A	-/1A or -/5A
Frequency	30-70Hz	30-70Hz	30-70Hz
Remote mountable display	●	●	●
Approved by classification societies	●	●	●
BASE / DIN rail mounting	●	●	●
Start / stop relay output to next generator	–	○	●
Synchronising	–	○	●
Differential relay	●	–	–
Load sharing	–	–	●
Display / PC cables	○	○	○
IP 54 protection of display	○	○	○
Loss of mains protection package	–	○	○
df / dt	–	○	○
Vector jump	–	○	○
Busbar and generator protection package	–	○	○
Generator add-on protection package	–	○	○
Zero + negative sequence	–	○	○
Voltage control	–	○	○
Analogue transducer output	–	○	○
Engine communication	–	○	○
Serial communication	–	○	○
Configurable ext. cards	–	○	○
Engine protection	–	○	○
Var / cos phi control	–	–	○
Analogue controller output	–	–	○
Combination outputs	–	–	○



● = standard ○ = optional – = not possible

	Generator protection Unit, GPU-3	Paralleling and Protection Unit, PPU-3	
			
Main function	Engine and generator control and protection unit for single operation	Engine and generator control and protection unit for single and parallel operation	
Auxiliary voltage	8-36V DC	8-36V DC	
Measuring voltage	100-690V	100-690V	
Current transformer	-/1A or -/5A	-/1A or -/5A	
Frequency	30-70Hz	30-70Hz	
Remote mountable display	●	●	
Approved by classification societies	●	●	
BASE / DIN rail mounting	●	●	
Start / stop relay output to next generator	●	●	
Busbar and generator protection package	●	●	
M-logic (micro PLC)	●	●	
Synchronising	○	●	
Load sharing	–	●	
IP 54 protection of display	○	○	
Loss of mains protection package	○	○	
Additional displays (DU-2)	○	○	
Voltage control	○	○	
Generator add-on protection package	○	○	
Analogue transducer output	○	○	
Engine communication	○	○	
Serial communication	○	○	
Configurable ext. cards	○	○	
Engine protection	○	○	
Analogue controller output	○	○	
Combination outputs	○	○	
Additional Operator Panel (AOP-1/AOP-2)	○	○	
TCP/IP modbus	○	○	
Class 0.5 measurement	○	○	
Var / cos phi control	–	○	



● = standard ○ = optional – = not possible

	PPU Power Management Unit, PPM-2 	Protection Power Management, PPM-3 	
Main function	Engine and generator control, protection and power management unit for parallel operation	Engine and generator control, protection and power management unit for parallel operation	
Auxiliary voltage	8-36V DC	8-36V DC	
Measuring voltage	100-690V	100-690V	
Current transformer	-/1A or -/5A	-/1A or -/5A	
Frequency	30-70Hz	30-70Hz	
Busbar and generator protection package	●	●	
Generator add-on protection package	●	●	
Power management	●	●	
Synchronising	●	●	
Load sharing	●	●	
Remote mountable display	●	●	
Engine protection	●	●	
Approved by classification societies	●	●	
BASE mounting	●	●	
Additional displays	○	○	
Additional Operator Panel (AOP-1)	–	○	
Additional Operator Panel (AOP-2)	●	○	
Available without display	–	○	
Voltage control	○	○	
Var / cos phi control	○	○	
Analogue controller output	○	○	
Analogue transducer output	○	○	
Combination outputs	○	○	
Engine communication	–	○	
Serial communication	○	○	
Display / PC cables	○	○	
IP 54 protection of display	○	○	
Configurable ext. cards	○	○	
TCP/IP	○	○	
Class 0.5 measurement	–	○	

● = standard ○ = optional – = not possible

	Engine Controller, Marine EC-1M 	Generator controller, Marine GC-1M 	
Main function	Engine control and protection	Engine and generator control and protection	
Auxiliary voltage	8-36V DC	8-36V DC	
Measuring voltage	50-480V	50-480V	
Current transformer	-	-/1A or -/5A	
Frequency	30-70Hz	30-70Hz	
Engine start / stop relay output	●	●	
Engine protection	●	●	
Approved by classification societies	●	●	
Generator protection package	○	●	
Engine communication	○	○	
Display / PC cables	○	○	
IP 54 protection of display	○	○	
Serial communication	○	-	
AMF logic	-	○	

● = standard ○ = optional - = not possible



	Gen-set Controller, GC-1F	Automatic Gen-set Controller, AGC-3	
			
Main function	Engine and generator control and protection unit for single operation	Island mode, AMF, fixed power, peak shaving, mains power export, load take over	
Auxiliary voltage	6-36V DC	8-36V DC	
Measuring voltage	50-480V	100-690V	
Current transformer	-1A or -5A	-1A or -5A	
Frequency	30-70Hz	30-70Hz	
Remote mountable display	–	●	
Engine protection	●	●	
AMF logic	○	●	
Busbar and generator protection package	● (Generator protection only)	○	
Start/stop relay output to next generator	–	●	
Synchronising	–	●	
BASE / DIN rail mounting	–	●	
IP protection of display	○ (IP 65)	○ (IP 54)	
Engine communication	○	○	
Serial communication	○	○	
Additional Operator Panel/Additional display	○	○	
Display / PC cables	○	○	
Loss of mains protection package	–	○	
df / dt	–	○	
Vector jump	–	○	
Positive Sequence	–	○	
Directional overcurrent	–	○	
Generator add-on protection package	–	○	
Zero + negative sequence	–	○	
Voltage control	–	○	
Var / cos phi control	–	○	
Analogue controller output	–	○	
Analogue transducer output	–	○	
Combination outputs	–	○	
Power management	–	○	
Load sharing	–	○	
Configurable ext. cards	–	○	
TCP/IP	–	○	
Alarm log printer	–	○	
Class 0,5 measurement	–	○	
Approvals	UL/cUL	UL/cUL	

● = standard ○ = optional – = not possible






	AGC 212	AGC 213	AGC 223	AGC 232	AGC 242	AGC 244	AGC 245	AGC 246
Main function:	Island mode	Island mode, AMF	Island mode, AMF, fixed power, peak shaving, load take over	Island mode, load sharing	Island mode, AMF, fixed power, peak shaving, load take over, load sharing	Island mode, AMF, fixed power, peak shaving, load take over, load sharing	Island mode, AMF, fixed power, peak shaving, load take over, load sharing	Island mode, AMF, fixed power, peak shaving, load take over, load sharing
Auxiliary voltage	6-36V DC	6-36V DC	6-36V DC	6-36V DC	6-36V DC	6-36V DC	6-36V DC	6-36V DC
Measuring Voltage:	50-690V AC	50-690V AC	50-690V AC	50-690V AC	50-690V AC	50-690V AC	50-690V AC	50-690V AC
Current transformer:	-/1A or -/5A	-/1A or -/5A	-/1A or -/5A	-/1A or -/5A	-/1A or -/5A	-/1A or -/5A	-/1A or -/5A	-/1A or -/5A
Frequency:	30-70Hz	30-70Hz	30-70Hz	30-70Hz	30-70Hz	30-70Hz	30-70Hz	30-70Hz
Engine protection	●	●	●	●	●	●	●	●
Busbar and generator protection package	●	●	●	●	●	●	●	●
Synchronising	●	●	●	●	●	●	●	●
Engine communication	●	●	●	●	●	●	●	●
Voltage control	●	●	●	●	●	●	●	●
Var / cos phi control	●	●	●	●	●	●	●	●
User-programmable logic (M-Logic)	●	●	●	●	●	●	●	●
Configurable inputs / outputs	●	●	●	●	●	●	●	●
High speed USB connection	●	●	●	●	●	●	●	●
AMF logic	-	●	●	-	●	●	●	●
Multi master Power Management	-	-	-	-	●	●	●	●
Redundant CANbus for power management	-	-	-	-	●	●	●	●
Start/stop relay output to next generator	-	-	-	●	●	-	-	-
Load sharing	-	-	-	●	●	-	-	-
IP65 protection	○	○	○	○	○	○	○	○
RS485	○	○	○	○	○	○	○	○
Additional Operator Panel	○	○	○	○	○	○	○	○
Loss of mains protection package	○	○	○	○	○	○	○	○
df / dt	○	○	○	○	○	○	○	○
Vector jump	○	○	○	○	○	○	○	○
Positive sequence	○	○	○	○	○	○	○	○
Directional overcurrent	○	○	○	○	○	○	○	○
Generator add-on protection package	○	○	○	○	○	○	○	○
Zero + negative sequence	○	○	○	○	○	○	○	○
Analogue controller output	○	○	○	○	○	○	○	○
TCP Modbus	○	○	○	○	○	○	○	○
Remote mountable display	-	-	-	-	-	-	-	-
Approvals	CE, UL/cUL pending	CE, UL/cUL pending	CE, UL/cUL pending	CE, UL/cUL pending	CE, UL/cUL pending	CE, UL/cUL pending	CE, UL/cUL pending	CE, UL/cUL pending



● = standard ○ = optional - = not possible

	Generator Paralleling Controller, GPC-3	Advanced Protection Unit, APU-3	
			
Main function	Engine and gen-set control and protection for single and parallel operation	Mains protection unit	
Auxiliary voltage	8-36V DC	8-36V DC	
Measuring voltage	100-690V	100-690V	
Current transformer	-1A or -5A	-1A or -5A	
Frequency	30-70 Hz	30-70 Hz	
Remote mountable display	●	●	
BASE / DIN rail mounting	●	●	
M-Logic (Micro PLC)	●	●	
Synchronising	●	○	
df/dt	○	●	
Vector jump	○	●	
Busbar and generator protection package	●	–	
Load sharing	●	–	
Start/stop relay output to next generator	●	–	
Over-/under voltage protection	–	●	
Over-/under frequency protection	–	●	
IP54 protection of display	○	○	
Positive sequence	○	○	
Directional overcurrent	○	○	
TCP/IP	○	○	
Zero + negative sequence	○	–	
Additional display	○	–	
Voltage control/Var/Pf	○	–	
Analogue transducer	○	–	
Engine communication	○	–	
Serial communication	○	–	
Configurable ext. cards	○	–	
Engine protection	○	–	
Analogue controller output	○	–	
Additional operator panel	○	–	
Class 0.5 measurement	○	–	
Approvals	UL/cUL	UL/cUL	

● = standard ○ = optional – = not possible

	Basic Gen-set Controller, BGC-2	Generator Paralleling Controller, GPC-2	Automatic Gen-set Controller, AGC-2
			
Main function	Island mode, AMF, fixed power, peak shaving, load take over, load sharing	Engine and generator control and protection unit for single and parallel operation	Island mode, AMF, fixed power, peak shaving, mains power export, load take over
Auxiliary voltage	8-36V DC	8-36V DC	8-36V DC
Measuring voltage	100/110V + 380/480V	100-690V	100-690V
Current transformer	-1A or -5A	-1A or -5A	-1A or -5A
Frequency	30-70Hz	30-70Hz	30-70Hz
Start/stop relay output to next generator	○	●	●
Synchronising	○	●	●
AMF logic	●	–	●
Remote mountable display	–	●	●
BASE / DIN rail mounting	–	●	●
Load sharing	○	●	○
Engine protection	●	○	○
Loss of mains protection package	○	○	○
df / dt	○	○	○
Vector jump	○	○	○
Busbar and generator protection package	○	○	○
Generator add-on protection package	○	○	○
Voltage control	○	○	○
Var / cos phi control	○	○	○
Analogue controller output	○	○	○
Analogue transducer output	○	○	○
Engine communication	○	○	○
Serial communication	○	○	○
Display / PC cables	○	○	○
IP 54 protection of display	○	○	○
Configurable ext. cards	○	○	○
Zero + negative sequence	–	○	○
Combination outputs	–	○	○
Additional Operator Panel	–	–	○
Positive Sequence	–	–	○
Power management	–	–	○

● = standard ○ = optional – = not possible

	Engine Controller, EC-1	Generator Controller, GC-1	
			
Main function	Engine control and protection	Engine and generator control and protection	
Auxiliary voltage	4-36V	4-36V	
Measuring voltage	50-480V	50-480V	
Current transformer	–	-/1A or -/5A	
Frequency	30-70Hz	30-70Hz	
Engine start / stop relay output	●	●	
Engine protection	●	●	
Generator protection package	○	●	
Engine communication	○	○	
Display / PC cables	○	○	
IP 54 protection of display	○	○	
AMF logic	–	○	
Serial communication	○	–	

● = standard ○ = optional – = not possible

Advanced Graphical Interface, AGI 107

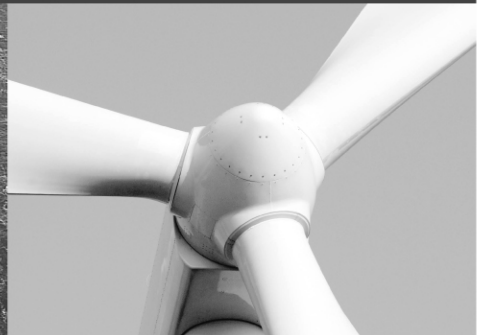


Main function	LCD Graphical Touch Control Panel		
Auxiliary voltage	24V DC \pm 17%		
Power consumption	25W		
Dimension (W x H x D)	188 x 143.3 x 40 mm		
Cut-out dimension (W x H)	175 x 133 mm		
Build height	6 mm		
Mounting depth	45 mm		
Touch display	7" TFT resistive		
Resolution	800 x 480 pixels		
Colors	65535		
Backlight	LED		
Dimmable	Yes		
Front mount	Yes		
Memory	16MB Flash		
System memory	64MB		
COM 1	RS-232/422/485 (DB9 female)		
COM 2	RS-232/422/485 (DB9 female & 5-pins plug connector)		
Ethernet (RJ45)	10/100-BaseT		
USB	Yes, Host x1		
Operation temp.	0 to 50°C		
Storage temp.	-20 to 60°C		
IP front	NEMA4, IP 65		
IP rear	IP 20		
Approvals	CE, FCC		

● = standard ○ = optional - = not possible



AGC 200 Advanced Gen-set Controller DATA SHEET



Operation modes

- Automatic mains failure/ATS
- Island operation
- Fixed power/base load
- Peak shaving
- Load takeover
- Mains power export
- Multiple gen-set load sharing (128)

Display and unit front

- Soft key for all operation and ease of use
- Full text LCD display (240 x 128 pixel)
- Operational down to -40°C/F including LCD
- kWh meter
- Operation hours/start/maintenance counters
- Event recorder with real-time clock (up to 4 GB)
- Push-buttons for start and stop
- Push-buttons for breaker operations
- Status texts
- Alarm indication
- Prepared for additional operator panels

General

- USB ver. 2 interface to PC
- Free PC utility software for commissioning
- Mini SCADA in PC utility software
- SD card slot for lifetime logging
- 3/2/1-phase monitoring

Engine control

- CAN J1939 and MTU MDEC/ADEC communication
- Start/stop sequences
- KWP 2000 – DM1 log – DM2 log

M-logic

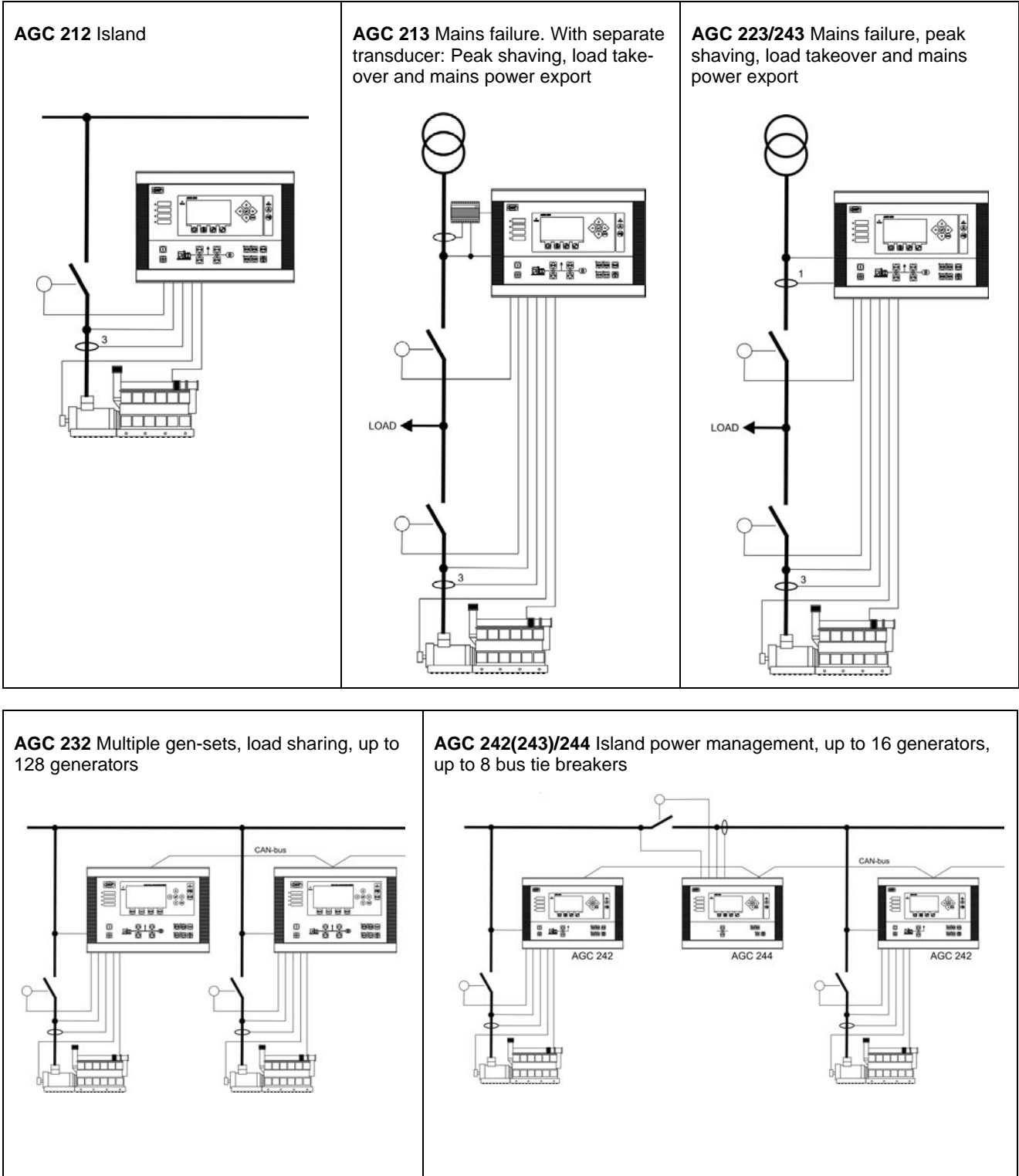
- Simple logic configuration tool
- Selectable input/output events

Optional applications

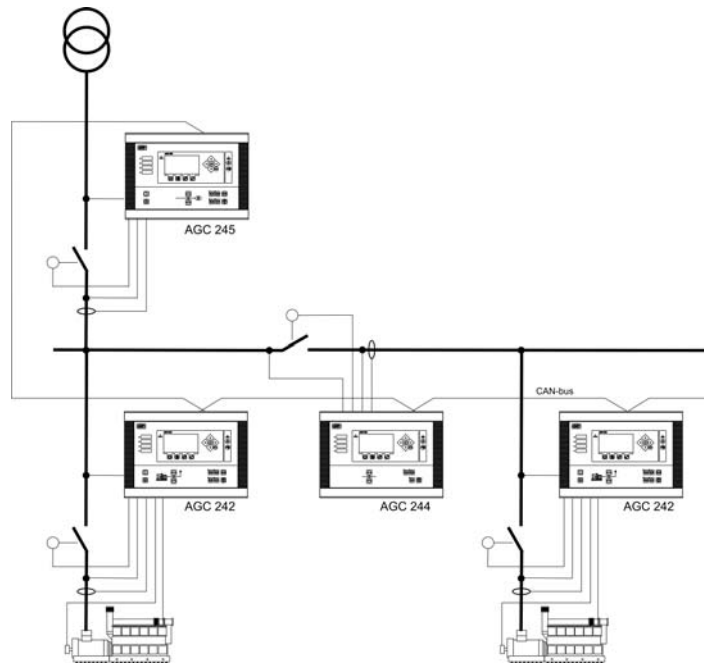
- Control of up to 16 gen-sets
- Control of up to 8 bus tie breakers
- Load-dependent start/stop operation
- Priority selection of gen-sets
- Ground relay control
- Plant division into sections for individual functionality
- Multiple gen-sets, load management
- Multi-master system



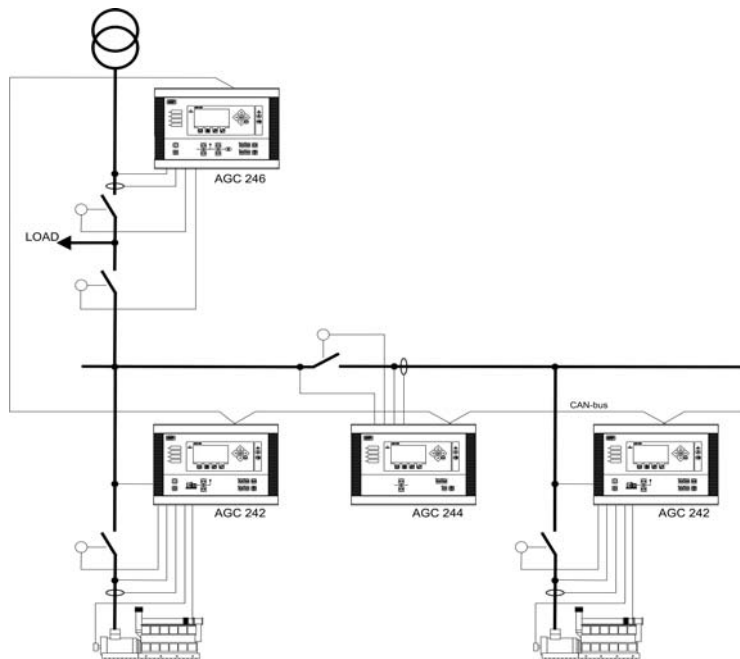
Single-line application diagrams



AGC 242(243)/244/245 Multiple gen-sets, load sharing, up to 16 generators, up to 8 bus tie breakers



AGC 242(243)/244/246 Multiple gen-sets, load sharing, up to 16 generators, up to 8 tie breakers



Standard functions

Model	AGC 200							
	AGC 212	AGC 213	AGC 223	AGC 232	AGC 242/243	AGC 244	AGC 245	AGC 246
Measuring								
Generator/busbar voltage (3-phase/4-wire)	✓	✓	✓	✓	✓			
Generator current (3 x true r.m.s.)	✓	✓	✓	✓	✓			
CT selectable 1/5	✓	✓	✓	✓	✓	✓	✓	✓
100 to 690V AC selectable	✓	✓	✓	✓	✓	✓	✓	✓
Mains/busbar voltage (3-phase/4-wire)		✓	✓	✓	✓	✓	✓	✓
Mains current or neutral current (1 x true r.m.s.) or ground current with 3 rd harmonic filter			✓	✓	✓	✓	✓	✓
Selectable AC configuration 3-phase/3-wire 3-phase/4-wire 2-phase/3-wire L1L3 (180° between phases) 2-phase/3-wire L1L2 (120° between phases) 1-phase/2-wire L1	✓	✓	✓	✓	✓	✓	✓	✓
Phase angle compensation gen/busbar/mains Synchronising over a D/Y transformer	✓	✓	✓	✓	✓	✓	✓	✓
Single/power management plant mode								
Island operation	✓	✓	✓	✓	✓			
Fixed power/base load		✓	✓		✓		✓	✓
AMF & ATS (auto mains failure operation)		✓	✓		✓		✓	✓
Peak shaving		✓	✓		✓		✓	✓
Load takeover		✓	✓		✓		✓	✓
Mains power export		✓	✓		✓	✓	✓	✓
AMF – Mode		✓	✓		✓		✓	✓
General								
Status relay	✓	✓	✓	✓	✓	✓	✓	✓
16A crank and run relay	✓	✓	✓	✓	✓			
Lamp test	✓	✓	✓	✓	✓	✓	✓	✓
USB interface to PC	✓	✓	✓	✓	✓	✓	✓	✓
Temperature-dependent cooling down Time-based cooling down Emergency cooling down	✓	✓	✓	✓	✓			
kWh meter Produced kWh meter day Produced kWh meter week Produced kWh meter year Produced kWh meter total	✓	✓	✓	✓	✓	✓	✓	✓
Operation hours and emergency hours counter GB and MB operation counter Start attempt counter Maintenance counters, hours and days	✓	✓	✓	✓	✓			
Free PC utility software for commissioning	✓	✓	✓	✓	✓	✓	✓	✓
Control								
Start/stop sequences	✓	✓	✓	✓	✓			
Synchronisation	✓	✓	✓	✓	✓	✓	✓	✓
Numbers of breakers/contactors to be controlled	1	2	2	1	1	1	1	2
Run coil	✓	✓	✓	✓	✓			
Stop coil with wire break supervision	✓	✓	✓	✓	✓			
J1939 regulation governor/AVR	✓	✓	✓	✓	✓			
Relay outputs for governor control/AVR	✓	✓	✓	✓	✓			
Analogue outputs for governor control/AVR	IOM 220	IOM 220	IOM 220	IOM 220	IOM 220			
Digital load sharing (CAN share), with first up discrimination			✓	✓	✓			
Analogue load sharing	IOM 230	IOM 230	IOM 230	IOM 230	IOM 230			
Event LOG with real-time clock Alarm LOG with real-time clock Battery test LOG with real-time clock Engine diagnostic active alarm LOG Engine diagnostic historical alarm LOG	✓	✓	✓	✓	✓	✓	✓	✓

Model			AGC 200							
			AGC 212	AGC 213	AGC 223	AGC 232	AGC 242/243	AGC 244	AGC 245	AGC 246
I/Os										
Inputs (configurable)			9	9	14	14	14	14	14	14
Relay outputs (configurable)			9	9	14	14	14	14	14	14
Multi-inputs (configurable)			3	3	3	3	3	3	3	3
Pick-up MPU/W/PNP/NPN/tacho			1	1	1	1	1	1	1	1
D+ alternator field flash circuit			✓	✓	✓	✓	✓			
CANbus communication interfaces			1	1	2	2	3	3	3	3
RS485/Modbus RTU slave interface(s)			1	1	1	1	1	1	1	1
TCP/IP Modbus communication			1	1	1	1	1	1	1	1
SD card					1	1	1	1	1	1
USB 2.0 service port			1	1	1	1	1	1	1	1
M-logic										
Simple logic configuration tool			✓	✓	✓	✓	✓	✓	✓	✓
Selectable input events			✓	✓	✓	✓	✓	✓	✓	✓
Selectable output commands			✓	✓	✓	✓	✓	✓	✓	✓
Power management functions										
Load-dependent start/stop							✓			
Priority selection										
Manual							✓			
Running hours										
Fuel optimisation										
Ground relay control							✓			
ATS control									✓	✓
Safety stop (fail class = trip and stop)							✓			
Load management							✓		✓	✓
Secured mode							✓			
Quick setup/broadcast							✓	✓	✓	✓
Base load							✓			
Heavy consumer (HC)							✓		✓	✓
Asymmetric load sharing (LS)							✓			
Common PF control							✓		✓	✓
CAN flags							✓	✓	✓	✓
Protection (ANSI)										
Reverse power	x2	32R	✓	✓	✓	✓	✓	✓	✓	✓
Short circuit	x2	50P/N	✓	✓	✓	✓	✓	✓	✓	✓
Overcurrent	x4	51	✓	✓	✓	✓	✓	✓	✓	✓
Voltage dep. overcurrent	x1	51V	✓	✓	✓	✓	✓	✓	✓	✓
Overvoltage	x2	59P	✓	✓	✓	✓	✓	✓	✓	✓
Undervoltage	x3	27P	✓	✓	✓	✓	✓	✓	✓	✓
Overfrequency	x3	81O	✓	✓	✓	✓	✓	✓	✓	✓
Underfrequency	x3	81R	✓	✓	✓	✓	✓	✓	✓	✓
Unbalanced voltage	x1	47	✓	✓	✓	✓	✓	✓	✓	✓
Unbalanced current	x1	46	✓	✓	✓	✓	✓	✓	✓	✓
Underexcitation or VAr import	x1	32RV	✓	✓	✓	✓	✓	✓	✓	✓
Overexcitation or VAr export	x1	32FV	✓	✓	✓	✓	✓	✓	✓	✓
Overload	x5	32F	✓	✓	✓	✓	✓	✓	✓	✓
Busbar/mains overvoltage	x3	59P	✓	✓	✓	✓	✓	✓	✓	✓
Busbar/mains undervoltage	x4	27P	✓	✓	✓	✓	✓	✓	✓	✓
Busbar/mains overfrequency	x3	81O	✓	✓	✓	✓	✓	✓	✓	✓
Busbar/mains underfrequency	x4	81U	✓	✓	✓	✓	✓	✓	✓	✓
Busbar/mains unbalanced voltage	x1	47	✓	✓	✓	✓	✓	✓	✓	✓
Load shed via current # levels	x3	51	✓	✓	✓	✓	✓	✓	✓	✓
Load shed via busbar freq. # levels	x3	81	✓	✓	✓	✓	✓	✓	✓	✓
Load shed via overload # levels	x3	32	✓	✓	✓	✓	✓	✓	✓	✓
Load shed via fast overload # levels	x3	32	✓	✓	✓	✓	✓	✓	✓	✓

Model			AGC 200							
			AGC 212	AGC 213	AGC 223	AGC 232	AGC 242/243	AGC 244	AGC 245	AGC 246
Multi-analogue input 1/with wire break supervision	x2	NA	✓	✓	✓	✓	✓	✓	✓	✓
Multi-analogue input 2/with wire break supervision	x2	NA	✓	✓	✓	✓	✓	✓	✓	✓
Multi-analogue input 3/with wire break supervision	x2	NA	✓	✓	✓	✓	✓	✓	✓	✓
Emergency stop	x1	1	✓	✓	✓	✓	✓	✓	✓	✓
Overspeed	x2	12	✓	✓	✓	✓	✓			
Low battery voltage	x1	27DC	✓	✓	✓	✓	✓	✓	✓	✓
High battery voltage	x1	59DC	✓	✓	✓	✓	✓	✓	✓	✓
Generator breaker external trip	x1	5	✓	✓	✓	✓	✓			
Mains breaker external trip	x1	5	✓	✓	✓	✓	✓		✓	✓
GB synchronisation failure	x1	25	✓	✓	✓	✓	✓	✓	✓	✓
GB open failure	x1	52BF	✓	✓	✓	✓	✓	✓	✓	✓
GB close failure	x1	52BF	✓	✓	✓	✓	✓	✓	✓	✓
GB position failure	x1	52BF	✓	✓	✓	✓	✓	✓	✓	✓
MB synchronisation failure	x1	25		✓	✓		✓ (243)		✓	✓
MB open failure	x1	52BF		✓	✓		✓ (243)		✓	✓
MB close failure	x1	52BF		✓	✓		✓ (243)		✓	✓
MB position failure	x1	52BF		✓	✓		✓ (243)		✓	✓
Close before excitation failure	x1	48	✓	✓	✓	✓	✓			
Phase sequence error	x1	47	✓	✓	✓	✓	✓	✓	✓	✓
Deload error	x1	34	✓	✓	✓	✓	✓	✓	✓	✓
Crank failure	x1	48	✓	✓	✓	✓	✓			
Running feedback error	x1	34	✓	✓	✓	✓	✓			
MPU wire break	x1	NA	✓	✓	✓	✓	✓			
Start failure	x1	48	✓	✓	✓	✓	✓			
Hz/V failure	x1	53	✓	✓	✓	✓	✓			
Stop failure	x1	48	✓	✓	✓	✓	✓			
Stop coil supervision (wire break)	x1	5	✓	✓	✓	✓	✓			
Engine heater	x1	26	✓	✓	✓	✓	✓			
Battery test alarm	x1	NA	✓	✓	✓	✓	✓			
Max. ventilation	x2	NA	✓	✓	✓	✓	✓	✓	✓	✓
Not in Auto	x1	34	✓	✓	✓	✓	✓	✓	✓	✓
Fuel fill check error	x1	NA	✓	✓	✓	✓	✓			
EIC warning via J1939/comm. link	x1	NA	✓	✓	✓	✓	✓			
EIC shutdown via J1939/comm. link	x1	NA	✓	✓	✓	✓	✓			
EIC coolant temperature via J1939/comm. link	x2	NA	✓	✓	✓	✓	✓			
EIC oil pressure via J1939/comm. link	x2	NA	✓	✓	✓	✓	✓			
EIC oil temperature via J1939/comm. link	x2	NA	✓	✓	✓	✓	✓			
EIC communication error	x1	NA	✓	✓	✓	✓	✓			

Setup

Setup is secured by three levels of passwords and is easily done via a menu structure on the display or via a PC and the free Multi-line 2 Windows® based PC utility software. The PC utility software can be downloaded free of charge from www.deif.com. This utility software allows the operator to monitor all relevant information during commissioning, save and upload/download settings, download software updates and even control the gen-set either from a USB connection local to the unit or over Ethernet from anywhere in the world.

M-logic

Customise your control system to your specific needs with this Boolean logic included in the AGC. Control functions can be modified or created based on digital inputs, J1939/comm. link data, analogue inputs, alarms, limits, specific functions or operating conditions. This powerful system configuration tool is included in all AGC systems without additional costs and is programmed by the free PC utility software.

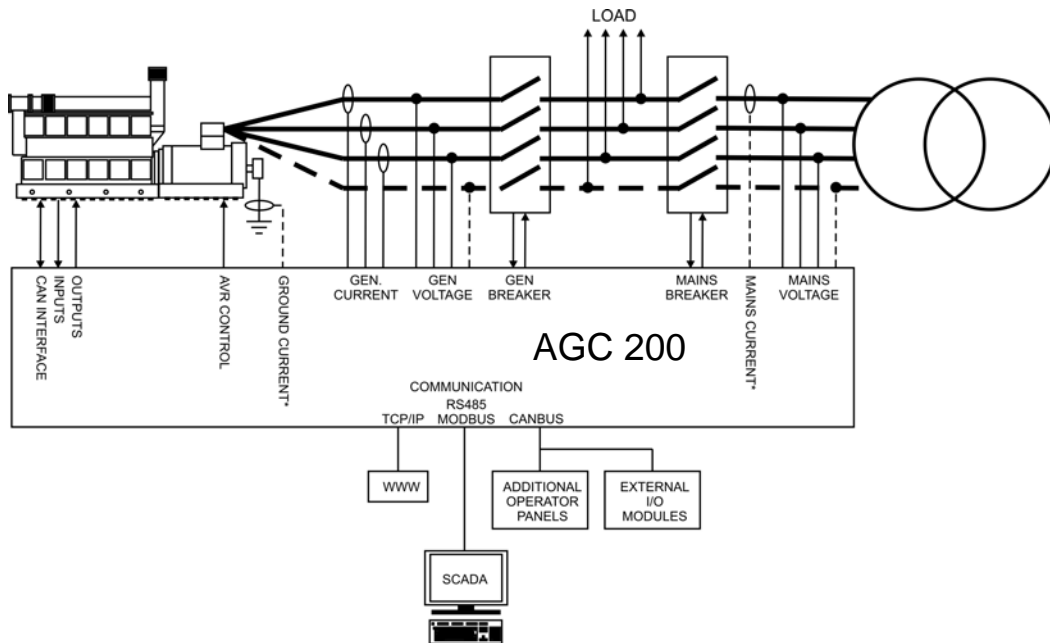
Available options

In order to perfectly match the product solution to specific applications, the functionality of the AGC 200 can be equipped with a number of available options. The options selected by the customer will be integrated in the standard AGC 200, hereby securing the same user interface unaffected by whether the application needs a highly complex or a more basic gen-set controller.

Option	Description	Option type	Note
A	Loss of mains protection package (ANSI)		
A1	Vector jump df/dt (ROCOF) Undervoltage with programmable time delay (6 point curve) $U_1 <$ Undervoltage and reactive power, U and Q<	(78) (81R) (27) (27+32RV)	Software
A4	Positive sequence (mains) voltage low	(27)	Software
A5	Directional overcurrent	(67)	Software
C	Generator add-on protection package (ANSI)		
C2	Negative sequence voltage high Negative sequence current high Zero sequence voltage high Zero sequence current high Power-dependent reactive power (12 point true field loss emulating the generator capability curve) IEC/IEEE inverse time overcurrent (curves: 6 fixed, 1 adjustable)	(47) (46) (59G) (50G) (40) (51)	Software
H	Serial communication		
H2	Modbus RTU (RS485)	Software	
J	Cables		
J4	Ethernet cable crossed, 3 m. UL94 (V1) approved	Other	
J7	PC cable for utility software (USB) 3 m. UL94 (V1) approved	Other	
L	Gasket		
L	Display gasket IP66	Other	Standard is IP52
L2	Display -40°C (-40°F)	Hardware	
N	Ethernet communication		
N5	Ethernet TCP/IP Modbus RTU	Software	
X	Display		
X4	Additional operator panel (AOP-2): 16 configurable LEDs, 8 configurable buttons and 1 status relay. Internal buzzer. CANbus communication. Includes 24V DC to 5V DC power supply	Other	Each AGC 200 can handle five X4 options

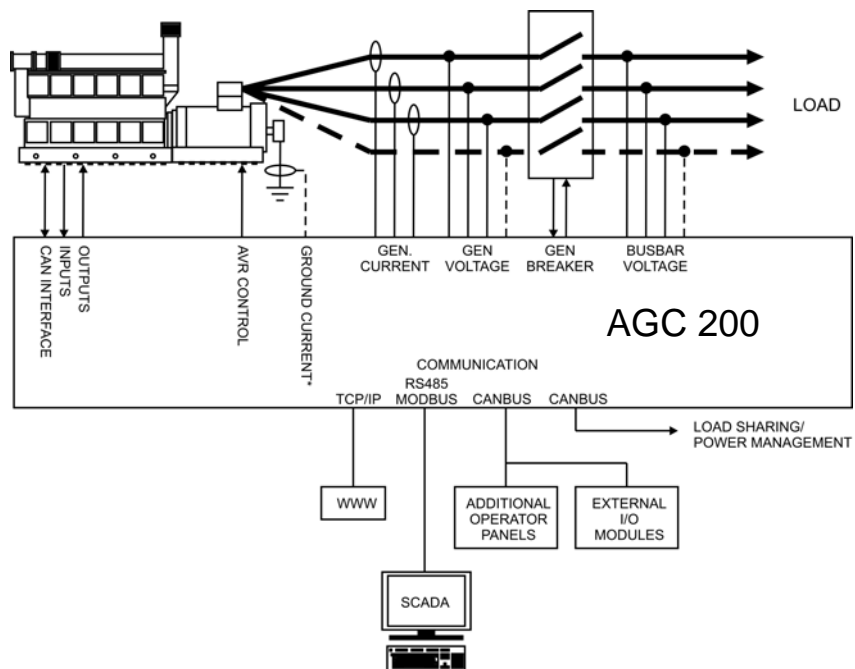
Functional block diagram

Automatic mains failure/mains power export/peak shaving/load takeover



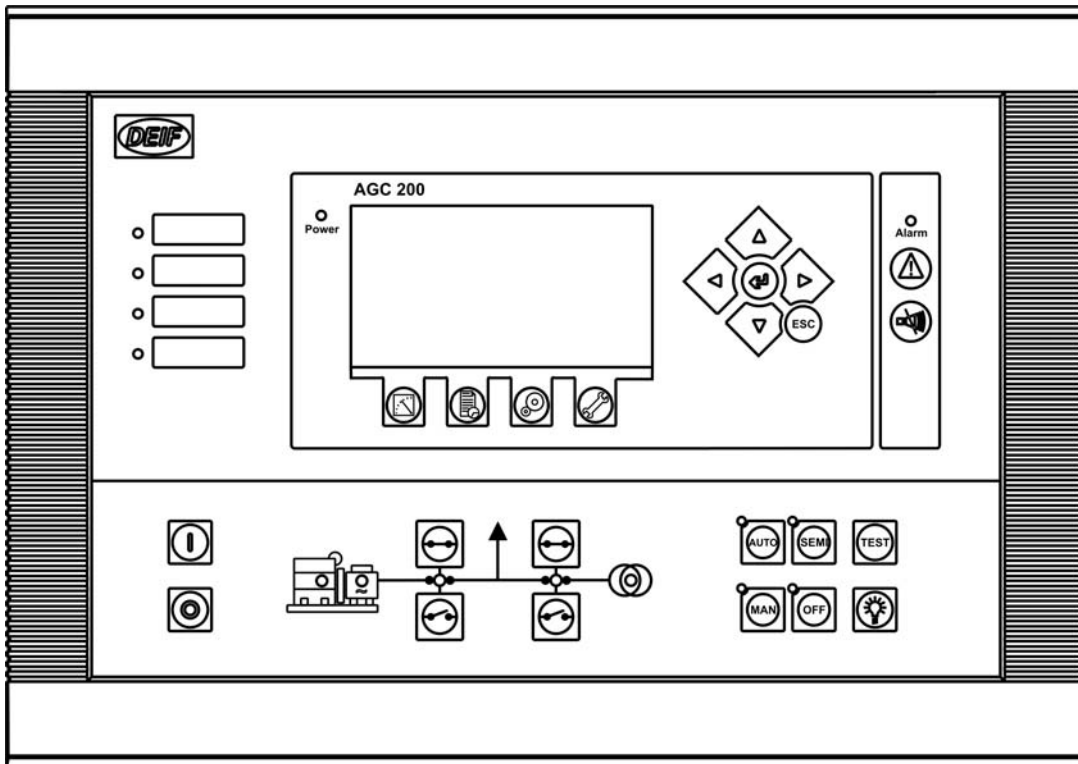
*Mains current and ground current use the same AC current input and can therefore not be mounted simultaneously. They may or may not be used.

Single generator/load sharing/power management

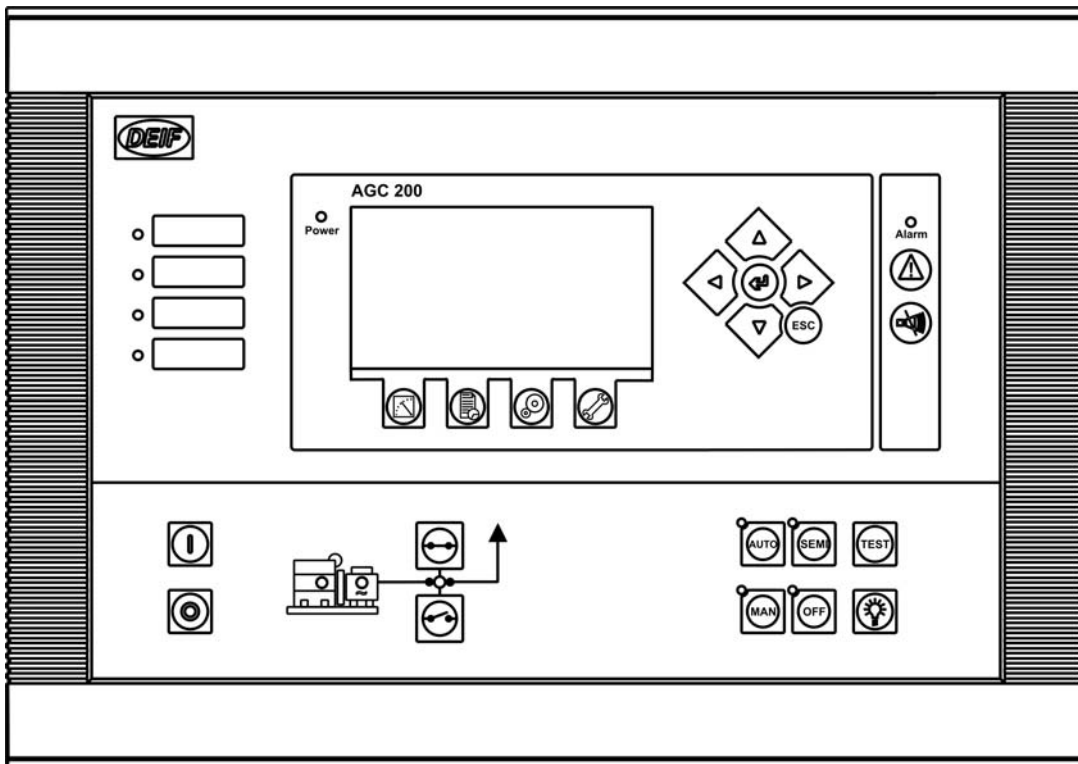


*Ground current may or may not be used.

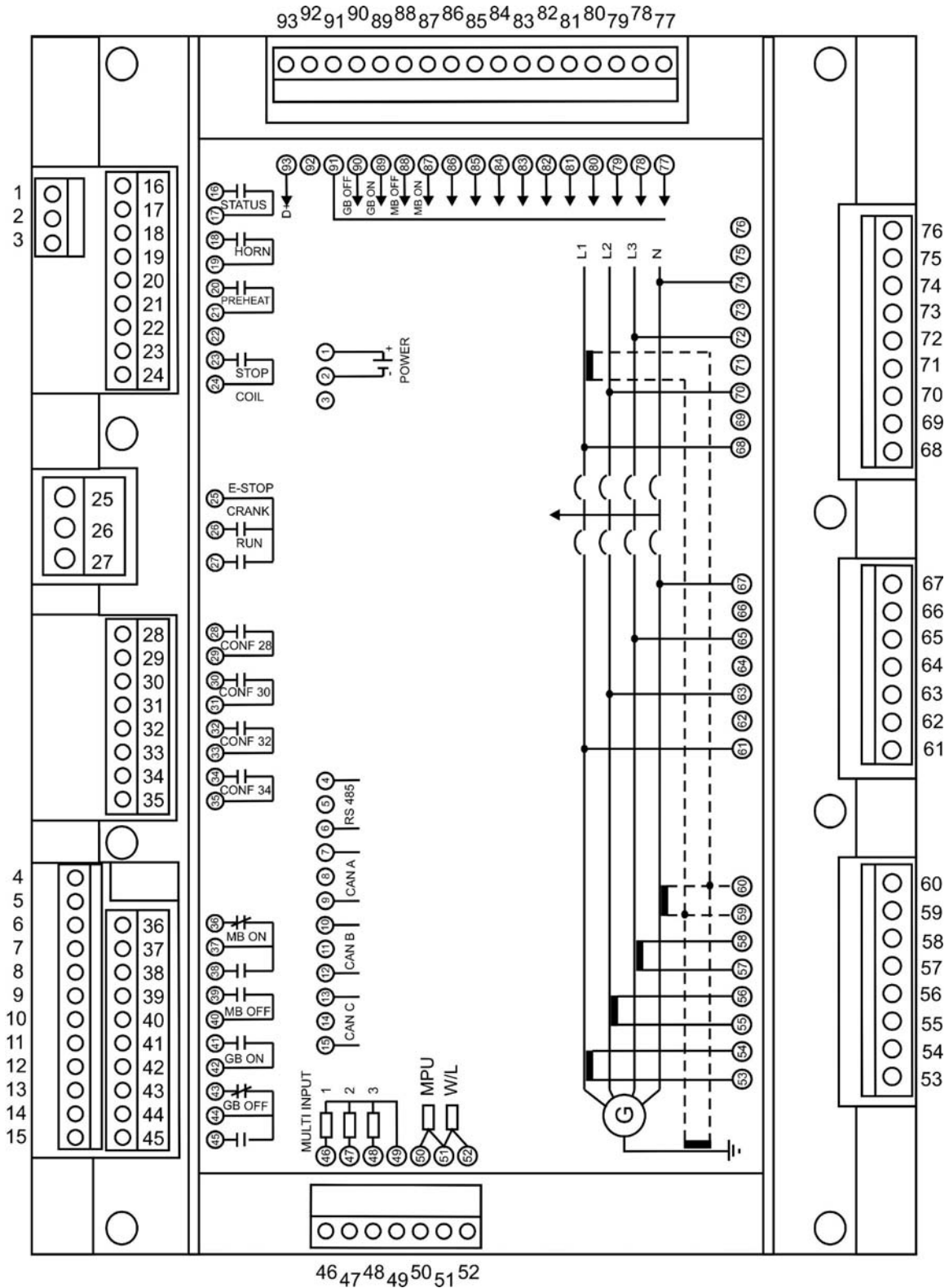
Display layout - AGC 213, 223, 243



Display layout - AGC 212, 232, 242



Rear side view



CANbus C is for engine communication. Available in all variants.
 CANbus A + C combination is only available in AGC 223/232.
 CANbus A + B + C combination is only available in AGC 24x.

Technical specifications

Accuracy:	Class 1.0 -40...15...30...70°C Temperature coefficient: +/-0.2% of full scale per 10°C Short circuit: 5% of 3.5*nominal current Earth current: 2% of 1A or 5A To IEC/EN 60688	Passive binary input voltage:	Bi-directional optocoupler ON: 8...36V DC <2 V: OFF Impedance:4.7 kΩ
Operating temp.: UL/cUL Listed:	-25...70°C (-13...158°F) Max. ambient temp. 50°C/122°F	Emergency stop input voltage:	ON: +8...36V DC (term. 25) <2 V: OFF Impedance: 4.7 kΩ
With option L2:	-40...70°C (-40...158°F)	Multi-functional inputs:	Current input: 0(4)-20 mA From active transmitter: 0-20 mA, +/-1% Impedance: 50 Ω
Storage temp.:	-40...70°C (-40...158°F)		Binary input: Dry contact inputs 3V DC internal supply, with cable supervision Max. resistance for ON detection: 100 Ω
Climate:	97% RH to IEC 60068-2-30		Pt100: -40...250°C (-40...482°F) +/-1% To IEC/EN 60751
Operating altitude:	Up to 3000 m above sea level		VDO: 0-2500 Ω, +/-1%
Meas. voltage: UL/cUL Listed:	100...690V AC (+20%) 100...600V AC Phase to phase	Relay outputs, electrical rating:	
Load:	1.5 MΩ	Relays 16-20 and 28-43:	250V AC/30V DC 8A
Frequency:	30...70 Hz	UL/cUL Listed:	250V AC/30V DC 6A General use B300 Pilot duty
Meas. current:	1A or 5A AC from current transformer	Relay 23:	36V DC 8A
Consumption max.:	0.3 VA/phase	UL/cUL Listed:	24V DC 8A General use
UL/cUL Listed:	Use listed or R/C (XODW2.8) current transformers	Relay 26 and 27:	36V DC 16A
Current overload:	4 x I _n continuously 20 x I _n 10 sec. (max. 75A) 80 x I _n 1 sec. (max. 300A)	UL/cUL Listed:	24V DC 16A General use
Magnetic pick-up input:	Voltage: 2-70 V peak Frequency: 10-10000 Hz Resistance: 250-3000 Ω	Mounting:	Panel mounted
Aux. supply: UL/cUL Listed:	6-36V DC continuously 9-32.5V DC 0V DC for 50 ms when coming from at least 12V DC (cranking dropout) Max. 25 W consumption With option L2 -40°C (-40°F) Max. 45 W consumption The aux. supply inputs are to be protected by a 12A slow-blow fuse	Front size:	312 x 219 mm (122.8 x 86.2 in)
		Display:	240 x 128 pixel backlight STN
		Safety:	To EN 61010-1, installation category (overvoltage category) III, 600 V, pollution degree 2 To UL508 and CSA22.2 No. 14-05 Installation category (overvoltage category) III, 600 V, pollution degree 2

Protection: Front: IP52/NEMA type 1
(IP66/NEMA type 1 with gasket, option L1)
Terminals: IP20/NEMA type 1
To IEC/EN 60529

EMC/CE: To EN 61000-6-1/2/3/4
IEC 60255-26
IEC 60533 power distr. zone
IACS UR E10 power distr. zone

Vibration: 3...13.2 Hz: 2 mm_{pp}
13.2...100 Hz: 0.7 g
To IEC 60068-2-6
To IACS UR E10

10...60 Hz: 0.15 mm_{pp}
60...150 Hz: 1 g
To IEC 60255-21-1 Response (class 2)

10...150 Hz: 2 g
To IEC 60255-21-1 Endurance (class 2)

Shock: 10 g, 11 msec, half sine
To IEC 60255-21-2 Response (class 2)

30 g, 11 msec, half sine
To IEC 60255-21-2 Endurance (class 2)

50 g, 11 msec, half sine
To IEC 60068-2-27

Bump: 20 g, 16 msec, half sine
To IEC 60255-21-2 (class 2)

Material: All plastic materials are self-extinguishing according to UL94 (V1)

Plug connections: AC voltage/current inputs:
3.5 mm² (13 AWG) multi-stranded

Other:
1.5 mm² (16 AWG) multi-stranded

Service port: USB A-B
TCP/IP: RJ 45

Tightening torque, min.: AC voltage input: 0.5 Nm (5-7 lb-in)
Other: 0.5 Nm (5-7 lb-in)

Weight: AGC 200: 1.6 kg (3.5 lbs)
Option J6: 0.2 kg (0.4 lbs)
AOP-2: 0.4 kg (0.9 lbs)

Response times:
(Delay set to minimum)

Busbar:
Over-/undervoltage: < 50 ms
Over-/underfrequency: < 50 ms

Generator:
Reverse power: <200 ms
Overcurrent: <200 ms
Short circuit: < 40 ms
Directional overcurrent: <100 ms
Over-/undervoltage: <200 ms
Over-/underfrequency: <300 ms
Overload: <200 ms
Current unbalance: <200 ms
Voltage unbalance: <200 ms
React. power import: <200 ms
React. power export: <200 ms
Negative sequence I: <400 ms
Negative sequence U: <400 ms
Zero sequence I: <400 ms
Zero sequence U: <400 ms
Overspeed: <400 ms
Digital inputs: <250 ms
Analogue input: <250 ms
Emergency stop: <200 ms
Earth current: <100 ms

Mains:
df/dt (ROCOF): <130 ms (4 periods)
Vector jump: < 40 ms
Positive sequence: < 60 ms

UL markings:

Wiring: Use 60/75°C copper conductors only

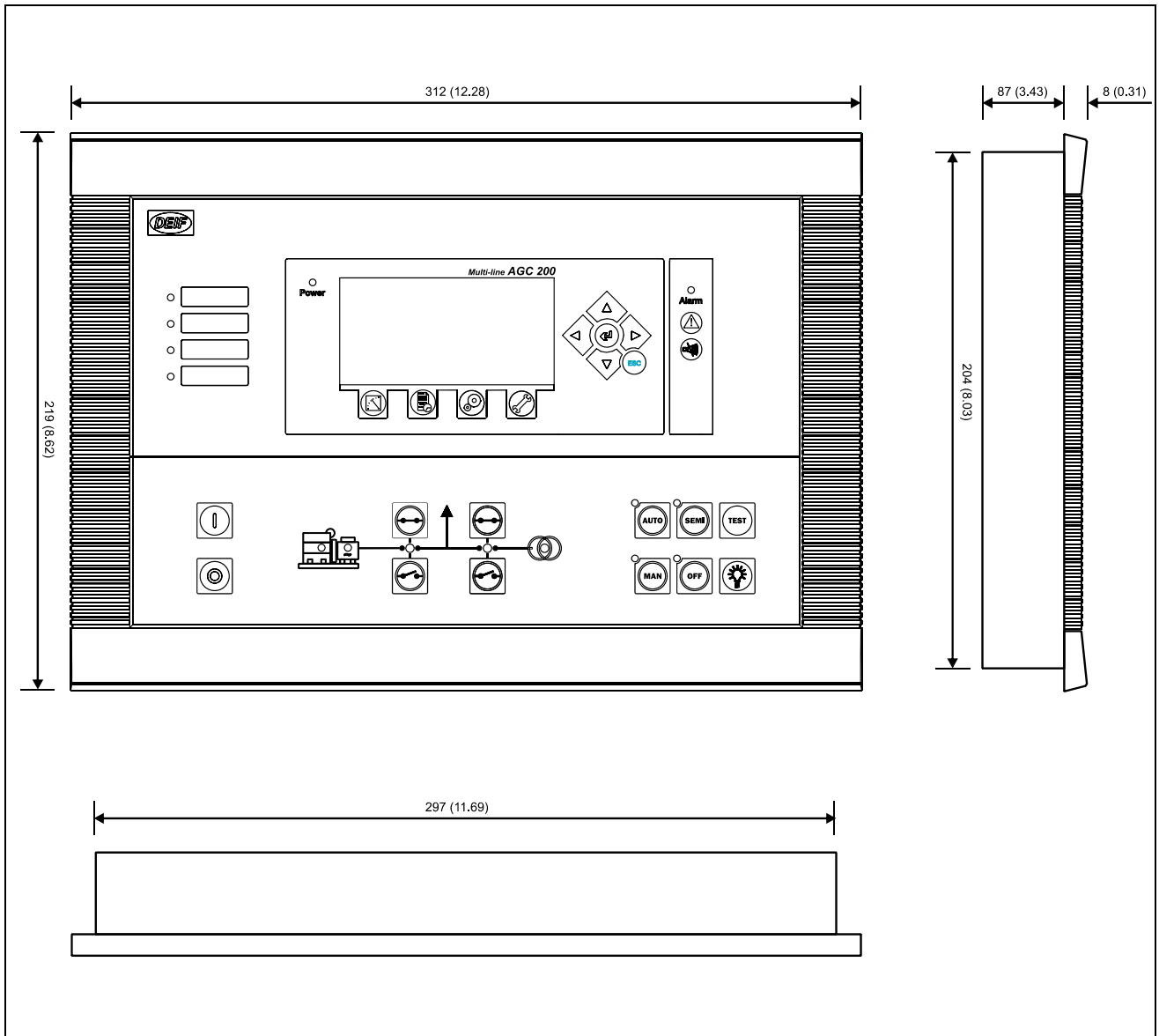
Wire size: AWG 30-12

Terminal tightening torque: 5-7 lb-in

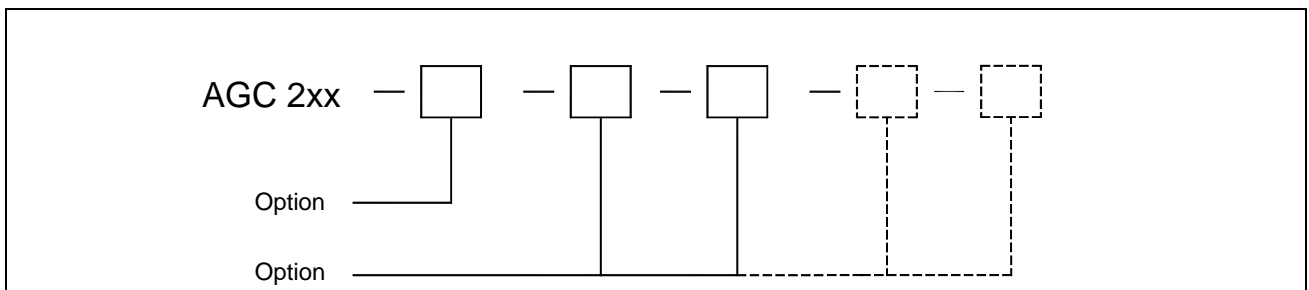
Mounting: For use on a flat surface of a type 1 enclosure

Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)

Unit dimensions in mm (inches)



Order specifications

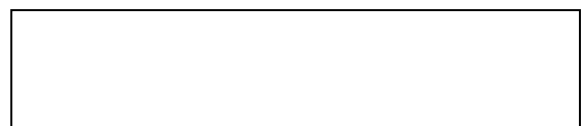


Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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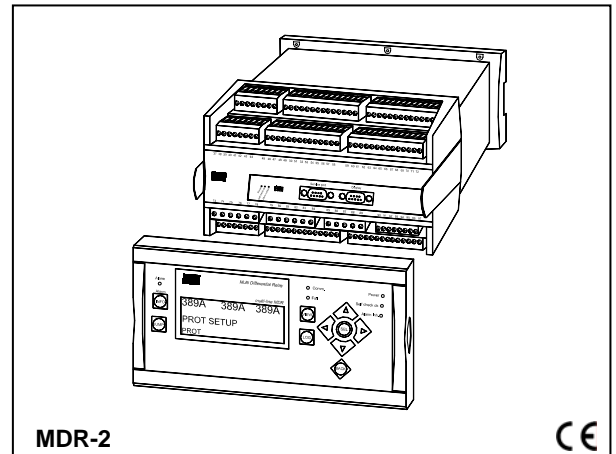


Type MDR-2

Multi differential protection relay multi-line 2

4921240275G

- **Relay for generators/electric motors**
- **3-phase AC measurements**
- **Dynamic compensation for ext. failures**
- **Short response time (50 ms)**
- **Display indicating all measurements**



Application

The MDR-2 differential protection relay is a micro-processor-based control unit containing all necessary functions for monitoring of the differential currents for a synchronous/asynchronous generator or motor (the object).

Via current transformers the MDR-2 measures each phase current on both sides of the object. The current transformers determine the limits of the protection area. Any failure within these limits (2- or 3-phase short circuits or earth leaks) will be detected as an error I_d : Differential currents, the currents flowing through the two current transformers of the phase in question differ, and, if a preset limit value is exceeded, a warning will be given or a tripping signal transmitted.

The MDR-2 dynamic compensation curves for warning and tripping are defined by the user.

Should an error occur outside the limits of the protection area, the MDR-2 will not transmit a tripping signal, as the above-mentioned phase currents are equal. In that way a selective protection is achieved.

Except for external measuring transformers the MDR-2 contains all necessary measuring circuits and presents all values on an LC display. Values and messages are presented in clear text (measuring values in engineering units).

The MDR-2 is a flexible and menu/PC programmed unit, enabling the user to easily adapt the unit to the object in question. The programming procedures are password protected.

Standard functions

The unit is designed for differential current protection of a 3-phase generator/motor.

Inputs and outputs:

- Inputs: - 6 currents via current transformers
- 2 binary control inputs
- Outputs: - 6 relay outputs
("SYSTEM OK", 5 configurable relays)

Generator protective functions:

- Differential current (3-phase) protection, with programmable dynamic compensation (pick-up curves)
- Warning: Programmable value and delay
- Trip: Programmable value and delay

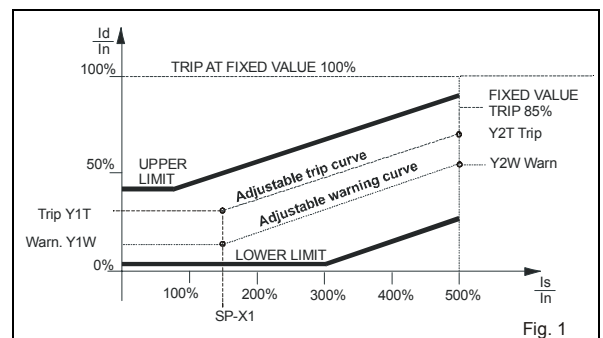


Fig. 1

A pick-up curve is shown in Fig. 1. The curves represent the warning and tripping values ($I_d/I_n=Y$), defined as the differential current (I_d) divided by the nominal generator/motor current (I_n) referring to the stabilisation current (I_s) divided by I_n ($I_s/I_n=X$).

The starting horizontal limit lines are placed according to the keyed in values of the points $P(X1, Y1T)$ and $P(X1, Y2T)$. These can be positioned anywhere within the marked area and must be decided according to the specifications of the plant in question.

For warning and tripping pick-up curves the following ranges are available:

- $I_d/I_n > 100\%$ Fixed tripping point
Independent of the stabilisation current
- $I_s/I_n > 500\%$ Fixed tripping ($I_d/I_n > 85\%$)
Fixed warning (Y2W)
- $I_s/I_n < 500\%$ Trip and warning programmable within "UPPER LIMIT" and "LOWER LIMIT" values and dependent on the I_s/I_n value

Type MDR-2

Display of values and texts:

- LEDs: Supervision, alarm
- Alarm and condition indication in clear text on LC display
- AC values (differential and actual currents for all 3 phases) on LC display

Acknowledgement of alarms:

- Automatic acknowledgement YES/NO (programmable)
- Remote acknowledgement via push button input
- Local acknowledgement via display front push button

Options

Overcurrent/short circuit protection (option C3):

- 2 x definite time or inverse time (curve with 6 programmable points) overcurrent protection (400% overcurrent max.)
- 1 x definite time short circuit protection (500% short circuit current max.)

Block differential current protection (option C4):

The block differential protection option protects a generator and a step-up transformer (a block) together.

The option handles the following:

- Step-up transformer ratio
- Different CT ratios on generator and on high voltage (HV) side of the step-up transformer
- Step-up transformer inrush current (2nd harmonic)
- Step-up transformer overexcitation current (5th harmonic)
- Step-up transformer phase angle shift from primary to secondary side. At present the following transformer couplings are supported:

- Dd 0, phase angle shift 0 deg.
- Dd 6, phase angle shift 180 deg.
- Dy 1, phase angle shift 30 deg.
- Dy 5, phase angle shift 150 deg.
- Dy 7, phase angle shift 210 deg.
- Dy 11, phase angle shift 330 deg.
- Yd 1, phase angle shift 30 deg.
- Yd11, phase angle shift 330 deg.

Cables (option J):

- J1: Display cable, 3m
- J2: Display cable, 6m
- J3: Serial interface cable for PC utility software
- J6: Display cable, 1m

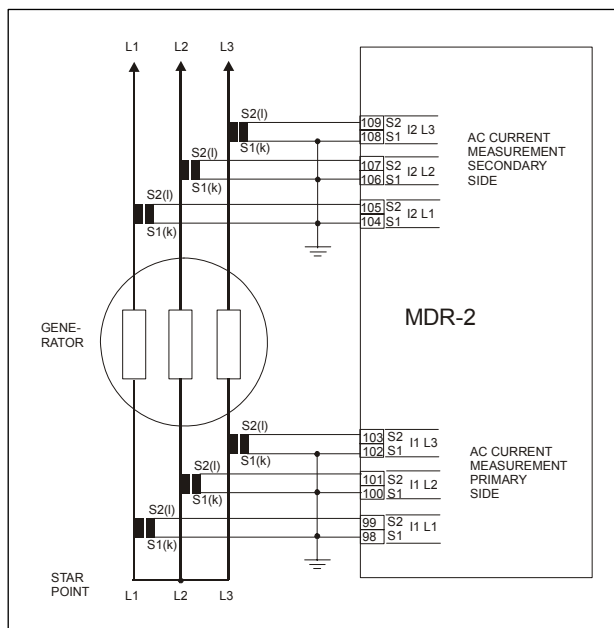
Documentation (option K):

- K1: Designer's Reference Handbook (hard copy)
- K2: CD-ROM with complete documentation

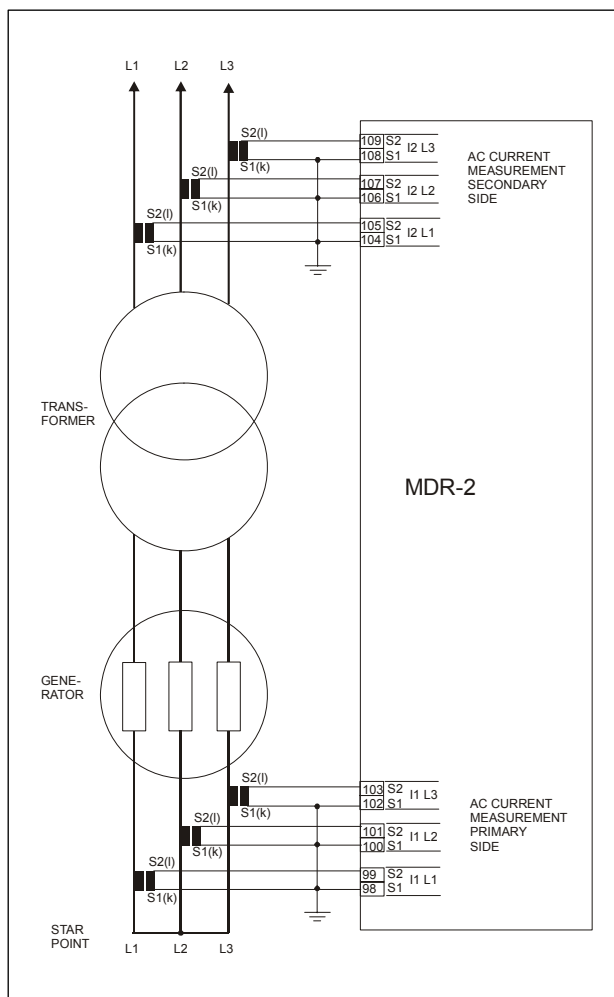
Display gasket (option L):

Rubber gasket makes display protection IP54 (standard IP52)

Principle diagram



Principle diagram, option C4



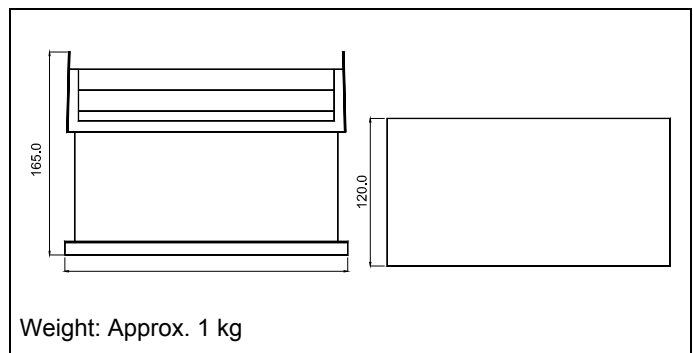
Type MDR-2

Technical specifications

Accuracy:	$0.1 \times I_N < I < I_N$: 1% of I_N $I_N < I$: 1% of I ($I_N = 1A$ or $5A$, $I =$ measured value)
Operating temp.:	-25...70°C (-13...158°F) (UL/cUL Listed: Max. surrounding air temp.: 55°C/131°F)
Climate:	Class HSE, to DIN 40040
Meas. frequency:	30...70Hz (nominal 50Hz or 60Hz)
Aux. supply:	12/24V DC -25/+30%, max. 8W The aux. supply inputs are to be protected by a 2A slow blow fuse (UL/cUL Listed: AWG 24)
Binary inputs:	Input voltage: 6...32V DC (bi-directional) Input impedance: Max. 2.4 kΩ
Meas. current:	-1A or -5A (option C4 -1A only) (UL/cUL Listed: From CTs 1-5A) Consumption: Max. 0.3VA per phase
Overcurrent:	4 x I_N , continuously 20 x I_N , 10 sec. (max. 75A) 80 x I_N , 1 sec. (max. 300A)
Response times:	Differential current: 50 ms Block diff. current (option): 120 ms Overcurrent (option): 70 ms Short circuit (option): 50 ms Response times are measured from end of period of measured current cycle
Relay outputs:	Contact rating: 5A/250V AC ("Status": 1A) (UL/cUL Listed: 250V AC/24V DC, 2A resistive load)
Safety:	To EN 61010-1. Installation cat. III, 600V. Pollution degree 2 To UL 508 and CSA 22.2 no. 14-05, overvoltage category III, 300V, pollution degree 2
Galv. separation:	Between AC inputs and others: 3250V AC – 50Hz – 1 min.
EMC/CE:	To EN 61000-1/2/3/4 and IEC 255-3
Connections:	Current: Max. 4 mm ² (multi-stranded) 6 mm ² (single-stranded) (UL/cUL Listed: AWG28-10) Tightening torque: 0.5-0.6 Nm (4.4-5.3 lb-in)

Connections:	Others: Max. 2.5 mm ² (multi-stranded) (UL/cUL Listed: AWG28-12) Tightening torque: 0.5-0.6 Nm (4.4-5.3 lb-in) Display: 9-pin SUB-D (female) Service port: 9-pin SUB-D (male)
Protection:	Terminals: IP20 Display front: IP52 (IP54 with gasket) (UL/cUL Listed: Type Complete Device, Open Type) According to IEC 529 and EN 60529
Material:	All plastic parts are self-extinguishing to UL 94 (V1)
Approval:	The MDR-2 is approved by the major classification societies. Contact DEIF for details UL and cUL
UL markings:	Wiring: Use 60/75°C copper conductors only Mounting: For use on a flat surface of type 1 enclosure Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)

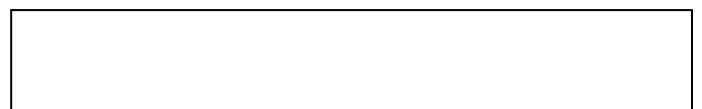
Dimensions



Order specifications

Type – Option – Option
Example: MDR-2 – J1

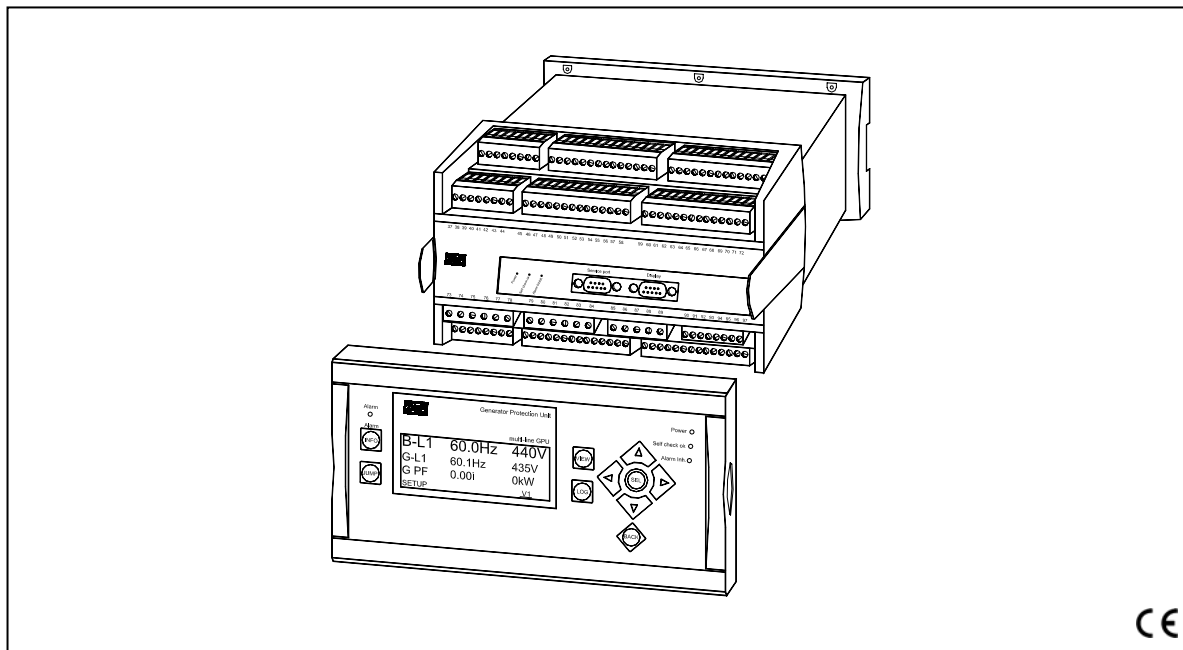
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Standard functions

Applications

- Generator protection

Functions

- 2 sets of alarm set points
- Alarm inhibit, automatic
- Horn relay
- Language selection
- kWh/kVArh outputs

Protections (ANSI)

- Reverse power (32)
- Overcurrent, 2 levels (51)
- Overcurrent, inverse, 1 level (51)

Display

- Separate mounting
- Easy to read
- Password-protected setup
- Configurable views
- Alarm list
- Event log (150 events)

Measuring system

- 3-phase true RMS
- Galvanically isolated voltage and current inputs
- -/1 or -/5A AC
- 100-25000V AC

GSM communication

- SMS messages at all alarms
- Dial up from PC utility software to control unit

Approvals

- Major marine societies
- Netmanagement
- TÜV Nord
- GOST-R
- UL

Application

The GPU generator protection unit is a compact microprocessor-based protection unit containing all functions necessary to protect a synchronous/asynchronous generator. It contains all necessary galvanically separated 3-phase measuring circuits.

The GPU is intended to be used on land-based applications as well as marine applications.

i Netmanagement and TÜV software must be specified upon ordering.

Display unit

The display unit is separate and can be installed directly on the main unit or in the front of the switchboard door (requires option J# - display cable).

The display unit shows all measured and calculated values as well as alarms and data from the event log.

The displayed values can be configured freely in order to match the customer or application specific requirements.

Self-test

The GPU automatically carries out a cyclical self-test at start-up. If any errors are found, they will be displayed in clear text in the display and indicated with a relay output.

Setup

Setup is easily done via a menu structure in the display (password-protected) or via the RS232 PC connection and the multi-line 2 Windows® based PC utility software. The PC utility software can be downloaded free of charge from www.deif.com. The utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates.

Options

In order to perfectly match the product solution to specific applications, the functionality of the GPU can be equipped with a number of available options. The options selected by the customer will be integrated in the standard GPU, thus securing the same user interface unaffected by whether the application needs a highly complex or a more basic generator controller.

Synchronising option

The GPU can be used for synchronising a circuit breaker. The speed and voltage set point is controlled by the GPU through relay outputs.

The GPU is only used as synchroniser. After the synchronising, the regulation is switched off but the protection is still active.

i AVR control requires option D2.

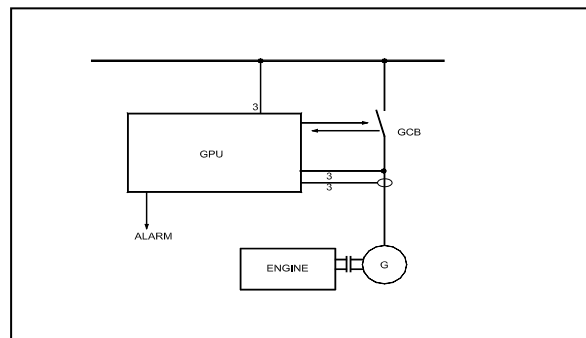
Approvals

The GPU is approved by the following societies and companies:

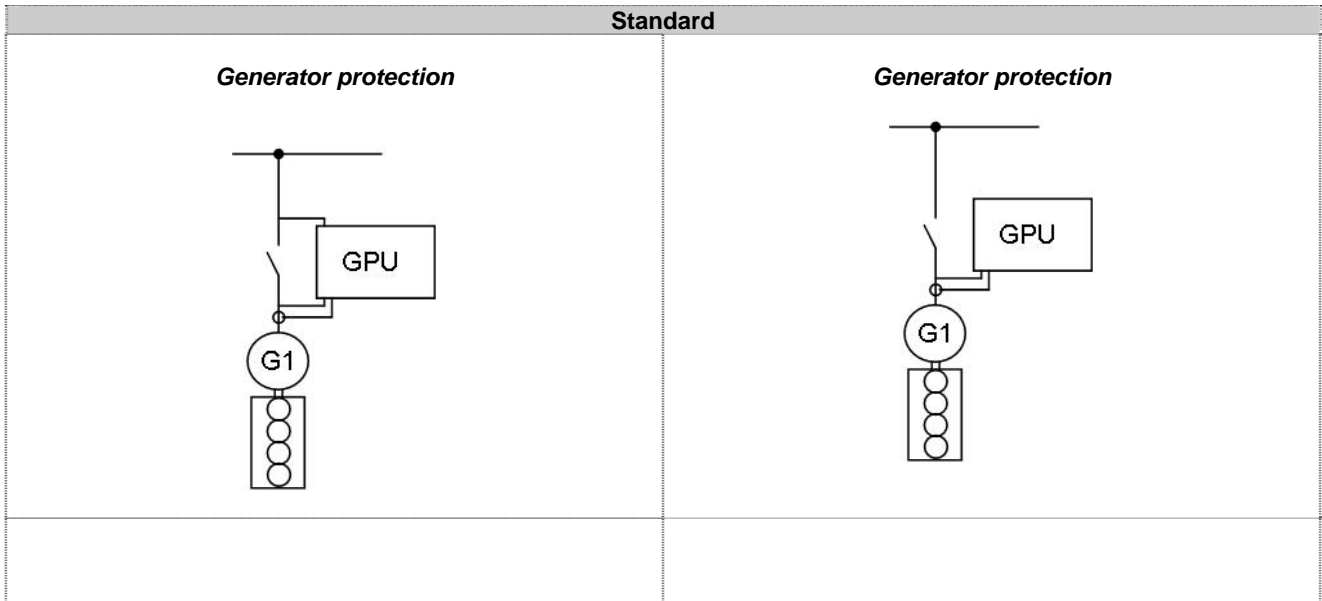
Marine	Land	Other
ABS		GOST-R
BV	Netmanagement	UL
DNV	TÜV Nord	
GL		
LR		
RINA		
RS		

i Please refer to www.deif.com for details and certificates.

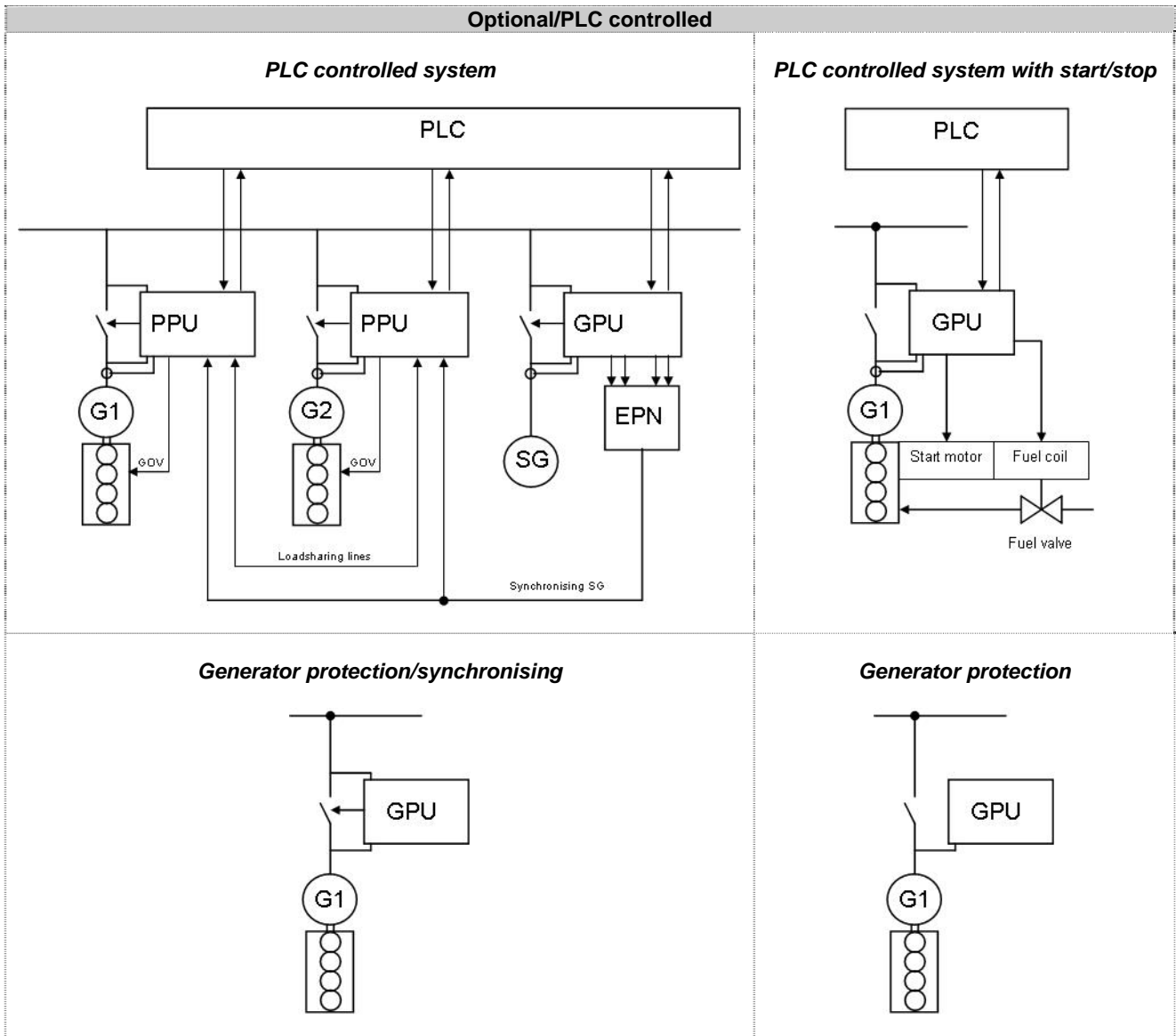
Principle diagram



Single line application diagrams



i Overcurrent and reverse power alarms are standard.



i The GPU can be used in simple or complex applications. The above shows very simple applications only.

Available options



Please notice that not all options can be selected for the same unit. Please refer to page 8 in this data sheet for further information about the location of the options in the unit.

Option	Description	Type	Note
A	Loss of mains protection package		
A1	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81) Vector jump (78) df/dt (ROCOF) (81)	Software option	
A2	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81) df/dt (ROCOF) (81)	Software option	
A3	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81) Vector jump (78)	Software option	
B	Generator/busbar/mains protection package		
B1	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81)	Software option	
C	Generator add-on protection package		
C1	Over- and undervoltage (generator) (27/59) Over- and underfrequency (generator) (81) Overload (32) Fast overcurrent (<42 ms, 350%, 2 levels) (50) Current unbalance (46) Voltage asymmetry (47) Reactive power import (excitation loss) (40) Reactive power export (overexcitation) (40)	Software option	
C2	Negative sequence voltage high (47) Negative sequence current high (46) Zero sequence voltage high (59) Zero sequence current high (50)	Software option	
D	Voltage control		
D2	Constant voltage control (stand-alone)	Software option	Requires option G2
F	Analogue transducer outputs		
F1	2 transducer outputs, 0-20mA or 4-20mA	Hardware option	Refer to page 7
F2	4 transducer outputs, 0-20mA or 4-20mA	Hardware option	Refer to page 7
G	Start/stop/synchronisation outputs		
G1	2 x relay outputs for starting and stopping of other generators (programmable)	Hardware option	Refer to page 7
G2	Synchronisation with relay speed governor outputs	Hardware option	Refer to page 7 Not with M1/M2
H	Serial communication		
H1	CAN-open	Hardware option	Refer to page 7
H2	Modbus RTU	Hardware option	Refer to page 7
H3	Profibus DP	Hardware option	Refer to page 7
H4	CAT CCM	Hardware option	Refer to page 7
H5	CAN bus (J1939 + MTU) engine communication for MTU MDEC Detroit Diesel DDEC Deutz EMR John Deere JDEC Volvo Penta D12AUX	Hardware option	Refer to page 7
H6	Cummins GCS or ECM	Hardware option	Refer to page 7
J	Cables		
J1	Display cable with plugs, 3 m. UL94 (V1) approved	Other	
J2	Display cable with plugs, 6 m. UL94 (V1) approved	Other	
J3	PC cable for utility software (RS232). UL94 (V1) approved	Other	
J6	Display cable with plugs, 1 m. UL94 (V1) approved	Other	
K	Documentation		
K1	Designer's Reference Handbook (hard copy)	Other	
K2	CD-ROM with complete documentation	Other	

Option	Description	Type	Note
L	Display gasket for IP54	Other	Standard is IP52
M	Configurable engine control cards		
M1	Engine control card with PT100 sensor inputs 4 x 4-20mA inputs 2 x PT100 inputs 1 x tachometer input (magnetic pick-up) 5 x binary inputs 3 x relay outputs	Hardware option	Refer to page 7 Engine start/stop logic can be switched ON/OFF Not with G2
M2	Engine control card with VDO sensor inputs 3 x 4-20mA inputs 3 x VDO (resistor) inputs 1 x tachometer input (magnetic pick-up) 9 x binary inputs 3 x relay outputs	Hardware option	Refer to page 7 Engine start/stop logic can be switched ON/OFF Not with G2
M	Configurable I/O extension cards		
M13	7 binary inputs, configurable	Hardware option	Refer to page 7
M14	4 relay outputs	Hardware option	Refer to page 7
M15	4 analogue inputs, configurable, 4-20mA	Hardware option	Refer to page 7
Z	Generator nominal power		
Z1	Generator nominal power >20MW	Software option	

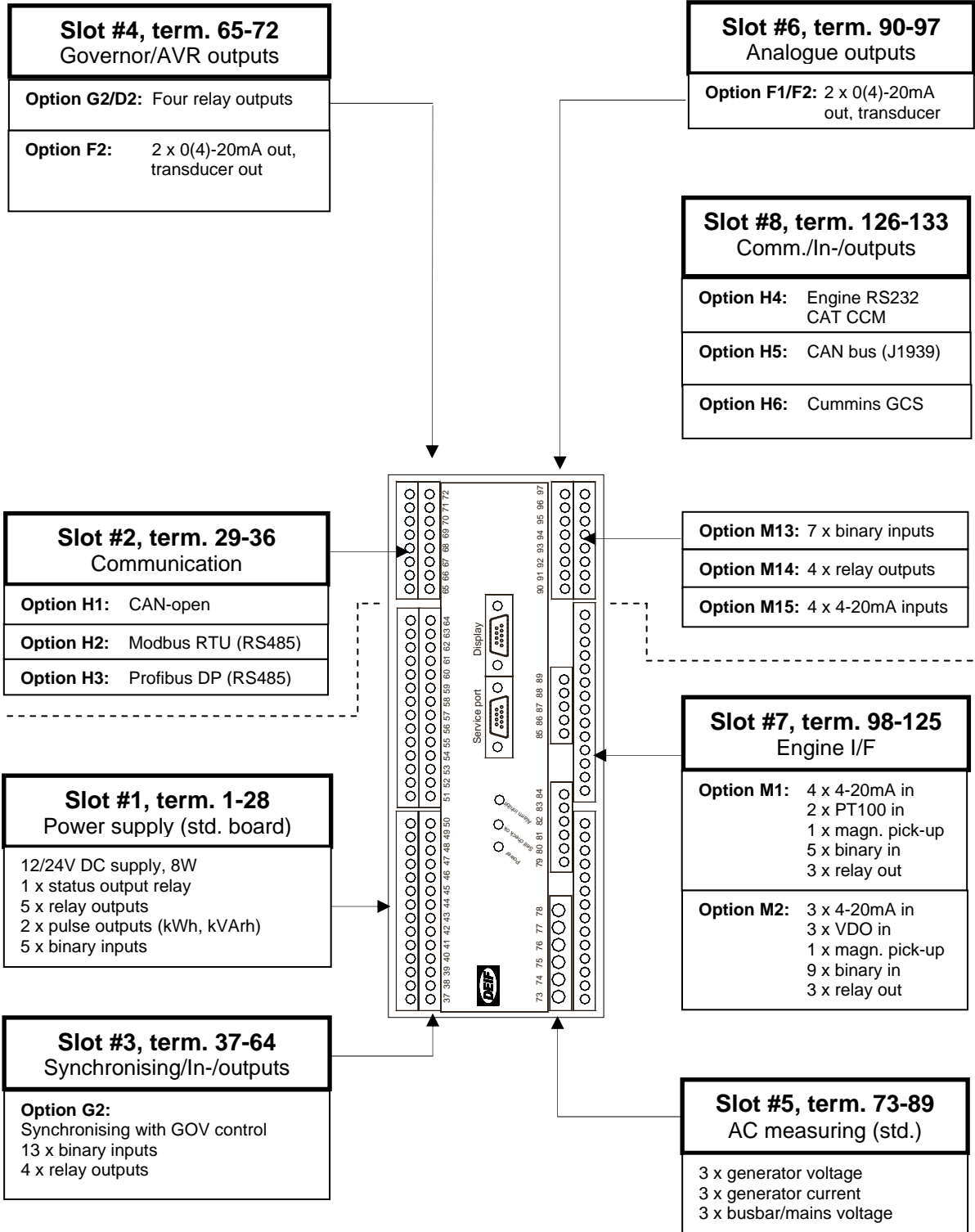
(ANSI# as per IEEE Std C37.2-1996 (R2001) in parenthesis).

Hardware overview



Each slot can hold no more than one hardware option. For instance, it is not possible to select option H2 and option H3 at the same time because both options require a PCB in slot #2.

Apart from the hardware options shown on this page, it is possible to select the software options mentioned on page 5 in this data sheet. Options A, B, C and D are software options.



Technical specifications

Accuracy:	Class 1.0 Class 2.0 for neg. seq. current To IEC/EN 60688	Analogue inputs:	4-20mA: Impedance max. 50Ω, not galvanically separated PT100: According to IEC/EN 60751 VDO: Resistor inputs, internal supply max. 480Ω
Operating temp.:	-25-70°C (-13-158°F) (UL/cUL Listed: Max. surround- ing air temp.: 55°C/131°F)	Mounting:	DIN-rail mount or base mount with 6 screws (Base mounting in marine applications)
Storage temp.:	-40-70°C (-40-158°F)	Climate:	97% RH to IEC 60068-2-30
Galvanic separation:	Between AC voltage, AC current and other I/Os: 3250V AC, 50Hz, 1 min. Between analogue outputs and other I/Os: 500V DC, 1 min. Between binary input groups and other I/Os: 500V DC, 1 min.	Analogue outputs:	0(4)-20mA Galvanically separated Active output (internal supply) Load max. 500Ω (UL/cUL Listed: Max. 20mA output)
Meas. voltage:	100-690V AC +/-20% (UL/cUL Listed: 110-480V AC phase-phase)	Safety:	To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2 To UL 508 and CSA 22.2 no. 14- 05, overvoltage category III, 300V, pollution degree 2
Consumption:	Max. 0.25VA/phase	Protection:	Unit: IP20 Display: IP52 (IP54 with gasket: Option L) (UL/cUL Listed: Type Complete Device, Open Type) To IEC/EN 60529
Meas. current:	-/1 or -/5A AC (UL/cUL Listed: From CTs 1-5A)	EMC/CE:	To EN 61000-6-1/2/3/4 IEC 60255-26 IEC 60533 power distr. zone IACS UR E10 power distr. zone
Consumption:	Max. 0.3VA/phase	Vibration:	3...13.2Hz: 2mmpp 13.2...100Hz: 0.7g To IEC 60068-2-6 & IACS UR E10 10...60Hz: 0.15mmpp 60...150Hz: 1g To IEC 60255-21-1 Response (class2) 10...150Hz: 2g To IEC 60255-21-1 Endurance (class2)
Current overload:	4 x I _n continuously 20 x I _n , 10 sec. (max. 75A) 80 x I _n , 1 sec. (max. 300A)		
Meas. frequency:	30-70Hz		
Aux. supply:	12/24V DC (8-36V continuously, 6V 1 sec.) Max. 8W consumption The aux. supply inputs are to be protected by a 2A slow blow fuse Recommended power supply is DEIF's DCP-2 (UL/cUL Listed: AWG 24)		
Binary inputs:	Optocoupler, bi-directional ON: Input voltage 8-36V DC Impedance typically 4.7kΩ OFF: <2V DC		
Relay outputs:	250V AC/24V DC, 5A (Unit status output: 1A) (UL/cUL Listed: 250V AC/24V DC, 2A resistive load)		

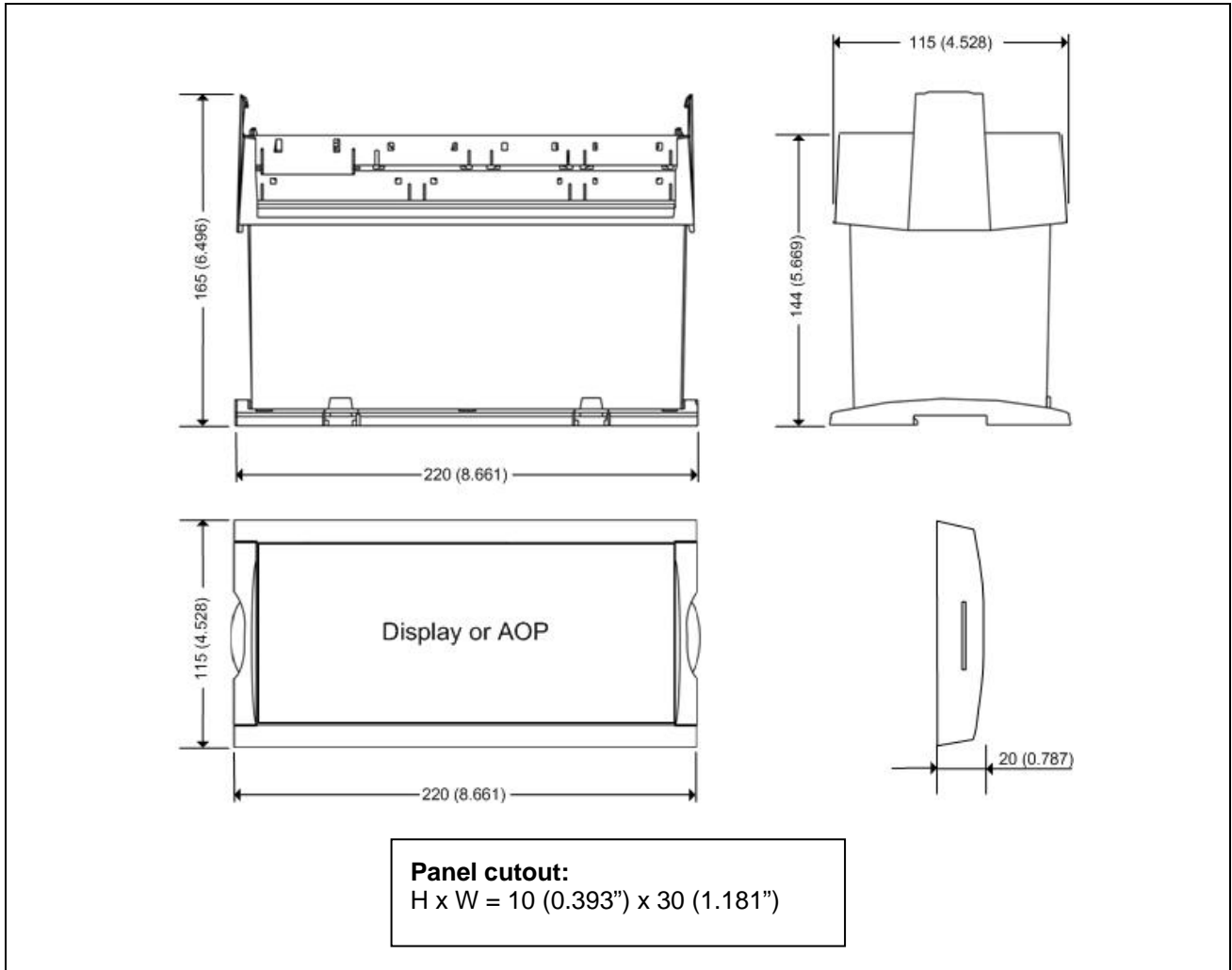
Data sheet

Generator Protection Unit

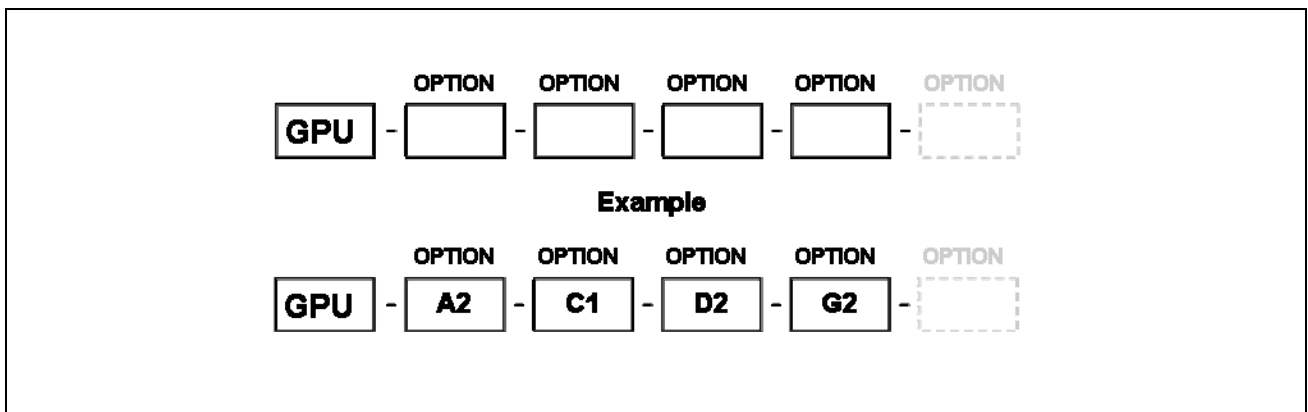
Shock (base mount):	10g, 11msec, half sine To IEC 60255-21-2 Response (class2) 30g, 11msec, half sine To IEC 60255-21-2 Endurance (class2) 50g, 11msec, half sine To IEC 60068-2-27
Bump:	20g, 16msec, half sine To IEC 60255-21-2 (class2)
Material:	All plastic materials are self-extinguishing according to UL94 (V1)
Plug connections:	AC current: 4.0 mm ² multi stranded (UL/cUL Listed: AWG28-10) Tightening torque: 0.5-0.6 Nm (4.4-5.3 lb-in) Other: 2.5 mm ² multi stranded (UL/cUL Listed: AWG28-12) Tightening torque: 0.5-0.6 Nm (4.4-5.3 lb-in) (UL/cUL Listed: AWG20) Display: 9-pole Sub-D female PC: 9-pole Sub-D male
Governors:	Multi-line 2 interfaces to all governors, including GAC, Barber-Colman, Woodward and Cummins See interfacing guide at www.deif.com

Open collector outputs:	Supply 8-36V DC, max. 10mA
Weight:	Main unit: 1.6 kg (3.5 lbs.) Option J1/J3: 0.2 kg (0.4 lbs.) Option J2: 0.4 kg (0.9 lbs.)
Approval:	The GPU is approved by the major classification societies Contact DEIF for details UL/cUL Listed to UL508
UL markings:	Wiring: Use 60/75°C copper conductors only Mounting: For use on a flat surface of type 1 enclosure Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)
Response times:	<i>Busbar 1 and 2:</i> Over-/undervoltage <50 ms Over-/underfrequency <50 ms <i>Generator:</i> Over-/undervoltage 70-300 ms Over-/underfrequency 70-300 ms Current: 100-300 ms Rocof: 100 ms (4 periods) Vector jump: 30 ms Fast overcurrent: <42 ms

Unit dimensions in mm (inches)



Order specifications



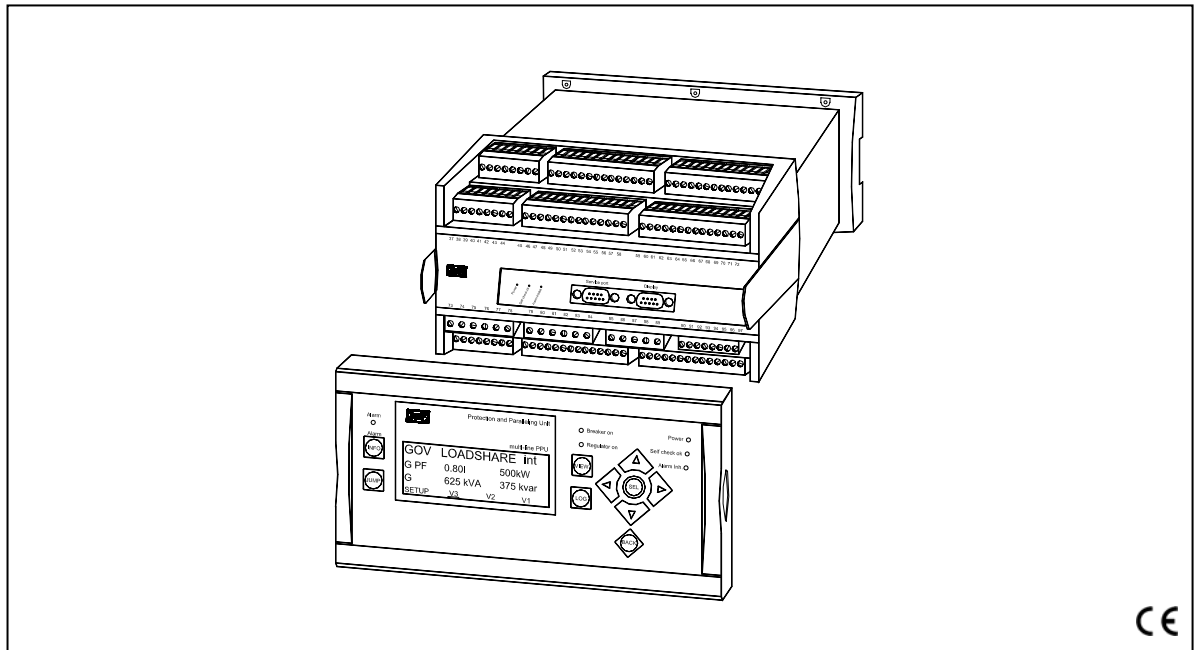
Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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Standard functions

Applications

- Stand-alone
- Parallel with other gen-sets
- Parallel with the mains

Control functions

- Synchronising
- Power and frequency controls

Operation modes

- Fixed frequency
- Fixed power (base load)
- Droop
- Load sharing

Protections (ANSI)

- Reverse power (32)
- Overcurrent, 2 levels (51)
- Overcurrent, inverse, 1 level (51)

Display

- Separate mounting
- Status texts
- Easy to read
- Programming

Measuring system

- 3-phase true RMS
- Galvanically isolated voltage and current inputs

General

- Free PC utility software for commissioning
- Additional functions and I/Os available

Approvals

- Marine approved

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Data sheet

Application

The Paralleling and Protection Unit (PPU) is a compact *all in one* microprocessor-based control unit containing all necessary functions for protection and control of a synchronous/asynchronous generator. It contains all necessary galvanically separated 3-phase measuring circuits.

The PPU is intended for land- or marine-based applications. It is designed for the following applications (can be combined):

1. Stand-alone
2. Parallel with other generators
3. Parallel with the mains

The PPU can synchronise the generator and after synchronisation carry out all necessary generator control and protective functions. It is well-suited for PLC-controlled systems and the interfacing can be done via binary and analogue I/Os or via (optional) serial communication.

Display unit

The display unit is separate and can be installed directly on the main unit or in the front of the switchboard door (requires option J# - display cable).

The display unit shows all measured and calculated values as well as alarms and data from the event log.

The displayed values can be configured freely in order to match the customer or application specific requirements.

Operation modes

Four different operation modes can easily be selected through digital inputs on the standard PPU, and the governor will be controlled accordingly:

1. Fixed frequency
2. Fixed power (base load)
3. Droop
4. Load sharing

If the automatic voltage regulator is controlled by the PPU (optional), the standard operation modes are extended with:

1. Fixed voltage
2. Fixed VAr
3. Fixed power factor
4. VAr sharing



AVR control requires option D1.

Self-test

The PPU automatically carries out a cyclical self-test at start-up. If any errors are found, they will be displayed in clear text in the display and indicated with a relay output.

Protection and Paralleling Unit

Setup

Setup is easily done via a menu structure in the display (password-protected) or via the RS232 PC connection and the multi-line 2 Windows® based PC utility software. The PC utility software can be downloaded free of charge from www.deif.com. The utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates.

Options

In order to perfectly match the product solution to specific applications, the functionality of the PPU can be equipped with a number of available options. The options selected by the customer will be integrated in the standard PPU, thus securing the same user interface unaffected by whether the application needs a highly complex or a more basic generator controller.

Approvals

The PPU is approved by the following societies:

Marine	Other
ABS	GOST-R
BV	UL
DNV	TÜV Nord
GL	
LR	
RINA	
RS	

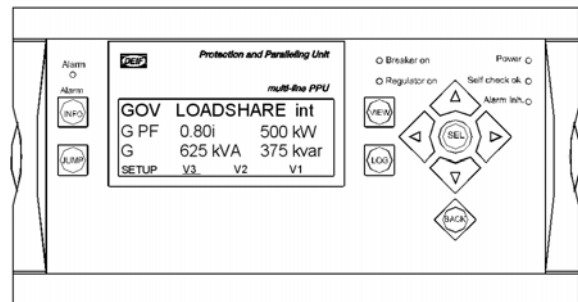


Please refer to www.deif.com for details and certificates.

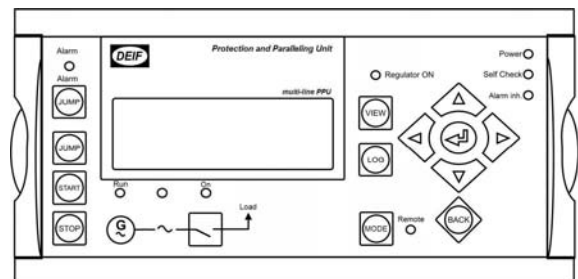
Display variants

Two display variants are available for the PPU. The display selection is depending on option M20.

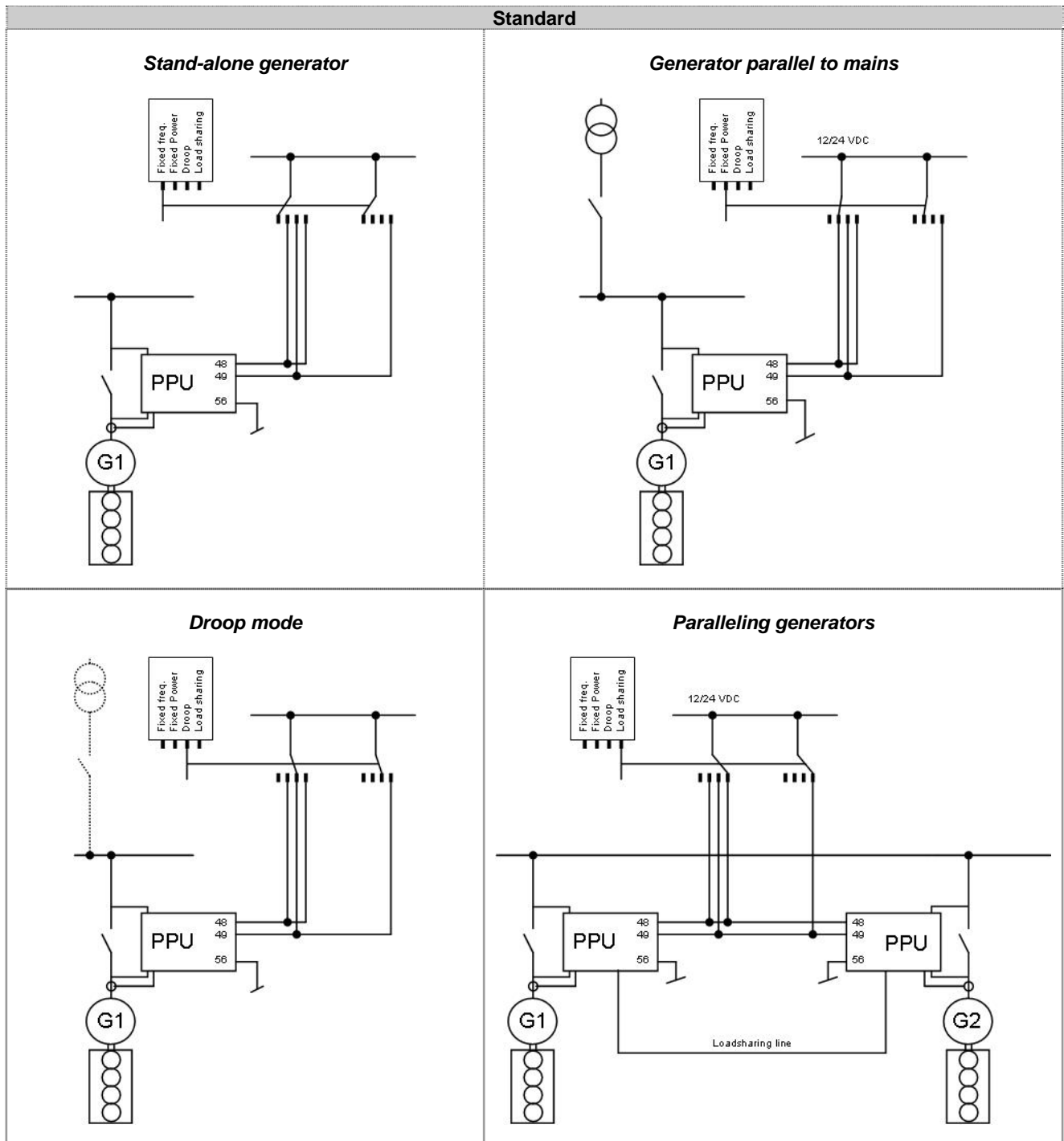
Standard delivery



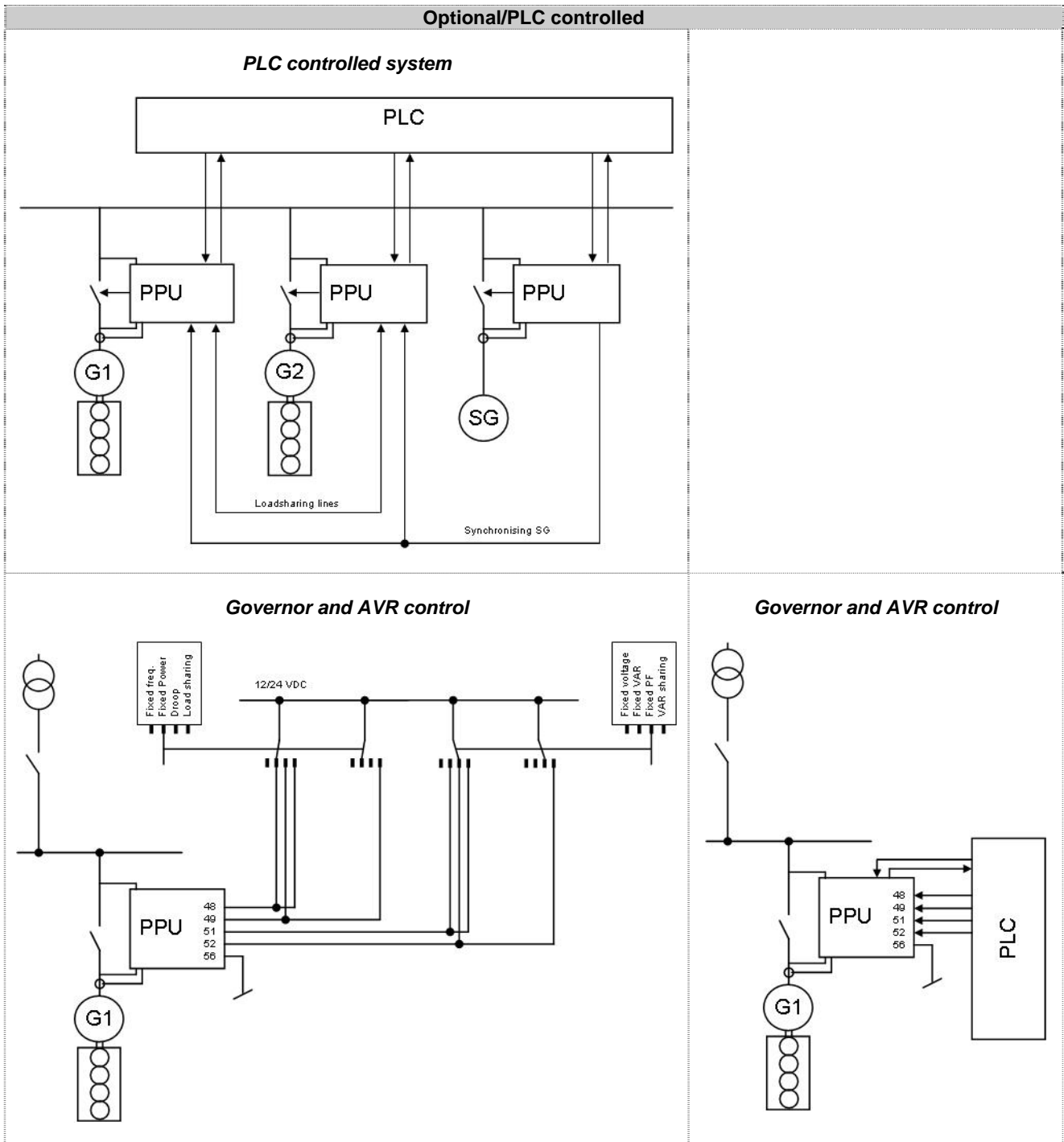
Engine and GB control (M20)



Single line application diagrams



The illustrations show that the operating modes are selected on the terminals 48 and 49 or a combination of those terminals.



i The PPU can be used in simple or complex applications. The above shows very simple applications only, but due to the flexible mode selection, the PPU can be used in all applications.

The PPU is also designed to work with the uni-line components such as the FAS (Full Automatic Synchroniser), should this be preferred.

Available options



Please notice that not all options can be selected for the same unit. Please refer to page 8 in this data sheet for further information about the location of the options in the unit.

Option	Description	Type	Note
A	Loss of mains protection package		
A1	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81) Vector jump (78) df/dt (ROCOF) (81)	Software option	
A2	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81) df/dt (ROCOF) (81)	Software option	
A3	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81) Vector jump (78)	Software option	
B	Generator/busbar/mains protection package		
B1	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81)	Software option	
C	Generator add-on protection package		
C1	Over- and undervoltage (generator) (27/59) Over- and underfrequency (generator) (81) Overload (32) Fast overcurrent (<42 ms, 350%, 2 levels) (50) Current unbalance (46) Voltage asymmetry (47) Reactive power import (excitation loss) (40) Reactive power export (overexcitation) (40)	Software option	
C2	Negative sequence voltage high (47) Negative sequence current high (46) Zero sequence voltage high (59) Zero sequence current high (50)	Software option	
D	Voltage/VAr/PF control		
D1	Selection between: Constant voltage control (stand-alone) Constant reactive power control (parallel with mains) Constant power factor control (parallel with mains) Reactive load sharing (island paralleling with other generators)	Software option	Not with EF2
E	Analogue controller outputs		
E1	+/-20mA for speed governor +/-20mA for AVR	Hardware option	AVR output is available if D1 is selected Refer to page 7
EF	Combination outputs		
EF2	+/-20mA for speed governor 1 x 0(4)-20mA transducer output	Hardware option	Refer to page 7
EF3	1 x PWM (Pulse Width Modulated) output for CAT speed governor 1 x PWM (Pulse Width Modulated) output for droop +/-20mA for speed governor or AVR 2 x relay outputs for speed governor or AVR	Hardware option	Refer to page 7
EF4	+/-20mA for speed governor or AVR 2 x relay outputs for speed governor or AVR	Hardware option	Refer to page 7
EF5	1 x PWM (Pulse Width Modulated) output for CAT speed governor +/-20mA for speed governor or AVR 2 x relay outputs for speed governor or AVR	Hardware option	Refer to page 7
F	Analogue transducer outputs		
F1	2 transducer outputs, 0-20mA or 4-20mA	Hardware option	Refer to page 7
H	Serial communication		
H1	CAN-open	Hardware option	Refer to page 7
H2	Modbus RTU	Hardware option	Refer to page 7
H3	Profibus DP	Hardware option	Refer to page 7
H4	CAT CCM	Hardware option	Refer to page 7

Option	Description	Type	Note
H5	CAN bus (J1939 + MTU) engine communication for MTU MDEC Detroit Diesel DDEC Deutz EMR John Deere JDEC Volvo Penta D12AUX	Hardware option	Refer to page 7
H6	Cummins GCS or ECM	Hardware option	Refer to page 7
J	Cables		
J1	Display cable with plugs, 3 m. UL94 (V1) approved	Other	
J2	Display cable with plugs, 6 m. UL94 (V1) approved	Other	
J3	PC cable for utility software (RS232). UL94 (V1) approved	Other	
J6	Display cable with plugs, 1 m. UL94 (V1) approved	Other	
K	Documentation		
K1	Designer's Reference Handbook (hard copy)	Other	
K2	CD-ROM with complete documentation	Other	
L	Display gasket for IP54	Other	Standard is IP52
M	Configurable engine control cards		
M1	Engine control card with PT100 sensor inputs 4 x 4-20mA inputs 2 x PT100 inputs 1 x tachometer input (magnetic pick-up) 5 x binary inputs 3 x relay outputs	Hardware option	Refer to page 7 Engine start/stop logic can be switched ON/OFF
M2	Engine control card with VDO sensor inputs 3 x 4-20mA inputs 3 x VDO (resistor) inputs 1 x tachometer input (magnetic pick-up) 9 x binary inputs 3 x relay outputs	Hardware option	Refer to page 7 Engine start/stop logic can be switched ON/OFF
M	Configurable I/O extension cards		
M13	7 binary inputs, configurable	Hardware option	Refer to page 7
M14	4 relay outputs	Hardware option	Refer to page 7
M15	4 analogue inputs, configurable, 4-20mA	Hardware option	Refer to page 7
M20	Display layout with engine and GB control (engine logic ON)	Other	Requires M1 or M2
Z	Generator nominal power		
Z1	Generator nominal power >20MW	Software option	

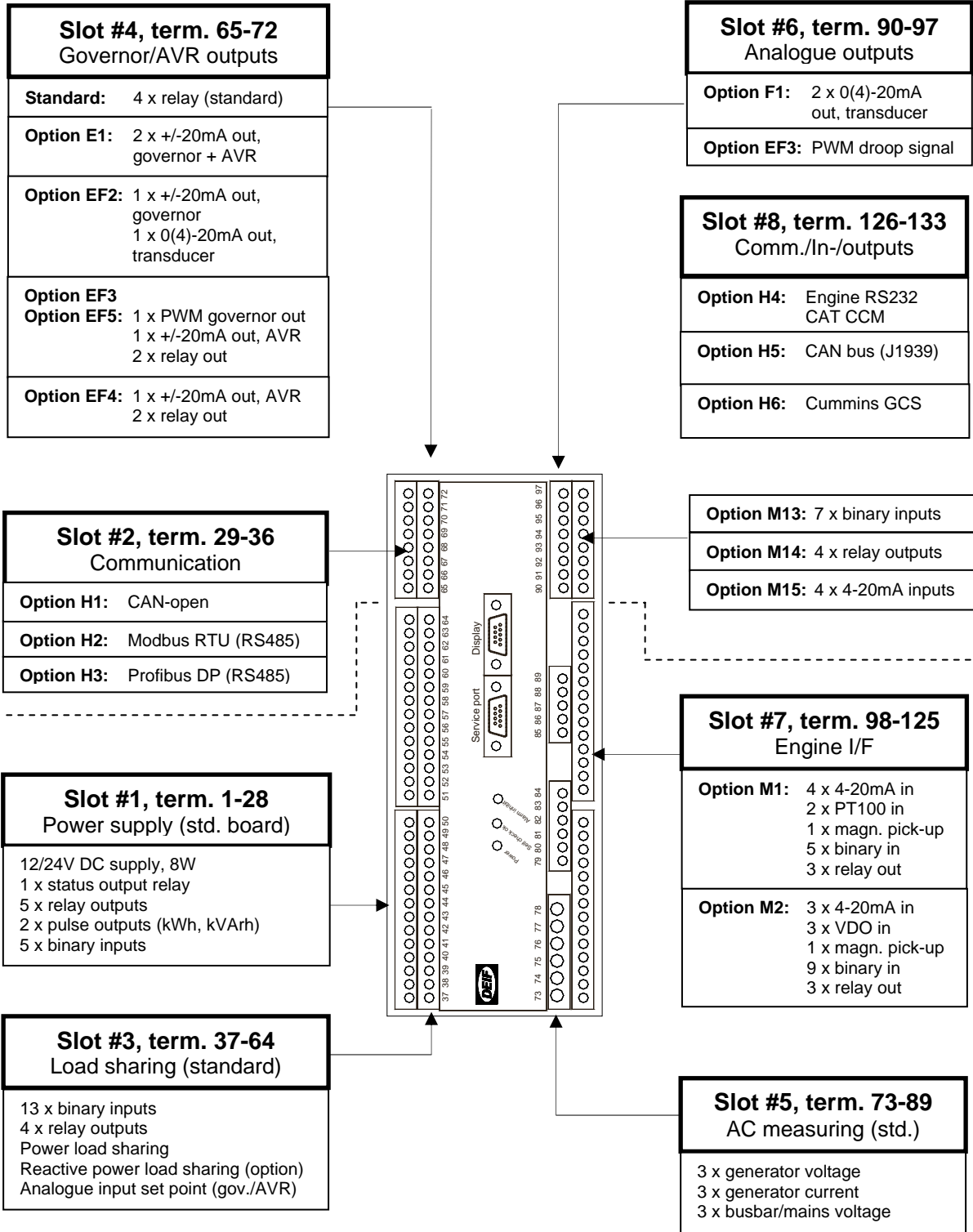
(ANSI# as per IEEE Std C37.2-1996 (R2001) in parenthesis).

Hardware overview



Each slot can hold no more than one hardware option. For instance, it is not possible to select option H2 and option H3 at the same time because both options require a PCB in slot #2.

Apart from the hardware options shown on this page, it is possible to select the software options mentioned on page 5 in this data sheet. Options A, B, C and D are software options.



Technical specifications

Accuracy:	Class 1.0 Class 2.0 for neg. seq. current To IEC/EN 60688	(UL/cUL Listed: 250V AC/24V DC, 2A resistive load)
Operating temp.:	-25-70°C (-13-158°F) (UL/cUL Listed: Max. surrounding air temp.: 55°C/131°F)	Analogue inputs: -10/+10V DC Not galvanically separated Impedance 100kΩ 4-20mA: Impedance max. 50Ω, not galvanically separated
Storage temp.:	-40-70°C (-40-158°F)	PT100: According to IEC/EN 60751
Galvanic separation:	Between AC voltage, AC current and other I/Os: 3250V AC, 50Hz, 1 min. Between analogue outputs and other I/Os: 500V DC, 1 min. Between binary input groups and other I/Os: 500V DC, 1 min.	VDO: Resistor inputs, internal supply max. 480Ω
Meas. voltage:	100-690V AC +/-20% (UL/cUL Listed: 110-480V AC phase-phase)	Mounting: DIN-rail mount or base mount with 6 screws (Base mounting in marine applications)
Consumption:	Max. 0.25VA/phase	Climate: 97% RH to IEC 60068-2-30
Meas. current:	-/1 or -/5A AC (UL/cUL Listed: From CTs 1-5A)	Load sharing lines: -/5/+5V DC, impedance 23.5kΩ
Consumption:	Max. 0.3VA/phase	Analogue outputs: 0(4)-20mA Galvanically separated Active output (internal supply) Load max. 500Ω (UL/cUL Listed: Max. 20mA output)
Current overload:	4 x I _n continuously 20 x I _n , 10 sec. (max. 75A) 80 x I _n , 1 sec. (max. 300A)	Safety: To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2 To UL 508 and CSA 22.2 no. 14-05, overvoltage category III, 300V, pollution degree 2
Meas. frequency:	30-70Hz	Protection: Unit: IP20 Display: IP52 (IP54 with gasket: Option L) (UL/cUL Listed: Type Complete Device, Open Type) To IEC/EN 60529
Aux. supply:	12/24V DC (8...36V continuously, 6V 1 sec.) Max. 8W consumption The aux. supply inputs are to be protected by a 2A slow blow fuse Recommended power supply is DEIF's DCP-2 (UL/cUL Listed: AWG 24)	EMC/CE: To EN 61000-6-1/2/3/4 IEC 60255-26 IEC 60533 power distr. zone IACS UR E10 power distr. zone
Binary inputs:	Optocoupler, bi-directional ON: Input voltage 8-36V DC Impedance typically 4.7kΩ OFF: <2V DC	
Relay outputs:	250V AC/24V DC, 5A (Unit status output: 1A)	

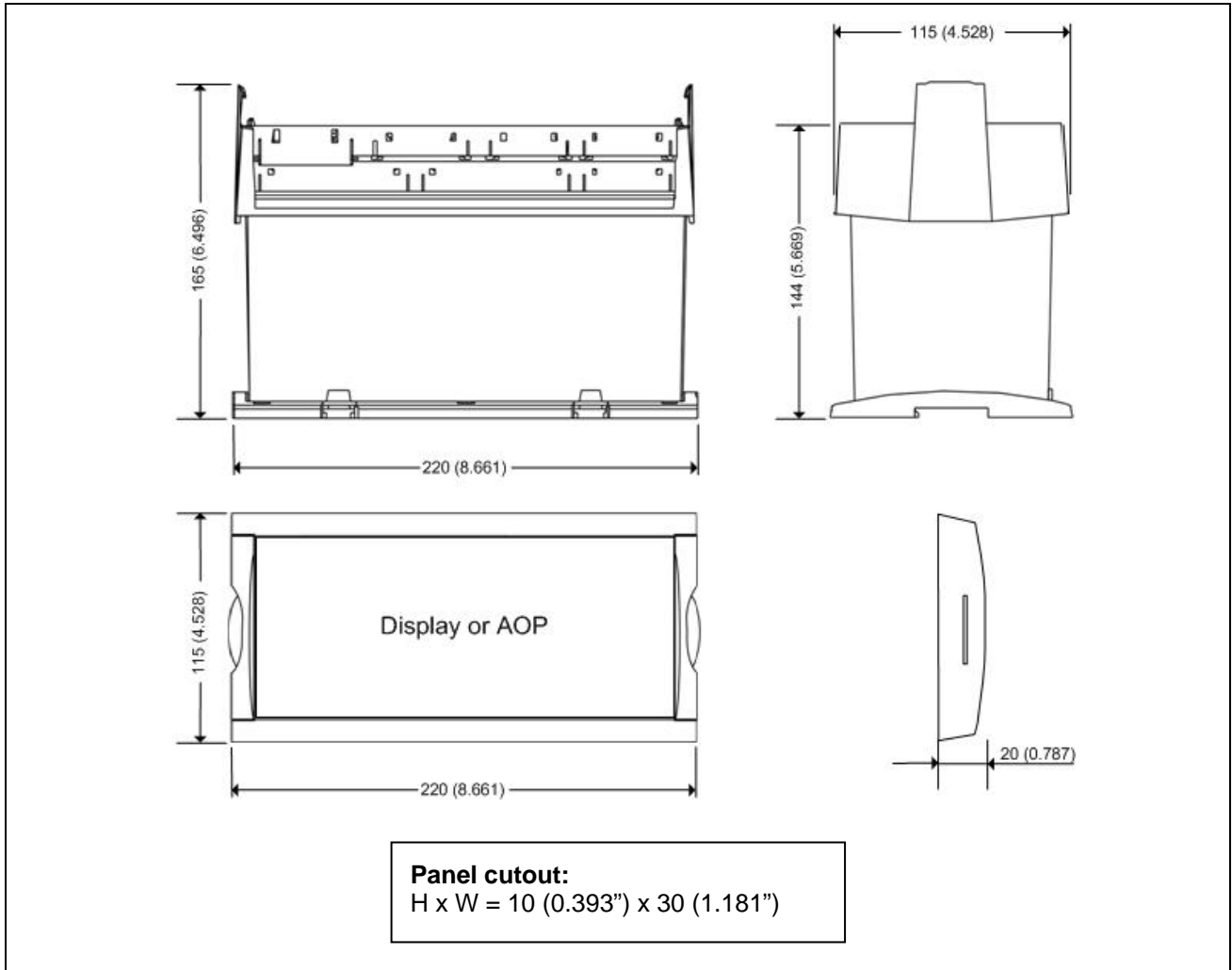
Data sheet

Vibration:	3...13.2Hz: 2mmpp 13.2...100Hz: 0.7g To IEC 60068-2-6 & IACS UR E10 10...60Hz: 0.15mmpp 60...150Hz: 1g To IEC 60255-21-1 Response (class2) 10...150Hz: 2g To IEC 60255-21-1 Endurance (class2)
Shock (base mount):	10g, 11msec, half sine To IEC 60255-21-2 Response (class2) 30g, 11msec, half sine To IEC 60255-21-2 Endurance (class2) 50g, 11msec, half sine To IEC 60068-2-27
Bump:	20g, 16msec, half sine To IEC 60255-21-2 (class2)
Material:	All plastic materials are self-extinguishing according to UL94 (V1)
Plug connections:	AC current: 4.0 mm ² multi stranded (UL/cUL Listed: AWG28-10) Tightening torque: 0.5-0.6 Nm (4.4-5.3 lb-in) Other: 2.5 mm ² multi stranded (UL/cUL Listed: AWG28-12) Tightening torque: 0.5-0.6 Nm (4.4-5.3 lb-in) (UL/cUL Listed: AWG20) Display: 9-pole Sub-D female PC: 9-pole Sub-D male

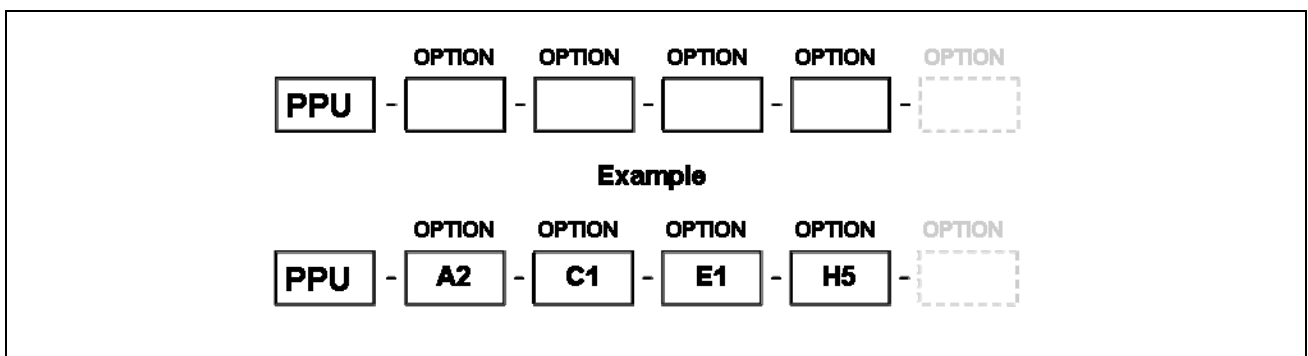
Protection and Paralleling Unit

Governors:	Multi-line 2 interfaces to all governors, including GAC, Barber-Colman, Woodward and Cummins See interfacing guide at www.deif.com
Open collector outputs:	Supply 8-36V DC, max. 10mA
Weight:	Main unit: 1.6 kg (3.5 lbs.) Option J1/J3: 0.2 kg (0.4 lbs.) Option J2: 0.4 kg (0.9 lbs.)
Approval:	The PPU is approved by the major classification societies Contact DEIF for details UL/cUL Listed to UL508
UL markings:	Wiring: Use 60/75°C copper conductors only Mounting: For use on a flat surface of type 1 enclosure Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)
Response times:	<i>Busbar 1 and 2:</i> Over-/undervoltage <50 ms Over-/underfrequency <50 ms <i>Generator:</i> Over-/undervoltage 70-300 ms Over-/underfrequency 70-300 ms Current: 100-300 ms Rocof: 100 ms (4 periods) Vector jump: 30 ms Fast overcurrent: <42 ms

Unit dimensions in mm (inches)



Order specifications



Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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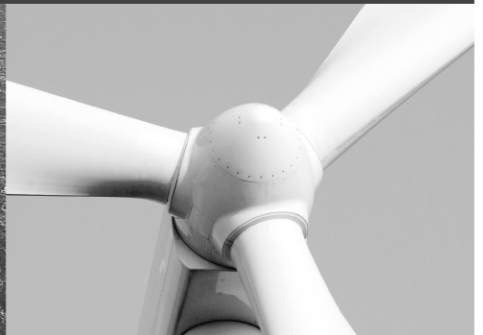




-power in control



Generator Protection Unit, GPU-3 DATA SHEET



Generator Protection (ANSI)

- 2 x reverse power (32)
- 5 x overload (32)
- 6 x overcurrent (50/51)
- 2 x overvoltage (59)
- 3 x undervoltage (27)
- 3 x over-/underfrequency (81)
- Voltage dependent overcurrent (51V)
- Current/voltage unbalance (60)
- Loss of excitation/overexcitation (40/32RV)
- 9 x NEL groups

Busbar protection (ANSI)

- 3 x overvoltage (59)
- 4 x undervoltage (27)
- 3 x overfrequency (81)
- 4 x underfrequency (81)
- Voltage unbalance
- 3 x NEL groups

M-logic (Micro PLC)

- Simple logic configuration tool
- Selectable input/output events

Display

- Status texts
- Info messages
- Alarm indication
- Prepared for remote mounting
- Prepared for additional remote displays

General

- USB interface to PC
- Free PC utility software for commissioning
- Programmable parameter, timer and alarms
- User-configurable texts



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Document no.: 4921240352B
SW version: 3.0x.x or later

Data sheet

Application

The Generator Protection Unit (GPU-3) is a compact microprocessor-based protection unit containing all necessary functions for protection of a synchronous/asynchronous generator. It contains all necessary galvanically separated 3-phase measuring circuits.

The GPU-3 is intended for land- and marine-based applications. It is well-suited for PLC-controlled systems, and the interfacing can be done via binary and analogue I/Os or via serial communication.

Display unit

The display unit is separate and can be installed directly on the main unit or in the front of the switchboard door (3m display cable included). Up to 2 additional displays can be installed within 200m.

The display unit shows all measured and calculated values as well as alarms and data from the event log.

Self-test

The GPU-3 automatically carries out a cyclical self-test at start-up. If any errors are found, they will be displayed in clear text in the display and indicated with a relay output (status output).

M-logic (Micro PLC)

This configuration tool is part of the PC utility software which is free of charge. With this tool, it is possible to customise the application to your needs. It is possible to dedicate specific functions or logical conditions to different inputs and outputs.

Setup

Setup is easily done via a menu structure in the display (password-protected) or via the USB PC connection and the Multi-line 2 Windows[®]-based PC utility software. The PC utility software can be downloaded free of charge from www.deif.com/Download_centre. The utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates.

Synchronisation

As an option, the GPU-3 can perform synchronisation of the generator. After closing of the breaker the regulation is switched OFF, and the GPU-3 will carry out all necessary protective functions.

Protection and Power Management

Engine control and protection

With the engine control and protection option added, the GPU-3 will control the start and stop sequences of the engine and furthermore it can be used as engine protection unit providing full back-up of engine shutdown channels in case the main processor fails.

The option includes an engine interface I/O card with separate power supply and processor. The card is equipped with the following I/Os:

In-/outputs	Available
Multi-inputs (with wire-break)	4-20mA
	Digital input
	PT100
	PT1000
	VDO
0-40V DC	3 (3)
Digital inputs	7 (6)
MPU input w/wirebreak	1
Start prepare relay	1
Starter relay	1
Run coil	1
Stop coil w/wirebreak	1
CANbus comm.	2



The number in parenthesis indicates the number of user configurable in-/outputs.



The CANbus communication is for option H7 only.

Options

In order to perfectly match the product solution to specific applications, the functionality of the GPU-3 can be equipped with a number of available options. The options selected by the customer will be integrated in the standard GPU-3, hereby securing the same user interface unaffected by whether the application needs a highly complex or a more basic gen-set controller.

Please refer to pages 5 and 6 for the options available.

Approvals

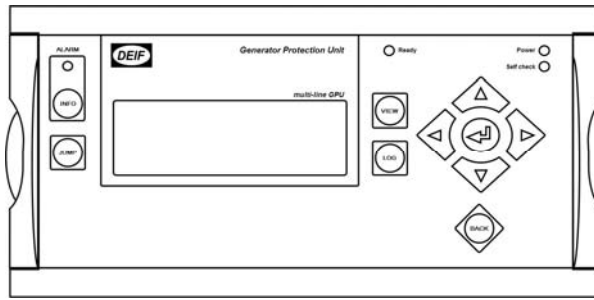
The GPU-3 is marine approved by all major classification societies and is UL/cUL listed.



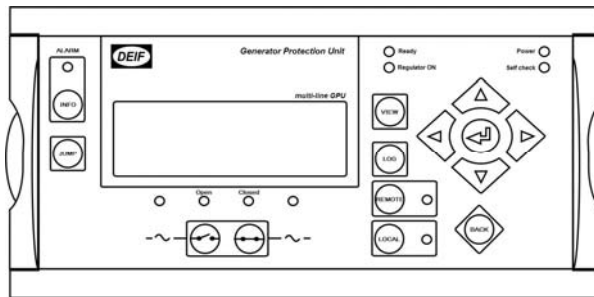
Please refer to www.deif.com for details and certificates.

Display layouts

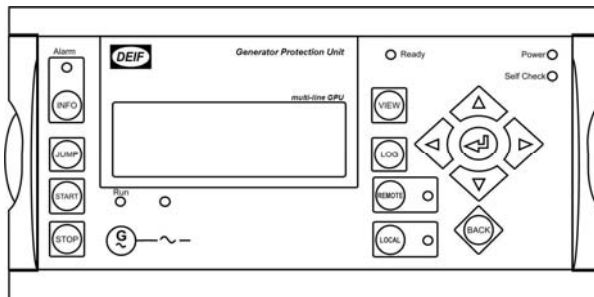
Standard delivery



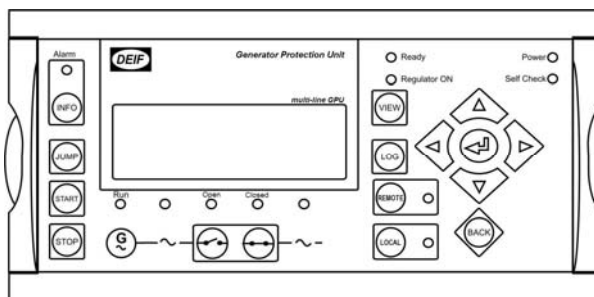
GB control (option Y5)



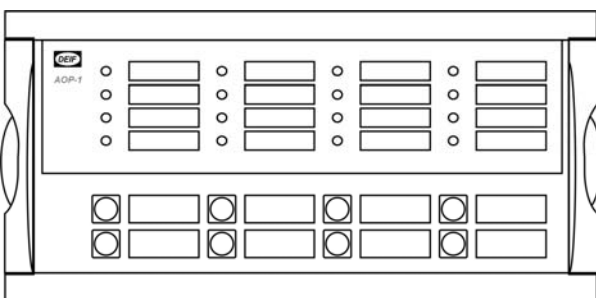
Engine control (option Y7)



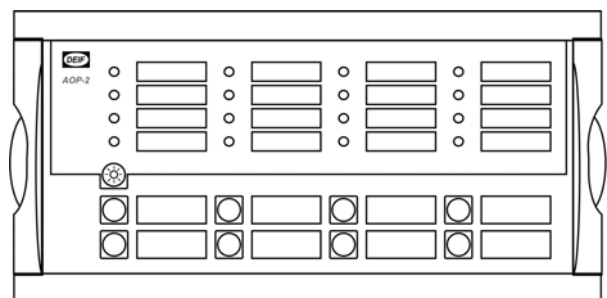
Engine and GB control (option Y1)

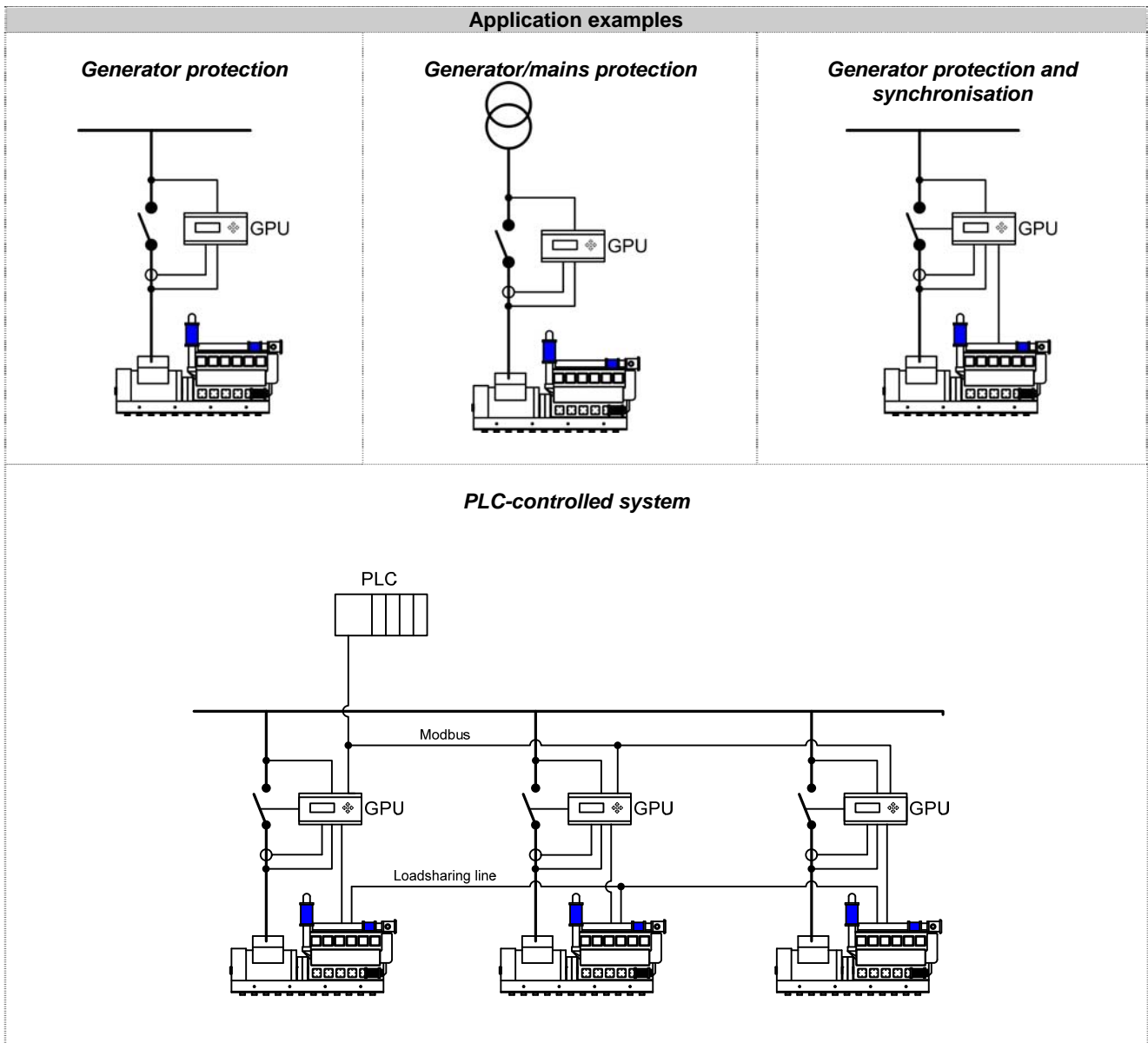


Additional operator's panel - AOP-1 (option X3)



Additional operator's panel - AOP-2 (option X4)





The GPU-3 can be used in simple or complex applications. The above shows very simple applications only, but due to the flexibility, the GPU-3 can be used in all types of applications.

Available options

Option	Description	Slot no.	Option type	Note
A	Mains protection package			
A1	Time-dependent undervoltage (27t) Undervoltage and reactive power low (27Q) Vector jump (78) df/dt (ROCOF) (81)		Software	
A4	Positive sequence (mains voltage low) (27)		Software	
A5	Directional overcurrent (67)		Software	
C	Generator add-on protection package			
C2	Negative sequence voltage high (47) Negative sequence current high (46) Zero sequence voltage high (59) Zero sequence current high (50) Power dependent reactive power import/export (40) Inverse time overcurrent (51)		Software	
D	Voltage control			
D1	Voltage control		Software	Requires G2
E and F	Analogue controller and transducer outputs			
E1	2 x +/-25mA (GOV/AVR or transducer)	4	Hardware	Not with E2, EF2, EF4, EF5 or M14.4 AVR output requires D1
E2	2 x 0(4)...20mA (GOV/AVR or transducer)	4	Hardware	Not with E1, EF2, EF4, EF5 or M14.4 AVR output requires D1
EF2	1 x +/-25mA (GOV/AVR or transducer) 1 x 0(4)...20mA (GOV/AVR or transducer)	4	Hardware	Not with E1, E2, EF4, EF5 or M14.4 AVR output requires D1
EF4	1 x +/-25mA (GOV/AVR or transducer) 2 x relay outputs (GOV/AVR or configurable)	4	Hardware	Not with E1, E2, EF2, EF5 or M14.4 AVR output requires D1
EF5	1 x PWM (Pulse Width Modulated) output for CAT GOV 1 x +/-25mA (GOV/AVR or transducer) 2 x relay outputs (GOV/AVR or configurable)	4	Hardware	Not with E1, E2, EF2, EF4 or M14.4 AVR output requires D1
F1	2 x 0(4)...20mA (transducer)	6	Hardware	Not with M13.6, M14.6 or M15.6
G	Synchronisation			
G2	Synchronisation (GOV/AVR control)		Software	Outputs for regulation are not included AVR control requires D1
H	Serial communication			
H2	Modbus RTU/ASCII (RS485)	2	Hardware	Not with H3, H8.2 or H9.2
H3	Profibus DP	2	Hardware	Not with H2, H8.2 or H9.2
H5	Engine comm.: MTU (ADEC/MDEC) and CANbus J1939 (H7)	8	Hardware	Not with H7, H8.8, M13.8, M14.8 or M15.8
H6	Cummins GCS	8	Hardware	Not with H5, H7, H8.8, M13.8, M14.8 or M15.8
H7	CANbus (J1939): Caterpillar Cummins CM850/570 Detroit Diesel (DDEC) Deutz (EMR) Iveco (NEF/CURS0R) John Deere (JDEC) Perkins Scania (EMS) Scania (EMS S6) Volvo Penta (EMS) Volvo (EMS2)	7	Software	Requires M4 Not with H5
H8.X	External I/O modules	2, 8	Hardware	H8.2: Not with H2, H3, H8.8 or H9.2 H8.8: Not with H5, H6, H8.2, M13.8, M14.8 or M15.8
H9.2	Modbus RTU/ASCII (RS232) and GSM modem connection	2	Hardware	Not with H2, H3 or H8.2

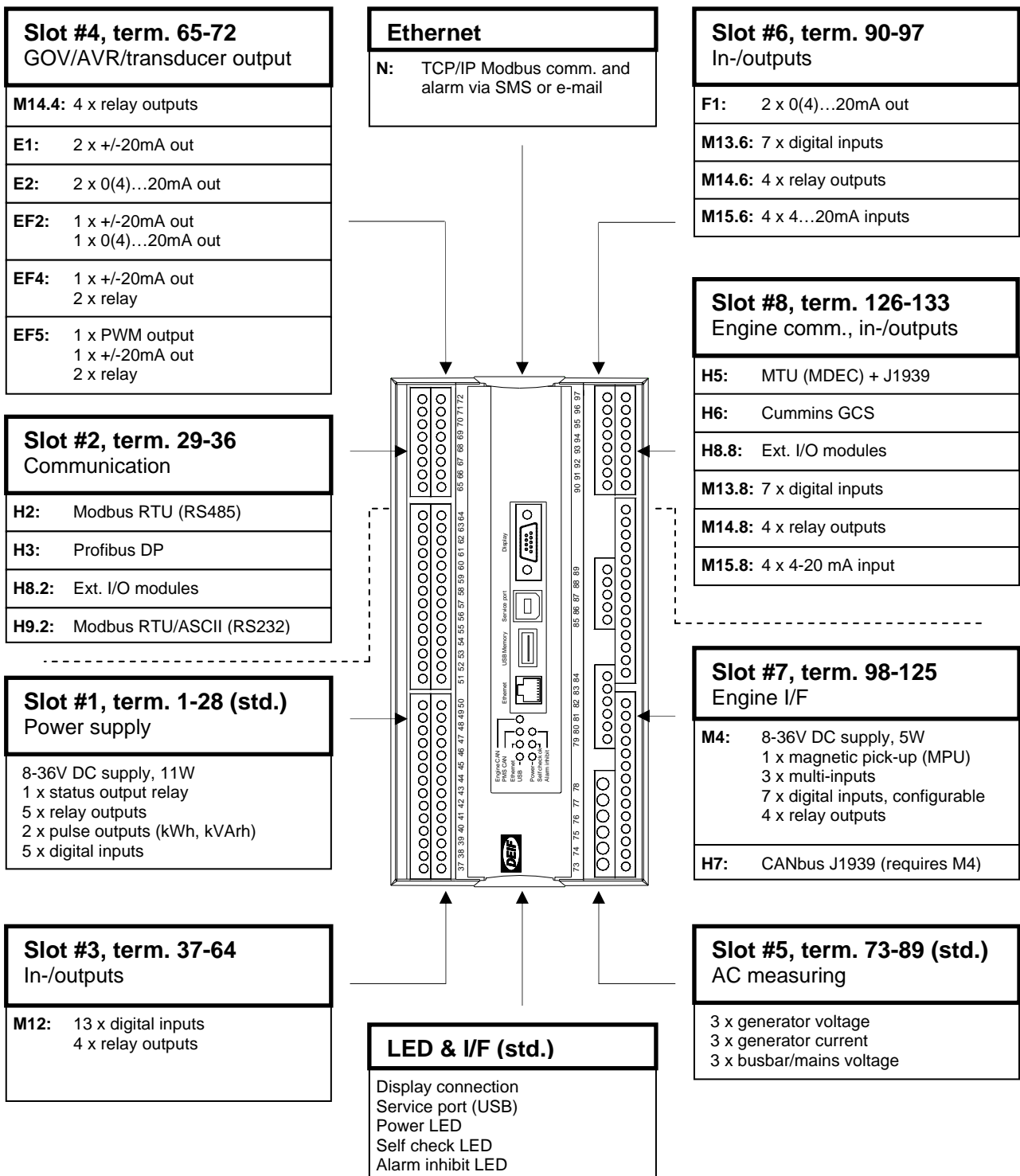
(ANSI# as per IEEE Std. C37.2-1996 (R2001) in parenthesis).

Option	Description	Slot no.	Option type	Note
J	Cables			One 3m display cable per GPU-3 unit is included as standard
J2	Display cable with plugs, 6m UL94 (V1) approved		Other	Not with J6 Will replace the std. display cable
J4	PC cable for option N-programming UL94 (Ethernet cable crossed), 3m UL94 (V1) Listed		Other	
J6	Display cable with plugs, 1m UL94 (V1) approved		Other	Not with J2 Will replace the std. display cable
J7	PC cable for utility software (USB) 3m UL94 (V1) approved		Other	
K	Documentation			
K1	Designer's Reference Handbook (hard copy)		Other	
K2	CD-ROM with complete documentation		Other	
L	Display gasket for IP54		Other	Standard is IP52
M	Engine control, digital and analogue I/Os			
M4	Engine control and protection (safety system) OR I/O extension	7	Hardware	
M12	13 binary inputs, configurable 4 relay outputs, configurable	3	Hardware	
M13.X	7 binary inputs, configurable	6, 8	Hardware	M13.6: Not with F1, M14.6 or M15.6 M13.8: Not with H5, H6, H8.8, M14.8 or M15.8
M14.X	4 relay outputs, configurable	4, 6, 8	Hardware	M14.4: Not with E1, E2, EF2, EF4 and EF5 M14.6: Not with F1, M13.6 or M15.6 M14.8: Not with H5, H6, H8.8, M13.8 or M15.8
M15.X	4 analogue inputs, configurable, 4...20mA	6, 8	Hardware	M15.6: Not with F1, M13.6 or M14.6 M15.8: Not with H5, H6, H8.8, M13.8 or M14.8
N	Ethernet TCP/IP communication			
N	Ethernet TCP/IP Modbus comm. and alarms via SMS or e-mail		Hardware/software	
Q	Measurement accuracy			
Q1	Verified class 0.5		Other	
X	Display			One display per GPU-3 unit is included as standard
X2	Additional standard display. CANbus comm.		Other	Two X2 options can be ordered for each GPU unit
X3	Additional operator's panel (AOP-1): 16 configurable LEDs and 8 configurable push-buttons		Other	Max. one AOP-1 for each display unit
X4	Additional operator's panel (AOP-2): 16 configurable LEDs, 8 configurable buttons and 1 status relay. CANbus comm.		Other	Five X4 options can be ordered for each GPU unit
Y	Display layout			
Y1	Engine and GB control		Other	Requires G2 and M4
Y5	GB control		Other	Requires G2
Y7	Engine control		Other	Requires M4



Please notice that not all options can be selected for the same unit. Please refer to page 7 in this data sheet for further information about the location of the HW options in the unit.

Hardware overview



i There can only be one hardware option in each slot. It is e.g. not possible to select option H2 and option H3 at the same time, because both options require a PCB in slot #2.

i Besides the hardware options shown on this page, it is possible to select the software options mentioned in the chapter 'Available options'.

Technical specifications

Accuracy:	Class 1.0 Positive, negative and zero sequence alarms: Class 1 within 5% voltage unbalance Class 1.0 for negative sequence current Fast overcurrent: 3% of 350%*I _n Analogue outputs: Class 1.0 according to total range Option EF4: Class 4.0 according to total range To IEC/EN 60688	Analogue inputs:	0(4)...20mA Impedance: 50Ω Not galvanically separated RPM (MPU): 2...70V AC, 10...10000Hz, 250...3000Ω
Operating temp.:	-25...70°C (-13...158° F) (UL/cUL Listed: Max. surrounding air temp.: 55°C/131°F)	Multi-inputs:	0(4)...20mA: 0-20mA, +/-1% Not galvanically separated Binary: Max. resistance for ON detection: 100Ω Not galvanically separated PT100/1000: -40...250°C, +/-1% Not galvanically separated To IEC/EN 60751 VDO: 0...1700Ω, +/-2% Not galvanically separated V DC: 0...40V DC, +/-1% Not galvanically separated
Storage temp.:	-40...70°C (-40...158° F)	Relay outputs:	Electrical rating: 250V AC/30V DC, 5A (UL/cUL Listed: 250V AC/24V DC, 2A resistive load) Thermal rating @ 50°C: 2A: Continuously 4A: t _{ON} = 5 sec., t _{OFF} = 15 sec. (Unit status output: 1A)
Climate:	97% RH to IEC 60068-2-30	Open collector outputs:	Supply: 8...36V DC, max. 10mA
Meas. voltage:	100-690V AC +/-20% (UL/cUL Listed: 480V AC phase-phase)	Analogue outputs:	0(4)...20mA and +/-25mA Galvanically separated Active output (internal supply) Load max. 500Ω (UL/cUL Listed: Max. 20mA output) Update rate: Transducer output: 250ms Regulator output: 100ms
Consumption:	Max. 0.25VA/phase		
Meas. current:	-/1 or -/5A AC (UL/cUL Listed: From CTs 1-5A)		
Consumption:	Max. 0.3VA/phase		
Current overload:	4 x I _n continuously 20 x I _n , 10 sec. (max. 75A) 80 x I _n , 1 sec. (max. 300A)		
Meas. frequency:	30...70Hz		
Aux. supply:	Terminals 1 and 2: 12/24V DC (8...36V continuously, 6V 1 sec.) Max. 11W consumption Terminals 98 and 99: 12/24V DC (8...36V continuously, 6V 1 sec.) Max. 5W consumption The aux. supply inputs are to be protected by a 2A slow-blow fuse (UL/cUL Listed: AWG 24)		
Binary inputs:	Optocoupler, bi-directional ON: 8...36V DC Impedance: 4.7kΩ OFF: <2V DC		

Data sheet

Galv. separation:	Between AC voltage, AC current and other I/Os: 3250V AC, 50Hz, 1 min. Between analogue outputs and other I/Os: 500V DC, 1 min. Between binary input groups and other I/Os: 500V DC, 1 min.
Response times: (Delay set to minimum)	
<i>Busbar:</i>	
Over-/undervoltage:	< 50ms
Over-/underfrequency:	< 50ms
Voltage unbalance:	<200ms
<i>Generator:</i>	
Reverse power:	<200ms
Overcurrent:	<200ms
Fast overcurrent:	< 40ms
Over-/undervoltage:	<200ms
Over-/underfrequency:	<300ms
Overload:	<200ms
Current unbalance:	<200ms
Voltage unbalance:	<200ms
React. power import:	<200ms
React. power export:	<200ms
Overspeed:	<400ms
Digital inputs:	<250ms
Emergency stop:	<200ms
Multi-inputs:	<800ms
Wire failure:	<600ms
<i>Mains:</i>	
df/dt (ROCOF):	<130ms (4 periods)
Vector jump:	< 40ms
Positive sequence:	< 60ms
Mounting:	DIN-rail mount or base mount with 6 screws
Safety:	To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2 To UL 508 and CSA 22.2 no. 14-05, overvoltage category III, 300V, pollution degree 2
EMC/CE:	To EN 61000-6-1/2/3/4 IEC 60255-26 IEC 60533 power distr. zone IACS UR E10 power distr. zone
Vibration:	3...13.2Hz: 2mm _{pp} 13.2...100Hz: 0.7g To IEC 60068-2-6 & IACS UR E10

Generator Protection Unit, GPU-3

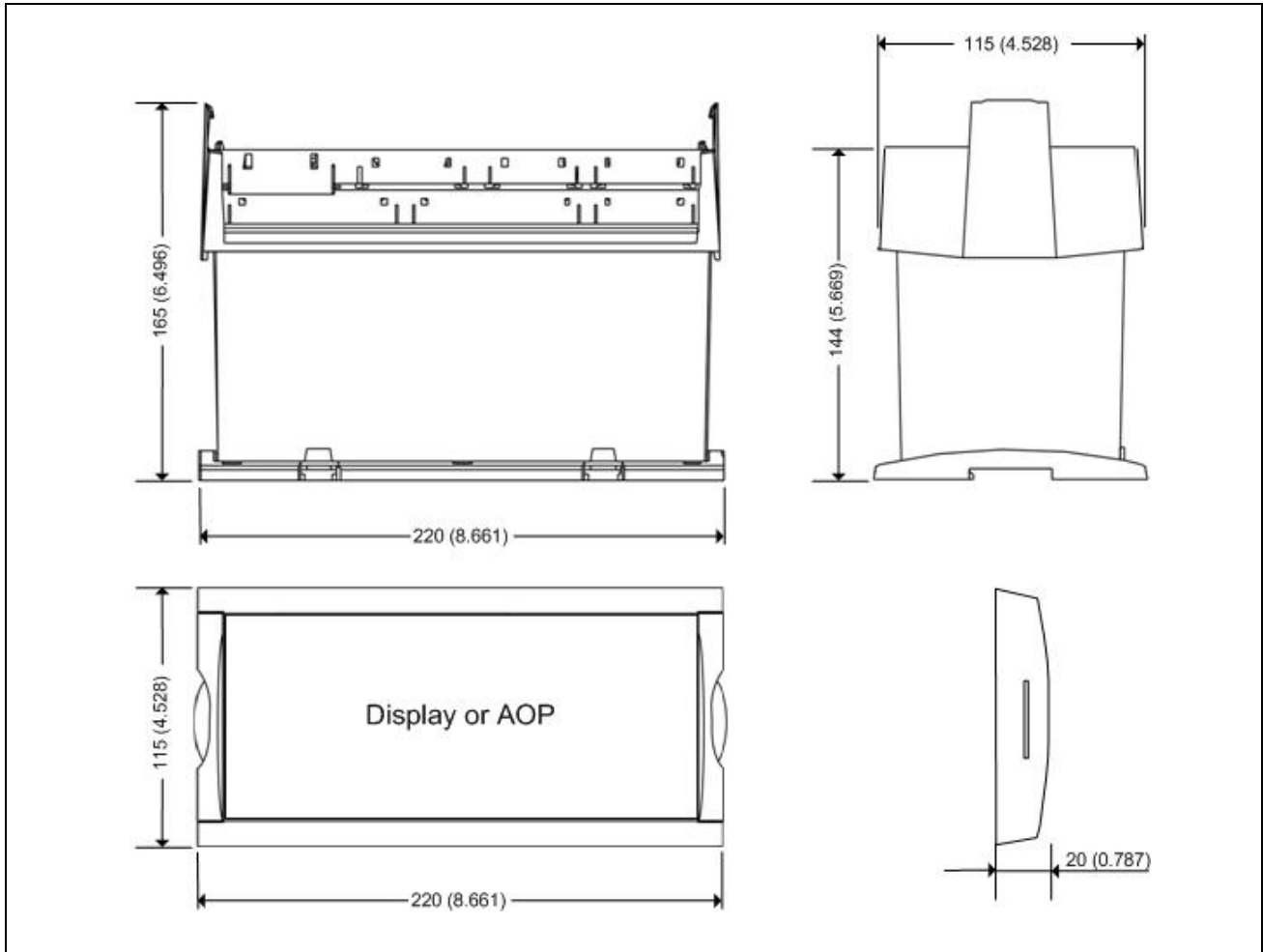
	10...60Hz: 0.15mm _{pp} 60...150Hz: 1g To IEC 60255-21-1 Response (class 2) 10...150Hz: 2g To IEC 60255-21-1 Endurance (class 2)
Shock (base mount):	10g, 11msec, half sine To IEC 60255-21-2 Response (class 2) 30g, 11msec, half sine To IEC 60255-21-2 Endurance (class 2) 50g, 11msec, half sine To IEC 60068-2-27
Bump:	20g, 16msec, half sine To IEC 60255-21-2 (class 2)
Material:	All plastic materials are self-extinguishing according to UL94 (V1)
Plug connections:	AC current: 0.2-4.0 mm ² stranded wire (UL/cUL Listed: AWG 18) AC voltage: 0.2-2.5 mm ² stranded wire (UL/cUL Listed: AWG 20) Relays: (UL/cUL Listed: AWG 22) Terminals 98-116: 0.2-1.5 mm ² stranded wire (UL/cUL Listed: AWG 24) Other: 0.2-2.5 mm ² stranded wire (UL/cUL Listed: AWG 24) Display: 9-pole sub-D female Service port: USB A-B
Protection:	Unit: IP20 Display: IP52 (IP54 with gasket: Option L) (UL/cUL Listed: Type Complete Device, Open Type) To IEC/EN 60529
Governors:	Multi-line 2 interfaces to all governors, including GAC, Barber-Colman, Woodward and Cummins See interfacing guide at www.deif.com

Data sheet

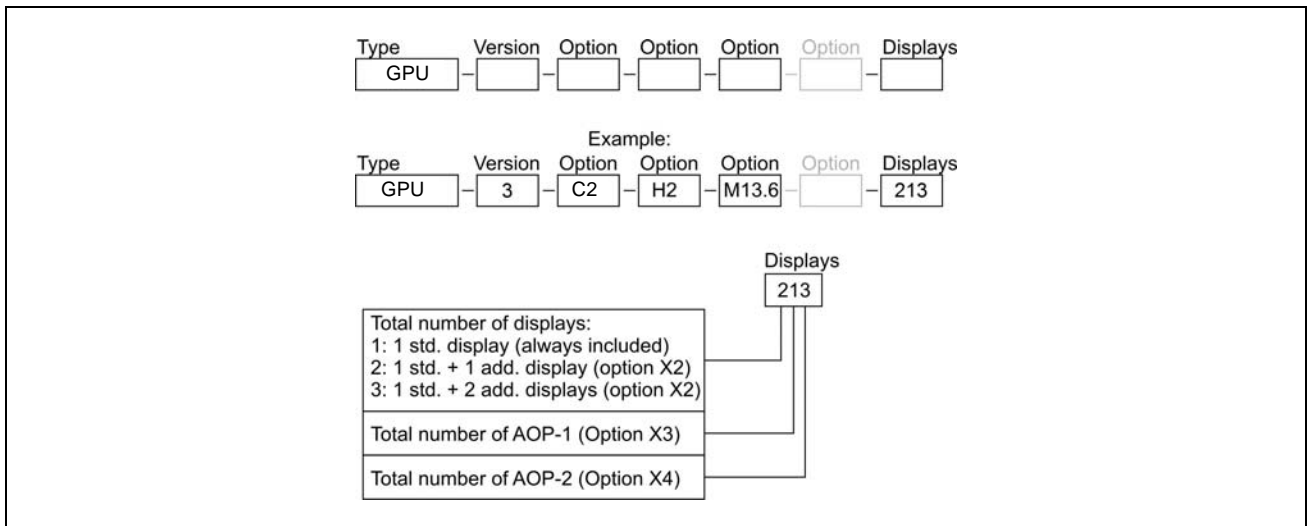
Generator Protection Unit, GPU-3

Approvals:	Marine approved by all major classification societies UL/cUL Listed to UL508
UL markings:	Wiring: Use 60/75°C copper conductors only Mounting: For use on a flat surface of type 1 enclosure Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)
AOP-2:	Maximum ambient temperature: 60°C Wiring: Use 60/75°C copper conductors only Mounting: For use on a flat surface of type 3 (IP54) enclosure Main disconnect must be provided by installer Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)
DC/DC converter for AOP-2:	Tightening torque: 0.5Nm (4.4lb-in) Wire size: AWG 22-14
Weight:	Base unit: 1.6 kg (3.5 lbs.) Option J1/J3/J6: 0.2 kg (0.4 lbs.) Option J2: 0.4 kg (0.9 lbs.) Display: 0.4 kg (0.9 lbs.)

Unit dimensions in mm (inches)



Order specifications

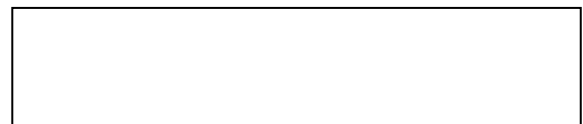


Due to our continuous development we reserve the right to supply equipment which may vary from the described.



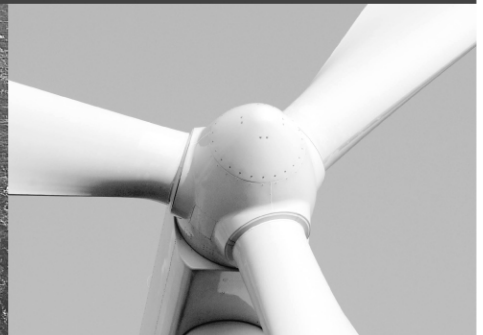
DEIF A/S, Frisenborgvej 33
DK-7800 Skive, Denmark

Tel.: +45 9614 9614, Fax: +45 9614 9615
E-mail: deif@deif.com, URL: www.deif.com





Paralleling and Protection Unit, PPU-3 DATA SHEET



Regulation modes

- Load sharing
- Fixed frequency
- Fixed power
- Frequency droop

Generator protection (ANSI)

- 2 x reverse power (32)
- 5 x overload (32)
- 6 x overcurrent (50/51)
- 2 x overvoltage (59)
- 3 x undervoltage (27)
- 3 x over-/underfrequency (81)
- Voltage dependent overcurrent (51V)
- Current/voltage unbalance (60)
- Loss of excitation/overexcitation (40/32RV)
- 9 x NEL groups

M-logic (Micro PLC)

- Simple logic configuration tool
- Selectable input/output events

Busbar protection (ANSI)

- 3 x overvoltage (59)
- 4 x undervoltage (27)
- 3 x overfrequency (81)
- 4 x underfrequency (81)
- Voltage unbalance
- 3 x NEL groups

Display

- Status texts
- Info messages
- Alarm indication
- Prepared for remote mounting
- Prepared for additional remote displays

General

- USB interface to PC
- Free PC utility software for commissioning
- Programmable parameter, timer and alarms
- User-configurable texts



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Document no.: 4921240354B
SW version: 3.0x.x or later

Data sheet

Application

The Paralleling and Protection Unit (PPU-3) is a compact *all in one* microprocessor-based control unit containing all necessary functions for protection and control of a synchronous/asynchronous generator. It contains all necessary galvanically separated 3-phase measuring circuits.

The PPU-3 is intended for marine-based applications. It is designed for the following applications (can be combined):

1. Stand-alone
2. Parallel with other generators

The PPU-3 can synchronise the generator and after synchronisation carry out all necessary generator control and protective functions. It is well-suited for PLC-controlled systems and the interfacing can be done via binary and analogue I/Os or via serial communication.

Display unit

The display unit is separate and can be installed directly on the main unit or in the front of the switchboard door (3m display cable included). Up to 2 additional displays can be installed within 200m.

The display unit shows all measured and calculated values as well as alarms and data from the event log.

Operation modes

Four different regulation modes can easily be selected through digital inputs on the standard PPU-3, and the governor will be controlled accordingly:

1. Fixed frequency
2. Fixed power (base load)
3. Frequency droop
4. Load sharing

If the automatic voltage regulator is controlled by the PPU-3, the standard operation modes are extended with:

1. Fixed voltage
2. Fixed VAR
3. Fixed power factor
4. Reactive load sharing
5. Voltage droop



AVR control requires option D1.

Paralleling and Protection Unit, PPU-3

Self-test

The PPU-3 automatically carries out a cyclical self-test at start-up. If any errors are found, they will be displayed in clear text in the display and indicated with a relay output (status output).

M-logic (Micro PLC)

This configuration tool is part of the PC utility software which is free of charge. With this tool, it is possible to customise the application to your needs. It is possible to dedicate specific functions or logical conditions to different inputs and outputs.

Engine control and protection

With the engine control and protection option added, the PPU-3 will control the start and stop sequences of the engine and furthermore it can be used as engine protection unit providing full back-up of engine shutdown channels in case the main processor fails.

Setup

Setup is easily done via a menu structure in the display (password-protected) or via the USB PC connection and the Multi-line 2 Windows®-based PC utility software. The PC utility software can be downloaded free of charge from www.deif.com/Download_centre. The utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates.

Options

In order to perfectly match the product solution to specific applications, the functionality of the PPU-3 can be equipped with a number of available options. The options selected by the customer will be integrated in the standard PPU-3, hereby securing the same user interface unaffected by whether the application needs a highly complex or a more basic gen-set controller.

Please refer to pages 5 and 6 for the options available.

Approvals

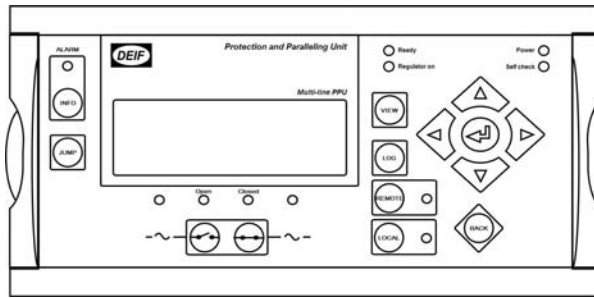
The PPU-3 is marine approved by all major classification societies and is UL/cUL listed.



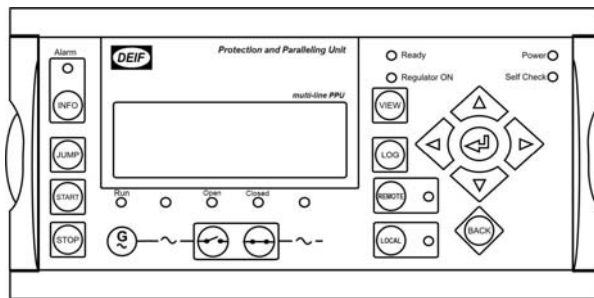
Please refer to www.deif.com for details and certificates.

Display layouts

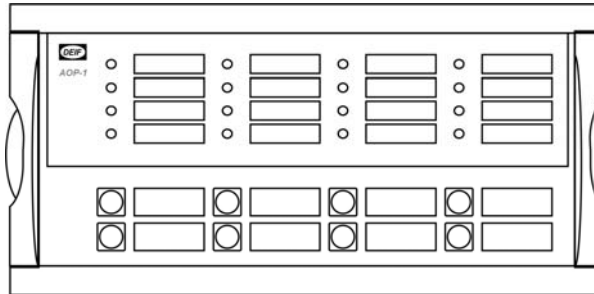
Standard delivery



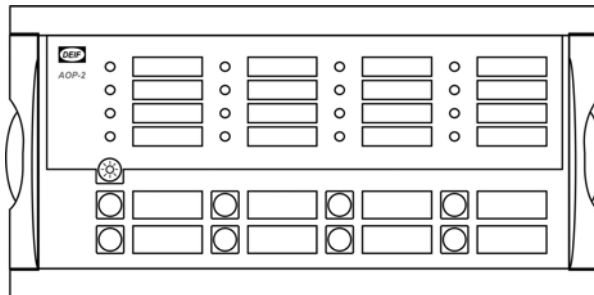
Engine and GB control (option Y1)

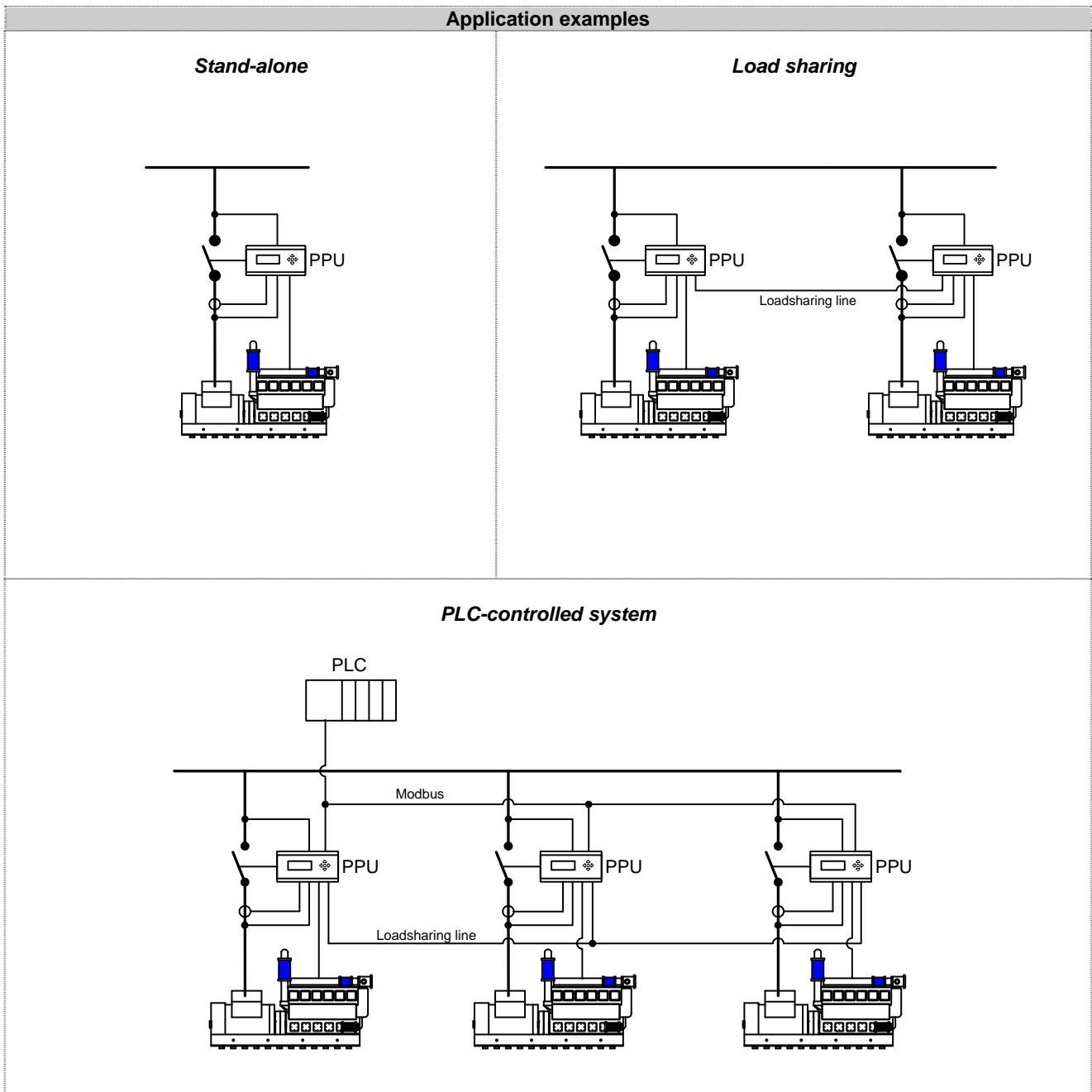


Additional operator's panel - AOP-1 (option X3)



Additional operator's panel - AOP-2 (option X4)





The PPU-3 can be used in simple or complex applications. The above shows some of the applications, but due to the flexible mode selection, the PPU-3 can be used in all applications.



The PPU-3 is also designed to work with the Uni-line components such as the FAS (Full Automatic Synchroniser), should this be preferred.

Available options

Option	Description	Slot no.	Option type	Note
A	Mains protection package			
A1	Time-dependent undervoltage (27t) Undervoltage and reactive power low (27Q) Vector jump (78) df/dt (ROCOF) (81)		Software	
A4	Positive sequence (mains voltage low) (27)		Software	
A5	Directional overcurrent (67)		Software	
C	Generator add-on protection package			
C2	Negative sequence voltage high (47) Negative sequence current high (46) Zero sequence voltage high (59) Zero sequence current high (50) Power dependent reactive power import/export (40) Inverse time overcurrent (51)		Software	
D	Voltage control			
D1	Constant voltage control Constant reactive power control Constant power factor control Reactive load sharing Voltage droop		Software	
E and F	Analogue controller and transducer outputs			
E1	2 x +/-25mA (GOV/AVR or transducer)	4	Hardware	Not with E2, EF2, EF4 or EF5 AVR output requires D1
E2	2 x 0(4)...20mA (GOV/AVR or transducer)	4	Hardware	Not with E1, EF2, EF4 or EF5 AVR output requires D1
EF2	1 x +/-25mA (GOV/AVR or transducer) 1 x 0(4)...20mA (GOV/AVR or transducer)	4	Hardware	Not with E1, E2, EF4 or EF5 AVR output requires D1
EF4	1 x +/-25mA (GOV/AVR or transducer) 2 x relay outputs (GOV/AVR or configurable)	4	Hardware	Not with E1, E2, EF2 or EF5 AVR output requires D1
EF5	1 x PWM (Pulse Width Modulated) output for CAT GOV 1 x +/-25mA (GOV/AVR or transducer) 2 x relay outputs (GOV/AVR or configurable)	4	Hardware	Not with E1, E2, EF2 or EF4 AVR output requires D1
F1	2 x 0(4)...20mA (transducer)	6	Hardware	Not with M13.6, M14.6 or M15.6
H	Serial communication			
H2	Modbus RTU/ASCII (RS485)	2	Hardware	Not with H3, H8.2 or H9.2
H3	Profibus DP	2	Hardware	Not with H2, H8.2 or H9.2
H5	Engine comm.: MTU (ADEC/MDEC) and CANbus J1939 (H7)	8	Hardware	Not with H7, H8.8, M13.8, M14.8 or M15.8
H6	Cummins GCS	8	Hardware	Not with H5, H7, H8.8, M13.8, M14.8 or M15.8
H7	CANbus (J1939): Caterpillar Perkins Cummins CM850/570 Scania (EMS) Detroit Diesel (DDEC) Scania (EMS S6) Deutz (EMR) Volvo Penta (EMS) Iveco (NEF/CURSORS) Volvo (EMS2) John Deere (JDEC)	7	Software	Requires M4 Not with H5
H8.X	External I/O modules	2, 8	Hardware	H8.2: Not with H2, H3, H8.8 or H9.2 H8.8: Not with H5, H6, H8.2, M13.8, M14.8 or M15.8
H9.2	Modbus RTU/ASCII (RS232) and GSM modem connection	2	Hardware	Not with H2, H3 or H8.2

(ANSI# as per IEEE Std. C37.2-1996 (R2001) in parenthesis)



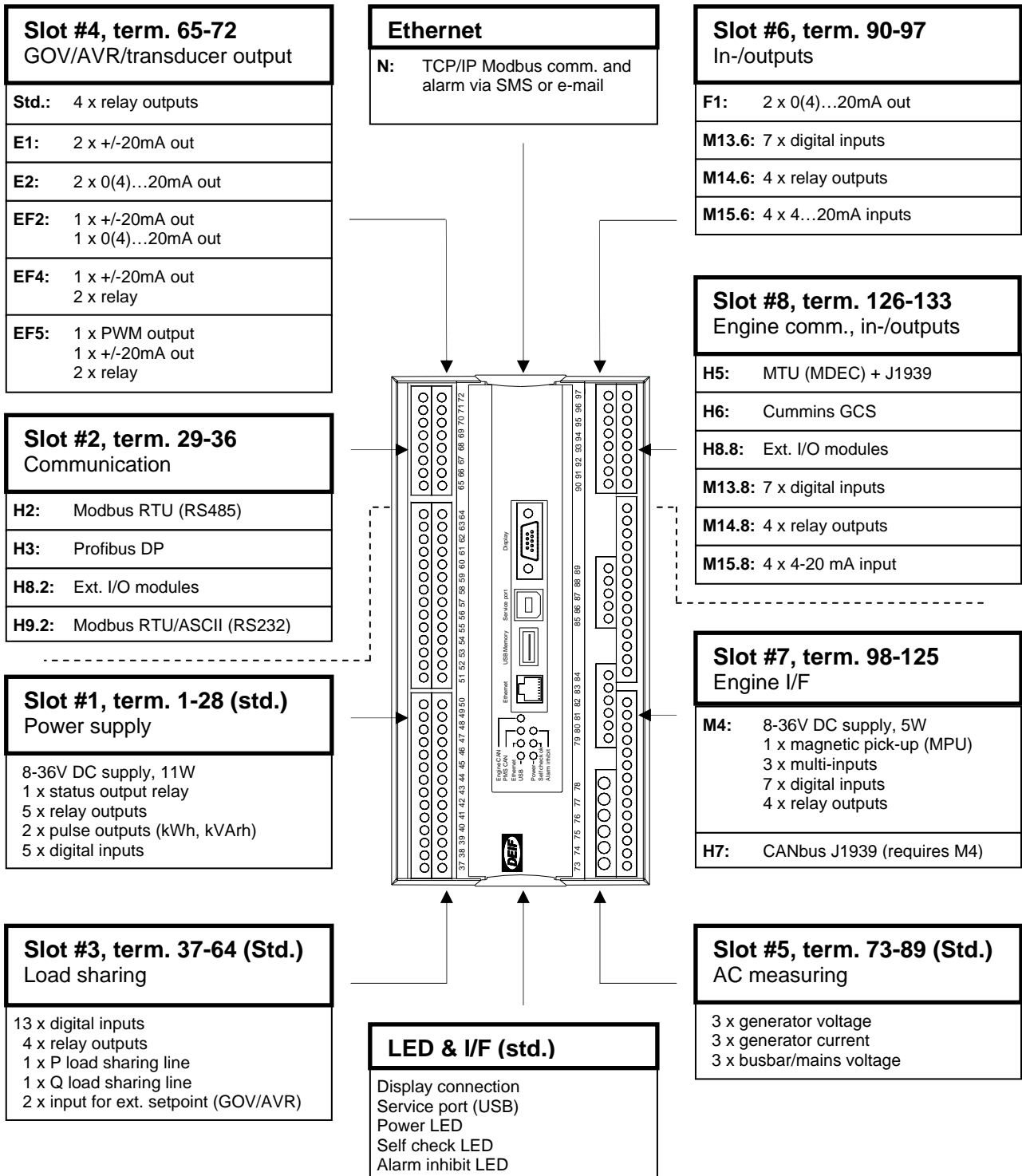
4 relays are available as standard in slot #4 for GOV/AVR control. If one of the options E1, E2, EF2, EF4 or EF5 is selected, these options will replace the 4 relays.

Option	Description	Slot no.	Option type	Note
J	Cables			One 3m display cable per PPU-3 unit is included as standard
J2	Display cable with plugs, 6m UL94 (V1) approved		Other	Not with J6 Will replace the std. display cable
J4	PC cable for option N-programming UL94 (Ethernet cable crossed), 3m UL94 (V1) Listed		Other	
J6	Display cable with plugs, 1m UL94 (V1) approved		Other	Not with J2 Will replace the std. display cable
J7	PC cable for utility software (USB) 3m UL94 (V1) approved		Other	
K	Documentation			
K1	Designer's Reference Handbook (hard copy)		Other	
K2	CD-ROM with complete documentation		Other	
L	Display gasket for IP54		Other	Standard is IP52
M	Engine control, binary and analogue I/Os			
M4	Engine control and protection (safety system) OR I/O extension	7	Hardware	
M13.X	7 binary inputs, configurable	6,8	Hardware	M13.6: Not with F1, M14.6 or M15.6 M13.8: Not with H5, H6, H8.8, M14.8 or M15.8
M14.X	4 relay outputs, configurable	6, 8	Hardware	M14.6: Not with F1, M13.6 or M15.6 M14.8: Not with H5, H6, H8.8, M13.8 or M15.8
M15.X	4 analogue inputs, configurable, 4...20mA	6, 8	Hardware	M15.6: Not with F1, M13.6 or M14.6 M15.8: Not with H5, H6, H8.8, M13.8 or M14.8
N	Ethernet TCP/IP communication			
N	Ethernet TCP/IP Modbus comm. and alarms via SMS or e-mail		Hardware/software	
Q	Measurement accuracy			
Q1	Verified class 0.5		Other	
X	Display			One display per PPU-3 unit is included as standard
X2	Additional standard display. CANbus comm.		Other	Two X2 options can be ordered for each PPU unit
X3	Additional operator's panel (AOP-1): 16 configurable LEDs and 8 configurable push-buttons		Other	Max. one AOP-1 for each display unit
X4	Additional operator's panel (AOP-2): 16 configurable LEDs, 8 configurable buttons and 1 status relay. CANbus comm.		Other	Five X4 options can be ordered for each PPU unit
Y	Display layout			
Y1	Engine and GB control		Other	Requires M4



Please notice that not all options can be selected for the same unit. Please refer to page 7 in this data sheet for further information about the location of the HW options in the unit.

Hardware overview



i There can only be one hardware option in each slot. It is e.g. not possible to select option H2 and option H3 at the same time, because both options require a PCB in slot #2.

i Besides the hardware options shown on this page, it is possible to select the software options mentioned in the chapter 'Available options'.

Technical specifications

Accuracy:	<p>Class 1.0</p> <p>Positive, negative and zero sequence alarms: Class 1 within 5% voltage unbalance</p> <p>Class 1.0 for negative sequence current</p> <p>Fast overcurrent: 3% of 350%*I_n</p> <p>Analogue outputs: Class 1.0 according to total range</p> <p>Option EF4: Class 4.0 according to total range</p> <p>To IEC/EN 60688</p>	Analogue inputs:	<p>0(4)...20mA</p> <p>Impedance: 50Ω</p> <p>Not galvanically separated</p> <p>RPM (MPU): 2...70V AC, 10...10000Hz, 250...3000Ω</p>
Operating temp.:	<p>-25...70°C (-13...158° F) (UL/cUL Listed: Max. surrounding air temp.: 55°C/131°F)</p>	Multi-inputs:	<p>0(4)...20mA: 0-20mA, +/-1% Not galvanically separated</p> <p>Binary: Max. resistance for ON detection: 100Ω Not galvanically separated</p> <p>PT100/1000: -40...250°C, +/-1% Not galvanically separated To IEC/EN 60751</p> <p>VDO: 0...1700Ω, +/-2% Not galvanically separated</p> <p>V DC: 0...40V DC, +/-1% Not galvanically separated</p>
Storage temp.:	<p>-40...70°C (-40...158° F)</p>	Relay outputs:	<p>Electrical rating: 250V AC/30V DC, 5A (UL/cUL Listed: 250V AC/24V DC, 2A resistive load)</p> <p>Thermal rating @ 50°C: 2A: Continuously 4A: t_{ON} = 5 sec., t_{OFF} = 15 sec. (Unit status output: 1A)</p>
Climate:	<p>97% RH to IEC 60068-2-30</p>	Open collector outputs:	<p>Supply: 8...36V DC, max. 10mA</p>
Meas. voltage:	<p>100-690V AC +/-20% (UL/cUL Listed: 480V AC phase-phase)</p>	Analogue outputs:	<p>0(4)...20mA and +/-25mA Galvanically separated Active output (internal supply) Load max. 500Ω (UL/cUL Listed: Max. 20mA output)</p> <p>Update rate: Transducer output: 250ms Regulator output: 100ms</p>
Consumption:	<p>Max. 0.25VA/phase</p>	Analogue load sharing lines:	<p>-5...0...+5V DC, Impedance: 23.5 kΩ</p>
Meas. current:	<p>-/1 or -/5A AC (UL/cUL Listed: From CTs 1-5A)</p>		
Consumption:	<p>Max. 0.3VA/phase</p>		
Current overload:	<p>4 x I_n continuously 20 x I_n, 10 sec. (max. 75A) 80 x I_n, 1 sec. (max. 300A)</p>		
Meas. frequency:	<p>30...70Hz</p>		
Aux. supply:	<p>Terminals 1 and 2: 12/24V DC (8...36V continuously, 6V 1 sec.) Max. 11W consumption</p> <p>Terminals 98 and 99: 12/24V DC (8...36V continuously, 6V 1 sec.) Max. 5W consumption</p> <p>The aux. supply inputs are to be protected by a 2A slow-blow fuse</p> <p>(UL/cUL Listed: AWG 24)</p>		
Binary inputs:	<p>Optocoupler, bi-directional ON: 8...36V DC Impedance: 4.7kΩ OFF: <2V DC</p>		

Data sheet

Paralleling and Protection Unit, PPU-3

Galv. separation:	Between AC voltage, AC current and other I/Os: 3250V AC, 50Hz, 1 min. Between analogue outputs and other I/Os: 500V DC, 1 min. Between binary input groups and other I/Os: 500V DC, 1 min.
Response times: (Delay set to minimum)	
<i>Busbar:</i>	
Over-/undervoltage:	< 50ms
Over-/underfrequency:	< 50ms
Voltage unbalance:	<200ms
<i>Generator:</i>	
Reverse power:	<200ms
Overcurrent:	<200ms
Fast overcurrent:	< 40ms
Over-/undervoltage:	<200ms
Over-/underfrequency:	<300ms
Overload:	<200ms
Current unbalance:	<200ms
Voltage unbalance:	<200ms
React. power import:	<200ms
React. power export:	<200ms
Overspeed:	<400ms
Digital inputs:	<250ms
Emergency stop:	<200ms
Multi-inputs:	<800ms
Wire failure:	<600ms
<i>Mains:</i>	
df/dt (ROCOF):	<130ms (4 periods)
Vector jump:	< 40ms
Positive sequence:	< 60ms
Mounting:	DIN-rail mount or base mount with 6 screws
Safety:	To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2 To UL 508 and CSA 22.2 no. 14-05, overvoltage category III, 300V, pollution degree 2
EMC/CE:	To EN 61000-6-1/2/3/4 IEC 60255-26 IEC 60533 power distr. zone IACS UR E10 power distr. zone
Vibration:	3...13.2Hz: 2mm _{pp} 13.2...100Hz: 0.7g To IEC 60068-2-6 & IACS UR E10

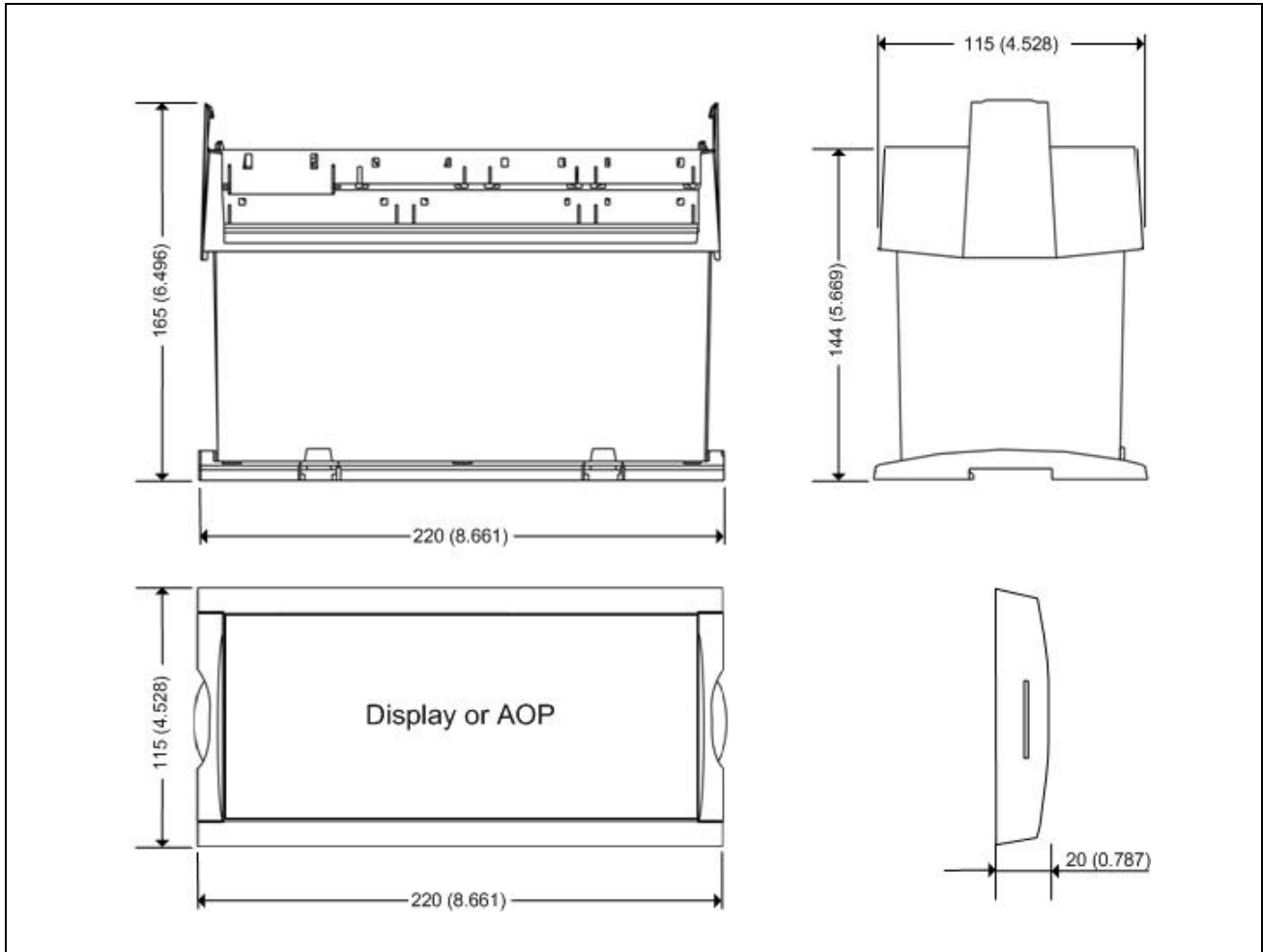
Shock (base mount):	10...60Hz: 0.15mm _{pp} 60...150Hz: 1g To IEC 60255-21-1 Response (class 2) 10...150Hz: 2g To IEC 60255-21-1 Endurance (class 2)
Bump:	10g, 11msec, half sine To IEC 60255-21-2 Response (class 2) 30g, 11msec, half sine To IEC 60255-21-2 Endurance (class 2) 50g, 11msec, half sine To IEC 60068-2-27
Material:	All plastic materials are self-extinguishing according to UL94 (V1)
Plug connections:	AC current: 0.2-4.0 mm ² stranded wire (UL/cUL Listed: AWG 18) AC voltage: 0.2-2.5 mm ² stranded wire (UL/cUL Listed: AWG 20) Relays: (UL/cUL Listed: AWG 22) Terminals 98-116: 0.2-1.5 mm ² stranded wire (UL/cUL Listed: AWG 24) Other: 0.2-2.5 mm ² stranded wire (UL/cUL Listed: AWG 24) Display: 9-pole sub-D female Service port: USB A-B
Protection:	Unit: IP20 Display: IP52 (IP54 with gasket: Option L) (UL/cUL Listed: Type Complete Device, Open Type) To IEC/EN 60529
Governors:	Multi-line 2 interfaces to all governors, including GAC, Barber-Colman, Woodward and Cummins See interfacing guide at www.deif.com

Data sheet

Paralleling and Protection Unit, PPU-3

Approvals:	Marine approved by all major classification societies UL/cUL Listed to UL508
UL markings:	Wiring: Use 60/75°C copper conductors only Mounting: For use on a flat surface of type 1 enclosure Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)
AOP-2:	Maximum ambient temperature: 60°C Wiring: Use 60/75°C copper conductors only Mounting: For use on a flat surface of type 3 (IP54) enclosure Main disconnect must be provided by installer Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)
DC/DC converter for AOP-2:	Tightening torque: 0.5Nm (4.4lb-in) Wire size: AWG 22-14
Weight:	Base unit: 1.6 kg (3.5 lbs.) Option J1/J3/J6: 0.2 kg (0.4 lbs.) Option J2: 0.4 kg (0.9 lbs.) Display: 0.4 kg (0.9 lbs.)

Unit dimensions in mm (inches)



Order specifications

Type Version Option Option Option Option Displays

PPU [] [] [] [] [] [] []

Example:

Type Version Option Option Option Option Displays

PPU [3] [E1] [H2] [M13.6] [] [] [213]

Displays

213

Total number of displays:
 1: 1 std. display (always included)
 2: 1 std. + 1 add. display (option X2)
 3: 1 std. + 2 add. displays (option X2)

Total number of AOP-1 (Option X3)

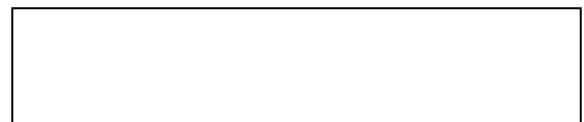
Total number of AOP-2 (Option X4)

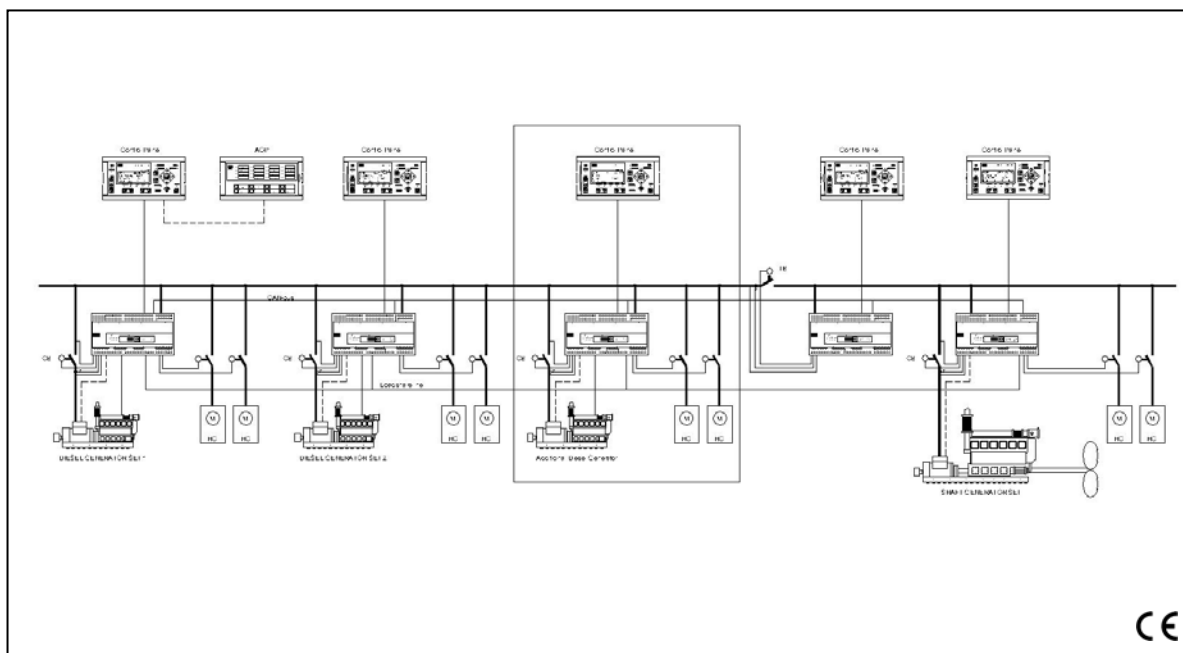
Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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Standard functions

Power management

- Load dependent start/stop
- Programmable start priority
- Heavy consumer control
- Blackout start sequence
- Supervision/control of a shore breaker
- Supervision/control of a bus coupler
- Additional operator panel (AOP)
- Symmetrical and asymmetrical load sharing
- Trip of non-essential load groups

Generator protection

- Over- and undervoltage
- Over- and underfrequency
- Reverse power
- Overcurrent
- Fast overcurrent (> 42ms)
- Overload
- Current unbalance
- Voltage asymmetry
- Loss of excitation and overexcitation

Busbar protection

- Over- and undervoltage
- Over- and underfrequency

Engine control

- Start/stop sequences
- AVR/speed governor control
- Overspeed protection
- 3 configurable alarm inputs with wire break supervision

Display

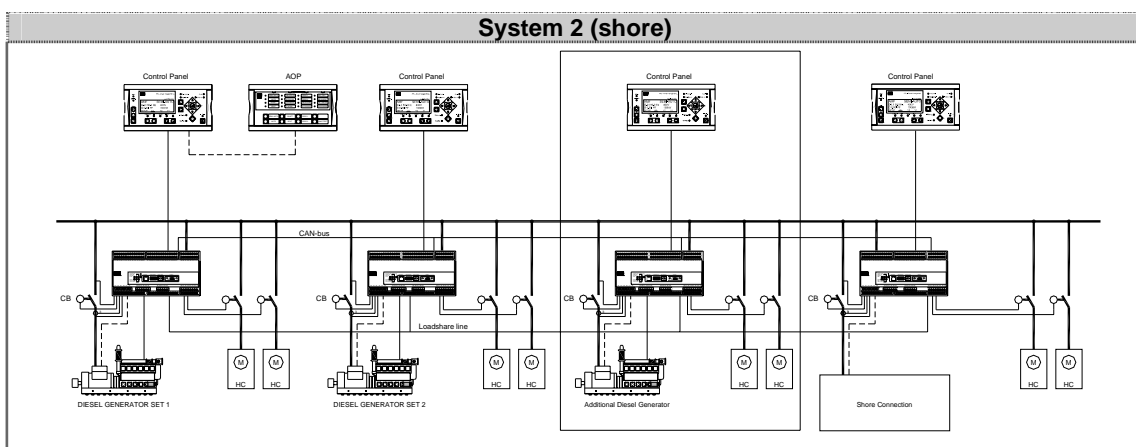
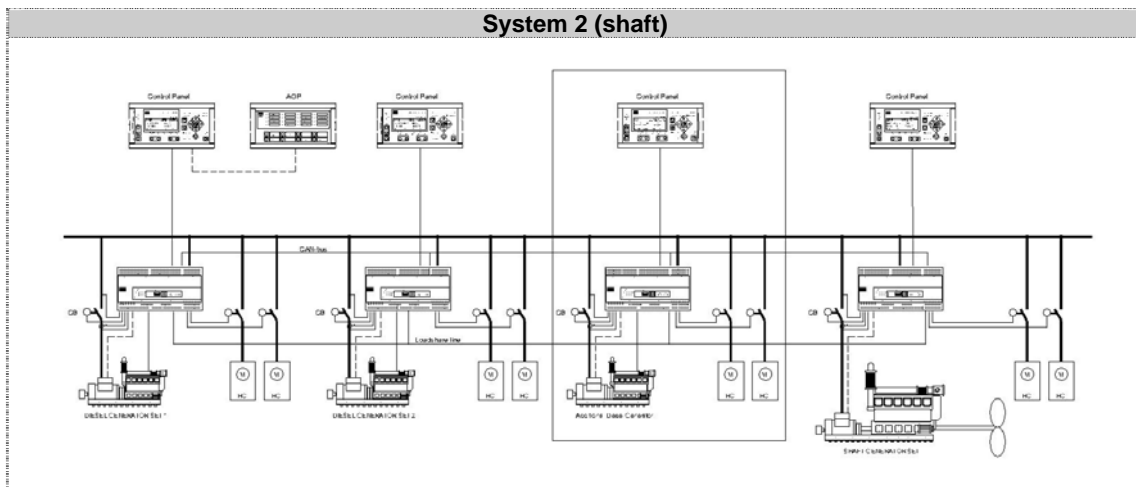
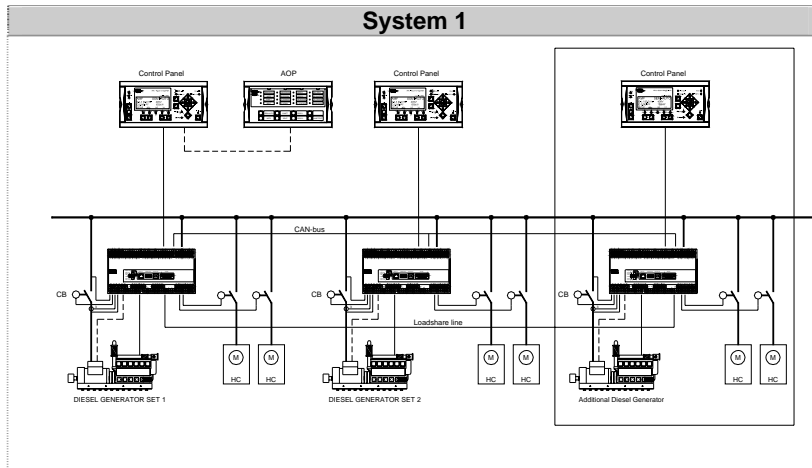
- Push-buttons for start/stop
- Push-buttons for breaker operations
- Information messages
- Status text
- Alarm indication
- Start/stop priority change

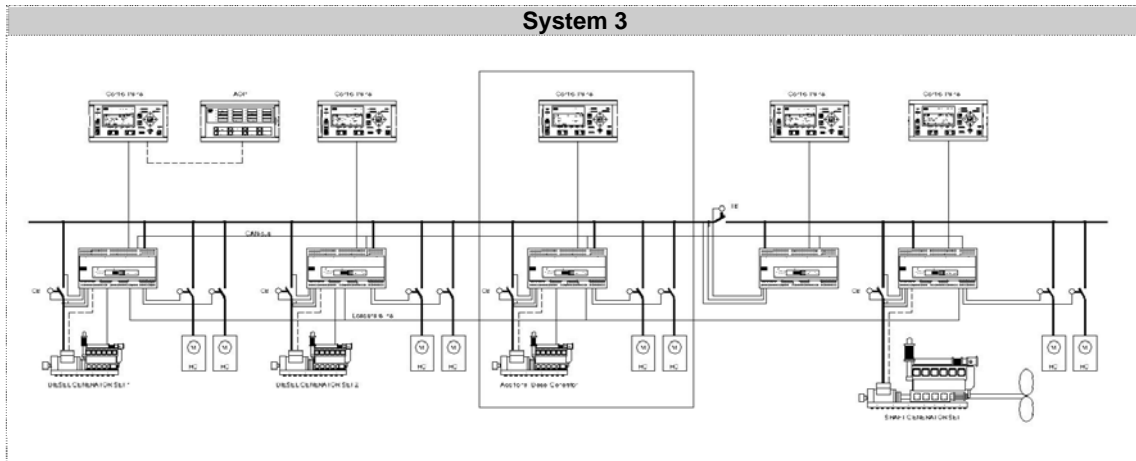
General

- Multiple AOP-2 in parallel
- Five standard languages (English, German, French, Spanish and Italian)
- Interfacing to alarm and monitoring systems (RS485 Modbus RTU or Ethernet TCP/IP Modbus)
- USB interface from laptop
- Password protected parameter changes via display or PC software
- PC software as commissioning tool
- Configurable I/Os, set points, timers and alarms

Application illustrations

SYSTEM	SYSTEM OVERVIEW	COMMENTS
SYSTEM 01	DG 1 + DG 2 + DGn	Minimum 2 diesel generators Maximum 8 diesel generators
SYSTEM 02a SYSTEM 02b	DG 1 + DG 2 + DGn + SG DG 1 + DG 2 + DGn + SC	Minimum 2 diesel generators and 1 shaft generator/shore connection Maximum 8 diesel generators and 1 shaft generator/shore connection
SYSTEM 03	DG 1 + DG 2 + DGn + SG + TB	Minimum 2 diesel generators, 1 shaft generator and 1 bus tie breaker Maximum 8 diesel generators, 1 shaft generator and 1 bus tie breaker





Data sheet

Application

The PPU Power Management (PPM) is a standard power management system for marine applications. The system has been designed to carry out *generator control*, *supervision* and *protection* functions of up to 8 generators running in parallel. The PPM supports different main systems depending on the individual application.

The system performs power management features such as load dependent start/stop, programmable start priority, heavy consumer control, blackout start sequence, supervision of a shore breaker and a bus coupler, symmetrical and asymmetrical load sharing, trip of non-essential load groups and programmable I/Os etc. (the PPM system covers the requirements for most simple and medium-sized marine systems).

Each unit contains all necessary 3-phase measuring circuits and presents all values and alarms on the LCD display.

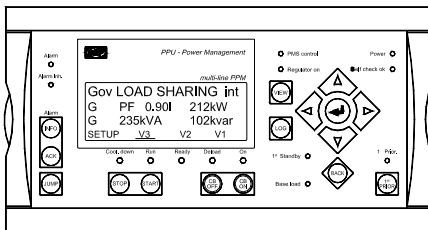
Besides the LCD display, the power management unit has an additional operator panel (AOP-2) with 8 push-buttons and 16 LEDs. The AOP-2 has a CANbus connection to the display unit and can be placed anywhere in the switchboard (max. 200 m from display unit). Multiple AOP-2s can be connected to the CANbus line with parallel operation (X4 option).

The AOP-2 enables status information over the system and includes plant mode control. Communication to an external alarm and monitoring system can be done via Ethernet TCP/IP Modbus, or RS485 Modbus RTU.

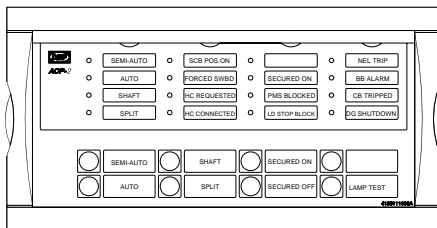
Display

The display is a separate unit and can be mounted directly on the PPM base unit or in the switchboard via the display cable. Up to 3 displays can be connected to the same main unit (X2 option).

Diesel generator



Additional operator panel (AOP-2)



PPU Power Management (PPM)

Power Management

The power management functions are handled in a separate 32-bit processor. As default the PM processor is placed in DG unit 1. The load dependent start/stop function can be adjusted as predicted available rated power (kW), as predicted available apparent power (KVA) or as percentage rated power (%). The start priority selection can either be handled from the PM unit for the entire system or locally via a 1st priority push-button on each display unit.

The heavy consumer control is able to be adjusted as fixed load or variable load (e.g. thrusters). The output signal can also be adjusted as either pulse signal or steady signal. If a blackout situation occurs, the operator can define the following functions:

- Start one or two diesel generators,
- automatically change plant mode to SEMI-AUTO or AUTO mode, and
- in case of short circuit to activate one or no start attempts

In case of an open bus coupling switch, the system can automatically be forced into switchboard control. This can be indicated at the AOP-2 and additionally at each display unit by a yellow PMS control LED.

The load dependent stop function can be blocked by either an external input or by a set point.

Using the set point will only block the load dependent stop function in case of heavy consumer operation.

Power and frequency control

The PPU Power Management (PPM) can control speed governors/AVRs by using relay or analogue output signals. The load sharing function has a separate analogue load share line. This allows placing of additional bus couplers anywhere in the switchboard and ensures active load sharing at open bus coupler positions.

The following regulator functions are available:

- Active load sharing
- Reactive load sharing
- Voltage control (option)
- PF, VAR control (option)

Available options

Option	Description	Placed in	Note
D	Voltage/var control		
D1	Selection between: - Constant voltage control (stand-alone) - Reactive load sharing (island paralleling with other generators)	Software option	Not with EF2
E	Analogue controller outputs		
E1	+/-20mA for speed governor +/-20mA for AVR	Slot #4	AVR: Only when option D is chosen Not with EF functions
F	Analogue transducer outputs		
F1	2 x 0(4)...20mA transducer outputs	Slot #6	
EF	Combination outputs		
EF2	+/-20mA for speed governor 1 x 0(4)...20mA transducer output	Slot #4	Not with E1
EF4	+/-20mA for speed governor or AVR 2 x relay outputs for speed governor or AVR	Slot #4	Not with E1, EF2 AVR: Requires D
H	Serial communication		
H2	Modbus RTU (RS485)	Slot #2	
J	Cables		
J2	Display cable with plugs, 6 m. UL94 (V1) approved	Other	
J4	PC cable for option N programming (Ethernet cable crossed), 3 m. UL94 (V1) approved.	Other	
J7	PC USB cable 3 m	Other	
K	Technical documentation		
K1	Hard copy (as standard enclosed as CD ROM)	Other	
L	Display gasket for IP54		
M	Configurable I/O extension cards		
M15	4 x 0(4)...20mA analogue inputs	Slot #6	Not with F1, M16, M18
M16	7 x binary inputs	Slot #6	Not with F1, M15, M18
M18	4 x relay outputs	Slot #6	Not with F1, M15, M16
N	Webarm functions		
N5	Ethernet TCP/IP Modbus	Software option	
X	Display		
X2	Additional display (DU-2)	Other	Max. 3 displays per main unit
X4	Additional operator panel (AOP-2)	Other	With same functions as standard AOP-2 for parallel operations in different locations



For detailed information about hardware options, please see hardware overview on page 6.



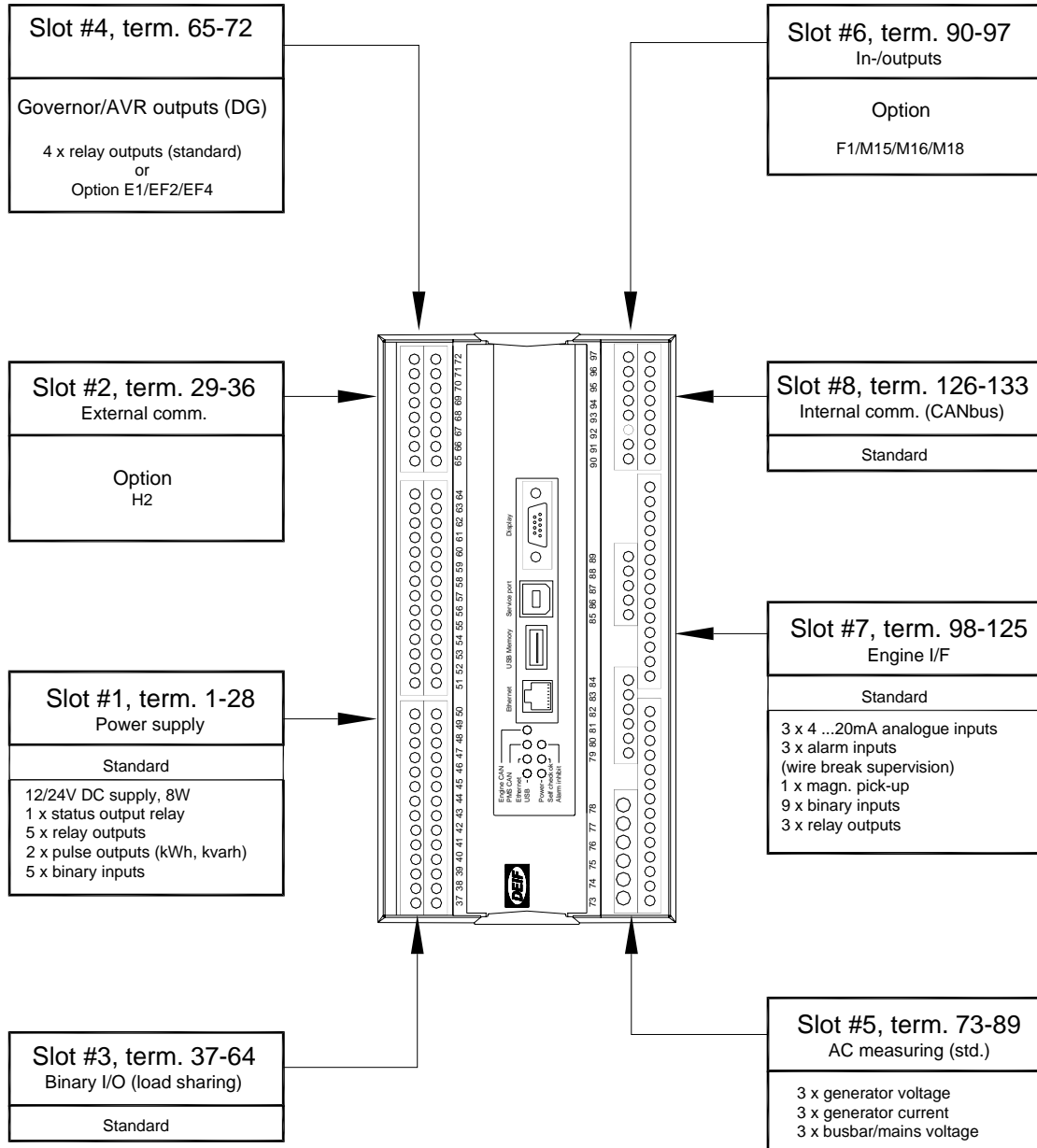
For detailed order information, please see order specifications on page 11.

Hardware overview



There can only be one hardware option in each slot. It is e.g. not possible to select option F1 and option M15 at the same time because all options require a PCB in slot #6.

Besides the hardware options shown on this page it is possible to select the software options mentioned on page 4 in this data sheet.



Technical specifications

<p>Accuracy: Class 1.0, to IEC/EN 60688</p> <p>Operating temp.: -25...70°C (-13...158°F) (UL/cUL Listed: Max. surrounding air temp.: 55°C/131°F)</p> <p>Storage temp.: -40...70°C (-40...158°F)</p> <p>Climate: 97% RH to IEC 60068-2-30</p> <p>Meas. voltage: 100-690V AC +/-20% (UL/cUL Listed: 110-480V AC phase-phase)</p> <p>Consumption: Max. 0.25VA/phase</p> <p>Meas. current: -/1 or -/5A AC (UL/cUL Listed: From CTs 1-5A)</p> <p>Consumption: Max. 0.3VA/phase</p> <p>Current overload: 4 x I_n continuously 20 x I_n, 10 sec. (max. 75A) 80 x I_n, 1 sec. (max. 300A)</p> <p>Meas. frequency: 30...70Hz</p> <p>Aux. supply: 8-36V DC Max. 11W consumption The aux. supply inputs are to be protected by a 2A slow blow fuse (UL/cUL Listed: AWG 24)</p> <p>Binary inputs: Optocoupler, bi-directional ON: 8...36V DC Impedance: 4.7kΩ OFF: <2V DC</p> <p>Relay outputs: Electrical rating: 250V AC/30V DC, 5A (UL/cUL Listed: 250V AC/24V DC, 2A resistive load) Thermal rating @ 50°C 2A: Continuously 4A: t_{ON} = 5 sec., t_{OFF} = 15 sec. (Unit status output: 1A)</p> <p>Open collector outputs: Supply 8...36V DC, max. 10mA</p> <p>Analogue inputs: -10...0...+10V DC Not galvanically separated Impedance: 100kΩ (0)4...20mA Impedance: 50Ω Not galvanically separated</p>	<p>Mounting: DIN-rail mount or base mount DEIF recommends base mounting for marine applications. If DIN-rail mounted in marine applications, additional means against excessive mechanical vibrations must be used.</p> <p>Load sharing lines: -5...0...+5V DC Impedance: 23.5kΩ</p> <p>Analogue outputs: 0(4)...20mA and +/-25mA Galvanically separated Active output (internal supply) Load max. 500Ω (UL/cUL Listed: Max. 20mA output)</p> <p>Safety: To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2 To UL 508 and CSA 22.2 no. 14-05, overvoltage category III, 300V, pollution degree 2</p> <p>Galv. separation: Between AC voltage, AC current and other I/Os: 3250V AC, 50Hz, 1 min. Between analogue outputs and other I/Os: 500V DC, 1 min. Between binary input groups and other I/Os: 500V DC, 1 min.</p> <p>EMC/CE: To EN 61000-6-1/2/3/4 IEC 60255-26 IEC 60533 power distr. zone IACS UR E10 power distr. zone</p> <p>Vibration: 3...13.2Hz: 2mmpp 13.2...100Hz: 0.7g To IEC 60068-2-6 & IACS UR E10 10...60Hz: 0.15mmpp 60...150Hz: 1g To IEC 60255-21-1 Response (class 2) 10...150Hz: 2g To IEC 60255-21-1 Endurance (class 2)</p> <p>Shock (base mount): 10g, 11msec, half sine To IEC 60255-21-2 Response (class 2) 30g, 11msec, half sine To IEC 60255-21-2 Endurance (class 2) 50g, 11msec, half sine To IEC 60068-2-27</p>
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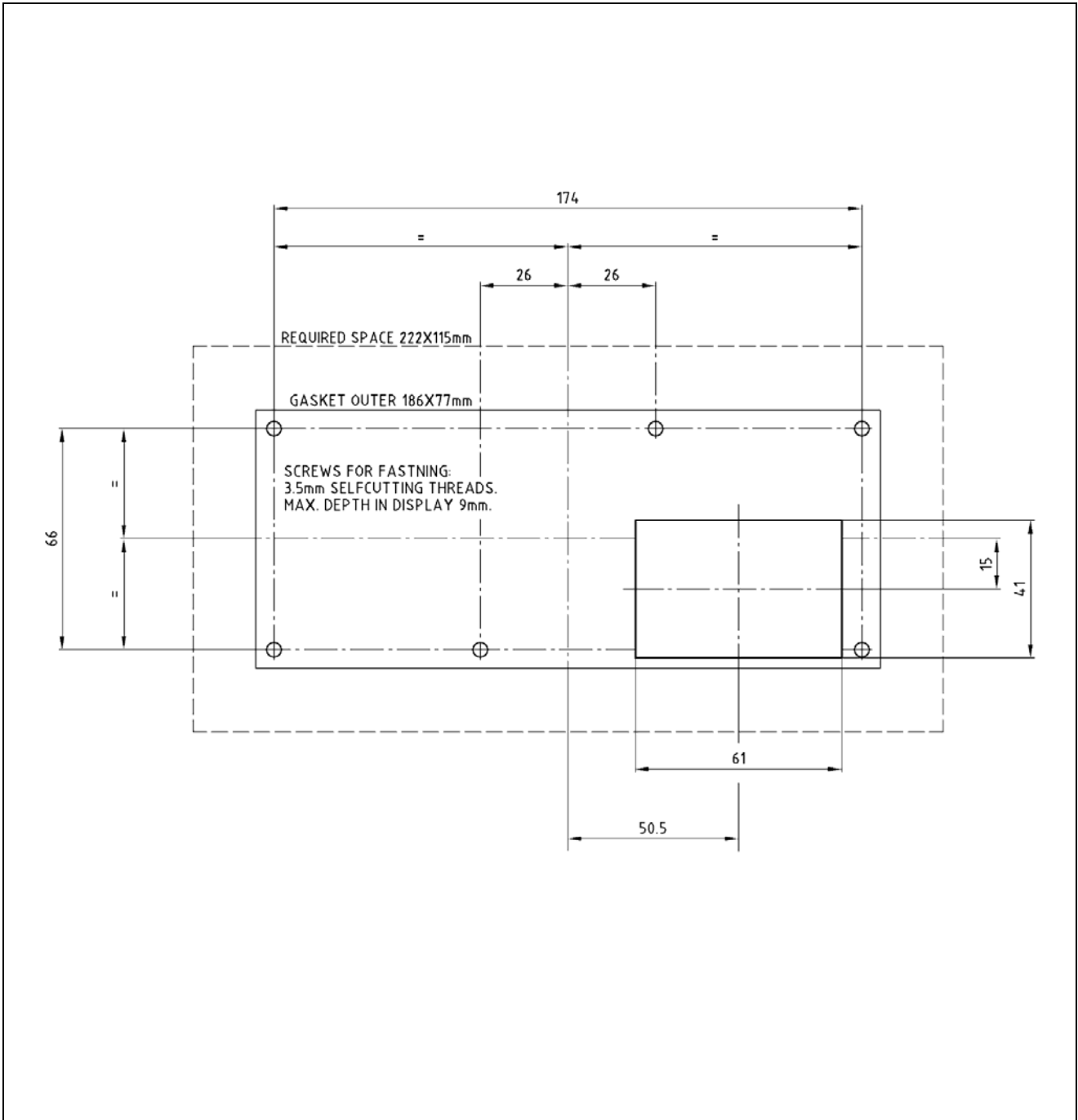
Data sheet

Bump:	20g, 16msec, half sine To IEC 60255-21-2 (class 2)
Material:	All plastic materials are self-extinguishing according to UL94 (V1)
Plug connections:	AC current: 0.2-4.0 mm ² stranded wire (UL/cUL Listed: AWG 18) AC voltage: 0.2-2.5 mm ² stranded wire (UL/cUL Listed: AWG 20) Relays: (UL/cUL Listed: AWG 22) Other: 2.5 mm ² multi-stranded (UL/cUL Listed: AWG 24) Display: 9-pole Sub-D female PC: USB A-B Ethernet: RJ45
Approvals:	The PPM is approved by the major classification societies. Contact DEIF for details. UL and cUL

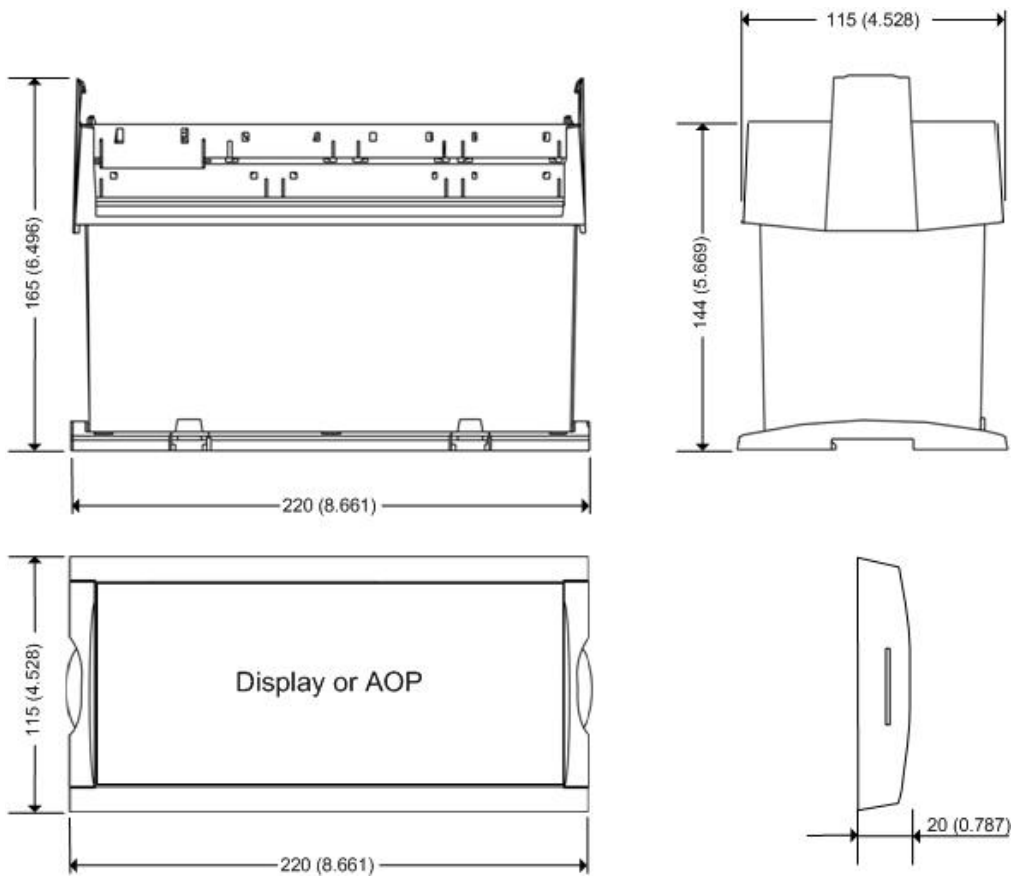
PPU Power Management (PPM)

UL markings:	Wiring: Use 60/75°C copper conductors only Mounting: For use on a flat surface of type 1 enclosure Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)
Governors:	Multi-line 2 interfaces to all governors, including GAC, Barber-Colman, Woodward and Cummins See interfacing guide at www.deif.com
Weight:	Main unit: 1.5 kg (3.40 lbs.) J1, cable 3 m: 0.2 kg (0.45 lbs.) Option J2: 0.4 kg (0.90 lbs.) Option J7: 0.2 kg (0.45 lbs.) Display: 0.4 kg (0.90 lbs.)
Protection:	Unit: IP20 Display: IP52 (IP54 with gasket: Option L) (UL/cUL Listed: Type Complete Device, Open Type) To IEC 529 and EN 60529

Panel cutout (mm)

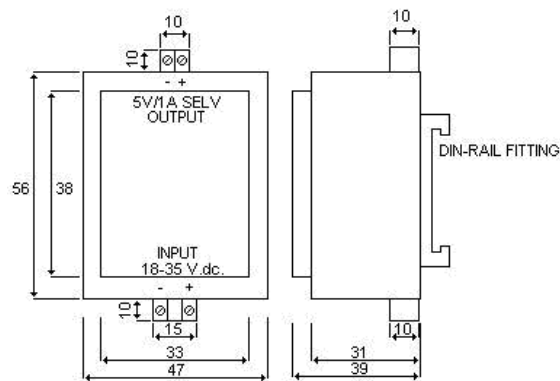


Unit dimensions in mm (inches)



Display size: H x W x D = 115 (4.528") x 220 (8.661") x 20 (0.787)

External 24V DC to 5V DC converter for the AOP-2



Order information

The PPM system is ordered in two steps:

Step 1: System information

Please indicate your type of PMS system and the number of DGs:

	1	2a (Shaft)	2b (Shore)	3
PMS system				

Number of DGs (2...8)	
------------------------------	--

Step 2: Unit option information

Option	D1 (X)	E1 (X)	F1 (X)	EF2 (X)	EF4 (X)	H2 (X)	J2 (X)	J4 (X)	J7 (X)	L (X)	M15 (X)	M16 (X)	M18 (X)	N5 (X)	X2 (0..2) @1	X4 (0..4) @2
Unit																
DGM																
DG2																
DG3																
DG4																
DG5																
DG6																
DG7																
DG8																
TB																
SG																

@1: One display per PPM unit is already included as standard, enter only the number of additional displays here
 @2: One AOP-2 is already included as standard, enter only the number of additional AOP-2s here

Option K1:

	UK
Documentation as hard copy (no. of sets)	

(Only one hard copy is included as standard).



For detailed information about options, please see option list on page 5.

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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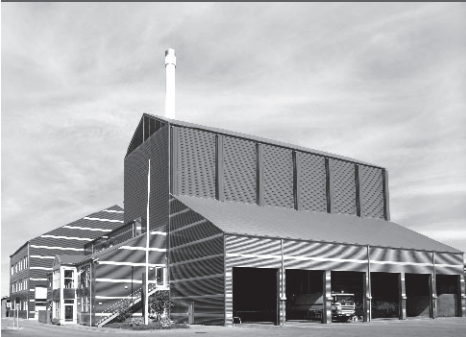
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-power in control



DATA SHEET



Protection and Power Management, PPM-3

- Protection (ANSI)
- Options
- Engine control and interface
- M-logic (Micro PLC)
- Application
- Technical specifications
- Order specification



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Document no.: 4921240337D
SW version: 3.04.0 or later

1. General	
1.1. General.....	3
1.1.1. PPM-3.....	3
1.1.2. Unit control modes AUTO.....	3
1.1.3. Unit control modes SEMI.....	3
1.1.4. Unit control modes SWBD.....	3
1.1.5. Setup.....	3
1.1.6. Unit definition.....	3
1.1.7. Unit dimensions in mm (inches).....	4
2. Display	
2.1. Display layouts.....	5
2.1.1. About displays.....	5
3. Protection (ANSI)	
3.1. Protection (ANSI).....	8
3.1.1. Standard functions.....	8
4. Options	
4.1. Options.....	9
4.1.1. Hardware overview.....	9
4.1.2. Available options.....	12
5. Engine control and interface	
5.1. Engine control and interface.....	15
6. M-logic (Micro PLC)	
6.1. M-logic (Micro PLC).....	16
7. Application	
7.1. Application.....	17
7.1.1. Plant operation.....	17
7.1.2. Configuration.....	17
7.1.3. Heavy consumer management.....	18
7.1.4. Load-dependent operation.....	18
7.1.5. Priority selection.....	18
7.1.6. Redundant CANbus.....	18
7.1.7. Power management applications.....	19
8. Technical specifications	
8.1. Technical specifications.....	21
9. Order specification	
9.1. Order specification.....	24

1. General

1.1 General

1.1.1 PPM-3

The Protection and Power Management (PPM-3) is a very flexible controller for marine applications with microprocessor-based control units containing all necessary functions for protection and control of diesel generators, shaft generators, shore connections and bus tie breakers. It contains all necessary 3-phase measuring circuits and all values and alarms are presented on the LCD display.

The PPM-3 is a compact all-in-one unit designed for the following applications:

- Multiple gen-sets
- Split busbars with independent section control
- Ring bus connection
- Shaft generator and shore connection control
- Bus tie breaker control
- Emergency generator control

1.1.2 Unit control modes AUTO

Auto control means that the plant is controlled automatically by PPM-3, and gen-set starting and stopping is based on power demand (when in DG supply operation). Upon operator command, switching between different operation modes is done automatically.

1.1.3 Unit control modes SEMI

Semi-auto control is an operator-dependent auto mode. This means that gen-set start/stop, synchronisation and opening of the breaker is carried out by PPM-3 on operator command only. A diesel generator unit connected in semi-auto will not be a part of the load-dependent start/stop function.

1.1.4 Unit control modes SWBD

Switchboard control means that PPM-3 is disabled totally with regards to start/stop/synchronising and load sharing. The protection functions remain active.

1.1.5 Setup

Setup is easily done via a menu structure in the display (password-protected) or via the USB PC connection and the Multi-line 2 Windows-based PC utility software. The PC utility software can be downloaded free of charge from www.deif.com. The utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates.

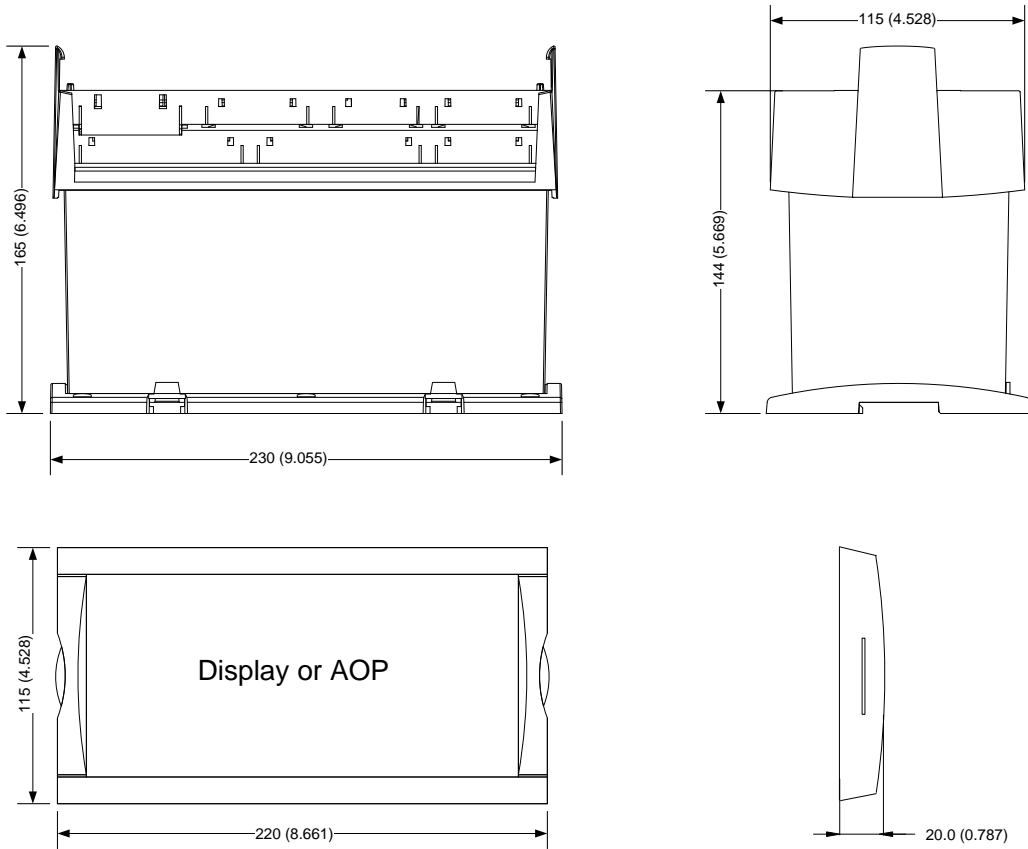
1.1.6 Unit definition

PPM DG	Diesel generator controller
PPM SG	Shaft generator controller
PPM SC	Shore connection controller
PPM BTB	Bus tie breaker controller
PPM EDG	Emergency diesel generator controller



One of the two CAN communications (1) is used for internal communication. CAN 2 is for communication options or redundant internal CAN.

1.1.7 Unit dimensions in mm (inches)



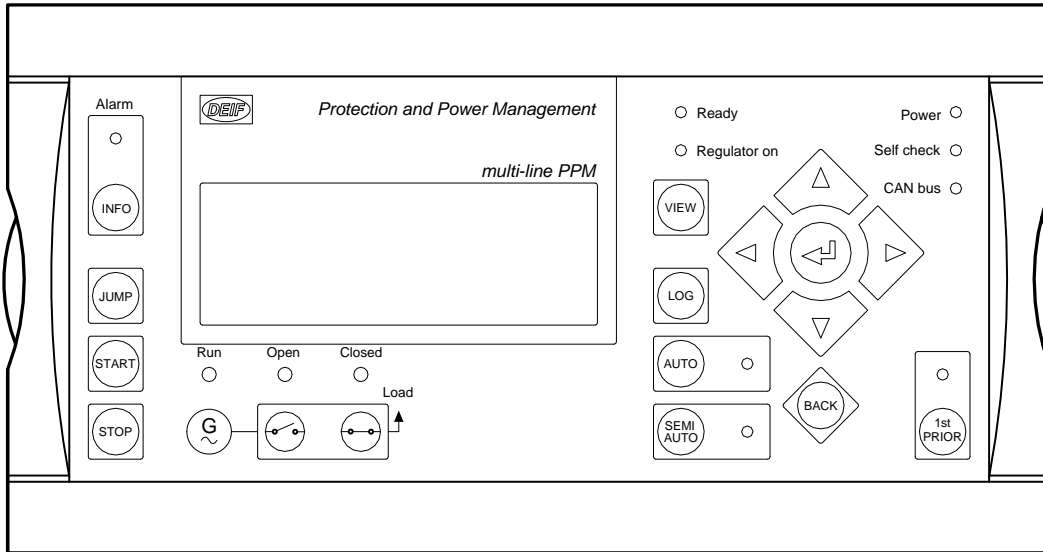
2. Display

2.1 Display layouts

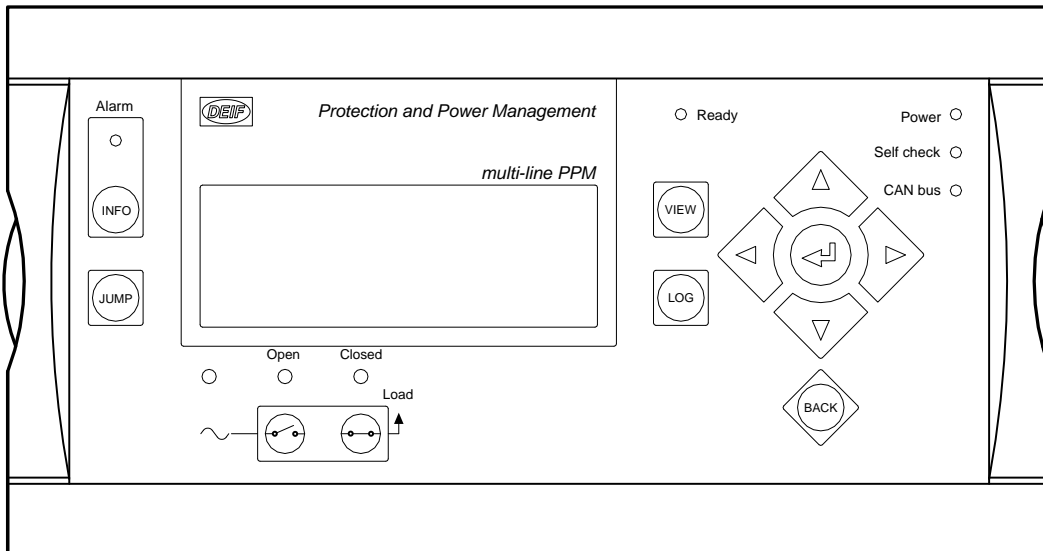
2.1.1 About displays

The display is separate and can be installed directly on the main unit or in the front of the switchboard door (requires option J1 - display cable). Additional displays can be installed within 200 m.

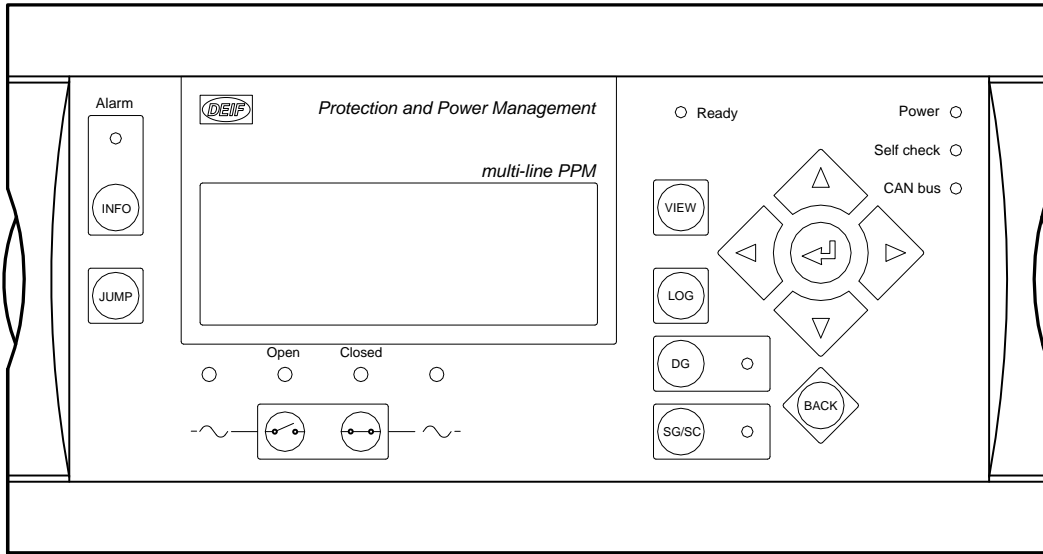
Diesel generator display



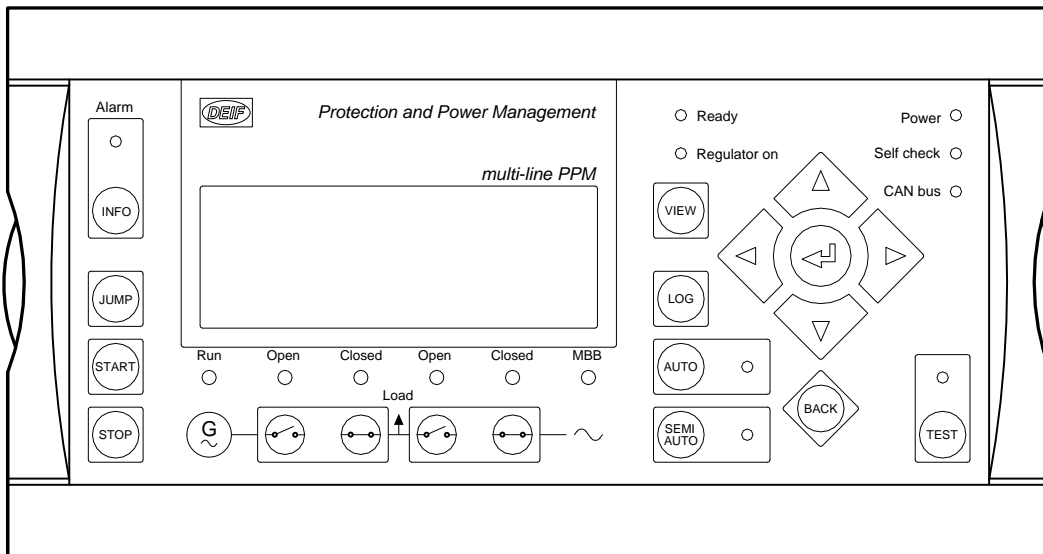
Shaft generator/shore connection display



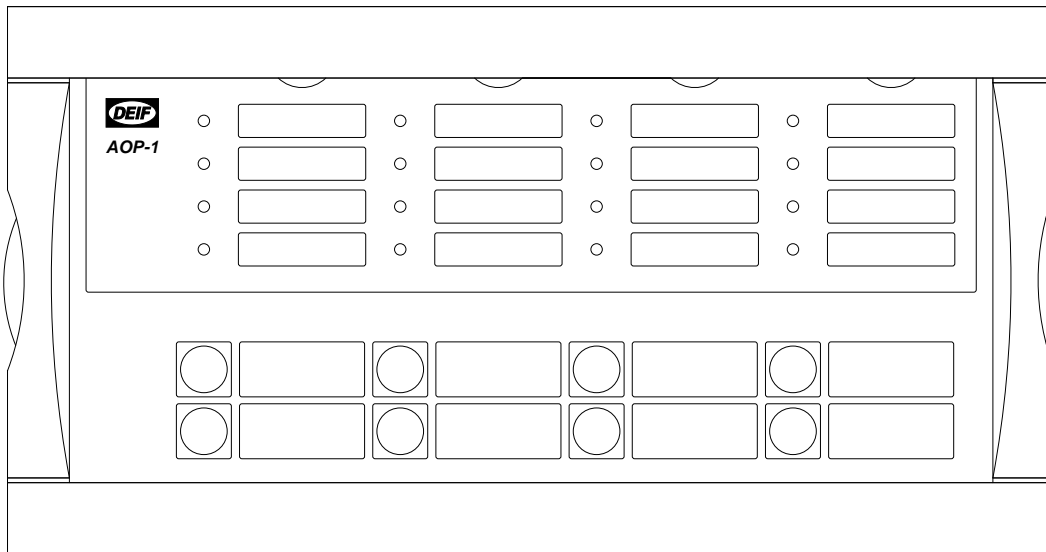
Bus tie breaker display



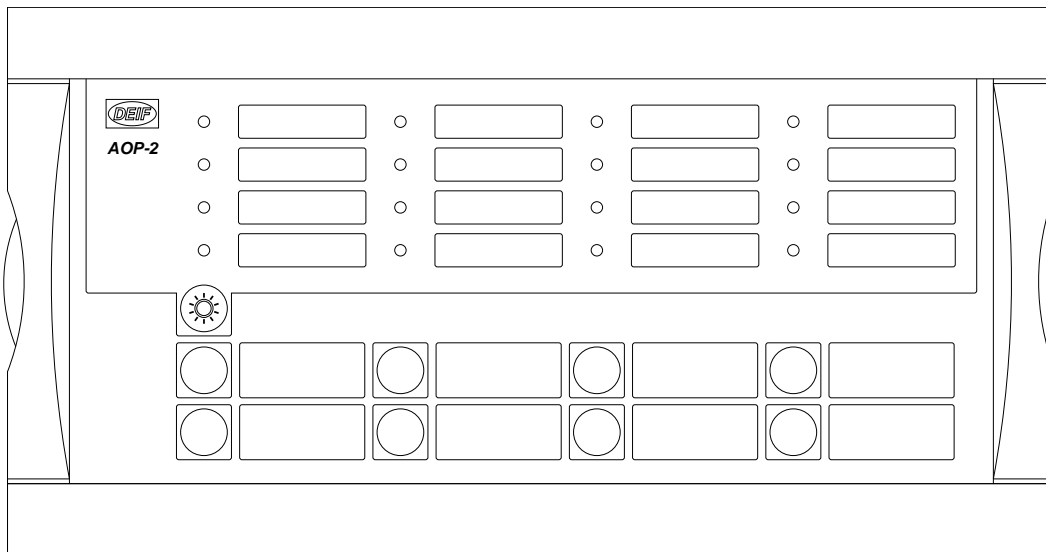
Emergency diesel generator display



Additional operator panel display - AOP-1



Additional operator panel display - AOP-2



3. Protection (ANSI)

3.1 Protection (ANSI)

3.1.1 Standard functions

The following protection functions are included as standard functions

Protection function	ANSI no. *	Levels
Generator reverse power	(32)	2 steps
Generator overcurrent	(50)	4 steps
Voltage-dependent overcurrent	(51V)	
Fast overcurrent	(51)	2 steps
Generator overvoltage	(59)	2 steps
Generator undervoltage	(27)	3 steps
Generator overfrequency	(81)	3 steps
Generator underfrequency	(81)	3 steps
Busbar overvoltage	(59 B)	3 steps
Busbar undervoltage	(27 B)	4 steps
Busbar overfrequency	(81 B)	3 steps
Busbar underfrequency	(81 B)	4 steps
Generator overload	(32)	5 steps
Current unbalance	(46)	
Voltage unbalance	(60)	
Overexcitation	(24)	
Loss of excitation	(40)	

* (ANSI# as per IEEE Std. C37.2-1996 (R2001) in parenthesis).

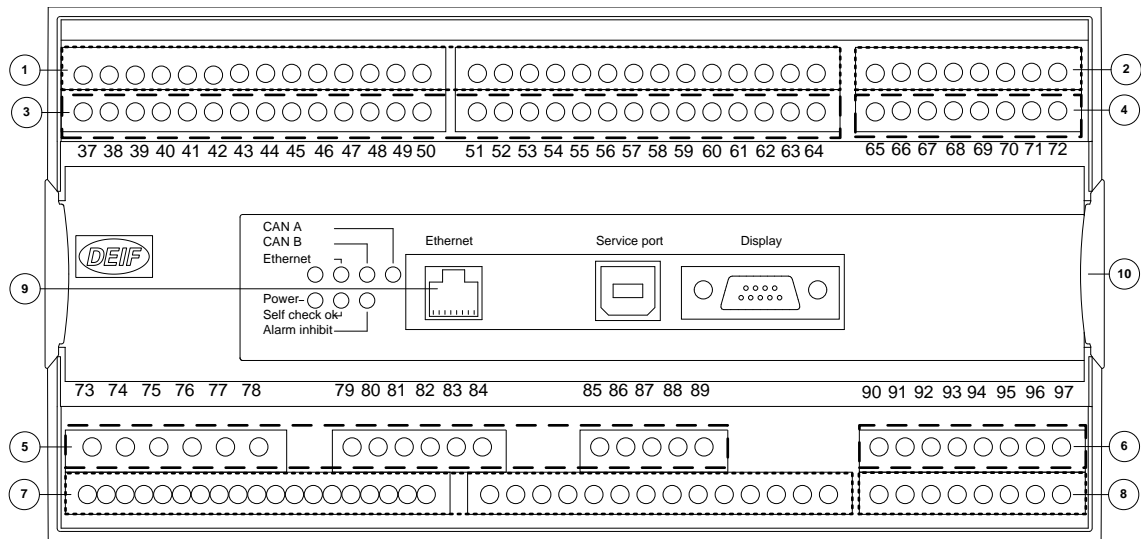
4. Options

4.1 Options

In order to perfectly match the product solution to specific applications, the functionality of the PPM-3 can be equipped with a number of available options. The options selected by the customer will be integrated in the standard PPM-3, hereby securing the same user interface unaffected by whether the application needs a highly complex or a more basic gen-set controller.

Please refer to the Available options chapter to see available options.

4.1.1 Hardware overview



1. The numbers in the drawing above refer to slot numbers.

Hardware overview

Slot	Option	Description
Slot #1, terminal 1-28 Power supply (standard)		8-36V DC supply, 11 W 1 x status output relay 5 x relay outputs 2 x pulse outputs (kWh, kVArh) 5 x digital inputs
Slot #2, terminal 29-36 Communication	H2	Modbus RTU (RS485)
	H3	Profibus DP
	H8.2	External I/O modules
Slot #3, terminal 37-64 In-/outputs/load sharing		13 x digital inputs
		4 x relay outputs (standard)
	G3	Active power load sharing (standard) Reactive power load sharing (requires option D1)
Slot #4, terminal 65-72 Governor, AVR, in-/outputs	M14.4	4 x relay (standard)
	E1	2 x +/-20 mA out
	E2	2 x 0(4)...20 mA out
	EF2	1 x +/-20 mA out 1 x 0(4)...20 mA out
	EF4	1 x +/-20 mA out 2 x relay
	EF5	1 x PWM governor output 1 x +/-20 mA out for AVR 2 x relay
Slot #5, terminal 73-89 AC measuring (standard)		3 x generator voltage 3 x generator current 3 x busbar/mains voltage
Slot #6, terminal 90-97 In-/outputs	F1	2 x 0(4)...20 mA out, transducer
	M13.6	7 x digital inputs
	M14.6	4 x relay outputs
	M15.6	4 x 4...20 mA inputs
Slot #7, terminal 98-125 Engine I/F (standard)		8-36V DC supply, 5 W 1 x magnetick pick-up (MPU) 3 x multi-inputs 7 x digital inputs 4 x relay outputs
	G5	Power management (standard)
	H7	J1939

Slot	Option	Description
Slot #8, terminal 126-133 Engine communication, in-/out-puts		MTU (MDEC) + J1939 (option H7)
	H8.8	External I/O modules
	M13.8	7 x digital inputs
	M14.8	4 x relay outputs
	M15.8	4 x 4-20 mA input
No. 9: Ethernet	N	TCP/IP Modbus communication and alarm via SMS or e-mail
No. 10: LED I/F		Display connection PC-programming connection



There can only be one hardware option in each slot. It is e.g. not possible to select option H2 and option H3 at the same time, because both options require a PCB in slot #2.



Besides the hardware options shown on this page, it is possible to select the software options mentioned in "Available options".


4.1.2 Available options


Option	Description	Slot no.	Option type	Note
D	Voltage/VAr/PF control			Not available for PPM SG/SC and PPM BTB
D1	Constant voltage control (stand-alone)		Software	
	Constant reactive power control (parallel with mains)			
	Constant power factor control (parallel with mains)			
	Reactive load sharing (island paralleling with other generators)			
E and F	Analogue controller and transducer outputs			
E1	2 x +/-25 mA (GOV/AVR or transducer)	4	Hardware	Not with E2, EF2, EF4 or EF5 AVR output requires D1
E2	2 x 0(4)...20 mA (GOV/AVR or transducer)	4	Hardware	Not with E1, EF2, EF4 or EF5 AVR output requires D1
EF2	1 x +/-25 mA (GOV/AVR or transducer) 1 x 0(4)...20 mA (GOV/AVR or transducer)	4	Hardware	Not with E1, E2, EF4 or EF5 AVR output requires D1
EF4	1 x +/-25 mA (GOV/AVR or transducer) 2 x relay outputs (GOV/AVR or configurable)	4	Hardware	Not with E1, E2, EF2 or EF5 AVR output requires D1
EF5	1 x PWM (Puls Width Modulated) output for CAT GOV+/-20 mA for AVR 2 x relay outputs (GOV/AVR or configurable)	4	Hardware	Not with E1, E2, EF2 or EF4 AVR output requires D1
F1	2 x 0(4)...20 mA (transducer)	6	Hardware	Not with M13.6, M14.6 or M15.6
H	Serial communication			
H2	Modbus RTU (RS485)	2	Hardware	Not with H3, H8.2
H3	Profibus DP	2	Hardware	Not with H2, H8.2
H5	CANbus: MTU (ADEC and MDEC) and all J1939 engine communication in option H7	8	Hardware	Not with H7, H8.8, M13.8, M14.8 or M15.8 Not available for PPM SG/SC and PPM BTB

Option	Description	Slot no.	Option type	Note
H7	CANbus (J1939): Caterpillar: Perkins Cummins CM850/570: Scania (EMS) Detroit Diesel (DDEC): Scania (EMS S6) Deutz (EMR): Volvo Penta (EMS) Iveco (NEF/CURSORS): Volvo (EMS2) John Deere (JDEC)	7	Software	Not with H5 or redundant PMS CANbus Not available for PPM SG/SC and PPM BTB
H8.X	External I/O modules	2, 8	Hardware	H8.2: Not with H2, H3, H8.8 H8.8: Not with H5, H8.2, M13.8, M14.8 or M15.8
J	Cables			
J2	Display cable with plugs, 6 m. UL94 (V1) approved		Other	
J4	PC cable for option N-programming UL94 (Ethernet cable crossed), 3 m. UL94 (V1) Listed		Other	Only in connection with option N
J6	Display cable with plugs, 1 m. UL94 (V1) approved		Other	
J7	PC cable for utility software (USB) 3 m. UL94 (V1) approved		Other	
K	Documentation			
K1	Designer's Reference Handbook (hard copy)		Other	
K2	CD-ROM with complete documentation		Other	
L	Display gasket for IP54		Other	Standard is IP52
M	Binary and analogue I/Os			
M13.X	7 binary inputs, configurable	6, 8	Hardware	M13.6: Not with F1, M14.6 or M15.6 M13.8: Not with H5, H8.8, M14.8 or M15.8
M14.X	4 relay outputs, configurable	6, 8	Hardware	M14.6: Not with F1, M13.6 or M15.6 M14.8: Not with H5, H8.8, M13.8 or M15.8

Option	Description	Slot no.	Option type	Note
M15.X	4 analogue inputs, configurable, 4...20 mA	6, 8	Hardware	M15.6: Not with F1, M13.6, M14.6 or M15.8 M15.8: Not with H5, H8.8, M13.8, M14.8 or M15.6
N	Ethernet TCP/IP communication			
N	Ethernet TCP/IP Modbus comm. and alarms via SMS or e-mail		Hardware/software	
Q	Measurement accuracy			
Q1	Verified class 0.5		Other	
X	Display			
X2	Additional standard display. CANbus comm.		Other	Two X2 options can be ordered for each PPM unit
X3	Additional operator panel (AOP-1): 16 configurable LEDs and 8 configurable push-buttons		Other	Max. one AOP-1 for each display unit
X4	Additional operator panel (AOP-2): 16 configurable LEDs, 8 configurable buttons and 1 status relay. CANbus comm.		Other	Five X4 options can be ordered for each PPM unit

(ANSI# as per IEEE Std. C37.2-1996 (R2001) in parenthesis).

 **Options E1, E2, EF2, EF4 and EF5 are used for GOV/AVR control. 4 relays are used as standard in the PPM-3 for GOV/AVR control. If selected, these options will replace the 4 relays.**

 **Please notice that not all options can be selected for the same unit. Please refer to the paragraph "Hardware overview" in this data sheet for further information about the location of the options in the unit.**

5. Engine control and interface

5.1 Engine control and interface

The PPM-3 is supplied with an engine interface I/O card with separate power supply and processor. The card is equipped with the following I/Os:

In-/outputs		Available
Multi-inputs	4-20 mA	3 (3)
	Digital inputs	
	Pt100	
	Pt1000	
	VDO	
	0-40V DC	
Digital inputs		7 (4)
RPM (MPU)		1
Relays		4
CANbus communication		2



The number in parenthesis indicates the number of user configurable in-/outputs.

6. M-logic (Micro PLC)

6.1 M-logic (Micro PLC)

This configuration tool is part of the PC utility software which is free of charge. With this tool, it is possible to customise the application to your needs. It is possible to dedicate specific functions or logical conditions to different inputs and outputs.

Logic 1	Item description (optional and saved in project file only)				
Event A	Operator	Event B	Operator	Event C	
NOT <input type="checkbox"/> BUS high-volt 1: Alarms	OR	NOT <input type="checkbox"/> Not used	OR	NOT <input type="checkbox"/> Not used	
Enable this rule <input checked="" type="checkbox"/>	Output: Activate Secured Mode: C		Delay (sec.) 0		
Logic 2	Item description (optional and saved in project file only)				
Event A	Operator	Event B	Operator	Event C	
NOT <input type="checkbox"/> Not used	OR	NOT <input type="checkbox"/> Not used	OR	NOT <input type="checkbox"/> Not used	
Enable this rule <input type="checkbox"/>	Output: Not used		Delay (sec.) 0		
Logic 3	Item description (optional and saved in project file only)				
Event A	Operator	Event B	Operator	Event C	
NOT <input type="checkbox"/> Not used	OR	NOT <input type="checkbox"/> Not used	OR	NOT <input type="checkbox"/> Not used	
Enable this rule <input type="checkbox"/>	Output: Not used		Delay (sec.) 0		
Logic 4	Item description (optional and saved in project file only)				
Event A	Operator	Event B	Operator	Event C	
NOT <input type="checkbox"/> Not used	OR	NOT <input type="checkbox"/> Not used	OR	NOT <input type="checkbox"/> Not used	
Enable this rule <input type="checkbox"/>	Output: Not used		Delay (sec.) 0		
Logic 5	Item description (optional and saved in project file only)				
Event A	Operator	Event B	Operator	Event C	
NOT <input type="checkbox"/> Not used	OR	NOT <input type="checkbox"/> Not used	OR	NOT <input type="checkbox"/> Not used	
Enable this rule <input type="checkbox"/>	Output: Not used		Delay (sec.) 0		
Logic 6	Item description (optional and saved in project file only)				
Event A	Operator	Event B	Operator	Event C	
NOT <input type="checkbox"/> Not used	OR	NOT <input type="checkbox"/> Not used	OR	NOT <input type="checkbox"/> Not used	
Enable this rule <input type="checkbox"/>	Output: Not used		Delay (sec.) 0		
Logic 7	Item description (optional and saved in project file only)				
Event A	Operator	Event B	Operator	Event C	
NOT <input type="checkbox"/> Not used	OR	NOT <input type="checkbox"/> Not used	OR	NOT <input type="checkbox"/> Not used	
Enable this rule <input type="checkbox"/>	Output: Not used		Delay (sec.) 0		
Logic 8	Item description (optional and saved in project file only)				
Event A	Operator	Event B	Operator	Event C	
NOT <input type="checkbox"/> Not used	OR	NOT <input type="checkbox"/> Not used	OR	NOT <input type="checkbox"/> Not used	

7. Application

7.1 Application

The Protection and Power Management (PPM-3) controllers are able to handle applications with up to

- 8 bus tie breakers (BTB)
- 16 diesel generators (DG)
- 1 emergency breaker (EDG)
- 2 shaft generators (SHAFT)
- 2 shore connections (SHORE)

The basic functions are:

- All breakers can be synchronised by choice
- Load-dependent start/stop operation
- Priority selection of gen-sets
- Redundant communication between the controllers
- Plant divided into sections for individual functionality
- Load transfer
- Heavy consumer management
- Multi-master system

In a multi-master system, all vital data is broadcasted from all units to all units, giving all units knowledge of their own position in the application. This philosophy makes the application immune to a failing master controller.

7.1.1 Plant operation

The plant operation depends on the plant configuration, i.e. if there are shaft generator(s), bus tie breaker(s), synchronisable shore connection(s) and/or an emergency diesel generator involved. Switching between different operation modes is done with push-buttons on the display.

Operation modes:

- Load sharing between diesel generators
- Fixed power (diesel generator)
- Load transfer between shaft- and diesel generator
- Load transfer between shore connection and diesel generator
- Split busbar

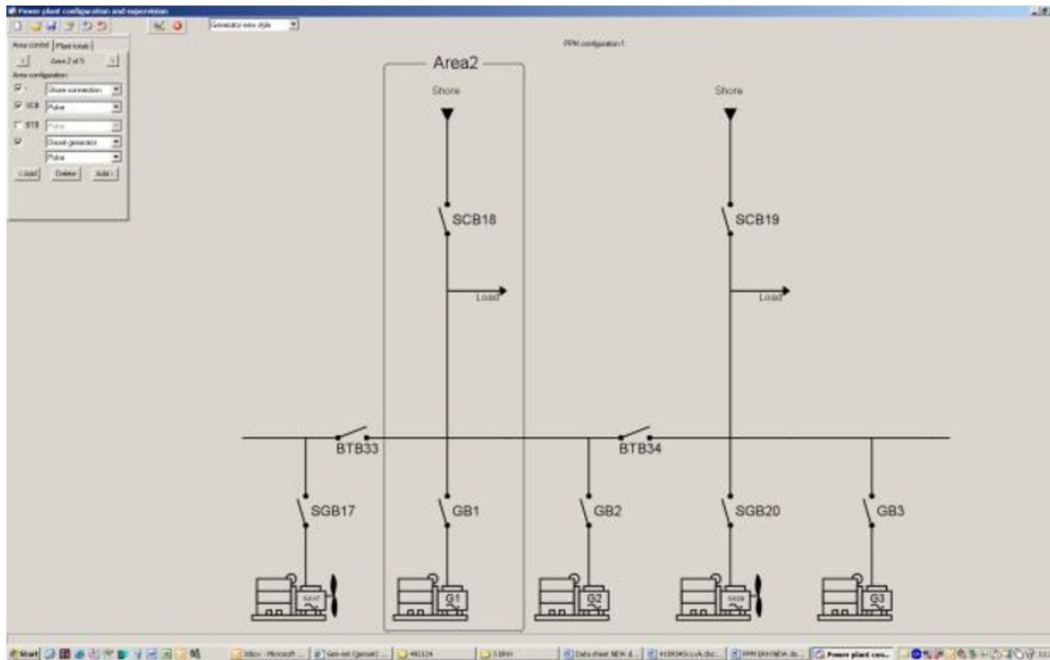
The plant operational modes supported by the power management options are:

- Diesel generator operation
- Shaft generator operation
- Shore connection operation
- Split busbar(s) operation
- Emergency/harbour generator operation

The plant operational modes are configurable and it is possible to change them on the fly, dependent on the actual or desired situation. The plant can be divided into sections by several bus tie breakers, making it possible to run different operation modes in each section.

7.1.2 Configuration

The setup of the application is easily configured using a computer and the DEIF PC utility software.



Your PC tool visualises it - the PPM-3 realises it.

7.1.3 Heavy consumer management

The heavy consumer management functions are available to ensure sufficient power capacity to handle the load either in terms of number of gen-sets or by soft starting the load. Available power can be reserved for heavy consumers with variable load, e.g. bow thrusters.

If a certain level of available power on the busbar is required to connect a heavy consumer, a function is available for starting additional generators. Furthermore, relays can be configured to activate when a specific level of available power is reached.

7.1.4 Load-dependent operation

The load-dependent starting and stopping of the gen-sets are based on a power available calculation. The next generator will start when the available power decreases below the adjustable setpoint. It will stop when too much power is available.

7.1.5 Priority selection

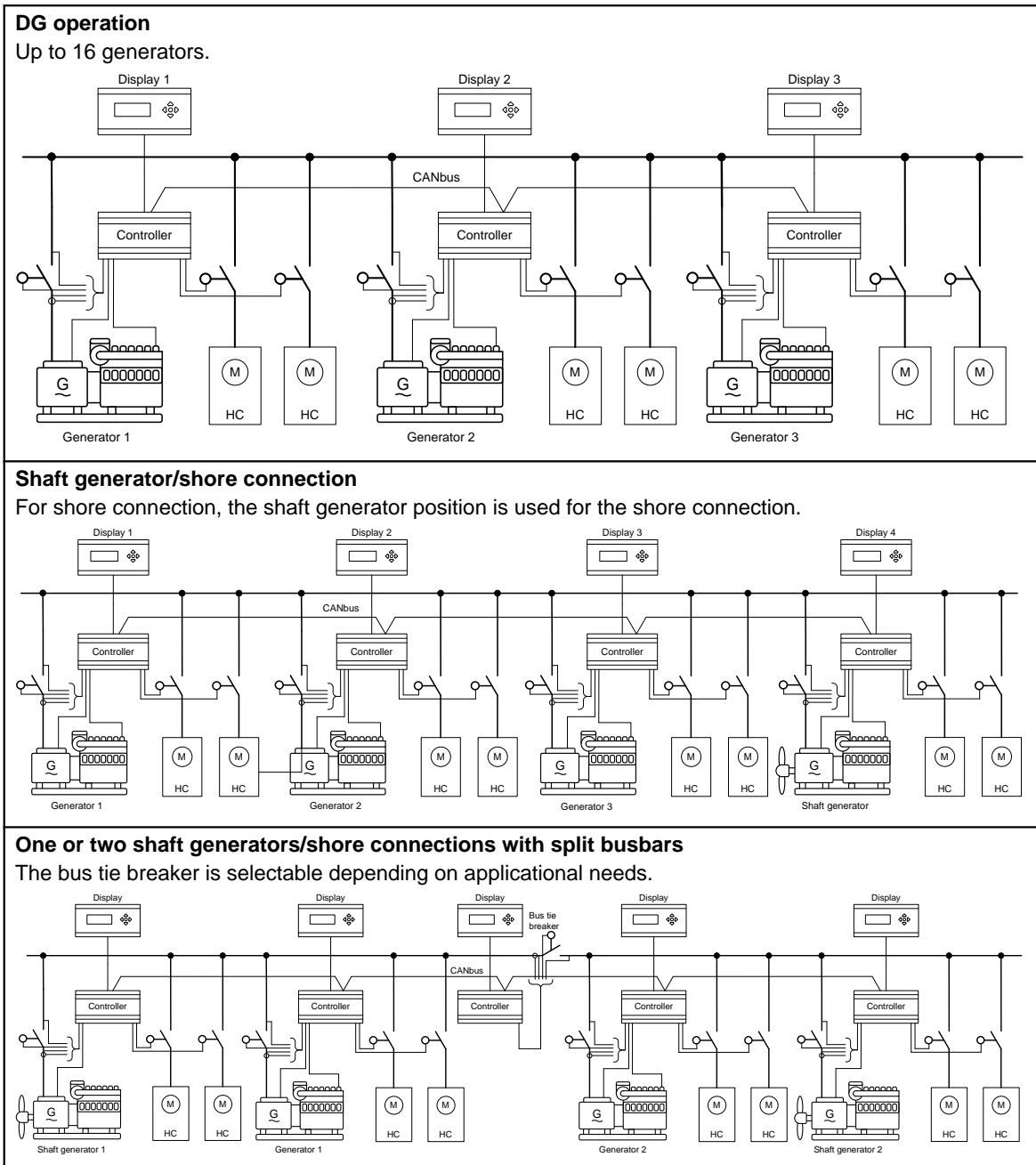
The start/stop priority of the diesel generators can be set in different ways:

- Manual selection with the 1st PRIOR push-button on each diesel generator unit
- Running hours
- Fuel-optimising calculating the best combination of generator kW size and the plant load. Works with up to 16 gen-sets.

7.1.6 Redundant CANbus

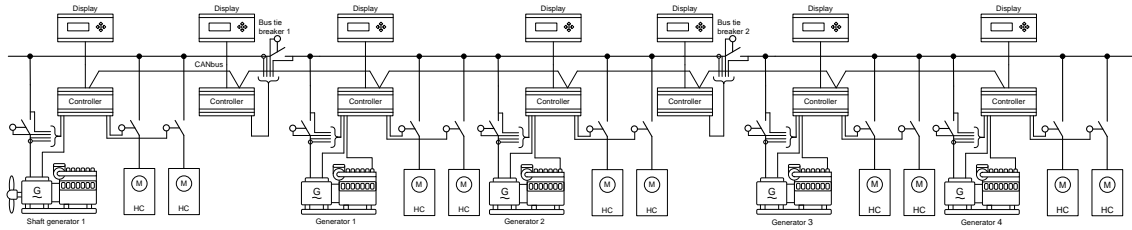
In systems requiring extra operation reliability, redundant CANbus communication lines can be used to provide back-up.

7.1.7 Power management applications



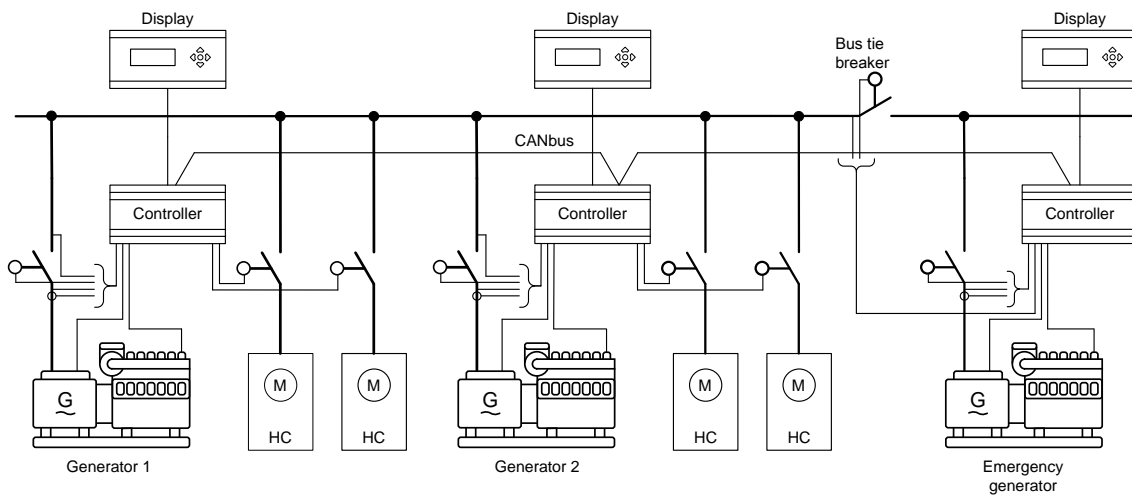
Multiple bus tie breakers

The bus tie breakers are selectable depending on applicational needs.



Emergency generator

The emergency generator can be combined with any other plant type.



8. Technical specifications

8.1 Technical specifications

Accuracy	Class 1.0 Positive, negative and zero sequence alarms: Class 1 within 5% voltage unbalance Class 1.0 for negative sequence current Fast overcurrent: 3% of 350%*I _n Analogue outputs: Class 1.0 according to total range Option EF4: Class 4.0 according to total range To IEC/EN60688
Operating temperature	-25...70°C (-13...158°F) (UL/cUL Listed: Max. surrounding air temperature: 55°C/131°F)
Storage temperature	-40...70°C (-40...158°F)
Climate	97% RH to IEC 60068-2-30
Measuring voltage	100-690V AC +/-20% (UL/cUL Listed: 480V AC phase-phase) Consumption: Max. 0.25 VA/phase
Measuring current	-/1 or -/5A AC (UL/cUL Listed: From CTs 1-5A) Consumption: Max. 0.3 VA/phase
Current overload	4 x I _n continuously 20 x I _n , 10 sec. (max. 75A) 80 x I _n , 1 sec. (max. 300A)
Measuring frequency	30...70 Hz
Aux. supply	Terminals 1 and 2: 12/24V DC (8...36 V continuously, 6 V 1 sec.). Max. 11 W consumption Terminals 98 and 99: 12/24V DC (8...36 V continuously, 6 V 1 sec.). Max. 5 W consumption The aux. supply inputs are to be protected by a 2A slow blow fuse. (UL/cUL Listed: AWG 24)
Binary inputs	Optocoupler, bi-directional. ON: 8...36V DC. Impedance: 4.7 kΩ. OFF: <2V DC
Analogue inputs	0(4)...20 mA: Impedance: 50 Ω. Not galvanically separated RPM (MPU): 2...70V AC, 10...10000 Hz, 250...3000 Ω
Multi-inputs	0(4)...20 mA: 0-20 mA, +/-1%. Not galvanically separated Binary: Max. resistance for ON detection: 100 Ω. Not galvanically separated Pt100/1000: -40...250°C, +/-1%. Not galvanically separated. To IEC/EN60751 VDO: 0-1700 Ω, +/-2%. Not galvanically separated V DC: 0...40V DC, +/-1%. Not galvanically separated
Relay outputs	Electrical rating: 250V AC/30V DC, 5A. (UL/cUL Listed: 250V AC/24V DC, 2A resistive load) Thermal rating @ 50°C: 2A: continuously. 4A: t _{on} = 5 sec., t _{off} = 15 sec. (Unit status output: 1A)

Open collector outputs	Supply: 8...36V DC, max. 10 mA
Analogue outputs	0(4)...20 mA and +/-25 mA. Galvanically separated. Active output (internal supply). Load max. 500 Ω . (UL/cUL Listed: Max. 20 mA output) Update rate: Transducer output: 250 ms. Regulator output: 100 ms
Analogue load sharing lines	-5...0...+5V DC. Impedance: 23.5 k Ω
Galvanic separation	Between AC voltage, AC current and other I/Os: 3250V AC, 50 Hz, 1 min. Between analogue outputs and other I/Os: 500V DC, 1 min. Between binary input groups and other I/Os: 500V DC, 1 min.
Response times (delay set to min.)	Busbar: Over-/undervoltage: <50 ms Over-/underfrequency: <50 ms Voltage unbalance: <250 ms Generator: Reverse power: <250 ms Overcurrent: <250 ms Voltage-dependent overcurrent: <250 ms Fast overcurrent: <40 ms Over-/undervoltage: <250 ms Over-/underfrequency: <350 ms Overload: <250 ms Current unbalance: <250 ms Voltage unbalance: <250 ms Reactive power import: <250 ms Reactive power export: <250 ms Overspeed: <500 ms Digital inputs: <250 ms Emergency stop: <200 ms Multi-inputs: <800 ms Wire failure: <600 ms
Mounting	DIN-rail mount or base mount with 6 screws
Safety	To EN 61010-1, installation category (overvoltage category) III, 600 V, pollution degree 2 To UL 508 and CSA 22.2 no. 14-05, overvoltage category III, 300 V, pollution degree 2
EMC/CE	To EN 61000-6-1/2/3/4. IEC 60255-26. IEC 60533 power distribution zone. IACS UR E10 power distribution zone
Vibration	3...13.2 Hz: 2mm _{pp} . 13.2...100 Hz: 0.7 g. To IEC 60068-2-6 & IACS UR E10 10...60 Hz: 0.15mm _{pp} . 60...150 Hz: 1 g. To IEC 60255-21-1 Response (class 2) 10...150 Hz: 2 g. To IEC 60255-21-1 Endurance (class 2)
Shock (base mount)	10 g, 11 ms, half sine. To IEC 60255-21-2 Response (class 2) 30 g, 11 ms, half sine. To IEC 60255-21-2 Endurance (class 2) 50 g, 11 ms, half sine. To IEC 60068-2-27
Bump	20 g, 16 ms, half sine. To IEC 60255-21-2 (class 2)
Material	All plastic materials are self-extinguishing according to UL94 (V1)

Plug connections	AC current: 0.2-4.0 mm ² stranded wire. (UL/cUL Listed: AWG 18) AC voltage: 0.2-2.5 mm ² stranded wire. (UL/cUL Listed: AWG 20) Relays: (UL/cUL Listed: AWG 22) Terminals 98-116: 0.2-1.5 mm ² stranded wire. (UL/cUL Listed: AWG 24) Other: 0.2-2.5mm ² stranded wire. (UL/cUL Listed: AWG 24) Display: 9-pole Sub-D female Service port: USB A-B
Protection	Unit: IP20. Display: IP52 (IP54 with gasket: Option L). (UL/cUL Listed: Type Complete Device, Open Type). To IEC/EN 60529
Governors	Multi-line 2 interfaces to all governors, including GAC, Barber-Colman, Woodward and Cummins See interfacing guide at www.deif.com
Approvals	UL/cUL Listed to UL508
UL markings	Wiring: Use 60/75°C copper conductors only Mounting: For use on a flat surface of type 1 enclosure Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)
AOP-2	Maximum ambient temperature: 60°C Wiring: Use 60/75°C copper conductors only Mounting: For use on a flat surface of type 3 (IP54) enclosure. Main disconnect must be provided by installer Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)
DC/DC converter for AOP-2	Tightening torque: 0.5 Nm (4.4 lb-in) Wire size: AWG 22-14
Weight	Base unit: 1.6 kg (3.5 lbs.) Option J1/J3/J6: 0.2 kg (0.4 lbs.) Option J2: 0.4 kg (0.9 lbs.) Display: 0.4 kg (0.9 lbs.)

9. Order specification

9.1 Order specification

Type	Option	Option	Option	Option	Option	Displays	AOP-1	AOP-2
PPM-3 Type	See option liste #	See option liste #	See option liste #	See option liste #	See option liste #	#	#	#

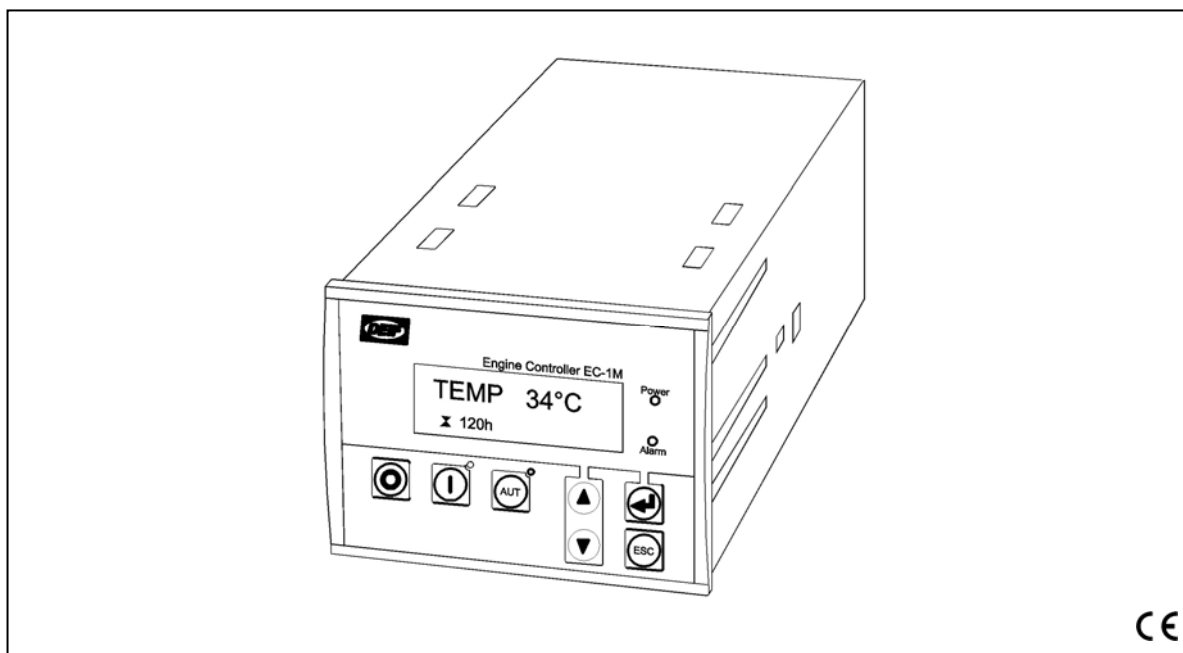
EXAMPLE:

Type	Option	Option	Option	Option	Displays	AOP-1	AOP-2
PPM-3 DG	H2	E1	F1	M13.8	1	1	0

Specify the ppm-3 type:

- DG (diesel generator)
- SG (shaft generator)
- SC (shore connection)
- BTB (bus tie breaker)
- EDG (emergency diesel genertor)

DEIF A/S reserves the right to change any of the above.



Standard functions

Engine control

- Start preparation (preheater or prelubrication)
- Start/stop sequences with selectable no. of start attempts
- Fuel solenoid selection (coil type)
- Idle speed control
- Local or remote start/stop
- Stop sequence with cool down
- Running speed detection selectable
 - Charger alternator input (W terminal) (option)
 - Binary input

Applications

- Automatic engine start/stop
- Engine protection

Engine monitoring

- 3 configurable inputs (option)
 - VDO or
 - 4-20 mA from active transducer or
 - Binary with cable supervision
- 6 binary inputs, configurable
- RPM input, selectable (option)
 - Magnetic pick-up
 - NPN or PNP pick-up
 - Tacho generator
 - Charger alternator W terminal

Clear text display

- 122 x 32 pixel back-light STN
- Graphic symbol messaging
- Clear text alarm messages
- Clear text diagnostics for both hardwired inputs and CANbus messages (J1939)
- Log book holding 30 log entries

Application

The Engine Controller EC-1M is a micro-processor based control unit containing all necessary functions for protection and control of a diesel engine. Furthermore, it contains a single-phase AC voltage measuring circuit. The unit is equipped with an LCD display presenting all values and alarms. EC-1M is a compact all-in-one unit designed for the following applications:

1. Automatic engine start/stop
2. Engine protection

Optional applications:

3. Generator voltage and frequency supervision

EC-1M automatically carries out a cyclical self test. If any errors are found, then the status relay output will deactivate (normally closed). In order to save battery power, the display can be set to switch off automatically after a given period of time. The display will turn on again, if events or alarms take place, or if one of the push-buttons is activated.

Setup

Setup is easily done via a PC Windows® based utility software (password protected) using the RJ45/RS232 PC connection. The PC interface box RJ45/RS232 needed for this operation is optional equipment for EC-1M. The PC utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates. Furthermore, the most often used settings can be accessed via the display push-buttons (password protected).

Options

In order to perfectly match EC-1M to specific applications, the unit can be equipped with a number of available options. The options selected by the customer will be integrated in the standard EC-1M hereby securing the same user interface unaffected by whether the application needs a basic or a more complex engine controller.



For approved installations, care must be taken to comply with the rules. In certain cases, additional engine protection equipment may be required. If in doubt, contact the classification society in question.

Terminals

Terminal	Technical data	Description
10...11	Status out. Contact ratings 1A 30V DC/V AC	General status output for marine approvals
12	Common	Common for term. 13...18
13	Digital input	Start enable/configurable
14	Digital input	Remote start/configurable
15	Digital input	Charge alternator D+ (running)/configurable
16	Digital input	Overspeed/configurable
17	Digital input	Coolant temperature/configurable
18	Digital input	Oil pressure/configurable
23	Common	Common for term. 24, 25 and 32 and emergency stop*
24	Relay output 1. Contact ratings 2A 30V DC/V AC	Horn. Function NO
25	Relay output 2. Contact ratings 2A 30V DC/V AC	Alarm/configurable. Function NO
26	Power supply –	GND
27	Power supply +	6...36V DC
28...31	Not used	Note 23 and 31 is internally connected
32	Relay output 3. Contact ratings 2A 30V DC/V AC	Start prepare/configurable. Function NO
33-34	Relay output 4. Contact ratings 8A 30V DC/V AC	Run coil/stop coil/configurable. Function NO
35-36	Relay output 5. Contact ratings 8A 30V DC/V AC	Starter (crank)/configurable. Function NO
Optional configurable inputs (option M17)		
4	Common	Common for term. 5...7
5	VDO1/4...20 mA/binary input	Fuel level/configurable
6	VDO2/4...20 mA/binary input	Oil pressure/configurable
7	VDO3/4...20 mA/binary input	Water temp./configurable
Optional CANbus #1 engine interface (option H5)		
1	CAN-L	CAN J1939 engine communication
2	CAN-GND	
3	CAN-H	

Terminal	Technical data	Description
Optional tacho RPM input (option M17)		
8	Tacho-GND	Magnetic pick-up. PNP or NPN/tacho generator/charge alternator W terminal
9	Tacho input	
Optional single-phase generator voltage input (option B2)		
19	L2 or N	Generator voltage and frequency
20	Not used	
21	L1	
22	Not used	

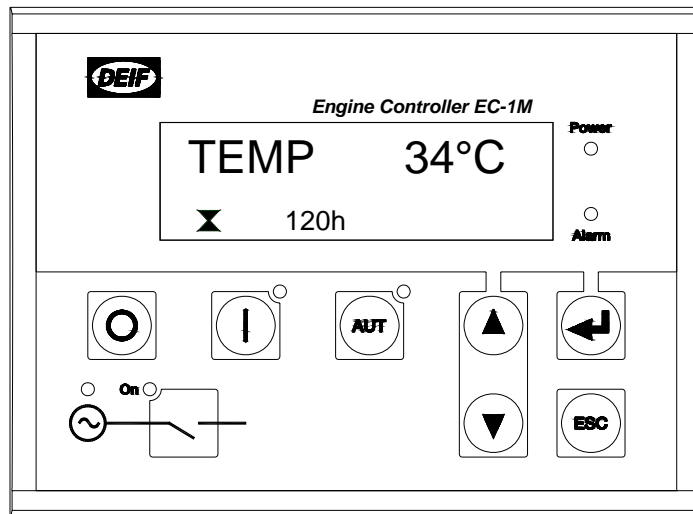
Available options

Option	Description	Type	Note
B	Generator protection		
B2	Single-phase (L-L or L-N), 50-550V AC, 50/60 Hz - Single-phase over- and undervoltage (27/59) - Single-phase over- and underfrequency (81)	Software option	
G	Control functions		
G6	Generator breaker control. See the display front layout below	Hardware option	Requires B2
H	Communication		
H1	CANopen communication	Hardware option	
H5	CANbus J1939 - Detroit Diesel DDEC - John Deere JDEC - Deutz EMR - Volvo Penta D12 AUX - Scania EMS	Hardware option	
J	Cables		
J5	PI-1 converter box kit (for PC connection)	Hardware option	
K	Installation Instructions and Reference Handbook		
K1	Installation Instructions and Reference Handbook (hard copy)	Other	
K2	Installation Instructions and Reference Handbook (CD)	Other	
L	Gasket for IP54	Hardware option	
M	Input options		
M17	3 configurable VDO, 4...20 mA, binary inputs Tacho input (magnetic pick-up, NPN, PNP pick-up, charge generator W input)	Hardware option	
Y	Front folio options		
Y2	Front folio for alarm unit (no start/stop/AUT buttons)	Hardware option	

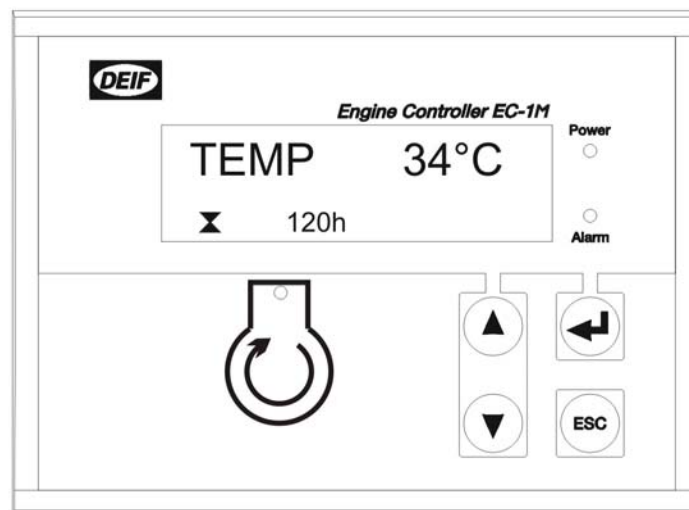
(ANSI# as per IEEE Std C37.2-1996(R2001) in parenthesis).

Engine Controller (Marine) EC-1M

Option G6 display layout



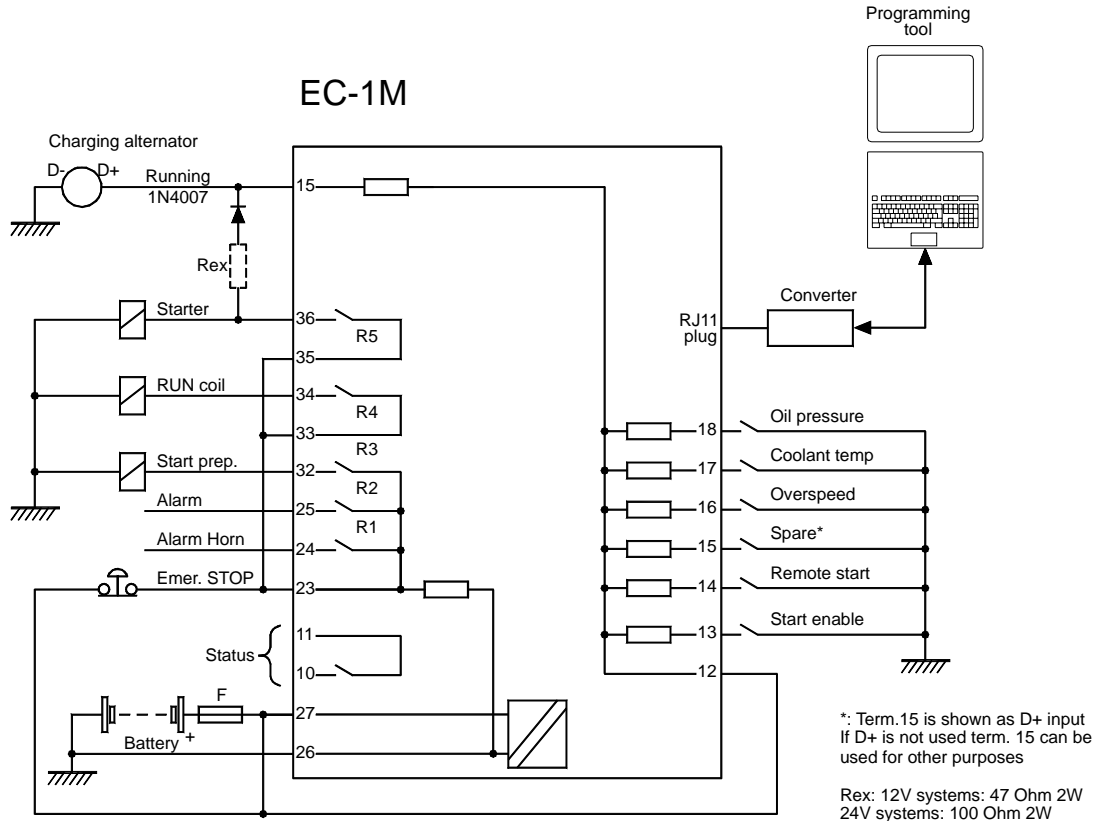
Option Y2 display layout



Wiring



F: Fuse: 2A slow-blow.



<p>H5 Engine communication</p> <p>Can H — 3 Com — 2 Can L — 1</p>		<p>B2 Generator voltage</p> <p>L1 — F — 21 Not used — 20 N/L2 — F — 19</p>
<p>M17 Multi-functional inputs VDO sensors</p> <p>VDO 3 — 7 VDO 2 — 6 VDO 1 — 5</p>	<p>M17 Multi-functional inputs 4-20 mA transmitters</p> <p>3 — + 2 — + 1 — +</p>	<p>M17 Multi-functional inputs Binary input w. cable superv.</p> <p>3 — R 2 — R 1 — R</p> <p>R = 100 Ohm</p>
<p>M17 Tacho input Magnetic pickup/Tacho generator</p> <p>9 — 8 —</p>	<p>M17 Tacho input NPN/PNP pickup</p> <p>+24 VDC — C out — 9 8 —</p> <p>C = 1µF/100V foil type</p>	<p>M17 Tacho input W input from charger alternator</p> <p>B+ — W — C B+ — out — 9 8 —</p> <p>C = 1µF/100V foil type</p>

Technical specifications

Accuracy:	Class 2.0 to EN 60688/IEC 688	Mounting:	Panel mounted
Operating temp.: (UL/cUL Listed:	-25...70°C Max. ambient temp. 40°C/104°F)	Size:	78 x 106 mm
Storage temp.:	-40...70°C	Climate:	-25...70°C to IEC 60068-2-1/2 97% RH to IEC 60068-2-30
Measuring input voltage: (UL/cUL Listed:	50...550V AC phase to phase 50...300V AC)	Display:	122 x 32 pixel back-light STN
Load:	1.5 MΩ	Safety:	To EN 61010-1, installation category (overvoltage category) III, 600 V, pollution degree 2
Frequency:	30...70 Hz	Protection:	Front: IP52 (IP54 with gasket, option L) Terminals: IP20 To IEC 529 and EN 60529
Pick-up input voltage: Frequency:	0.5...70 V peak 10-10000 Hz	EMC/CE:	To EN 61000-6-1/2/3/4 SS4631503 (PL4) and IEC 255-3
Aux. supply: (UL/cUL Listed:	6...36V DC continuously 12/24V DC) Max. 8 W consumption	Material:	All plastic materials are self-extinguishing according to UL94 (V1)
Passive binary in voltage:	Bi-directional optocoupler 8...36V DC	Plug connections:	AC voltage inputs: 3.5 mm ² multi-stranded Other: 1.5 mm ² multi-stranded
Impedance:	4.7 kΩ	PC connection:	RS232 converter box (option J5)
VDO inputs:	Resistor inputs, internal 4 V supply	Approval:	UL/cUL to UL 508 Major classification societies (see www.deif.com for details)
Analogue input:	From active transducer	Weight:	Approx. 0.7 kg (1.5 lbs)
Current:	4...20 mA	UL markings:	
Impedance:	50 Ω	Wiring:	Use 60/75°C copper conductors only AWG 30-12
Active binary in internal voltage:	Dry contact inputs (note 1) 4V DC supply, with cable supervision	Terminal tightening torque:	5-7 lb-in
Impedance:	240 Ω ~ 16 mA	Mounting:	For use on a flat surface of a type 1 enclosure
Relay outputs:		Installation:	To be installed in accordance with the NEC (US) or the CEC (Canada)
3 relays: (UL/cUL Listed:	30V DC/AC 2A 30V DC 2A resistive)		
2 relays: (UL/cUL Listed:	30V DC/AC 8A 30V DC 4A resistive)		
1 status relay: (UL/cUL Listed:	24V DC 1A 24V DC 1A)		

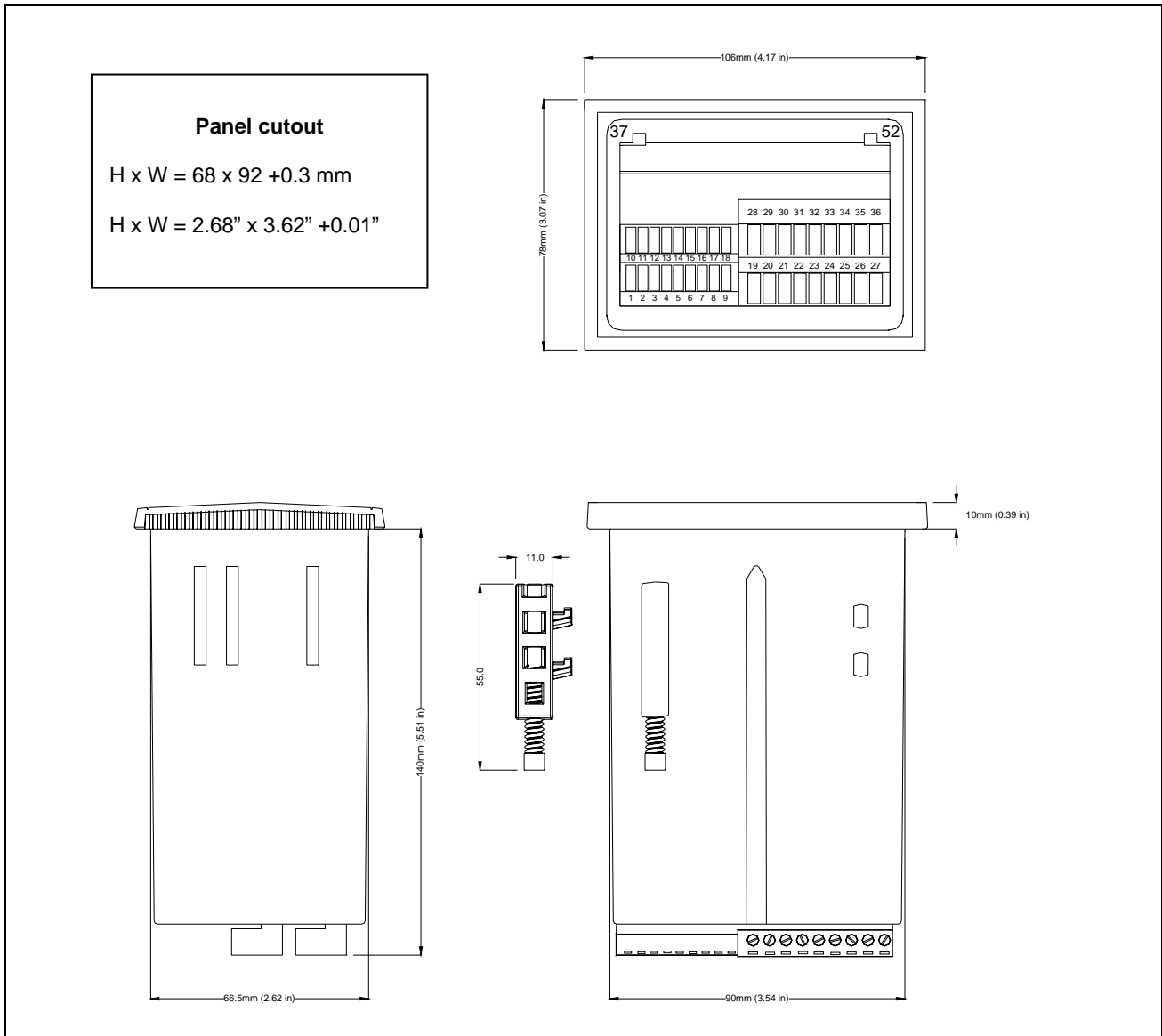


Note 1: Only 3 inputs are available.

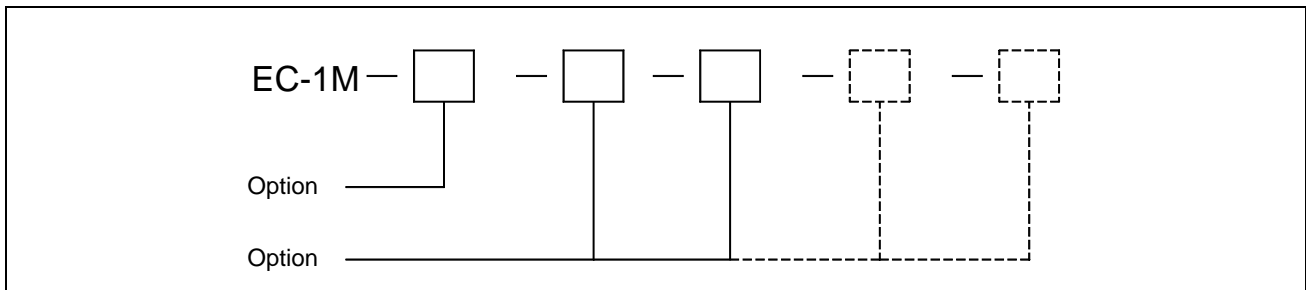


It is possible to combine VDO inputs with binary and 4...20 mA inputs in a mix.

Unit dimensions



Order specifications



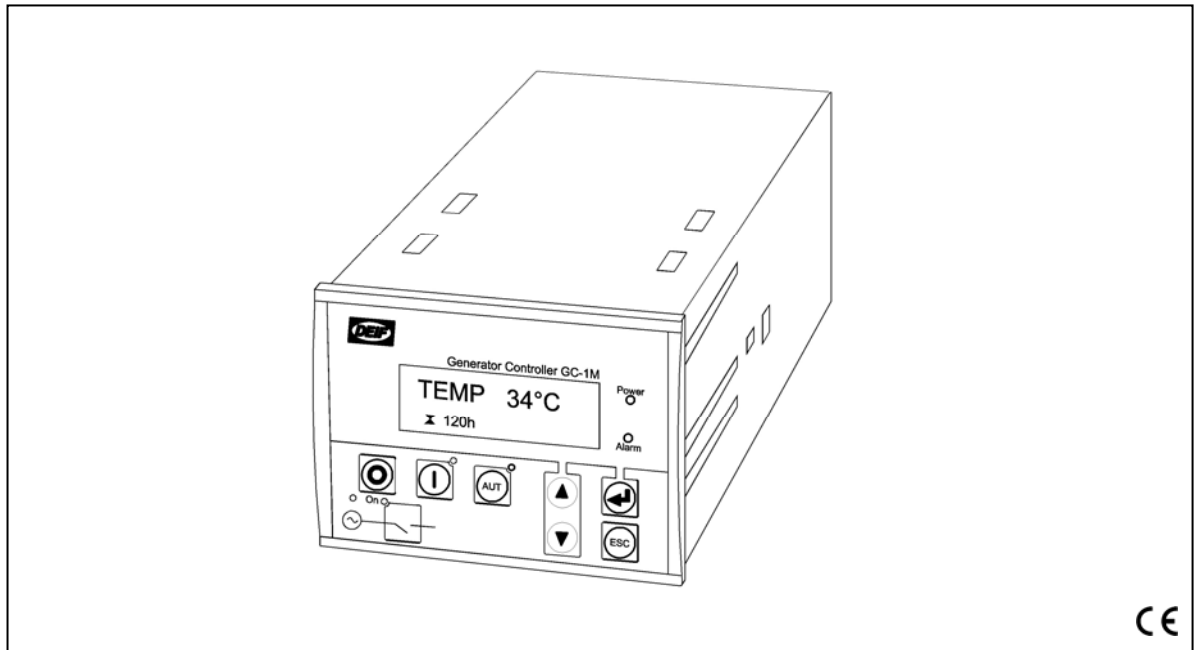
Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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Standard functions

Engine control

- Start preparation (preheater or prelubrication)
- Start/stop sequences with selectable no. of start attempts
- Fuel solenoid selection (coil type)
- Idle speed control
- Local or remote start/stop
- Stop sequence with cool-down
- Running speed detection selectable
 - Charger alternator input (W terminal) or tacho generator
 - Binary input (D+)
 - Oil pressure based run detection
 - Generator voltage/frequency

Generator monitoring

- 3 or 1-phase generator monitoring
 - Voltage/current/frequency/power/reactive power

Generator protection (ANSI)

- Over-/undervoltage (27/59)
- Over-/underfrequency (81)
- Overcurrent (51)
- Reverse power (32)

Engine monitoring

- 3 configurable inputs
 - VDO or
 - 4-20 mA from active transducer or
 - Binary with cable supervision
- 6 binary inputs, configurable
- RPM input, selectable
 - Magnetic pick-up
 - NPN or PNP pick-up
 - Tacho generator
 - Charger alternator W terminal

Clear text display

- 122 x 32 pixel backlight STN
- Graphic symbol messaging
- Clear text alarm messages
- Clear text diagnostics for both hardwired inputs and CANbus messages (J1939)
- Log book holding 30 log entries
- Real time clock for time and date

Application

The Generator Controller GC-1M is a micro-processor based control unit containing all necessary functions for protection and control of a diesel engine. Furthermore, it contains a three-phase AC voltage measuring circuit. The unit is equipped with an LCD display presenting all values and alarms. GC-1M is a compact all-in-one unit designed for the following applications:

1. Automatic engine start/stop
2. Engine protection
3. Breaker control
4. Generator protection

Optional applications:

5. Automatic Mains Failure
6. CANbus J1939 engine communication

GC-1M automatically carries out a cyclical self test. If any errors are found, then the status relay output will deactivate (normally closed). In order to save battery power, the display can be set to switch off automatically after a given period of time.



For approved installations, care must be taken to comply with the rules. In certain cases, additional engine protection equipment may be required. If in doubt, contact the classification society in question.

The display will turn on again, if events or alarms take place, or if one of the push-buttons is activated.

Setup

Setup is easily done via a PC Windows® based utility software (password protected) using the RJ11/RS232 PC connection. The PC interface box RJ11/RS232 needed for this operation is optional equipment for GC-1M. The PC utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates. Furthermore, the most frequently used settings can be accessed via the display push-buttons (password protected).

Options

The options selected by the customer will be integrated in the standard GC-1M hereby securing the same user interface unaffected by whether the application needs a basic or a more complex generator controller.

Terminals

Terminal	Technical data	Description
4	Common for terminals 5-7	
5	VDO1, 4..20 mA, dig. inp.	Fuel level/configurable
6	VDO2, 4..20 mA, dig. inp.	Oil pressure/configurable
7	VDO3, 4..20 mA, dig. inp.	Water temp./configurable
8-9	Tacho input	Magnetic pick-up/PNP/NPN/tacho generator/charge alternator W terminal
10-11	Status out, 1A 30V DC/V AC	General status output for marine approvals
12	Common	Common for term. 13-18
13	Digital input term. 13	Start enable/configurable
14	Digital input term. 14	Remote start/configurable
15	Digital input term. 15	Charge alternator D+ (running)/configurable
16	Digital input term. 16	Overspeed/configurable
17	Digital input term. 17	Coolant temperature/configurable
18	Digital input term. 18	Oil pressure/configurable
23	Common	Common for term. 24, 25 and 32 and emergency stop*
24	NO relay output 1, 2A 30V DC/V AC	Horn
25	NO relay output 2, 2A 30V DC/V AC	Alarm/configurable
26	Power supply – (gnd)	
27	Power supply + 6...36V DC	
28-31	Not used	
32	NO relay output 3, 2A 30V DC/V AC	Start prepare/configurable
33-34	NO relay output 4, 8A 30V DC/V AC	Run coil/stop coil/configurable
35-36	NO relay output 5, 8A 30V DC/V AC	Starter (crank)/configurable
37	Generator L3 voltage	Voltage range 50-480V AC Ph-Ph value
38	Generator neutral voltage	
39	Generator L2 voltage	
41	Generator L1 voltage	
49-50	Generator breaker control relay, 2A 30V DC/V AC	

Terminal	Technical data	Description
53	I L3 s2	Generator current L3
54	I L3 s1	
55	I L2 s2	Generator current L2
56	I L2 s1	
57	I L1 s2	Generator current L1
58	I L1 s1	

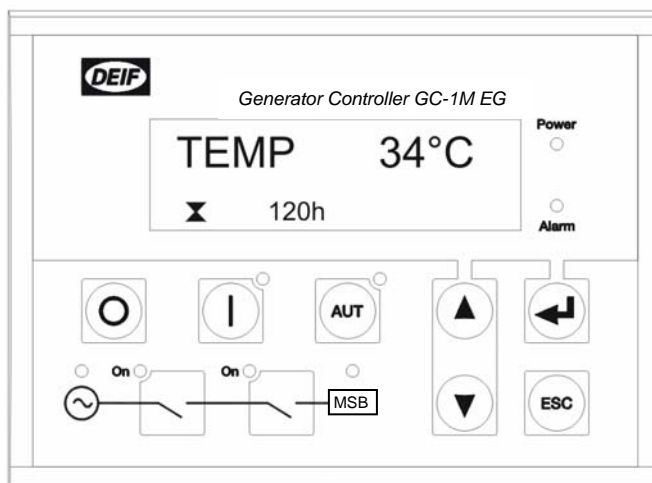
Optional emergency generator control		
43	Mains L3 voltage	Voltage range 50-480V AC Ph-Ph value
45	Mains L2 voltage	
46	Mains neutral voltage	
47	Mains L1 voltage	
51-52	Mains breaker control relay, 2A 30V DC/V AC	Configurable
Optional CANbus engine interface		
1	CAN-L	CAN J1939 engine communication
2	CAN-GND	
3	CAN-H	

Available options

Option	Description	Type	Note
B	Generator protection		
B3	Emergency generator control - Generator and mains tie breaker control - Change-over (no synchronisation)	Software option	
H	Communication		
H5	CANbus J1939 - Detroit Diesel DDEC - John Deere JDEC - Deutz EMR - Volvo Penta D12 AUX - Scania DEC	Software option	
J	Cables		
J5	PI-1 converter box kit (for PC connection)	Hardware option	
K	Documentation		
K1	Installation Instructions and Reference Handbook (hard copy)	Other	
K2	CD-ROM with complete documentation	Other	
L	Gasket for IP54	Hardware option	

(ANSI# as per IEEE Std C37.2-1996 (R2001) in parenthesis).

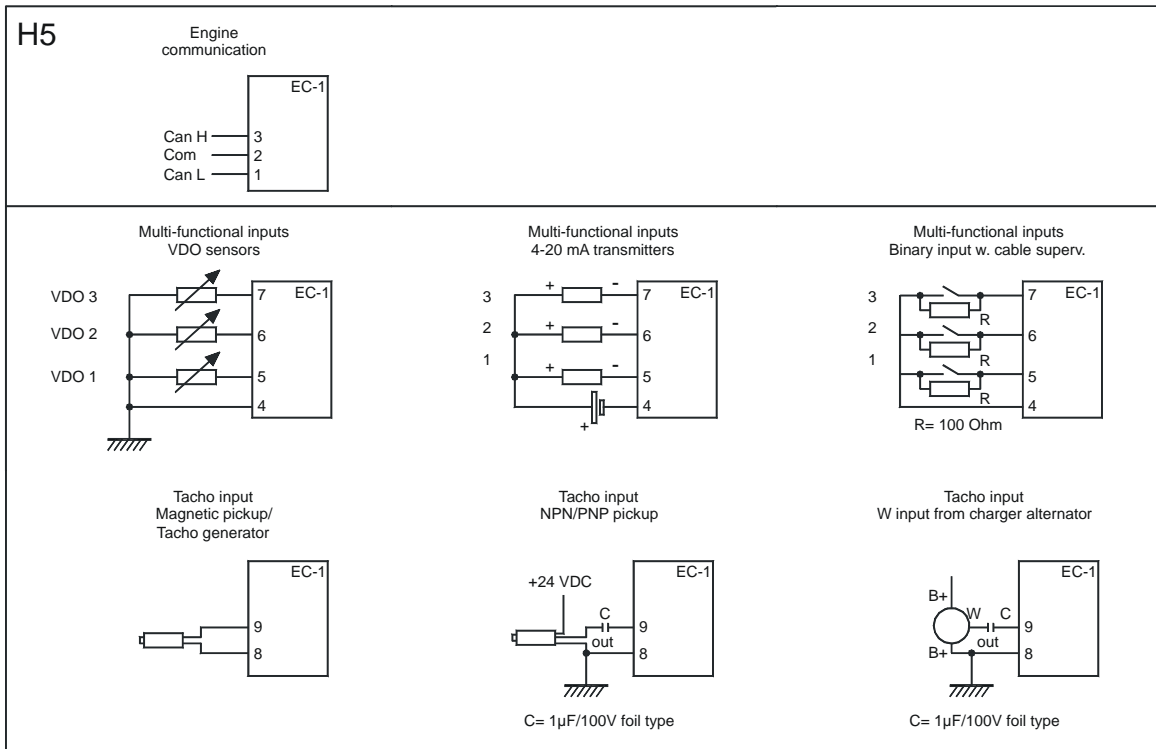
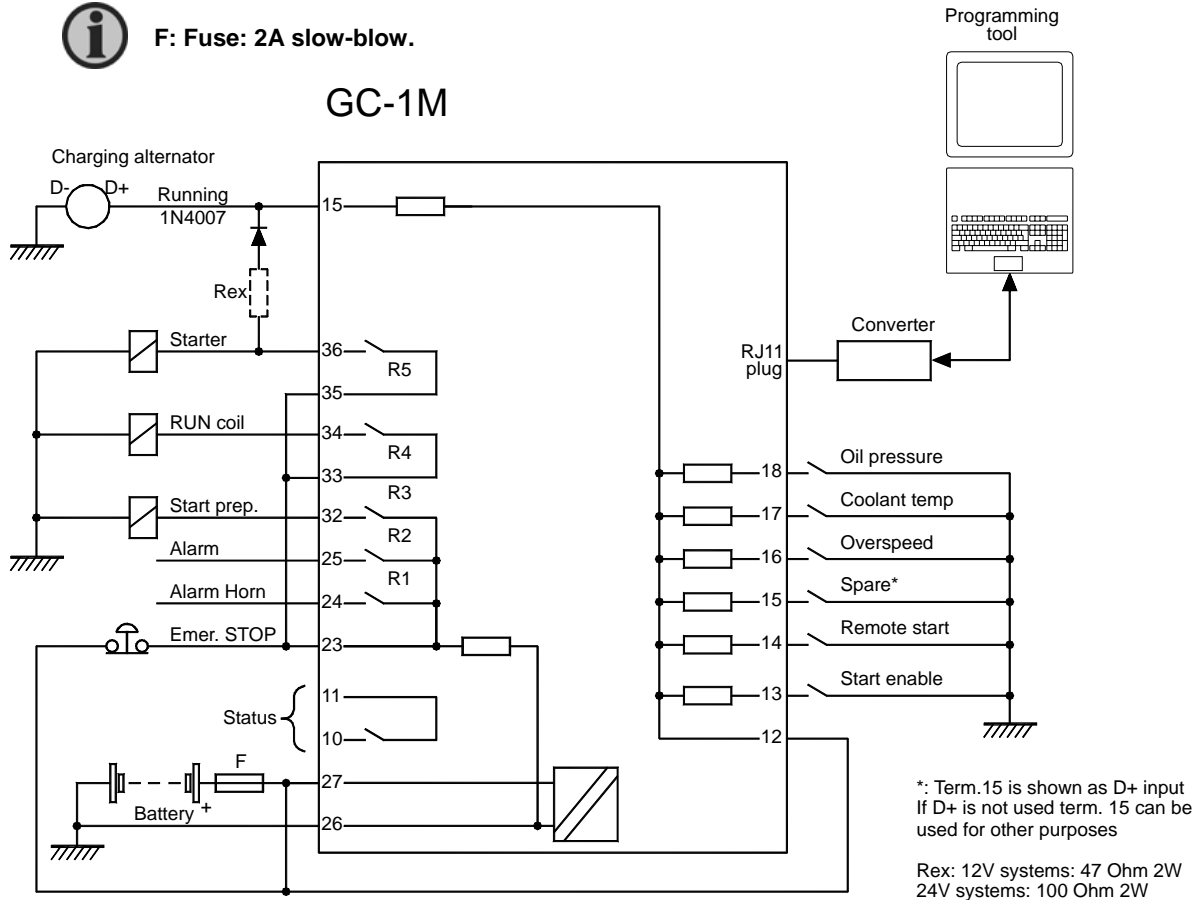
Option B3 display layout



Wiring, engine interface

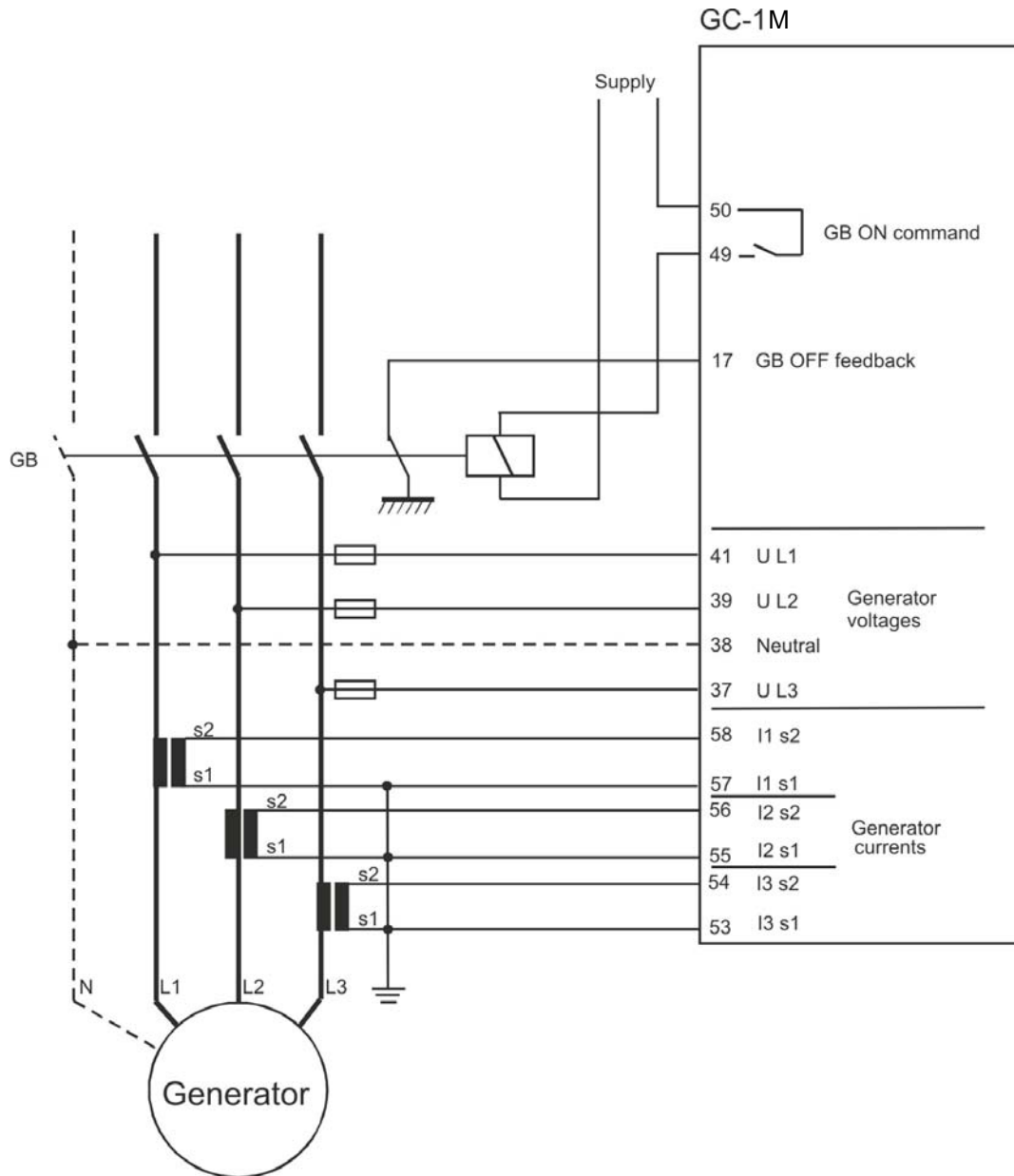


F: Fuse: 2A slow-blow.



Wiring, AC interface

Connection of the 3-phase voltage and current



The AC current grounding can be made as required to s1 or s2.

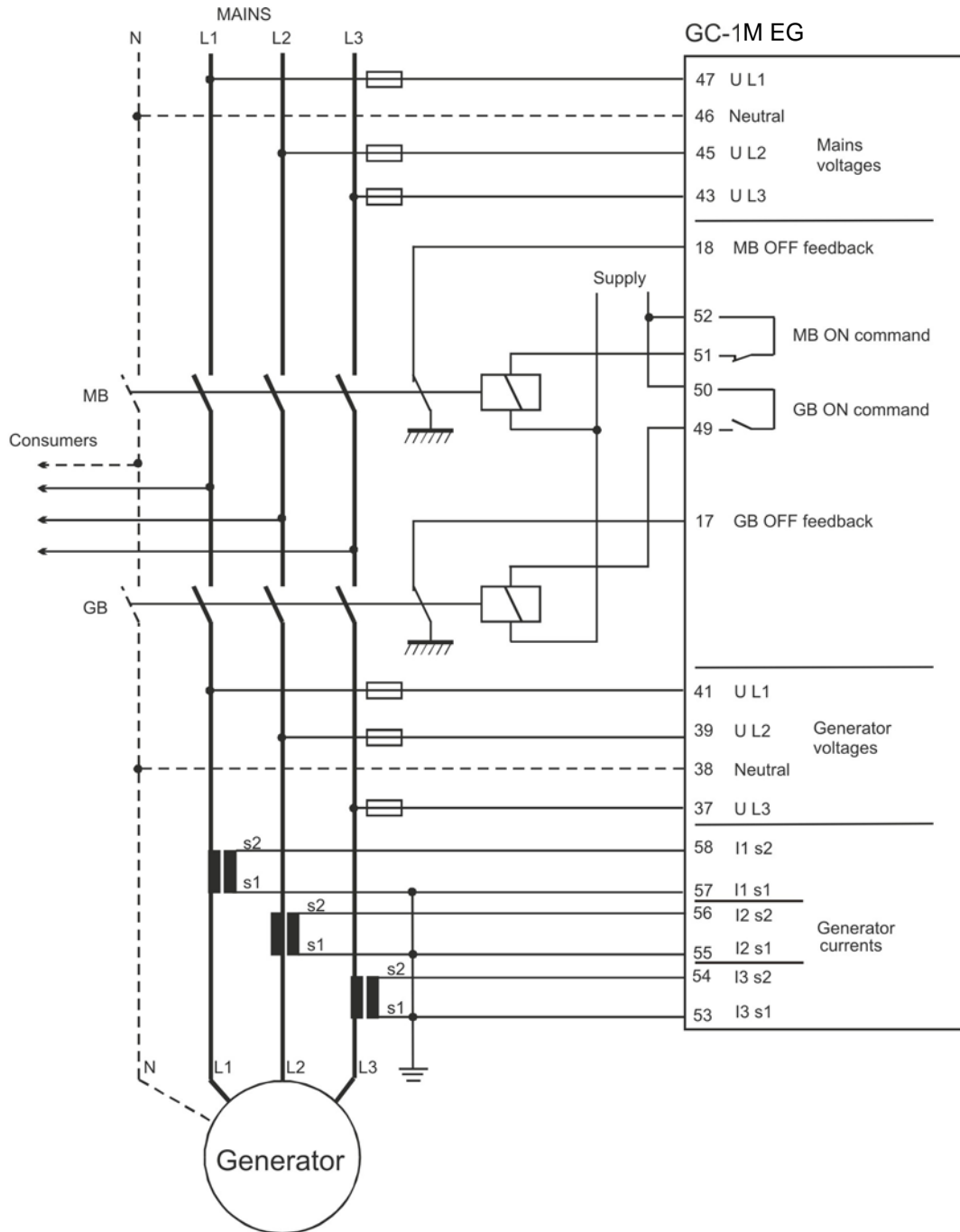


GB: Use a contactor. The ON output from the GC-1M is a constant signal. Remember to use free-wheel diodes across the contactor coils, if DC voltage is used as supply for these.

Fuse for AC voltage: Max. 2A slow-blow.

Generator Controller (Marine) GC-1M

Wiring, EG (option B3)



The AC current grounding can be made as required to s1 or s2.



GB and MB: Use contactors. The ON outputs from the GC-1M EG are constant signals. Remember to use free-wheel diodes across the contactor coils, if DC voltage is used as supply for these.

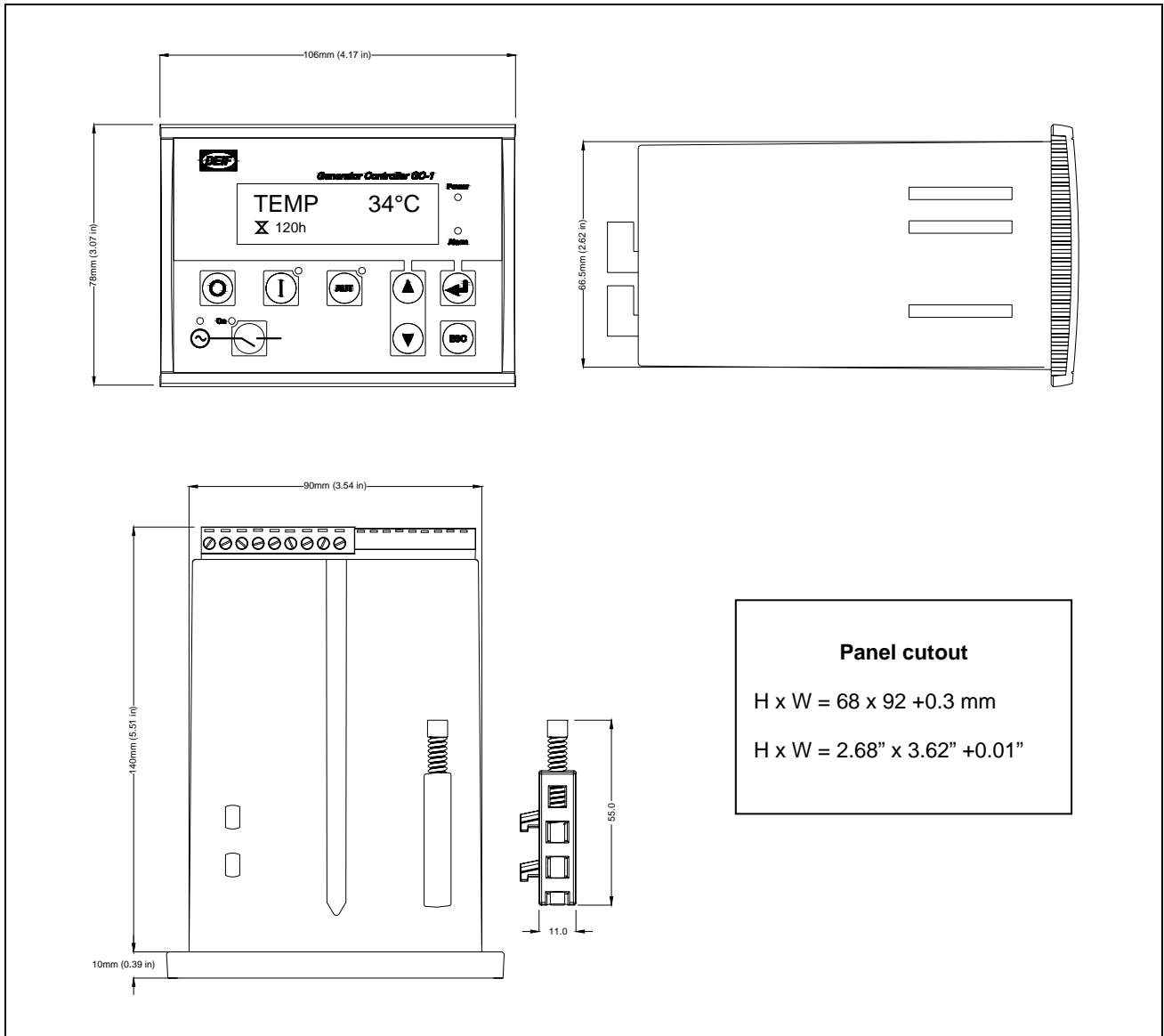
Fuse for AC voltage: Max. 2A slow-blow.

Technical specifications

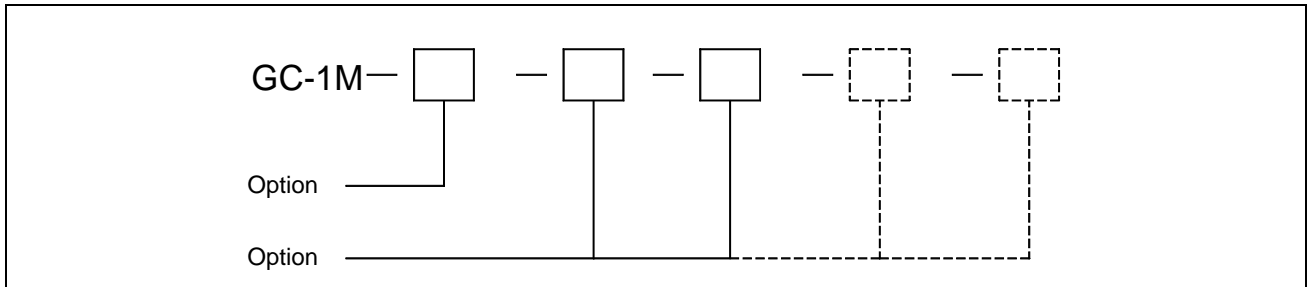
Accuracy:	Class 2.0 to EN 60688/IEC 688	Relay outputs:	5 relays: 30V DC/AC 2A (UL/cUL Listed: 30V DC 2A resistive)
Operating temp.: (UL/cUL Listed:	-25...70°C (-13...158°F) Max. ambient temp. 40°C/104°F)	2 relays: 30V DC/AC 8A (UL/cUL Listed: 30V DC 4A resistive)	1 status relay: 24V DC 1A (UL/cUL Listed: 24V DC 1A)
Storage temp.:	-40...70°C (-40...158°F)	Mounting:	Panel mounted
Measuring input voltage: (UL/cUL Listed:	50...550V AC phase to phase 50...300V AC)	Size:	78 x 106 mm (3.07" x 4.17")
Load:	1.5 MΩ	Climate:	25...70°C to IEC 60068-2-1/2 97% RH to IEC 60068-2-30
Frequency:	30...70 Hz	Display:	122 x 32 pixel backlight STN
Measuring input current:	1 or 5A AC from current transformer	Safety:	To EN 61010-1, installation category (overvoltage category) III, 600 V, pollution degree 2
Consumption max.:	0.3 VA/phase	Protection:	Front: IP52 (IP54 with gasket, option L) Terminals: IP20 To IEC 529 and EN 60529
Current overload: (UL/cUL Listed:	10A continuously, 20A, 5 sec. Use listed or R/C (XODW2.8 current transformers))	EMC/CE:	To EN 61000-6-1/2/3/4 SS4631503 (PL4) and IEC 255-3
Pickup input voltage: Frequency:	0.5...70 V peak 10-10000 Hz	Material:	All plastic materials are self-extinguishing according to UL94 (V1)
Aux. supply: (UL/cUL Listed:	6...36V DC continuously 12/24V DC) Max. 8 W consumption	Plug connections:	AC voltage inputs: 3.5 mm ² multi-stranded AC current inputs: 4.5 mm ² multi-stranded Other: 1.5 mm ² multi-stranded
Passive binary in voltage:	Bi-directional optocoupler 8...36V DC	PC connection:	RS232 converter box (option J5)
Impedance:	4.7 kΩ	Approval:	UL/cUL to UL 508 Major classification societies (see www.deif.com for details)
VDO inputs:	Resistor inputs, internal 4 V supply	Weight:	Approx. 0.9 kg (1.9 lbs)
Analogue input:	From active transducer	UL markings:	
Current:	4...20 mA	Wiring:	Use 60/75°C copper conductors only AWG 30-12
Impedance:	50 Ω	Terminal tightening torque:	5-7 lb-in
Active binary in internal voltage:	Dry contact inputs (note 1) 4V DC supply, with cable supervision	Mounting:	For use on a flat surface of a type 1 enclosure
Impedance:	240 Ω ~ 16 mA	Installation:	To be installed in accordance with the NEC (US) or the CEC (Canada)

**Only 3 inputs are available.****It is possible to combine VDO inputs with binary and 4...20 mA inputs in a mix.**

Unit dimensions in mm (inches)



Order specifications



Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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-power in control



DATA SHEET



Genset Controller, GC-1F

- Engine control
- Generator monitoring
- Generator protection (ANSI)
- Engine monitoring
- Display panel



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Document no.: 4921240310H

This data sheet includes the following versions:

GC-1F	SW version 1.2x.x
GC-1F/2	SW version 2.0x.x or later

Application

The Gen-set Controller GC-1F is a microprocessor-based control unit containing all necessary functions for protection and control of a diesel engine. Furthermore, it contains a three-phase AC voltage measuring circuit. The unit is equipped with an LCD display presenting all values and alarms. GC-1F is a compact all-in-one unit designed for the following applications:

1. Automatic engine start/stop
2. Engine protection
3. Breaker control
4. Generator protection
5. Automatic Mains Failure

GC-1F automatically carries out a cyclical self test. If any errors are found, the status relay output will deactivate (normally closed). In order to save battery power, the display can be set to switch off automatically after a given period of time. The display will turn on again, if events or alarms take place, or if one of the push-buttons is activated.

Setup

Setup is easily done via a PC Windows® based utility software (password-protected). A PC interface box is needed for this operation (option J5). Option J5 is optional equipment for GC-1F. The PC utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates. Furthermore, the most frequently used settings can be accessed via the display push-buttons (password-protected).

Language

Master language is English and furthermore, there are three selectable languages. These are listed in the order specification.

Translation

This function makes it possible to change all texts used in the unit.

Options

The options selected by the customer will be integrated in the standard GC-1F, hereby securing the same user interface unaffected by whether the application needs a basic or a more complex gen-set controller.

Terminals

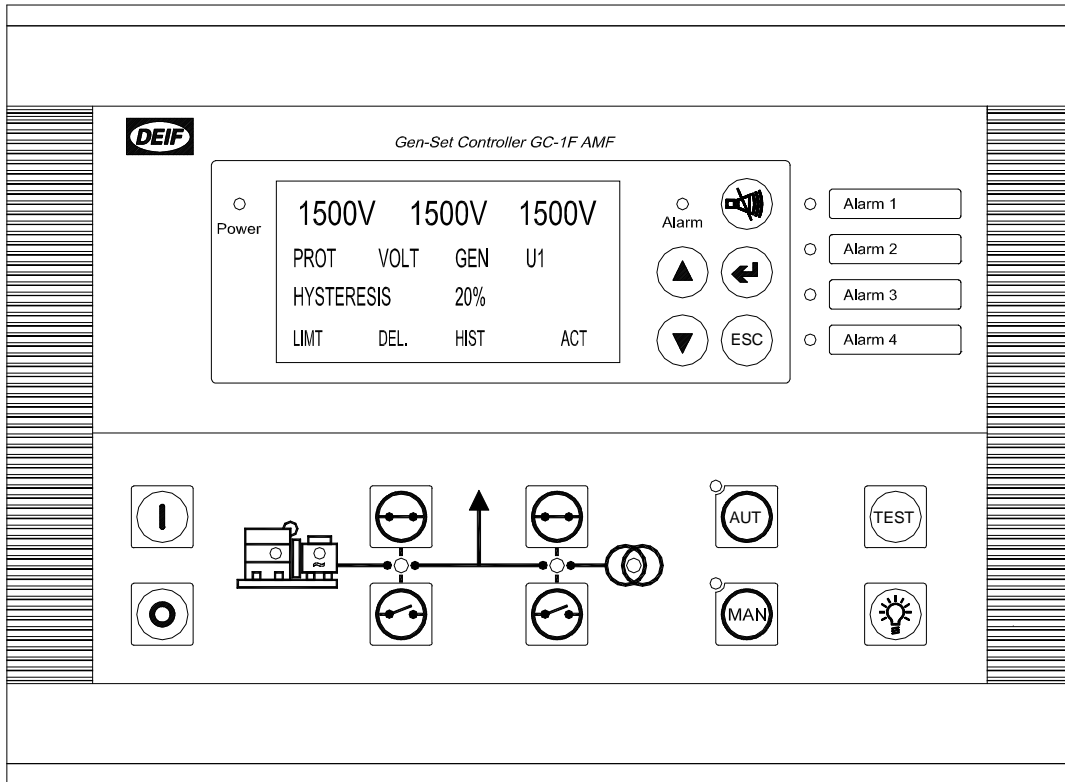
Terminal	Technical data	Description
1	Power supply +	Aux. supply
2	Power supply –	GND
3-4	Status out/configurable. Contact ratings 1 A 24V DC/V AC Resistive	General status output for marine approvals/only configurable in hw 1.05 and sw 2x.x.
9	Common	Common for term. 10...15
10	Digital input	Start enable/configurable
11	Digital input	Remote start/stop/configurable
12	Digital input	Charge alternator D+ (running)/configurable
13	Digital input	Configurable
14	Digital input	Coolant temperature/configurable
15	Digital input	Oil pressure/configurable
19	Common	Common for emergency stop term. 20
20	Emergency stop and common for 21...23	Common for relays 1, 2 and 3 and input for emergency stop*
21	Relay output 21.	Start prepare/configurable. Function NO
22	Relay output 22.	Starter (crank)/configurable. Function NO
23	Relay output 23.	Run coil/configurable. Function NO
24-25	Relay output 24.	Horn/configurable. Function NO
26-27	Relay output 26.	Alarm/configurable. Function NO
Multi-functional inputs		
5	Common	Common for term. 6...8
6	VDO1/0(4)...20 mA/binary input	Fuel level/configurable
7	VDO2/0(4)...20 mA/binary input	Oil pressure/configurable
8	VDO3/0(4)...20 mA/binary input	Water temp./configurable
Tacho RPM input		
16	RPM input	Magnetic pick-up/tacho generator
17	RPM-GND	Common for RPM input
18	RPM input W	Magnetic pick-up. PNP, NPN or charge alternator W terminal

3-phase generator voltage input		
33	Gen. voltage L1	Generator voltage and frequency
34	Gen. neutral	
35	Not used, must not be connected	
36	Gen. voltage L2	
37	Not used, must not be connected	
38	Gen. voltage L3	
3-phase generator current input		
39	Gen. current L1, s1	Generator current
40	Gen. current L1, s2	
41	Gen. current L2, s1	
42	Gen. current L2, s2	
43	Gen. current L3, s1	
44	Gen. current L3, s2	
Optional 3-phase mains voltage inputs (option B3)		
28	Mains voltage L1	
29	Mains voltage neutral	
30	Mains voltage L2	
31	Not used, must not be connected	
32	Mains voltage L3	
Breaker relays		
45	Relay R45.	Generator circuit breaker/configurable, function NO (normally open)
46	Relay R45	
Optional relay for closing mains breaker (option B3)		
47	Relay R47.	Mains circuit breaker/configurable, function NC (normally closed).
48	Relay R47	
Optional relay NO contact (option M19)		
47	Relay R47. Contact ratings 2 A 30V DC/250V AC (UL/cUL Listed: Contact ratings 2 A 30V DC/30V AC)	Mains circuit breaker/configurable, function NO (normally open)
48	Relay R47	
Optional Modbus RS485 interface (option H2)		
49	B (-)	Modbus RS485 RTU or ASCII
50	GND	
51	A (+)	
Optional CANbus #1 engine interface		
53	CAN-H	CAN J1939 engine communication
54	CAN-GND	
55	CAN-L	
Optional CANbus AOP-2 interface (option X4)		
57	CAN-H	CAN communication line to AOP-2
58	CAN-GND	
59	CAN-L	
Optional CANbus #2 ext. I/O interface (option H8)		
57	CAN-H	CAN communication line to external I/O
58	CAN-GND	
59	CAN-L	

Available options

Option	Description	Type	Note
B	Generator protection		
B3	Automatic Mains Failure - Generator and mains breaker control - Change-over (no synchronisation)	Hardware option	
G	Breaker		
G6	Front layout with generator breaker	Hardware option	
H	Communication		
H2	Modbus RS485 RTU or ASCII	Hardware option	
H5	CANbus J1939 CANbus #1 comm. - Detroit Diesel - John Deere - Deutz - Volvo Penta EMS - Volvo Penta EMS 2 - Scania EMS - Scania EMS 2 - MTU MDEC 302 - MTU MDEC 303 - MTU ADEC - Cummins - Iveco - Perkins - Caterpillar	Hardware option	
H8	External I/O CANbus #2 comm.	Hardware option	See supported modules in option H8 documentation
J	Cables		
J5	PI-1 converter box kit (for PC connection)	Hardware option	
K	Documentation		
K1	Installation Instructions and Reference Handbook (hard copy)	Other	
K2	CD-ROM with complete documentation	Other	
L	Gasket for IP65	Hardware option	
L2	Heatfoil for display (display will operate down to -40°C)	Hardware option	Only HW 1.05 and ASW 2.0x.x
M			
M19	Mains circuit breaker/configurable, contact function NO (normally open)	Hardware option	Only HW 1.05 and ASW 2.0x.x
X	Display		
X4	Additional operator panel (AOP-2): 16 configurable LEDs, 8 configurable buttons and 1 status relay. CANbus #2 comm.	Hardware option	Maximum of 2 AOP2s
Y	Folio		
Y2	Engine folio without generator symbol, generator and mains breaker	Hardware option	

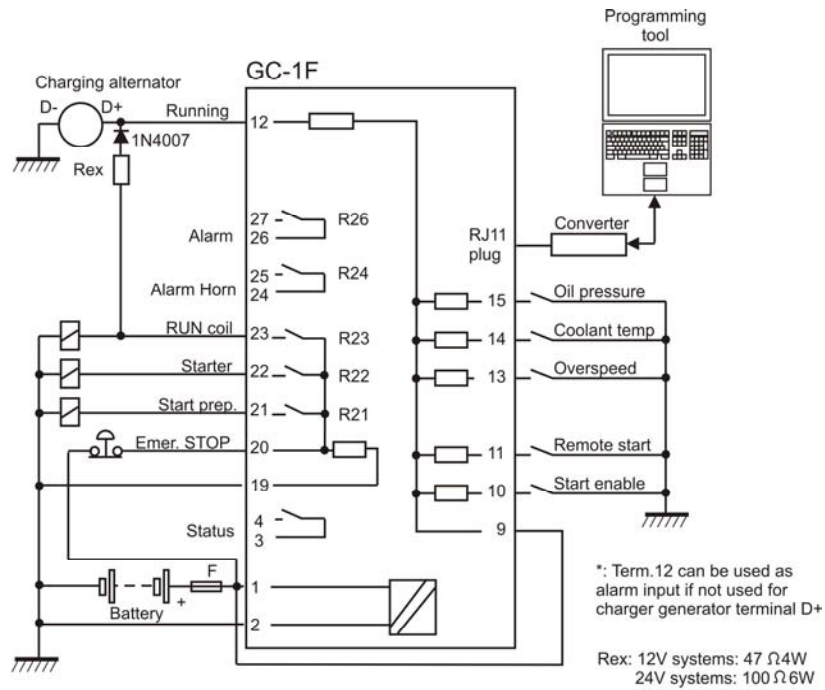
Option B3 display layout



Wiring, engine interface



F: Fuse: Min. 2 A slow-blow.



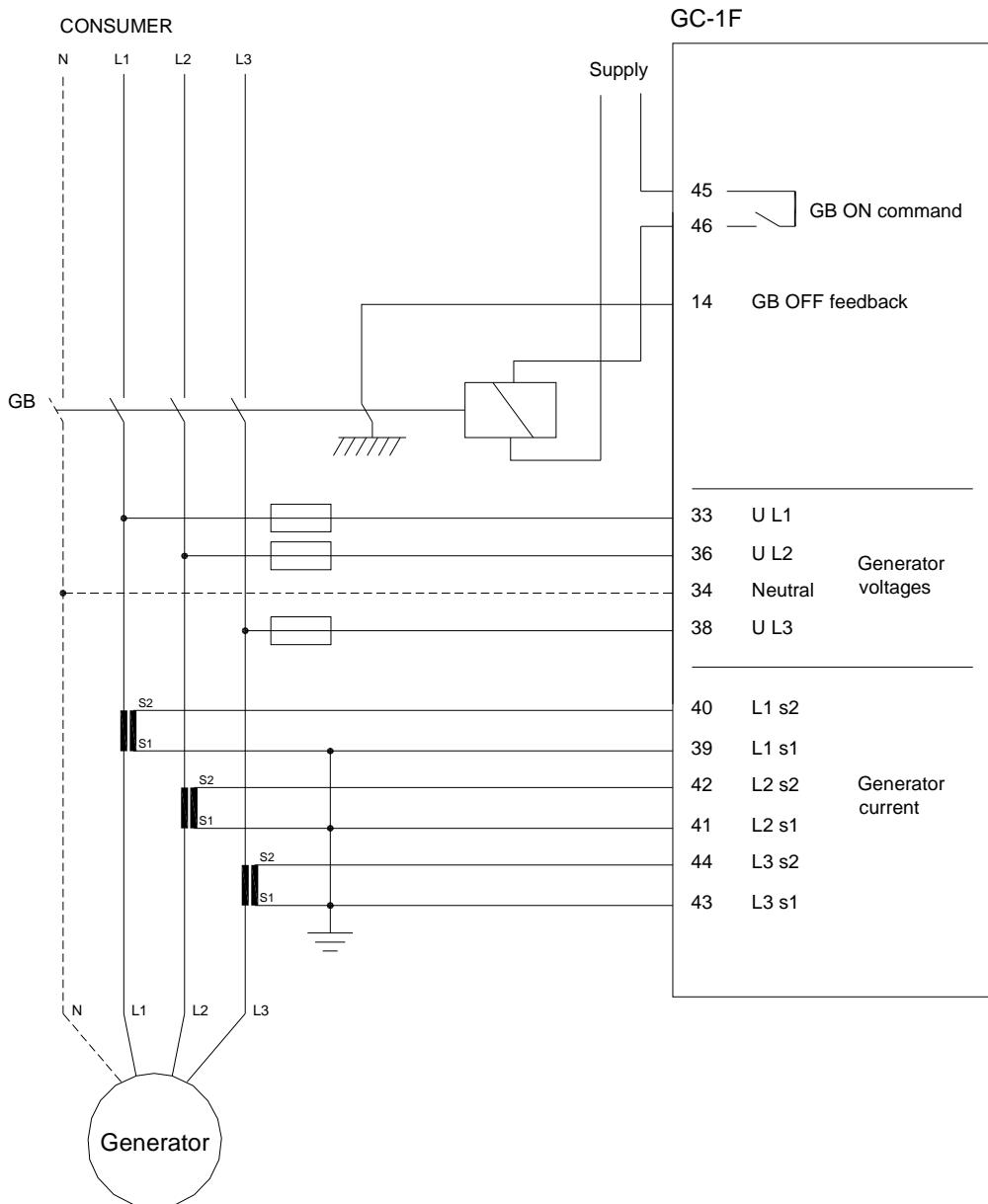
<p>Engine communication option H5</p>	<p>Modbus option H2</p>	<p>External I/O and AOP2 option H8 / X4</p>
<p>Multi-functional inputs VDO sensors</p>	<p>Multi-functional inputs Analogue 0(4)-20mA</p>	<p>Multi-functional inputs Binary input w. wirebreak</p> <p>R= 100 Ohm</p>
<p>Tacho input Magnetic pickup/ Tacho generator</p>	<p>Tacho input NPN/PNP pickup</p>	<p>Tacho input W input from charger alternator</p>



It is possible to combine VDO inputs with binary and 0(4)...20 mA inputs in a mix.

Wiring, AC interface

Connection of the 3-phase voltage and current



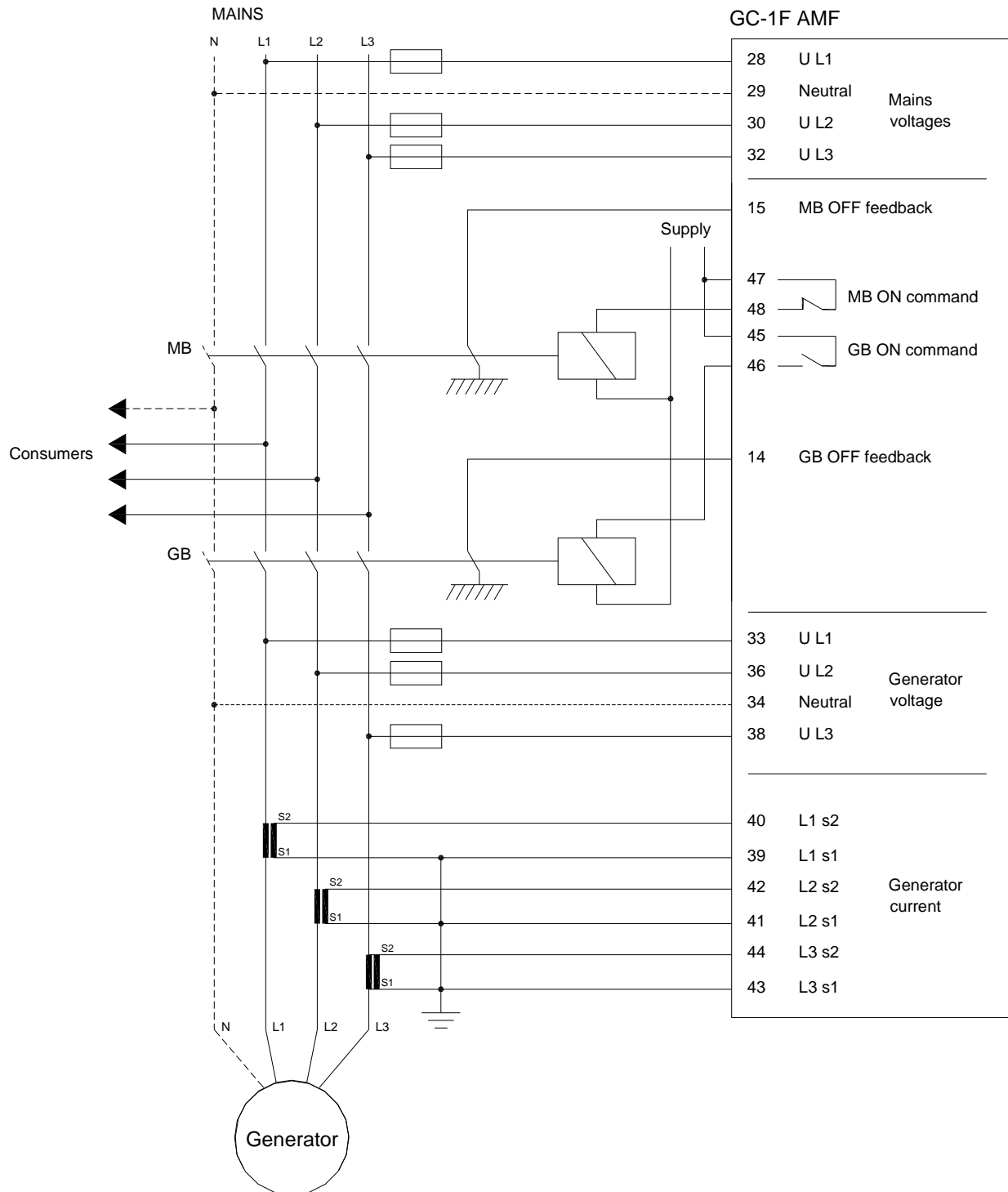
The AC current grounding can be made as required to s1 or s2.



GB: Use a contactor. The ON output from the GC-1F is a constant signal. Remember to use free-wheel diodes across the contactor coils, if DC voltage is used as supply for these.

Fuse for AC voltage: Max. 2 A slow-blow.

Wiring, AMF (option B3)



The AC current grounding can be made as required to s1 or s2.



GB and MB: Use contactors. The ON outputs from the GC-1F AMF are constant signals. Remember to use free-wheel diodes across the contactor coils, if DC voltage is used as supply for these.

Fuse for AC voltage: Max. 2 A slow-blow.

Technical specifications

Accuracy:	Class 2.0 To EN 60688	Current:	(0)4...20 mA
Operating temp.:	-20...70°C (-4...158°F) -40...70°C (-40...158°F) with option L2	Impedance:	50 Ω
(UL/cUL Listed:	Max. 50°C ambient)	Active binary input voltage:	Dry contact inputs (see note) 3V DC supply, with cable supervision
Storage temp.:	-40...70°C (-40...158°F)	Relay outputs:	Impedance: 240 Ω ~ 16 mA
Heatfoil (option L2):	Display will operate down to -40°C	Relays 21-23:	30V AC/DC 2 A (UL/cUL Listed: 30V DC 1 A Resistive)
Measuring input voltage:	50...480V AC (+20%) Phase-to-phase	Relays 45, 47:	250V AC/30V DC 2 A (UL/cUL Listed: 30V DC 2 A Resistive)
Short-circuit protection:	3% of 350%*In (only available from HW 1.05 and 2.0x.x)	Relays 24, 26:	30V AC/DC 8 A (UL/cUL Listed: 30V DC 6 A Resistive)
(UL/cUL Listed:	50...300V AC)	Status relay/config.:	24V DC 1 A Resistive
Load:	1.5 MΩ/phase	Response times:	(Delay set to min.) Generator:
Frequency:	30...70 Hz	Reverse power	< 400 ms
Measuring input current:	1 A or 5A AC from current transformer	Power/overload	< 400 ms
Current overload:	4 x In continuously 20 x In, 10 sec. (max. 75 A) 80 x In, 1 sec. (max. 300 A)	Overcurrent	< 400 ms
Consumpt. max.:	0.3 VA/phase	Over-/undervoltage	< 400 ms
(UL/cUL Listed:	Use listed or R/C (XODW2.8) current transformers)	Over-/underfrequency	< 400 ms
Pick-up input voltage:	2...70 V peak	Fast overcurrent	< 300 ms
Frequency:	10-10000 Hz	Mounting:	Panel-mounted
Aux. supply:	6-36V DC continuously Max. 8 W consumption Including L2 heatfoil, max. 16 W	(UL/cUL Listed:	For use on a flat surface of a type 1 enclosure. Main disconnect shall be provided by installer)
(UL/cUL Listed:	7.5...32.7V DC)	Size:	160 x 220 mm (6.30" x 8.66")
Passive binary input voltage:	Bi-directional optocoupler 6...36V DC	Climate:	97% RH to IEC 60068-2-30, test Db -20°C (-40°) to IEC 60068-2-1 +70°C to IEC 60068-2-2
Impedance:	4.7 kΩ	Display:	128 x 64 pixel backlight STN 3 line views can max. show a value of 9999
Dropout cranking:	Able to survive 0 V for 50 ms at 12V DC aux. supply before dropout	Safety:	To EN 61010-1, UL508 and CSA22.2 No. 14-05 Installation category (overvoltage category) III, 300V, pollution degree 2
VDO inputs:	Resistor inputs, internal 3 V supply	Protection:	Front: IP52/NEMA type 1 (IP65/NEMA type 1 with gasket, option L) Terminals: IP20/NEMA type 1 To IEC/EN 60529
Analogue input:	From active transducer	EMC/CE:	To EN 61000-6-1/2/3/4 IEC 60255-22-1/EN 61000-4-18

Data sheet

Gen-set Controller GC-1F

(PL3), IEC 60255-26

Material: All plastic materials are self-extinguishing acc. to UL94 (V1)

Plug connections: AC voltage/current inputs:
3.5 mm² (13 AWG) multi-stranded
Other:
1.5 mm² (16 AWG) multi-stranded

(UL/cUL Listed: Wire size: AWG 30-12
Use 60/75°C copper conductors only)

Tightening torque, min.: AC voltage input: 0.5Nm (5-7lb-in)
Other: 0.5Nm (5-7lb-in)

PC connection: RS232 converter box (option J5)

Weight: Approx. 0.9 kg (1.9lbs)

Installation: To be installed in acc. with the NEC (US) or the CEC (Canada)

Approval: CE & UL/cUL Listed

Additional operator panel AOP-2

Operating temp.: -20...70°C (-4...158°F)

(UL/cUL Listed: Max. 60°C ambient)

Storage temp.: -40...70°C (-40...158°F)

Aux. supply: 18...36V DC by external DC/DC converter 12DCR24/5 supplied from controlled Class 2 source

Terminals: Tightening torque: 0.4Nm (4lb-in)

Wiring: Size AWG 30-12
Use 60/75°C copper conductors only

Mounting: Panel-mounted

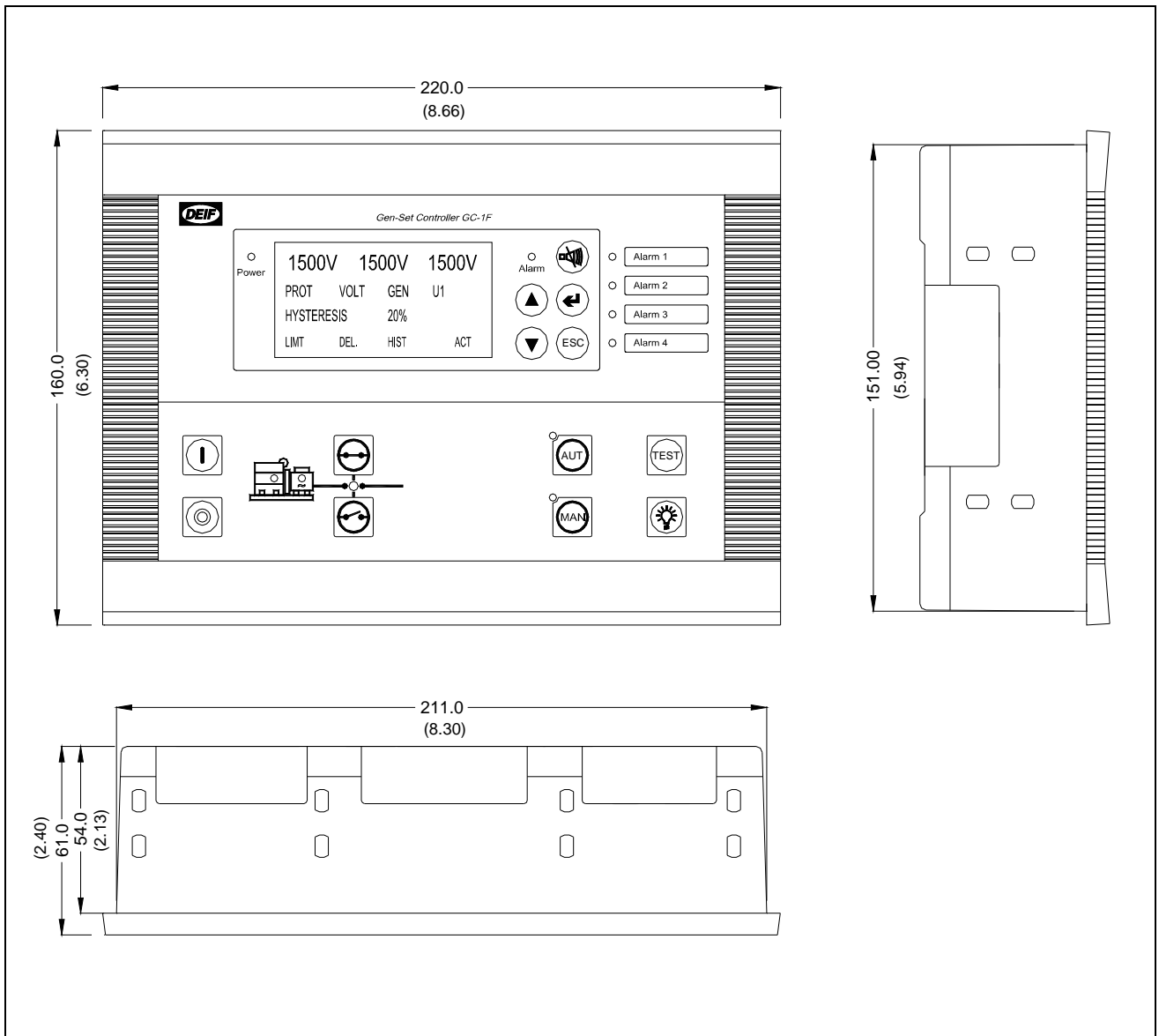
(UL/cUL Listed: For use on a flat surface of type 1 (IP54) enclosure
Main disconnect must be provided by installer)

Installation:

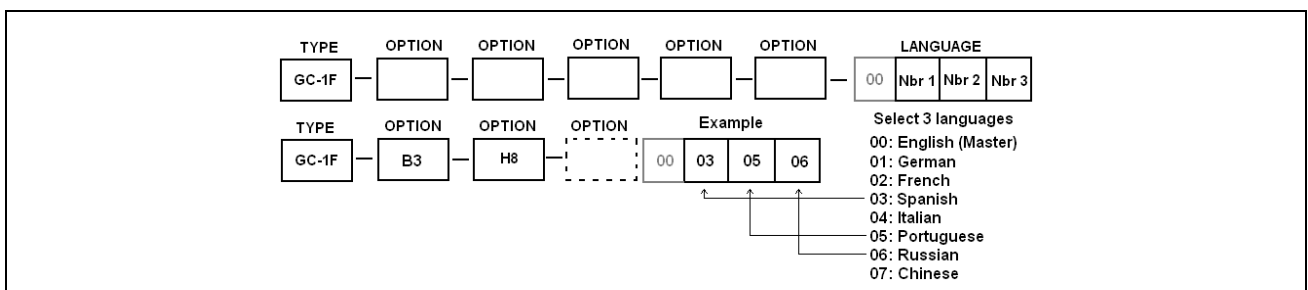
(UL/cUL Listed: To be installed in acc. with the NEC (US) or the CEC (Canada)

Approval: CE & UL/cUL Listed

Unit dimensions in mm (inches)



Order specifications

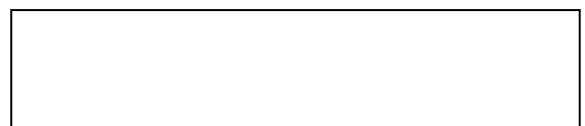


Due to our continuous development we reserve the right to supply equipment which may vary from the described.



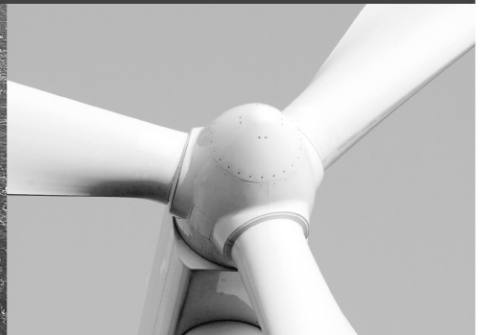
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AGC Automatic Gen-set Controller DATA SHEET



Operation modes

- Automatic mains failure
- Island operation
- Fixed power/base load
- Peak shaving
- Load take over
- Mains power export
- Remote maintenance

Engine control

- Start/stop sequences
- Run and stop coil
- Relay outputs for governor control

Generator Protection (ANSI)

- 2 x reverse power (32)
- 5 x overload (32)
- 6 x overcurrent (50/51)
- 2 x overvoltage (59)
- 3 x undervoltage (27)
- 3 x over-/underfrequency (81)
- Voltage-dependent overcurrent (51V)
- Current/voltage unbalance (60)
- Loss of excitation/overexcitation (40/32RV)
- Multi-inputs, 3 configurable
- Pressure, temperature and fuel level, 2 levels

Display

- Push-buttons for start, stop and breaker operation
- Status texts and alarm indications
- Remote mounting and additional remote displays

Busbar protection (ANSI)

- 3 x overvoltage (59)
- 4 x undervoltage (27)
- 3 x overfrequency (81)
- 4 x underfrequency (81)
- Voltage unbalance

M-logic (Micro PLC)

- Simple logic configuration tool
- Selectable input events
- Selectable output commands

General

- USB interface to PC
- Free PC utility software for commissioning
- Mini SCADA in PC utility software
- 3/2/1-phase monitoring
- Close before excitation



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Document no.: 4921240295M
SW version: 3.5x.x or later

Application

The Automatic Gen-set Controller is a microprocessor based control unit containing all necessary functions for protection and control of a gen-set. It contains all necessary 3-phase measuring circuits and all values and alarms are presented on the LCD display.

The AGC is a compact all-in-one unit designed for the following applications:

- Automatic mains failure
- Island operation
- Fixed power/base load
- Peak shaving
- Load take over
- Mains power export (fixed power to mains)

Optional applications:

- Multiple gen-sets, load sharing
- Power management (island operation)
- Power management (island operation, split bus)
- Power management (island operation, ring bus)
- Power management (parallel with mains)
- Power management (parallel with mains, split bus)
- Power management (parallel with mains, ring bus)



The AGC can operate in automatic mains failure mode as a secondary mode regardless of the type of application - except the island applications.

The display is separate and can be installed directly on the main unit or in the front of the switchboard door (requires option J1 - display cable). Additional displays can be installed within 200m.

The AGC is supplied with an engine interface I/O card with separate power supply and processor. The card is equipped with the following I/Os:

In-/outputs	Available
Multi-inputs: 4-20mA Digital inputs PT100 PT1000 VDO 0-40V DC	3 (3)
Digital inputs	7 (6)
RPM (MPU)	1
Relays	4
CANbus comm.	2



The number in parenthesis indicates the number of user configurable in-/outputs.



The two CAN communications are only available, if option G4, G5 or H5 is selected.

Test

The available gen-set modes except island operation include a test mode. The test can be configured in 3 different ways.

Simple: Gen-set starting and running for a preset time. Generator breaker is open during the test.

Load: Gen-set starting, synchronisation of the generator breaker. The test is carried out for a preset period of time at a fixed power setpoint parallel to the mains.

Full: Gen-set starting, synchronisation of the generator breaker, de-load and opening of the mains breaker. The test is carried out for a preset period of time after which the load is transferred back to the mains connection.

Setup

Setup is easily done via a menu structure in the display (password protected) or via the USB PC connection and the Multi-line 2 Windows® based PC utility software. The PC utility software can be downloaded free of charge from www.deif.com/Download_centre. The utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates.

Options

In order to perfectly match the product solution to specific applications, the functionality of the AGC can be equipped with a number of available options. The options selected by the customer will be integrated in the standard AGC, hereby securing the same user interface unaffected by whether the application needs a highly complex or a more basic gen-set controller.

Please refer to pages 8, 9 and 10 for the options available.

Unit definitions

AGC: The standard control unit designed for a number of applications (1-9). An extensive list of hardware and software options is available for the AGC.

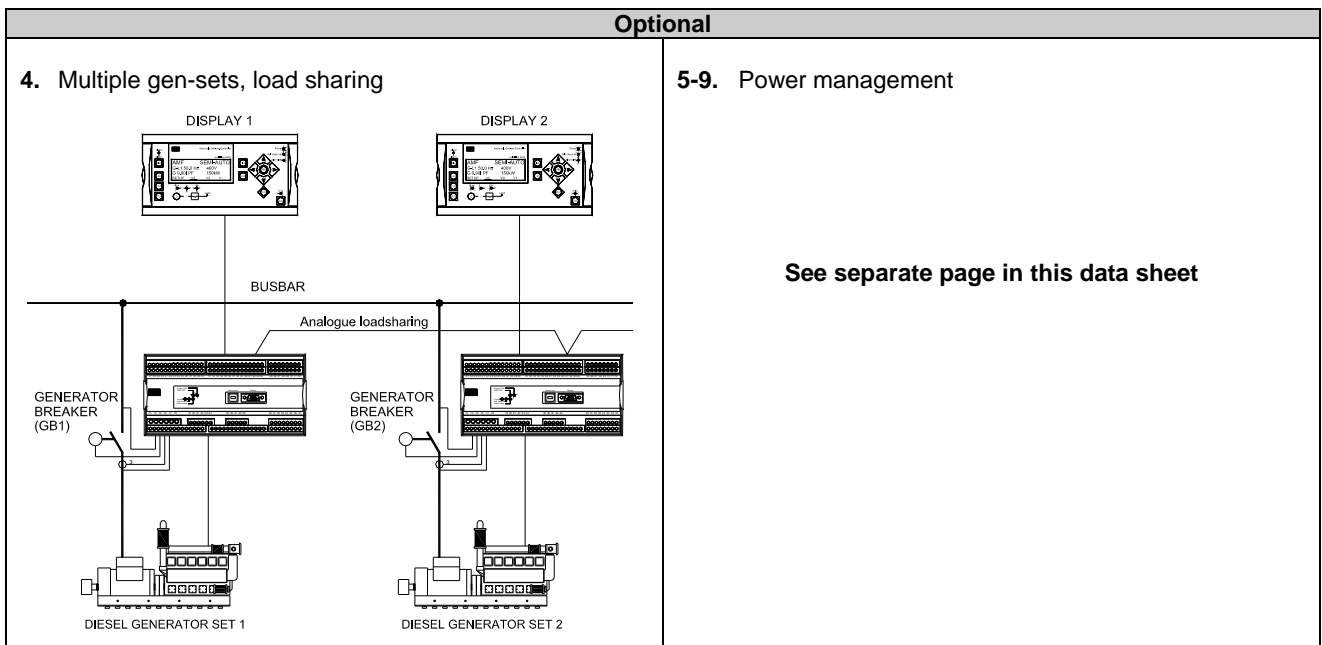
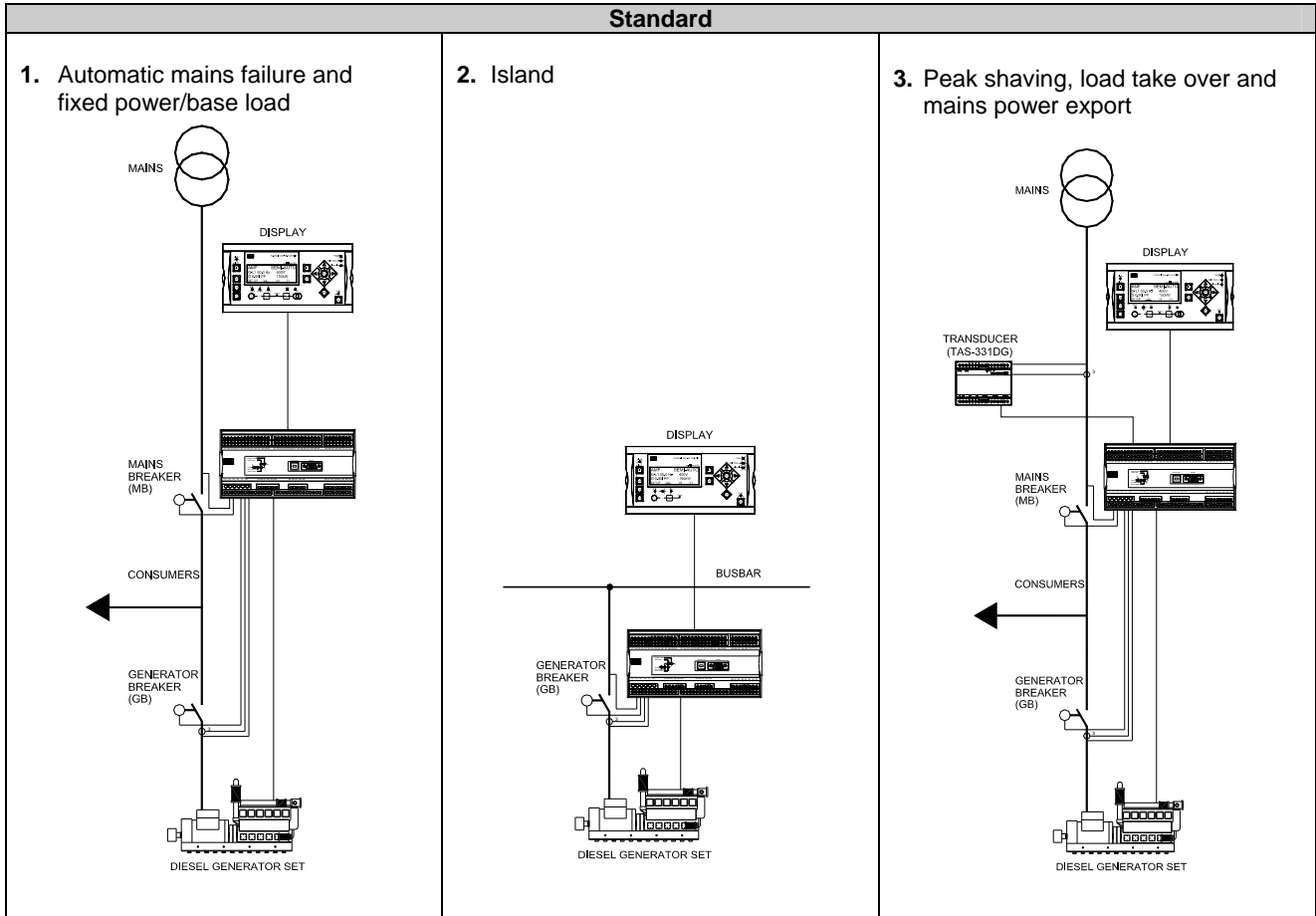
AGC mains: A power management control unit used in the parallel with mains power management application (6-9). Several options are available for the AGC mains.

AGC BTB: A power management control unit used in the power management application to split the busbar (8). Several options are available for the AGC BTB.

M-logic (Micro PLC)

This configuration tool is part of the PC utility software which is free of charge. With this tool it is possible to customise the application to your needs. It is possible to dedicate specific functions or logical conditions to different inputs and outputs.

Single line application diagrams



Power management (option G4/G5)

Description

The AGC can be equipped with a power management option (G4 or G5). Using this possibility, the AGC will be able to handle applications with up to

- 16 mains incoming
- 16 mains breakers
- 16 tie breakers
- 8 bus tie breakers (BTBs)
- 16 generators (256 on request)
- 16 generators
- 16 generator breakers

The basic functions are:

- All 56 breakers can be synchronised by choice
- Load dependent start/stop operation
- Priority selection of gen-sets
- Priority selection of mains
- Redundant communication between the controllers
- Plant divided into sections for individual functionality
- Selectable mains priority and parallel operation
- The plant mains failure sequence can call for support on local plant sections
- Load management
- Quick setup/broadcast
- Asymmetric load sharing
- CAN flags
- Droop frequency/voltage
- Heavy consumer (HC)
- Non-essential load (NEL)/load shedding
- Secured mode
- Base load
- Multi-master system

In a multi-master system, all vital data is broadcasted from all units to all units, giving all units knowledge of their own position in the application. This philosophy makes the application immune to a failing master controller.

Application

The plant modes supported by the power management options are:

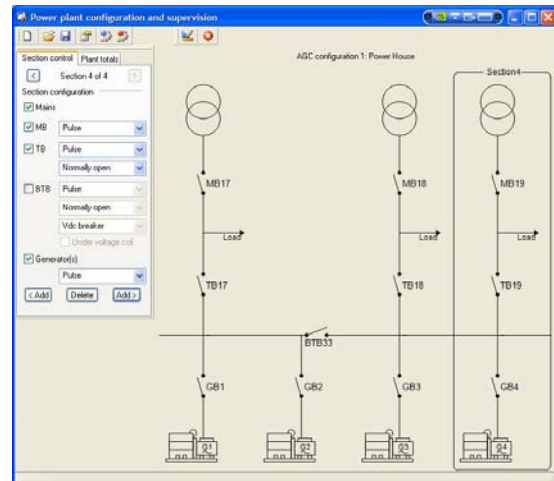
- Automatic mains failure/ATS
- Island operation
- Fixed power/base load
- Peak shaving
- Load take over
- Mains power export (fixed power to mains)

The plant modes are configurable and it is possible to change the plant mode on the fly both in single gen-set and in power management applications.

The plant can be divided into sections by several bus tie breakers, making it possible to run different plant modes in each section.

Configuration

The setup of the application is easily configured using a computer and the DEIF PC utility software.



Your PC tool visualises it - the AGC realises it.

Load management

The load management is primarily handled by the tie breakers. Functions are available to ensure sufficient power capacity to handle the load either in terms of number of gen-sets or by soft starting the load.

If a certain level of available power on the busbar is required to connect a load group, functions are available both for starting additional generators and relays can be configured to activate when a specific level of available power is reached.

Load dependent operation

The load dependent starting and stopping of the gen-sets is based on a *power available* calculation. The next generator will start when the available power decreases below the adjustable setpoint. It will stop when too much power is available.

Data sheet

Priority selection

Priority routines are individually made for the mains in the plant sections and for the gen-sets.

The mains priority routines in the AGC mains are:

- Selected primary mains
- Parallel mains

The gen-set priority routines in the AGC are:

- Manual selection based on ID
- Running hours
- Fuel optimising calculating the best combination of generator kW size and the plant load. Works with up to 16 gen-sets

Automatic Gen-set Controller

Redundant AGC mains and CANbus

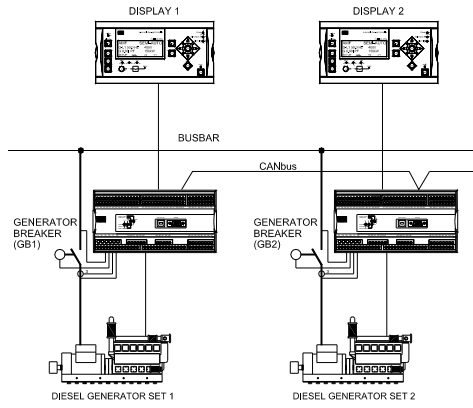
In emergency systems requiring extra operation reliability, redundant AGC mains units and redundant CANbus communication lines can be used to provide back-up.



Redundant AGC mains units are only supported in the application: Dual mains (7).

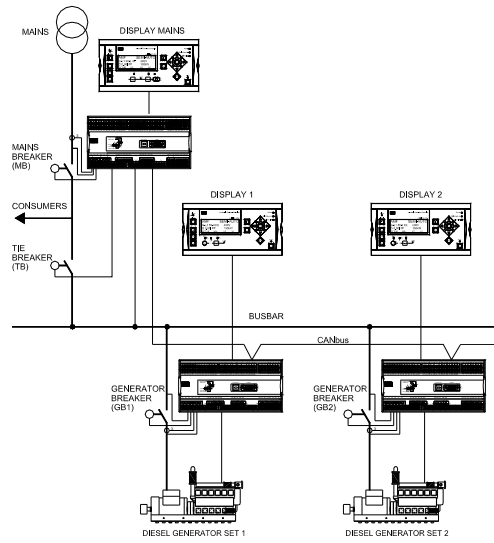
Optional power management applications

5. Island operation



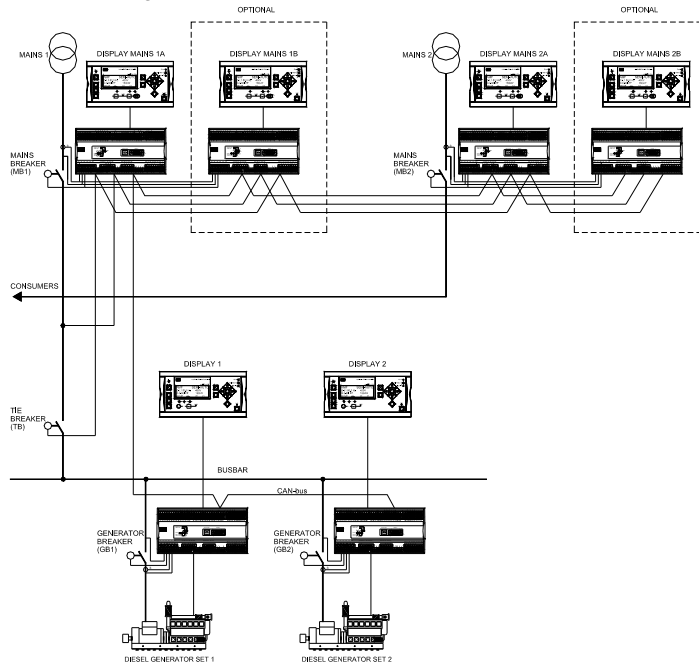
6. Parallel with mains

The tie breaker is selectable depending on applicational needs.



7. Parallel with 2 mains/dual mains application

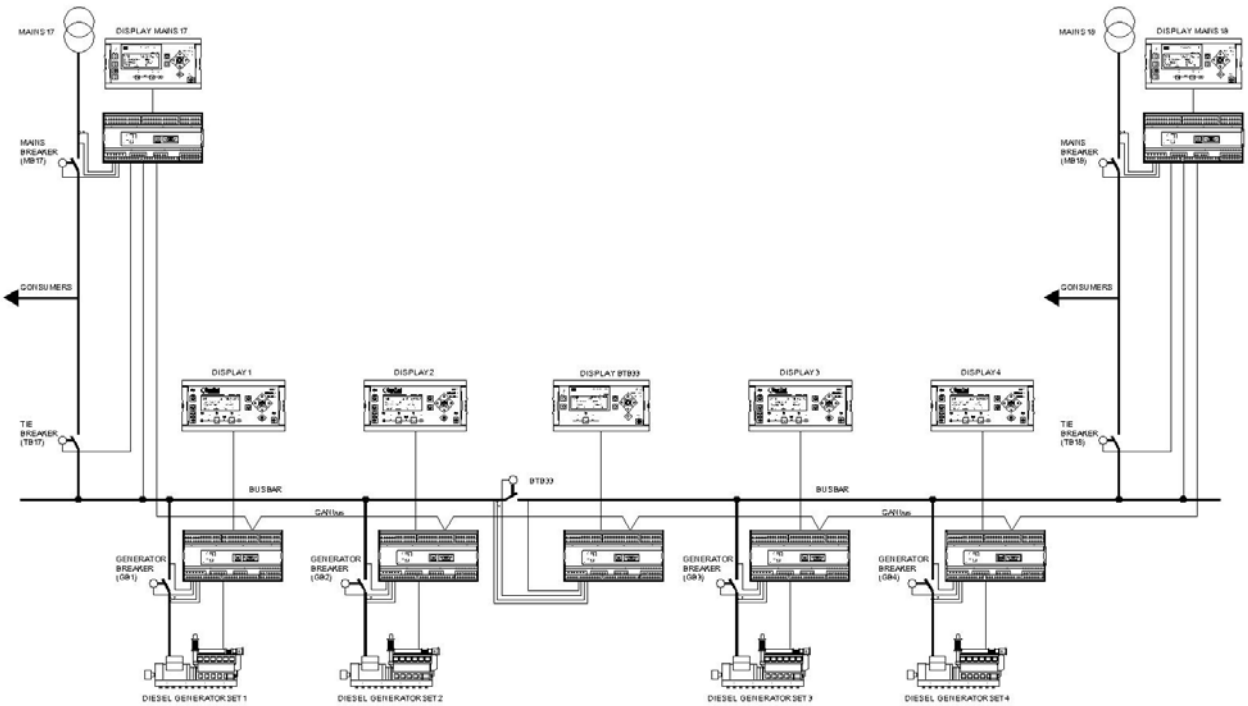
The tie breaker is selectable depending on applicational needs.



Optional power management applications

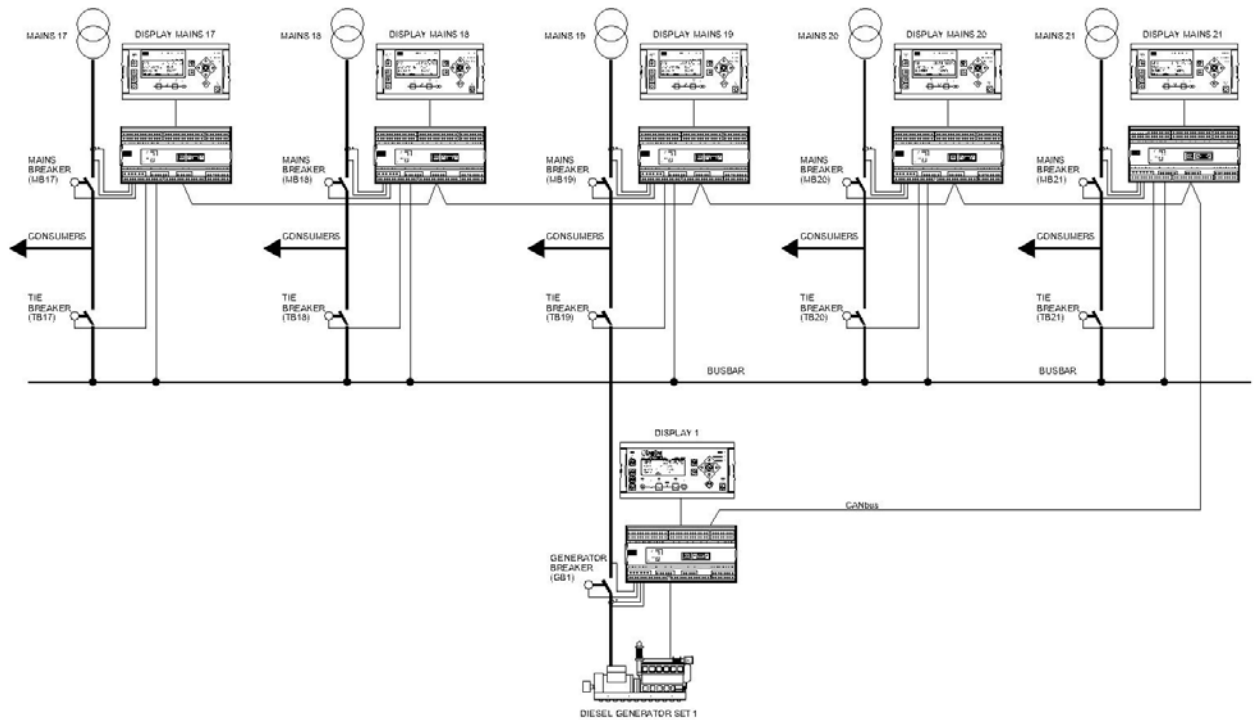
8. H-coupling

The tie breaker controlled by the AGC mains is selectable depending on applicational needs.



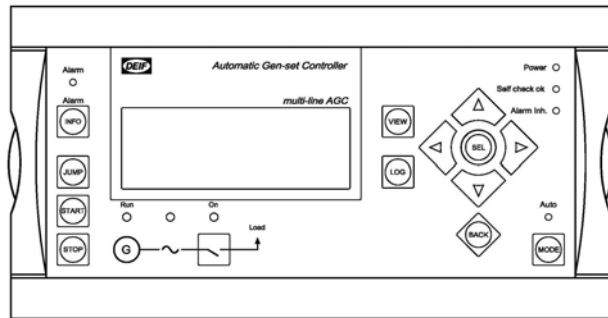
9. X mains and 1 DG

The tie breaker controlled by the AGC mains is selectable depending on applicational needs.

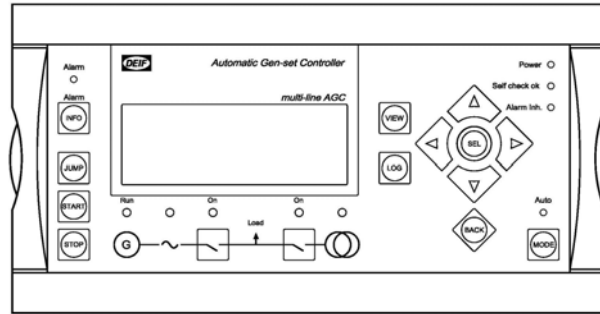


Display layouts

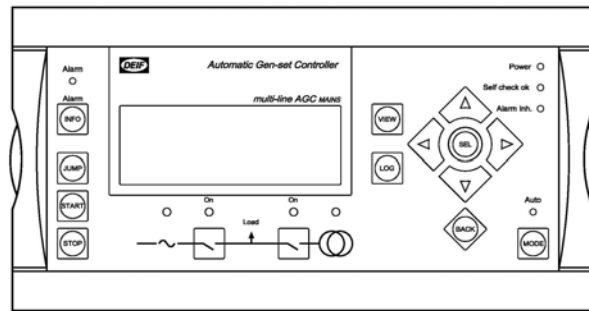
Engine and generator breaker control (Island)
(option Y1)



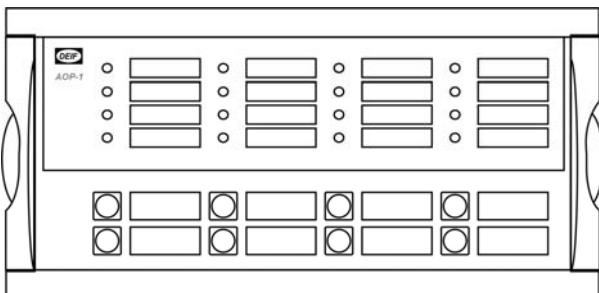
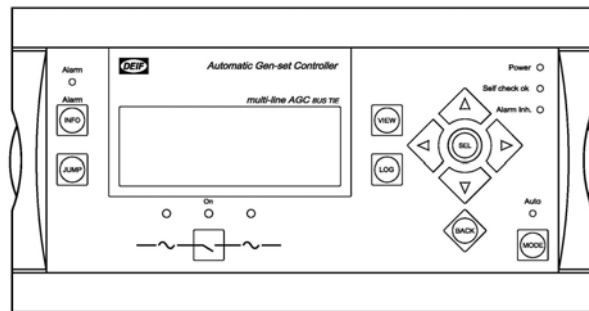
Generator breaker and mains breaker control
(option Y3)



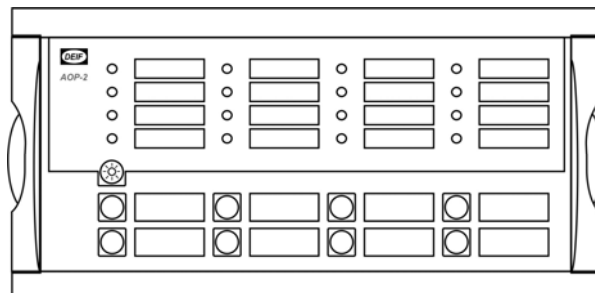
Tie breaker and mains breaker control
(option Y4)



Bus tie breaker control
(option Y5)



Additional operator's panel - AOP-1 (option X3)



Additional operator's panel - AOP-2 (option X4)

Available options

Option	Description	Slot no.	Option type	Note
A	Mains protection package			
A1	Time-dependent undervoltage (27t) Undervoltage and reactive power lov (27Q) Vector jump (78) df/dt (ROCOF) (81)		Software	
A4	Positive sequence (mains voltage low) (27)		Software	
A5	Directional overcurrent (67)		Software	
C2	Negative sequence voltage high (47) Negative sequence current high (46) Zero sequence voltage high (59) Zero sequence current high (50)		Software	
D	Voltage/VAr/PF control			Not available for AGC mains and AGC bus tie
D1	Constant voltage control (stand-alone) Constant reactive power control (parallel with mains) Constant power factor control (parallel with mains) Reactive load sharing (island paralleling with other generators)		Software	Not with EF2
E and F	Analogue controller and transducer outputs			
E1	2 x +/-25mA (GOV/AVR or transducer)	4	Hardware	Not with E2, EF2, EF4 or EF5 AVR output requires D1
E2	2 x 0(4)...20mA (GOV/AVR or transducer)	4	Hardware	Not with E1, EF2, EF4 or EF5 AVR output requires D1
EF2	1 x +/-25mA (GOV/AVR or transducer) 1 x 0(4)...20mA (GOV/AVR or transducer)	4	Hardware	Not with E1, E2, EF4 or EF5 AVR output requires D1
EF4	1 x +/-25mA (GOV/AVR or transducer) 2 x relay outputs (GOV/AVR or configurable)	4	Hardware	Not with E1, E2, EF2 or EF5 AVR output requires D1
EF5	1 x PWM (Pulse Width Modulated) output for CAT GOV +/-20mA for AVR. 2 x relay outputs for AVR	4	Hardware	Not with E1, E2, EF2 or EF4 AVR output requires D1
F1	2 x 0(4)...20mA (transducer)	6	Hardware	Not with H8.2, M13.6, M14.6 or M15
G	Load sharing/power management			
G3	Load sharing with analogue lines	3	Hardware/software	If M12 is present, G3 is a software option Not available for AGC mains and AGC bus tie
G4	Power management, 16 gen-sets, 8 bus tie breakers	7	Software	Not with H7 or G5
G5	Power management, 16 mains, 16 gen-sets, 8 bus tie breakers	7	Software	Not with H7 or G4
H	Serial communication			
H2	Modbus RTU (RS485)	2	Hardware	Not with H3, H8.2
H3	Profibus DP	2	Hardware	Not with H2, H8.2
H5	CANbus: MTU (ADEC and MDEC) and all J1939 engine comm.	8	Hardware	Not with H6, H7, M13.8, M14.8, M15.8 or H8.8 Not available for AGC mains and AGC bus tie
H6	Cummins GCS	8	Hardware	Not with H5, H7, M13.8, M14.8, M15.8 or H8.8 Not available for AGC mains and AGC bus tie
H7	CANbus (J1939):	7	Software	Not with H5, H6 or G5 Not available for AGC mains and AGC bus tie
	Caterpillar Cummins CM850/570 Detroit Diesel (DDEC) Deutz (EMR) Iveco (NEF/CURSORS) John Deere (JDEC)			Perkins Scania (EMS) Scania (EMS S6) Volvo Penta (EMS) Volvo (EMS2)
H8.X	External I/O modules	2, 8	Hardware	H8.2: Not with H2, H3 H8.8: Not with H5, H6, M13.8, M14.8 or M15.8
H11	LED I/F card w/RS232 service port		Hardware	Not with N Class 1.0 measurements



Options E1, E2, EF2 and EF4 are used for GOV/AVR control. 4 relays are used as standard in the AGC for GOV/AVR control. If selected, these options will replace the 4 relays.

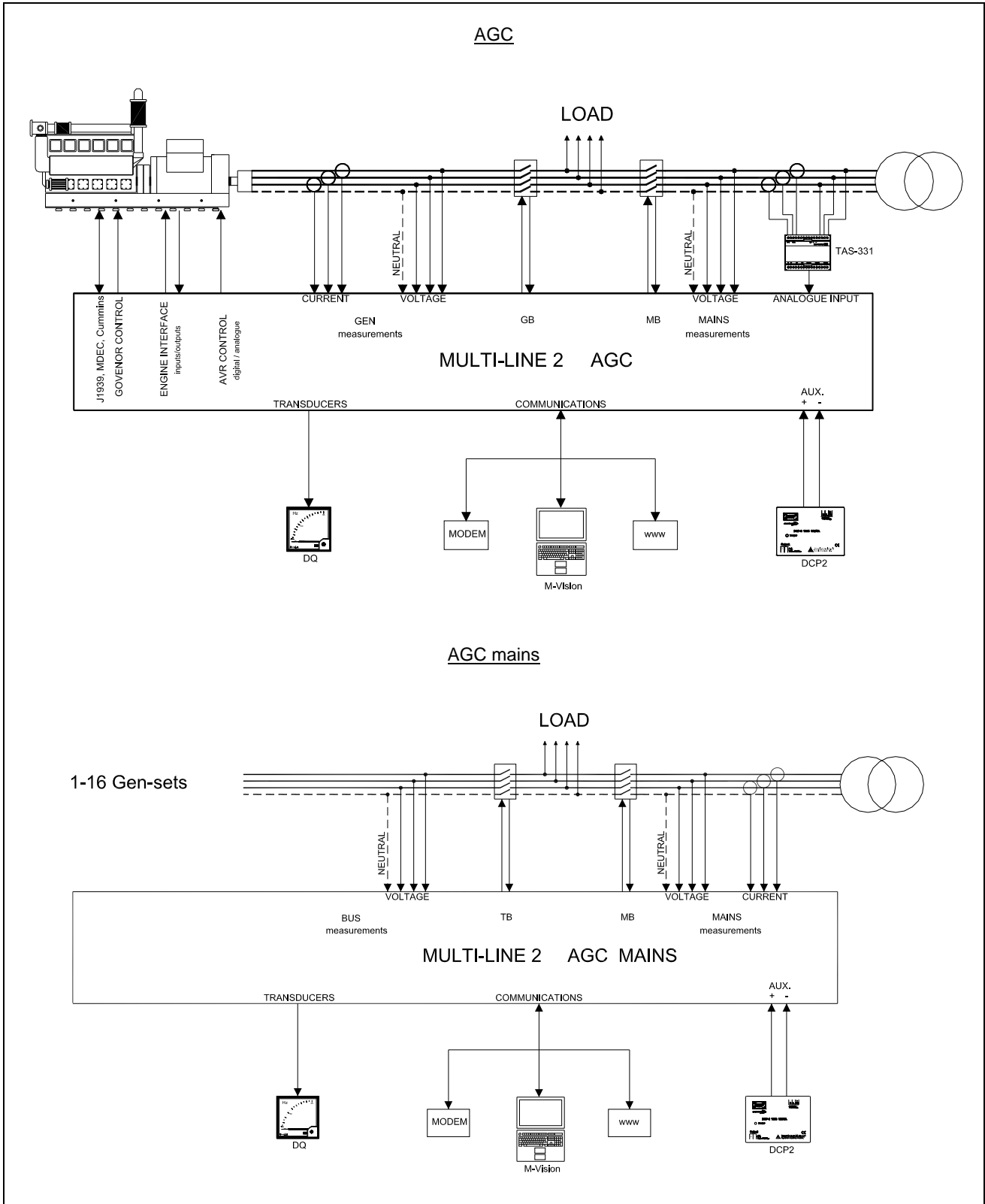
Option	Description	Slot no.	Option type	Note
J	Cables			
J1	Display cable with plugs, 3 m. UL94 (V1) approved		Other	
J2	Display cable with plugs, 6 m. UL94 (V1) approved		Other	
J3	PC cable for utility software (RS232) 3 m. UL94 (V1) approved		Other	Only with H11
J4	PC cable for option N-programming (Ethernet cable crossed), 3 m. UL94 (V1) approved		Other	
J6	Display cable with plugs, 1 m. UL94 (V1) approved		Other	
J7	PC cable for utility software (USB) 3 m. UL94 (V1) approved		Other	Not with H11
J8	Display CAN cable for connection to display in the <i>Remote Maintenance Box</i>		Other	
K	Documentation			
K1	Designer's Reference Handbook (hard copy)		Other	
K2	CD-ROM with complete documentation		Other	
L	Display gasket for IP54		Other	Standard is IP52
M	Binary and analogue I/Os			
M12	13 binary inputs, 4 relay outputs, configurable	3	Hardware/software	If G3 is present, M12 is a software option
M13.X	7 binary inputs, configurable	6, 8	Hardware	M13.6: Not with F1, M14.6 or M15 M13.8: Not with H5, H6, M14.8, M15.8 or H8.8
M14.X	4 relay outputs, configurable	6, 8	Hardware	M14.6: Not with F1, M13.6 or M15 M14.8: Not with H5, H6, M13.8, M15.8 or H8.8
M15.X	4 analogue inputs, configurable, 4...20mA	6, 8	Hardware	M15.6: Not with F1, M13.6, M14.6 or M15.8 M15.8: Not with H5, H6, M13.8, M14.8, H8.8 or M15.6
N	Option N (N3)			
N	- Modbus TCP/IP - SMS/e-mail alarms		Hardware	
P	Printer			
P1	Event and alarm printer software		Software	Only with H11
Q	Measurement accuracy			
Q1	Verified class 0.5		Other	Not with H11
X	Display			
X2	Additional standard display (DU-2). CANbus comm.		Other	Two options X2 can be ordered for each AGC unit Only available if the AGC unit is ordered with a display
X3	Additional operator panel (AOP-1): 16 configurable LEDs and 8 configurable push-buttons		Other	
X4	Additional operator panel (AOP-2): 16 configurable LEDs, 8 configurable buttons and 1 status relay. CANbus comm.		Other	Five options X4 can be ordered for each AGC unit Only available if the AGC unit is ordered with a display
Y	Display layout			
Y1	Engine and generator breaker control (island)		Other	Available for AGC gen-set controller
Y3	Generator breaker and mains breaker control		Other	Available for AGC gen-set controller
Y4	Tie breaker and mains breaker control		Other	Available for AGC mains controller
Y5	Bus tie breaker control		Other	Available for AGC BTB controller

(ANSI# as per IEEE Std C37.2-1996 (R2001) in parenthesis).



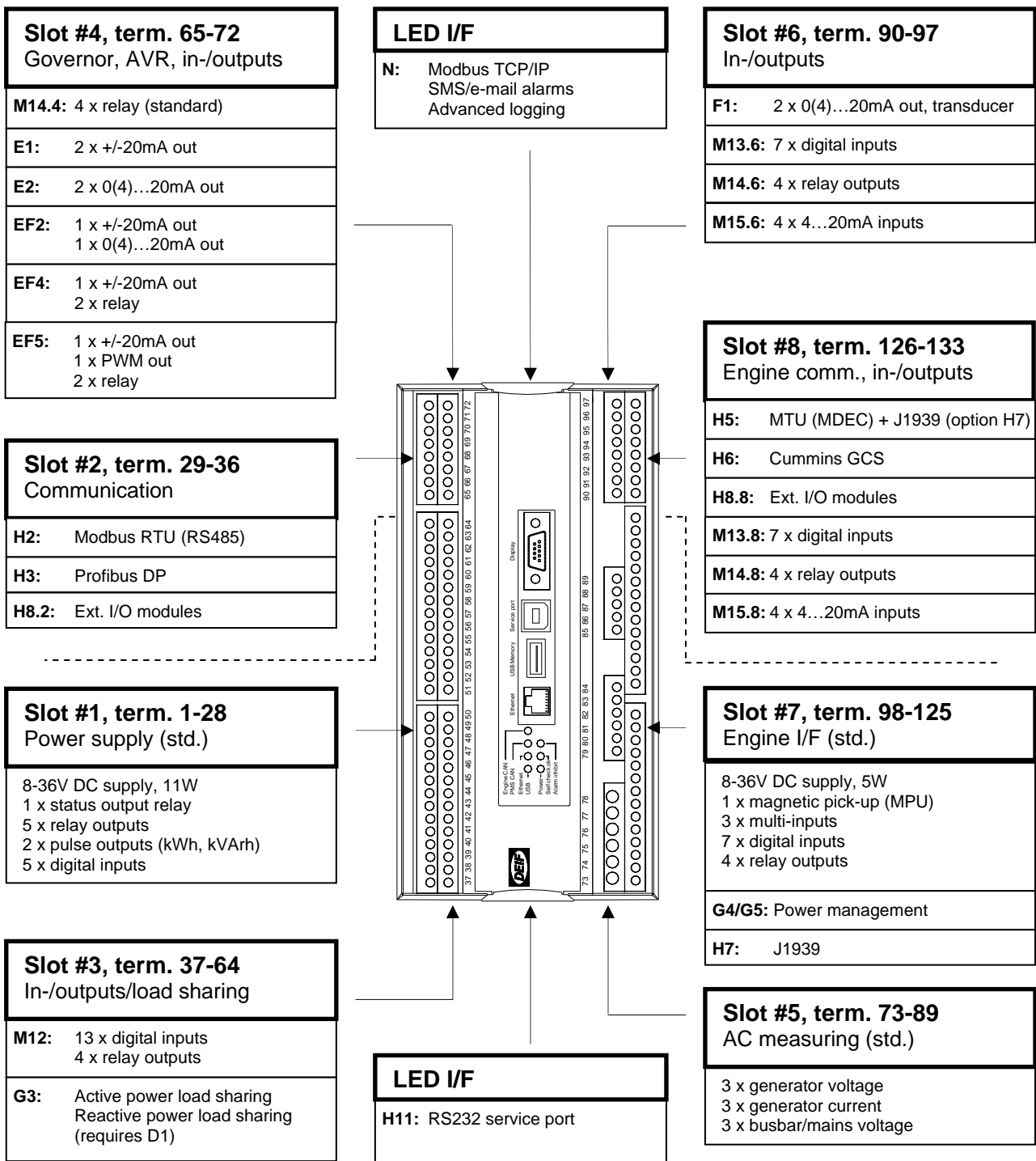
Please notice that not all options can be selected for the same unit. Please refer to page 12 in this data sheet for further information about the location of the options in the unit.

Principle diagrams



DEIF supplies a complete range of current transformers (DCT range of CTs), power supplies (DCP range), meters (DQ range) and transducers (TAS range) that are suitable for use with our range of generator controls and protection relays - please see www.deif.com for full details.

Hardware overview



i There can only be one hardware option in each slot. It is e.g. not possible to select option H2 and option H3 at the same time, because both options require a PCB in slot #2.

i Besides the hardware options shown on this page, it is possible to select the software options mentioned in the chapter 'Available options'.

Technical specifications

Accuracy:	<p>Class 1.0 Class 0.5 with option Q1</p> <p>Positive, negative and zero sequence alarms: Class 1 within 5% voltage unbalance</p> <p>Class 1.0 for neg. seq. current</p> <p>Fast overcurrent: 3% of 350%*In</p> <p>Analogue outputs: Class 1.0 according to total range</p> <p>Option EF4: Class 4.0 according to total range</p> <p>To IEC/EN60688</p>	<p>0(4)...20mA: Impedance: 50Ω Not galvanically separated</p> <p>RPM (MPU): 2...70V AC, 10...10000Hz, 250...3000Ω</p>
Operating temp.:	<p>-25...70°C (-13...158° F) (UL/cUL Listed: Max. surrounding air temp.: 55°C/131°F)</p>	<p>Multi-inputs:</p> <p>0(4)...20mA: 0-20mA, +/-1% Not galvanically separated</p> <p>Binary: Max. resistance for ON detection: 100Ω Not galvanically separated</p> <p>PT100/1000: -40...250°C, +/-1% Not galvanically separated To IEC/EN60751</p> <p>VDO: 0...1700Ω, +/-2% Not galvanically separated</p> <p>V DC: 0...40V DC, +/-1% Not galvanically separated</p>
Storage temp.:	<p>-40...70°C (-40...158° F)</p>	
Climate:	<p>97% RH to IEC 60068-2-30</p>	
Meas. voltage:	<p>100-690V AC +/-20% (UL/cUL Listed: 480V AC phase-phase)</p>	<p>Relay outputs:</p> <p>Electrical rating: 250V AC/30V DC, 5A (UL/cUL Listed: 250V AC/24V DC, 2A resistive load)</p> <p>Thermal rating @ 50°C: 2A: Continuously 4A: t_{ON} = 5 sec., t_{OFF} = 15 sec. (Unit status output: 1A)</p>
Consumption:	<p>Max. 0.25VA/phase</p>	
Meas. current:	<p>-/1 or -/5A AC (UL/cUL Listed: From CTs 1-5A)</p>	
Consumption:	<p>Max. 0.3VA/phase</p>	
Current overload:	<p>4 x I_n continuously 20 x I_n, 10 sec. (max. 75A) 80 x I_n, 1 sec. (max. 300A)</p>	
Meas. frequency:	<p>30...70Hz</p>	
Aux. supply:	<p>Terminals 1 and 2: 12/24V DC (8...36V continuously, 6V 1 sec.) Max. 11W consumption</p> <p>Terminals 98 and 99: 12/24V DC (8...36V continuously, 6V 1 sec.) Max. 5W consumption</p> <p>The aux. supply inputs are to be protected by a 2A slow blow fuse (UL/cUL Listed: AWG 24)</p>	<p>Open collector outputs:</p> <p>Supply: 8...36V DC, max. 10mA</p>
Binary inputs:	<p>Optocoupler, bi-directional ON: 8...36V DC Impedance: 4.7kΩ OFF: <2V DC</p>	<p>Analogue outputs:</p> <p>0(4)...20mA and +/-25mA Galvanically separated Active output (internal supply) Load max. 500Ω (UL/cUL Listed: Max. 20mA output)</p> <p>Update rate: Transducer output: 250 ms Regulator output: 100 ms</p>
Analogue inputs:	<p>-10...+10V DC: Not galvanically separated Impedance: 100kΩ</p>	<p>Load sharing lines:</p> <p>-5...0...+5V DC, Impedance: 23.5 kΩ</p> <p>Galv. separation:</p> <p>Between AC voltage, AC current and other I/Os: 3250V AC, 50Hz, 1 min.</p> <p>Between analogue outputs and other I/Os: 500V DC, 1 min.</p> <p>Between binary input groups and other I/Os: 500V DC, 1 min.</p>

Data sheet

Response times:

(Delay set to min.)

Busbar:

Over-/undervoltage: < 50ms
Over-/underfrequency: < 50ms
Voltage unbalance: <250ms

Generator:

Reverse power: <250ms
Overcurrent: <250ms
Fast overcurrent: < 40ms
Directional overcurrent: <100ms
Over-/undervoltage: <250ms
Over-/underfrequency: <350ms
Overload: <250ms
Current unbalance: <250ms
Voltage unbalance: <250ms
React. power import: <250ms
React. power export: <250ms
Voltage dep. I>: <250ms
Negative sequence I: <500ms
Negative sequence U: <500ms
Zero sequence I: <500ms
Zero sequence U: <500ms
Overspeed: <500ms
Digital inputs: <250ms
Emergency stop: <200ms
Multi-inputs: <800ms
Wire failure: <600ms

Mains:

df/dt (ROCOF): <130ms (4 periods)
Vector jump: < 40ms
Positive sequence: < 60ms

Mounting: DIN-rail mount or base mount with 6 screws

Safety: To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2
To UL 508 and CSA 22.2 no. 14-05, overvoltage category III, 300V, pollution degree 2

EMC/CE: To EN 61000-6-1/2/3/4
IEC 60255-26
IEC 60533 power distr. zone
IACS UR E10 power distr. zone

Vibration: 3...13.2Hz: 2mm_{pp}
13.2...100Hz: 0.7g
To IEC 60068-2-6 & IACS UR E10

10...60Hz: 0.15mm_{pp}
60...150Hz: 1g
To IEC 60255-21-1 Response (class2)

10...150Hz: 2g
To IEC 60255-21-1 Endurance (class2)

Automatic Gen-set Controller

Shock (base mount):

10g, 11msec, half sine
To IEC 60255-21-2 Response (class2)

30g, 11msec, half sine
To IEC 60255-21-2 Endurance (class2)

50g, 11msec, half sine
To IEC 60068-2-27

Bump: 20g, 16msec, half sine
To IEC 60255-21-2 (class2)

Material: All plastic materials are self-extinguishing according to UL94 (V1)

Plug connections:

AC current:
0.2-4.0 mm² stranded wire
(UL/cUL Listed: AWG 18)

AC voltage:
0.2-2.5 mm² stranded wire
(UL/cUL Listed: AWG 20)

Relays:
(UL/cUL Listed: AWG 22)

Terminals 98-116:
0.2-1.5 mm² stranded wire
(UL/cUL Listed: AWG 24)

Other:
0.2-2.5 mm² stranded wire
(UL/cUL Listed: AWG 24)

Display:
9-pole Sub-D female

Service port:
USB A-B

Protection: Unit: IP20
Display: IP52 (IP54 with gasket: Option L)
(UL/cUL Listed: Type Complete Device, Open Type)

To IEC/EN 60529

Governors: Multi-line 2 interfaces to all governors, including GAC, Barber-Colman, Woodward and Cummins

See interfacing guide at
www.deif.com

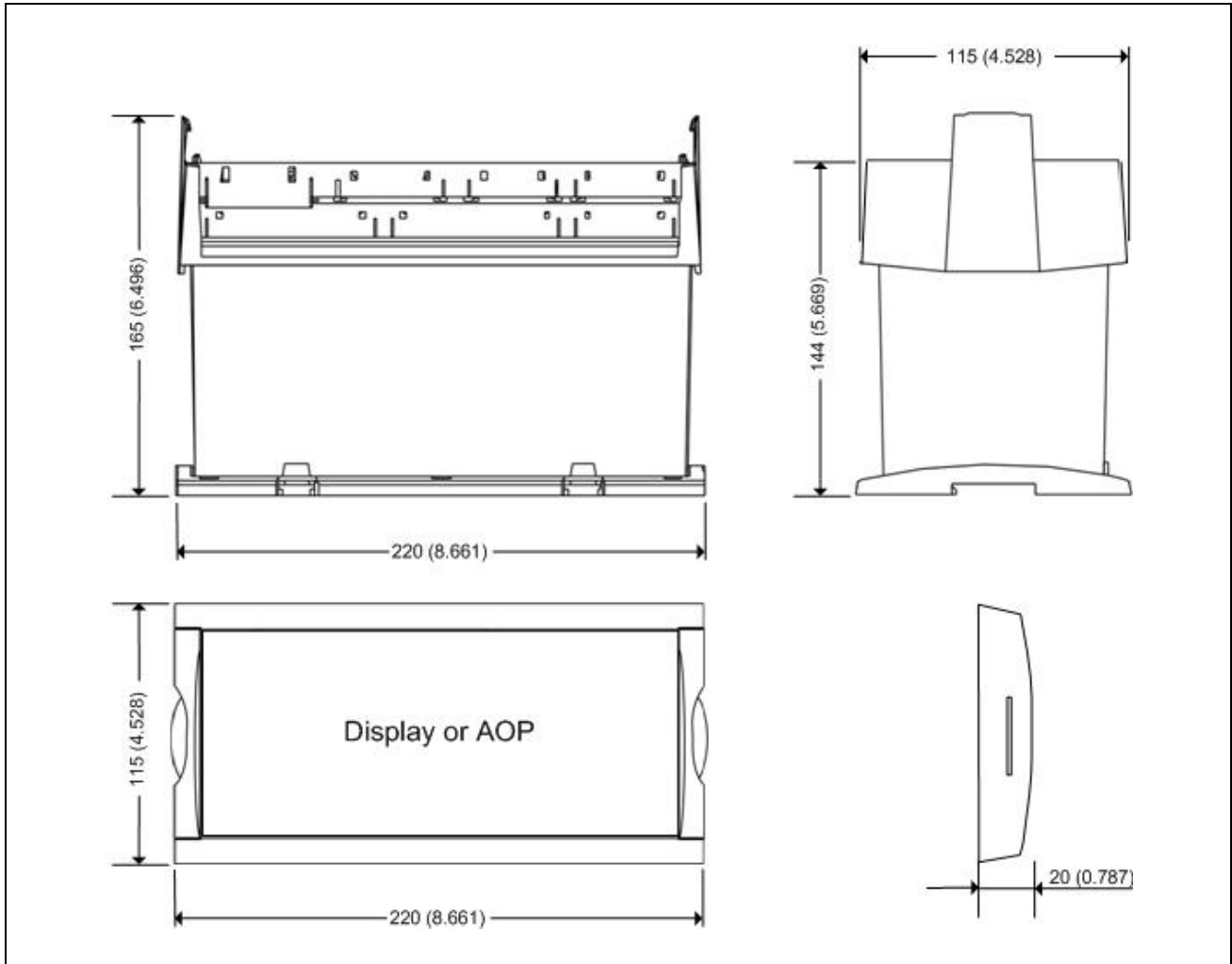
Approvals: UL/cUL Listed to UL508

Data sheet

Automatic Gen-set Controller

UL markings:	Wiring: Use 60/75°C copper conductors only
	Mounting: For use on a flat surface of type 1 enclosure
	Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)
AOP-2:	Maximum ambient temperature: 60°C
	Wiring: Use 60/75°C copper conductors only
	Mounting: For use on a flat surface of type 3 (IP54) enclosure Main disconnect must be provided by installer
	Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)
DC/DC converter for AOP-2:	Tightening torque: 0.5Nm (4.4lb-in)
	Wire size: AWG 22-14
Weight:	Base unit: 1.6 kg (3.5 lbs.)
	Option J1/J3/J4/J6/J7: 0.2 kg (0.4 lbs.)
	Option J2: 0.4 kg (0.9 lbs.)
	Display: 0.4 kg (0.9 lbs.)

Unit dimensions in mm (inches)



Order specifications

TYPE	VERSION	OPTION	OPTION	OPTION	OPTION	Displays	TYPE	VERSION	OPTION	OPTION	OPTION	OPTION	Displays																												
AGC							AGC mains		G5																																
<p>Example</p> <table border="1"> <thead> <tr> <th>TYPE</th> <th>VERSION</th> <th>OPTION</th> <th>OPTION</th> <th>OPTION</th> <th>OPTION</th> <th>Displays</th> </tr> </thead> <tbody> <tr> <td>AGC</td> <td>3.x</td> <td>A1</td> <td>E1</td> <td>H5</td> <td></td> <td>213</td> </tr> </tbody> </table>							TYPE	VERSION	OPTION	OPTION	OPTION	OPTION	Displays	AGC	3.x	A1	E1	H5		213	<p>Example</p> <table border="1"> <thead> <tr> <th>TYPE</th> <th>VERSION</th> <th>OPTION</th> <th>OPTION</th> <th>OPTION</th> <th>OPTION</th> <th>Displays</th> </tr> </thead> <tbody> <tr> <td>AGC mains</td> <td>3.x</td> <td>G5</td> <td>M13.6</td> <td>M14.8</td> <td></td> <td>105</td> </tr> </tbody> </table>							TYPE	VERSION	OPTION	OPTION	OPTION	OPTION	Displays	AGC mains	3.x	G5	M13.6	M14.8		105
TYPE	VERSION	OPTION	OPTION	OPTION	OPTION	Displays																																			
AGC	3.x	A1	E1	H5		213																																			
TYPE	VERSION	OPTION	OPTION	OPTION	OPTION	Displays																																			
AGC mains	3.x	G5	M13.6	M14.8		105																																			
<p>Total number of displays: 0: No display 1: 1 Std. display 2: 1 Std. + 1 add. display (Option X2) 3: 1 Std. + 2 add. displays (Option X2)</p> <p>Total number of AOP-1 (Option X3)</p> <p>Total number of AOP-2 (Option X4)</p>							<p>i The AGC mains unit is only usable with option G5, this option is already included when ordered. The AGC bus tie unit is only usable with option G4 or G5.</p> <p>i Specify the AGC type: DG/mains/BTB.</p>																																		

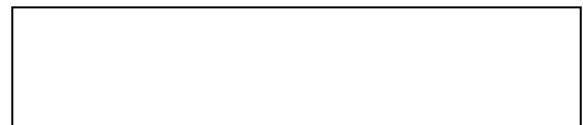


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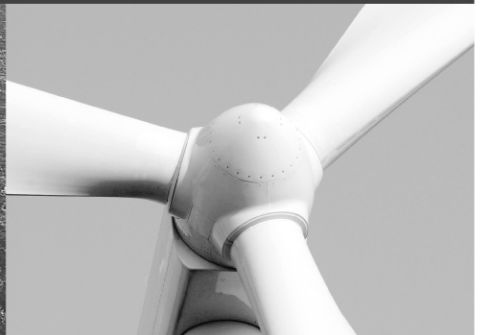


Due to our continuous development we reserve the right to supply equipment which may vary from the described.





Generator Paralleling Controller, GPC-3 DATA SHEET



Regulation modes

- Load sharing
- Fixed frequency
- Fixed power
- Frequency droop

Generator protection (ANSI)

- 2 x reverse power (32)
- 5 x overload (32)
- 6 x overcurrent (50/51)
- 2 x overvoltage (59)
- 3 x undervoltage (27)
- 3 x over-/underfrequency (81)
- Voltage-dependent overcurrent (51V)
- Current/voltage unbalance (60)
- Loss of excitation/overexcitation (40/32RV)
- 9 x NEL groups

M-logic (Micro PLC)

- Simple logic configuration tool
- Selectable input/output events

Busbar protection (ANSI)

- 3 x overvoltage (59)
- 4 x undervoltage (27)
- 3 x overfrequency (81)
- 4 x underfrequency (81)
- Voltage unbalance
- 3 x NEL groups

Display

- Status texts
- Info messages
- Alarm indication
- Prepared for remote mounting
- Prepared for additional remote displays

General

- USB interface to PC
- Free PC utility software for commissioning
- Programmable parameter, timer and alarms
- User-configurable texts



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Document no.: 4921240351B
SW version: 3.0x.x or later

Data sheet

Application

The Generator Paralleling Controller (GPC-3) is a compact *all in one* microprocessor-based control unit containing all necessary functions for protection and control of a synchronous/asynchronous generator. It contains all necessary galvanically separated 3-phase measuring circuits.

The GPC-3 is intended for land-based applications. It is designed for the following applications (can be combined):

1. Stand-alone
2. Parallel with other generators
3. Parallel to mains

The GPC-3 can synchronise the generator and after synchronisation carry out all necessary generator control and protective functions. It is well-suited for PLC-controlled systems and the interfacing can be done via binary and analogue I/Os or via serial communication.

Display unit

The display unit is separate and can be installed directly on the main unit or in the front of the switchboard door (3m display cable included). Up to 2 additional displays can be installed within 200m.

The display unit shows all measured and calculated values as well as alarms and data from the event log.

Operation modes

Four different regulation modes can easily be selected through digital inputs on the standard GPC-3, and the governor will be controlled accordingly:

1. Fixed frequency
2. Fixed power (base load)
3. Frequency droop
4. Load sharing

If the automatic voltage regulator is controlled by the GPC-3, the standard operation modes are extended with:

1. Fixed voltage
2. Fixed VAR
3. Fixed power factor
4. Reactive load sharing
5. Voltage droop



AVR control requires option D1.

Protection and Power Management

Self-test

The GPC-3 automatically carries out a cyclical self-test at start-up. If any errors are found, they will be displayed in clear text in the display and indicated with a relay output (status output).

M-logic (Micro PLC)

This configuration tool is part of the PC utility software which is free of charge. With this tool, it is possible to customise the application to your needs. It is possible to dedicate specific functions or logical conditions to different inputs and outputs.

Engine control and protection

With the engine control and protection option added, the GPC-3 will control the start and stop sequences of the engine and furthermore it can be used as engine protection unit providing full back-up of engine shutdown channels in case the main processor fails.

Setup

Setup is easily done via a menu structure in the display (password-protected) or via the USB PC connection and the Multi-line 2 Windows®-based PC utility software. The PC utility software can be downloaded free of charge from www.deif.com/Download_centre. The utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates.

Options

In order to perfectly match the product solution to specific applications, the functionality of the GPC-3 can be equipped with a number of available options. The options selected by the customer will be integrated in the standard GPC-3, hereby securing the same user interface unaffected by whether the application needs a highly complex or a more basic gen-set controller.

Please refer to pages 5 and 6 for the options available.

Approvals

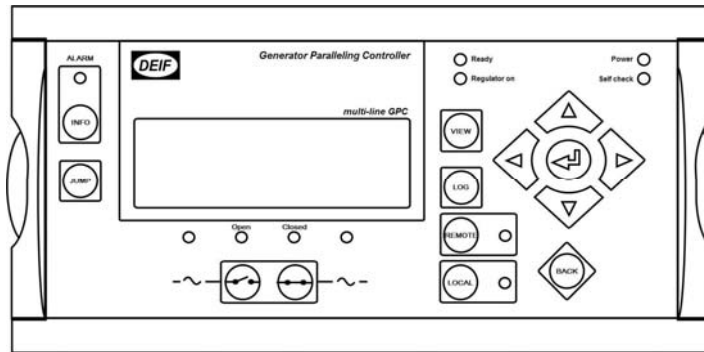
The GPC-3 is UL/cUL listed.



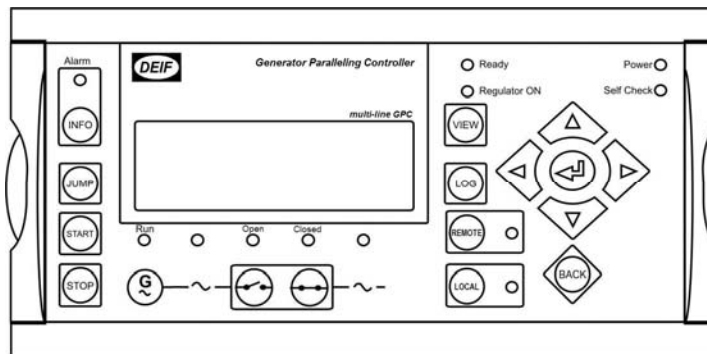
Please refer to www.deif.com for details and certificates.

Display layouts

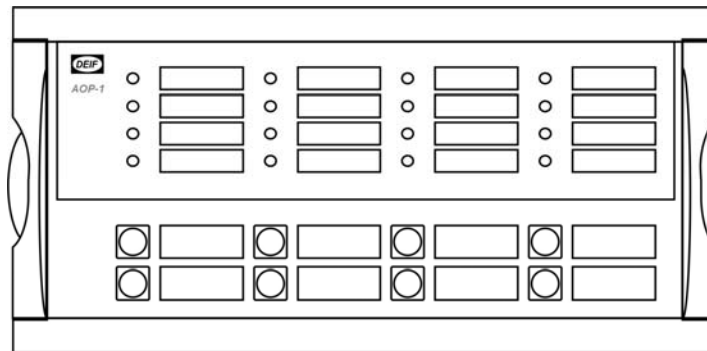
Standard delivery



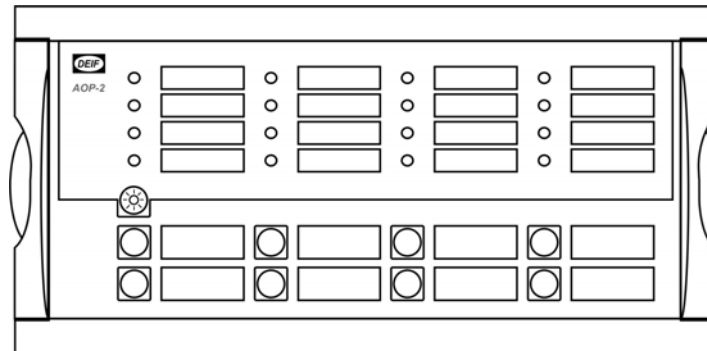
Engine and GB control (option Y1)

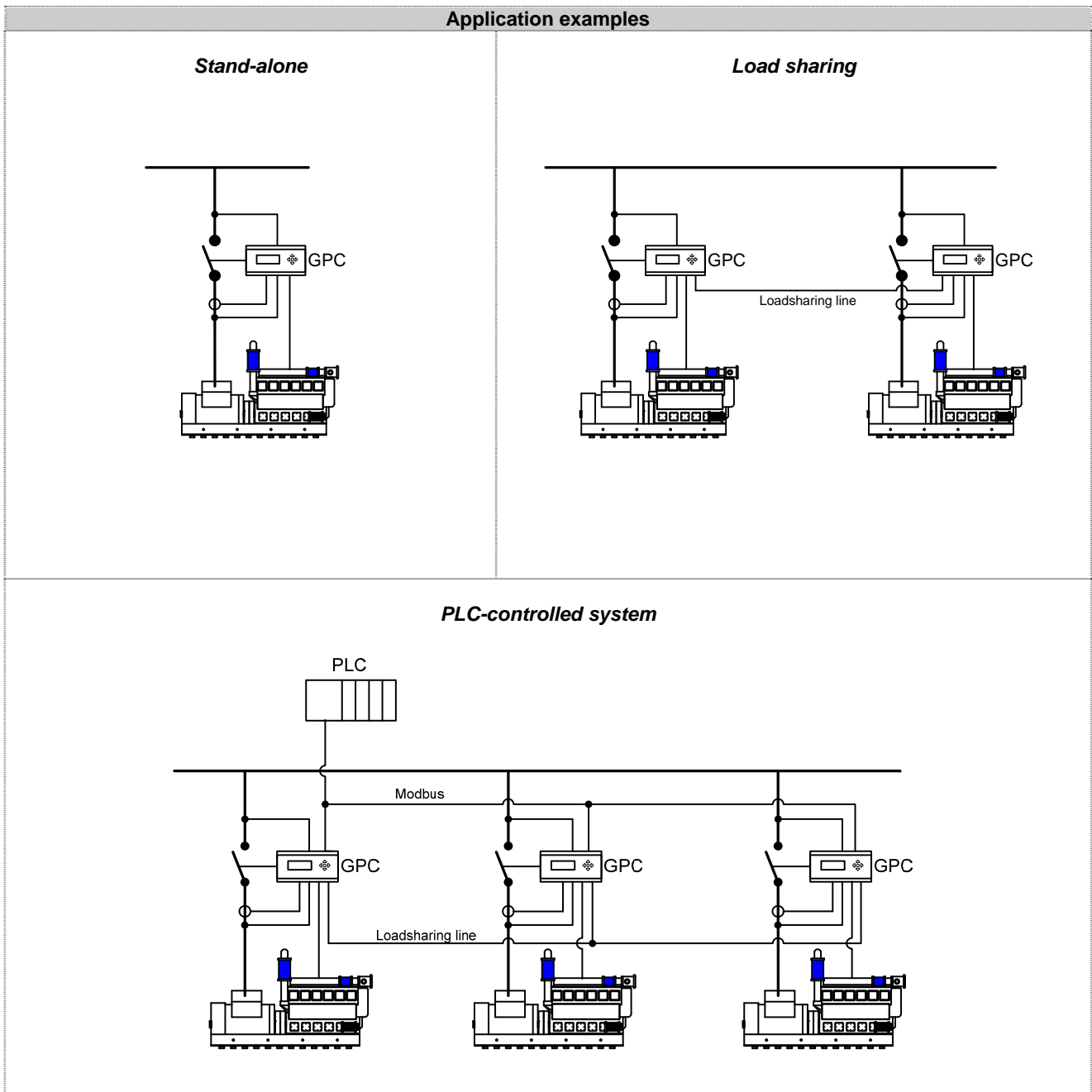


Additional operator's panel - AOP-1 (option X3)



Additional operator's panel - AOP-2 (option X4)





The GPC-3 can be used in simple or complex applications. The above shows some of the applications, but due to the flexible mode selection, the GPC-3 can be used in all applications.



The GPC-3 is also designed to work with the Uni-line components such as the FAS (Full Automatic Synchroniser), should this be preferred.

Available options

Option	Description	Slot no.	Option type	Note
A	Mains protection package			
A1	Time-dependent undervoltage (27t) Undervoltage and reactive power low (27Q) Vector jump (78) df/dt (ROCOF) (81)		Software	
A4	Positive sequence (mains voltage low) (27)		Software	
A5	Directional overcurrent (67)		Software	
C	Generator add-on protection package			
C2	Negative sequence voltage high (47) Negative sequence current high (46) Zero sequence voltage high (59) Zero sequence current high (50) Power dependent reactive power import/export (40) Inverse time overcurrent (51)		Software	
D	Voltage control			
D1	Constant voltage control Constant reactive power control Constant power factor control Reactive load sharing Voltage droop		Software	
E and F	Analogue controller and transducer outputs			
E1	2 x +/-25mA (GOV/AVR or transducer)	4	Hardware	Not with E2, EF2, EF4 or EF5 AVR output requires D1
E2	2 x 0(4)...20mA (GOV/AVR or transducer)	4	Hardware	Not with E1, EF2, EF4 or EF5 AVR output requires D1
EF2	1 x +/-25mA (GOV/AVR or transducer) 1 x 0(4)...20mA (GOV/AVR or transducer)	4	Hardware	Not with E1, E2, EF4 or EF5 AVR output requires D1
EF4	1 x +/-25mA (GOV/AVR or transducer) 2 x relay outputs (GOV/AVR or configurable)	4	Hardware	Not with E1, E2, EF2 or EF5 AVR output requires D1
EF5	1 x PWM (Pulse Width Modulated) output for CAT GOV 1 x +/-25mA (GOV/AVR or transducer) 2 x relay outputs (GOV/AVR or configurable)	4	Hardware	Not with E1, E2, EF2 or EF4 AVR output requires D1
F1	2 x 0(4)...20mA (transducer)	6	Hardware	Not with M13.6, M14.6 or M15.6
H	Serial communication			
H2	Modbus RTU/ASCII (RS485)	2	Hardware	Not with H3, H8.2 or H9.2
H3	Profibus DP	2	Hardware	Not with H2, H8.2 or H9.2
H5	Engine comm.: MTU (ADEC/MDEC) and CANbus J1939 (H7)	8	Hardware	Not with H7, H8.8, M13.8, M14.8 or M15.8
H6	Cummins GCS	8	Hardware	Not with H5, H7, H8.8, M13.8, M14.8 or M15.8
H7	CANbus (J1939): Caterpillar Perkins Cummins CM850/570 Scania (EMS) Detroit Diesel (DDEC) Scania (EMS S6) Deutz (EMR) Volvo Penta (EMS) Iveco (NEF/CURSORS) Volvo (EMS2) John Deere (JDEC)	7	Software	Requires M4 Not with H5
H8.X	External I/O modules	2, 8	Hardware	H8.2: Not with H2, H3, H8.8 or H9.2 H8.8: Not with H5, H6, H8.2, M13.8, M14.8 or M15.8
H9.2	Modbus RTU/ASCII (RS232) and GSM modem connection	2	Hardware	Not with H2, H3 or H8.2

(ANSI# as per IEEE Std. C37.2-1996 (R2001) in parenthesis)



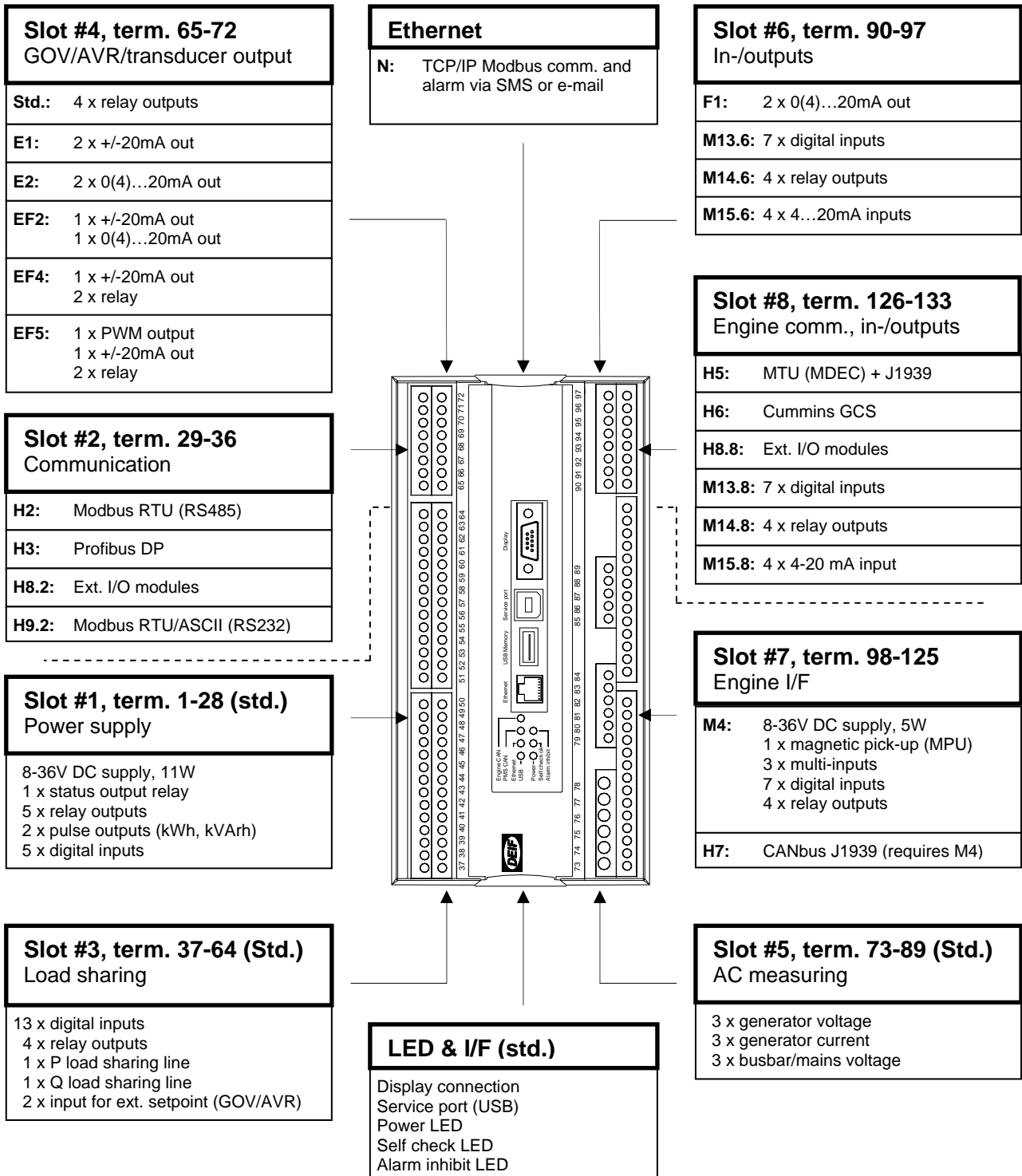
4 relays are available as standard in slot #4 for GOV/AVR control. If one of the options E1, E2, EF2, EF4 or EF5 is selected, these options will replace the 4 relays.

Option	Description	Slot no.	Option type	Note
J	Cables			One 3m display cable per GPC-3 unit is included as standard
J2	Display cable with plugs, 6m UL94 (V1) approved		Other	Not with J6 Will replace the std. display cable
J4	PC cable for option N-programming UL94 (Ethernet cable crossed), 3m UL94 (V1) Listed		Other	
J6	Display cable with plugs, 1m UL94 (V1) approved		Other	Not with J2 Will replace the std. display cable
J7	PC cable for utility software (USB) 3m UL94 (V1) approved		Other	
K	Documentation			
K1	Designer's Reference Handbook (hard copy)		Other	
K2	CD-ROM with complete documentation		Other	
L	Display gasket for IP54		Other	Standard is IP52
M	Engine control, binary and analogue I/Os			
M4	Engine control and protection (safety system) OR I/O extension	7	Hardware	
M13.X	7 binary inputs, configurable	6,8	Hardware	M13.6: Not with F1, M14.6 or M15.6 M13.8: Not with H5, H6, H8.8, M14.8 or M15.8
M14.X	4 relay outputs, configurable	6, 8	Hardware	M14.6: Not with F1, M13.6 or M15.6 M14.8: Not with H5, H6, H8.8, M13.8 or M15.8
M15.X	4 analogue inputs, configurable, 4...20mA	6, 8	Hardware	M15.6: Not with F1, M13.6 or M14.6 M15.8: Not with H5, H6, H8.8, M13.8 or M14.8
N	Ethernet TCP/IP communication			
N	Ethernet TCP/IP Modbus comm. and alarms via SMS or e-mail		Hardware/software	
Q	Measurement accuracy			
Q1	Verified class 0.5		Other	
X	Display			One display per GPC-3 unit is included as standard
X2	Additional standard display. CANbus comm.		Other	Two X2 options can be ordered for each GPC unit
X3	Additional operator's panel (AOP-1): 16 configurable LEDs and 8 configurable push-buttons		Other	Max. one AOP-1 for each display unit
X4	Additional operator's panel (AOP-2): 16 configurable LEDs, 8 configurable buttons and 1 status relay. CANbus comm.		Other	Five X4 options can be ordered for each GPC unit
Y	Display layout			
Y1	Engine and GB control		Other	Requires M4



Please notice that not all options can be selected for the same unit. Please refer to page 7 in this data sheet for further information about the location of the HW options in the unit.

Hardware overview



i There can only be one hardware option in each slot. It is e.g. not possible to select option H2 and option H3 at the same time, because both options require a PCB in slot #2.

i Besides the hardware options shown on this page, it is possible to select the software options mentioned in the chapter 'Available options'.

Technical specifications

Accuracy:	Class 1.0 Positive, negative and zero sequence alarms: Class 1 within 5% voltage unbalance Class 1.0 for negative sequence current Fast overcurrent: 3% of 350%*I _n Analogue outputs: Class 1.0 according to total range Option EF4: Class 4.0 according to total range To IEC/EN 60688	Analogue inputs:	0(4)...20mA Impedance: 50Ω Not galvanically separated RPM (MPU): 2...70V AC, 10...10000Hz, 250...3000Ω
Operating temp.:	-25...70°C (-13...158° F) (UL/cUL Listed: Max. surrounding air temp.: 55°C/131°F)	Multi-inputs:	0(4)...20mA: 0-20mA, +/-1% Not galvanically separated Binary: Max. resistance for ON detection: 100Ω Not galvanically separated PT100/1000: -40...250°C, +/-1% Not galvanically separated To IEC/EN 60751 VDO: 0...1700Ω, +/-2% Not galvanically separated V DC: 0...40V DC, +/-1% Not galvanically separated
Storage temp.:	-40...70°C (-40...158° F)	Relay outputs:	Electrical rating: 250V AC/30V DC, 5A (UL/cUL Listed: 250V AC/24V DC, 2A resistive load) Thermal rating @ 50°C: 2A: Continuously 4A: t _{ON} = 5 sec., t _{OFF} = 15 sec. (Unit status output: 1A)
Climate:	97% RH to IEC 60068-2-30	Open collector outputs:	Supply: 8...36V DC, max. 10mA
Meas. voltage:	100-690V AC +/-20% (UL/cUL Listed: 480V AC phase-phase)	Analogue outputs:	0(4)...20mA and +/-25mA Galvanically separated Active output (internal supply) Load max. 500Ω (UL/cUL Listed: Max. 20mA output) Update rate: Transducer output: 250ms Regulator output: 100ms
Consumption:	Max. 0.25VA/phase	Analogue load sharing lines:	-5...0...+5V DC, Impedance: 23.5 kΩ
Meas. current:	-/1 or -/5A AC (UL/cUL Listed: From CTs 1-5A)		
Consumption:	Max. 0.3VA/phase		
Current overload:	4 x I _n continuously 20 x I _n , 10 sec. (max. 75A) 80 x I _n , 1 sec. (max. 300A)		
Meas. frequency:	30...70Hz		
Aux. supply:	Terminals 1 and 2: 12/24V DC (8...36V continuously, 6V 1 sec.) Max. 11W consumption Terminals 98 and 99: 12/24V DC (8...36V continuously, 6V 1 sec.) Max. 5W consumption The aux. supply inputs are to be protected by a 2A slow-blow fuse (UL/cUL Listed: AWG 24)		
Binary inputs:	Optocoupler, bi-directional ON: 8...36V DC Impedance: 4.7kΩ OFF: <2V DC		

Data sheet

Generator Paralleling Controller, GPC-3

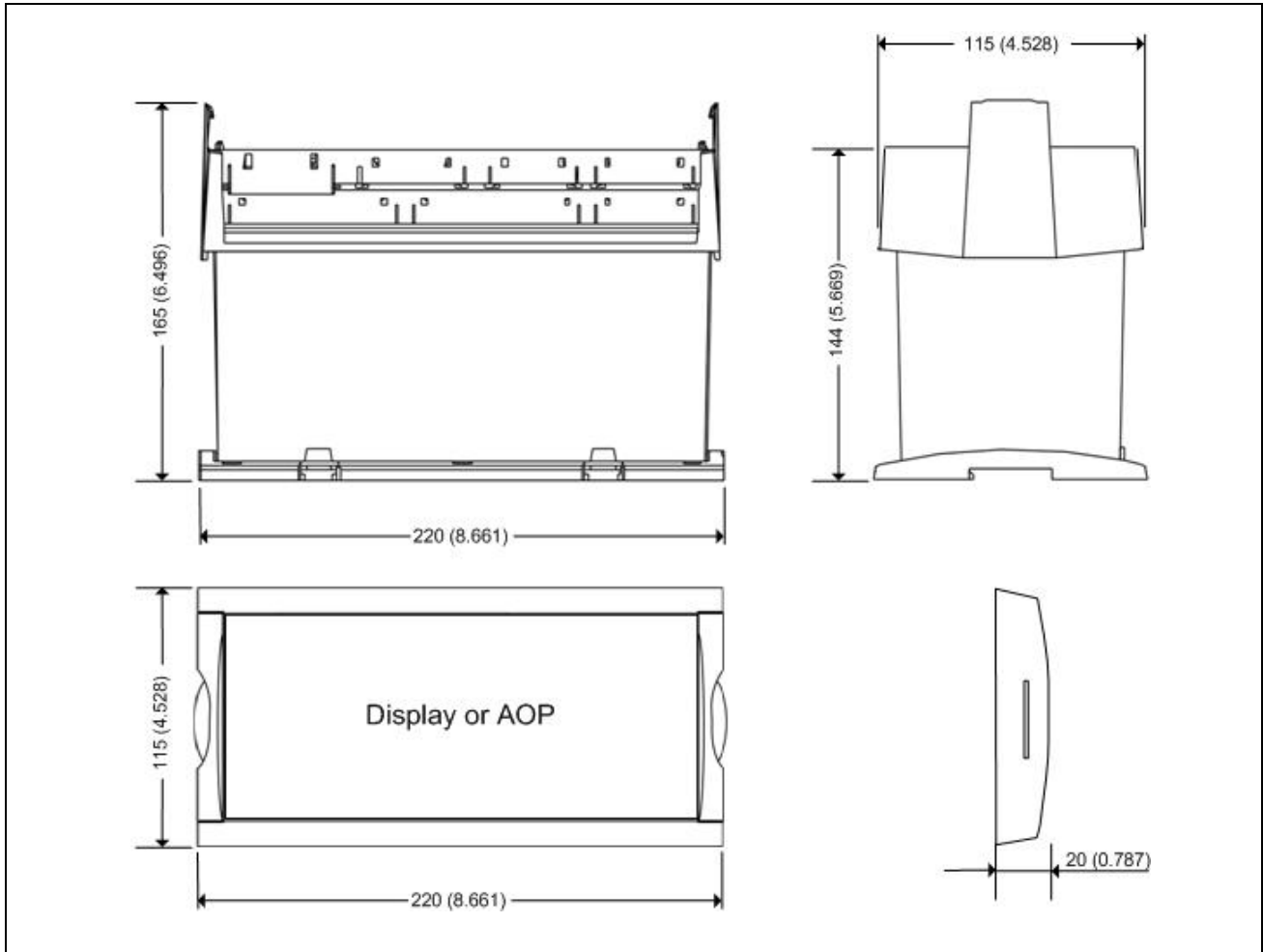
Galv. separation:	Between AC voltage, AC current and other I/Os: 3250V AC, 50Hz, 1 min. Between analogue outputs and other I/Os: 500V DC, 1 min. Between binary input groups and other I/Os: 500V DC, 1 min.	10...60Hz: 0.15mm _{pp} 60...150Hz: 1g To IEC 60255-21-1 Response (class 2) 10...150Hz: 2g To IEC 60255-21-1 Endurance (class 2)
Response times: (Delay set to minimum)		
<i>Busbar:</i>		
Over-/undervoltage:	< 50ms	
Over-/underfrequency:	< 50ms	
Voltage unbalance:	<200ms	
<i>Generator:</i>		
Reverse power:	<200ms	
Overcurrent:	<200ms	
Fast overcurrent:	< 40ms	
Over-/undervoltage:	<200ms	
Over-/underfrequency:	<300ms	
Overload:	<200ms	
Current unbalance:	<200ms	
Voltage unbalance:	<200ms	
React. power import:	<200ms	
React. power export:	<200ms	
Overspeed:	<400ms	
Digital inputs:	<250ms	
Emergency stop:	<200ms	
Multi-inputs:	<800ms	
Wire failure:	<600ms	
<i>Mains:</i>		
df/dt (ROCOF):	<130ms (4 periods)	
Vector jump:	< 40ms	
Positive sequence:	< 60ms	
Mounting:	DIN-rail mount or base mount with 6 screws	
Safety:	To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2 To UL 508 and CSA 22.2 no. 14-05, overvoltage category III, 300V, pollution degree 2	
EMC/CE:	To EN 61000-6-1/2/3/4 IEC 60255-26 IEC 60533 power distr. zone IACS UR E10 power distr. zone	
Vibration:	3...13.2Hz: 2mm _{pp} 13.2...100Hz: 0.7g To IEC 60068-2-6 & IACS UR E10	
Shock (base mount):		10g, 11msec, half sine To IEC 60255-21-2 Response (class 2) 30g, 11msec, half sine To IEC 60255-21-2 Endurance (class 2) 50g, 11msec, half sine To IEC 60068-2-27
Bump:		20g, 16msec, half sine To IEC 60255-21-2 (class 2)
Material:		All plastic materials are self-extinguishing according to UL94 (V1)
Plug connections:		AC current: 0.2-4.0 mm ² stranded wire (UL/cUL Listed: AWG 18) AC voltage: 0.2-2.5 mm ² stranded wire (UL/cUL Listed: AWG 20) Relays: (UL/cUL Listed: AWG 22) Terminals 98-116: 0.2-1.5 mm ² stranded wire (UL/cUL Listed: AWG 24) Other: 0.2-2.5 mm ² stranded wire (UL/cUL Listed: AWG 24) Display: 9-pole sub-D female Service port: USB A-B
Protection:		Unit: IP20 Display: IP52 (IP54 with gasket: Option L) (UL/cUL Listed: Type Complete Device, Open Type) To IEC/EN 60529
Governors:		Multi-line 2 interfaces to all governors, including GAC, Barber-Colman, Woodward and Cummins See interfacing guide at www.deif.com

Data sheet

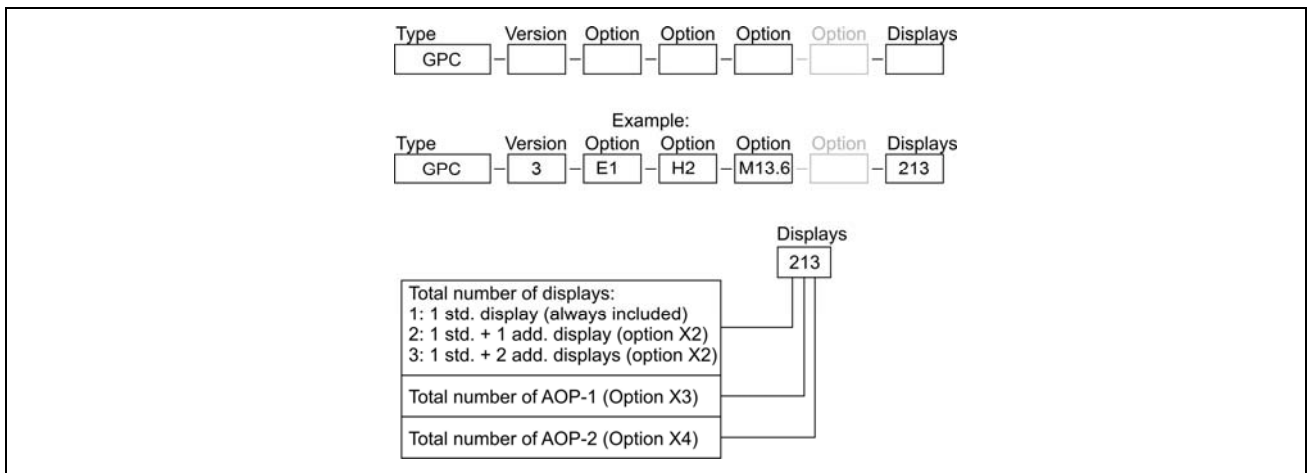
Generator Paralleling Controller, GPC-3

Approvals:	UL/cUL Listed to UL508
UL markings:	Wiring: Use 60/75°C copper conductors only Mounting: For use on a flat surface of type 1 enclosure Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)
AOP-2:	Maximum ambient temperature: 60°C Wiring: Use 60/75°C copper conductors only Mounting: For use on a flat surface of type 3 (IP54) enclosure Main disconnect must be provided by installer Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)
DC/DC converter for AOP-2:	Tightening torque: 0.5Nm (4.4lb-in) Wire size: AWG 22-14
Weight:	Base unit: 1.6 kg (3.5 lbs.) Option J1/J3/J6: 0.2 kg (0.4 lbs.) Option J2: 0.4 kg (0.9 lbs.) Display: 0.4 kg (0.9 lbs.)

Unit dimensions in mm (inches)



Order specifications



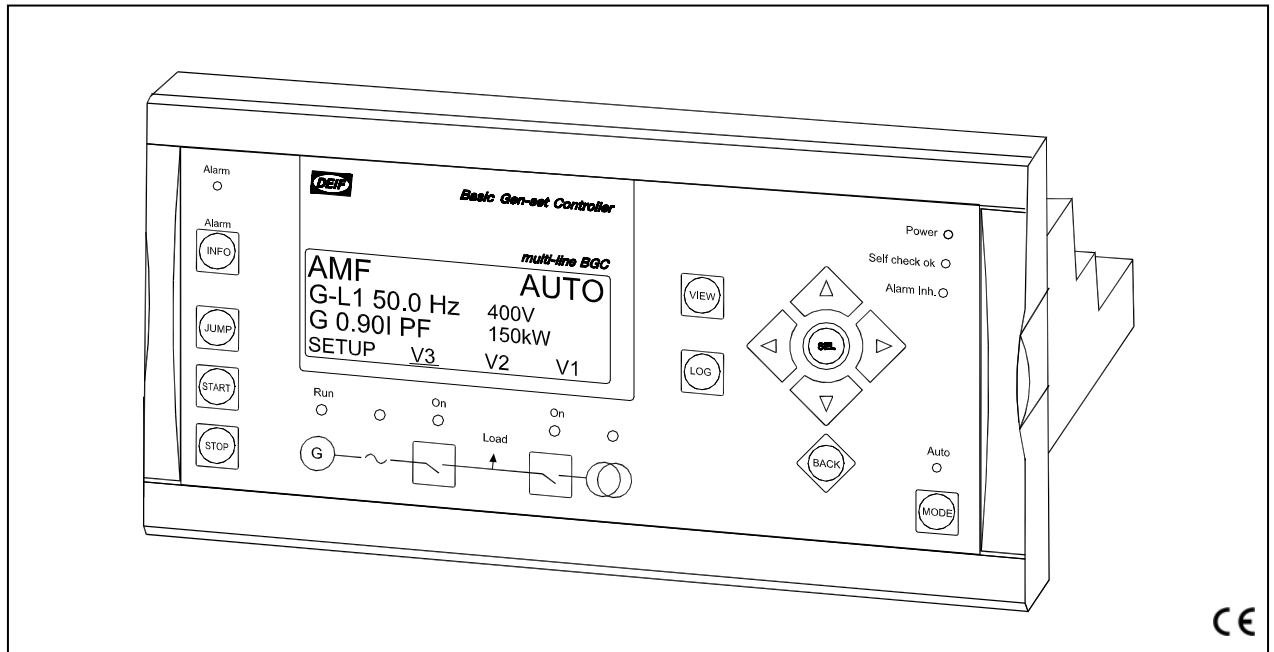
Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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Standard functions

Applications

- AMF (no synchronising)
- Island mode (stand alone)

Generator controls

- Engine start/stop
- Configurable start sequence

Protection and I/Os (ANSI)

- Reverse power (32)
- Overcurrent, 2 levels (51)
- 3 configurable VDO inputs
- 1-5 configurable digital inputs
- 1-3 configurable outputs

Display

- Status texts
- Easily readable
- Password-protected setup
- Configurable views
- Complete alarm list
- Event log (150 events)
- Language configuration

M-logic

- Simple logic configuration tool
- Selectable input events
- Selectable output commands

Measurement system

- 3-phase true RMS (100-480V AC)
- Supports delta V applications
- -/1 and -/5A AC
- 100-25000V AC trafo ratios

Breaker types

- Contactor
- Circuit breaker
- Compact breaker

General

- Approval: Gost-R
- PC software available
- Additional functions available
- Additional applications available
- Additional I/Os available

Application

The Basic Gen-set Controller is a microprocessor-based control unit containing all necessary functions for control and protection of a gen-set and control of mains and generator breaker. The standard control functions include start and stop sequences for the engine, but regulation control is also possible. The BGC contains all necessary 3-phase measuring circuits and all values and alarms are presented on the LCD display.

The BGC is a compact all-in-one unit designed for the following standard and optional applications:

Standard applications: (no synchronising)

1. Automatic mains failure (no back sync.)
2. Island operation

Optional applications: (synchronising)

3. Multiple gen-sets, load sharing
4. Peak shaving
5. Fixed power to mains
6. Automatic mains failure (back sync.)
7. Load takeover

The optional applications require governor/AVR control for parallel operation. (Option G2 or G3).

The generator and mains breaker types can be configured to be either a circuit breaker, a contactor or the compact breaker which requires a signal to reset the breaker from tripped to open position.

Configurable inputs/outputs:

The BGC is supplied with a standard number of inputs and outputs that can be used for control and/or protection purposes. The number of configurable I/Os depends on the used breaker type.

The table *only* shows available I/Os for the standard unit (no hardware options are selected.) This means that additional I/Os can be selected (please refer to the option list for more).

I/O \ PCB	Circuit breaker	Contactor	Compact breaker
MPU (Tacho)	1	1	1
Digital inputs	9 (5)	9 (7)	9 (5)
VDO	3	3	3
Relay outputs	9 (1)	9 (3)	9 (1)

i The number in parenthesis indicates the number of user configurable digital inputs/relay outputs. (Horn output, start/stop functionality and breaker handling occupies the I/Os not freely configurable).

Additional I/Os can be selected.

i Example: BGC - M13.2 - M14.3 gives an **additional 7** digital inputs/4 digital outputs. Please see the option list and hardware overview in this data sheet.

Governor and AVR control

Speed governor control and automatic voltage regulation are optional functions and can be analogue or digital. (Both digital AVR + GOV outputs require a total of 4 relay outputs. Note that 3-13 relays are available depending on options and breaker selection.

Setup

Setup is easily done via a menu structure in the display (password protected, 3 levels) or via the RJ45/RS232 PC connection and the Multi-line 2 Windows® based PC utility software. The PC interface box needed for this operation is optional equipment for the BGC. The utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates.

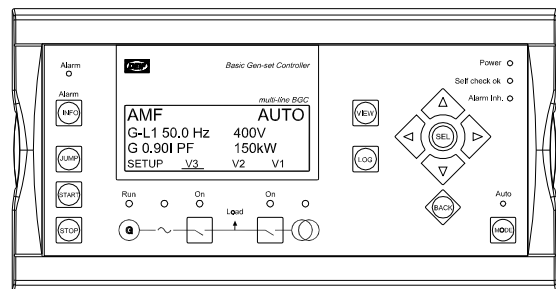
Options

In order to perfectly match the product solution to specific applications, the functionality of the BGC can be equipped with a number of available options. The options selected by the customer will be integrated in the standard BGC hereby securing the same user interface unaffected by whether the application needs a highly complex or a more basic gen-set controller.

Display variants

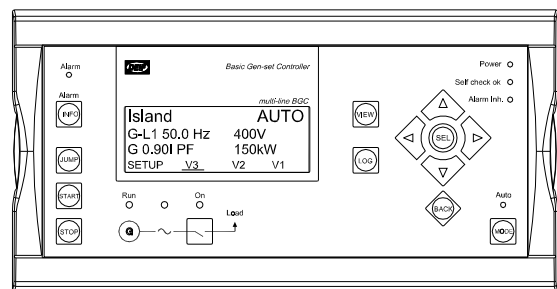
Two display variants are available for the BGC unit. The unit is normally supplied with the AMF folio.

AMF folio

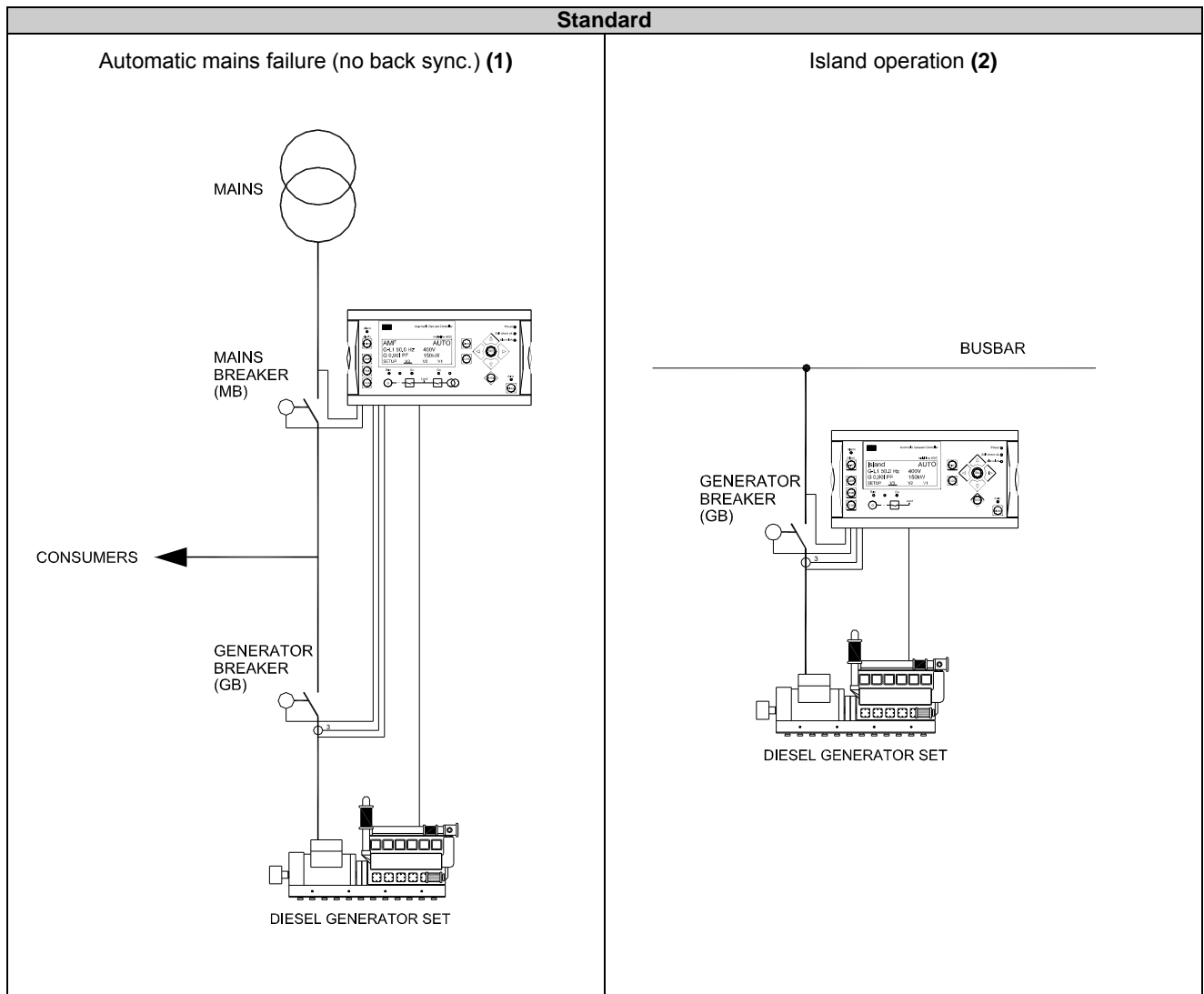


If the unit is used in island applications, the island folio is selectable (Specify option Y1).

Island folio

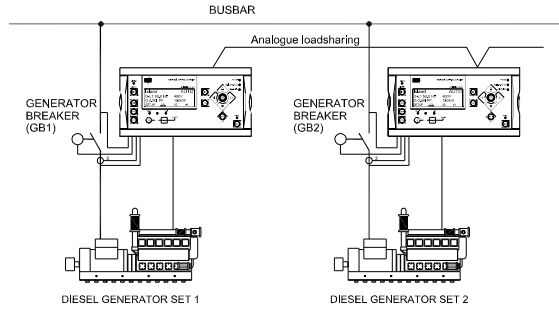


Single line application diagrams

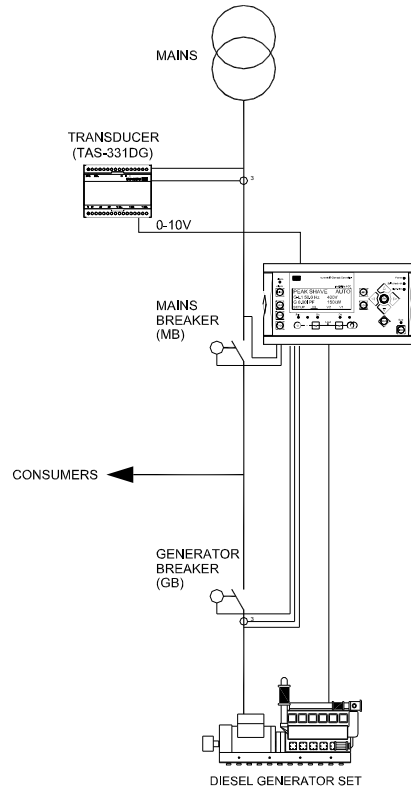


Optional

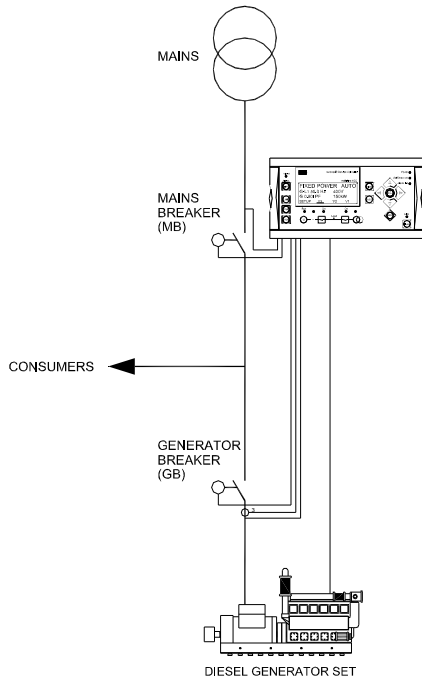
Multiple gen-sets, load sharing (3)



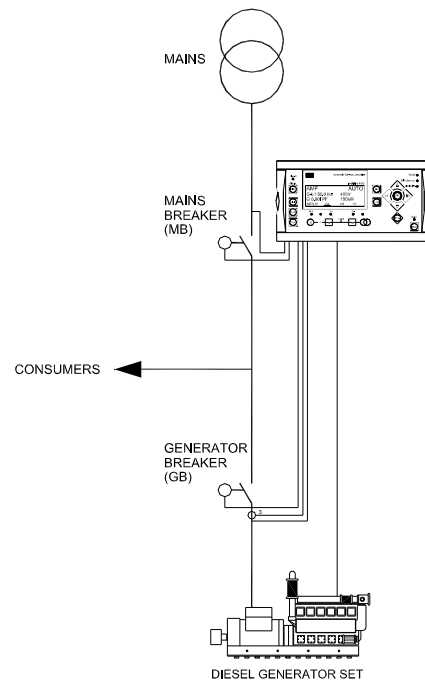
Peak shaving, load takeover (4/7)



Fixed power to mains (5)



Automatic mains failure (back sync.) (6)



Available options



Option slot #4 is allocated to options G2 and G3 only. The two remaining slots (#2 and #3) can hold a maximum of two hardware options per unit.

Option	Description	Type	Note
A	Loss of mains protection package		
A1	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81) Vector jump (78) df/dt (ROCOF) (81)	Software option	
A2	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81) df/dt (ROCOF) (81)	Software option	
A3	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81) Vector jump (78)	Software option	
B	Generator/busbar/mains protection package		
B1	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81)	Software option	
C	Generator add-on protection package		
C1	Over- and undervoltage (generator) (27/59) Over- and underfrequency (generator) (81) Overload (32) Short circuit (50) Current unbalance (46) Voltage asymmetry (47) Reactive power import (excitation loss) (40) Reactive power export (overexcitation) (40)	Software option	
D	Voltage/VAr/PF control		
D1	Selection between: Constant voltage control (stand-alone) Constant power factor control (parallel with mains) Reactive load sharing (island paralleling with other generators) Constant reactive power control (parallel with mains (with option H2/H3))	Software option	Option D1 requires option G2 or G3 See note below
D2	Constant voltage (stand-alone/sync.)	Software option	Option D2 requires option G2 or G3 See note below
F	Analogue transducer outputs		
F1	2 transducer outputs, 0...20mA or 4...20mA	Hardware option	
F2	4 transducer outputs, 0...20mA or 4...20mA	Hardware option	Two boards occupied - see hardware overview
G	Control functions		
G1	2 load-dependent relays (high load/low load)	Hardware option	Option M14.X (relay outputs) is included
G2	Synchronising with analogue lines (Option included in G3)	Hardware option	Two other hardware options available Parallel mains operation
G3	Synchronising with analogue lines and kW load sharing (G3 includes all functionality contained in option G2)	Hardware option	Two other hardware options available Parallel mains operation/ parallel DG operation

Note regarding option D1 and D2:
Analogue output for AVR is included on terminals 63/64.



When relay control is needed please check the I/O list to ensure that a sufficient number of relays are available. D1 or D2 follows option G2/G3 and 3-5 relays are available depending on the breaker configuration. Option M14.X offers extra relay outputs that can be used for controlling of the governor and AVR.

Available options (continued from page 5)

Option	Description	Type	Note
H	Serial communication		
H1	CAN-open	Hardware option	
H2	Modbus RTU	Hardware option	
H3	Profibus DP	Hardware option	
H4	CAT CCM	Hardware option	
H5	CAN-bus (J1939 + MTU) engine communication: MTU MDEC Detroit Diesel DDEC Deutz EMR John Deere JDEC Scania EMS 1&2 Volvo Penta EMS 1&2	Hardware option	
H6	Cummins ECM (RS485) engine communication	Hardware option	
J	Cables		
J5	BGC converter box kit	Other	
K	Documentation		
K1	Designer's Reference Handbook (hard copy)	Other	
K2	CD-ROM with complete documentation	Other	
L	Gasket	Other	Display IP 54
M	Configurable I/O extension cards		
M13.X	7 binary inputs, configurable	Hardware option	Can be placed in both slot 2 and 3 if 14 extra binary inputs are needed
2M13	14 binary inputs	Hardware option	Same as M13.2/M13.3 Occupies slot 2 and 3
M14.X	4 relay outputs	Hardware option	Can be placed in both slot 2 and 3 if 8 extra relay outputs are needed
2M14	8 relay outputs	Hardware option	Same as M14.2/M14.3 Occupies slot 2 and 3
M15	4 analogue inputs, configurable, 4...20mA	Hardware option	
Y	Display layout		
Y1	BGC display for island operation (no mains breaker)	Hardware option	

(ANSI# as per IEEE Std C37.2-1996(R2001) in parenthesis).

Specification of options M13.X and M14.X:



.X signifies the slot position. M13.2 therefore means that this option is placed in slot #2 and M13.3 means that this option is placed in slot #3.

Hardware overview

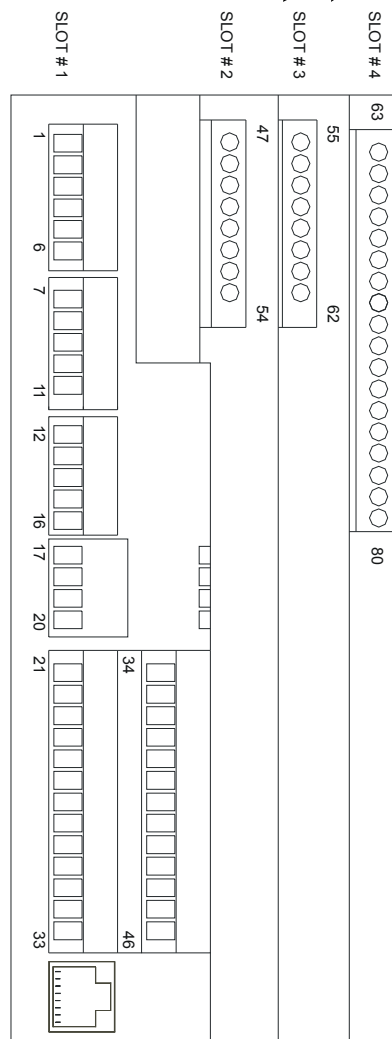


There can only be one hardware option in each slot. This means that slot 2 and 3 can hold one or two options only, never three. Example given: option G1 and F1 can be ordered but not G1, F1 and H1.

Besides the hardware options shown on this page, it is possible to select the software options mentioned in the options overview.

Slot #1, term. 1-46 Power supply/I/Os	
Standard:	AC measurements DC supply Digital I/Os VDO inputs RPM (tacho) input

Slot #2, term. 47-54 Slot #3, term. 55-63 Option (hardware)	
Option F1:	2 transducer outputs, 0-20/4-20mA
Option F2:	4 transducer outputs, 0-20/4-20mA <i>Occupies slot 2 and slot 3</i>
Option G1:	2 x relay outputs for load-dep. start/stop
Option H1:	CAN-open
Option H2:	Modbus RTU
Option H3:	Profibus DP
Option H4:	CAT CCM
Option H5:	CANbus (J1939+MTU)
Option H6:	Cummins ECM
Option M13.X:	7 binary inputs, configurable
Option M14.X:	4 relay outputs
Option M15:	4 analogue inputs Configurable, 4-20mA
Option 2M13:	14 binary inputs <i>Occupies slot 2 and slot 3</i>
Option 2M14:	4 relay outputs, <i>Occupies slot 2 and slot 3</i>



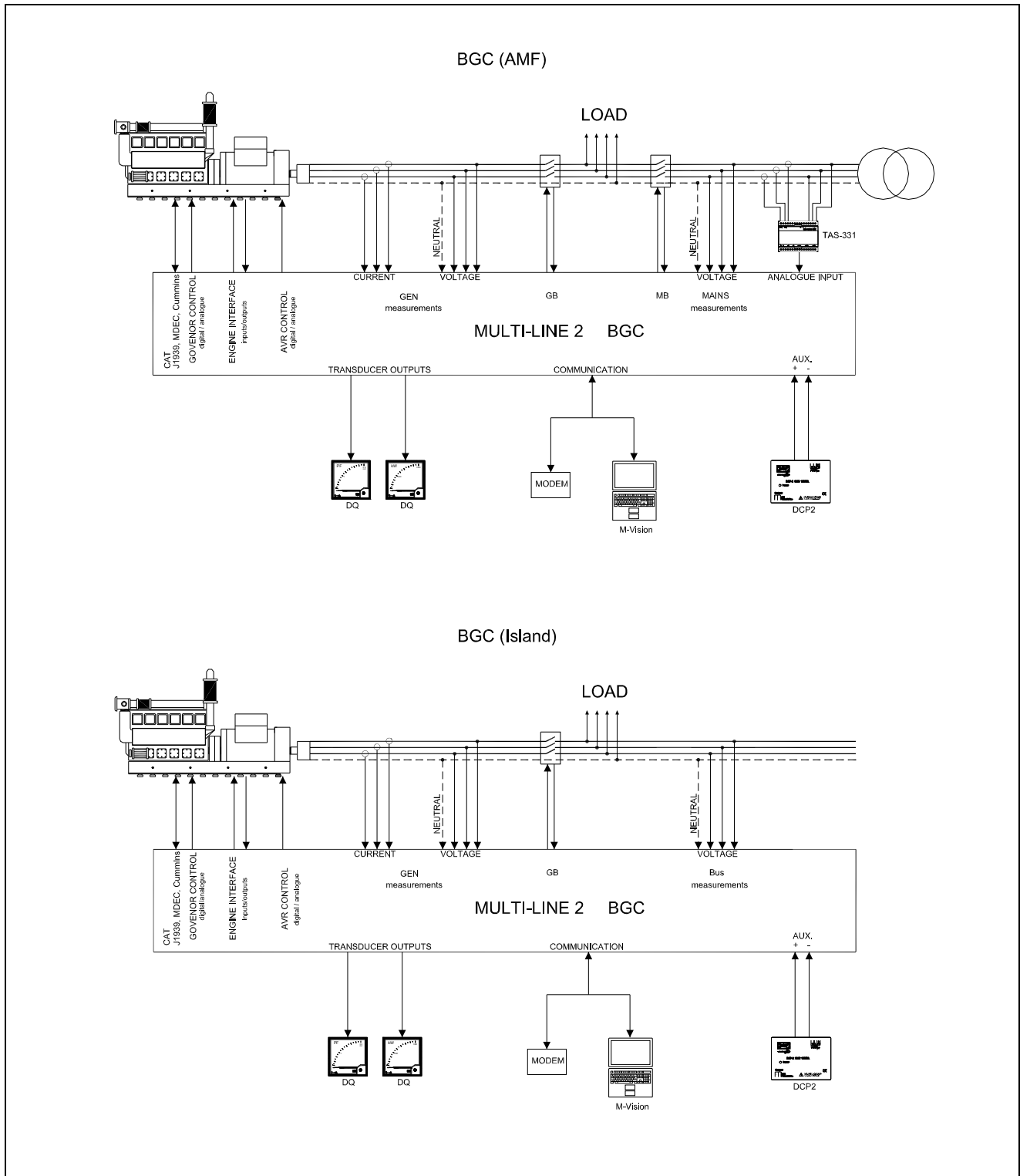
M13.X and M14.X:
-X indicates slot position.

(Can be selected for slot #2 and slot #3 at the same time).

RJ45 connection PC service port, option J5	
PC inter- face:	Converter box complete with cables

Slot #4, term. 63-80 Synchronising/regulation	
Option G2:	Synchronising and governor control <i>(No load sharing)</i>
Option G3:	Synchronising and governor control <i>(load sharing)</i>

Principle diagram

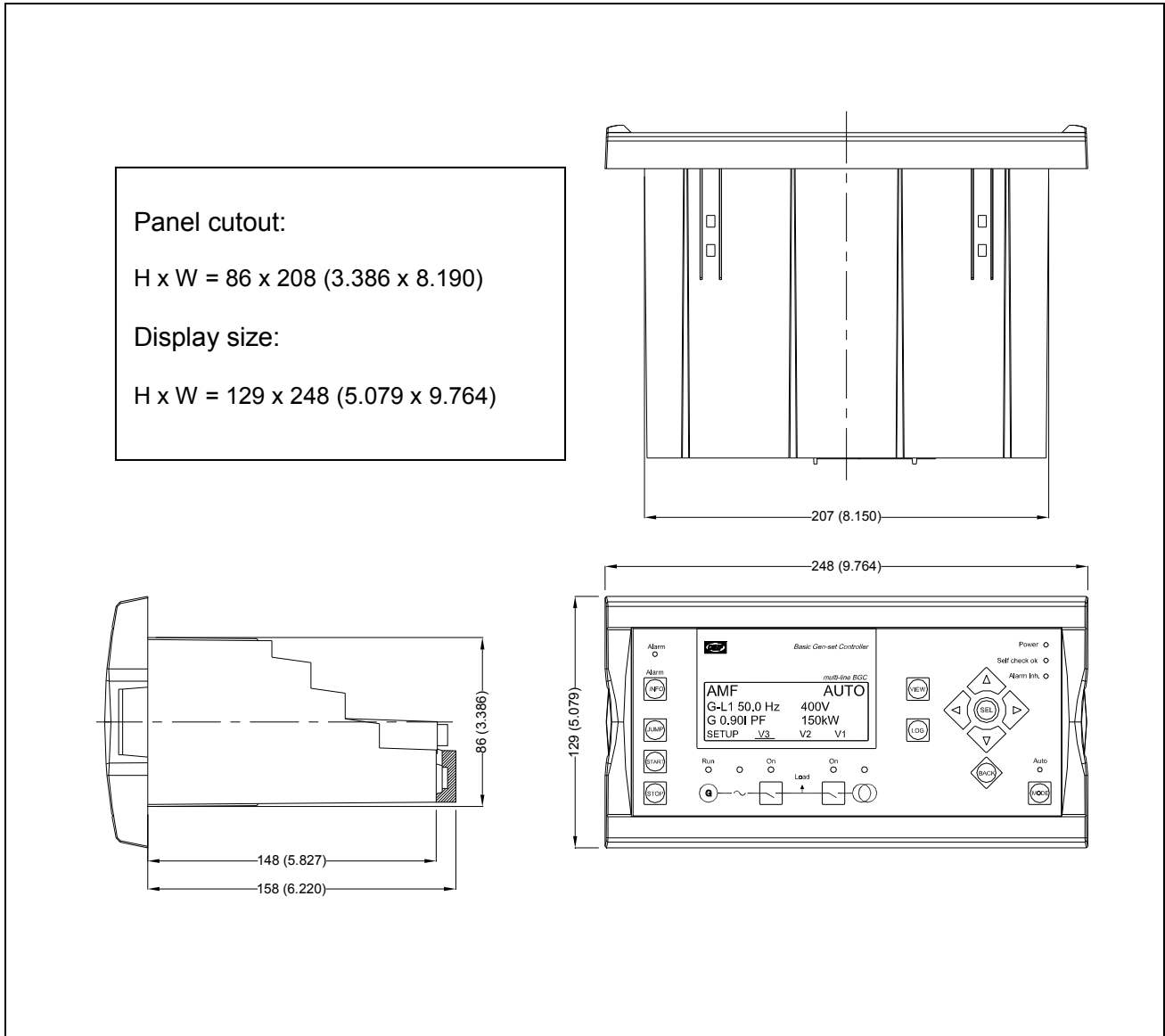


DEIF supplies a complete range of current transformers (**MAK** range of CTs), power supplies (**DCP** range), meters (**DQ** range) and transducers (**TAS** range) that are suitable for use with our range of generator controls and protection relays - please see www.deif.com for full details.

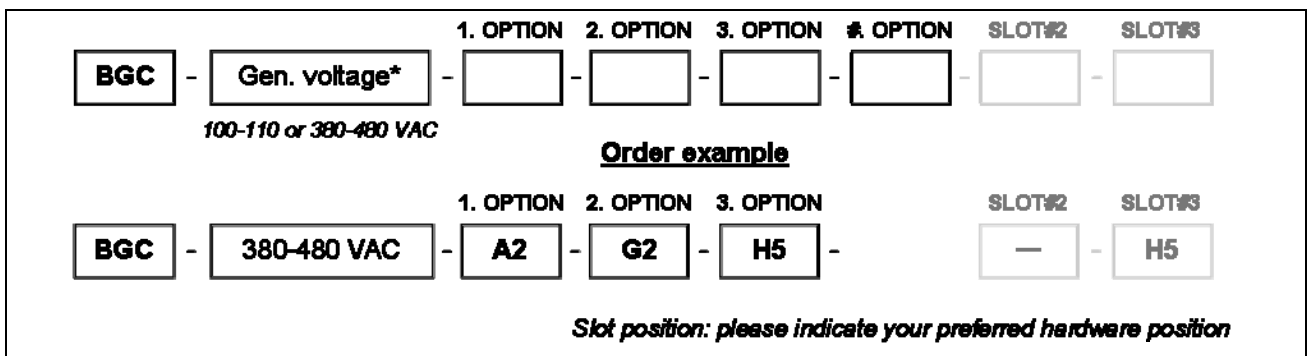
Technical specifications

Accuracy:	Class 1.0, to IEC 688 Short circuit: 5% of 350% * I _N Analogue outputs: Class 1 of acc. to max. range Acc. to IEC688	Load sharing lines:	+/-5V DC Impedance: 23.5kΩ
Operating temp.:	-25-70°C (-13-158°F)	Analogue outputs:	0(4)-20mA (transducer) and +/-25mA (regulation) Galvanically separated Active output (internal supply) Load max. 500Ω
Galvanic separation:	Between AC voltage, AC current and other I/Os: 2200V AC, 50Hz, 1 min. Between analogue outputs: 500V DC, 1 min.	Safety:	To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2
Meas. voltage:	100-480V AC +/-20%	Protection:	Unit: IP20 Display: IP52 (IP54 with gasket option L) Acc. to IEC529 and EN 60529
Consumption:	Max. 0.15VA/phase	EMC/CE:	To EN 61000-6-1/2 SS4631503 (PL4) and IEC 255-3
Meas. current:	-/1 or -/5A AC	VDO inputs:	Resistor inputs, internal supply
Consumption:	Max. 0.3VA/phase	Material:	All plastic materials are self- extinguishing according to UL94 (V1)
Current overload:	4 x I _n continuously 20 x I _n , 10 sec. (max. 75A) 80 x I _n , 1 sec. (max. 300A)	Plug connections:	AC current: 4 mm ² multi-stranded Other: 2.5 mm ² multi-stranded
Meas. frequency:	30-70Hz	PC:	RS232 converter box (Option J5)
Aux. supply:	12/24V DC, -25/+30% Max. 8W consumption	Approval:	Gost-R (Russia)
Binary inputs:	Bi-directional optocoupler ON: 5-36V DC OFF: <2V DC Impedance max. 4.7kΩ	Weight:	Approx. 1 kg (2.2 lbs)
Relay outputs:	250V AC/8A or 24V DC/2A	Response times:	
Analogue inputs:	+/-10V DC Not galvanically separated Impedance: 100kΩ 4-20mA inputs: Impedance: 50Ω Not galvanically separated MPU (tacho): 2-70V AC, 10-10000Hz, Impedance: 200kΩ	<i>Busbar 1 and 2:</i>	Over-/undervoltage <50 ms Over-/underfrequency <50 ms
Mounting:	Panel mounted	<i>Generator:</i>	Reverse power: <400 ms Overcurrent: <300 ms Fast overcurrent: <40 ms Over-/undervoltage: <300 ms Over-/underfrequency: <300 ms Overload 1/Overload 2: <1200/400 ms Current unbalance: <300 ms Voltage unbalance: <300 ms React. power import: <400 ms React. power export: <400 ms
Climate:	Class HSE, to DIN 40040	<i>Mains:</i>	ROCOF: 130 ms (4 periods) Vector jump <20 ms

Unit dimensions in mm (inches)



Order specifications

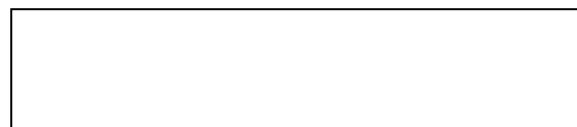


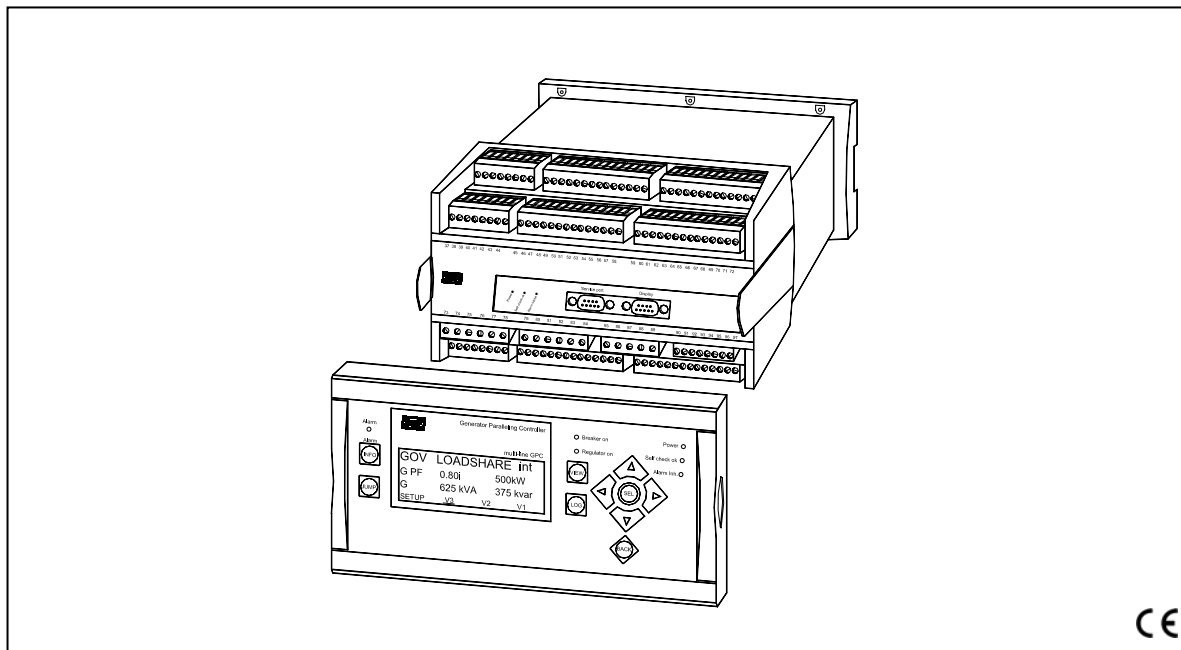
Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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Standard functions

Applications

- Stand-alone
- Parallel with other gen-sets
- Parallel with the mains

Control functions

- Synchronising
- Power and frequency controls

Operation modes

- Fixed frequency
- Fixed power (base load)
- Droop
- Load sharing

Protections (ANSI)

- Reverse power (32)
- Overcurrent, 2 levels (51)
- Overcurrent, inverse, 1 level (51)

Display

- Separate mounting
- Status texts
- Easy to read
- Programming

Measuring system

- 3-phase true RMS
- Galvanically isolated voltage and current inputs

GSM communication

- SMS messages at all alarms
- Dial up from PC utility software to control unit

Data sheet

Application

The Generator Paralleling Controller (GPC) is a compact *all-in-one* microprocessor-based control unit containing all necessary functions for protection and control of a synchronous/asynchronous generator. It contains all necessary galvanically separated 3-phase measuring circuits.

The GPC is intended for land-based applications. It is designed for the following applications (can be combined):

1. Stand-alone
2. Parallel with other generators
3. Parallel with the mains

The GPC can synchronise the generator and after synchronisation carry out all necessary generator control and protective functions. It is well-suited for PLC-controlled systems and the interfacing can be done via binary and analogue I/Os or via (optional) serial communication.

Display unit

The display unit is separate and can be installed directly on the main unit or in the front of the switchboard door (requires option J# - display cable).

The display unit shows all measured and calculated values as well as alarms and data from the event log.

The displayed values can be configured freely in order to match the customer or application specific requirements.

Operation modes

Four different operation modes can easily be selected through digital inputs on the standard GPC, and the governor will be controlled accordingly:

1. Fixed frequency
2. Fixed power (base load)
3. Droop
4. Load sharing

If the automatic voltage regulator is controlled by the GPC (optional) the standard operation modes are extended with:

1. Fixed voltage
2. Fixed VAR
3. Fixed power factor
4. VAR sharing



AVR control requires option D1.

Self-test

The GPC automatically carries out a cyclical self-test at start-up. If any errors are found, they will be displayed in clear text in the display and indicated with a relay output.

Generator Paralleling Controller

Setup

Setup is easily done via a menu structure in the display (password-protected) or via the RS232 PC connection and the multi-line 2 Windows® based PC utility software. The PC utility software can be downloaded free of charge from www.deif.com. The utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates.

Options

In order to perfectly match the product solution to specific applications, the functionality of the GPC can be equipped with a number of available options. The options selected by the customer will be integrated in the standard GPC, thus securing the same user interface unaffected by whether the application needs a highly complex or a more basic generator controller.

Approvals

The GPC is approved by the following societies:

Other
GOST-R
UL
TÜV Nord

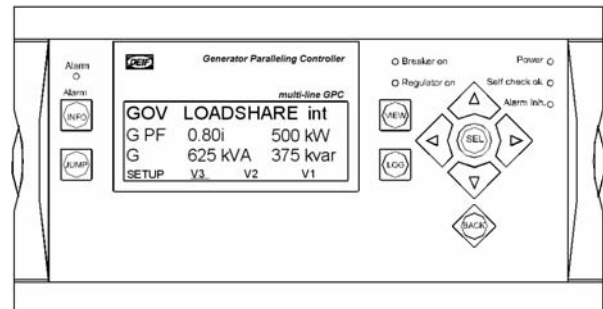


Please refer to www.deif.com for details and certificates.

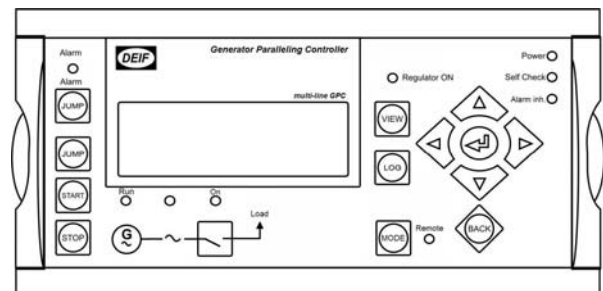
Display variants

Two display variants are available for the GPC. The display selection is depending on option M20.

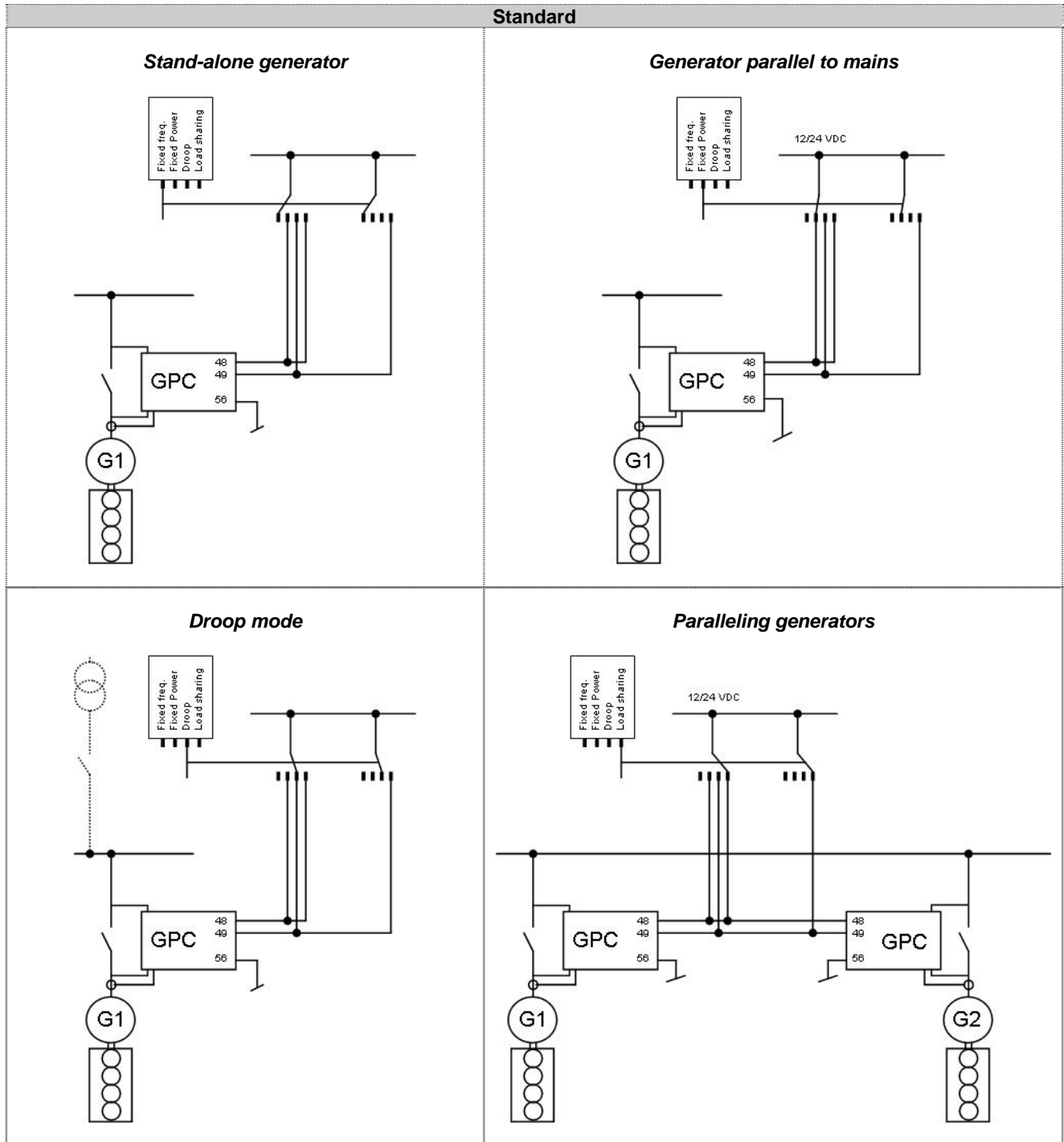
Standard delivery



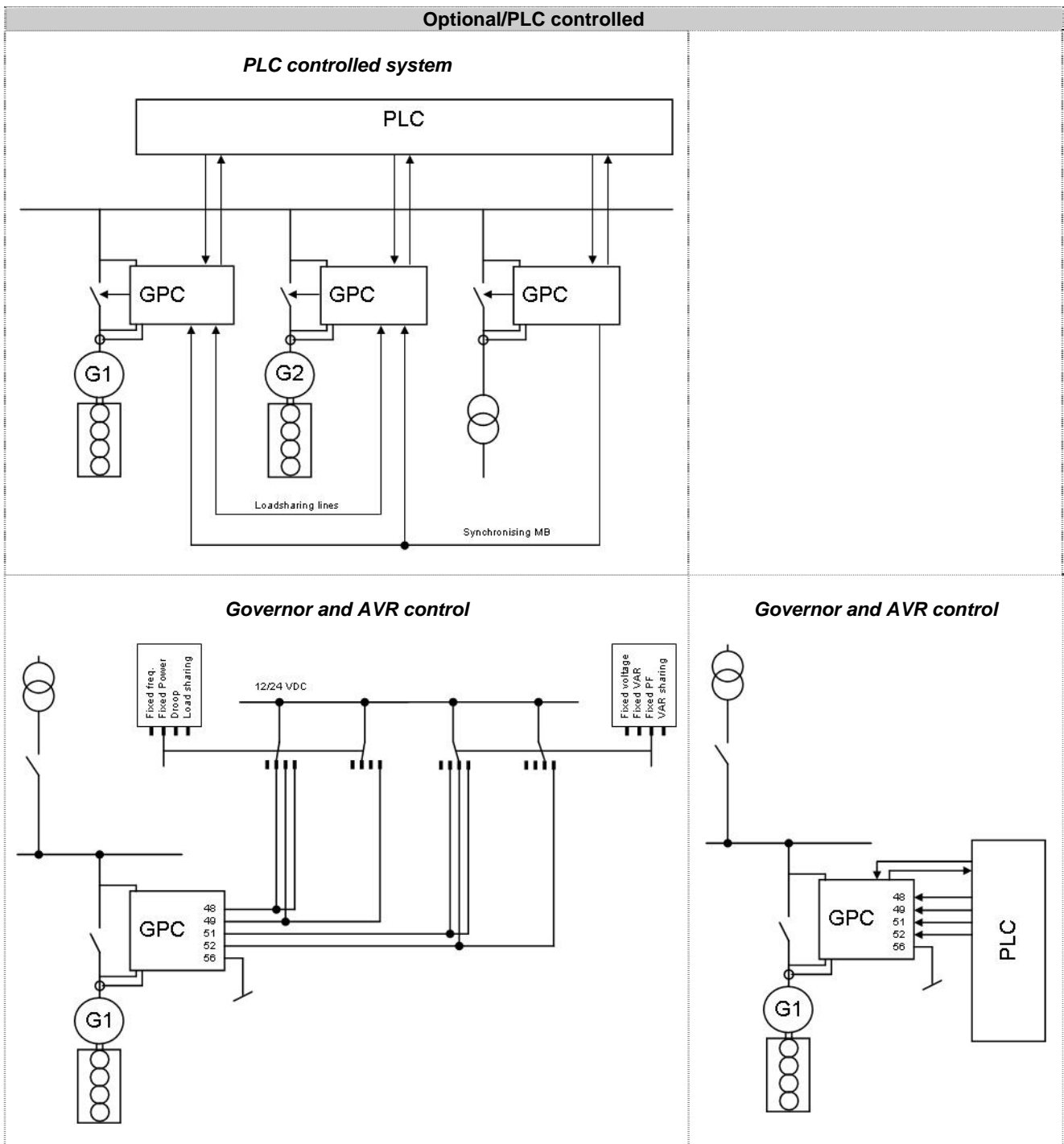
Engine and GB control (M20)



Single line application diagrams



The illustrations show that the operating modes are selected on the terminals 48 and 49 or a combination of those terminals.



The GPC can be used in simple or complex applications. The above shows very simple applications only, but due to the flexible mode selection, the GPC can be used in all applications.



The GPC is also designed to work with the uni-line components such as the FAS (Full Automatic Synchroniser), should this be preferred.

Available options



Please notice that not all options can be selected for the same unit. Please refer to page 7 in this data sheet for further information about the location of the options in the unit.

Option	Description	Type	Note
A	Loss of mains protection package		
A1	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81) Vector jump (78) df/dt (ROCOF) (81)	Software option	
A2	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81) df/dt (ROCOF) (81)	Software option	
A3	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81) Vector jump (78)	Software option	
B	Generator/busbar/mains protection package		
B1	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81)	Software option	
C	Generator add-on protection package		
C1	Over- and undervoltage (generator) (27/59) Over- and underfrequency (generator) (81) Overload (32) Fast overcurrent (<42 ms, 350%, 2 levels) (50) Current unbalance (46) Voltage asymmetry (47) Reactive power import (excitation loss) (40) Reactive power export (overexcitation) (40)	Software option	
C2	Negative sequence voltage high (47) Negative sequence current high (46) Zero sequence voltage high (59) Zero sequence current high (50)	Software option	
D	Voltage/VAr/PF control		
D1	Selection between: Constant voltage control (stand-alone) Constant reactive power control (parallel with mains) Constant power factor control (parallel with mains) Reactive load sharing (island paralleling with other generators)	Software option	Not with EF2
E	Analogue controller outputs		
E1	+/-20mA for speed governor +/-20mA for AVR	Hardware option	AVR output is available if D1 is selected Refer to page 7
EF	Combination outputs		
EF2	+/-20mA for speed governor 1 x 0(4)-20mA transducer output	Hardware option	Refer to page 7
EF3	1 x PWM (Pulse Width Modulated) output for CAT speed governor 1 x PWM (Pulse Width Modulated) output for droop +/-20mA for speed governor or AVR 2 x relay outputs for speed governor or AVR	Hardware option	Refer to page 7
EF4	+/-20mA for speed governor or AVR 2 x relay outputs for speed governor or AVR	Hardware option	Refer to page 7
EF5	1 x PWM (Pulse Width Modulated) output for CAT speed governor +/-20mA for speed governor or AVR 2 x relay outputs for speed governor or AVR	Hardware option	Refer to page 7
F	Analogue transducer outputs		
F1	2 transducer outputs, 0-20mA or 4-20mA	Hardware option	Refer to page 7
H	Serial communication		
H1	CAN-open	Hardware option	Refer to page 7
H2	Modbus RTU	Hardware option	Refer to page 7
H3	Profibus DP	Hardware option	Refer to page 7
H4	CAT CCM	Hardware option	Refer to page 7

Option	Description	Type	Note
H5	CAN bus (J1939 + MTU) engine communication for MTU MDEC Detroit Diesel DDEC Deutz EMR John Deere JDEC Volvo Penta D12AUX	Hardware option	Refer to page 7
H6	Cummins ECM	Hardware option	Refer to page 7
J	Cables		
J1	Display cable with plugs, 3 m. UL94 (V1) approved	Other	
J2	Display cable with plugs, 6 m. UL94 (V1) approved	Other	
J3	PC cable for utility software (RS232). UL94 (V1) approved	Other	
J6	Display cable with plugs, 1 m. UL94 (V1) approved	Other	
K	Documentation		
K1	Designer's Reference Handbook (hard copy)	Other	
K2	CD-ROM with complete documentation	Other	
L	Display gasket for IP54	Other	Standard is IP52
M	Configurable engine control cards		
M1	Engine control card with PT100 sensor inputs 4 x 4-20mA inputs 2 x PT100 inputs 1 x tachometer input (magnetic pick-up) 5 x binary inputs 3 x relay outputs	Hardware option	Refer to page 7 Engine start/stop logic can be switched ON/OFF
M2	Engine control card with VDO sensor inputs 3 x 4-20mA inputs 3 x VDO (resistor) inputs 1 x tachometer input (magnetic pick-up) 9 x binary inputs 3 x relay outputs	Hardware option	Refer to page 7 Engine start/stop logic can be switched ON/OFF
M	Configurable I/O extension cards		
M13	7 binary inputs, configurable	Hardware option	Refer to page 7
M14	4 relay outputs	Hardware option	Refer to page 7
M15	4 analogue inputs, configurable, 4...20mA	Hardware option	Refer to page 7
M20	Display layout with engine and GB control (engine logic ON)	Other	Requires M1 or M2
O	Water turbine control		
O1	Water turbine control with integrated water level dependent power control	Hardware option	Includes M1 and M15
Z	Generator nominal power		
Z1	Generator nominal power >20MW	Software option	

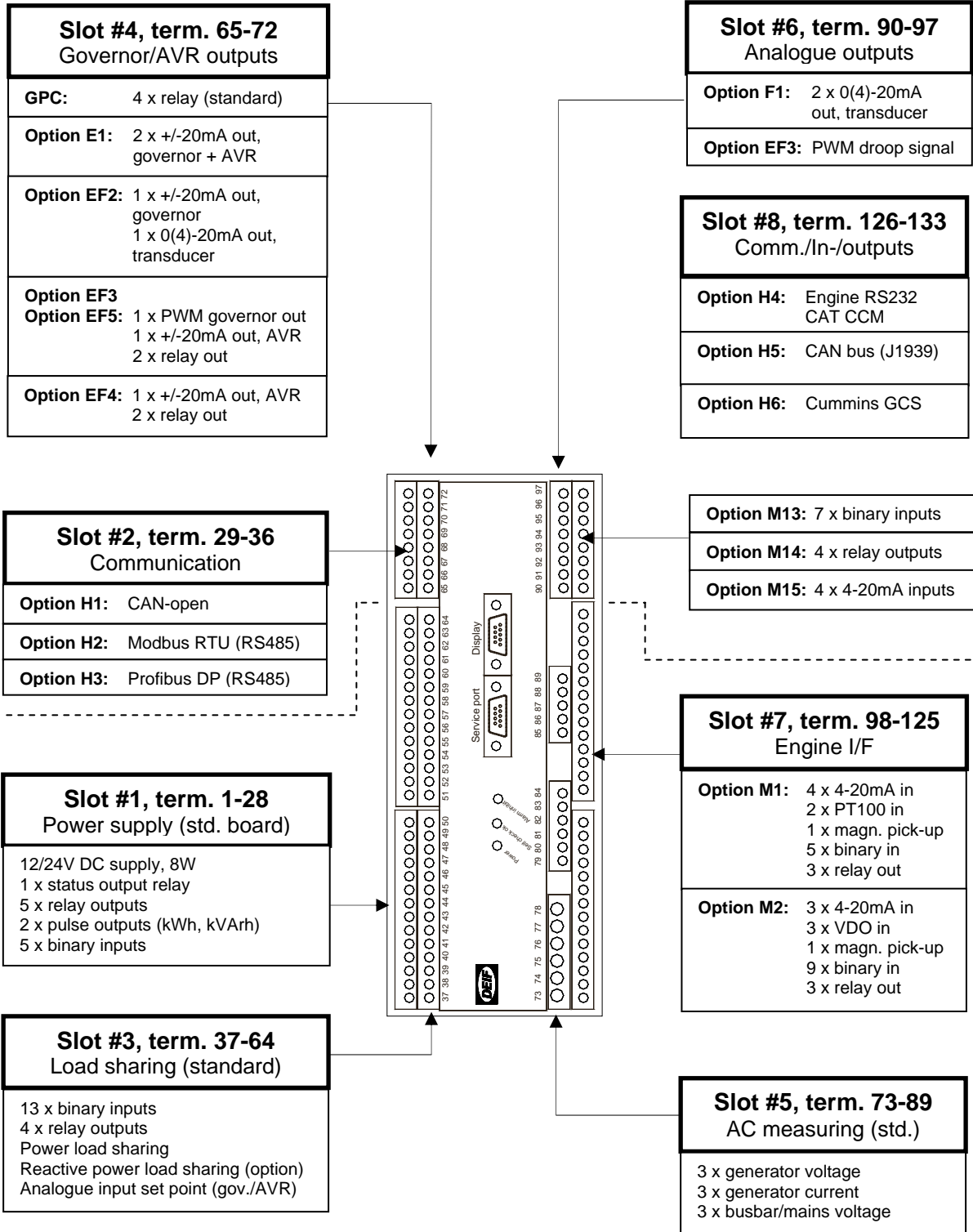
(ANSI# as per IEEE Std C37.2-1996 (R2001) in parenthesis).

Hardware overview



Each slot can hold no more than one hardware option. For instance, it is not possible to select option H2 and option H3 at the same time because both options require a PCB in slot #2.

Apart from the hardware options shown on this page, it is possible to select the software options mentioned on page 5 in this data sheet. Options A, B, C and D are software options.



Technical specifications

Accuracy:	Class 1.0 Class 2.0 for neg. seq. current To IEC/EN 60688	Analogue inputs:	-10/+10V DC Not galvanically separated Impedance 100kΩ 4-20mA: Impedance max 50Ω, not galvanically separated PT100: According to IEC/EN 60751 VDO: Resistor inputs, internal supply max. 480Ω
Operating temp.:	-25-70°C (-13-158°F) (UL/cUL Listed: Max. surrounding air temp.: 55°C/131°F)	Mounting:	DIN-rail mount or base mount with 6 screws
Storage temp.:	-40-70°C (-40-158°F)	Climate:	97% RH to IEC 60068-2-30
Galvanic separation:	Between AC voltage, AC current and other I/Os: 3250V AC, 50Hz, 1 min. Between analogue outputs and other I/Os: 500V DC, 1 min. Between binary input groups and other I/Os: 500V DC, 1 min.	Load sharing lines:	-5/+5V DC, impedance 23.5kΩ
Meas. voltage:	100-690V AC +/-20% (UL/cUL Listed: 110-480V AC phase-phase)	Analogue outputs:	0(4)-20mA Galvanically separated Active output (internal supply) Load max. 500Ω (UL/cUL Listed: Max. 20mA output)
Consumption:	Max. 0.25VA/phase	Safety:	To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2 To UL 508 and CSA 22.2 no. 14-05, overvoltage category III, 300V, pollution degree 2
Meas. current:	-/1 or -/5A AC (UL/cUL Listed: From CTs 1-5A)	Protection:	Unit: IP20 Display: IP52 (IP54 with gasket: Option L) (UL/cUL Listed: Type Complete Device, Open Type) To IEC/EN 60529
Consumption:	Max. 0.3VA/phase	EMC/CE:	To EN 61000-6-1/2/3/4 IEC 60255-26 IEC 60533 power distr. zone IACS UR E10 power distr. zone
Current overload:	4 x I _n continuously 20 x I _n , 10 sec. (max. 75A) 80 x I _n , 1 sec. (max. 300A)	Vibration:	3...13.2Hz: 2mmpp 13.2...100Hz: 0.7g To IEC 60068-2-6 & IACS UR E10 10...60Hz: 0.15mmpp 60...150Hz: 1g To IEC 60255-21-1 Response (class2) 10...150Hz: 2g To IEC 60255-21-1 Endurance (class2)
Meas. frequency:	30-70Hz		
Aux. supply:	12/24V DC (8-36V continuously, 6V 1 sec.) Max. 8W consumption The aux. supply inputs are to be protected by a 2A slow blow fuse Recommended power supply is DEIF's DCP-2 (UL/cUL Listed: AWG 24)		
Binary inputs:	Optocoupler, bi-directional ON: Input voltage 8-36V DC Impedance typically 4.7kΩ OFF: <2V DC		
Relay outputs:	250V AC/24V DC, 5A (Unit status output: 1A) (UL/cUL Listed: 250V AC/24V DC, 2A resistive load)		

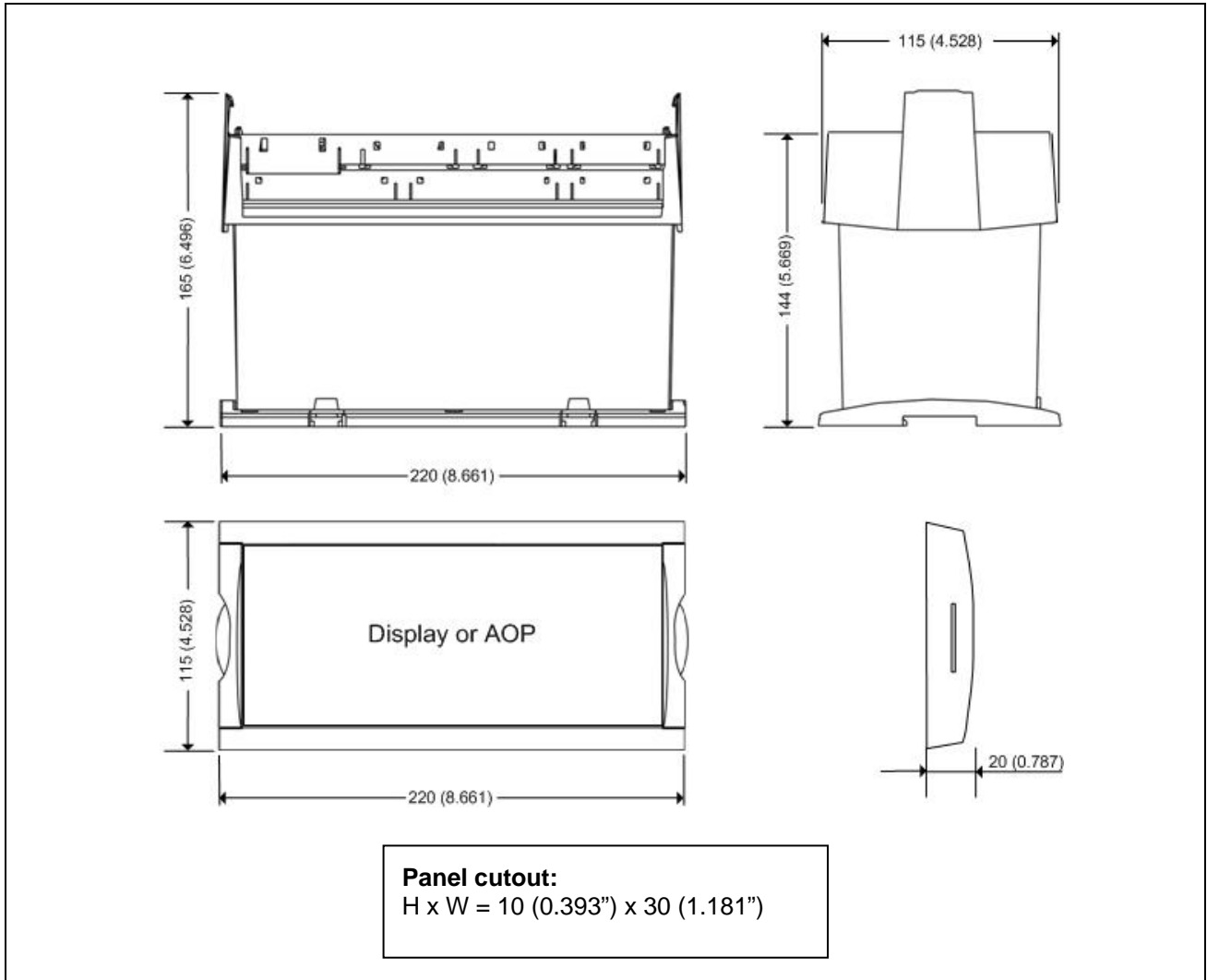
Data sheet

Shock (base mount):	10g, 11msec, half sine To IEC 60255-21-2 Response (class2)
	30g, 11msec, half sine To IEC 60255-21-2 Endurance (class2)
	50g, 11msec, half sine To IEC 60068-2-27
Bump:	20g, 16msec, half sine To IEC 60255-21-2 (class2)
Material:	All plastic materials are self-extinguishing according to UL94 (V1)
Plug connections:	AC current: 4.0 mm ² multi stranded (UL/cUL Listed: AWG28-10) Tightening torque: 0.5-0.6 Nm (4.4-5.3 lb-in)
	Other: 2.5 mm ² multi stranded (UL/cUL Listed: AWG28-12) Tightening torque: 0.5-0.6 Nm (4.4-5.3 lb-in) (UL/cUL Listed: AWG20)
	Display: 9-pole Sub-D female
	PC: 9-pole Sub-D male

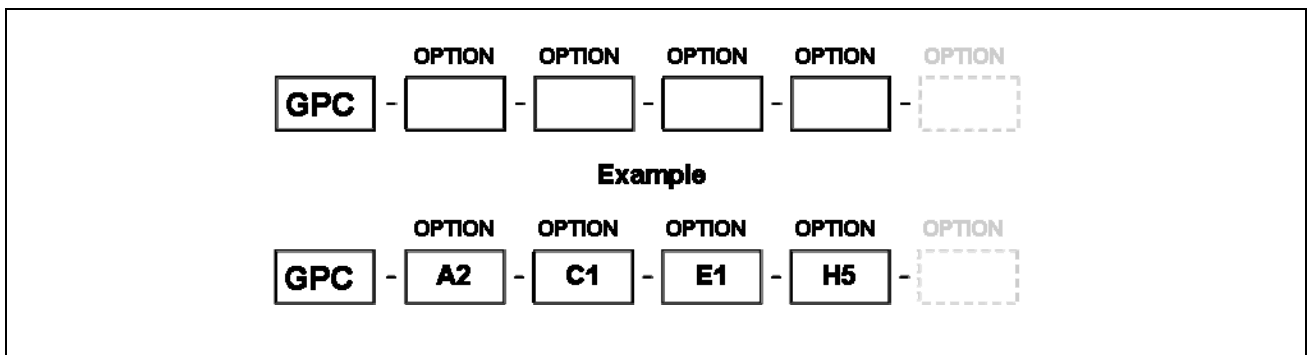
Generator Paralleling Controller

Governors:	Multi-line 2 interfaces to all governors, including GAC, Barber-Colman, Woodward and Cummins See interfacing guide at www.deif.com
Open collector outputs:	Supply 8-36V DC, max. 10mA
Weight:	Main unit: 1.6 kg (3.5 lbs.) Option J1/J3: 0.2 kg (0.4 lbs.) Option J2: 0.4 kg (0.9 lbs.)
Approval:	UL/cUL Listed to UL508
UL markings:	Wiring: Use 60/75°C copper conductors only Mounting: For use on a flat surface of type 1 enclosure Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)
Response times:	<i>Busbar 1 and 2:</i> Over-/undervoltage <50 ms Over-/underfrequency <50 ms <i>Generator:</i> Over-/undervoltage 70-300 ms Over-/underfrequency 70-300 ms Current: 100-300 ms Rocof: 100 ms (4 periods) Vector jump: 30 ms Fast overcurrent: <42 ms

Unit dimensions in mm (inches)



Order specifications



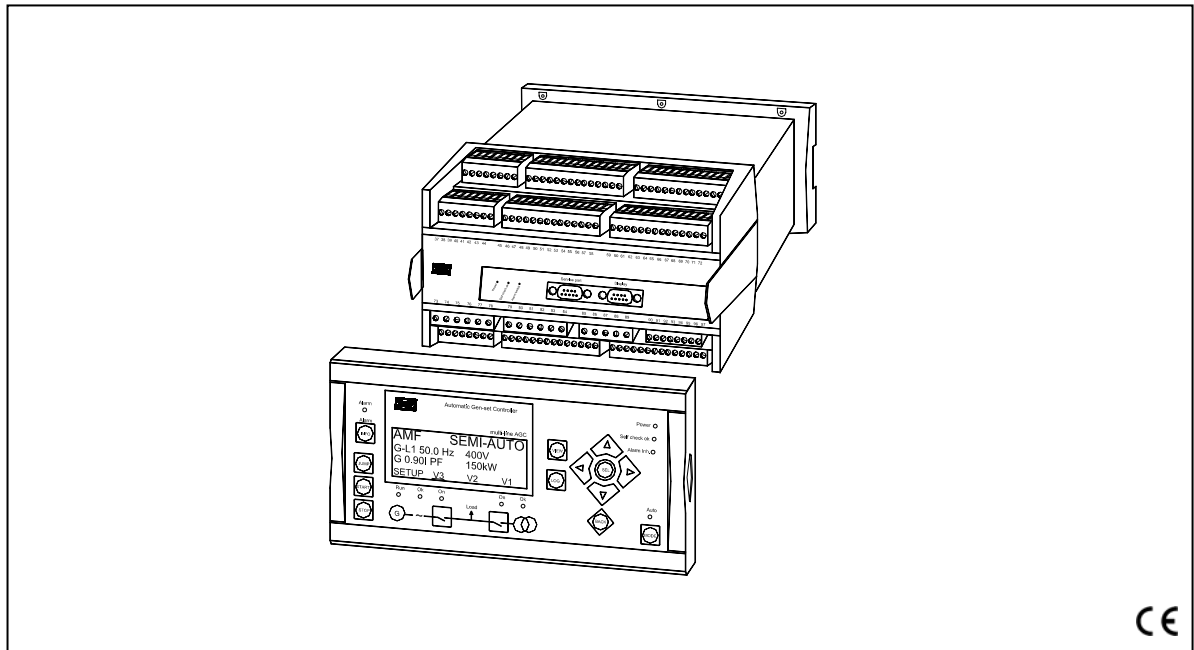
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Standard functions

Operation modes

- Automatic mains failure
- Island operation
- Fixed power/base load
- Peak shaving
- Load take over
- Mains power export

Engine control

- Start/stop sequences
- Fuel solenoid selection
- Relay outputs for governor control

Protection (ANSI)

- Overcurrent, 2 levels (51)
- Reverse power (32)
- 4-20 mA inputs
- PT100 or VDO inputs
- Digital inputs

Display

- Prepared for remote mounting
- Push-buttons for start and stop
- Push-buttons for breaker operations
- Status texts

M-logic

- Simple logic configuration tool
- Selectable input events
- Selectable output commands

GSM communication

- SMS messages at all alarms
- Dial up from PC utility software to control unit

Application

The Automatic Gen-set Controller is a micro-processor based control unit containing all necessary functions for protection and control of a gen-set. It contains all necessary 3-phase measuring circuits and all values and alarms are presented on the LCD display

The AGC is a compact all-in-one unit designed for the following applications:

1. Automatic mains failure
2. Island operation
3. Fixed power/base load
4. Peak shaving
5. Load take over
6. Mains power export (fixed power to mains)

Optional applications:

7. Multiple gen-sets, load sharing
8. Power management (island operation)
9. Power management (parallel with mains)



The AGC can operate in automatic mains failure mode as a secondary mode regardless of the type of application - except the island applications.

The AGC automatically carries out a cyclical self-test at start-up. If any errors are found, they will be displayed in clear text in the display and indicated with a relay output.

The display is separate and can be installed directly on the main unit or in the front of the switchboard door (requires option J1 – display cable).

The AGC is supplied with an engine interface I/O card. Two selections are possible:

I/O \ PCB	M1 (standard)	M2 (option)
4-20 mA	4 (3)*	3 (2)*
Tacho	1	1
Digital inputs	5 (3)	9 (7)
PT100	2	-
VDO	-	3
Relay outputs	3 (0)	3 (0)

*Depends on the selected gen-set mode



The number in parenthesis indicates the number of user configurable digital inputs/relay outputs.



M1 is supplied, if M2 is not specified.

Test

The available gen-set modes except island operation include a test mode. The test can be configured to include either:

- gen-set starting and running for a preset time. Generator breaker is open during the test,

or

- gen-set starting and synchronisation of the generator breaker. The test is carried out for a preset period of time at a fixed power set point parallel to the mains.

Setup

Setup is easily done via a menu structure in the display (password protected) or via the RS232 PC connection and the multi-line 2 Windows® based PC utility software. The PC utility software can be downloaded free of charge from www.deif.com. The utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates.

Options

In order to perfectly match the product solution to specific applications, the functionality of the AGC can be equipped with a number of available options. The options selected by the customer will be integrated in the standard AGC hereby securing the same user interface unaffected by whether the application needs a highly complex or a more basic gen-set controller.

Unit definitions

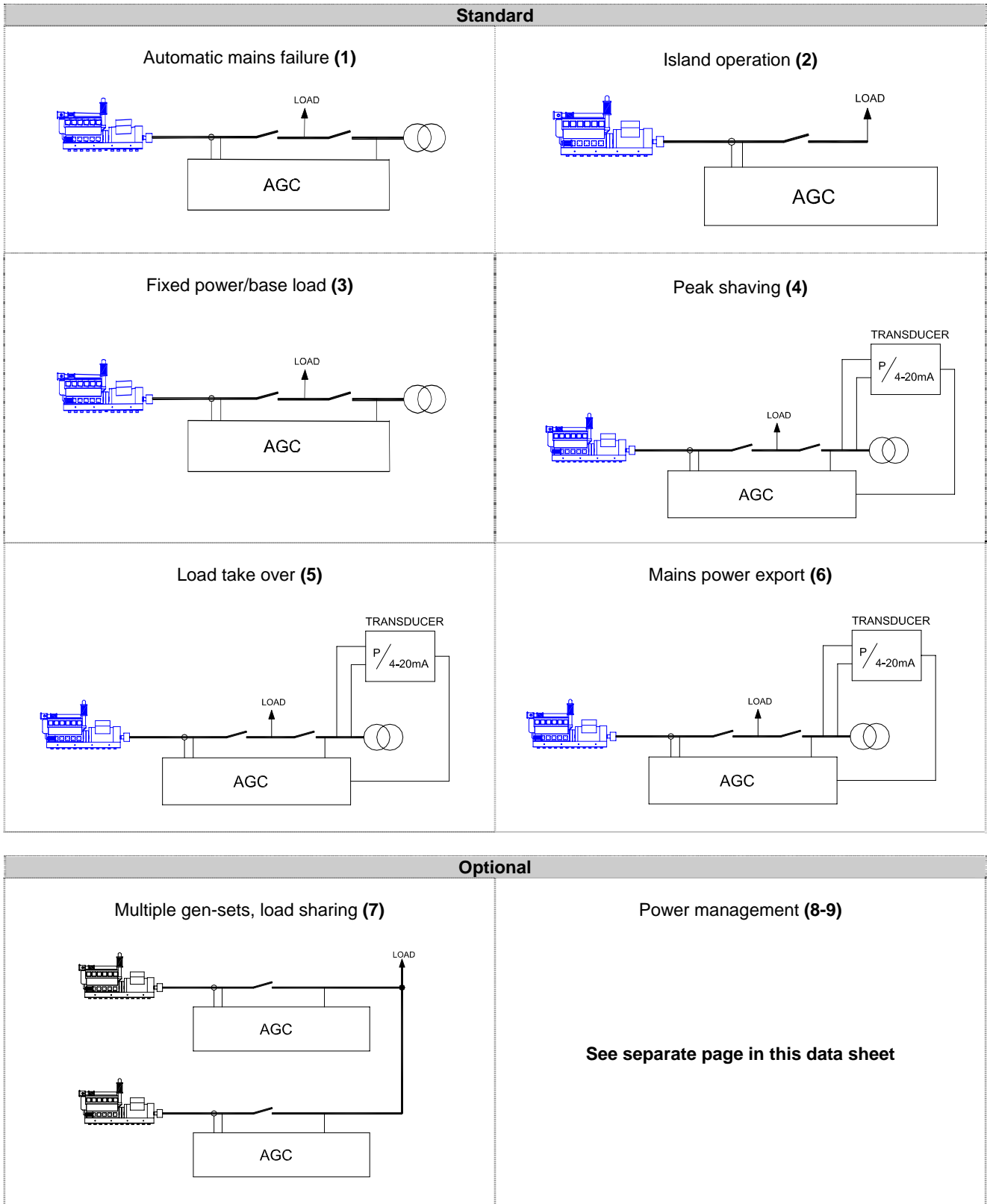
AGC: The standard control unit designed for a number of applications (1-9). An extensive list of hardware and software options is available for the AGC.

AGC mains: A special power management control unit used in the parallel with mains power management application (9). Several options are available for the AGC mains.

M-logic

This configuration tool is part of the PC utility software which is free of charge. With this tool it is possible to customise the application to your needs. It is possible to dedicate specific functions or logical conditions to different inputs and outputs.

Single line application diagrams



Power management (option G5)

Description

The AGC can be equipped with a power management option (G5). Using this possibility the AGC will be able to handle applications with up to 16 gen-sets.

The basic functions are:

- Multi-master system
- Control of up to 16 gen-sets
- Load dependent operation
- Priority selection
- Ground relay control
- Tie breaker control (selectable)
- Mains breaker control

In a multi-master system the power management control is automatically performed by the available gen-set AGCs. This means that the system is not dependent on one master unit. The communication between the AGC units is CAN bus.

Application

The power management option supports two basic configurations only:

- Island operation
- Parallel to mains

The gen-set modes supported by the power management option are:

- Automatic mains failure
- Island operation
- Fixed power/base load
- Peak shaving
- Load take over
- Mains power export (fixed power to mains)

These are the selectable gen-set modes of the entire plant, and they are adjusted on the AGC mains unit. The AGC mains is not necessarily in island operation configuration, since no mains breaker is to be controlled.

Test

The available gen-set modes except island operation include a test mode. The test can be configured to include either:

- gen-set starting and running for a preset time. Generator breaker is open during the test, or
- gen-set starting and synchronisation of the generator breaker. The test is carried out for a preset period of time at a fixed power set point parallel to the mains.

Priority selection

The priority routines in the AGC are based on:

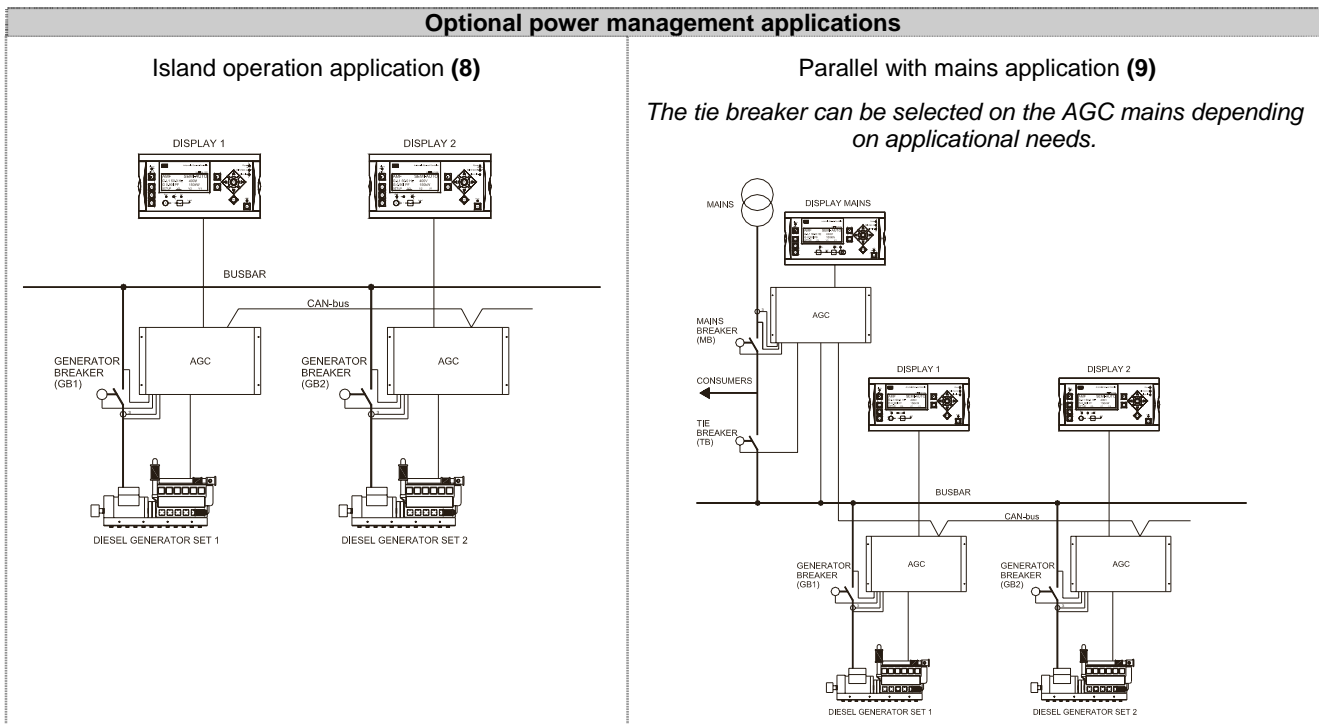
- manual selection
- running hours
- fuel optimising

Load dependent operation

The load dependent starting and stopping of the gen-sets are based on a *power available* calculation. The next generator will start, when the available power decreases below the adjustable set point. It will stop, when too much power is available.

Ground relay

If configurable relays are available in the specific AGC units (option dependent), it is possible to control the star point ground connection of the generators. This is in order to have only one ground connection at a time.



Available options



Please notice that not all options can be selected for the same unit. Please refer to page 8 in this data sheet for further information about the location of the options in the unit.

Option	Description	Type	Note
A	Loss of mains protection package		
A1	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81) Vector jump (78) df/dt (ROCOF) (81)	Software option	
A2	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81) df/dt (ROCOF) (81)	Software option	
A3	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81) Vector jump (78)	Software option	
A4	Positive sequence (mains voltage low) (27)	Software option	
B	Generator/busbar/mains protection package		
B1	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81)	Software option	
C	Generator add-on protection package		
C1	Over- and undervoltage (generator) (27/59) Over- and underfrequency (generator) (81) Overload (32) Peak current (50) Current unbalance (46) Voltage asymmetry (47) Reactive power import (excitation loss) (32) Reactive power export (overexcitation) (32)	Software option	This option is not available for AGC mains
C2	Negative sequence voltage high (47) Negative sequence current high (46) Zero sequence voltage high (59) Zero sequence current high (50)	Software option	This option is not available for AGC mains
D	Voltage/var/PF control		This option is not available for AGC mains
D1	Selection between: Constant voltage control (stand-alone) Constant reactive power control (parallel with mains) Constant power factor control (parallel with mains) Reactive load sharing (island paralleling with other generators)	Software option	Not with EF2
E	Analogue controller outputs		This option is not available for AGC mains
E1	+/-20mA for speed governor +/-20mA for AVR	Hardware option	AVR outputs are available if D1 is selected Refer to page 8 See note 2
EF	Combination outputs		
EF2	+/-20mA for speed governor 1 x 0(4)...20mA transducer output	Hardware option	Refer to page 8 See note 2
EF3	1 x PWM (Pulse Width Modulated) output for CAT speed governor 1 x PWM (Pulse Width Modulated) output for droop +/-20mA for speed governor or AVR 2 x relay outputs for speed governor or AVR	Hardware option	Refer to page 8 See note 2
EF4	+/-20mA for speed governor or AVR 2 x relay outputs for speed governor or AVR	Hardware option	Refer to page 8 See note 2
EF5	1 x PWM (Pulse Width Modulated) output for CAT speed governor +/-20mA for speed governor or AVR 2 x relay outputs for speed governor or AVR	Hardware option	Refer to page 8 See note 2
F	Analogue transducer outputs		This option is not available for AGC mains
F1	2 transducer outputs, 0...20mA or 4...20mA	Hardware option	Refer to page 8

G	Load sharing/power management		
G3	Load sharing with analogue lines	Hardware option	M12 is possible Refer to page 8 This option is not available for AGC mains
G5	Power management, 16 gen-sets	Hardware option	Refer to page 8
H	Serial communication		
H2	Modbus RTU	Hardware option	Refer to page 8
H3	Profibus DP	Hardware option	Refer to page 8
H4	CAT CCM	Hardware option	Refer to page 8 This option is not available for AGC mains
H5	CAN bus (J1939) MTU Detroit Deutz John Deere Volvo Penta		Refer to page 8 This option is not available for AGC mains
H6	Cummins GCS	Hardware option	Refer to page 8 This option is not available for AGC mains
J	Cables		
J1	Display cable with plugs, 3 m. UL94 (V1) approved	Other	
J2	Display cable with plugs, 6 m. UL94 (V1) approved	Other	
J3	PC cable for utility software (RS232). UL94 (V1) approved	Other	
J6	Display cable with plugs, 1 m. UL94 (V1) approved	Other	
K	Designer's reference handbook (hard copy)	Other	
L	Display gasket for IP54	Other	Standard is IP52
M	Configurable engine control cards		
M1	Engine control card with Pt100 sensor inputs 4 x 4...20mA inputs 2 x Pt100 inputs 1 x tachometer input (magnetic pick-up) 5 x binary inputs 3 x relay outputs	Hardware option	Refer to page 8 See note 1
M2	Engine control card with VDO sensor inputs 3 x 4...20mA inputs 3 x VDO (resistor) inputs 1 x tachometer input (magnetic pick-up) 9 x binary inputs 3 x relay outputs	Hardware option	Refer to page 8 See note 1
M	Configurable I/O extension cards		
M12	13 x binary inputs, 4 x relay outputs	Hardware option	G3 is possible Refer to page 8
M13	7 binary inputs, configurable	Hardware option	Refer to page 8
M14	4 relay outputs	Hardware option	Refer to page 8
M15	4 analogue inputs, configurable, 4...20mA	Hardware option	Refer to page 8
N	Ethernet TCP/IP communication		
N1	Integrated WebServer with web pages for plant presentation	Hardware option	Option H2 is required Refer to page 8
P	Printer		
P1	Event and alarm printer software	Software option	Printer and cable are included in this option
X	Display		
X3	Additional operator panel (AOP) 16 configurable LEDs and 8 configurable buttons	Other	
Y	Display layout		
Y1	AGC display for island operation (no mains breaker)	Other	

(ANSI# as per IEEE Std C37.2-1996(R2001) in parenthesis).

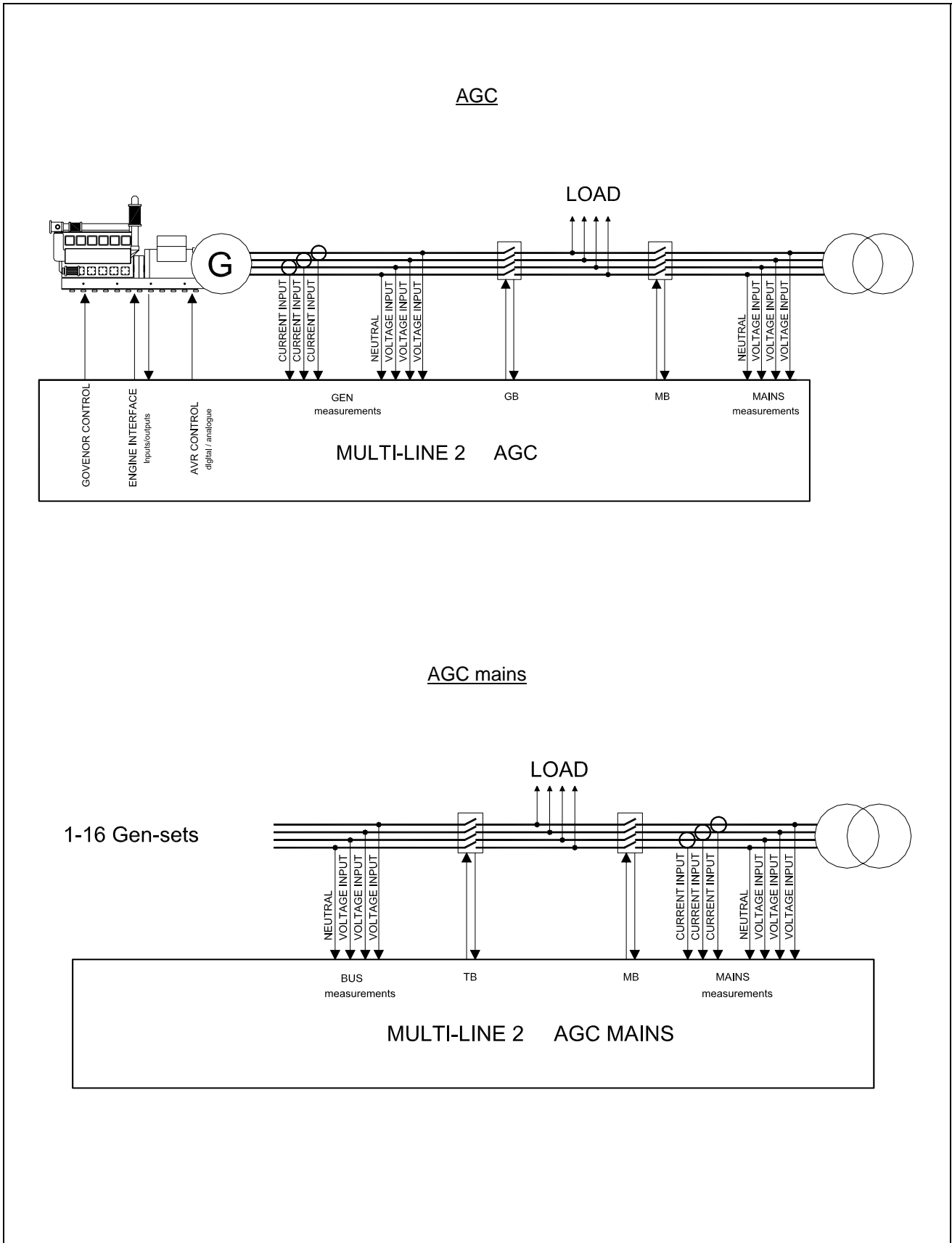


Option M1/M2 is used for engine control/protection. Option M1 is delivered as standard in the AGC. If option M2 is selected, it will replace option M1.



Options E1, EF2, EF3, EF4 and EF5 are used for GOV/AVR control. 4 relays are used as standard in the AGC for GOV/AVR control. If selected, these options will replace the 4 relays.

Principle diagrams

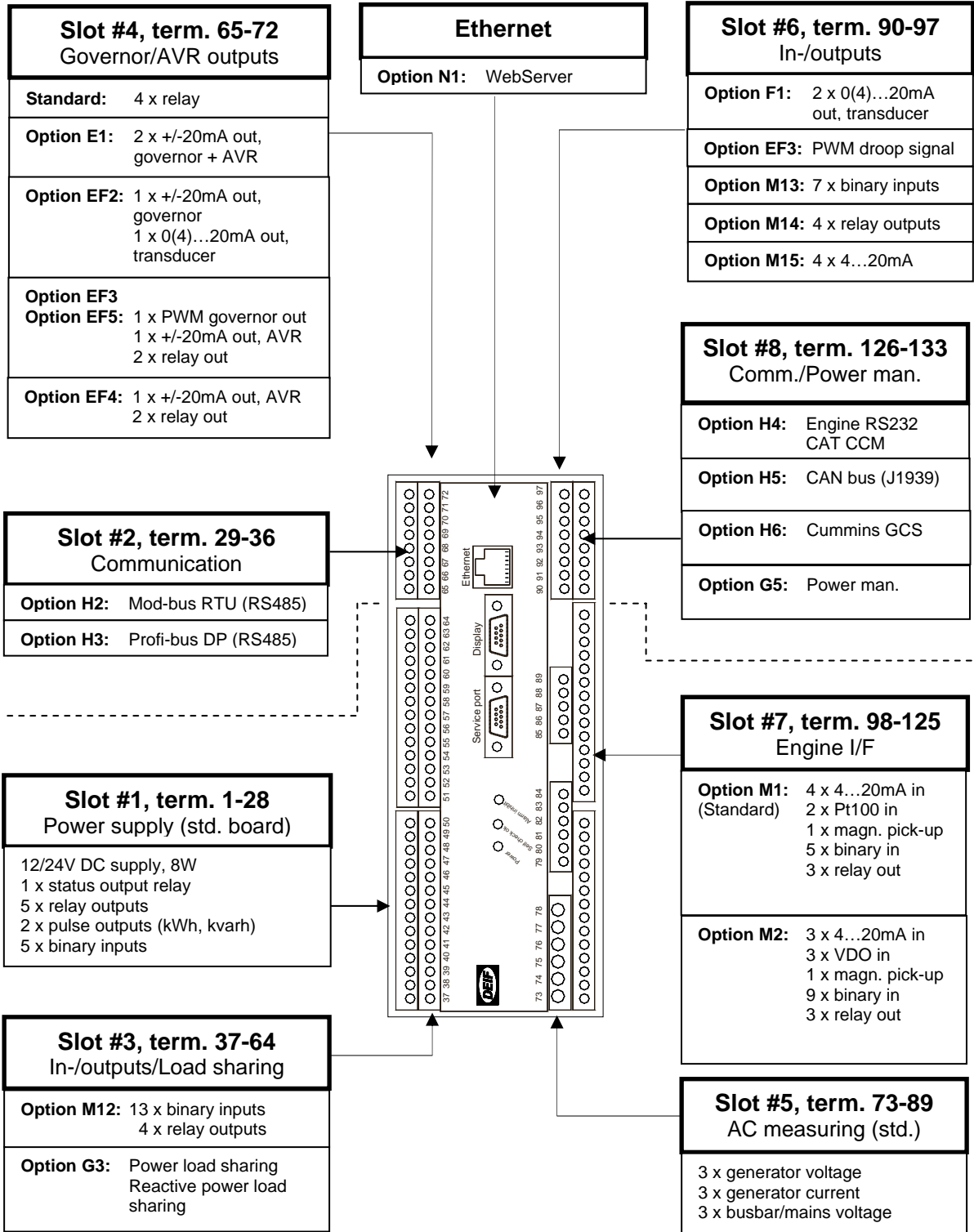


Hardware overview



There can only be one hardware option in each slot. It is e.g. not possible to select option H2 and option H3 at the same time because both options require a PCB in slot #2.

Besides the hardware options shown on this page it is possible to select the software options mentioned on page 5 in this data sheet. Options A, B, C, D and P are software options.



Technical specifications

<p>Accuracy: Class 1.0 Class 2.0 for neg. seq. current To IEC/EN 60688</p> <p>Operating temp.: -25...70°C (-13...158°F) (UL/cUL Listed: Max. surrounding air temp.: 55°C/131°F)</p> <p>Storage temp.: -40...70°C (-40...158°F)</p> <p>Galvanic separation: Between AC voltage, AC current and other I/Os: 3250V AC, 50Hz, 1 min. Between analogue outputs and other I/Os: 500V DC, 1 min. Between binary input groups and other I/Os: 500V DC, 1 min.</p> <p>Meas. voltage: 100-690V AC +/-20% (UL/cUL Listed: 110-480V AC phase-phase)</p> <p>Consumption: Max. 0.25VA/phase</p> <p>Meas. current: -/1 or -/5A AC (UL/cUL Listed: From CTs 1-5A)</p> <p>Consumption: Max. 0.3VA/phase</p> <p>Current overload: 4 x I_n continuously 20 x I_n, 10 sec. (max. 75A) 80 x I_n, 1 sec. (max. 300A)</p> <p>Meas. frequency: 30...70Hz</p> <p>Aux. supply: 12/24V DC (8...36V continuously, 6V 1 sec.) Max. 8W consumption The aux. supply inputs are to be protected by a 2A slow blow fuse Recommended power supply is DEIF's DCP-2 (UL/cUL Listed: AWG 24)</p> <p>Binary inputs: Optocoupler, bi-directional ON: Input voltage 8...36V DC Impedance typically 4.7kΩ OFF: <2V DC</p> <p>Relay outputs: 250V AC/24V DC, 5A (Unit status output: 1A) (UL/cUL Listed: 250V AC/24V DC, 2A resistive load)</p>	<p>Analogue inputs: -10...0...+10V DC Not galvanically separated Impedance min. 100kΩ 4-20 mA: Impedance max 50Ω, not galvanically separated PT100: According to IEC/EN 60751 VDO: Resistor inputs, internal supply max. 480Ω</p> <p>Mounting: DIN-rail mount or base mount with 6 screws</p> <p>Climate: 97% RH to IEC 60068-2-30</p> <p>Load sharing lines: -5...0...+5V DC</p> <p>Analogue outputs: 0(4)...20mA Galvanically separated Active output (internal supply) Load max. 500Ω (UL/cUL Listed: Max. 20mA output)</p> <p>Safety: To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2 To UL 508 and CSA 22.2 no. 14-05, overvoltage category III, 300V, pollution degree 2</p> <p>Protection: Unit: IP20 Display: IP52 (IP54 with gasket: Option L) (UL/cUL Listed: Type Complete Device, Open Type) To IEC/EN 60529</p> <p>EMC/CE: To EN 61000-6-1/2/3/4 IEC 60255-26 IEC 60533 power distr. zone IACS UR E10 power distr. zone</p> <p>Vibration: 3...13.2Hz: 2mm_{pp} 13.2...100Hz: 0.7g To IEC 60068-2-6 & IACS UR E10 10...60Hz: 0.15mm_{pp} 60...150Hz: 1g To IEC 60255-21-1 Response (class2) 10...150Hz: 2g To IEC 60255-21-1 Endurance (class2)</p>
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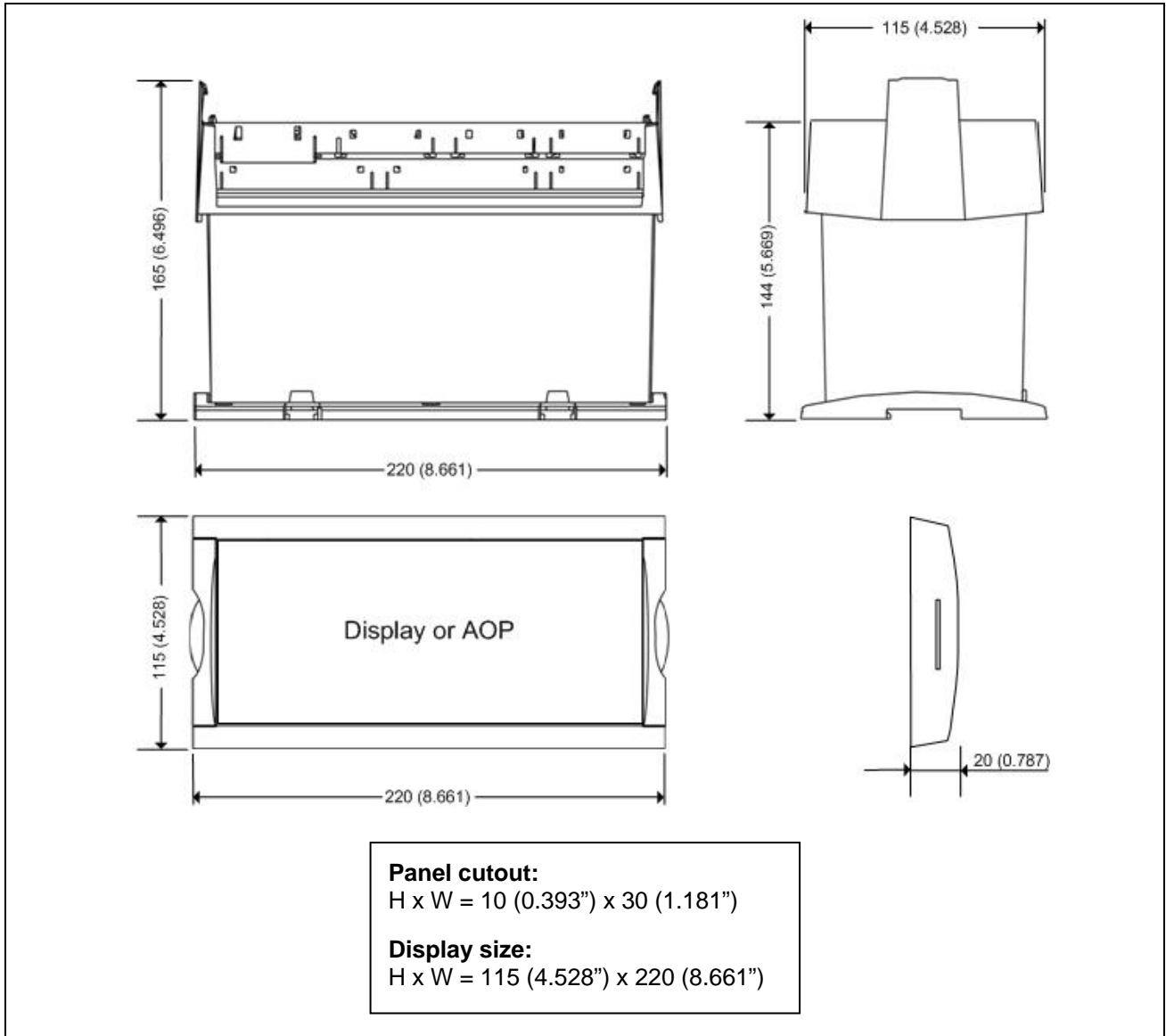
Data sheet

Shock (base mount):	10g, 11msec, half sine To IEC 60255-21-2 Response (class2) 30g, 11msec, half sine To IEC 60255-21-2 Endurance (class2) 50g, 11msec, half sine To IEC 60068-2-27
Bump:	20g, 16msec, half sine To IEC 60255-21-2 (class2)
Material:	All plastic materials are self-extinguishing according to UL94 (V1)
Plug connections:	AC current: 4.0 mm ² multi stranded (UL/cUL Listed: AWG28-10) Tightening torque: 0.5-0.6 Nm (4.4-5.3 lb-in) Other: 2.5 mm ² multi stranded (UL/cUL Listed: AWG28-10) Tightening torque: 0.5-0.6 Nm (4.4-5.3 lb-in) Display: 9-pole Sub-D female PC: 9-pole Sub-D male

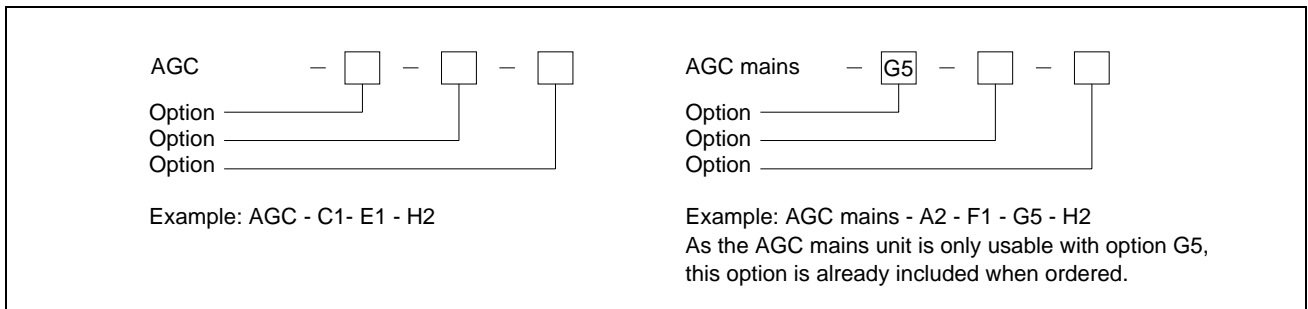
Automatic Gen-set Controller

Governors:	Multi-line 2 interfaces to all governors, including GAC, Barber-Colman, Woodward and Cummins. See interfacing guide at www.deif.com
Open collector outputs:	Supply 8...36V DC, max. 10mA
Weight:	Main unit: 1.6 kg (3.5 lbs.) Option J1/J3: 0.2 kg (0.4 lbs.) Option J2: 0.4 kg (0.9 lbs.)
Approval:	UL/cUL Listed to UL508
UL markings:	Wiring: Use 60/75°C copper conductors only Mounting: For use on a flat surface of type 1 enclosure Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)

Unit dimensions in mm (inches)



Order specifications



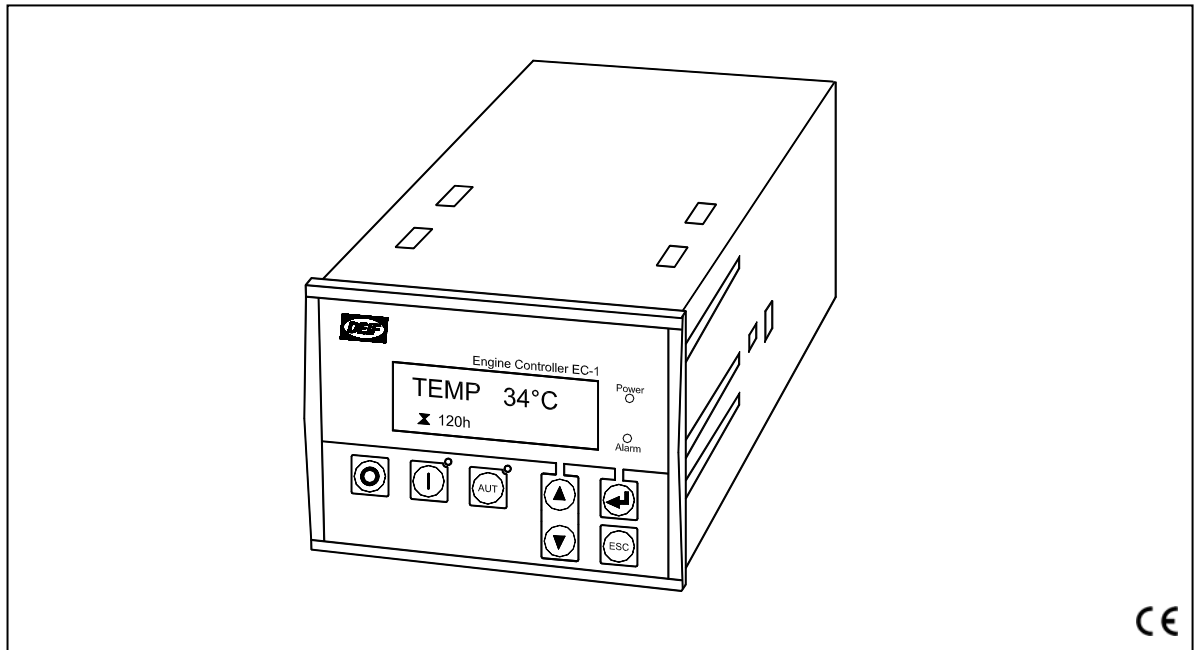
Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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Standard functions

Engine control

- Start preparation (preheater or prelubrication)
- Start/stop sequences with selectable no. of start attempts
- Fuel solenoid selection (coil type)
- Idle speed control
- Local or remote start/stop
- Stop sequence with cool down
- Running speed detection selectable
 - Charger alternator input (W terminal) (option)
 - Binary input

Applications

- Automatic engine start/stop
- Engine protection

Engine monitoring

- 3 configurable inputs (option)
 - VDO or
 - 4-20 mA from active transducer or
 - Binary with cable supervision
- 6 binary inputs, configurable
- RPM input, selectable (option)
 - Magnetic pick-up
 - NPN or PNP pick-up
 - Tacho generator
 - Charger alternator W terminal

Clear text display

- 122 x 32 pixel back-light STN
- Graphic symbol messaging
- Clear text alarm messages
- Clear text diagnostics for both hardwired inputs and CANbus messages (J1939)
- Log book holding 30 log entries

Application

The Engine Controller EC-1 is a micro-processor based control unit containing all necessary functions for protection and control of a diesel engine. Furthermore, it contains a single-phase AC voltage measuring circuit. The unit is equipped with an LCD display presenting all values and alarms. EC-1 is a compact all-in-one unit designed for the following applications:

1. Automatic engine start/stop
2. Engine protection

Optional applications:

3. Generator voltage and frequency supervision

EC-1 automatically carries out a cyclical self test. If any errors are found, then the status relay output will deactivate (normally closed). In order to save battery power, the display can be set to switch off automatically after a given period of time. The display will turn on again, if events or alarms take place, or if one of the push-buttons is activated.

Setup

Setup is easily done via a PC Windows® based utility software (password protected) using the RJ45/RS232 PC connection. The PC interface box RJ45/RS232 needed for this operation is optional equipment for EC-1. The PC utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates. Furthermore, the most often used settings can be accessed via the display push-buttons (password protected).

Options

In order to perfectly match EC-1 to specific applications, the unit can be equipped with a number of available options. The options selected by the customer will be integrated in the standard EC-1 hereby securing the same user interface unaffected by whether the application needs a basic or a more complex engine controller.

Terminals

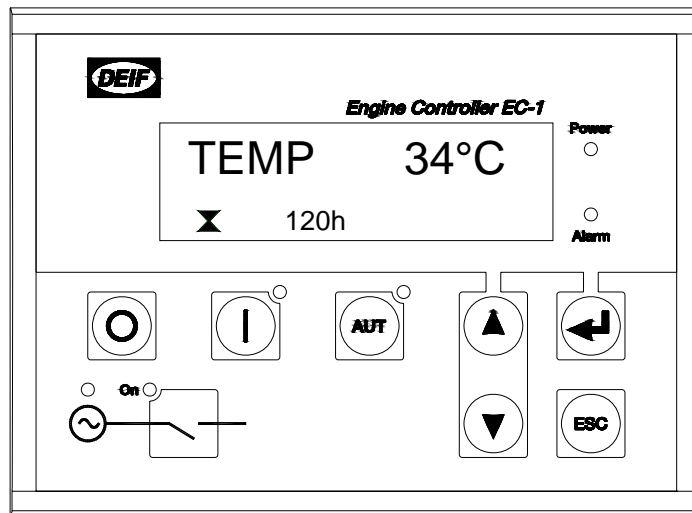
Terminal	Technical data	Description
10...11	Status out. Contact ratings 1A 30V DC/V AC	General status output for marine approvals
12	Common	Common for term. 13...18
13	Digital input	Start enable/configurable
14	Digital input	Remote start/configurable
15	Digital input	Charge alternator D+ (running)/configurable
16	Digital input	Overspeed/configurable
17	Digital input	Coolant temperature/configurable
18	Digital input	Oil pressure/configurable
23	Common	Common for term. 24, 25 and 32 and emergency stop*
24	Relay output 1. Contact ratings 2A 30V DC/V AC	Horn. Function NO
25	Relay output 2. Contact ratings 2A 30V DC/V AC	Alarm/configurable. Function NO
26	Power supply –	GND
27	Power supply +	6...36V DC
28...31	Not used	Note 23 and 31 is internally connected
32	Relay output 3. Contact ratings 2A 30V DC/V AC	Start prepare/configurable. Function NO
33-34	Relay output 4. Contact ratings 8A 30V DC/V AC	Run coil/stop coil/configurable. Function NO
35-36	Relay output 5. Contact ratings 8A 30V DC/V AC	Starter (crank)/configurable. Function NO
Optional configurable inputs (option M17)		
4	Common	Common for term. 5...7
5	VDO1/4...20 mA/binary input	Fuel level/configurable
6	VDO2/4...20 mA/binary input	Oil pressure/configurable
7	VDO3/4...20 mA/binary input	Water temp./configurable
Optional CANbus #1 engine interface (option H5)		
1	CAN-L	CAN J1939 engine communication
2	CAN-GND	
3	CAN-H	
Optional tacho RPM input (option M17)		
8	Tacho-GND	Magnetic pick-up. PNP or NPN/tacho generator/charge alternator W terminal
9	Tacho input	
Optional single-phase generator voltage input (option B2)		
19	L2 or N	Generator voltage and frequency
20	Not used	
21	L1	
22	Not used	

Available options

Option	Description	Type	Note
B	Generator protection		
B2	Single-phase (L-L or L-N), 50-550V AC, 50/60 Hz - Single-phase over- and undervoltage (27/59) - Single-phase over- and underfrequency (81)	Software option	
G	Control functions		
G6	Generator breaker control. See the display front layout below	Hardware option	Requires B2
H	Communication		
H1	CANopen communication	Hardware option	
H5	CANbus J1939 - Detroit Diesel DDEC - John Deere JDEC - Deutz EMR - Volvo Penta D12 AUX - Scania EMS	Hardware option	
J	Cables		
J5	PI-1 converter box kit (for PC connection)	Hardware option	
K	Installation Instructions and Reference Handbook		
K1	Installation Instructions and Reference Handbook (hard copy)	Other	
K2	Installation Instructions and Reference Handbook (CD)	Other	
L	Gasket for IP54	Hardware option	
M	Input options		
M17	3 configurable VDO, 4...20 mA, binary inputs Tacho input (magnetic pick-up, NPN, PNP pick-up, charge generator W input)	Hardware option	

(ANSI# as per IEEE Std C37.2-1996(R2001) in parenthesis).

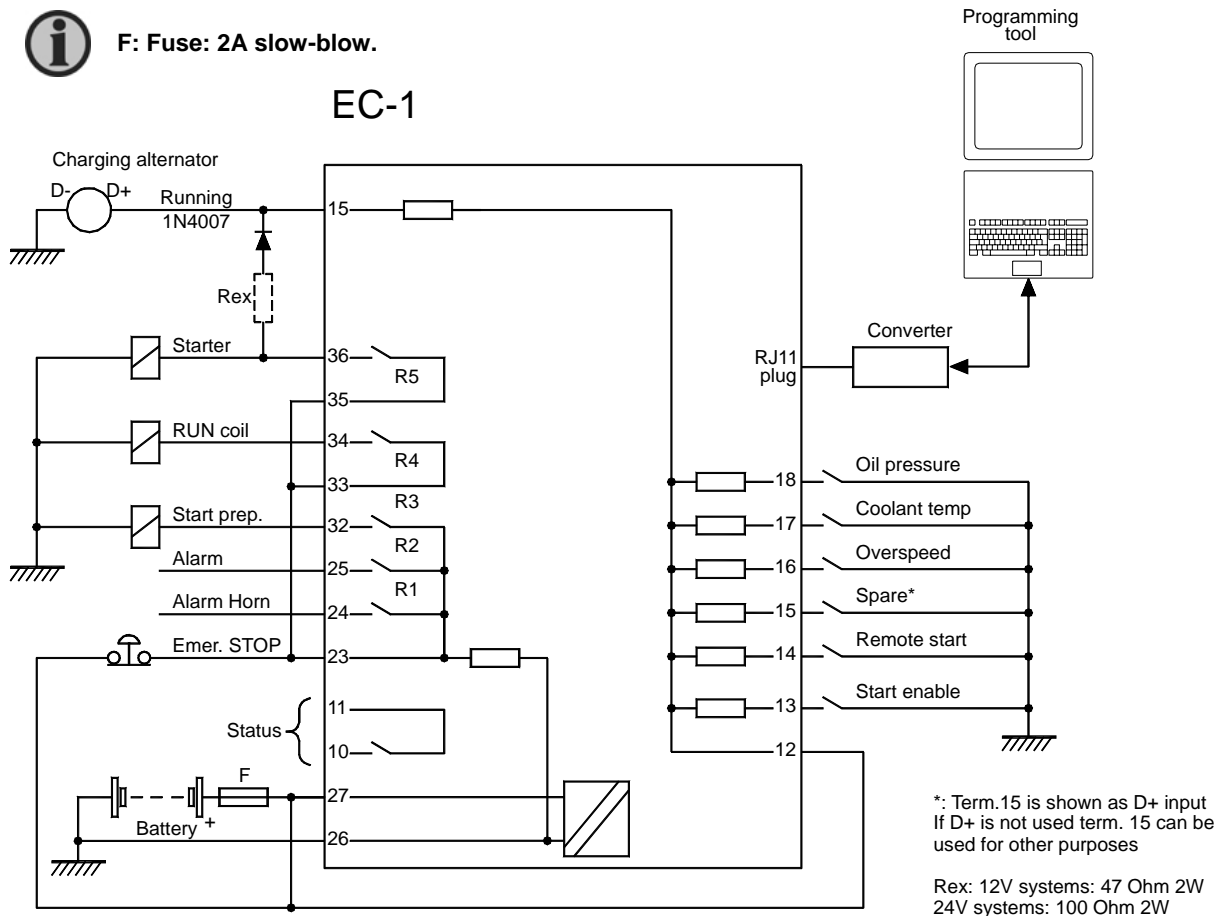
Option G6 display layout



Wiring



F: Fuse: 2A slow-blow.



<p>H5 Engine communication</p>		<p>B2 Generator voltage</p>
<p>M17 Multi-functional inputs VDO sensors</p>	<p>M17 Multi-functional inputs 4-20 mA transmitters</p>	<p>M17 Multi-functional inputs Binary input w. cable superv.</p> <p>R= 100 Ohm</p>
<p>M17 Tacho input Magnetic pickup/ Tacho generator</p>	<p>M17 Tacho input NPN/PNP pickup</p> <p>C= 1µF/100V foil type</p>	<p>M17 Tacho input W input from charger alternator</p> <p>C= 1µF/100V foil type</p>

Technical specifications

Accuracy:	Class 2.0 to EN 60688/IEC 688	Mounting:	Panel mounted
Operating temp.: (UL/cUL Listed:	-25...70°C Max. ambient temp. 40°C/104°F)	Size:	78 x 106 mm
Storage temp.:	-40...70°C	Climate:	-25...70°C to IEC 60068-2-1/2 97% RH to IEC 60068-2-30
Measuring input voltage: (UL/cUL Listed:	50...550V AC phase to phase 50...300V AC)	Display:	122 x 32 pixel back-light STN
Load:	1.5 MΩ	Safety:	To EN 61010-1, installation category (overvoltage category) III, 600 V, pollution degree 2
Frequency:	30...70 Hz	Protection:	Front: IP52 (IP54 with gasket, option L) Terminals: IP20 To IEC 529 and EN 60529
Pick-up input voltage: Frequency:	2.0...70 V peak 10-10000 Hz	EMC/CE:	To EN 61000-6-1/2/3/4 SS4631503 (PL4) and IEC 255-3
Aux. supply: (UL/cUL Listed:	6-36V DC continuously 12/24V DC) Max. 8 W consumption	Material:	All plastic materials are self-extinguishing according to UL94 (V1)
Passive binary in voltage:	Bi-directional optocoupler 8...36V DC	Plug connections:	AC voltage inputs: 3.5 mm ² multi-stranded Other: 1.5 mm ² multi-stranded
Impedance:	4.7 kΩ	PC connection:	RS232 converter box (option J5)
VDO inputs:	Resistor inputs, internal 4 V supply	Approval:	UL/cUL to UL 508
Analogue input:	From active transducer	Weight:	Approx. 0.7 kg (1.5 lbs)
Current:	4...20 mA	UL markings:	
Impedance:	50 Ω	Wiring:	Use 60/75°C copper conductors only AWG 30-12
Active binary in internal voltage:	Dry contact inputs (note 1) 4V DC supply, with cable supervision	Terminal tightening torque:	5-7 lb-in
Impedance:	240 Ω ~ 16 mA	Mounting:	For use on a flat surface of a type 1 enclosure
Relay outputs:		Installation:	To be installed in accordance with the NEC (US) or the CEC (Canada)
3 relays: (UL/cUL Listed:	30V DC/AC 2A 30V DC 2A resistive)		
2 relays: (UL/cUL Listed:	30V DC/AC 8A 30V DC 4A resistive)		
1 status relay: (UL/cUL Listed:	24V DC 1A 24V DC 1A)		

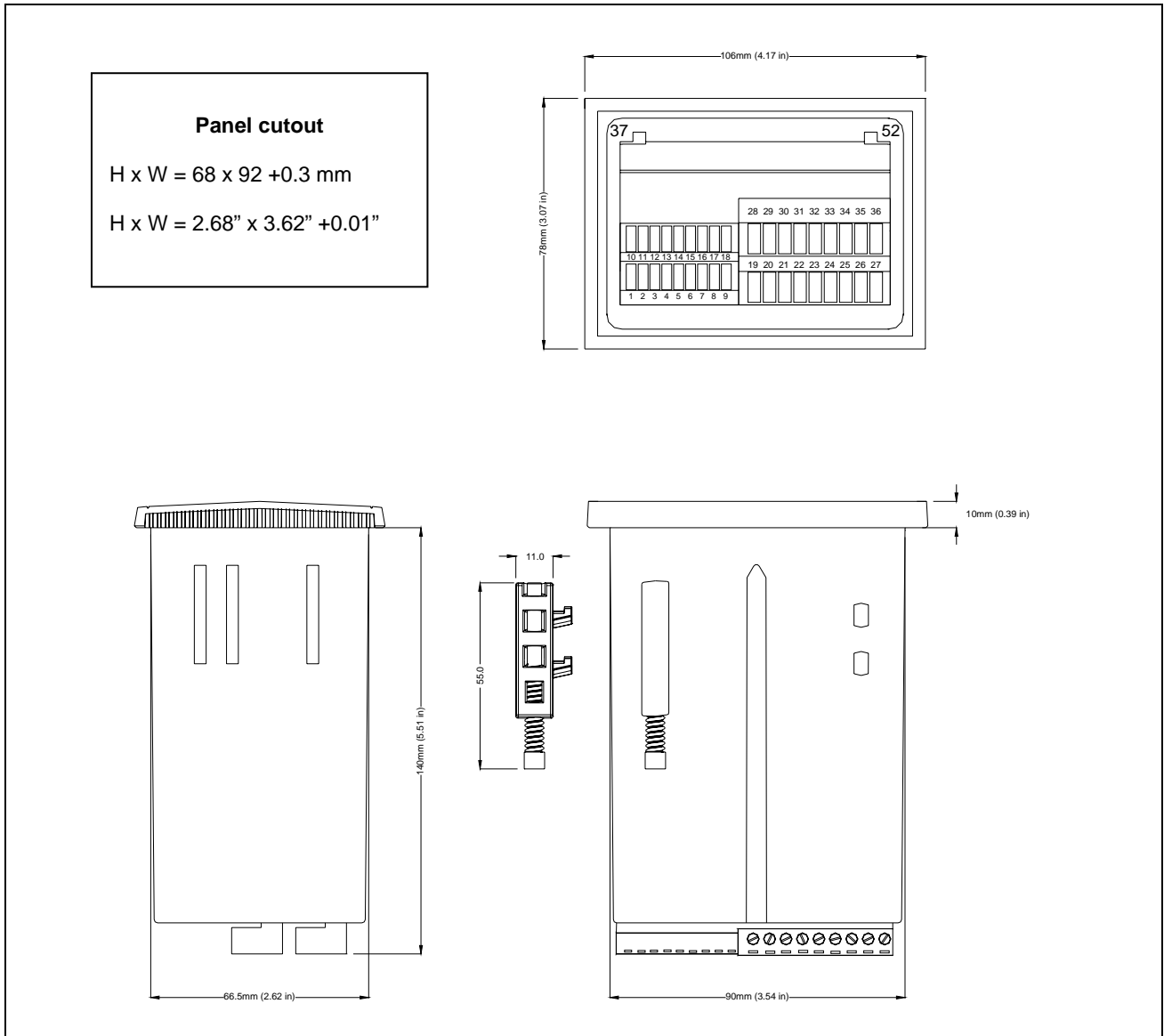


Only 3 inputs are available.

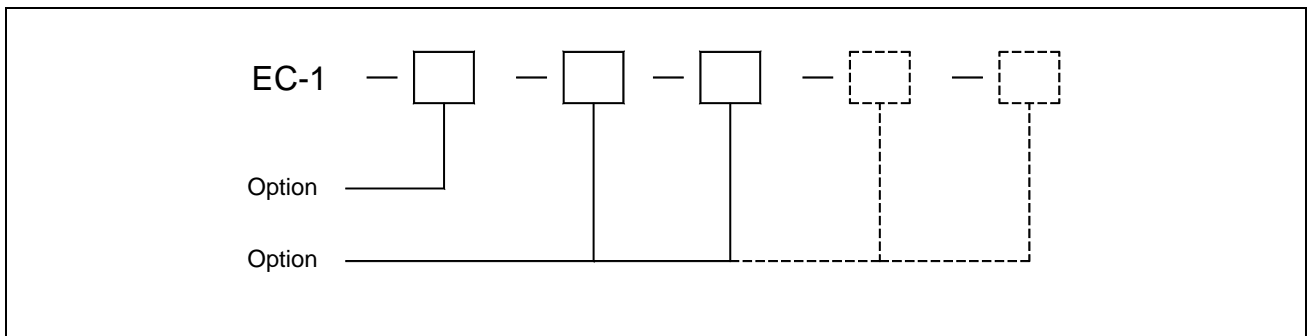


It is possible to combine VDO inputs with binary and 4...20 mA inputs in a mix.

Unit dimensions



Order specifications

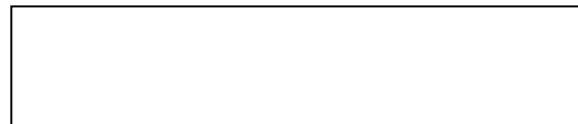


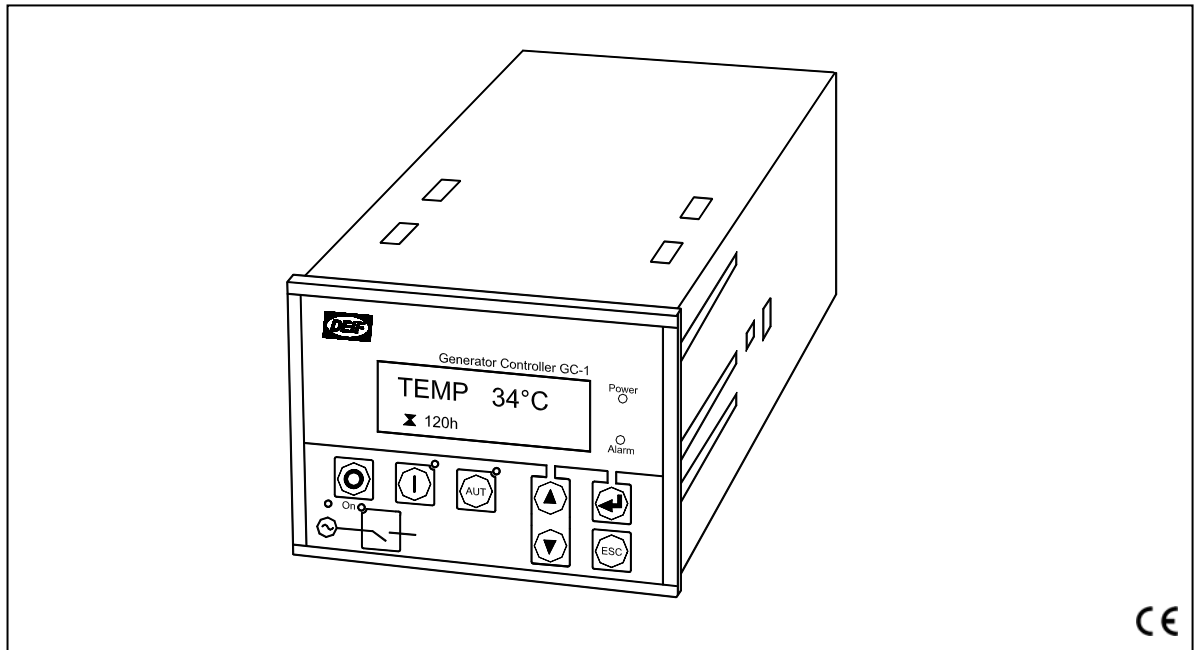
Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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Standard functions

Engine control

- Start preparation (preheater or prelubrication)
- Start/stop sequences with selectable no. of start attempts
- Fuel solenoid selection (coil type)
- Idle speed control
- Local or remote start/stop
- Stop sequence with cool-down
- Running speed detection selectable
 - Charger alternator input (W terminal) or tacho generator
 - Binary input (D+)
 - Oil pressure based run detection
 - Voltage/frequency

Generator monitoring

- 3 or 1-phase generator monitoring
 - Voltage/current/frequency/power/reactive power

Generator protection (ANSI)

- Over-/undervoltage (27/59)
- Over-/underfrequency (81)
- Overcurrent (51)
- Reverse power (32)

Engine monitoring

- 3 configurable inputs
 - VDO or
 - 4-20 mA from active transducer or
 - Binary with cable supervision
- 6 binary inputs, configurable
- RPM input, selectable
 - Magnetic pick-up
 - NPN or PNP pick-up
 - Tacho generator
 - Charger alternator W terminal

Clear text display

- 122 x 32 pixel backlight STN
- Graphic symbol messaging
- Clear text alarm messages
- Clear text diagnostics for both hardwired inputs and CANbus messages (J1939)
- Log book holding 30 log entries
- Real time clock for time and date

Application

The Generator Controller GC-1 is a micro-processor based control unit containing all necessary functions for protection and control of a diesel engine. Furthermore, it contains a three-phase AC voltage measuring circuit. The unit is equipped with an LCD display presenting all values and alarms. GC-1 is a compact all-in-one unit designed for the following applications:

1. Automatic engine start/stop
2. Engine protection
3. Breaker control
4. Generator protection

Optional applications:

5. Automatic Mains Failure
6. CANbus J1939 engine communication

GC-1 automatically carries out a cyclical self test. If any errors are found, then the status relay output will deactivate (normally closed). In order to save battery power, the display can be set to switch off automatically after a given period of time.

The display will turn on again, if events or alarms take place, or if one of the push-buttons is activated.

Setup

Setup is easily done via a PC Windows® based utility software (password protected) using the RJ11/RS232 PC connection. The PC interface box RJ11/RS232 needed for this operation is optional equipment for GC-1. The PC utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates. Furthermore, the most frequently used settings can be accessed via the display push-buttons (password protected).

Options

The options selected by the customer will be integrated in the standard GC-1 hereby securing the same user interface unaffected by whether the application needs a basic or a more complex generator controller.

Terminals

Terminal	Technical data	Description
4	Common for terminals 5-7	
5	VDO1, 4..20 mA, dig. inp.	Fuel level/configurable
6	VDO2, 4..20 mA, dig. inp.	Oil pressure/configurable
7	VDO3, 4..20 mA, dig. inp.	Water temp/configurable
8-9	Tacho input	Magnetic pick-up/PNP/NPN/tacho generator/charge alternator W terminal
10-11	Status out, 1A 30V DC/V AC	General status output for marine approvals
12	Common	Common for term. 13-18
13	Digital input term. 13	Start enable/configurable
14	Digital input term. 14	Remote start/configurable
15	Digital input term. 15	Charge alternator D+ (running)/configurable
16	Digital input term. 16	Overspeed/configurable
17	Digital input term. 17	Coolant temperature/configurable
18	Digital input term. 18	Oil pressure/configurable
23	Common	Common for term. 24, 25 and 32 and emergency stop*
24	NO relay output 1, 2A 30V DC/V AC	Horn
25	NO relay output 2, 2A 30V DC/V AC	Alarm/configurable
26	Power supply – (gnd)	
27	Power supply + 6...36V DC	
28-31	Not used	
32	NO relay output 3, 2A 30V DC/V AC	Start prepare/configurable
33-34	NO relay output 4, 8A 30V DC/V AC	Run coil/stop coil/configurable
35-36	NO relay output 5, 8A 30V DC/V AC	Starter (crank)/configurable
37	Generator L3 voltage	Voltage range 50-480V AC Ph-Ph value
38	Generator neutral voltage	
39	Generator L2 voltage	
41	Generator L1 voltage	
49-50	Generator breaker control relay, 2A 30V DC/V AC	
53	I L3 s1	Generator current L3
54	I L3 s2	
55	I L2 s1	Generator current L2
56	I L2 s2	
57	I L1 s1	Generator current L1
58	I L1 s2	

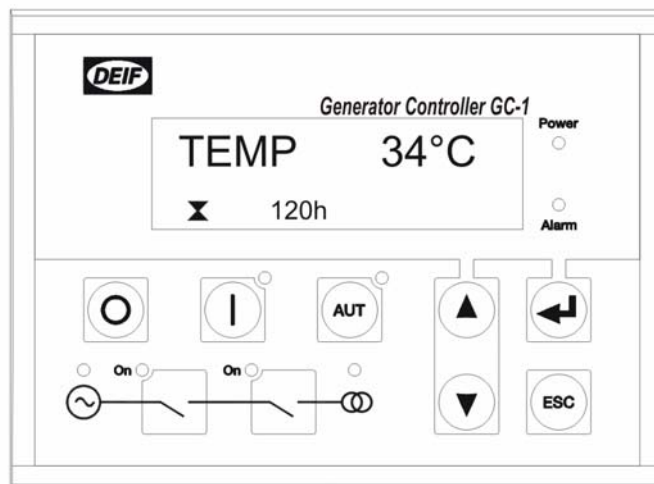
Optional AMF control		
43	Mains L3 voltage	Voltage range 50-480V AC Ph-Ph value
45	Mains L2 voltage	
46	Mains neutral voltage	
47	Mains L1 voltage	
51-52	Mains breaker control relay, 2A 30V DC/V AC	Configurable
Optional CANbus engine interface		
1	CAN-L	CAN J1939 engine communication
2	CAN-GND	
3	CAN-H	

Available options

Option	Description	Type	Note
B	Generator protection		
B3	Automatic Mains Failure - Generator and mains breaker control - Change-over (no synchronisation)	Software option	
H	Communication		
H5	CANbus J1939 - Detroit Diesel DDEC - John Deere JDEC - Deutz EMR - Volvo Penta D12 AUX - Scania DEC	Software option	
J	Cables		
J5	PI-1 converter box kit (for PC connection)	Hardware option	
K	Documentation		
K1	Installation Instructions and Reference Handbook (hard copy)	Other	
K2	CD-ROM with complete documentation	Other	
L	Gasket for IP54	Hardware option	

(ANSI# as per IEEE Std C37.2-1996 (R2001) in parenthesis).

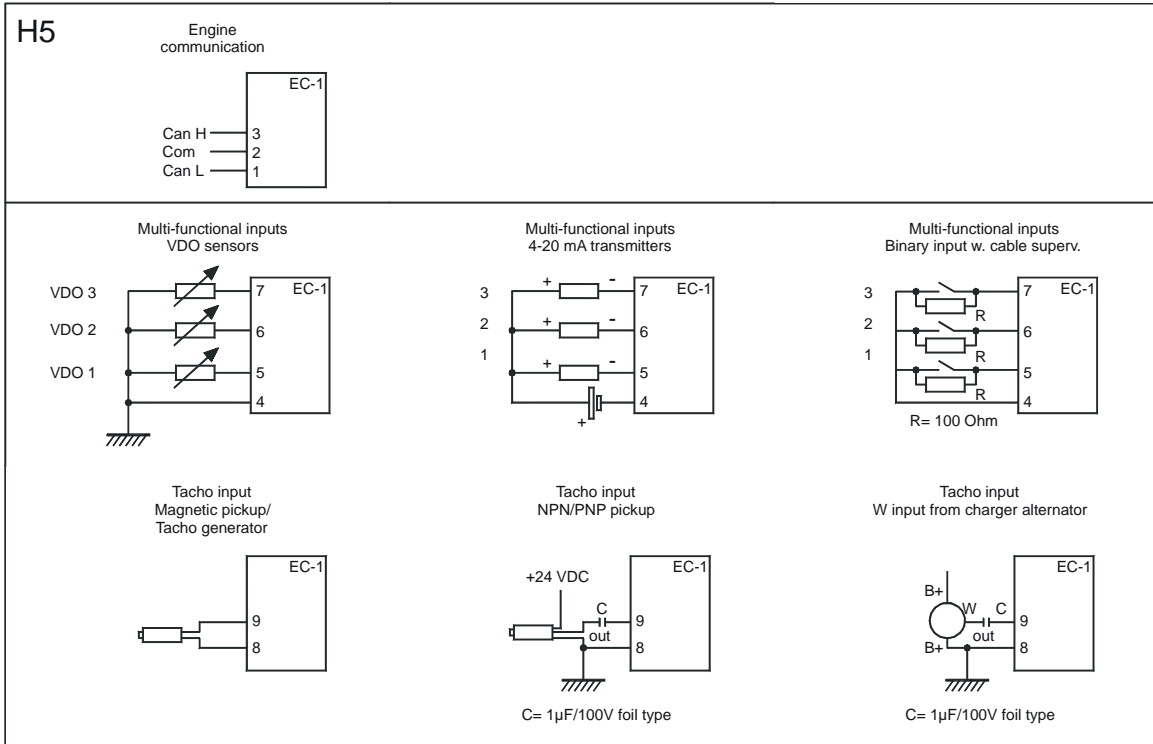
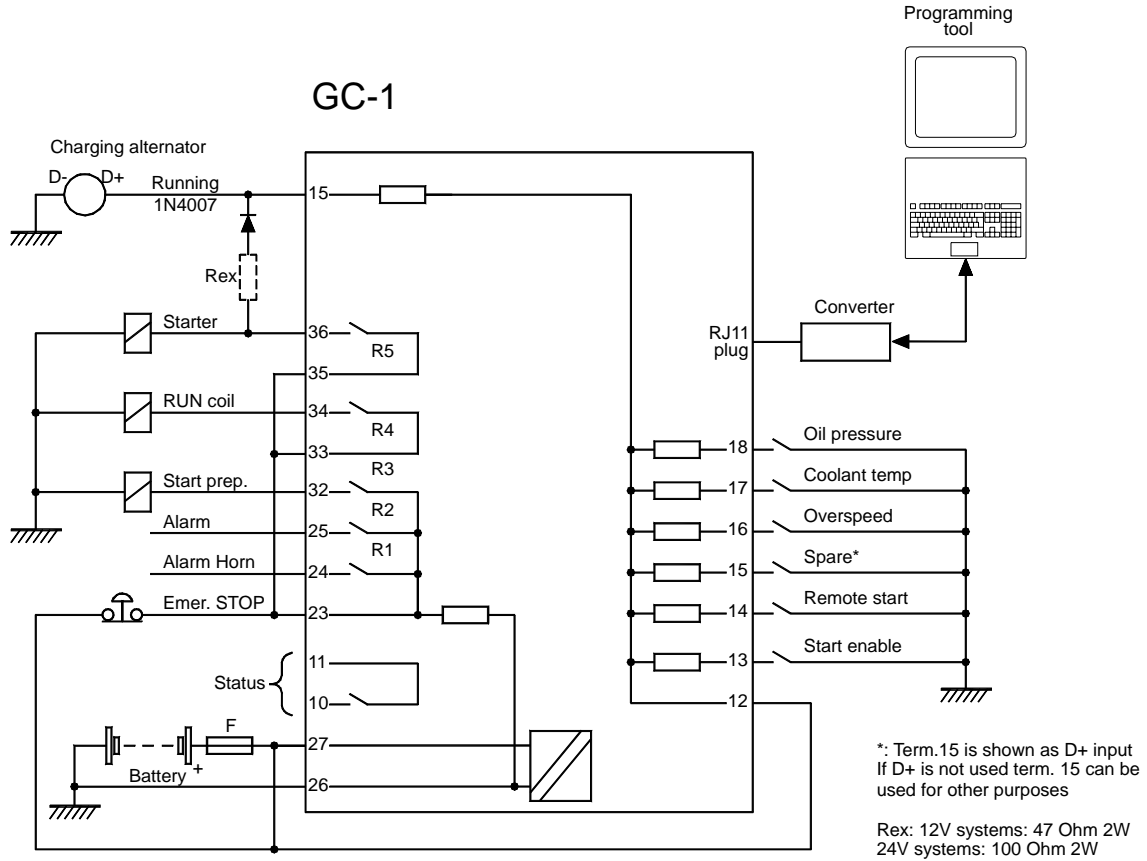
Option B3 display layout



Wiring, engine interface

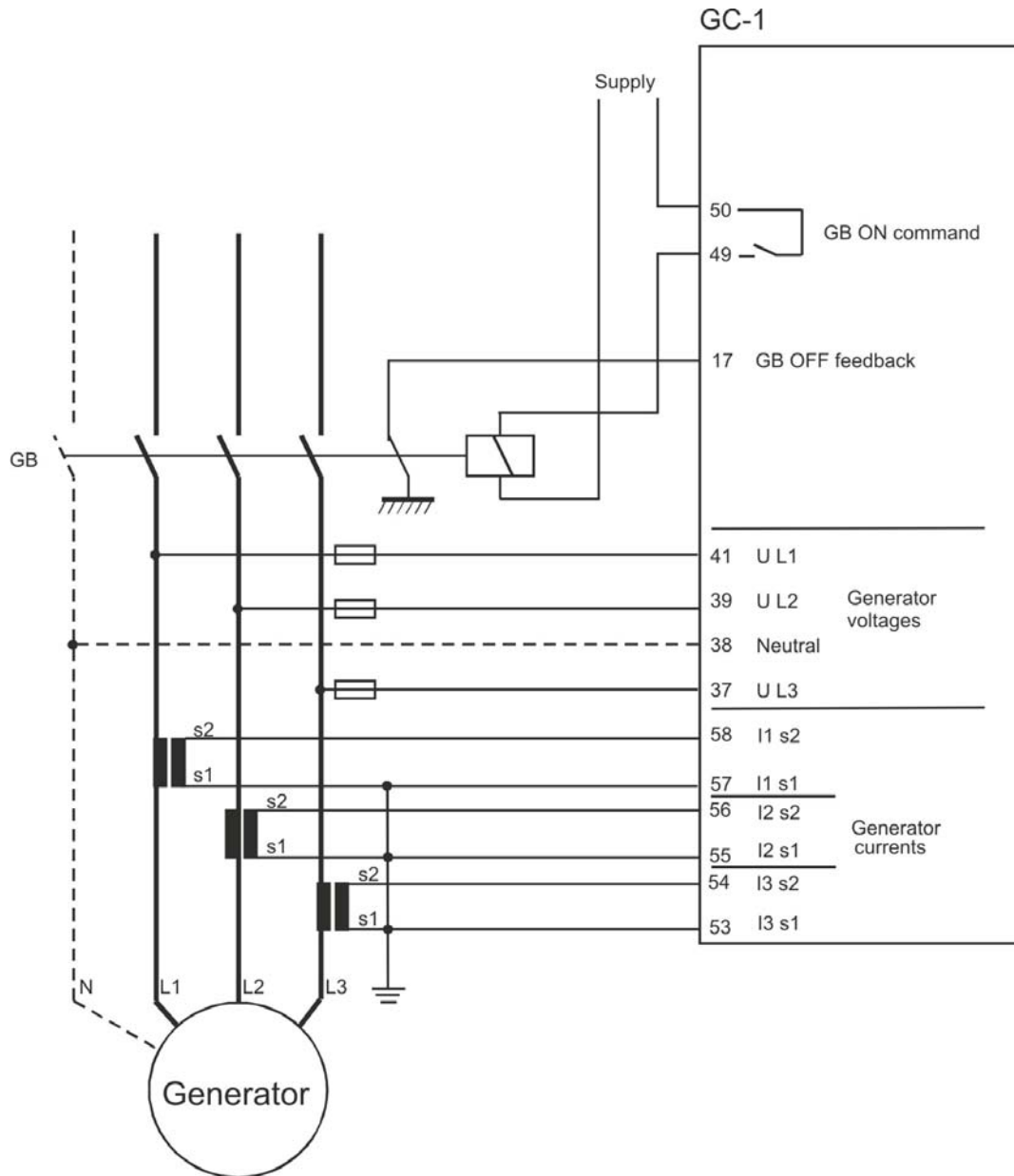


F: Fuse: 2A slow-blow.



Wiring, AC interface

Connection of the 3-phase voltage and current



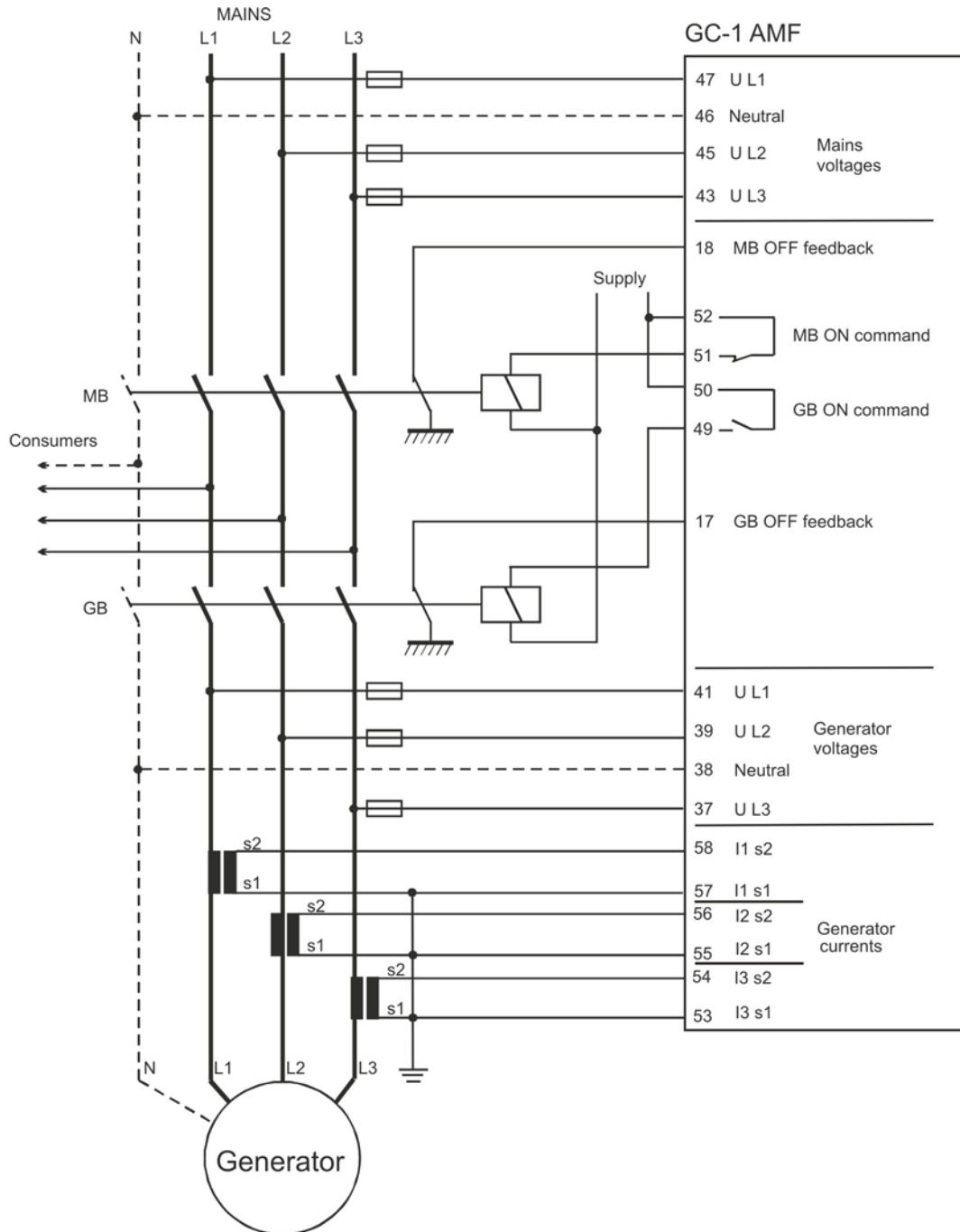
The AC current grounding can be made as required to s1 or s2.



GB: Use a contactor. The ON output from the GC-1 is a constant signal. Remember to use free-wheel diodes across the contactor coils, if DC voltage is used as supply for these.

Fuse for AC voltage: Max. 2A slow-blow.

Wiring, AMF (option B3)



The AC current grounding can be made as required to s1 or s2.



GB and MB: Use contactors. The ON outputs from the GC-1 AMF are constant signals. Remember to use free-wheel diodes across the contactor coils, if DC voltage is used as supply for these.

Fuse for AC voltage: Max. 2A slow-blow.

Technical specifications

Accuracy:	Class 2.0 to EN 60688/IEC 688
Operating temp.: (UL/cUL Listed:	-25...70°C (-13...158°F) Max. ambient temp. 40°C/104°F)
Storage temp.:	-40...70°C (-40...158°F)
Measuring input voltage: (UL/cUL Listed:	50...550V AC phase to phase 50...300V AC)
Load:	1.5 MΩ
Frequency:	30...70 Hz
Measuring input current:	1 or 5A AC from current transformer
Consumption max.:	0.3 VA/phase
Current overload: (UL/cUL Listed:	10A continuously, 20A, 5 sec. Use listed or R/C (XODW2.8 current transformers))
Pickup input voltage: Frequency:	0.5...70 V peak 10-10000 Hz
Aux. supply: (UL/cUL Listed:	6-36V DC continuously 12/24V DC) Max. 8 W consumption
Passive binary in voltage:	Bi-directional optocoupler 8...36V DC
Impedance:	4.7 kΩ
VDO inputs:	Resistor inputs, internal 4 V supply
Analogue input:	From active transducer
Current:	4...20 mA
Impedance:	50 Ω
Active binary in internal voltage:	Dry contact inputs (note 1) 4V DC supply, with cable supervision
Impedance:	240 Ω ~ 16 mA

Relay outputs:	5 relays: 30V DC/AC 2A (UL/cUL Listed: 30V DC 2A resistive) 2 relays: 30V DC/AC 8A (UL/cUL Listed: 30V DC 4A resistive) 1 status relay: 24V DC 1A (UL/cUL Listed: 24V DC 1A)
Mounting:	Panel mounted
Size:	78 x 106 mm (3.07" x 4.17")
Climate:	25...70°C to IEC 60068-2-1/2 97% RH to IEC 60068-2-30
Display:	122 x 32 pixel backlight STN
Safety:	To EN 61010-1, installation category (overvoltage category) III, 600 V, pollution degree 2
Protection:	Front: IP52 (IP54 with gasket, option L) Terminals: IP20 To IEC 529 and EN 60529
EMC/CE:	To EN 61000-6-1/2/3/4 SS4631503 (PL4) and IEC 255-3
Material:	All plastic materials are self-extinguishing according to UL94 (V1)
Plug connections:	AC voltage inputs: 3.5 mm ² multi-stranded AC current inputs: 4.5 mm ² multi-stranded Other: 1.5 mm ² multi-stranded
PC connection:	RS232 converter box (option J5)
Approval:	UL/cUL to UL 508
Weight:	Approx. 0.9 kg (1.9 lbs)
UL markings:	Wiring: Use 60/75°C copper conductors only AWG 30-12
Terminal tightening torque:	5-7 lb-in
Mounting:	For use on a flat surface of a type 1 enclosure
Installation:	To be installed in accordance with the NEC (US) or the CEC (Canada)

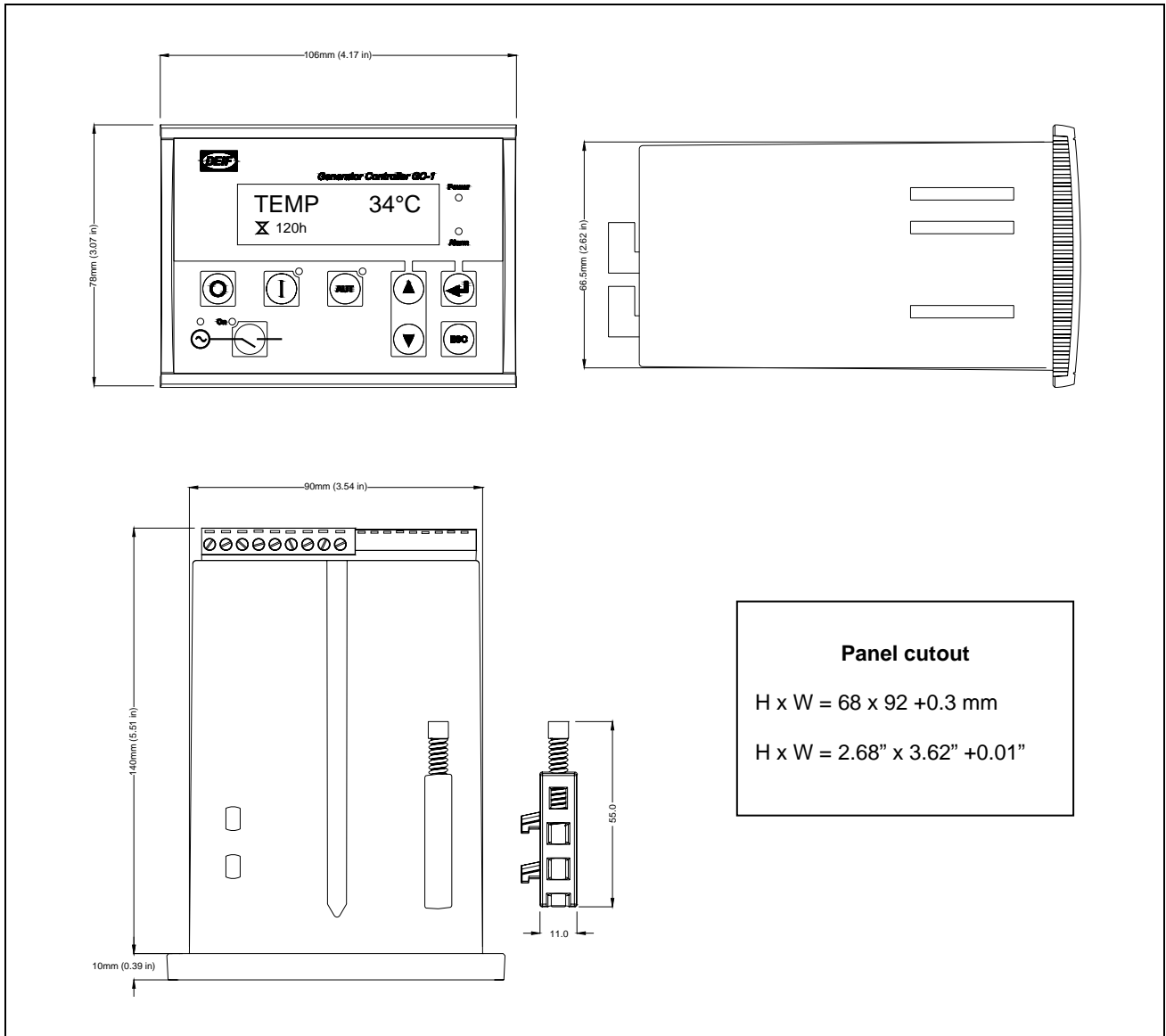


Only 3 inputs are available.

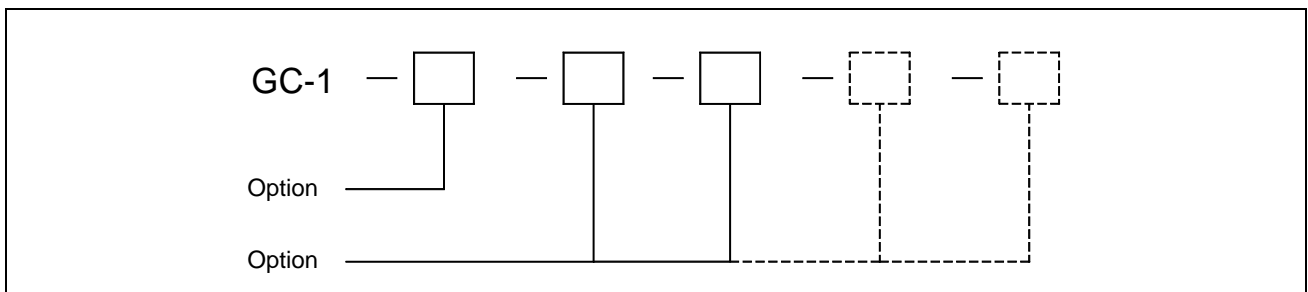


It is possible to combine VDO inputs with binary and 4...20 mA inputs in a mix.

Unit dimensions in mm (inches)



Order specifications

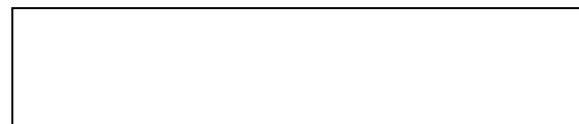


Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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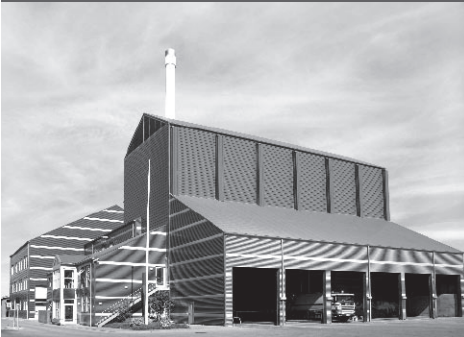




-power in control



DATA SHEET



Advanced Graphical Interface, AGI 107

- Graphic overview and touch screen control
- Compatible with DEIF controllers
- Easy programming
- Create macro commands
- Multi-language support
- IP65 protected



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Document no.: 4921240387A
SW version: 1.2

1. General information

1.1. Application and advantages.....3
1.1.1. Application.....3
1.1.2. Advantages.....3
1.1.3. Available models.....3

2. Technical information

2.1. Specifications.....4
2.1.1. Product data.....4
2.1.2. Unit dimensions.....6

3. Ordering information

3.1. How to order AGI 107.....7
3.1.1. Order specifications.....7
3.1.2. Disclaimer7

1. General information

1.1 Application and advantages

1.1.1 Application

DEIF's LCD Graphical Touch Controller, the AGI 107, can be connected to all types of multi-line controllers from DEIF. It provides you with a full graphical overview and touch screen control of the connected controllers. Using the included DEIF screen designer software, you can programme the connected controllers efficiently and intuitively directly on the touch screen.

Moreover, the powerful project manager workspace supports multiple applications.

1.1.2 Advantages

- Ample choice of communication drivers for industrial devices.
- Multiple driver communication capacity.
- Full vector graphic support with True Type fonts. Portrait mode operation.
- Display dynamic data in multiple formats: numerical, text, bar-graph, slider, gauge and graphic image formats.
- Multiple image formats supported: bitmap JPEG and dynamic GIF.
- Multiple objects properties with dynamic control, including visibility and position.
- Pop-up screens and windows.
- Data acquisition and trend presentations. Trend data can be transferred to a host computer.
- Multi-language applications with Unicode support. Up to 10 run-time languages are possible. Application text can be exported/imported for translation.
- Powerful script languages with easy-to use editor. Macro commands can be triggered by touch screen, events and timers.
- Alarms and historical alarm log. Alarm and event information can be printed or transferred to a host computer.
- Multiple level of password protection.
- Compatible with DEIF's Multi-line controllers and other DEIF/third party products with Modbus protocol.

1.1.3 Available models

AGI 107 (7")



2. Technical information

2.1 Specifications

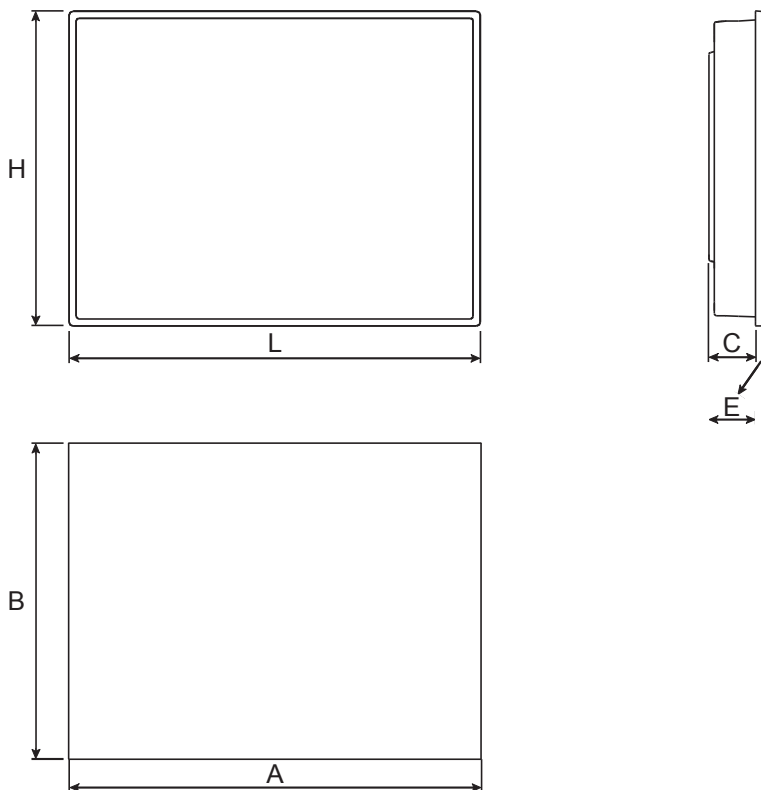
2.1.1 Product data

Description	Specification
Display	
Type	TFT
Resolution	800x480 pixels
Active display area	7" diagonal
Colours	65535
Backlight	LED
Dimming	Yes
Memory	
User memory	16MB flash
System memory	64MB
Battery back-up	128KB/1MB
Front panel	
Touch screen	4 wires, analogue resistive
Power on LED	Yes
Dimming	Adjustable
Front panel thickness	6 mm
Interfaces	
Serial	COM1: RS-232/422/485 (DB9 female) COM2: RS-232/422/485 (DB9 female and 5-pin plug)
Ethernet (RJ45)	10/100 baseT
USB	Yes, Host x 1
Functionality	
Vector graphics	Yes
Multiple drivers	Yes
Multi-language	10 online languages max.
Data acquisition and trends	Yes
Recipes	Yes
Alarms	Yes
Event list	Yes
Password	Yes

Description	Specification
Hardware RTC	Yes, with battery back-up
Screensaver	Yes
Buzzer	Yes, audible feedback for touch screen
Ratings	
Power supply voltage	24 VDC +/-17% (see DEIF's DBC-1 product range*)
Current consumption	0.4 A
Power consumption	25 W
Weight	0.66 kg
Net weight	1.0 kg
Battery	Rechargeable, not user-replaceable
Environmental conditions	
Operating temperature	0 to 50°C
Storage temperature	-20 to +60°C
Operating and storage humidity	10 to 95% RH at 40°C, non-condensing
Protection class	Front: IP65 Rear: IP20
Dimensions	
Faceplate LxH	185.5 mm (7.30") x 143 mm (5.62")
Cutout A+B	175 mm (6.89") x 133 mm (5.23")
Mounting depth C	36 mm (1.41")
Approvals	
CE FCC	Emission EN 6100-6-4 Immunity EN 61000-6-2 For installation in industrial environments

* To maintain a high level of quality, we recommend the use of DEIF battery chargers (DBC-1) and auxiliary products.

2.1.2 Unit dimensions



Model	A	B	C	E	H	L
AGI 107	175 mm (6.89")	133 mm (5.23")	36 mm (1.41")	6 mm (0.23")	143 mm (5.62")	185.5 mm (7.30")

Unit dimensions in mm (inches).

3. Ordering information


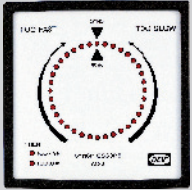
3.1 How to order AGI 107



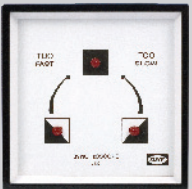
3.1.1 Order specifications


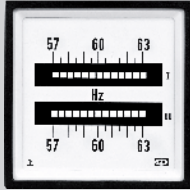

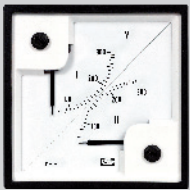

Product	DEIF order number
AGI 107	1241000001A

3.1.2 Disclaimer

DEIF A/S reserves the right to change any of the contents of this document without prior notice.

	LED Synchrosopes, RSQ-3 	Check Synchronising Relays, CSQ-3 	
Main function:	Electronic synchroscope.	Combined check synchronising relay and synchroscope.	
Size (mm):	Q96	Q96	
Customised scale:	✓	✓	
Exchangeable scale:	–	–	
Protection IP52:	✓	✓	
Protection IP54 on request:	–	–	
Mains voltage:	100...127V AC (115V AC) 220...240V AC (230V AC) 380...415V AC (400V AC) 440...480V AC (450V AC)	100...127V AC (115V AC) 220...240V AC (230V AC) 380...415V AC (400V AC) 440...480V AC (450V AC)	
Frequency range:	40...70Hz	40...70Hz	
Contact rating:	–	250V-8A-2000VA (AC) 24V-8A-200W (DC)	
Approved by classification societies:	–	✓	

	Phase Sequence Meters, PHQ 	Phase Sequence Relays, RMT-111Q96 	Lamp Synchrosopes, LSQ 
Main function:	PHQ is a solid state phase sequence meter provided with 2 glow discharge lamps for indication of correct or in-correct connection of the phases and phase breakage.	RMT-111Q96 is a phase sequence relay with contacts and is applied for check of the phase sequence. Provided with long-life LED indicators.	Lamp synchroscope for indication of phase sequence accordance between generator and bus-bar prior to connection.
Size (mm):	Q96	Q96 (flush mounting)	Q96, Q144
Customisable scale:	✓	✓	✓
Exchangeable scale:	–	–	–
Protection IP52:	✓	✓	✓
Protection IP54 on request:	✓	✓	–
Mains voltage:	380...440V AC	230V AC ±20% Max. 3W 400V AC ±20% Max. 3W	100-110 / 220-230-240 / 380-415-440V AC ±20%
Frequency range:	45...65Hz	47...63Hz	40...70Hz
Relay output:	–	Changeover switch	–
Approved by classification societies:	–	✓	–

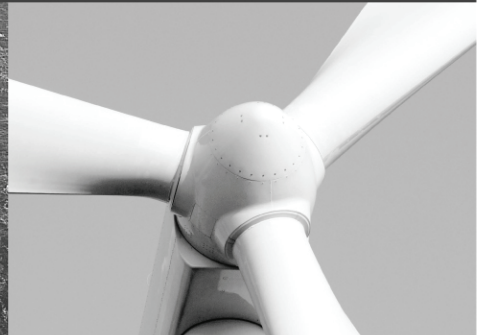
	Double Frequency Meters, 2FQ 	Double Frequency Meters, 2FTQ 	Zero Voltage Meters, NEQ 
Main function	Double pointer frequency meter, based on 2 moving coil instruments mounted diagonally. Accurate and linear read-out.	Double reed frequency meter with 2 rows of reeds.	Zero voltage meter for indication of voltage match between generator and bus-bar prior to connection.
Size (mm):	Q96	Q96, Q144	Q72, Q96
Pointer deflection:	90°	–	90°
Customised scale:	✓	✓	✓
Exchangeable scale:	–	–	–
Protection IP52:	✓	✓	✓
Protection IP54 on request:	–	✓	–
Accuracy class:	0.5	0.5	1.5 and 3.0
Scale / measuring range:	45...55 / 55...65 / 45...65Hz Others on request	47...53 / 45...55 / 57...63 / 55...65Hz	110-220 / 220-440 / 400-800V AC (1.5...4VA)
Measuring voltage:	100...230V AC ±15% 400...440V AC ±15%	100-110-220-230-240-380-400-415-440V AC ±15%	–
	Double Voltmeters, 2EVQ 	Double Voltmeters, 2EQ 	
Main function:	Double voltmeter based on 2 moving iron systems mounted diagonally.	Double voltmeter based on 2 independent moving iron systems with joint scale.	
Size (mm):	Q96	Q96	
Pointer deflection:	90°	90°	
Customised scale:	✓	✓	
Exchangeable scale:	–	–	
Protection IP52:	✓	✓	
Protection IP54 on request:	–	–	
Accuracy class:	1.5	1.5	
Scale / measuring range:	0...150 / 300 / 600V	0...150 / 250 / 500V	
Measuring frequency:	50 or 60Hz	50 or 60Hz	



-power in control



Electronic potentiometer EPQ96-2 DATA SHEET



Function

- Replaces normal motor potentiometers

Adjustment

- Integrating time (like variable gearboxes)
- Output start value
- Output end value
- Output value after power up
- Last value after power up

Extra functions included

- PWM output for speed control
- PWM output for speed droop settings
- J 1939 to analogue converter

Modes

- Manual/auto switch

Housing

- Flush mounting 96 x 96



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Document no.: 4921240364B

Technology

The EPQ96-2 is an electronic unit to replace normal motor potentiometers. It contains no movable parts and is thus maintenance-free. The EPQ96-2 is CE-marked for residential, commercial and light industry plus industrial environment.

Application/function

The EPQ96-2 converts the relay output from a PI controller to a control voltage/current or PWM signal as input for the electronic speed governor. In case of supply voltage drop-out, the potentiometer is automatically preset according to the adjusted preset value or preset to the value before supply drop-out after reconnection of the supply voltage. The output is based on a 20mA current generator shunted internally by means of a 500Ω resistor, resulting in the output signals shown below. The EPQ96-2 is equipped with two push-buttons on the front for settings between manual or auto mode.

Automatic control:

The speed is controlled by signals fed via relay contacts, e.g. by the DEIF synchroniser type FAS-113DG/115DG or the load sharing units type LSU-112DG/113DG/114DG.

Manual control:

The speed is controlled by activating two push-buttons on the front of the unit after the EPQ96-2 is set to manual mode.

Adjustments

Integrating time:

To be set within the range: 2.5...25s (set to "x1") or 12.5...125s (set to "x5") by means of a switch and a potentiometer "time" located on the rear.

Output:

To be set within the range: 0...±10V DC, 0...±20mA DC. ±10V is set by means of a jumper mounted on the terminals.

Start/end value: the start value and the end value can be adjusted inside the output span to any value between 20% span and up to 100% span by means of two potentiometers "min", "max" located on the rear of the unit.

Preset:

The output value after a reset or after a power-up can be adjusted by means of a potentiometer "preset" located on the rear to any value inside the selected output span.

Last:

By means of the switch on the rear, the start value after a power-up can be the output value just before a power-down, the actual output value is kept in memory and the output is reloaded after power-up.

Push-buttons

The EPQ96-2 has two push-buttons for selection of auto/man mode and two push-buttons for up/down control.

Indicators

The EPQ96-2 is equipped with two yellow LEDs located on the front. The LEDs are located in conjunction with the manual up and down push-buttons. The LEDs are on when the respective control inputs are active or if the push-buttons for up and down is activated in manual mode. When the output is integrated to max value, the respective LED is flashing.

The EPQ96-2 is also equipped with two yellow LEDs for indicating the auto or manual mode and a yellow LED flashing when a CAN telegram is received and one green LED for indication of power on. If the unit fails, this green LED is flashing one time per second, and the status relay is deactivated.

Inputs

The EPQ96-2 has input for preset, up, down. All inputs can be controlled by 18...32V DC as input.

Special input

The EPQ96-2 has a J1939 input (CAN). This input can convert a standard TSC1 telegram into an analogue or a PWM signal. This input is specially intended for interfacing our AGC 200 to an engine equipped with an analogue governor.

Digital Outputs

The EPQ96-2 has a relay output for indication of auto mode. The relay contact is closed in auto mode, configured ND, and a status relay output for indication of correct function. The status output is closed when the unit is working, configured NE. Besides this, the EPQ96-2 has also a built-in relay that will disconnect the electronic circuit and only keep the 500ohm shunt resistor connected to output terminals. This relay is deactivated if the supply voltage is interrupted or if the EPQ96-2 fails, this function will ensure local control of the engine.

Analogue outputs

The EPQ96-2 has one analogue output that can operate in the range -10...0...10V or -20...0...20mA; the output impedance is 500ohm. Besides this, the EPQ96-2 also has a PWM output giving a PWM signal of 0...6V 500Hz. This output is controlled in auto/manual mode similar to the analogue output. The EPQ96-2 also has a fixed PWM output giving a signal from 0...6V DC 500Hz. This output is set by means of a potentiometer "PWM duty", located on the rear.

Power up functions

The output after a power-up can be the adjusted preset value or the output value before a power-down (last mode).

The setting preset/last is done by means of a switch located on the rear. After a power-up, the EPQ96-2 will always automatically be set to auto.

Supply

The EPQ96-2 can be supplied from 9...31,2V DC. The unit will operate down to 5V.

Housing

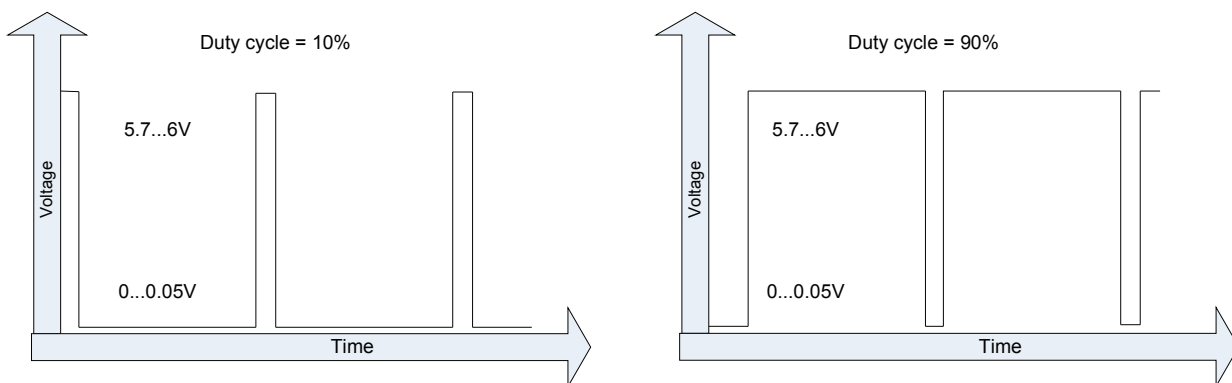
96 x 96 in front, cut-out 92 x 92.

PWM output

The EPQ96-2 has two PWM outputs for use together with e.g. a Caterpillar governor. Both outputs are a 500Hz 6V PWM signal. One output is proportional to the up/down control. The outputs are based on an open collector with a 1k pull-up resistor connected to an internal 6V DC supply. The below table shows the relationship between the analogue output and the PWM output.

Analogue output V	PWM output
-10V (-20mA)	0% Duty cycle
-8V (-16mA)	10%
-6V (-12mA)	20%
-4V (-8mA)	30%
-2V (-4mA)	40%
0V (0mA)	50%
2V (4mA)	60%
4V (8mA)	70%
6V (12mA)	80%
8V (16mA)	90%
10V (20mA)	100%

The other output is intended for adjusting the speed droop settings on e.g. a Caterpillar governor. The output is adjustable by means of a potentiometer, "PWM duty", located on the rear of the unit. The setting is only done once during commissioning. Note that the two PWM outputs are not galvanically separated, and they have a common terminal for the PWM return.

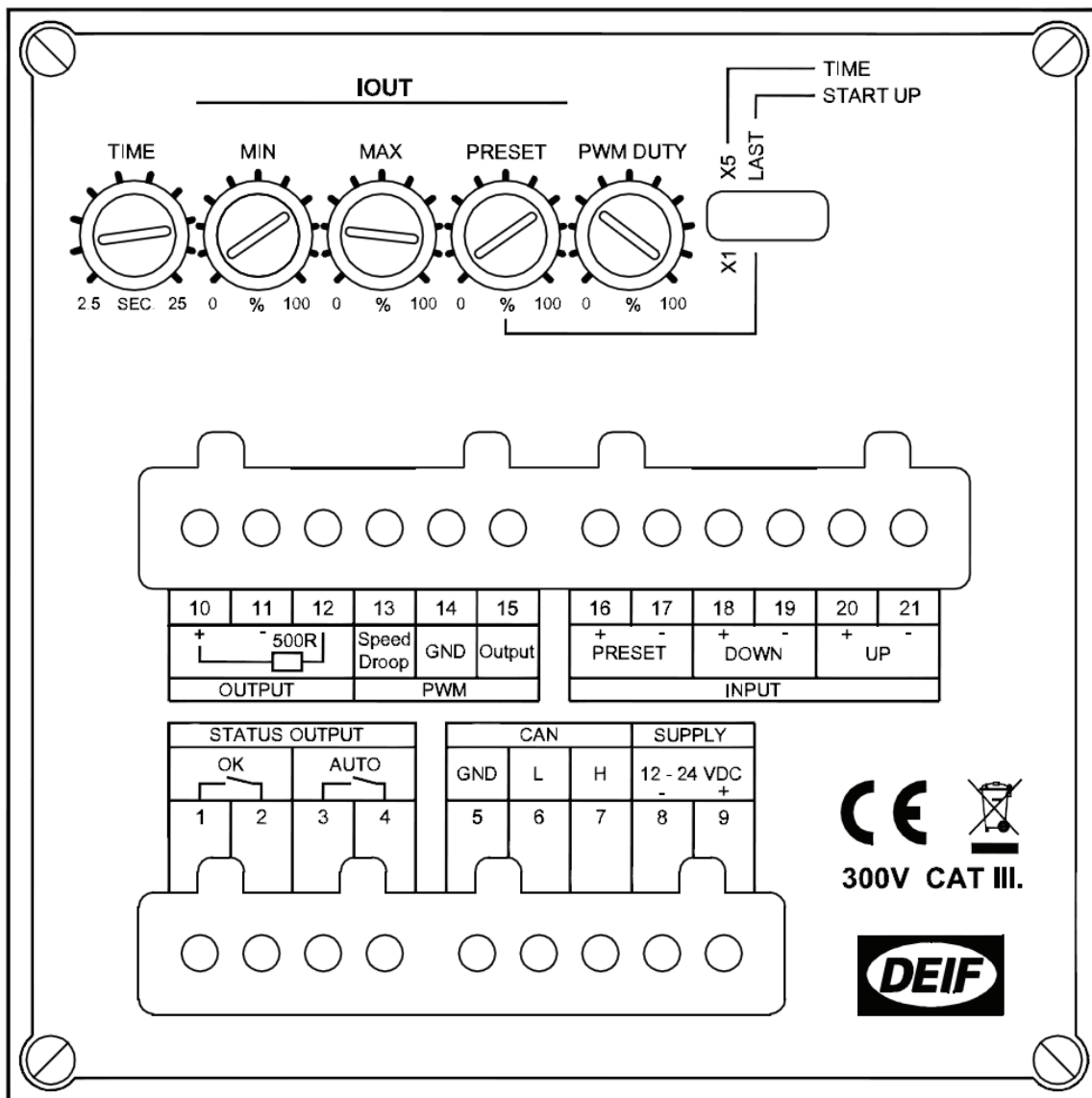


AGC 200 CAN Interface

If an AGC 200 has to be connected to an analogue governor, the EPQ96-2 can be used for converting the CAN telegram into an analogue voltage signal, current signal or a PWM signal. The EPQ96-2 will automatically recognise the CAN telegram and adjust the settings according to the nominal frequency set by the AGC 200.

When the EPQ96-2 detects a CAN telegram, the following mode will be activated:
 The "TIME" setpoint will internally be adjusted to minimum; this is done so that the integrating time is controlled from the AGC 200. The min settings and the max settings will be expanded to cover full scale, and the preset will be interrupted. The span, time and the preset value is now controlled entirely from the AGC 200. When the EPQ96-2 is set to manual mode, all the controls are reactivated. To control the engine the same way in auto mode as in manual mode, it is important that the settings done on the EPQ96-2 is identical to the settings done on the AGC 200, so that auto mode and manual mode become identical; e.g. if the span on the AGC 200 is set to cover the range 49...53Hz, preset is set to 50Hz and integrating time is set to 10s, it is recommended to adjust the min, max, preset and time values on the EPQ96-2 to cover approx. the same. These settings will then be activated when the EPQ96-2 is set to manual mode. If the EPQ96-2 is set to manual mode, the actual CAN value is kept into memory in the EPQ96-2 and reloaded when the EPQ96-2 is set back to auto mode.

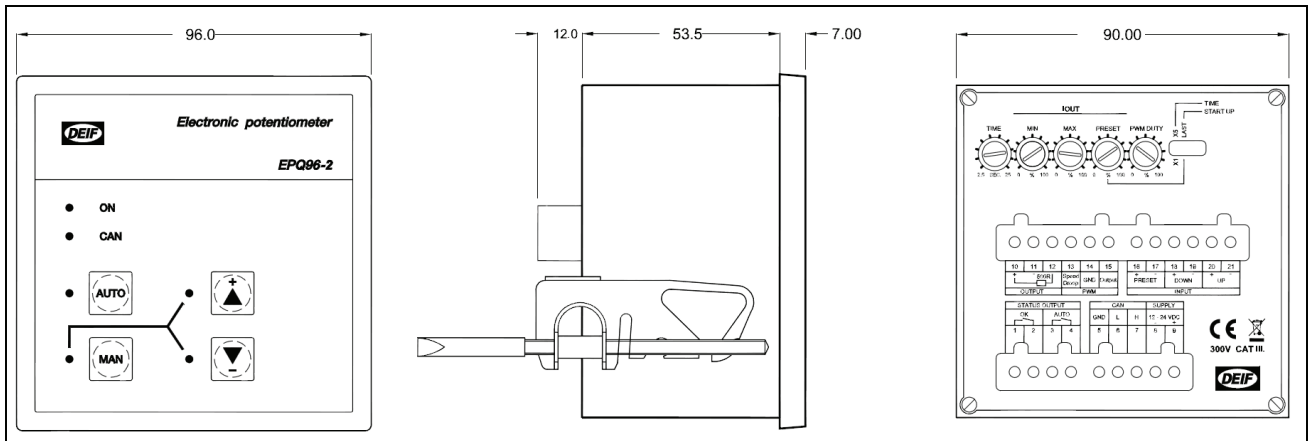
Terminals and settings



Technical specifications

Supply voltage	12...24V DC -25%/+30% (9...31.2V) Load dump protected according to IEC 7637-2
Output voltage	0...±10V DC Output impedance 500 Ω
Output current	0...±20mA DC R load max 500Ω
Start/End value adjustment	-/+ 10V or +/- 20mA, min span value is 10% e.g. 2V or 4mA (10% of 20V or 40mA)
Preset value adjustment	Between the start and end output value
Integrating time (2 ranges)	2.5...25s or 12.5...125s (linear ramp time from -10V to 10V or -20mA to 20mA) note 1
Accuracy of setpoint setting	±20% of potentiometer full scale
Resolution settings	10bit
Accuracy reproduction	±0,5%
Ripple	2.5mV RMS or 5uA RMS
Resolution	2.5mV or 5uA RMS (13bit)
Response time	<0.1s
PWM output	0...6V DC 500Hz ±50Hz
PWM output	Low level 0...0.05V; High level 5.7...6V
PWM resolution	10.000step (>13bit)
PWM response time	<0.1s
Input: preset, up, down	Voltage 9...31.2V DC current consumption 10mA at 24V, all inputs are mutually galvanically separated.
Output contact: auto/man	Auto mode equal to closed contact. Max load 30V AC/30V DC and 50mA
Output contact: status	OK mode equal to closed contact. Max load 30V AC/30V DC and 50mA
Temperature	-10...55°C (nominal), -25...70°C (operating), -40...70°C (storage)
Galvanic separation	Between supply voltage and remaining circuits: 500V - 50Hz - 1 min. and between status output and remaining circuits, and between CAN input and remaining circuits. None between input/output
Safety	300V Cat. III Pollution degree 2 according to IEC 61010-1
Climate:	IEC 60068-2-30
EMC:	To IEC 61000-6-1, 61000-6-2, 61000-6-3, 61000-6-4, 60255-22-1
Materials	Self-extinguishing plastic (polycarbonate), to UL94 (V0)
Terminals	Screw terminals: 2.5 mm ² (multi-stranded), 4 mm ² (single-stranded), CAN + status outputs 1 mm ² .
Protection	IP52 (panel front), IP20 (panel rear). To IEC and EN 60529
Note 1	The slope is independent of the adjusted span; e.g. if the integrating time is adjusted to 20s with a span of 0...10V, if the span is readjusted to e.g. 0...5V, the integrating time from 0...5V will now be 10s.

Unit dimensions in mm



Order specifications

Example: EPQ96-2



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Due to our continuous development we reserve the right to supply equipment which may vary from the described.

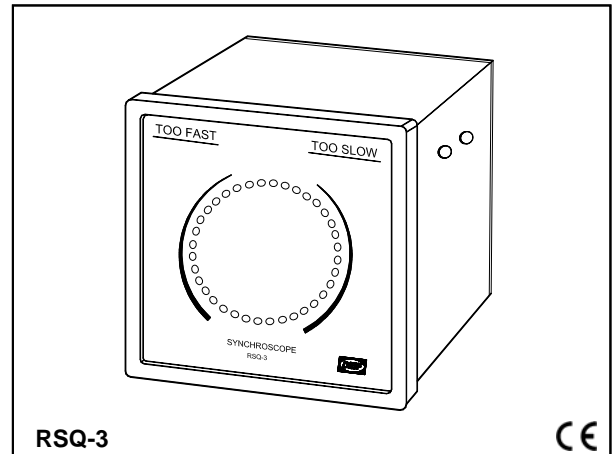


Type RSQ-3

- **Precision LED synchronoscope**
- **High immunity to harmonic distortion**

Read Synchronoscope

4921240265E



Application

The RSQ-3 is a microprocessor-based synchronising unit, providing visual indication of relevant values for synchronising a generator to a net (busbar). It can be used in any kind of installation where manual synchronising is required.

Measuring principle

The unit measures the busbar (U_{BUSBAR}) and generator (U_{GEN}) voltages and frequencies and compares these, plus compares the phase angle relationship.

Operation

The rotation of the red LED circle indicates the frequency difference. The faster the rotation, the larger the frequency difference. One rotation per second equals 1 Hz difference.

The position of the lit red LED indicates the phase difference between U_{GEN} and U_{BUSBAR} . The circle represents a degree scale from 0-360 degrees with zero degree at the 12 o'clock position. With 36 LEDs the resolution on the reading is 10 degrees.

If the frequency difference between U_{GEN} and U_{BUSBAR} is higher than 3 Hz, the rotation of the LED circle stops. If it stops with a lit red LED at 'TOO SLOW', the frequency of the U_{GEN} is lower than U_{BUSBAR} . If it stops with a lit red LED at 'TOO FAST', the frequency of the U_{GEN} is higher than U_{BUSBAR} .

Type RSQ-3

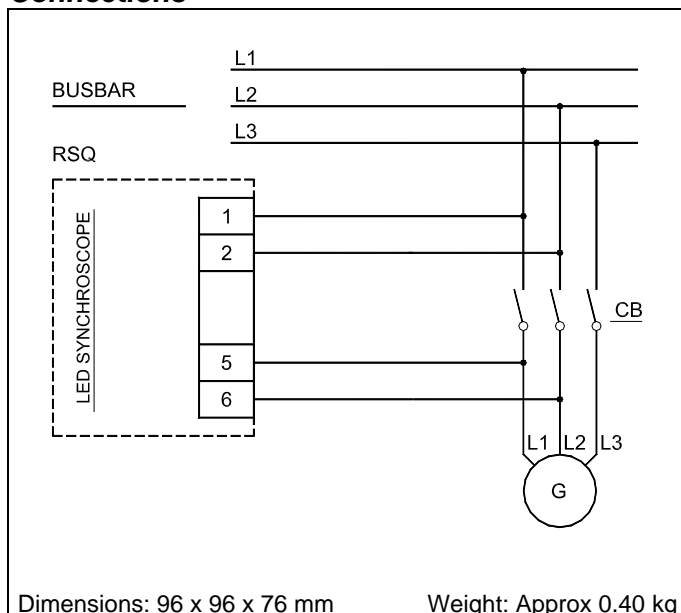
Technical specifications

Accuracy:	±2 electrical degrees
Resolution:	10 electrical degrees
Max. freq. difference:	No limit
Frequency range:	40...70 Hz (supply)
Temperature:	-25...70°C (operating)
Temperature drift:	Setpoints: Max. ±0.2% of full scale per 10°C
Shock test:	15 g – 6 times – 3 directions 50 g/6 ms 22 g/20 ms
Galvanic separation:	Between inputs and ground: 3750 V - 50 Hz - 1 min.
Input range (U_N):	100...127V AC ±20% 220...240V AC ±20% 380...415V AC ±20% 440...480V AC -20% (Above 450V AC: +10%)
Busbar input:	Load: 2 kΩ/V
Generator input:	(Max. 3.0 VA at nominal voltage) Supply for the unit
Max. input voltage:	1.2 x U _N , continuously Above 450 V: 1.1 x U _N , continuously 2 x U _N , for 10 sec.
Climate:	HSE, to DIN 40040
EMC:	CE marked according to EN 50081-1/2, EN 50082-1/2 and IEC 255-3
Safety:	To EN 61010-1. Installation cat. III, 600 V. Pollution degree 2
Connections:	Max. 2.5 mm ² (single-stranded) Max. 1.5 mm ² (multi-stranded)
Materials:	All plastic parts are self-extinguishing to UL94 (V0)
Protection:	Front: IP52. Terminals: IP20, to IEC 529 and EN 60529
Type approval:	For current approvals see www.deif.com or contact DEIF A/S
UL listing:	On request, the instrument can be delivered according to UL listing: UL508, E230690

Indication

LEDs	Light
TOO FAST	Red LED stopped. Frequency difference too high. GEN too high
TOO SLOW	Red LED stopped. Frequency difference too high. GEN too low

Connections



Order specifications

Type - Input voltage

Example: RSQ-3 - 230V AC
RSQ-3 - 230V AC UL listed

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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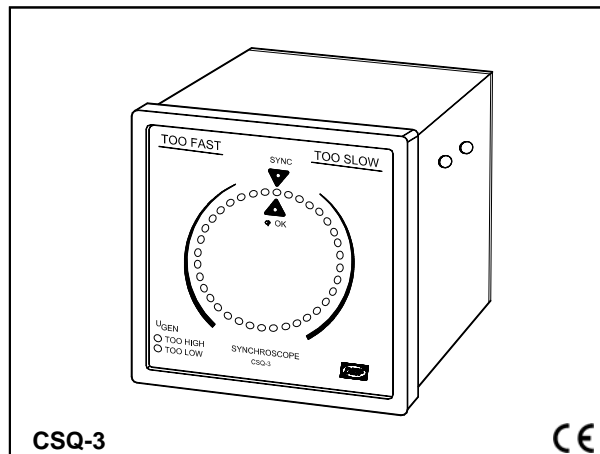


Check Synchronising Relay

4921240263G

Type CSQ-3

- **Multifunction precision LED synchronoscope**
- **Easy push-button programming of all setpoints**
- **Very high user safety**
- **High immunity to harmonic distortion**
- **Dead-bus functionality**
- **Version for marine applications**



Application

The CSQ-3 is a microprocessor based synchronising unit. It can be used in any kind of installation where manual or semi-automatic synchronising is required.

Versions

Two versions optimised for land or marine applications exist.

Measuring principle

The unit measures the busbar (U_{BUSBAR}) and generator (U_{GEN}) voltages and frequencies and compares these, plus compares the phase angle relationship.

Settings

The unit is equipped with several user settings, hidden under the front foil. This placement gives a high degree of user safety because no hazardous voltages are present, i.e. the unit can be programmed while running without the risk of electric shock or damage to installations.

Phase window, $\Delta\varphi$

Here the phase window for synchronisation is chosen. It can be set both symmetrically and asymmetrically.

Voltage difference, ΔU

Here the allowed voltage difference between U_{GEN} and U_{BUSBAR} is set. It can be set both symmetrically and asymmetrically. Measurement is done relatively to U_{BUSBAR} .

Length of SYNC pulse, T_R

Determines the length of the SYNC pulse (SYNC relay activating time). This value must be matched to the time characteristic of the circuit breaker.

SYNC relay delay, T_d

Determines the time U_{GEN} and U_{BUSBAR} have to be within the phase window before the SYNC relay is activated. This parameter can only be adjusted when $T_R = \infty$ is selected.

Dead-bus function/offset voltage, T_R

The allowed noise level voltage on U_{BUSBAR} can be set to determine dead-bus mode. It is measured relatively to U_{GEN} .

Factory settings

All the above mentioned settings are preset from the factory. At any time, these factory defaults can be restored.

Sealing of settings

If necessary, the settings can be sealed when the wanted functionality is obtained. This is very easy because of the placement under the front foil/cover.

Operation

The rotation of the red LED circle indicates the frequency difference. The faster the rotation, the larger the frequency difference. One rotation per second equals 1 Hz difference. The position of the lit red LED indicates the phase difference between U_{GEN} and U_{BUSBAR} . The circle represents a degree-

scale from 0-360 degrees with zero degree at the 12 o'clock position. With 36 LEDs the resolution on the reading is 10 degrees.

If the frequency difference between U_{GEN} and U_{BUSBAR} is higher than 3 Hz, the rotation of the LED circle stops. If it stops with a lit red LED at "TOO SLOW", the frequency of the U_{GEN} is lower than U_{BUSBAR} . If it stops with a lit red LED at "TOO FAST", the frequency of the U_{GEN} is higher than U_{BUSBAR} .

When the phase angle between U_{GEN} and U_{BUSBAR} is within the preset $\Delta\varphi$ window, then the yellow LED " $\Delta\varphi$ OK" will be lit. If the voltage difference between U_{GEN} and U_{BUSBAR} is outside the preset ΔU range, one of the two red LEDs will be lit and the SYNC relay cannot be activated. If the voltage on U_{GEN} is higher than U_{BUSBAR} , LED " U_{GEN} TOO HIGH" will be lit. If the voltage on U_{GEN} is lower than U_{BUSBAR} , LED " U_{GEN} TOO LOW" will be lit.

If both the " U_{GEN} TOO LOW" and " U_{GEN} TOO HIGH" LEDs are lit simultaneously, it indicates an overvoltage error at the input.

Normal synchronising

The unit automatically calculates the synchronising parameters to check if there is the required space for the synchronising signal inside the preset phase window. These calculations compare the frequency difference with T_R and the size of the phase window. When T_R is set to ∞ , T_d can be set by the user and is included in the calculations.

If the $\Delta\varphi$ window is set symmetrically, both underfrequency synchronising and overfrequency synchronising is possible.

Under- or overfrequency synchronising

When the $\Delta\varphi$ window is set asymmetrically, the following functionality is possible:

If the $\Delta\varphi$ window is set asymmetrically with a lower positive than negative $\Delta\varphi$ value, only synchronising with the generator input at higher frequency than the busbar input is possible (positive slip frequency).

If the $\Delta\varphi$ window is set asymmetrically with a higher positive than negative $\Delta\varphi$ value, only synchronising with the generator input at lower frequency than the busbar input is possible (negative slip frequency).

Dead-bus function

When activated, the dead-bus function enables the SYNC relay to be activated, when no busbar voltage is present (i.e. during a power failure). When the generator voltage is within 80% of nominal level and the busbar voltage is under the preset busbar offset level, the SYNC relay will be activated, regardless of all other parameters. When the voltage on the busbar has been restored, the CSQ-3 will remain in the dead-bus function for a period of 5 seconds.

Therefore, be careful when using this feature!

Type CSQ-3

Technical specifications

Accuracy:	±2 electrical degrees
Resolution:	10 electrical degrees
Max. freq. difference:	No limit
Frequency range:	40...70 Hz (supply)
SYNC output:	1 SPST-NO-contact
Relay contact ratings: (Gold plate silver alloy)	AC1: 8A, 250V AC DC1: 8A, 24V DC AC15: 3A, 250V AC DC13: 3A, 24V DC
Mechanical life:	2 x 10 ⁷
Electrical life:	1 x 10 ⁵ (nominal value)
Optocoupler output:	(Only on marine version) System status off = failure 2 wires AWG 20 (red/black) 30 mm length Max. 40 V, 10 mA
Temperature:	-25...70°C (operating)
Temperature drift:	Setpoints: Max. ±0.2% of full scale per 10°C
Shock test:	15 g – 6 times – 3 directions 50 g/6 ms 22 g/20 ms
Galvanic separation:	Between inputs, output and ground: 3750 V - 50 Hz - 1 min
Input range (U_N):	100...127V AC ±20% 220...240V AC ±20% 380...415V AC ±20% 440...480V AC -20% (Above 450V AC: +10%)
Busbar input:	Load: 2 kΩ/V
Generator input:	(Max. 2 VA at nominal voltage) Supply for the unit
Max. input voltage:	1.2 x U _N , continuously Above 450 V: 1.1 x U _N , continuously 2 x U _N , for 10 sec.
Climate:	HSE, to DIN 40040
EMC:	CE marked according to EN 50081-1/2, EN 50082-1/2 and IEC 255-3
Safety:	To EN 61010-1. Installation cat. III, 600 V. Pollution degree 2
Connections:	Max. 2.5 mm ² (single-stranded) Max. 1.5 mm ² (multi-stranded)
Materials:	All plastic parts are self-extinguishing to UL94 (V0)
Protection:	Front: IP52. Terminals: IP20, to IEC 529 and EN 60529
Type approval:	For current approvals see www.deif.com or contact DEIF A/S
UL listing:	On request, the instrument can be delivered according to UL listing: UL508, E230690

Settings

Setting of	Range
Δφ Phase difference	±5...20° in 1° step or ±10...40° in 2° step
ΔU Voltage difference	±1...10% in 1% step
T _R Length of SYNC pulse	0...1 sec. in 0.1 sec. step or ∞
T _d SYNC relay delay	0...1 sec. in 0.1 sec. step
U _{OFFSET} Dead-bus offset voltage	Off or 4 levels of noise suppression

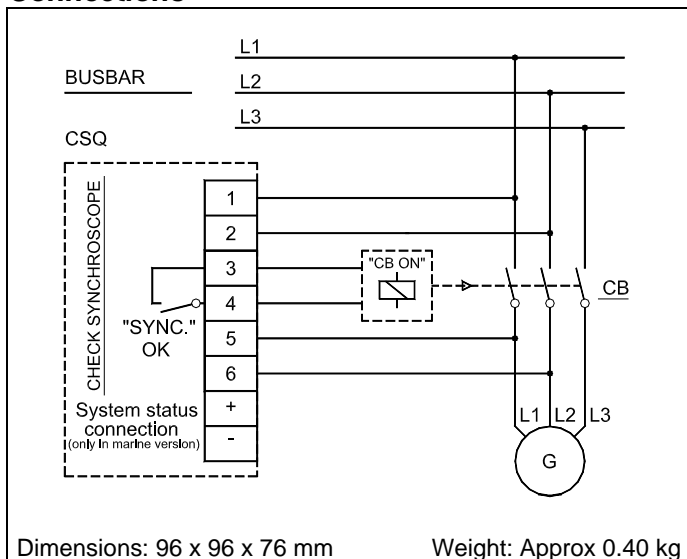
Indication

LEDs	Light
SYNC	Green, when the SYNC relay is activated
Δφ OK	Yellow, when inside the phase window
TOO FAST	Red LED stopped. Frequency difference too high. GEN too high
TOO SLOW	Red LED stopped. Frequency difference too high. GEN too low
U _G TOO LOW	Red, when outside the ΔU level
U _G TOO HIGH	Red, when outside the ΔU level
U _G TOO LOW U _G TOO HIGH	When both are red simultaneously, there is an overvoltage error on the input

Once the relay has been mounted and adjusted, the front cover may be sealed to prevent unwanted change of the setting.

For more information about the product, a User's manual (document no. 4189340263) is available at www.deif.com.

Connections



Order specifications

Type - Input voltage - Version		
Example: CSQ-3	230V AC	Land
CSQ-3	230V AC	Marine
CSQ-3	230V AC	Land UL listed

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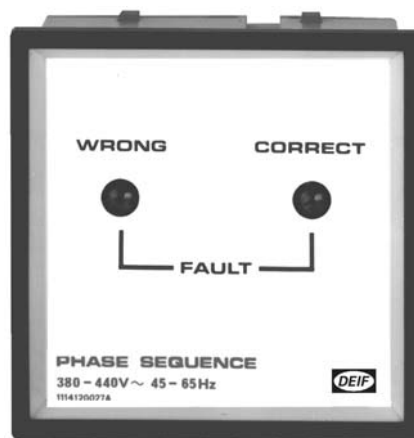
-power in control-



Phase sequence indicators

Type PHQ

4921240014D



- *Continuous operation*
- *Clear indication of incorrect connection*
- *Clear indication of phase breakage*
- *Q96 housing*

Construction

PHQ96 is a solid state phase sequence meter provided with 2 glow discharge lamps for indication of correct and incorrect connection of the phases plus phase breakage.

The meter is CE classified for residential, commercial and light industry plus industrial environment, and is housed in a standard housing, 96 x 96 mm, to DIN 43700.

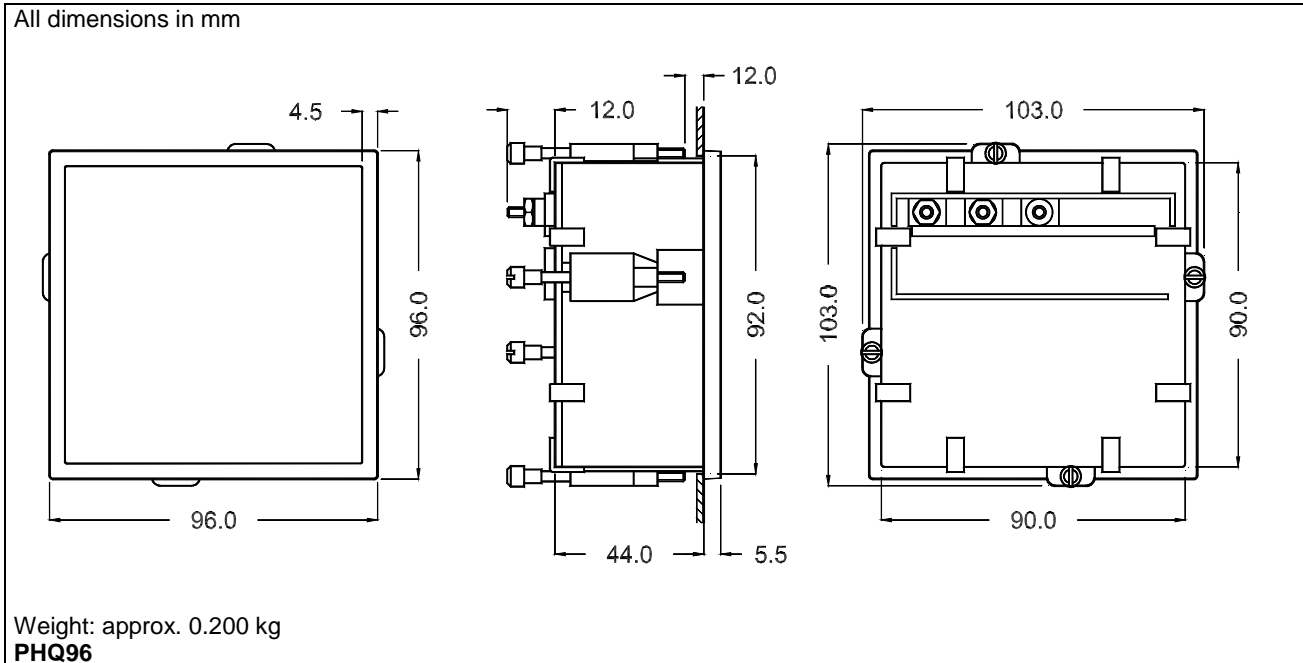
Indication

Lamp marked "CORRECT" lit:	On correct connection of the phases
Lamp marked "WRONG" lit:	On wrong connection of the phases
Both lamps lit:	On phase breakage

Technical specifications

Measuring voltage:	380-440V AC $\pm 20\%$.
Frequency range:	45...65Hz.
Temperature:	-10...55°C (nominal), -25...60°C (operating), -25...65°C (storage).
Climate:	Class HUE, to DIN 40040.
EMC:	To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-22-1 (class 3).
Materials:	Self-extinguishing plastic material, to UL94 (V0).
Connections:	3 terminals on the rear, marked "R" - "S" - "T".
Protection:	IP52 from front terminals IP00, to IEC 529 and EN 60529. IP54 from front on request.

Dimensions



Order specifications

Type

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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Type RMT-111Q96

- **With changeover switch**
- **Clear indication of incorrect connection**
- **Clear indication of phase breakage**
- **Long-life LED indicators**
- **Continuous operation**
- **Q96 housing for flush mounting**

Application

The phase sequence relay with relay contacts type RMT-111Q96 is applied for check of the phase sequence of a power plant.

The 400V AC version of the RMT-111Q96 is type approved by GL, LR and DNV.

A check of the phase sequence is especially required when connecting equipment to a new voltage source, e.g. when changing from the mains supply of a vessel to the mains at a harbour.

The indicator may furthermore be applied for alarm indication on phase breakage.

The RMT-111Q96 is equipped with 2 LEDs on the front for indication of the phase condition.

Measuring principle

The RMT-111Q96 is connected to all 3 phases of a 3 phase system and registrates the direction of the phase rotation.

If the phase sequence of the supervised power source is correct (L1 - L2 - L3), the LED marked "CORRECT" is lit, and the relay is energised.

If the phase sequence of the supervised power source is incorrect, i.e. the phase sequence is reversed (L1 - L3 - L2), the LED marked "REVERSED" is lit, and the relay is de-energised.

Should a phase breakage occur, both LEDs will be lit for clear indication of the fault condition, and the relay is de-energised.

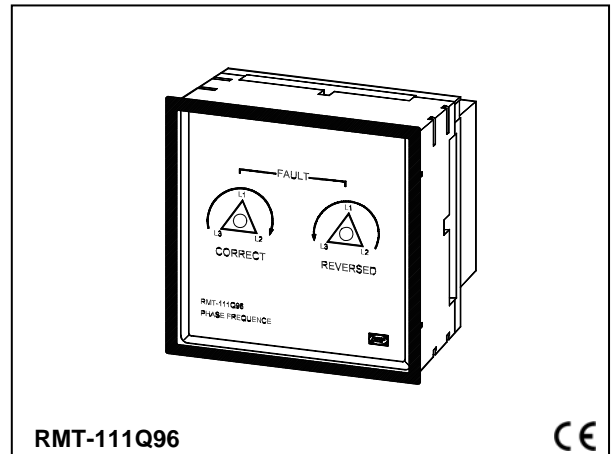
Relay contacts

The RMT-111Q96 is provided with a changeover switch:

Terminals 1-2 closed:	Shore connection OK (relay energised)
Terminals 2-3 closed.	Shore connection not OK (relay de-energised)

Phase sequence relays Generator controls

4921240131F



Technical specifications

Meas. voltage: 230V AC $\pm 20\%$ or
400V AC $\pm 20\%$

Consumption: Max. 3W.

Frequency range: 47...63Hz.

Relay output: Changeover switch.

Contact ratings: 250V-6A-1500VA (AC)
24V - 6A - 150W (DC)

Contact voltage: Max. 250V (AC).

General technical specifications

Temperature: -10...55°C (nominal)
-25...60°C (operating)
-25...65°C (storage)

Shock test: 15g – 6 times – 3 directions
50g/6ms
22g/20ms

Climate: HUE, to DIN 40040.

EMC: To EN 50081-1/2, EN 50082-1/2,
SS4361503 (PL4) and IEC 255-3.

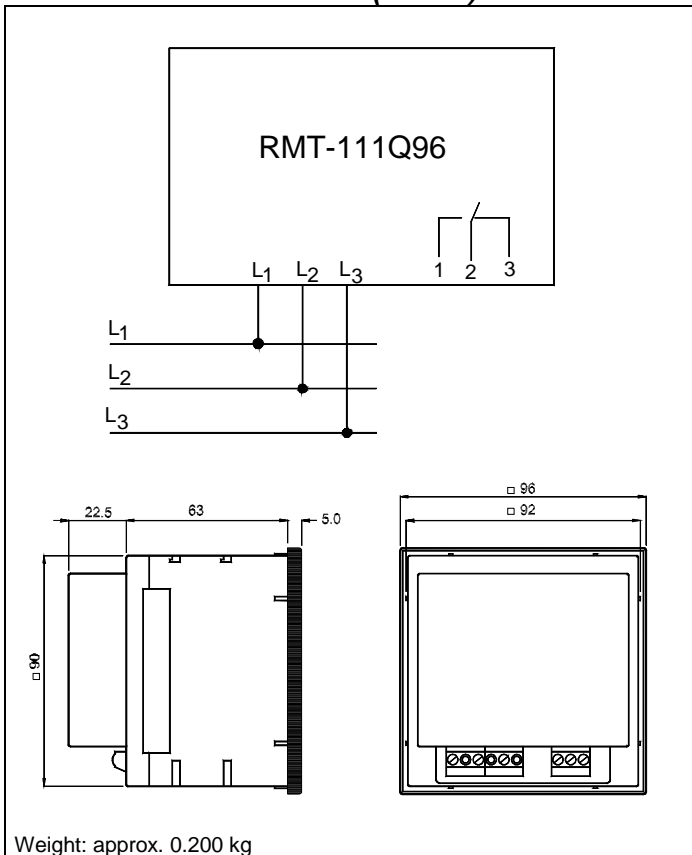
Connections: Max. 4 mm² (single-stranded)
Max. 2.5 mm² (multi-stranded)

Materials: All plastic parts are self-extinguishing to UL94 (VO).

Protection: Case: IP53. Terminals: IP20,
to IEC 529 and EN 60529.

Type RMT-111Q96

Connections/dimensions (in mm)



Order specifications

Type – Measuring Voltage

Example: RMT-111Q96 – 400V AC

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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power in control

Lamp synchrosopes

Type LSQ

4921240073D



- *For indication of phase and voltage accordance*
- *Robust, 3 lamp synchroscope*
- *DIN standard sizes: Q96 and Q144*

Available types

Type	LSQ96	LSQ144
Size	96 x 96 mm	144 x 144 mm

Application/function

The lamp synchroscope is applied for indication of phase and voltage accordance between generator and busbar. The LSQ is CE marked for residential, commercial and light industry plus industrial environment.

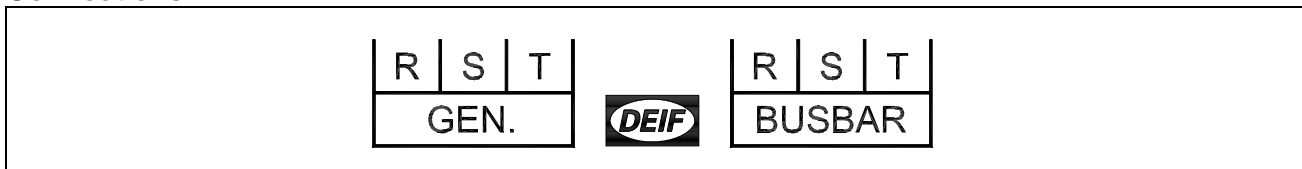
The synchroscope is equipped with 3 LEDs and is housed in a DIN standard case.

The LEDs are lit in turn if all phase voltages are present. When the phases and voltages of the generator are in accordance with those of the bus bar, the top LED is switched off, while the two others are lit with half intensity.

Technical specifications

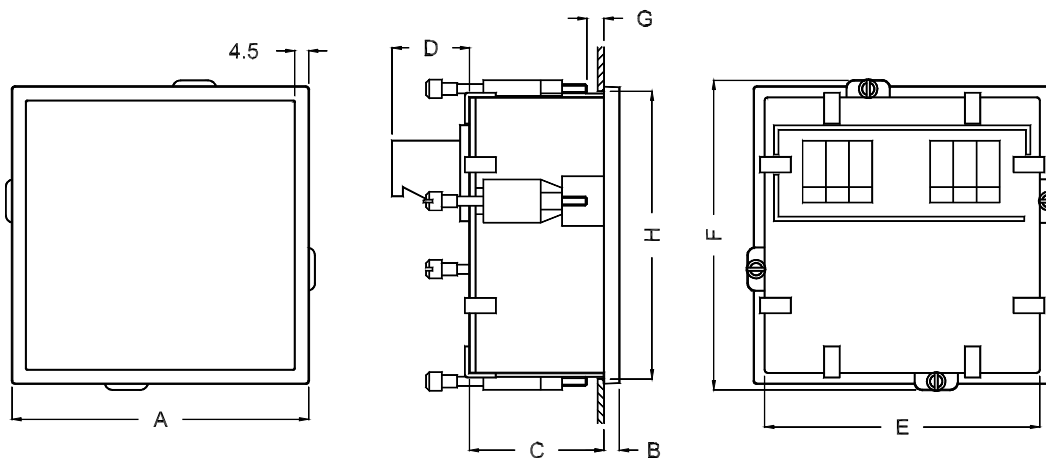
Measuring voltage:	100-110V AC, 220-230-240V AC, 380-415-440V AC \pm 20%
Frequency range:	40...70Hz
Temperature:	-10...55°C (nominal) -25...60°C (operating) -25...65°C (storage)
Shock test:	15g – 6 times – 3 directions, 50g/6ms, 22g/20ms
Measuring current:	0...4mA per phase between V_{GEN} and V_{BB}
Galvanic separation:	None
EMC:	To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-4 (class 3)
Materials:	All plastic materials are self-extinguishing to UL94 (V0)
Connections:	Max. 2.5 mm ² (multi-stranded). Max. 4 mm ² (single-stranded)
Protection:	Front: IP52, terminals: IP20, to EN 60529 and IEC 529

Connections



Dimensions

All dimensions in mm



LSQ

Type	A	B	C	D	E	F	G	H	Weight (kg)
LSQ96	96 x 96	5.5	44	21.5	91 x 91	103	12	92 x 92 +0.8	Approx. 0.300
LSQ144	144 x 144	8.0	46	20.5	137 x 137	150	15	138 x 138+1.8	Approx. 0.550

Order specifications

Example:	Type LSQ96	Measuring voltage 380-415-440V AC
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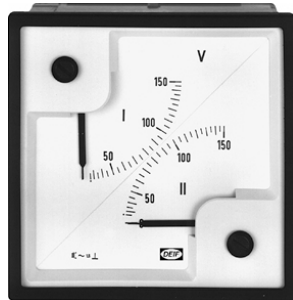
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Double frequency meters and double voltmeters

Types 2FQ, 2FTQ, 2EVQ, 2EQ

4921240005K



2EVQ



2FTQ



2FQ



2EQ

- *Robust and thoroughly tested construction*
- *DIN size design*
- *High accuracy*
- *High immunity to 3rd harmonics*

Available types

Type	Double frequency meters		Double voltmeters	
	Pointer frequency	Reed frequency	Double scale	Joint scale
96 x 96 mm 144 x 144 mm	2FQ96-x	2FTQ96-x 2FTQ144-x	2EVQ96-x	2EQ96/2

Construction

2FQ Double pointer frequency meter, consisting of two moving coil instruments mounted diagonally in one housing. A compact instrument with accurate and linear read-out.

2FTQ Double reed frequency meter with two rows of reeds mounted in one housing. Exchangeable scale.

2EVQ Double voltmeter consisting of two moving iron systems mounted diagonally in one housing.

2EQ Double voltmeter consisting of two mutually independent moving iron systems with a joint scale. Point of rotation of pointer for both systems at lower right corner.

Technical specifications

Type	2FQ	2FTQ	2EVQ ³⁾	2EQ ⁴⁾
Accuracy ¹⁾	Class 0.5	Class 0.5	Class 1.5	
Scale/meas. range	45...55/55...65/45...65 Hz 360...440 Hz (others on request)	47...53/45...55/57...63/55...65 Hz	0...150/300/ 500/600 V	0...150/250/ 500/ 600 V
Measuring voltage/ frequency	100...230V AC $\pm 15\%$ 400...440V AC $\pm 15\%$	100-110-220-230-240-380- 400-415-440V AC $\pm 15\%$	Frequency: 15...100 Hz	
Consumption	3...9 mA	10...15 mA	1.5...4 VA	5 VA
Temperature	-10...55°C (nominal) -25...60°C (operating) -25...65°C (storage)			
Shock test	15 g – 6 times – 3 directions, 50 g/6 ms, 22 g/20 ms			15 g – 6 times – 3 directions
EMC	To IEC/EN 61000-6-2/3 CE-marked for residential, commercial and light industry plus industrial environment			
Protection	IP52	IP52 ²⁾	IP52	IP52

¹⁾ (-10...15...30...55°C) to IEC/EN 60051-1

³⁾ Cat. III 600 V

²⁾ IP54 from front with gasket

⁴⁾ Cat. III 300 V

Further technical specifications: See data sheet no. 4921210012

Dimensions

All dimensions in mm

2FQ/2FTQ/2EVQ 2FTQ and 2EVQ: Connecting screw is positioned under the cover

All dimensions in mm

2EQ Connecting screw is positioned under the cover

Connections

Generator Mains

Type	A (mm)	B (mm)	C (mm)	D (mm)	Depth behind panel	Weight (approx. kg)
2FQ96-x	96 x 96	90 x 90	5.5	92 x 92 +0.8	85.5 mm	0.310
2EQ96/2	96 x 96	91 x 91	5.5	92 x 92 +0.8	97 mm	0.400
2FTQ96-x/2EVQ96-x	96 x 96	90 x 90	5.5	92 x 92 +0.8	63 mm	0.440/0.260
2FTQ144-x	144 x 144	136 x 136	8.0	138 x 138 +1.0	63 mm	0.780

Order specifications (Examples)

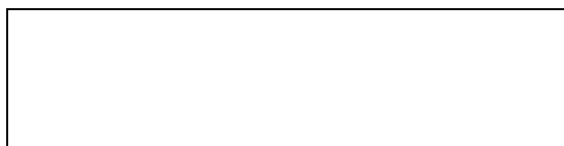
Type	Scale/measuring range	Measuring voltage
2FQ	2 x 45...55 Hz	230V AC
2FTQ	2 x 55...65 Hz	380V AC
2EVQ/2EQ (direct connection)	2 x 0...500V AC	0...500V AC
2EVQ/2EQ (with voltage transformer)	2 x 0...15 kV	12 kV/110V AC

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Zero voltage meters

Type NEQ

4921210049D



- *Simple and thoroughly tested synchronisation supervision*
- *Easily read scale*
- *DIN standard sizes: Q72 and Q96*

Construction and application

The zero voltage meter type NEQ is a moving iron instrument calibrated to full scale deflection at twice the nominal mains voltage, whereas 2/3 deflection corresponds to nominal mains voltage.

Because of the expanded scale graduation within the range 0...0.5 of full scale, the NEQ is highly applicable to supervise the synchronisation of a generator to the busbar.

The neutrals of the busbar and the generator are connected together, and the NEQ is then connected to the same phase of the busbar and of the generator respectively. The NEQ thus measures the differential voltage between the two units. (At absolute phase accordance the voltage is zero).

As the NEQ solely measures the differential voltage without indicating the polarity of this, a frequency measurement is recommended as a supplement.

Using this low-priced combination, manual synchronisation is easily and with certainty obtained.

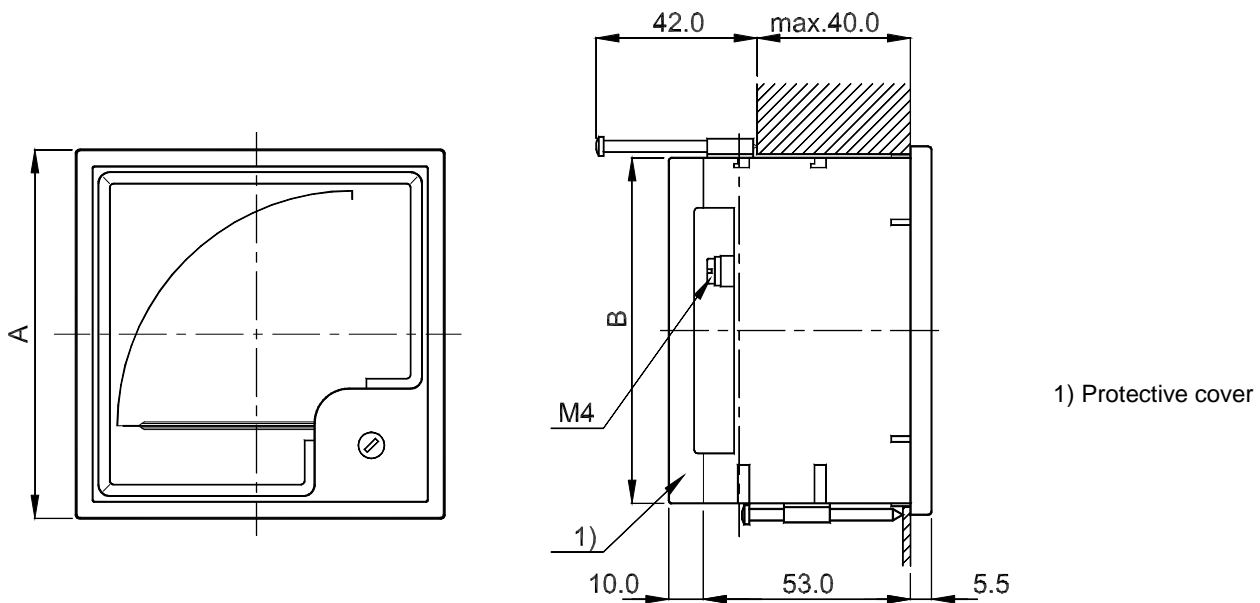
Technical specifications

Accuracy:	Class 1.5 within the range 0.45...0.75 of full scale deflection Class 3 outside this range. (-10...15...30...55°C)
Measuring range:	110/220V AC, 220/440V AC, 400/800V AC
Consumption:	1.5...4VA
Temperature:	-10...55°C (nominal), -25...60°C (operating), -25...65°C (storage)
Shock test:	15g – 6 times – 3 directions, 50g/6ms, 22g/20ms
EMC:	The NEQ is CE marked for residential, commercial and light industry plus industrial environment, to EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-4 (class 3)

Further technical specifications: See data sheet No. 4921210012

Dimensions

All dimensions in mm



NEQ

Type	A	B	Panel cut-out	Weight
NEQ72	72 x 72	66.5 x 66.5	68 x 68 +0.4	Approx. 0.200 kg
NEQ96	96 x 96	90 x 90	92 x 92 +0.4	Approx. 0.210 kg

Order specifications

Example:	Type NEQ96	Measuring range 400/800V AC
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	ANSI code 27, 59	ANSI code 59	ANSI code 27
			
	RMV-112D	RMV-122D	RMV-132D
Main functions:	Under- /overvoltage protection: <ul style="list-style-type: none"> • timer controlled tripping • adjustable hysteresis 	Overvoltage protection (2 levels): <ul style="list-style-type: none"> • timer controlled tripping • adjustable hysteresis 	Undervoltage protection (2 levels): <ul style="list-style-type: none"> • timer controlled tripping • adjustable hysteresis
Aux. voltage (U _n): 57.7...690V AC 24-48-110-220V DC	✓	✓	✓
Meas. voltage (U _n): 57.7...690V AC	✓	✓	✓
Meas. current (I _n): 0.4...5.0A	–	–	–
Frequency range: 40..45...65..70Hz	✓	✓	✓
Outputs:	1 minimum and 1 maximum relay output Settings: ±20% of U nom Delay: 0.5...10 s Hysteresis: 1...10% of U nom	2 maximum relay outputs Settings: 0...+20% of U nom Delay: 0.5...10 s Hysteresis: 1...10% of U nom	2 minimum relay outputs Settings: 0...-20% of U nom Delay: 0.5...10 s Hysteresis: 1...10% of U nom
Measuring system:	Δ, 3 phase 3 wire, Y, 3 phase 4 wire	Δ, 3 phase 3 wire, Y, 3 phase 4 wire	Δ, 3 phase 3 wire, Y, 3 phase 4 wire
Approved by classification societies:	✓	✓	✓
	ANSI code 27, 59		
			
	RMV-142D		
Main functions:	Under- /overvoltage protection: <ul style="list-style-type: none"> • timer controlled tripping • adjustable hysteresis 		
Aux. voltage (U _n): 57.7...690V AC 24-48-110-220V DC	✓		
Meas. voltage (U _n): 57.7...690V AC	✓		
Meas. current (I _n): 0.4...5.0A	–		
Frequency range: 40..45...65..70Hz	✓		
Outputs:	1 minimum and 1 maximum relay output Settings: ±20% of U nom Delay: 0.5...10 s Hysteresis: 1...10% of U nom		
Measuring system:	2 phase, single phase		
Approved by classification societies:	✓		

	ANSI code 50, 51  RMC-111D	ANSI code 50, 51  RMC-121D	ANSI code 50, 51  RMC-122D
Main functions:	Short circuit relay: <ul style="list-style-type: none"> • short circuit protection • timer controlled tripping 	Short circuit current relay: <ul style="list-style-type: none"> • short circuit protection • timer controlled tripping 	Overcurrent and short circuit relay: <ul style="list-style-type: none"> • short circuit/overcurrent protection • timer controlled tripping
Aux. voltage (U _n): 57.7...690V AC 24-48-110-220V DC	✓	✓	✓
Meas. voltage (U _n): 57.7...690V AC	-	-	-
Meas. current (I _n): 0.4...5.0A	✓	✓	✓
Frequency range: 40..45...65..70Hz	✓	✓	✓
Outputs:	1 maximum relay output Setting: 100...400% of I _{nom} Delay: 0.1...1/5/10 s	1 maximum relay output with 2 sets of contacts Setting: 100...400% of I _{nom} Delay: 0.1...1/5/10 s	2 maximum relay outputs Settings: 50...150% of I _{nom} , 100...400% of I _{nom} Delay: 0.1...1/5/10 s, 0.5...20/60/120 s
Measuring system:	3 phase	3 phase	3 phase
Approved by classification societies:	✓	✓	✓
	ANSI code 87  RMC-131D	ANSI code 50, 51  RMC-132D	ANSI code 50N, 51N  RMC-142D
Main functions:	Differential current relay: <ul style="list-style-type: none"> • protection against short circuits and leakage current in the generator winding • timer controlled tripping 	Dual overcurrent relay: <ul style="list-style-type: none"> • overcurrent protection • timer controlled tripping 	Stator earth fault relay: <ul style="list-style-type: none"> • earth fault protection at 2 level • built-in filter for 3rd harmonic • timer controlled tripping
Aux. voltage (U _n): 57.7...690V AC 24-48-110-220V DC	✓	✓	✓
Meas. voltage (U _n): 57.7...690V AC	-	-	-
Meas. current (I _n): 0.4...5.0A	✓	✓	✓
Frequency range: 40..45...65..70Hz	✓	✓	✓
Outputs:	1 maximum relay output with 2 sets of contacts Settings: 4...40% of I _{nom} Delay: 0.1...1/5/10 s	2 maximum relay outputs Settings: 50...150% of I _{nom} Delay: 0.5...20/60/120 s	2 maximum relay outputs Settings: 2...20%, 10...110% of I _{nom} Delay: 0.5...20/60/120 s
Measuring system:	3 phase	3 phase	Single phase
Approved by classification societies:	✓	✓	✓

	ANSI code 32  RMP-111D	ANSI code 32  RMP-112D	ANSI code 32  RMP-121D
Main functions:	Overload relay: <ul style="list-style-type: none"> • overload protection of generator and prime mover • real power relay • timer controlled tripping 	Overload/reverse power relay: <ul style="list-style-type: none"> • combined overload and reverse power protection • protection against "motoring" • timer controlled tripping 	Reverse power relay: <ul style="list-style-type: none"> • "motoring" protection of generator and prime mover • timer controlled tripping
Aux. voltage (U_n): 57.7...690V AC 24-48-110-220V DC	✓	✓	✓
Meas. voltage (U_n): 57.7...690V AC	✓	✓	✓
Meas. current (I_n): 0.4...5.0A	✓	✓	✓
Frequency range: 40..45...65..70Hz	✓	✓	✓
Outputs:	1 maximum relay output Settings: 25...125% of P nom Delay: 0.4...20 s	1 max. + 1 min. relay output Settings: 25...125%, 0...-25% of P nom Delay: 0.4...20 s	1 minimum relay output Settings: 0...-25% of P nom Delay: 0.4...20 s
Measuring system:	2W3, 3 phase 3 wire unbal. load 3W3, 3 phase 3 wire unbal. load 3W4, 3 phase 4 wire unbal. load	2W3, 3 phase 3 wire unbal. load 3W3, 3 phase 3 wire unbal. load 3W4, 3 phase 4 wire unbal. load	1W, single phase 1W3, 3 phase 3 wire bal. load 1W4, 3 phase 4 wire bal. load
Approved by classification societies:	✓	✓	✓
	ANSI code 32  RMQ-111D	ANSI code 32  RMQ-121D	
Main functions:	Loss of excitation relay: <ul style="list-style-type: none"> • protection of generators against loss of excitation • timer controlled tripping 	Overexcitation relay: <ul style="list-style-type: none"> • protection of generator against overexcitation (over var) • timer controlled tripping 	
Aux. voltage (U_n): 57.7...690V AC 24-48-110-220V DC	✓	✓	
Meas. voltage (U_n): 57.7...690V AC	✓	✓	
Meas. current (I_n): 0.4...5.0A	✓	✓	
Frequency range: 40..45...65..70Hz	✓	✓	
Outputs:	1 maximum relay output Settings: -25...-25% of Q nom Delay: 0.4...20 s	1 maximum relay output Settings: 25...125% of Q nom Delay: 0.4...20 s	
Measuring system:	1var3, 3 phase 3 wire bal. load 1var4, 3 phase 4 wire bal. load	1var3, 3 phase 3 wire bal. load 1var4, 3 phase 4 wire bal. load	
Approved by classification societies:	✓	✓	

	ANSI code 81	ANSI code 78	ANSI code 78
			
	RMF-112D	LMR-111D	LMR-122D
Main functions:	Frequency relay: <ul style="list-style-type: none"> combined underfrequency/overfrequency protection timer controlled tripping 	Loss of mains relay: <ul style="list-style-type: none"> detection of vector shift generator disconnection on mains failure 	Loss of mains relay: <ul style="list-style-type: none"> detection of vector shift detection of ROCOF (df/dt)
Aux. voltage (U _n): 57.7...690V AC 24-48-110-220V DC	✓	✓	✓
Meas. voltage (U _n): 57.7...690V AC	✓	✓	✓
Meas. current (I _n): 0.4...5.0A	—	—	—
Frequency range: 40..45...65..70Hz	✓	✓	✓
Outputs:	1 min. and 1 max. relay output Settings: ±10% of f nom, ±20% of f nom at f nom = 55Hz Delay: 0...10 s Nom. frequency: 50Hz, 55Hz, 60Hz	2 relay outputs Settings: 2...20 electr. deg. Delay: 0.5...5 s	2 relay outputs Settings: 2...20 electr. deg. / 0.3...5 Hz/s Delay: 0.5...5 s
Measuring system:	2 phase, single phase	2 phase, single phase	2 phase, single phase
Approved by classification societies:	✓	✓	✓
	ANSI code 27, 59, 78, 81		
			
	G59		
Main functions:	Protection relay package: <ul style="list-style-type: none"> combined vector shift and ROCOF protection of over-/underfrequency 3 phase protection of over-/undervoltage 		
Aux. voltage (U _n): 57.7...690V AC 24-48-110-220V DC	✓		
Meas. voltage (U _n): 57.7...690V AC	✓		
Meas. current (I _n): 0.4...5.0A	—		
Frequency range: 40..45...65..70Hz	✓		
Outputs:	4 relay outputs, setting of set point: 2...20 electr. deg. / 0.3...5 Hz/s / 90...100% of f _n / 100...110% of f _n / 80...100% of U _n / 100...120% of U _n Hysteresis: 1...10% of U _n		
Measuring system:	2 phase, single phase: Vector shift, ROCOF, frequency, 3 phase 3 wire, U, 3 phase 4 wire: Voltage		
Approved by classification societies:	—		

	ANSI code 25  FAS-113DG	ANSI code 25  FAS-115DG	
Main functions:	Synchroniser: <ul style="list-style-type: none"> • synchronisation of generator to busbar • circuit breaker time compensation 	Synchroniser: <ul style="list-style-type: none"> • synchronisation of generator to busbar • voltage matching • circuit breaker time compensation 	
Aux. voltage (U_n): 57.7...690V AC 24-48-110-220V DC	✓	✓	
Meas. voltage (U_n): 57.7...690V AC	✓	✓	
Meas. current (I_n): 0.4...5.0A	-	-	
Frequency range: 40..45...65..70Hz	✓	✓	
Outputs:	Synch. pulse output: 1 relay output Freq. control outputs: 2 relay outputs	Synch. pulse output: 1 relay output Freq. control outputs: 2 relay outputs Voltage control: 2 relay outputs	
Measuring system:	2 phase, single phase	2 phase, single phase	
Approved by classification societies:	✓	✓	
	ANSI code 25  HAS-111DG	ANSI code 18  EPN-110DN	
Main functions:	Paralleling relay: <ul style="list-style-type: none"> • synchronisation of generator to busbar • setting of phase angle • setting of maximum frequency and voltage difference 	Electronic potentiometer: <ul style="list-style-type: none"> • control of electronic governor • setting of integrating time • adjustment of output signal 	
Aux. voltage (U_n): 57.7...690V AC 24-48-110-220V DC	✓	✓	
Meas. voltage (U_n): 57.7...690V AC	✓	-	
Meas. current (I_n): 0.4...5.0A	-	-	
Frequency range: 40..45...65..70Hz	✓	-	
Outputs:	Synch. pulse output: 1 relay output	1 analogue output Settings: 0...±1V/0...±5V	
Measuring system:	2 phase, single phase	-	
Approved by classification societies:	✓	✓	

	ANSI code 90  LSU-112DG	ANSI code 90  LSU-113DG	ANSI code 90  LSU-114DG
Main functions:	Load sharing unit: <ul style="list-style-type: none"> built-in power and freq. transducer constant power or isochronous mode 	Load sharing unit: <ul style="list-style-type: none"> reverse power protection and low power detection built-in power and freq. transducer constant power or isochr. mode 	Load sharing unit: <ul style="list-style-type: none"> automatic start/stop outputs built-in power and freq. transducer constant power or isochronous mode
Aux. voltage (U_n): 57.7...690V AC 24-48-110-220V DC	✓	✓	✓
Meas. voltage (U_n): 57.7...690V AC	✓	✓	✓
Meas. current (I_n): 0.4...5.0A	✓	✓	✓
Frequency range: 40..45...65..70Hz	✓	✓	✓
Outputs:	Speed control: 2 relay outputs	Speed control: 2 relay outputs Reverse power protection: 1 relay output, fixed settings: -P> 5% / 5 s, -P> 5% / 10 s, -P> 10% / 5 s or -P> 10% / 10 s Low power detect.: 1 relay output, fixed setting: P<5%	Speed control: 2 relay outputs Start/stop: 2 relay outputs, fixed settings: P>80%, P<20%
Measuring system:	1W3, 3 phase 3 wire bal. load Single phase	1W3, 3 phase 3 wire bal. load Single phase	1W3, 3 phase 3 wire bal. load Single phase
Approved by classification societies:	✓	✓	✓
	ANSI code 90  LSU-122DG		
Main functions:	var load sharing unit: <ul style="list-style-type: none"> built-in reactive power transducer control of AVR input for external voltage transducer 		
Aux. voltage (U_n): 57.7...690V AC 24-48-110-220V DC	✓		
Meas. voltage (U_n): 57.7...690V AC	✓		
Meas. current (I_n): 0.4...5.0A	✓		
Frequency range: 40..45...65..70Hz	✓		
Outputs:	Voltage control: 2 relay outputs		
Measuring system:	1var3, 3 phase 3 wire bal. load Single phase		
Approved by classification societies:	✓		

ANSI codes 27/59, 59, 27

Type RMV-112D, RMV-122D, RMV-132D

- **Undervoltage/overvoltage**
- **3 phase measurement**
- **LED indication of fault condition**
- **Timer controlled tripping**
- **LED indication for activated relay**
- **35 mm DIN rail or base mounting**

Application

The protective voltage relays types RMV-112D, RMV-122D and RMV-132D form part of a complete DEIF series of relays for protection and control of generators and are applicable to both marine and land-based installations. Also available are voltage relays for single phase measurement (RMV-142D).

The relays are type approved by major classification societies.

The voltage relays are applied for protection of generators, motors and transformers against adverse system voltage conditions. The relay supervises all 3 phase voltages. The following types are available:

- type RMV-112D (ANSI codes 27/59)
undervoltage and overvoltage relay (U< + U>)
- type RMV-122D (ANSI code 59)
overvoltage relay (2 levels: U> + U>)
- type RMV-132D (ANSI code 27)
undervoltage relay (2 levels: U< + U<).

Measuring principle

The relays measure all 3 phase voltages, providing an RMS measurement of sinusoidal voltages.

Undervoltage/overvoltage (U< + U>)

If the voltage either drops below the lower setpoint or exceeds the upper setpoint, the associated output is activated.

Overvoltages (U> and U>)

The highest input voltage is detected, and if this exceeds its setpoint, the output is activated.

Undervoltages (U< and U<)

The lowest input voltage is detected, and if this is lower than the set value, the output is activated.

The setpoint values are set on the front of the relays by means of potentiometers.

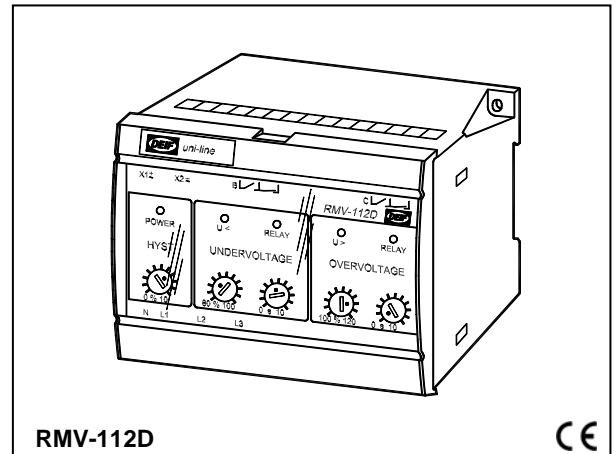
Timer functions

When a setpoint is exceeded, its timer starts and will run as long as the fault condition prevails. The delay does not depend on the exceeding of the setpoint. If the fault disappears, the timer is reset. When the timer expires, the contact and its built-in hysteresis circuit are activated, and the associated red LED is lit.

Voltage relays

Uni-line

4921240096G



Hysteresis

The relays are provided with an adjustable hysteresis (common to both contacts), i.e. a difference of 1...10% of U_n between energising and de-energising of the relay. The relay is deactivated when the fault voltage equals or is less than the preset hysteresis.

Relay outputs

The relays are provided with 2 outputs: U< outputs with a minimum contact, U> outputs with a maximum contact, either normally energised or normally de-energised. The contact may be set to open or to close on activation.

Normally energised contact

Recommended for land-based installations for warning and alarm purposes.

In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact

Recommended for marine installations for regulating and control purposes.

An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit

The contact can be locked in its warning position, even if the input voltages return to normal (add "L" to contact type in order specifications, if this is required).

The latch circuit is reset by disconnecting the auxiliary supply.

Power-up/power-down circuits

The relays are provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

Note: Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Likewise, the relays are provided with a 200 ms power-down circuit, ensuring supervision and maintenance of any setpoint exceedings for 200 ms after disconnection of the auxiliary voltage.

Types RMV-112D, RMV-122D, RMV-132D

Technical specifications

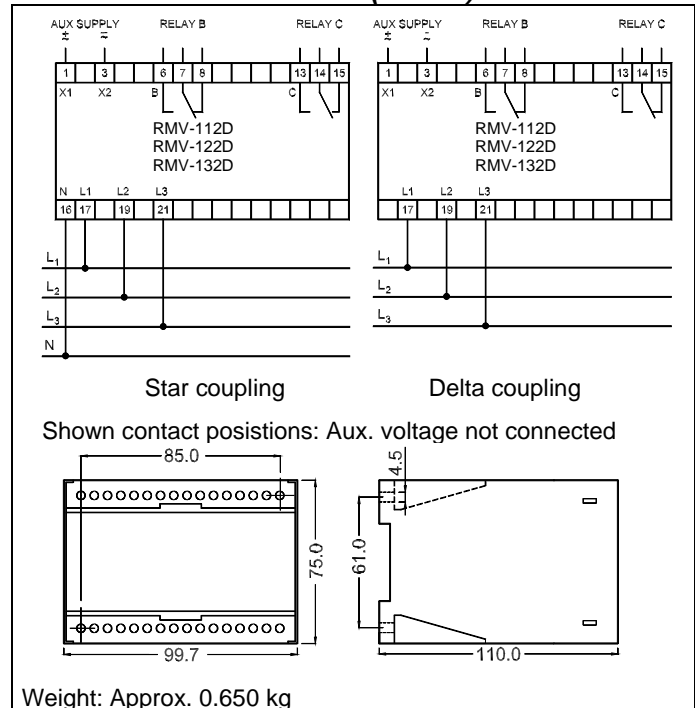
Meas. range (U_n):	See supply voltage (AC ranges only) UL/cUL listed: 57.7...450V AC
Frequency range:	40...45...65...70 Hz
Max. input voltage:	1.2 x U _n , continuously, 2 x U _n for 10 s
Load:	2 kΩ/V
Outputs:	RMV-112D 1 min. + 1 max. contact RMV-122D 2 maximum contacts RMV-132D 2 minimum contacts
Contact type:	Relays B + C: Normally energised ("NE"), or normally de-energised ("ND") with or without latch circuit ("L")
Relay contacts:	1 change-over switch per relay
Contact ratings:	250V AC/24V DC, 8A (200 x 10 ³ change-overs at resistive load) UL/cUL listed: Resistive load only
Contact voltage:	Max. 250V AC/150V DC
Response time:	<100 ms
Temperature:	-25...70°C (-13...158°F) (operating) UL/cUL listed: Max. surrounding air temp. 60°C/140°F
Temperature drift:	Setpoints: Max. 0.2% of full scale per 10°C/50°F
Galvanic separation:	Between inputs and outputs: 3250 V – 50 Hz - 1 min.
Supply voltage (U_n):	57.7-63.5-100-110-127-200-220-230- 240-380-400-415-440-450-480-660- 690V AC ±20% (max. 3.5 VA) 24-48-110-220V DC -25/+30% (max. 2 W) UL/cUL listed: Only 24V DC and 110V AC DC supply must be from a class 2 power source
Climate:	HSE, to DIN 40040
EMC:	To EN 61000-6-1/2/3/4, SS4361503 (PL4) and IEC 255-3
Connections:	Max. 4.0 mm ² (single-stranded) Max. 2.5 mm ² (multi-stranded)
Materials:	All plastic parts are self-extinguishing to UL94 (V1)
Protection:	Case: IP40. Terminals: IP20, to IEC 529 and EN 60529
Type approval:	The Uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.
UL markings:	Wiring: Use 60/75°C (140/167°F) copper conductors only Wire size: AWG 12-16 or equivalent Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)

Settings and indication

Setting of	LED	Relay
Undervoltage limit: (80...100%) of U _n	"U<"	Yellow LED is lit when the input voltage is lower than the preset limit, but the relay has not yet been activated
Overvoltage limit: (100...120%) of U _n	"U>"	Yellow LED is lit when the input voltage exceeds the preset limit, but the relay has not yet been activated
Time delay: (0...10 s) in seconds	"RELAY"	Relay is activated and red LED lit after the timer has expired
Hysteresis: (1...10%) of U _n		Relay contact is reset when fault voltage equals or is less than the preset hysteresis

The relays are furthermore equipped with a green LED marked "POWER" for indication of power ON. Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

Connections/dimensions (in mm)



Order specifications

Type – Coupling – Meas. volt. (U_n) – Relay B – Relay C – Supply voltage
Star coupling: Specify phase-neutral voltage
Delta coupling: Specify phase-phase voltage
Examples:
RMV-112D – delta – 400V AC – NDL + NDL – 24V DC
RMV-122D – star – 230V AC – NDL + NDL – 230V AC
RMV-132D – delta – 400V AC – NE + NE – 110V DC

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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ANSI codes 27/59

Type RMV-142D

- **Undervoltage/overvoltage**
- **Single phase measurement**
- **LED indication of fault condition**
- **Timer controlled tripping**
- **LED indication for activated relay**
- **35 mm DIN rail or base mounting**

Application

The protective voltage relay type RMV-142D forms part of a complete DEIF series of relays for protection and control of generators.

The RMV-142D is type approved by major classification societies and is applicable to both marine and land-based installations.

Voltage relays performing a 3 phase measurement are also available:

- RMV-112D for undervoltage/overvoltage
- RMV-122D for overvoltage
- RMV-132D for undervoltage

The RMV-142D is a combined undervoltage and overvoltage relay ($U<$ + $U>$) and is applied for protection of generators, motors and transformers against adverse system voltage conditions.

Measuring principle

The relay measures the voltage of one phase (single phase measurement) or measures the voltage between 2 phases, providing an RMS measurement of sinusoidal voltages.

If the voltage either drops below the lower setpoint, or exceeds the upper setpoint, the associated output is activated.

The setpoint values are set on the front of the relay by means of potentiometers.

Timer functions

When the voltage drops below the lower setpoint or exceeds the upper setpoint, the associated timer starts and will run as long as the fault condition prevails. The delay does not depend on the exceeding of the setpoint. If the fault disappears, the timer is reset.

When the timer expires, the contact and its built-in hysteresis circuit are activated, and the associated red LED is lit.

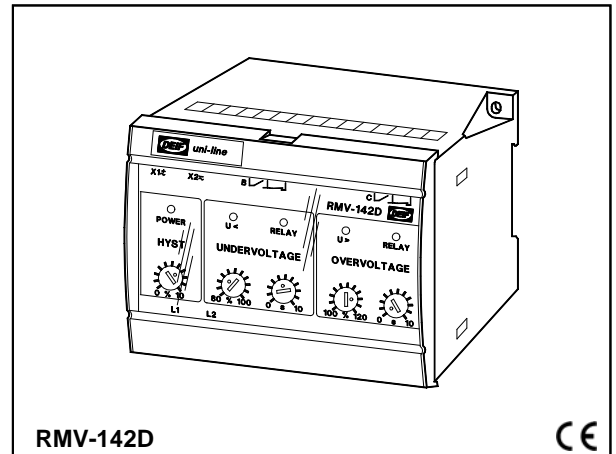
Hysteresis

The relays are provided with an adjustable hysteresis (common to both contacts), i.e. a difference of 1...10% of U_n between energising and de-energising of the relay. The relay is deactivated when the fault voltage equals or is less than the preset hysteresis.

Voltage relays

Uni-line

4921240128F



Relay outputs

The RMV-142D is provided with two outputs:

- undervoltage ($U<$) a minimum contact (normally energised/normally de-energised)
- overvoltage ($U>$) a maximum contact (normally energised/normally de-energised)

The contact may be set to open or to close on activation.

Normally energised contact

Recommended for land-based installations for warning and alarm purposes.

In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact

Recommended for marine installations for regulating and control purposes.

An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit

The contact can be locked in its warning position, even if the input voltage returns to normal (add "L" to contact type in order specifications, if this is required).

The latch circuit is reset by disconnecting the auxiliary supply.

Power-up/power-down circuits

The relays are provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

Note: Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Likewise, the relays are provided with a 200 ms power-down circuit, ensuring supervision and maintenance of any setpoint exceedings for 200 ms after disconnection of the auxiliary voltage.

Type RMV-142D

Technical specifications

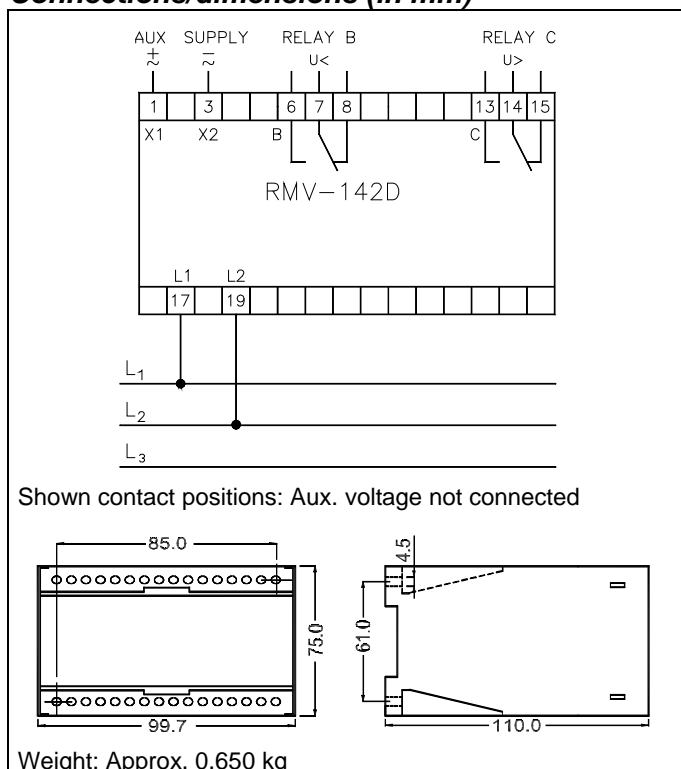
Meas. range (U_n):	See supply voltage (AC ranges only) UL/cUL listed: 57.7...450V AC
Frequency range:	40...45...65...70 Hz
Max. input voltage:	1.2 x U_n , continuously, 2 x U_n for 10 s
Load:	2 k Ω /V
Outputs:	1 minimum + 1 maximum contact
Contact type:	Relays B + C: Normally energised ("NE"), or normally de-energised ("ND") with or without latch circuit ("L")
Relay contacts:	1 change-over switch per relay
Contact ratings:	250V AC/24V DC, 8A (200 x 10 ³ change-overs at resistive load) UL/cUL listed: Resistive load only
Contact voltage:	Max. 250V AC/150V DC
Response time:	<100 ms
Temperature:	-25...70°C (-13...158°F) (operating) UL/cUL listed: Max. surrounding air temp. 60°C/140°F
Temperature drift:	Setpoints: Max. 0.2% of full scale per 10°C/50°F
Galvanic separation:	Between inputs and outputs: 3250 V – 50 Hz - 1 min
Supply voltage (U_n):	57.7-63.5-100-110-127-200-220-230- 240-380-400-415-440-450-480-660- 690V AC \pm 20% (max. 3.5 VA) 24-48-110-220V DC -25/+30% (max. 2 W) UL/cUL listed: Only 24V DC and 110V AC DC supply must be from a class 2 power source
Climate:	HSE, to DIN 40040
EMC:	To EN 61000-6-1/2/3/4, SS4361503 (PL4) and IEC 255-3
Connections:	Max. 4 mm ² (single-stranded) Max. 2.5 mm ² (multi-stranded)
Materials:	All plastic parts are self-extinguishing to UL94 (V1)
Protection:	Case: IP40. Terminals: IP20, to IEC 529 and EN 60529
Type approval:	The Uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.
UL markings:	Wiring: Use 60/75°C (140/167°F) copper conductors only Wire size: AWG 12-16 or equivalent Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)

Settings and indication

Setting of	LED	Relay
Undervoltage limit: (80...100%) of U_n	"U<"	Yellow LED is lit when input voltage is lower than the preset limit, but the relay has not yet been activated.
Overvoltage limit: (100...120%) of U_n	"U>"	Yellow LED is lit when the input voltage exceeds the preset limit, but the relay has not yet been activated.
Time delay: (0...10 s) in seconds	"RELAY"	Relay is activated and red LED lit after the timer has expired.
Hysteresis: (1...10%) of U_n		Relay contact is reset when the fault voltage equals or is less than the preset hysteresis.

The relays are furthermore equipped with a green LED marked "POWER" for indication of power ON. Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

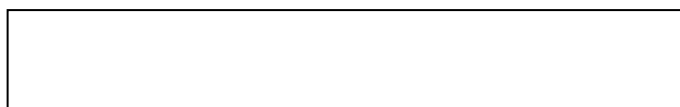
Connections/dimensions (in mm)



Order specifications

Type – Meas.volt. (U_n) – Relay B – Relay C – Supply volt.
Example:
 RMV-142D – 400V AC – ND – ND – 24V DC

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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ANSI codes 50/51

Types RMC-111D, RMC-122D, RMC-132D

- **Short circuit/overcurrent**
- **3 phase measurement**
- **LED indication of fault condition**
- **Timer controlled tripping**
- **LED indication for activated relay**
- **35 mm DIN rail or base mounting**

Application

The protective current relays types RMC-111D, RMC-122D and RMC-132D form part of a complete DEIF series of relays for protection and control of generators. The relays are applicable to both marine and land-based installations. Also available are differential current relays (RMC-131D).

The relays are type approved by major classification societies.

RMC-111D (ANSI codes 50/51)

This short circuit relay is applied in cases where only protection against short circuit currents is required ($I_{>>}$).

RMC-122D (ANSI codes 50/51)

This combined short circuit and overcurrent relay is applied for protection of generators against both overcurrents and short circuit currents ($I_{>} + I_{>>}$).

RMC-132D (ANSI codes 50/51)

This double overcurrent relay is applied in cases where protection against overcurrents at two levels is required ($I_{>} + I_{>>}$).

Measuring principle

The relays measure the highest of the 3 phase currents, providing an RMS measurement at sinusoidal currents.

The measurement is based on average values for $I_{>}$, peak values for $I_{>>}$. If a current exceeds a set point, the output is activated.

The set point values are set on the front of the relays by means of potentiometers. If exceeded, a fault signal is generated, and the associated yellow LED is lit.

Timer functions

When the set point is exceeded, its timer starts and will run as long as the fault condition prevails.

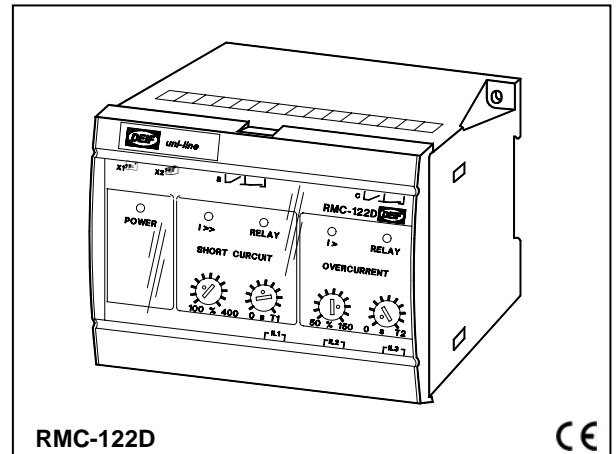
The delay (3 ranges) does not depend on the exceeding of the set point.

If the fault disappears, the timer is reset. When the timer expires, the contact is activated and the associated red LED is lit.

Current relays

uni-line

4921240102E



Relay outputs

The relays are provided with outputs as follows:

RMC-111D:	$I_{>>}$	1 max. contact
RMC-122D:	$I_{>} + I_{>>}$	2 max. contacts
RMC-132D:	$I_{>} + I_{>>}$	2 max. contacts

which are either normally energised or normally de-energised contacts. The contact(s) may be set to open or to close on activation.

Normally energised contact

Recommended for land-based installations for warning and alarm purposes. In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact

Recommended for marine installations for regulating and control purposes. An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit

The contacts can be locked in their warning position, even if the input currents return to normal (add "L" to contact type in order specifications, if this is required).

The latch circuit is reset by disconnecting the auxiliary supply.

Hysteresis

In order to avoid "chatter" on the relay contacts the contact functions are provided with a hysteresis, i.e. a difference of 2% of full scale between energising and de-energising of the relay.

Power-up/power-down circuits

The relays are provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

Note: Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Likewise, the relays are provided with a 200 ms power-down circuit, ensuring supervision and maintenance of any set point exceedings for 200 ms after disconnection of the auxiliary voltage.

Types RMC-111D, RMC-122D, RMC-132D

Technical specifications

Meas. range (I_n):	0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC UL/cUL listed: 0.4...5.0A AC
Adjusted ranges:	75...100% of I_n (e.g. 0.4, 0.45, etc.) (lowest meas. range: 0.3A)
Frequency range:	40...45...65...70Hz
Short circuit current:	1.0...4.0 x I_n
Overcurrent:	0.5...1.5 x I_n
Max. input current:	4 x I_n , continuously, 20 x I_n for 10 s (max. 75A) 80 x I_n for 1 s (max. 300A)
Load:	Max. 0.3VA per phase
Output(s):	1(2) maximum contact(s)
Contact type:	Relay B (+relay C): Normally energised ("NE"), or normally de-energised ("ND") with or without latch circuit ("L")
Relay contacts:	1 change-over switch per relay
Contact ratings:	250V AC/24V DC, 8A (200 x 10 ³ change-overs at resistive load) UL/cUL listed: Resistive load only
Contact voltage:	Max. 250V AC/150V DC
Hysteresis:	2% of full scale (F.S.)
Response time:	<50 ms short circuit current <500 ms overcurrent
Temperature:	-25...70°C (-13...158°F) (operating) UL/cUL listed: Max. surrounding air temp. 60°C/140°F
Temperature drift:	Set points: Max. 0.2% of full scale per 10°C/50°F
Galvanic separation:	Between inputs, outputs and aux. voltage: 3250V - 50Hz - 1 min
Supply voltage (U_n):	57.7-63.5-100-110-127-200-220-230- 240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA) 24-48-110-220V DC -25/+30% (max. 2W) UL/cUL listed: Only 24V DC and 110V AC DC supply must be from a class 2 power source
Climate:	HSE, to DIN 40040
EMC:	To EN 61000-6-1/2/3/4, SS4361503 (PL4) and IEC 255-3
Connections:	Max. 4 mm ² (single-stranded) Max. 2.5 mm ² (multi-stranded)
Materials:	All plastic parts are self-extinguishing to UL94 (V1)
Protection:	Case: IP40. Terminals: IP20, to IEC 529 and EN 60529
Type approval:	The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.
UL markings:	Wiring: Use 60/75°C (140/167°F) copper conductors only

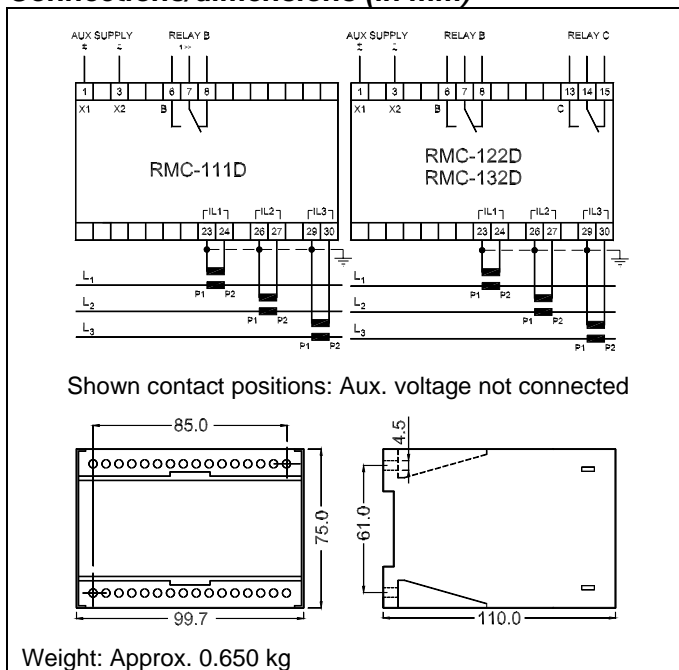
UL markings, cont.: Wire size:
AWG 12-16 or equivalent
Installation:
To be installed in accordance with the
NEC (US) or the CEC (Canada)

Settings and indication

Setting of	LED/relay
Short circuit current set point: (100...400%) of I_n Time delay: (0-T1) in seconds 0...1/0...5/0...10 s	"I>>" yellow LED is lit when the set point has been exceeded, but the output contact not yet activated. Contact is activated and red LED lit after the timer has expired.
Overcurrent set point(s): (50...150%) of I_n Time delay: (0...T2) in seconds 0...20/0...60/0...120 s	"I>" yellow LED is lit when the set point has been exceeded, but the output contact not yet activated. Contact is activated and red LED lit after the timer has expired.

The relays are furthermore equipped with a green LED marked "POWER" for indication of power ON. Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

Connections/dimensions (in mm)



Order specifications

Type – Meas. current (I_n) – Relay B – (Relay C) – Time delay (T1 – T2) – Supply voltage
Examples:
 RMC-122D – 5A AC – NDL – ND – 1 s – 400V AC
 RMC-111D – 1A AC – NE – 5 s – 380V AC

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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ANSI codes 50/51

Type RMC-121D

- **Measurement of 3 phase currents**
- **LED indication of fault condition**
- **Timer controlled tripping**
- **LED indication for activated relay**
- **35 mm DIN rail or base mounting**

Application

The protective current relay type RMC-121D forms part of a complete DEIF series of relays for protection and control of generators and is primarily designed for marine applications. Also available are short circuit relays (RMC-111D), combined short circuit and overcurrent relays (RMC-122D) and double overcurrent relays (RMC-132D).

Measuring principle

The relay measures the highest of the 3 phase currents, providing an RMS measurement at sinusoidal currents.

In order to obtain a short response time on a fault condition, the measurement is based on peak values.

The set point value is set on the front of the relay by means of a potentiometer. If exceeded, a fault signal is generated, and the associated yellow LED is lit.

Timer function

When the set point has been exceeded, the associated timer starts and will run as long as the fault condition prevails.

The delay (3 ranges) does not depend on the exceeding of the set point. If the fault disappears, the timer is reset. When the timer expires, the contact is activated and the associated red LED is lit.

Relay output

The RMC-121D is provided with one relay coil with 2 maximum contacts. The relay can be configured either to normally energised or normally de-energised. The contacts may be set to open or to close on activation (same function on both contacts).

Normally energised contact

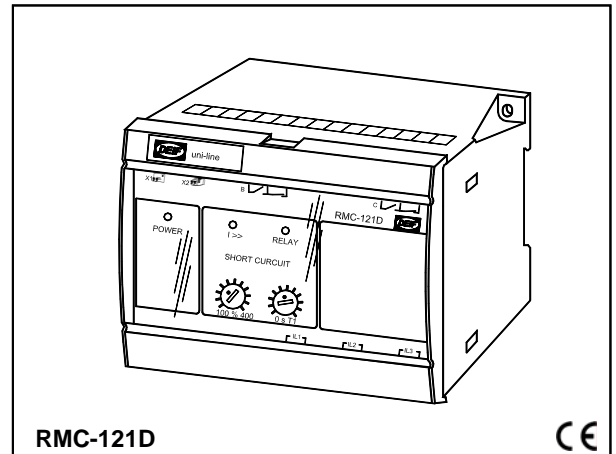
Recommended for marine installations for warning and alarm purposes.

In case of an auxiliary supply drop-out, the contacts are activated immediately.

Short circuit current relay

uni-line

4921240260B



Normally de-energised contact

Recommended for marine installations for regulating and control purposes.

An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit

The contacts can be locked in their warning position, even if the input currents return to normal. (Add "L" to contact type in order specifications, if this is required).

The latch circuit is reset by disconnecting the auxiliary supply.

Hysteresis

In order to avoid "chatter" on the relay contacts the contact functions are provided with a hysteresis, i.e. a difference of 2% of full scale between energising and de-energising of the relay.

Power-up/power-down circuits

The RMC-121D is provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

Note: Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Likewise, the RMC-121D is provided with a 200 ms power-down circuit, ensuring supervision and maintenance of any set point exceedings for 200 ms after disconnection of the auxiliary voltage.

Note: A special version is available where the 200 ms power-down is enlarged to 1 sec.

Type RMC-121D

Technical specifications

Meas. range (I_n):	0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC UL/cUL listed: 0.4...5.0A AC
Adjusted ranges:	75...100% of I_n (e.g. 0.4, 0.45, etc.) (Lowest measuring range: 0.3A)
Frequency range:	40... <u>45...65</u> ...70Hz
Short circuit current:	1.0...4.0 x I_n
Max. input current:	4 x I_n , continuously 20 x I_n for 10 s (max. 75A) 80 x I_n for 1 s (max. 300A)
Load:	Max. 0.3VA per phase
Outputs:	2 maximum contacts
Contact type:	Contact B, contact C: Normally energised ("NE"), or normally de-energised ("ND") with or without latch circuit ("L")
Relay contacts:	2 sets of change-over switches
Contact ratings:	250V AC/24V DC, 8A (200 x 10 ³ change-overs at resistive load) UL/cUL listed: Resistive load only
Contact voltage:	Max. 250V AC/150V DC
Hysteresis:	2% of full scale (F.S.)
Response time:	<50 ms short circuit current
Temperature:	-25...70°C (-13...158°F) (operating) UL/cUL listed: Max. surrounding air temp. 60°C/140°F
Temperature drift:	Set points: Max. 0.2% of full scale per 10°C/50°F
Galvanic separation:	Between inputs, outputs and aux. voltage: 3250V - 50Hz - 1 min.
Supply voltage (U_n):	57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA) 24-48-110-220V DC -25/+30% (Max. 2W) UL/cUL listed: Only 24V DC and 110V AC DC supply must be from a class 2 power source
Climate:	HSE, to DIN 40040
EMC:	To EN 61000-6-1/2/3/4, SS4361503 (PL4) and IEC 255-3
Connections:	Max. 4.0 mm ² (single-stranded) Max. 2.5 mm ² (multi-stranded)
Materials:	All plastic parts are self-extinguishing to UL94 (V1)
Protection:	Case: IP40. Terminals: IP20, to IEC 529 and EN 60529
Type approval:	The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S

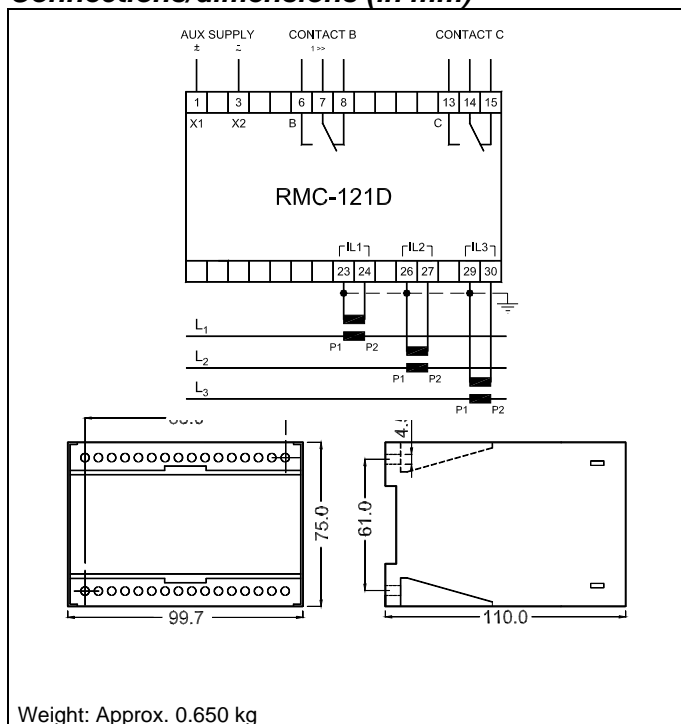
UL markings:	Wiring: Use 60/75°C (140/167°F) copper conductors only Wire size: AWG 12-16 or equivalent Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)
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Settings and indication

Setting of	LED/relay
Short circuit current set point: (100...400%) of I_n	"I>>" yellow LED is lit when the set point has been exceeded, but the output contact not yet activated
Time delay: (0...T1) in seconds 0...1/0...5/0...10 s	Contact is activated and red LED lit after the timer has expired

The relays are furthermore equipped with a green LED marked "POWER" for indication of power ON. Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting

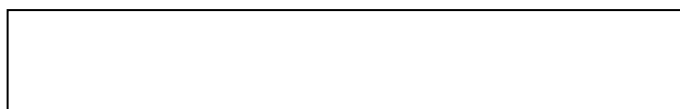
Connections/dimensions (in mm)



Order specifications

Type – Measuring current (I_n) – Relay – Time delay (T1) – Supply voltage Example: RMC-121D – 5A AC – NDL – 1 s – 400V AC

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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ANSI code 87
Type RMC-131D

- **Measurement of 3 phase currents**
- **Non-stabilised measurement**
- **LED indication of fault condition**
- **Timer controlled tripping**
- **LED indication for activated relay**
- **Extra change-over relay contact for signalling**
- **35 mm DIN rail or base mounting**

Application

The protective differential current relay type RMC-131D forms part of a complete DEIF series of relays for protection and control of generators, and is primarily designed for marine applications. Also available are short circuit relays (RMC-111D), combined short circuit and overcurrent relays (RMC-122D) and double overcurrent relays (RMC-132D).

The RMC-131D is type approved by major classification societies and is applied for protection of e.g. generators in 3-phase networks against leakage currents.

Measuring principle

The relay compares the differential current of each of the 3 phases, providing an RMS measurement at sinusoidal currents.

In order to obtain a short response time on a fault condition, the measurement is based on peak values.

The differential currents are obtained by connecting the external current transformers for each winding in parallel with inverse polarity.

The measurement is not stabilized, implying that the relay contact is activated for disconnection of the supervised unit when the differential current of the individual phases exceeds its set point, irrespective of the amperage of these.

The 3 differential currents are measured by the relay and the highest of these is selected. If this exceeds the set point, the output is activated.

The set point value is set on the front of the relay by means of a potentiometer. If exceeded, a fault signal is generated, and the associated yellow LED is lit.

Timer function

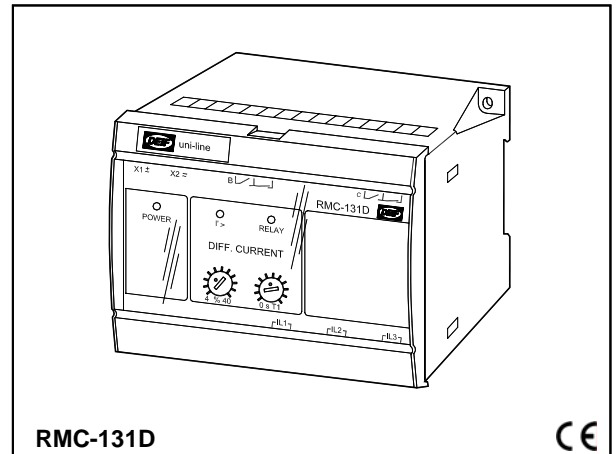
When the set point has been exceeded, the associated timer starts and will run as long as the fault condition prevails.

The delay (3 ranges) does not depend on the exceeding of the set point. If the fault disappears, the timer is reset. When the timer expires, the contact is activated and the associated red LED is lit.

Differential current relays

uni-line

4921240104H



Relay output

The RMC-131D is provided with one relay coil with 2 maximum contacts. The relay can be configured either to normally energised or normally de-energised. The contacts may be set to open or to close on activation (same function on both contacts).

Normally energised contact

Recommended for marine installations for warning and alarm purposes.

In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact

Recommended for marine installations for regulating and control purposes.

An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit

The contact can be locked in its warning position, even if the input currents return to normal (add "L" to contact type in order specifications, if this is required).

The latch circuit is reset by disconnecting the auxiliary supply.

Hysteresis

In order to avoid "chatter" on the relay contacts the contact functions are provided with a hysteresis, i.e. a difference of 2% of full scale between energising and de-energising of the relay.

Power-up/power-down circuits

The RMC-131D is provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

Note: Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Likewise, the RMC-131D is provided with a 200 ms power-down circuit, ensuring supervision and maintenance of any set point exceedings for 200 ms after disconnection of the auxiliary voltage.

Type RMC-131D

Technical specifications

Meas. range (I_n):	0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC UL/cUL listed: 0.4...5.0A AC
Adjusted range:	75...100% of I_n (e.g. 0.4, 0.45, etc.) (lowest meas. range: 0.3A)
Frequency range:	40...45...65...70Hz
Differential current:	0.04...0.4 x I_n
Max. input current:	4 x I_n , continuously, 20 x I_n for 10 s (max. 75A) 80 x I_n for 1 s (max. 300A)
Load:	Max. 0.3VA per phase
Output:	1 maximum contact
Contact type:	Contact B, contact C: Normally energised ("NE"), or normally de-energised ("ND") with or without latch circuit ("L")
Relay contact:	2 sets of change-over switches
Contact ratings:	250V AC/24V DC, 8A (200 x 10 ³ change-overs at resistive load) UL/cUL listed: Resistive load only
Contact voltage:	Max. 250V AC/150V DC
Hysteresis:	2% of full scale (F.S.)
Response time:	<50 ms
Temperature:	-25...70°C (-13...158°F) (operating) UL/cUL listed: Max. surrounding air temp. 60°C/140°F
Temperature drift:	Set points: max. 0.2% of full scale per 10°C/50°F
Galvanic separation:	Between inputs, outputs and aux. voltage: 3250V - 50Hz - 1 min
Supply voltage (U_n):	57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA) 24-48-110-220V DC -25/+30% (max. 2W) UL/cUL listed: Only 24V DC and 110V AC DC supply must be from a class 2 power source
Climate:	HSE, to DIN 40040
EMC:	To EN 61000-6-1/2/3/4, SS4361503 (PL4) and IEC 255-3
Connections:	Max. 4 mm ² (single-stranded) Max. 2.5 mm ² (multi-stranded)
Materials:	All plastic parts are self-extinguishing to UL94 (V1)
Protection:	Case: IP40. Terminals: IP20, to IEC 529 and EN 60529
Type approval:	The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.

UL markings: Wiring:
Use 60/75°C (140/167°F) copper conductors only

Wire size:
AWG 12-16 or equivalent

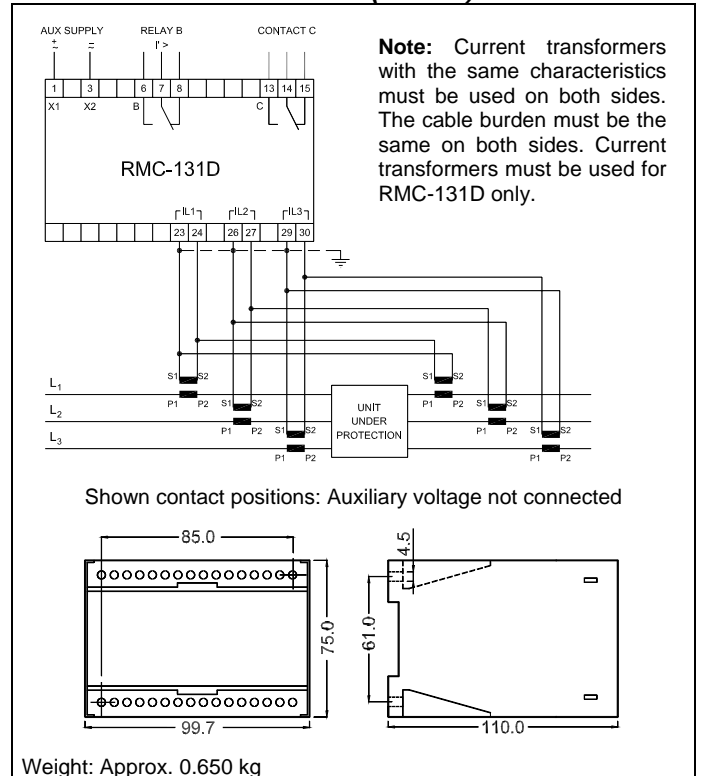
Installation:
To be installed in accordance with the NEC (US) or the CEC (Canada)

Settings and indication

Setting of	LED/relay
Differential current set point: (4...40%) of I_n	"I">" yellow LED is lit when the set point has been exceeded, but the contact not yet activated.
Time delay: (0...T1) in seconds 0...1/0...5/0...10 s	Contact is activated and red LED lit after the timer has expired.

The relay is furthermore equipped with a green LED marked "POWER" for indication of power ON. Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

Connections/dimensions (in mm)



Order specifications

Type – Measuring current (I_n) – Relay – Time delay (T1) – Supply voltage
Example: RMC-131D – 5A AC – NEL – 5 s – 440V AC

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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ANSI codes 50N/51N, 50G/51G

Type RMC-142D

- **Earth fault protection at 2 levels**
- **Built-in filter for 3rd harmonic**
- **LED indication of fault condition**
- **Timer controlled tripping**
- **LED indication for activated relay**
- **35 mm DIN rail or base mounting**

Application

The protective stator earth fault relay type RMC-142D forms part of a complete DEIF series of relays for protection and control of generators. The RMC-142D is primarily designed for land based installations. Also available are short circuit relays (RMC-111D), combined short circuit and overcurrent relays (RMC-122D) and double overcurrent relays (RMC-132D).

The RMC-142D is CE marked and is applied for protection of voltage sources and load networks against earth fault in a solid earthing or a low-resistance earthing system.

Measuring principle

The relay measures the leakage or a short circuit from one or more of the phases to earth.

In order to obtain a short response time on a fault condition, the measurement is based on peak values.

The earth fault current protection is i.e. obtained by connecting an external current transformer in the star point of the protected voltage source.

In order to prevent malfunction due to 3rd harmonic the RMC-142D is equipped with a special filter cutting off frequencies higher than 50/60Hz.

The set point values are set on the front of the relay by means of potentiometers. If exceeded, a fault signal is generated, and the associated yellow LED is lit.

Timer function

When the set point is exceeded, its timer starts and will run as long as the fault condition prevails.

The delay (3 ranges) does not depend on the exceeding of the set point.

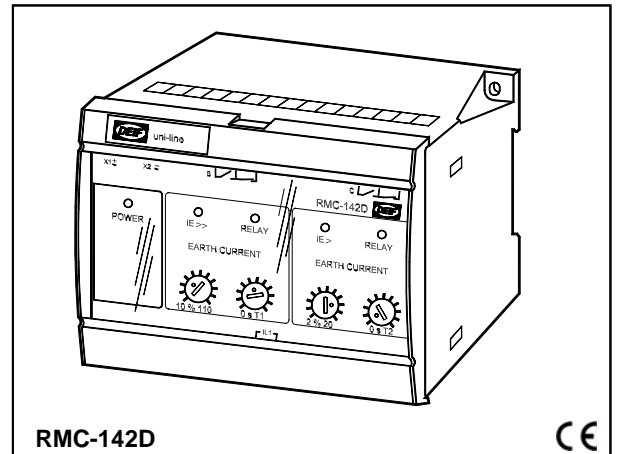
If the fault disappears, the timer is reset.

When the timer expires, the contact is activated and the associated red LED is lit.

Stator earth fault relays

uni-line

4921240148E



Relay outputs

The RMC-142 is provided with 2 outputs with maximum contacts either normally energised or normally de-energised. The contact may be set to open or close on activation.

Normally energised contact

Recommended for warning and alarm purposes.

In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact

Recommended for installations for regulating and control purposes.

An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit

The contact can be locked in its warning position, even if the earth faulty current (leakage current) return to normal (add "L" to contact type in order specifications, if this is required).

The latch circuit is reset by disconnecting the auxiliary supply.

Hysteresis

In order to avoid "chatter" on the relay contacts the contact functions are provided with a hysteresis, i.e. a difference of 2% of full scale between energising and de-energising of the delay.

Power-up/power-down circuits

The RMC-142D is provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

Note: Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Likewise, the RMC-142D is provided with a 200 ms power-down circuit, ensuring supervision and maintenance of any set point exceedings for 200 ms after disconnection of the auxiliary voltage.

Type RMC-142D

Technical specifications

Meas. range (I_n):	0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC UL/cUL listed: 0.4...5.0A AC
Adjusted range:	75...100% of I_n (e.g. 0.4, 0.45, etc.) (lowest meas. range: 0.3A)
Frequency range:	40...50/60...70Hz
Nominal frequency:	50Hz or 60Hz
3rd harmonic reject.:	Better than 18db
Max. input current:	4 x I_n , continuously, 20 x I_n for 10 s (max. 75A) 80 x I_n for 1 s (max. 300A)
Load:	Max. 0.3VA per phase
Outputs:	2 maximum contacts
Contact type:	Relays B + C: normally energised ("NE"), or normally de-energised ("ND") with or without latch circuit ("L")
Relay contact:	1 change-over switch per relay
Contact ratings:	250V AC/24V DC, 8A (200 x 10 ³ change-overs at resistive load) UL/cUL listed: Resistive load only
Contact voltage:	Max. 250V AC/150V DC
Hysteresis:	2% of full scale (F.S.)
Response time:	<50 ms
Temperature:	-25...70°C (-13...158°F) (operating) UL/cUL listed: Max. surrounding air temp. 60°C/140°F
Temperature drift:	Set points: Max. 0.2% of full scale per 10°C/50°F
Galvanic separation:	Between inputs, outputs and aux. voltage: 3250V - 50Hz - 1 min
Supply voltage (U_n):	57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA) 24-48-110-220V DC -25/+30% (max. 2W) UL/cUL listed: Only 24V DC and 110V AC DC supply must be from a class 2 power source
Climate:	HSE, to DIN 40040
EMC:	To EN 61000-6-1/2/3/4, SS4361503 (PL4) and IEC 255-3
Connections:	Max. 4 mm ² (single-stranded) Max. 2.5 mm ² (multi-stranded)
Materials:	All plastic parts are self-extinguishing to UL94 (V1)
Protection:	Case: IP40. Terminals: IP20, to IEC 529 and EN 60529
Type approval:	The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.
UL markings:	Wiring: Use 60/75°C (140/167°F) copper conductors only

UL markings, cont.: Wire size:
AWG 12-16 or equivalent

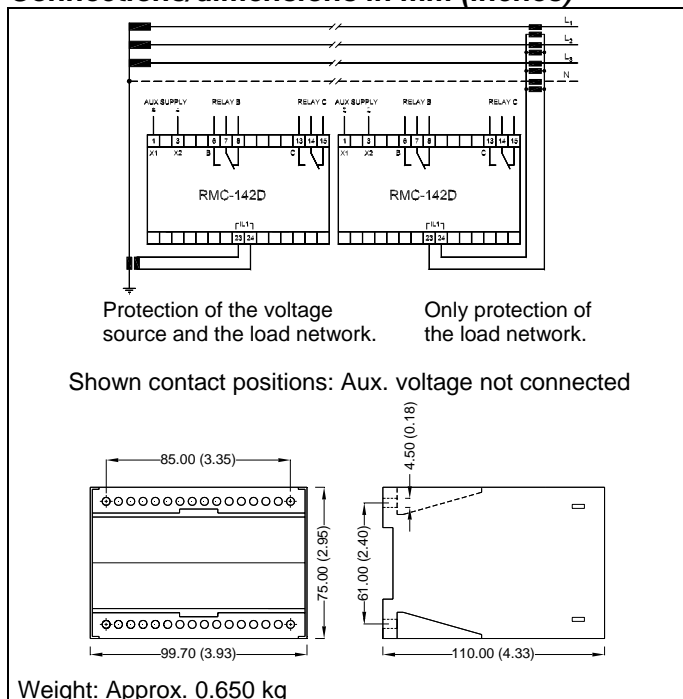
Installation:
To be installed in accordance with the NEC (US) or the CEC (Canada)

Settings and indication

Setting of	LED	Relay
Earth current set point: (10...110%) of I_n	iE>>	Yellow LED is lit when the set point has been exceeded, but the output contact not yet activated.
Time delay: (0-T1) in seconds 0...1/0...5/0...10s		Contact is activated and red LED lit after the timer has expired.
Earth current set point: (2...20%) of I_n	iE>	Yellow LED is lit when the set point has been exceeded, but the output contact not yet activated.
Time delay: (0-T2) in seconds 0...20/0...60/0...120s		Contact is activated and red LED lit after the timer has expired.

The relays are furthermore equipped with a green LED marked "POWER" for indication of power ON. Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

Connections/dimensions in mm (inches)



Order specifications

Type – Measuring current (I_n) – Nom. frequency – relay B – Relay C – Time delay (T1-T2) – Supply voltage
Example: RMC-142D – 5A AC – 50Hz – NDL – 1 s – 20 s – 440VAC

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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ANSI code 32
Type RMP-111D

- **Protection of prime mover**
- **3 phase measurement**
- **LED indication of alarm condition**
- **Timer controlled tripping**
- **LED indication for activated relay**
- **35 mm DIN rail or base mounting**

Application

The protective overload relay type RMP-111D forms part of a complete DEIF series of relays for protection and control of generators, and is applicable to both marine and land-based installations. Also available are reverse power relays (RMP-121D) and combined overload and reverse power relays (RMP-112D).

The RMP-111D is type approved by major classification societies and is applied for protection of the prime mover against overload.

This is especially required if the prime mover is underdimensioned in proportion to the AC generator.

Measuring principle

The relay measures all 3 phase currents and phase voltages.

The TDM (Time-Division-Multiplication) principle ensures an accurate measurement of the RMS value of the power ($3 \times U \times I \times \cos\phi$), irrespective of wave form and asymmetry.

The RMP-111D is available with the following couplings:

2W3	2 element 3 phase 3 wire, unbalanced load.
3W3(4)	3 element 3 phase 3 wire (4 wire), unbalanced load.

If the power exceeds a set point, the output is activated.

The set point value is set on the front of the relay by means of a potentiometer. If exceeded, a fault signal is generated, and the associated yellow LED is lit.

Timer function

When the set point is exceeded, the associated timer starts and will run as long as the fault condition prevails.

The delay does not depend on the exceeding of the set point.

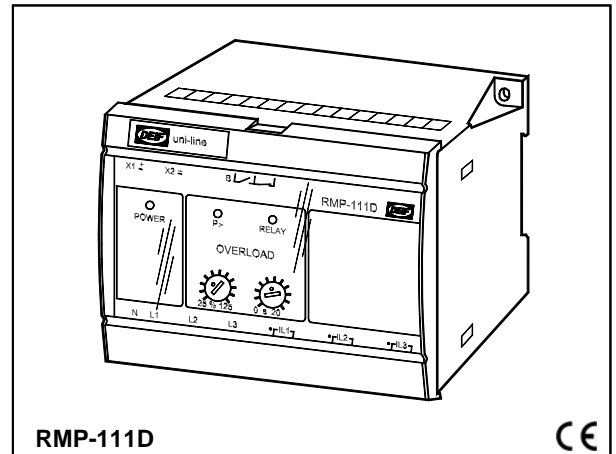
If the fault disappears, the timer is reset.

When the timer expires, the contact is activated and the associated red LED is lit.

Overload relays

uni-line

4921240108F



Relay output

The RMP-111D is provided with an output with a maximum contact, either normally energised or normally de-energised.

The contact may be set to open or to close on activation.

Normally energised contact

Recommended for land-based installations for warning and alarm purposes.

In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact

Recommended for marine installations for regulating and control purposes.

An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit

The contacts can be locked in their warning position, even if the input power returns to normal (add "L" to contact type in order specifications, if this is required).

The latch circuit is reset by disconnecting the auxiliary supply.

Hysteresis

In order to avoid "chatter" on the relay contacts the contact functions are provided with a hysteresis, i.e. a difference of 2% of full scale between energising and de-energising of the relay.

Note: Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Likewise, the RMP-111D is provided with a 200 ms power-down circuit, ensuring supervision and maintenance of any set point exceedings for 200 ms after disconnection of the auxiliary voltage.

Type RMP-111D

Technical specifications

Meas. current (I_n):	0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC UL/cUL listed: 0.4...5.0A AC
Adjusted range:	75...100% of I _n (e.g. 0.4, 0.45, etc.) (lowest meas. range: 0.3A)
Overload:	4 x I _n , continuously, 20 x I _n for 10 s (max. 75A) 80 x I _n for 1 s (max. 300A)
Load:	Max. 0.5VA per phase
Meas. voltage (U_n):	(See supply voltage - AC ranges) UL/cUL listed: 57.7...450V AC
Overload:	1.2 x U _n , continuously, 2 x U _n for 10 s
Load:	2kΩ/V
Frequency range:	40...45...65...70Hz
Output:	1 maximum contact
Contact type:	Relay B: normally energised ("NE"), or normally de-energised ("ND") With or without latch circuit ("L")
Relay contact:	1 change-over relay
Contact ratings:	250V AC/24V DC, 8A (200 x 10 ³ change-overs at resistive load) UL/cUL listed: Resistive load only
Contact voltage:	Max. 250V AC/150V DC
Hysteresis:	2% of full scale
Response time:	<400 ms
Temperature:	-25...70°C (-13...158°F) (operating) UL/cUL listed: Max. surrounding air temp. 60°C/140°F
Temperature drift:	Set points: Max. ±0.2% of full scale per 10°C/50°F
Galvanic separation:	Between inputs, outputs and aux. voltage: 3250V - 50Hz - 1 min
Supply voltage (U_n):	57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA) 24-48-110-220V DC -25/+30% (max. 2W) UL/cUL listed: Only 24V DC and 110V AC DC supply must be from a class 2 power source
Climate:	HSE, to DIN 40040
EMC:	To EN 61000-6-1/2/3/4, SS4361503 (PL4) and IEC 255-3
Connections:	Max. 4 mm ² (single-stranded) Max. 2.5 mm ² (multi-stranded)
Materials:	All plastic parts are self-extinguishing to UL94 (V1)
Protection:	Case: IP40. Terminals: IP20, to IEC 529 and EN 60529
Type approval:	The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.

UL markings:

Wiring:
Use 60/75°C (140/167°F) copper conductors only

Wire size:
AWG 12-16 or equivalent

Installation:
To be installed in accordance with the NEC (US) or the CEC (Canada)

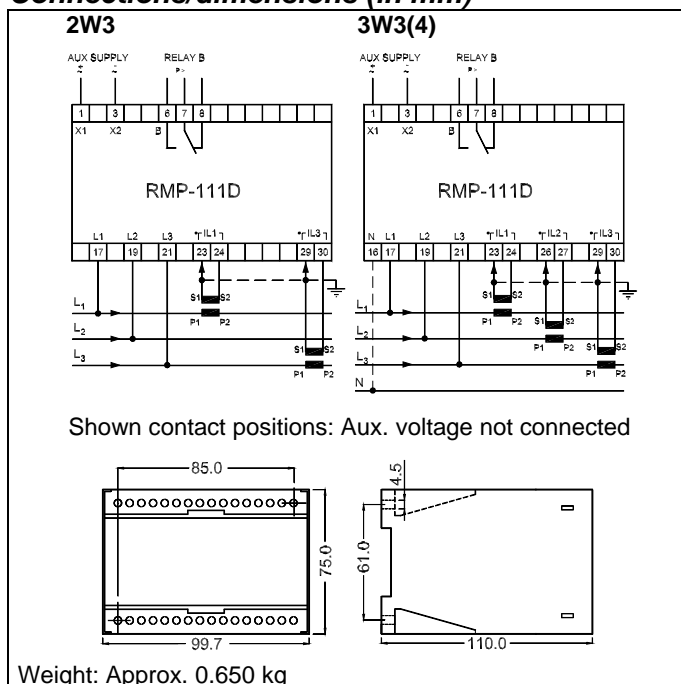
Settings and indication

Setting of	LED/relay
Overload set point: (25...125%) of P _n	"P>" yellow LED is lit when the set point has been exceeded, but the contact not yet activated.
Time delay: (0...20 s) in seconds	Contact is activated and red LED lit after the timer has expired.

The relay is furthermore equipped with a green LED marked "POWER" for indication of power ON.

Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

Connections/dimensions (in mm)



Order specifications

Type – Coupling – Meas. power (P_n) – Measuring voltage – Relay B – Supply voltage
Example: RMP-111D – 3W4 – 0..100W – 3 x 63.5V AC NDL – 230V AC
Meas. power (P_n) = $\frac{\text{Primary power}}{\text{CT ratio} \times \text{VT ratio}}$

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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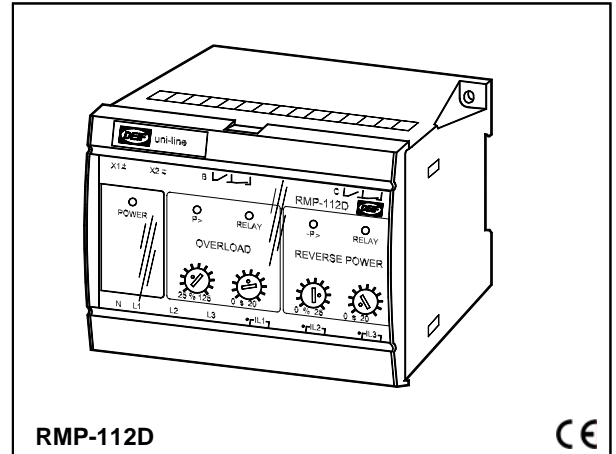


ANSI code 32
Type RMP-112D

Overload/reverse power relays

uni-line
4921240110F

- **Combined overload and reverse power**
- **3 phase measurement**
- **LED indication of fault condition**
- **Timer controlled tripping**
- **LED indication for activated relay**
- **35 mm DIN rail or base mounting**



Application

The protective overload and reverse power relay type RMP-112D forms part of a complete DEIF series of relays for protection and control of generators, and is applicable to both marine and land-based installations. Also available are overload relays (RMP-111D) and reverse power relays (RMP-121D).

The RMP-112D is type approved by major classification societies and is applied for protection of the prime mover against overload and for protection against reverse power.

Protection of the prime mover against overload is especially required if this is undersized in proportion to the AC generator. Supervision of the reverse power will prevent a generator running in parallel with other generators from running as a motor - thus protecting the prime mover - and will at the same time ensure that the remaining generators connected to the system are not disconnected due to overload of these.

Measuring principle

The relay measures all 3 phase currents and phase voltages. The TDM (Time-Division-Multiplication) principle ensures an accurate measurement of the RMS value of both the active power and the reverse power ($3 \times U \times I \times \cos\phi$), irrespective of wave form and asymmetry. The RMP-112D is available with the following couplings:

2W3	2 element 3 phase 3 wire, unbalanced load.
3W3(4)	3 element 3 phase 3 wire (4 wire), unbalanced load.

If either the power (P>) or the reverse power (-P>) exceeds its set point, the associated output is activated. The set points are set on the front of the relay by means of potentiometers. If exceeded, a fault signal is generated, and the associated yellow LED is lit.

Timer functions

When the set point is exceeded, the associated timer starts and will run as long as the fault condition prevails. The delay does not depend on the exceeding of the set point. If the fault disappears, the timer is reset. When the timer expires, the contact is activated and the associated red LED is lit.

Relay outputs

The RMP-112D is provided with 2 outputs:

- overload, a maximum contact (normally energised or normally de-energised)
- reverse power, a minimum contact (normally energised or normally de-energised)

The contacts may be set to open or to close on activation.

Normally energised contact

Recommended for land-based installations for warning and alarm purposes. In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact

Recommended for marine installations for regulating and control purposes. An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit

The contacts can be locked in their warning position, even if the input power returns to normal (add "L" to contact type in order specifications, if this is required).

The latch circuit is reset by disconnecting the auxiliary supply.

Hysteresis

In order to avoid "chatter" on the relay contacts the contact functions are provided with a hysteresis, i.e. a difference of 2% of full scale between energising and de-energising of the relay.

Power-up/power-down circuits

The RMP-112D is provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

Note: Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Likewise, the RMP-112D is provided with a 200 ms power-down circuit, ensuring supervision and maintenance of any set point exceedings for 200 ms after disconnection of the auxiliary voltage.

Type RMP-112D

Technical specifications

Meas. current (I_n):	0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC UL/cUL listed: 0.4...5.0A AC
Adjusted range:	75...100% of I _n (e.g. 0.4, 0.45 etc.) (lowest meas. range: 0.3A)
Overload:	4 x I _n , continuously, 20 x I _n for 10 s (max. 75A) 80 x I _n for 1 s (max. 300A)
Load:	Max. 0.5VA per phase
Meas. voltage (U_n):	(See supply voltage - AC ranges) UL/cUL listed: 57.7...450V AC
Overload:	1.2 x U _n , continuously, 2 x U _n for 10 s
Load:	2kΩ/V
Frequency range:	40...45...65...70Hz
Outputs:	1 max. and 1 min. contact
Contact type:	Relays B + C: normally energised ("NE"), or normally de-energised ("ND") with or without latch circuit ("L")
Relay contacts:	1 change-over switch per contact
Contact ratings:	250V AC/24V DC, 8A (200 x 10 ³ change-overs at resistive load) UL/cUL listed: Resistive load only
Contact voltage:	Max. 250V AC/150V DC
Hysteresis:	2% of full scale (F.S.)
Response time:	<400 ms
Temperature:	-25...70°C (-13...158°F) (operating) UL/cUL listed: Max. surrounding air temp. 60°C/140°F
Temperature drift:	Set points: Max. ±0.2% of full scale per 10°C/50°F
Galvanic separation:	Between inputs, outputs and aux. voltage: 3250V - 50Hz - 1 min
Supply voltage (U_n):	57.7-63.5-100-110-127-200-220-230- 240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA) 24-48-110-220V DC -25/+30% (max. 2W) UL/cUL listed: Only 24V DC and 110V AC DC supply must be from a class 2 power source
Climate:	HSE, to DIN 40040
EMC:	To EN 61000-6-1/2/3/4, SS4361503 (PL4) and IEC 255-3
Connections:	Max. 4 mm ² (single-stranded) Max. 2.5 mm ² (multi-stranded)
Materials:	All plastic parts are self-extinguishing to UL94 (V1)
Protection:	Case: IP40. Terminals: IP20, to IEC 529 and EN 60529
Type approval:	The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.
UL markings:	Wiring: Use 60/75°C (140/167°F) copper conductors only

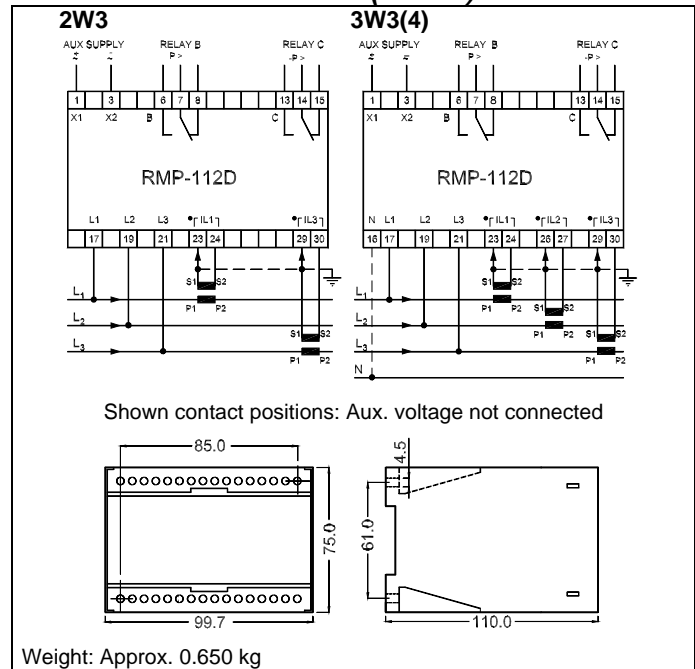
UL markings, cont.: Wire size:
AWG 12-16 or equivalent
Installation:
To be installed in accordance with the
NEC (US) or the CEC (Canada)

Settings and indication

Setting of	LED/relay
Overload set point: (25...125%) of P _n	"P>" yellow LED is lit when the set point has been exceeded, but the output contact not yet activated.
Reverse power set point: (0...25%) of P _n	"-P>" yellow LED is lit when the set point has been exceeded, but the output contact not yet activated.
For both: Time delay: (0...20 s) in seconds	Contact is activated and red LED lit after the timer has expired.

The relay is furthermore equipped with a green LED marked "POWER" for indication of power ON. Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

Connections/dimensions (in mm)



Order specifications

Type - Coupling - Meas. Power (P_n) - Meas. voltage - Relay B - Relay C - Supply voltage

Example:
RMP-112D - 3W3 - 0..100W - 3 x 110V AC - NDL - NE
230V AC

$$\text{Meas. power (P}_n\text{)} = \frac{\text{Primary power}}{\text{CT ratio} \times \text{VT ratio}}$$

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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ANSI code 32
Type RMP-121D

- **Protection against "motoring"**
- **Single phase measurement**
- **LED indication of fault condition**
- **Timer controlled tripping**
- **LED indication for activated relay**
- **35 mm DIN rail or base mounting**

Application

The protective reverse power relay type RMP-121D forms part of a complete DEIF series of relays for protection and control of generators, and is applicable to both marine and land-based installations. Also available are overload relays (RMP-111D) and combined overload and reverse power relays (RMP-112D).

The RMP-121D is type approved by major classification societies.

The protective reverse power relay will prevent a generator running in parallel with other generators from running as a motor ("motoring") in case of lost prime mover torque, and will thus protect the prime mover, at the same time ensuring that the remaining generators connected to the system are not overloaded.

The RMP-121D likewise protects against reverse power arisen from an increase of the power of other generators connected to the system.

Measuring principle

The applied TDM (Time-Division-Multiplication) principle ensures an accurate measurement of the RMS value of the power ($U \times I \times \cos-\phi$), irrespective of wave form. The RMP-121D is available with the following connections:

- 1W single phase
- 1W3 1 element 3 phase 3 wire, balanced load
- 1W4 1 element 3 phase 4 wire, balanced load

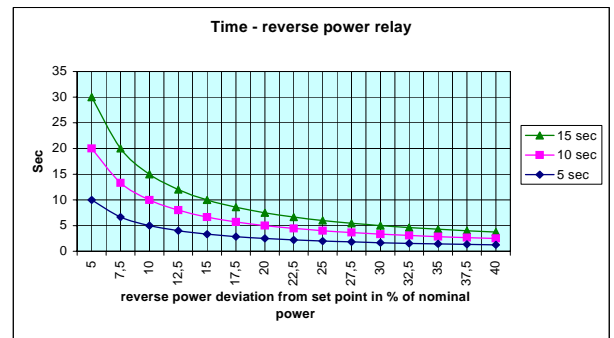
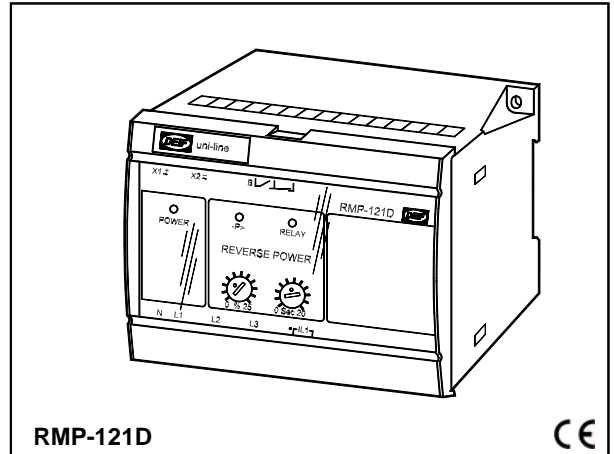
The set point value is set on the front of the relay by means of a potentiometer. If exceeded, a fault signal is generated, and the associated yellow LED is lit.

Timer function

The RMP-121D can be delivered with two different timer characteristics:

- Normal timer characteristic means that the delay does not depend on the exceeding of the set point.
- Inverse timer characteristic means that if the -P set point is exceeded by 10% of nominal power, the inverse timer functionality gives the same delay as the time potentiometer. If the -P set point is exceeded by 20% of nominal power, the delay will be half the value set on the time potentiometer.

Reverse power relays
uni-line
4921240106H



Relay output

The RMP-121D is provided with an output with a minimum contact, either normally energised or normally de-energised. The contact may be set to open or to close on activation.

Normally energised contact

Recommended for land-based installations for warning and alarm purposes. In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact

Recommended for marine installations for regulating and control purposes. An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit

The contact can be locked in its warning position, even if the input returns to normal (add "L" to contact type in order specifications, if this is required). Disconnecting the auxiliary supply resets the latch circuit.

Hysteresis

In order to avoid "chatter" on the relay contacts the contact functions are provided with a hysteresis, i.e. a difference of 2% of full scale between energising and de-energising of the relay.

Power-up/power-down circuits

The RMP-121D is provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

Note: Normally energised contacts are not activated until 200 ms after connection of the auxiliary voltage.

Likewise, the RMP-121D has a ride-through circuit that allows for continued operation, supervision and maintenance in the event of a momentary loss of power for up to 200 ms.

Type RMP-121D

Technical specifications

Meas. current (I_n):	0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC UL/cUL listed: 0.4...5.0A AC
Adjusted range:	75...100% of I _n (e.g. 0.4, 0.45, etc.) (lowest meas. range: 0.3A)
Overload:	4 x I _n , continuously, 20 x I _n for 10 s (max. 75A) 80 x I _n for 1 s (max. 300A)
Load:	Max. 0.5VA per phase
Meas. voltage (U_n):	(See supply voltage - AC ranges) UL/cUL listed: 57.7...450V AC
Overload:	1.2 x U _n , continuously, 2 x U _n for 10 s
Load:	2kΩ/V
Frequency range:	40...45...65...70Hz
Output:	1 minimum contact
Contact type:	Relay B: normally energised ("NE"), or normally de-energised ("ND") with or without latch circuit ("L")
Relay contact:	1 change-over switch
Contact ratings:	250V AC/24V DC, 8A (200 x 10 ³ change-overs at resistive load) UL/cUL listed: Resistive load only
Contact voltage:	Max. 250V AC/150V DC
Hysteresis:	2% of full scale (F.S.)
Response time:	<400 ms
Temperature:	-25...70°C (-13...158°F) (operating) UL/cUL listed: Max. surrounding air temp. 60°C/140°F
Temperature drift:	Set points: Max. ±0.2% of F.S. per 10°C/50°F
Galvanic separation:	Between inputs, outputs and aux. voltage: 3250V - 50Hz - 1 min.
Supply voltage (U_n):	57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA) 24-48-110-220V DC -25/+30% (max. 2W) UL/cUL listed: Only 24V DC and 110V AC DC supply must be from a class 2 power source
Climate:	HSE, to DIN 40040
EMC:	To EN 61000-6-1/2/3/4, SS4361503 (PL4) and IEC 255-3
Connections:	Max. 4 mm ² (single-stranded) Max. 2.5 mm ² (multi-stranded)
Materials:	All plastic parts are self-extinguishing to UL94 (V1)
Protection:	Case: IP40. Terminals: IP20, to IEC 529 and EN 60529
Type approval:	The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.
UL markings:	Wiring: Use 60/75°C (140/167°F) copper conductors only

UL markings, cont.: Wire size:
AWG 12-16 or equivalent
Installation:
To be installed in accordance with the NEC (US) or the CEC (Canada)

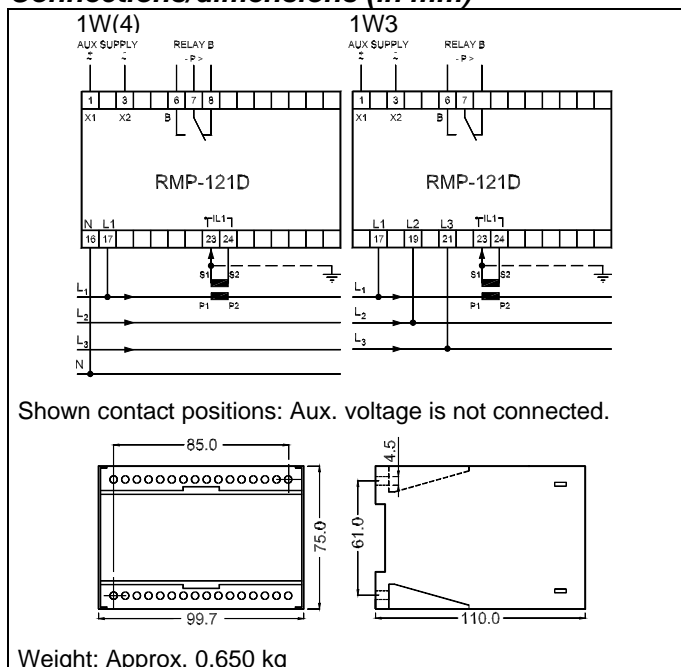
Settings and indication

Setting of	LED/relay
Reverse power set point: (0...25%) of -P _n	"-P>" yellow LED is lit when the set point has been exceeded, but the relay not yet activated.
Time delay: (0...20 s) in seconds	Contact is activated and red LED lit after the timer has expired.

The relay is furthermore equipped with a green LED marked "POWER" for indication of power ON.

Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

Connections/dimensions (in mm)



Order specifications

Type - Coupling - Meas. power (-P_n) - Measuring voltage - Relay B - Supply voltage - Timer characteristic

Example:
RMP-121D - 1W3 - 0...100W - 110V AC - NEL - 220V DC - Normal timer characteristic

$$\text{Meas. power (P}_n\text{)} = \frac{\text{Primary power}}{\text{CT ratio} \times \text{VT ratio}}$$

Notice: Specify phase to phase voltage for coupling 1W3 and 1W4

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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ANSI code 40

Type RMQ-111D, RMQ-121D

- **Loss of excitation/overexcitation**
- **Protection of generators**
- **Single phase measurement**
- **Timer controlled tripping**
- **LED indication of fault/activated relay**
- **35 mm DIN rail or base mounting**

Application

The protective loss of excitation relay type RMQ-111D and the overexcitation relay type RMQ-121D form part of a complete DEIF series of relays for protection and control of generators.

The relays are type approved by major classification societies and are applicable to both marine and land-based installations.

Loss of excitation relay type RMQ-111D (ANSI code 40)

This relay is applied to protect a generator running in parallel with other generators from running as an induction generator due to underexcitation.

The RMQ-111D will thus protect the generator against damages caused by excessive heating due to slip frequency current flow, at the same time preventing transfer of reactive load from a faulty generator.

The RMQ-111D is especially applied in cases where applying an undervoltage relay for protection does not suffice, because the remaining generators of the system can supply sufficient reactive power to magnetize the faulty generator, thus maintaining the terminal voltage of the generators.

Overexcitation relay type RMQ-121D (ANSI code 40/O)

This relay is applied to protect a generator against overexcitation and will prevent it from generating too high currents in case of heavy inductive loads.

The RMQ-121D will thus protect the generator against damages caused by excessive heating of its windings, at the same time preventing transfer of reactive load to a faulty generator.

Measuring principle

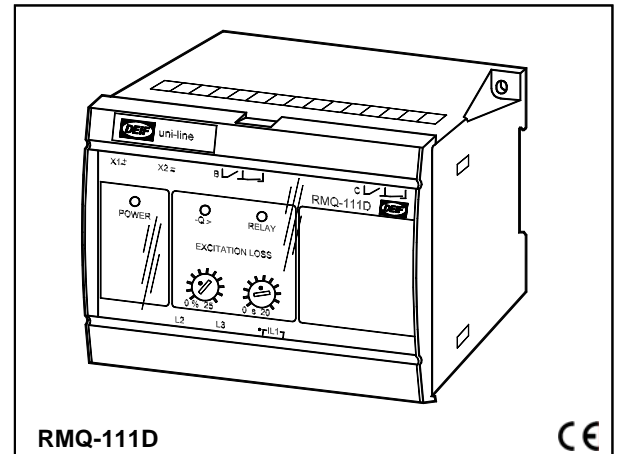
The applied TDM (Time-Division-Multiplication) principle ensures an accurate measurement of the RMS value of the reactive power ($U \times I \times \sin(\varphi)$), irrespective of wave form. The relays are available with connection 1var3(4), i.e. 1 element 3 phase 3 wire (4 wire), balanced load.

If the reactive power exceeds the set point, the output is activated. The set point value is set on the front of the relay by means of a potentiometer. If the reactive power exceeds this, a fault signal is generated, and the associated yellow LED is lit.

Excitation relays

uni-line

4921240112F



Timer function

When the set point is exceeded, the associated timer starts and will run as long as the fault condition prevails. The delay does not depend on the exceeding of the set point. If the fault disappears, the timer is reset. When the timer expires, the contact is activated and the associated red LED is lit.

Relay output

The relays are provided with outputs as follows:

RMQ-111D -Q> 1 minimum contact
 RMQ-121D Q> 1 maximum contact
 either normally energised or normally de-energised. The contact may be set to open or to close on activation.

Normally energised contact

Recommended for land-based installations for warning and alarm purposes. In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact

Recommended for marine installations for regulating and control purposes. An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit

The contacts can be locked in their warning position, even if the input returns to normal (add "L" to contact type in order specifications, if this is required). The latch circuit is reset by disconnecting the auxiliary supply.

Hysteresis

In order to avoid "chatter" on the relay contacts the contact functions are provided with a hysteresis, i.e. a difference of 2% of full scale between energising and de-energising of the relay.

Power-up/power-down circuits

The relays are provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

Note: Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Likewise, the relays are provided with a 200 ms power-down circuit, ensuring supervision and maintenance of any set point exceedings for 200 ms after disconnection of the auxiliary voltage.

Type RMQ-111D, RMQ-121D

Technical specifications

Meas. range (I_n):	0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC UL/cUL listed: 0.4...5.0A AC
Adjusted ranges:	75...100% of I _n (e.g. 0.4, 0.45, etc.) (lowest meas. range: 0.3A)
Overload:	4 x I _n , continuously, 20 x I _n for 10 s (max. 75A) 80 x I _n for 1 s (max. 300A)
Load:	Max. 0.5VA per phase
Meas. voltage (U_n):	(see supply voltage - AC ranges)
Overload:	1.2 x U _n , continuously, 2 x U _n for 10 s
Load:	2kΩ/V
Frequency range:	40...45...65...70Hz
Output:	1 minimum contact
Contact type:	Relay B: normally energised ("NE"), or normally de-energised ("ND") with or without latch circuit ("L")
Relay contact:	1 change-over relay
Contact ratings:	250V AC/24V DC, 8A (200 x 10 ³ change-overs at resistive load) UL/cUL listed: Resistive load only
Contact voltage:	Max. 250V AC/150V DC
Hysteresis:	2% of full scale (F.S.)
Response time:	<400 ms
Temperature:	-25...70°C (-13...158°F) (operating) UL/cUL listed: Max. surrounding air temp. 60°C/140°F
Temperature drift:	Set points: Max. ±0.2% of full scale per 10°C/50°F
Galvanic separation:	Between inputs, outputs and aux. voltage: 3250V - 50Hz - 1 min.
Supply voltage (U_n):	57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690VAC ±20% (max. 3.5VA) 24-48-110-220V DC -25/+30% (max. 2W) UL/cUL listed: Only 24V DC and 110V AC DC supply must be from a class 2 power source
Climate:	HSE, to DIN 40040
EMC:	To EN 61000-6-1/2/3/4, SS4361503 (PL4) and IEC 255-3
Connections:	Max. 4 mm ² (single-stranded) Max. 2.5 mm ² (multi-stranded)
Materials:	All plastic parts are self-extinguishing to UL94 (V1)
Protection:	Case: IP40. Terminals: IP20, to IEC 529 and EN 60529
Type approval:	The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.
UL markings:	Wiring: Use 60/75°C (140/167°F) stranded copper conductors only

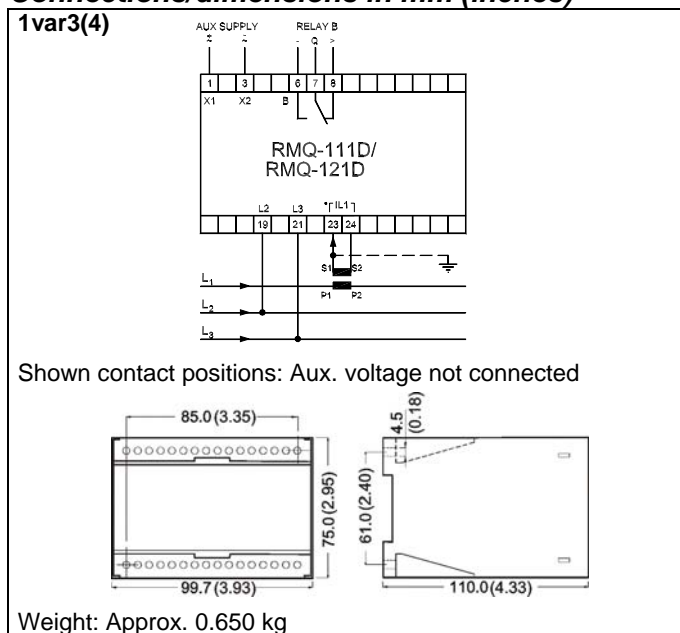
UL markings, cont.: Wire size:
AWG 12-16 or equivalent
Installation:
To be installed in accordance with the NEC (US) or the CEC (Canada)

Settings and indication

Setting of	LED	Relay
Reactive power set point: RMQ-111D: (0...25%) of Q _n	"-Q>"	Yellow LED is lit when the reactive power has dropped below the set point, but the relay has not yet been activated.
Reactive power set point: RMQ-121D: (25...125%) of Q _n	"Q>"	Yellow LED is lit when the reactive power exceeds the set point, but the relay has not yet been activated.
Time delay: (0...20 s) in sec.	"RELAY"	Contact is activated and red LED lit after timer has expired.

The relay is furthermore equipped with a green LED marked "POWER" for indication of power ON. Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

Connections/dimensions in mm (inches)



Order specifications

Type - Measuring power (Q_n) - Measuring voltage - Relay B - Supply voltage

Examples:
RMQ-111D - 0...100var - 110V AC - ND - 220V DC
RMQ-121D - 0...1000var - 660V AC - NE - 24V DC

$$\text{Meas. power (Q}_n\text{)} = \frac{\text{Primary power}}{\text{CT ratio} \times \text{VT ratio}}$$

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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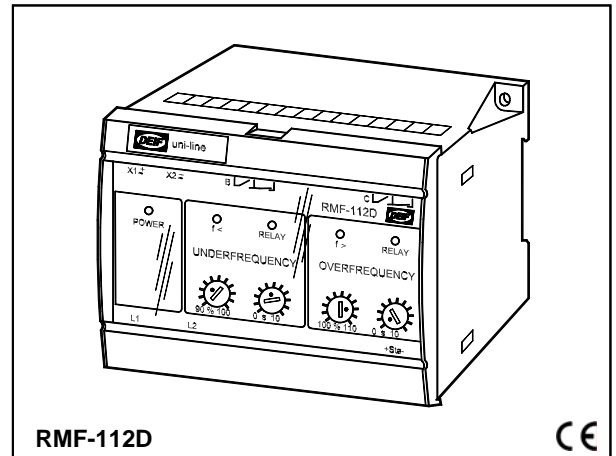


ANSI code 81
Type RMF-112D

Frequency relays

uni-line
4921240223C

- **Combined underfrequency/overfrequency**
- **For single and 3 phase networks**
- **LED indication of fault condition**
- **Timer controlled tripping**
- **LED indication for activated relay**
- **35 mm DIN rail or base mounting**



Application

The digital, combined underfrequency and overfrequency relay type RMF-112D forms part of a complete DEIF series of relays for protection and control of generators.

The relay is type approved by major classification societies and is applicable to both marine and landbased installations.

The RMF-112D is applied for protection against underfrequency and overfrequency by supervising the frequency (of generators) in single phase and 3 phase networks.

Measuring principle

The relay measures the voltage between 2 phases or between one phase and the neutral.

To avoid unwanted underfrequency alarms, the RMF-112D relay is not activated until the measuring voltage exceeds 60% of U_n .

If either the underfrequency or overfrequency exceeds its set point, its associated output is activated.

The set point values are set on the front of the relay by means of potentiometers. If exceeded, a fault signal is generated, and the associated yellow LED is lit.

Timer functions

When the set point is exceeded, its associated timer starts and will run as long as the fault conditions prevail. The delay does not depend on the exceeding of the set point.

If the fault disappears, the timer is reset. When the timer expires, the contact is activated and the associated red LED is lit.

Relay outputs

The RMF-112D is provided with 2 outputs:

- f< a minimum contact (normally energised or normally de-energised)
- f> a maximum contact (normally energised or normally de-energised)

The contacts may be set to open or to close on activation.

Normally energised contact

Recommended for land-based installations for warning and alarm purposes.

In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact

Recommended for marine installations for regulating and control purposes.

An auxiliary supply failure will not result in an unwanted activation of the contact.

Latch circuit

The contact can be locked in its warning position, even if the input frequency returns to normal (add "L" to contact type in order specifications, if this is required).

The latch circuit is reset by disconnecting the auxiliary supply.

Hysteresis

In order to avoid "chatter" on the relay contacts the contact functions are provided with a hysteresis, i.e. a difference of 0.25Hz between energising and de-energising of the relay.

Power-up/power-down circuits

The RMF-112D is provided with a 200 ms power-up circuit, ensuring the correct voltage function of the relay on connection of the auxiliary voltage.

Note: Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Likewise, the RMF-112D is provided with a 200 ms power-down circuit, ensuring supervision and maintenance of any set point exceedings for 200 ms after disconnection of the auxiliary voltage.

Type RMF-112D

Technical specifications

Meas. voltage (U_n):	See supply voltage - AC ranges UL/cUL listed: 57.7...450V AC
Voltage range:	60...120% of U _n
Overload:	1.2 x U _n , continuously, 2 x U _n for 10 s
Load:	2kΩ/V
Frequency range:	40...45...65...70Hz
Nom. frequency (f_n):	50Hz, 55Hz or 60Hz
Output:	1 min. and 1 max. contact
Contact type:	Relays B + C: normally energised ("NE"), or normally de-energised ("ND") with or without latch circuit ("L")
Relay contacts:	1 change-over switch per relay
Contact ratings:	250V AC/24V DC, 8A (200 x 10 ³ change-overs at resistive load) UL/cUL listed: Resistive load only
Contact voltage:	Max. 250V AC/150V DC
Optocoupler output:	System status off = failure UL/cUL listed: 30V DC, 5mA
Hysteresis:	0.25Hz
Response time:	<90 ms
Temperature:	-25...70°C (-13...158°F) (operating) UL/cUL listed: Max. surrounding air temp. 60°C/140°F
Temperature drift:	±0.1Hz per 10°C/50°F
Galvanic separation:	Between inputs and outputs: 3250V - 50Hz - 1 min.
Supply voltage:	57.7-63.5-100-110-127-200-220-230- 240-380-400-415-440-450-660-690V AC ±20% (max. 4VA) 24-48-110-220V DC -25/+30% (max. 3.5W) UL/cUL listed: Only 24V DC and 110V AC DC supply must be from a class 2 power source
Climate:	HSE, to DIN 40040
EMC:	To EN 61000-6-1/2/3/4, SS4361503 (PL4) and IEC 255-3
Connections:	Max. 4 mm ² (single-stranded) Max. 2.5 mm ² (multi-stranded)
Materials:	All plastic parts are self-extinguishing to UL94 (V1)
Protection:	Case: IP40. Terminals: IP20, to IEC 529 and EN 60529
Type approval:	The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.
UL markings:	Wiring: Use 60/75°C (140/167°F) copper conductors only Wire size: AWG 12-16 or equivalent Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)

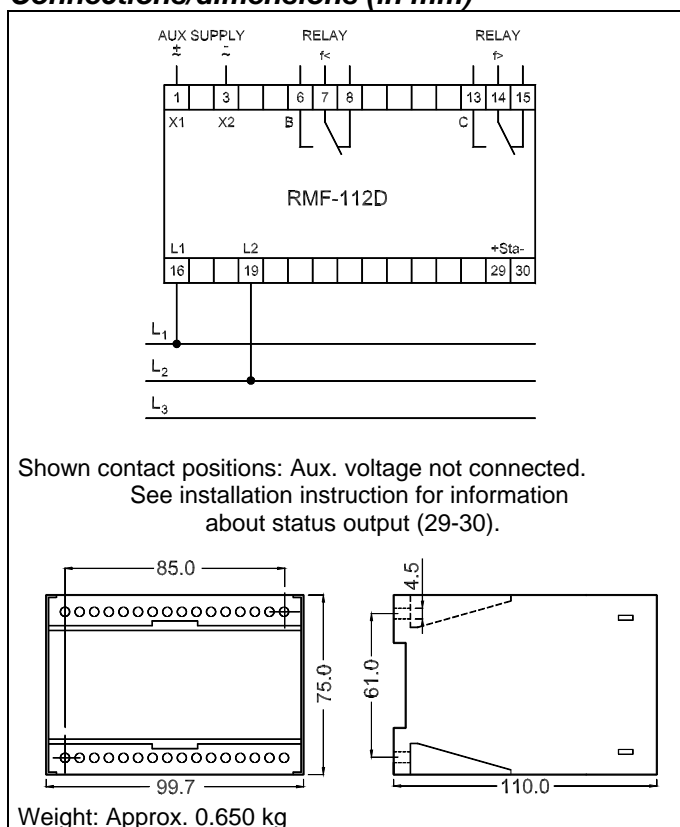
Settings and indication

Setting of	LED/relay
Underfrequency set point: (90...100%) of f _n (80...100%) of f _n at f _n = 55Hz	"f<" yellow LED is lit when the frequency has dropped below the set point, but the relay not yet activated.
Overfrequency set point: (100...110%) of f _n (100...120%) of f _n at f _n = 55Hz	"f>" yellow LED is lit when the set point is exceeded, but the relay not yet activated.
Time delay: (0...10 s) in seconds	Contact is activated and red LED lit after the timer has expired.

The relay is furthermore equipped with a green LED marked "POWER" for indication of power ON.

Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

Connections/dimensions (in mm)



Order specifications

Type – Meas. Voltage – Nom. Frequency – Relay B – Relay C – Supply voltage

Example:

RMF-112D – 380V AC – 50Hz – NE – ND – 24V DC

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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ANSI code 78
Type LMR-111D

- **Detection of vector shift**
- **Mains disconnection on mains failure**
- **Ensures no asynchronous reconnection**
- **LED indication of fault condition**
- **LED indication for activated relay**
- **35 mm DIN rail or base mounting**

Application

The loss of mains relay type LMR-111D forms part of a complete DEIF series of relays for protection and control of generators.

This relay is applied for protection of synchronous generators, running in parallel with the mains.

A mains failure will be detected, provided a disconnection at an arbitrary point of the network results in a swift change of the generator frequency (vector shift). An opening signal is then transmitted to the mains circuit breaker, and the generator will thus be protected against damages caused by an automatic reconnection to the high-voltage network.

The LMR-111D will on the other hand not detect the normal relatively slow and acceptable changes of the frequency of the network (the mains).

Furthermore, separation of a generator from the mains in case of mains failure is also stipulated as a condition in most national rules for connection of synchronous generators to the mains. Regarding Great Britain, see Engineering Recommendation G59.

Measuring principle

The relay supervises the angular velocity of the phases of the mains. The velocity is supervised by comparing the times for the latest two full cycles with the times for the full cycles of the previous 4th and 5th period.

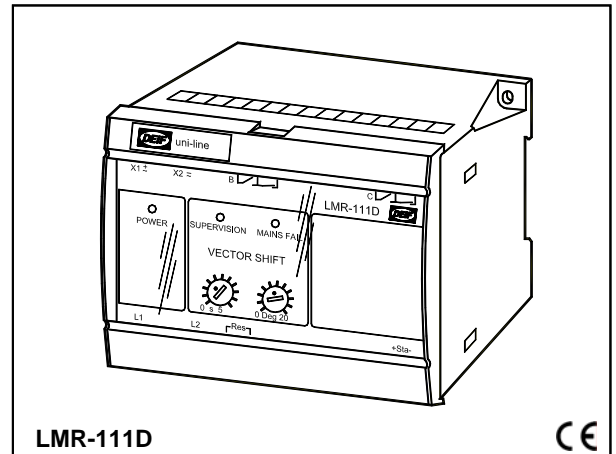
After 5 periods have passed (after connection to the mains) the relay will thus have performed the first measurement. After this the LMR-111D will within one period detect a vector shift.

This method of measurement (comparing periods 1 and 2 with periods 4 and 5) ensures correct detection of a vector shift occurring very close to the zero crossing of the AC voltage.

If the difference between the measurements exceeds the set point, the output is activated. Within 30 ms (inclusive of contact delay), an opening signal is transmitted to mains circuit breaker, and the LED marked "MAINS FAIL" is lit. The set point value is set on the front of the relay by means of a potentiometer marked "SENS".

Loss of mains relay

uni-line
4921240214D



The LMR-111D is provided with 1 reset input connected to contacts to the generator circuit breaker and to the mains circuit breaker. These 2 contacts should close when their respective circuit breaker is opened.

When the RESET (22-23) is activated, the LMR-111D will not detect a possible mains failure. This function ensures that the relay is only active when both circuit breakers are closed and the generator thus is running in parallel with the mains.

On receipt of a reset signal (transmitted by the mains circuit breaker auxiliary contact during opening of its circuit breaker), an internal timer is started. When this expires (after 2 s), the opening signal to the mains circuit breaker is cancelled, and the LED "MAINS FAIL" is switched off.

The LMR-111D is provided with an adjustable initialising timer, which is activated on cancellation of the reset signal (closing of circuit breakers). When this timer expires, the LMR-111D is activated and the LED "Supervision" is lit. The time delay is set on the front of the relay by means of the potentiometer "Delay".

Relay outputs

The LMR-111D is provided with 2 output contacts (with common set points), either normally energised or normally de-energised. The contacts may be set to open or to close on activation.

Normally energised contact

Recommended for warning and alarm purposes. In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact

Recommended for regulating and control purposes. An auxiliary supply failure will not result in an unwanted activation of the contact.

Power-up circuit

The relays are provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

Note: Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Type LMR-111D

Technical specifications

Meas. voltage (U_n):	See supply voltage - AC ranges UL/cUL listed: 57.7...450V AC
Overload:	1.2 x U _n , continuously, 2 x U _n for 10 s
Load:	2kΩ/V
Frequency range:	40...45...65...70Hz
"RESET" inputs:	Input voltage: 18...250V AC/DC for "activated" condition Input impedance: 100kΩ
Output:	2 change-over switches
Contact type:	Relays B + C: Normally energised ("NE"), or normally de-energised ("ND")
Contact ratings:	250V AC/24V DC, 8A (200 x 10 ³ change-overs at resistive load) UL/cUL listed: Resistive load only
Contact voltage:	Max. 250V AC/150V DC
Response time:	<30 ms
Temperature:	-25...70°C (-13...158°F) (operating) UL/cUL listed: Max. surrounding air temp. 60°C/140°F
Temperature drift:	Set points: Max. ±0.2% of full scale per 10°C/50°F
Galvanic separation:	Between inputs and outputs: 3250V - 50Hz - 1 min.
Supply voltage (U_n):	57.7-63.5-100-110-127-200-220-230- 240-380-400-415-440-450-660-690V AC ±20% (max. 4VA) 24-48-110-220V DC -25/+30% (max. 3.5W) UL/cUL listed: Only 24V DC and 110V AC DC supply must be from a class 2 power source
Climate:	HSE, to DIN 40040
EMC:	To EN 61000-6-1/2/3/4, SS4361503 (PL4) and IEC 255-3
Connections:	Max. 4 mm ² (single-stranded) Max. 2.5 mm ² (multi-stranded)
Materials:	All plastic parts are self-extinguishing to UL94 (V1)
Protection:	Case: IP40. Terminals: IP20, to IEC 529 and EN 60529
Type approval:	The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S.
UL markings:	Wiring: Use 60/75°C (140/167°F) copper conductors only Wire size: AWG 12-16 or equivalent Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)

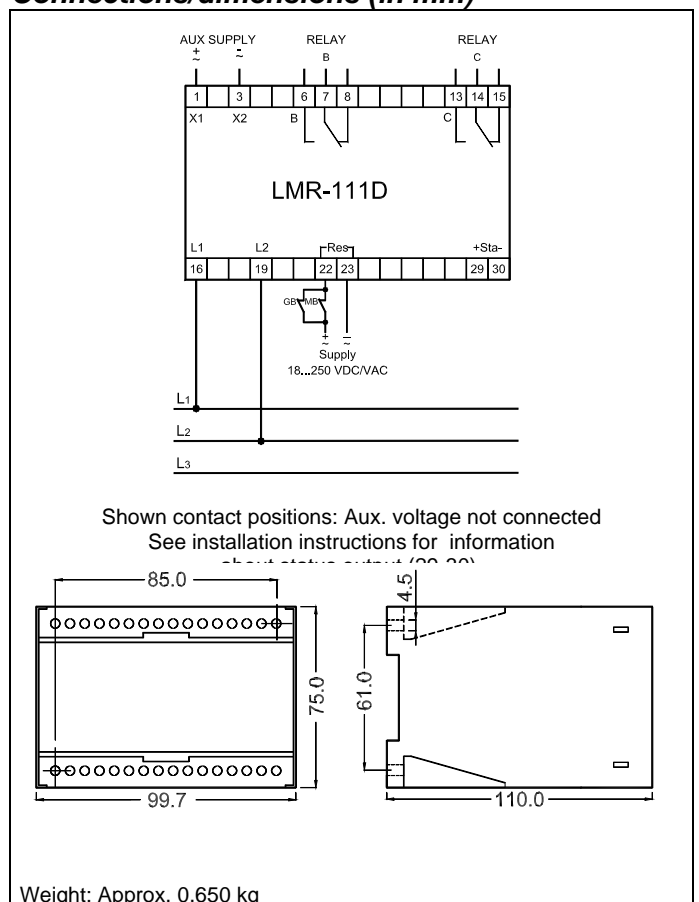
Settings and indication

Setting of	LED/relay
Initialising ("DELAY") (0.5...5 s)	Yellow LED "SUPERVISION" is lit after the timer has expired.
Sensitivity ("SENS"): (2...20 electr. degr.)	Red LED "MAINS FAIL" is lit during fault condition.

The relay is furthermore equipped with a green LED marked "POWER" for indication of power ON.

Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

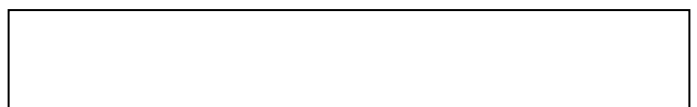
Connections/dimensions (in mm)



Order specifications

Type – Meas. voltage – Relay B – Relay C – Supply voltage Example: LMR-111D – 380V AC – NE – NE – 24V DC

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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ANSI code 78

Type LMR-122D

- **Detection of vector shift and ROCOF (df/dt)**
- **Generator disconnection on mains failure**
- **Ensures no asynchronous reconnection**
- **LED indication of fault condition**
- **LED indication for activated relay**
- **35 mm DIN rail or base mounting**

Application

The loss of mains relay type LMR-122D forms part of a complete DEIF series of relays for protection and control of generators.

This relay is applied for protection of synchronous generators, running in parallel with the mains.

A mains failure will be detected, provided a disconnection at an arbitrary point of the network results in a swift change of the generator frequency. An opening signal is then transmitted to the mains circuit breaker, and the generator will thus be protected against damages caused by an automatic reconnection to the high-voltage network.

The LMR-122D will on the other hand not detect the normal relatively slow and acceptable changes of the frequency of the network (the mains).

Furthermore, separation of a generator from the mains in case of mains failure is also stipulated as a condition in most national rules for connection of synchronous generators to the mains. Regarding Great Britain, see Engineering Recommendation G59.

Measuring principle

After 5 periods have passed (after connection to the mains) the relay will thus have performed the first measurement. After this the LMR-122D will within 30 ms for vector shift and 100 ms for ROCOF (df/dt) detect a possible mains failure.

The ROCOF (Rate of change of frequency - df/dt) supervises the change in frequency for every period. If the change in frequency for four periods in a row exceeds the setpoint, the output is activated. Within 100 ms (inclusive of contact delay), an opening signal is transmitted to mains circuit breaker, and the LED marked "MAINS FAIL" is lit.

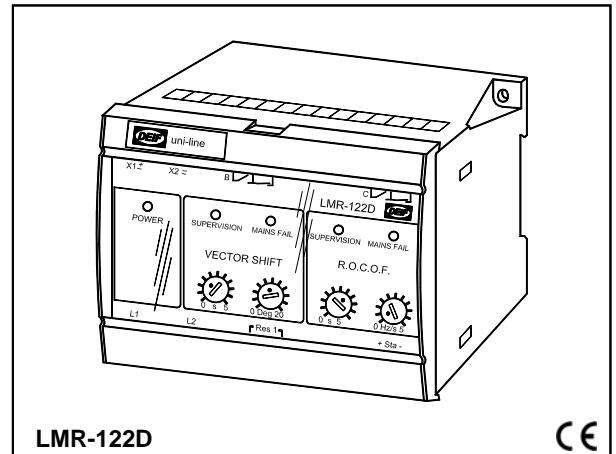
The vector shift function supervises the angular velocity of the phases of the mains. The velocity is supervised by comparing the times for the latest two full cycles with the times for the full cycles of the previous 4th and 5th period. If the difference between the measurements exceeds the set point, the output is activated. Within 30 ms (inclusive of contact delay) an opening signal is transmitted to mains circuit breaker, and the LED marked "MAINS FAIL" is lit.

The LMR-122D is provided with 1 reset input connected to contacts to the generator circuit breaker and to the

Loss of mains relays

uni-line

4921240220C



mains circuit breaker. These 2 contacts should close when their respective circuit breaker is opened.

When RESET (22-23) is activated the LMR-122D will not detect a possible mains failure

On receipt of a reset signal (transmitted by the mains circuit breaker auxiliary contact during opening of its circuit breaker), an internal timer is started. When this expires (after 2 s), the opening signal to the mains circuit breaker is cancelled, and the LED "MAINS FAIL" is switched off.

The LMR-122D is provided with an adjustable initialising timer, which is activated on cancellation of the reset signal (closing of circuit breakers). When this timer expires, the LMR-122D is activated and the LED "SUPERVISION" is lit. The time delay is set on the front of the relay by means of a potentiometer.

Furthermore the relay is equipped with a self-check function. This function supervises the micro-processor and will switch the status output (29-30) to position OFF and start flashing with the power led, should the function detect a fault.

Relay outputs

The LMR-122D is provided with 2 output contacts B: Vector shift, C: ROCOF, either normally energised or normally de-energised. The contacts may be set to open or to close on activation.

Normally energised contact

Recommended for warning and alarm purposes. In case of an auxiliary supply drop-out, the contact is immediately activated.

Normally de-energised contact

Recommended for regulating and control purposes. An auxiliary supply failure will not result in an unwanted activation of the contact.

Power-up circuit

The relays are provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

Note: Normally energised contacts are not activated (contact does not open/close) until 200 ms after connection of the auxiliary voltage.

Type LMR-122D

Technical specifications

Meas. voltage (U_n):	See supply voltage - AC ranges UL/cUL listed: 57.7...450V AC
Overload:	1.2 x U _n , continuously, 2 x U _n for 10 s
Load:	2kΩ/V
Frequency range:	40...45...65...70Hz
"RESET" inputs:	Input voltage: 18...250V AC/DC for "activated" condition Input impedance: 100kΩ
Output:	2 change-over switches
Contact type:	Relays B + C: normally energised ("NE"), or normally de-energised("ND")
Contact ratings:	250V AC/24V DC, 8A (200 x 10 ³ change-overs at resistive load) UL/cUL listed: Resistive load only
Contact voltage:	Max. 250V AC/150V DC
Response time:	ROCOF (df/dt) <100 ms Vector shift <30 ms
Optocoupler output:	System status off = failure UL/cUL listed: 30V DC, 5mA
Temperature:	-25...70°C (-13...158°F) (operating) UL/cUL listed: Max. surrounding air temp. 60°C/140°F
Temperature drift:	Set points: Max. ±0.2% of full scale per 10°C/50°F
Galvanic separation:	Between inputs and outputs: 3250V - 50Hz - 1 min
Supply voltage (U_n):	57.7-63.5-100-110-127-200-220-230- 240-380-400-415-440-450-660-690V AC ±20% (max. 4VA) 24-48-110-220V DC -25/+30% (max. 3.5W) UL/cUL listed: Only 24V DC and 110V AC DC supply must be from a class 2 power source
Climate:	HSE, to DIN 40040
EMC:	To EN 61000-6-1/2/3/4, SS4361503 (PL4) and IEC 255-3
Connections:	Max. 4 mm ² (single-stranded) Max. 2.5 mm ² (multi-stranded)
Materials:	All plastic parts are self-extinguishing to UL94 (V1)
Protection:	Case: IP40. Terminals: IP20, to IEC 529 and EN 60529
UL markings:	Wiring: Use 60/75°C (140/167°F) copper conductors only Wire size: AWG 12-16 or equivalent

UL markings, cont.: Installation:
To be installed in accordance with the
NEC (US) or the CEC (Canada)

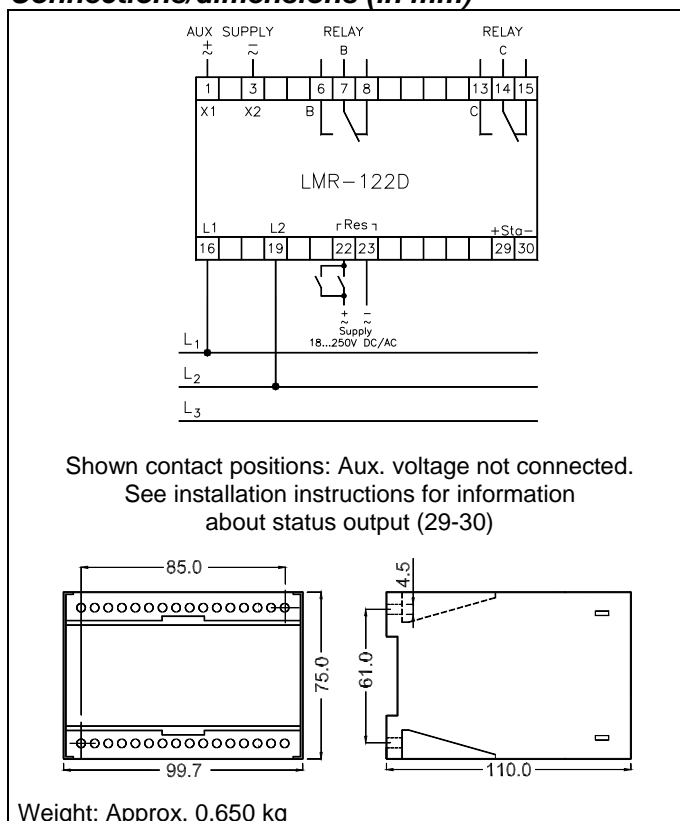
Settings and indication

Setting of	LED/relay
Sensitivity: Vector shift set point (2...20 elect. degr.)	Red LED "MAINS FAIL" is lit during fault condition.
Sensitivity: ROCOF (df/dt) set point (0.3...5) Hz/s	Red LED "MAINS FAIL" is lit during fault condition.
For both initialising delays: (0.5...5 s)	Yellow LED "SUPERVISION" is lit after the timer has expired.

The relay is furthermore equipped with a green LED marked
"POWER" for indication of power ON.

Once the relay has been mounted and adjusted, the
transparent front cover may be sealed, preventing unwanted
change of the setting.

Connections/dimensions (in mm)



Order specifications

Type - Meas. voltage - Relay B - Relay C - Supply voltage
Example:
LMR-122D - 380V AC - NE - NE - 24V DC

Due to our continuous development we reserve the right to
supply equipment which may vary from the described.



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ANSI codes 27, 59, 78, 81

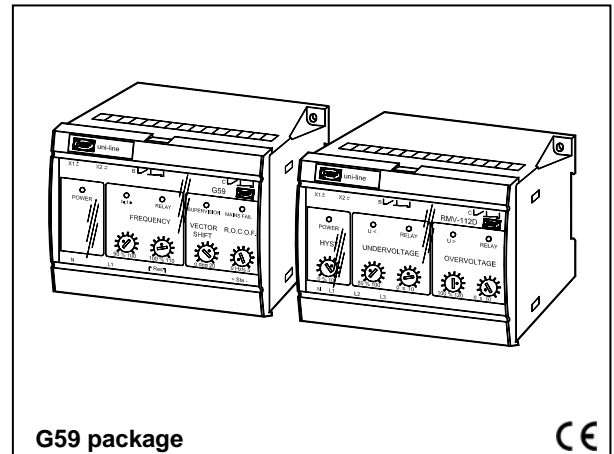
Type G59 package

G59 protection relay package

uni-line

4921240217D

- **Combined vector shift and ROCOF (df/dt)**
- **Protection of over-/underfrequency**
- **3 phase protection of over-/undervoltage**
- **Digital data processing**
- **Fast decoupling of the generator**
- **Ensures no asynchronous reconnection**



Application

The mains decoupling relay - type G59 package - forms part of a complete DEIF series of relays for the protection and control of generators.

This package is applied for the protection of synchronous generators, running in parallel with the mains. The package protects against over-/underfrequency, over-/undervoltage, vector shift and/or ROCOF (rate of change of frequency, df/dt).

In applications with only vector shift or ROCOF, the set point for the unwanted part is set at maximum and this part is hereby disabled.

A mains failure will be detected, provided a disconnection at an arbitrary point of the network results in a swift change of the generator frequency. An opening signal is then transmitted to the mains circuit breaker, and the generator will then be protected against damage caused by an automatic reconnection to the high-voltage network.

On the other hand, the vector shift/ROCOF will not detect the relatively slow and acceptable changes of the network frequency (the mains).

Frequency and voltage protection is needed to protect loads against unacceptable voltages and frequencies.

Furthermore, separating the generator from the mains in case of mains failure is also stipulated as a condition in most national rules for connection of synchronous generators to the mains.

Measuring principle

ROCOF, vector shift and frequency measure the voltage between 2 phases or between one phase and neutral. High measuring accuracy is achieved by digital data processing.

The ROCOF supervises the frequency change for every period. If the frequency change exceeds the set point for four periods in a row, the ROCOF has detected a failure.

The vector shift supervises the angular velocity of the mains by comparing the times for the latest two full cycles (1st, 2nd) with the times for the full cycles of the previous 4th and 5th period. If the vector shift or the ROCOF detects a failure, an opening signal is transmitted to the mains circuit breaker, and the LED marked "MAINS FAIL" is lit.

The over-/underfrequency supervise the frequency by supervising the latest 4 periods. If the under- or overfrequency set point is exceeded, the output is activated and the associated red LED is lit.

The over-/undervoltage part measures all 3 phase voltages. If the voltage drops below the set point or exceeds the upper set point, the associated output is activated and the associated red LED is lit.

The vector shift and the ROCOF are provided with 1 reset input connected to contacts to the generator circuit breaker and to the mains circuit breaker. These 2 contacts close when the respective circuit breaker is opened. When RESET (22-23) is activated, the vector shift and the ROCOF part will not detect a possible mains failure. This function ensures that the relay is only active when both circuit breakers are closed and the generator is thus running in parallel with the mains.

The vector shift and the ROCOF are provided with an initialising timer, which is activated when cancelling the reset signal (closing of circuit breakers). When this timer expires, the vector shift and the ROCOF are activated and the LED "SUPERVISION" is lit. The time delay is fixed at 5s.

Relay outputs

The package is provided with 4 outputs either normally energised or normally de-energised. The contacts may be set to open or to close on activation.

Power-up circuit

The relays are provided with a 200 ms power-up circuit, ensuring the correct function of the relay on connection of the auxiliary voltage.

Type G59 package

Technical specifications

Meas. voltage (U_n): See supply voltage - AC ranges

Overload: 1.2 x U_n , continuously
2 x U_n for 10 s

Load: 2k Ω /V
UL/cUL listed: 57.7...450V AC

Frequency range: 40...45...65...70Hz

Nom. frequency (f_n): 50Hz or 60Hz

“RESET” inputs: Input voltage:
18...250V AC/DC for “activated”
condition

Input impedance: 100k Ω

Output: 4 change-over switches

Contact type: Relays B₁+C₁, B₂+C₂:
Normally energised (“NE”), or
normally de-energised (“ND”)
with or without latch circuit (“l”)

Contact ratings: 250V AC/24V DC, 8A
(200 x 10³ change-overs at resistive
load)

Contact voltage: Max. 250V AC/150V DC

UL/cUL listed: Resistive load only

Response time: Vector shift <30 ms
R.O.C.O.F. <100 ms
Frequency <100 ms
Voltage <100 ms

Galvanic separation: Between inputs and outputs:
3250V - 50Hz - 1 min.

Supply voltage (U_n): 57.7-63.5-100-110-127-200-220-230-
240-380-400-415-440-450-660-690V AC
 \pm 20% (max. 4VA)
24-48-110-220V DC -25/+30%
(max. 5.5W)

UL/cUL listed: Only 24V DC and
110V AC

DC supply must be from a class 2 power
source

Climate: HSE, to DIN 40040

EMC: To EN 61000-6-1/2/3/4,
SS4361503 (PL4) and IEC 255-3

Connections: Max. 4.0 mm² (single-stranded)
Max. 2.5 mm² (multi-stranded)

Materials: All plastic parts are self-extinguishing to
UL94 (V1)

Protection: Case: IP40. Terminals: IP20,
to IEC 529 and EN 60529

UL markings:

Wiring:

Use 60/75°C (140/167°F) copper
conductors only

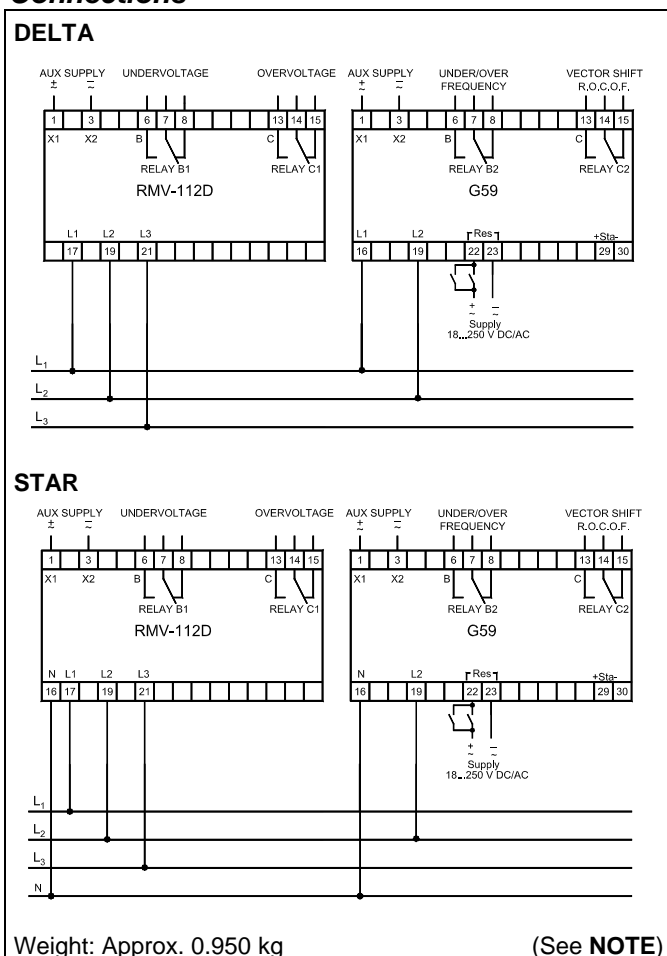
Wire size:

AWG 12-16 or equivalent

Installation:

To be installed in accordance with the
NEC (US) or the CEC (Canada)

Connections



NOTE:

See the installation instructions for information about status
output (29-30).

Type G59 package

Settings and indications

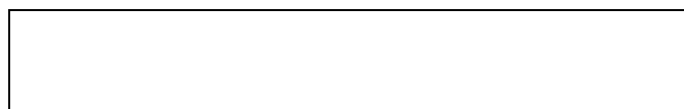
Setting of	LED/relay
Vector shift set point: (2...20 elect. degr.) Initialising delay: Fixed at 5s	Red LED "MAINS FAIL" is lit during fault condition
R.O.C.O.F. set point: (0.3...5) Hz/s Initialising delay: Fixed at 5s	Red LED "MAINS FAIL" is lit during fault condition
Underfrequency set point: (90...100%) of f_n	"f>, f<" yellow LED is lit when the frequency has dropped below the set point, but the relay is not yet activated
Overfrequency set point: (100...110%) of f_n	"f>, f<" yellow LED is lit when the set point is exceeded, but the relay is not yet activated
Undervoltage limit: (80...100%) of U_n	"U<" yellow LED is lit when the input voltage is lower than the preset limit, but the relay is not yet activated
Overvoltage limit: (100...120%) of U_n	"U<" yellow LED is lit when the input voltage is lower than the preset limit, but the relay is not yet activated
Hysteresis: (1...10%) of U_n	Relay contact is reset when fault voltage equals or is less than the preset hysteresis

Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

Order specifications

Relay B₁:	Undervoltage
Relay C₁:	Overvoltage
Relay B₂:	Over-/underfrequency
Relay C₂:	Vector shift/ROCOF
Star coupling:	Specify phase-neutral voltage
Delta coupling:	Specify phase-phase voltage
Type – Coupling – Meas. voltage – Nom. frequency – Relay B₁ – Relay C₁ – Relay B₂ – Relay C₂ – Supply voltage	
<i>Examples:</i>	
G59 package – delta – 400V AC – 50Hz – NDL – NDL – NDL – ND – 24V DC	
G59 package – star – 230V AC – 50Hz – NDL – NDL – NDL – ND – 230V AC	

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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ANSI code 25
Type FAS-113DG

- **Synchronisation of generator to busbar**
- **Circuit breaker time compensation**
- **LED indication of status**
- **LED for activated control**
- **LED for synchronising signal**
- **35 mm DIN rail or base mounting**

Application

The FAS-113DG synchroniser is applied for synchronisation of a generator to the busbar and closing of its circuit breaker when the voltage difference, the slip frequency and the phase angles are within the preset limits. The synchroniser can be applied in conjunction with a wide range of prime movers, as its control pulses may be set to fit several types - from slowly reacting diesel engines to swiftly reacting gas turbines.

Function

The FAS-113DG performs a dynamic synchronisation, ensuring that the slip frequency is always positive to prevent reverse power conditions to occur (see option D). In order to calculate when to transmit the closing signal to the generator breaker, the synchroniser measures the actual slip frequency and compares this with the circuit breaker closing time (potentiometer marked BREAKER). When the slip frequency and the voltage deviation are within the settings (potentiometers marked FREQ and VOLTAGE), the above calculation is performed, and the synchroniser transmits the closing signal to the breaker "x" degrees before top allowing time for this to close.

In case of harmonic distortion or noise on the voltage inputs the FAS-113DG is equipped with special filters on the AC voltage inputs to avoid imprecise synchronisation pulse to be transmitted. Furthermore a df/dt (ROCOF) function is implemented, if the filters are unable to make the necessary filtering of the input signals, the df/dt function will prevent imprecise synchronisation pulse to be transmitted. If the df/dt function is active, the situation will be indicated by a flashing Δf LED (see option C).

The FAS-113DG is provided with an analogue frequency output and an analogue voltage output, intended for common control of the frequency and the voltage of DEIF load sharing units type LSU-112/113/114DG and LSU-122DG, a function applied for simultaneous synchronisation of all generators of a plant to the busbar.

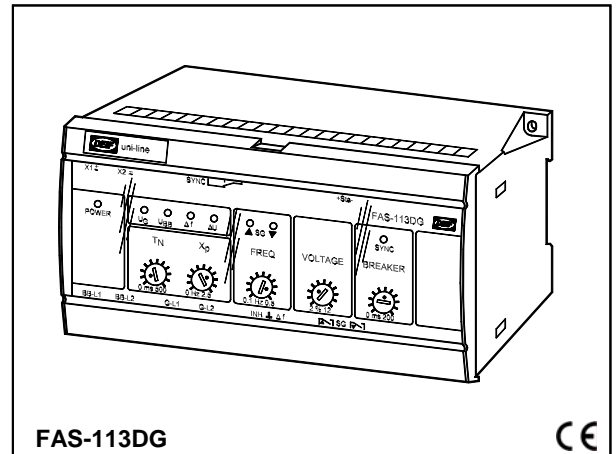
Regulator output

The unit is provided with 2 contact outputs for speed control:

Synchronisers

uni-line

4921240114G



Frequency control:

The regulating speed of the servomotors for the prime mover is controlled by the built-in P controller of the FAS-113DG according to its setting for:

T_N (pulse length):

The min. duration of the control pulse.

X_P (proportional band):

The zone within which the pulse/pause ratio changes proportionally to the frequency deviation from f_{set} .

Dead band 0.05Hz:

The zone within which no control pulses are emitted.

The phase angle advance is calculated and a synchronising signal transmitted provided that:

1. the voltage difference is within $\pm 2... \pm 12\%$ of the busbar voltage, and
2. the frequency difference is within $\pm 90\%$ of the value set on the FREQ potentiometer, and
3. the generator frequency is higher than the busbar frequency (see option D also).

When the above 3 conditions are fulfilled, a synchronising signal is transmitted, the yellow LED SYNC is lit, and the output contact is activated for 400 ms.

Special function for commissioning

The FAS-113DG is equipped with a function for checking of the phase sequence. When the frequency and the voltage between the busbar and the generator inputs are the same and the phase is inside $\pm 5^\circ$ for 1 s, the sync. relay is activated. If the generator is stopped and the star point is opened and the generator breaker is closed, the FAS-113DG will transmit a closing signal if the phase sequence is OK.

Self-monitoring

The FAS-113DG is equipped with a self-monitoring function. The function supervises the built-in micro-controller and hereby verifies if the programme is running correctly. The green LED marked POWER is connected to this function. Constant green light indicates that the supply voltage is accepted and the unit is running correctly. Flashing green light 2-3Hz indicates that the supply voltage is accepted but the unit is running incorrectly. In this situation the status output terminals 17 and 18 are activated (open).

FAS-113DG

Terminals/function

Connection	Connect	
Busbar	L1 to term. 24	L2 to term. 26
Generator	L1 to term. 29	L2 to term. 31

Terminal no.	Description/action
1 and 3 X1/X2	Input for supply voltage
8, 9 and 10	Relay contact for circuit breaker. On time 400 ms
17 and 18 Sta	Status output, activated (closed) when the supply voltage is connected and the unit is working correctly
24 and 26 BB/L1 BB/L2	Input for busbar voltage measurement. This input becomes active when the voltage level exceeds 80% of nominal voltage
29 and 31 G/L1 G/L2	Input for generator voltage measurement. When the voltage level on this input exceeds 60% of nominal voltage, the FAS-113DG is activated and the regulator outputs (SG) become active. Note that with an auxiliary contact on the generator circuit breaker this function can be used for resetting of the FAS-113DG after synchronisation and hereby deactivation of the SG outputs. This function allows the supply voltage to be connected at any time
33 ("ΔU") Option F	This output is intended for common control of the voltage of all the connected reactive power load sharing units type LSU-122DG in a generator island. If terminal 33 is connected to the common voltage line (US) on the LSU-122DGs, the FAS-113DG will regulate the voltage on the generator island so it matches the voltage on the unit the island is about to be connected to
34 and 35 ("INH")	May be connected to a potential-free N/O contact. When this contact is activated, the FAS-113DG will not transmit a closing signal (terminals 9 and 10), but the SYNC LED will be lit when the sync. pulse is transmitted. This function can be used for testing purposes. Note that if the FAS-113DG is equipped with option A or B, this input has a different function
36 ("Δf")	This output is intended for common control of the frequency of all the connected load sharing units type LSU-112/113/114DG in a generator island. If terminal 36 is connected to the common frequency line (FS) on the LSUs, the FAS-113DG will control the frequency on the generator island so it matches the frequency on the unit the island is about to be connected to
35 ("⊥")	Common earth terminal for the above input/output
38 and 39 Relay con- tacts "SG"	Relay contact for increase of the speed
40 and 41 Relay con- tacts "SG"	Relay contact for decrease of the speed
NOTE: Relay con- tacts	Relays (SG) should always be connected via external aux. relays when a DC pilot motor is applied. A transient suppressor should always be connected across the relay coil of the external relays

Options

The FAS-113DG can be configured with the following options:

Frequency controller, option A

The FAS-113DG is set to act as a frequency controller ensuring a stable generator frequency according to the setting (50Hz or 60Hz). The function is activated when the INH input is closed. If the INH input is open, the FAS-113DG functions as a normal synchroniser. When the input INH is activated, the FAS-113DG will act as a frequency controller and regulate the generator to the frequency setting (50Hz or 60Hz) $\pm 0.05\text{Hz}$, and no sync. pulse will be transmitted.

Dead bus, option B

When implemented the dead bus function enables the FAS-113DG to transmit a closing signal to the generator breaker when no busbar voltage is present. When the generator voltage is within 60% of nominal level and the busbar voltage is below 20% of nominal level, the FAS-113DG will start to control the generator frequency according to the setting (50Hz or 60Hz). When the frequency becomes nominal within $\pm 0.05\text{Hz}$, $\pm 0.5\text{Hz}$ or $\pm 3\text{Hz}$ depending on internal jumper setting, $\pm 0.5\text{Hz}$ is set as default if no specific request is made, and the voltage level is nominal \pm the setting (potentiometer marked VOLTAGE), the sync. pulse is transmitted to the breaker. Please note that after closing of the breaker (voltage on both inputs on the FAS-113DG), the voltage input on terminal 29 or 31 or the supply voltage on terminal 1 or 3 must be disconnected, otherwise the FAS-113DG will run the generator into overspeed. If the INH input is activated (closed), the FAS-113DG will not activate the sync. relay even if there is a dead bus situation. When INH is deactivated, the FAS-113DG will transmit the closing signal.

Deactivation of the df/dt protection function, option C

If instability in the speed loop control system occurs resulting in jitter on the voltage signals (fast instability typically occurs, if the governor is responding to engine firings), and it is not possible to adjust this on the governor, or in applications with much noise and harmonic distortion (frequency converters), the df/dt protection function can be activated resulting in NO sync. pulse. If this is the case, and the switchgear is properly protected against wrong synchronisation, the df/dt protection function can be disabled. Please note that when this function is disabled, noise on the busbar and the generator inputs of the FAS-113DG can, at worst, result in a 180° out of phase synchronisation.

Type FAS-113DG

Options, continued

Accept of both undersynchronisation and oversynchronisation of the generator breaker, option D

Option D can be activated in applications where a fast synchronisation has priority and the risk for reverse power is unimportant. With this option activated the FAS-113DG will regulate the generator to perform either an under- or an oversynchronisation, the parameter used for either under- or oversynchronisation is the parameter which first obtains a synchronisation as fast as possible.

Extended circuit breaker closing time, option E

In applications with very slow generator circuit breakers with closing time up to 400 ms this option will prolong the setting of the closing time (potentiometer marked BREAKER) to cover the range 200...400 ms.

Voltage difference analogue output, option F

This output is standard 0...5...10V corresponding to 80...100...120% of U_{nom} for control of the LSU-122DG. If option F is selected, the output is changed to -10...0...10V corresponding to 90...100...110% of U_{nom} for control of the units in the multi-line series, e.g. PPU/GPC.

Technical specifications

Accuracy:

Breaker closing: Slip frequency 0.1...0.25Hz: $\pm 3^\circ$ el.
Slip frequency 0.25...0.5Hz: $\pm 5^\circ$ el.

Meas. voltage: See supply voltage - AC ranges

Load: 2k Ω /V
UL/cUL listed: 57.7...450V AC

Frequency range: 40...45...65...70Hz

Breaker closing pulse length: 400 ms \pm 10 ms

Inhibit input: Potential-free contact
Open: 5V. Closed: 5mA
UL/cUL listed: +/-5V DC (using pot. free ext. contacts)

Contact outputs:

Sync. pulse output: 1 change-over switch

Freq. control outp.: 2 make contacts

Contact ratings: AC1/DC1: 250V AC/24V DC, 8A
AC15/ DC13: 250V AC/24V DC, 3A
UL/cUL listed: Resistive load only

Life electrical: 1 x 10⁵ (nominal value)

Analogue output:

Freq. difference: 1 analogue output:
-10...0...10V DC ~ -5...0...5Hz

Volt. difference: 1 analogue output:
0...5...10V DC ~ 80...100...120% of U_n
-10...0...10V DC ~ 90...100...110% of U_n with option F activated
UL/cUL listed: +/-10V DC

Optocoupler outp.: System status off = Failure
Max. voltage 30V DC, max. current 5mA
Voltage drop 1.5V ~ 2mA
UL/cUL listed: 30V DC, 5mA

Temperature: -25...70°C (-13...158°F) (operating)
UL/cUL listed:
Max. surrounding air temp. 60°C/140°F

Temperature drift: Set-points:
Max. $\pm 0.2\%$ of full scale per 10°C/50°F

Galv. separation: Between inputs and outputs:
3250V - 50Hz - 1 min.

Supply volt. (U_n): 57.7-63.5-100-110-127-200-220-230-240-
380-400-415-440-450-660-690V AC $\pm 20\%$
(max. 3.5VA)

24-48-110-220V DC -25/+30%
(max. 2.5W)

UL/cUL listed:
Only 24V DC and 110V AC
DC supply must be from a class 2 power source

Climate: HSE, to DIN 40040

EMC: To EN 61000-6-1/2/3/4,
SS4361503 (PL4) and IEC 255-3

Connections: Max. 4 mm² (single-stranded)
Max. 2.5 mm² (multi-stranded)

Materials: All plastic parts are self-extinguishing to
UL94 (V1)

Protection: Case: IP40. Terminals: IP20, to IEC 529
and EN 60529

Type approval: The uni-line components are approved by
the major classification societies. For
current approvals see www.deif.com or
contact DEIF A/S

UL markings: Wiring:
Use 60/75°C (140/167°F) copper
conductors only

Wire size:
AWG 12-16 or equivalent

Installation:
To be installed in accordance with the
NEC (US) or the CEC (Canada)

Type FAS-113DG

Settings

Setting of	Range
T _N Control pulse length	25...500 ms
X _P Proportional band	±0.25...±2.5Hz
f _{set} Slip frequency	0.1...0.5Hz *
ΔU _{max} Acceptable volt. diff.	±2...±12% of U _{BB}
T _{BC} Breaker closure time	20...200 ms (200...400 ms) option E

* Accept of max. df/dt depends on f_{set}

0.1Hz ~ 2.5Hz/sec.

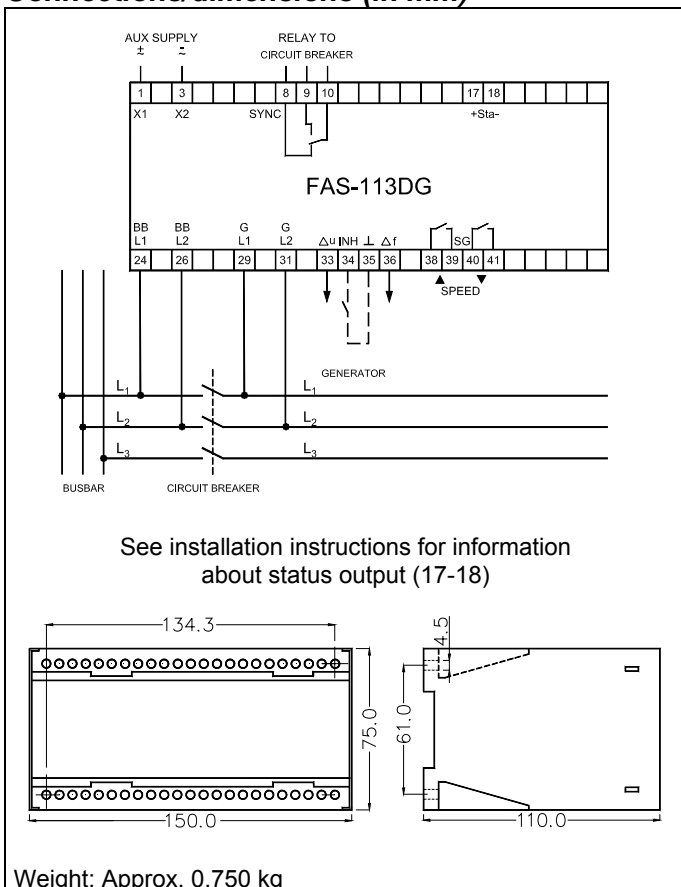
0.5Hz ~ 12.5Hz/sec.

Indication

LEDs	Light
U _G Generator voltage	Green, when value is within the acceptable range Switched off, if outside this range
U _{BB} Busbar voltage	
Δf Frequency difference (df/dt check)	
ΔU Voltage difference	
SYNC Synchronising	Yellow, when relay is activated
SG▲ Increase speed (freq.)	
SG▼ Decrease speed (freq.)	

Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

Connections/dimensions (in mm)



Order specifications

Type – Measuring voltage – Supply voltage –
(Option – Generator frequency)

Example:

FAS-113DG – 380V AC – 24V DC – Option A – 50Hz

NOTE:

Option A and option B cannot be chosen at the same time.

Regarding option B, please remember to indicate the accuracy for the frequency if this differs from ±0.5Hz. Other settings are ±0.05Hz or ±3Hz.

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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-power in control-

ANSI code 25

Type FAS-115DG

- **Synchronisation of generator to busbar**
- **Circuit breaker time compensation**
- **Voltage matching**
- **LED indication of status**
- **LED for activated control**
- **LED for synchronising signal**
- **35 mm DIN rail or base mounting**

Application

The FAS-115DG synchroniser is applied for synchronisation of a generator to the busbar and closing of its circuit breaker when the voltage difference, the slip frequency and the phase angles are within the preset limits. The synchroniser can be applied in conjunction with a wide range of prime movers, as its control pulses may be set to fit several types - from slowly reacting diesel engines to swiftly reacting gas turbines.

Function

The FAS-115DG performs a dynamic synchronisation, ensuring that the slip frequency is always positive to prevent reverse power conditions to occur (see option D). Furthermore the FAS-115DG is provided with relay outputs for controlling the AVR for voltage matching. In order to calculate when to transmit the closing signal to the generator breaker, the synchroniser measures the actual slip frequency and compares this with the circuit breaker closing time (potentiometer marked BREAKER). When the slip frequency and the voltage deviation are within the settings (potentiometers marked FREQ and VOLTAGE), the above calculation is performed, and the synchroniser transmits the closing signal to the breaker "x" degrees before top allowing time for this to close.

In case of harmonic distortion or noise on the voltage inputs the FAS-115DG is equipped with special filters on the AC voltage inputs to avoid imprecise synchronisation pulse to be transmitted. Furthermore a df/dt (ROCOF) function is implemented, if the filters are unable to make the necessary filtering of the input signals, the df/dt function will prevent imprecise synchronisation pulse to be transmitted. If the df/dt function is active, the situation will be indicated by a flashing Δf LED (see option C).

The FAS-115DG is provided with an analogue frequency output and an analogue voltage output, intended for common control of the frequency and the voltage of DEIF load sharing units type LSU-112/113/114DG and LSU-122DG, a function applied for simultaneous synchronisation of all generators of a plant to the busbar.

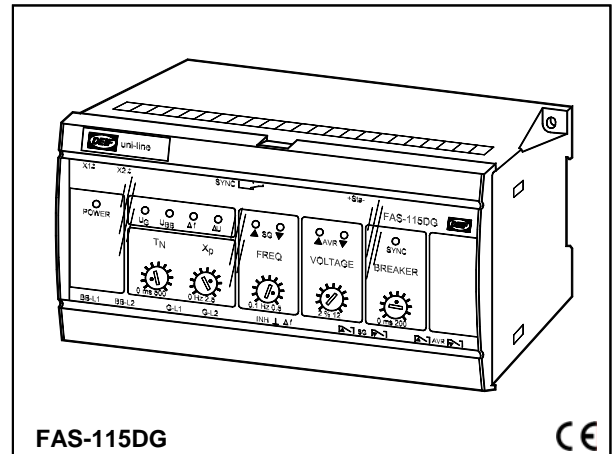
Regulator output

The unit is provided with 2 contact outputs for speed control and 2 contact outputs for voltage control:

Synchronisers

uni-line

4921240116G



Frequency control:

The regulating speed of the servomotors for the prime mover is controlled by the built-in P controller of the FAS-115DG according to its setting for:

T_N (pulse length):

The min. duration of the control pulse.

X_P (proportional band):

The zone within which the pulse/pause ratio changes proportionally to the frequency deviation from f_{set} .

Dead band 0.05Hz:

The zone within which no control pulses are emitted.

Voltage control:

Regulation of the servomotor for the AVR is controlled by the built-in on/off regulator of the FAS-115DG.

The phase angle advance is calculated and a synchronising signal transmitted provided that:

1. the voltage difference is within $\pm 2... \pm 12\%$ of the busbar voltage, and
2. the frequency difference is within $\pm 90\%$ of the value set on the FREQ potentiometer, and
3. the generator frequency is higher than the busbar frequency (see option D also).

When the above 3 conditions are fulfilled, a synchronising signal is transmitted, the yellow LED SYNC is lit, and the output contact is activated for 400 ms.

Special function for commissioning

The FAS-115DG is equipped with a function for checking of the phase sequence. When the frequency and the voltage between the busbar and the generator inputs are the same and the phase is inside $\pm 5^\circ$ for 1 s, the sync. relay is activated. If the generator is stopped and the star point is opened and the generator breaker is closed, the FAS-115DG will transmit a closing signal if the phase sequence is OK.

Self-monitoring

The FAS-115DG is equipped with a self-monitoring function. The function supervises the built-in micro-controller and hereby verifies if the programme is running correctly. The green LED marked POWER is connected to this function. Constant green light indicates that the supply voltage is accepted and the unit is running correctly. Flashing green light 2-3Hz indicates that the supply voltage is accepted but the unit is running incorrectly. In this situation the status output terminals 17 and 18 are activated (open).

Type FAS-115DG

Terminals/function

Connection	Connect	
Busbar	L1 to term. 24	L2 to term. 26
Generator	L1 to term. 29	L2 to term. 31

Terminal no.	Description/action
1 and 3 X1/X2	Input for supply voltage
8, 9 and 10	Relay contact for circuit breaker. On time 400 ms
17 and 18 Sta	Status output, activated (closed) when the supply voltage is connected and the unit is working correctly
24 and 26 BB/L1 BB/L2	Input for busbar voltage measurement. This input becomes active when the voltage level exceeds 80% of nominal voltage
29 and 31 G/L1 G/L2	Input for generator voltage measurement. When the voltage level on this input exceeds 60% of nominal voltage, the FAS-115DG is activated and the regulator outputs (SG) become active. Note that with an auxiliary contact on the generator circuit breaker this function can be used for resetting of the FAS-115DG after synchronisation and hereby deactivation of the SG outputs. This function allows the supply voltage to be connected at any time
33 ("ΔU") Option F	This output is intended for common control of the voltage of all the connected reactive power load sharing units type LSU-122DG in a generator island. If terminal 33 is connected to the common voltage line (US) on the LSU-122DGs, the FAS-115DG will regulate the voltage on the generator island so it matches the voltage on the unit the island is about to be connected to
34 and 35 ("INH")	May be connected to a potential-free N/O contact. When this contact is activated, the FAS-115DG will not transmit a closing signal (terminals 9 and 10), but the SYNC LED will be lit when the sync. pulse is transmitted. This function can be used for testing purposes. Note that if the FAS-115DG is equipped with option A or B, this input has a different function
36 ("Δf")	This output is intended for common control of the frequency of all the connected load sharing units type LSU-112/113/114DG in a generator island. If terminal 36 is connected to the common frequency line (FS) on the LSUs, the FAS-115DG will control the frequency on the generator island so it matches the frequency on the unit the island is about to be connected to
35 ("⊥")	Common earth terminal for the above input/output
38 and 39 Relay contacts "SG"	Relay contact for increase of the speed
40 and 41 Relay contacts "SG"	Relay contact for decrease of the speed
43 and 44 Relay contacts "AVR"	Relay contact for increase of the voltage
45 and 46 Relay contacts "AVR"	Relay contact for decrease of the voltage
NOTE: Relay contacts	Relays (SG) should always be connected via external aux. relays when a DC pilot motor is applied. A transient suppressor should always be connected across the relay coil of the external relays

Options

The FAS-115DG can be configured with the following options:

Frequency controller, option A

The FAS-115DG is set to act as a frequency controller ensuring a stable generator frequency according to the setting (50Hz or 60Hz). The function is activated when the INH input is closed. If the INH input is open, the FAS-115DG functions as a normal synchroniser. When the input INH is activated, the FAS-115DG will act as a frequency and voltage controller and regulate the generator to the frequency setting (50Hz or 60Hz) $\pm 0.05\text{Hz}$ and the voltage to nominal $\pm 2\%$. No sync. pulse will be transmitted.

Dead bus, option B

When implemented the dead bus function enables the FAS-115DG to transmit a closing signal to the generator breaker when no busbar voltage is present. When the generator voltage is within 60% of nominal level and the busbar voltage is below 20% of nominal level, the FAS-115DG will start to control the generator frequency and voltage according to the setting (50Hz or 60Hz). When the frequency becomes nominal within $\pm 0.05\text{Hz}$, $\pm 0.5\text{Hz}$ or $\pm 3\text{Hz}$ depending on internal jumper setting, $\pm 0.5\text{Hz}$ is set as default if no specific request is made, and the voltage level is nominal \pm the setting (potentiometer marked VOLTAGE), the sync. pulse is transmitted to the breaker. Please note that after closing of the breaker (voltage on both inputs on the FAS-115DG), the voltage input on terminal 29 or 31 or the supply voltage on terminal 1 or 3 must be disconnected, otherwise the FAS-115DG will run the generator into overspeed. If the INH input is activated (closed), the FAS-115DG will not activate the sync. relay even if there is a dead bus situation. When INH is deactivated, the FAS-115DG will transmit the closing signal.

Deactivation of the df/dt protection function, option C

If instability in the speed loop control system occurs resulting in jitter on the voltage signals (fast instability typically occurs, if the governor is responding to engine firings), and it is not possible to adjust this on the governor, or in applications with much noise and harmonic distortion (frequency converters), the df/dt protection function can be activated resulting in NO sync. pulse. If this is the case, and the switchgear is properly protected against wrong synchronisation, the df/dt protection function can be disabled. Please note that when this function is disabled, noise on the busbar and the generator inputs of the FAS-115DG can, at worst, result in a 180° out of phase synchronisation.

Type FAS-115DG

Options, continued

Accept of both undersynchronisation and oversynchronisation of the generator breaker, option D

Option D can be activated in applications where a fast synchronisation has priority and the risk for reverse power is unimportant. With this option activated the FAS-115DG will regulate the generator to perform either an under- or an oversynchronisation, the parameter used for either under- or oversynchronisation is the parameter which first obtains a synchronisation as fast as possible.

Extended circuit breaker closing time, option E

In applications with very slow generator circuit breakers with closing time up to 400 ms this option will prolong the setting of the closing time (potentiometer marked BREAKER) to cover the range 200...400 ms.

Voltage difference analogue output, option F

This output is standard 0...5...10V corresponding to 80...100...120% of U_{nom} for control of the LSU-122DG. If option F is selected, the output is changed to -10...0...10V corresponding to 90...100...110% of U_{nom} for control of the units in the multi-line series, e.g. PPU/GPC.

Technical specifications

Accuracy:

Breaker closing: Slip frequency 0.1...0.25Hz: $\pm 3^\circ$ el.
Slip frequency 0.25...0.5Hz: $\pm 5^\circ$ el.

Meas. voltage: See supply voltage - AC ranges
UL/cUL listed: 57.7...450V AC

Load: 2k Ω /V

Frequency range: 40...45...65...70Hz

Breaker closing pulse length: 400 ms \pm 10 ms

Inhibit input: Potential-free contact
Open: 5V. Closed: 5mA
UL/cUL listed: +/-5V DC (using pot. free ext. contacts)

Contact outputs:

Sync. pulse output: 1 change-over switch

Freq. control outp.: 2 make contacts

Volt. control outp.: 2 make contacts

Contact ratings: AC1/DC1: 250V AC/24V DC, 8A
AC15/DC13: 250V AC/24V DC, 3A

UL/cUL listed: Resistive load only

Life electrical: 1 x 10⁵ (nominal value)

Analogue output:

Freq. difference: 1 analogue output:
-10...0...10V DC ~ -5...0...5Hz

Volt. difference: 1 analogue output:
0...5...10V DC ~ 80...100...120% of U_n
-10...0...10V DC ~ 90...100...110% of U_n with option F activated
UL/cUL listed: +/-10V DC

Optocoupler outp.: System status off = Failure
Max. voltage 30V DC, max. current 5mA
Voltage drop 1.5V ~ 2mA

UL/cUL listed: 30V DC, 5mA

Temperature: -25...70°C (-13...158°F) (operating)
UL/cUL listed:
Max. surrounding air temp. 60°C/140°F

Temperature drift: Set-points:
Max. $\pm 0.2\%$ of full scale per 10°C/50°F

Galv. separation: Between inputs and outputs:
3250V - 50Hz - 1 min.

Supply volt. (U_n): 57.7-63.5-100-110-127-200-220-230-240-
380-400-415-440-450-660-690V AC $\pm 20\%$
(max. 3.5VA)

24-48-110-220V DC -25/+30%
(max. 2.5W)

UL/cUL listed:
Only 24V DC and 110V AC
DC supply must be from a class 2 power source

Climate: HSE, to DIN 40040

EMC: To EN 61000-6-1/2/3/4,
SS4361503 (PL4) and IEC 255-3

Connections: Max. 4 mm² (single-stranded)
Max. 2.5 mm² (multi-stranded)

Materials: All plastic parts are self-extinguishing to
UL94 (V1)

Protection: Case: IP40. Terminals: IP20, to IEC 529
and EN 60529

Type approval: The uni-line components are approved by
the major classification societies. For
current approvals see www.deif.com or
contact DEIF A/S

UL markings: Wiring:
Use 60/75°C (140/167°F) copper
conductors only

Wire size:
AWG 12-16 or equivalent

Installation:
To be installed in accordance with the
NEC (US) or the CEC (Canada)

Type FAS-115DG

Settings

Setting of	Range
T _N Control pulse length	25...500 ms
X _P Proportional band	±0.25...±2.5Hz
f _{set} Slip frequency	0.1...0.5Hz *
ΔU _{max} Acceptable volt. diff.	±2...±12% of U _{BB}
T _{BC} Breaker closure time	20...200 ms (200...400 ms) option E

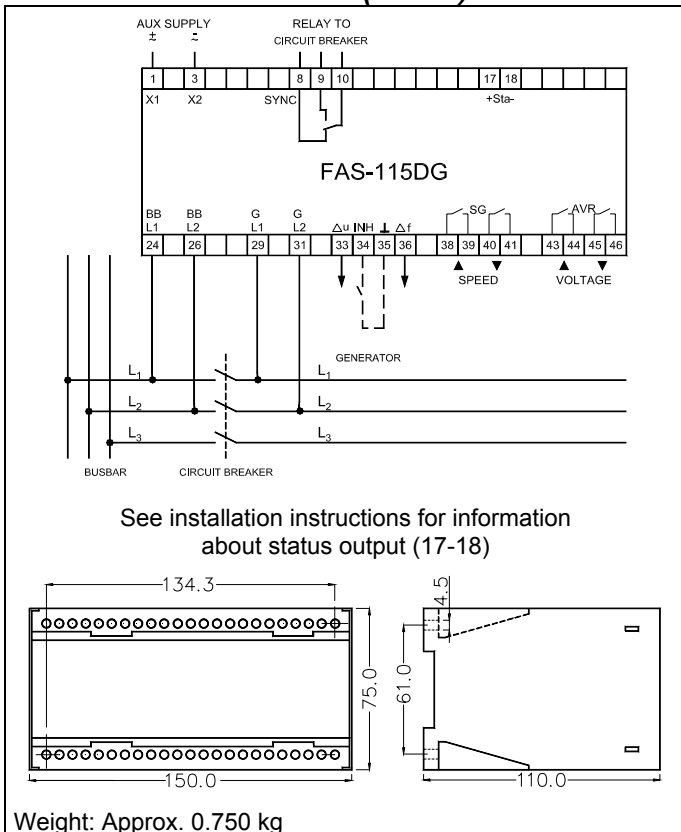
* Accept of max. df/dt depends on f_{set}
 0.1Hz ~ 2.5Hz/sec.
 0.5Hz ~ 12.5Hz/sec.

Indication

LEDs	Light
U _G Generator voltage	Green, when value is within the acceptable range
U _{BB} Busbar voltage	
Δf Frequency difference	
ΔU Voltage difference	
SYNC Synchronising	Yellow, when relay is activated
SG▲ Increase speed (freq.)	
SG▼ Decrease speed (freq.)	
AVR▲ Increase voltage	
AVR▼ Decrease voltage	

Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

Connections/dimensions (in mm)



Order specifications

Type – Measuring voltage – Supply voltage –
 (Option – Generator frequency)

Example:

FAS-115DG – 380V AC – 24V DC – Option A – 50Hz

NOTE:

Option A and option B cannot be chosen at the same time. Regarding option B, please remember to indicate the accuracy for the frequency if this differs from ±0.5Hz. Other settings are ±0.05Hz or ±3Hz.

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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-power in control-

ANSI code 25

Type HAS-111DG

- **Synchronisation of generator to busbar**
- **Setting of phase angle difference**
- **Setting of frequency and voltage diff.**
- **LED indication of status**
- **LED for synchronising signal**
- **35 mm DIN rail or base mounting**

Application

The HAS-111DG synchroniser is applied to check the synchronisation conditions. The paralleling relay transmits a synchronisation pulse when the phase angle, frequency and voltage deviations are within the set limits. Besides this, the HAS-111DG is equipped with 2 analogue outputs. These outputs can be used for regulating purposes together with DEIF A/S load sharing units.

Function

The HAS-111DG can be used in installations where manual or semi-automatic synchronising is required, or by using the Δf and/or the ΔU output for automatic synchronisation of a generator island to another utility (shaft generator).

Settings

The HAS-111DG is equipped with 5 potentiometers accessible from the front of the unit.

Phase:

Here the phase window for synchronisation is chosen. It can be set symmetrically or asymmetrically.

Frequency:

Here the max. slip frequency difference is chosen. It can be set both symmetrically and asymmetrically around 0Hz.

Voltage:

Here the allowed voltage difference between U_{GEN} and U_{BUSBAR} is chosen. It can be set symmetrically.

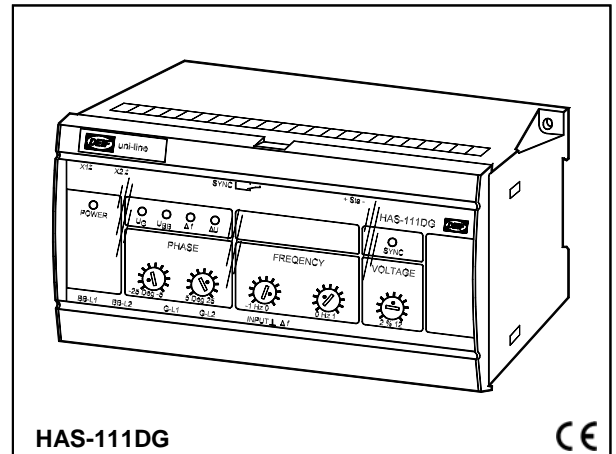
Because of the separate adjustments for positive and negative slip frequency, the HAS-111DG may be set to transmit a synchronisation pulse so that either a supersynchronous or a subsynchronous connection of the generator will be obtained.

In case of harmonic distortion or noise on the voltage inputs, the HAS-111DG is equipped with special filters on the AC voltage inputs to avoid incorrect synchronisation pulse to be transmitted. Furthermore a df/dt (ROCOF) function is implemented; if the filters are unable to make the necessary filtering of the input signals, the df/dt function will prevent imprecise activation of the sync. relay. If the df/dt function is

Paralleling relays

Uni-line

4921240144G



active, the situation will be indicated by a flashing Δf LED (see option C).

The HAS-111DG is provided with an analogue frequency output and an analogue voltage output, intended for common control of the frequency and the voltage of DEIF load sharing units type LSU-112/113/114-DG and LSU-122DG; a function applied for simultaneous synchronisation of all generators of a plant to the busbar. By means of the input marked INPUT, an oversynchronous or an undersynchronous connection of the generator(s) can be obtained.

The HAS-111DG measures the busbar and generator voltages in order to obtain data on frequency, phase and voltage deviation. A synchronising signal is transmitted when the following conditions are fulfilled:

1. The voltage difference is within $\pm 2... \pm 12\%$ of the busbar voltage set on the VOLTAGE potentiometer, and
2. the frequency difference Δf is within $-1...0\text{Hz}$ and $0...1\text{Hz}$ of the values set on the FREQUENCY potentiometers, and
3. the phase angle difference is within $-25...-5^\circ$ el. and $5...25^\circ$ el. of the value set on the PHASE potentiometers, and
4. the Δf allows a synchronisation pulse of min. 100ms without exceeding the setting of the PHASE potentiometers.

When the above 4 conditions are fulfilled, a synchronising signal is transmitted and the yellow SYNC LED is lit. The pulse length (100ms...3s) depends on the other settings of the relay, but the signal continues as long as the above conditions are fulfilled, however max. 3s (see option D).

Self-monitoring

The HAS-111DG is equipped with a self-monitoring function. The function supervises the built-in micro-controller and hereby verifies if the programme is running correctly. The green LED marked POWER is connected to this function. Constant green light indicates that the supply voltage is accepted and the unit is running correctly. Flashing green light 2-3Hz indicates that the supply voltage is accepted but the unit is running incorrectly. In this situation, the status output terminals 17 and 18 are activated (open).

Type HAS-111DG

Terminals/function

Connection	Connect	
	Busbar	L1 to term. 24
Generator	L1 to term. 29	L2 to term. 31

Terminal no.	Description/action
1 and 3 X1/X2	Input for supply voltage.
8, 9 and 10	Relay contact for circuit breaker.
17 and 18 Sta	Status output, activated (closed) when the supply voltage is connected and the unit is working correctly.
24 and 26 BB/L1 BB/L2	Input for busbar voltage measurement. This input becomes active when the voltage level exceeds 60% of nominal voltage.
29 and 31 G/L1 G/L2	Input for generator voltage measurement. This input becomes active when the voltage level exceeds 60% of nominal voltage.
33 ("ΔU") Option E	This output is intended for common control of the voltage of all the connected reactive power load sharing units type LSU-122DG in a generator island. If terminal 33 is connected to the common voltage line (US) on the LSU-122DGs, the HAS-111DG will regulate the voltage on the generator island, so it matches the voltage on the unit the island is about to be connected to.
34 and 35 ("INPUT")	May be connected to a potential-free N/O contact. When this contact is activated, the HAS-111DG will control the connected LSU-112/113/114DG unit(s) to control the generator island frequency towards the busbar frequency less 50% of the setting of the negative FREQUENCY potentiometer. Vice versa, if the input is opened.
36 ("Δf")	This output is intended for common control of the frequency of all the connected load sharing units type LSU-112/113/114DG in a generator island. If terminal 36 is connected to the common frequency line (FS) on the LSUs, the HAS-111DG will control the frequency on the generator island, so it matches the frequency on the unit the island is about to be connected to (see above regarding INPUT).
35 ("⊥")	Common earth terminal for the above input/output.

Options

The HAS-111DG can be configured with the following options:

Increased phase window, option A

When implemented, the accept phase window can be adjusted in the range from -50...-10° el. and 10...50° el.

Dead bus, option B1

When B1 is implemented, the dead bus function enables the HAS-111DG to transmit a closing signal to the generator breaker when no busbar voltage is present. When the generator voltage is within the setting on the potentiometer marked VOLTAGE with nominal voltage as reference, and the busbar voltage is below 25% of nominal voltage, the HAS-111DG will transmit a 200ms closing signal to the breaker. If option D is enabled, the sync. signal will stay on as long as the conditions are OK (see option D).

Dead bus, option B2

When B2 is implemented, the dead bus function enables the HAS-111DG to transmit a closing signal to the breaker when no busbar **or** no generator voltage is present. When the voltage is within 80% of nominal voltage on the active side of the breaker and below 25% of nominal voltage on the passive side of the breaker, a 200ms closing signal is transmitted. If option D is enabled, the sync. signal will stay on as long as the conditions are OK (see option D).

Dead bus, option B3

When B3 is implemented, the function – in addition to the function described under B2 – also enables the HAS-111DG to transmit a closing signal to the breaker when no busbar **and** no generator voltage is present. When the voltage is below 25% of nominal, a 200ms closing signal is transmitted. If option D is enabled, the sync. signal will stay on as long as the conditions are OK (see option D).



Options B2 and B3: Please contact DEIF for status on marine approvals.

Deactivation of the df/dt protection function, option C

If instability in the speed loop control system occurs, resulting in jitter on the voltage signals (fast instability typically occurs if the governor is responding to engine firings), and it is not possible to adjust this on the governor, or in applications with much noise and harmonic distortion (frequency converters), the df/dt protection function can be activated resulting in NO sync. pulse. If this is the case, and the switchgear is properly protected against wrong synchronisation, the df/dt protection function can be disabled. Please note that when this function is disabled, noise on the busbar and the generator inputs of the HAS-111DG can, at worst, result in a 180° out-of-phase synchronisation.

Continuous sync. pulse, option D

When implemented, the sync. relay contact will stay on as long as the conditions are OK. The following will deactivate the relay: If the voltage gets outside the settings on the potentiometer marked VOLTAGE, or the phase angle gets outside the set phase window, or if the busbar or the generator voltage drops below 80% or goes higher than 120% of nominal voltage.

Functionality with option B enabled: Whenever the status of the generator or busbar conditions are changed, the sync. relay output is reset. If the conditions are still OK, the relay is activated again after 1s. For example, in case of dead bus on one side, the sync. relay will be activated and the breaker closed. Now, the HAS-111DG will "see" a new situation (voltage on both sides of the breaker), a reset will be carried out, and after 1s the relay is activated again. In this case, the sync. relay output cannot be used to operate contactors directly.

Voltage difference analogue output, option E

This output is standard 0...5...10V corresponding to 80...100...120% of U_{nom} for controlling of the LSU-122DG. If option E is selected, the output is changed to -10...0...10V corresponding to 90...100...110% of U_{nom} for control of the units in the Multi-line series, e.g. PPU/GPC.

Type HAS-111DG

Technical specifications

Accuracy:

Breaker closing: Slip frequency 0Hz: $\pm 2^\circ$ el.
Slip frequency 0.1...0.5Hz: $\pm 3^\circ$ el.
Slip frequency 0.5...1Hz: $\pm 5^\circ$ el.

Meas. voltage: See supply voltage (AC ranges only)

Load: $2k\Omega/V$
UL/cUL listed: 57.7...450V AC

Frequency range: 40...45...65...70Hz

Digital input: Potential-free contact
Open: 5V. Closed: 5mA

Contact output:

Sync. pulse output: 1 change-over switch
Contact ratings: AC1/DC1: 250V AC/24V DC, 8A
AC15/DC13: 250V AC/24V DC, 3A
UL/cUL listed: Resistive load only

Life electrical: 1×10^5 (nominal value)

Analogue output:

Freq. difference: 1 analogue output:
 $-10...0...10V$ DC $\sim -5...0...5Hz$
Volt. difference: 1 analogue output:
 $0...5...10V$ DC $\sim 80...100...120\%$ of U_n
 $-10...0...10V$ DC $\sim 90...100...110\%$ of U_n
with option E activated
UL/cUL listed: $\pm 10V$ DC

Optocoupler output: System status off = Failure
Max. voltage 30V DC, max. current 5mA
Voltage drop 1.5V \sim 2mA
UL/cUL listed: 30V DC, 5mA

Temperature: $-25...70^\circ C$ ($-13...158^\circ F$) (operating)
UL/cUL listed:
Max. surrounding air temp. $60^\circ C/140^\circ F$

Temperature drift: Setpoints:
Max. $\pm 0.2\%$ of full scale per $10^\circ C/50^\circ F$

Galv. separation: Between inputs and outputs:
 $3250V - 50Hz - 1$ min.

Supply volt. (U_n): 57.7-63.5-100-110-127-200-220-230-
240-380-400-415-440-450-660-690V AC
 $\pm 20\%$ (max. 3.5VA)
24-48-110-220V DC $-25/+30\%$
(max. 2.5W)
UL/cUL listed:
Only 24V DC and 110V AC
DC supply must be from a class 2
power source

Climate: HSE, to DIN 40040

EMC: To EN 61000-6-1/2/3/4,
SS4361503 (PL4) and IEC 255-3

Connections: Max. 4 mm² (single-stranded)
Max. 2.5 mm² (multi-stranded)

Materials: All plastic parts are self-extinguishing to
UL94 (V1)

Protection: Case: IP40. Terminals: IP20, to IEC 529
and EN 60529

Type approval: The Uni-line components are approved
by the major classification societies. For
current approvals, see www.deif.com or
contact DEIF A/S

UL markings: Wiring:
Use $60/75^\circ C$ ($140/167^\circ F$) copper
conductors only

Wire size:
AWG 12-16 or equivalent

Installation:
To be installed in accordance with the
NEC (US) or the CEC (Canada)

Settings

Setting of	Range
Acceptable phase angle difference	Negative: $-25...-5^\circ$ el. Positive: $5...25^\circ$ el.
Acceptable frequency difference	Negative: $-1...0Hz$ Positive: $0...1Hz$
Acceptable voltage difference	$\pm 2... \pm 12\%$ of U_n

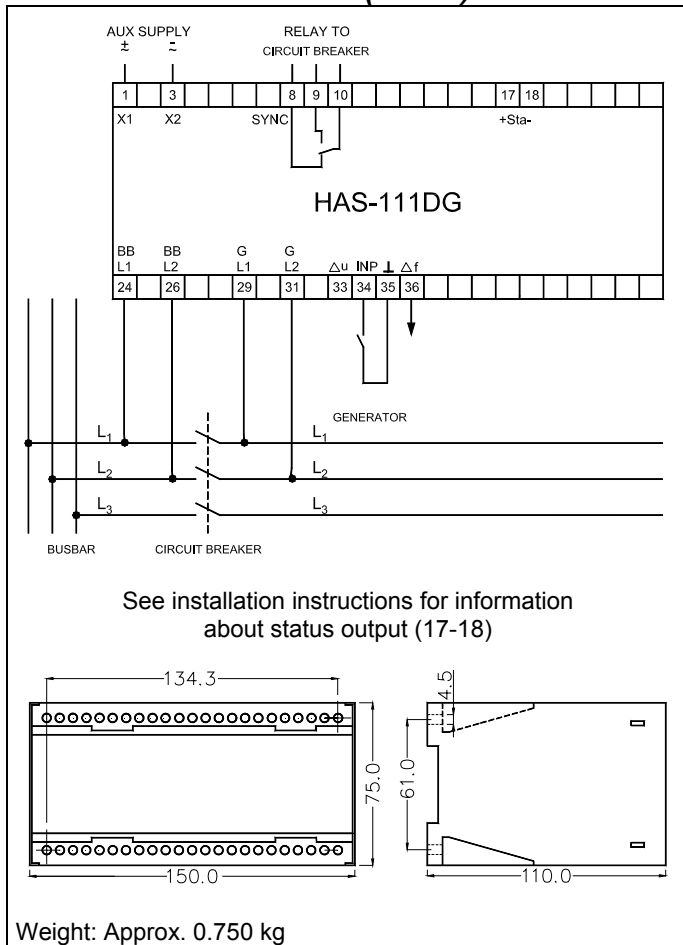
Indication

LEDs	Light
U_G Generator voltage	Green, when value is within the acceptable range
U_{BB} Busbar voltage	
Δf Frequency difference	Switched off,
ΔU Voltage difference	if outside this range
SYNC Synchronising	Yellow, when relay is activated

Once the relay has been mounted and adjusted, the transparent front cover may be sealed to prevent unwanted change of the setting.

Type HAS-111DG

Connections/dimensions (in mm)



Order specifications

Type - Measuring voltage - Supply voltage - (Option)

Example:

HAS-111DG - 380V AC - 24V DC - Option A

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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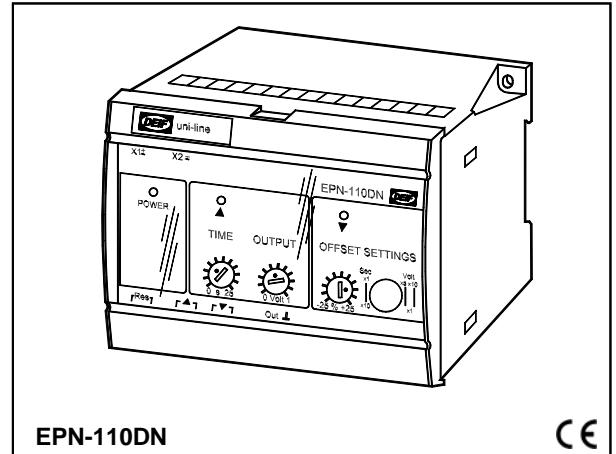
-power in control-

ANSI code 18
Type EPN-110DN

Electronic potentiometers

Uni-line
4921240126G

- **Control of electronic governors**
- **Setting of integrating time**
- **Adjustment of output signal**
- **Offset adjustment**
- **LED indication for activated input**
- **35 mm DIN rail or base mounting**



Application

The electronic potentiometer type EPN-110DN forms part of a complete DEIF series of relays for protection and control of generators, and is applicable to both marine and land-based installations.

The EPN-110DN is type approved by major classification societies and is an electronic unit to replace normal motor potentiometers.

The potentiometer converts the relay output of a PI step controller - e.g. one of the DEIF load sharing units type LSU.. or one of the DEIF synchronisers type FAS.., or any other type of PI step controller provided with relay outputs - to a control voltage for the speed governor/AVR.

Measuring principle

The EPN-110DN is provided with 3 inputs:

- “▲” (frequency or voltage increase)
- “▼” (frequency or voltage decrease)
- “RES” (reset of the unit).

Note: During power-up, the potentiometer is automatically reset.

On activation of one of the inputs “▲” and “▼”, the analogue output of the potentiometer to the speed governor/the AVR is changed correspondingly.

The EPN-110DN is furthermore provided with an offset adjustment for change of the point where the control loop starts and to which the unit returns after reset. Both the output signal, the rate of change of this (the integrating time) and the offset are set on potentiometers on the front of the EPN-110DN.

Outputs/settings

The EPN-110DN is equipped with 2 LED indicators on the front of the unit, which are lit when their input (“▲” and “▼” respectively) has been activated.

To ensure that the EPN-110DN can be connected to all common electronic speed governors and AVRs, the analogue output of the EPN-110DN has been designed as a current generator shunted by a 500Ω potentiometer.

Output signal

Potentiometer “OUTPUT” (0...±1V DC x 1, x 5 or x 10)

The maximum and minimum change of the frequency/voltage of the connected speed governor/AVR, controlled by the EPN-110DN.

The range (“x 1”, “x 5” or “x 10”) is selected by means of 2 DIP switches accessible from the front of the relay.

A special output 0...5...10V DC is available for interfacing between a DEIF synchroniser type FAS-115DG and a VAr load sharing unit type LSU-122DG, applied for voltage adaption to obtain simultaneous synchronisation of all generators of a plant to the busbar.

Integrating time

Potentiometer “TIME” (2.5 s...25 s x 1 or x 10)

How quickly the output integrates from the minimum to the maximum setting (or vice versa). This setting thus determines how quickly e.g. a load sharing will be carried out.

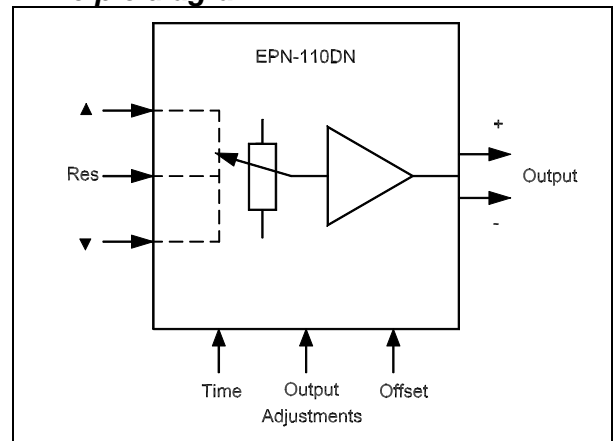
The range (“x 1” or “x 10”) is selected by means of a DIP switch accessible from the front of the relay.

Offset

Potentiometer “OFFSET” (-25...0...25% of output)

The point where the control loop starts. This setting determines e.g. to which frequency the generator should be reset instantaneously during power-up or on activation of the reset input.

Principle diagram



Type EPN-110DN

Technical specifications

Relay input:	Potential-free relay contacts Open contact: 15V DC Closed contact: 4mA
Analogue output:	0...±1V DC (DIP switches set to "x1") or: 0...±5V DC (DIP switches set to "x5") or: 0...±10V DC (DIP switches set to "x10") UL/cUL listed: +/-10V DC
Output resistance:	0...500Ω potentiometer
Offset adjustment:	-25...0...25% of output
Ripple:	Max. 5mV RMS
Resolution:	5mV DC (12-bit D/A converter)
Response time:	<100 ms, input to output
Temperature:	-25...70°C (-13...158°F) (operating) UL/cUL listed: Max. surrounding air temp. 60°C/140°F
Temperature drift:	Setpoints: Max. ±0.2% of full scale per 10°C/50°F
Galvanic separation:	3250V - 50Hz - 1 min Supply voltage to other circuits None between inputs and DC output
Supply voltage (U_n):	57.7-63.5-100-110-127-200-220-230- 240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA) 24-48-110-220V DC -25/+30% (max. 2W) UL/cUL listed: Only 24V DC and 110V AC DC supply must be from a class 2 power source
Climate:	HSE, to DIN 40040
EMC:	To EN 61000-6-1/2/3/4, SS4361503 (PL4) and IEC 255-3
Connections:	Max. 4mm ² (single-stranded) Max. 2.5mm ² (multi-stranded)
Materials:	All plastic parts are self-extinguishing to UL94 (V1)
Protection:	Case: IP40. Terminals: IP20, to IEC 529 and EN 60529
Type approval:	The Uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S
UL markings:	Wiring: Use 60/75°C (140/167°F) copper conductors only Wire size: AWG 12-16 or equivalent

UL markings, cont.: Installation:
To be installed in accordance with the
NEC (US) or the CEC (Canada)

Settings

Setting of	Range
Integrating time:	2.5 s...25 s or 25...250 s
Output:	-1...0...1V DC, -5...0...5V DC or -10...0...10V DC
Offset:	-25...0...25% of output

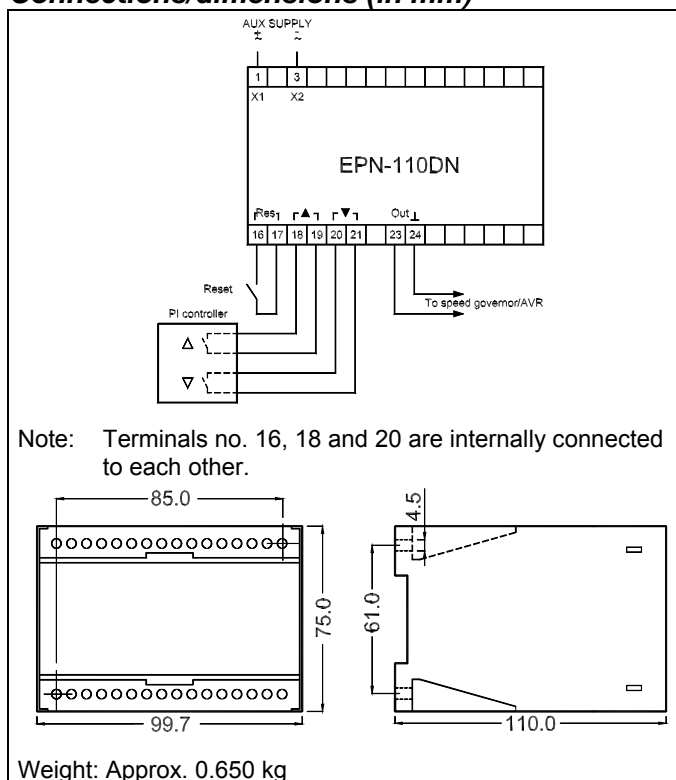
Indication

LED	Light
"▲" (Increase)	Yellow, when relay is activated
"▼" (Decrease)	

The relay is furthermore equipped with a green LED marked "POWER" for indication of power ON.

Once the relay has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

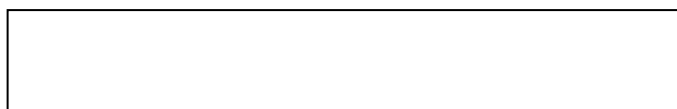
Connections/dimensions (in mm)



Order specifications

Type - Output - Supply voltage
Example: EPN-110DN -5...0...5V DC - 24V DC

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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ANSI code 90

Type LSU-112DG

- **For control of diesel and gas generators**
- **Built-in power and frequency transducer**
- **Constant power or isochronous mode**
- **LED indication of status**
- **LED indication for activated control**
- **35 mm DIN rail or base mounting**

Application

The LSU-112DG is a control unit for control of the prime mover in a power unit.

The LSU-112DG can control the power unit

- in stand-alone mode, performing frequency control
- parallel with grid, performing power control
- parallel with other power units, performing frequency and power control

The unit is designed for connection to a mechanical speed governor, however in conjunction with the DEIF electronic potentiometer type EPN-110DN or EPQ-96 it can control electronic speed governors as well.

The LSU-112DG has a built-in frequency transducer. If a very stable frequency is wanted, an external frequency transducer common for all the LSU-112DGs in the power plant can be connected. If a number of power units are to be synchronised to the busbar at the same time, the frequency may likewise be controlled externally.

Function

The LSU-112DG is measuring the voltage and the current from which the frequency and the power produced by the power unit are measured. The built-in power transducer is based on an $I \times \cos \phi$ principle.

The following couplings are available:

- 1W(4) – single phase
- 1W3 – 1 element 3 phase, 3 wire, balanced load

If unbalanced load can be expected, an external power transducer with an output of 4...20mA can be connected to the LSU-112DG. In this case the built-in $I \times \cos \phi$ transducer is automatically interrupted.

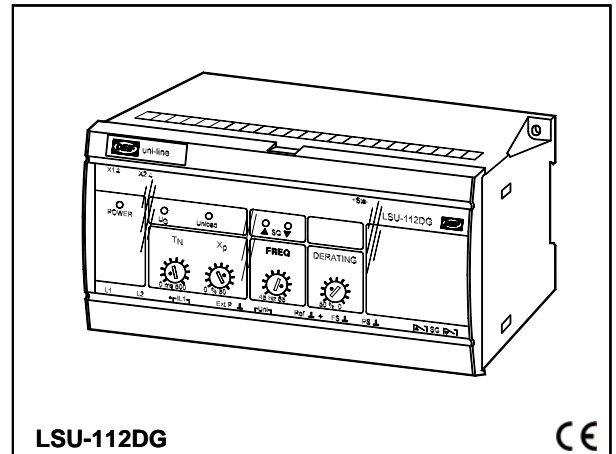
The power and frequency measured by each LSU-112DG are fed to 2 paralleling lines for comparison with the frequency (FS) and power (PS) of the other connected LSU-112DG.

If L1 or L2 is disconnected from the LSU-112DG at the same time as a power unit in a power plant is disconnected from the power line (busbar), built-in relays in the LSU-112DG ensure that the power output and the frequency output of the associated unit are disconnected from the paralleling lines. Likewise the power and frequency outputs are disconnected if the auxiliary voltage to the LSU-112DG is disconnected.

Load sharing units

uni-line

4921240118F



The LSU-112DG is equipped with an unload input. When activated this input will control the power unit to zero power, and at the same time the power output of the LSU-112DG is disconnected from the paralleling line.

The calibration of the LSU-112DG is done so it matches its power unit. This means that load sharing between power units with different size will be performed according to the actual size of the individual power unit in the plant. E.g. a 100kW PU and a 150kW PU running in parallel will share a total load of 125kW into 50kW and 75kW. If the 150kW PU is derated to 100kW by means of the DERATING potentiometer on the front of the LSU-112DG, the load in the above example will then be shared equally between the 2 power units.

Regulator output

The unit is provided with 2 contact outputs for speed control:

Power and frequency control:

The regulating speed of the servomotors for the prime mover is controlled by the built-in P controller of the LSU-112DG according to its setting for:

T_N (pulse length):

The min. duration of the control pulse.

X_P (proportional band):

The zone within which the pulse/pause ratio changes proportionally to the frequency/power deviation from the required value.

Dead band:

The zone within which no control pulses are emitted:

Power: $\pm 0.5\%$ of P_n (or for derated value)

Frequency: $\pm 0.1\text{Hz}$

Self-monitoring

The LSU-112DG is equipped with a self-monitoring function. The function supervises the built-in micro-controller and hereby verifies if the programme is running correctly. The green LED marked "POWER" is connected to this function. Constant green light indicates that the supply voltage is accepted and the unit is running correctly. Flashing green light 2-3Hz indicates that the supply voltage is accepted but the unit is running incorrectly. In this situation the status output terminals 17 and 18 are activated (open).

Type LSU-112DG

Terminals/function

Connection type	Connect	
1W3 (standard)	L1 to term. 24	L2 to term. 26
1W (betw. phase/neutral)	L1 (P) to term. 24	Neutral to term. 26

Terminal no.	Description/action
1 and 3 X1/X2	Input for supply voltage
17 and 18 Sta	Status output, activated (closed) when the supply voltage is connected and the unit is working correctly
28 and 29 IL1	Input for the current measurement. Note that S1 on the external current transformer is connected to terminal 28, and S2 is connected to terminal 29
31 and 32 Ext. P.	Must be short-circuited, if the internal power transducer is used (normal). For applications with unbalanced load it is recommended to use an external power transducer (replacing the built-in one). Connect external power transducer to 31 (+) and 32 (-). The output of the external transducer must be 4...20mA DC. The output of the connected transducer must limit the output to min. 2mA and max. 22mA. DEIF transducer type TAS-331DG is recommended
33 and 34 ("Unl")	May be connected to a potential-free N/O relay contact. When this contact is activated, the power of the generator is regulated to zero (unloading) and the LSU-112DG is disconnected from the PS power line
35 ("Ref.")	Reference input. Must be connected to term. 36 ("⊥"), if not used. This input is used to control the power unit running in power control mode (fixed load to grid). A +0.5V...5V connected to the input with respect to ⊥ will control the PU in the range 10...100% power. The input activates at 0.55V and deactivates at 0.45V. Please notice that when this input is active the LSU-112DG is still connected to the PS and FS lines. In this mode the PS line acts only as an output
37 ("+5V")	Reference output. This voltage output can be used for local power control mode. If terminal 37 is feeding a voltage divider, and the output from the voltage divider is connected to terminal 35, local power control can be performed
36 ("⊥")	Common earth terminal for the above reference input/output
38 (FS) and 39 ("⊥")	Paralleling line for frequency sharing of the connected LSU-112DGs
40 (PS) and 41 ("⊥")	Paralleling line for power sharing of the connected LSU-112DGs. Normally 5V at nominal busbar voltage and cos phi = 1. If cos phi 0.8 is stated on the label, 4V correspond to 100% power
43 and 44 Relay contacts "SG"	Relay contact for increase of the speed
45 and 46 Relay contacts "SG"	Relay contact for decrease of the speed
NOTE: Relay contacts	Relays (SG) should always be connected via external auxiliary relays when a DC pilot motor is applied. A transient suppressor should always be connected across the relay coil of the external relays

NOTE:

All terminals marked "⊥" are internally connected.

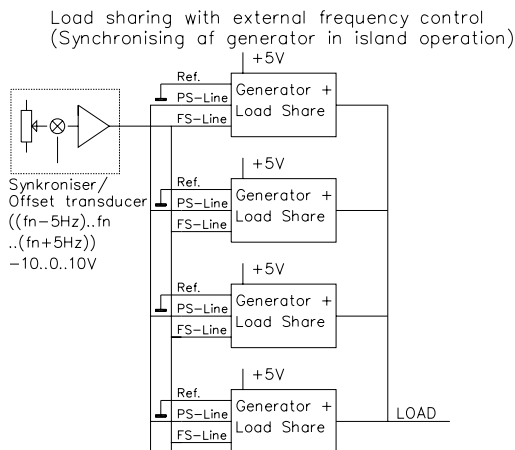
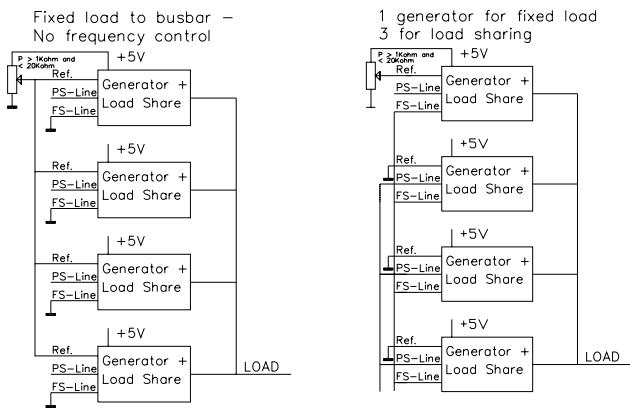
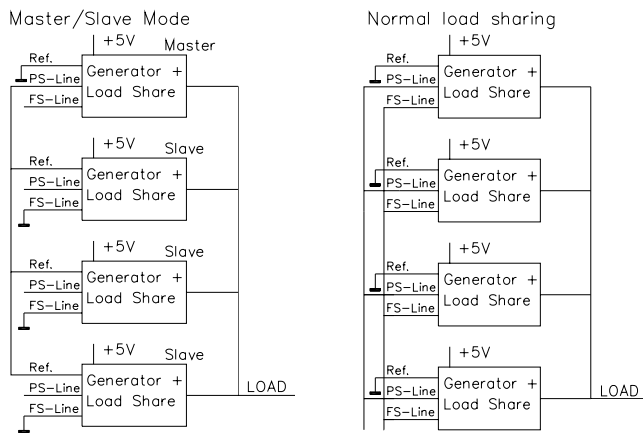
For correct function of the LSU-112DG any analogue DC input must not exceed 110% of its nominal value. To ensure correct power measurement it is important that the AC current input does not exceed 110% of its nominal value. To accomplish this it is important to take the value of the max. cos phi into consideration when ordering/configuring the LSU-112DG, e.g. by using the kVA figure of the generator and cos phi = 1.

Application

The schematic drawings on the next page show the different couplings for the LSU-112DG. For further information see the Application notes for uni-line, doc. no. 4189340150.

Type LSU-112DG

Schematic drawings



Technical specifications

- Meas. current (I_n):** 0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC (calibration modules)
- UL/cUL listed: 0.4...5.0A AC
- Adjusted range:** 75...100% of I_n (e.g. 0.45, adjusted by means of a built-in potentiometer) (Lowest meas. range: 0.3A)
- Overload:** 4 x I_n , continuously
20 x I_n for 10 s (max. 75A)
80 x I_n for 1 s (max. 300A)
- Load:** Max. 0.5VA (per phase) at I_n
- Meas. voltage (U_n):** (See supply voltage - AC ranges)
- Voltage range:** U_n 60...120%
- Overload:** 1.2 x U_n , continuously
2 x U_n for 10 s
- Load:** 2k Ω /V
- UL/cUL listed: 57.7...450V AC
- Frequency range:** 40...45...65...70Hz
- Inputs:**
- Unload:** Potential-free relay contact
Open: 5V. Closed: 5mA
- UL/cUL listed:
+/-5V DC (using pot. free ext. contacts)
- Reference input:** 0.5...5V \pm 1% (10...100% power)
Input resistance: \geq 2M Ω
- Ext. power input:** 4...20mA DC \pm 2%
- Ext. frequency input:** -5...0...5V \pm 2% ~ 0... \pm 2.5Hz
Max. -10...0...10V ~ -5...0...5Hz
- Contact outputs:**
- Speed control:** 2 make contacts
- Contact ratings:** AC1/DC1: 250V AC/24V DC, 8A
AC15/DC13: 250V AC/24V DC, 3A
- UL/cUL listed: Resistive load only
- Life electrical:** 1 x 10⁵ (nominal value)
- Analogue outputs:**
- PS line, FS line:** 2 parallel, analogue lines (-5...0...5V)
5V \pm 2% = 2.5Hz ~ 100% power
0V \pm 2% = 0Hz ~ 0% power
- Reference output:** Reference voltage: 5.0V \pm 1%
Load: Max. 5mA ($R \geq$ 1k Ω)
- UL/cUL listed: +/-5V DC
- Optocoupler output:** System status off = Failure
Max. voltage 30V DC, max. current 5mA
Voltage drop 1.5V ~ 2mA
- UL/cUL listed: 30V DC, 5mA
- Temperature:** -25...70°C (-13...158°F) (operating)
- UL/cUL listed:
Max. surrounding air temp. 60°C/140°F

Type LSU-112DG

Technical specifications, continued

Temperature drift:	Set-points: Max. ±0.2% of full scale per 10°C/50°F
Galvanic separation:	Between meas. voltage, meas. current, relay outputs, analogue inputs/outputs and aux. voltage: 3250V - 50Hz - 1 min.
Supply voltage (U_n):	57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA) 24-48-110-220V DC -25/+30% (max. 2.5W) UL/cUL listed: Only 24V DC and 110V AC DC supply must be from a class 2 power source
Climate:	HSE, to DIN 40040
EMC:	To EN 61000-6-1/2/3/4, SS4361503 (PL4) and IEC 255-3
Connections:	Max. 4mm ² (single-stranded) Max. 2.5mm ² (multi-stranded)
Materials:	All plastic parts are self-extinguishing to UL94 (V1)
Protection:	Case: IP40. Terminals: IP20, to IEC 529 and EN 60529
Type approval:	The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S
UL markings:	Wiring: Use 60/75°C (140/167°F) copper conductors only Wire size: AWG 12-16 or equivalent Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)

Settings

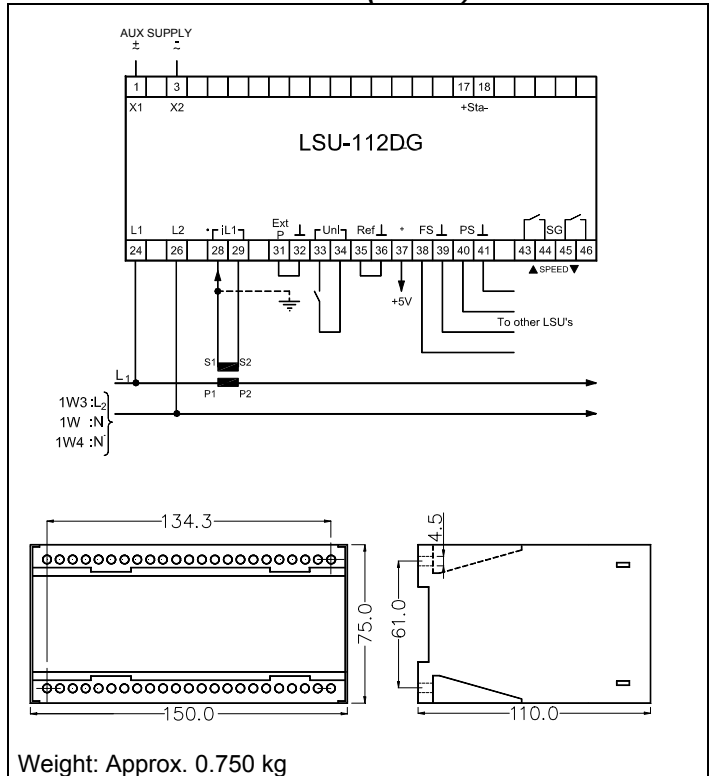
Setting of	Range
T _N Control pulse length	25...500 ms
X _P Proportional band	0...±50% of P _n 0...±2.5Hz of set frequency
Frequency	45...65Hz
Derating	50...0% of P _n

Indication

LEDs	Lit	Switched off
U _G Generator voltage	(Green) Present	Failure
Unload Unloading of this generator	(Green) Gen. unloaded	Normal load
SG▲ Increase speed (power)	(Yellow) Relay activated	Relay not activated
SG▼ Decrease speed (power)		

Once the unit has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

Connections/dimensions (in mm)



Order specifications

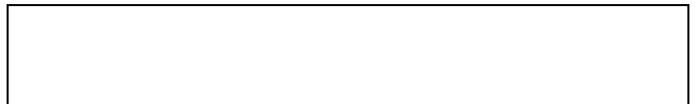
Type – Coupling – Measuring power (P_n) – Cos-phi – Measuring voltage – Supply voltage

Example:

LSU-112DG – 1W3 – 100W – 0.8 – 100V – 24V DC

$$\text{Meas. power} = \frac{\text{Primary power}}{\text{CT ratio} \times \text{VT ratio}}$$

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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ANSI code 90

Type LSU-113DG

- **For control of diesel and gas generators**
- **Built-in power and frequency transducer**
- **Reverse power protection/unload and trip**
- **Constant power or isochronous mode**
- **LED indication of status/activated control**
- **35 mm DIN rail or base mounting**

Application

The LSU-113DG is a control unit for control of the prime mover in a power unit.

The LSU-113DG can control the power unit

- in stand-alone mode, performing frequency control
- parallel with grid, performing power control
- parallel with other power units, performing frequency and power control

The unit is designed for connection to a mechanical speed governor, however in conjunction with the DEIF electronic potentiometer type EPN-110DN or EPQ-96 it can control electronic speed governors as well.

The LSU-113DG has a built-in frequency transducer. If a very stable frequency is wanted, an external frequency transducer common for all the LSU-113DGs in the power plant can be connected. If a number of power units are to be synchronised to the busbar at the same time, the frequency may likewise be controlled externally.

Function

The LSU-113DG is measuring the voltage and the current from which the frequency and the power produced by the power unit are measured. The built-in power transducer is based on an $I \times \cos \phi$ principle.

The following couplings are available:

- 1W(4) – single phase
- 1W3 – 1 element 3 phase, 3 wire, balanced load

If unbalanced load can be expected, an external power transducer with an output of 4...20mA can be connected to the LSU-113DG. In this case the built-in $I \times \cos \phi$ transducer is automatically interrupted.

The power and frequency measured by each LSU-113DG are fed to 2 paralleling lines for comparison with the frequency (FS) and power (PS) of the other connected LSU-113DG.

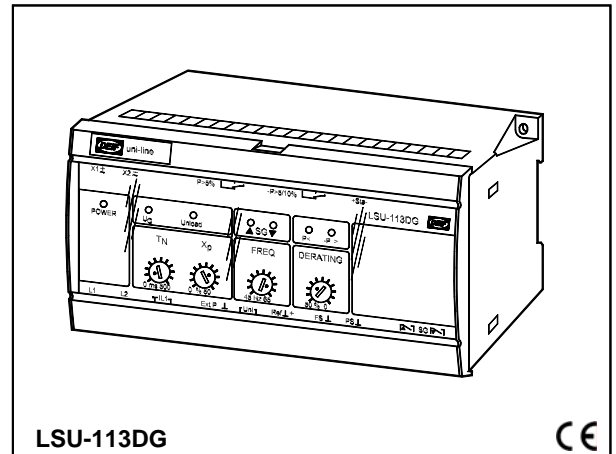
If L1 or L2 is disconnected from the LSU-113DG at the same time as a power unit in a power plant is disconnected from the power line (busbar), built-in relays in the LSU-113DG ensure that the power output and the frequency output of the associated unit are disconnected from the paralleling lines. Likewise the power and frequency outputs are disconnected if the auxiliary voltage to the LSU-113DG is disconnected.

The LSU-113DG is equipped with an unload input and a "low power" output. When activated the input will control the power unit to zero power, and the output will trip the breaker below $P < 5\%$ of P_{nom} . At the same time the input is activated, the power output of the LSU-113DG is disconnected from the paralleling line.

Load sharing units

uni-line

4921240120H



The LSU-113DG is provided with a reverse power output. The set-point for this output is:

- P >5% fixed delay 5 s or 10 s
- P >10% fixed delay 5 s or 10 s

The calibration of the LSU-113DG is done so it matches its power unit. This means that load sharing between power units with different size will be performed according to the actual size of the individual power unit in the plant. E.g. a 100kW PU and a 150kW PU running in parallel will share a total load of 125kW into 50kW and 75kW. If the 150kW PU is derated to 100kW by means of the DERATING potentiometer on the front of the LSU-113DG, the load in the above example will then be shared equally between the 2 power units.

Outputs

The unit is provided with 2 contact outputs for speed control:

Power and frequency control:

The regulating speed of the servomotors for the prime mover is controlled by the built-in P controller of the LSU-113DG according to its setting for:

T_N (pulse length):

The min. duration of the control pulse.

X_P (proportional band):

The zone within which the pulse/pause ratio changes proportionally to the frequency/power deviation from the required value.

Dead band:

The zone within which no control pulses are emitted:

Power: $\pm 0.5\%$ of P_n (or for derated value)

Frequency: $\pm 0.1\text{Hz}$

Tripping output:

2 change-over contacts, normally de-energized, for low power and reverse power tripping.

Self-monitoring

The LSU-113DG is equipped with a self-monitoring function. The function supervises the built-in micro-controller and hereby verifies if the programme is running correctly. The green LED marked "POWER" is connected to this function. Constant green light indicates that the supply voltage is accepted and the unit is running correctly. Flashing green light 2-3Hz indicates that the supply voltage is accepted but the unit is running incorrectly. In this situation the status output terminals 17 and 18 are activated (open).

Type LSU-113DG

Terminals/function

Connection type	Connect	
1W3 (standard)	L1 to term. 24	L2 to term. 26
1W (betw. phase/neutral)	L1 (P) to term. 24	Neutral to term. 26

Terminal no.	Description/action
1 and 3 X1/X2	Input for supply voltage
8, 9 and 10 ("P <5%")	After unloading (short-circuit of terminals 33 and 34 ("Unl")) an opening signal is transmitted to the generator circuit breaker when the power has dropped to 5% or less of P_n
13, 14 and 15 ("-P >5/10% 5 s/10 s")	Relay output for reverse power protection. The -P > set-point is set by DEIF to either -P >5% (delay: 5 s or 10 s) or -P >10% (delay: 5 s or 10 s)
17 and 18 Sta	Status output, activated (closed) when the supply voltage is connected and the unit is working correctly
28 and 29 IL1	Input for the current measurement. Note that S1 on the external current transformer is connected to terminal 28, and S2 is connected to terminal 29
31 and 32 Ext. P.	Must be short-circuited, if the internal power transducer is used (normal). For applications with unbalanced load it is recommended to use an external power transducer (replacing the built-in one). Connect external power transducer to 31 (+) and 32 (-). The output of the external transducer must be 4...20mA DC. The output of the connected transducer must limit the output to min. 2mA and max. 22mA. DEIF transducer type TAS-331DG is recommended
33 and 34 ("Unl")	May be connected to a potential-free N/O relay contact. When this contact is activated, the power of the generator is regulated to zero (unloading) and the LSU-113DG is disconnected from the PS power line
35 ("Ref.")	Reference input. Must be connected to term. 36 ("⊥"), if not used. This input is used to control the power unit running in power control mode (fixed load to grid). A +0.5V...5V connected to the input with respect to ⊥ will control the PU in the range 10...100% power. The input activates at 0.55V and deactivates at 0.45V. Please notice that when this input is active the LSU-113DG is still connected to the PS and FS lines. In this mode the PS line acts only as an output
37 ("+5V")	Reference output. This voltage output can be used for local power control mode. If terminal 37 is feeding a voltage divider, and the output from the voltage divider is connected to terminal 35, local power control can be performed
36 ("⊥")	Common earth terminal for the above reference input/output
38 (FS) and 39 ("⊥")	Paralleling line for frequency sharing of the connected LSU-113DGs
40 (PS) and 41 ("⊥")	Paralleling line for power sharing of the connected LSU-113DGs. Normally 5V at nominal busbar voltage and $\cos \phi = 1$. If $\cos \phi = 0.8$ is stated on the label, 4V correspond to 100% power
43 and 44 Relay con- tacts "SG"	Relay contact for increase of the speed
45 and 46 Relay con- tacts "SG"	Relay contact for decrease of the speed
NOTE: Relay contacts	Relays (SG) should always be connected via external auxiliary relays when a DC pilot motor is applied. A transient suppressor should always be connected across the relay coil of the external relays

NOTE:

All terminals marked "⊥" are internally connected.

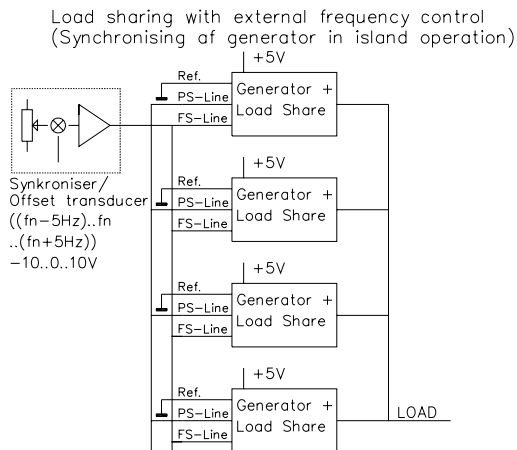
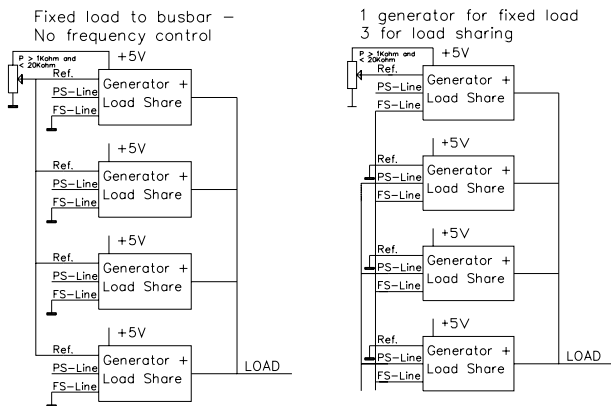
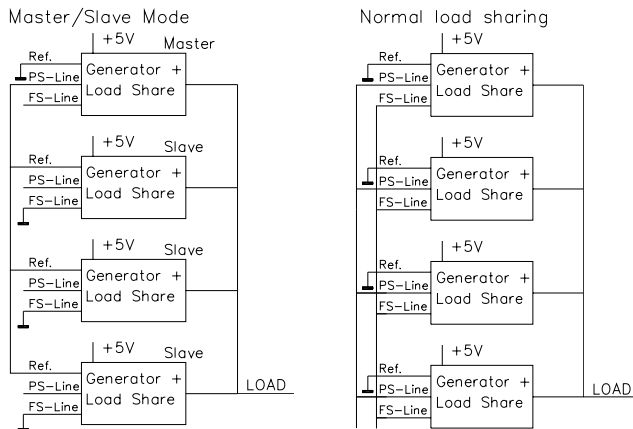
For correct function of the LSU-113DG any analogue DC input must not exceed 110% of its nominal value. To ensure correct power measurement it is important that the AC current input does not exceed 110% of its nominal value. To accomplish this it is important to take the value of the max. $\cos \phi$ into consideration when ordering/configuring the LSU-113DG, e.g. by using the kVA figure of the generator and $\cos \phi = 1$.

Application

The schematic drawings on the next page show the different couplings for the LSU-113DG. For further information see the Application notes for uni-line, doc. no. 4189340150.

Type LSU-113DG

Schematic drawings



Technical specifications

Meas. current (I_n): 0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC (calibration modules)

UL/cUL listed: 0.4...5.0A AC

Adjusted range: 75...100% of I_n (e.g. 0.45, adjusted by means of a built-in potentiometer) (Lowest meas. range: 0.3A)

Overload: 4 x I_n, continuously
20 x I_n for 10 s (max. 75A)
80 x I_n for 1 s (max. 300A)

Load: Max. 0.5VA (per phase) at I_n

Meas. voltage (U_n): (See supply voltage - AC ranges)

Voltage range: U_n 60...120%

Overload: 1.2 x U_n, continuously
2 x U_n for 10 s

Load: 2kΩ/V

UL/cUL listed: 57.7...450V AC

Frequency range: 40...45...65...70Hz

Inputs:
Unload: Potential-free relay contact
Open: 5V. Closed: 5mA

UL/cUL listed: +/-5V DC (using pot. free ext. contacts)

Reference input: 0.5...5V ±1% (10...100% power)
Input resistance: ≥2MΩ

Ext. power input: 4...20mA DC ±2%

Ext. frequency input: -5...0...5V ±2% ~ 0...±2.5Hz
Max. -10...0...10V ~ -5...0...5Hz

Contact outputs:
Speed control: 2 make contacts

P< -P>: 2 change-over contacts

Contact ratings: AC1/DC1: 250V AC/24V DC, 8A
AC15/DC13: 250V AC/24V DC, 3A

UL/cUL listed: Resistive load only

Life electrical: 1 x 10⁵ (nominal value)

Analogue outputs:
PS line, FS line: 2 parallel, analogue lines (-5...0...5V)
5V ±2% = 2.5Hz ~ 100% power
0V ±2% = 0Hz ~ 0% power

Reference output: Reference voltage: 5.0V ±1%
Load: Max. 5mA (R ≥ 1kΩ)

UL/cUL listed: +/-5V DC

Optocoupler output: System status off = Failure
Max. voltage 30V DC, max. current 5mA
Voltage drop 1.5V ~ 2mA

UL/cUL listed: 30V DC, 5mA

Type LSU-113DG

Technical specifications, continued

Temperature:	-25...70°C (-13...158°F) (operating)
	UL/cUL listed: Max. surrounding air temp. 60°C/140°F
Temperature drift:	Set-points: Max. ±0.2% of full scale per 10°C/50°F
Galvanic separation:	Between meas. voltage, meas. current, relay outputs, analogue inputs/outputs and aux. voltage: 3250V - 50Hz - 1 min.
Supply voltage (U_n):	57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA)
	24-48-110-220V DC -25/+30% (max. 2.5W)
	UL/cUL listed: Only 24V DC and 110V AC DC supply must be from a class 2 power source
Climate:	HSE, to DIN 40040
EMC:	To EN 61000-6-1/2/3/4, SS4361503 (PL4) and IEC 255-3
Connections:	Max. 4mm ² (single-stranded) Max. 2.5mm ² (multi-stranded)
Materials:	All plastic parts are self-extinguishing to UL94 (V1)
Protection:	Case: IP40. Terminals: IP20, to IEC 529 and EN 60529
Type approval:	The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S
UL markings:	Wiring: Use 60/75°C (140/167°F) copper conductors only
	Wire size: AWG 12-16 or equivalent
	Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)

Settings

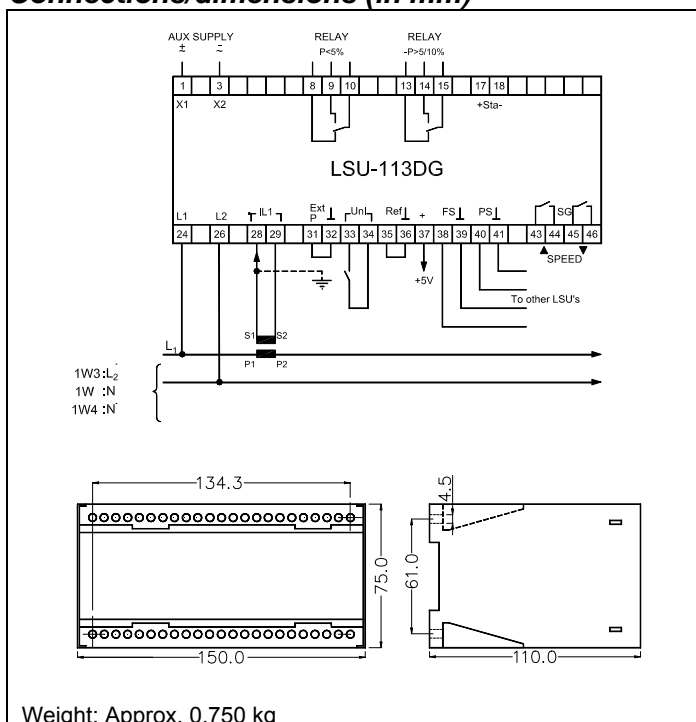
Setting of	Range
T _N Control pulse length	25...500 ms
X _P Proportional band	0...±50% of P _n 0...±2.5Hz of set frequency
Frequency	45...65Hz
Derating	50...0% of P _n
Reverse power	-5% of P _n or -10% of P _n , 5s or 10s
Low power	5% of P _n

Indication

LEDs	Lit	Switched off
U _G Generator voltage	(Green) Present	Failure
-P> 5%/10% Reverse power	(Yellow) Fault	Normal Associated re-lay deactivated
P<5% Low power	(Yellow)	
Unload Unloading of this generator	(Green) Gen. unloaded	Normal load
SG▲ Increase speed (power)	(Yellow) Relay activated	Relay not activated
SG▼ Decrease speed (power)	Relay activated	

Once the unit has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

Connections/dimensions (in mm)



Order specifications

Type – Coupling – Measuring power (P_n) – Set point "-P>" – Delay – Cos-φ – Measuring voltage – Supply voltage
Example: LSU-113DG – 1W3 – 100W – 5% – 10 s – 0.8 – 100V – 24V DC
$\text{Meas. power} = \frac{\text{Primary power}}{\text{CT ratio} \times \text{VT ratio}}$

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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ANSI code 90
Type LSU-114DG

- **For control of diesel and gas generators**
- **Built-in power and frequency transducer**
- **Constant power or isochronous mode**
- **LED indication for status/activated control**
- **With start/stop outputs**
- **35 mm DIN rail or base mounting**

Application

The LSU-114DG is a control unit for control of the prime mover in a power unit.

The LSU-114DG can control the power unit

- in stand-alone mode, performing frequency control
- parallel with grid, performing power control
- parallel with other power units, performing frequency and power control

The unit is designed for connection to a mechanical speed governor, however in conjunction with the DEIFA electronic potentiometer type EPN-110DN or EPQ-96 it can control electronic speed governors as well.

The LSU-114DG has a built-in frequency transducer. If a very stable frequency is wanted, an external frequency transducer common for all the LSU-114DGs in the power plant can be connected. If a number of power units are to be synchronised to the busbar at the same time, the frequency may likewise be controlled externally.

Function

The LSU-114DG is measuring the voltage and the current from which the frequency and the power produced by the power unit are measured. The built-in power transducer is based on an $I \times \cos \phi$ principle.

The following couplings are available:

- 1W(4) – single phase
- 1W3 – 1 element 3 phase, 3 wire, balanced load

If unbalanced load can be expected, an external power transducer with an output of 4...20mA can be connected to the LSU-114DG. In this case the built-in $I \times \cos \phi$ transducer is automatically interrupted.

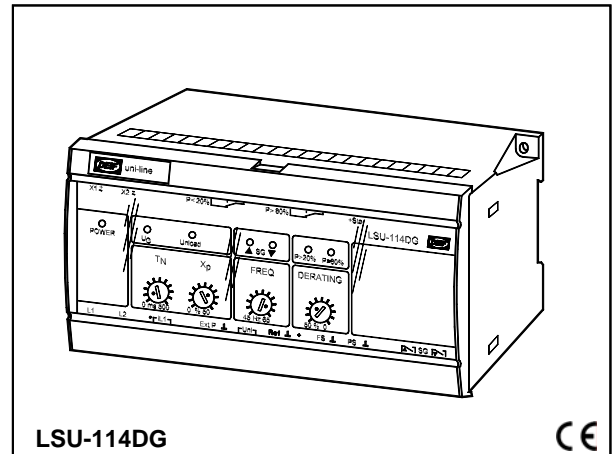
The power and frequency measured by each LSU-114DG are fed to 2 paralleling lines for comparison with the frequency (FS) and power (PS) of the other connected LSU-114DG.

If L1 or L2 is disconnected from the LSU-114DG at the same time as a power unit in a power plant is disconnected from the power line (busbar), built-in relays in the LSU-114DG ensure that the power output and the frequency output of the associated unit are disconnected from the paralleling lines. Likewise the power and frequency outputs are disconnected if the auxiliary voltage to the LSU-114DG is disconnected.

The LSU-114DG is equipped with an unload input. When activated the input will control the power unit to zero power, and at the same time the power output of the LSU-114DG is disconnected from the paralleling line.

Load sharing units

uni-line
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The LSU-114DG is equipped with 2 outputs for start and stop of the next PU. The start output is activated if $P_n > 80\%$, and the stop output is activated if $P_n < 20\%$.

NOTE: Start/stop signals are transmitted without time delay.

The calibration of the LSU-114DG is done so it matches its power unit. This means that load sharing between power units with different size will be performed according to the actual size of the individual power unit in the plant. E.g. a 100kW PU and a 150kW PU running in parallel will share a total load of 125kW into 50kW and 75kW. If the 150kW PU is derated to 100kW by means of the DERATING potentiometer on the front of the LSU-114DG, the load in the above example will then be shared equally between the 2 power units.

Outputs

The unit is provided with 2 contact outputs for speed control:

Power and frequency control:

The regulating speed of the servomotors for the prime mover is controlled by the built-in P controller of the LSU-114DG according to its setting for:

T_N (pulse length):

The min. duration of the control pulse.

X_P (proportional band):

The zone within which the pulse/pause ratio changes proportionally to the frequency/power deviation from the required value.

Dead band:

The zone within which no control pulses are emitted:

Power: $\pm 0.5\%$ of P_n (or for derated value)

Frequency: $\pm 0.1\text{Hz}$

Start/stop outputs:

2 change-over contacts, normally de-energized, for start and stop of next PU.

Self-monitoring

The LSU-114DG is equipped with a self-monitoring function. The function supervises the built-in micro-controller and hereby verifies if the programme is running correctly. The green LED marked "POWER" is connected to this function. Constant green light indicates that the supply voltage is accepted and the unit is running correctly. Flashing green light 2-3Hz indicates that the supply voltage is accepted but the unit is running incorrectly. In this situation the status output terminals 17 and 18 are activated (open).

Type LSU-114DG

Terminals/function

Connection type	Connect	
1W3 (standard)	L1 to term. 24	L2 to term. 26
1W (betw. phase/neutral)	L1 (P) to term. 24	Neutral to term. 26

Terminal no.	Description/action
1 and 3 X1/X2	Input for supply voltage
8, 9 and 10 ("P <20%")	Relay output for stop of the next stand-by PU. NOTE: Signal is transmitted without time delay
13, 14 and 15 ("P >80%")	Relay output for start of the next stand-by PU. NOTE: Signal is transmitted without time delay
17 and 18 Sta	Status output, activated (closed) when the supply voltage is connected and the unit is working correctly
28 and 29 IL1	Input for the current measurement. Note that S1 on the external current transformer is connected to terminal 28, and S2 is connected to terminal 29
31 and 32 Ext. P.	Must be short-circuited, if the internal power transducer is used (normal). For applications with unbalanced load it is recommended to use an external power transducer (replacing the built-in one). Connect external power transducer to 31 (+) and 32 (-). The output of the external transducer must be 4...20mA DC. The output of the connected transducer must limit the output to min. 2mA and max. 22mA. DEIF transducer type TAS-331DG is recommended
33 and 34 ("Unl")	May be connected to a potential-free N/O relay contact. When this contact is activated, the power of the generator is regulated to zero (unloading) and the LSU-114DG is disconnected from the PS power line
35 ("Ref.")	Reference input. Must be connected to term. 36 ("⊥"), if not used. This input is used to control the power unit running in power control mode (fixed load to grid). A +0.5V...5V connected to the input with respect to ⊥ will control the PU in the range 10...100% power. The input activates at 0.55V and deactivates at 0.45V. Please notice that when this input is active the LSU-114DG is still connected to the PS and FS lines. In this mode the PS line acts only as an output
37 ("+5V")	Reference output. This voltage output can be used for local power control mode. If terminal 37 is feeding a voltage divider, and the output from the voltage divider is connected to terminal 35, local power control can be performed
36 ("⊥")	Common earth terminal for the above reference input/output
38 (FS) and 39 ("⊥")	Paralleling line for frequency sharing of the connected LSU-114DGs
40 (PS) and 41 ("⊥")	Paralleling line for power sharing of the connected LSU-114DGs. Normally 5V at nominal busbar voltage and cos phi = 1. If cos phi 0.8 is stated on the label, 4V correspond to 100% power
43 and 44 Relay con- tacts "SG"	Relay contact for increase of the speed
45 and 46 Relay con- tacts "SG"	Relay contact for decrease of the speed
NOTE: Relay con- tacts	Relays (SG) should always be connected via external auxiliary relays when a DC pilot motor is applied. A transient suppressor should always be connected across the relay coil of the external relays

NOTE:

All terminals marked "⊥" are internally connected.

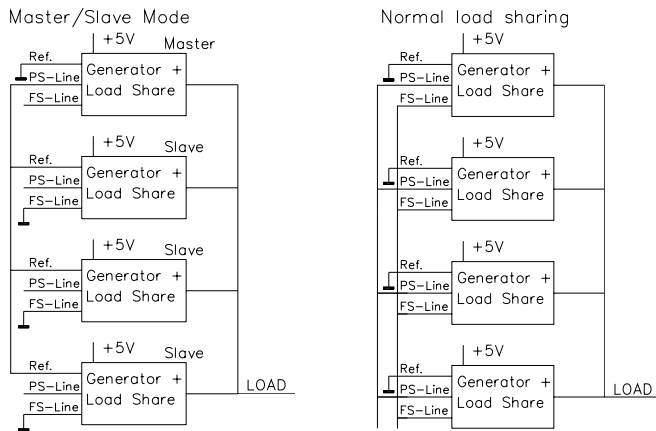
For correct function of the LSU-114DG any analogue DC input must not exceed 110% of its nominal value. To ensure correct power measurement it is important that the AC current input does not exceed 110% of its nominal value. To accomplish this it is important to take the value of the max. cos phi into consideration when ordering/configuring the LSU-114DG, e.g. by using the kVA figure of the generator and cos phi = 1.

Application

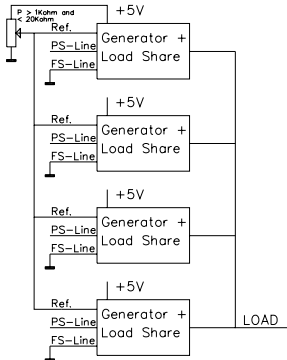
The schematic drawings on the next page show the different couplings for the LSU-114DG. For further information see the Application notes for uni-line, doc. no. 4189340150.

Type LSU-114DG

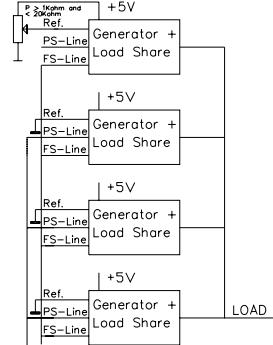
Schematic drawings



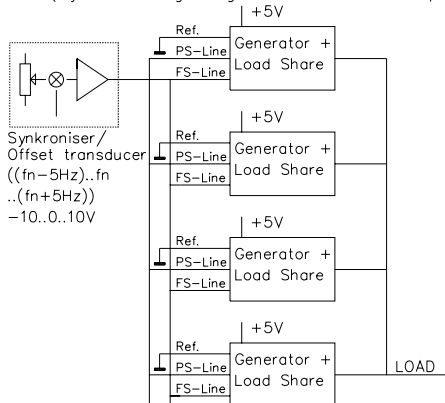
Fixed load to busbar – No frequency control



1 generator for fixed load 3 for load sharing



Load sharing with external frequency control (Synchronising of generator in island operation)



Technical specifications

Meas. current (I_n): 0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC (calibration modules)

UL/cUL listed: 0.4...5.0A AC

Adjusted range: 75...100% of I_n (e.g. 0.45, adjusted by means of a built-in potentiometer) (Lowest meas. range: 0.3A)

Overload: 4 x I_n, continuously
20 x I_n for 10 s (max. 75A)
80 x I_n for 1 s (max. 300A)

Load: Max. 0.5VA (per phase) at I_n

Meas. voltage (U_n): (See supply voltage - AC ranges)

Voltage range: U_n 60...120%

Overload: 1.2 x U_n, continuously
2 x U_n for 10 s

Load: 2kΩ/V

UL/cUL listed: 57.7...450V AC

Frequency range: 40...45...65...70Hz

Inputs:

Unload: Potential-free relay contact
Open: 5V. Closed: 5mA

UL/cUL listed: +/-5V DC (using pot. free ext. contacts)

Reference input: 0.5...5V ±1% (10...100% power)
Input resistance: ≥2MΩ

Ext. power input: 4...20mA DC ±2%

Ext. frequency input: -5...0...5V ±2% ~ 0...±2.5Hz
Max. -10...0...10V ~ -5...0...5Hz

Contact outputs:

Speed control: 2 make contacts

Start/stop: 2 change-over contacts

Contact ratings: AC1/DC1: 250V AC/24V DC, 8A
AC15/DC13: 250V AC/24V DC, 3A

UL/cUL listed: Resistive load only

Life electrical: 1 x 10⁵ (nominal value)

Analogue outputs:

PS line, FS line: 2 parallel, analogue lines (-5...0...5V)
5V ±2% = 2.5Hz ~ 100% power
0V ±2% = 0Hz ~ 0% power

Reference output: Reference voltage: 5.0V ±1%
Load: Max. 5mA (R ≥ 1kΩ)

UL/cUL listed: +/-5V DC

Optocoupler output:

System status off = Failure
Max. voltage 30V DC, max. current 5mA
Voltage drop 1.5V ~ 2mA

UL/cUL listed: 30V DC, 5mA

Type LSU-114DG

Technical specifications, continued

Temperature:	-25...70°C (-13...158°F) (operating)
	UL/cUL listed: Max. surrounding air temp. 60°C/140°F
Temperature drift:	Set-points: Max. ±0.2% of full scale per 10°C/50°F
Galvanic separation:	Between meas. voltage, meas. current, relay outputs, analogue inputs/outputs and aux. voltage: 3250V - 50Hz - 1 min.
Supply voltage (U_n):	57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690V AC ±20% (max. 3.5VA)
	24-48-110-220V DC -25/+30% (max. 2.5W)
	UL/cUL listed: Only 24V DC and 110V AC DC supply must be from a class 2 power source
Climate:	HSE, to DIN 40040
EMC:	To EN 61000-6-1/2/3/4, SS4361503 (PL4) and IEC 255-3
Connections:	Max. 4mm ² (single-stranded) Max. 2.5mm ² (multi-stranded)
Materials:	All plastic parts are self-extinguishing to UL94 (V1)
Protection:	Case: IP40. Terminals: IP20, to IEC 529 and EN 60529
Type approval:	The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S
UL markings:	Wiring: Use 60/75°C (140/167°F) copper conductors only

Wire size:
AWG 12-16 or equivalent

Installation:
To be installed in accordance with the NEC (US) or the CEC (Canada)

Settings

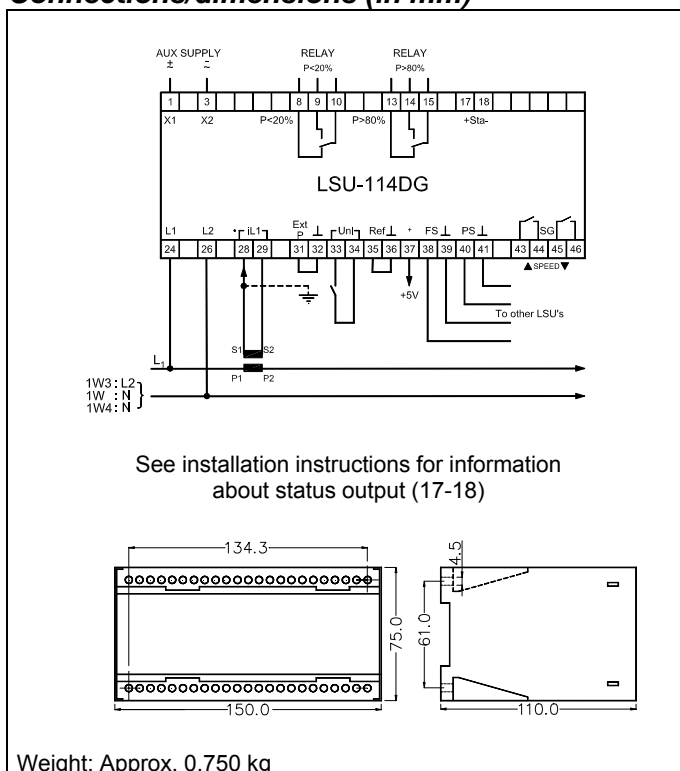
Setting of	Range
T _N Control pulse length	25...500 ms
X _P Proportional band	0...±50% of P _n 0...±2.5Hz of set frequency
Frequency	45...65Hz
Derating	50...0% of P _n
Start/stop (fixed)	80% of P _n and 20% of P _n

Indication

LEDs	Lit	Switched off
U _G Generator voltage	(Green) Present	Failure
P >80% Start	(Yellow) Exceeded	Normal Associated re-lay deactivated
P <20% Stop		
Unload Unloading of this generator	(Green) Gen. unloaded	Normal load
SG▲ Increase speed (power)	(Yellow) Relay activated	Relay not activated
SG▼ Decrease speed (power)		

Once the unit has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

Connections/dimensions (in mm)



Order specifications

Type – Coupling – Measuring power (P_n) – Cos-φ – Measuring voltage – Supply voltage

Example:
LSU-114DG – 1W3 – 100W – 0.8 – 100V – 24V DC

$$\text{Meas. power} = \frac{\text{Primary power}}{\text{CT ratio} \times \text{VT ratio}}$$

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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ANSI code 90

Type LSU-122DG

- **For control of diesel or gas generators**
- **Built-in reactive power transducer**
- **Control of AVR**
- **LED indication of status**
- **LED indication for activated control**
- **35 mm DIN rail or base mounting**

Application

The LSU-122DG is a control unit for control of the generator in a power unit.

The LSU-122DG can control the power unit

- in stand alone mode, performing voltage control
- parallel with grid, performing reactive power control
- parallel with other power units, performing voltage and reactive power control

The unit is designed for connection to a motor potentiometer for control of the AVR, however in conjunction with the DEIF electronic potentiometer type EPN-110DN or EPQ-96 it can control most electronic AVRs.

All the LSU-122DGs in the power plant must be connected to a common voltage transducer. If a number of generators are to be synchronised to the busbar at the same time, the voltage may likewise be controlled externally.

Function

The LSU-122DG is measuring the voltage and the current from which the reactive power produced by the power unit is calculated. The built-in reactive power transducer is based on an $I \times \sin \phi$ principle.

The following couplings are available:

- 1var single phase
- 1var3 1 element, 3 phase 3 wire balanced load

If unbalanced load can be expected an external reactive power transducer with an output of 4...20mA can be connected to the LSU-122DG. In this case the built-in $I \times \sin \phi$ transducer is automatically interrupted.

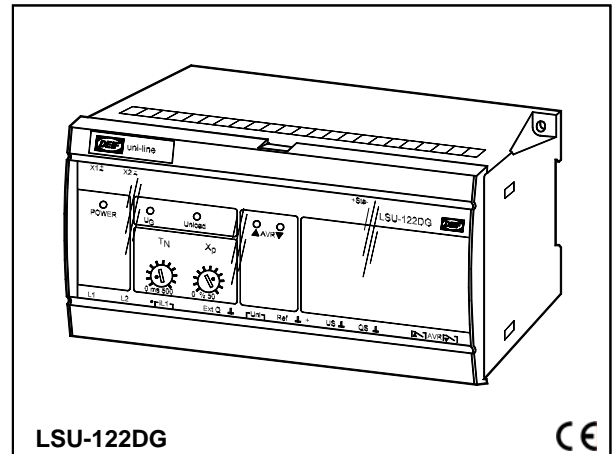
The reactive power measured by each LSU-122DG is fed to a common line for comparison with the reactive power (QS) of the other connected LSU-122DG. The voltage line (US) from each LSU-122DG is connected to the common voltage transducer.

If L1 or L2 is disconnected from the LSU-122DG at the same time as a power unit in a power plant is disconnected from the power line (busbar), built-in relays in the LSU-122DG ensure that the reactive power output (QS) and the voltage input (US) of the associated unit are disconnected from the paralleling lines. Likewise the reactive power and voltage lines are disconnected, if the auxiliary voltage to the LSU-122DG is disconnected.

var load sharing units

uni-line

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The LSU-122DG is equipped with an unload input. When activated this input will control the power unit (generator) to zero reactive power, and at the same time the reactive power output of the LSU-122DG is disconnected from the paralleling line.

The calibration of the LSU-122DG is done so it matches its power unit. This means that load sharing between power units with different size will be performed according to the actual size of the individual power units in the plant. E.g. a 100kVA generator and a 150kVA generator running in parallel will share a total load of 125kvar into 50kvar and 75kvar.

Regulator output

The unit is provided with 2 contact outputs for voltage control:

Reactive power and voltage control:

The regulating speed of the motor potentiometer for the AVR is controlled by the built-in P controller of the LSU-122DG according to its setting for:

T_N (pulse length):

The min. duration of the control pulse.

X_P (proportional band):

The zone within which the pulse ratio changes proportionally to the voltage/reactive power deviation from the required value.

Dead band:

The zone within which no control pulses are emitted:

Power: $\pm 0.5\%$ of P_n

Voltage: $\pm 1\%$ of U_n

Self-monitoring

The LSU-122DG is equipped with a self-monitoring function. The function supervises the built-in micro-controller and hereby verifies if the programme is running correctly. The green LED marked "POWER" is connected to this function. Constant green light indicates that the supply voltage is accepted and the unit is running correctly. Flashing green light 2-3Hz indicates that the supply voltage is accepted but the unit is running incorrectly. In this situation the status output terminals 17 and 18 are activated (open).

Type LSU-122DG

Terminals/function

Connection type	Connect	
	1var3 (standard)	L1 to term. 24
1var (betw. phase/neutral)	L1 (P) to term. 24	Neutral to term. 26

Terminal no.	Description/action
1 and 3 (X1/X2)	Input for supply voltage
17 (+) and 18 (-) (Sta)	Status output, activated (closed) when the supply voltage is connected and the unit is working correctly
28 and 29 (IL1)	Input for the current measurement. Note that S1 on the external current transformer is connected to terminal 28, and S2 is connected to terminal 29
31 and 32 ("Ext. Q.")	Must be short-circuited, if the internal reactive power transducer is used (normal). For applications with unbalanced load it is recommended to use an external reactive power transducer (replacing the built-in one). Connect external transducer to 31 (+) and 32 (-). The output of the external transducer must be 4...20mA DC. The output of the connected transducer must limit the output swing to min. 2mA and max. 22mA. DEIF transducer type TAS-331DG is recommended
33 and 34 ("Unl")	May be connected to a potential-free N/O relay contact. When this contact is activated, the reactive power of the generator is regulated to zero (unloading), and the LSU-122DG is disconnected from the paralleling QS power line
35 ("Ref.")	Reference input. Must be connected to term. 36 ("⊥"), if not used. This input is used to control the power unit running in reactive power control mode (fixed reactive load to grid). A +0.5V...5V connected to the input with respect to (⊥) will control the generator in the range 10...100% reactive power. The input activates at 0.55V and deactivates at 0.45V. Please notice that when this input is active the LSU-122DG is still connected to the QS and US lines. In this mode the QS line acts only as an output
37 ("+5V")	Reference output. This voltage output can be used for local reactive power control mode. If terminal 37 is feeding a voltage divider, and the output from the voltage divider is connected to terminal 35, local power control can be performed
36 ("⊥")	Common earth terminal for the above reference input/output
38 ("US") and 39 ("⊥")	Paralleling line for voltage regulation of the generator. Normally connected to an external voltage transducer. The output of the external common voltage transducer must be 0...5...10V corresponding to 80...100...120% of U_n and must be connected to terminal 37 if voltage control is not used
40 ("QS") and 41 ("⊥")	Paralleling line for reactive power sharing of the connected LSU-122DGs. Normally 5V at nominal busbar voltage and $\cos \phi = 1$. If $\cos \phi = 0.8$ is stated on the label, 4V correspond to 100% reactive power. $\cos \phi$ is used instead of $\sin \phi = 0.6$ to make it comparable to the LSU-112/113/114DG
43 and 44 Relay con- tacts "AVR"	Relay contact for increase of the excitation (voltage)
45 and 46 Relay con- tacts "AVR"	Relay contact for decrease of the excitation (voltage)
NOTE: Relay con- tacts	Relays (AVR) should always be connected via external auxiliary relays when a DC pilot motor is applied. A transient suppressor should always be connected across the relay coil of the external relays

NOTE:

All terminals marked "⊥" are internally connected.

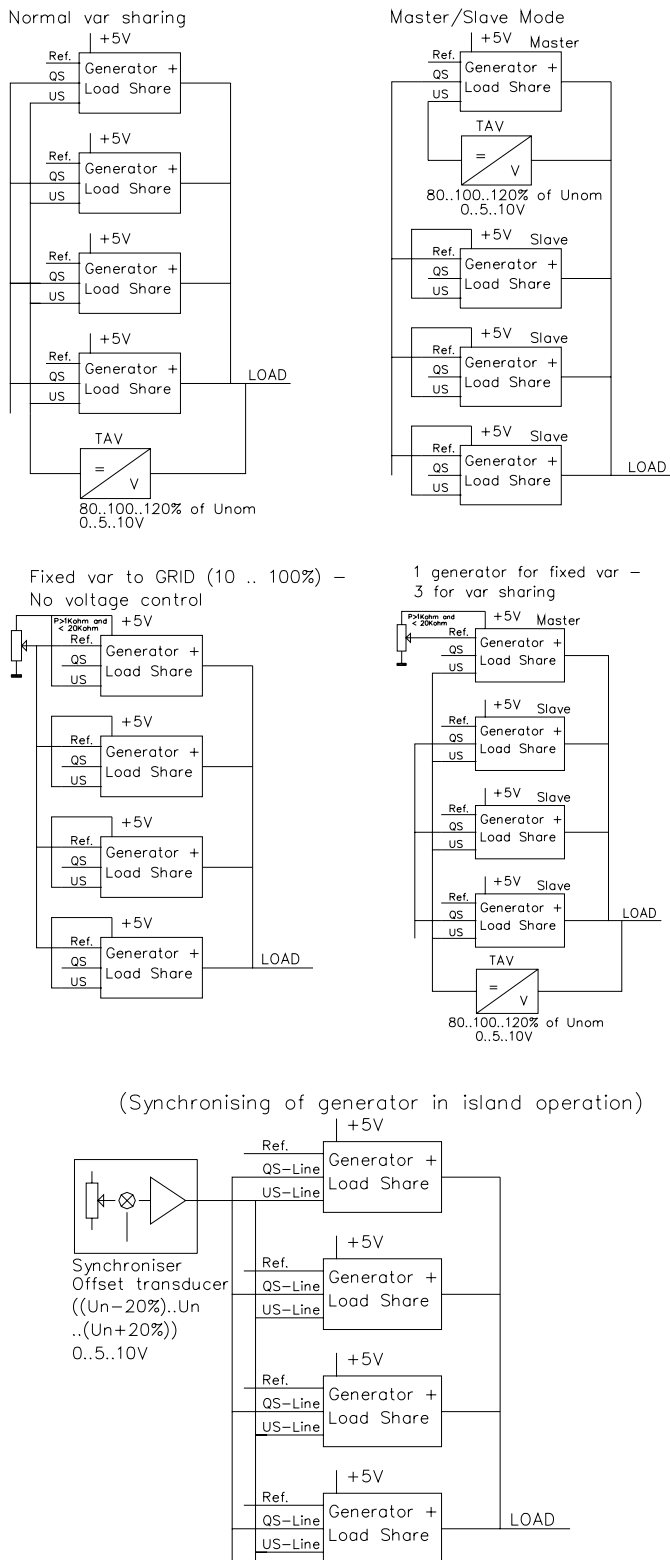
For correct function of the LSU-122DG any analogue DC input must not exceed 110% of its nominal value. To ensure correct reactive power measurement it is important that the AC current input does not exceed 110% of its nominal value. To accomplish this it is important to take the value of the max. $\cos \phi$ for the generator into consideration when ordering/configuring the LSU-122DG, e.g. by using the kVA figure of the generator and $\cos \phi = 1$. Please notice that if the LSU-122DG is to be used in an installation which also includes our LSU-112/113/114DG, the measuring power (W/var) and the $\cos \phi$ must be identical for both units, because the current input values for both units are alike.

Application

The schematic drawings on the next page show the different couplings for the LSU-122DG. For further information see the Application notes for uni-line, doc. no. 4189340150.

Type LSU-122DG

Schematic drawings



Please notice that unused ref. inputs must be connected to terminal 36 ("⊥").

Technical specifications

Meas. current (I_n): 0.3-0.4-0.5-0.6-0.8-1.0-1.3-1.5-2.0-2.5-3.0-4.0-5.0A AC (calibration modules)

UL/cUL listed: 0.4...5.0A AC

Adjusted range: 75...100% of I_n (e.g. 0.45 adjusted by means of a built-in potentiometer) (Lowest meas. range: 0.3A)

Overload: 4 x I_n, continuously
 20 x I_n for 10 s (max. 75A)
 80 x I_n for 1 s (max. 300A)

Load: Max. 0.5VA (per phase) at I_n

Meas. voltage (U_n): (See supply voltage - AC ranges)

Voltage range: U_n 60...120%

Overload: 1.2 x U_n, continuously
 2 x U_n for 10 s

Load: 2kΩ/V

UL/cUL listed: 57.7...450V AC

Frequency range: 40...45...65...70Hz

Inputs:
Unload: Potential-free relay contact
 Open: 5V. Closed: 5mA

UL/cUL listed: +/-5V DC (using pot. free ext. contacts)

Reference input: 0.5...5V ±1% (10...100% reactive power)
 Input resistance: ≥2MΩ

Ext. power input: 4...20mA DC ±2%

Ext. voltage input: 0...5...10V ±2% ~ 80...100...120% of U_n from external voltage transducer

Contact outputs:
Voltage control: 2 make contacts

Contact ratings: AC1/DC1: 250V AC/24V DC, 8A
 AC15/DC13: 250V AC/24V DC, 3A

UL/cUL listed: Resistive load only

Life electrical: 1 x 10⁵ (nominal value)

Analogue outputs:
QS line: 1 analogue line (-5...0...5V)
 5V ±2% = 100% reactive power
 0V = 0% reactive power

Reference output: Reference voltage: 5.0V ±1%
 Load: Max. 5mA (R ≥ 1kΩ)

UL/cUL listed: +/-5V DC

Optocoupler output: System status off = Failure
 Max. voltage 30V DC, max. current 5mA
 Voltage drop 1.5V ~ 2mA

UL/cUL listed: 30V DC, 5mA

Type LSU-122DG

Technical specifications, continued

Temperature:	-25...70°C (-13...158°F) (operating)
	UL/cUL listed: Max. surrounding air temp. 60°C/140°F
Temperature drift:	Set-points: Max. ±0.2% of full scale per 10°C/50°F
Galvanic separation:	Between meas. voltage, meas. current, relay outputs, analogue inputs/outputs and aux. voltage: 3250V - 50Hz - 1 min.

Supply voltage (U_n): 57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-660-690 V AC ±20% (max. 3.5VA)

24-48-110-220V DC -25/+30%
(max. 2.5W)

UL/cUL listed:
Only 24V DC and 110V AC
DC supply must be from a class 2 power source

Climate: HSE, to DIN 40040

EMC: To EN 61000-6-1/2/3/4, SS4361503 (PL4) and IEC 255-3

Connections: Max. 4mm² (single-stranded)
Max. 2.5mm² (multi-stranded)

Materials: All plastic parts are self-extinguishing to UL94 (V1)

Protection: Case: IP40. Terminals: IP20, to IEC 529 and EN 60529

Type approval: The uni-line components are approved by the major classification societies. For current approvals see www.deif.com or contact DEIF A/S

UL markings: Wiring:
Use 60/75°C (140/167°F) copper conductors only

Wire size:
AWG 12-16 or equivalent

Installation:
To be installed in accordance with the NEC (US) or the CEC (Canada)

Settings

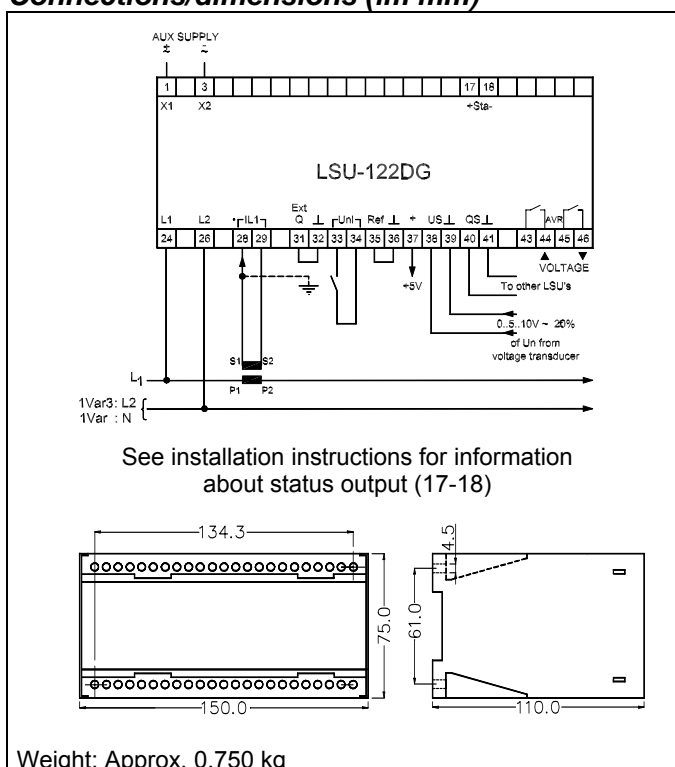
Setting of	Range
T _N Control pulse length	25...500 ms
X _P Proportional band	0...±50% of Q _n 0...±10% of U _n

Indication

LEDs	Lit	Switched off
U _G Generator voltage	(Green) Present	Failure
Unload Unloading of this generator	(Green) Gen. unloaded	Normal load
AVR▲ Increase voltage (reactive power)	(Yellow) Relay activated	Relay not activated
AVR▼ Decrease voltage (reactive power)	(Yellow) Relay activated	Relay not activated

Once the unit has been mounted and adjusted, the transparent front cover may be sealed, preventing unwanted change of the setting.

Connections/dimensions (in mm)



Order specifications

Type – Coupling – Measuring power (P_n[*]) – Cos-φ – Measuring voltage – Supply voltage
Example: LSU-122DG – 1var3 – 100var – 0.8 – 100V – 24V DC
$\text{Meas. power} = \frac{\text{Primary power}}{\text{CT ratio} \times \text{VT ratio}}$
*) The reactive power should be calibrated to equal the active power of the generator

Due to our continuous development we reserve the right to supply equipment which may vary from the described.





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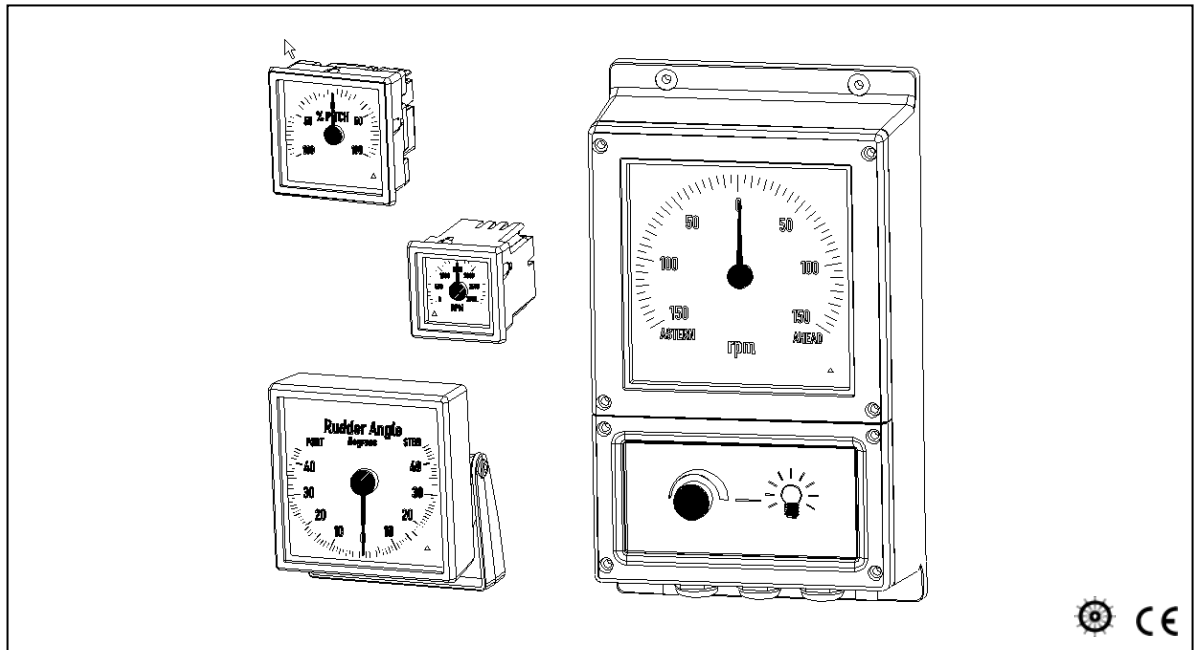
Marine Bridge Instrumentation

	XL	BRW-2	BW
			
Types:	XL72, XL96, XL144, XL192	BRW-2	BW144, BW192
Panel cutout according to DIN:	Q72, Q96, Q144, Q192	–	–
Pointer deflection:	180°, 240°, 300°, 360°	180°, 240°, 300°, 360°	180°, 240°, 300°, 360°
Protection IP52/IP54:	IP52	–	–
Protection IP66:	On request	✓	✓
Built-in dimmer:	–	✓	✓
Long life LED illumin.:	✓	✓	✓
Accuracy class:	0.5	0.5	0.5
Scale base colour:	White or black	White or black	White or black
Figures, div. lines:	Black, yellow, red, green, etc.	Black, yellow, red, green, etc.	Black, yellow, red, green, etc.
Pointer:	Yellow illuminated or black shadow	Yellow illuminated or black shadow	Yellow illuminated or black shadow
Interface:	Analogue or CANopen	Analogue or CANopen	Analogue or CANopen
Type approved by:	MED	MED	MED

	Panorama Rudder Indicator	Panorama Rudder Indicator	
			
Types:	TRI-2 (Ø370)	RT-2	
Panel cutout according to DIN:	–	–	
Pointer deflection:	3 × 90°	0...90°, 0...140°	
Protection IP52/IP54:	IP54	IP66	
Protection IP66:	–	–	
Built-in dimmer:	✓	–	
Long life LED illumin.:	✓	–	
Accuracy class:	1.5	0.5	
Scale base colour:	White or black	–	
Figures, div. lines:	Black, yellow, red, green, etc.	–	
Pointer:	Black or yellow	–	
Interface:	Analogue	0...20mA or 4...20mA	
Type approved by:	MED	CCS, GL, GOST-R	

	WSS	WSS-L	WSDI-2	
				
Description:	Wind Sensor Static	Wind Sensor Static	Display	
Supply voltage:	12V DC ±20%, max. 1.1A 24V DC ±20%, max. 0.6A	12V DC ±20%, max. 1.1A 24V DC ±20%, max. 0.6A	12/24V DC	
Internal heater:	✓	–	–	
Interface:	RS485 NMEA0183	RS485 NMEA0183	RS485 NMEA0183	
Measure:	Relative Wind Speed Range: 0...99.9 KTS Resolution: 0.1 KTS Response time: 1.0s Direction Range: 0...360° Resolution: 1° Accuracy: ±3° Response time: 1.0s	Relative Wind Speed Range: 0...99.9 KTS Resolution: 0.1 KTS Response time: 1.0s Direction Range: 0...360° Resolution: 1° Accuracy: ±3° Response time: 1.0s	Speed M/S Knots Beaufort Direction ±180°	
Display:	–	–	Speed: 4-digit 7-seg. display Direction: Analogue pointer	
Built-in dimmer:	–	–	✓	
Protection (IP):	IP66 (EN60529)	IP66 (EN60529)	IP66 (front) IP20 (terminals)	
Temperature range:	Operating -52°C ...+60°C Storage: -60°C ...+70°C RH: 0...100% Pressure: 600...1100hPa	Operating: 0°C...+60°C	–	
Dimensions:	12 × 12 x 19 cm	19 × 12 cm	17.2 × 17.2 × 7 cm	
Weight:	0.8 kg	0.8 kg	0.55 kg	
Approvals:	GL, DNV, CCS, GOST, RS Pending: RRR	GOST	Pending (CCS, DNV, GL, GOST, RS)	
Accessories:	IP66 connection box kit for cable extension IP67 connector kit for cable extension Extension cable 1...300 metres	IP66 connection box kit for cable extension IP67 connector kit for cable extension Extension cable 1...300 metres	IP66 rear cover	

	WSDI	WSI		
				
Description:	Indicator	Interface box		
Supply voltage:	110 or 230V AC 50-60Hz	24V DC, 0.9A (+30% -25%)		
Heater:	-	-		
Supply internal heater:	-	-		
Interface:	RS422	TTL		
Measure:	Input: TTL Speed, dir. Output: RS422 NMEA0183	Input: RS485 NMEA0183 Output: 30V DC 0.6A to WSS / WSS-L Output: TTL 5V to WSDI		
Display:	Speed: 2½-digit 7-seg. display Direction: 64 LED I circle	-		
Built-in dimmer:	✓	-		
Protection (IP):	IP52 (front) IP20 (terminals)	IP40 (front) IP20 (terminals)		
Temperature range:	-	-		
Dimensions:	14.5 × 14.5 × 11 cm	10 × 7.5 × 11 cm		
Weight:	0.8 kg	0.45 kg		
Approvals:	GOST	GOST		
Accessories:	External dimmer unit/panel (1033290002)	DCP-2405 24V DC power supply (1240020003)		



Product design

Linearity

- Class 0.5

Scales

- Standard scale design
- Custom scale design

Robust design

- Shock: 100 g 11 ms
- Vibration: 2.1 g

Approval

- Major class approvals, see www.deif.com for certificates

Housing

- Panel types (XL)
- Bridge wing types (BW and BRW-2)

Illumination

- Direct pointer illumination
- Transillumination of the scale with white LEDs

Pointers

- Standard pointer
- Rotating disc

Analogue interface

- Single analogue input with several ranges
- Dual analogue input for direct connection to SIN/COS transmitter

CAN interface

- Dual communication line for redundancy, according to marine standard
- Custom CAN solutions

Technology

The new DEIF indicators use a centre-placed, microprocessor-controlled x-coil system. This patented x-coil technology is the core of this new product series. The clear advantages of this indicator principle compared to the more fragile moving-coil system are e.g. superb accuracy (class 0.5), improved response time with practically no overshoot, excellent torque of the x-coil system, direct pointer illumination, connection to CANbus, improved shock resistance, more robust construction, 360° pointer movement etc.

For supplying the built-in microprocessor, the XL/BW/BRW-2 indicators need connection to an aux. supply.

HousingXL type

The XL type is designed for panel mounting in standard cut-out DIN holes. Since the frame sizes are not according to DIN norms, IP66 protection is possible without compromising the unique design of the indicator.

BW and BRW-2 types

Indicators for bridge wing mounting. These are basically XL indicators with an outside enclosure and with built-in dimmer. IP66 protection is standard.

Interface

Due to the microprocessor-controlled x-coil technology, the indicators have a wide range of interfaces:

Analogue interface

Both single and dual analogue signals are supported by the analogue interface. This enables the indicators to replace a number of existing products, e.g. all standard analogue ranges and special SIN/COS indicators.

Galvanic separation between analogue inputs, aux. supply and dimmer. Dual inputs share common ground.

Custom CAN interface

A single line CANbus for direct connection of indicators to a CAN transmitter. The interface is tested with several standard CAN transmitters, but special solutions are also possible.

Dual CAN interface

The CANopen interface offers functionality with 1 or 2 CAN lines and full redundancy from two galvanically separated CAN lines.

Galvanic separation between CAN 1, CAN 2 and supply.

The CANopen application is based on:

- CiA Draft Standard 301 - Application Layer and Communication Profile - Version 4.02
- CiA Draft Standard Proposal 302 - Framework for CANopen Managers and Programmable CANopen Devices - Version 3.3.0
- CiA Draft Standard Proposal 305 - Layer Setting Services and Protocol - Version 1.1.1

More detailed CAN information is available on www.deif.com (documentation), and EDS file is available from the software download section.

Illumination

Direct pointer illumination (black scales) is based on separate LEDs (yellow), and the scale is trans-illuminated using white LEDs. Black shadow pointer is used for white scale designs.

Pointers

Standard pointers are virtually lightguides shaped as needle type pointers. The full length illumination of the pointer makes the read-out extremely easy, even at longer distances. As an option, a rotating disc with illuminated symbol is available.

Pointer deflection

The pointer is able to move 360 degrees (endlessly). Standard pointer movement is clockwise. Counter-clockwise movement is optional.

Error functions

The indicators have two different error functions:

Internal error warning LED

The amber coloured warning LED is triangular and is placed in the lower right corner of the scale, except in XL72 where it is in the lower left corner.

If there is an internal error (microprocessor stops), the flashing warning LED will indicate to the operator that the product is out of order (only analogue types). Using the CAN interface, this function is handled by a missing heartbeat signal on the CANbus. On CAN types a missing or invalid CAN signal will also start the warning LED. During start-up the warning LED will flash for a few seconds, until the indicator is ready.

External error pointer indication

This is a new functionality on this type of product. Due to the possibility of 360 degrees pointer rotation, the unused scale part (typically the 240...0 degrees area) is used as an error indication field. Under certain conditions the pointer will move to this position:

- Out of range analogue input signal
- Missing CAN signal

More detailed information about error functionality is available on www.deif.com (User's Manual).

CAN setup

When using the CAN interface, the setup of the instrument can be changed from the master using LSS (Layer Setting Services). After changing to configuration state mode, it is then possible to change Baud rate and Node-ID.

Default setup is:

- Baud rate 125 kbit/s
- Node-ID number 1

Customer configuration

The flexibility of the XL/BW/BRW-2 series requires the customer to make some selections for use when ordering the indicator. These selections determine how the indicator will appear at delivery. The table below will guide you through the configuration via the necessary selections.

Customer configuration

Customer options		Note		
Housing	XL standard (rear mounted)	Size: <input type="checkbox"/> 72	Please note recommended cut-out on dimension pages!	
		<input type="checkbox"/> 96		
		<input type="checkbox"/> 144		
		<input type="checkbox"/> 192		
	Protection: <input type="checkbox"/> IP52 (standard)			
	<input type="checkbox"/> IP66			
Bridge wing mounted	Type:	<input type="checkbox"/> BW144	IP66 (standard)	
		<input type="checkbox"/> BW192	IP66 (standard)	
		<input type="checkbox"/> BRW-2	IP66 (standard)	
Input	Analogue	Type:	<input type="checkbox"/> Single	Input 1 terminals used
			<input type="checkbox"/> Dual SIN/COS potentiometer	(Not current input/loop) ¹
			<input type="checkbox"/> Dual linear potentiometer	(Not current input/loop) ¹
		Range:	<input type="checkbox"/> 0...1 V	Load: 1 kOhm
			<input type="checkbox"/> 0...10 V	Load: 10 kOhm
			<input type="checkbox"/> -1...0...1 V	Load: 1 kOhm
			<input type="checkbox"/> -5...0...5 V	Load: 10 kOhm
			<input type="checkbox"/> -10...0...10 V	Load: 10 kOhm
			<input type="checkbox"/> 0...1 mA	Load: 1 kOhm
			<input type="checkbox"/> 0...20 mA	Load: 50 Ohm
			<input type="checkbox"/> 4...20 mA/20...4 mA	Load: 50 Ohm, 4...20 mA on input 1 and 20...4 mA on input 2
			<input type="checkbox"/> -0.5...0...0.5 mA	Load: 1 kOhm
			<input type="checkbox"/> -1...0...1 mA	Load: 1 kOhm
			<input type="checkbox"/> -10...0...10 mA	Load: 50 Ohm
			<input type="checkbox"/> -20...0...20 mA	Load: 50 Ohm
<input type="checkbox"/> Others	Specify request (within limits, page 6)			
Digital	Type:	<input type="checkbox"/> Dual CANopen		
		<input type="checkbox"/> CAN custom	Specify CAN transmitter and system	
Pointer	<input type="checkbox"/> Standard		Colour defined by scale design	White with yellow illumination or black shadow without illumination
	<input type="checkbox"/> Rotating disc (Only on XL72/96 and XL/BW144 and only black disc/scale base)		<input type="checkbox"/> Standard (known)	Specify design number from standard scale design document
			<input type="checkbox"/> Custom (new)	Specify design (see next page)
	ONLY 360 degree scales! Pointer position at electrical mid. of input		<input type="checkbox"/> Pointer at 12 o'clock	Electrical mid. examples: 4...20 mA => 12 mA 10-0-10 V => 0 V 0-10 V => 5 V
			<input type="checkbox"/> Pointer at 3 o'clock	
			<input type="checkbox"/> Pointer at 6 o'clock	
<input type="checkbox"/> Pointer at 9 o'clock				
Deflection	<input type="checkbox"/> Standard	Positive input moves pointer clockwise (CW)	4...20 mA is always CW on input 1 and CCW on input 2 (20...4 mA)	
	<input type="checkbox"/> Reversed	Positive input moves pointer counterclockwise (CCW)		
Scale	Design	<input type="checkbox"/> Standard (known)	Specify design number from standard scale design document	
		<input type="checkbox"/> Custom (new)	Specify design (see next page)	



1) Dual input cannot be used in combination with current loops. Due to the design of the input circuit, only one indicator can be used per output in this configuration. If multiple indicators are needed on the same output, please use the voltage versions.



Please notice that not all options can be selected for the same indicator, and that some options may exclude others.

Scale design

Standard designs:

Please see the "XL/BW/BRW-2 standard scale designs" document on www.deif.com for a complete list of standard designs.

Custom designs:

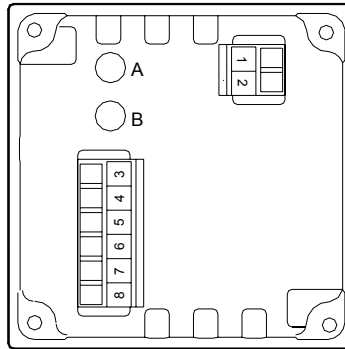
If the standard designs do not meet your requirements, it is possible to specify a design according to custom specifications.

Some limitations are however still present, due to product performance, automatic testing and approvals. Please contact DEIF for further information and design samples.

Terminals

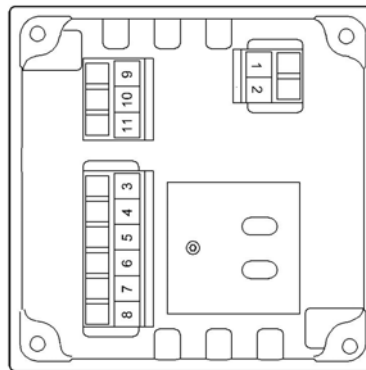
XL/BW analogue input version

PIN no.	Function		Note
1	Supply voltage	0 V	Consumption aux. supply connection: Max. 150 mA
2		24 V	
3	Analogue input	Input 1	Input 1 and GND used for single input. On 4...20 mA, input 1 is CW and input 2 CCW
4		GND	
5		Input 2	
6	Illumination	Illumination +	Dimmer input. Dimmer range 7...30V DC Consumption max. 30 mA
7		Illumination GND	
8	-	NC	Not connected - can be used freely
A	Analogue adjustment	Max. adjustment	Max. and min. adjustment, sealed by label. On 360 degree versions, A is EM selection and B digital offset
B		Min. adjustment	



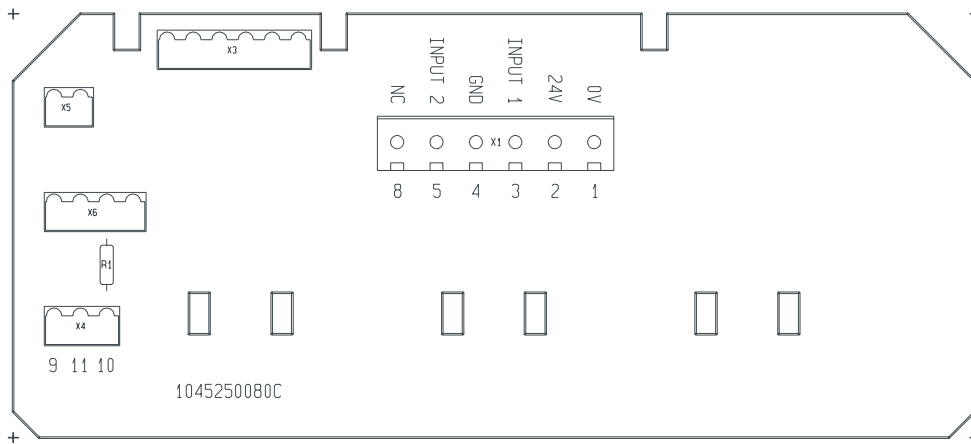
XL/BW CANopen input version

PIN no.	Function		Note
1	Supply voltage	0 V	Consumption aux. supply connection: Max. 150 mA
2		24 V	
3	CAN connection	CAN 1 H input	CAN 1 line
4		CAN 1 L input	
5		CAN 1 GND	
6		CAN 2 H input	CAN 2 line
7		CAN 2 L input	
8		CAN 2 GND	
9	Illumination analogue dimmer	NC	Dimmer input. Dimmer range 7...30V DC Consumption max. 30 mA
10		Illumination GND	
11		Illumination +	



BRW-2 analogue input PCB

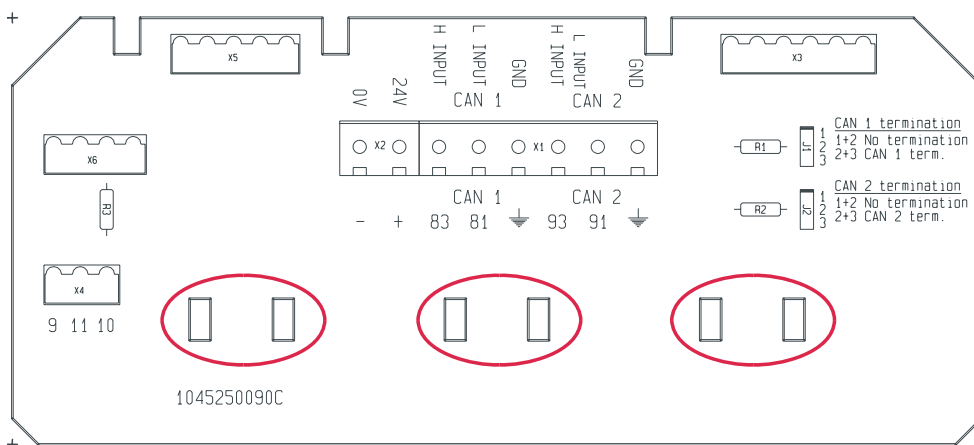
PIN no.	Function		Note
1	Supply voltage	0 V	Consumption aux. supply connection: Max. 150 mA
2		24 V	
3	Analogue input	Input 1	Input 1 and GND used for single input. On 4...20 mA, input 1 is CW and input 2 CCW
4		GND	
5		Input 2	



Connection interface board.

BRW-2 CANopen input PCB

PIN no.	Function		Note
-	Supply voltage	0 V	Consumption aux. supply connection: Max. 150 mA 18...31.2V DC
+		24 V	
83	CAN connection	CAN 1 H input	CAN 1 line
84		CAN 1 L input	
⊥		CAN 1 GND	
93		CAN 2 H input	CAN 2 line
91	CAN 2 L input		
⊥		CAN 2 GND	



Use strips to terminate cable shields to PCB to avoid noise (see red markings). Jumpers J1 and J2 are used as end resistors (terminations) of CAN 1 and CAN 2.

Technical specifications

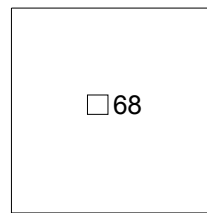
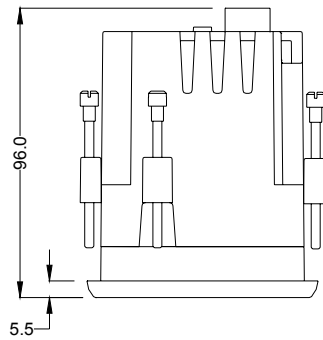
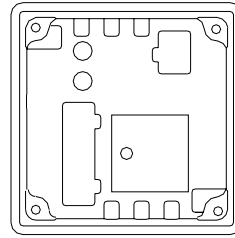
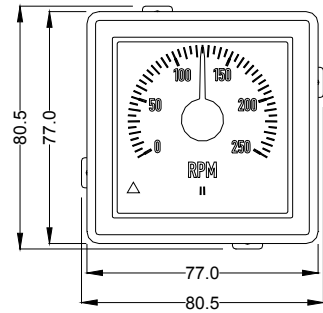
Indicators are designed according to the standards below			Standards	
Accuracy	Class 0.5 (-10...15-30...55°C) measured at 360° deflection, corresponds to ±1.8° error		According to DEIF interpretation of EN 60051	
Response time	Maximum pointer speed is 90° per sec. To prevent overshoot, the pointer is ramped up/down during movement			
Indicator frame sizes and panel cut-out	Type:	Front size:	XL will typically fit DIN 43700 cut-out, but DEIF recommends a bit larger cut-out to better match IP66 gasket option!	
	XL72	77 x 77 mm		68.5x68.5 mm
	XL96	102 x 102 mm		92.5x92.5 mm
	XL144	148.5 x 148.5 mm		138.5x138.5 mm
XL192	196 x 196 mm	186.5x186.5 mm		
For BW and BRW-2, see the dimensional drawing				
Aux. supply	24V DC -25/+30% (18...24...31.2V DC) Reverse polarity protected			
Illumination supply	7-30 V (max. 31.2V DC)			
Galvanic separation	600V AC between the following groups: CAN: Aux. supply; CAN 1; CAN 2 Analogue: Aux. supply; Analogue inputs (common); Dimmer			
Scale	Base material: PMMA			
Pointer	Transparent polycarbonate with white print and yellow illumination (588nm), or Transparent polycarbonate with black print (shadow)			
Window	Antiglare 3 mm polycarbonate with UV blocking		UL94 V0	
Disc	XL96	Ø 47 mm		
	XL144	Ø 70.5 mm		
Always black scale base				
Housing	XL/BW: ASA/PC LURAN-S (plastic) BRW-2: LURAN-S, colour code: Ral 7001		UL94 V0	
Mounting angle	The indicators can be mounted at any angle between 0...150° horizontal without this affecting the calibration		DIN 16257	
Compass safety distance	Steering compass: 0.50 m, stand-by/emergency compass: 0.10 m		IEC 945 and EN 60945	
Measuring ranges	See standard ranges and load on page 3 Limits are ±1...±30V DC and ±1...±25 mA DC Load special inputs: 1 kΩ/V on voltage input and 1 V on current input			
Analogue adjustments	Adjustments on rear side: A: Max. adjustment ±10% B: Min. adjustment ±5% On 360 degree versions: A: EM selector (CW = standard, CCW = 180 degree change) B: Digital offset of pointer, +/-10 degrees			
Out of range (analogue)	When the input is 2% out of range, the pointer is moved to error position		See the user's manual for details	
Protection	XL standard: IP52 from front, mounted in panel, IP20 from rear (IP66 from front when recommended gasket is used) BW and BRW-2 standard: IP66		IEC 529 and EN 60529	
Climate	Class H S E, short term condensing allowed		DIN 40040	
	Max. 95% RH: Max. 30 days per year			
	Max. 85% RH: Remaining days Max. 75% RH: Average per year			
Temperature	Nominal: -10...55°C Operating: -25...70°C Storage: -40...70°C		EN 60051	
	Influence: Max. ±1.5% within -15...55°C			
Panel influence	The accuracy is affected neither by the material nor by the thickness of the panel		EN 60051	
Panel thickness	Max. 18 mm (on XL versions, DIN rear mounted)			
Mechanical shock test	18 x 50 g half sine (11 ms)		IEC 600068-2-27	
Drop impact resistance	18 x 100 g (peak)			

Technical specifications, continued

Indicators are designed according to the standards below		Standards
Vibration test	3...13.2 Hz: 2 mm (peak-peak) 13.2...100 Hz: 0.7 g	EN 60945 DNV Class A
	3...13.2 Hz: 6 mm (peak-peak) 13.2...50 Hz: 2.1 g	DNV Class C
Safety	300 V – CAT. III. Pollution deg. 2	EN 61010-1
Consumption (analogue)	Aux. supply: 65...75 mA/24V DC Illum. supply: 15 mA/24V DC (XL72/96), 20 mA/24V DC (XL144/192)	
Consumption (CAN) including illumination	100...130 mA/24V DC	
EMC	CE marked for industrial environment	EN 61000-6-V2/4 and EN 60945

Dimensions in mm

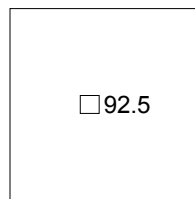
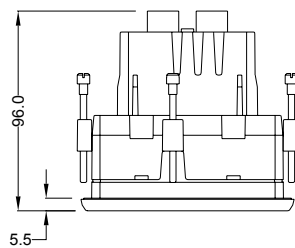
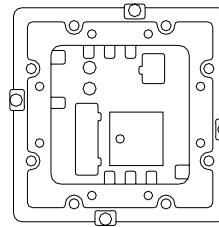
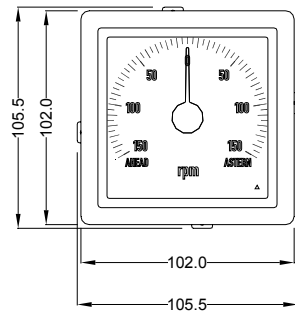
XL72



Panel cutout

Weight: Approx. 245 g

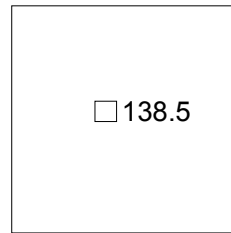
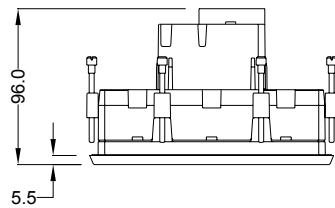
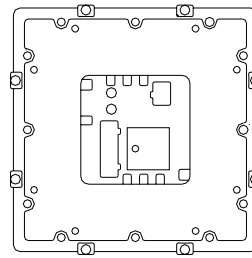
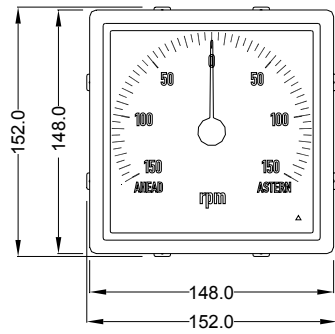
XL96



Panel cutout

Weight: Approx. 280 g

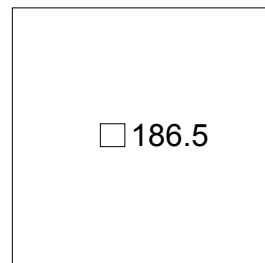
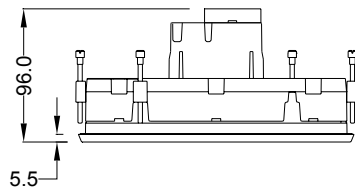
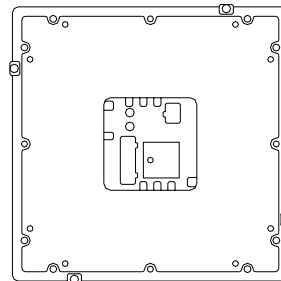
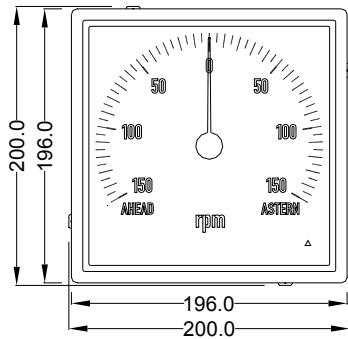
XL144



Panel cutout

Weight: Approx. 350 g

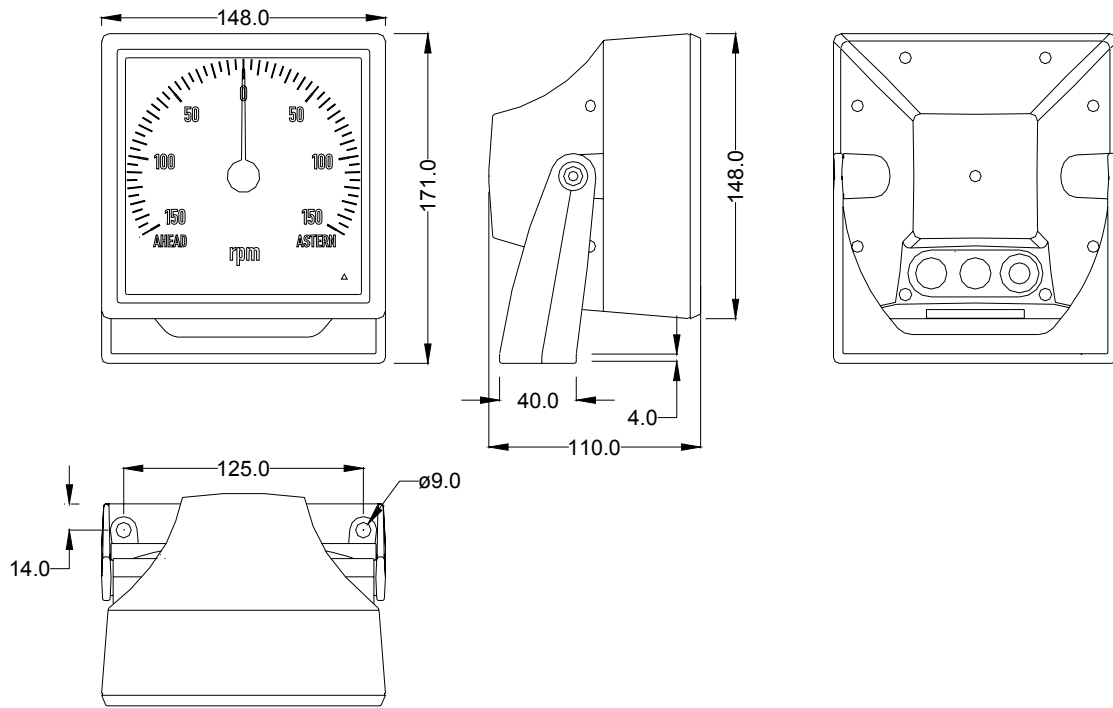
XL192



Panel cutout

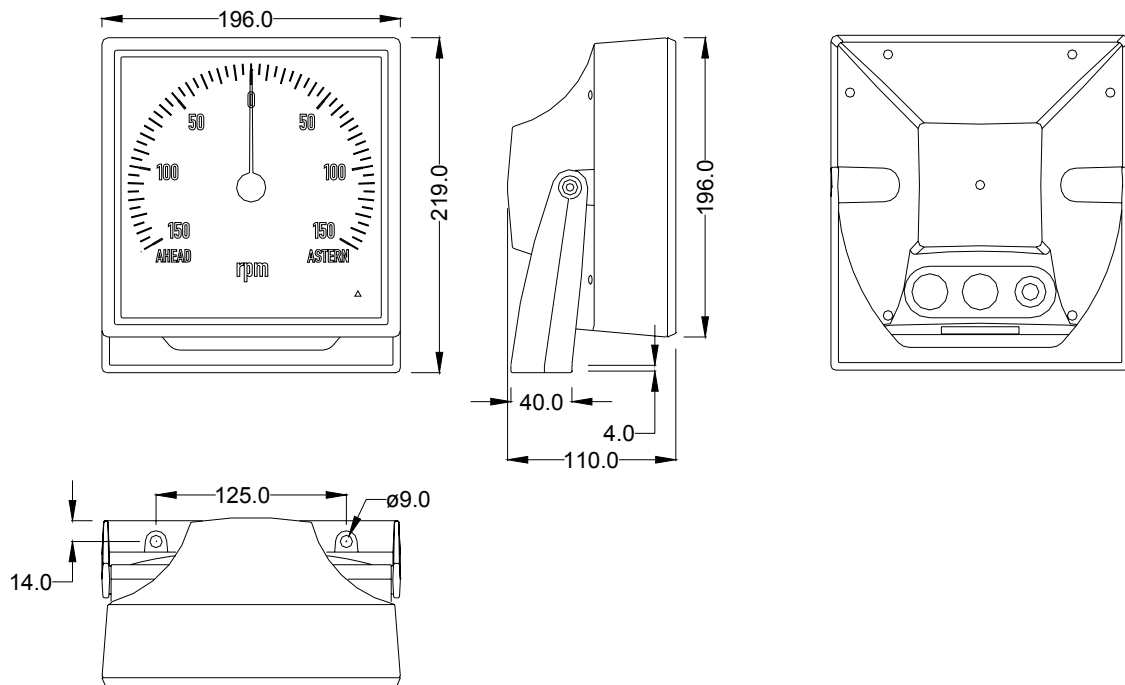
Weight: Approx. 475 g

BW144

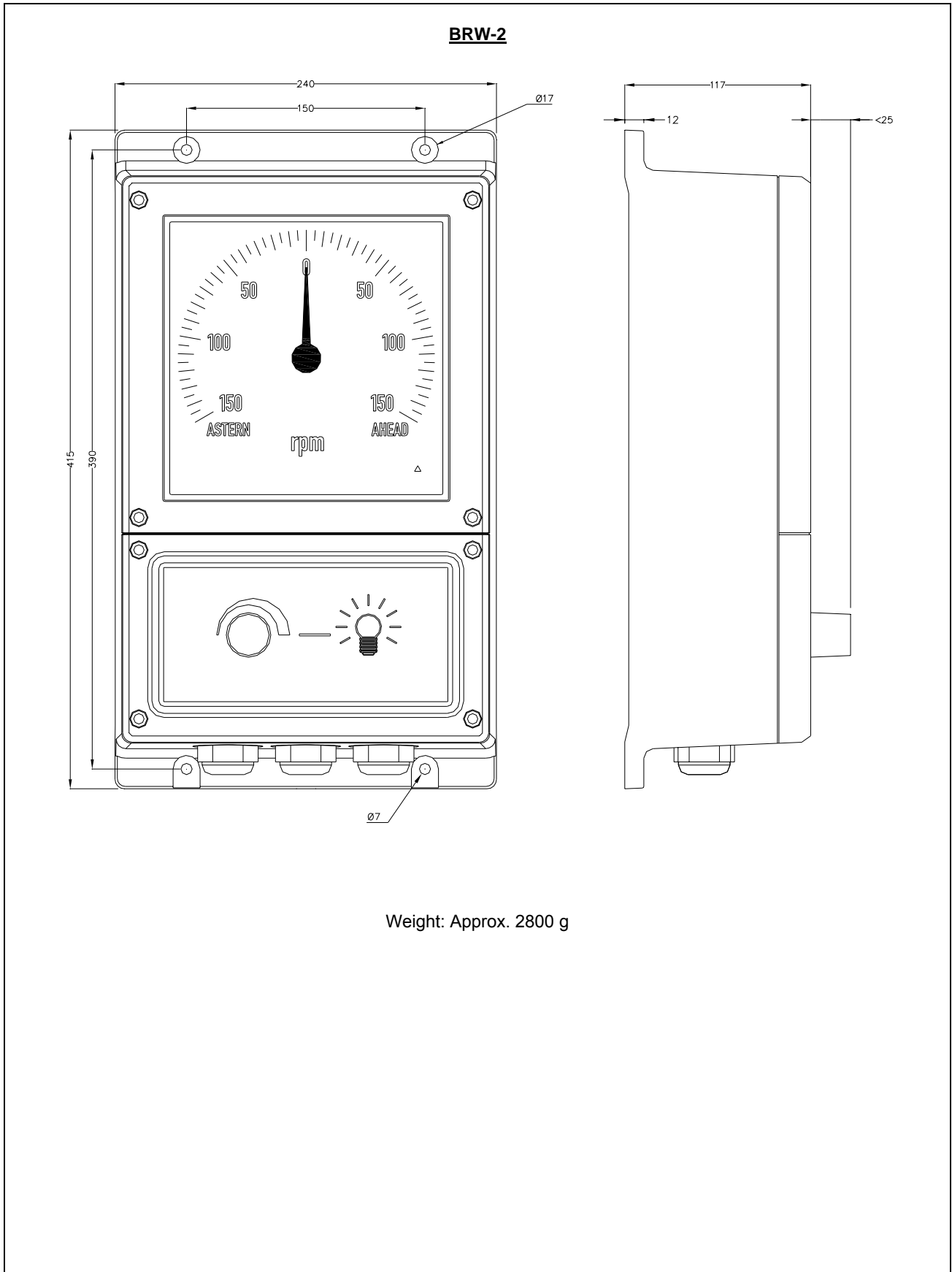


Weight: Approx. 540 g

BW192



Weight: Approx. 800 g



Weight: Approx. 2800 g

Order specifications

Fill in the configuration form on page 3.



If a required standard design is not found, please prepare drafts of preferred custom scale design, e.g. with reference to existing designs. At request DEIF provides scale designs for inspiration. The customer always approves the final scale design.



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Due to our continuous development we reserve the right to supply equipment which may vary from the described.



Type TRI-2

- **Approved according to the Marine Equipment Directive**
- **3 extra large, easily-read scales**
- **Readable from up to 5 meters**
- **Black or white scales**
- **Long-life LED illumination**
- **Built-in dimmer**

Application

The panorama rudder indicator type TRI-2 is applied for the indication of the rudder position on the bridge.

The TRI-2 is CE marked for marine, residential, commercial and light industry plus industrial environment.

The TRI-2 is housed in a matt black, waterproof case for deck head suspension.

Equipped with 3 large scales, the TRI-2 ensures a quick and easy reading of the rudder angle from any angle up to 250° and from a distance of up to 5 metres from the indicator.

Scale colour

The indicator is available with 2 types of scales:

- 1) White scales with black figures, division lines and black pointer.
- 2) Black scales, where the figures, division lines and the pointer are yellow, giving the clearest read-out of the pointer position.

On both white and black scales starboard is marked with a green section (to the right), port with a red section (to the left) underneath the division lines.

Illumination

The TRI-2 is equipped with long-life LEDs, ensuring easy and clear reading of the scales in the dim light on the bridge.

White scales are translucent, implying that the division lines and the figures are clearly visible, and that the pointer is seen clearly as a shadow.

On black scales the figures, the division lines and a broad, yellow section underneath these are transilluminated. The pointer is clearly visible as a shadow against this yellow section.

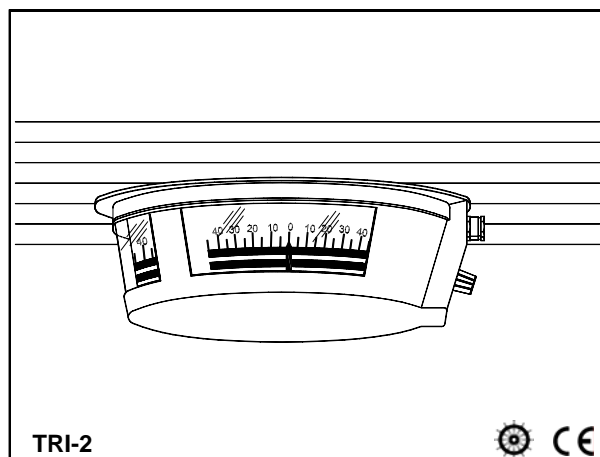
The light intensity can be changed by means of a built-in dimmer, accessible on the rear plate of the indicator.

If remote dimming is preferred, this built-in dimmer may be removed from the indicator (after dismantling of the rear plate) and mounted e.g. in a control panel. A plug for sealing of the hole in the rear plate is included on delivery.

Panorama rudder indicator

Marine bridge instrumentation

4921250043F



Measuring principle

The indicator consists of a robust moving coil system equipped with 3 pointers mounted on a common shaft.

Technical specifications

Accuracy: Class 1.5 (-10...+15...30...55°C) to EN 60051 and IEC 51.

Temperature: -10...+55°C (nominal)
-25...+70°C (storage)

Measuring ranges:

voltage:	Lowest:	0...4V DC
	Highest:	0...100V DC
	Load:	0.7kΩ/V
current:	Lowest:	-2...0...2V DC
	Highest:	-100...0...100V DC
	Load:	1.4kΩ/V
suppressed current:	Lowest:	0...1mA DC
	Highest:	0...100mA DC
	Load:	3.0V
Scale types:	Lowest:	-1...0...1mA DC
	Highest:	-100...0...100mA DC
	Load:	1.5V
Scale types:	1) White scale base	4...20mA
	2) Black scale base	Load: 4.0V

- 1) White scale base
with black figures/division lines and black pointer.
- 2) Black scale base
with yellow figures/division lines and yellow pointer.

Standard scales: 35...0...35°, 45...0...45°
60...0...60°, 70...0...70°
Others on request.

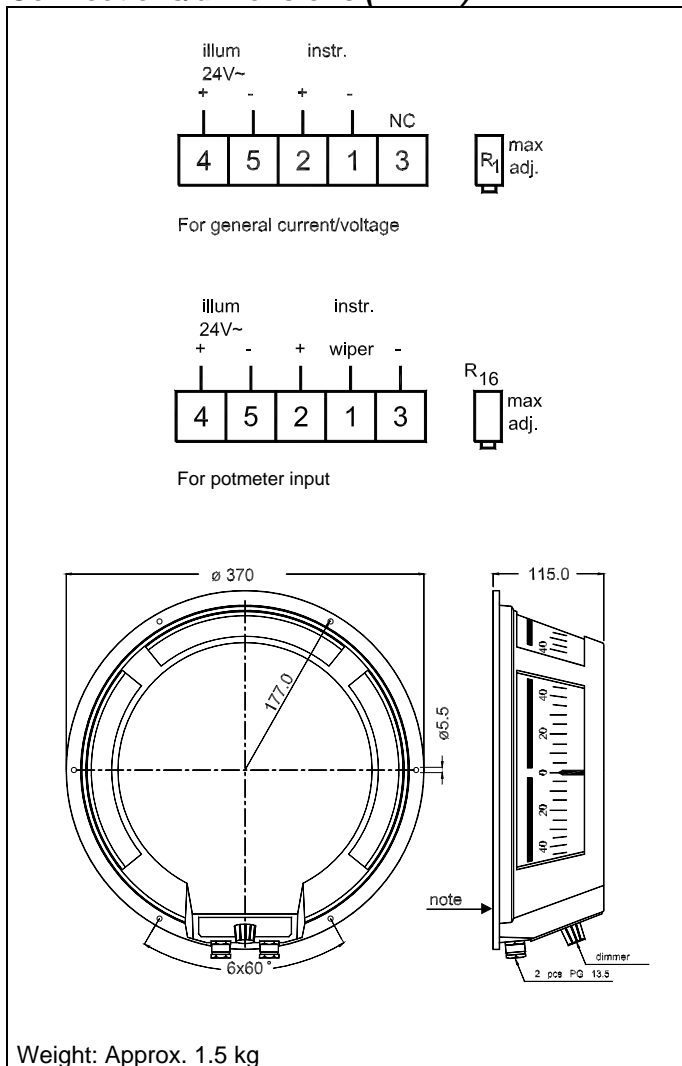
Pointer: Increasing positive input signal moves pointer from left to right (clockwise, CW).

Type TRI-2

Technical specifications

Illumination:	Long-life LEDs.
Dimmer:	Built-in. Can be removed and mounted e.g. in a control panel if remote dimmer is preferred.
Galvanic separation:	2kV - 50Hz - 1 min.
Compass safety distance:	1 m.
Auxiliary voltage:	
illumination:	24V AC/DC -25/+30%.
consumption:	Max. 113mA.
EMC:	To IEC 60945 (1996), EN 50081-1/2, EN 50082-1/2.
Connections:	Built-in screw terminals.
cable dimension:	0.2...2.5 mm ² .
cable entries:	Via two PG 13.5 cable glands. Cable diameter: 11 mm.
Materials:	
plastic housing:	ABS/PC blend. Fire retarding and self-extinguishing to UL94 (V0).
metal parts:	All external metal parts are made out of corrosion-resistant materials.
Protection:	IP54 to IEC 529 and EN 60529.

Connections/dimensions (in mm)



Note: Option:
Cable entry via two PG 13.5 cable glands.

Order specifications

Type – Scale – Scale type – Measuring range

Example:

TRI-2 – 45...0...45° - black - 0...20mA

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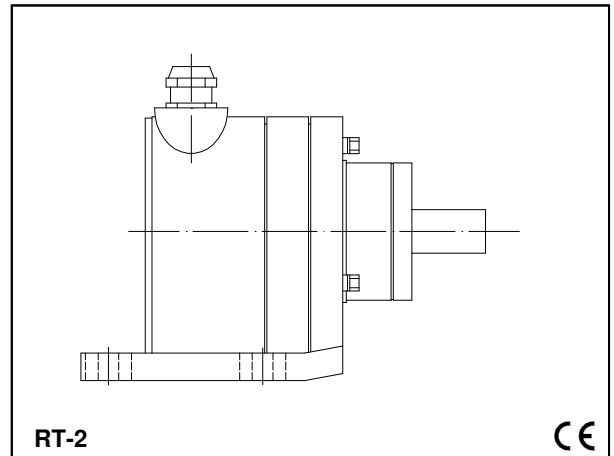


Type RT-2

Rudder angle transmitter

4921250052C

- **Analogue output for direct connection of one or more indicators**
- **Measuring output:
DC-current signal 0..20mA or 4..20mA**
- **Angle position 0..90° or 0..140°**
- **Continuous shaft rotation**
- **Potentiometers
for adjustment of span and zero**



Application

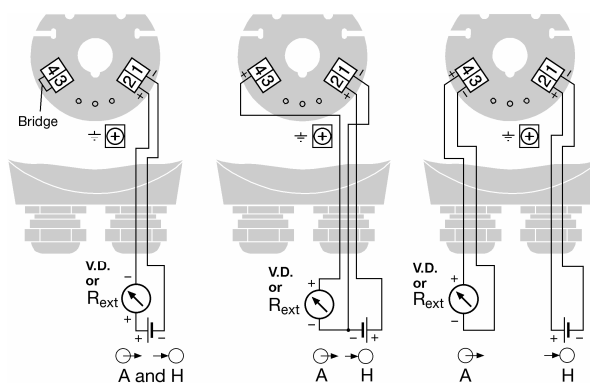
The RT-2 converts the position angle of shaft into a load-independent direct current signal, proportional to the angle position. The output signal has two operations: 0..20mA or 4..20mA (live zero).

The robust housing has made it ideal for machines and e.g. as rudder transmitter aboard ships.

Selection of output signal

Remove the 3 screws that fasten the cover. Undo the gland nut and remove the pinch ring and seal from the gland opening. Place these parts over the cable in the correct order and pass the end of the cable through the gland hole into the rear of the transmitter. The maximum wire gauge the terminals can accept is 1.5 mm².

Strip the insulation to a suitable length of the leads and connect them to the terminals gnd, (-1, +2) supply and (-3, +4) output signal according to the fig. 1.



A = Measuring output ...
 ... as 2-wire connection (4..20mA, signal in output/powering circuit)
 ... as 3 or 4 wire connection (0-20mA)

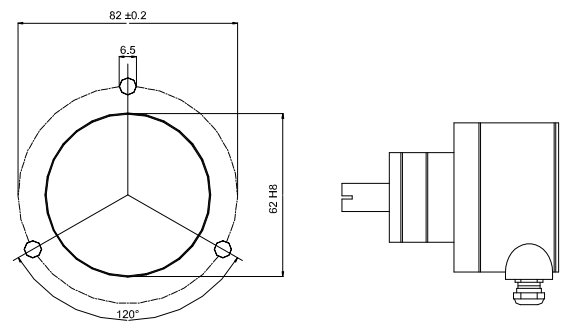
H = DC power supply
 (H = 12...33V)

R_{ext} = External resistance

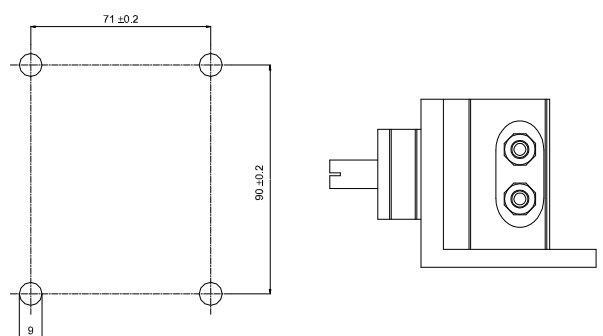
V.D. = External voltage drop (e.g. specified in datasheet for DEIF indicators)

Mounting

RT-2 is intended for either mounting directly on the device being measured or on a flange where the mounting bracket is fixed with 4 bolts.



Direct mounting



Mounting bracket

The M6 screws are needed for the directly mounted version and 4 M8 nuts and bolts for mounting bracket version. The screws, respectively nuts and bolts are not supplied, because the required length varies according to the thickness of the mounting surface.

Type RT-2

Technical specifications

Measuring input: 0-90° or 0-140°
(span adjustment -30/+5% of full range)

Measuring output:
Output variable I_A : Load-independent DC current proportional to the input angle.

Ranges: 4..20mA, 2-wire connection
0..20mA, 3-wire connection
0..20mA, 4-wire connection

Accuracy: Limit of error $\leq 0.5\%$

Power supply H: 12..33V DC

Max. residual ripple: 10% p.p.

Max. current consumption: Approx. 5 mA + I_A

Mechanical withstand:

Permissible vibration: 0..200Hz, \rightarrow 10 g continuous
0..200Hz, \rightarrow 15 g for 2 hours
200..500Hz, \rightarrow 5 g continuous
200..500Hz, \rightarrow 10 g for 2 hours

Shock: 3 x 50 g every 10 impulses in all 3 axes

Permissible static load on the shaft:
Max. 1000 N (radial)
Max. 500 N (axial)
(If subjected to vibration the shaft load should be as low as possible to ensure optimum life of the bearing)

Mounting position: Any

Material:
Housing (main part): Steel, Finish QPQ (nitro-carbonated)

Rear (cover): Metal (aluminium)

Cable glands: Metal

Regulations:
Test voltage: 500 Veff, 50 Hz, 1 min. all electrical connections against housing

Housing protection: IP66 acc. to EN 60 529

Environmental conditions:

Climatic rating: Temperature -25 to +70°C
Annual mean relative humidity $\leq 90\%$

Transportation and storage: -40 to +80°C

Order specifications

Type	Angle	Bracket
RT-2	0-140°	with
RT-2	0-90°	with
RT-2	0-140°	without
RT-2	0-90°	without

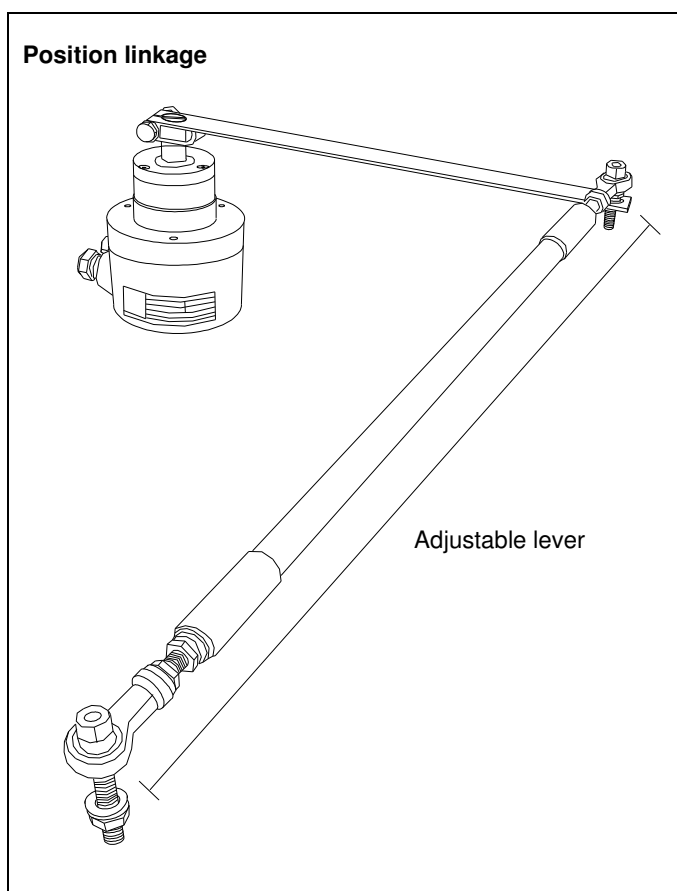
Position linkage 1124410004

Adjustable lever 1124410003

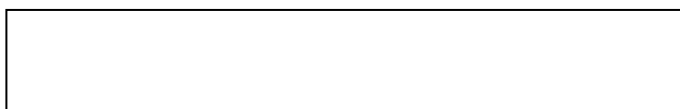
Weight

With bracket 3.3 kg

Without bracket 2.9 kg



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-power in control-



-power in control

Wind sensor type WSS and WSS-L DATA SHEET



Static sensor

- No moving parts
- High-precision ultrasonic measurements

High resolution

- Wind direction 1°
- wind speed 0,1 knot

Approval

- GL, DNV, CCS, RS, GOST-R

Robust design

- Sea-water proof housing
- Vibration tested up to 2.3g

Watertight

- According to IP66

Extreme temperatures

- WSS operates down to -52°C
- WSS-L is not recommended below 0 °C
- Both operates to +60 °C

Heating element

- WSS has built-in, automatically activated, heating element to prevent ice

Wide power supply range

- Nominal 12V DC or 24V DC supply voltage

Interface

- RS485 I/O using NMEA 0183 data protocol for direct connection to WSDI-2 wind display, VDR (voyage data recorder) or Dynamic Positioning System.



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Document no.: 4921250059D

Data sheet

Technology

DEIF Static Wind Sensor Technology uses ultrasound to determine horizontal wind speed and direction. The WSS and WSS-L sensors have no moving parts so they are free from the challenges posed by conventional mechanical wind sensors (friction, inertia, time constant, over-speeding, starting threshold). The unique triangular design of the sensor array assures accurate measurement of wind from all directions. The WSS sensor is automatically heated when used in cold climates. Finally, WSS/WSS-L sensors are maintenance-free and do not require field calibration.

Versions

The wind sensor is available in two versions:

- WSS with built-in heating element to prevent ice
- WSS-L without heating

Applications

WSS/WSS-L are classified for residential, commercial and light industry plus industrial environment. The WSS sensor can be used in almost any conditions, where the WSS-L is only specified down to 0°C, but it will work far below that temperature as long as ice or snow is not covering the sensor elements or obstructing the sight between the elements. The WSS-L should only be used in relatively warm geographic areas or in applications where wind data is mainly for information and not critical for operation or safety.

- The WSS or WSS-L can be directly connected to the DEIF WSDI-2 display forming a superb wind system.
- Alternatively, it can be used with the former display – WSDI – which required a WSI interface box.
- It forms part of the WSS upgrade kit used to replace the old DEIF 879 dynamic wind sensor.
- Finally WSS or WSS-L can be used as precise stand-alone wind sensors in a system (e.g. a DP system).

Housing

The WSS is designed to withstand the hostile environment onboard a ship. The 1" stainless steel mounting rod with standard 3/4" pipe thread makes the mounting easy and secures good earth connection through the hull of the ship.

Interface

The WSS/WSS-L has a RS485 two-way interface with communication following the NMEA 0183 protocol.

Supply

The WSS can be supplied from a DC supply of nominal 12...24V DC.

Cable

The WSS is connected with a single 4 x 0.75mm² screened cable. Cable extension can be made by a standard 4 x 0.75mm² screened cable, e.g. UL2464 18AWG4C+AE, length max. 300 metres, the capacity between each signal conductors should not exceed 70nF. Twisted pair is recommended. (see options)

Wind Sensor Static WSS/WSS-L



Error flag

The WSS/WSS-L continuously evaluates the measurements, and if obstructions or incorrect measurements are detected, an invalid flag is set in the NMEA0183 message to indicate that data is invalid and should not be used. This could be caused by a bird landing on the sensor. As soon as the disturbance disappears, the flag will be cleared and valid measurements sent.

Customised setup

Forming part of a normal wind system, the WSS will not need any setup. If the sensor is used for special applications, there might be special needs, for example storing data for automatic sensor alignment corrections. Such special needs can often be accomplished by sending control commands to the sensor via the RS485 interface, so please contact DEIF if you have special needs like this.

Option

- A VDR (voyage data recorder) can be connected directly to the RS485 port.
- Bird avoidance option, a needle cap to prevent birds from landing on the sensor, disturbing the measurements or damaging the ultrasound elements.
- WSS-shielded extension cable, variable length from 1 to 300 meters.
- IP67 connector kit, for use with extension cable (for soldering).
- IP66 connection box kit, for use with extension cable.

Technical specifications

Sensors are designed according to the standards below		Standards
Power supply	12V or 24V DC (9.0...31.2V DC)	
Power consumption	WSS-L and WSS with inactive heating element: < 0.1W WSS with maximum heating ≤ 15W	
Interface	RS485 bus (I/O). The bus should be terminated with 120 to 200 ohm for pure RS485 operation. Combined RS485 (I/O) and NMEA0183 (I) operation: A combination of up to ten RS485 (I/O) and one NMEA0183 listeners can be connected to the WSS data interface at the same time. The data line must be terminated with a 200 to 250 ohm resistor to obtain ≥ +/- 2.1V output necessary for a standard NMEA0183 input circuit to work. The NMEA0183 input load must be ≤ 2mA @ +/- 2V. NOTE: A NMEA-buffer is recommended if connection of more than one standard NMEA-input is needed.	NMEA 0183 ver. 2.x-3.0
Data sentence	NMEA0183: \$WIMWV – Wind speed and direction data \$WIXDR – Transducer Measurement Response \$WITXT – Error messaging For details, see the Appendix to User's Manual, Wind measuring system, document no. 4189350028.	NMEA 0183 ver. 3.0
Wind speed	Range: 0...116 KTS (0...60m/s) Resolution: 0.1 Knots Accuracy: 0...68 KTS: ±0.6 KTS or ±3%, whichever is greater > 68 KTS: ±5%	
Wind direction	Range: 0... 360° continuously Resolution: 1° Accuracy: ±3% in relation to wind direction	
Update interval	1 second	
Start-up time	< 5 sec. from power on to valid data output	
Connection	2 meter 4 x 0.75mm ² screened cable type UL2464 18AWG/4C+DW+AL/MY+Jacket. The 2m cable is fixed mounted on the sensor and is open-ended.	
Mounting	¾" pipe thread: Outer diam: 1.04 inch (26.4mm), 14 threads per inch.	
Compass safety distance	0.2 meter (8 inch)	IEC 945 and EN 60945
Protection	IP66	IEC 529 and EN 60529
Relative humidity	0... 100%	EN/IEC 60068-1/2
Pressure	600...1100hPa	
Temperature	WSS operating range: -52...+60°C (class approved for: -25...+60°C) WSS-L operating range: 0...60°C (see note) Storage (both): -60...+70°C Note: WSS-L has no automatic heating element to prevent ice, the sensor will work below 0°C, but it will depend on weather conditions.	EN 60051
Vibration test	3...13.2Hz: 2mm (peak-peak) 13.2...100Hz: 0.7g	EN 60945, EN/IEC60068-2-6 and DNV Class A
	3...15Hz: + 2.5mm (peak) 15...50Hz: 2.3g	GL curve 4 for masts
Safety	Cat.III, poll.dg.2, 550VAC rms, 50Hz, 1 minute,	EN 61010-1
EMC	CE-marked for industrial environment	EN 61000-1-1/2/3/4
Housing	Wind sensor housing: Polycarbonate +10% glass fibre Mounting tap: Corrosion-resistant stainless steel	UL94 V0
Weight	0.8 kg	
Dimensions, cardboard box	450 x 315 x 230	
Approvals	Type-approved according to:	GL, DNV, CCS, RS and GOST-R

Accessories	<p><u>IP66 Connection box kit</u>: IP66 Connection box w/cable glands and screw terminals to extend the sensor cable with an extension cable.</p> <p><u>IP67 Connector kit</u>: water tight male and female connector for soldering to respectively the sensor cable and the extension cable.</p> <p><u>Extension cable</u>: 1 to 300 meters 4x0.75mm² shielded cable (1m steps) DEIF id.no.1020230016.</p> <p><u>Bird avoidance kit</u>: Spike kit to prevent birds from interrupting the wind measurements or in worst case from damaging the sensor.</p>	
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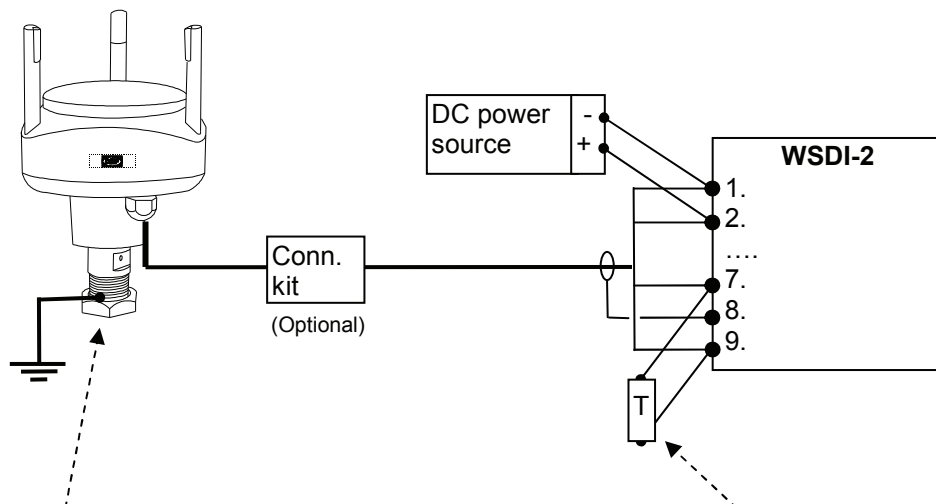
Labels

Product label:

WSS		CE logo
SN:		Disposal icon
DEIF logo	Bar code + item number	

Terminals and function – cable colours and function

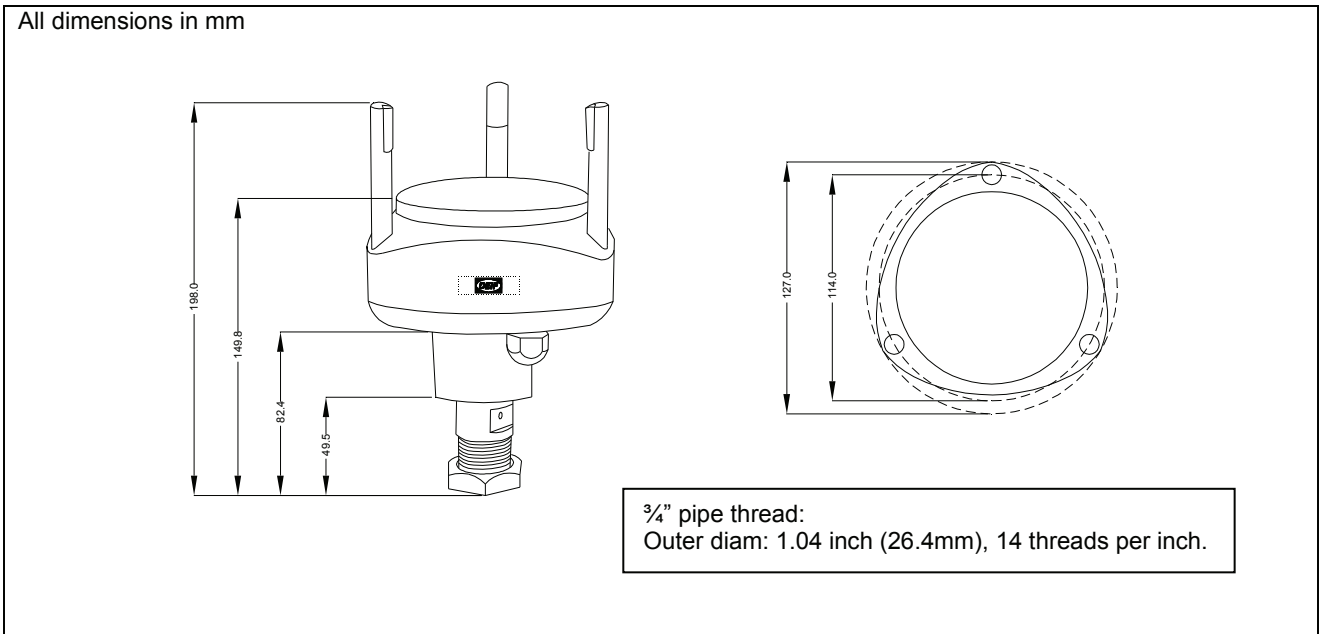
Cable colour	Function	Note
Black	Supply voltage -	DC supply voltage for the wind sensor
Red	Supply voltage +	
Orange	RS485 comm. A	Wind speed and direction data output
Brown	RS485 comm. B	
Shield	Electrical shielding of data signal	See warning below.



IMPORTANT!
The stainless steel mounting base on the WSS/WSS-L must be connected to the ship's metal hull or another good ground connection!

IMPORTANT!
The data bus must be terminated with a resistor (see technical spec. above) to secure stable operation!

Unit dimensions, WSS and WSS-L



Order specifications

Examples: WSS
WSS-L upgrade kit

Example - ordering a wind system example:
WSDI-2 FWD
WSS
Connector box kit
Extension cable 80 meter



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-power in control

Wind display type WSDI-2 DATA SHEET



Displays

- Relative or true wind speed and direction
- Wind speed in: m/s, knots or Beaufort

Read-out

- Black base, white lines and figures
4-digit 7-segment red display

Approval

- Major class approvals, see homepage for certificates

Housing

- Front 172 x 172, panel cutout according to size Q144

Robust design

- Shock: 100 g 11 ms

Watertight

- According to IP66 from front

Illumination

- Direct pointer illumination
- Trans-illumination of the scale by white LEDs

Dimmer

- Front or remote control of the light intensity

Interface

- RS485 (NMEA 0183) wind sensor input
- Direct WSS sensor connection

User interface

- Two push-buttons on the front allows the user to select wind speed units, control the light intensity and change settings



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Document no.: 4921250062C

Displayed data

The DEIF wind indicator type WSDI-2 presents relative (apparent) or true wind data relative to ship on the high precision read-outs.

NOTE: True wind requires the NCI-1 option box.

Technology

The WSDI-2 uses a centre-placed microprocessor-controlled x-coil system for indication of the wind direction, combined with a 4-digit 7-segment display for indication of the wind speed. Compared to the traditional digital method, the clear advantage of this indicator principle, using an analogue pointer, is a more pedagogic presentation of the wind direction. This has been accomplished by means of the unique performance of the x-coil technology, well-known and proven in the DEIF XL instruments.

Housing

The WSDI-2 is designed for front mounting, using a standard cutout for size 144 combined with a front measure of 172 x 172 to give a clear read-out. The instrument is front mounted by means of four screws, one in each corner of the instrument. The screws are then covered by the front frame.

Interface

The WSDI-2 connects to any sensor with an RS422/485 communication port with NMEA 0183 protocol. DEIF wind sensor type WSS can be directly connected to the WSDI-2.

Illumination

The WSDI-2 has direct yellow pointer illumination. The scale base is black, and the figures and lines are white and illuminated from behind by white LEDs.

Supply

The WSDI-2 is supplied from nominal 12...24V DC.

Pointer

The WSDI-2 is equipped with a pointer made by light guide material and shaped as a needle pointer. Compared to traditional read-out based on LEDs arranged in a circle, the illumination method of the pointer makes the read-out extremely easy, even at longer distances and also in bright sunlight.

Pointer deflection

The pointer is able to move 360 degrees (endlessly).

Display

The WSDI-2 is equipped with a red 4-digit 7-segment display. The intensity can be controlled in steps to match the actual situation, and in addition, a "bright sunlight step" can be selected to provide easy read-out in bright sunlight.

Error function

The WSDI-2 is equipped with a triangular LED located in the lower left corner of the display. This LED will flash if the unit is out of order.

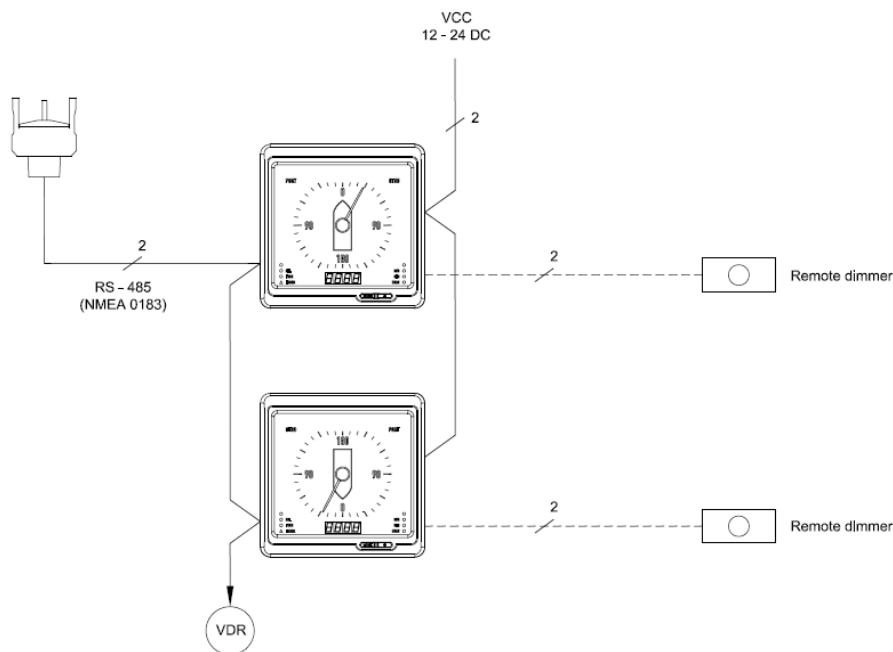
Operation and setup

The WSDI-2 is equipped with two push-buttons located on the front. These push-buttons are used to set up the read-out on the display – m/s, knots, Beaufort. In addition, the push-buttons can be used to control the illumination intensity.

Available sensors, accessory and options

- WSS or WSS-L static wind sensor
- IP66 rear cover
- NCI-1 NMEA 0183 to CAN interface box

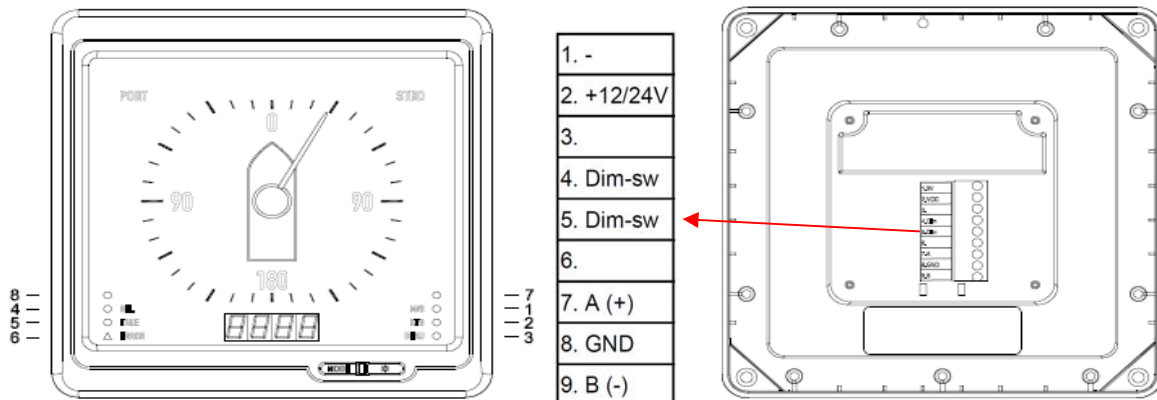
Single line application diagram



User interface - push-buttons on front side

Type	Function	Remark
1. Status LED	M/S	Indicates selection of wind speed read-out in m/s
2. Status LED	KTS	Indicates selection of wind speed read-out in knots
3. Status LED	BEAU	Indicates selection of wind speed read-out in Beaufort
4. Status LED	REL	Indicates selection of wind values relative to ship
5. Status LED	TRUE	Indicates selection of true wind values
6. Error LED	ERROR	Indicates internal error (orange flash)
7. Status LED	Service tool	See error functions section in User's Manual/Installation Note
8. Status LED	Service tool	
7-segment display	Wind speed/ information (4-digit)	Guides the user in the menu system and provides information about dimmer levels, setup, etc.
Analogue scale and pointer	Wind direction	360 degrees pointer rotation on a black back illuminated scale
1. Push-button	MODE	Selects operation and setup modes
2. Push-button	Dimmer	Selects dimmer level and provides enter function

@: All status LEDs and 7-segment displays are red.



Terminals and function - connector located on rear side

Terminal no.	Signal	Marking	Remark
1	0 V	1.-	Aux. supply, 9.0...31.2V DC, <5 W
2	12/24 V	2. +12/24 V	
3	CAN-H	3.	Do not connect
4	Dimmer (CAN-C)	4.Dim-sw	Connect to a potential free contact. Open 2.5 V, closed 0.1 mA
5	Dimmer or CAN-L	5.Dim-sw	
6	Not used	6.	Do not connect
7	RS485 (Data+)	7.A (+)	Connect to orange wire on WSS
8	RS485-GND	8. Data GND	Normally not connected, can be connected to screen on WSS to suppress EMC
9	RS485 (Data-)	9.B (-)	Connect to brown wire on WSS

¹⁾ If the wind sensor is type WSS, the supply must be able to provide 12 V/24V DC/2A. If the sensor is type WSS-L, the supply must be able to provide 12 V/24V DC/0.6A. See the WSS documentation for more details.

User menu

Two push-buttons, "MODE" and "☀️", control the user interface.

The following can be set/selected using the setup and the select key:

Daily menu:

- Wind speed type (M/S, KNOTS, BEAUFORT)
- Dimmer level (0-9)

Advanced menu:

- Wind type (relative or true)
- Damping (1, 5, 10 or 30 seconds)
- Beep (on, off)
- Light group (0-6, none)

Installation menu:

- Input type (NMEA 0183, NMEA 0183+remote dimmer, CAN, Demo)
- Light mode (L1, L2)
- Offset correction (± 180 degrees)
- Service tool
- Source reset

For further information about the menu structure, please see the User's Manual/Installation Note.

Versions

WSDI-2 FWD, for mounting on forward bridge

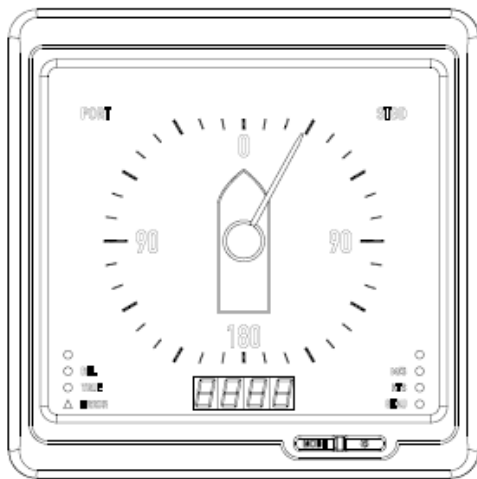
Ship's bow and scale value zero are located at 12 o'clock.

WSDI-2 AFT, for mounting on aft bridge

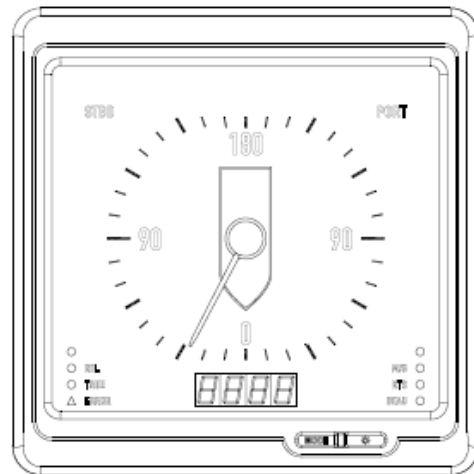
Ship's bow and scale value zero are located at 6 o'clock.

Scale designs

There are two types: FWD (forward) and AFT. Please notice the inverted pointer on the AFT version. Both types are shown with identical input signal.



FWD



AFT

Technical specifications

Indicators are designed according to the standards below		Standards
Sensor input	RS485	
Accuracy	Analogue instrument (wind direction) class 0.5 (-10...15...30...55°C) Digital instrument ±1 digit	IEC/EN 60051
Response time	Analogue instrument 90° per sec./no overshoot	
Instrument size	Panel cutout	DIN 43700 for panel cut-out only
	136 x 136 mm	
	Front	
	172 x 172 mm	
Aux. supply	12/24 V (9.0...31.2V DC), <5 W	
Remote dimmer	Potential free contact. Open 2.5 V, closed 0.1 mA	
Galvanic separation	500 V between groups (RS485, PSU, remote dimmer/CAN)	
Scale	Black base, white figures and lines	
Pointer	Transparent polycarbonate with white print and yellow illumination (588 nm)	
Window	Antiglare 2 mm Acrylic (UV-resistant)	
Housing	ASA-PC blend	UL94 V0
Connections	Screw terminals: 2.5 mm ² (multi-stranded), 4 mm ² (single-stranded)	
Mounting angle	The indicator can be mounted at any angle between 0...150° horizontal without this affecting the calibration	DIN 16257
Compass safety distance	<0.2 m	IEC/EN 60945
Communication	RS485 interface and NMEA 0183 MWV sentence	NMEA 0183 ver. 2.x-3.0
	Proprietary CAN for use with NCI-1 NMEA to CAN interface box	
Out of range	Flashing orange LED	
Protection	From front IP66, from rear IP20/IP66 when using IP66 rear cover option	IEC/EN 60529
Climate	Class H S E, short-term condensing allowed	IEC/EN 60068-2-30 Max. 97% RH
	Max. 95% RH: Max. 30 days per year	
	Max. 85% RH: Remaining days	
	Max. 75% RH: Average per year	
Temperature	Nominal: -10...55°C	IEC/EN 60068-2-1 Cold IEC/EN 60068-2-1 Dry heat
	Operating: -25...70°C	
	Storage: -40...80°C	
	Influence: Max. ±1.5% within -15...55°C	
Panel influence	The accuracy is affected neither by the material nor by the thickness of the panel	IEC/EN 60051
Panel thickness	No limit	
Mechanical shock test	18 x 50 g half sine (11 ms)	IEC/EN 60068-2-27
Vibration test	3...13.2 Hz: 2 mm (peak-peak)	IEC/EN 60945 DNV Class A
	13.2...100 Hz: 0.7 g	
Safety	300 V – Cat. III. Pollution deg. 2	IEC/EN 61010-1
EMC	CE-marked for industrial environment	IEC/EN 60945
Weight	0.55 kg	
Dimensions, cardboard box	220 x 200 x 100 mm	

NMEA 0183 used in DEIF wind sensor type WSS

MWV, wind speed and direction response:

Sentence format: \$WIMWV,296,R,9.7,N,A*20<cr><lf>

where

- \$ = Start of the message
- WI = Talker identifier (WI = weather instrument)
- MWV = Wind speed and direction response identifier
- 296 = Wind direction value (degrees)
- R = Wind direction unit (R = relative)
- 9.7 = Wind speed value (knots)
- N = Wind speed unit (knots)
- A = Data status: A = valid, V = invalid
- * = Check sum delimiter
- 20 = Two-character check sum for the response
- <cr><lf> = Response terminator

Update rate: Every second.

Labels

Product label:

DEIF WSDI-2 wind display		CE logo	Logo
Bar code + item number	Made in Denmark		DEIF logo

Warranty label:

Placed over the centre mounting screw on the rear side (below the product label).



System connection with DEIF WSS sensor

RS485 (I/O) operation:

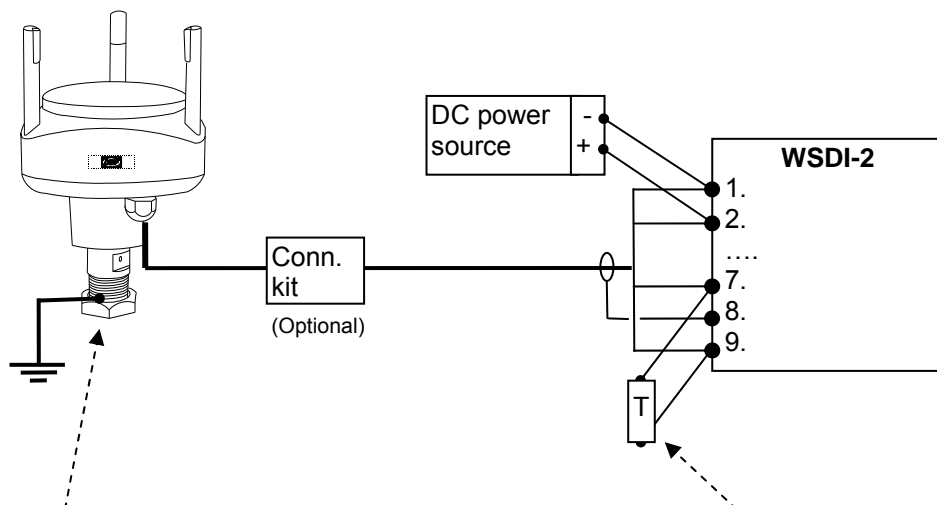
The bus should be terminated with 120 Ohm for pure RS485 operation.

Combined RS485 (I/O) and NMEA 0183 (I) operation:

A combination of up to ten RS485 (I/O) and one NMEA 0183 listeners can be connected to the WSS data interface at the same time.

The data line must be terminated with a 200 to 250 Ohm resistor to obtain $\geq \pm 2.1$ V output necessary for a standard NMEA 0183 input circuit to work (a 200 Ohm resistor is included in the WSDI-2 package). The NMEA 0183 input load must be ≤ 2 mA @ ± 2 V.

NOTE: The NCI-1 option box or a NMEA-buffer is recommended if connection of more than one standard NMEA input is needed.



IMPORTANT!
The stainless steel mounting base on the WSS/WSS-L must be connected to the ship's metal hull or another good ground connection!

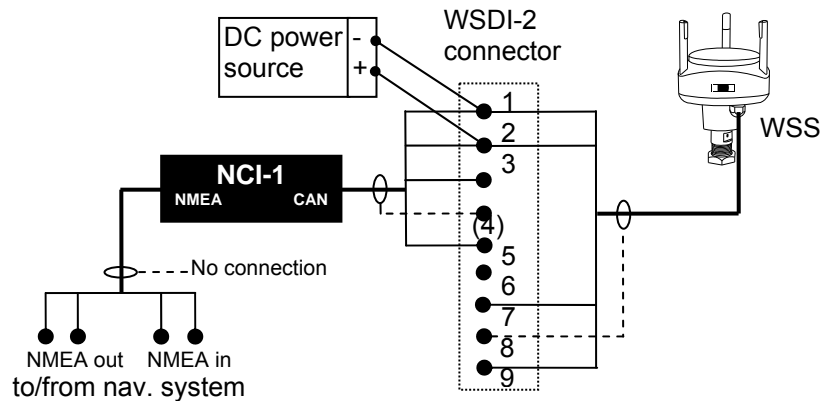
IMPORTANT!
The data bus must be terminated with a resistor (see technical spec. above) to secure stable operation!

NCI-1 NMEA 0183 to CAN interface box (option)

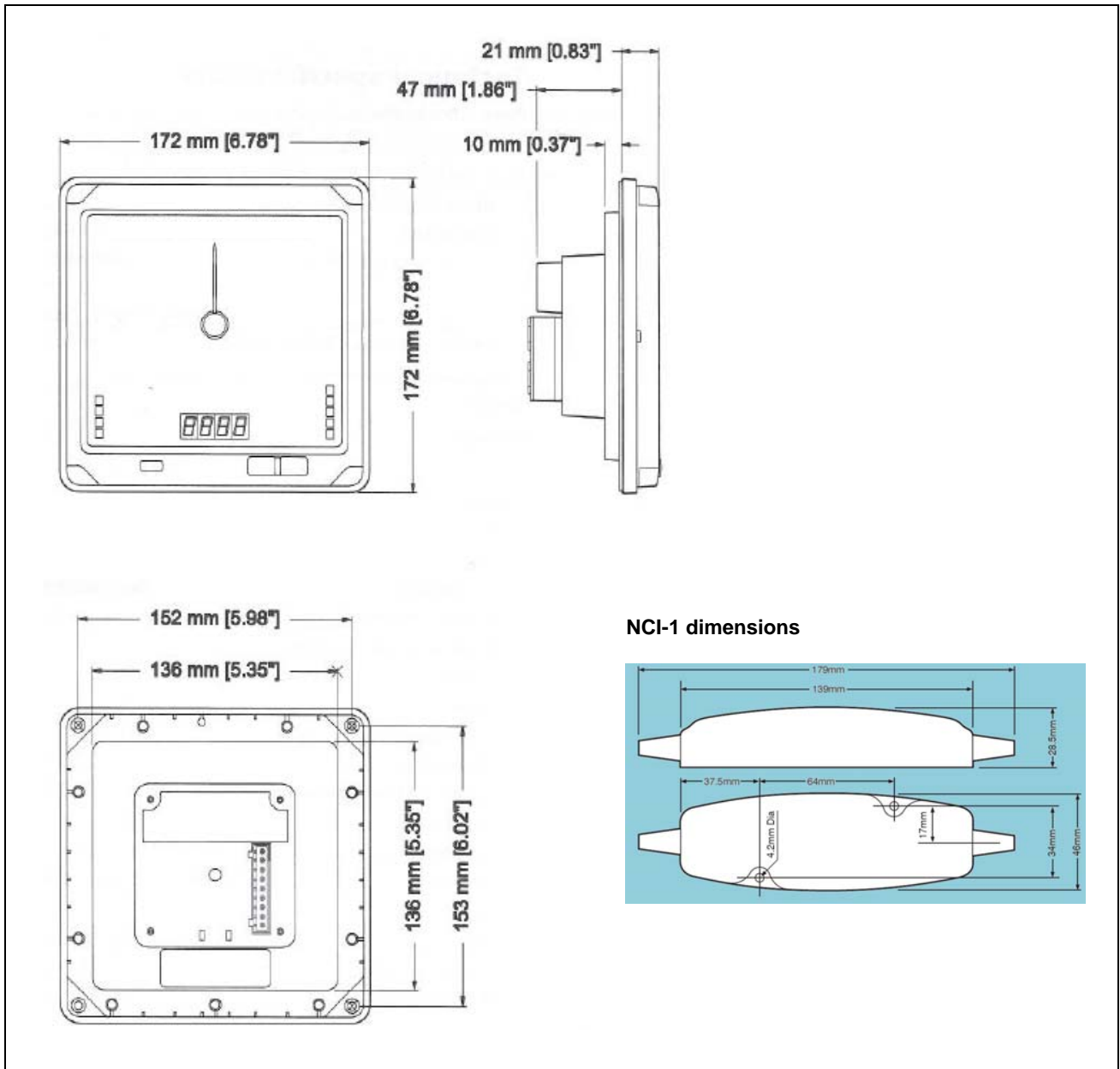
The NCI-1 is used to connect the WSDI-2 to the ship's navigation system in order to:

- receive speed data for true wind calculations
- provide buffered wind data on the NMEA 0183 output for up to eight NMEA inputs (listeners)
- provide MWV and VWR wind data sentences

Option: NCI-1 NMEA 0183 to CAN interface box		Standards
Connections	1.5 m NMEA 0183 cable with 4 wires and shield 1.5 m CAN cable with 2 CAN wires, 2 aux. supply wires and shield	
Input	NMEA 0183 opto-insulated (1.5 kV)	NMEA 0183 ver.2.x-3 IEC 61162-1:2000
	Differential input voltage min. 1.8 V	
	Max. input voltage: Continuous +/-15 V Less than 1 second: +/-35 V	
Output	Receiving sentence: VHW (water speed) or RMC, VTG (COG)	
	NMEA 0183/RS422 insulated (1.5 kV) from aux. supply and CAN	
	Output current max. 20 mA	
	Output voltage min. 2.1 V @ 100 Ohm load	
	Drives up to 8 NMEA 0183 inputs	
Aux. supply	Transmitting sentences: MWV and VWR	
	Nominal voltage 12...24V DC (8...35V DC)	
CANbus	Consumption max. 0.8 W @ full load on data channel	
	Built-in network terminator (120 Ohm)	
Environment	Proprietary protocol	
	Same as for the WSDI-2 display unit	
Size	Length 179 mm, width 46 mm, height 28.5 mm	




Unit dimensions in mm (inches)




Order specifications

Example: WSDI-2 FWD or WSDI-2 AFT (only two versions exist)



FWD



AFT

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



DEIF A/S, Frisenborgvej 33
DK-7800 Skive, Denmark

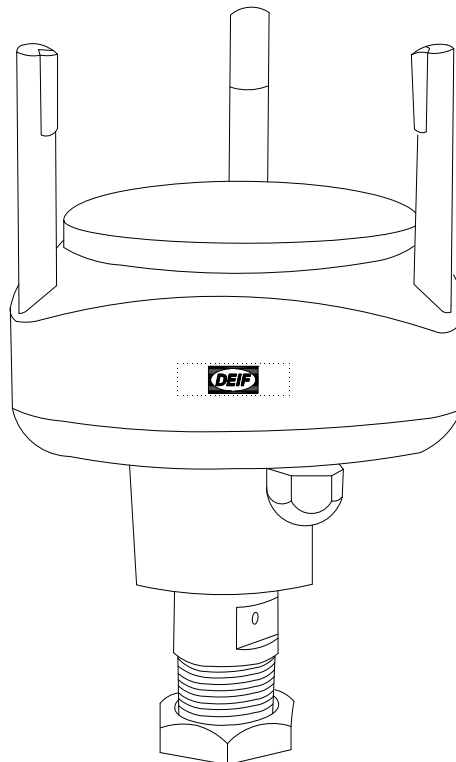
Tel.: +45 9614 9614, Fax: +45 9614 9615
E-mail: deif@deif.com, URL: www.deif.com



Ultrasonic wind measuring system

Type WSDI, WSI, WSS or WSS-L

4921250063A



- *Sea-waterproof construction*
- *Accurate read-out of wind direction and wind speed*
- *WSS with built-in heater for freezingly cold conditions*
- *WSS-L where freezingly cold conditions is not an issue*
- *NMEA data output*
- *1-3 displays per sensor*
- *Based on ultrasonic principle – no moving parts*

Application

The wind measuring system is a fast responding and accurate system designed for measurement of wind speed and wind direction on-board ships. The wind measuring system is classified for residential, commercial and light industry plus industrial environment.

This system offers the advantage of reading the measuring results from several locations on-board, e.g. at control desks both on the bridge and on the bridge wings.

The WSDI displays are provided with data output for serial transfer of measuring values to the navigation computer of the ship and/or to a personal computer via NMEA protocol.

The system indicates relative wind speed and wind direction. If indication of absolute wind speed and wind direction is required, these values must be calculated separately.

Construction

The wind measuring system consists of three components: A **wind sensor** (WSS or WSS-L), an **interface box** (WSI) and 1-3 **displays** (WSDI) for indication of wind speed and wind direction.

Wind sensor type WSS or WSS-L

The sensor is based on 3 ultrasonic transducers arranged in a triangle for measuring of wind speed and wind direction by measuring the time it takes the ultrasound to travel from one transducer to the other two.

The **WSS** has a built-in heater that is automatically activated when the temperature drops to a level increasing the risk of icing. The **WSS-L** does not have a heater and should not be used where stable operation below the freezing point is required.

Placing: Ideally, the wind sensor should be placed far from large objects that might influence the measuring results; however, in practice this is normally not possible on-board a ship. The best result is achieved by placing the sensor at the top of a mast in the opposite end of the superstructure.

Placing the sensor just above the superstructure is disadvantageous, especially where the superstructure consists of wide side faces, over which the wind is forced. This may result in turbulence, velocities and wind directions that are out of proportion to the actual, undisturbed wind speed and wind direction.

Connections: The wind sensor is supplied with 2 metres fixed cable. From factory, the cable is connected to the sensor via a waterproof gland, and this must not be replaced by another cable; the cable may be extended by using a standard connecting box. Optional: "IP66 connection box kit" or "IP67 connector kit" can be ordered together with the transducer and used to connect the fixed transducer cable with an extension cable. (Note: IP67 connectors are for soldering).

Installation cable: 4 x 0.75mm² screened cable, e.g. UL2464 18AWG4C+AE, length max. 300 metres, capacity max. 70nF between signal conductors. Optional: a suitable extension cable can be ordered with the transducer in length from 1 to 300 meters.

Mounting: The sensor is delivered with a mounted steel tap. The tap is fastened on the mast using e.g. a pole/tube with an inner 3/4" RG thread.

WSS interface box type WSI

The interface box is connected between the WSS/WSS-L sensor and the WSDI display. The interface box is supplied from an 18...32V DC supply and will then supply the ultrasonic transducers and the built-in heating element and at the same time convert the data signal for wind direction and wind speed into a TTL signal intended for the display. This is to make it possible to replace an existing wind sensor type 879.3c with our new sensor type WSS, and to be able to connect the sensor to the existing display type 879.50/879.521. Please note that the new name for the display is WSDI. Besides, the already mounted cable for the sensor can still be used.

Display type WSDI

The WSDI display is equipped with a display for read-out of wind speed plus a circle of red LEDs for indication of wind direction. On the display a ship's symbol plus graduation lines are printed.

The keyboard on the front of the display is provided with 3 push-buttons at the right for setting of:

Light intensity: The light intensity is adjusted to a suitable level by pressing the up arrow (▲)/down arrow (▼) keys to increase/decrease the light intensity (8 levels).

Read-out in "m/s" or "knots": The "MODE" push-button is used to change the measuring unit for the wind speed between reading in m/s or knots. A red LED at the centre of the display is lit, indicating the selected measuring unit.

Technical specifications

Wind sensor type WSS and WSS-L

Sensor generally:

- Power supply:	12V DC $\pm 20\%$ (max. 1.1A) 24V DC $\pm 20\%$ (max. 0.6A)
- Temperature:	Working range: WSS: -52...+60°C (Class-approved: -25...+60°C) WSS-L: 0...+60°C (WSS-L is without heater, which means that there is no prevention of icing. Operation below 0°C is weather-dependent)
	Storage: -60...+70°C
- Relative humidity:	0...100%
- Pressure:	600...1100hPa
- Electrical connection:	2m 4 x 0.75mm ² screened cable type UL2464 18AWG/4C+DW+AL/MY+Jacket. The 2m cable is fixed mounted on the sensor and is open-ended.
- Materials:	Wind sensor housing: Polycarbonate +10% glass fibre Mounting tap: Corrosion-resistant stainless steel Weight: 0.8kg
- Compass minimum distance:	20 cm (8 inch)
- Protection:	IP66, to EN 60529
- Electromagnetic compatibility:	EN 61326: 1997 + Am 1:1998 + Am 2:2001

Wind speed section:

- Measuring range:	0...99.9 KTS
- Resolution:	0.1 KTS
- Linearity:	0...68 KTS: ± 0.6 KTS or $\pm 3\%$, whichever is greater 68...99.9 KTS: $\pm 5\%$
- Response time:	1.0 s

Wind direction section:

- Measuring range:	0...360° continuously
- Resolution:	1°
- Accuracy:	$\pm 3^\circ$ in relation to the wind direction
- Response time:	1.0 s

Communication port:

- RS485:	NMEA 0183 protocol. For further information, see specific manual
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Installation options:

- IP66 Connection box kit	IP66 Connection box w/cable glands and screw terminals	20 35 00 00 08
- IP67 Connector kit	1 pcs, Plug Male 7 pin. IP67, for soldering 1 pcs, Screw cap for male plug 1 pcs, Plug female 7 pin. IP67, for soldering 1 pcs, Screw cap for female plug	10 22 00 00 52 10 29 92 00 02 10 22 00 00 53 10 29 92 00 03
- Extension cable	1 to 300 meters 4x0.75mm ² cable (1m steps)	10 20 23 00 16

WSS interface box type WSI:

- Power supply:	24V DC +30% -25% reverse polarity protected (working voltage 18...32V DC)
- Power consumption:	Max. 0.9A at 24V DC (1.25A at 18V DC). A 2A fuse is recommended as protection for the supply input
- Galvanic separation:	Between supply and the rest: 600V
- Output for WSS supply:	30V DC 0.6A to WSS
- Output for display WSDI:	TTL. 5V wind speed and direction
- Input from WSS wind sensor:	RS485 communication for wind speed and direction
- EMC:	According to EN 61000-6-1/2/3/4
- Protection:	Housing: IP40. Terminals: IP20 to IEC 529 and EN 60529
- Temperature:	Operating: -25°...70°C to EN 60051 Storage: -50°...90°C
- Material:	Polycarbonate (30% GFR) UL94V0
- Mounting:	Mounted on a 35mm DIN rail or by means of two 4mm screws according to DIN 46277 and DIN EN50022
- Vibration:	3...13.2Hz: 2mm (peak-peak) EN 60945 13.2...100Hz: 0.7g DNV Class A
- Weight:	0.45kg

Display type WSDI:

- Number of LEDs in circle: 64 pcs.
- Display: 2½ digit luminous 7-segment displays, height 14mm
- m/s or knots: Indication of m/s or knots is changed by means of the "MODE" push-button
- Power supply: 110 or 220V AC, 50-60Hz
- Power consumption: 6W
- EMC: According to EN 61000-6-1/2/3/4
- Protection: Housing: IP52. Terminals: IP20 to IEC 529 and EN 60529
- Material: All plastic parts are self-extinguishing to UL 94 (V0)
- Weight: 0.8kg
- Data-out (serial): NMEA 0183 (EIA/RS422), version 2.x-3.0 or IEC 61162-1
Optional: NMEA-0183 version 1.5

Transmission speed: 4800 Baud
Number of bits: 8
Number of parity bits: 0
Number of stop bits: 1
Transmission interval: 1 s
- Protocol NMEA 0183 ver. 1.5: \$IIMWD,xxx,T,,,yy.y,N,,*zz<CR><LF>
Wind direction (0...360°) xxx
Wind speed (0.0...99.9 KTS) yy.y
Hexadecimal check sum zz
(XOR of all characters until the "*" -character (not included))
End of transmission (EOT) <CR><LF>
- Protocol NMEA 0183 ver. 2.x-3.0: \$WIMWV,xxx,x,R,yy.y,N,A*zz<CR><LF>
Wind direction (0...360°) xxx,x
Wind speed (0.0...99.9 KTS) yy.y
Hexadecimal check sum zz
(XOR of all characters until the "*" -character (not included))
End of transmission (EOT) <CR><LF>
- Connection: Terminal "A" signal, terminal "B" return (0V). Use a 2-wire screened cable
- Signal levels for NMEA 0183 (EIA/RS422):

The NMEA 0183 standard requires the following signals levels:

"1" between -15V and +0.5V |Isink| ≥ 0mA
"0" between +15V and +4V |Isource| ≥ 15mA @ +4V

The display type WSDI releases the following levels:

"1" -9.5V ±0.5V |Isink| ≥ 1mA @ -8V
"0" +9.5V ±0.5V |Isource| ≥ 15mA @ +8V

Please notice that NMEA does not request that the output may settle power in "1" condition, but it is permissible. This is used in WSDI in order to make it compatible with RS-232C/V24.

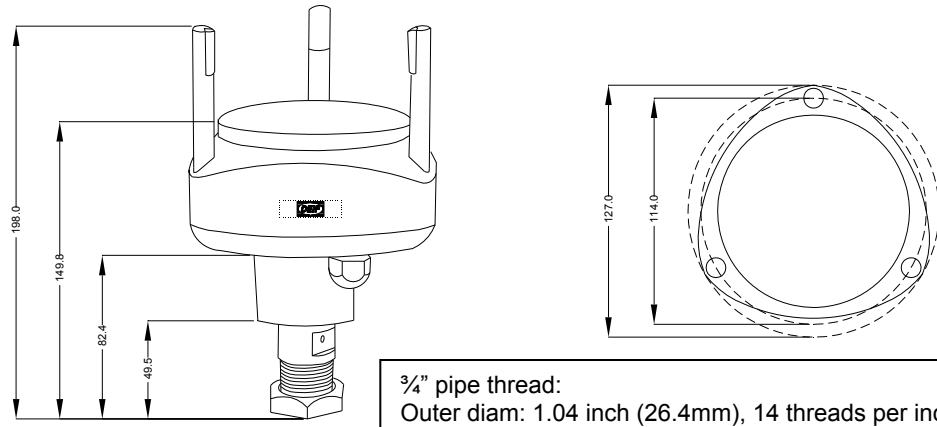
The NMEA 0183 signal is inverted like RS232.

The "A" and the "B" signals are galvanically separated as prescribed by NMEA. An RS232C receiver may be connected. Applicable would be a PC with the following configuration:

Transmission speed: 4800 Baud
Number of data bits: 8
Parity bits: None
Number of stop bits: None

Dimensions, wind sensor WSS

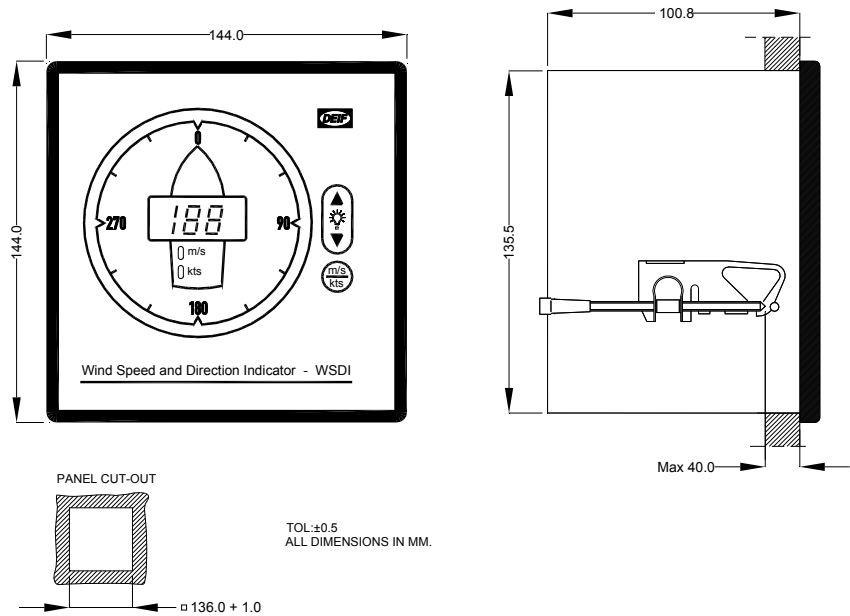
All dimensions in mm



WSS

Dimensions, display

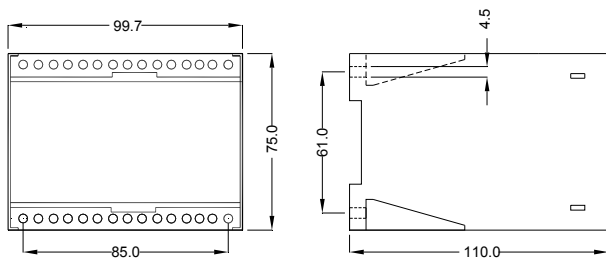
All dimensions in mm



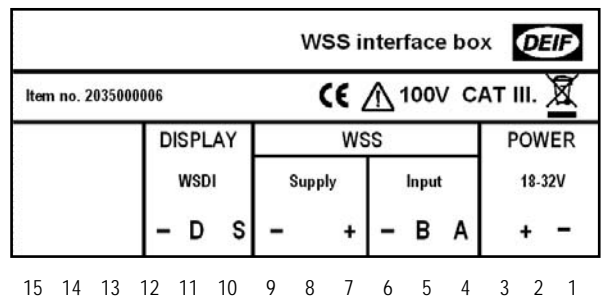
WSDI

WSS interface box type WSI

Dimensions



Front panel



Connections

WSS interface box WSI

Pin no.	Function		Note
1	Supply voltage	-	24V DC supply for the interface box
2		+	
3		NC	
4	RS485 comm.	A	Wind speed and direction data from the wind sensor
5		B	
6		GND	
7	Power supply out	+	30V DC supply for the wind sensor
8		NC	
9		-	
10	Wind speed	TTL out	Wind speed and direction data to the display type WSDI
11	Direction	TTL out	
12	Common	GND	
13		NC	Do not connect
14		NC	
15		NC	



IMPORTANT!

The WSS stainless steel mounting base shall be connected to ships earth cable (or steel hull).


Display WSDI

Pin no.	Function		Note
AC	Supply	220V AC or 110V AC	To change from 220V AC to 110V AC or vice versa, see the manual for WSS
AC			
GND	EARTH		The ship's hull, it is not necessary to connect this terminal
1	AUX +5V DC	External mode control Input from WSS interface box	For external dimmer and read-out of m/s or KTS in the display
2	0V		Terminal 12 on the WSS interface box
3	Wind speed		Terminal 10 on the interface box
4	Direction		Terminal 11 on the interface box
5	Screen		The cable screen. Do not connect the other end
A	Signal	NMEA	NMEA0183 version 1.5 or 2.x-3.0
B	Return		
	Screen		
9	Mode shift	m/s or KTS	Read-out in the display
10	Dimmer	▼	Decrease illumination
11	Dimmer	▲	Increase illumination

Wind sensor WSS

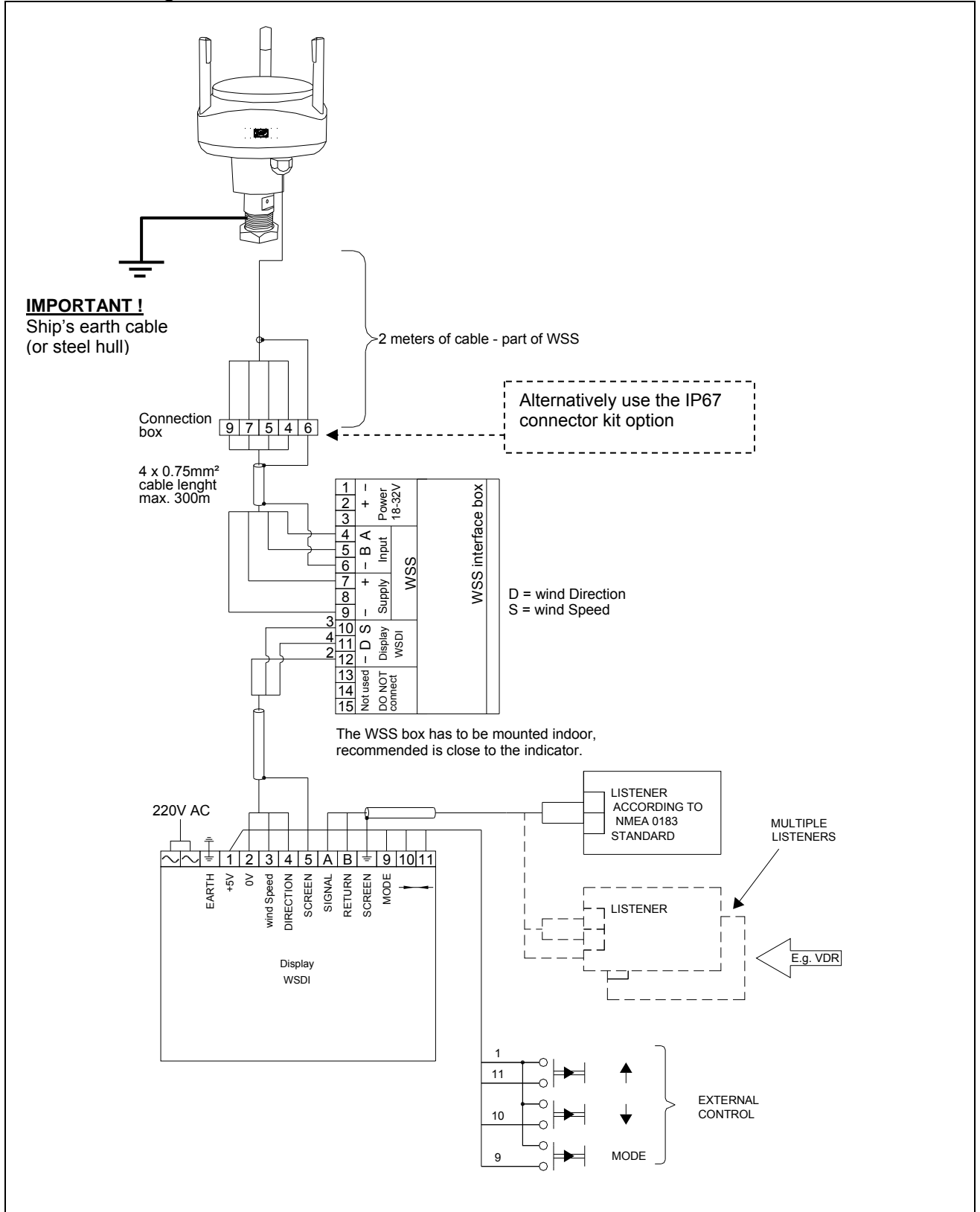
Cable colour	Function		Note
Black	Supply voltage	-	30V DC supply for the WSS wind sensor
Red		+	
Orange	RS485 comm.	A	Wind speed and direction data output
Brown		B	

IP67 Connector kit assembly instruction (OPTIONAL)

WSS/WSS-L cable (black) Male (CON1) connector	 Connector pin no.	WSS extender cable xx meters Female (CON2) connector	Signal comments
Black (-) ●	1	Black (-) ●	30V DC Supply for WSS/WSS-L
Red (+) ●	2	Red (+) ●	
Orange ●	3	Orange ●	RS485 Comm. From WSS/WSS-L
Brown ●	4	Brown ●	
Screen ●	5	Screen ●	Cable screen

Each connector must be soldered to respective cable (detailed information is available in the installation instruction).

Connection diagram



Order specifications

Example:	Type WSS	Power supply 220V AC
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E-mail: deif@deif.com, URL: www.deif.com






Due to our continuous development we reserve the right to supply equipment which may vary from the described.



Other Products

	Sirens (electrical), 212	Sirens (pneumatic), 208	
			
Description:	Electrical siren applicable for factories, ports, marine use etc.	Pneumatic siren applicable for factories, ports, marine use etc. For compressed air.	
Voltage (AC, DC)	24, 220V AC/DC	–	
Air pressure:	–	3.5 atm., 5.5 atm., 8.5 atm.	
Consumption (Amps and Watt):	9.5, 1.9, 1.1, 3.4, 1.7A, 160, 270W	–	
m3/h:	–	9, 11, 13	
Frequency (Hz):	800, 1000	600, 800, 1000	
Sound pressure (1m dB):	110, 115	110, 114, 118	
Protection:	IP54 (upright mounting only)	IP54	

	Bells, 117	Bells, 118R	Bells, 124
			
Description:	White bakelite bell with dome of bright nickel plated steel, ø100mm.	Waterproof, grey bakelite bell with dome of grey enamelled steel, ø100mm.	Waterproof, black bell made out of corrosion protected light metal alloy with brass dome, ø200mm.
Voltage (AC, DC):	24V DC 24V AC	12, 24V DC 24, 220V AC	12, 24, 220V DC 220V AC
Coil resistance (Ohms):	1 × 4, 1 × 12, 1 × 50, 1 × 200	2 × 2.5, 2 × 5, 2 × 20, 2 × 80, 2000	2 × 9, 2 × 37, 2 × 25, 2 × 300, 2 × 1200
Consumption (Amps):	0.6, 0.3, 0.2, 0.1	0.5, 0.3, 0.2, 0.08, 0.03	0.4, 0.3, 0.1, 0.05
Sound pressure (1m dB):	90	93, 96	100
Protection:	IP20	IP54	IP54

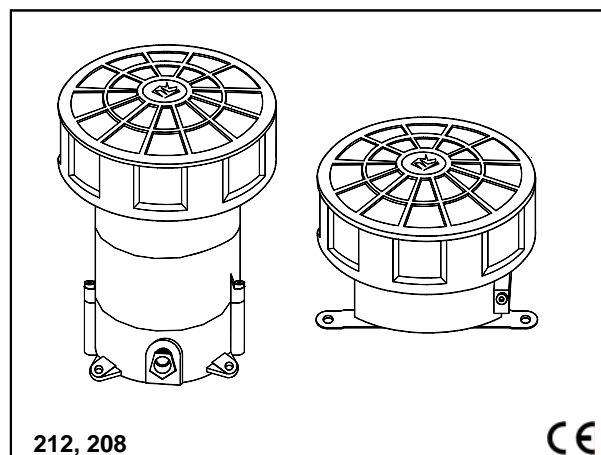
	Diaphragm horns, 172	Diaphragm horns, 173	
			
Description:	Robust and waterproof diaphragm horns applicable for use in engine rooms, factories etc.	Robust and waterproof diaphragm horns applicable for use in engine rooms, factories etc.	
Voltage (AC, DC)	24, 220V DC	220V AC	
Coil resistance (Ohms):	2 x 1.5, 2 x 7, 2 x 50, 2 x 200	2 x 3, 2 x 50, 2 x 170	
Consumption (Amps):	1.6, 0.8, 0.6, 0.3	1.2, 0.6, 0.3	
Frequency (Hz):	300	100	
Sound pressure (1m dB):	100	100	
Protection:	IP54	IP54	

Types 212 and 208

Sirens

4921200002E

- **Extremely reliable**
- **Enclosure to IP54**
- **Sound pressures 110...118dB**
- **Voltages 24 and 220V**
- **For compressed air or CO₂ (type 208)**
- **Pendant or upright mounting**

**Application**

The sirens types 212 and 208 may be used for all applications, as e.g. factories, ports and for marine use.

The DEIF sirens were previously manufactured by the company MALLING. The MALLING marine products were widely recognized for their applicability and reliability, being thoroughly tested and very robust.

The DEIF sirens combine these advantages with an updating of the construction to ensure that the sirens now are designed to meet the latest requirements of the Machinery Directive and of the EMC Directive.

Type 212

An electrical siren, available with sound pressures 110dB or 115dB, for 24V and 220/230V AC/DC.

Type 208

A pneumatic siren, specifically designed for compressed air or carbon dioxide (CO₂), fitted with an air adjusting screw. Connected to a CO₂ system with a pressure of up to 50 atm., the supply has to be reduced, until a suitable signal is obtained.

Type 212 and 208

Technical specifications

Electrical siren type 212.8...

Type	212.8.24	212.8.220
Voltage	24V AC/DC	220/230V AC 220V DC
Consumption	9.5A 160W	1.1A 160W
Frequency	800Hz	800Hz
Sound pressure	110dB 1 m	110dB 1 m
EAN No. 5703..	727000517	727000531

Electrical siren type 212.10

Type	212.10.220
Voltage	220/230V AC 220V DC
Consumption	1.7A 270W
Frequency	1000Hz
Sound pressure	115dB 1 m
EAN No. 5703..	727000562

Pneumatic siren type 208

Air pressure	3.5 atm. 5,5 atm. 8.5 atm.
m3/h	9 11 13
Frequency	600Hz 800Hz 1000Hz
Sound pressure	110dB 1 m 114dB 1 m 118dB 1 m
EAN No. 5703..	727000616

EMC: EN 50081-1/2 and EN 50082-1/2

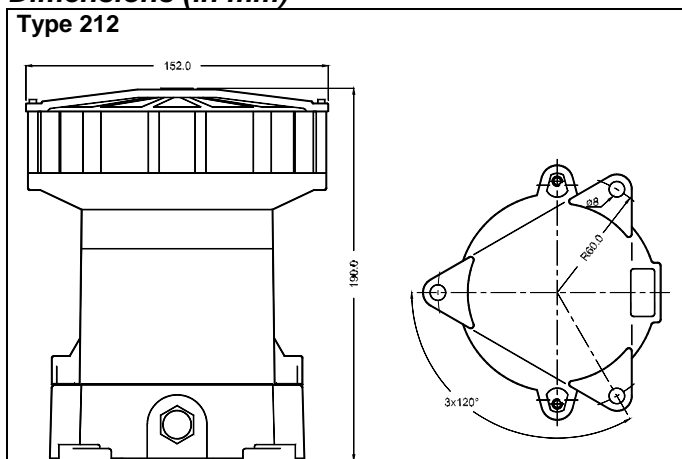
Materials: Corrosion protected enamelled light metal

Connections: Type 208: 1/4" WRG

Protection: IP54 to IEC 529 and EN 60529
(Type 212: upright mounting only)

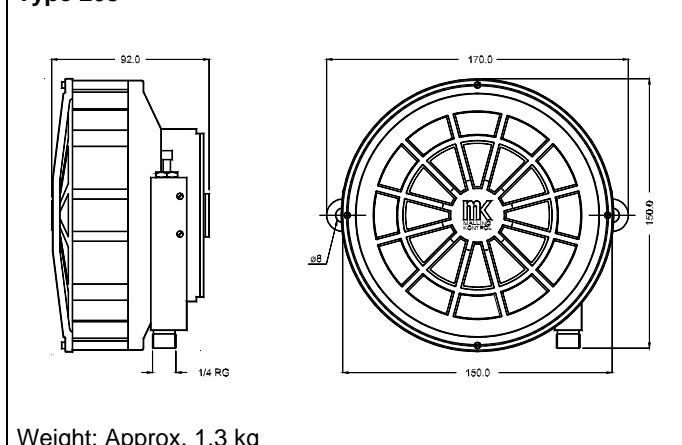
Mounting: Pendant or upright

Dimensions (in mm)



Weight: Approx. 2.3 kg

Type 208



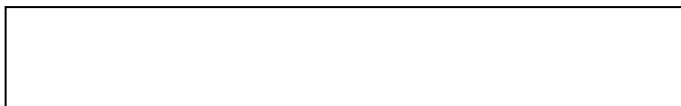
Weight: Approx. 1.3 kg

Order specifications

Type - (voltage)

Examples:
212.8.220 – 220/230V AC

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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Bells

Type 117, 118R, 124

492120005D



117



118R



124

- *Types 118R and 124 waterproof*
- *For voltages: 12...24...220V AC/DC*
- *Sound pressures: 90dB...93dB...96dB...100dB*

Description

Type 117

White bakelite bell with dome of bright nickel plated steel, ø100 mm.

Type 118R

Waterproof, grey bakelite bell with dome of grey enamelled steel, ø100 mm.

Type 124

Waterproof, black bell made out of corrosion protected light metal alloy with brass dome, ø200 mm.

Technical specifications

	Type	Voltage		Coil resistance	Consumption	Sound pressure	EAN. No.
		=/DC	-/AC	(Ohms)	(Amps)	1m dB)	
Bell	117.24	24		1 x 200	0.1	90	5703727000043
Bell (Waterproof)	118R12	12	24	2 x 20	0.2	93	5703727000135
	118R24	24		2 x 80	0.08	96	5703727000142
	118R220		220	1 x 2000	0.03	96	5703727000166
Bell (Waterproof)	124.12	12		2 x 9	0.4	100	5703727000210
	124.24	24		2 x 37	0.3	100	5703727000227
	124.220	220	220	2 x 1200	0.05	100	5703727000258

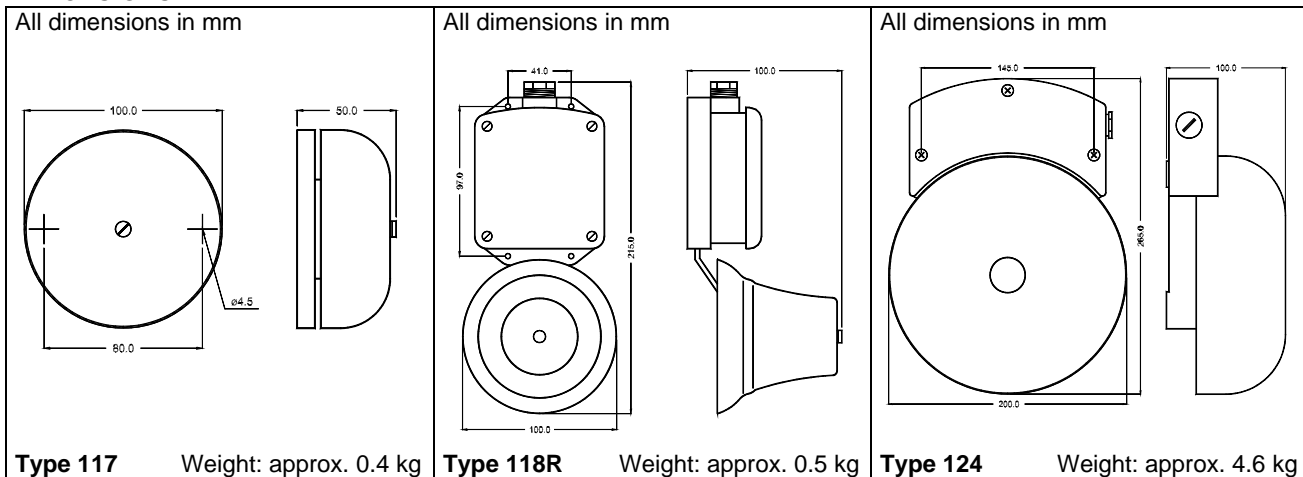
Temperature: -10...55°C (nominal), -25...60°C (operation), -40...70°C (storage).

Protection: Type 117: IP20, to EN 60529 and IEC 529.

Types 118R, 124: IP54, to EN 60529 and IEC 529.

EMC: To EN 50081-1/2 and EN 50082-1/2. CE marked for residential, commercial and light industry plus industrial environment.

Dimensions



Order specifications

	Type	Voltage	(EAN No.)
Example:	118R220	220V AC	5703727000166

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Diaphragm horns

Types 172, 173

492120008D



- *Extremely reliable, thoroughly tested mechanical construction*
- *Protection: IP54*
- *Sound pressure: 100dB*
- *For AC voltages: 220V*
- *For DC voltages: 24...220V*
- *For engine rooms, factories etc.*

Description

The diaphragm horns types 172 and 173 are typically applied in engine rooms, factories, etc. where a robust, waterproof audial indicator giving a loud and clear signal is needed.

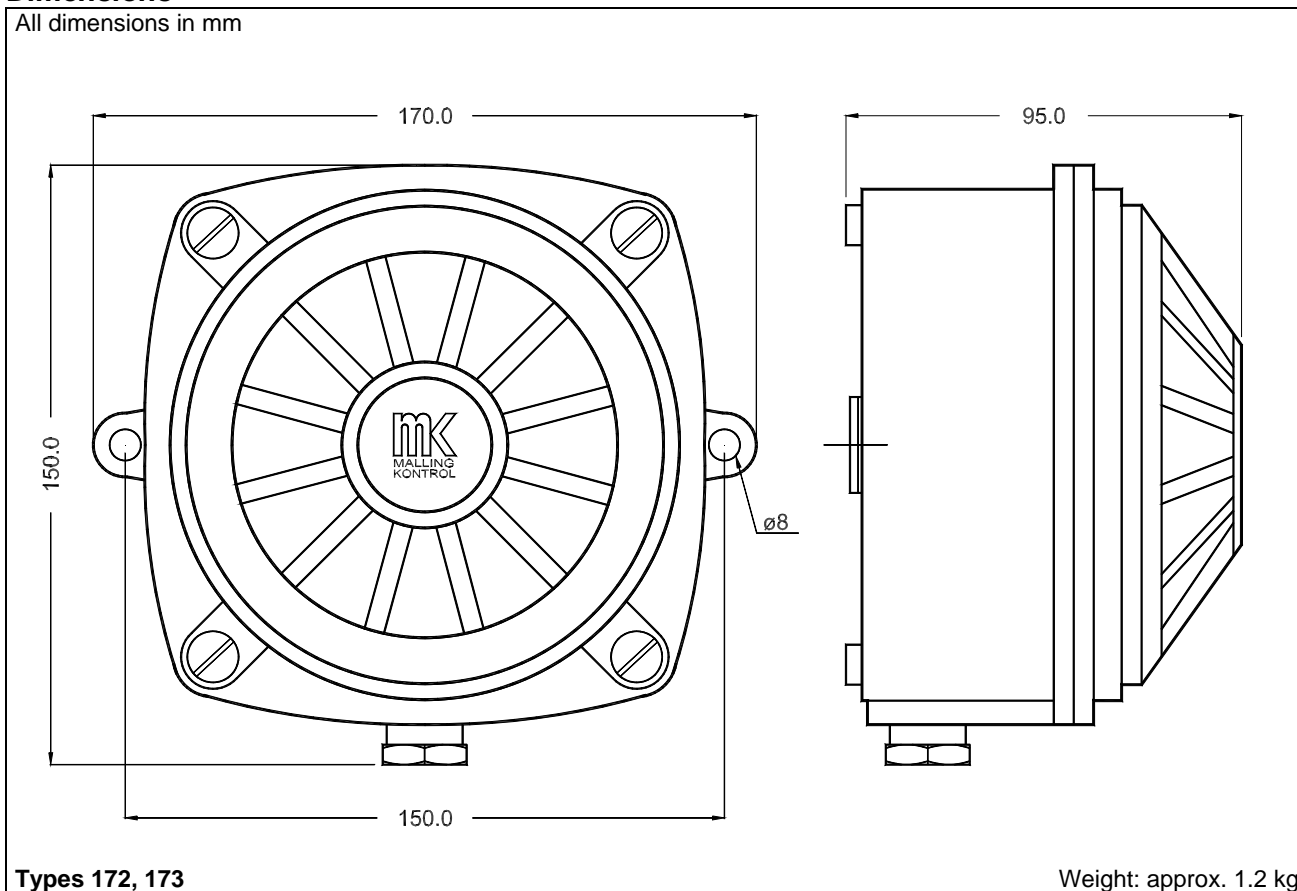
Technical specifications

Type	Voltage		Coil resistance (Ohms)	Consumption (Amps)	Frequency (Hz)	Sound pressure (1m dB)	EAN No.
	=/DC	/AC					
172.24	24		2 x 7	0.8	300	100	5703727000326
172.220	220		2 x 200	0.3	300	100	5703727000340
173.220		220/230	2 x 170	0.3	100	100	5703727000449

Protection: IP54, to EN 60529 and IEC 529.

EMC: To EN 50081-1/2 and EN 50082-1/2. CE marked for residential, commercial and light industry plus industrial environment.

Dimensions



Order specifications

	Type	Voltage	(EAN No.)
Example:	172.24	24V DC	5703727000326

Due to our continuous development we reserve the right to supply equipment which may vary from the described.

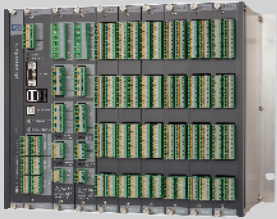



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Renewable Energy Controls

	Delomatic Energy Control System, DM-4 REC-1 		
Main function:	<p>The DM4-REC (Renewable Energy Control system) is designed as a highly flexible, modular process controller covering the special demands of renewable energy plants regarding reliability, robustness, flexibility and remote access to functionality.</p> <p>Suitable for both wind power and hydropower applications.</p>		

	Thyristor Control Module, TCM-2 		
Main function:	Minimisation of grid impact at cut-in and cut-out.		
Aux. supply:	18-36V DC or 19.2-30V AC		
Operating temperature:	-25 to +70°C		
Protection class:	IP20		
Mounting:	Vertical or horizontal		
Thyristor ignition pulses:	500mA current limited, 100kHz, di/dt 1 A/us, Gate cathode voltage 0-5V		
Grid:	110V AC to 690V AC (phase-to-phase) 40-70Hz		
Digital inputs:	9-36V DC		
RPM input:	9-36V DC		
Analogue input:	0-10V, 10kOhm		
Current measuring input:	-/1 or -/5Arms AC		
Current overload:	4 * In continuously 10 * In for 10 s		
Digital outputs:	9-36V DC		

	Generator Protection Unit, GPU-2 Hydro	Generator Protection Unit, GPU-2	Generator Paralleling Controller, GPC-2
			
Aux.: 8-36V DC	✓	✓	✓
Meas. voltage: 100-690V	✓	✓	✓
Current transformer: -1A or -5A	✓	✓	✓
Frequency: 30-70Hz	✓	✓	✓
Loss of mains protection package	A	A	A
df / dt	A	A	A
Vector jump	A	A	A
Busbar and generator protection package	B1	B1	B1
Generator add-on protection package	C1	C1	C1
Zero + negative sequence	C2	C2	C2
Voltage control	D2	D2	D1
Var / cos phi control	-	-	D1
Analogue controller output	-	-	E1
Analogue transducer output	F	F	F
Combination outputs	-	-	EF
Start / stop relay output to next generator	-	G1	✓
Power management	-	-	-
AMF logic	-	-	-
Synchronising	G2	G2	✓
Load sharing	-	-	✓
Engine communication	-	H4/H5/H6	H4/H5/H6
Serial communication	H1/H2/H3	H1/H2/H3	H1/H2/H3
Remote mountable display	✓	✓	✓
Display / PC cables	J	J	J
IP54 protection of display	L	L	L
Available without display	✓	✓	✓
Configurable ext. cards	M	M	M
Engine protection	-	M1/M2	M1/M2
Approved by classification societies	✓	✓	-
BASE / DIN rail mounting	✓	✓	✓
Additional Operator Panel	-	-	-

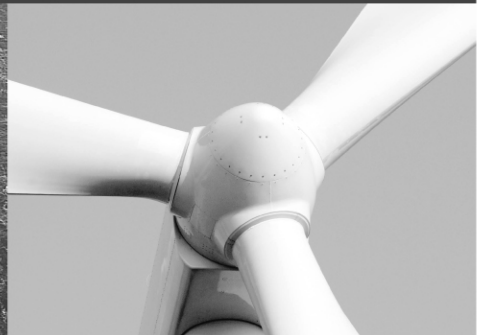
Generator Protection Unit, GPU-3 Hydro



Aux.: 8-36V DC	✓		
Meas. voltage: 100-690V	✓		
Current transformer: -1A or -5A	✓		
Frequency: 30-70Hz	✓		
Remote mountable display	✓		
Approved by classification societies	✓		
BASE / DIN rail mounting	✓		
Start / stop relay output to next generator	✓		
Busbar and generator protection package	✓		
M-logic (micro PLC)	✓		
Synchronising	Option		
IP 54 protection of display	Option		
Loss of mains protection package	Option		
Additional displays (DU-2)	Option		
Voltage control	Option		
Generator add-on protection package	Option		
Analogue transducer output	Option		
Engine communication	Option		
Serial communication	Option		
Configurable ext. cards	Option		
Engine protection	Option		
Analogue controller output	Option		
Combination outputs	Option		
Additional Operator Panel (AOP-1/AOP-2)	Option		
TCP/IP modbus	Option		
Class 0.5 measurement	Option		



Renewable Energy Control System, DM-4 REC-1 DATA SHEET



Typical applications

- Pitch-regulated wind turbines
- Pitch motion controller
- Stall-regulated wind turbines

Modular concept

- Free configurable modular I/O
- Single module for all standard I/Os
- Only four types of modules necessary to build a complex control system
- Double-Euro (6TE system) DM-4 racks available in four standard widths; 24TE, 30TE, 42TE and 60TE
- Modular application software ready as template for our customers
- Thyristor soft starter for asynchronous generators as external module available

Features

- Operating temperature -25...70°C
- Vibration DNV class A+C
- Electrical measurement class 0.5
- Approved for marine applications, used in ships and land-based power stations
- Fibre-optic link (ARC-net) as field bus between different DM-4 units for distributed I/O
- CANbus and RS485 available as interface to other protocol systems
- Preemptive multi-tasking RTOS
- Application SW in ANSI c
- Common multi-user interface for local and remote machine operators, SCADA functions and statistics, operate via Ethernet, RS485 or local USB port
- Remote software updating and debugging through Ethernet interface
- Advanced functions for operational statistics and documentation



Application

The DM-4 REC-1 is designed as a highly flexible, modular process controller covering the special demands of wind power plants regarding reliability, robustness, flexibility and remote access to functionality.

Based on an existing generator control system approved for marine applications and used in thousands of ships and land-based power stations over the last 25 years, DM-4 REC-1 matches the special demands of harsh environments and far-away-locations faced in the offshore and land-based decentralised Renewable Energy generation.

With no need for additional systems, the DM-4 REC-1 integrates the following typical functions of a power plant control system on one single hardware and software platform:

- Standard PLC-control functions using temperature measurements, analogue and digital I/O for different units of the power plant (e.g. motors, pumps, hydraulic systems, brakes, fans etc.). Even fast and complex control algorithms can be implemented, since the programming is made on source code-level in standard ANSI c
- Grid protection functionality
- Generator protection functionality for synchronous and asynchronous generators.
- Precise electrical measurements (U, I, P, Q, f, Phi class 0.5) and accumulated counting of energy.
- Blind power control and regulation.
- Remote SCADA interface via Ethernet, TCP/IP or RS485 interfaces.
- Logging of operational data, both event (main state log) and time-based (10 min log).
- Multi-user network-based Human Machine operator Interface (HMI) with a configurable menu structure and functionality. Using standard HW (industrial touch screen and laptop), which is connected wireless or wired or by network to the DM-4 REC-1, an operator interface for surveilling, testing and servicing the machine is implemented, which can be used at every location within the power plant, and parallel in any remote location.

If DM-4 REC-1 is used as wind turbine controller, the following functions can be integrated without the need for additional control systems:

- Advanced pitch control or active stall control
- Advanced yaw control
- Interfacing to frequency converter units and special generators by standard industrial bus systems (CANbus, RS485) and integration of such systems into logging and overall turbine control
- Integration of all types of wind measurement sensors
- Integration of vibration and condition monitoring systems into logging and overall machine control.

- Integration of signals from the safety system into logging and safety redundant controller behaviour.

System components

As a quite unique feature, the whole DM-4 REC-1 system is composed by only four PCB modules:

- **PCM (8 TE):** This is the mainboard of the DM-4 REC-1, carrying rack-system-supply, system main CPU and I/O-Router in distributed configurations and various external interfaces (3 x CAN, 1 x RS485, wire and optical ARC-net, USB, Ethernet). (PCM4.4 is without Ethernet).
- **SCM (6 TE):** A high precision three-phase AC measurement module, including three-phase electrical measurement (class 0.5) of U, I, real power, blind power and phase angle, and an additional three-phase interface for the voltage in a second system (typically generator and busbar for synchronisation purpose).
- **IOM (6 TE):** A universal I/O module for standard I/O signals, carrying Pt100/Pt1000 temperature measurements, analogue inputs for both current and voltage signals, digital inputs for positive or negative logic, digital inputs capable of measuring frequencies, analogue current-outputs and digital outputs.
- **SSI (6 TE):** An input module for six SSI encoder signals. All six encoder signals are transferred to the main controller by the CAN interface. Furthermore, there is a CAN/RS485 gateway on this module

A TCM, Thyristor Control Module, is available as a system component for the DM-4 REC-1 system. For further information about the TCM, please see the separate data sheet.

All four modules are placed within a standard industry rack. Each rack always carries one PCM-module, and a selectable number of both SCM and/or IOM and/or SSI modules. The available standard sizes are:

- 24 TE for 1...2 modules (IOM, SCM or SSI)
- 30 TE for 3 modules
- 42 TE for 4...5 modules
- 60 TE for 6...8 modules

PCM 4.3 and 4.4

The power and main control module is an 8 TE module, which is always placed in the leftmost slot of a DM-4 REC-1. It supplies all modules except from SSI, which has its own supply input. PCM is the master for the back plane bus, and it carries the controller system's main CPU and the following interfaces:

- 3 CAN interfaces 125...250 kbps
- 1 RS485 interface 4800 to 57600 Baud
- 1 ARC-net interface 2.5 Mbps
- 1 optical ARC-net interface 2.5 Mbps
- 1 USB service port
- 1 Ethernet port 10/100 Mbps (PCM 4.3)
- 1 display port (4800 to 57600 Baud TTL) for additional external mini display or other serial interfaces.

The PCM 4.3 acts as the main computer within a DM-4 REC-1 wind power control system. All application software for controlling and supervising the plant is located in the PCM 4.3. By updating the SW for this board, you have full control over the plant's entire functionality. If multiple racks are used, then each rack will contain one PCM. But only one of these, namely the PCM 4.3 will act as the plant main CPU.

The PCM 4.4 will act as I/O-routers mapping all I/O and field busses over ARC-net between the main CPU and the decentralised IOM and SCM modules located in different DM-4 racks.

PCM 4.3/4.4 can also be used as a pitch motion controller located in the hub and connected to the main controller.

SCM 4.1

The SCM is an electrical measurement module with six voltage inputs for direct measurement of three-phase-grids up to 690V AC phase-phase (L1 L2 L3 N generator, L1 L2 L3 N grid/busbar), and three current inputs for connection of current transformers with either 1- or 5Arms secondary nominal current. The SCM offers a certified class 0.5 measurement of voltage, current, real power, blind power and phase angle in a three-phase AC net from 40 to 70 Hz.

The measurement is available once per period and can be read by the main CPU, where all further protection and logging algorithms are included as a part of the application software package for the plant. This allows maximum flexibility in adapting measurement logging and protection functionality to the actual application. On demand, we offer approved software modules for standard protection functions.

The SCM module also implements an embedded vector jump, ($\Delta\phi$) vector jump protection functions which can be configured from the main controller.

IOM 4.2

The IOM is a multi-functional I/O module for connection of various standard sensors. It also interfaces to other systems by standard analogue and digital signals. The module includes:

- **6 inputs for connection of Pt100 or Pt1000** sensors in either 2-, 3- or 4-wire connection
- **4 analogue input channels** for either -20...+20 mA or -10...+10 V signals, 16 bit resolution
- **4 analogue output channels** which can produce a source/sink-current between -20 and +20 mA on an external resistor up to 500 Ohm (to produce e.g. +/- 10 V signals, 12 bit resolution)
- **12 digital inputs** for 9...36V DC with a common rail, which can either be used for positive (common -) or negative (common +) logic
- **4 digital inputs** for 9...36 V, which can each be individually connected to positive or negative logic, and which include a high-precision **frequency measurement** (1.25 MHz sampling rate for signals up to 1 kHz) in order to measure RPM and other process units, which are frequency-based.
- **10 digital outputs** which are externally supplied with 9...36V DC, and each of which can both source (positive logic) or sink (negative logic) up to 200 mA output-current continuously. The outputs are current-limited for short-circuit-protection. Additionally, there is a thermal protection for all outputs, in the case of thermal overload if one output is permanently shorted.
- There is optical isolation between the analogue I/O, the digital I/O and the internal rack-potentials, so the risk for unintended ground-loops via analogue signals between different IO modules is eliminated.

SSI 4.1

The SSI module is an SSI to CAN converter module with six SSI channels, each consisting of one clock out and one data in channel. Furthermore, each channel has its own encoder supply out, ensuring that the supply voltage for each SSI encoder is present and secured by separated overcurrent protection. This way, one channel may suffer a complete cable fault without preventing any other SSI channel from normal operation.

- 6 SSI encoder input with auxiliary supply out, max. 100 mA.
- 125, 250, 1000 kHz frequency
- 8-32 bits resolution
- 1 CAN interface 250 kHz for reading out encoder signals
- 1 RS485 interface supporting 4800 to 115200 Baud

Human Machine Interface

The DM-4 REC-1 has implemented a unique interface, which makes it extremely flexible to adapt to different types of power plants, where standard Windows-based HW, such as any industrial touch screens, laptops, PDAs and standard PCs can be used as operator terminals.

Multiple operators can in parallel be connected to the controller, seeing the same process visualisation (HMI), everyone on his own terminal, while one of them has the clearance to operate the machine by pressing command buttons and interacting with other types of command elements (e.g. switches, potentiometers etc., which are visible on the actual HMI page of the controller).

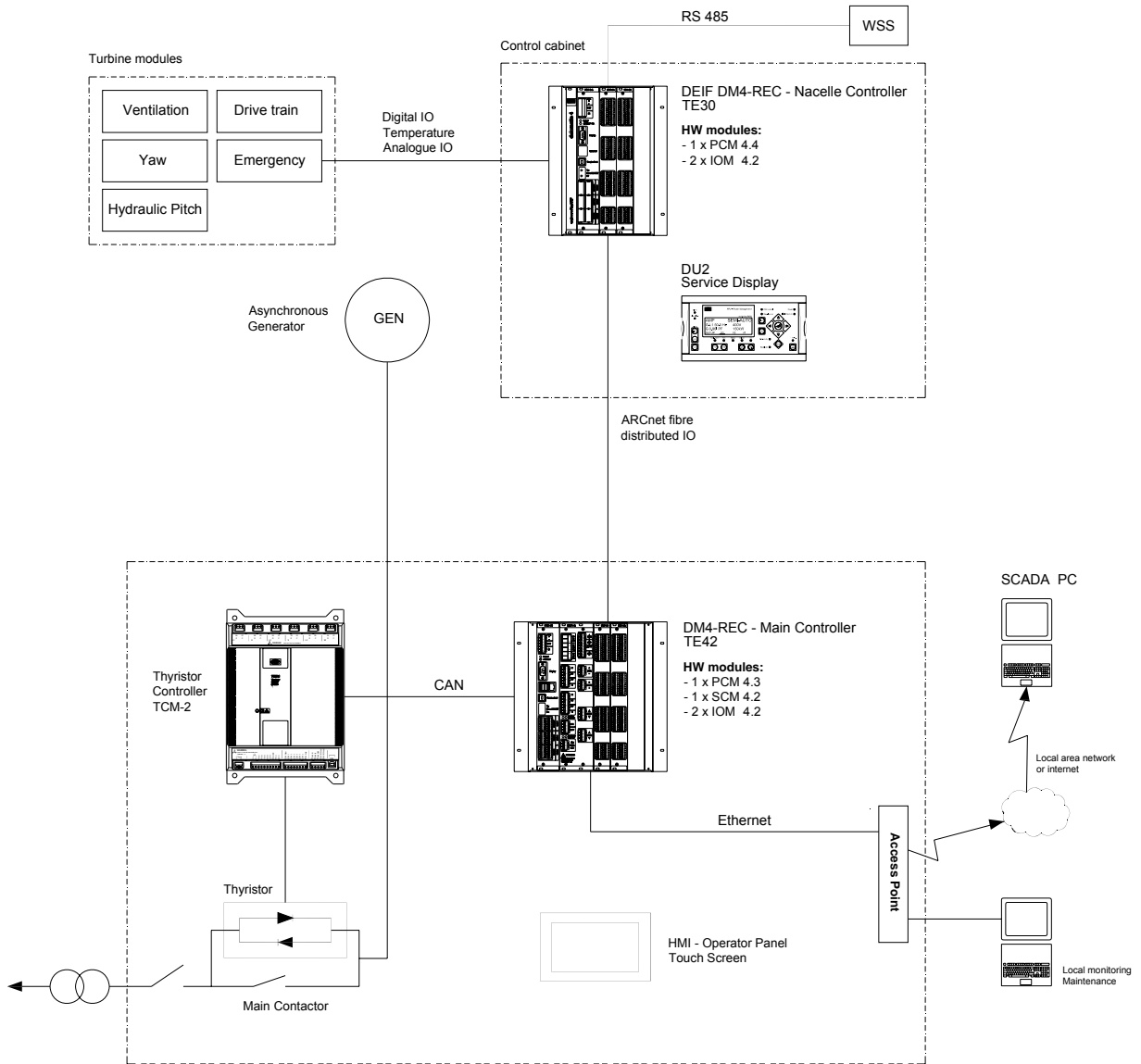
The HMI is based on a browser principle, which means that a part of the application software within the PCM-Main-Controller includes the definition of a set of "home pages" for this controller system. The PCM is the "server", while the different operator terminals are "clients", which only include a plant-unspecific browser software.

All pages are composed with a set of basic graphic and text elements in all available colours and sizes. This offers the maximum degree of freedom for an individual design of the HMI for each power plant.

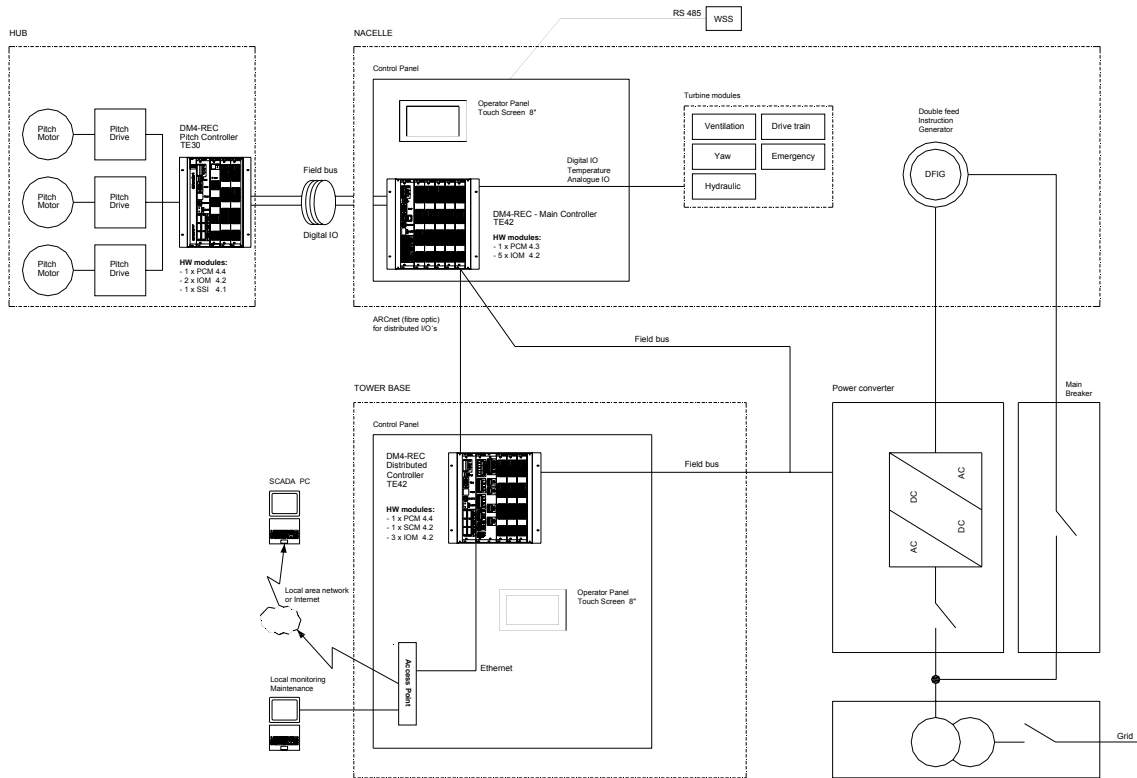
A huge advantage is that the design of the HMI is located within the PCM 4.3/4.4 main controller as an integrated part of the application software, while all user terminals (PC, laptop, PDA or whatever type you use) contain only a standard browser software. This means, that all application-specific means are centrally located within one software package, and you do not have to update all operator terminals with a revised application, when you change something within the HMI for this power plant.

Application diagrams

Wind turbine controller for pitch-regulated wind turbines with distributed I/O and asynchronous generator



Wind turbine controller with electrical pitch and power converter



Technical specifications

Rack system

Reference temp.:	15...30°C (-13...86°F)
Operating temp.:	-25...70°C (-13...158°F)
Storage temp.:	-40...85°C (-40...185°F)
Vibration class:	DNV A+C 2.0 mm _{pp} : 3.0...13.2 Hz 0.7 g: 13.2...100 Hz 6.0 mm _{pp} : 3.0...13.2 Hz 2.1 g: 13.2...50 Hz To IEC 60068-2-6 Fc
Shock:	50 g, 11 msec., half sine To IEC 60068-2-27 Ea
Protection class:	IP 2x Higher class by application of standard housing for DM-4 racks
Climate:	55°C 97% RH To IEC 60068-2-30 Db
Mounting:	Vertical mounting
EMC/CE:	EMC/CE: To EN61000-6-2/4
Material:	Plastic headers acc. UL94-V0, Al-case, steel cover plates
Connectors:	PHÖNIX Self-secure feather force 6/8/20 Arms Screw terminals 20 Arms
Weight:	Depends on configuration

PCM module (4.3 and 4.4)

Aux. supply:	18...30V DC Max. 6A
CAN:	3 independent bus lines 125...250 kbps
RS485:	1 interface from 4800-57600 Baud
USB:	1 interface up to 256 kbps
ARC-net:	1 interface optical or electrical connections, 2.5 Mbit
Ethernet:	1 interface 100 Mbit

SCM module

Safety:	To EN 61010-1 Overvoltage category III, 690V AC, pollution degree 2
Meas. range (Un):	Max 690 Vrms direct. Other range by use of voltage transformer ../100 or ../110V AC Burden max 0.5 mA or 0.3 VA per phase Overload <130% of Un continuously <200% of Un for 10 s External fuse max. 2A slow-blow
Meas. range (In):	Current transformer ../- 1 Arms or ../-5 Arms Burden max 0.4 VA per phase Overload 20 Arms continuously <75A for 10 s <300A for 1 s
Galvanic separation:	3.25 kV isolation be- tween voltage and cur- rent measurement in- puts and all other po- tentials
Frequency of grid:	40...70 Hz
Accuracy:	Acc. to IEC 60688 0.5% at reference tem- peratures 1.0% at operational temperatures
Harmonics:	Up to 500 Hz are measured

Technical specifications**IOM module**

Digital inputs:	9...36V DC, app. 2.4 kOhm, common rail which can be common + or common -. Inputs are optically insulated from other potentials 600 V insulation.
Frequency input:	Same as digital inputs with two terminals for each input. Frequency up to 1 kHz, with duty cycle >40% or 500 Hz with duty cycle >20%.
Resolution:	0.8µSec. (1.25 MHz sampling rate).
Analogue inputs:	Either -20 mA ... +20 mA impedance app. 50 Ohm or -10 V ... + 10 V impedance app. 10 kOhm. Share analogue supply with analogue outputs and Pt100 inputs, galvanically insulated from the rest of the system (600 Vrms).
Resolution:	16 bit.
Accuracy:	0.5% of full range input (40 mA/20 V) at reference temperature. 1.0% of full range input (40 mA/20 V) at operational temperature.
Pt100/Pt1000 sensor input:	2-, 3- or 4-wire connection. Open input and short circuit are detected.
Resolution:	0.1°K.
Measurement range:	-40 to 200°C.
Accuracy temperature inputs:	4-wire: 0.5°K at reference temperature. 2.0°K at operational temperature. 2- or 3-wire (2-wire only when cables are shorter than 1 m): 1.0°K at reference temperature. 2.5°K at operational temperature.
Analogue outputs:	-20 mA ... +20 mA over burden 0...500 Ohm.
Resolution:	12 bit.
Accuracy:	0.5% of full range output (40 mA) at reference temperature. 1.0% of full range output (40 mA) at operational temperature.
Digital outputs:	Output voltage 8...35V DC with external supply 9...36V DC. Output current 0..200 mA source and sink. Current limited for short-circuit-protection. Unlimited short-circuit, until thermal overload of cooling assembly is reached. In case of a thermal overload of the output stages, a signal is generated to the PCM- main-controller, so the application can take a controlled action.

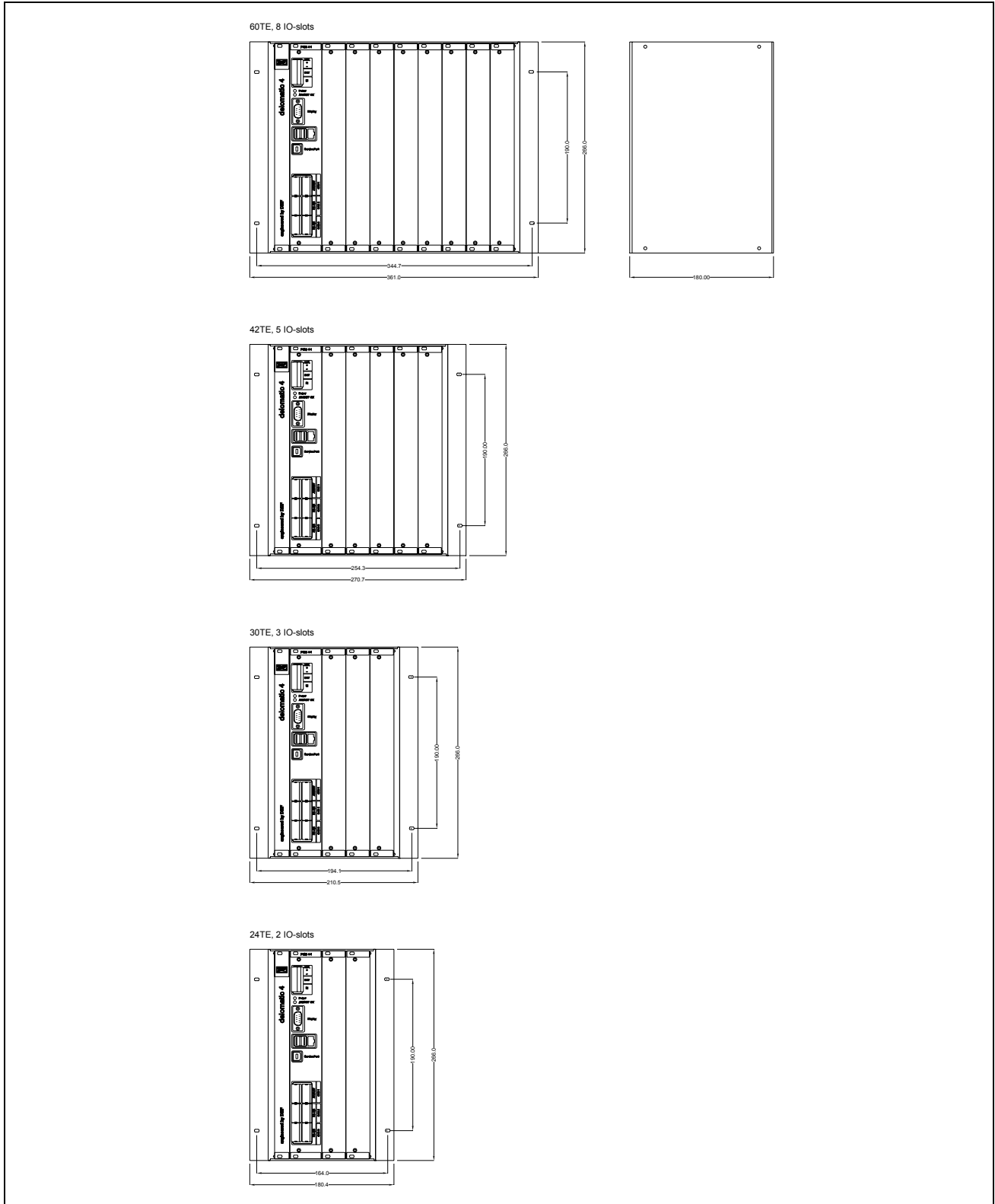
SSI module

Aux. supply:	18...30V DC, max. 1A.
CAN:	1 interface 250 Kbits, balanced bus line.
RS485:	1 interface supporting 4800 to 115200 Baud.
SSI channels:	6 separate with supply out, 18...30V DC, max 100 mA and individually configurable.
SSI resolution:	8-32 bit.
SSI frequency:	125/250/1000 kHz.
SSI frame delay:	50us-50 ms.
SSI error detection:	Frame error, wire break and transfer of sensor-specific errors.
SSI coding:	Gray or binary code conversion.

Open source software

This product contains open source software licensed under e.g. GNU General Public License (GNU GPL) and GNU Lesser Public License (GNU LGPL). The source code for this software can be obtained by contacting DEIF A/S at support@deif.com. DEIF A/S reserves the right to charge for the cost of this service.

Unit dimensions in mm

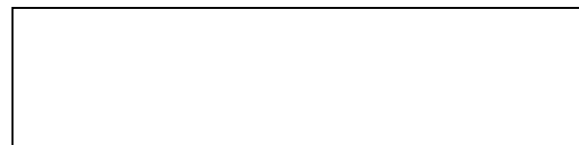


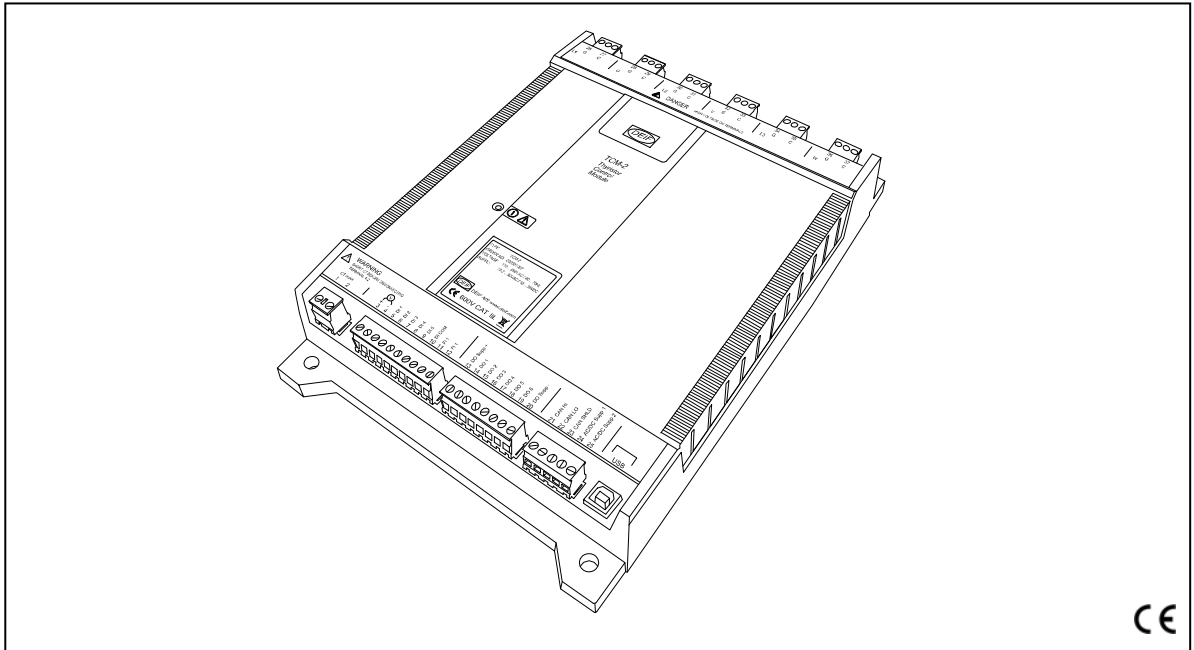
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Typical applications

Heavy duty cut-in controller for asynchronous wind turbine generators

- Advanced cut-in by acceleration-depending double cut-in ramp
- Strongly reduced grid impact under cut-in
- Stand-alone unit with external rpm pulse sensor on generator shaft
- Applicable for 1- and 2-speed asynchronous generators
- -25 – +70°C

Application

The TCM-2 is a microprocessor-based controller designed to minimise the grid impact at cut in and out. It works by interfacing directly to the 6-pulse thyristor bridge. The interface is designed as 6 highly insulated ignition pulse stages for generation of a 100kHz/500mA firing current for a broad range of thyristors with a gate voltage between 0 and 5V.

The device is designed to provide 6 digital inputs, 6 digital outputs and an analogue input (0-10V) line, and can therefore be used as a stand-alone controller. The IO lines are designed to withstand the environment. The TCM-2 integrates directly into the power cabinet, thus functioning as a stand-alone thyristor controller for wind turbines with 1- or 2-speed asynchronous generators.

An input is dedicated to connecting a single-phased current measurement transformer (either 1Arms or 5Arms secondary mean current). This makes it possible to measure the actual thyristor current during operation.

The TCM-2 can be powered from either 18-36V DC or 19.2-30V AC. This flexibility makes it easy to integrate it into a power switchboard cabinet.

As a second mode of operation, the TCM-2 can be directly controlled via CAN bus. This makes it possible for other process control units to set the actual ignition angle for the thyristor bridge on a periodical base. Thus, any control application based on a 6-pulse thyristor bridge can be implemented.

Stand alone mode rpm regulated wind turbine cut-in controller for asynchronous generators.

The ignition angle under cut-in is controlled in the following ways:

1. For low-, medium- and high-wind situations, the cut-in of both generator stages is implemented as an innovative strategy: Based on the measured generator shaft speed and actual grid frequency, a dynamical recalculation of an optimal 2-step ignition ramp is performed in real time. This calculated ramp allows a cut-in of an asynchronous generator, which in low-wind as well as in medium- and high-wind can provide minimum impact on the grid and drivetrain. This procedure is used for all cut-in procedures, both of the large and the small generator stage, except for the cut-down procedure (large to small generator), which is handled by a dedicated algorithm.

2. In the cut-down condition where the small generator stage is used as electrical brake, another regulation strategy for the ignition angle control is applied. This strategy is based upon minimising the mechanical loads by significantly reducing the voltage on the small generator when it crosses its maximum momentum at approximately +3% slip, i.e. shortly before reaching the normal operational speed.

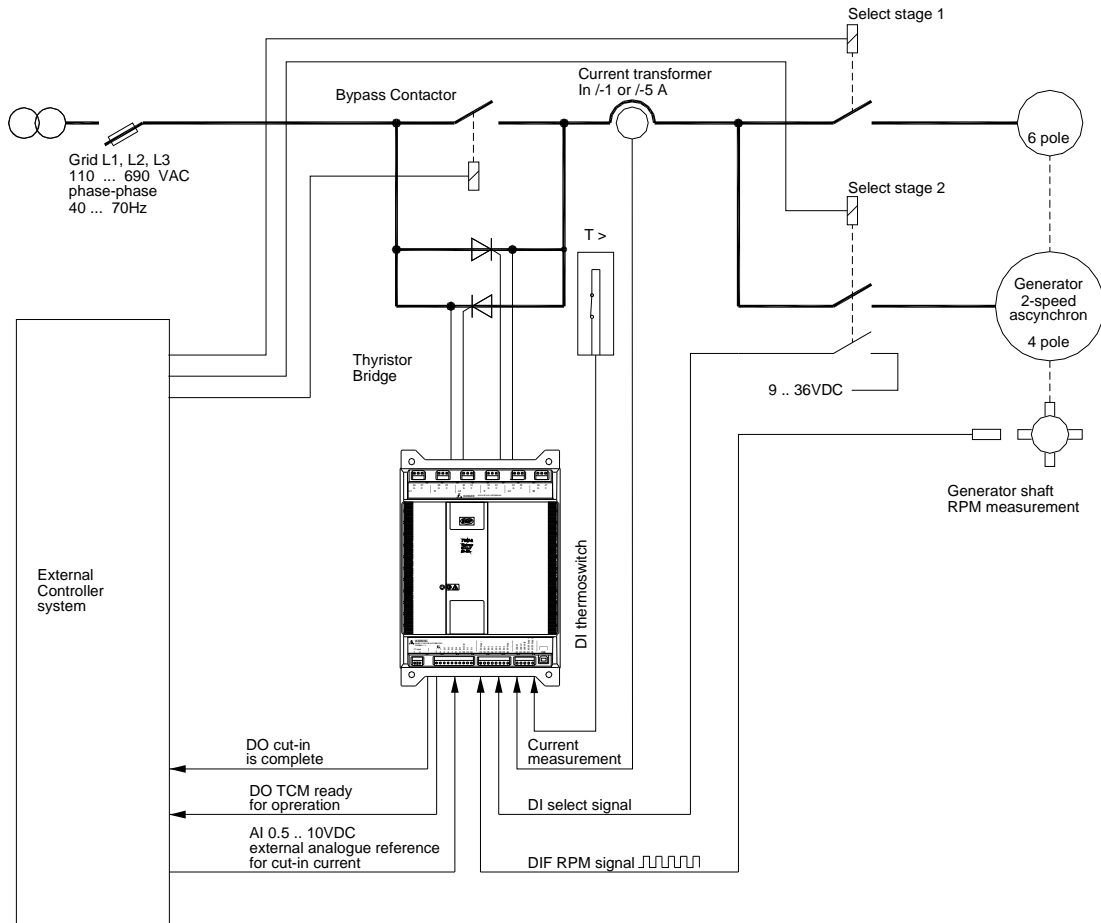
Note: None of the regulation algorithms use the generator's phase angle between current and voltage of the generator as an input value for the algorithm. They are solely based on the rpm and the current amplitude measurement.

The ignition angle during motor start is controlled in the following way: The external analogue signal is interpreted as a set point for the desired generator current under motor start. The thyristor bridge is regulated to obtain a generator current amplitude which produces an rms current of the size $(\text{Analogue Signal}/10\text{V}) * (1\text{A or }5\text{A})$ on the secondary side of the CT.

Options

The TCM-2 will be adapted and parameterised from DEIF to provide optimal performance for each type of application.

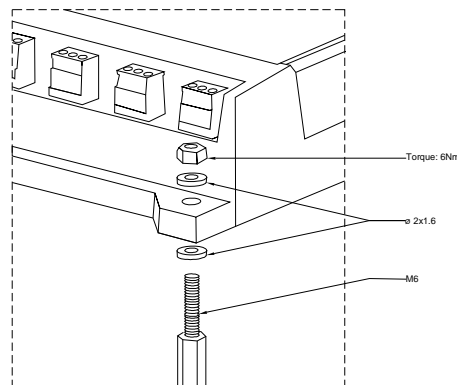
Operation mode diagram



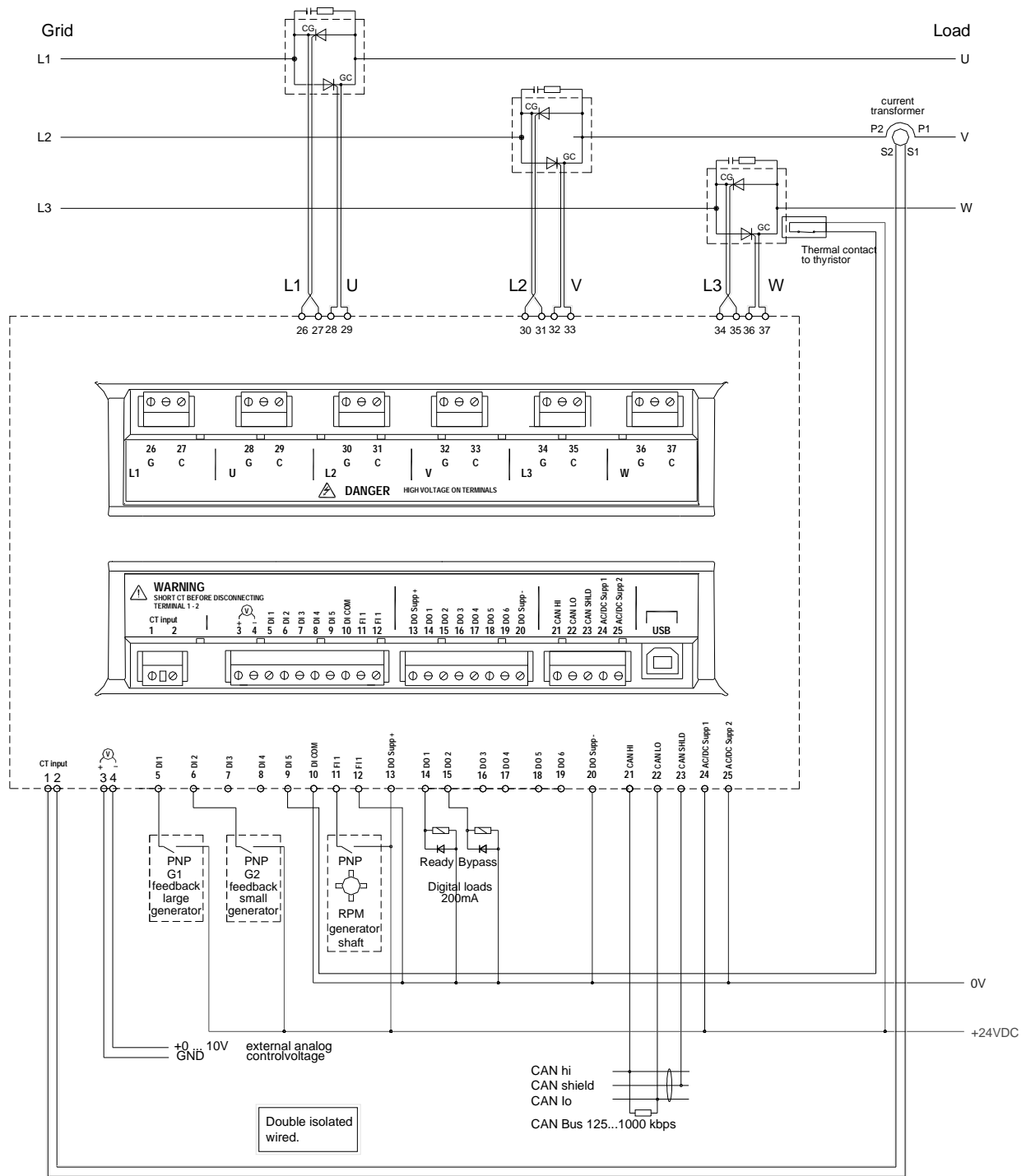
Mounting

The TCM-2 housing is designed to protect the electronics inside. It is easy to install the module using standard tools and parts. A description of torque and needed parts are provided.

Adapter plates for mounting the TCM-2 in existing switchboard cabinets are available on request.



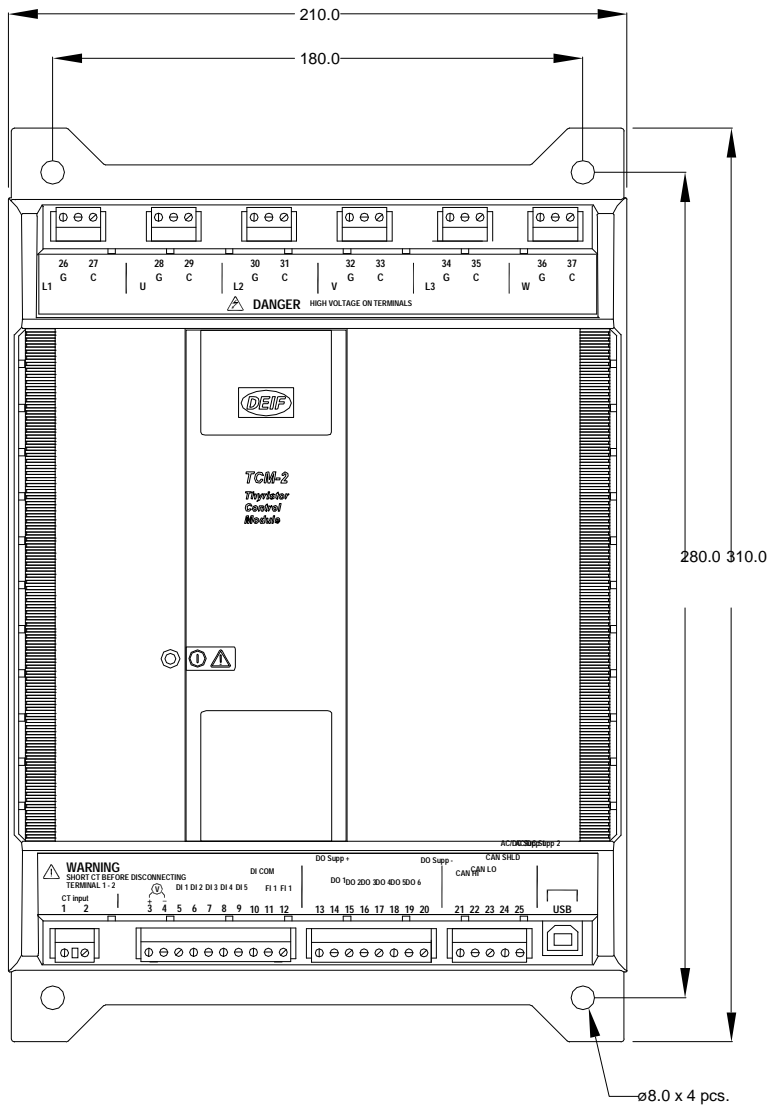
Connection diagram



Technical specifications

Aux. supply:	18-36V DC or 19.2-30V AC Max. 2A	Digital inputs:	9-36V DC, app. 2.4kOhm, input optically insulated, PNP or NPN selectable as a group.
Operating temp.:	-25 – +70°C (-13 – +158° F)	RPM input:	9-36V DC, app. 2.4kOhm, optically insulated, PNP or NPN. 1 to 12 pulses per turn, duty cycle > 20%
Protection class:	IP20	Analogue input:	0-10V, 10kOhm, differential mode not gal- vanically insulated.
Mounting:	Vertical or horizontal with thyristor terminals up or to the side for operation under full temp. range and protection class	Current measurement input:	-1 or -5Arms AC
Safety:	To EN 61010-1 over voltage category III, 690V AC, pollu- tion degree 3	Current overload:	4 * in continuously 10 * In for 10 s
EMC/CE:	To EN 61000-6-2/4	Digital outputs:	With external Supply 9-36V DC, max 1.5V voltage drop, 200mA source/sink continuously
Material:	Plastic case, black, Foil- covered,	Weight:	Approx. 1 kg
Connectors:	PHÖNIX Screw terminals 20Arms		
Thyristor ignition pulses:	500mA current limited, 100kHz, dl/dt 1 A/us, Gate cathode voltage 0-5V		
Grid:	110V AC to 690V AC (phase-to-phase) 40-70Hz		

Unit dimensions in mm

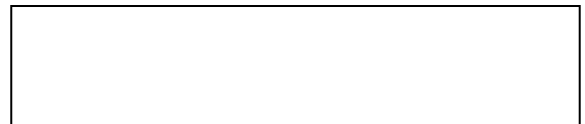


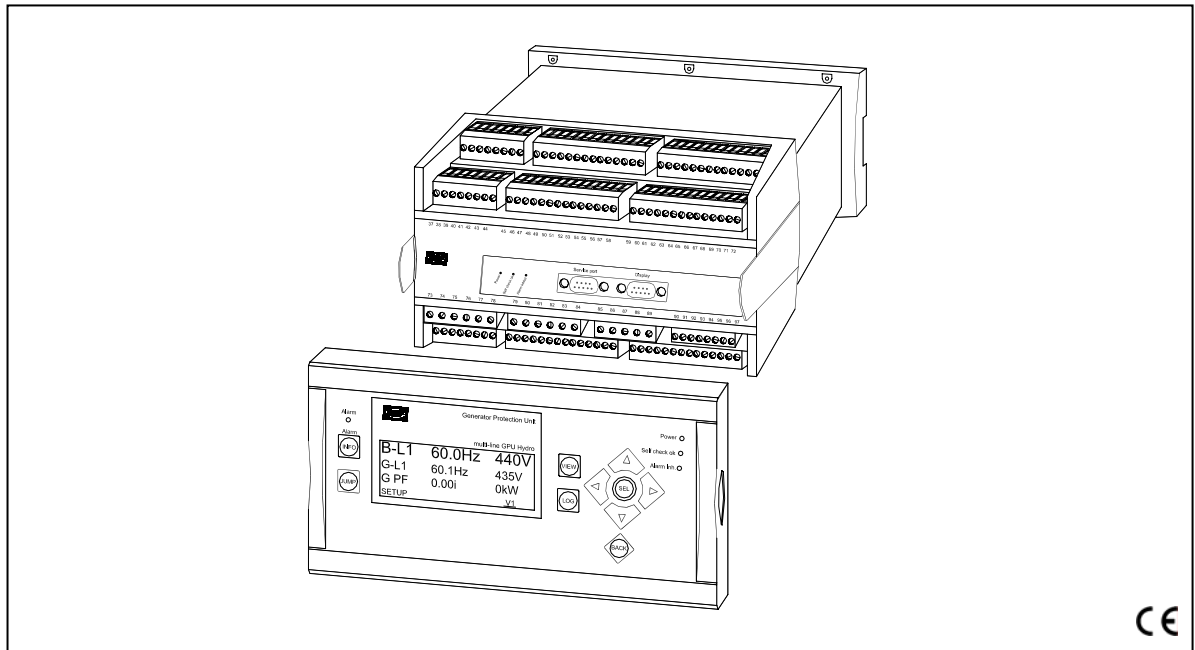
Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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Standard functions

Applications

- Generator protection for hydro turbine driven generators

Functions

- 2 sets of alarm set points
- Alarm inhibit, automatic
- Horn relay
- Language selection
- kWh/kVArh outputs

Protections (ANSI)

- Reverse power (32)
- Overcurrent, 2 levels (51)
- Overcurrent, inverse, 1 level (51)

Display

- Separate mounting
- Easy to read
- Password-protected setup
- Configurable views
- Alarm list
- Event log (150 events)

Measuring system

- 3-phase true RMS
- Galvanically isolated voltage and current inputs
- -/1 or -/5A AC
- 100-25000V AC

GSM communication

- SMS messages at all alarms
- Dial up from PC utility software to control unit

Approvals

- Netmanagement
- TÜV Nord
- GOST-R
- UL

Data sheet

Application

The GPU Hydro generator protection unit is a compact microprocessor-based protection unit containing all functions necessary to protect a hydro turbine driven synchronous/asynchronous generator. It contains all necessary galvanically separated 3-phase measuring circuits.

i Netmanagement and TÜV software must be specified upon ordering.

Display unit

The display unit is separate and can be installed directly on the main unit or in the front of the switchboard door (requires option J# - display cable).

The display unit shows all measured and calculated values as well as alarms and data from the event log.

The displayed values can be configured freely in order to match the customer or application specific requirements.

Self-test

The GPU Hydro automatically carries out a cyclical self-test at start-up. If any errors are found, they will be displayed in clear text in the display and indicated with a relay output.

Setup

Setup is easily done via a menu structure in the display (password-protected) or via the RS232 PC connection and the multi-line 2 Windows® based PC utility software. The PC utility software can be downloaded free of charge from www.deif.com. The utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates.

Options

In order to perfectly match the product solution to specific applications, the functionality of the GPU Hydro can be equipped with a number of available options. The options selected by the customer will be integrated in the standard GPU Hydro, thus securing the same user interface unaffected by whether the application needs a highly complex or a more basic generator controller.

Generator Protection Unit, GPU Hydro

Synchronising option

The GPU Hydro can be used for synchronising a circuit breaker. The speed and voltage set point is controlled by the GPU Hydro through relay outputs.

The GPU Hydro is only used as synchroniser. After the synchronising, the regulation is switched off but the protection is still active.

i AVR control requires option D2.

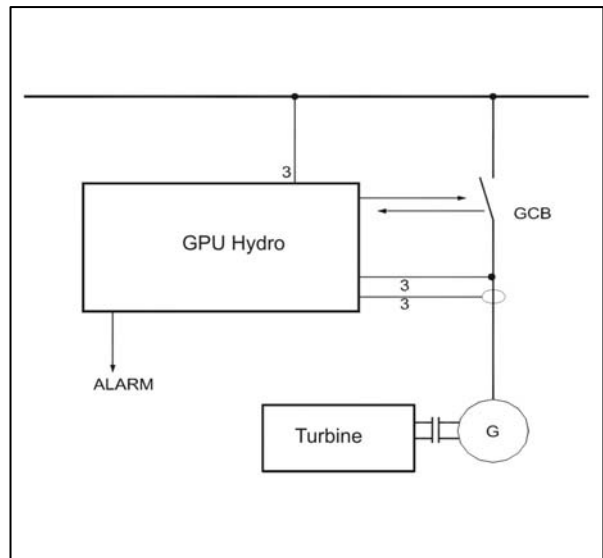
Approvals

The GPU Hydro is approved by the following societies and companies:

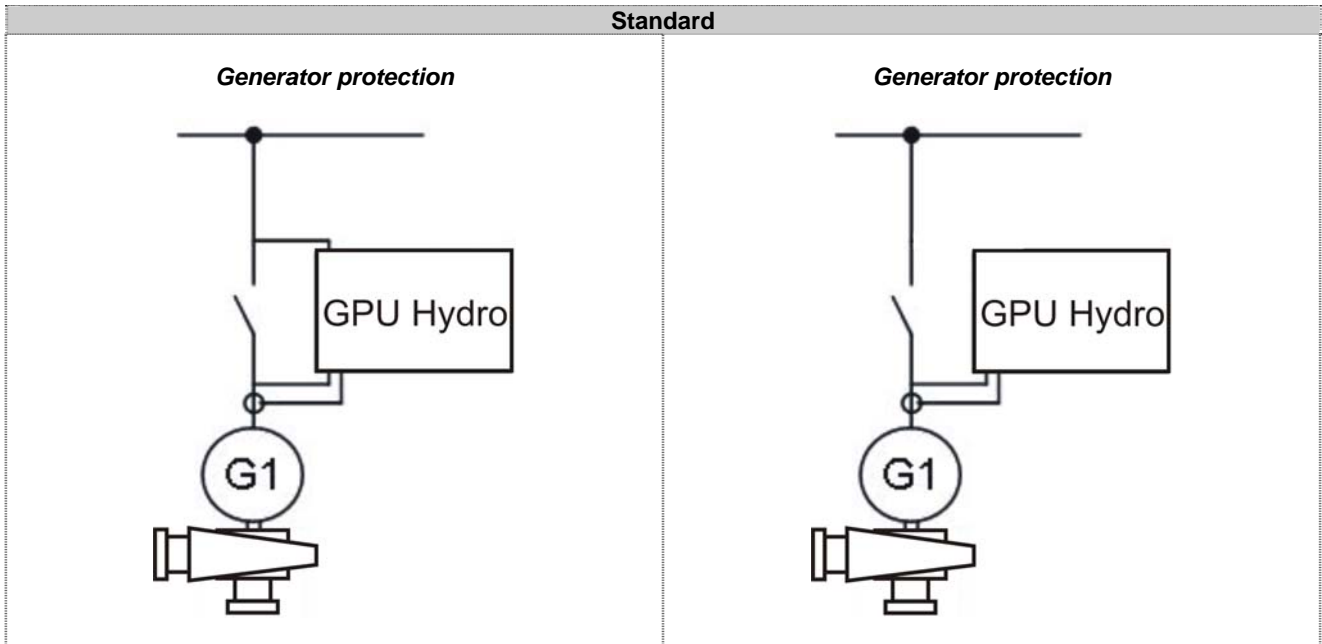
Land	Other
	GOST-R
Netmanagement	UL
TÜV Nord	

i Please refer to www.deif.com for details and certificates.

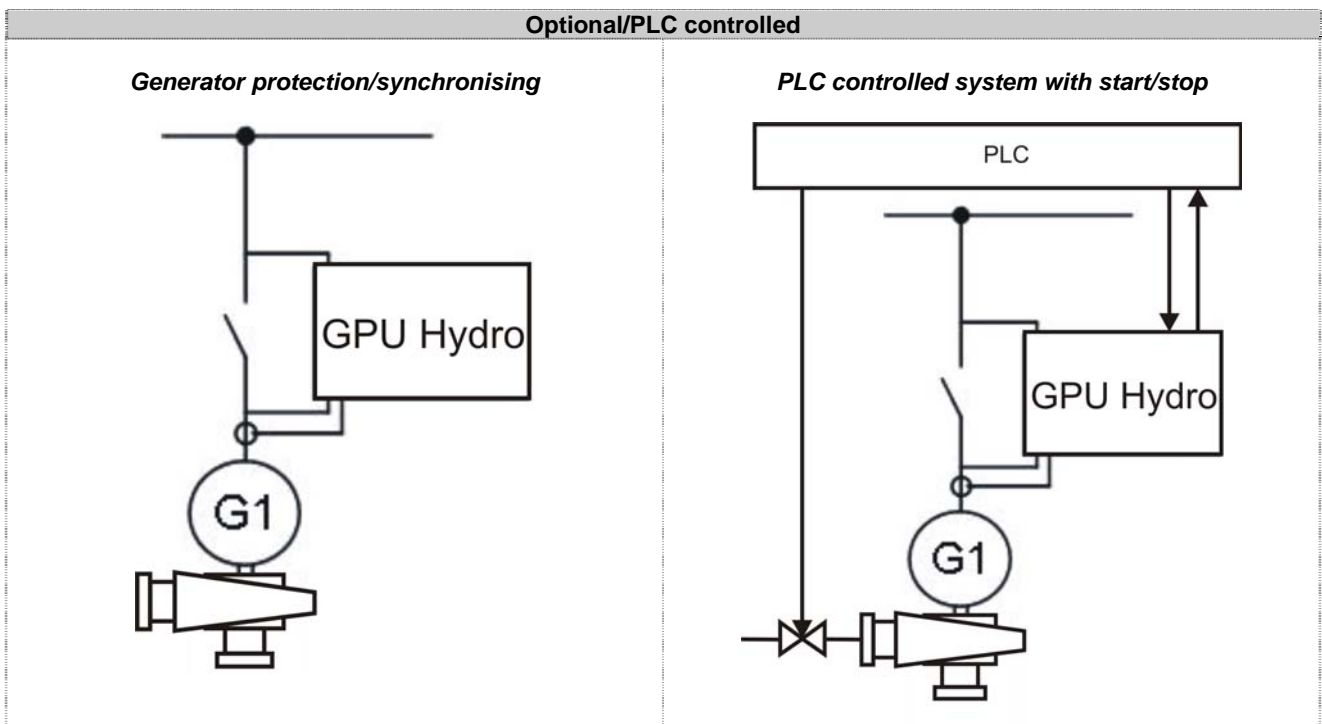
Principle diagram



Single line application diagrams



i Overcurrent and reverse power alarms are standard.



i The GPU Hydro can be used in simple or complex applications. The above shows very simple applications only.

Available options



Please notice that not all options can be selected for the same unit. Please refer to page 5 in this data sheet for further information about the location of the options in the unit.

Option	Description	Type	Note
A	Loss of mains protection package		
A1	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81) Vector jump (78) df/dt (ROCOF) (81)	Software option	
A2	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81) df/dt (ROCOF) (81)	Software option	
A3	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81) Vector jump (78)	Software option	
B	Generator/busbar/mains protection package		
B1	Over- and undervoltage (generator and busbar/mains) (27/59) Over- and underfrequency (generator and busbar/mains) (81)	Software option	
C	Generator add-on protection package		
C1	Over- and undervoltage (generator) (27/59) Over- and underfrequency (generator) (81) Overload (32) Fast overcurrent (<42 ms, 350%, 2 levels) (50) Current unbalance (46) Voltage asymmetry (47) Reactive power import (excitation loss) (40) Reactive power export (overexcitation) (40)	Software option	
C2	Negative sequence voltage high (47) Negative sequence current high (46) Zero sequence voltage high (59) Zero sequence current high (50)	Software option	
D	Voltage control		
D2	Constant voltage control (stand-alone)	Software option	Requires option G2
F	Analogue transducer outputs		
F1	2 transducer outputs, 0-20mA or 4-20mA	Hardware option	Refer to page 5
F2	4 transducer outputs, 0-20mA or 4-20mA	Hardware option	Refer to page 5
G	Start/stop/synchronisation outputs		
G2	Synchronisation with relay speed governor outputs	Hardware option	Refer to page 5
H	Serial communication		
H1	CAN-open	Hardware option	Refer to page 5
H2	Modbus RTU	Hardware option	Refer to page 5
H3	Profibus DP	Hardware option	Refer to page 5
J	Cables		
J1	Display cable with plugs, 3 m. UL94 (V1) approved	Other	
J2	Display cable with plugs, 6 m. UL94 (V1) approved	Other	
J3	PC cable for utility software (RS232). UL94 (V1) approved	Other	
J6	Display cable with plugs, 1 m. UL94 (V1) approved	Other	
K	Documentation		
K1	Designer's Reference Handbook (hard copy)	Other	
K2	CD-ROM with complete documentation	Other	
L	Display gasket for IP54	Other	Standard is IP52
M	Configurable engine control cards		
M1	Turbine control card with PT100 sensor inputs 4 x 4-20mA inputs 2 x PT100 inputs 1 x tachometer input (magnetic pick-up) 5 x binary inputs 3 x relay outputs	Hardware option	Refer to page 5 Start/stop logic can be switched ON/OFF
M	Configurable I/O extension cards		
M13	7 binary inputs, configurable	Hardware option	Refer to page 5
M14	4 relay outputs	Hardware option	Refer to page 5
M15	4 analogue inputs, configurable, 4-20mA	Hardware option	Refer to page 5

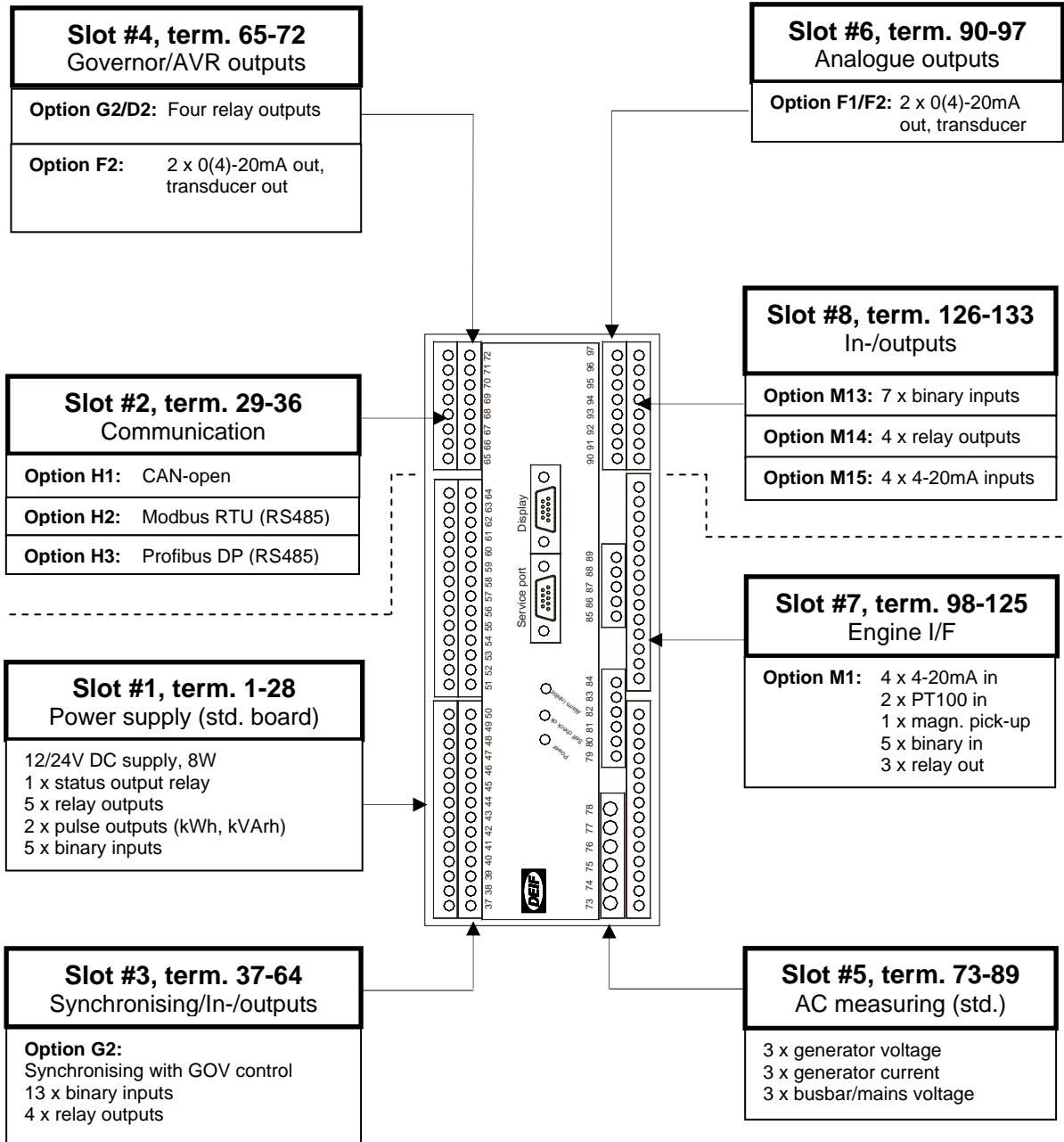
(ANSI# as per IEEE Std C37.2-1996 (R2001) in parenthesis).

Hardware overview



Each slot can hold no more than one hardware option. For instance, it is not possible to select option H2 and option H3 at the same time because both options require a PCB in slot #2.

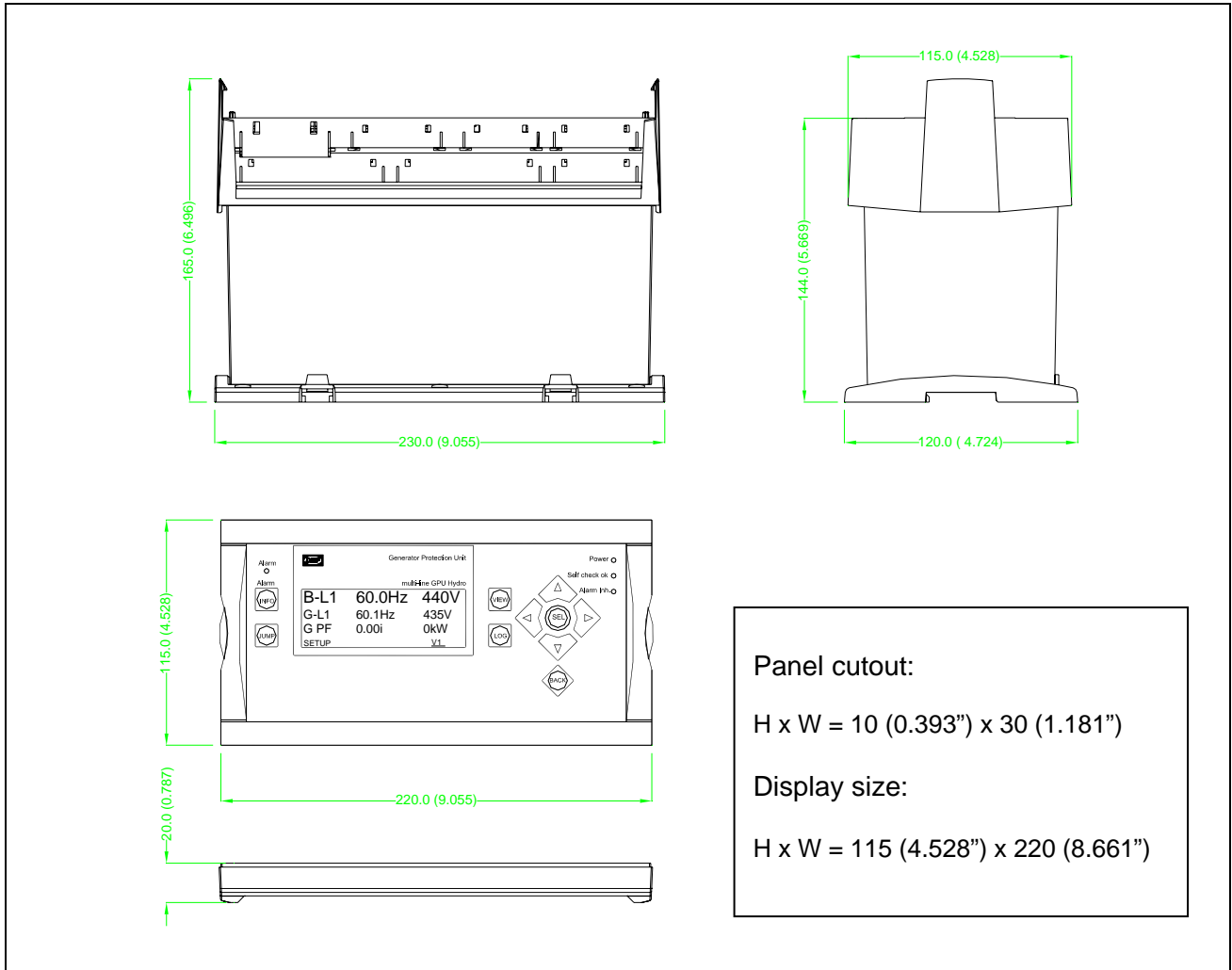
Apart from the hardware options shown on this page, it is possible to select the software options mentioned on page 4 in this data sheet. Options A, B, C and D are software options.



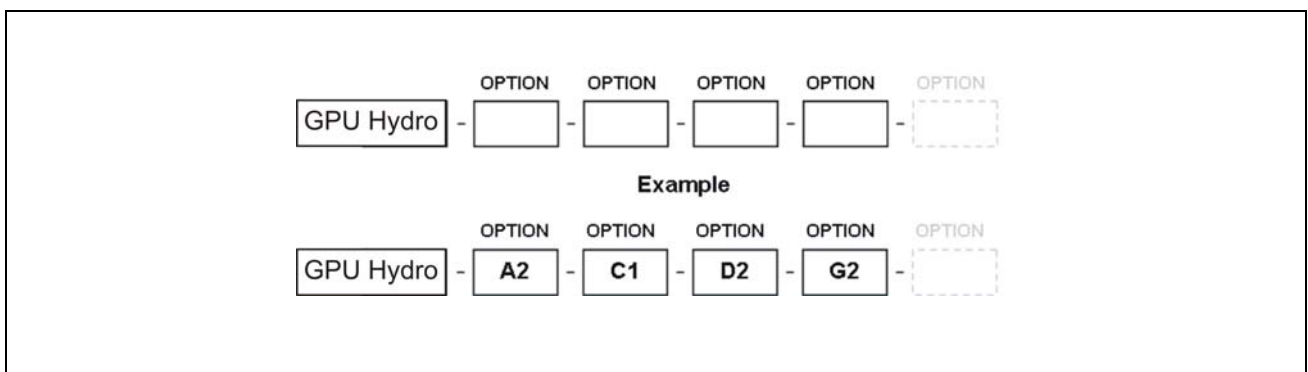
Technical specifications

<p>Accuracy: Class 1.0 Class 2.0 for neg. seq. current (To IEC 688)</p> <p>Operating temp.: -25-70°C (-13-158° F)</p> <p>Galvanic separation: Between AC voltage, AC current and other I/Os: 3250V AC, 50Hz, 1 min. Between analogue outputs: 500V DC, 1 min.</p> <p>Meas. voltage: 100-690V AC +/-20%</p> <p>Consumption: Max. 0.25VA/phase</p> <p>Meas. current: -/1 or -/5A AC</p> <p>Consumption: Max. 0.3VA/phase</p> <p>Current overload: 4 x I_n continuously 20 x I_n, 10 sec. (max. 75A) 80 x I_n, 1 sec. (max. 300A)</p> <p>Meas. frequency: 30-70Hz</p> <p>Aux. supply: 12/24V DC (8-36V continuously, 6V 1 sec.) Max. 8W consumption Recommended power supply is DEIF's DCP-2</p> <p>Binary inputs: Optocoupler, bi-directional ON: Input voltage 8-36V DC Impedance typically 4.7kΩ OFF: <2V DC</p> <p>Relay outputs: 250V AC/24V DC, 8A (Unit status output: 1A)</p> <p>Analogue inputs: 4-20mA: Impedance max. 50Ω, not galvanically separated PT100: According to EN/IEC 60751 + A2</p> <p>Mounting: DIN-rail mount or base mount with 6 screws (Base mounting in marine applications)</p> <p>Climate: Class HSE, to DIN 40040</p>	<p>Analogue outputs: 0(4)-20mA Galvanically separated Active output (internal supply) Load max. 500Ω</p> <p>Safety: To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2</p> <p>Protection: Unit: IP20 Display: IP52 (IP54 with gasket: Option L) To IEC 529 and EN 60529</p> <p>EMC/CE: To EN 50081-1/2, EN 50082-1/2 SS4631503 (PL4) and IEC 255-3</p> <p>Material: All plastic materials are self-extinguishing according to UL94 (V1)</p> <p>Plug connections: AC current: 4.0 mm² multi stranded Other: 2.5 mm² multi stranded Display: 9-pole Sub-D female PC: 9-pole Sub-D male</p> <p>Open collector outputs: Supply 8-36V DC, max. 10mA</p> <p>Weight: Main unit: 1.6 kg (3.5 lbs.) Option J1/J3: 0.2 kg (0.4 lbs.) Option J2: 0.4 kg (0.9 lbs.)</p> <p>Approval: UL 508</p> <p>Response times: <i>Busbar 1 and 2:</i> Over-/undervoltage <50 ms Over-/underfrequency <50 ms <i>Generator:</i> Over-/undervoltage 70-300 ms Over-/underfrequency 70-300 ms Current: 100-300 ms Rocof: 100 ms (4 periods) Vector jump: 30 ms Fast overcurrent: <42 ms</p>
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Unit dimensions in mm (inches)



Order specifications



Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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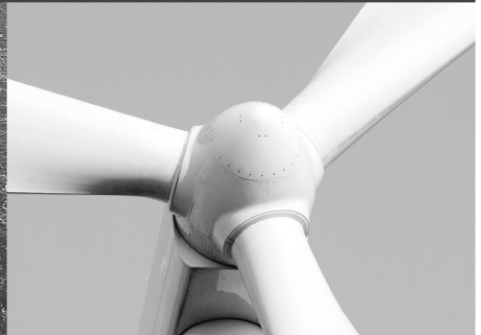




-power in control



Generator Protection Unit, GPU-3 Hydro DATA SHEET



Generator Protection (ANSI)

- 2 x reverse power (32)
- 5 x overload (32)
- 6 x overcurrent (50/51)
- 2 x overvoltage (59)
- 3 x undervoltage (27)
- 3 x over-/underfrequency (81)
- Voltage-dependent overcurrent (51V)
- Current/voltage unbalance (60)
- Loss of excitation/overexcitation (40/32RV)
- 9 x NEL groups

Busbar protection (ANSI)

- 3 x overvoltage (59)
- 4 x undervoltage (27)
- 3 x overfrequency (81)
- 4 x underfrequency (81)
- Voltage unbalance
- 3 x NEL groups

M-logic (Micro PLC)

- Simple logic configuration tool
- Selectable input/output events

Display

- Status texts
- Info messages
- Alarm indication
- Prepared for remote mounting
- Prepared for additional remote displays

General

- USB interface to PC
- Free PC utility software for commissioning
- Programmable parameters, timers and alarms
- User-configurable texts



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Document no.: 4921240353B
SW version: 3.0x.x or later

Application

The Generator Protection Unit (GPU-3 Hydro) is a compact microprocessor-based protection unit containing all necessary functions for protection of a hydro turbine driven synchronous/asynchronous generator. It contains all necessary galvanically separated 3-phase measuring circuits.

The GPU-3 Hydro is well-suited for PLC-controlled systems, and the interfacing can be done via digital and analogue I/Os or via serial communication.

Display unit

The display unit is separate and can be installed directly on the main unit or in the front of the switchboard door (3m display cable included). Up to 2 additional displays can be installed within 200m.

The display unit shows all measured and calculated values as well as alarms and data from the event log.

Self-test

The GPU-3 Hydro automatically carries out a cyclical self-test at start-up. If any errors are found, they will be displayed in clear text in the display and indicated with a relay output (status output).

M-logic (Micro PLC)

This configuration tool is part of the PC utility software which is free of charge. With this tool, it is possible to customise the application to your needs. It is possible to dedicate specific functions or logical conditions to different inputs and outputs.

Setup

Setup is easily done via a menu structure in the display (password-protected) or via the USB PC connection and the Multi-line 2 Windows®-based PC utility software. The PC utility software can be downloaded free of charge from www.deif.com/Download_centre. The utility software offers additional features such as monitoring of all relevant information during commissioning, saving and downloading of settings and downloading of software updates.

Synchronisation

As an option, the GPU-3 Hydro can perform synchronisation of the generator. After closing of the breaker the regulation is switched OFF, and the GPU-3 Hydro will carry out all necessary protective functions.

Options

In order to perfectly match the product solution to specific applications, the functionality of the GPU-3 Hydro can be equipped with a number of available options. The options selected by the customer will be integrated in the standard GPU-3 Hydro, hereby securing the same user interface unaffected by whether the application needs a highly complex or a more basic gen-set controller.

Please refer to pages 5 and 6 for the options available.

Approvals

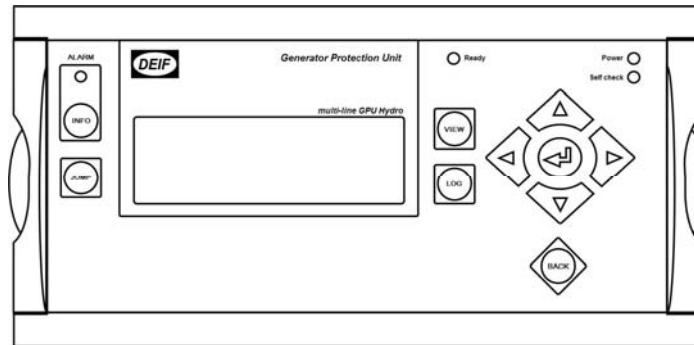
The GPU-3 Hydro is UL/cUL listed.



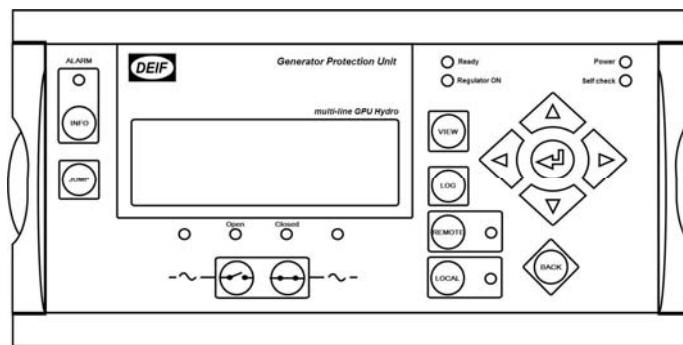
Please refer to www.deif.com for details and certificates.

Display layouts

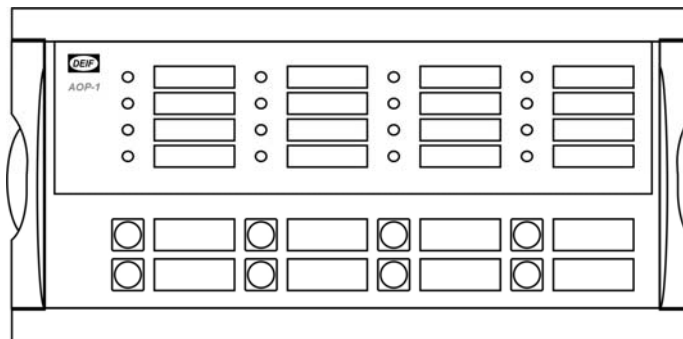
Standard delivery



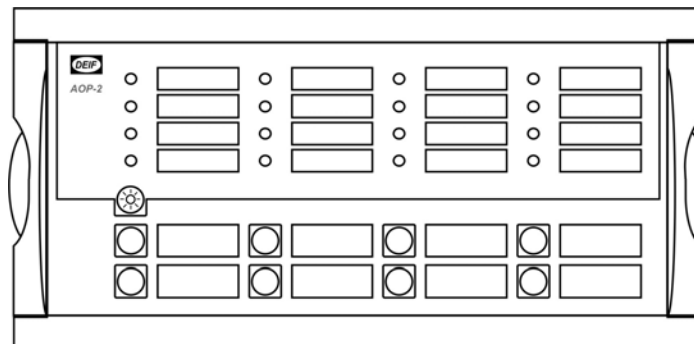
GB control (option Y5)

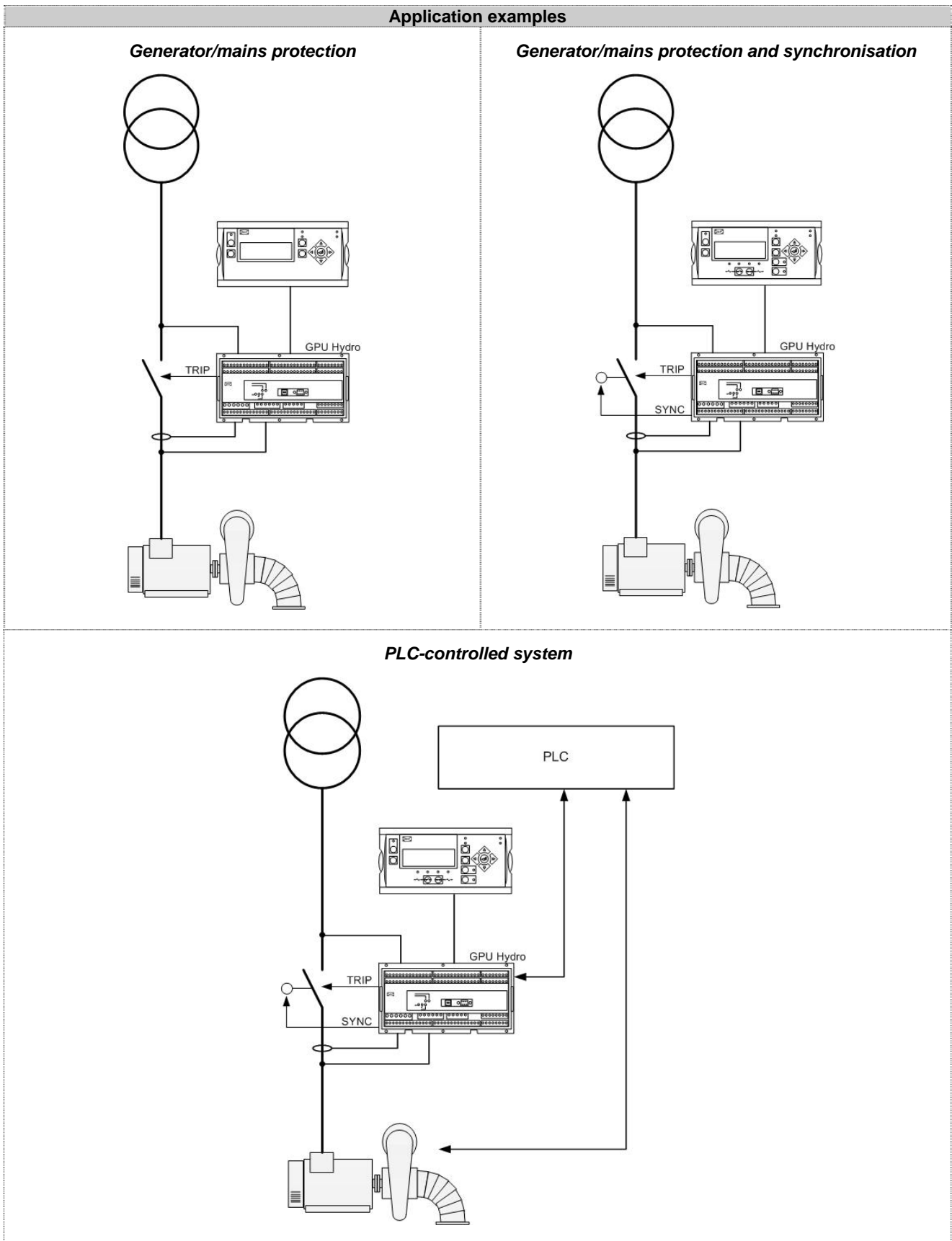


Additional operator's panel - AOP-1 (option X3)



Additional operator's panel - AOP-2 (option X4)





The GPU-3 Hydro can be used in simple or complex applications. The above shows very simple applications only, but due to the flexibility, the GPU-3 Hydro can be used in all types of applications.

Option	Description	Slot no.	Option type	Note
A	Mains protection package			
A1	Time-dependent undervoltage (27t) Undervoltage and reactive power low (27Q) Vector jump (78) df/dt (ROCOF) (81)		Software	
A4	Positive sequence (mains voltage low) (27)		Software	
A5	Directional overcurrent (67)		Software	
C	Generator add-on protection package			
C2	Negative sequence voltage high (47) Negative sequence current high (46) Zero sequence voltage high (59) Zero sequence current high (50) Power dependent reactive power import/export (40) Inverse time overcurrent (51)		Software	
D	Voltage control			
D1	Voltage control		Software	Requires G2
E and F	Analogue controller and transducer outputs			
E1	2 x +/-25mA (GOV/AVR or transducer)	4	Hardware	Not with E2, EF2, EF4 or M14.4 AVR output requires D1
E2	2 x 0(4)...20mA (GOV/AVR or transducer)	4	Hardware	Not with E1, EF2, EF4 or M14.4 AVR output requires D1
EF2	1 x +/-25mA (GOV/AVR or transducer) 1 x 0(4)...20mA (GOV/AVR or transducer)	4	Hardware	Not with E1, E2, EF4 or M14.4 AVR output requires D1
EF4	1 x +/-25mA (GOV/AVR or transducer) 2 x relay outputs (GOV/AVR or configurable)	4	Hardware	Not with E1, E2, EF2 or M14.4 AVR output requires D1
F1	2 x 0(4)...20mA (transducer)	6	Hardware	Not with M13.6, M14.6 or M15.6
G	Synchronisation			
G2	Synchronisation (GOV/AVR control)		Software	Outputs for regulation are not included AVR control requires D1
H	Serial communication			
H2	Modbus RTU/ASCII (RS485)	2	Hardware	Not with H3, H8.2 or H9.2
H3	Profibus DP	2	Hardware	Not with H2, H8.2 or H9.2
H8.X	External I/O modules	2, 8	Hardware	H8.2: Not with H2, H3, H8.8 or H9.2 H8.8: Not with H5, H6, H8.2, M13.8, M14.8 or M15.8
H9.2	Modbus RTU/ASCII (RS232) and GSM modem connection	2	Hardware	Not with H2, H3 or H8.2
J	Cables			One 3m display cable per GPU-3 Hydro unit is included as standard
J2	Display cable with plugs, 6m UL94 (V1) approved		Other	Not with J6 Will replace the std. display cable
J4	PC cable for option N-programming UL94 (Ethernet cable crossed), 3m UL94 (V1) Listed		Other	
J6	Display cable with plugs, 1m UL94 (V1) approved		Other	Not with J2 Will replace the std. display cable
J7	PC cable for utility software (USB) 3m UL94 (V1) approved		Other	
K	Documentation			
K1	Designer's Reference Handbook (hard copy)		Other	
K2	CD-ROM with complete documentation		Other	
L	Display gasket for IP54		Other	Standard is IP52
M	Engine control, digital and analogue I/Os			
M4	Engine control OR I/O extension	7	Hardware	
M12	13 binary inputs, configurable 4 relay outputs, configurable	3	Hardware	
M13.X	7 binary inputs, configurable	6, 8	Hardware	M13.6: Not with F1, M14.6 or M15.6 M13.8: Not with H5, H6, H8.8, M14.8 or M15.8
M14.X	4 relay outputs, configurable	4, 6, 8	Hardware	M14.4: Not with E1, E2, EF2 and EF4 M14.6: Not with F1, M13.6 or M15.6 M14.8: Not with H5, H6, H8.8, M13.8 or M15.8
M15.X	4 analogue inputs, configurable, 4...20mA	6, 8	Hardware	M15.6: Not with F1, M13.6 or M14.6 M15.8: Not with H5, H6, H8.8, M13.8 or M14.8

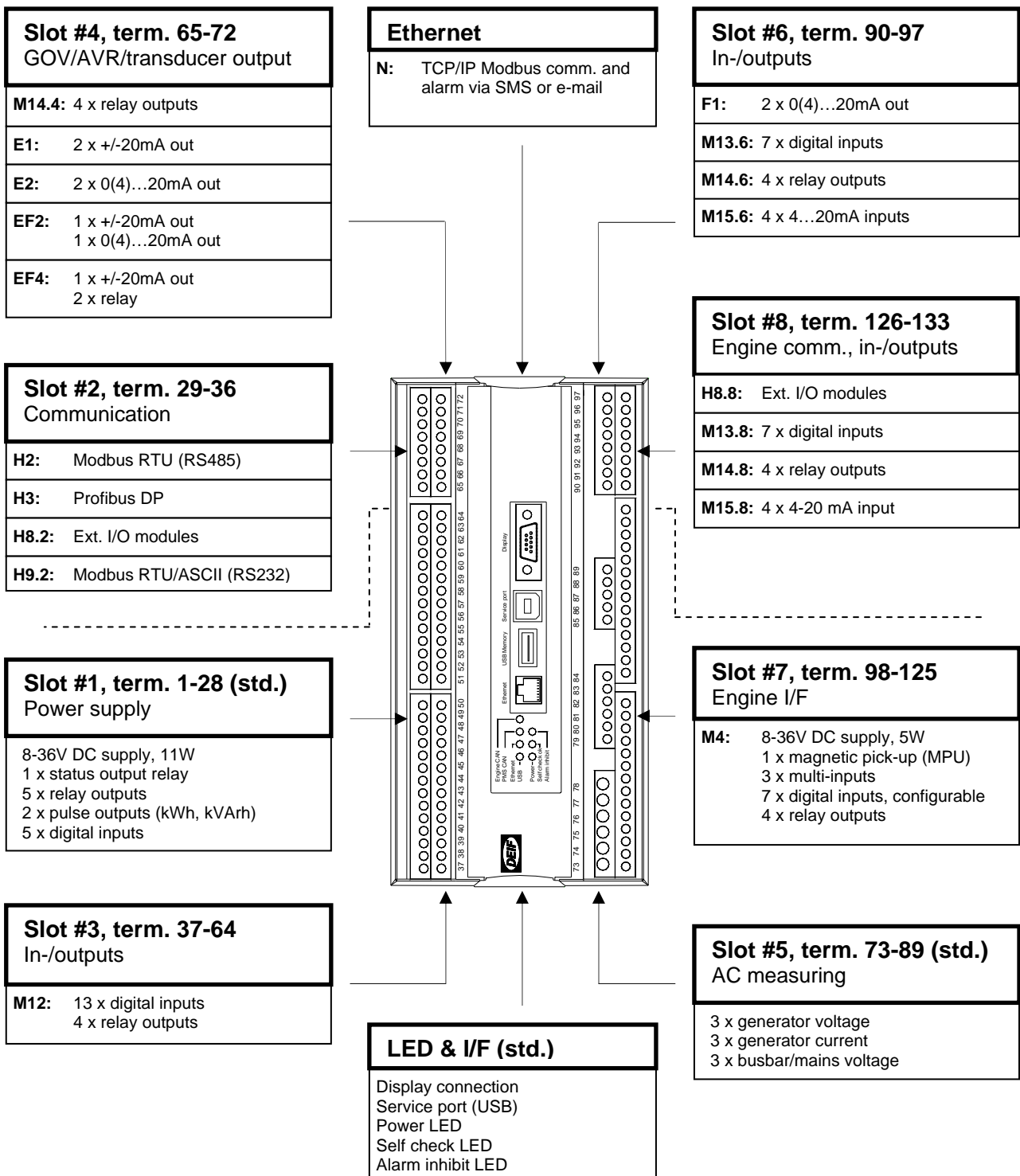
(ANSI# as per IEEE Std. C37.2-1996 (R2001) in parenthesis).

Option	Description	Slot no.	Option type	Note
N	Ethernet TCP/IP communication			
N	Ethernet TCP/IP Modbus comm. and alarms via SMS or e-mail		Hardware/software	
Q	Measurement accuracy			
Q1	Verified class 0.5		Other	
X	Display			One display per GPU-3 Hydro unit is included as standard
X2	Additional standard display. CANbus comm.		Other	Two X2 options can be ordered for each GPU Hydro unit
X3	Additional operator's panel (AOP-1): 16 configurable LEDs and 8 configurable push-buttons		Other	Max. one AOP-1 for each display unit
X4	Additional operator's panel (AOP-2): 16 configurable LEDs, 8 configurable buttons and 1 status relay. CANbus comm.		Other	Five X4 options can be ordered for each GPU Hydro unit
Y	Display layout			
Y5	GB control		Other	Requires G2



Please notice that not all options can be selected for the same unit. Please refer to page 7 in this data sheet for further information about the location of the HW options in the unit.

Hardware overview



i There can only be one hardware option in each slot. It is e.g. not possible to select option H2 and option H3 at the same time, because both options require a PCB in slot #2.

i Besides the hardware options shown on this page, it is possible to select the software options mentioned in the chapter 'Available options'.

Technical specifications

Accuracy:	<p>Class 1.0</p> <p>Positive, negative and zero sequence alarms: Class 1 within 5% voltage unbalance</p> <p>Class 1.0 for negative sequence current</p> <p>Fast overcurrent: 3% of 350%*I_n</p> <p>Analogue outputs: Class 1.0 according to total range</p> <p>Option EF4: Class 4.0 according to total range</p> <p>To IEC/EN 60688</p>	Analogue inputs:	<p>0(4)...20mA</p> <p>Impedance: 50Ω</p> <p>Not galvanically separated</p> <p>RPM (MPU): 2...70V AC, 10...10000Hz, 250...3000Ω</p>
Operating temp.:	<p>-25...70°C (-13...158° F) (UL/cUL Listed: Max. surrounding air temp.: 55°C/131°F)</p>	Multi-inputs:	<p>0(4)...20mA: 0-20mA, +/-1% Not galvanically separated</p> <p>Binary: Max. resistance for ON detection: 100Ω Not galvanically separated</p> <p>PT100/1000: -40...250°C, +/-1% Not galvanically separated To IEC/EN 60751</p> <p>VDO: 0...1700Ω, +/-2% Not galvanically separated</p> <p>V DC: 0...40V DC, +/-1% Not galvanically separated</p>
Storage temp.:	-40...70°C (-40...158° F)	Relay outputs:	<p>Electrical rating: 250V AC/30V DC, 5A (UL/cUL Listed: 250V AC/24V DC, 2A resistive load)</p> <p>Thermal rating @ 50°C: 2A: Continuously 4A: t_{ON} = 5 sec., t_{OFF} = 15 sec. (Unit status output: 1A)</p>
Climate:	97% RH to IEC 60068-2-30	Open collector outputs:	Supply: 8...36V DC, max. 10mA
Meas. voltage:	<p>100-690V AC +/-20% (UL/cUL Listed: 480V AC phase-phase)</p>	Analogue outputs:	<p>0(4)...20mA and +/-25mA Galvanically separated Active output (internal supply) Load max. 500Ω (UL/cUL Listed: Max. 20mA output)</p> <p>Update rate: Transducer output: 250ms Regulator output: 100ms</p>
Consumption:	Max. 0.25VA/phase		
Meas. current:	<p>-/1 or -/5A AC (UL/cUL Listed: From CTs 1-5A)</p>		
Consumption:	Max. 0.3VA/phase		
Current overload:	<p>4 x I_n continuously 20 x I_n, 10 sec. (max. 75A) 80 x I_n, 1 sec. (max. 300A)</p>		
Meas. frequency:	30...70Hz		
Aux. supply:	<p>Terminals 1 and 2: 12/24V DC (8...36V continuously, 6V 1 sec.) Max. 11W consumption</p> <p>Terminals 98 and 99: 12/24V DC (8...36V continuously, 6V 1 sec.) Max. 5W consumption</p> <p>The aux. supply inputs are to be protected by a 2A slow-blow fuse</p> <p>(UL/cUL Listed: AWG 24)</p>		
Binary inputs:	<p>Optocoupler, bi-directional ON: 8...36V DC Impedance: 4.7kΩ OFF: <2V DC</p>		

Data sheet

Generator Protection Unit, GPU-3 Hydro

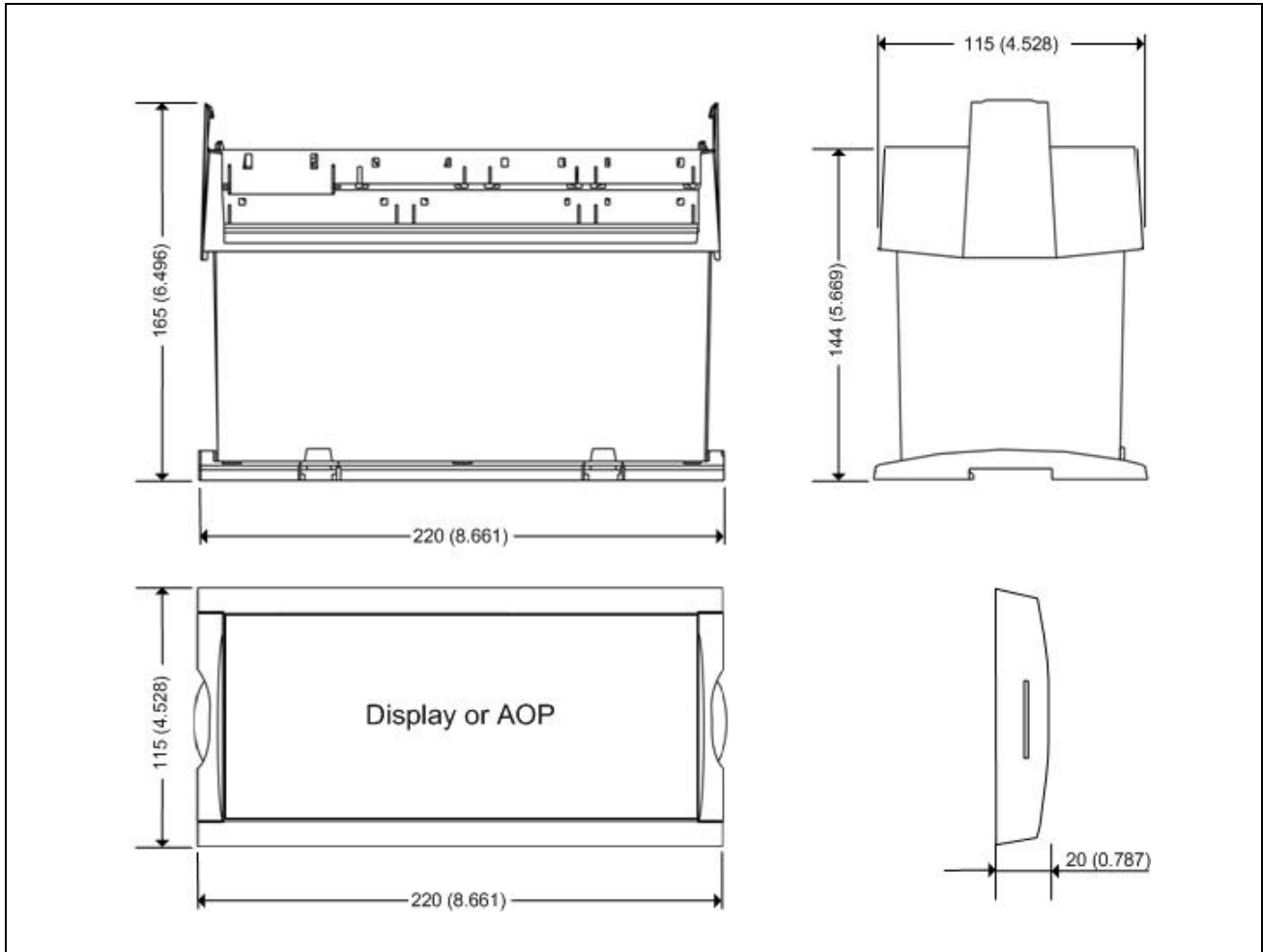
Galv. separation:	Between AC voltage, AC current and other I/Os: 3250V AC, 50Hz, 1 min. Between analogue outputs and other I/Os: 500V DC, 1 min. Between binary input groups and other I/Os: 500V DC, 1 min.	10...60Hz: 0.15mm _{pp} 60...150Hz: 1g To IEC 60255-21-1 Response (class 2) 10...150Hz: 2g To IEC 60255-21-1 Endurance (class 2)
Response times: (Delay set to minimum)		
<i>Busbar:</i>		
Over-/undervoltage:	< 50ms	
Over-/underfrequency:	< 50ms	
Voltage unbalance:	<200ms	
<i>Generator:</i>		
Reverse power:	<200ms	
Overcurrent:	<200ms	
Fast overcurrent:	< 40ms	
Over-/undervoltage:	<200ms	
Over-/underfrequency:	<300ms	
Overload:	<200ms	
Current unbalance:	<200ms	
Voltage unbalance:	<200ms	
React. power import:	<200ms	
React. power export:	<200ms	
Overspeed:	<400ms	
Digital inputs:	<250ms	
Emergency stop:	<200ms	
Multi-inputs:	<800ms	
Wire failure:	<600ms	
<i>Mains:</i>		
df/dt (ROCOF):	<130ms (4 periods)	
Vector jump:	< 40ms	
Positive sequence:	< 60ms	
Mounting:	DIN-rail mount or base mount with 6 screws	
Safety:	To EN 61010-1, installation category (overvoltage category) III, 600V, pollution degree 2 To UL 508 and CSA 22.2 no. 14-05, overvoltage category III, 300V, pollution degree 2	
EMC/CE:	To EN 61000-6-1/2/3/4 IEC 60255-26 IEC 60533 power distr. zone IACS UR E10 power distr. zone	
Vibration:	3...13.2Hz: 2mm _{pp} 13.2...100Hz: 0.7g To IEC 60068-2-6 & IACS UR E10	
Shock (base mount):		10g, 11msec, half sine To IEC 60255-21-2 Response (class 2) 30g, 11msec, half sine To IEC 60255-21-2 Endurance (class 2) 50g, 11msec, half sine To IEC 60068-2-27
Bump:		20g, 16msec, half sine To IEC 60255-21-2 (class 2)
Material:		All plastic materials are self-extinguishing according to UL94 (V1)
Plug connections:		AC current: 0.2-4.0 mm ² stranded wire (UL/cUL Listed: AWG 18) AC voltage: 0.2-2.5 mm ² stranded wire (UL/cUL Listed: AWG 20) Relays: (UL/cUL Listed: AWG 22) Terminals 98-116: 0.2-1.5 mm ² stranded wire (UL/cUL Listed: AWG 24) Other: 0.2-2.5 mm ² stranded wire (UL/cUL Listed: AWG 24) Display: 9-pole sub-D female Service port: USB A-B
Protection:		Unit: IP20 Display: IP52 (IP54 with gasket: Option L) (UL/cUL Listed: Type Complete Device, Open Type) To IEC/EN 60529
Governors:		Multi-line 2 interfaces to all governors, including GAC, Barber-Colman, Woodward and Cummins See interfacing guide at www.deif.com

Data sheet

Generator Protection Unit, GPU-3 Hydro

Approvals:	UL/cUL Listed to UL508
UL markings:	Wiring: Use 60/75°C copper conductors only Mounting: For use on a flat surface of type 1 enclosure Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)
AOP-2:	Maximum ambient temperature: 60°C Wiring: Use 60/75°C copper conductors only Mounting: For use on a flat surface of type 3 (IP54) enclosure Main disconnect must be provided by installer Installation: To be installed in accordance with the NEC (US) or the CEC (Canada)
DC/DC converter for AOP-2:	Tightening torque: 0.5Nm (4.4lb-in) Wire size: AWG 22-14
Weight:	Base unit: 1.6 kg (3.5 lbs.) Option J1/J3/J6: 0.2 kg (0.4 lbs.) Option J2: 0.4 kg (0.9 lbs.) Display: 0.4 kg (0.9 lbs.)

Unit dimensions in mm (inches)



Order specifications

Type Version Option Option Option Option Displays

GPU Hydro

Example:

Type Version Option Option Option Option Displays

GPU Hydro 3 C2 H2 M13.6 213

Displays

213

Total number of displays:
 1: 1 std. display (always included)
 2: 1 std. + 1 add. display (option X2)
 3: 1 std. + 2 add. displays (option X2)

Total number of AOP-1 (Option X3)

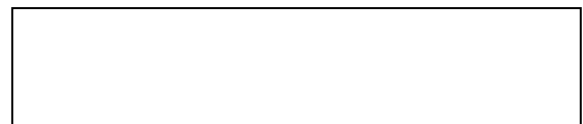
Total number of AOP-2 (Option X4)

Due to our continuous development we reserve the right to supply equipment which may vary from the described.









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Switchboard Instrumentation

	Battery Charger, DCP2-1205	Battery Charger, DCP2-2405	Battery Charger, DCP2-1210
			
Main function:	The DCP2 can be applied as battery charger or as a universal DC voltage supply.	The DCP2 can be applied as battery charger or as a universal DC voltage supply.	The DCP2 can be applied as battery charger or as a universal DC voltage supply.
Input voltage:	1 x 230V AC $\pm 15\%$ 47...63Hz	1 x 230V AC $\pm 15\%$ 47...63Hz	1 x 230V AC $\pm 15\%$ 47...63Hz
Output voltage:	12V DC (adjustable 11.8...13.8V DC)	24V DC (adjustable 23.5...27.5V DC)	12V DC (adjustable 11.8...13.8V DC)
Output current:	5A (typical current limit 6A)	5A (typical current limit 6A)	10A (typical current limit 12.5A)
Protection:	IP20	IP20	IP20
Size:	147 x 123 x 86 mm	147 x 123 x 86 mm	205 x 123 x 86 mm
Weight:	Approx. 0.8 kg	Approx. 0.8 kg	Approx. 1.2 kg
	Battery Charger, DCP2-2410	Battery Charger, DCP2-2420	Battery Charger, DCP2-2420
			
Main function:	The DCP2 can be applied as battery charger or as a universal DC voltage supply.	The DCP2 can be applied as battery charger or as a universal DC voltage supply.	The DCP2 can be applied as battery charger or as a universal DC voltage supply.
Input voltage:	1 x 115V AC $\pm 15\%$ 1 x 230V AC $\pm 15\%$ 47...63Hz	1 x 230V AC $\pm 15\%$ 47...63Hz	3 x 400/480V AC $\pm 15\%$ 47...63Hz
Output voltage:	24V DC (adjustable 23.5...27.5V DC)	24V DC (adjustable 23.5...27.5V DC)	24V DC (adjustable 23.5...27.5V DC)
Output current:	10A (typical current limit 12.5A)	20A (typical current limit 25A)	20A (typical current limit 25A)
Protection:	IP20	IP20	IP20
Size:	205 x 123 x 86 mm	240 x 153 x 86 mm	240 x 153 x 86 mm
Weight:	Approx. 1.2 kg	Approx. 1.9 kg	Approx. 1.9 kg

Battery Charger, DCP2-2440



Main function: The DCP2 can be applied as battery charger or as a universal DC voltage supply.

Input voltage: 3 x 400/480V AC ±15%
47...63Hz

Output voltage: 24V DC
(adjustable 23.5...27.5V DC)

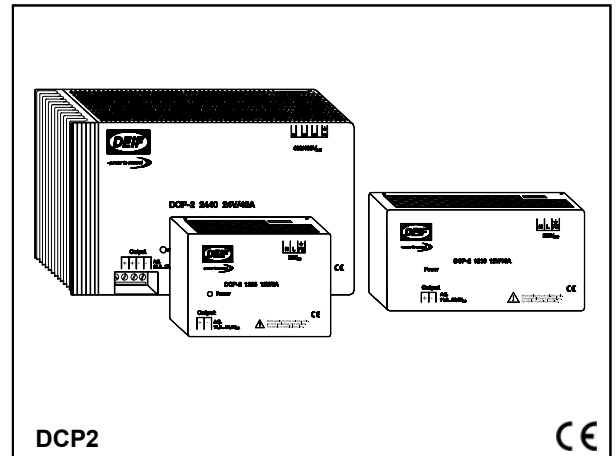
Output current: 40A
(typical current limit 45A)

Protection: IP20

Size: 292 x 185 x 130 mm

Weight: Approx. 3.6 kg

- **Easy installation - DIN-rail mounting**
- **Automatic recovery from overload conditions**
- **5-10-20-40A types**
- **Switch mode power technology**
- **Extremely low ripple <100mV**



Application

The DCP2 can be applied as battery charger or stabilized network component as a universal DC voltage supply. As battery charger parallel operation with other DC consumers is possible.

DCP2 as battery charger

As battery charger the DCP2 is applied to charge and to maintain the full-charge condition of closed or gastight 24V (12V) Pb batteries.

In parallel operation with a battery and other consumers the nominal power for the consumers is given until interruption from the battery, e.g. for the reason of recharging/maintenance.

DCP2 as network component (power supply)

As stabilized network component the DCP2 supplies connected consumers with a stabilized DC voltage.

Protection

The DCP2 is protected against continuous short circuit as well as continuous no-load operation. Further characteristics of the DCP2 are the high efficiency and the high voltage stabilization.

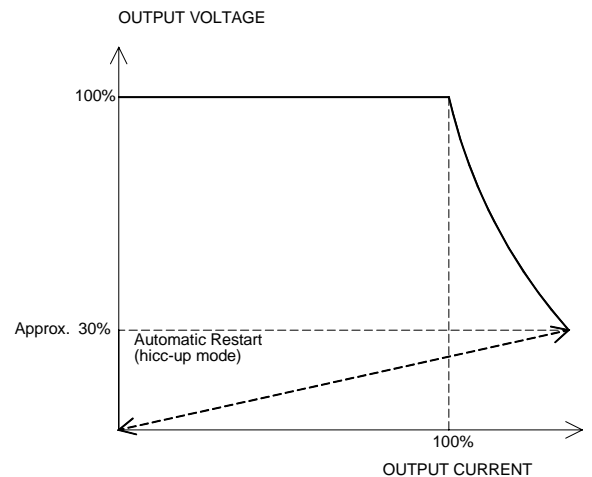
Principle/operation

Application as stabilized net unit (supply)

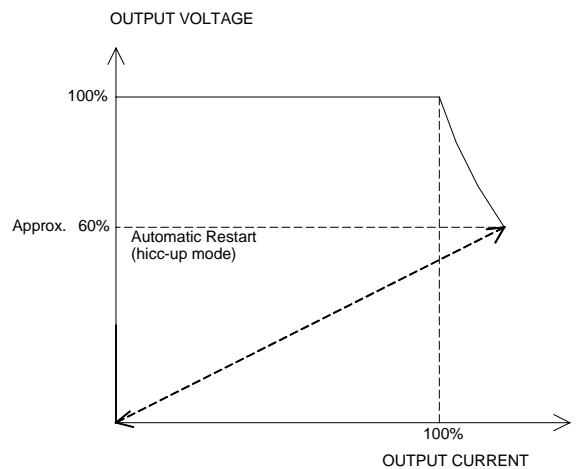
The DCP2 supplies a constant output voltage, according to setting, in the range of 23.5-27.5V DC respectively 11.8-13.8V DC (stabilized network component).

The output voltage is held constant as long as the load does not exceed the nominal current. A load exceeding the current limitation will automatically reduce the output voltage (see the curves in the next column). Typical current limit for each type is specified under Technical specifications, section Output current.

For 10A, 20A and 40A types:



For 5A types:



Type DCP2

Application as battery charger

When charging of a discharged battery is initiated, a high charging current will flow, which is limited and controlled by the DCP2. Voltage will immediately jump to approx. 2.1V per cell (12.6V for 12V types and 25.2V for 24V types).

Normally it is recommended from manufacturers of Pb batteries to obtain 2.25V per cell at temperatures up to 30°C, before the battery is fully charged and trickling can start. For a 12V Pb battery this gives a trickle charging voltage of 13.5V (2.25 x 6 cells) and 27V (2.25 x 12 cells) for 24V batteries.

According to information from battery manufacturers, the charging voltage must be reduced by higher ambient temperatures and increased by low temperature.

For that reason it is important to adjust the DC voltage output to the correct level according to the specification for connected batteries. In case the voltage is adjusted too high according to ambient temperature, gassing might occur and cause damage to the sealed battery. As opposed to this, a too low adjustment will cause an insufficient charging.

Factory setting of the output voltage is 26.8V DC for 24V types and 13.4V DC for 12V types.

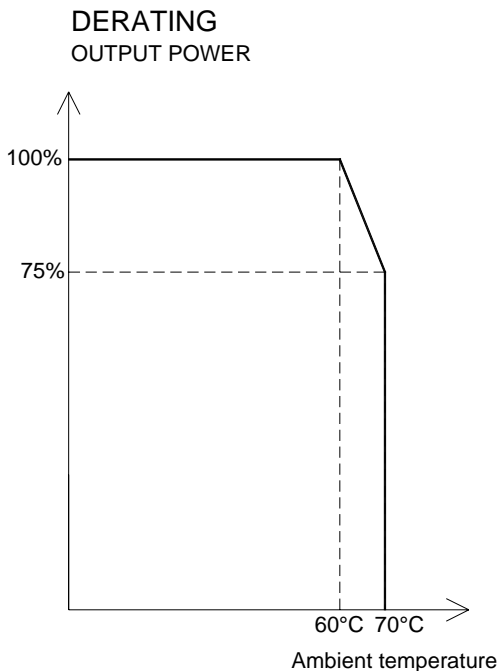
Charging

Charging is carried out according to an I/U characteristic.

When the charging voltage has reached the set value, charging will be with constant voltage. The charging current drops to trickle charging current in addition to the current for other connected consumers.

When reaching the trickle charging voltage the current drops, which prevents overcharge of the battery (no gassing).

At an ambient temperature >60°C the load capacity of the unit drops as illustrated below.



To prevent overheating of the unit, the consumer load must be reduced equivalently.

Type DCP2

Technical specifications

General data:

Duty ratio:	Continuous duty is allowed
Cooling:	Convection
Maintenance:	None
Short circuit:	Protected against continuous short circuit
No-load operation:	Protected against continuous no-load operation
Mounting:	DIN-rail, EN 50022-35
Installation:	Wall mounted, input terminals placed at the top and output terminals at the bottom

Input voltage:	DCP2-1205, -1210, -2405, -2410 and -2420: 1 x 230V AC $\pm 15\%$
	DCP2-2410/115V: 1 x 115V AC $\pm 15\%$
	DCP2-2420 and -2440: 3 x 400/480V AC $\pm 15\%$

Input current:	0.70A at 230V AC	DCP2-1205
	1.32A at 230V AC	DCP2-1210
	1.23A at 230V AC	DCP2-2405
	2.20A at 230V AC	DCP2-2410
	4.00A at 115V AC	DCP2-2410/115
	4.20A at 230V AC	DCP2-2420
	3 x 1.50A at 3 x 400V AC 3 x 3.00A at 3 x 400V AC	DCP2-2420 DCP2-2440

Peak inrush current:	<30A DCP2-1205, -1210, -2405, -2410, -2410/115V
	<50A DCP2-2420, -2440

Freq. range:	47...63Hz (supply)
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Power factor $\cos \varphi$:

DCP2-1205:	0.46 capacitive at 230V AC
DCP2-1210:	0.48 capacitive at 230V AC
DCP2-2420:	0.53 capacitive at 230V AC
DCP2-2405, -2410:	0.52 capacitive at 400V AC
DCP2-2410/115V:	0.52 capacitive at 115V AC
DCP2-2420, -2440:	0.53 capacitive at 400V AC

Fuse:	DCP2-1205, -2405: 5 x 20 mm T3.15A/250V internal
	DCP2-1210, -2410, -2410/115V: 5 x 20 mm T6.3A/250V internal
	DCP2-2420: 5 x 20 mm T10A/250V internal

DCP2-2420, -2440:	Three poles, C-fuse or motor circuit breaker Switch - external (setting 3A)
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Output voltage:	DCP2-12XX: 12V DC (adjustable 11.8...13.8V DC) Factory setting 13.4V DC $\pm 1\%$
	DCP2-24XX: 24V DC (adjustable 23.5...27.5V DC) Factory setting 26.8V DC $\pm 1\%$

Output current:	DCP2-XX05: 5A (typical current limit 6A)
	DCP2-XX10, DCP2-2410/115V: 10A (typical current limit 12.5A)
	DCP2-2420: 20A (typical current limit 25A)
DCP2-2440: 40A (typical current limit 45A)	

Power output:	DCP2-1205	60W
	Attention:	Max. output power 60W at adjustment 13.8V max. 4.3A
	DCP2-2405	120W
	Attention:	Max. output power 120W at adjustment 27.5V max. 4.3A
	DCP2-1210	120W
	Attention:	Max. output power 120W at adjustment 13.8V max. 8.6A
	DCP2-2410, -2410/115V	240W
	Attention:	Max. output power 240W at adjustment 27.5V max. 8.6A
	DCP2-2420	480W (1 phase supply)
	Attention:	Max. output power 480W at adjustment 27.5V max. 17.4A
DCP2-2420	480W	
Attention:	Max. output power 480W at adjustment 27.5V max. 17.4A	
DCP2-2440	960W	
Attention:	Max. output power 960W at adjustment 27.5V max. 34.8A	

Output ripple:	<100 mV _{pp}
-----------------------	-----------------------

Efficiency (typical):

DCP2-1205	82%
DCP2-1210	83%
DCP2-2405	86%
DCP2-2410	89%
DCP2-2410/115V	88%
DCP2-2420	88% (1 phase supply)
DCP2-2420	90%
DCP2-2440	90%

Regulation:

Line regulation:	<0.2% of output voltage at $U_{in} \pm 15\%$
Load regulation:	<1% of output voltage between 0 and rated current
Dynamics:	<2 ms at a load distribution of 10 to 90% from rated current, peaks <2%

Type DCP2

Technical specifications, cont.

Hold-up time:	DCP2-XX05	>80 ms at $U_{in} = 230V$ AC
	DCP2-XX10 and -2410/115V	>15 ms at $U_{in} = 230V$ AC
	DCP2-2420	>15 ms at $U_{in} = 230V$ AC
	DCP2-2420	>5 ms at $U_{in} = 400V$ AC
	DCP2-2440	>5 ms at $U_{in} = 400V$ AC

The determined time, during which a power supply/charger's output remains within a specified voltage range after its input ceases

EMC:	EN 61000-6-3
	EN 61000-6-4
	EN 61000-6-1
	EN 61000-6-2
	EN 61000-6-5

RFI suppression:	According to VDE0875 T11/EN55011 class B
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Static discharge ESD:	8kV contact discharge
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IEC 1000-4-2:	15kV free air discharge
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Electromagnetic fields:	10V/m according to IEC 1000-4-3
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Burst IEC 1000-4-4:	4kV input 2kV output AC-coupled
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Surge IEC 1000-4-5:	4kV asymmetrical 4kV symmetrical
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Galvanic separation:	Between AC voltage, output and protective earth (PE):
	3.11kV DC between terminals Prim./Sec.
	3.11kV DC between terminals Prim./PE
	0.78kV DC between terminals Sec./PE

Safety:	VDE0805/EN60950/IEC950/EN61010-1
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Protection:	Class I
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Deg. of protection:	IP20
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Leakage current:	<0.75mA (47-63Hz line frequency) (DCP2-2420 3 phase supply and DCP2-2440 <3.5mA)
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Temperature:	-10...70°C (operating, free convection)
	-25...85°C (storage)

Reduction of output power:	2.5%/K above +60°C
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Terminals:	DCP2-1205, -1210, -2405, -2410 and -2410/115V:	Primary max. 2.5 mm ² Secondary 2.5 mm ²
	DCP2-2420:	Primary max. 2.5 mm ² Secondary 4.0 mm ²

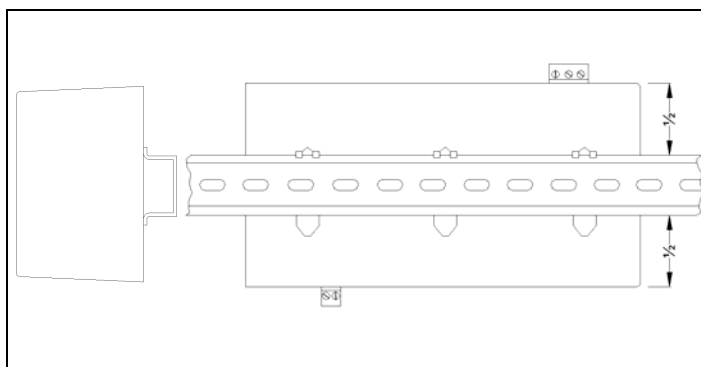
DCP2-2440:	Primary max. 2.5 mm ² Secondary 10.0 mm ²
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Indication:	Green LED – operating indication
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Housing:	All plastic parts are self-extinguishing to UL94 (V0) DCP2-2440 is encapsulated in a metal housing
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Dimensions: W x H x D	147 x 123 x 86 mm	(DCP2-1205, -2405)
	205 x 123 x 86 mm	(DCP2-1210, -2410, -2410/115V)
	240 x 153 x 86 mm	(DCP2-2420)
	292 x 185 x 130 mm	(DCP2-2440)

Mounting:	DIN-rail, EN 50022-35
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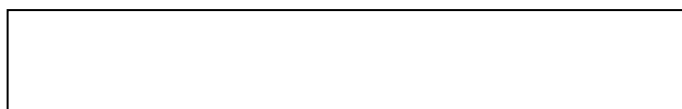
Distance for convection:	100 mm above and below the DCP2 30 mm to each side
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Weight:	DCP2-1205	0.8 kg
	DCP2-2405	0.8 kg
	DCP2-1210	1.2 kg
	DCP2-2410	1.2 kg
	DCP2-2410/115V	1.2 kg
	DCP2-2420	1.9 kg
	DCP2-2440	3.6 kg

Order specifications

Type – output voltage – output current – supply
Example: DCP2 – 24V DC – 5A DC – 1 x 230V AC





Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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	Measuring CT: ASR/ASK/ EASR/EASK	Split core CT: KBU	Summation CT: KSU/SUSK	Primary winding CT: WSK	Protection CT: SASR/SASK
					
Primary current	30 – 7,500 A	100 – 5,000 A	1 or 5 A	1 – 100 A	50 – 2,000A
Secondary current	5 or 1 A	5 or 1 A	5 or 1 A	5 or 1 A	5 or 1 A
Burden	1.0 – 45 VA	1.25 – 30 VA	15 – 30 VA	2.5 – 15 VA	1.0 – 15 VA
Acc. class/ protection class	0.2S – 0.2 – 0.5S – 0.5 – 1.0	0.5 – 1.0	0.5 – 1.0	0.5 – 1.0	5P4 – 5P5 – 5P10 – 10P5 – 10P10
Standards	DIN VDE 0414/1; DIN 42600; and DIN EN 60044/1 edition 12/2003 as well as regulation VBG 4				
Insulation class	E (120°C max.)				
Ambient temperature	-5 – 55°C				
Storage temperature	-25 – 70°C				
Rated maximum operating voltage	$U_m \leq 0.72 \text{ kV}$				
Test voltage	$U_m \leq 0.72 \text{ kV}$				
Operating frequency	50 and 60 Hz (16 2/3 Hz up to 400 Hz on request)				
Class of accuracy	0.2S – 0.2 – 0.5S – 0.5 – 1.0				
Rated secondary current	5 A or 1 A				
Thermal short circuit current (I_{TH})	$I_{TH} = 60 \times I_N$				
Dynamic short circuit current (I_{dyn})	$2.5 \times I_{TH}$				
Continuous overcurrent	$1.0 \times I_N$ ($1.2 \times I_N$ available on request)				
Security factor (FS)	FS 5 up to 1500 A nominal current – FS 10 from 1600 A nominal current				
Accessories	DIN-rail mounting – Mounting kit – Copper tubes – Secondary cap Locking pistons – Sealed shutters – Copper busbars				
Various	<ul style="list-style-type: none"> • Unbreakable plastic housings • Black polycarbonate • Flame resistant • Self-extinguishing • Transformer housings are ultrasonically welded • Nickel-plated secondary terminals with plus-minus nickel-plated screw M 5 × 10mm • Integrated secondary locking caps 				

FOR DETAILED INFORMATION – PLEASE SEE WWW.DEIF.COM



-power in control

TECHNICAL DOCUMENTATION



Measuring current transformers, type ASR/ASK/EASR/EASK

DEIF A/S · Frisenborgvej 33 · DK-7800 Skive · Tel.: +45 9614 9614 · Fax: +45 9614 9615 · info@deif.com · www.deif.com

Document no.: 4921210111E

Current transformers overview

Click on a product name or check mark to jump to information page.

Page	6	7	8	9	10	11	13	14	15	16	18	19	22	24	25	26	Page
Primary nominal current	ASR 14.3*	ASR 20.3*	ASR 201.3*	ASR 21.3*	ASR 21.5	ASR 22.3*	ASK 205.3*	ASK 21.3*	ASK 231.5	ASK 31.3*	ASK 318.3*	ASK 31.4*	ASK 31.5*	ASK 31.6	ASK 41.3*	ASK 421.4	Primary nominal current
A																	A
1																	1
2.5																	2.5
5																	5
10																	10
15																	15
20																	20
25																	25
30	✓													✓		✓	30
40	✓					✓		✓					✓	✓		✓	40
50	✓	✓	✓		✓	✓		✓	✓	✓		✓	✓	✓		✓	50
60	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	60
75	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	75
80		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	80
100		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	100
125		✓	✓		✓				✓							✓	125
150		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	150
200		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	200
250		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	250
300		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	300
400				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	400
500				✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	500
600				✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	600
750										✓	✓	✓	✓	✓	✓	✓	750
800															✓		800
1000																	1000
1200																	1200
1250																	1250
1500																	1500
1600																	1600
1800																	1800
2000																	2000
2500																	2500
3000																	3000
3200																	3200
4000																	4000
5000																	5000
6000																	6000
7500																	7500
Primary conductor in mm							20×5	20×10	30×10	30×10 2×20×10	31×18	30×10 2×20×10	30×10 2×20×10	30×10 20×13	40×12 32×18	20×10	Primary conductor in mm
Round conductor in mm	14	21	21	22.5	21	22.5	17.5	19.2	28	26	26	28	28	23	26	20	Round conductor in mm
Transform. width in mm	45	45	44	49.5	50	61	49.5	61	50	61	61	61	61	95	61	71	Transform. width in mm

* For the current transformers above, click-on mountings are available for fitment onto 35mm DIN-rails (DIN 50022).

Current transformers overview

Click on a product name or check mark to jump to information page.

Page	27	30	31	34	35	37	40	42	43	46	48	49	50	53	55	57	Page
Primary nominal current	ASK 41.4*	ASK 41.5*	ASK 412.4	ASK 41.6	ASK 541.4	ASK 51.4	ASK 51.6	ASK 561.4	ASK 61.4	ASK 61.6	ASK 63.4	ASK 63.6	ASK 81.4	ASK 83.4	ASK 101.4	ASK 103.3	Primary nominal current
A																	A
1																	1
2.5																	2.5
5																	5
10																	10
15																	15
20																	20
25																	25
30					✓												30
40					✓												40
50	✓	✓	✓	✓	✓												50
60	✓	✓	✓	✓	✓												60
75	✓	✓	✓	✓	✓												75
80	✓	✓	✓	✓	✓												80
100	✓	✓	✓	✓	✓	✓	✓			✓							100
125		✓			✓												125
150	✓	✓	✓	✓	✓	✓	✓			✓							150
200	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓					200
250	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓					250
300	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓			300
400	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			400
500	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		500
600	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	600
750	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	750
800	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	800
1000	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	1000
1200						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	1200
1250						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	1250
1500									✓	✓	✓	✓	✓	✓	✓	✓	1500
1600									✓	✓	✓	✓	✓	✓	✓	✓	1600
1800														✓	✓		1800
2000													✓	✓	✓	✓	2000
2500														✓	✓	✓	2500
3000																✓	3000
3200																	3200
4000																	4000
5000																	5000
6000																	6000
7500																	7500
Primary conductor in mm	40×10 2×30×5	40×10 or 2×30×5	40×12 30×15	40×12 30×15	40×10 2×30×5	50×12 2×40×10	50×12 40×30	60×10 2×50×10	63×10 2×50×10	60×10 50×35	60×30 50×40	60×30	80×10 60×30 2×60×10	84×34	100×10 2×80×10	2×100×10 3×80×10	Primary conductor in mm
Round conductor in mm	32	32	30.5	32	32	44	40	44	44	40	44	30	55	34	70	85	Round conductor in mm
Transform. width in mm	71	71	71	95	86	86	95	86	96	95	96	88	120	96	130	172	Transform. width in mm

* For the current transformers above, click-on mountings are available for fitment onto 35mm DIN-rails (DIN 50022).

Current transformers overview

Click on a product name or check mark to jump to information page.

Page	58	60	61	62	63	64	65	66	67	68	70	71	72	73	74	75	Page
Primary nominal current	ASK 103.41	ASK 105.6	ASK 105.6N	ASK 123.3	ASK 127.4	ASK 127.6	ASK 128.4	ASK 129.10	ASK 130.3	ASK 130.5	EASR 14.3*	EASR 22.3*	EASK 21.3*	EASK 31.3*	EASK 31.4*	EASK 31.5*	Primary nominal current
A																	A
1																	1
2.5																	2.5
5																	5
10																	10
15																	15
20																	20
25																	25
30																	30
40																	40
50																	50
60																	60
75											✓					✓	75
80											✓						80
100											✓	✓	✓	✓	✓	✓	100
120											✓						120
125											✓						125
150											✓	✓	✓	✓	✓	✓	150
200												✓	✓	✓	✓	✓	200
250												✓	✓	✓	✓	✓	250
300									✓	✓		✓	✓	✓	✓	✓	300
400	✓						✓		✓	✓		✓	✓	✓	✓	✓	400
500	✓						✓		✓	✓		✓	✓	✓	✓	✓	500
600	✓	✓					✓		✓	✓		✓		✓	✓	✓	600
750	✓	✓					✓		✓	✓				✓	✓	✓	750
800	✓	✓					✓										800
1000	✓	✓		✓	✓	✓	✓	✓	✓	✓							1000
1200	✓	✓		✓	✓	✓	✓	✓	✓	✓							1200
1250	✓	✓		✓	✓	✓	✓	✓	✓	✓							1250
1500	✓	✓		✓	✓	✓	✓	✓	✓	✓							1500
1600		✓			✓			✓	✓	✓							1600
1800		✓		✓	✓	✓		✓									1800
2000	✓	✓		✓	✓	✓	✓	✓	✓	✓							2000
2400																	2400
2500		✓	✓	✓	✓	✓	✓	✓		✓							2500
3000		✓	✓	✓		✓		✓		✓							3000
3200										✓							3200
4000			✓	✓		✓		✓									4000
5000			✓			✓											5000
6000						✓		✓									6000
7500								✓									7500
Primary conductor in mm	103×41	100×55	100×55	123×30 3×100×10	120×70	120×72	128×38	120×90	130×25	130×30			20×10	30×10 2×20×10	30×10 2×20×10	30×10 2×20×10	Primary conductor in mm
Round conductor in mm	40	55	55	100	70	72	38	90	25	30	14	22.5	19.2	26	28	28	Round conductor in mm
Transform. width in mm	99	129	129	172	159	205	100	250	180	180	44	61	61	61	61	61	Transform. width in mm

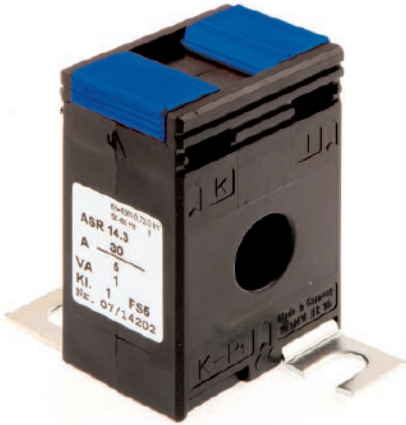
* For the current transformers above, click-on mountings are available for fitment onto 35mm DIN-rails (DIN 50022).

Current transformers overview

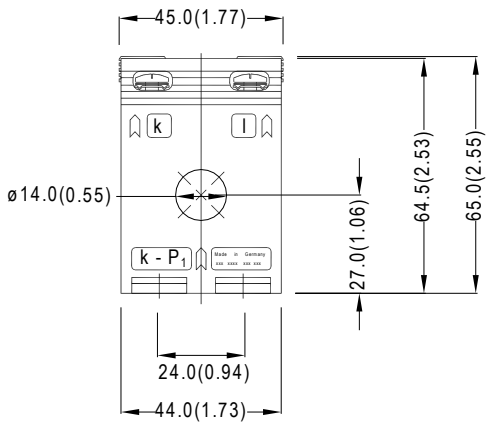
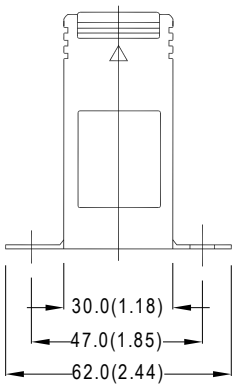
Click on a product name or check mark to jump to information page.

Page	77	78	80	81	82	83	85	86	87	88	89	90	91	92	93		Page
Primary nominal current	EASK 31.6	EASK 41.4*	EASK 41.5*	EASK 41.6	EASK 541.4	EASK 51.4	EASK 51.6	EASK 61.4	EASK 61.6	EASK 63.6	EASK 81.4	EASK 105.6	EASK 123.3	EASK 130.3	EASK 130.5		Primary nominal current
A																	A
1																	1
2.5																	2.5
5																	5
10																	10
15																	15
20																	20
25																	25
30																	30
40																	40
50	✓																50
60																	60
75	✓		✓	✓	✓												75
80			✓														80
100	✓	✓	✓	✓	✓	✓	✓										100
120																	120
125			✓														125
150	✓	✓	✓	✓	✓	✓	✓										150
200	✓	✓	✓	✓	✓	✓	✓	✓	✓								200
250	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓							250
300	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓							300
400	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓						400
500	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	500
600	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	600
750	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	750
800			✓														800
1000			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		1000
1200							✓	✓	✓	✓	✓	✓	✓	✓	✓		1200
1250							✓	✓	✓	✓	✓	✓	✓	✓	✓		1250
1500								✓	✓	✓	✓	✓	✓	✓	✓		1500
1600												✓	✓	✓	✓		1600
1800																	1800
2000												✓	✓		✓		2000
2400															✓		2400
2500												✓	✓		✓		2500
3000												✓	✓		✓		3000
3200																	3200
4000																	4000
5000																	5000
6000																	6000
7500																	7500
Primary conductor in mm	30×10 20×13	40×10 2×30×5	40×10 2×30×5	40×12 30×15	40×10 2×30×5	50×12 2×40×10	50×12 40×30	60×10 2×50×10	60×10 50×30	60×30	80×10 60×30 2×60×10	100×55	123×25 2×100×10	130×25	130×30		Primary conductor in mm
Round conductor in mm	23	32	32	32	32	44	40	44	40	30	55	55	100	25	30		Round conductor in mm
Transform. width in mm	95	71	71	95	86	86	95	96	96	88	120	129	172	180	180		Transform. width in mm

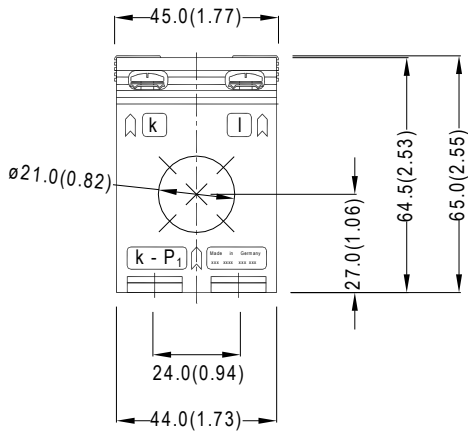
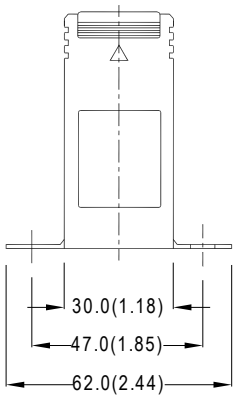
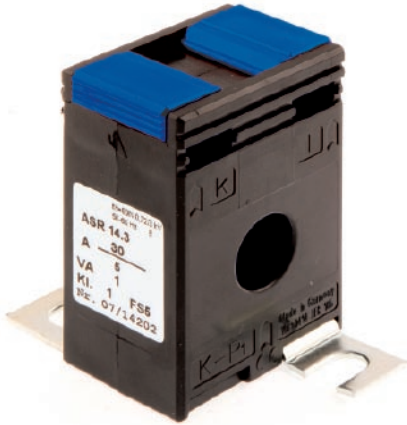
* For the current transformers above, click-on mountings are available for fitment onto 35mm DIN-rails (DIN 50022).



Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1	0.5	1	0.5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.
30	1	✓		✓	
40	1	✓		✓	
50	1.5	✓		✓	
60	1.5	✓		✓	
75	1.5	✓		✓	

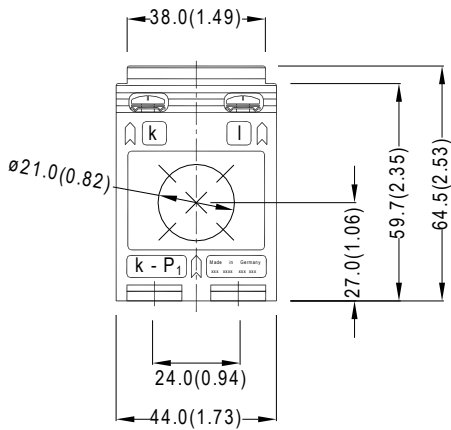
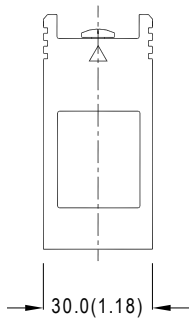


Round conductor	Ø 14mm
Weight	0.180-0.240 kg (0.40-0.53lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990005
Sealed shutter	Not available



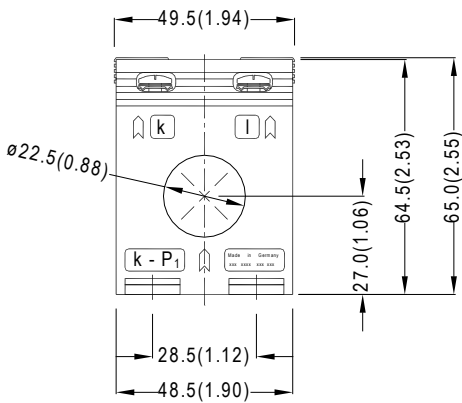
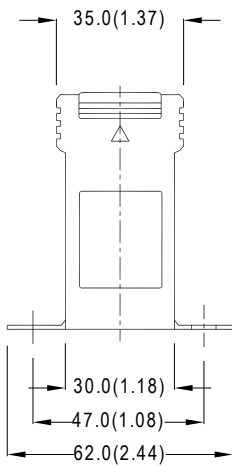
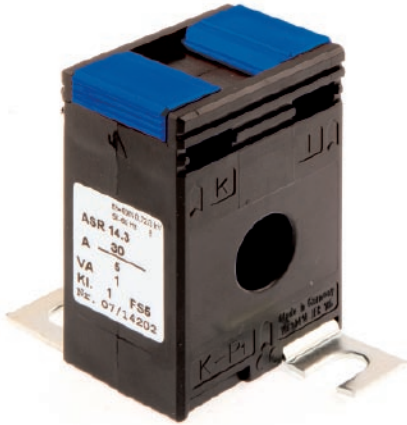
Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1	0.5	1	0.5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.
50	1	✓		✓	
60	1	✓		✓	
	1.25				
75	1.25	✓		✓	
	1.5	✓		✓	
80	1.25	✓		✓	
	1.5	✓		✓	
100	1.5	✓	✓	✓	✓
	2.5	✓		✓	✓
125	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
	3.75	✓		✓	
150	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
	3.75	✓		✓	
200	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
	3.75	✓	✓	✓	✓
250	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
300	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓

Round conductor	Ø 21mm
Weight	0.120-0.190kg (0.26-0.42lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990005
Sealed shutter	Not available



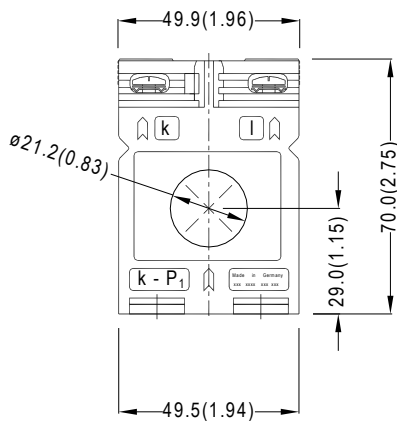
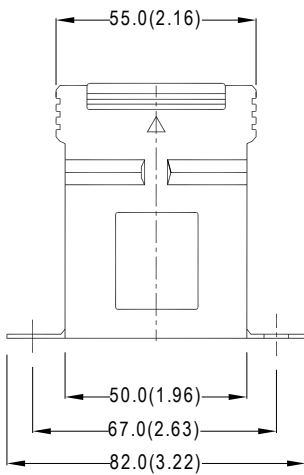
Secondary current		5A			1A		
Primary current A	Burden VA	Accuracy class			Accuracy class		
		3	1	0.5	3	1	0.5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.		
50	1	✓			✓		
60	1		✓			✓	
	1.25	✓			✓		
75	1.25		✓			✓	
	1.5		✓			✓	
80	1.25		✓			✓	
	1.5		✓			✓	
100	1.5		✓	✓		✓	✓
	2.5		✓			✓	
125	1.5		✓	✓		✓	✓
	2.5		✓	✓		✓	✓
	3.75				✓		
150	1.5		✓	✓		✓	✓
	2.5		✓	✓		✓	✓
	3.75		✓			✓	
200	1.5		✓	✓		✓	✓
	2.5		✓	✓		✓	✓
	3.75		✓	✓		✓	✓
250	2.5		✓	✓		✓	✓
	5		✓	✓		✓	✓
300	2.5		✓	✓		✓	✓
	5		✓	✓		✓	✓

Round conductor	Ø 21mm
Weight	0.120-0.190kg (0.26-0.42lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990005
Sealed shutter	Not available



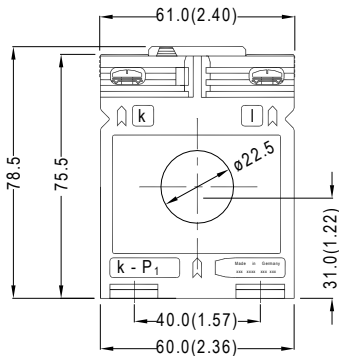
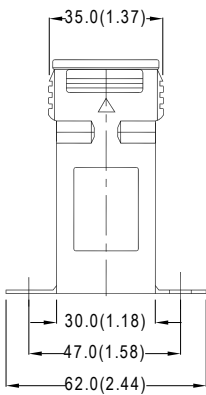
Secondary current		5A	1A
Primary current A	Burden VA	Accuracy class	Accuracy class
		1	1
		Art.-no.	Art.-no.
100	1	✓	✓
150	1.5	✓	✓
	2.5	✓	✓
200	1.5	✓	✓
	2.5	✓	✓
	5	✓	✓
250	1.5	✓	✓
	2.5	✓	✓
	5	✓	✓
300	1.5	✓	✓
	2.5	✓	✓
	5	✓	✓
400	2.5	✓	✓
	5	✓	✓
	10	✓	✓
500	2.5	✓	✓
	5	✓	✓
	10	✓	✓
600	2.5	✓	✓
	5	✓	✓
	10	✓	✓

Round conductor	Ø 22.5mm
Weight	0.150-0.300kg (0.33-0.66lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990006
Sealed shutter	Not available



Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1	0.5	1	0.5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.
50	1.5	✓	✓	✓	✓
	2.5	✓			
60	1.5	✓	✓	✓	✓
	2.5	✓		✓	
	3.75	✓		✓	
75	1.5	✓	✓	✓	✓
	2.5	✓		✓	
	3.75	✓		✓	
80	1.5	✓	✓	✓	✓
	2.5	✓		✓	
	5	✓		✓	
100	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
	5	✓		✓	
125	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
	5	✓		✓	
150	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓		✓	
200	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
250	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
300	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
400	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
500	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
600	15	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓

Round conductor	Ø 21mm
Weight	0.210-0.410kg (0.46-0.90lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Not available

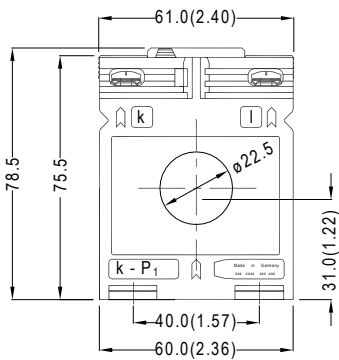
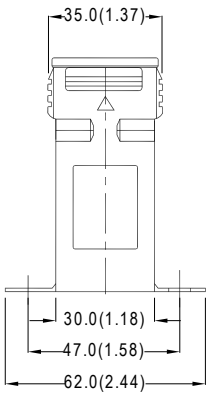


Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		1	0.5	0.2s	1	0.5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.	Art.-no.
40	1	✓			✓	
	1.5	✓			✓	
50	1	✓			✓	
	1.5	✓			✓	
60	1	✓			✓	
	1.5	✓			✓	
75	1.5	✓			✓	
	2.5	✓			✓	
80	1.5	✓			✓	
	2.5	✓			✓	
100	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓		✓	✓
	3.75	✓			✓	
150	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓		✓	✓
200	1.5		✓			✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓			✓	
250	1.5		✓			✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
300	15	✓			✓	
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
400	15	✓			✓	
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
500	15	✓			✓	
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
600	15	✓			✓	
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓

Round conductor	Ø 22.5mm
Weight	0.170-0.500kg (0.37-1.10lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990001
Sealed shutter	Type: 59040



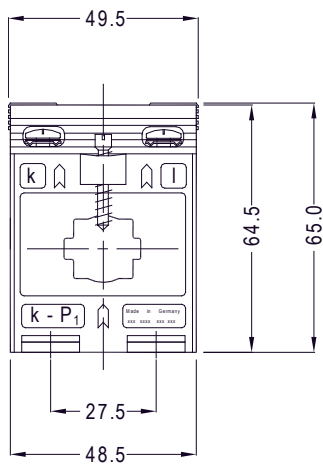
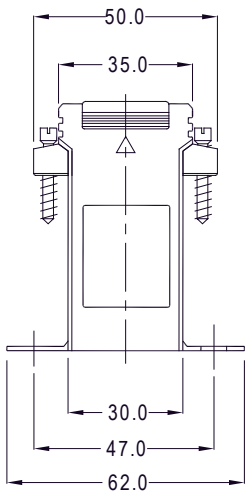
Secondary current		5A	1A
Primary current A	Burden VA	Accuracy class	Accuracy class
		1	1
		Art.-no.	Art.-no.
200-100	5-2.5	✓	✓
300-150	5-2.5	✓	✓
	10-5	✓	✓
400-200	5-2.5	✓	✓
	10-5	✓	✓
500-250	5-2.5	✓	✓
	10-5	✓	✓
600-300	5-2.5	✓	✓
	10-5	✓	✓



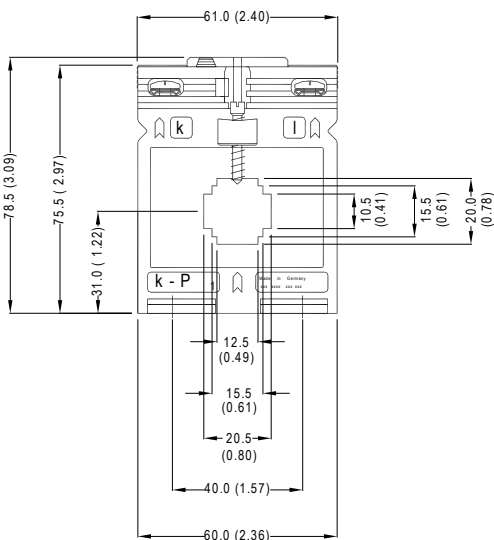
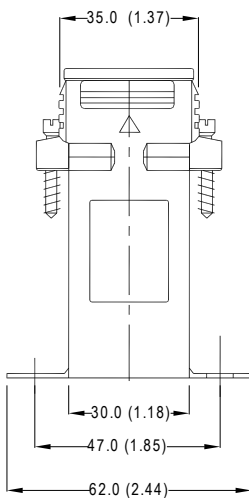
Round conductor	Ø 22.5mm
Weight	0.170-0.500kg (0.37-1.10lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990001
Sealed shutter	Type: 59040



Secondary current		5A	1A
Primary current A	Burden VA	Accuracy class	Accuracy class
		1	1
		Art.-no.	Art.-no.
60	1	✓	✓
75	1	✓	✓
80	1.25	✓	✓
100	1.25	✓	✓
	1.5	✓	✓
150	1.5	✓	✓
	2.5	✓	✓
200	1.5	✓	✓
	2.5	✓	✓
250	2.5	✓	✓
	5	✓	✓
300	2.5	✓	✓
	5	✓	✓
400	2.5	✓	✓
	5	✓	✓
	10	✓	✓

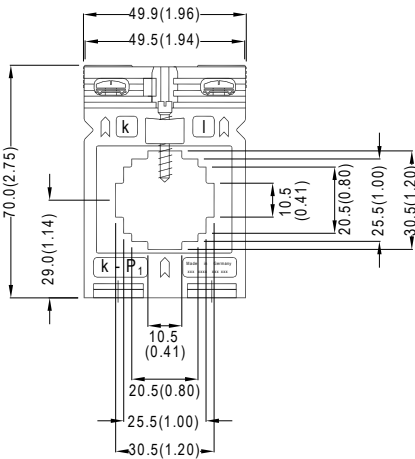
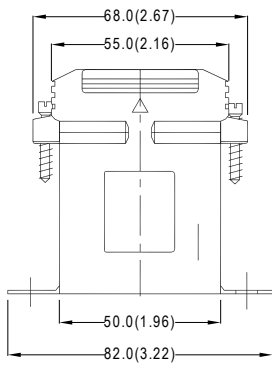


Primary conductor	20 × 5mm
Round conductor	Ø 17.5mm
Weight	0.180-0.370kg (0.40-0.82lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990006
Sealed shutter	Type: 55014



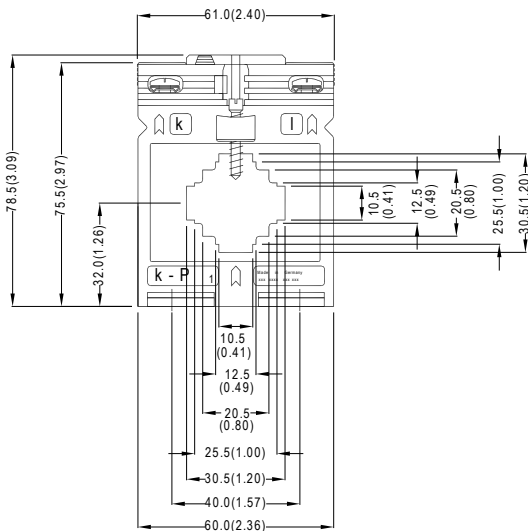
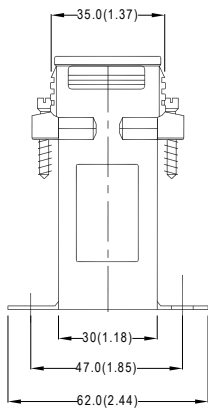
Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		1 Art.-no.	0.5 Art.-no.	0.2s Art.-no.	1 Art.-no.	0.5 Art.-no.
40	1	✓			✓	
50	1	✓			✓	
	1.5	✓			✓	
60	1	✓			✓	
	1.5	✓			✓	
75	1.5	✓			✓	
	2.5	✓			✓	
80	1.5	✓			✓	
	2.5	✓			✓	
100	1.5	✓	✓		✓	✓
	2.5	✓	✓		✓	✓
	3.75	✓			✓	
150	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓		✓	✓
200	1.5		✓			✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓			✓	
250	1.5		✓			✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
300	1.5	✓			✓	
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
400	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
	15	✓			✓	
500	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
	15	✓			✓	
600	2.5	✓	✓		✓	✓
	5	✓	✓		✓	✓
	10	✓	✓		✓	✓
	15	✓			✓	

Primary conductor	20 × 10mm
Round conductor	Ø 19.2mm
Weight	0.190-0.380kg (0.42-0.84lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990001
Sealed shutter	Type: 59040



Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1	0,5	1	0,5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.
50	1	✓		✓	
	1,25	✓		✓	
60	1	✓		✓	
	1,25	✓		✓	
75	1,25	✓		✓	
80	1,25	✓		✓	
100	1,5	✓		✓	
125	1,5	✓		✓	✓
150	1,5	✓		✓	✓
	2,5	✓		✓	
200	2,5	✓	✓	✓	✓
	5	✓		✓	
250	2,5	✓	✓	✓	✓
	5	✓	✓	✓	✓
300	2,5	✓	✓	✓	✓
	5	✓		✓	
400	2,5	✓	✓	✓	✓
	5	✓	✓	✓	✓
500	2,5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓		✓	
600	2,5	✓	✓		
	5	✓	✓		
	10	✓			

Primary conductor	30 × 10mm
Round conductor	Ø 28mm
Weight	0.190-1.000kg (0.42-2.20lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Not available

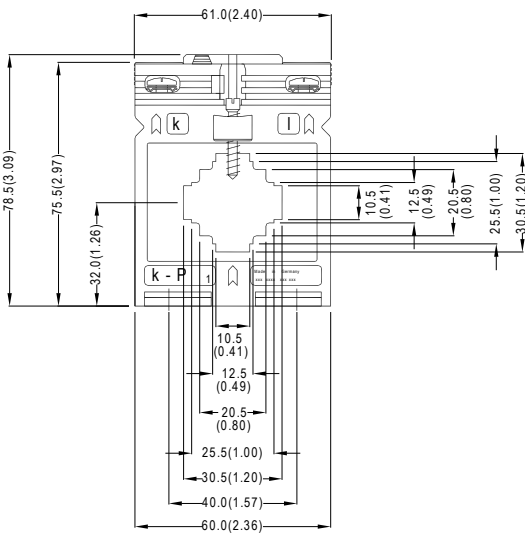
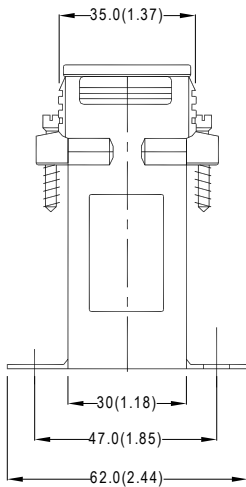


Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		1 Art.-no.	0,5 Art.-no.	0,2s Art.-no.	1 Art.-no.	0,5 Art.-no.
50	1	✓			✓	
60	1	✓			✓	
75	1	✓			✓	
	1.5	✓			✓	
80	1.5	✓			✓	
	2.5	✓			✓	
100	1.5	✓	✓		✓	✓
	2.5	✓	✓		✓	✓
150	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓		✓	✓
200	1.5	✓	✓		✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓		✓	✓
250	1.5	✓	✓		✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓			✓	
300	1.5	✓	✓		✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓			✓	✓
400	1.5	✓			✓	
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
500	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
600	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
	15	✓	✓		✓	✓
750	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓

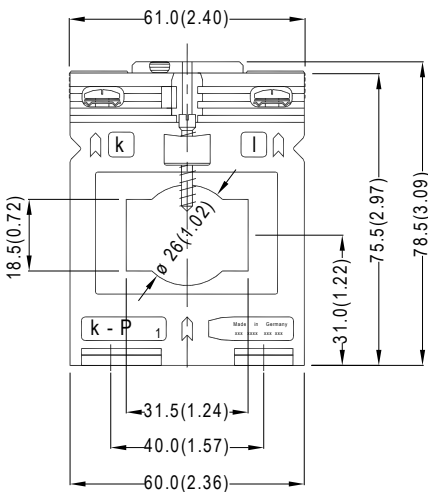
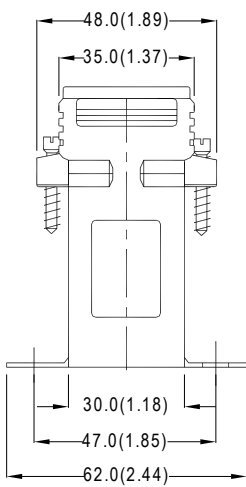
Primary conductor	30 × 10mm 2 × 20 × 10mm
Round conductor	Ø 26mm
Weight	0.200-1.100kg (0.44-2.43lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990001
Sealed shutter	Type: 59040



Secondary current		5A	1A
Primary current A	Burden VA	Accuracy class	Accuracy class
		1	1
		Art.-no.	Art.-no.
200-100	5-2.5	✓	✓
300-150	5-2.5	✓	✓
400-200	5-2.5	✓	✓
	10-5	✓	✓
500-250	5-2.5	✓	✓
	10-5	✓	✓
600-300	10-5	✓	✓
	15-7.5	✓	✓

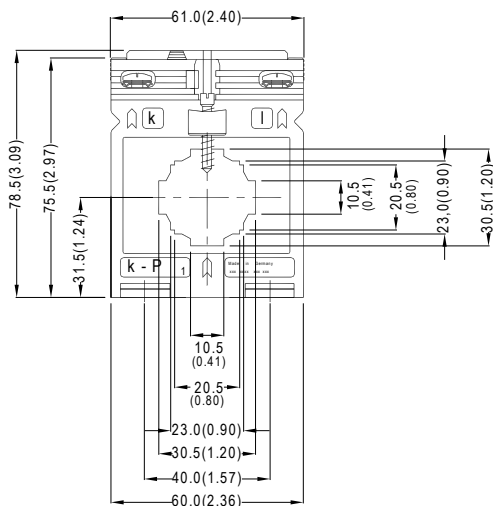
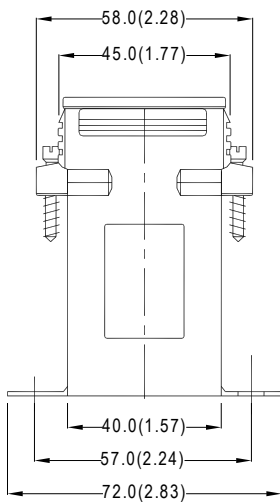


Primary conductor	30 × 10mm 2 × 20 × 10mm
Round conductor	Ø 26mm
Weight	0.200-1.100kg (0.44-2.43lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990001
Sealed shutter	Type: 59040



Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
60	1	✓		✓	
75	1	✓		✓	
	1.5	✓		✓	
80	1.5	✓		✓	
	2.5	✓		✓	
100	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
150	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
200	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
250	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓		✓	
300	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓		✓	
400	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
500	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
600	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
750	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓

Primary conductor	31 × 18mm
Round conductor	Ø 26mm
Weight	0.220-0.350kg (0.49-0.77lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990001
Sealed shutter	Type: 59040

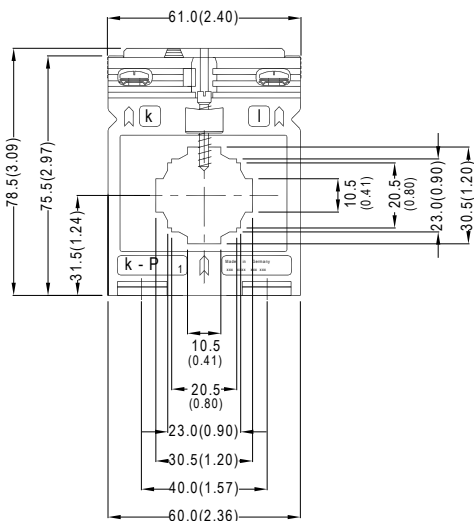
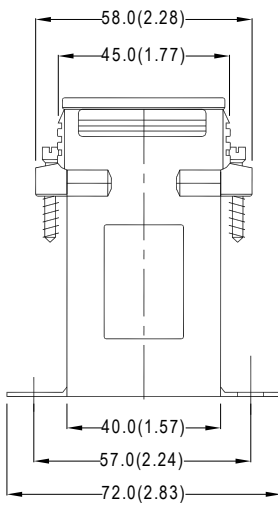


Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		1 Art.-no.	0.5 Art.-no.	0.2s Art.-no.	1 Art.-no.	0.5 Art.-no.
50	1.25	✓			✓	
	1.5	✓			✓	
60	1.25	✓			✓	
	1.5	✓			✓	
75	1.5	✓			✓	
	2.5	✓			✓	
80	1.5	✓			✓	
	2.5	✓			✓	
100	1.5	✓	✓		✓	✓
	2.5	✓	✓		✓	✓
	3.75	✓			✓	
150	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓		✓	
200	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓			✓	
250	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓			✓	
	15	✓			✓	
300	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
	15	✓			✓	
400	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
	15	✓			✓	✓
500	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
	15	✓			✓	✓
600	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	✓
750	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	✓

Primary conductor	30 × 10mm 2 × 20 × 10mm
Round conductor	Ø 28mm
Weight	0.220-0.480kg (0.49-1.06lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990002
Sealed shutter	Type: 59041



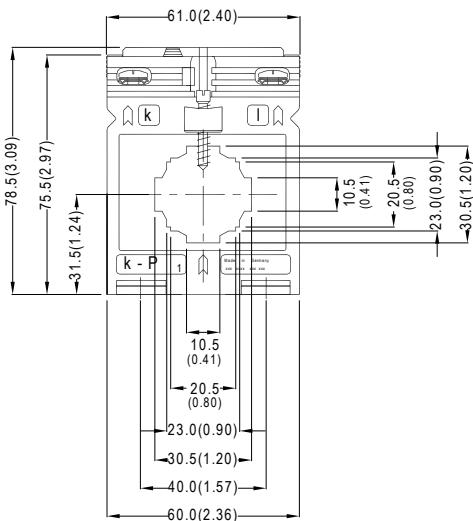
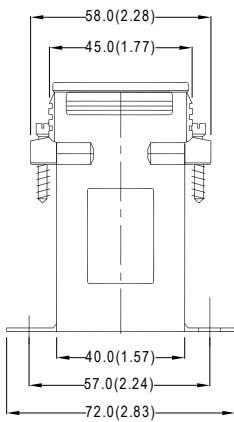
Secondary current		5A	1A
Primary current A	Burden VA	Accuracy class	Accuracy class
		1	1
		Art.-no.	Art.-no.
200-100	5-2.5	✓	✓
300-150	5-2.5	✓	✓
	10-5	✓	✓
400-200	5-2.5	✓	✓
	10-5	✓	✓
500-250	5-2.5	✓	✓
	10-5	✓	✓
600-300	5-2.5	✓	✓
	10-5	✓	✓
	15-7.5	✓	✓



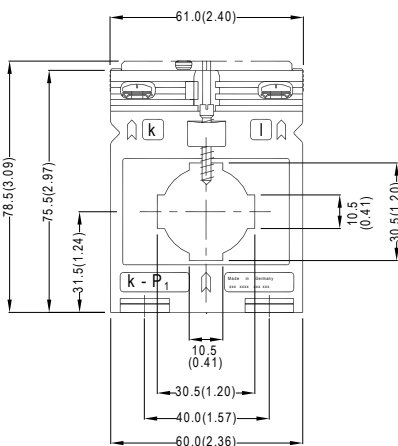
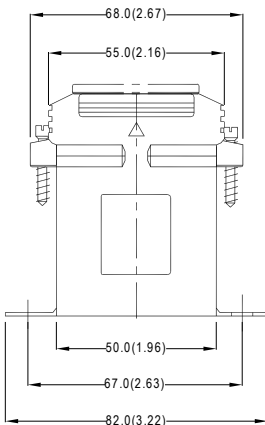
Primary conductor	30 × 10mm 2 × 20 × 10mm
Round conductor	Ø 28mm
Weight	0.220-0.480kg (0.49-1.06lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990002
Sealed shutter	Type: 59041



Secondary current		5A	1A
Primary current A	Burden VA	Accuracy class	Accuracy class
		1	1
		Art.-no.	Art.-no.
300-200-100	10-5-2.5	✓	✓
400-200-100	10-5-2.5	✓	✓
600-300-150	10-5-2.5	✓	✓
	15-10-5	✓	✓
600-400-200	10-5-2.5	✓	✓
	15-10-5	✓	✓

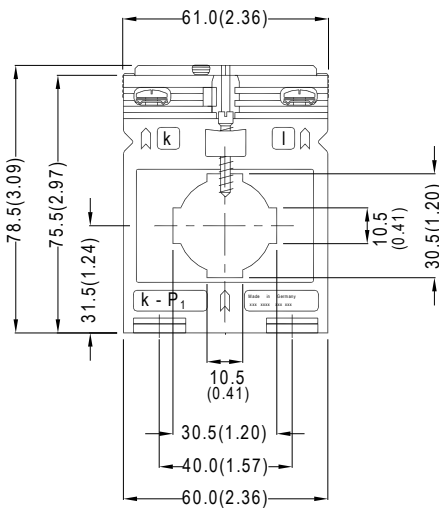
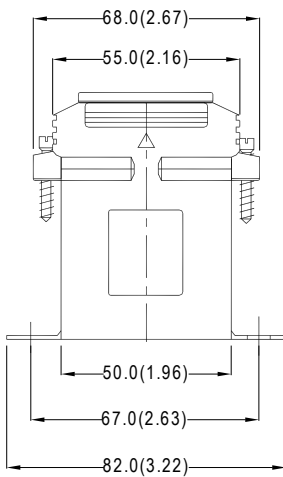


Primary conductor	30 × 10mm 2 × 20 × 10mm
Round conductor	Ø 28mm
Weight	0.220-0.480kg (0.49-1.06lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990002
Sealed shutter	Type: 59041



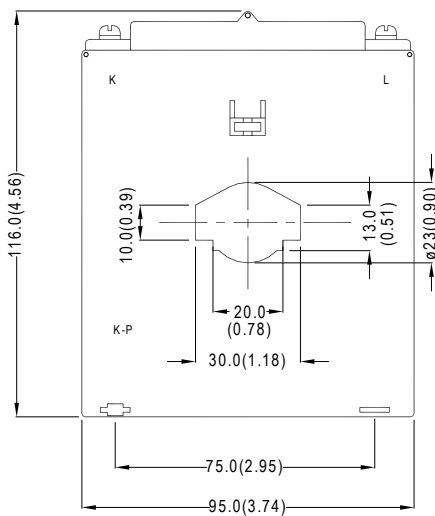
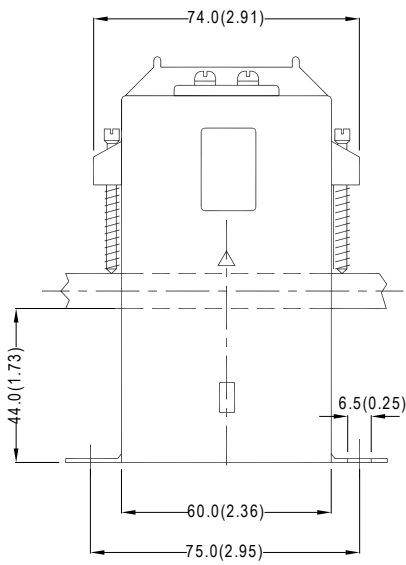
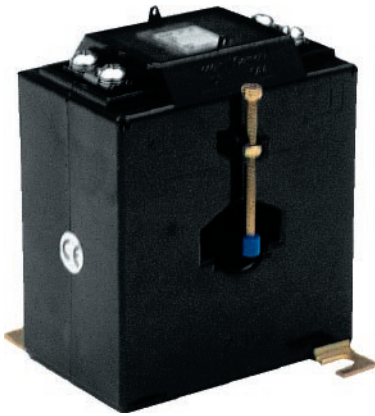
Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
40	1	✓		✓	
50	1.5	✓		✓	
	2.5	✓		✓	
60	1.5	✓		✓	
	2.5	✓		✓	
75	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
80	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
100	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
150	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	7.5	✓		✓	
200	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
250	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
300	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
400	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
500	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
600	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
750	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	

Primary conductor	30 × 10mm 2 × 20 × 10mm
Round conductor	Ø 28mm
Weight	0.240-0.520kg (0.53-1.15lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990003
Sealed shutter	Type: 59041



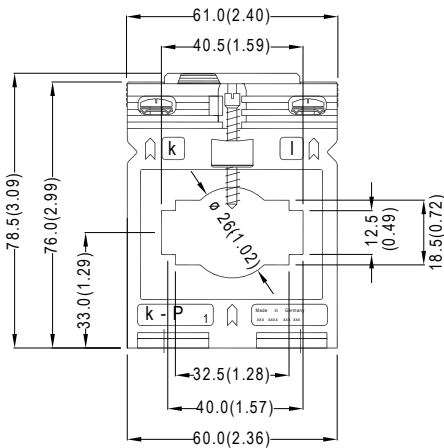
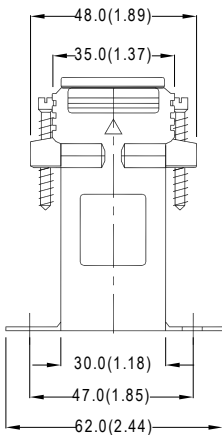
Secondary current		5A	1A
Primary current A	Burden VA	Accuracy class	Accuracy class
		1	1
		Art.-no.	Art.-no.
150-75	5-2.5	✓	✓
200-100	5-2.5	✓	✓
	10-5	✓	✓
300-150	5-2.5	✓	✓
	10-5	✓	✓
	15-7.5	✓	✓
400-200	5-2.5	✓	✓
	10-5	✓	✓
	15-7.5	✓	✓
500-250	5-2.5	✓	✓
	10-5	✓	✓
	15-7.5	✓	✓
600-300	5-2.5	✓	✓
	10-5	✓	✓
	15-7.5	✓	✓

Primary conductor	30 × 10mm 2 × 20 × 10mm
Round conductor	Ø 28mm
Weight	0.240-0.520kg (0.53-1.15lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990003
Sealed shutter	Type: 59041



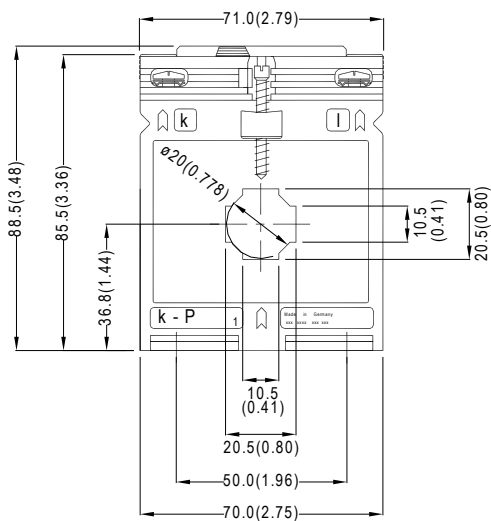
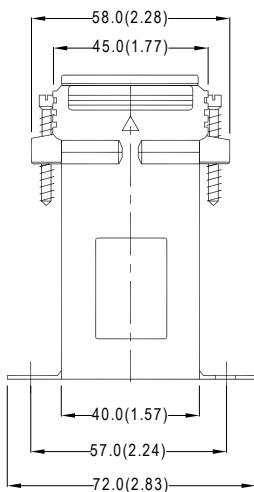
Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1	0.5	1	0.5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.
30	1.5	✓		✓	
40	1.5	✓		✓	
50	1.5		✓		✓
	2.5	✓	✓	✓	✓
60	1.5		✓		✓
	2.5	✓	✓	✓	✓
	5	✓		✓	
75	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
80	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓		✓	
100	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
150	2.5		✓		✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
200	2.5		✓		✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
250	15	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
300	15	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
400	15	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
500	15	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
600	15	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
750	15	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓

Primary conductor	30 × 10mm 20 × 13mm
Round conductor	Ø 23mm
Weight	0.310-1.900kg (0.68-4.19lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59044



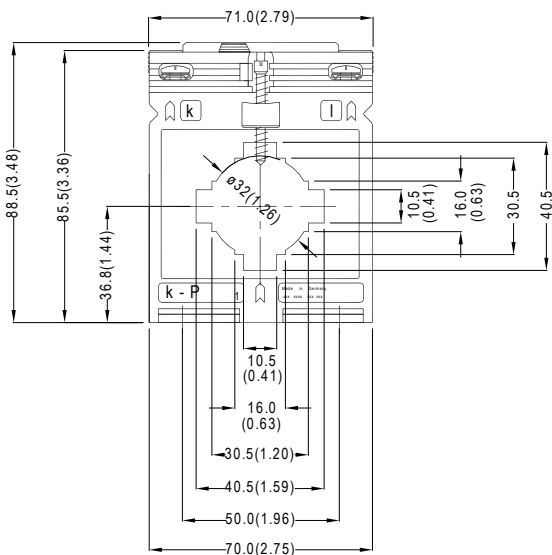
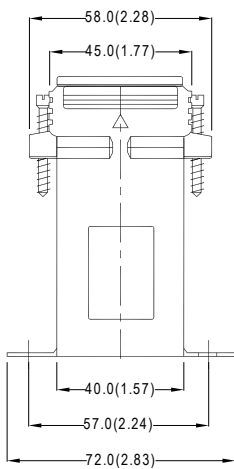
Secondary current		5A	1A
Primary current A	Burden VA	Accuracy class	Accuracy class
		1	1
		Art.-no.	Art.-no.
100	1	✓	✓
	1.5	✓	✓
150	1.5	✓	✓
	2.5	✓	✓
200	1.5	✓	✓
	2.5	✓	✓
250	1.5	✓	✓
	2.5	✓	✓
	5	✓	✓
300	1.5	✓	✓
	2.5	✓	✓
	5	✓	✓
400	1.5	✓	
	2.5	✓	
	5	✓	
500	1.5	✓	
	2.5	✓	
	5	✓	
	10	✓	
600	1.5	✓	
	2.5	✓	
	5	✓	
	10	✓	
750	2.5	✓	
	5	✓	
	10	✓	
	15	✓	
800	2.5	✓	
	5	✓	
	10	✓	
	15	✓	

Primary conductor	40 × 12mm 32 × 18mm
Round conductor	Ø 26mm
Weight	0.180-0.300kg (0.40-0.66lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990001
Sealed shutter	Type: 59040



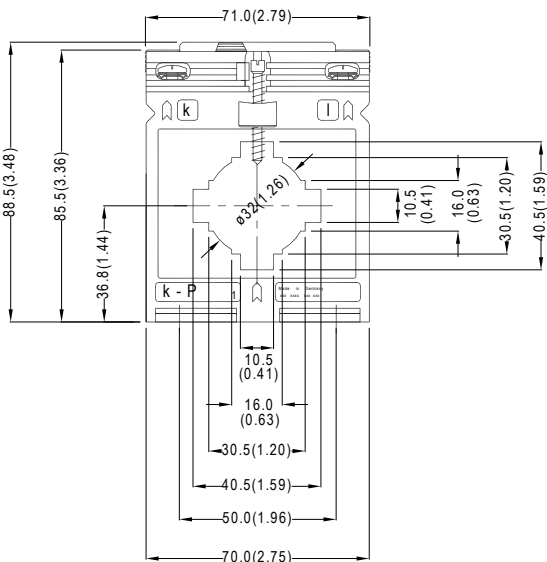
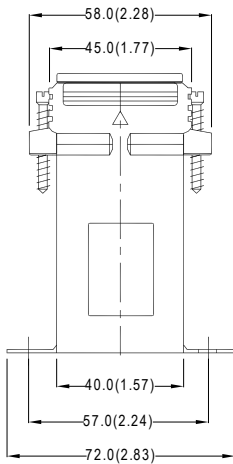
Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
40	1.5	✓		✓	
50	1.5	✓	✓	✓	✓
	2.5	✓		✓	
60	1.5	✓	✓	✓	✓
	2.5	✓		✓	
	3.75			✓	
75	2.5	✓	✓	✓	✓
	5	✓		✓	
80	2.5	✓	✓	✓	✓
	5	✓		✓	
100	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓		✓	
125	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓		✓	
150	2.5		✓		✓
	5	✓	✓	✓	✓
	10	✓		✓	
200	2.5		✓		✓
	5	✓	✓	✓	✓
	10	✓		✓	
	15	✓		✓	
250	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
300	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
400	5		✓		✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
500	5		✓		✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	

Primary conductor	20 × 10mm
Round conductor	Ø 20mm
Weight	0.290-1.000kg (0.64-2.20lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59041



Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		1 Art.-no.	0.5 Art.-no.	0.2s Art.-no.	1 Art.-no.	0.5 Art.-no.
50	1.25	✓			✓	
	1.5	✓			✓	
60	1.25	✓			✓	
	1.5	✓			✓	
75	1.5	✓			✓	
	2.5	✓			✓	
80	1.5	✓			✓	
	2.5	✓			✓	
100	1.5	✓	✓		✓	✓
	2.5	✓	✓		✓	✓
	3.75	✓			✓	
150	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓		✓	✓
200	1.5		✓	✓		✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓			✓	
250	1.5		✓			✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓			✓	
300	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
	15	✓			✓	
400	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓			✓	
500	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	✓
600	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
	15	✓	✓		✓	✓
750	2.5			✓		
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	✓
800	5	✓	✓		✓	✓
	10	✓	✓		✓	✓
	15	✓			✓	
	30	✓			✓	
1000	5	✓	✓		✓	✓
	10	✓	✓		✓	✓
	15	✓	✓		✓	✓
	30	✓			✓	

Primary conductor	40 × 10mm 2 × 30 × 5mm
Round conductor	Ø 32mm
Weight	0.240-0.800kg (0.53-1.76lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990004
Sealed shutter	Type: 59041

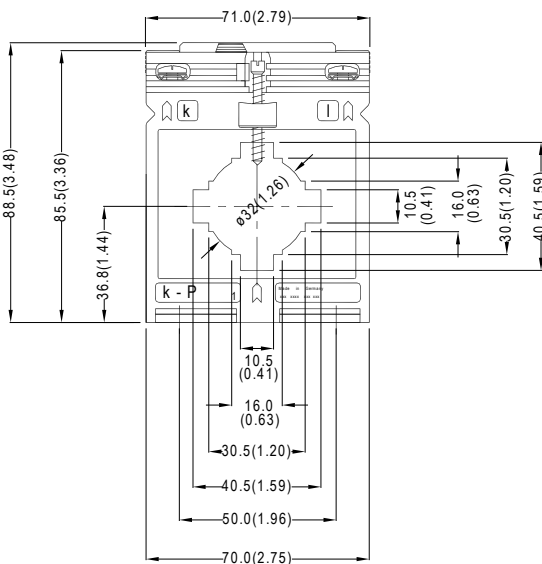
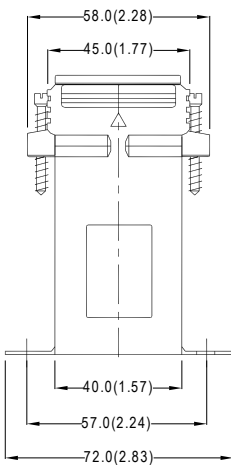


Secondary current		5A	1A
Primary current A	Burden VA	Accuracy class	Accuracy class
		1	1
		Art.-no.	Art.-no.
200-100	5-2.5	✓	✓
300-150	5-2.5	✓	✓
	10-5	✓	✓
400-200	5-2.5	✓	✓
	10-5	✓	✓
500-250	5-2.5	✓	✓
	10-5	✓	✓
600-300	5-2.5	✓	✓
	10-5	✓	✓
800-400	5	✓	
	5-2.5	✓	✓
	10-5	✓	✓
	15-7.5	✓	✓
1000-500	5-2.5	✓	✓
	10-5	✓	✓
	15-7.5	✓	✓

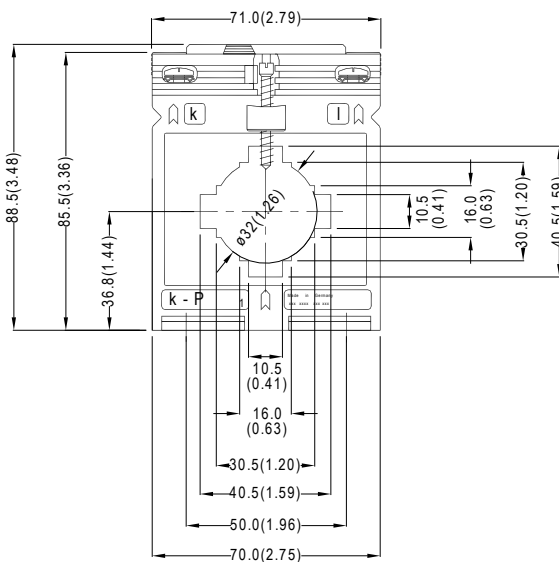
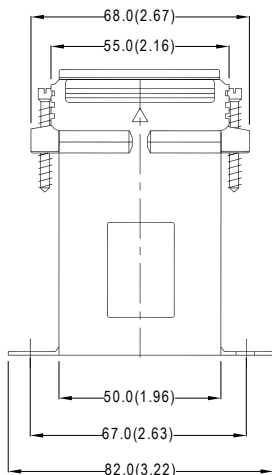
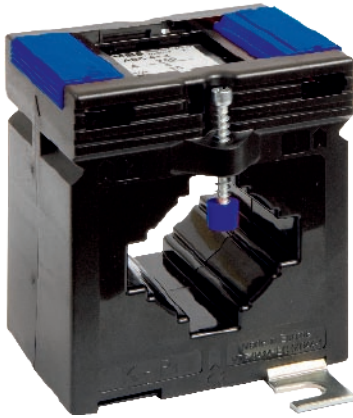
Primary conductor	40 × 10mm 2 × 30 × 5mm
Round conductor	Ø 32mm
Weight	0.240-0.800kg (0.53-1.76lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990004
Sealed shutter	Type: 59041



Secondary current		5A	1A
Primary current A	Burden VA	Accuracy class	Accuracy class
		1	1
		Art.-no.	Art.-no.
400-200-100	10-5-2.5	✓	✓
600-300-150	10-5-2.5	✓	✓
800-400-200	10-5-2.5	✓	✓
1000-500-250	10-5-2.5	✓	✓
	15-7.5-2.5	✓	✓

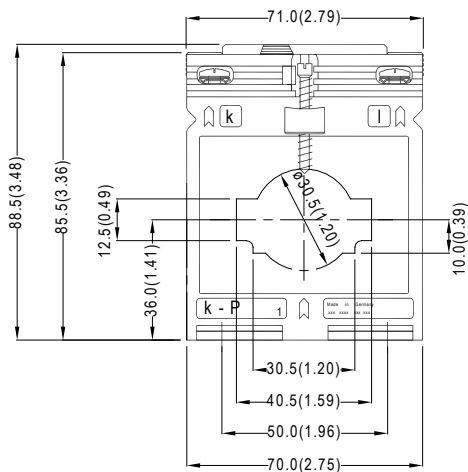
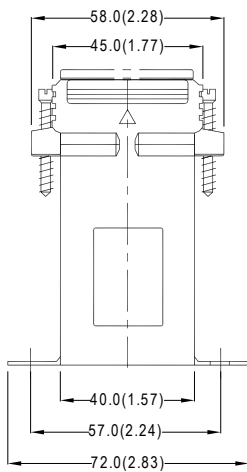


Primary conductor	40 × 10mm 2 × 30 × 5mm
Round conductor	Ø 32mm
Weight	0.240-0.800kg (0.53-1.76lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990004
Sealed shutter	Type: 59041



Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
50	1,5	✓		✓	
60	1,5	✓		✓	
	2,5	✓		✓	
75	1,5	✓	✓	✓	✓
	2,5	✓	✓	✓	✓
80	1,5	✓	✓	✓	✓
	2,5	✓	✓	✓	✓
100	1,5	✓	✓	✓	✓
	2,5	✓	✓	✓	✓
	3,75	✓		✓	
150	2,5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	7,5	✓	✓	✓	✓
200	2,5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓		✓	✓
250	2,5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	✓
300	2,5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
400	2,5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
500	2,5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
600	2,5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
750	2,5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
800	2,5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
1000	2,5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓

Primary conductor	40 × 10mm
Round conductor	Ø 32mm
Weight	0.250-0.510kg (0.55-1.12lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990004
Sealed shutter	Type: 59041

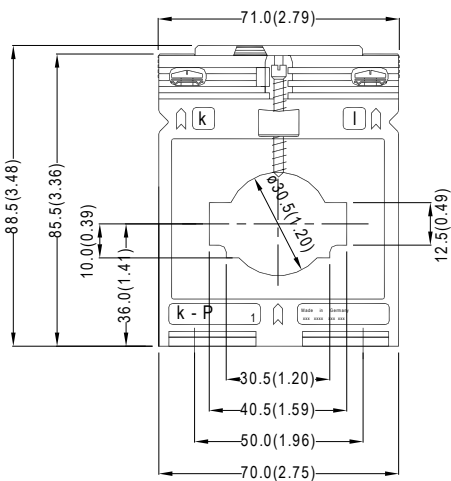
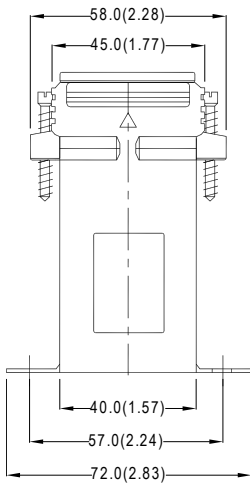


Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
50	1.25	✓		✓	
	1.5	✓		✓	
60	1.25	✓		✓	
	1.5	✓		✓	
75	1.5	✓		✓	
	2.5	✓		✓	
80	1.5	✓		✓	
	2.5	✓		✓	
100	1.5	✓	✓	✓	✓
	2.5	✓		✓	
	3.75	✓		✓	
150	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
	5	✓		✓	
200	2.5	✓	✓	✓	✓
	5	✓		✓	
250	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓		✓	✓
300	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓		✓	✓
	15	✓		✓	
400	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
500	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
600	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
750	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
800	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	

Primary conductor	40 × 12mm 30 × 15mm
Round conductor	Ø 30.5mm
Weight	0.250-0.510kg (0.55-1.12lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990004
Sealed shutter	Type: 59041



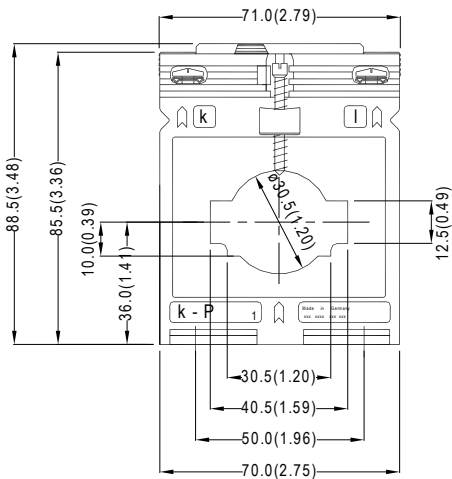
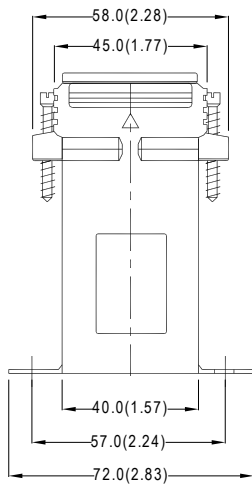
Secondary current		5A	1A
Primary current A	Burden VA	Accuracy class	Accuracy class
		1	1
		Art.-no.	Art.-no.
200-100	5-2.5	✓	✓
300-150	5-2.5	✓	✓
	10-5	✓	✓
400-200	5-2.5	✓	✓
	10-5	✓	✓
500-250	5-2.5	✓	✓
	10-5	✓	✓
600-300	5-2.5	✓	✓
	10-5	✓	✓
800-400	5-2.5	✓	✓
	10-5	✓	✓
	15-7.5	✓	✓



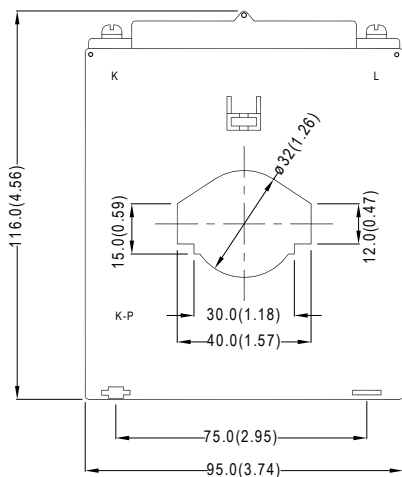
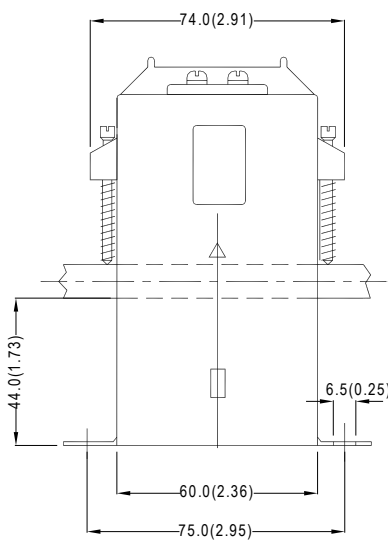
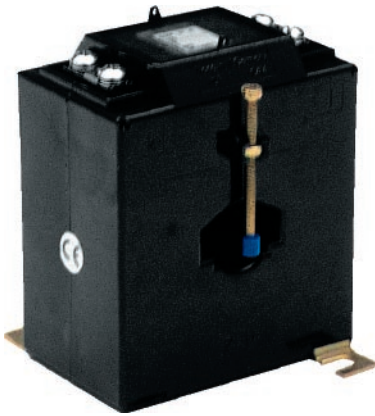
Primary conductor	40 × 12mm 30 × 15mm
Round conductor	Ø 30.5mm
Weight	0.250-0.510kg (0.55-1.12lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990004
Sealed shutter	Type: 59041



Secondary current		5A	1A
Primary current A	Burden VA	Accuracy class	Accuracy class
		1	1
		Art.-no.	Art.-no.
400-200-100	10-5-2.5	✓	
	15-7.5-2.5		✓
600-300-150	10-5-2.5	✓	✓
800-400-200	10-5-2.5	✓	✓

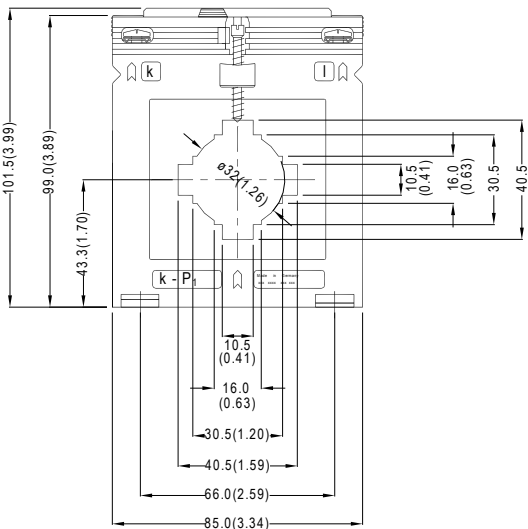
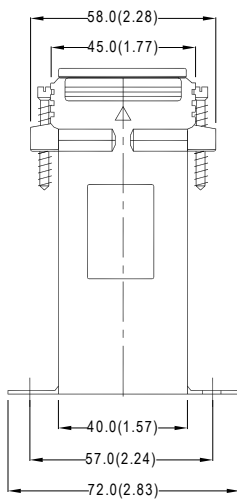


Primary conductor	40 × 12mm 30 × 15mm
Round conductor	Ø 30.5mm
Weight	0.250-0.510kg (0.55-1.12lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990004
Sealed shutter	Type: 59041



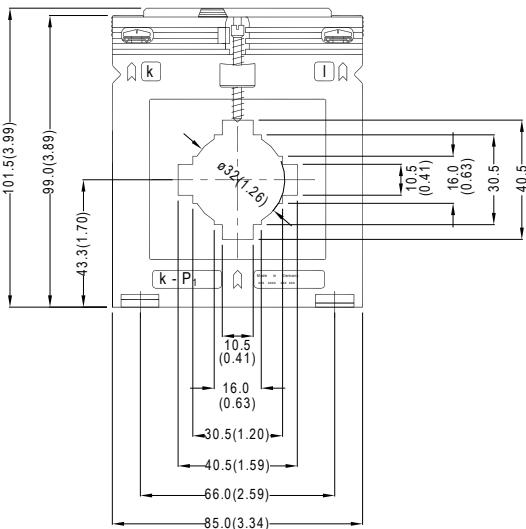
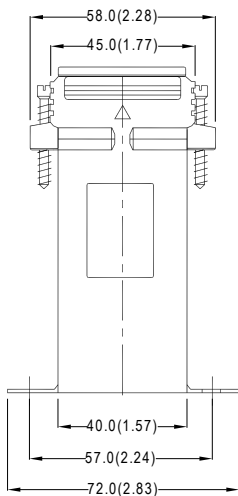
Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
50	1.5	✓	✓	✓	✓
	2.5	✓		✓	
60	1.5	✓	✓	✓	✓
	2.5	✓		✓	
75	1.5	✓		✓	
	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
80	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
100	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
150	2.5		✓		✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
200	15	✓	✓	✓	✓
	2.5		✓		✓
	5	✓	✓	✓	✓
250	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	2.5		✓		✓
300	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
400	2.5		✓		✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
500	15	✓	✓	✓	✓
	2.5		✓		✓
	5	✓	✓	✓	✓
600	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
750	5		✓		✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
800	30	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1000	30	✓	✓	✓	✓
	45	✓	✓	✓	✓
	5		✓		✓
	10	✓	✓	✓	✓

Primary conductor	40 × 12mm 30 × 15mm
Round conductor	Ø 32mm
Weight	0.320-2.000kg (0.71-4.41lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59044



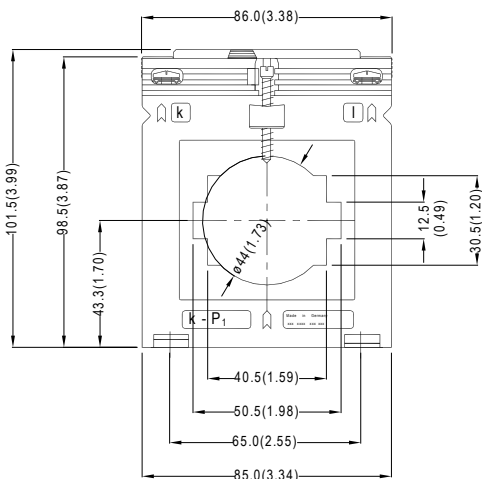
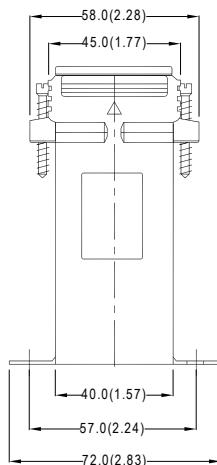
Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		1 Art.-no.	0.5 Art.-no.	0.2s Art.-no.	1 Art.-no.	0.5 Art.-no.
30	1				✓	
	1.5	✓				
40	1.5	✓			✓	
	2.5	✓			✓	
50	1.5	✓			✓	
	2.5	✓			✓	
60	1.5	✓	✓		✓	✓
	2.5	✓			✓	
75	1.5	✓	✓		✓	✓
	2.5	✓	✓		✓	✓
	5	✓			✓	
80	1.5		✓			✓
	2.5	✓	✓		✓	✓
	5	✓			✓	
100	1.5			✓		
	2.5		✓			✓
	5	✓	✓		✓	✓
125	10	✓			✓	
	2.5		✓			✓
	5	✓	✓		✓	✓
150	10	✓			✓	
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
200	10	✓			✓	
	2.5		✓	✓		✓
	5	✓	✓	✓	✓	✓
250	15	✓			✓	
	2.5		✓	✓		✓
	5	✓	✓	✓	✓	✓

Primary conductor	40 × 10mm 2 × 30 × 5mm
Round conductor	Ø 32mm
Weight	0.270-1.000kg (0.60-2.20lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59042



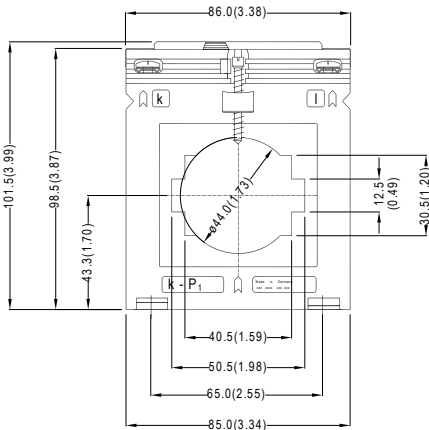
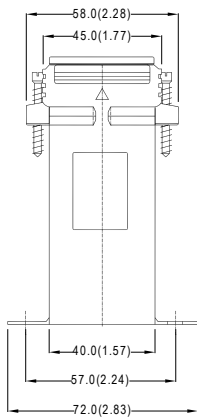
Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		1	0.5	0.2s	1	0.5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.	Art.-no.
300	2.5		✓	✓		✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	✓
400	2.5		✓	✓		✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓			✓	✓
500	2.5			✓		
	5		✓	✓		✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	
600	2.5			✓		
	5		✓	✓		✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
750	2.5			✓		
	5			✓		
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		1✓	✓
800	10	✓	✓		✓	✓
	15	✓	✓		✓	✓
	30	✓	✓		✓	✓
1000	2.5			✓		
	5		✓	✓		✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
1000	2.5			✓		
	5		✓	✓		✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
1000	2.5			✓		
	5		✓	✓		✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
1000	2.5			✓		
	5		✓	✓		✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓

Primary conductor	40 × 10mm 2 × 30 × 5mm
Round conductor	Ø 32mm
Weight	0.270-1.000kg (0.60-2.20lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59042



Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		1	0.5	0.2s	1	0.5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.	Art.-no.
100	1.5	✓	✓		✓	
	2.5	✓	✓			
150	1.5	✓	✓		✓	✓
	2.5	✓	✓		✓	✓
200	1.5		✓	✓		✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
250	1.5		✓			✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
300	10	✓			✓	
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
400	10	✓			✓	
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	15	✓	✓		✓	
500	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
600	15	✓	✓		✓	
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
750	15	✓	✓		✓	
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
800	30	✓			✓	
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	✓
1000	30	✓			✓	
	2.5			✓		
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
1200	15	✓	✓	✓	✓	✓
	30	✓			✓	
	5	✓	✓		✓	✓
	10	✓	✓		✓	✓
1250	15	✓	✓		✓	✓
	30	✓			✓	
	5	✓	✓		✓	✓
	10	✓	✓		✓	✓

Primary conductor	50 × 12mm 2 × 40 × 10mm
Round conductor	Ø 44mm
Weight	0.260-0.720kg (0.57-1.59lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59042

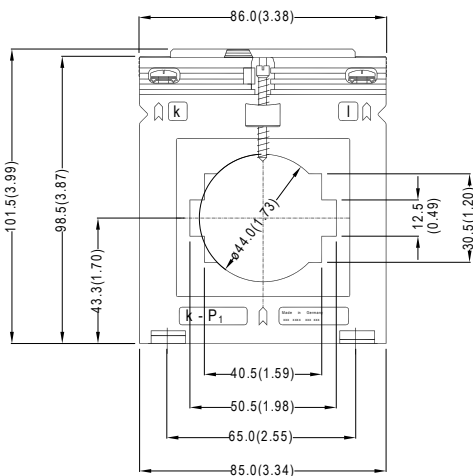
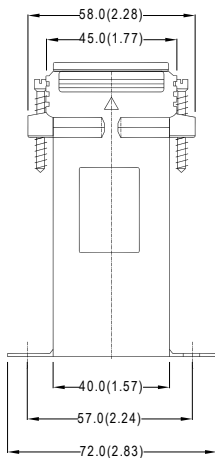


Secondary current		5A	1A
Primary current A	Burden VA	Accuracy class	Accuracy class
		1	1
		Art.-no.	Art.-no.
400-200	5-2.5	✓	✓
	10-5	✓	✓
500-250	5-2.5	✓	✓
	10-5	✓	✓
600-300	5-2.5	✓	✓
	10-5	✓	✓
800-400	5-2.5	✓	✓
	10-5	✓	✓
	15-7.5	✓	✓
1000-500	5-2.5	✓	✓
	10-5	✓	✓
	15-7.5	✓	✓
1200-600	5-2.5	✓	✓
	10-5	✓	✓
	15-7.5	✓	✓
	30-15	✓	✓

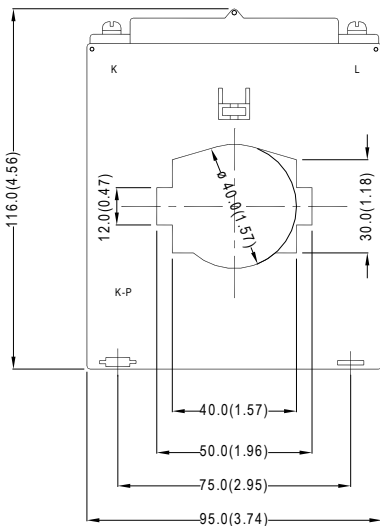
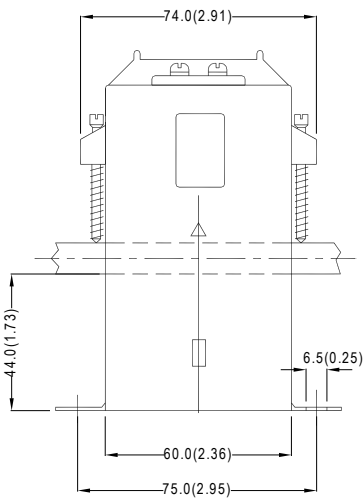
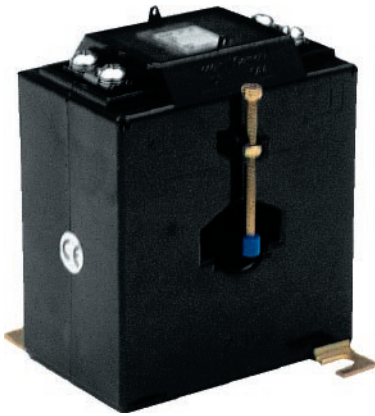
Primary conductor	50 × 12mm 2 × 40 × 10mm
Round conductor	Ø 44mm
Weight	0.260-0.720kg (0.57-1.59lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59042



Secondary current		5A	1A
Primary current A	Burden VA	Accuracy class	Accuracy class
		1	1
		Art.-no.	Art.-no.
800-400-200	10-5-2.5	✓	✓
1000-500-250	10-5-2.5	✓	✓
	15-7.5-2.5	✓	✓
1200-600-300	10-5-2.5	✓	✓
	15-7.5-2.5	✓	✓
1200-1000-300	7.5-5-2.5	✓	✓
1000-600-400	10-5-2.5	✓	✓
1000-600-300	15-10-5	✓	✓
600-400-200	15-7.5-5	✓	✓
1000-800-600	15-10-5	✓	✓
1000-600-300	10-5-2.5	✓	✓

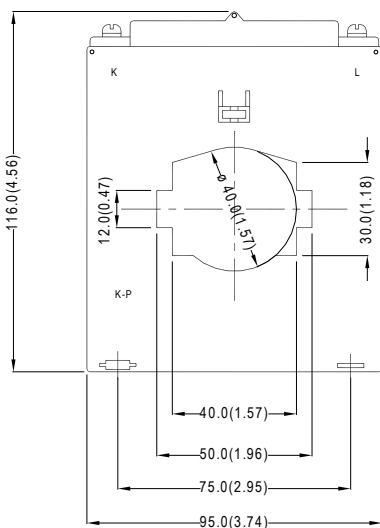
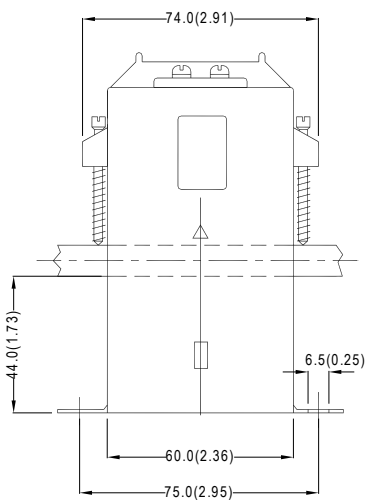


Primary conductor	50 × 12mm 2 × 40 × 10mm
Round conductor	Ø 44mm
Weight	0.260-0.720kg (0.57-1.59lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59042



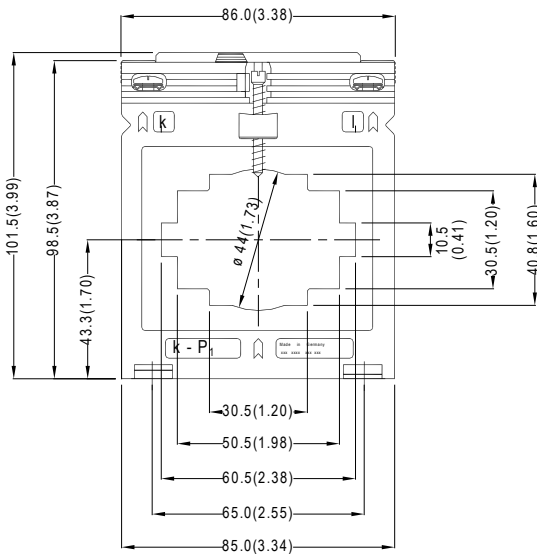
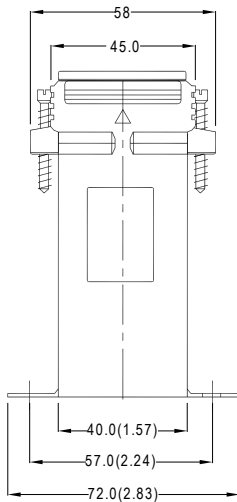
Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
100	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
150	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
200	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
250	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
300	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
400	2.5		✓		✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
500	2.5		✓		✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓

Primary conductor	50 × 12mm 40 × 30mm
Round conductor	Ø 40mm
Weight	0.360-1.280kg (0.79-2.82lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59044



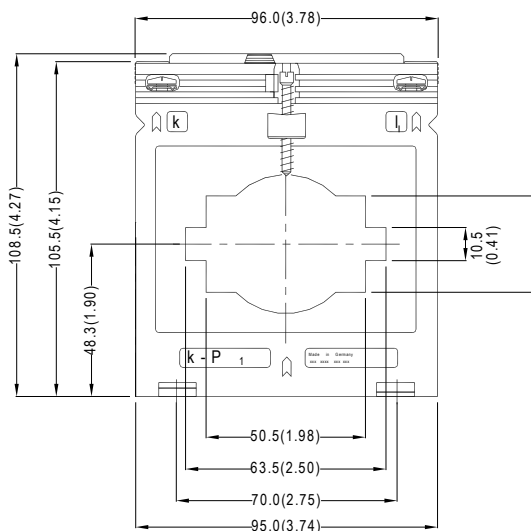
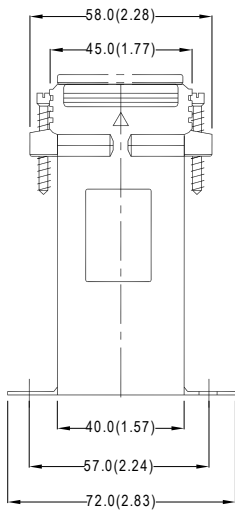
Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
600	2.5		✓		✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
750	30	✓		✓	
	2.5		✓		✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
800	15	✓	✓	✓	✓
	30	✓		✓	
	45	✓		✓	
	1000	5		✓	
1200	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓		✓	
1250	5		✓		✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
1250	45	✓		✓	

Primary conductor	50 × 12mm 40 × 30mm
Round conductor	Ø 40mm
Weight	0.360-1.280kg (0.79-2.82lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59044



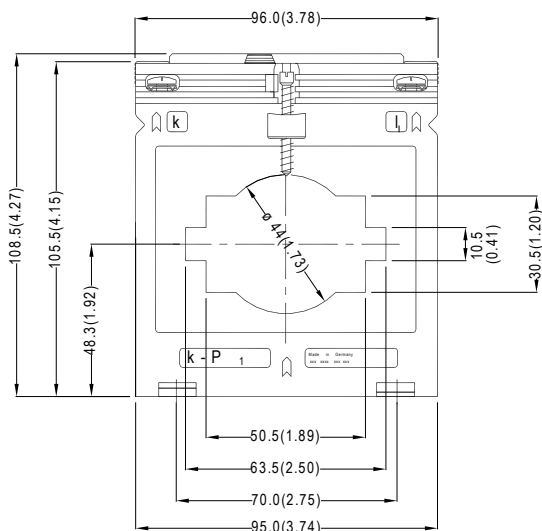
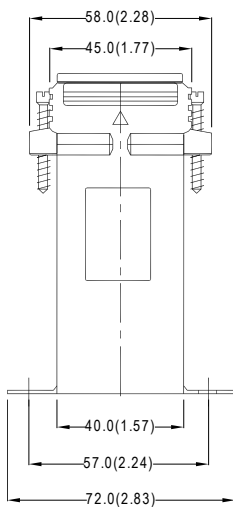
Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
200	2.5	✓		✓	
250	2.5	✓		✓	
	5	✓		✓	
300	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
400	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓		✓	
500	2.5		✓		✓
	5	✓	✓	✓	✓
	10	✓		✓	
	15	✓		✓	
600	2.5		✓		✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
750	2.5		✓		✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
800	5	✓	✓		✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
1000	5	✓	✓		✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
1200	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
1250	5	✓	✓		✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	

Primary conductor	60 × 10mm 2 × 50 × 10mm
Round conductor	Ø 44mm
Weight	0.300-0.660kg (0.66-1.46lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59042



Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		1 Art.-no.	0.5 Art.-no.	0.2s Art.-no.	1 Art.-no.	0.5 Art.-no.
200	2.5	✓	✓		✓	✓
	1.5	✓	✓	✓	✓	✓
250	2.5	✓	✓	✓	✓	✓
	5				✓	
300	1.5	✓	✓		✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
400	1.5	✓	✓		✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
500	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
600	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	2.5	✓	✓	✓	✓	✓
750	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
800	2.5	✓	✓		✓	✓
	5	✓	✓		✓	✓
	10	✓	✓		✓	✓
1000	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	✓
	2.5			✓		
	5	✓	✓	✓	✓	✓
1200	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	✓
	30	✓	✓		✓	✓
	5	✓	✓	✓	✓	✓
1250	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	✓
1500	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	✓
1600	5	✓	✓		✓	✓
	10	✓	✓		✓	✓
	15	✓	✓		✓	✓
	30	✓	✓		✓	✓

Primary conductor	63 × 10mm 2 × 50 × 10mm
Round conductor	Ø 44mm
Weight	0.300-0.630kg (0.66-1.39lbs)
Security factor	200A-1,500A = FS 5 1,600A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59042

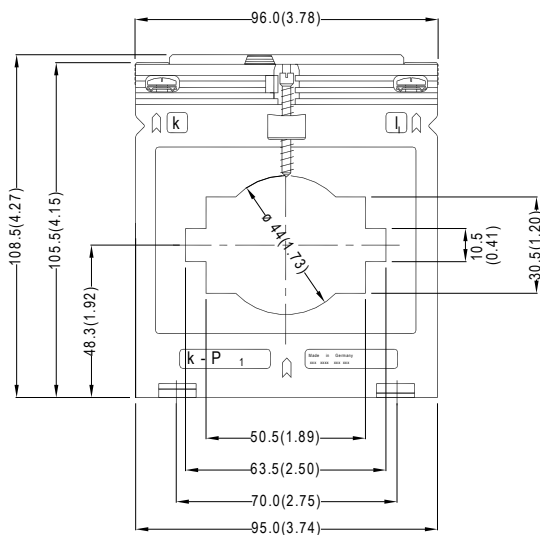
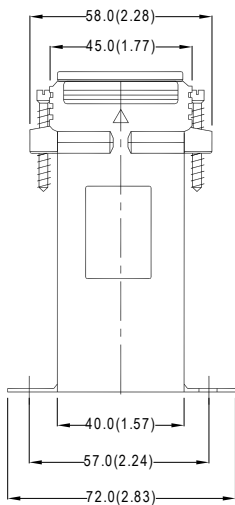


Secondary current		5A	1A
Primary current A	Burden VA	Accuracy class	Accuracy class
		1	1
		Art.-no.	Art.-no.
500-250	5-2.5	✓	✓
600-300	5-2.5	✓	✓
	10-5	✓	✓
800-400	5-2.5	✓	✓
	10-5	✓	✓
	15-7.5	✓	✓
1000-500	5-2.5	✓	✓
	10-5	✓	✓
	15-7.5	✓	✓
1200-600	5-2.5	✓	✓
	10-5	✓	✓
	15-7.5	✓	✓
1500-750	5-2.5	✓	✓
	10-5	✓	✓
	15-7.5	✓	✓
	30-15	✓	✓
1600-800	5-2.5	✓	✓
	10-7.5	✓	✓
	15-7.5	✓	✓
	30-15	✓	✓

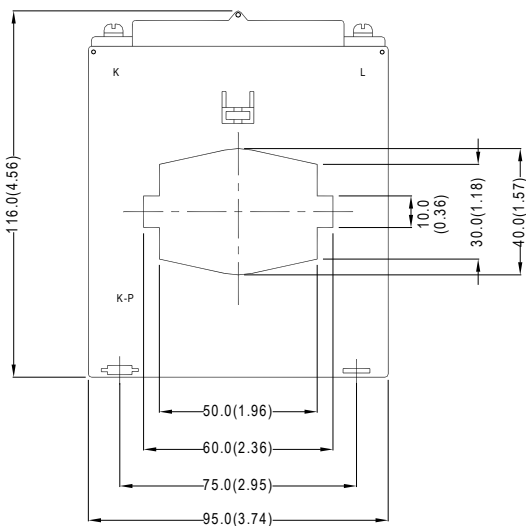
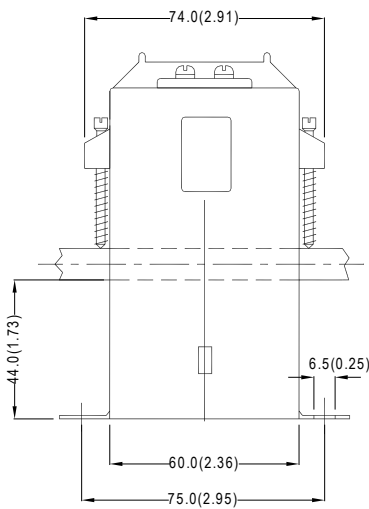
Primary conductor	63 × 10mm 2 × 50 × 10mm
Round conductor	Ø 44mm
Weight	0.300-0.630kg (0.66-1.39lbs)
Security factor	200A-1,500A = FS 5 1,600A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59042



Secondary current		5A	1A
Primary current A	Burden VA	Accuracy class	Accuracy class
		1	1
		Art.-no.	Art.-no.
800-400-200	10-5-2.5	✓	✓
1000-500-250	10-5-2.5	✓	✓
	15-7.5-2.5	✓	✓
1000-600-300	10-5-2.5	✓	✓
	15-7.5-2.5	✓	✓
1200-600-300	10-5-2.5	✓	✓
	15-7.5-2.5	✓	✓
1500-750-400	10-5-2.5	✓	✓
	15-7.5-2.5	✓	✓
1600-800-400	10-5-2.5	✓	✓
	15-7.5-2.5	✓	✓
1000-600-400	10-5-2.5	✓	✓

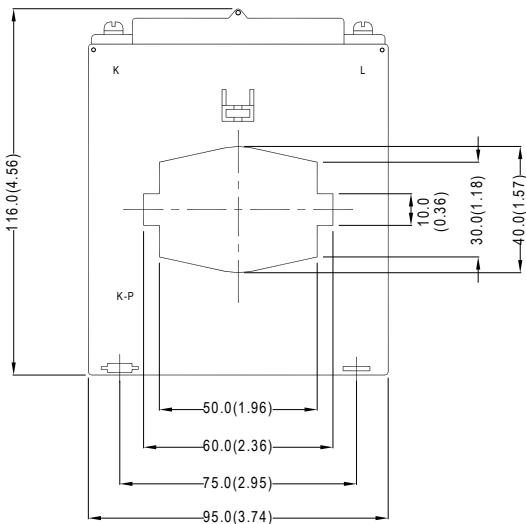
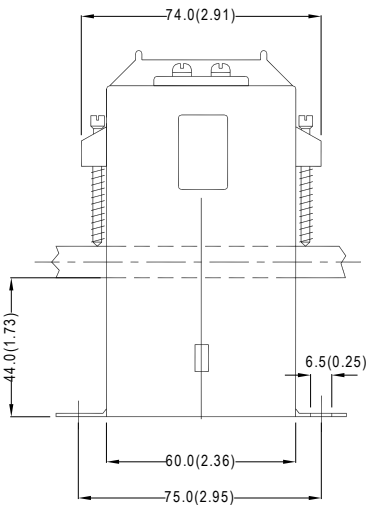


Primary conductor	63 × 10mm 2 × 50 × 10mm
Round conductor	Ø 44mm
Weight	0.300-0.630kg (0.66-1.39lbs)
Security factor	200A-1,500A = FS 5 1,600A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59042



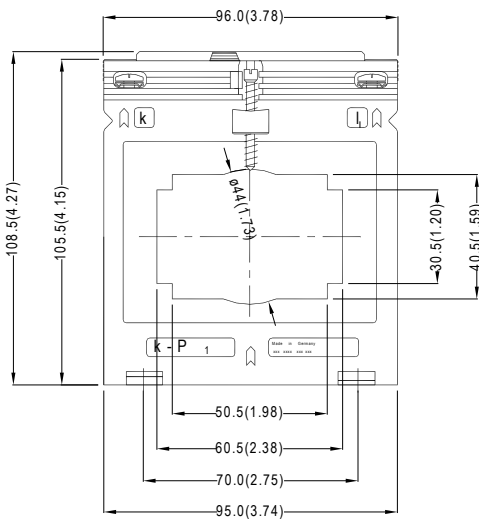
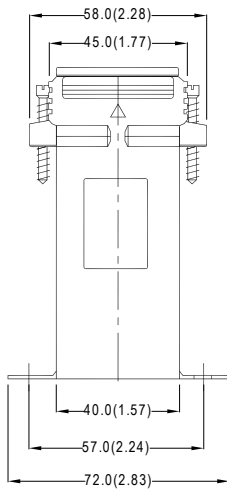
Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
100	1.5	✓	✓	✓	✓
	2.5	✓		✓	
150	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
200	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓		✓	
250	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
300	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
400	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
500	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	

Primary conductor	60 × 10mm 50 × 30mm
Round conductor	Ø 40mm
Weight	0.310-1.000kg (0.68-2.20lbs)
Security factor	100A-1,500A = FS 5 1,600A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59044



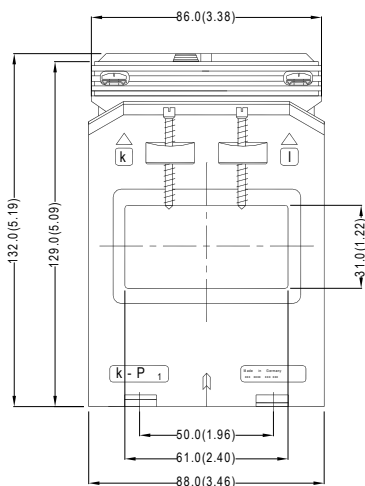
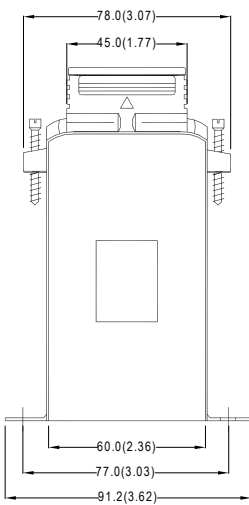
Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
600	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
750	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
800	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
1000	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓		✓	
1200	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓		✓	
1250	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓		✓	
1500	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓		✓	
1600	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓		✓	

Primary conductor	60 × 10mm 50 × 30mm
Round conductor	Ø 40mm
Weight	0.310-1.000kg (0.68-2.20lbs)
Security factor	100A-1,500A = FS 5 1,600A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59044



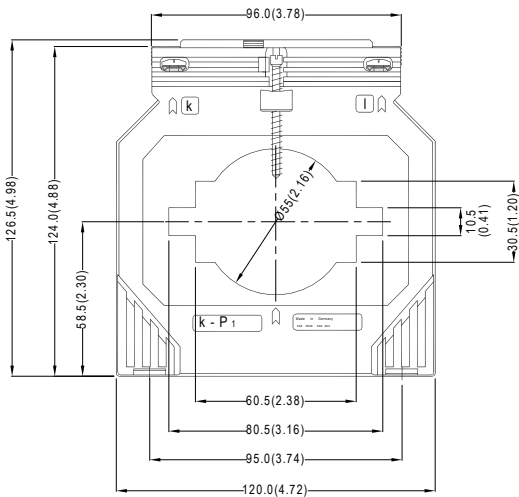
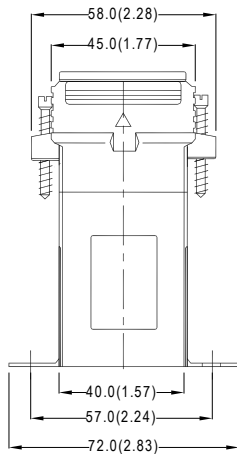
Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
300	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
400	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
500	5	✓	✓	✓	✓
	10	✓		✓	
600	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
750	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
800	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1000	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1200	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1250	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1500	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1600	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1800	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
2000	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓

Primary conductor	60 × 30mm 50 × 40mm
Round conductor	Ø 44mm
Weight	0.300-0.800kg (0.66-1.76lbs)
Security factor	300A-1,500A = FS 5 1,600A-2,000A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59042



Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
200	1.5	✓		✓	
	2.5	✓		✓	
250	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
	5				
300	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓		✓	
400	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓			
500	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓		✓	
	15	✓		✓	
600	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
750	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
	30				
800	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1000	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
1200	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
1250	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
1500	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
1600	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
2000	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	

Primary conductor	60 × 30mm
Round conductor	Ø 30mm
Weight	0.200-1.300kg (0.44-2.87lbs)
Security factor	200A-1,500A = FS 5 1,600A-2,000A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59042

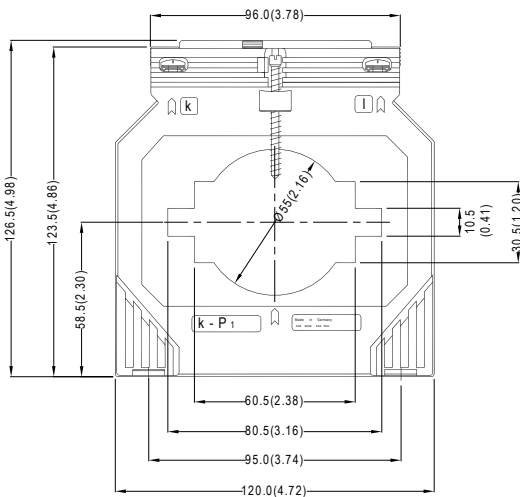
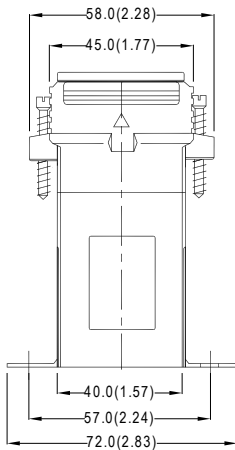


Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		1	0.5	0.2s	1	0.5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.	Art.-no.
400	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10		✓			
500	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
600	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
750	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	✓
800	2.5	✓	✓		✓	✓
	5	✓	✓		✓	✓
	10	✓	✓		✓	✓
	15	✓	✓		✓	✓
1000	2.5	✓		✓		
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓			✓	
1200	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓			✓	
1250	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓			✓	
1500	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓			✓	
	45	✓			✓	
1600	5	✓	✓			✓
	10	✓	✓		✓	✓
	15	✓	✓		✓	✓
	30	✓			✓	
	45	✓			✓	
2000	10	✓	✓		✓	✓
	15	✓	✓		✓	✓
	30	✓			✓	
	45	✓			✓	

Primary conductor	80 × 10mm 60 × 30mm 2 × 60 × 10
Round conductor	Ø 55mm
Weight	0.400-1.000kg (0.88-2.20lbs)
Security factor	400A-1,500A = FS 5 1,600A-2,000A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59042



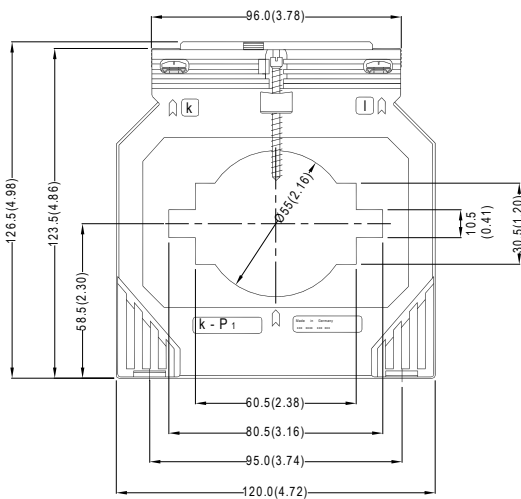
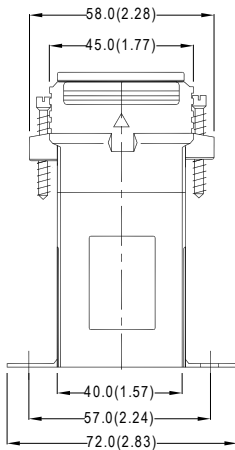
Secondary current		5A	1A
Primary current A	Burden VA	Accuracy class	Accuracy class
		1	1
		Art.-no.	Art.-no.
1000-500	10-5	✓	✓
	15-7.5	✓	✓
1200-600	10-5	✓	✓
	15-7.5	✓	✓
1500-750	10-5	✓	✓
	15-7.5	✓	✓
	30-15	✓	✓
1600-800	10-5	✓	✓
	15-7.5	✓	✓
	30-15	✓	✓
2000-1000	10-5	✓	✓
	15-7.5	✓	✓
	30-15	✓	✓



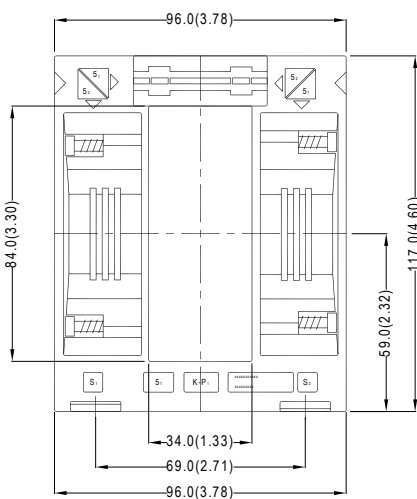
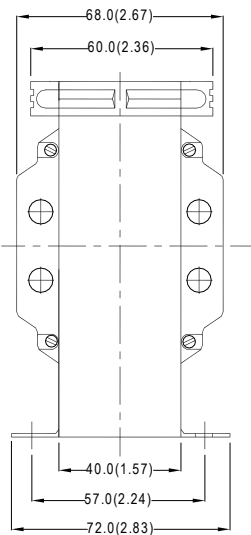
Primary conductor	80 × 10mm 60 × 30mm 2 × 60 × 10
Round conductor	Ø 55mm
Weight	0.400-1.000kg (0.88-2.20lbs)
Security factor	400A-1,500A = FS 5 1,600A-2,000A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59042



Secondary current		5A	1A
Primary current A	Burden VA	Accuracy class	Accuracy class
		1	1
		Art.-no.	Art.-no.
2000-1500-1000	30-15-10	✓	✓
2000-1000-500	30-10-5	✓	✓
1600-800-400	15-10-5	✓	✓
1500-1000-500	15-10-5	✓	✓
1200-800-600	15-10-5	✓	✓
1500-1000-750	15-10-5	✓	✓
1000-750-500	10-5-2.5	✓	✓



Primary conductor	80 × 10mm 60 × 30mm 2 × 60 × 10
Round conductor	Ø 55mm
Weight	0.400-1.000kg (0.88-2.20lbs)
Security factor	400A-1,500A = FS 5 1,600A-2,000A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59042



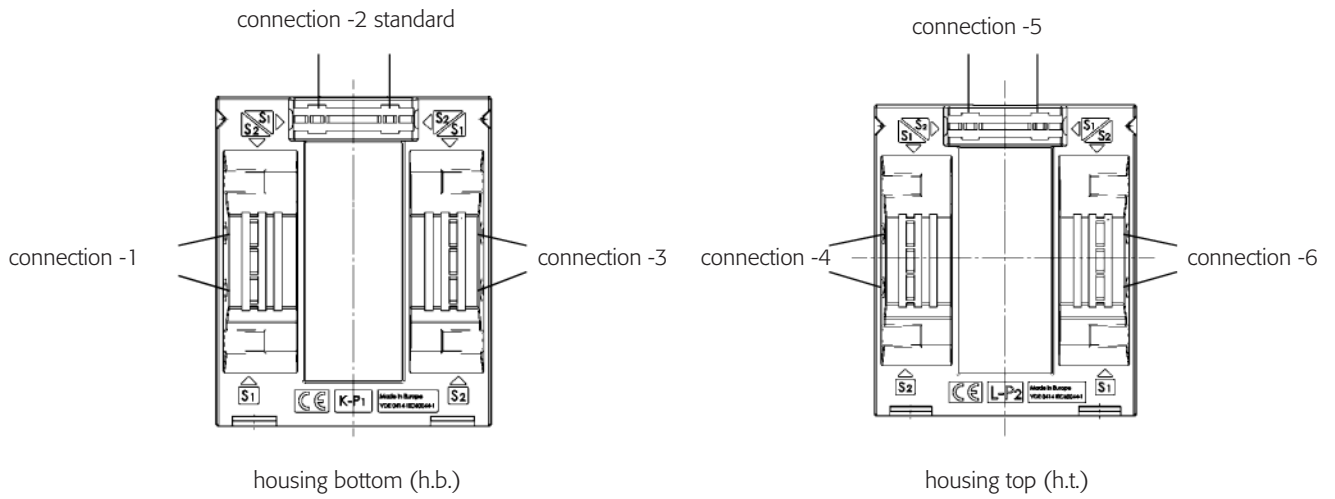
Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
300	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
400	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
500	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
600	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓		✓	
750	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
800	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
1000	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1200	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1250	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1500	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1600	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
1800	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
2000	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
2500	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	

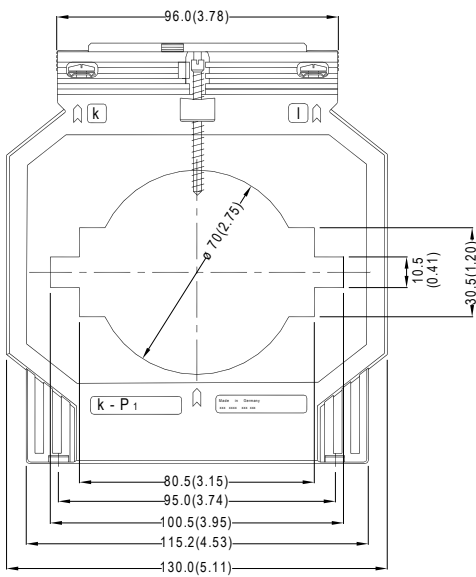
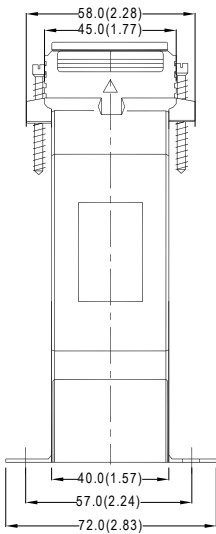
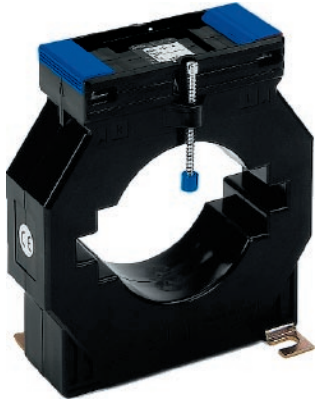
Primary conductor	83 × 34mm
Round conductor	Ø 34mm
Weight	0.400-0.850kg (0.88-1.87lbs)
Security factor	300A-1,500A = FS 5 1,600A-2,500A = FS 10
DIN rail mounting	Not available
Sealed shutter	Not available



Connection options

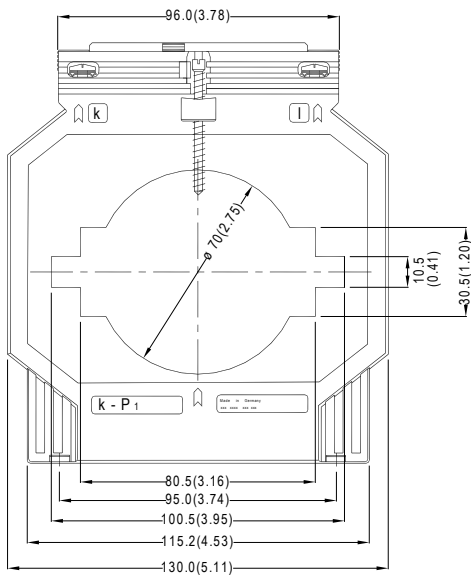
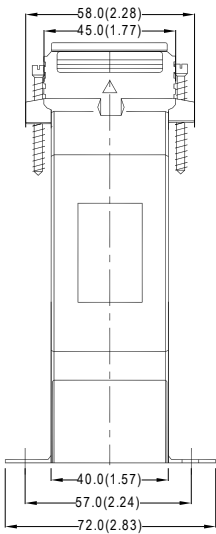
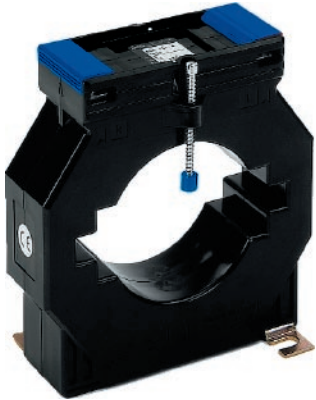
The Measuring current transformers ASK 83.4 is a multipurpose transformer which can be installed vertically or horizontally. There are 6 connection options to choose from.





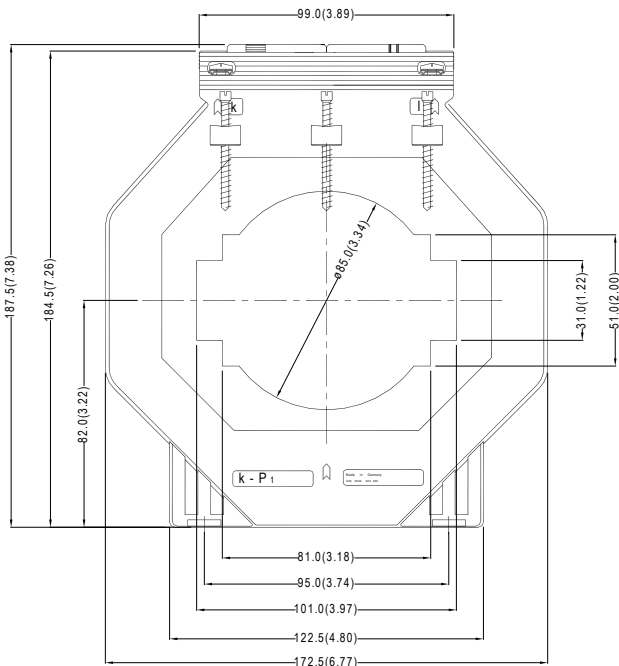
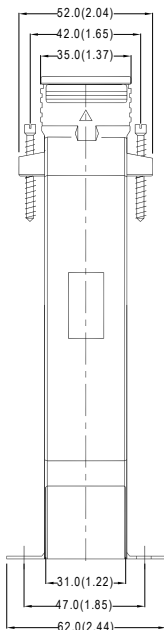
Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
500	2.5		✓		✓
	5	✓	✓	✓	✓
	10	✓		✓	
600	2.5		✓		✓
	5	✓	✓	✓	✓
	10	✓	✓		
750	2.5		✓		✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
800	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
1000	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
	30	✓		✓	
1200	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
	30	✓		✓	
1250	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
	30	✓		✓	
1500	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
1600	5		✓		✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
	45	✓		✓	
1800	5		✓		✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
	45	✓		✓	
2000	5		✓		✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓		✓	
2500	5		✓		✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓		✓	

Primary conductor	100 × 10mm 2 × 80 × 10mm
Round conductor	Ø 70mm
Weight	0.200-0.740kg (0.44-1.63lbs)
Security factor	500A-1,500A = FS 5 1,600A-2,500A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59042



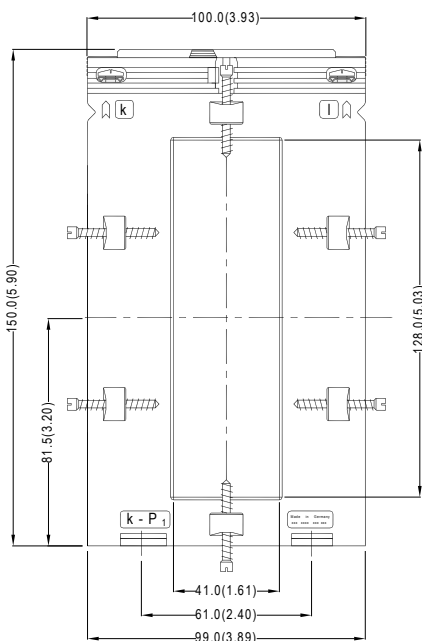
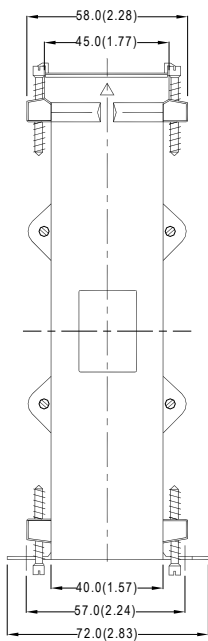
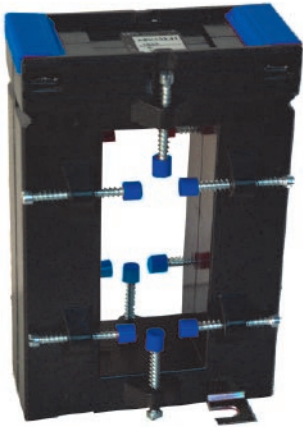
Secondary current		5A	1A
Primary current A	Burden VA	Accuracy class	Accuracy class
		1	1
		Art.-no.	Art.-no.
1200-600	10-5	✓	✓
	15-7.5	✓	✓
1500-750	10-5	✓	✓
	15-7.5	✓	✓
1600-800	10-5	✓	✓
	15-7.5	✓	✓
	30-15	✓	✓
2000-1000	10-5	✓	✓
	15-7.5	✓	✓
	30-15	✓	✓
2500-1250	10-5	✓	✓
	15-7.5	✓	✓
	30-15	✓	✓

Primary conductor	100 × 10mm 2 × 80 × 10mm
Round conductor	Ø 70mm
Weight	0.200-0.740kg (0.44-1.63lbs)
Security factor	500A-1,500A = FS 5 1,600A-2,500A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59042



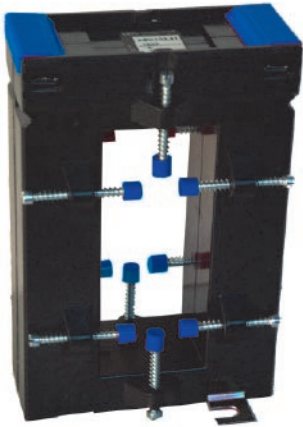
Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
750	2.5		✓		✓
	5	✓		✓	
	10	✓		✓	
800	2.5		✓		✓
	5	✓	✓	✓	✓
	10	✓		✓	
	15	✓		✓	
1000	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1200	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1250	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
1500	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
1600	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓		✓	
	45	✓		✓	
2000	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
2500	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓		✓	
3000	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓		✓	

Primary conductor	2 × 100 × 10mm 3 × 80 × 10mm
Round conductor	Ø 85mm
Weight	0.500-0.800kg (1.10-1.76lbs)
Security factor	750A-1,500A = FS 5 1,600A-3,000A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59040 (x2)

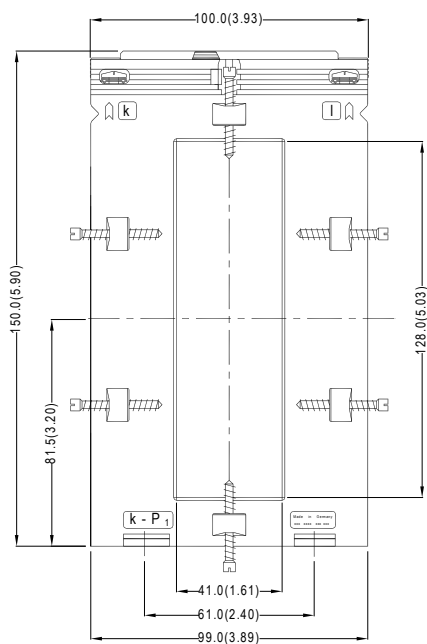
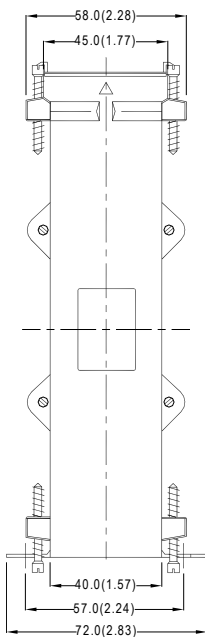


Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1	0.5	1	0.5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.
400	2.5	✓	✓	✓	✓
	5	✓		✓	
500	2.5	✓	✓	✓	✓
	5	✓		✓	
600	2.5	✓	✓	✓	✓
	5	✓		✓	
750	2.5	✓	✓	✓	✓
	5	✓		✓	
800	5	✓	✓	✓	✓
	10	✓		✓	
1000	10	✓	✓	✓	✓
	15	✓		✓	
1200	10	✓	✓	✓	✓
	15	✓		✓	
1250	10	✓	✓	✓	✓
	15	✓		✓	
1500	15	✓	✓	✓	✓
	30	✓		✓	
2000	15	✓	✓	✓	✓
	30	✓		✓	

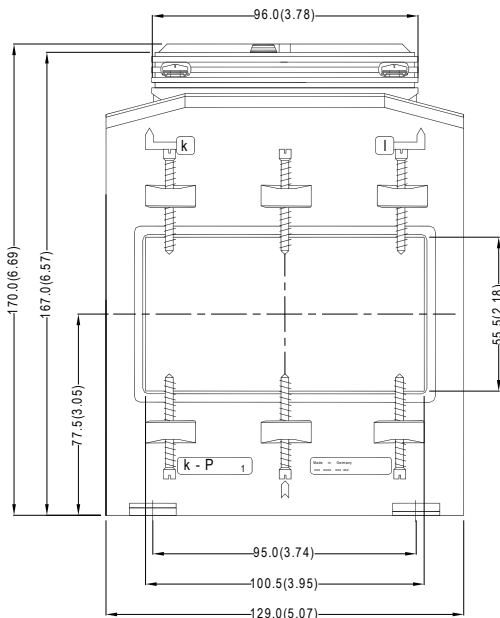
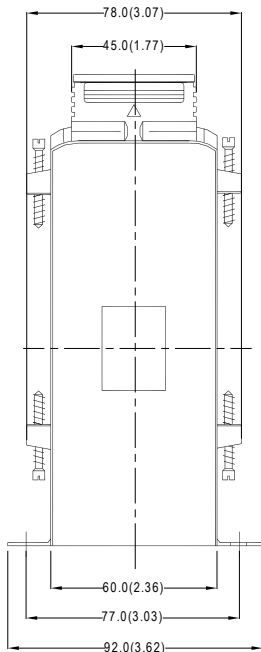
Primary conductor	103 × 41mm
Round conductor	Ø 40mm
Weight	0.580-0.950kg (1.28-2.09lbs)
Security factor	400A-1,500A = FS 5 1,600A-2,000A = FS 10
DIN rail mounting	Not available
Sealed shutter	Not available



Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1	0.5	1	0.5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.
1000-500	5-2.5	✓	✓	✓	✓
1200-600	5-2.5	✓	✓	✓	✓
1500-750	10-5	✓	✓	✓	✓
	15-7.5	✓	✓	✓	✓
2000-1000	15-7.5	✓	✓	✓	✓
	30-15	✓	✓	✓	✓



Primary conductor	103 × 41mm
Round conductor	Ø 40mm
Weight	0.580-0.950kg (1.28-2.09lbs)
Security factor	400A-1,500A = FS 5 1,600A-2,000A = FS 10
DIN rail mounting	Not available
Sealed shutter	Not available

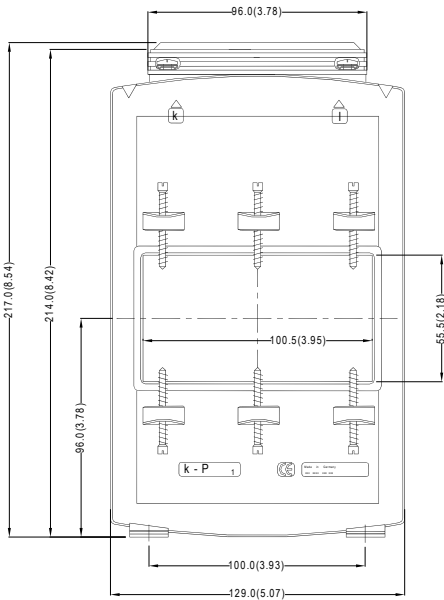
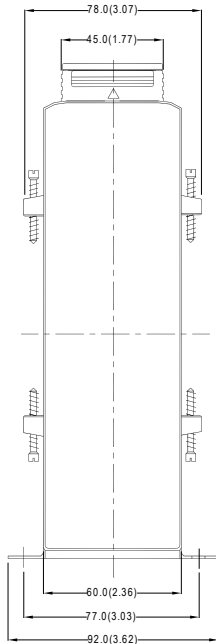


Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		1 Art.-no.	0.5 Art.-no.	0.2s Art.-no.	1 Art.-no.	0.5 Art.-no.
600	2.5		✓	✓		✓
	5	✓	✓		✓	✓
	10	✓			✓	
750	2.5		✓	✓		✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	
800	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
1000	2.5		✓	✓		
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	
	15		✓		✓	
1200	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	✓
1250	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30		✓			
1500	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	
1600	5	✓	✓	✓		
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	✓
1800	5	✓	✓		✓	✓
	10	✓	✓		✓	✓
	15	✓	✓		✓	✓
	30	✓			✓	
2000	5		✓	✓		
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	✓
	45	✓			✓	
2400	5		✓	✓		
	10		✓	✓		
	15		✓	✓		
	30		✓			
2500	5		✓	✓		
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	✓
	45	✓			✓	
3000	5		✓	✓		
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	✓
	45	✓			✓	

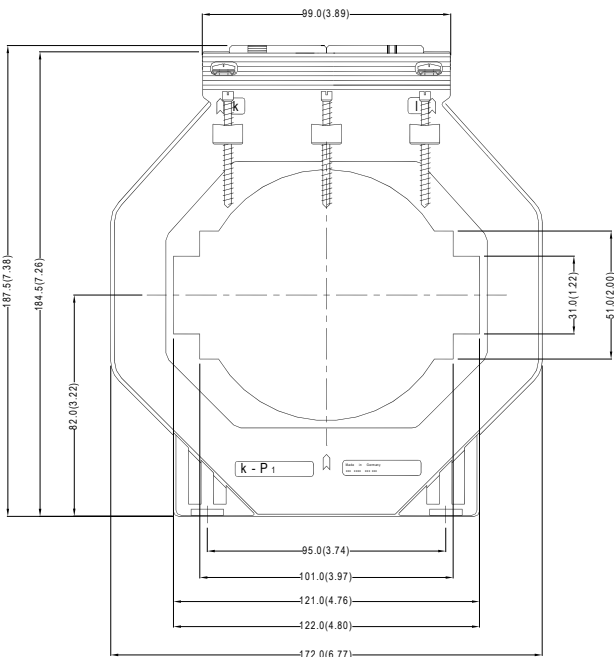
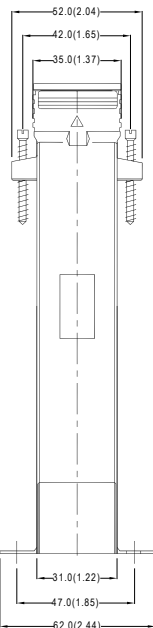
Primary conductor	100 × 55mm
Round conductor	Ø 55mm
Weight	0.800-1.580kg (1.76-3.48lbs)
Security factor	600A-1,500A = FS 5 1,600A-3,000A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59042



Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
2500	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓		✓	
3000	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓		✓	
4000	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓		✓	
5000	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓		✓	

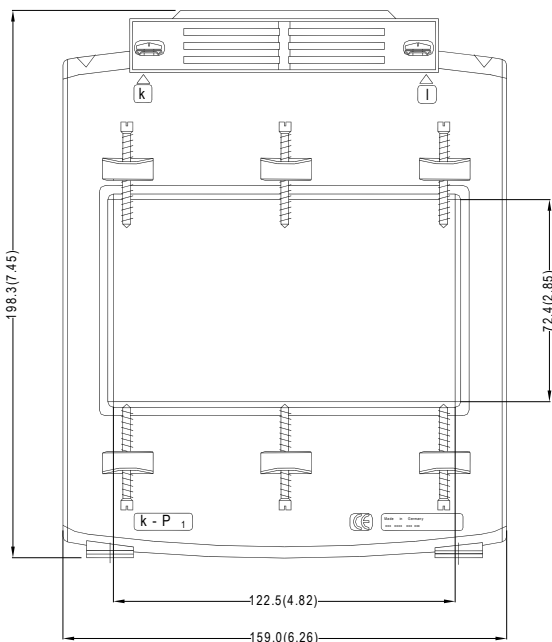
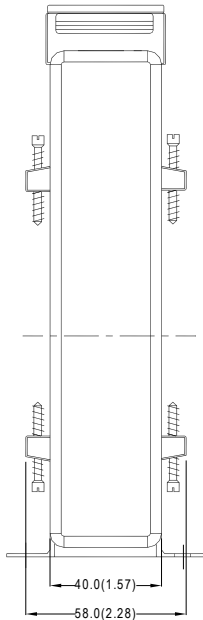


Primary conductor	100 × 55mm
Round conductor	Ø 55mm
Weight	0.800-2.220kg (1.76-4.89lbs)
Security factor	FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59042



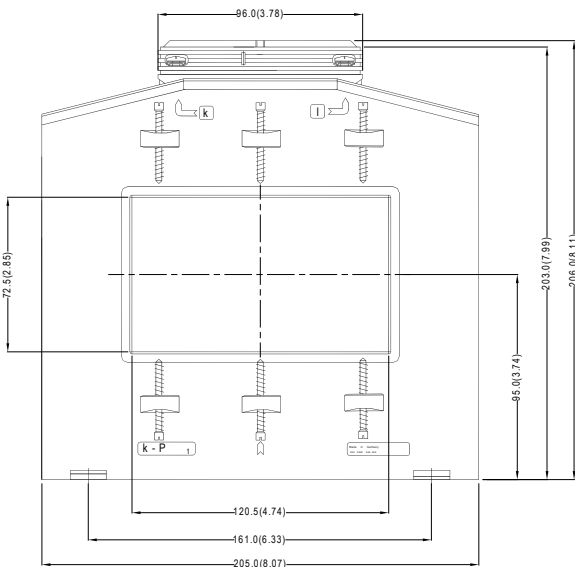
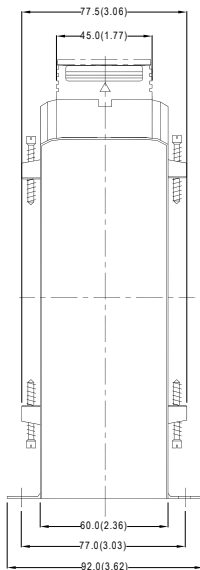
Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		1	0.5	0.2s	1	0.5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.	Art.-no.
750	2.5		✓			
	5		✓			
	10		✓			
1000	2.5		✓	✓		
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
1200	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
	15	✓	✓		✓	✓
1250	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	✓
1500	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	✓
	30	✓	✓		✓	
1600	5	✓		✓		
	10	✓		✓		
	15	✓		✓		
	30	✓	✓			
1800	5	✓	✓		✓	✓
	10	✓	✓		✓	✓
	15	✓	✓		✓	✓
	30	✓			✓	
2000	5		✓	✓		✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	✓
	45	✓			✓	
2500	5		✓	✓		
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	✓
	45	✓			✓	
3000	5		✓	✓		
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	✓
	45	✓			✓	
4000	10	✓	✓		✓	✓
	15	✓	✓		✓	✓
	30	✓	✓		✓	✓
	45	✓			✓	

Primary conductor	123 × 30mm 3 × 100 × 10mm
Round conductor	Ø 100mm
Weight	0.500-1.300kg (1.10-2.87lbs)
Security factor	1,000A-1,500A = FS 5 1,600A-4,000A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59040



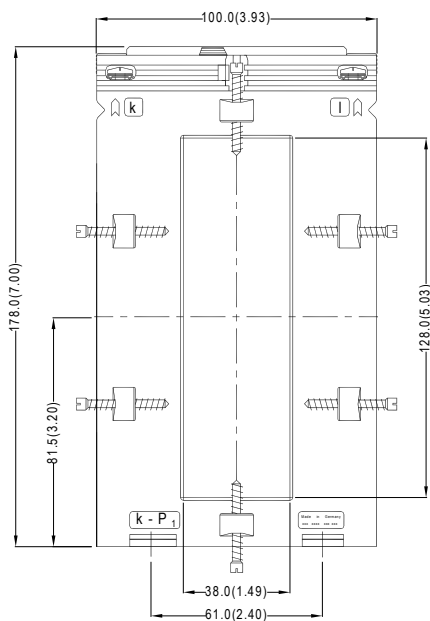
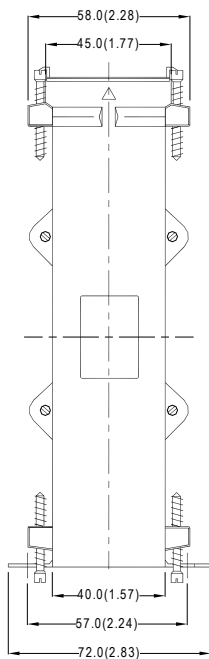
Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
1000	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
1200	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
1250	15	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1500	30	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1600	30	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1800	30	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
2000	45	✓	✓	✓	✓
	30	✓	✓	✓	✓
	15	✓	✓	✓	✓
	10	✓	✓	✓	✓
2500	45	✓	✓	✓	✓
	30	✓	✓	✓	✓
	15	✓	✓	✓	✓
	10	✓	✓	✓	✓

Primary conductor	120 × 70mm
Round conductor	Ø 70mm
Weight	1.000-1.700kg (2.20-3.75lbs)
Security factor	1,000A-1,500A = FS 5 1,600A-2,500A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59042



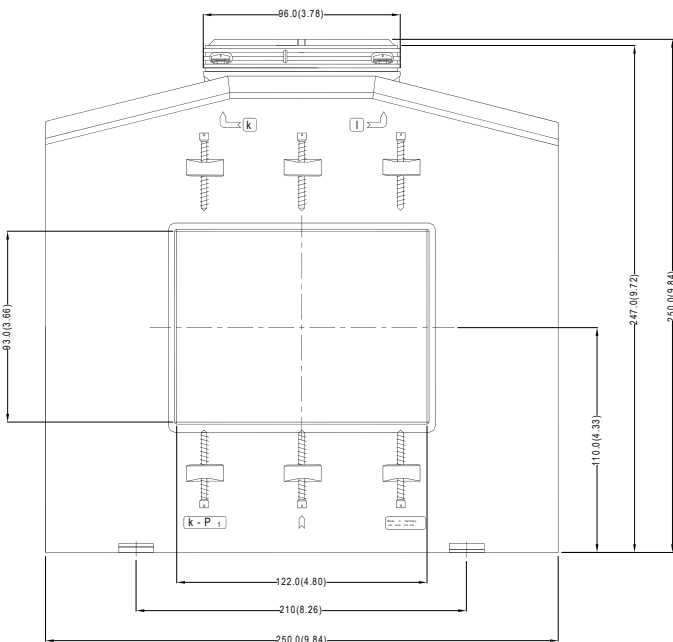
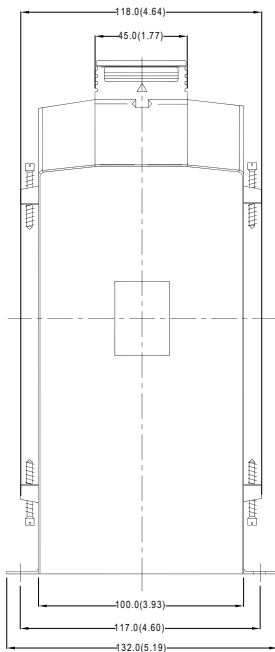
Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
1000	5	✓	✓	✓	✓
	10	✓		✓	
1200	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
1250	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
1500	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
1800	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
2000	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓		✓	
2500	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓		✓	
3000	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓		✓	
4000	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓		✓	
5000	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓		✓	
6000	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓		✓	

Primary conductor	120 × 72mm
Round conductor	Ø 72mm
Weight	0.750-5.040kg (1.65-11.11lbs)
Security factor	1,000A-1,500A = FS 5 1,600A-6,000A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59042



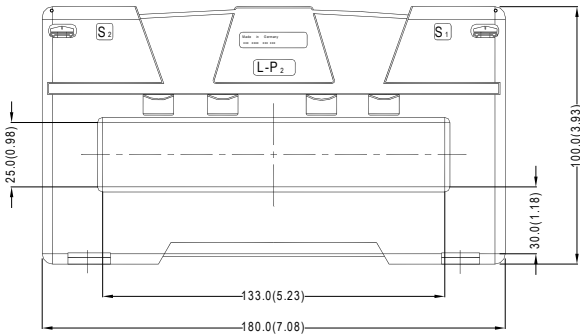
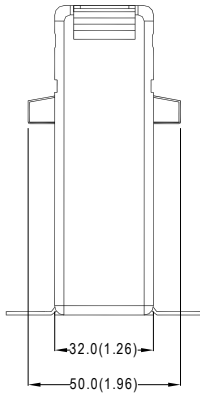
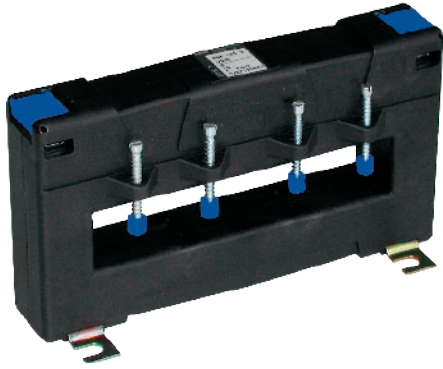
Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1	0.5	1	0.5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.
400	2.5	✓	✓	✓	✓
	5	✓		✓	
500	2.5	✓	✓	✓	✓
	5	✓		✓	
600	2.5	✓	✓	✓	✓
	5	✓		✓	
750	2.5	✓	✓	✓	✓
	5	✓		✓	
800	5	✓	✓	✓	✓
	10	✓		✓	
1000	10	✓	✓	✓	✓
	15	✓		✓	
1200	10	✓	✓	✓	✓
	15	✓		✓	
1250	10	✓	✓	✓	✓
	15	✓		✓	
1500	15	✓	✓	✓	✓
	30	✓		✓	
2000	15	✓	✓	✓	✓
	30	✓		✓	
2500	15	✓	✓	✓	✓
	30	✓		✓	

Primary conductor	128 × 38mm
Round conductor	Ø 38mm
Weight	0.500-1.100kg (1.10-2.43lbs)
Security factor	400A-1,500A = FS 5 1,600A-2,500A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59042



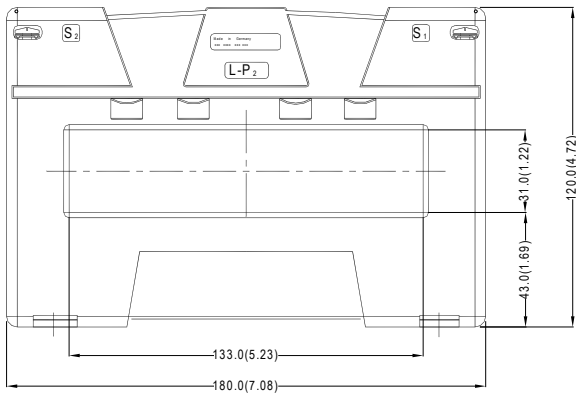
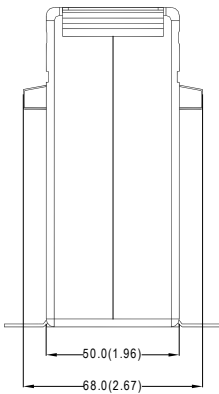
Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
1000	5	✓	✓	✓	✓
	10	✓		✓	
	15	✓		✓	
1200	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
1250	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
1500	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
1600	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
1800	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
2000	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
2500	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓	✓	✓	✓
3000	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓	✓	✓	✓
4000	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓	✓	✓	✓
5000	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓	✓	✓	✓
6000	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓	✓	✓	✓
7500	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
	45	✓	✓	✓	✓

Primary conductor	120 × 90mm
Round conductor	Ø 90mm
Weight	0.800-5.040kg (1.76 – 11.11lbs)
Security factor	1,000A-1,500A = FS 5 1,600A-7,500A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59042



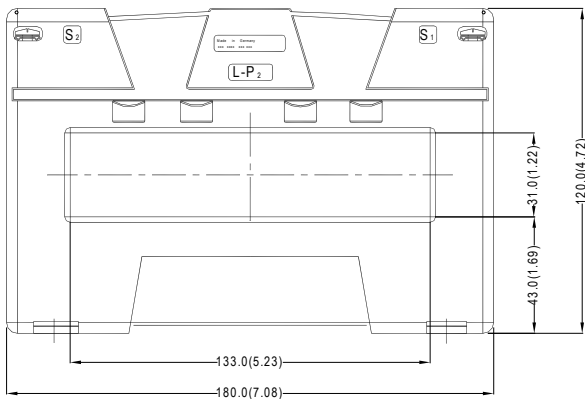
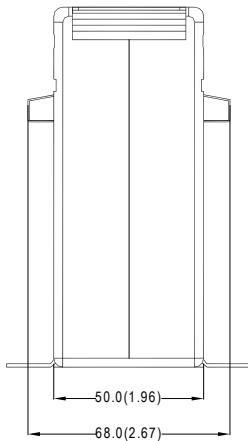
Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		1	0.5	0.2s	1	0.5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.	Art.-no.
300	2.5	✓	✓		✓	✓
	5	✓	✓		✓	✓
400	2.5	✓	✓		✓	✓
	5	✓	✓		✓	✓
500	10	✓	✓		✓	✓
	2.5	✓	✓		✓	✓
	5	✓	✓		✓	✓
600	10	✓	✓		✓	✓
	15	✓			✓	
	2.5	✓	✓		✓	✓
750	5	✓	✓		✓	✓
	10	✓	✓		✓	✓
	15	✓	✓		✓	✓
1000	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	✓
	30	✓			✓	
1200	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	✓
1250	30	✓			✓	
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
1500	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
1600	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	✓
	5	✓	✓	✓	✓	✓

Primary conductor	130 × 25mm
Round conductor	Ø 25mm
Weight	0.700-1.280kg (1.54-2.82lbs)
Security factor	300A-1,500A = FS 5 1,600A = FS 10
DIN rail mounting	Not available
Sealed shutter	Not available



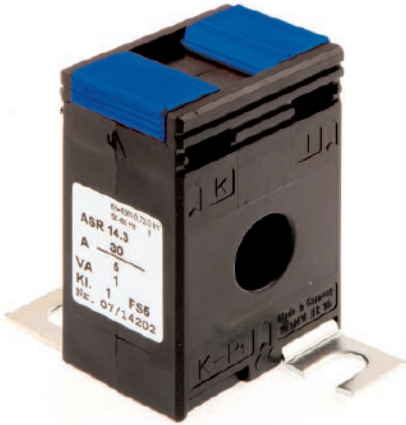
Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		1	0.5	0.2s	1	0.5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.	Art.-no.
300	2.5	✓	✓		✓	✓
	5	✓	✓		✓	✓
	10	✓	✓		✓	✓
400	2.5	✓	✓		✓	✓
	5	✓	✓		✓	✓
	10	✓	✓		✓	✓
500	2.5	✓	✓		✓	✓
	5	✓	✓		✓	✓
	10	✓	✓		✓	✓
	15	✓	✓		✓	✓
600	2.5	✓	✓		✓	✓
	5	✓	✓		✓	✓
	10	✓	✓		✓	✓
	15	✓	✓		✓	✓
750	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
	15	✓	✓		✓	✓
1000	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	✓
	30	✓	✓		✓	✓
1200	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	✓

Primary conductor	130 × 30mm
Round conductor	Ø 30mm
Weight	0.740-1.280kg (1.63-2.82lbs)
Security factor	300A-1,500A = FS 5 1,600A-3,200A = FS 10
DIN rail mounting	Not available
Sealed shutter	Not available

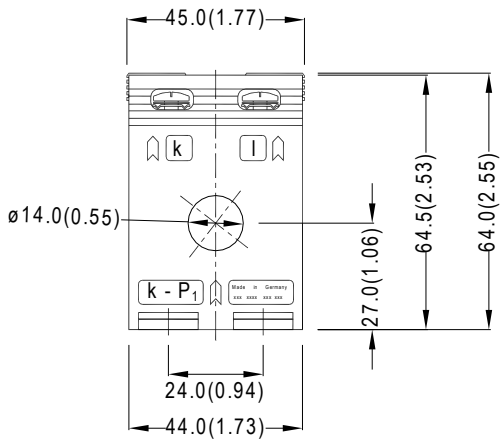
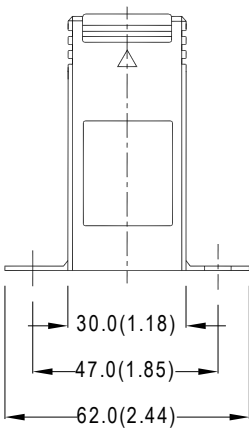


Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		1	0.5	0.2s	1	0.5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.	Art.-no.
1250	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	✓
	45	✓				
1500	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	✓
	45	✓				
1600	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	✓
	45	✓				
2000	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	✓
	45	✓	✓			
2400	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	✓
	45	✓	✓			
2500	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓	✓	✓	✓
	45	✓	✓			
3000	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓	✓	✓	✓
	45	✓	✓			
3200	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓	✓	✓	✓
	45	✓			✓	

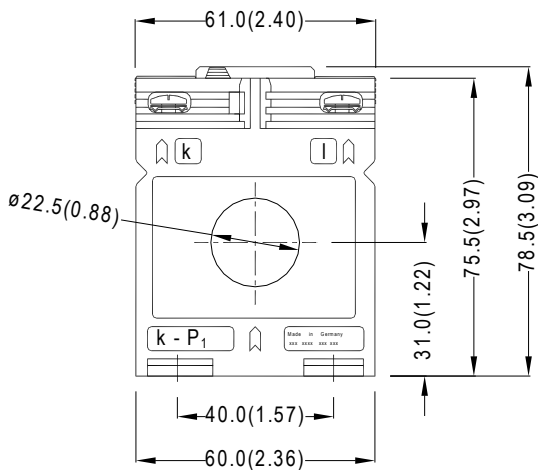
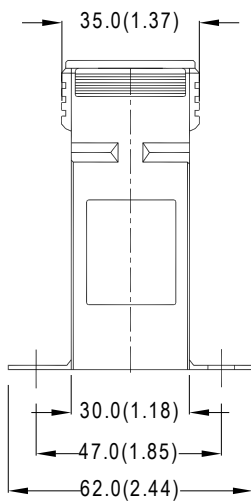
Primary conductor	130 × 30mm
Round conductor	Ø 30mm
Weight	0.740-1.280kg (1.63-2.82lbs)
Security factor	300A-1,500A = FS 5 1,600A-3,200A = FS 10
DIN rail mounting	Not available
Sealed shutter	Not available



Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		0.5	0.5s	0.2	0.5	0.2
		Art.-no.	Art.-no.	Art.-no.	Art.-no.	Art.-no.
75	1.5	✓	✓		✓	
80	1.5	✓	✓		✓	
100	1.5	✓	✓	✓	✓	✓
120	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓		✓	
125	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓	✓	✓	✓
150	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓	✓	✓	✓



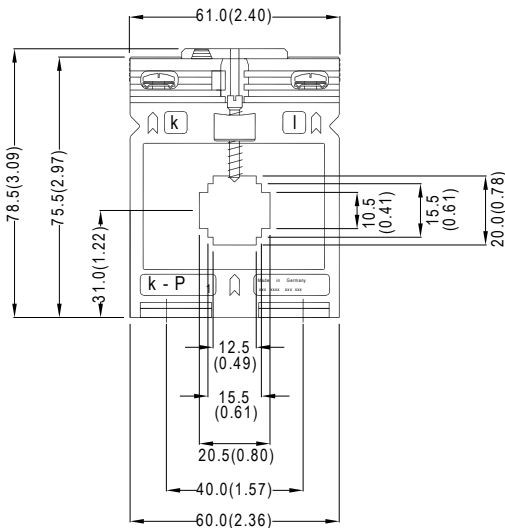
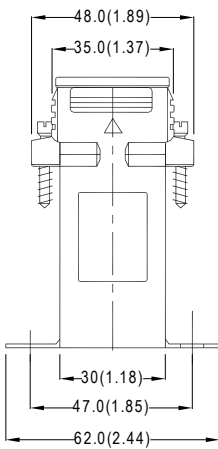
Round conductor	Ø 14mm
Weight	0.180-0.240kg (0.40-0.53lbs)
Security factor	FS 5
DIN rail mounting	Item number 1213990005
Sealed shutter	Not available



Approved current transformer for tariff applications

Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		0.5 Art.-no.	0.5s Art.-no.	0.2 Art.-no.	0.5 Art.-no.	0.2 Art.-no.
100	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓		✓	
150	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓		✓	
200	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
250	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
300	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓			
400	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
500	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
600	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓

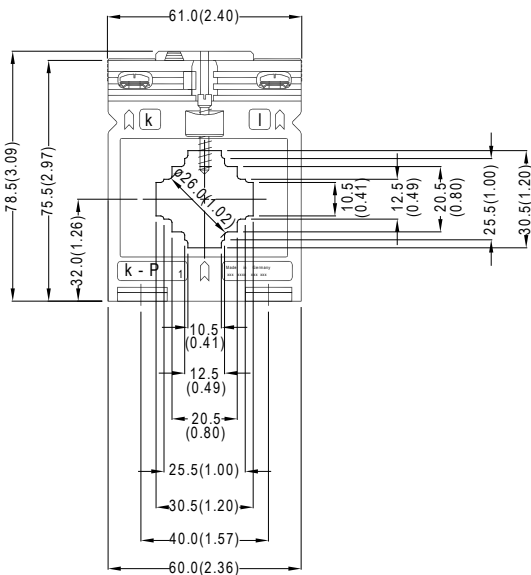
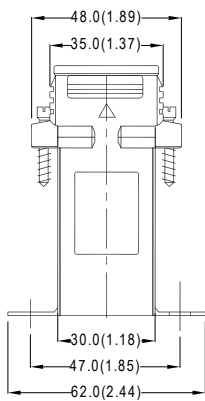
Round conductor	Ø 22.5mm
Weight	0.180-0.240kg (0.40-0.53lbs)
Security factor	FS 5
DIN rail mounting	Item number 1213990005
Sealed shutter	Not available



Approved current transformer for tariff applications

Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		0.5 Art.-no.	0.5s Art.-no.	0.2 Art.-no.	0.5 Art.-no.	0.2 Art.-no.
100	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓		✓	
150	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓		✓	
200	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
250	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
300	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓			
400	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
500	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓

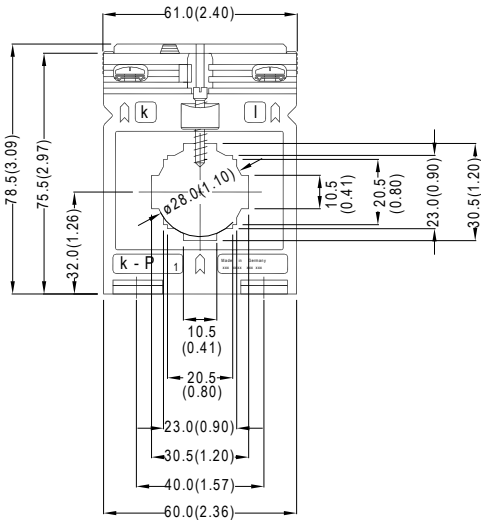
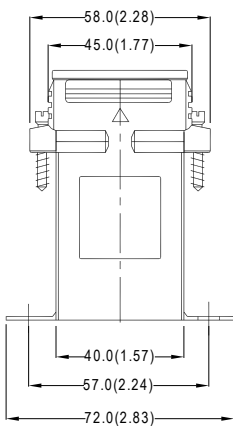
Primary conductor	20 × 10mm 2 × 30 × 5mm
Round conductor	Ø 19.2mm
Weight	0.190-0.380kg (0.42-0.84lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990001
Sealed shutter	Type: 59040



Approved current transformer for tariff applications

Secondary current		5A		
Primary current A	Burden VA	Accuracy class		
		0.5 Art.-no.	0.5s Art.-no.	0.2 Art.-no.
100	1.5	✓	✓	✓
	2.5	✓	✓	
150	1.5	✓	✓	✓
	2.5	✓	✓	
200	2.5	✓	✓	✓
	5	✓	✓	✓
250	2.5	✓	✓	✓
	5	✓	✓	✓
300	2.5	✓	✓	✓
	5	✓	✓	✓
400	2.5	✓	✓	✓
	5	✓	✓	✓
500	2.5	✓	✓	✓
	5	✓	✓	✓
600	2.5	✓	✓	✓
	5	✓	✓	✓
750	2.5	✓	✓	✓
	5	✓	✓	✓

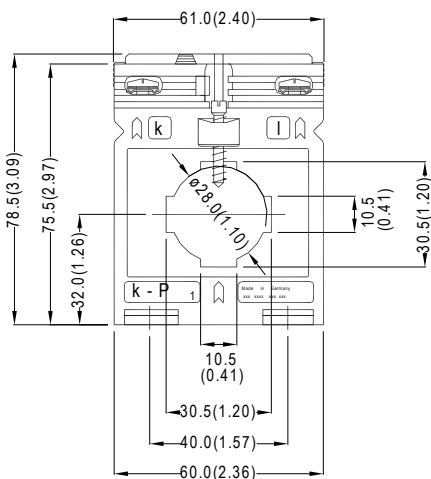
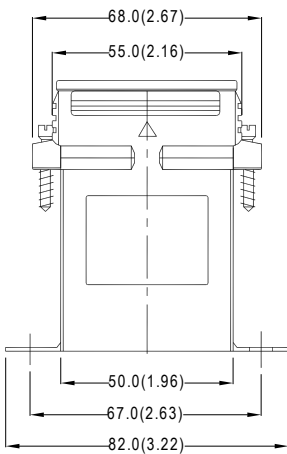
Primary conductor	30 × 10mm 2 × 20 × 10mm
Round conductor	Ø 26mm
Weight	0.200-1.100kg (0.44-2.43lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990001
Sealed shutter	Type: 59040



Approved current transformer for tariff applications

Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		0.5 Art.-no.	0.5s Art.-no.	0.2 Art.-no.	0.5 Art.-no.	0.2 Art.-no.
100	1.5			✓		
	2.5	✓	✓	✓	✓	✓
150	2.5	✓	✓	✓	✓	✓
	5	✓	✓		✓	
200	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
250	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
300	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
400	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
500	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
600	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	
750	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	

Primary conductor	30 × 10mm 2 × 20 × 10mm
Round conductor	Ø 28mm
Weight	0.220-0.480kg (0.49-1.06lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990002
Sealed shutter	Type: 59041



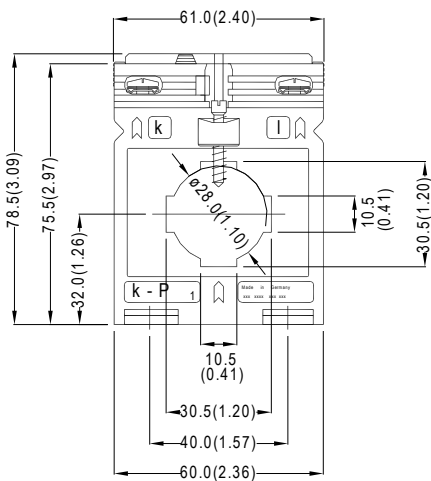
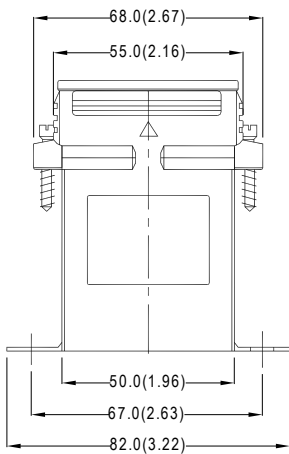
Approved current transformer for tariff applications

Secondary current		5A				1A	
Primary current A	Burden VA	Accuracy class				Accuracy class	
		0.5 Art-no.	0.5s Art-no.	0.2 Art-no.	0.2s Art-no.	0.5 Art-no.	0.2 Art-no.
75	2.5	✓	✓			✓	
100	2.5	✓	✓	✓		✓	✓
	5	✓	✓			✓	
150	2.5	✓	✓	✓	✓	✓	✓
	5	✓	✓	✓		✓	✓
200	2.5	✓	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓	✓
	10	✓	✓			✓	
250	2.5	✓	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓	✓
	10	✓	✓	✓		✓	✓
	15	✓	✓			✓	
300	2.5	✓	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓	✓
	10	✓	✓	✓		✓	✓
	15	✓	✓			✓	
400	2.5	✓	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓	✓
	15	✓	✓			✓	
500	2.5	✓	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓	✓
	15	✓	✓			✓	
600	2.5	✓	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓	✓
	15	✓	✓			✓	
750	2.5	✓	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓	✓
	15	✓	✓			✓	

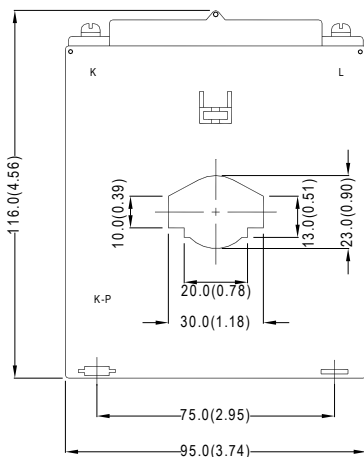
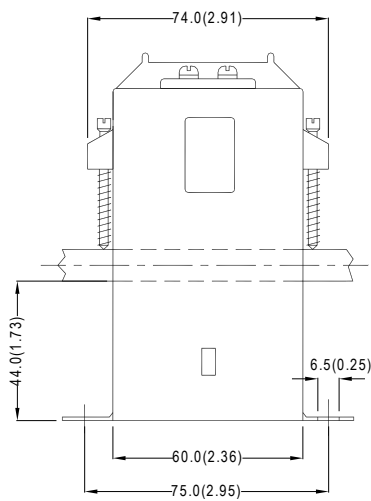
Primary conductor	30 × 10mm 2 × 20 × 10mm
Round conductor	Ø 28mm
Weight	0.240-0.520kg (0.53-1.15lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990003
Sealed shutter	Type: 59041



Secondary current		5A	
Primary current A	Burden VA	Accuracy class	
		0.5 Art.-no.	0.5s Art.-no.
200-100	5-2.5	✓	✓
	10-5	✓	
300-150	5-2.5	✓	✓
	10-5	✓	✓
400-200	5-2.5	✓	✓
	10-5	✓	✓
500-250	5-2.5	✓	✓
	10-5	✓	✓
600-300	5-2.5	✓	✓
	10-5	✓	✓



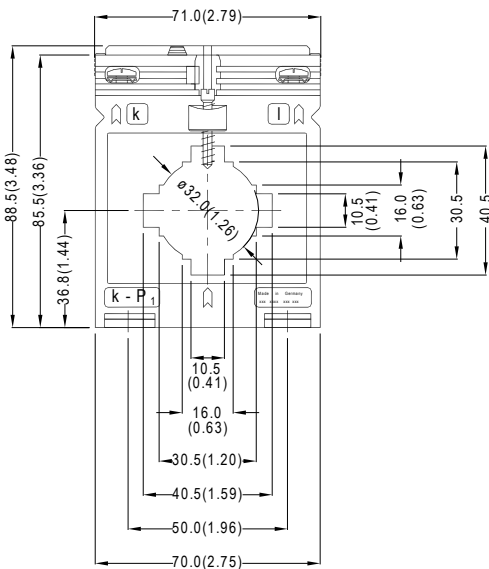
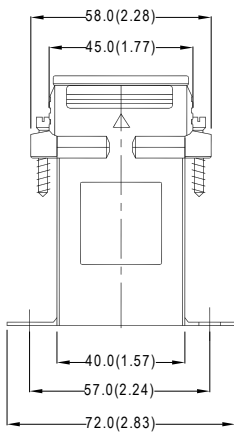
Primary conductor	30 × 10mm 2 × 20 × 10mm
Round conductor	Ø 28mm
Weight	0.240-0.520kg (0.53-1.15lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990003
Sealed shutter	Type: 59041



Approved current transformer for tariff applications

Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		0.5 Art.-no.	0.5s Art.-no.	0.2 Art.-no.	0.5 Art.-no.	0.2 Art.-no.
50	2.5	✓	✓		✓	
	5	✓	✓		✓	
75	2.5	✓	✓		✓	
	5	✓	✓		✓	
100	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	
150	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	
	15	✓	✓		✓	
200	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	
250	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	
300	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	
	30	✓	✓		✓	
400	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	
500	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	
600	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
750	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	

Primary conductor	30 × 10mm 20 × 13mm
Round conductor	Ø 23mm
Weight	0.310-1.900kg (0.68-4.19lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59044



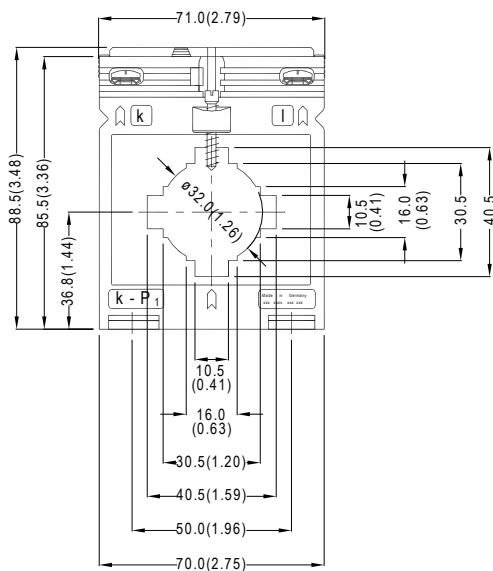
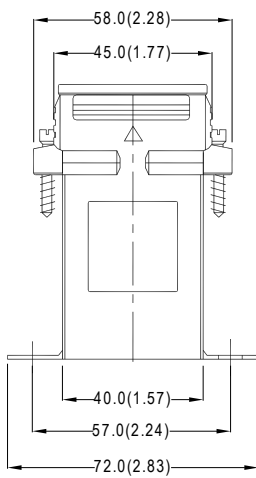
Approved current transformer for tariff applications

Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		0.5 Art.-no.	0.5s Art.-no.	0.2 Art.-no.	0.5 Art.-no.	0.2 Art.-no.
100	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓		✓	
150	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓		✓	
200	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
250	1.5					✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
300	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	
400	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
500	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
600	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
750	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	

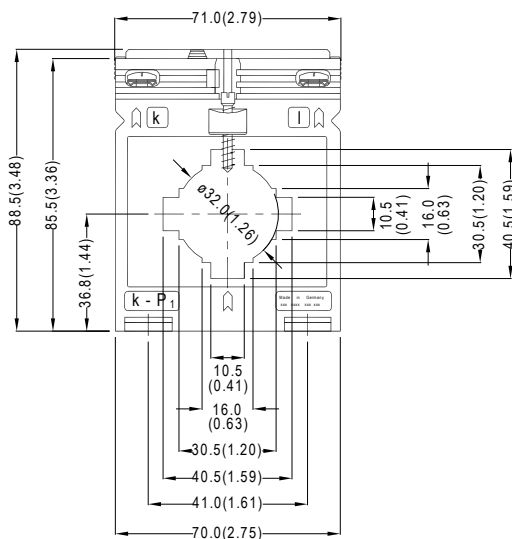
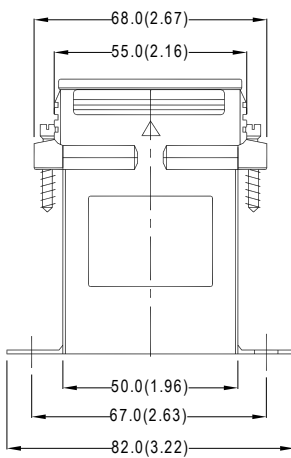
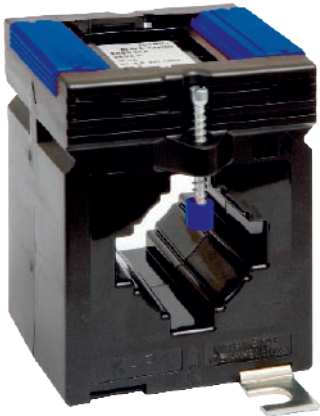
Primary conductor	40 × 10mm 2 × 30 × 5mm
Round conductor	Ø 32mm
Weight	0.240-0.800kg (0.53-1.76lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990004
Sealed shutter	Type: 59041



Secondary current		5A	
Primary current A	Burden VA	Accuracy class	
		0.5 Art.-no.	0.5s Art.-no.
200-100	5-2.5	✓	✓
	10-5	✓	✓
300-150	5-2.5	✓	✓
	10-5	✓	✓
400-200	5-2.5	✓	✓
	10-5	✓	✓
500-250	5-2.5	✓	✓
	10-5	✓	✓
600-300	5-2.5	✓	✓
	10-5	✓	✓

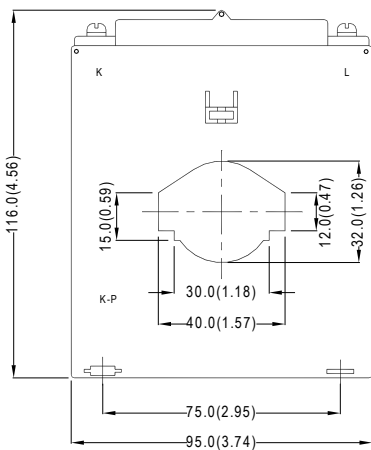
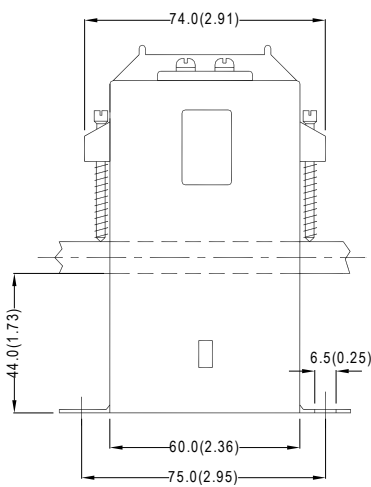


Primary conductor	40 × 10mm 2 × 30 × 5mm
Round conductor	Ø 32mm
Weight	0.240-0.800kg (0.53-1.76lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990004
Sealed shutter	Type: 59041



Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		0.5 Art.-no.	0.5s Art.-no.	0.2 Art.-no.	0.5 Art.-no.	0.2 Art.-no.
75	2,5	✓			✓	
80	2,5	✓	✓		✓	
100	1,5	✓	✓	✓	✓	✓
	2,5	✓	✓		✓	✓
150	2,5	✓	✓	✓	✓	✓
	5	✓	✓		✓	✓
200	2,5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10				✓	
250	2,5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15					
300	2,5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	
400	2,5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	
500	2,5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	
600	2,5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
750	2,5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
800	2,5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
1000	2,5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓

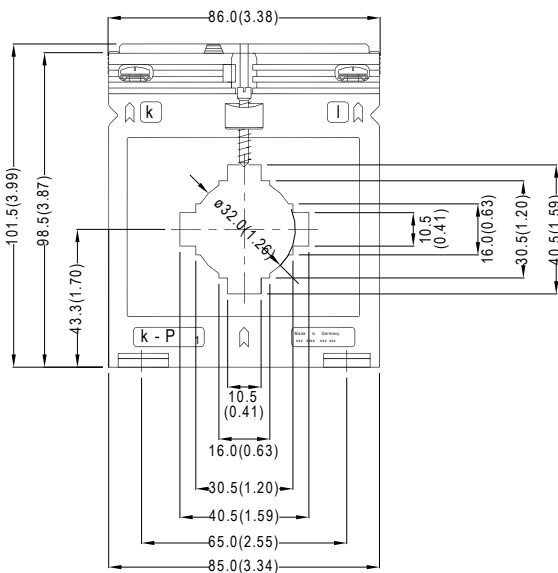
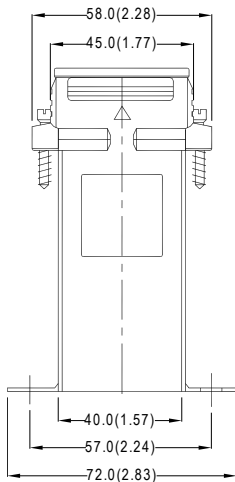
Primary conductor	40 × 10mm
Round conductor	Ø 32mm
Weight	0.250-0.510kg (0.55-1.12lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990004
Sealed shutter	Type: 59041



Approved current transformer for tariff applications

Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		0.5 Art.-no.	0.5s Art.-no.	0.2 Art.-no.	0.5 Art.-no.	0.2 Art.-no.
75	2.5	✓	✓		✓	
	5	✓	✓		✓	
100	2.5	✓	✓	✓	✓	✓
	5	✓	✓		✓	
	10	✓	✓		✓	
150	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	
	15	✓	✓		✓	
200	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	
250	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	
300	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
400	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
500	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
600	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓			
750	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
1000	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓			

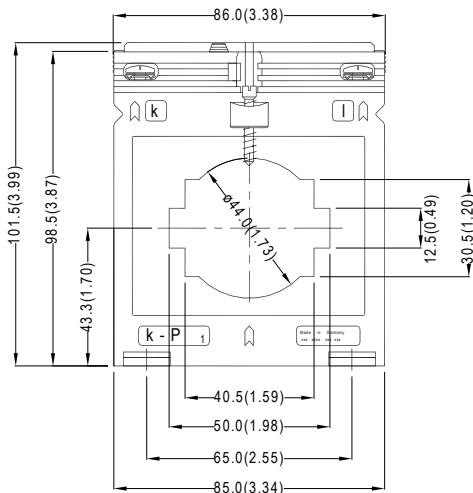
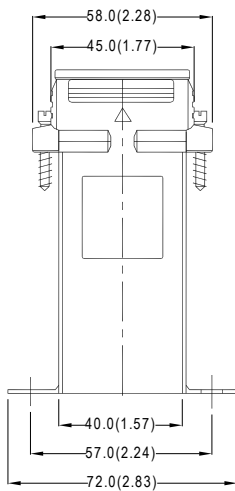
Primary conductor	40 × 12mm 30 × 15mm
Round conductor	Ø 32mm
Weight	0.320-2.000kg (0.71-4.41lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59044



Approved current transformer for tariff applications

Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		0.5 Art.-no.	0.5s Art.-no.	0.2 Art.-no.	0.5 Art.-no.	0.2 Art.-no.
75	1.5	✓	✓		✓	
	2.5	✓	✓		✓	
100	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓		✓	
150	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	
200	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	
250	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	
300	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
400	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
500	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
600	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
750	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
1000	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓

Primary conductor	40 × 10mm 2 × 30 × 5mm
Round conductor	Ø 32mm
Weight	0.270-1.000kg (0.60-2.20lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59042



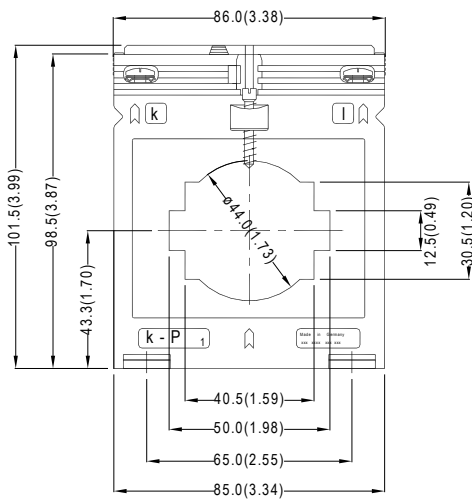
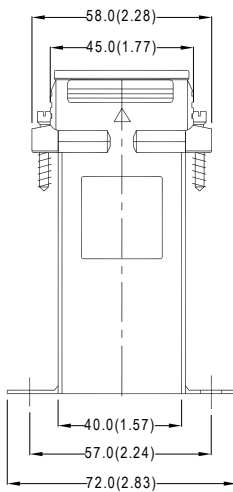
Approved current transformer for tariff applications

Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		0.5 Art.-no.	0.5s Art.-no.	0.2 Art.-no.	0.5 Art.-no.	0.2 Art.-no.
100	1.5	✓	✓		✓	
	2.5	✓	✓		✓	
150	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓		✓	
200	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
250	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
300	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
400	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
500	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
600	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
750	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
1000	15	✓	✓	✓	✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓

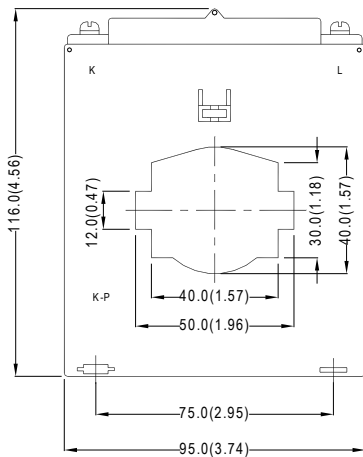
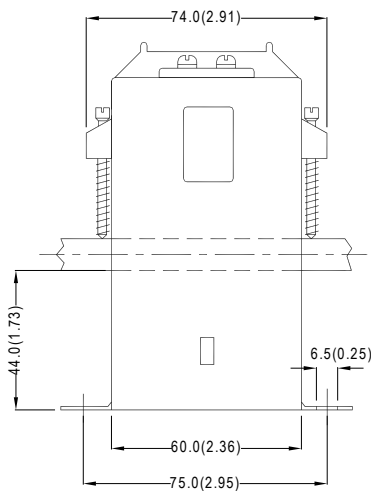
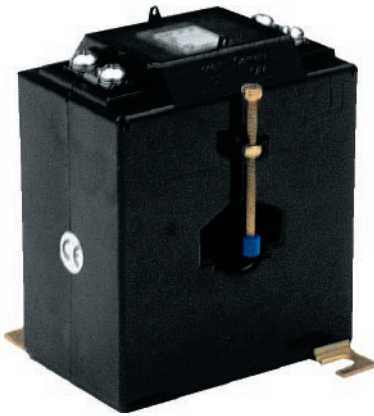
Primary conductor	50 × 12mm 2 × 40 × 10mm
Round conductor	Ø 44mm
Weight	0.260-0.720kg (0.57-1.59lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	



Secondary current		5A	1A
Primary current A	Burden VA	Accuracy class	Accuracy class
		0.5	0.5s
		Art.-no.	Art.-no.
200-100	5-2.5	✓	✓
300-150	5-2.5	✓	✓
400-200	5-2.5	✓	✓
	10-5	✓	✓
500-250	5-2.5	✓	✓
	10-5	✓	✓
600-300	5-2.5	✓	✓
	10-5	✓	✓
1000-500	5-2.5	✓	✓
	10-5	✓	✓



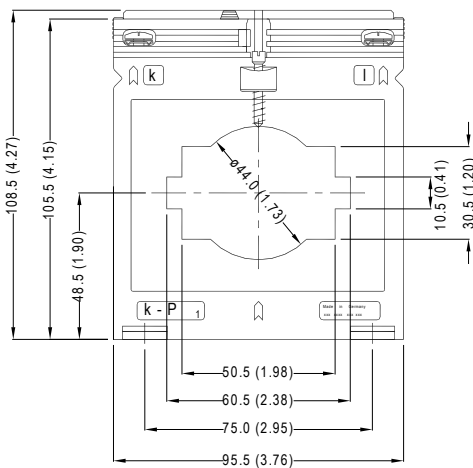
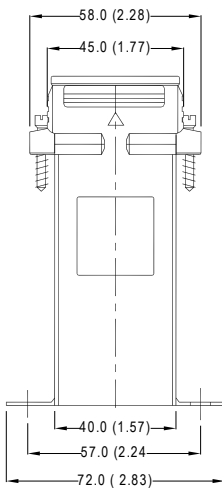
Primary conductor	50 × 12mm 2 × 40 × 10mm
Round conductor	Ø 44mm
Weight	0.260-0.720kg (0.57-1.59lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	



Approved current transformer for tariff applications

Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		0.5 Art.-no.	0.5s Art.-no.	0.2 Art.-no.	0.5 Art.-no.	0.2 Art.-no.
100	2.5	✓	✓	✓	✓	✓
	5	✓	✓		✓	✓
150	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
200	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
250	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	✓
300	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	✓
400	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	✓
500	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	✓
600	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
750	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
1000	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	✓
1200	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	✓
1250	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	✓

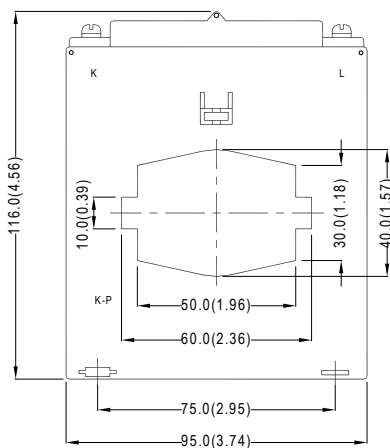
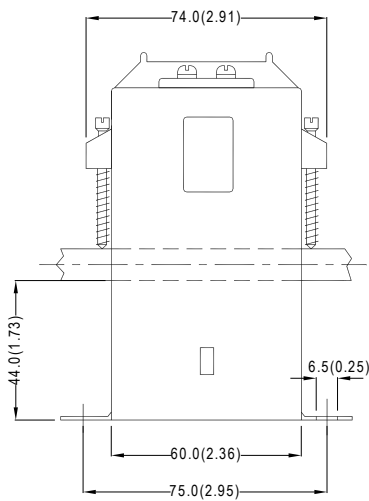
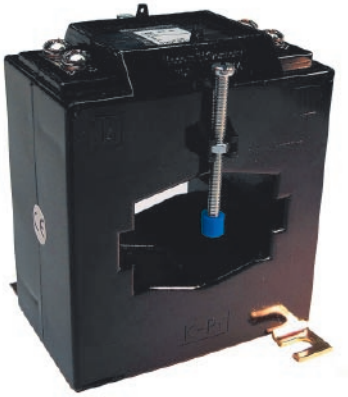
Primary conductor	50 × 12mm 40 × 30mm
Round conductor	Ø 40mm
Weight	0.360-1.280kg (0.79-2.82lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59044



Approved current transformer for tariff applications

Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		0.5 Art.-no.	0.5s Art.-no.	0.2 Art.-no.	0.5 Art.-no.	0.2 Art.-no.
200	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓	✓	✓	✓
250	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
300	1.5	✓	✓	✓	✓	✓
	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
400	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
500	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
600	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
750	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
1000	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓	✓	✓	✓
1200	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
1250	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓	✓	✓	✓
1500	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓	✓	✓	✓

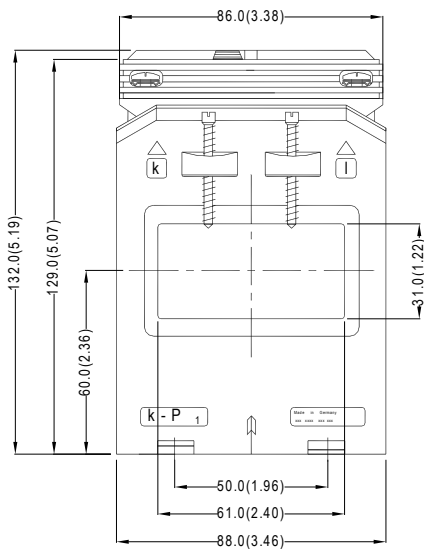
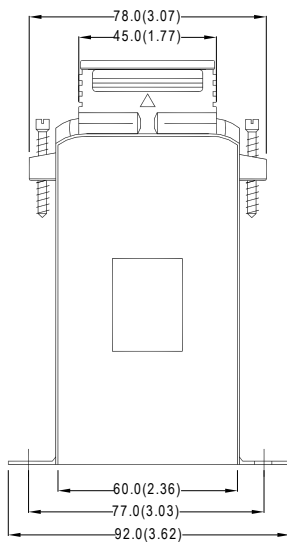
Primary conductor	60 × 100mm 2 × 50 × 10mm
Round conductor	Ø 44mm
Weight	0.300-0.630kg (0.66-1.39lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 590402



Approved current transformer for tariff applications

Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		0.5	0.5s	0.2	0.5	0.2
		Art.-no.	Art.-no.	Art.-no.	Art.-no.	Art.-no.
200	2.5	✓	✓	✓	✓	✓
	5	✓	✓		✓	
250	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	
300	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	
400	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	
500	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	
600	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	
750	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	
1000	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓			
1200	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓			
1250	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓			
1500	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓			

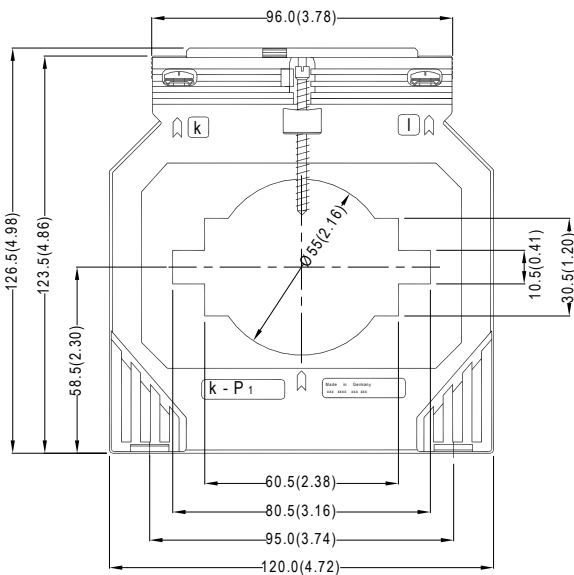
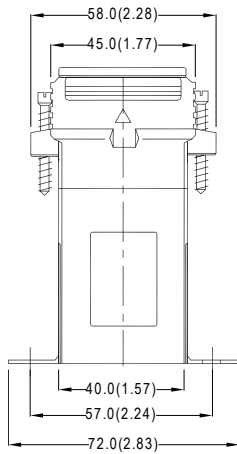
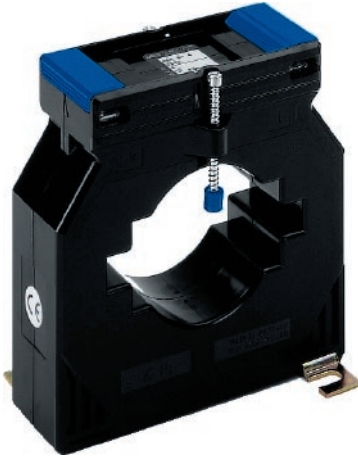
Primary conductor	60 × 10mm 50 × 30mm
Round conductor	Ø 40mm
Weight	0.310-1.000kg (0.68-2.20lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59044



Approved current transformer for tariff applications

Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		0.5 Art.-no.	0.5s Art.-no.	0.2 Art.-no.	0.5 Art.-no.	0.2 Art.-no.
250	2.5	✓	✓	✓	✓	✓
	5	✓	✓		✓	
300	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	
400	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	✓
500	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	
600	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
750	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	
1000	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	
1200	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	
1250	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	
1500	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	

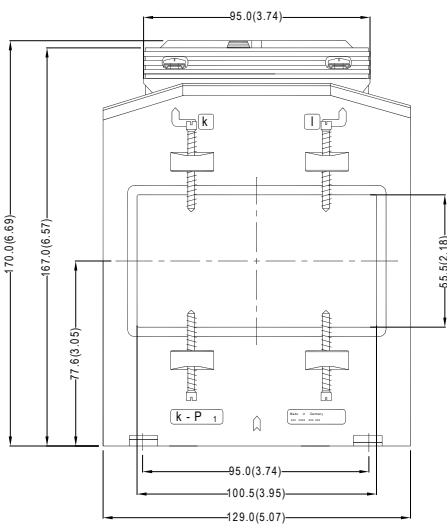
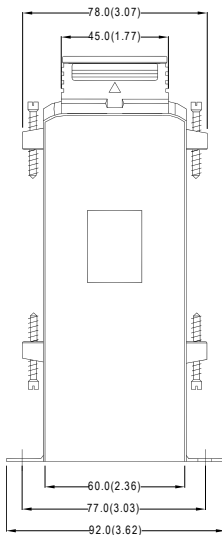
Primary conductor	60 × 30mm
Round conductor	Ø 30mm
Weight	0.200-1.30kg (0.44-2.87lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59042



Approved current transformer for tariff applications

Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		0.5 Art.-no.	0.5s Art.-no.	0.2 Art.-no.	0.5 Art.-no.	0.2 Art.-no.
400	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	
500	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
600	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓		
750	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓		
1000	2.5	✓	✓	✓		
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	
1200	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	
1250	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
1500	2.5	✓		✓		
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓

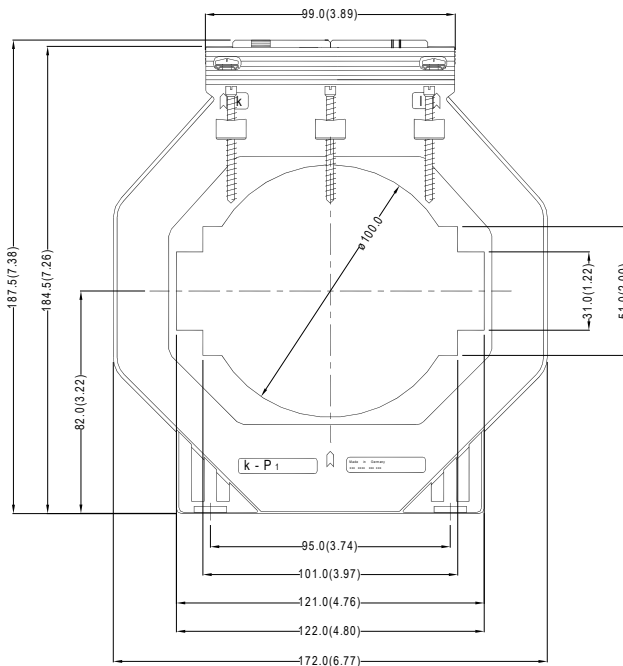
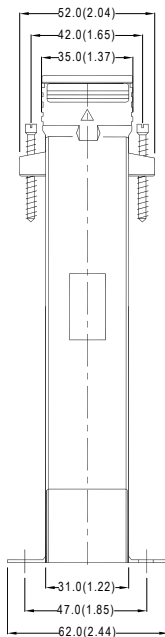
Primary conductor	80 × 10mm 60 × 30mm 2 × 60 × 10mm
Round conductor	Ø 55mm
Weight	0.400-1.000kg (0.88-2.20lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59042



Approved current transformer for tariff applications

Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		0.5 Art.-no.	0.5s Art.-no.	0.2 Art.-no.	0.5 Art.-no.	0.2 Art.-no.
600	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
750	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
1000	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
1200	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
1250	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓	✓	✓	✓
1500	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓	✓	✓	✓
1600	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓	✓	✓	✓
2000	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓	✓	✓	✓
2500	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓	✓	✓	✓
3000	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓	✓	✓	✓

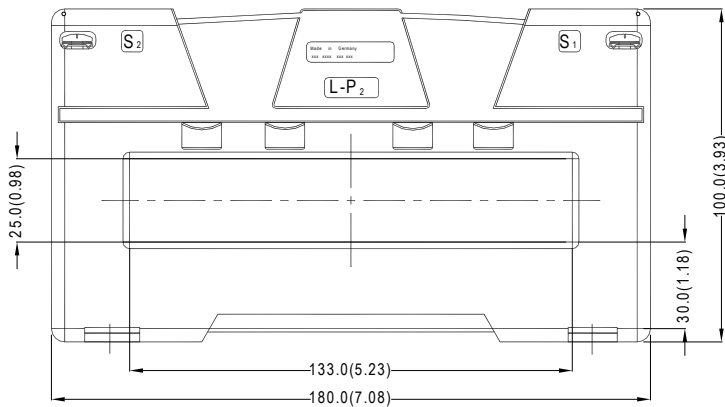
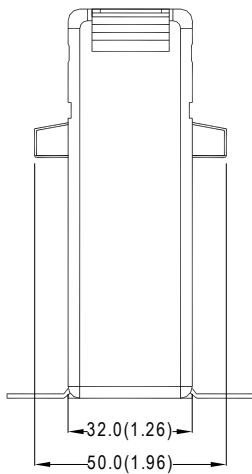
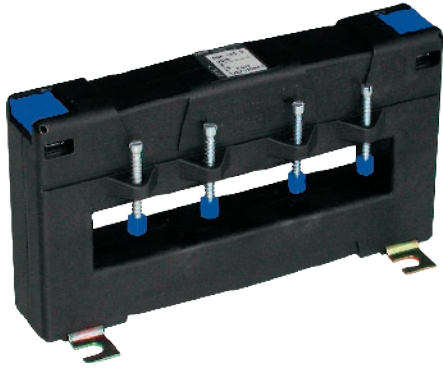
Primary conductor	100 × 55mm
Round conductor	∅ 55mm
Weight	0.800-1.580kg (1.76-3.48lbs)
Security factor	600A-1,500A = FS 5 1,600A-3,000A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59042



Approved current transformer for tariff applications

Secondary current		5A		
Primary current A	Burden VA	Accuracy class		
		0.5 Art.-no.	0.5s Art.-no.	0.2 Art.-no.
750	2.5	✓	✓	
	5	✓	✓	
	10	✓	✓	
1000	2.5	✓	✓	✓
	5	✓	✓	✓
	10	✓	✓	
1200	5	✓	✓	✓
	10	✓	✓	✓
	15	✓	✓	
1250	5	✓	✓	✓
	10	✓	✓	✓
	15	✓	✓	✓
1500	5	✓	✓	✓
	10	✓	✓	✓
	15	✓	✓	✓
	30	✓	✓	
1600	5	✓	✓	✓
	10	✓	✓	✓
	15	✓	✓	✓
	30	✓	✓	
2000	5	✓	✓	✓
	10	✓	✓	✓
	15	✓	✓	✓
	30	✓	✓	
2500	5	✓	✓	✓
	10	✓	✓	✓
	15	✓	✓	✓
	30	✓	✓	
3000	5	✓	✓	✓
	10	✓	✓	✓
	15	✓	✓	✓
	30	✓	✓	

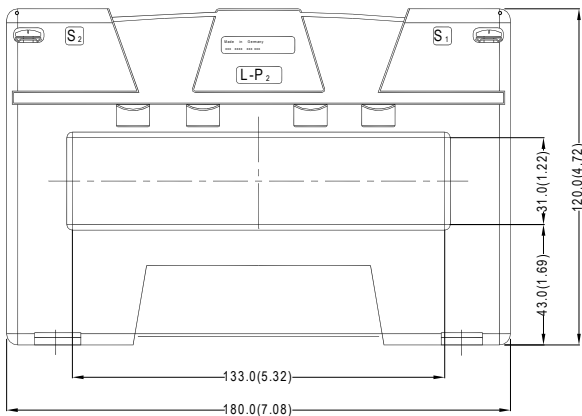
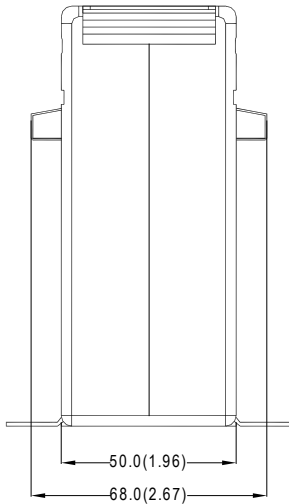
Primary conductor	123 × 30mm 3 × 100 × 10mm
Round conductor	Ø 100mm
Weight	0.500-1.300kg (1.10-2.87lbs)
Security factor	1,000A-1,500A = FS 5 1,600A-3,000A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59040



Approved current transformer for tariff applications

Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		0.5 Art.-no.	0.5s Art.-no.	0.2 Art.-no.	0.5 Art.-no.	0.2 Art.-no.
300	2.5	✓	✓		✓	
	5	✓			✓	
400	2.5	✓	✓	✓	✓	✓
	5	✓	✓		✓	
	10	✓			✓	
500	2.5	✓	✓	✓	✓	✓
	5	✓	✓		✓	
	10	✓			✓	
600	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓			✓	
750	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	
	15	✓			✓	
1000	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	
1200	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
1250	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
1500	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓			✓	
1600	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	

Primary conductor	130 × 25mm
Round conductor	Ø 180mm
Weight	0.700-1.200kg (1.54-2.65lbs)
Security factor	400A-1,500A = FS 5 1,600A = FS 10
DIN rail mounting	Not available
Sealed shutter	Not available



Approved current transformer for tariff applications

Secondary current		5A			1A	
Primary current A	Burden VA	Accuracy class			Accuracy class	
		0.5 Art.-no.	0.5s Art.-no.	0.2 Art.-no.	0.5 Art.-no.	0.2 Art.-no.
300	2.5	✓	✓		✓	
	5	✓	v		✓	
	10	✓			✓	
400	2.5	✓	✓	✓	✓	✓
	5	✓	✓		✓	
	10	✓	✓		✓	
500	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	
	10	✓	✓		✓	
	15	✓			✓	
600	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓		✓	
	15	✓			✓	
750	2.5	✓	✓	✓	✓	✓
	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓		✓	
1000	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	
1200	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	
1250	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	
1500	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	
1600	5	✓	✓	✓	✓	✓
	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓		✓	
2000	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓	✓	✓	✓
2400	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓	✓	✓	✓
2500	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓	✓	✓	✓
3000	10	✓	✓	✓	✓	✓
	15	✓	✓	✓	✓	✓
	30	✓	✓	✓	✓	✓

Primary conductor	130 × 30mm 180mm
Round conductor	Ø 30mm
Weight	0.740-1.200kg (1.63-2.82lbs)
Security factor	400A-1,500A = FS 5 1,600A-3,000A = FS 10
DIN rail mounting	Not available
Sealed shutter	Not available

Test certificate

On request, we can provide you with a test certificate for a specific current transformer along with the CT. Please inform us when placing your order.

Sealed shutter

On request, we can supply a transparent plastic cover. The cover seals the connections on the CT in a way that leaves the type label visible. Please check availability on each individual data sheet.



Excitation curve

On request, we can provide you with an excitation curve for a specific current transformer along with the CT. Please inform us when placing your order.

Optional frequency

Frequency range for a standard CT is 50-60Hz. On request, we can provide you with a frequency range from 16 2/3 – 400Hz. Please inform us when placing your order.

Cast resin

Cast resin is standard for all CT's with a nominal current $>4,000A$. On request, all CT's with a nominal current $<4,000A$ can be produced with cast resin. Please inform us when placing your order. The min. and max. weight specification for each type refers to standard versions. The specification is different if cast resin is ordered for CT's $<4,000A$.

Mounting

Foot angle for screw mounting and busbar mounting screws with isolating protection caps are supplied along with the CT. DIN-rail mounting for tubes, plug-ins and protection transformers is available on request for certain CT types. Please check availability on each individual data sheet.





-power in control

TECHNICAL DOCUMENTATION



Split core current transformers, type KBU

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Document no.: 4921210112B

Current transformers overview

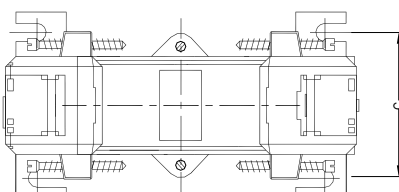
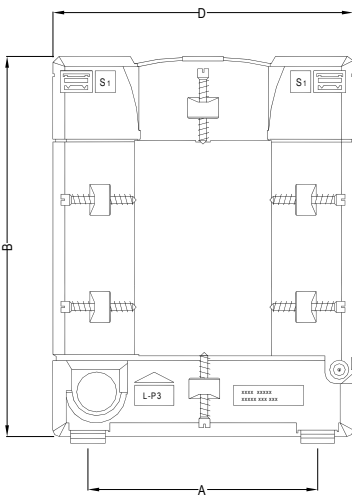
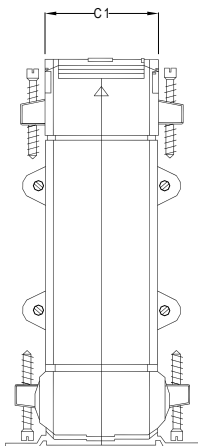
Click on a product name or check mark to jump to information page.

Page	3	4	5	6													Page
Primary nominal current	KBU 23	KBU 58	KBU 812	KBU 816													Primary nominal current
A																	A
1																	1
2.5																	2.5
5																	5
10																	10
15																	15
20																	20
25																	25
30																	30
40																	40
50																	50
60																	60
75																	75
80																	80
100	✓																100
125																	125
150	✓																150
200	✓																200
250	✓	✓	✓														250
300	✓	✓	✓														300
400	✓	✓	✓														400
500		✓	✓														500
600		✓	✓														600
750		✓	✓														750
800		✓	✓														800
1000		✓	✓	✓													1000
1200			✓	✓													1200
1250			✓														1250
1500			✓	✓													1500
1600				✓													1600
1800																	1800
2000				✓													2000
2500				✓													2500
3000				✓													3000
3200																	3200
4000				✓													4000
5000				✓													5000
6000																	6000
7500																	7500
Primary conductor in mm	20×30	50×80	80×120	80×160													Primary conductor in mm
Round conductor in mm	20	50	80	80													Round conductor in mm
Transform. width in mm	93	125	155	195													Transform. width in mm

* For the current transformers above, click-on mountings are available for fitment onto 35mm DIN-rails (DIN 50022).

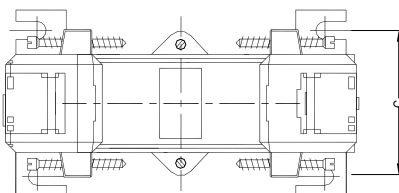
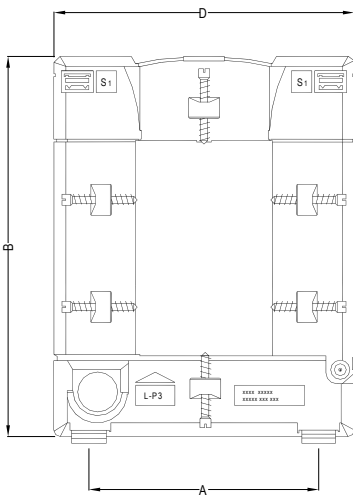
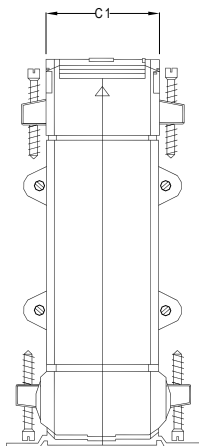


Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1	0.5	1	0.5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.
100	1.25	✓		✓	
150	1.5	✓		✓	
200	1.5	✓		✓	
250	1.5	✓		✓	
300	1.5		✓		✓
	3.75	✓		✓	
400	2.5		✓		✓
	5	✓		✓	



Type	KBU 23	KBU 58
A	93	125
B	106	158
C/C1	34/58	34/58
D	20	50
E	30	80

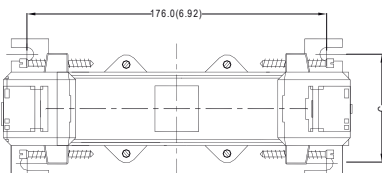
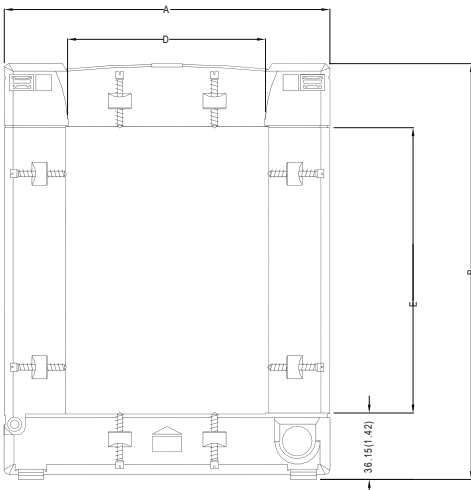
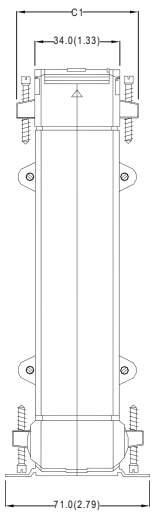
Primary conductor	20 × 30mm
Round conductor	Ø 20mm
Weight	0.550-1.320kg (1.21-2.91lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Not available



Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1	0.5	1	0.5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.
250	1		✓		✓
	1.5	✓		✓	
300	1.5		✓		✓
	2.5	✓		✓	
400	1.5		✓		✓
	2.5	✓		✓	
500	2.5		✓		✓
	5	✓		✓	
600	2.5		✓		✓
	5	✓		✓	
750	2.5		✓		✓
	5	✓		✓	
800	2.5		✓		✓
	7.5	✓		✓	
1000	5		✓		✓
	10	✓		✓	

Type	KBU 23	KBU 58
A	93	125
B	106	158
C/C1	34/58	34/58
D	20	50
E	30	80

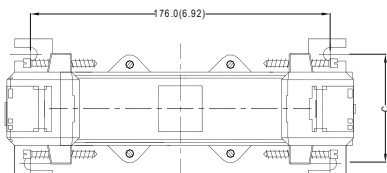
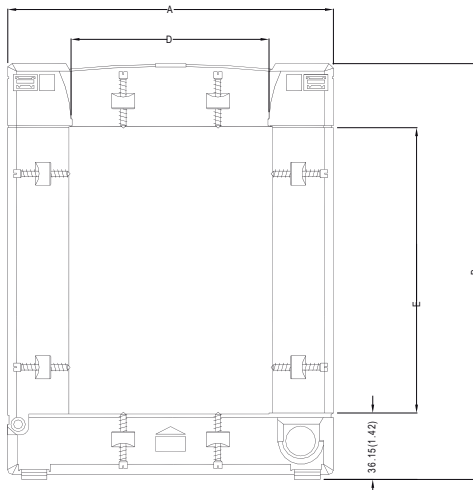
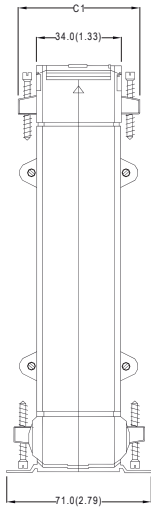
Primary conductor	50 × 80mm
Round conductor	Ø 20mm
Weight	0.920-1.320kg (2.03-2.91lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Not available



Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1	0.5	1	0.5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.
250	1		✓		✓
	1.5	✓		✓	
300	1.5		✓		✓
	2.5	✓		✓	
400	1.5		✓		✓
	2.5	✓		✓	
500	2.5		✓		✓
	5	✓		✓	
600	2.5		✓		✓
	5	✓		✓	
750	2.5		✓		✓
	5	✓		✓	
800	2.5		✓		✓
	7.5	✓		✓	
1000	5		✓		✓
	10	✓		✓	
1200	5		✓		✓
	10	✓		✓	
1250	7.5		✓		✓
	15	✓		✓	
1500	7.5		✓		✓
	15	✓		✓	

Type	KBU 812	KBU 816
A	155	195
B	198	243
C/C1	34/58	64/79
D	80	80
E	120	160

Primary conductor	80 × 120mm
Round conductor	Ø 80mm
Weight	1.580-1.550kg (2.87-3.09lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Not available



Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1	0.5	1	0.5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.
1000	10	✓	✓	✓	✓
	15	✓		✓	
1200	10	✓	✓	✓	✓
	15	✓		✓	
1500	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1600	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
2000	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
2500	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
3000	15	✓	✓	✓	✓
	30	✓		✓	
4000	15	✓	✓	✓	✓
	30	✓	✓	✓	✓
5000	15	✓	✓	✓	✓
	30	✓	✓	✓	✓

Type	KBU 812	KBU 816
A	155	195
B	198	243
C/C1	34/58	64/79
D	80	80
E	120	160

Primary conductor	80 × 160mm
Round conductor	Ø 80mm
Weight	1.320-3.980kg (2.91-8.77lbs)
Security factor	1,000A-1,500A = FS 5 1,600A-5,000A = FS 10
DIN rail mounting	Not available
Sealed shutter	Not available

Test certificate

On request, we can provide you with a test certificate for a specific current transformer along with the CT. Please inform us when placing your order.

Sealed shutter

On request, we can supply a transparent plastic cover. The cover seals the connections on the CT in a way that leaves the type label visible. Please check availability on each individual data sheet.



Excitation curve

On request, we can provide you with an excitation curve for a specific current transformer along with the CT. Please inform us when placing your order.

Optional frequency

Frequency range for a standard CT is 50-60Hz. On request, we can provide you with a frequency range from 16 2/3 – 400Hz. Please inform us when placing your order.

Cast resin

Cast resin is standard for all CT's with a nominal current $>4,000A$. On request, all CT's with a nominal current $<4,000A$ can be produced with cast resin. Please inform us when placing your order. The min. and max. weight specification for each type refers to standard versions. The specification is different if cast resin is ordered for CT's $<4,000A$.

Mounting

Foot angle for screw mounting and busbar mounting screws with isolating protection caps are supplied along with the CT. DIN-rail mounting for tubes, plug-ins and protection transformers is available on request for certain CT types. Please check availability on each individual data sheet.





-power in control

TECHNICAL DOCUMENTATION



Summation current transformers, type KSU/SUSK

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Document no.: 4921210113B

Current transformers overview

Click on a product name or check mark to jump to information page.

Page	5	6	7	8	9	10	11	12									Page
Primary nominal current	KSU 2	KSU 3	SUSK 3	SUSK 4	SUSK 5	SUSK 6	SUSK 7	SUSK 8									Primary nominal current
A																	A
1	✓	✓	✓	✓	✓	✓	✓	✓									1
2.5																	2.5
5	✓	✓	✓	✓	✓	✓	✓	✓									5
10																	10
15																	15
20																	20
25																	25
30	✓	✓	✓	✓	✓	✓	✓	✓									30
40	Current circuits	Current circuits	Current circuits	Current circuits	Current circuits	Current circuits	Current circuits	Current circuits									40
50																	50
60																	60
75																	75
80																	80
100																	100
125																	125
150																	150
200																	200
250																	250
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2000																	2000
2500																	2500
3000																	3000
3200																	3200
4000																	4000
5000																	5000
6000																	6000
7500																	7500
Primary conductor in mm																	Primary conductor in mm
Round conductor in mm																	Round conductor in mm
Transform. width in mm	57	57	65	65	65	65	65	65									Transform. width in mm

* For the current transformers above, click-on mountings are available for fitment onto 35mm DIN-rails (DIN 50022).

Guidance when ordering summation current transformers

Summation current transformers are suitable for the summation of several synchronized alternating currents with similar phases but with differing load phase shifts. It is also possible to have the summation of currents with varied nominal voltages of similar phase positions. These measurements cannot be used for tariff applications, as the existing voltage differences are recorded as errors.

With the counter connection of the main transformer to the summation current transformer, it is possible to receive secondary currents which are proportional to the differences of the primary input currents.

The built-in technical know-how enables the summation current transformers to add secondary currents of varying nominal transmissions from the main transformer.

The secondary connections of each main transformer are connected to the allocated primary inputs of the summation current transformers.

The number of windings of individual partially wound primary circuits of the summation current transformer is proportionally aligned to the ratio of the primary nominal current of the corresponding main transformer, and to the sum of the nominal currents of all the summation current transformers being connected to the main transformer.

For the visual display of the current, a measuring unit can be used with a measuring range similar to the secondary nominal current of the summation current transformers.

It is irrelevant for the main transformers with similar nominal transmission ratios, to which primary circuit of the summation current transformer the connection is made.

With main transformers of different nominal transmission ratios, care must be taken to adhere to the assigned connection to the terminals of the summation current transformers.

If the current flow in the main transformer is interrupted, the secondary circuit of the main transformer must neither be short-circuited nor be connected to the summation current transformer, or to the main transformer.

Summation current transformers with unallocated primary circuits must remain open for a later connection to an additional main transformer. The secondary output current of the summation current transformer is in this instance lower than the secondary nominal current of the summation current transformer by a quantity equal to the ratio of the primary nominal current of this "missing" main transformer and the sum of all the primary nominal currents of the main transformer.

The nominal secondary current of a main transformer must be equal to the nominal primary current of the input allocation of the summation current transformer.

Guidance when ordering summation current transformers

Please find below an example for the correct selection of measuring components for summation current transformers.

Example:

Actual situation:	3 transmission ratios	1000 / 5 VA
		800 / 5 VA
		<u>600 / 5 VA</u>
	Overall current	2400 / 5 VA

Burden:
– 1 current meter
– 1 power recorder

Looking for: 1 summation current transformer and the VA power of an individual main transformer

Required active performance of the summation current transformer:

Current meter	1.5 VA
Performance recorder	7.0 VA
Measurement conductor loss	1.5 VA
consumption Po summation ct	<u>4.0 VA</u>
Interim result	14.0 VA

The individual transformer must provide its VA share from this 14.0 VA corresponding to its ratio to the "total transmission".

Consideration must also be given to the respective power loss between the main transformer and the summation transformer plus other possible losses.

1. Main transformer 1000 / 5 $\frac{1000}{2400} \times 14.0 = 5.83 \text{ VA} + \text{additional possible losses}$

2. Main transformer 800 / 5A $\frac{800}{2400} \times 14.0 = 4.67 \text{ VA} + \text{additional possible losses}$

3. Main transformer 600 / 5A $\frac{600}{2400} \times 14.0 = 3.50 \text{ VA} + \text{additional possible losses}$

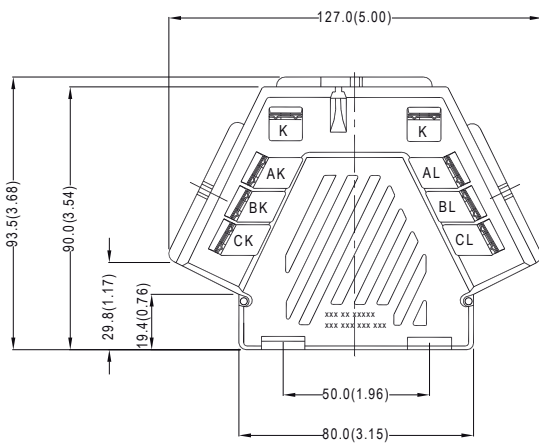
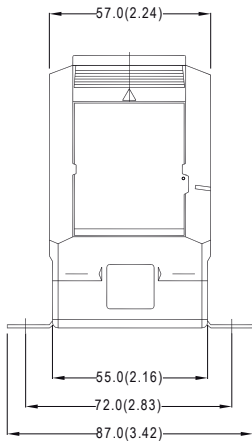
The VA values of the main transformers are to be rounded up to the corresponding VA values in our charts.

The ratio of the primary current of a main transformer to the sum of the primary currents of all main current transformers the ratio must not exceed 1:8.

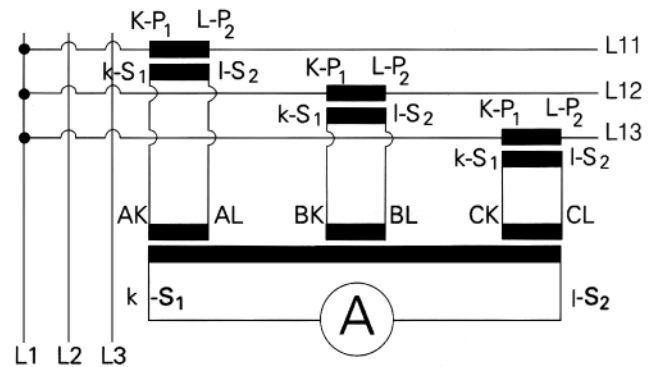
Important indication to the power measuring

Too many rising deviation can prevent the measuring transformer acting as a current transformer from fulfilling its protective function with regard to the connected measuring units, as in normal operation its functions is well below its saturation limit, and in the event of over currents, the saturation limit is reached considerably later and takes the function almost as a protection current transformer.

If there is too much of a decrease, the measuring transformer, as a result of the continuous excess demands will reach the saturation limit too soon and indirectly function as a switch, rendering a measuring impossible.



Secondary current			5A		1A	
Type	Primary current A	Burden VA	Accuracy class		Accuracy class	
			1	0.5	1	0.5
			Art.-no.	Art.-no.	Art.-no.	Art.-no.
2	1+1	5	✓	✓	✓	✓
		10	✓	✓	✓	✓
		15	✓	✓	✓	✓
		20	✓		✓	
		25	✓		✓	
		30	✓		✓	
2	5+5	5	✓	✓	✓	✓
		10	✓	✓	✓	✓
		15	✓	✓	✓	✓
		20	✓		✓	
		25	✓		✓	
		30	✓		✓	



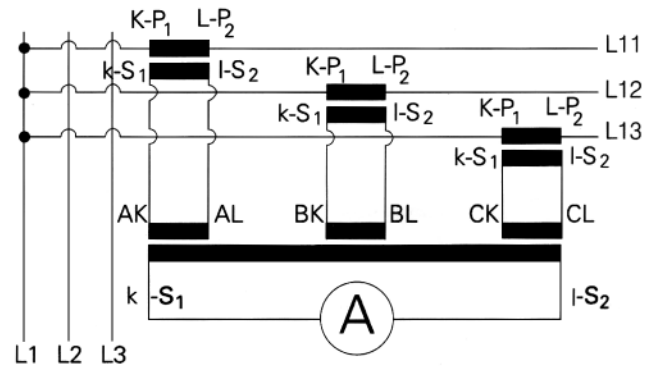
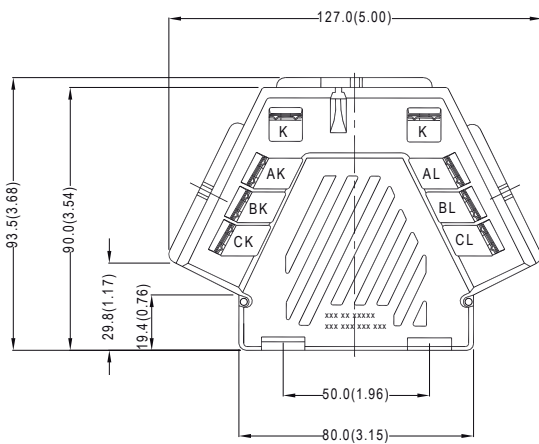
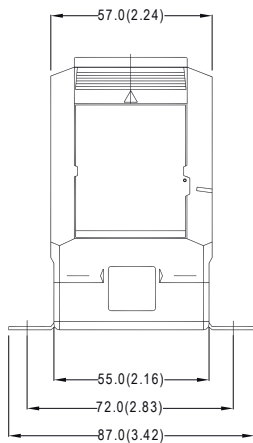
Connection example for different ratios

AK-AL	=	1000/5
BK-BL	=	800/5
CK-CL	=	600/5

Weight	0.300-1.100kg (0.66-2.43lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter Primary	Type: 59041 (x2)



Secondary current			5A		1A	
Type	Primary current A	Burden VA	Accuracy class		Accuracy class	
			1	0.5	1	0.5
			Art.-no.	Art.-no.	Art.-no.	Art.-no.
3	1+1+1	5	✓	✓	✓	✓
		10	✓	✓	✓	✓
		15	✓	✓	✓	✓
		30	✓		✓	
3	5+5+5	5	✓	✓	✓	✓
		10	✓	✓	✓	✓
		15	✓	✓	✓	✓
		30	✓		✓	



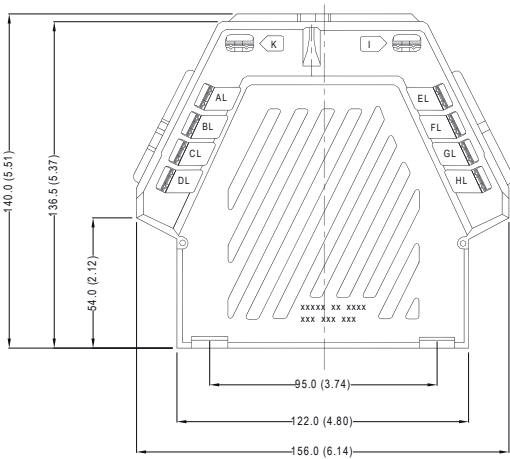
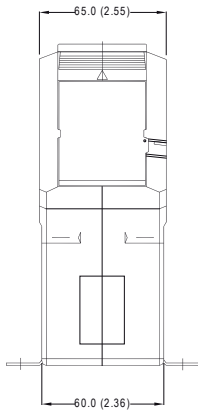
Connection example for different ratios

AK-AL	=	1000/5
BK-BL	=	800/5
CK-CL	=	600/5

Weight	0.300-0.750kg (0.66-1.65lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter Primary	Type: 59041 (x2)



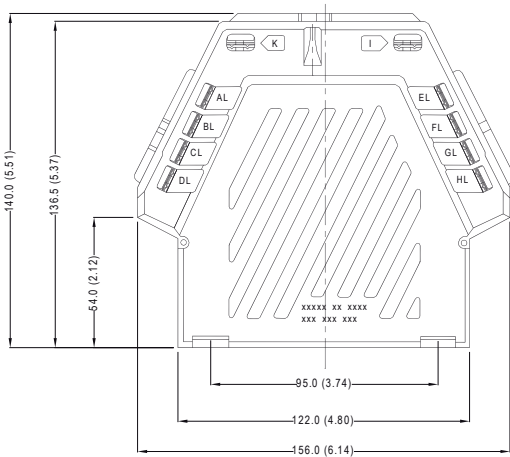
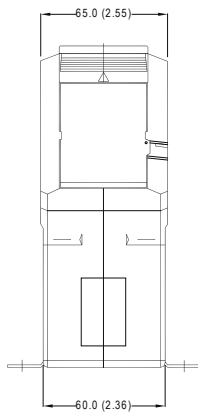
Secondary current			5A		1A	
Type	Primary current A	Burden VA	Accuracy class		Accuracy class	
			1	0.5	1	0.5
			Art.-no.	Art.-no.	Art.-no.	Art.-no.
3	1+1+1	5	✓	✓	✓	✓
		10	✓	✓	✓	✓
		15	✓	✓	✓	✓
		30	✓	✓	✓	✓
3	5+5+5	5	✓	✓	✓	✓
		10	✓	✓	✓	✓
		15	✓	✓	✓	✓
		30	✓	✓	✓	✓



Weight	0.480-1.130kg (1.06-2.49lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter Primary	Type: 59041 (x2)
Sealed shutter Primary	Type: 59042



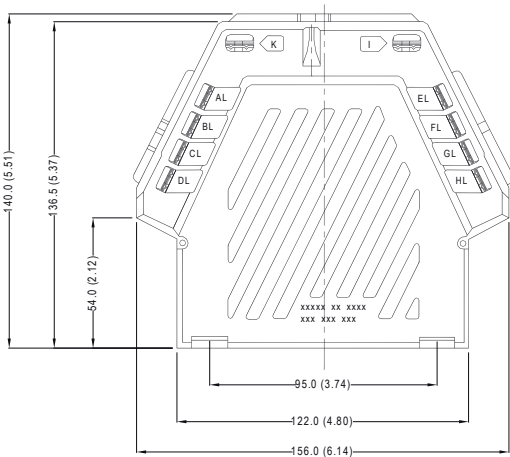
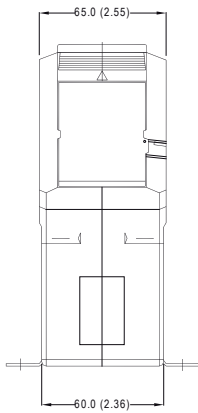
Secondary current			5A		1A	
Type	Primary current A	Burden VA	Accuracy class		Accuracy class	
			1	0.5	1	0.5
			Art.-no.	Art.-no.	Art.-no.	Art.-no.
4	1+1+1+1	5	✓	✓	✓	✓
		10	✓	✓	✓	✓
		15	✓	✓	✓	✓
		25	✓	✓		
		30	✓	✓		
4	5+5+5+5	5	✓	✓	✓	✓
		10	✓	✓	✓	✓
		15	✓	✓	✓	✓
		25	✓		✓	
		30	✓		✓	



Weight	0.500-1.210kg (1.10-2.67lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter Primary	Type: 59041 (x2)
Sealed shutter Primary	Type: 59042



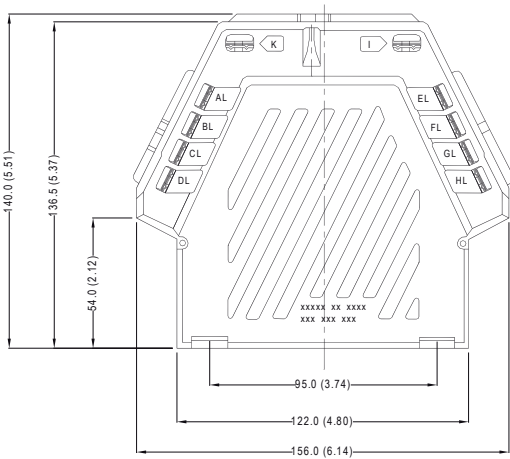
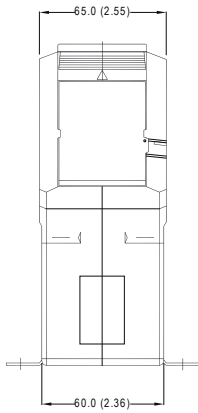
Secondary current			5A		1A	
Type	Primary current A	Burden VA	Accuracy class		Accuracy class	
			1	0.5	1	0.5
			Art.-no.	Art.-no.	Art.-no.	Art.-no.
5	1+1+1+1+1	5	✓	✓	✓	✓
		10	✓	✓	✓	✓
		15	✓	✓	✓	✓
		30	✓	✓		
5	5+5+5+5+5	5	✓	✓	✓	✓
		10	✓	✓	✓	✓
		15	✓	✓	✓	✓
		30	✓		✓	



Weight	0.500-1.240kg (1.10-2.73lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter Primary	Type: 59041 (x2)
Sealed shutter Primary	Type: 59042



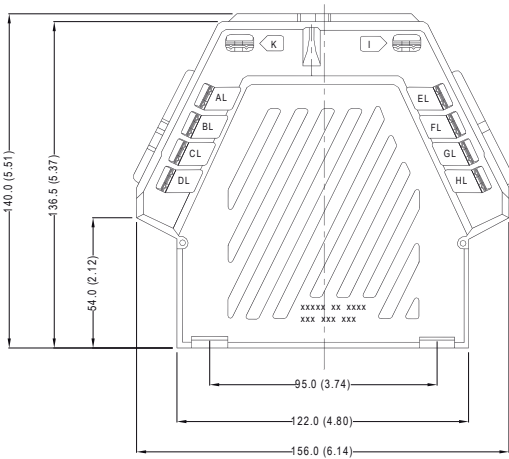
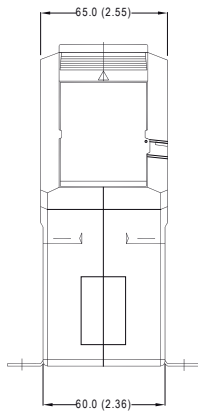
Secondary current			5A		1A	
Type	Primary current A	Burden VA	Accuracy class		Accuracy class	
			1	0.5	1	0.5
			Art.-no.	Art.-no.	Art.-no.	Art.-no.
6	1+1+1+1+1+1	5	✓	✓	✓	✓
		10	✓	✓	✓	✓
		15	✓	✓	✓	✓
		30	✓	✓		
6	5+5+5+5+5+5	5	✓	✓	✓	✓
		10	✓	✓	✓	✓
		15	✓	✓	✓	✓
		30	✓		✓	



Weight	0.500-1.250kg (1.10-2.76lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter Primary	Type: 59041 (x2)
Sealed shutter Primary	Type: 59042



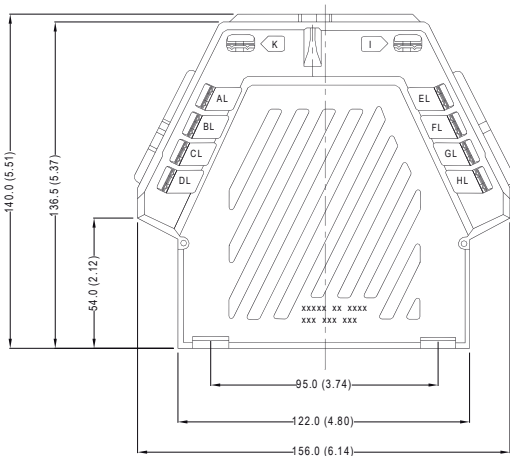
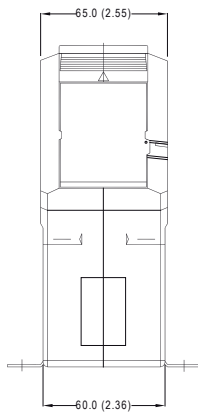
Secondary current			5A		1A	
Type	Primary current A	Burden VA	Accuracy class		Accuracy class	
			1	0.5	1	0.5
			Art.-no.	Art.-no.	Art.-no.	Art.-no.
7	1+1+1+1+1+1+1	5	✓	✓	✓	✓
		10	✓	✓	✓	✓
		15	✓	✓	✓	✓
		30	✓	✓		
7	5+5+5+5+5+5+5	5	✓	✓	✓	✓
		10	✓	✓	✓	✓
		15	✓	✓	✓	✓
		30	✓		✓	



Weight	0.500-1.200kg (1.10-2.65lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter Primary	Type: 59041 (x2)
Sealed shutter Primary	Type: 59042



Secondary current			5A		1A	
Type	Primary current A	Burden VA	Accuracy class		Accuracy class	
			1	0.5	1	0.5
			Art.-no.	Art.-no.	Art.-no.	Art.-no.
8	1+1+1+1+1+1+1	5	✓	✓	✓	✓
		10	✓	✓	✓	✓
		15	✓	✓	✓	✓
		30	✓	✓		
8	5+5+5+5+5+5+5	5	✓	✓	✓	✓
		10	✓	✓	✓	✓
		15	✓	✓	✓	✓
		30	✓		✓	



Weight	0.710-1.280kg (1.57-2.82lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter Primary	Type: 59041 (x2)
Sealed shutter Primary	Type: 59042

Test certificate

On request, we can provide you with a test certificate for a specific current transformer along with the CT. Please inform us when placing your order.

Sealed shutter

On request, we can supply a transparent plastic cover. The cover seals the connections on the CT in a way that leaves the type label visible. Please check availability on each individual data sheet.



Excitation curve

On request, we can provide you with an excitation curve for a specific current transformer along with the CT. Please inform us when placing your order.

Optional frequency

Frequency range for a standard CT is 50-60Hz. On request, we can provide you with a frequency range from 16 2/3 – 400Hz. Please inform us when placing your order.

Cast resin

Cast resin is standard for all CT's with a nominal current >4,000A. On request, all CT's with a nominal current <4,000A can be produced with cast resin. Please inform us when placing your order. The min. and max. weight specification for each type refers to standard versions. The specification is different if cast resin is ordered for CT's <4,000A.

Mounting

Foot angle for screw mounting and busbar mounting screws with isolating protection caps are supplied along with the CT. DIN-rail mounting for tubes, plug-ins and protection transformers is available on request for certain CT types. Please check availability on each individual data sheet.





-power in control

TECHNICAL DOCUMENTATION



Primary winding current transformer, type WSK

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Document no.: 4921210115B

Current transformers overview

Click on a product name or check mark to jump to information page.

Page	4	5	6	7	8	9											Page
Primary nominal current	WSK 30*	WSK 40*	WSK 40 N*	WSK 60	WSK 70.6 N	WSK 31.5											Primary nominal current
A																	A
1	✓	✓															1
2.5	✓	✓															2.5
5	✓	✓		✓													5
10	✓	✓		✓													10
15	✓	✓		✓													15
20	✓	✓		✓													20
25		✓		✓	✓	✓											25
30		✓	✓	✓	✓	✓											30
40			✓		✓	✓											40
50			✓		✓	✓											50
60					✓	✓											60
75					✓	✓											75
80					✓	✓											80
100					✓	✓											100
125						✓											125
150						✓											150
200																	200
250																	250
300																	300
400																	400
500																	500
600																	600
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800																	800
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1200																	1200
1250																	1250
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1800																	1800
2000																	2000
2500																	2500
3000																	3000
3200																	3200
4000																	4000
5000																	5000
6000																	6000
7500																	7500
Primary conductor in mm																	Primary conductor in mm
Round conductor in mm																	Round conductor in mm
Transform. width in mm	61	71	71	71	60	70											Transform. width in mm

* For the current transformers above, click-on mountings are available for fitment onto 35mm DIN-rails (DIN 50022).

Primary winding current transformer

Based on the physical operating principle of current transformers, the required core volume transferring an amount of power, increases rapidly with a decreasing nominal current. As there are limits on increasing the transformer size, Primary winding current transformer are being used.

Interim current transformers also belong to the group of Primary winding current transformer. This construction is mainly used for primary currents of up to 10A, and achieves a transformation at a higher or lower secondary current values. In addition to their application in adapting a measuring circuit on existing measuring units, interim current transformers are being used also for lowering the power loss by the transmission of analogically measured values over great distances. This is made possible by means of a squared dependence of the power loss from the flowing current.

$$PV = I^2 \times Z[\text{VA}]$$

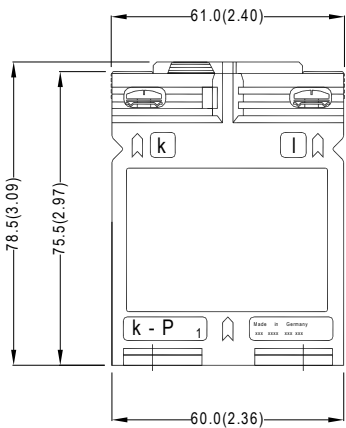
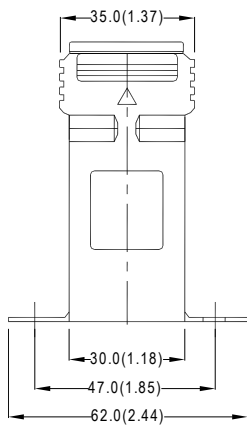
apparent power [VA]

This means when the original nominal current is halved, the conductor loss drops down to 25% of its original value.

Indication: The selection of the nominal power of the initially activated main transformer is achieved through the application of the following measurement comparisons.

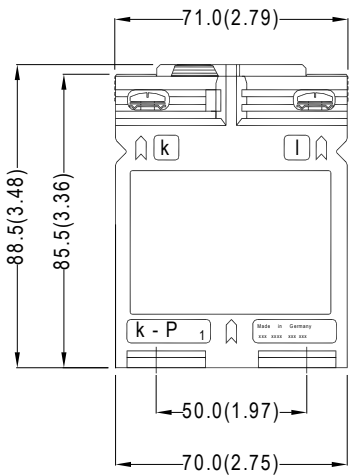
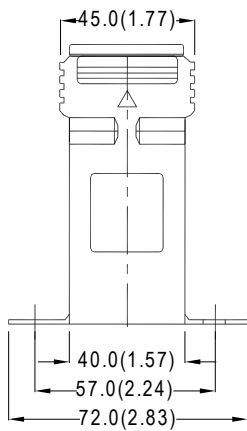
$$P_{GH} = P_Z \times \left(\frac{I_2}{I_1}\right)^2 + P_E + P_{HZ}$$

P_{GH}	apparent power of the main transformer
P_Z	secondary performance of the interim transformer (nominal performance inclusive of conductor losses)
P_E	consumption of the interim transformer by nominal current
P_{HZ}	conductor losses between main- and interim transformer by nominal current
I_1	primary nominal current of the interim transformer
I_2	secondary nominal current of the interim transformer



Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
1	2.5	✓	✓	✓	✓
	5	✓		✓	
2.5	2.5	✓	✓	✓	✓
	5	✓		✓	
5	2.5	✓	✓	✓	✓
	5	✓		✓	
10	2.5	✓	✓	✓	✓
	5	✓		✓	
15	2.5	✓	✓	✓	✓
	5	✓		✓	
20	2.5	✓	✓	✓	✓
	5	✓		✓	

Weight	0.200-0.450kg (0.44-0.99lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990001
Sealed shutter	Type: 59040

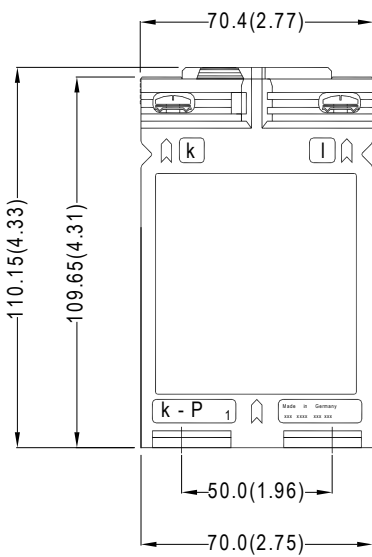
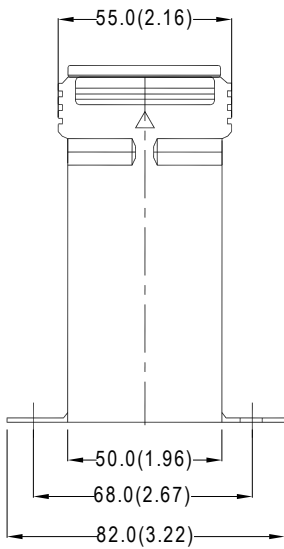


Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
1	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
2.5	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
5	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
10	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
15	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
20	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
25	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
30	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓

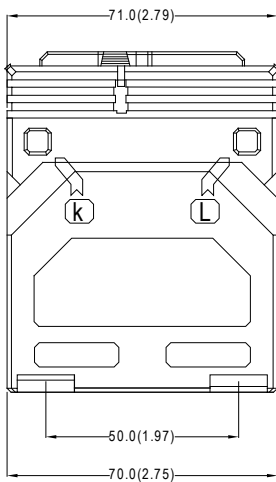
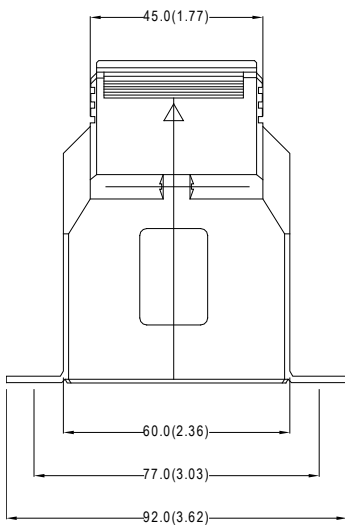
Weight	0.230-0.500kg (0.51-1.10lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990004
Sealed shutter	Type: 59041



Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1	0.5	1	0.5
		Art.-no.	Art.-no.	Art.-no.	Art.-no.
30	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
40	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
50	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓

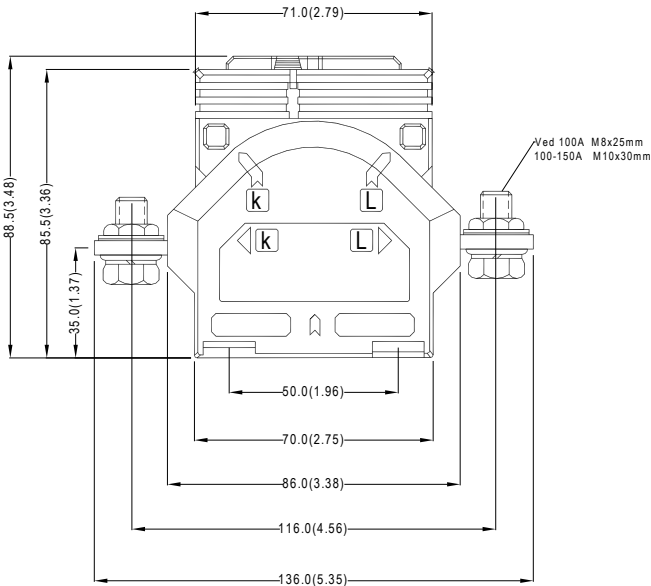
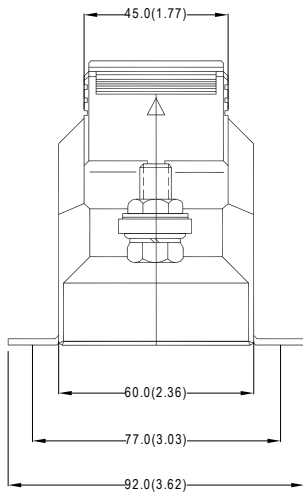


Weight	0.320-0.560kg (0.71-1.23lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990003
Sealed shutter	Type: 59041



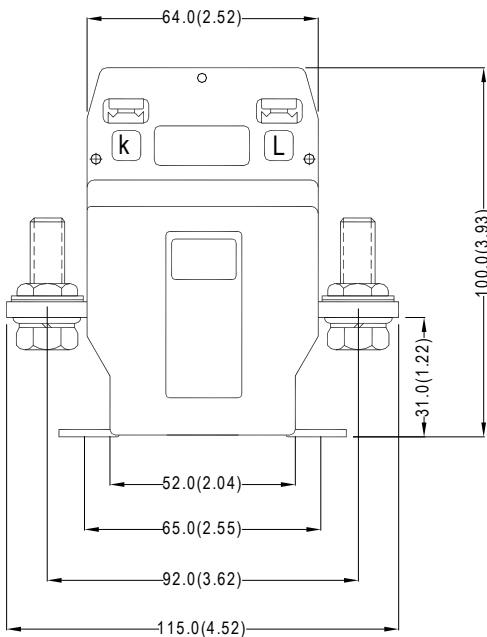
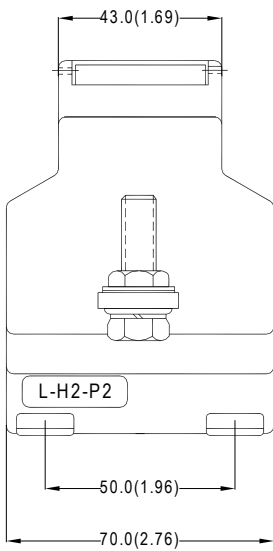
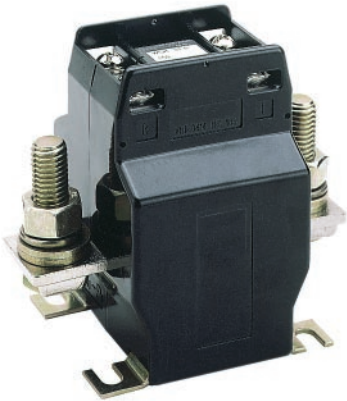
Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
5	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
10	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
15	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
20	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
25	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
30	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	

Weight	0.290-0.610kg (0.64-1.34lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59041



Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
25	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
30	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
40	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
50	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
60	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
75	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
80	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	
100	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓		✓	

Weight	0.400-0.800kg (0.88-1.76lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59041



Secondary current		5A		1A	
Primary current A	Burden VA	Accuracy class		Accuracy class	
		1 Art.-no.	0.5 Art.-no.	1 Art.-no.	0.5 Art.-no.
25	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
30	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
40	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
50	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
60	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
75	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
80	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
100	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
150	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓

Weight	0.800-1.000kg (1.76-2.20lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59045

Test certificate

On request, we can provide you with a test certificate for a specific current transformer along with the CT. Please inform us when placing your order.

Sealed shutter

On request, we can supply a transparent plastic cover. The cover seals the connections on the CT in a way that leaves the type label visible. Please check availability on each individual data sheet.



Excitation curve

On request, we can provide you with an excitation curve for a specific current transformer along with the CT. Please inform us when placing your order.

Optional frequency

Frequency range for a standard CT is 50-60Hz. On request, we can provide you with a frequency range from 16 2/3 – 400Hz. Please inform us when placing your order.

Cast resin

Cast resin is standard for all CT's with a nominal current $>4,000A$. On request, all CT's with a nominal current $<4,000A$ can be produced with cast resin. Please inform us when placing your order. The min. and max. weight specification for each type refers to standard versions. The specification is different if cast resin is ordered for CT's $<4,000A$.

Mounting

Foot angle for screw mounting and busbar mounting screws with isolating protection caps are supplied along with the CT. DIN-rail mounting for tubes, plug-ins and protection transformers is available on request for certain CT types. Please check availability on each individual data sheet.





-power in control

TECHNICAL DOCUMENTATION



Protection current transformer, type SASR/SASK

DEIF A/S · Frisenborgvej 33 · DK-7800 Skive · Tel.: +45 9614 9614 · Fax: +45 9614 9615 · info@deif.com · www.deif.com

Document no.: 4921210114B

Current transformers overview

Click on a product name or check mark to jump to information page.

Page	6		7		8		9				11			12		Page
Primary nominal current	SASR 22.3*		SASK 21.3*		SASK 31.5*		SASK 31.6				SASK 421.4			SASK 41.4		Primary nominal current
Accuracy classes for sec. 5A and sec. 1A with information of max. burden in VA																
A	5P5	10P5	5P5	10P5	5P5	10P5	5P5	10P5	5P10	10P10	5P4	5P5	10P5	5P5	10P5	A
50							✓	✓								50
60							✓	✓	✓	✓						60
75						✓										75
80						✓	✓			✓						80
100		✓			✓	✓	✓	✓	✓	✓						100
120														✓		120
125	✓	✓	✓	✓	✓	✓								✓		125
150	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	150
200	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	200
250	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	250
300	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	300
400					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	400
500					✓	✓	✓	✓	✓	✓				✓	✓	500
600					✓	✓								✓	✓	600
750					✓	✓								✓		750
800																800
1000																1000
1200																1200
1250																1250
1500																1500
1600																1600
1800																1800
2000																2000
2500																2500
3000																3000
4000																4000
5000																5000
6000																6000
7500																7500
Primary conductor in mm			20×10		30×10 2×20×10		30×10 20×13				20×10			40×10 2×30×5		Primary conductor in mm
Round conductor in mm	22.5		19.2		28		23				20			32		Round conductor in mm
Transform. width in mm	61		61		61		95				71			71		Transform. width in mm

* For the current transformers above, click-on mountings are available for fitment onto 35mm DIN-rails (DIN 50022).

Current transformers overview

Click on a product name or check mark to jump to information page.

Page	13				15				17				19				Page
Primary nominal current	SASK 41.6				SASK 41.10				SASK 541.4				SASK 51.4				Primary nominal current
	Accuracy classes for sec. 5A and sec. 1A with information of max. burden in VA																
A	5P5	10P5	5P10	10P10	5P5	10P5	5P10	10P10	5P5	10P5	5P10	10P10	5P5	10P5			A
50																	50
60																	60
75																	75
80																	80
100	✓	✓	✓	✓	✓	✓		✓	✓								100
120																	120
125									✓	✓							125
150	✓	✓	✓	✓	✓	✓		✓	✓					✓			150
200	✓	✓	✓	✓	✓	✓		✓	✓					✓	✓		200
250	✓	✓	✓	✓	✓	✓		✓	✓					✓	✓		250
300	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓		✓	✓		300
400	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓		✓	✓		400
500	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓		✓	✓		500
600	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓		✓	✓		600
750					✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		750
800					✓	✓	✓	✓									800
1000									✓	✓	✓	✓		✓	✓		1000
1200																	1200
1250																	1250
1500																	1500
1600																	1600
1800																	1800
2000																	2000
2500																	2500
3000																	3000
4000																	4000
5000																	5000
6000																	6000
7500																	7500
Primary conductor in mm	40×12 30×15				40×10				40×10 2×30×5				50×12 2×40×10				Primary conductor in mm
Round conductor in mm	32				32				32				44				Round conductor in mm
Transform. width in mm	95				150				86				86				Transform. width in mm

* For the current transformers above, click-on mountings are available for fitment onto 35mm DIN-rails (DIN 50022).

Current transformers overview

Click on a product name or check mark to jump to information page.

Page	20				22		23				25		26				Page
Primary nominal current	SASK 51.6				SASK 61.4		SASK 61.10				SASK 63.6		SASK 105.6				Primary nominal current
	Accuracy classes for sec. 5A and sec. 1A with information of max. burden in VA																
A	5P5	10P5	5P10	10P10	5P5	10P5	5P5	10P5	5P10	10P10	5P5	10P5	5P5	10P5			A
50																	50
60																	60
75																	75
80																	80
100																	100
120																	120
125																	125
150	✓	✓	✓	✓													150
200	✓	✓	✓	✓	✓	✓					✓	✓					200
250	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					250
300	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					300
400	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					400
500	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					500
600	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			600
750	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			750
800																	800
1000	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			1000
1200					✓	✓	✓	✓	✓	✓			✓	✓			1200
1250					✓	✓	✓	✓	✓	✓			✓	✓			1250
1500							✓	✓	✓	✓			✓	✓			1500
1600													✓	✓			1600
1800																	1800
2000							✓	✓	✓	✓							2000
2500																	2500
3000																	3000
4000																	4000
5000																	5000
6000																	6000
7500																	7500
Primary conductor in mm	50×12 40×30				60×10 2×50×10		60×10 0×30				60×30		100×55				Primary conductor in mm
Round conductor in mm	40				44		30				30		55				Round conductor in mm
Transform. width in mm	95				96		150				88		129				Transform. width in mm

* For the current transformers above, click-on mountings are available for fitment onto 35mm DIN-rails (DIN 50022).

Protection current transformers – technical concepts

Application

Current transformers are for the galvanic separation, proportional transformation of alternating currents of larger currents into smaller, direct measurable values. There are two categories subject to their application: measuring transformers and protection transformers.

All current transformers manufactured by DEIF are for low voltage applications with a max. phase to phase voltage of 0.72kV.

Measuring transformer

Measuring transformers are used to measure current, power, power factor and energy consumption combined with an equivalent measurement unit. Using its magnetic circle, current transformers allow a high transmission accuracy in the nominal current range, whilst simultaneously protecting the connected appliances against over current. The magnetic saturation in the measuring core ensures protection in the event of an over current.

Protection current transformers

Protection current transformers are for the control of protecting relays which have the task to separate switched circuits in the event of over current. For a save function of these relays a proportional transfer ratio of the transformer up to a multiple of the nominal current is necessary. The dimensioning of this transformer unit secures a proportional current transfer, up to a multiple of the nominal currents, determined by the protection class.

Technical standards

All DEIF current transformers are produced in accordance with the technical requirements of DIN EN 60044/1 (edition 12/2003)

Technical characteristics

Application use: Indoors, without condensation

Protection current transformers

Ambient temperature: - 5°C ... + 40°C.

Housing material: Polycarbonate, self-extinguishing

Housing form: halve-cup-shaped, ultrasonically welded

Isolation class: E

Thermal rated nominal continuous current: $1.2 \times I_N$

Secondary rated currents: 5A or 1A

Thermal rated short time current: $60 \times I_N$ (max.100kA)

Max. excess temperature of the secondary winding: 75°C

Isolating test voltage: 3kV U_{EFF} ; 50Hz, 1min

Safety instructions

The protection current transformer's physical characteristics has its many advantages and with all these built-in features it is very easy to attend to this transformer with their secondary circuits open. This can be very harmful to the operator or transformers as multiple kilovolt surges can occur. In order to prevent any mishaps an operation as described above ist forbidden.

Ordering instructions

For the correct processing of your order, please make available the following specification: Transformer type, transmission ratio, accuracy class and rated burden

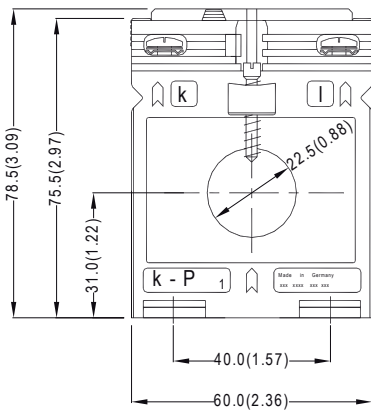
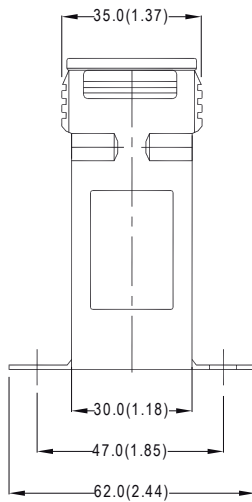
Accuracy classes of current transformers:

Class	Current error (\pm %) by % I_N						Phase displacement error (\pm minutes) by % I						total error by $n \times I_N$
	1%	5%	20%	50%	100%	120%	1%	5%	20%	50%	100%	120%	
Measuring transformer													
0.2s	0.75	0.35	0.20		0.20	0.20	30	15	10		10	10	>10
0.2		0.75	0.35		0.20	0.20		30	15		10	10	>10
0.5s	1.50	0.75	0.50		0.50	0.50	90	45	30		30	30	>10
0.5		1.50	0.75		0.50	0.50		90	45		30	30	>10
1		3.00	1.50		1.00	1.00		180	90		60	60	>10
3			3.00	3.00	3.00	3.00					120	120	>10
Protection current transformer													
5P(n)		3.00	1.50		1.00	1.00		180	90		60	60	< 5
10P(n)				3.00	3.00	3.00				120	120	120	<10

n... over current rated limiting factor



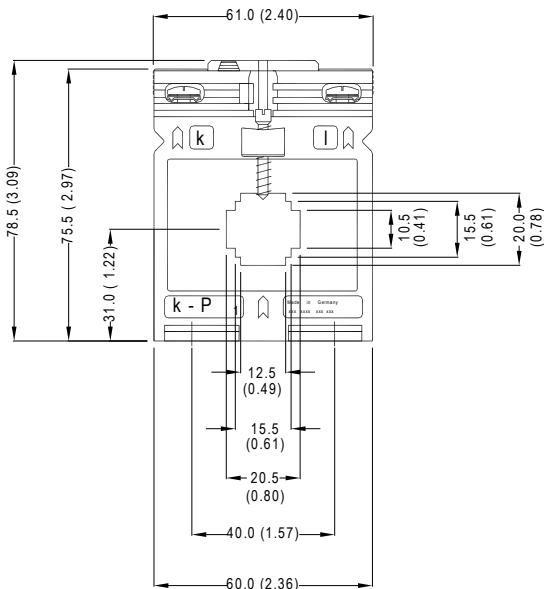
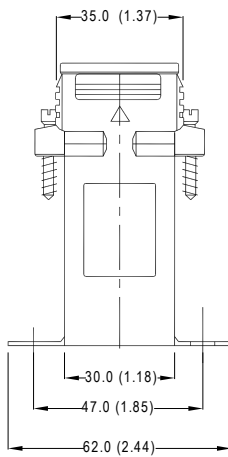
Secondary current		5A		1A	
Primary current A	Burden VA	Protection class		Protection class	
		5P5 Art.-no.	10P5 Art.-no.	5P5 Art.-no.	10P5 Art.-no.
100	1				✓
125	1	✓	✓		
	1.5			✓	✓
150	1	✓	✓		
	1.5			✓	✓
200	1	✓	✓		
	1.5			✓	✓
250	1	✓	✓		
	1.5			✓	✓
300	1	✓	✓		
	1.5		✓	✓	✓



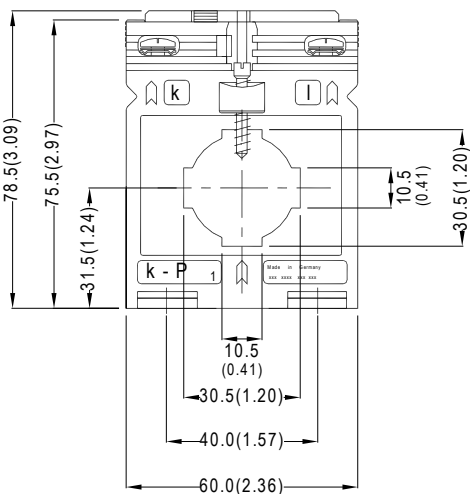
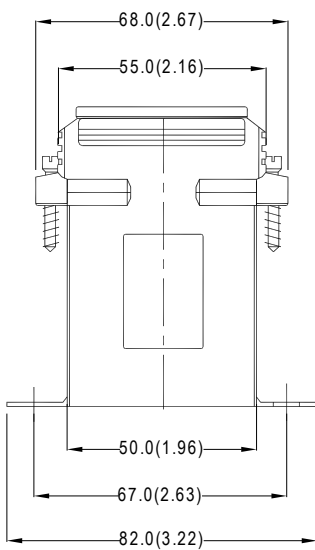
Round conductor	Ø 22.5mm
Weight	0.280-0.400kg (0.62-0.88lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990001
Sealed shutter	Type: 59040



Secondary current		5A		1A	
Primary current A	Burden VA	Protection class		Protection class	
		5P5 Art.-no.	10P5 Art.-no.	5P5 Art.-no.	10P5 Art.-no.
125	1	✓	✓		
	1.5			✓	✓
150	1	✓	✓		
	1.5			✓	✓
200	1	✓	✓		
	1.5			✓	✓

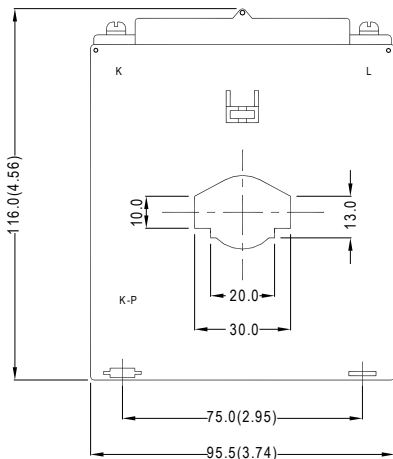
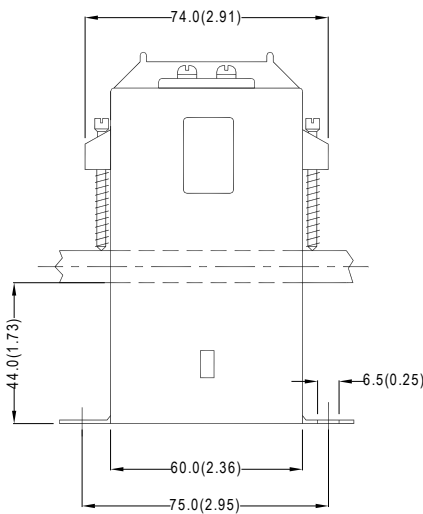


Primary conductor	20 × 10mm
Round conductor	Ø 19mm
Weight	0.190-0.380kg (0.42-0.84lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990006
Sealed shutter	Type: 59040



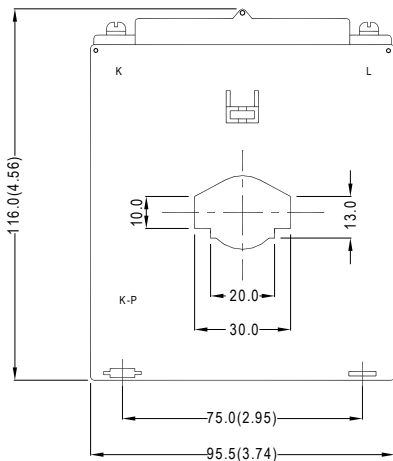
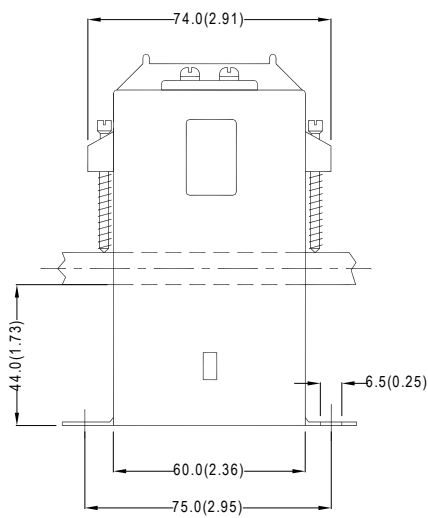
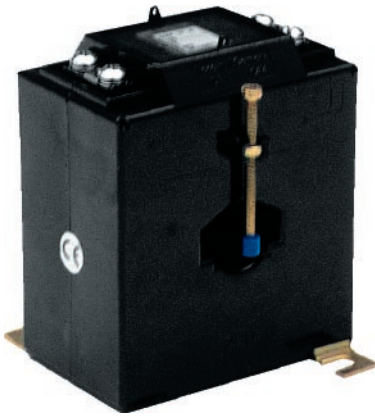
Secondary current		5A		1A	
Primary current A	Burden VA	Protection class		Protection class	
		5P5 Art.-no.	10P5 Art.-no.	5P5 Art.-no.	10P5 Art.-no.
75	1			✓	✓
80	1			✓	✓
100	1	✓	✓		
	1.5			✓	✓
125	1	✓	✓		
	1.5		✓	✓	✓
150	1	✓	✓		
	1.5	✓	✓	✓	✓
200	1	✓	✓		
	1.5	✓	✓	✓	✓
	2.5			✓	✓
250	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
300	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
400	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
500	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
600	1.5	✓	✓	✓	✓
	2.5			✓	✓
750	1.5	✓	✓	✓	✓
	2.5			✓	✓
	5				✓

Primary conductor	30 × 10mm 2 × 20 × 10mm
Round conductor	Ø 28mm
Weight	0.240 - 0.520kg (0.53– 1.15lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990003
Sealed shutter	Type: 59041



Secondary current		5A			
Primary current A	Burden VA	Protection class			
		5P5 Art.-no.	10P5 Art.-no.	5P10 Art.-no.	10P10 Art.-no.
50	1.5	✓	✓		
	2.5	✓	✓		
60	1.5	✓	✓		✓
	2.5	✓	✓		
80	1.5	✓	✓	✓	✓
	2.5	✓	✓		
100	1.5	✓	✓	✓	✓
	2.5	✓	✓		✓
	5	✓	✓		
150	2.5	✓	✓	✓	✓
	5	✓	✓		
	7.5	✓	✓		
200	2.5	✓	✓	✓	✓
	5	✓	✓		✓
	7.5	✓	✓		
250	10	✓	✓		
	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	7.5	✓	✓		
300	10	✓	✓		
	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
400	10	✓	✓		
	15	✓	✓		
	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
500	7.5	✓	✓		
	10	✓	✓		
	15	✓	✓		
	2.5	✓	✓	✓	✓
600	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓		✓
	15	✓	✓		

Primary conductor	30 × 10mm 20 × 13mm
Round conductor	Ø 23mm
Weight	0.310 - 1.900kg (0.68– 4.19lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59044

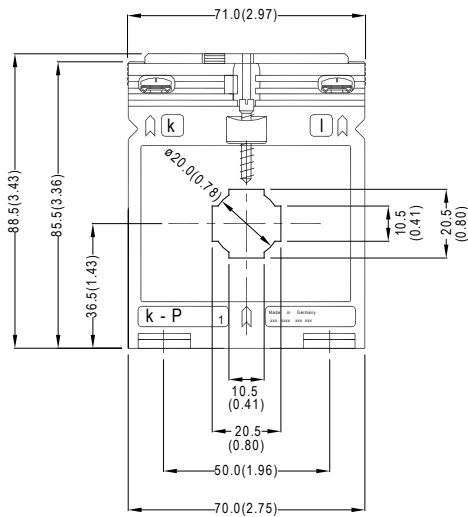
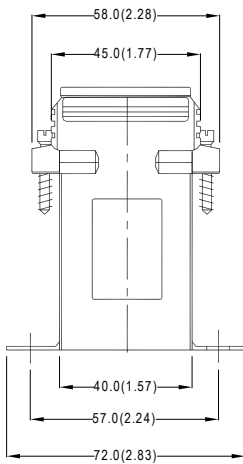


Secondary current		1A			
Primary current A	Burden VA	Protection class			
		5P5 Art.-no.	10P5 Art.-no.	5P10 Art.-no.	10P10 Art.-no.
50	1.5	✓	✓		
	2.5	✓	✓		
60	1.5	✓	✓	✓	✓
	2.5	✓	✓		
80	1.5	✓	✓	✓	✓
	2.5	✓	✓		
	5		✓		
100	2.5	✓	✓	✓	✓
	5	✓	✓		
150	2.5	✓	✓	✓	✓
	5	✓	✓		
	7.5	✓	✓		
200	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	7.5	✓	✓		
250	10	✓	✓		
	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	7.5	✓	✓		
300	10	✓	✓		
	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
400	7.5	✓	✓	✓	✓
	10	✓	✓		
	15	✓	✓		
	2.5	✓	✓	✓	✓
500	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓		✓
	15	✓	✓		✓
600	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓		✓
	15	✓	✓		

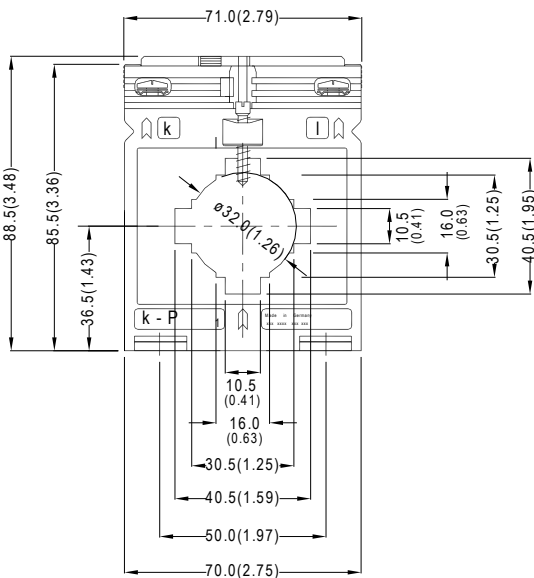
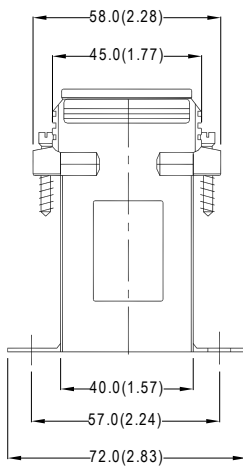
Primary conductor	30 × 10mm 20 × 13mm
Round conductor	Ø 23mm
Weight	0.310 - 1.900kg (0.68– 4.19lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59044



Secondary current		5A		1A	
Primary current A	Burden VA	Protection class		Protection class	
		5P5 Art.-no.	10P5 Art.-no.	5P5 Art.-no.	10P5 Art.-no.
200	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
250	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
300	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
400	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓

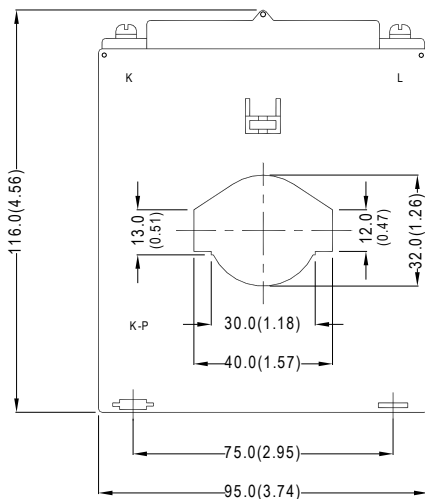
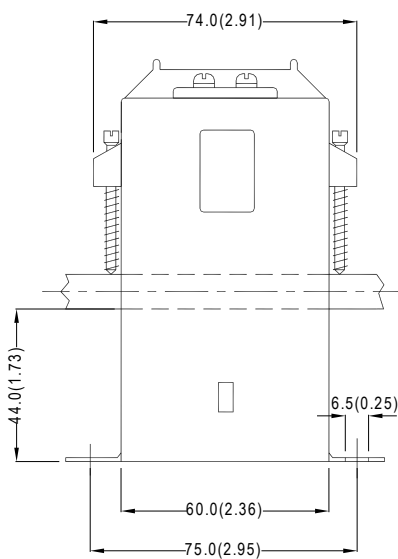
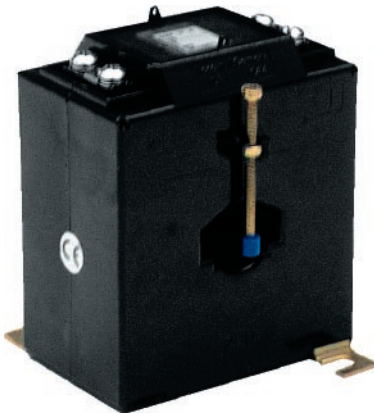


Primary conductor	20 × 10mm
Round conductor	Ø 20mm
Weight	0.290 - 1.000kg (0.64-2.20lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59041



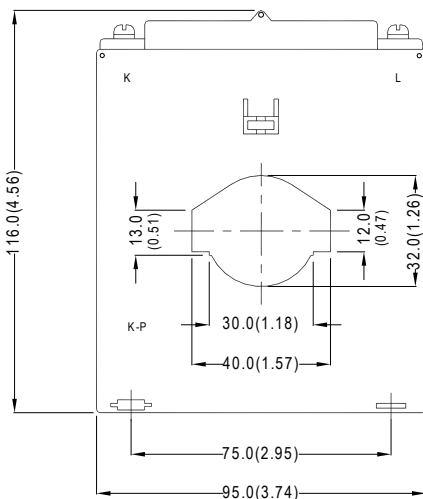
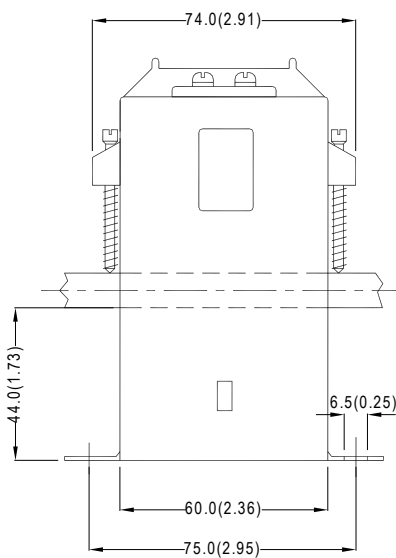
Secondary current		5A		1A	
Primary current A	Burden VA	Protection class		Protection class	
		5P5 Art.-no.	10P5 Art.-no.	5P5 Art.-no.	10P5 Art.-no.
120	1	✓	✓	✓	✓
125	1	✓	✓	✓	✓
150	1	✓	✓		
	1.5		✓	✓	✓
200	1.5	✓	✓	✓	✓
250	1.5	✓	✓	✓	✓
	2.5		✓	✓	✓
300	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
400	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
500	1.5	✓	✓	✓	✓
	2.5			✓	✓
600	1.5	✓	✓	✓	✓
	2.5			✓	✓
750	1.5	✓	✓	✓	✓
	2.5		✓	✓	✓

Primary conductor	40 × 10mm 2 × 30 × 5mm
Round conductor	Ø 32mm
Weight	0.240 - 0.800Kg (0.53-1.76lbs)
Security factor	FS 5
DIN rail mounting	Item number: 1213990004
Sealed shutter	Type: 59041



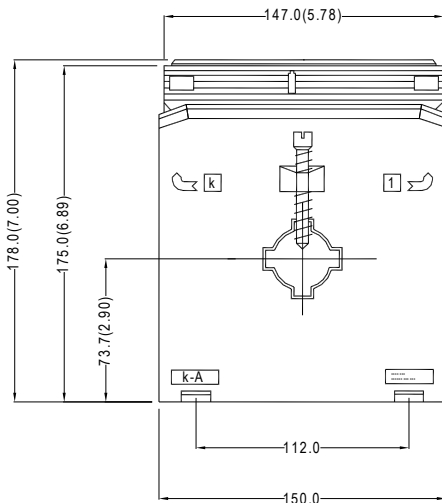
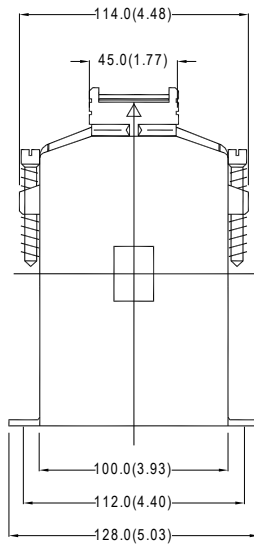
Secondary current		5A			
Primary current A	Burden VA	Protection class			
		5P5 Art.-no.	10P5 Art.-no.	5P10 Art.-no.	10P10 Art.-no.
100	1.5	✓	✓	✓	✓
	2.5	✓	✓		
150	2.5	✓	✓	✓	✓
	5	✓	✓		
200	2.5	✓	✓	✓	✓
	5	✓	✓		
	7.5	✓	✓		
250	10		✓		
	2.5	✓	✓	✓	✓
	5	✓	✓		✓
	7.5	✓	✓		
300	10	✓	✓		
	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	7.5	✓	✓		
400	10	✓	✓		
	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
500	10	✓	✓		
	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
600	10	✓	✓		
	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓

Primary conductor	40 × 12mm 30 × 15mm
Round conductor	Ø 32mm
Weight	0.320 - 2.000kg (0.71-4.41lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59044



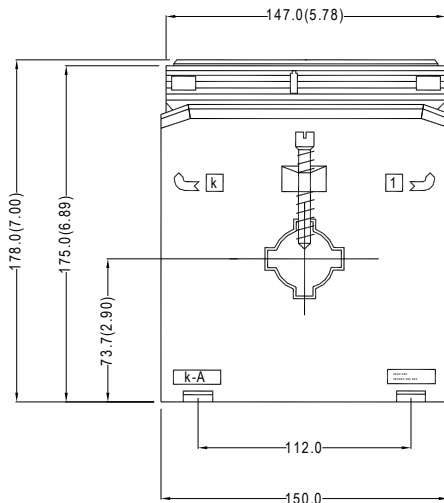
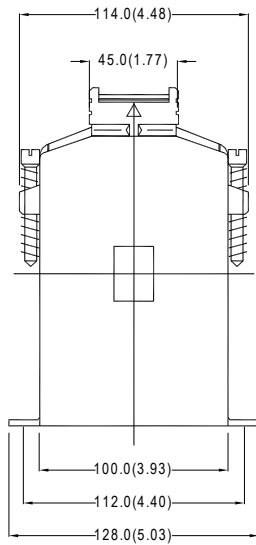
Secondary current		1A			
Primary current A	Burden VA	Protection class			
		5P5 Art.-no.	10P5 Art.-no.	5P10 Art.-no.	10P10 Art.-no.
100	1.5	✓	✓	✓	✓
	2.5	✓	✓		
150	2.5	✓	✓	✓	✓
	5	✓	✓		
200	7.5		✓		
	2.5	✓	✓	✓	✓
	5	✓	✓		
	7.5	✓	✓		
250	10		✓		
	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
300	7.5	✓	✓		
	10	✓	✓		
	2.5	✓	✓	✓	✓
400	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓		
	2.5	✓	✓	✓	✓
500	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
600	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓		
	2.5	✓	✓	✓	✓

Primary conductor	40 × 12mm 30 × 15mm
Round conductor	Ø 32mm
Weight	0.320 - 2.000kg (0.71-4.41lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59044



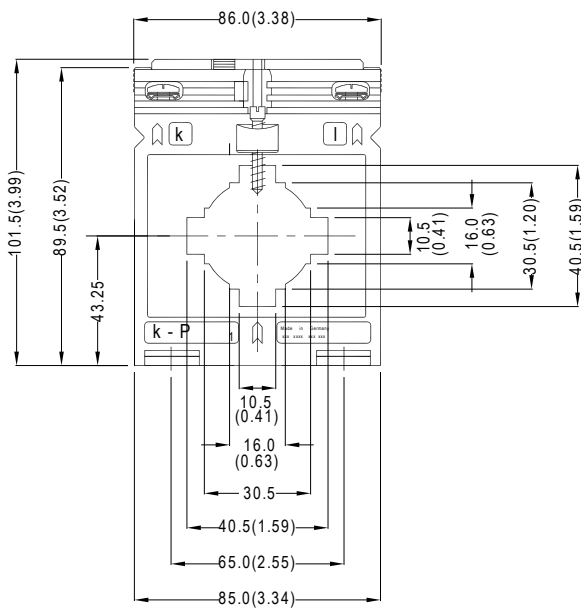
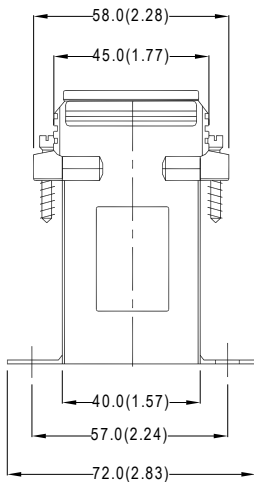
Secondary current		5A			
Primary current A	Burden VA	Protection class			
		5P5 Art.-no.	10P5 Art.-no.	5P10 Art.-no.	10P10 Art.-no.
100	5	✓	✓		✓
	7.5	✓	✓		
	10	✓	✓		
	15		✓		
150	5	✓	✓		
	7.5	✓	✓		
	10	✓	✓		
	15	✓	✓		
200	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓		
250	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓		✓
300	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓		✓
400	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
500	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
600	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
750	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
800	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓

Primary conductor	40 × 10mm
Round conductor	Ø 32mm
Weight	0.900-4.240kg (1.98-9.35lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Not available



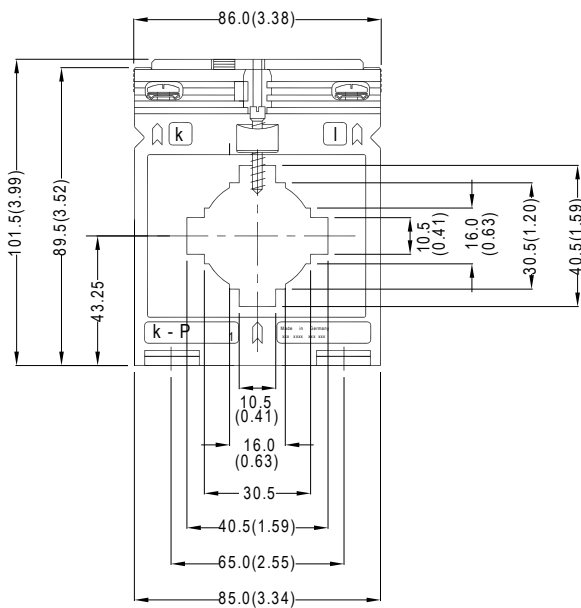
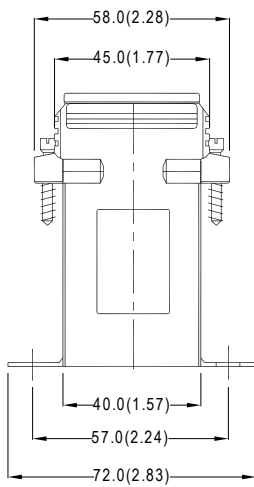
Secondary current		1A			
Primary current A	Burden VA	Protection class			
		5P5 Art.-no.	10P5 Art.-no.	5P10 Art.-no.	10P10 Art.-no.
100	5	✓	✓		✓
	7.5	✓	✓		
	10	✓	✓		
	15		✓		
150	5	✓	✓		✓
	7.5	✓	✓		
	10	✓	✓		
	15	✓	✓		
200	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓		
250	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓		✓
300	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓		✓
400	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
500	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
600	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
750	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
800	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓

Primary conductor	40 × 10mm
Round conductor	Ø 32mm
Weight	0.900-4.240kg (1.98-9.35lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Not available



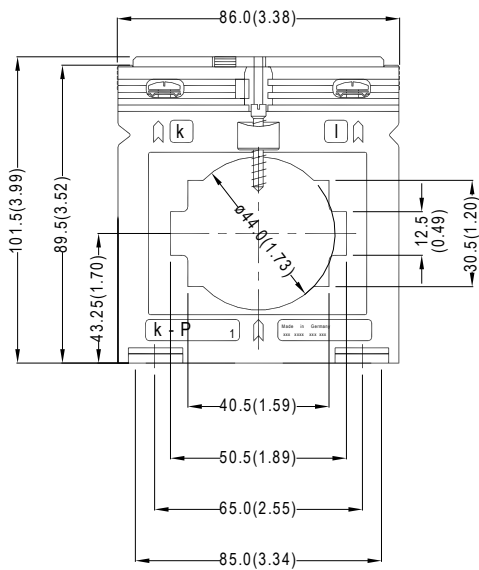
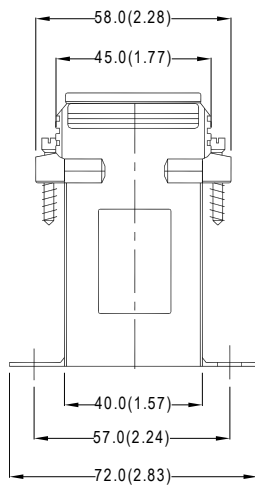
Secondary current		5A			
Primary current A	Burden VA	Protection class			
		5P5 Art.-no.	10P5 Art.-no.	5P10 Art.-no.	10P10 Art.-no.
100	1	✓	✓		
	1.5	✓	✓		
125	1	✓	✓		
	1.5	✓	✓		
150	2.5		✓		
	1.5	✓	✓		
200	2.5	✓	✓		
	1.5	✓	✓		
250	2.5	✓	✓		✓
	1.5	✓	✓		✓
300	2.5	✓	✓		
	5		✓		
	1.5	✓	✓	✓	✓
400	2.5	✓	✓		
	5	✓	✓		
	1.5	✓	✓	✓	✓
500	2.5	✓	✓	✓	✓
	5	✓	✓		
	7.5		✓		
600	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
	5	✓	✓		
750	7.5		✓		
	2.5	✓	✓	✓	✓
	5	✓	✓		
1000	2.5	✓	✓	✓	✓
	5	✓	✓		
	7.5	✓	✓		
	10	✓	✓		

Primary conductor	40 × 10mm 2 × 30 × 15mm
Round conductor	Ø 32mm
Weight	0.270-1.000kg (0.60-2.20lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59042



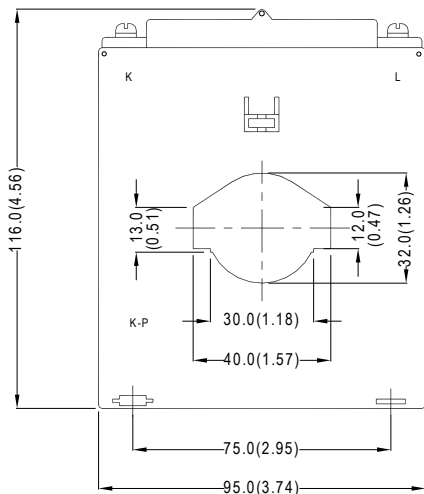
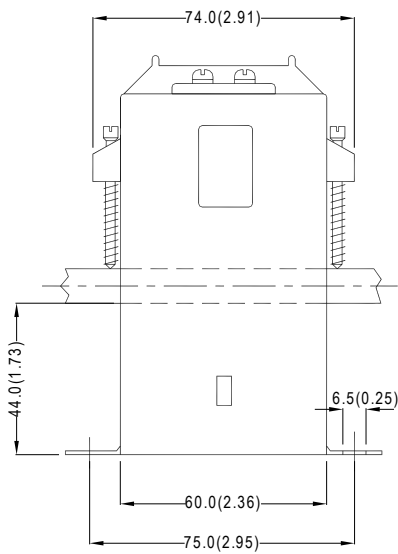
Secondary current		1A			
Primary current A	Burden VA	Protection class			
		5P5 Art.-no.	10P5 Art.-no.	5P10 Art.-no.	10P10 Art.-no.
100	1	✓	✓		
	1,5	✓	✓		
125	1	✓	✓		
	1,5	✓	✓		
150	2,5	✓	✓		
	1,5	✓	✓		
200	2,5	✓	✓		
	1,5	✓	✓		
250	2,5	✓	✓	✓	✓
	1,5	✓	✓	✓	✓
300	2,5	✓	✓		
	1,5	✓	✓	✓	✓
400	5		✓		
	1,5	✓	✓	✓	✓
500	2,5	✓	✓	✓	✓
	1,5	✓	✓	✓	✓
600	5	✓	✓		
	2,5	✓	✓	✓	✓
750	7,5	✓	✓		
	1,5	✓	✓	✓	✓
1000	2,5	✓	✓	✓	✓
	5	✓	✓		✓
1000	7,5	✓	✓		
	10	✓	✓		

Primary conductor	40 × 10mm 2 × 30 × 15mm
Round conductor	Ø 32mm
Weight	0.270-1.000kg (0.60-2.20lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59042



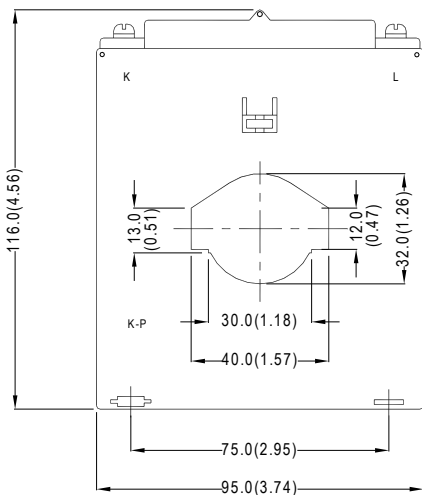
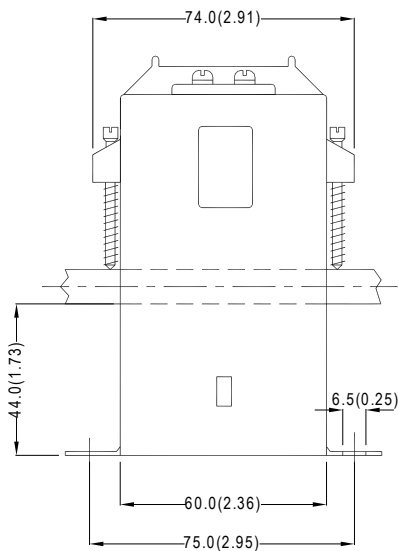
Secondary current		5A		1A	
Primary current A	Burden VA	Protection class		Protection class	
		5P5 Art.-no.	10P5 Art.-no.	5P5 Art.-no.	10P5 Art.-no.
150	1			✓	✓
200	1	✓	✓	✓	✓
	1.5		✓	✓	✓
250	1.5	✓	✓	✓	✓
	2.5				✓
300	1.5	✓	✓	✓	✓
	2.5			✓	✓
400	1.5	✓	✓	✓	✓
	2.5		✓	✓	✓
500	1.5	✓	✓	✓	✓
	2.5		✓	✓	✓
600	1.5	✓	✓	✓	✓
	2.5		✓	✓	✓
	5				✓
1000	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
	5			✓	✓

Primary conductor	50 × 12mm 2 × 40 × 10mm
Round conductor	Ø 44mm
Weight	0.260-0.720kg (0.57-1.59lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59042



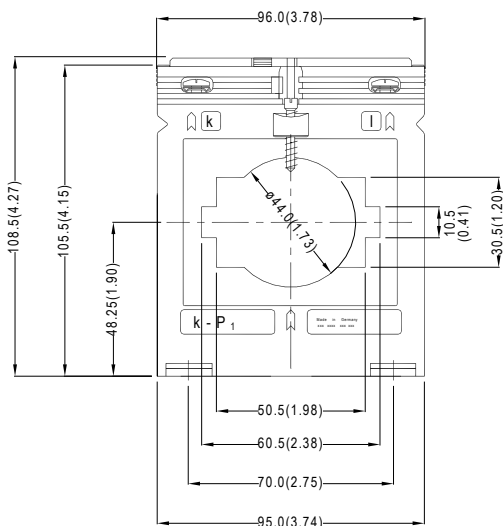
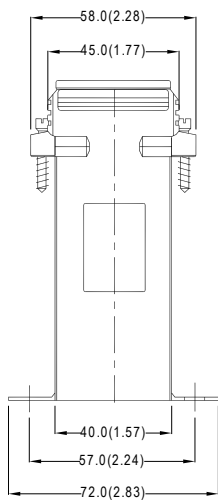
Secondary current		5A			
Primary current A	Burden VA	Protection class			
		5P5 Art.-no.	10P5 Art.-no.	5P10 Art.-no.	10P10 Art.-no.
150	1.5	✓	✓	✓	✓
	2.5	✓	✓		
200	1.5	✓	✓	✓	✓
	2.5	✓	✓		
	5	✓	✓		
250	2.5	✓	✓	✓	✓
	5	✓	✓		
	7.5		✓		
300	2.5	✓	✓	✓	✓
	5	✓	✓		
	7.5	✓	✓		
400	2.5	✓	✓	✓	✓
	5	✓	✓		
	7.5	✓	✓		
500	2.5	✓	✓	✓	✓
	5	✓	✓		
	7.5	✓	✓		
	10	✓	✓		
600	2.5	✓	✓	✓	✓
	5	✓	✓		
	7.5	✓	✓		
	10	✓	✓		
750	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	7.5	✓	✓		
	10	✓	✓		
1000	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	7.5	✓	✓		
	10	✓	✓		

Primary conductor	50 × 12mm 40 × 30mm
Round conductor	Ø 40mm
Weight	0.360-1.280kg (0.79-2.82lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59044



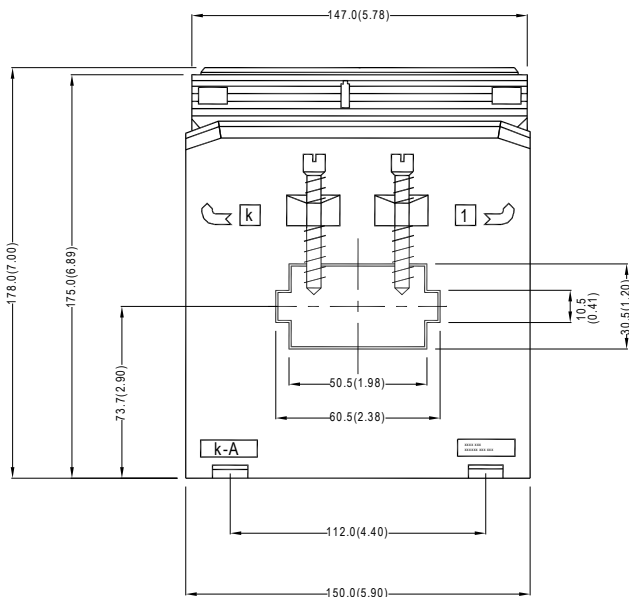
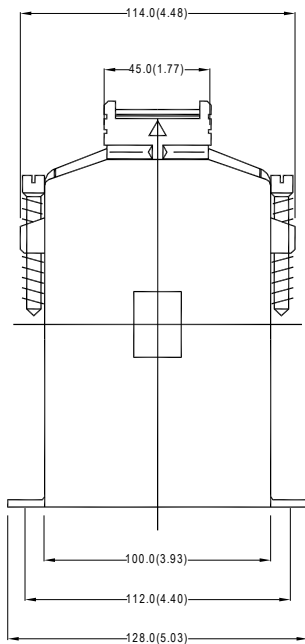
Secondary current		1A			
Primary current A	Burden VA	Protection class			
		5P5 Art.-no.	10P5 Art.-no.	5P10 Art.-no.	10P10 Art.-no.
150	1.5	✓	✓	✓	✓
	2.5	✓	✓		
200	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
	5	✓	✓		
250	2.5	✓	✓	✓	✓
	5	✓	✓		
	7.5		✓		
300	2.5	✓	✓	✓	✓
	5	✓	✓		
	7.5		✓		
400	2.5	✓	✓	✓	✓
	5	✓	✓		
	7.5	✓	✓		
500	2.5	✓	✓	✓	✓
	5	✓	✓		✓
	7.5	✓	✓		
	10	✓	✓		
600	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	7.5	✓	✓		
	10	✓	✓		
750	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	7.5	✓	✓		
	10	✓	✓		
1000	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
	7.5	✓	✓		
	10	✓	✓		

Primary conductor	50 × 12mm 40 × 30mm
Round conductor	Ø 40mm
Weight	0.360-1.280kg (0.79-2.82lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59044



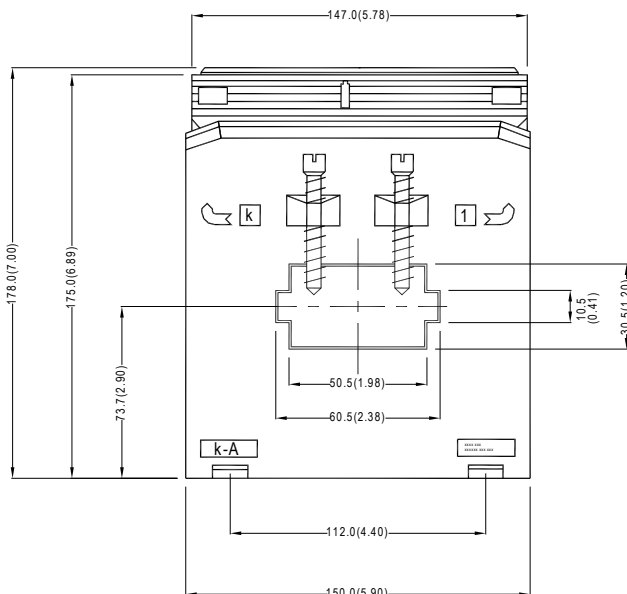
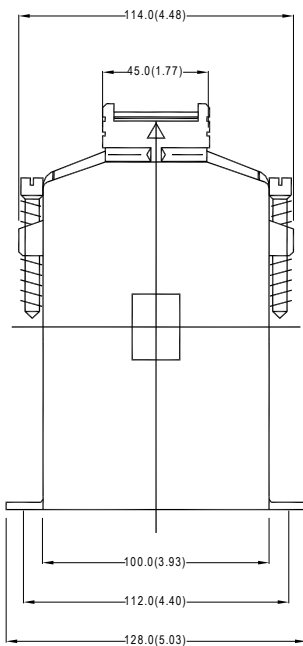
Secondary current		5A		1A	
Primary current A	Burden VA	Protection class		Protection class	
		5P5 Art.-no.	10P5 Art.-no.	5P5 Art.-no.	10P5 Art.-no.
200	1	✓	✓	✓	✓
	1.5	✓	✓	✓	✓
250	1	✓	✓	✓	✓
	1.5	✓	✓	✓	✓
300	1.5	✓	✓	✓	✓
	2.5		✓	✓	✓
400	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
500	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
600	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
	5			✓	✓
750	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
1000	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
1200	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
1250	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓

Primary conductor	60 × 10mm 2 × 50 × 10m.
Round conductor	Ø 44mm
Weight	0.300-0.630kg (0.66-1.39lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59042



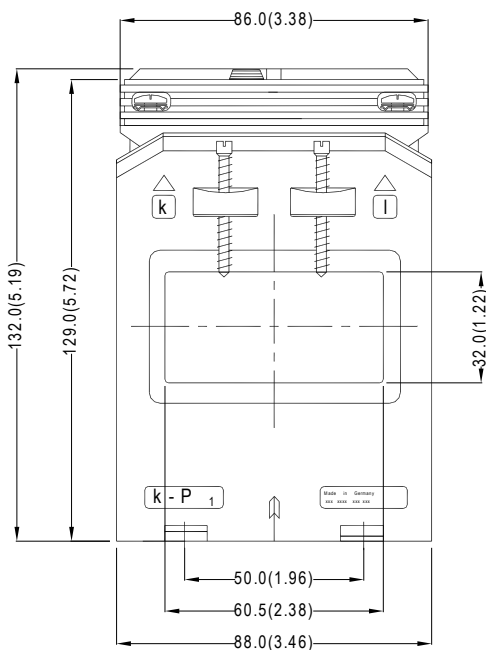
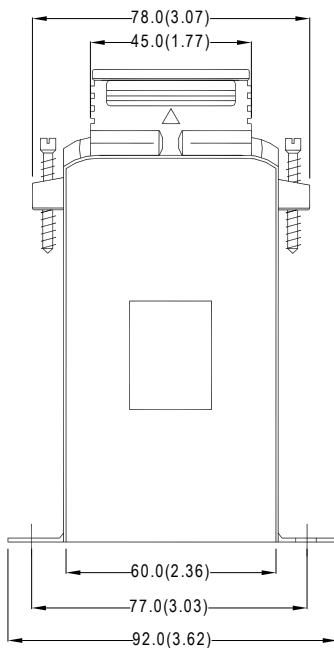
Secondary current		5A			
Primary current A	Burden VA	Protection class			
		5P5 Art.-no.	10P5 Art.-no.	5P10 Art.-no.	10P10 Art.-no.
250	5	✓	✓	✓	✓
	7.5	✓	✓		✓
	10	✓	✓		
300	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓		✓
	15	✓	✓		
400	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
500	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
600	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
750	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1000	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1200	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1250	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1500	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
2000	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓

Primary conductor	60 × 10mm 50 × 30mm
Round conductor	Ø 30mm
Weight	0.300-3.360kg (0.66-7.41lbs)
Security factor	250A-1,500A = FS 5 1,600A-5,000A = FS 10
DIN rail mounting	Not available
Sealed shutter	Not available



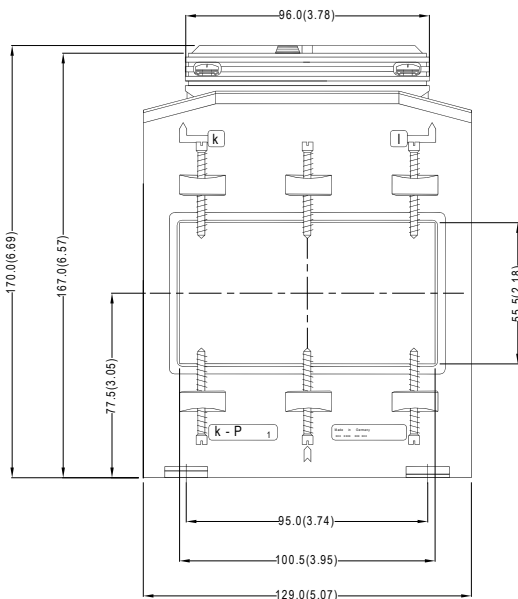
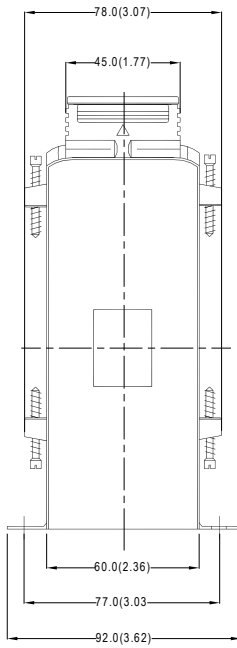
Secondary current		1A			
Primary current A	Burden VA	Protection class			
		5P5 Art.-no.	10P5 Art.-no.	5P10 Art.-no.	10P10 Art.-no.
250	5	✓	✓	✓	✓
	7.5	✓	✓		✓
	10	✓	✓		
300	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓		✓
	15	✓	✓		
400	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
500	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
600	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
750	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1000	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1200	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1250	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1500	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
2000	5	✓	✓	✓	✓
	7.5	✓	✓	✓	✓
	10	✓	✓	✓	✓
	15	✓	✓	✓	✓

Primary conductor	60 × 10mm 50 × 30mm
Round conductor	Ø 30mm
Weight	0.300-3.360kg (0.66-7.41lbs)
Security factor	250A-1,500A = FS 5 1,600A-5,000A = FS 10
DIN rail mounting	Not available
Sealed shutter	Not available



Secondary current		5A		1A	
Primary current A	Burden VA	Protection class		Protection class	
		5P5 Art.-no.	10P5 Art.-no.	5P5 Art.-no.	10P5 Art.-no.
200	1.5	✓	✓	✓	✓
	2.5		✓	✓	✓
250	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
300	1.5	✓	✓	✓	✓
	2.5	✓	✓	✓	✓
400	2.5	✓	✓	✓	✓
	5		✓	✓	✓
500	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
600	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
750	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
1000	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓

Primary conductor	60 × 30mm
Round conductor	Ø 30mm
Weight	0.200-1.300kg (0.44-2.87lbs)
Security factor	FS 5
DIN rail mounting	Not available
Sealed shutter	Type: 59042



Secondary current		5A		1A	
Primary current A	Burden VA	Protection class		Protection class	
		5P5 Art.-no.	10P5 Art.-no.	5P5 Art.-no.	10P5 Art.-no.
600	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
750	2.5	✓	✓	✓	✓
	5	✓	✓	✓	✓
1000	10		✓	✓	✓
	15				✓
1200	5	✓	✓	✓	✓
	10	✓	✓	✓	✓
1250	15		✓	✓	✓
	5	✓	✓	✓	✓
1500	10	✓	✓	✓	✓
	15	✓	✓	✓	✓
1600	10	✓	✓	✓	✓
	15	✓	✓	✓	✓

Primary conductor	100 × 55mm
Round conductor	Ø 55mm
Weight	0.800-1.580kg (1.76-3.48lbs)
Security factor	600A-1,500A = FS 5 1,600A = FS 10
DIN rail mounting	Not available
Sealed shutter	Type: 59042

Test certificate

On request, we can provide you with a test certificate for a specific current transformer along with the CT. Please inform us when placing your order.

Sealed shutter

On request, we can supply a transparent plastic cover. The cover seals the connections on the CT in a way that leaves the type label visible. Please check availability on each individual data sheet.



Excitation curve

On request, we can provide you with an excitation curve for a specific current transformer along with the CT. Please inform us when placing your order.

Optional frequency

Frequency range for a standard CT is 50-60Hz. On request, we can provide you with a frequency range from 16 2/3 – 400Hz. Please inform us when placing your order.


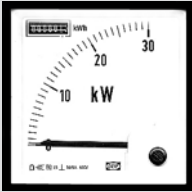



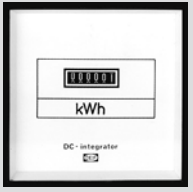
Cast resin

Cast resin is standard for all CT's with a nominal current $>4,000A$. On request, all CT's with a nominal current $<4,000A$ can be produced with cast resin. Please inform us when placing your order. The min. and max. weight specification for each type refers to standard versions. The specification is different if cast resin is ordered for CT's $<4,000A$.

Mounting

Foot angle for screw mounting and busbar mounting screws with isolating protection caps are supplied along with the CT. DIN-rail mounting for tubes, plug-ins and protection transformers is available on request for certain CT types. Please check availability on each individual data sheet.



	kWh or kvarh Meters WQ2R96	kWh or kvarh Meters WQR96-x	kWh or kvarh Meters WQR96-c
			
Main function:	Measurement of power or reactive power	Measurement of power or reactive power	Measurement of power or reactive power
Size (mm):	Q96	Q96	Q96
Mounting:	Panel	Panel	Panel
Pointer deflection:	-	90°	240°
Protection:	IP52	IP52	IP52
Accuracy class:	1 (IEC1036)	1 (IEC1036)	1 (IEC1036)
Connection	1W, 1W3, 1W4, 2W3, 3W3 (4)	1W, 1W3, 1W4, 2W3, 3W3 (4)	1W, 1W3, 1W4, 2W3, 3W3 (4)
Frequency:	45...65Hz	45...65Hz	45...65Hz
Measuring range:	Measuring current: direct or from C.T./-1A or -5A Measuring voltage: 57-100-230-400V AC	Measuring current: direct or from C.T./-1A or -5A Measuring voltage: 57-100-230-400V AC	Measuring current: direct or from C.T./-1A or -5A Measuring voltage: 57-100-230-400V AC
Pulse outputs:	2 relays	1 relay	1 relay
	kWh or kvarh Meters WQR96	Energy Meters (kWh) TAE-2	DC Integrators / Pulse-transmitters, DCF-Q96
			
Main function:	Measurement of power or reactive power.	DIN-rail meter with a 6-digit register for accumulated measurement of energy.	Accumulates momentary measurements from a transducer into reading of fx kWh or Ah.
Size (mm):	Q96	90 x 105	103 x 92
Mounting:	Panel	DIN rail	Panel or base
Protection:	IP52	IP20	IP52
Accuracy class:	1 (IEC 1036)	1	0.5
Connection:	1W, 1W3, 1W4, 2W3, 3W3 (4)	3 phase 3 wire, 2 external C.T.'s 3 phase 4 wire, 3 external C.T.'s Single phase, 1 external C.T.	-
Measuring current:	-	-1A or -5A	-
Measuring voltage:	-	3 x 230V/400V AC -20/+25% or 3 x 132V/230V AC -20/+25%	-
Measuring range:	Measuring current: direct or from C.T./-1A or -5A Measuring voltage: 57-100-230-400V AC	30...2000/1A or 5A	1V..10V DC, 1...20mA, 4...20mA
Frequency:	45...65Hz	45...65Hz	-
Auxiliary voltage:	-	-	100...440V AC ±20%, 24V DC ±25%
Pulse outputs:	1 relay	Relay contact	1 relay

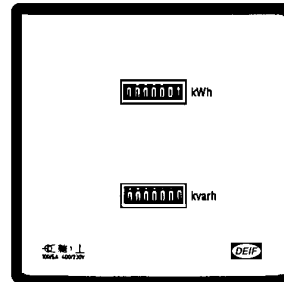
kWh meters

Types WQR96, WQ2R96, WQR96-x, WQR96-c

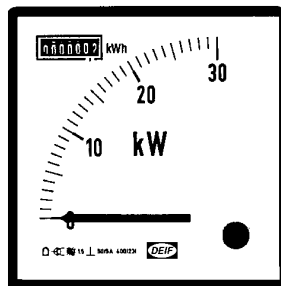
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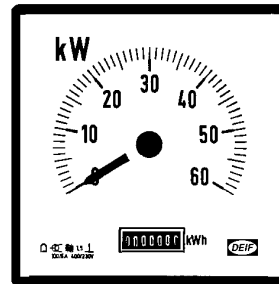
WQR96



WQ2R96



WQR96-x



WQR96-c

- Accuracy class 1.0
- For single phase and 3 phase networks
- Microprocessor controlled meters with pulse output
- Simultaneous measurement of two quantities (except type WQR96)
- Standard Q96 DIN housing

Application

The kWh meters types WQR.. and WQ2R.. are intended for energy measurement in single phase and 3 phase networks, providing a class 1.0 measurement of the imported or exported energy. The meters are microprocessor controlled, equipped with a 7-digit electromechanical counter which retains the reading in case of supply voltage failure. The meters are furthermore equipped with 1 or 2 pulse outputs. The meters can be adapted to the applied current transformers.

- WQR96** Meter with a 7-digit register and one pulse output for measurement of one type of energy only (kWh or kvarh).
- WQ2R96** Meter with two 7-digit registers and two pulse outputs for measurement of two types of energy (both kWh and kvarh imported or exported).
- WQR96-x** Meter with both a 7-digit register and one pulse output for energy measurement (kWh or kvarh) and a 90° instrument for simultaneous indication of the momentary power value (active or reactive).
- WQR96-c** Meter with both a 7-digit register and one pulse output for energy measurement (kWh or kvarh) and a 240° instrument for simultaneous indication of the momentary power value (active or reactive).

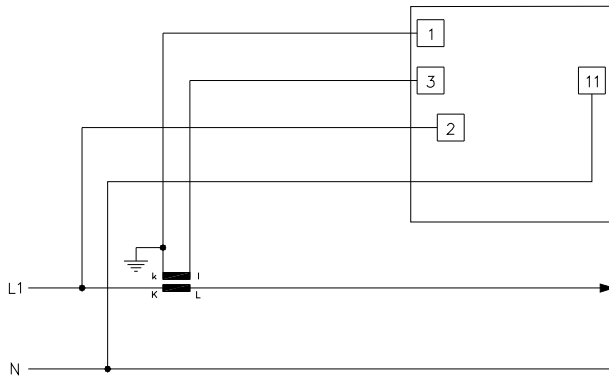
All types can be ordered for single phase networks or 3 phase networks with/without neutral, balanced/unbalanced load.

Technical specifications

Accuracy:	energy power	Class 1.0 (-10...15...30...55°C), to EN 61036 and IEC 1036. ± 1.5% of scale
Frequency:		45...65Hz. Rated frequency: 50Hz or 60Hz
Measuring current:		Current transformer -/1A or -/5A. Max. current 1.6 I _n . Consumption: < 0.1VA.
Measuring voltage:		Standard: 57-100-230-400V AC ±20%. Consumption: < 3VA.
Overloads	currents	3 x I _n , continuously, 25 x I _n for 3 s 50 x I _n for 1 s
	voltages	1.2 x U _n
Relay outputs		Contact rating: 250V – 6A – 50Hz. Max. switching power 1500VA. 1, 10 or 100 pulses per kWh (or MWh). Max. 4000 pulses per hour. Pulse duration: 100ms.
Electromechanical counter		7 digits, each 4 x 1.2mm
Temperature:		-10...55°C (nominal) -10...60°C (operating) -25...65°C (storage)
Climate:		Class JVF, to DIN 40040
EMC:		To EN 50081-1/2 and EN 50082-1/2
Safety:		To IEC 1010-1. Installation cat. II, 600V. Installation cat. III, 300V. Pollution degree 2.
Materials:		All plastic materials are self-extinguishing to UL94 (V0)
Connections:		Relay output: max. 1mm ²
Protection:		Front: IP52, terminals: IP00, to EN 60529 and IEC 529

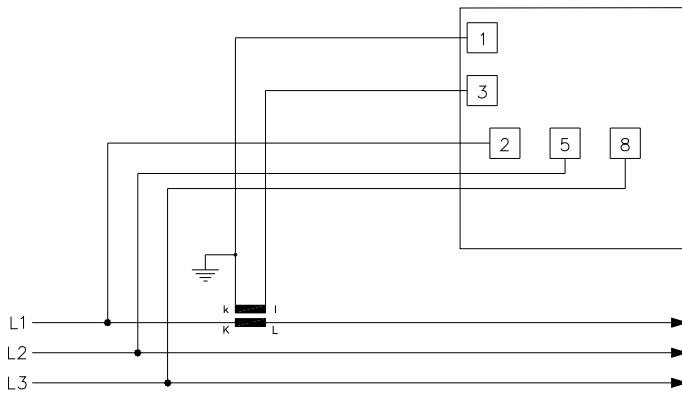
Connections

Single phase networks



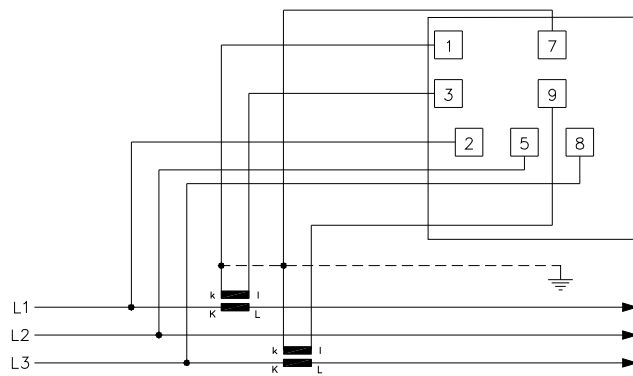
(Connection 1W) WQR96, WQ2R96, WQR96-x, WQR96-c

3 phase, 3 wire networks, balanced load



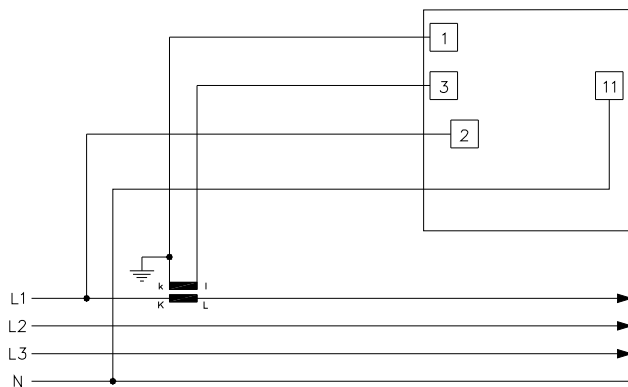
(Connection 1W3) WQR96, WQ2R96, WQR96-x, WQR96-c

3 phase, 3 wire networks, unbalanced load



(Connection 2W3) WQR96, WQ2R96, WQR96-x, WQR96-c

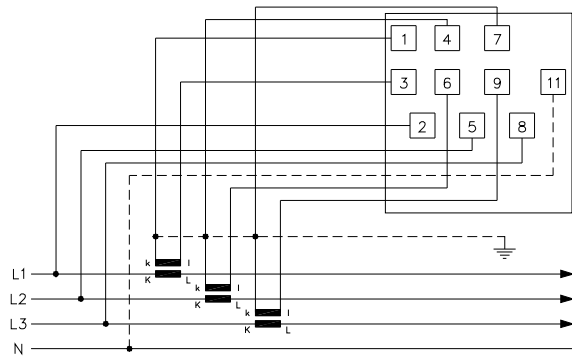
3 phase, 4 wire networks, balanced load



(Connection 1W4) WQR96, WQ2R96, WQR96-x, WQR96-c

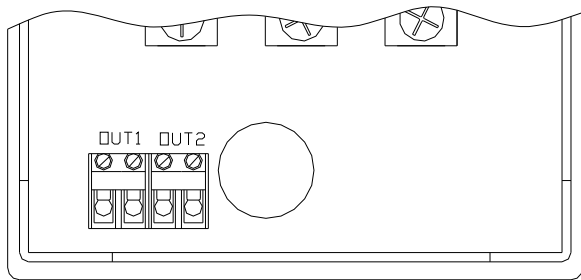
Connections (continued)

3 phase, 4 wire networks, unbalanced load



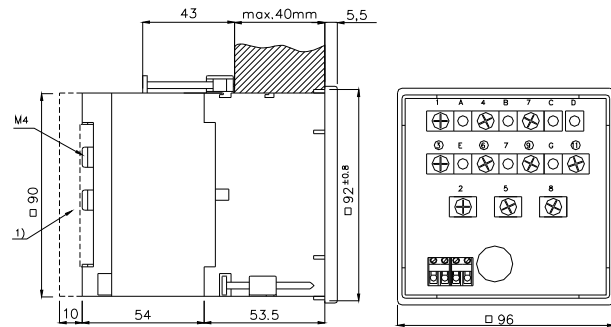
(Connection 3W4) WQR96, WQ2R96, WQR96-x, WQR96-c

Auxiliary voltage/output connections



WQR96, WQ2R96, WQR96-x, WQR96-c

Dimensions



1) Protective cover

Weight: ca. 0.6 kgs

WQR96, WQ2R96, WQR96-x, WQR96-c

Order specifications

WQR96/WQ2R96:

Type	Conn.	VT ratio	CT ratio	Register(s)	Relay 1	Relay 2
Examples:						
WQR96	1W3	10,000/100V	100/1A	10p/Mvarh	10p/Mvarh	
WQ2R96	3W4	10,000/100V	50/1A	1p/MWh E*/MWh I*	1p/Mwh	1p/Mwh

WQR96-x/WQR96-c:

Type	Conn.	VT ratio	CT ratio	Register	Relay 1	Scale
Examples:						
WQR96-x	3W4	10,000/400V	100/5A	10p/MWh	10p/MWh	0...2MW
WQR96-c	3W4	10,000/100V	200/5A	1p/MWh	1p/MWh	0...4MW

*) E = exported energy
I = imported energy

Note: If no VT the pulse duration is normally 1, 10 or 100p/kWh/kvarh

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



DEIF A/S, Frisenborgvej 33
DK-7800 Skive, Denmark

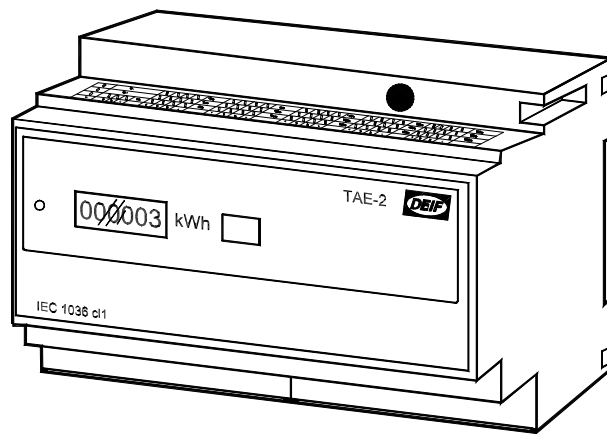


Tel.: +45 9614 9614, Fax: +45 9614 9615
E-mail: deif@deif.com, URL: www.deif.com

Energy meters

Type TAE-2

4921220030D



- *Direct reading of up to 2000A/1 or 5A*
- *Pulse output via relay contact*
- *LED for indication of correct connection and correct function*
- *User setting of current transformer ratio*
- *For 35 mm DIN rail*

Application

The energy meter type TAE-2 is applied to kWh measurement, measuring the electricity consumption in 3 phase or single phase networks. The meter is applicable to 3 phase 3 wire, 3 phase 4 wire and single phase networks.

The unit is provided with a microprocessor-based circuit, which is connected to a mechanical counter for registration of the consumption in kWh.

The TAE-2 is furthermore provided with a relay contact output. The unit can consequently be connected to various measuring terminals, tariff units, computers, etc.

The measuring range of the energy meter depends on the ratio of the external current transformers. The measuring range is set by the user on the front of the meter.

On the front the TAE-2 is equipped with a LED for indication of correct connection of the unit. At correct connection the LED flashes at a frequency corresponding to 125Wh, irrespective of the selected current transformer ratio. If the TAE-2 has been incorrectly connected, the LED is lit continuously.

The TAE-2 is CE marked to EN 61036 and IEC 1036.

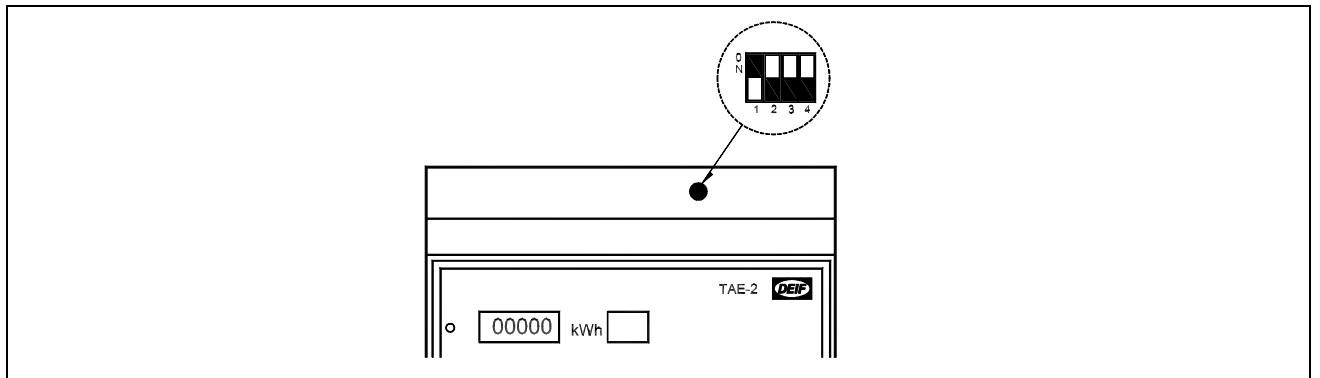
Technical specifications

Connection		3 phase 3 wire (2 external current transformers), or: 3 phase 4 wire (3 external current transformers), or: single phase (1 external current transformer)
Measuring voltage		230V/400V AC $-20/+20\%$ or: 132/230 V AC $-20/+20\%$ Consumption < 3VA.
		The measuring voltage is internally connected to the supply voltage.
Measuring current		Consumption: 0.1VA. $I_n = 1A$ or $5A$, $I_b = 0.05 \times I_n$, $I_{max} = 1.2 \times I_n$
Overcurrent		$25 \times I_n$ for 3 s/ $50 \times I_n$ for 1 s
Measuring range		30-50-60-80-100-150-200-250-300-400-500-600-800-1000-1500-2000/1A or 5A
		Determined by the current transformer ratio.
Measuring frequency		45...65Hz
Read-out		6 digit mechanical counter. No reset function.
Output		Relay contact output.
	Pulse ratio	1 pulse per kWh. Max. number of pulses 4000 per hour.
	Pulse width	100 ms
	Contact ratings	250V-6A-1500VA(AC) 24V-6A-150VA (DC)
	Max. voltage	250V
Safety		600V-Cat II Pollution deg. 2 to EN61010-1
Indication		LED for indication of correct connection and correct function.
		Flash frequency: 125Wh
Accuracy		Class 1 ($-10...15...30...55^\circ\text{C}$), to EN 61036 and IEC 1036
Temperature		$-10...55^\circ\text{C}$ (nominal), $-20...70^\circ\text{C}$ (storage)
Humidity		Up to 95% (without condensing)
EMC	Emission	To EN 61036 and IEC 1036
	Immunity	To EN 61036 and IEC 1036
Connections		Screw terminals, 2.5 mm ²
Protection		IP 20, to EN 60529 and IEC 529
Materials		All plastic parts are self-extinguishing to UL94 (V0).

Selection of current transformer ratio

The measuring range is selected according to the ratio of the external current transformers by means of dip switches. These are easily accessible through a hole in the front plate of the meter. The selected current transformer ratio will not be activated until the TAE-2 has been reconnected (i.e. after disconnection and reconnection of the power supply).

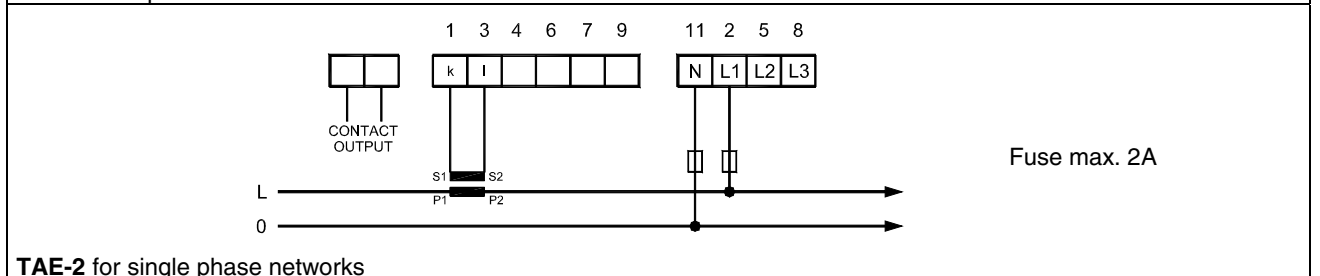
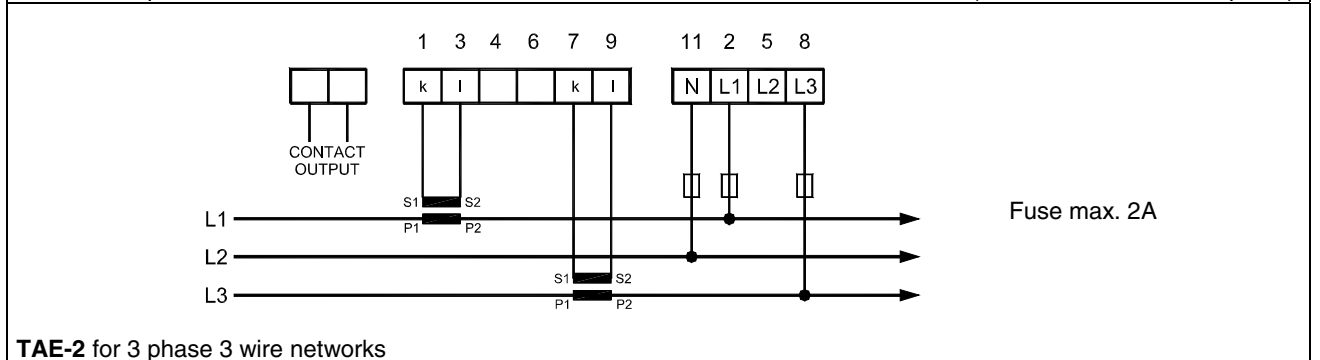
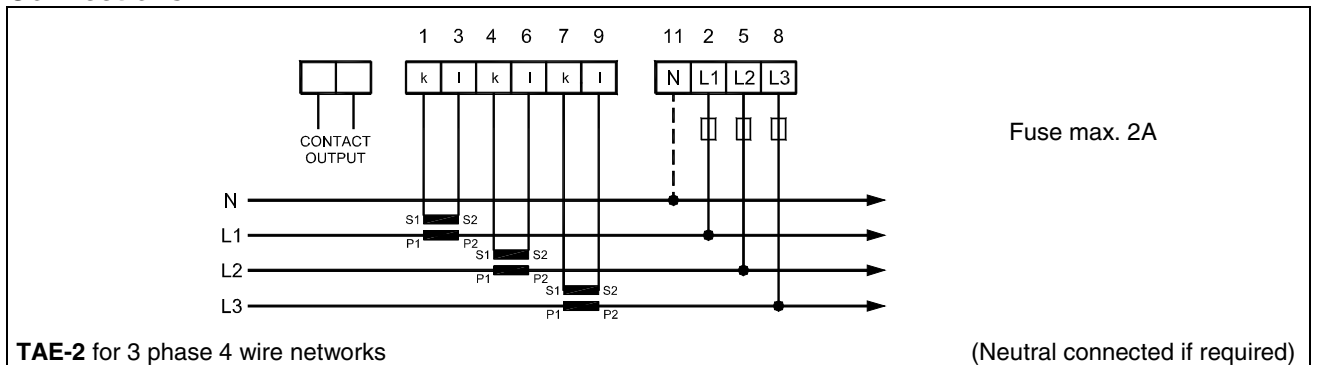
After selection of the current transformer ratio the hole is sealed using a plug, which is included on delivery.



Current transformer ratio

In	1	2	3	4	In	1	2	3	4	In	1	2	3	4	In	1	2	3	4	In	1	2	3	4	
30	○	○	○	○	50	●	○	○	○	100	○	○	●	○	250	●	●	●	○	500	○	●	●	●	○
On	●				60	○	●	○	○	150	●	○	○	○	300	○	○	○	●	600	●	●	○	○	○
Off	○				80	●	●	○	○	200	○	●	○	○	400	●	○	○	○	800	○	○	●	○	○

Connections

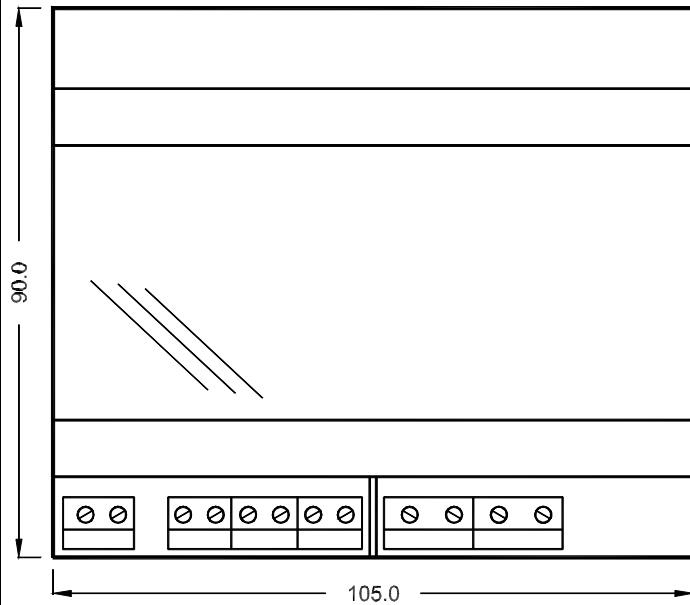


The power should flow from P1 towards P2.

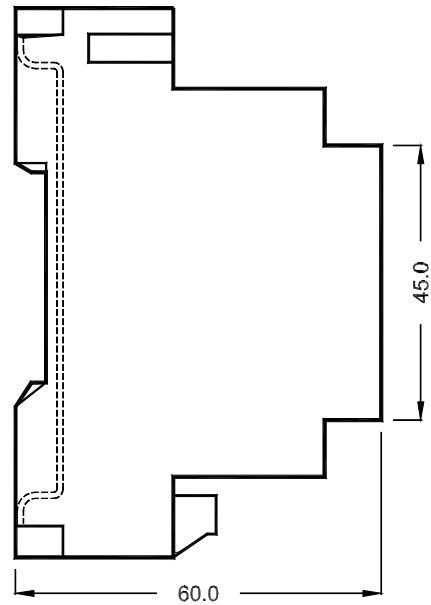
After connection of the TAE-2, the 2 covers (included on delivery) are placed over the terminals.

Dimensions

All dimensions in mm



TAE-2

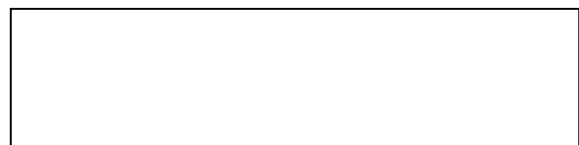


Weight: approx. 0.300 kg

Order specifications

Type	Voltage	EAN-number
TAE-2	3 x 132/230V AC 30-2000/5A	5703727001088
TAE-2	3 x 230/400V AC 30-2000/5A	5703727001095
TAE-2	3 x 132/230V AC 30-2000/1A	5703727001101
TAE-2	3 x 230/400V AC 30-2000/1A	5703727001118
TAE-2	1 x 230V AC 5A	5703727001125
TAE-2	1 x 230V AC 1A	5703727001132

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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DK-7800 Skive, Denmark

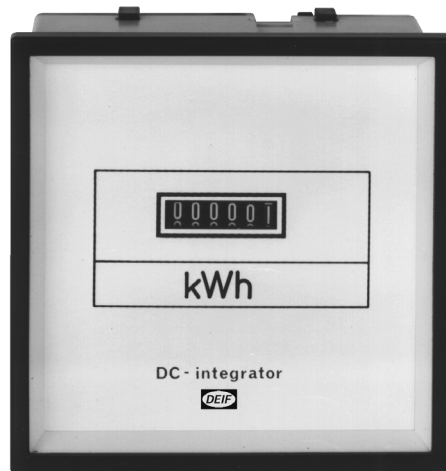
Tel.: +45 9614 9614, Fax: +45 9614 9615
E-mail: deif@deif.com, URL: www.deif.com



DC integrator Pulse transmitter

Type DCF-Q96

4921220014D

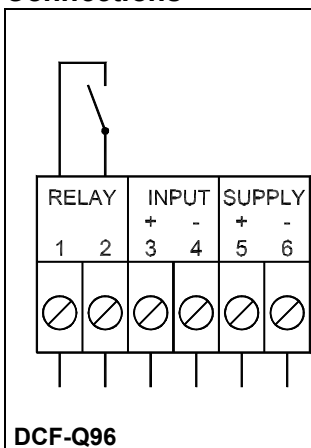


- ***Converts DC signals into a frequency proportional pulse signal***
- ***Recording of kWh and kvarh in conjunction with transducers types TAP/TAQ***
- ***High accuracy (crystal controlled)***
- ***Relay output for connection to external counter***

Technical specifications

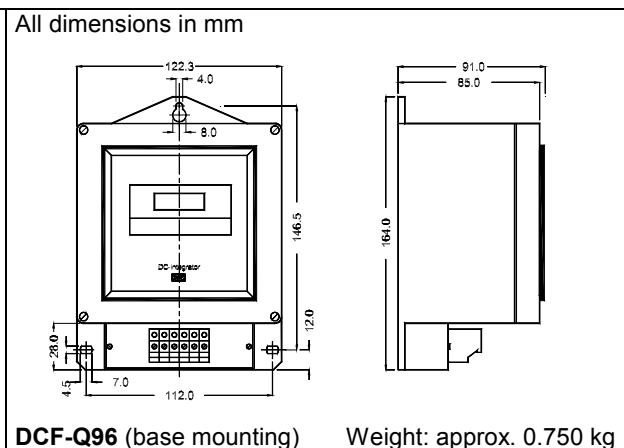
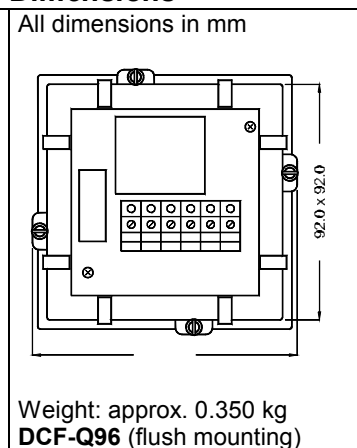
Measuring ranges, DC (standard)	Voltage: 1V...10V DC, R _i : 10k Ω. Current: 1...20mA, voltage drop: <1.3V. Live zero: 20% of measuring range.
Effective measuring range	2...120% of specified measuring range. Input signals <2% or >170% of the specified measuring range: the function of the transducer is automatically blocked.
Pulse frequency	Proportional to the fed input signal within 2...120% of the specified measuring range. The pulse frequency (~100% input signal) may be set within the range 1...999 p.p.h. (pulses per hour) at intervals of 1 p.p.h. by means of 3 built-in rotary switches.
Accuracy	Class 0.5% of set value (p.p.h.) (-10...15...30...55°C) to EN 60051 and IEC 51.
Temperature drift	Max. 0.15% of set value (p.p.h.) per 10°C.
Non-linearity	Max. 0.1% of set value (p.p.h.) for inputs: 2...120%.
Auxiliary voltage drift	Max. 0.05% of set value (p.p.h.) per 10% variation of auxiliary voltage.
Counter	Built-in electromechanical 6 digit counter without reset function.
Relay output	For connection to external counter: potential-free N/O contact (normally open). "ON"-time: approx. 200ms. Rating: Max. 250V-2A-400VA (AC), 250V-2A-50W (DC), at resistive load and 2 x 10 ⁶ changeovers. Mechanical life: 2 x 10 ⁷ changeovers.
Auxiliary voltage	100-110-127-220-230-240-380-400-415-440V AC ±20%, 40...70Hz 24V DC ±25% (DC inverter built in).
Burden	AC voltages: 3...5VA. DC voltages: 4W.
Galvanic separation	Between input, output, auxiliary voltage. 2kV - 50Hz - 1 min. (test voltage).
Temperature	-10...55°C (nominal), -25...60°C (operating), -40...70°C (storage).
Climate	Class HUE, to DIN 40040.
EMC:	EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4), IEC 255-22-1 (class 3). CE marked for residential, commercial and light industry plus industrial environment.
Protection	IP53. Terminals: IP20. To EN 60529 and IEC 529.
Materials	Self-extinguishing plastic materials, to UL94 (V0)
Connections	Screw terminals: Max. 2.5 mm ² (multi-stranded), max. 4 mm ² (single stranded).
Dimensions (flush mounting)	96 x 96 x 75 mm, to DIN 43700. Panel cut-out: 92 x 92 mm +0.8

Connections



DCF-Q96

Dimensions



Order specifications

Example:	Type	Mounting	DC input	Pulse frequency	"Unit" (e.g. kWh, m ³ /h)	Auxiliary voltage
	DCF-Q96	Base	0...10V DC	1...999 p.p.h.	kWh	230V AC


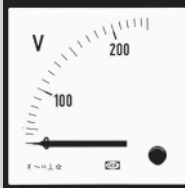



Due to our continuous development we reserve the right to supply equipment which may vary from the described.

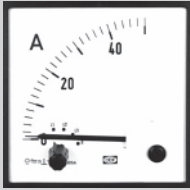






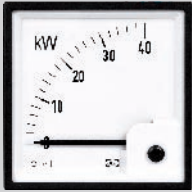


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	Moving Coil, DQ  (240°)	Moving Coil, VDQ  (90°)	Moving Iron, EQ 
Main function:	Measurement of DC currents and DC voltages.	Measurement of AC currents and AC voltages.	Measurement of AC currents and AC voltages, adjusted for other frequency range 16..65Hz. The instruments measure true RMS.
Size (mm):	Q48...Q144	Q72...Q144	Q48...Q144
Pointer deflection:	90°, 240°	90°, 240°	90°
Customised and exchangeable scale available for 90°:	✓	✓	✓
Protection IP52:	✓	✓	✓
Protection IP54 on request:	✓	✓	✓
Accuracy class:	1.5	1.5	1.5
Measuring range:	60mV...300V 1mA...5...10...15...40A, 4...20mA (except from Q48: 1mA..600mA, 4...20mA)	25...300V, 1...600mA	40...800V (Q48: 40...300V) 1...60A (Q48: 1...40A)
Approved by classification societies:	✓	✓	✓
	Edgewise Moving Coil, DPR 	Slim Edgewise Moving Coil, DSM 	
Main function:	Measurement of DC currents and DC voltages.	Measurement of DC currents and DC voltages.	
Size (mm):	48 × 24, 72 × 36, 96 × 48, 144 × 72 (vertical or horizontal)	72 × 24, 96 × 24, 144 × 36 (vertical or horizontal)	
Pointer deflection:	–	–	
Customised and exchangeable scale available for 90°:	✓	✓	
Protection IP52:	✓	✓	
Protection IP54 on request:	–	–	
Accuracy class:	1.5	1.5	
Measuring range:	1...600V 1...600mA, 4...20mA	60mV...600V (DSM72) 60mV...100V (DSM96) 60mV...300V (DSM144) 1...600mA, 4-20mA	




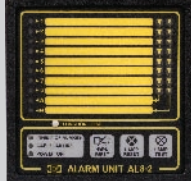
	Ammeters w/built-in switch, VDQ96-sw	Voltmeters w/built-in switch, EQ96-sw7	Voltmeters w/built-in switch, EQ96-sw4
			
Main function:	Measurement of AC currents. Selected with built-in switch, measurement of current in a 3-phase network is possible.	Measurement of AC voltages. Selection of measurement of phase to phase voltage or phase to zero voltage in a 3-phase network is possible by means of built-in switch.	Measurement of AC voltages. Measurement of phase to phase voltage in a 3-phase network is possible by means of built-in switch.
Size (mm):	Q96	Q96	Q96
Pointer deflection:	90°	90°	90°
Customised and exchangeable scale available for 90°:	✓	–	–
Protection IP52:	✓	✓	✓
Protection IP54 on request:	–	–	–
Accuracy class:	1.5	1.5	1.5
Measuring range:	0...1A, 0...5A or from current transformer(s) Scale: According to the used current transformer Frequency: 45...65Hz	Phase to phase voltages up to 600V or phase to zero voltages up to 350V Scale: 0...300V, 0...500V, 0...600V, 0...800V, 120V for VT - x/100V, 132V for VT - x/110V, Frequency: 40...60Hz	Phase to phase voltages up to 600V or phase to zero voltages up to 350V Scale: 0...300V, 0...500V, 0...600V, 120V for VT - x/100V, 132V for VT - x/110V, Frequency: 40...60Hz
	Bimetallic Instruments, BQ	Combined Ammeters, BEQ	
			
Main function:	Measurement of currents. Provided with a maximum-reading pointer.	Measurement of currents. Combined bimetallic system and moving iron system for maximum and momentary reading. Provided with a maximum-reading pointer.	
Size (mm):	Q48, Q72, Q96	Q72, Q96	
Pointer deflection:	90°	90°	
Customised and exchangeable scale available for 90°:	–	–	
Protection IP52:	✓	✓	
Protection IP54 on request:	–	–	
Accuracy class:	3	3 (1.5 for moving iron)	
Measuring range:	Measuring range: 0...6A or 0...1.2A Overload: 1.2 × nominal current (-/5A or -/1A) continuously Scale: Always 120% of the current transformer Setting time: BQ48: 4 or 8 min, BQ72-x/BQ96-x: 8 or 15 min	Measuring range: 0...6A or 0...1.2A Overload: 1.2 × nominal current (-/5A or -/1A) continuously Scale: Always 120% of the current transformer Setting time: Bimetallic system: 8 or 15 min	

	Watt or var Meters, WQ 	Power Factor Meters, PFQ 	PT100Ohm Temperature Meters, PTQ 
Main function:	Measurement of power or reactive power.	Measurement of CosPhi.	Measurement of temperature.
Size (mm):	Q96, Q144	Q96, Q144	Q96, Q144
Pointer deflection:	90°, 240°	90°, 240°	90°, 240°
Customised and exchangeable scale available for 90°:	✓	✓	✓
Protection IP52:	✓	✓	✓
Protection IP54 on request:	✓	✓	✓
Accuracy class:	1.5	1.5	1.5
Measuring range:	Frequency: 45...65Hz Measuring current: Direct or from CT -/1A or -/5A Measuring voltage: 100...110...127...220...230...240...380...400...415...440...450...480V AC	0.5 cap. ...1...0.5 ind., 0.7 cap. ...1...0.3 ind., 0...1 cap., 0...1 ind. Voltage: 57.7...63.5...100...110...127...220...230...240...380...400...415...440V AC ±20% Current (Inom): -/1A and -/5A from external current transformer	PT100 ohm sensor, 2 or 3 wire: Different ranges available within the range of 0...800°C Min. temperature difference: 25°C Min./max. temperature: -200°C/+800°C Aux. supply: 24...48...110...220V AC (AC: 1VA, DC: 15mA)

	Pointer Frequency Meters, FQ 	Reed Frequency Meters, FTQ 	Shunt Resistors 
Main function:	Measurement of frequency.	Measurement of frequency with 13 or 21 reeds.	Dimensions: To DIN 43703 Ranges: 1...2500A, 60/150mV Form A and B: 60/150mV Form C: 50mV
Size (mm):	Q72, Q96	Q72, Q96	—
Pointer deflection:	90°	—	—
Customised and exchangeable scale available for 90°:	✓	✓	—
Protection IP52:	✓	✓	—
Protection IP54 on request:	✓	✓	—
Accuracy class:	0.5	0.5	0.5
Measuring range:	Measuring voltage: 85...265V AC or 340...506V AC Scale/meas. range: 45...55Hz, 55...65Hz, 45...65Hz (Others on request)	Measuring voltage: 100...110...220...230...240...380...400...415...440V AC ±15% Scale/meas. range: 47...53Hz, 45...55Hz, 57...63Hz, 55...65Hz	—

	Multi-instrument, MIB	Multi-instrument, MIC	Multi-instrument, MIC-2
			
Size (mm):	Q96	Q96	Q96
Main function:	Measurement of voltage, current, active-, reactive- and apparent power, frequency, energy kWh/kvarh (import, export, net, total), min./max. values, PF, THD.	Measurement of voltage, current, active-, reactive- and apparent power, frequency, energy kWh/kvarh (import, export, net, total), PF, THD.	Measurement of voltage, current, active-, reactive- and apparent power, frequency, energy kWh/kvarh (import, export, net, total), PF, THD, demand, min./max. values with time stamp
Connection:	Suitable for all 3-phase network topologies	Suitable for all 3-phase network topologies	Suitable for all 2- and 3-phase network topologies
Accuracy class:	0.5% on measured values 1.0% on calculated values	0.2% measured values 0.5% calculated values	0.2% on measured values 0.5% on calculated values
Output:	Optional: 2 digital pulse/limit outputs Optional: RS485 serial output with Modbus RTU protocol	RS485 serial output with Modbus RTU protocol. Optional: 2 digital pulse/limit outputs + 2 relays	Optional modules: Communication: TCP/IP Ethernet, Profibus. I/O: digital input, digital output, relay, analogue input
Measuring current:	-1A or -5A	-1A or -5A	-1A or -5A
Measuring voltage:	400V AC Ph-N/690V AC Ph-Ph 50/60Hz	230V AC N-Ph (400V AC Ph-Ph) 50/60Hz	400V AC Ph-N/690V AC Ph-Ph 50/60Hz
Auxiliary supply:	100...415V AC 50/60Hz 100...300V DC	85...264V AC 50/60Hz / 24...48, 100...280V DC	100...415V AC 50/60Hz 100...300V DC
	Multi-instrument, MIQ96-2		
			
Size (mm):	Q96		
Main function:	Measurement of voltage, current, active-, reactive- and apparent power, frequency and energy import (kWh, kvarh), export (kWh, kvarh), PF, THD, MD (max. demands).		
Connection:	Single phase 3-phase 3 wire balanced load 3-phase 4-wire balanced load 3-phase 3-wire unbalanced load 3-phase 4-wire unbalanced load		
Accuracy class:	0.5 of most values 1.0 of a few values		
Output:	RS485 serial + 2 relays Pulse output/limit switches		
Measuring current:	-1A or -5A		
Measuring voltage:	230V AC N-Ph (400V AC Ph-Ph) 50/60Hz		
Auxiliary supply:	Universal AC/DC power supply 40...276V AC, 40...65Hz <5VA or 19...300V DC <5W		

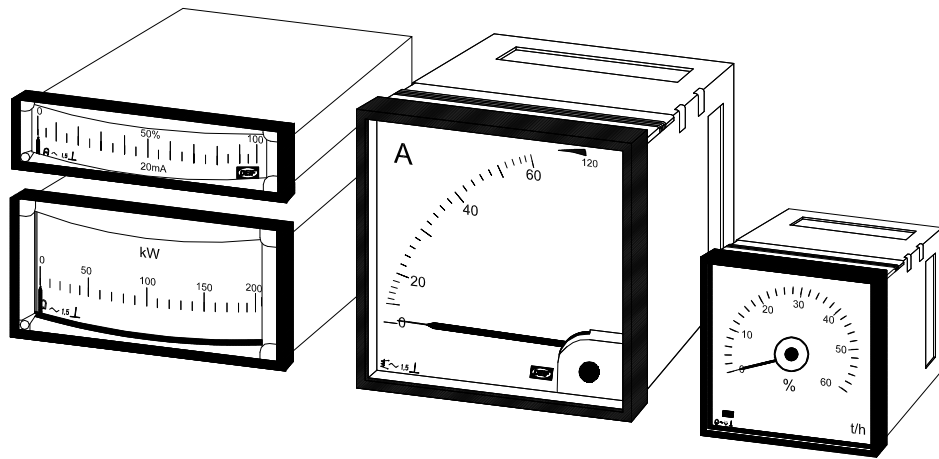
	Insulation Monitor, ADL-111Q96 	Selectable Insulation Monitor, SIM-Q/SIM-Q LF 	Insulation Monitors, AAL-111Q96 
Main function:	Supervision of the insulation resistance between an insulated low-voltage distribution network and earth cable/safety cable.	Supervision of the insulation resistance between an insulated low-voltage distribution network and earth cable/safety cable.	Supervision of the insulation resistance between an insulated low-voltage distribution network and earth cable/safety cable.
Size (mm):	Q96	Q96	Q96
Selectable modes:	–	Monitoring, fault finding, test	–
Customised and exchangeable scale available:	–	✓	✓
Protection:	IP52	IP52	IP52
Accuracy class:	–	1...0Mohm scale ±5% of scale length 10...0Mohm scale ±2% of scale length	±2% of scale length
Relay output:	Built-in relay can either be selected as NE or ND. Alarm set point adjustable from the rear	Built-in relay can either be selected as NE or ND. Alarm set point adjustable from the rear	Built-in relay. Alarm set point adjustable from the rear
Input:	Meas. voltage: ±12V DC ±5% (24V), ±28V DC ±5% (110, 220V) Mains voltage: 24V DC, 110V DC, 220V DC +30% -25%	Meas. voltage: ±28V DC ±5% Mains voltage: Max. 690V AC +20% continuously SIM-Q: 20Hz...500Hz SIM-Q LF: 5Hz...500Hz	Meas. voltage: 12V DC ±10% Mains voltage: Max. 440V AC +20% continuously
Mains voltage/leakage cap.:	Selectable for either max. 1µF or max. 20µF	Selectable for either max. 50µF or max. 500µF	–
Auxillary supply:	24V DC, 110V DC, 220V DC +30% -25%	100...110...127 or 220...230...240 or 400...450...480V AC ±20% 40...70Hz (< 4VA) 24V DC ±25% (appr. 4W)	110...220...380...415...440V AC ±20%, 45...65Hz (appr. 4VA), 24V DC ±25% (appr. 4W)
Approved by classification societies:	✓	✓	✓
	Remote Position Indicators, PIR25-1, PIR25-2 	Running Hours Counters, HC48 	Running Hours Counters, HC36/24 
Main function:	Indication of circuit breaker position or tie breaker position.	For AC or DC measuring voltage.	Synchronous motor (AC). Step motor (DC). For panel mounting.
Size (mm):	Q25	Q48 Adapter frames 55 × 55 or 72 × 72	36 × 24
Black focusing screen ("round"):	✓	–	–
White focusing screen ("square"):	✓	–	–
Frequency 50Hz or 60Hz:	–	✓	✓
Protection IP40:	–	(Special IP65 available)	✓
Accuracy class:	–	AC: 1/100 hour (36 s) DC: 1/10 hour (6 min)	–
Measuring range:	Nominal voltages: 4...48...110...230V AC/DC	Counting range: AC: 99999.99 hours / DC: 999999.9 hours Voltage: 24-110-230V AC ±10% and 10-48V DC, 110V DC ±10%	Counting range: AC: 99999.99 hours / DC: 999999.9 hours - automatically resets to zero Voltage: 24...110...230V AC ±10% and 12...36V DC, 110V DC ±10% Resolution: For AC - 1/100 hours (36 s), for DC - 1/10 hours (6 min)

	DIN Rail Instruments, D45 	DIN Rail Instruments, E45 	DIN Rail Instruments, B45 
Main function:	Moving coil DC instrument for DIN rail mounting (35 × 15 mm).	Moving iron AC instrument for DIN rail mounting (35 × 15 mm).	Bimetallic instrument with maximum reading pointer. For DIN rail mounting (35 × 15 mm).
Size (mm):	Q45	Q45	Q45
Pointer deflection:	90°	90°	90°
Customised and exchangeable scale available for 90°:	✓	✓	✓
Protection IP52:	✓	✓	✓
Protection IP54 on request:	–	–	–
Accuracy class:	1.5	1.5	3.0
Measuring range:	1V...300V (incl. 0...60mV/5mA) 1mA...600mA and (4...20mA)	6V...400V, 100mA...25A Standard ranges: 1...5...10...15...25A, incl. -1A and -5A for external CT	Nominal current -/5A. Overload: 1.2 × nominal current continuously. Scale: Always 120% of the current transformer. Setting time: 8 min
	Alarm Panels, AL8-2 		
Main function:	Suitable to switchboards in industrial and marine plants for alarm and control purposes.		
Size (mm):	Q96		
Selectable modes:	–		
Customised and exchangeable scale available:	–		
Protection:	IP54		
Accuracy class:	–		
Relay output:	Two user configurable output relays One output for horn (alarm)		
Input:	8 alarm inputs		
Mains voltage/ leakage cap.:	–		
Auxillary supply:	12...24...48...110V DC ±25% (min. 10V DC)		
Approved by classification societies:	✓		

Switchboard instruments

Types DQ, VDQ, DPR, DSM, EQ

49212100120



- **Standard DIN sizes**

Quadratic instruments: Q48...Q144

Edgewise instruments: 48 x 24... 144 x 72 mm

Slim edgewise instruments: 72 x 24... 144 x 36 mm

- **Accuracy class 1.5**

- **Exchangeable scale (quadratic instruments)**

Contents

Special versions	page 2
General technical specifications	page 3
Quadratic moving coil instruments with/without rectifier	page 4
Quadratic moving iron instruments.....	page 5
Edgewise moving coil instruments	page 6
Slim edgewise moving coil instruments.....	page 7
Dimensional details.....	page 8

Available types

Quadratic instruments				
	48 x 48 mm	72 x 72 mm	96 x 96 mm	144 x 144 mm
Moving coil 90°	DQ48-x	DQ72-x	DQ96-x	DQ144-x
Moving coil 240°	DQ48-c DQ48-xc	DQ72-c DQ72-xc	DQ96-c DQ96-xc	DQ144-c DQ144-xc
- with rectifier 90°		VDQ72-x	VDQ96-x	VDQ144-x
- with rectifier 240°		VDQ72-c VDQ72-xc	VDQ96-c VDQ96-xc	VDQ144-c VDQ144-xc
Moving iron 90°	EQ48-x	EQ72-x	EQ96-x	EQ144-x
Edgewise instruments				
	48 x 24 mm	72 x 36 mm	96 x 48 mm	144 x 72 mm
Moving coil	DPR48	DPR72	DPR96	DPR144
Slim edgewise instruments				
		72 x 24 mm	96 x 24 mm	144 x 36 mm
Moving coil		DSM72	DSM96	DSM144

Special versions

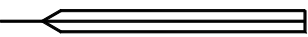
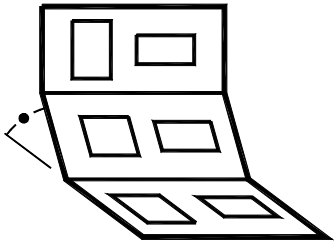
General	Antiglare glass
	IP54 from front (incl. rubber gasket) (types DQ and EQ)
	Adjustable red pointer (types Q48-x, Q72-x, Q96-x, Q144-x) (IP52)
	Other measuring ranges than those stated in this data sheet
Scale	Non-standard scale e.g. ammeter with 3, 4, 5 or 6 times overload range
	Scale according to table or curve
	Single scale with double row of figures (standard scale)
	Double scale with 2 rows of figures (standard divisions)
	Single scale with fine divisions for standard pointer
	Red line at specified value
	Coloured section for specific scale range
	Additional text on scale, Roman types (e.g. "Generator")
Moving iron instruments	Adjusted to a specified frequency, 100...500Hz
	Adjusted for DC measurement
	Adjusted to accuracy class 1.0 (not possible for type Q48)
Moving coil instruments	Suppressed zero (DQ.-x/DQ.-c/-xc: Max. 20%)
	Zero at centre of scale or the like
	Integrated adjustment potentiometer ($\pm 10\%$ standard, up to $\pm 50\%$ on request)
	Adjusted to accuracy class 1.0 (not possible for type Q48)

Accessories: Blank covers types Q72, Q96, Q144

Blank covers are typically applied to cover panel cut-outs provided for later extension of the switchboard.

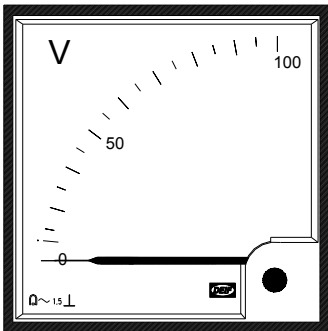
The blank covers consist of a standard bezel with spring clamp for mounting in the panel, mounted with a white, opal PVC plate instead of glass. (Depth behind panel: Approx. 12 mm).

General technical specifications

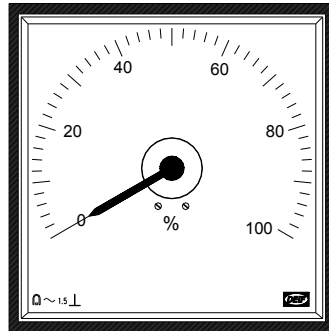
Instruments are designed according to below mentioned standards					Standards
Accuracy	Class 1.5 (-10...15...30...55°C) Linear scales: ±1.5% of full scale value (FS) Non-linear scales: ±1.5% of scale length				EN 60051 and IEC 51
Instrument sizes	48 x 24 mm	72 x 24 mm 72 x 36 mm	96 x 24 mm 96 x 48 mm 96 x 96 mm	144 x 36 mm 144 x 72 mm 144 x 144 mm	DIN 43700
Bezels	Slim bezels				DIN 43718
Scale/pointer	 Standard pointer				DIN 43802
Mounting angle	Standard: Vertical (90 ±5°) Other angles: Specify angle to horizontal  ⊥ vertical mounting ∠60° 60° to horizontal (e.g.) □ horizontal mounting For edgewise instruments only, furthermore specify: Horizontal or vertical scale				DIN 16257
Measuring ranges	See pages 4-7. Others on request.				DIN 43701
Protection	Standard version		IP54 version*		*) Marked with label: "IP54 from front only when rubber gasket is mounted" IEC 529 and EN 60529
(Housings)	From front	From rear	From front	From rear	
	IP52	IP52	IP54	IP52	
(Terminals)	Quadratic	Edgewise	Quadratic	Edgewise	
Climate	Class HUE Short-term condensing allowed Max. 95% RH: Max. 30 days per year Max. 85% RH: Remaining days Max. 75% RH: Average per year				DIN 40040
Temperature	-10...55°C (nominal) -25...60°C (operating) -25...65°C (storage)				EN 60051 and IEC 51
Panel influence	The accuracy is affected neither by the material nor by the thickness of the panel				EN 60051 and IEC 51
Shock test	15g - 6 times - 3 directions 50g/6ms 22g/20ms				IEC 68-2-27, Test: Ea
Vibrations	3-13.2Hz: 3mm 13.2-100Hz: 1g				GL + LR: Test 1 DNV: Class A
Materials	All plastic materials are self-extinguishing				UL94 (V0)
Safety	For detailed information: Please see the individual types Pollution deg. 2 Quadratic instruments are supplied with protective cover fitted over terminals				EN 61010-1
EMC	CE classified for residential, commercial and light industry plus industrial environment				EN 61000-6-3/4 EN 61000-6-1/2

Quadratic moving coil instruments

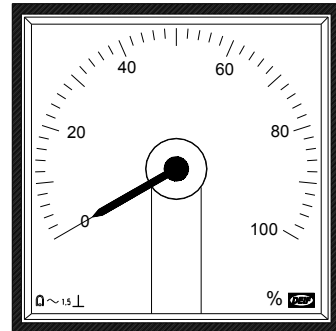
Application:	Measurement of DC currents and DC voltages		
Scale:	Linear		
Scale lengths:	DQ48/72/96/144-x:	41/62/92/135 mm	
	DQ48/72/96/144-xc/-c:	75/113/151/230 mm	
Accuracy:	Class 1.5		
Burdens:	Voltmeters:	1mA,	R _i : 1 kΩ/V
	Ammeters:	60mV...0.5V	
	Ammeters:	4...20mA (see note 3 below)	
Housings:	Plastic		



DQ96-x (exchangeable scale)



DQ96-c (non-exch. scale)



DQ96-xc (exchangeable scale)

Type	Size (mm)	Measuring range - V ¹⁾	Measuring range - A ¹⁾
DQ48-x	48 x 48	60mV ... 300V	1mA ... 600mA ²⁾ , 4...20mA ³⁾
DQ72-x	72 x 72	60mV ... 300V	1mA ... 5-10-15-40A ²⁾ , 4...20mA ³⁾
DQ96-x	96 x 96	60mV ... 300V	1mA ... 5-10-15-40A ²⁾ , 4...20mA ³⁾
DQ144-x	144 x 144	60mV ... 300V	1mA ... 5-10-15-40A ²⁾ , 4...20mA ³⁾
DQ48-xc/DQ48-c	48 x 48	60mV ... 300V	1mA ... 600mA ²⁾ , 4...20mA ³⁾
DQ72-xc/DQ72-c	72 x 72	60mV ... 300V	1mA ... 5-10-15-40A ²⁾ , 4...20mA ³⁾
DQ96-xc/DQ96-c	96 x 96	60mV ... 300V	1mA ... 5-10-15-40A ²⁾ , 4...20mA ³⁾
DQ144-xc/DQ144-c	144 x 144	60mV ... 300V	1mA ... 5-10-15-40A ²⁾ , 4...20mA ³⁾

- Standard measuring ranges: 1 - 1.2 - 1.5 - 2 - 2.5 - 3 - 4 - 5 - 6 - 8 and multiples of 10 thereof
- Safety: Cat. III 300V max. (515V ph-ph (300 x √3))
- Higher measuring ranges: For use with standard shunt: 60mV or 150mV
Supplied with shunt lead, 2 x 1 m – 1 mm² (0.035Ω)
- 4...20mA: Electrically suppressed, voltage drop at 20mA = 1.6V for -x and 1.80V for -c/-xc

Quadratic moving coil instruments with rectifier

Application:	Measurement of AC currents and AC voltages. Measures average value, calibrated to R.M.S. value at sinusoidal current/voltage
VDQ.. Voltmeters 25...300V:	R _i : Approx. 1kΩ/V. Range <50V AC: Scale non-linear Max. 515V derived from voltages with max. 300V to earth (300V – cat. III / 600V cat. II)
VDQ.. Ammeters 1...600mA:	Voltage drop: Approx. 1.2V

Order specifications

Examples:	Type/point of rotation of pointer ¹⁾	Measuring range	Scale
	DQ96-x	0...10V DC	0...100%
	VDQ96-x	0...100V AC	0...100V

1) "-x": Lower right corner, exchangeable scale, "-c": Centre, "-xc": Centre, exchangeable scale.

Quadratic moving iron instruments

Application: Measurement of AC currents and AC voltages, adjusted for frequency range 16..65Hz. Calibration for other frequency ranges (see page 2). The instruments measure true R.M.S.

Working range: Ammeters are designed according to EN60051-2 (Item 6.4.1 and 6.4.2)
 Continuous overload: $I_N \times 1.2$.
 Short duration overload: $I_N \times 5$ for 5 sec. $I_N \times 10$ for 0.5 sec.
 Valid for -/1A, -/5A and direct connections.

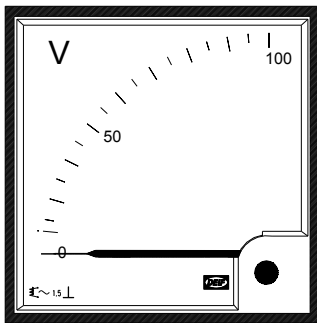
Scale range: The scale is standard designed with a 2 times overload range (non-standard scale – see page 2)

Scale lengths: EQ48/72/96/144-x: 41/62/92/135 mm

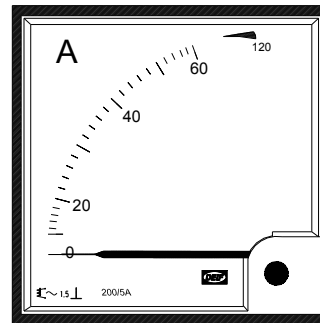
Accuracy: Class 1.5

Burdens: Voltmeters: Approx. 1.5...4VA
 Ammeters: Approx. 0.5...1.2VA

Housings: Plastic



EQ96-x (voltmeter)

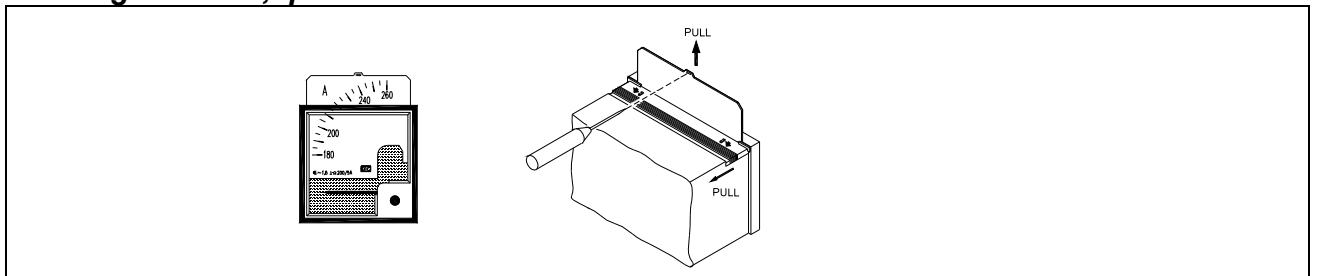


EQ96-x (ammeter)

Type	Size (mm)	Measuring range - V ¹⁾	Measuring range - A ¹⁾
EQ48-x	48 x 48	40V ... 300V ⁴⁾	1A ... 40A ^{2) + 3)}
EQ72-x	72 x 72	40V ... 800V ³⁾	1A ... 60A ²⁾
EQ96-x	96 x 96	40V ... 800V ³⁾	1A ... 60A ²⁾
EQ144-x	144 x 144	40V ... 800V ³⁾	1A ... 60A ²⁾

- 1) Standard measuring ranges: 1 - 1.2 - 1.5 - 2 - 2.5 - 3 - 4 - 5 - 6 - 8 and multiples of 10 thereof
- 2) Safety: Cat. III 600V max. ph-ph voltage according to scheme
- 3) Higher measuring ranges: For use with external current transformer, -/5A, -/1A
- 4) Higher measuring ranges: For use with external voltage transformer, -/100V (-/110V)
- 5) Max. 515V derived from voltages with max. 300V to earth (300V – cat. III / 600V cat. II)

Exchange of scale, quadratic instruments



- 1) Press cover at top of instrument as shown
- 2) Remove scale by means of a suitable tool (e.g. screwdriver)
- 3) After exchange of scale: Refit cover (press till it snaps into place)

Note: Interrupt signal to terminals before exchanging the scale.

Order specifications

	Type	Measuring range	Scale
Example:	EQ96-x	0...500A AC, 500/1A	0...500A x 2

Edgewise moving coil instruments

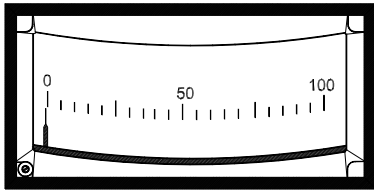
Application: Measurement of DC currents and DC voltages

Scale: Linear

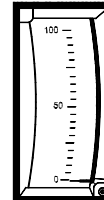
Accuracy: Class 1.5

Burdens: Voltmeters: 1mA, R_i: 1kΩ/V
Ammeters: 60mV...0.5V

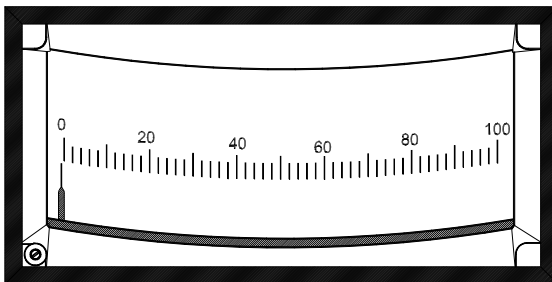
Housings: Plastic



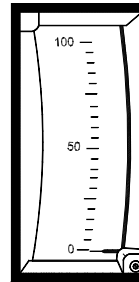
DPR96



DPR48



DPR144



DPR72

Type	Size (mm)	Measuring range - V ¹⁾	Measuring range - A ¹⁾
DPR48	48 x 24	1V ... 600V	1mA ... 600mA ²⁾ , 4...20mA
DPR72	72 x 36	1V ... 600V	1mA ... 600mA ²⁾ , 4...20mA
DPR96	96 x 48	1V ... 600V	1mA ... 600mA ²⁾ , 4...20mA
DPR144	144 x 72	1V ... 600V	1mA ... 600mA ²⁾ , 4...20mA

- 1) Standard measuring ranges: 1 - 1.2 - 1.5 - 2 - 2.5 - 3 - 4 - 5 - 6 - 8 and multiples of 10 thereof
- 2) Safety: Cat. III 600V max. ph-ph voltage according to scheme
- 3) Higher measuring ranges: For use with standard shunt: 60mV or 150mV
Supplied with shunt lead, 2 x 1 m – 1 mm² (0.035Ω)

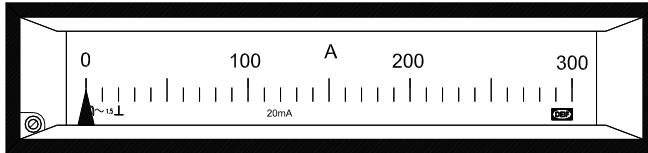
Order specifications

Example:	Type	Scale type/Mounting ¹⁾	Measuring range	Scale
	DPR96	Horizontal	4...20mA DC	0...10 bar

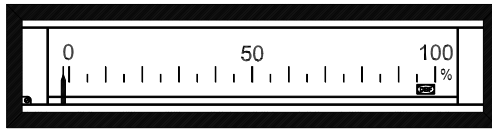
1) Horizontal or vertical scale.

Slim edgewise moving coil instruments

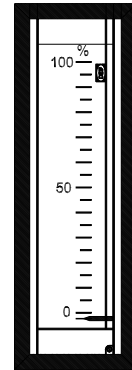
Application:	Measurement of DC currents and DC voltages		
Scale:	Linear		
Scale lengths:	DSM72/96/144: 52/70/95 mm		
Accuracy:	Class 1.5		
Burdens:	Voltmeters:	1mA, R _i : 1kΩ/V	
	Ammeters:	60mV...0.5V	
Housings:	Plastic		



DSM144



DSM96



DSM72

Type	Size (mm)	Measuring range - V ¹⁾	Measuring range - A ¹⁾
DSM72	72 x 24	60mV ... 600V	1mA ... 600mA ²⁾ , 4...20mA
DSM96	96 x 24	60mV ... 100V	1mA ... 600mA ²⁾ , 4...20mA
DSM144	144 x 36	60mV ... 300V	1mA ... 600mA ²⁾ , 4...20mA

- 1) Standard measuring ranges: 1 - 1.2 - 1.5 - 2 - 2.5 - 3 - 4 - 5 - 6 - 8 and multiples of 10 thereof
- 2) Safety
 DSM 72: Cat. III 600V max. ph-ph voltage according to scheme
 DSM 96: Cat. III 100V max. ph-ph voltage according to scheme
 DSM 144: Cat. III 300V max. ph-ph voltage according to scheme
- 3) Higher measuring ranges: For use with separate standard shunt: 60mV or 150mV
 Supplied with shunt lead, 2 x 1 m – 1 mm² (0.035Ω)

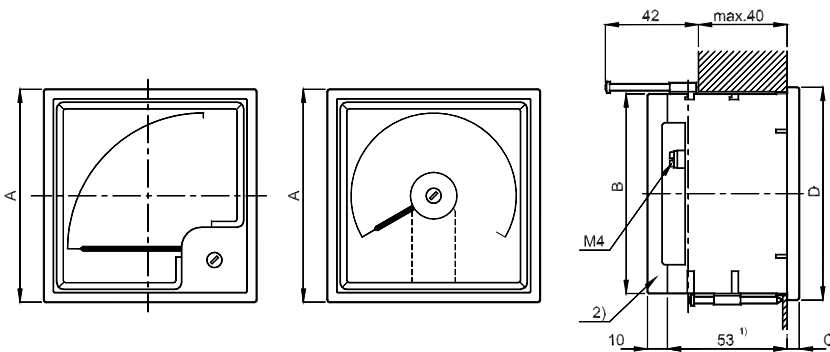
Order specifications

Example:	Type	Scale type/Mounting ¹⁾	Measuring range	Scale
	DSM144	Horizontal	0...20mA DC	0...300A

- 1) Horizontal or vertical scale.

Dimensional details

Quadratic instruments (90° and 240°)



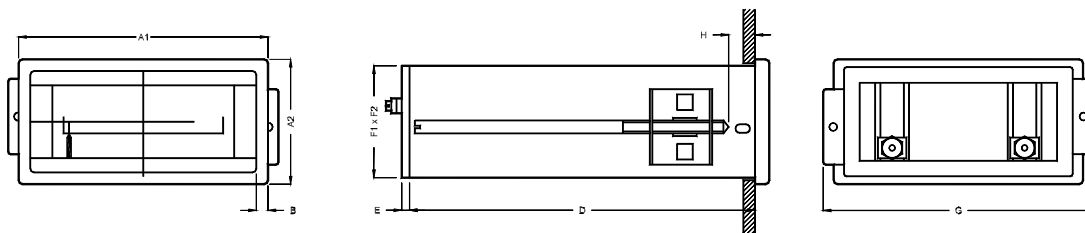
1) For range 15...40A = 59 mm

2) Protective power

All dimensions in mm

Type	A	C	B	Panel cut-out	Weight (approx.)
90° Moving coil and moving iron instruments					
Q48-x	48 x 48	5.0	42.8 x 48.8	45 x 45 +0.3	0.090 kg
Q72-x	72 x 72	5.5	66.5 x 66.5	68 x 68 +0.4	0.200 kg
Q96-x	96 x 96	5.5	90 x 90	92 x 92 +0.4	0.210 kg
Q144-x	144 x 144	8.0	136 x 136	138 x 138 +0.5	0.350 kg
240° Moving coil instruments					
DQ48-xc/c	48 x 48	5.0	42.8 x 48.8	45 x 45 +0.3	0.180 kg
DQ72-xc/c	72 x 72	5.5	66.5 x 66.5	68 x 68 +0.4	0.220 kg
DQ96-xc/c	96 x 96	5.5	90 x 90	92 x 92 +0.4	0.250 kg
DQ144-xc/c	144 x 144	8.0	136 x 136	138 x 138 +0.5	0.400 kg

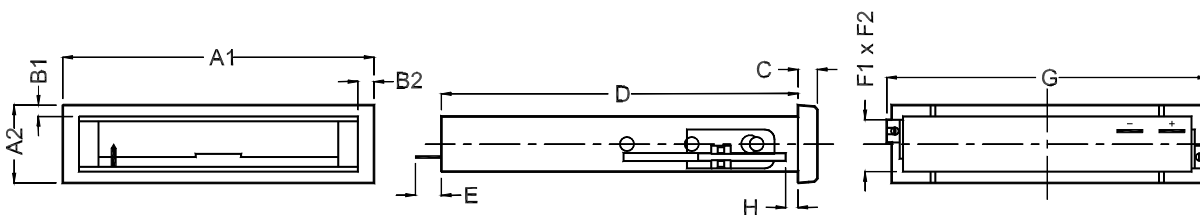
Edgewise moving coil instruments



All dimensions in mm

Type	A	B	C	D + E (max.)	E	F1 x F2	G	H	Panel cut-out	Weight (approx.)
DPR48	48 x 24	3	5	75	8	45 x 18	53	34	43.2 +0.3 x 22.2 +0.3	0.050 kg
DPR72	72 x 36	4	5	99	9	66 x 32.5	79	34	68 +0.7 x 33.0 +0.6	0.100 kg
DPR96	96 x 48	4.5	5.5	143	7	91 x 43	104	17	92 +0.8 x 45.0 +0.6	0.450 kg
DPR144	144 x 72	5.5	8	192	3	136 x 66	150	17	138 +1.0 x 68.0 +0.7	0.950 kg

Slim edgewise instruments



All dimensions in mm

Type	A	B	C	D	E	F1 x F2	G	H (max)	Panel cut-out	Weight (approx.)
DSM72	72 x 24	3.5 x 5	6	90	8	17 x 65	75	40	68 + .7 x 22.2 +0.3	0.080 kg
DSM96	96 x 24	3.5 x 5	6	110	8	17 x 89	99	40	92 +0.8 x 22.2 +0.3	0.100 kg
DSM144	144 x 36	4 x 6.5	7	164	9	32 x 137	147	40	138 +1.0 x 33.0 +0.6	0.240 kg

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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Voltmeters and ammeters with built-in switch

Types EQ96-sw4, EQ96-sw7, VDQ96-sw

49212100771



EQ96-sw4



EQ96-sw7



VDQ96-sw

- *By activation of switch on the front measurement of:*
 - *phase to phase voltage (EQ96-sw4)*
 - *phase to phase voltage or phase to zero voltage (EQ96-sw7)*
 - *current in a 3-phase network (VDQ96-sw)*
- *DIN size Q96*
- *Accuracy class 1.5*
- *Exchangeable scale*
- *OFF position on switch*

Application

The voltmeters type EQ96-sw4/sw7 and ammeters type VDQ96-sw are designed for use in e.g. power stations, distribution substations and transformer stations. In addition to normal measurement of AC voltages and currents respectively, both types are on the front provided with a switch, which can be set to measurement of:

EQ96-sw4 3-phase: L1 - L2, L2 - L3, L3 - L1, OFF

EQ96-sw7 3-phase/4-wire: L1 - L2, L2 - L3, L3 - L1, L1 - 0 (N), L2 - 0 (N), L3 - 0 (N), OFF
3-phase/3-wire: L1 - L2, L2 - L3, L3 - L1, OFF

Note: Error > 1.5% if phase voltages differ more than 10%

VDQ96-sw Phase currents (L1 - L2 - L3) in 3-phase networks

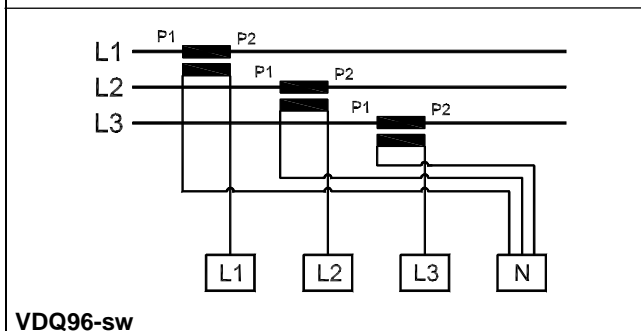
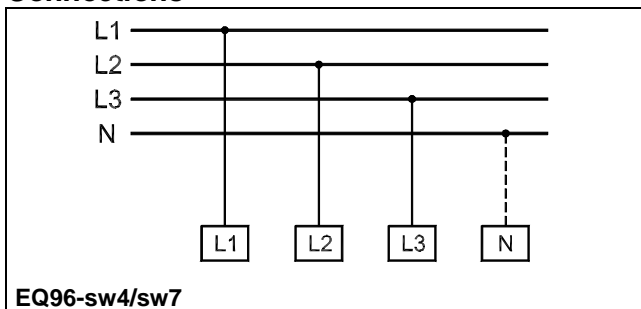
Note: When the switch is in position "0", the internal circuits are short-circuited

Technical specifications

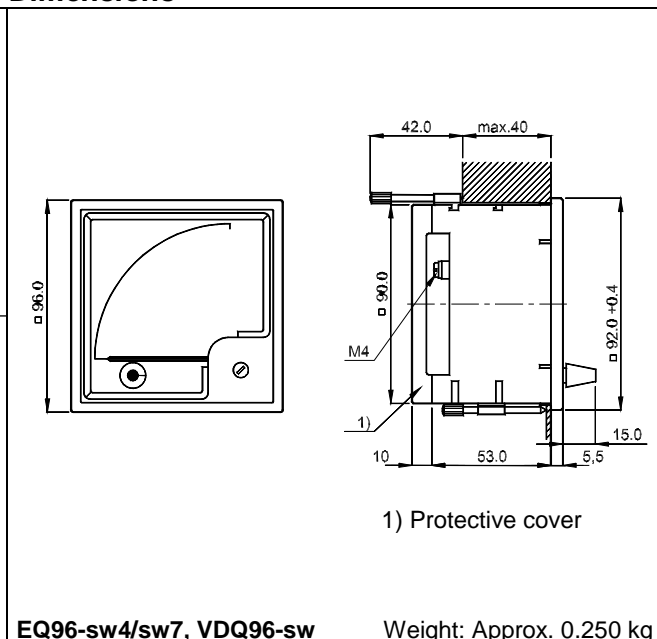
	Voltmeter type EQ96-sw4/sw7	Ammeter type VDQ96-sw
Accuracy	Class 1.5 (-10...15...30...55°C) EN/IEC 60051	
Scale	Exchangeable for -/120 and -/132V Measuring range according to the used voltage transformer	Exchangeable Measuring range according to the used current transformer
Measuring range	300V, 500V, 600V, 800V* -/120V (100V + 20%), -/132V (110V + 20%)	0...1A, 0...5A or from current transformer(s) Max. 515V derived from voltages with max. 300V to earth (300V – Cat. III / 600V Cat. II)
Burden	1kΩ/V	-/1A: Approx. 0.1VA. -/5A: Approx. 0.15VA
Frequency	40...60Hz	45...65Hz
Temperature	-10...55°C (nominal), -25...60°C (operating), -25...65°C (storage)	
Test voltage	2kV - (50Hz - 1 min.)	
EMC	EN 6100-6-1/2/3/4 CE-marked for residential, commercial and light industry plus industrial environment	
Materials	Self-extinguishing plastic, to UL94 (V0)	
Protection	IP52, EN/IEC 60525	
Mounting	Vertical flush mounting	

*800V: only EQ96-sw7. Up to 600V: Cat III. Above 600V: only Cat II.

Connections



Dimensions



Order specifications

Examples:	Type	Measuring range	Scale
	EQ96-sw4	0...500V AC	0...500V
	EQ96-sw7	0...500V AC	0...500V
	VDQ96-sw	500/1A	0...500A

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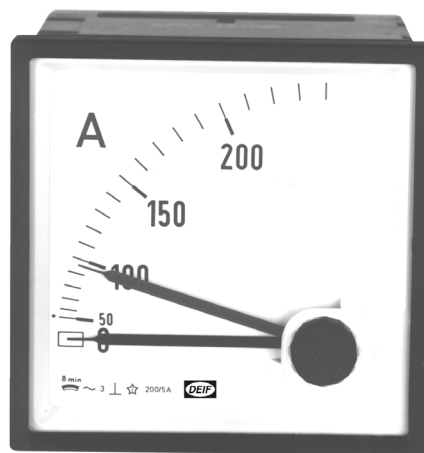
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Bimetallic instruments

Type BQ

4921210015D



- *DIN standard sizes: Q48, Q72, Q96*
- *Exchangeable scale*
- *All DIN sizes – including Q48 – for direct connection to 1A or 5A CT*

Construction

Bimetallic instruments (maximum demand ammeters) are specifically suitable for thermic control of cables, transformers, etc. Due to the inertia of the system, the instrument is not affected by brief current pulses.

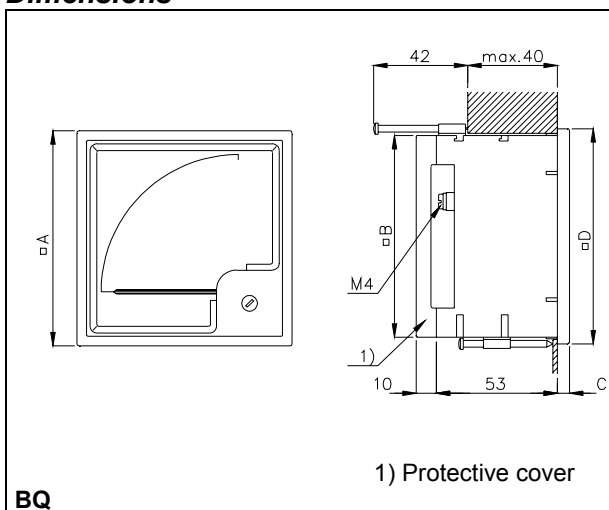
The system consists of 2 mechanically connected bimetallic spiral springs. One of the spiral springs is heated by the measuring current and consequently expands according to the temperature, which gives a quadratic scale graduation. The other spiral spring expands in the opposite direction, compensating for changes in the ambient temperature.

The instrument is provided with a red maximum-reading pointer. This pointer can be reset to the position of the black pointer by means of a knob on the front of the instrument.

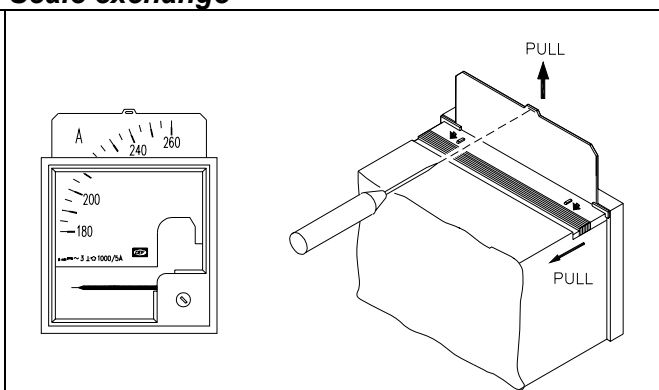
Technical specifications

Accuracy:	BQ system: class 3.0 (-10...15...30...55°C) to EN 60051 and IEC 51.
Standard scale:	Always 120% of the current transformer. Exchangeable scale. End values: 6-12-18-24-30-36-48-60-72-90-96 and multiples of 10 thereof.
Setting time:	BQ48-x: 4 or 8 min. BQ72-x / BQ96-x: 8 or 15 min.
Measuring range:	0...6A or 0...1.2A.
Overload:	1.2 x nominal current (-/5A or -/1A) continuously. 10 x nominal current for 1 s.
Burden:	-/1A: approx. 1.2VA. -/5A: approx. 2.2VA.
Temperature:	-10...55°C (nominal), -25...60°C (operating), -25...65°C (storage).
EMC:	To EN 50081-1/2 and EN 50082-1/2. CE marked for residential, commercial and light industry plus industrial environment.
Materials:	Self-extinguishing plastic to UL94 (V0).
Protection:	IP52, to EN 60529 and IEC 529.

Dimensions



Scale exchange



- 1) Press cover at top of instrument as shown.
- 2) Remove scale by means of suitable tool (e.g. screwdriver).
- 3) After exchange of scale:
Refit cover (press till it snaps into place).

Note: Interrupt signal to terminals before exchanging the scale.

Type	A	B	C	D	Weight
BQ48-x	48 x 48	42.8 x 42.8	5.0	45 x 45 +0.6	Approx. 0.100 kg
BQ72-x	72 x 72	66.5 x 66.5	5.5	68 x 68 +0.7	Approx. 0.150 kg
BQ96-x	96 x 96	90 x 90	5.5	92 x 92 +0.8	Approx. 0.200 kg

Order specifications

	Type	Setting time	Scale	Current transformer
Example:	BQ48-x	8 min.	0...600A	500/1A

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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Combined ammeters

Type BEQ

4921210018D



- *Maximum and instantaneous readings*
- *DIN standard sizes: Q72 and Q96*
- *Exchangeable scale*
- *8 min or 15 min*
- *For -/1A or -/5A current transformer*

Application and construction

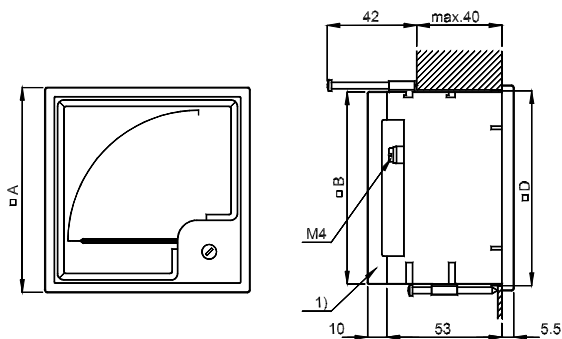
The instrument type BEQ is specifically suited for indication of thermal loads in conjunction with cables, transformers, etc. The instrument is equipped with a bimetallic system and a moving iron system, used for maximum reading and instantaneous reading respectively. Due to the thermal characteristic of the bimetallic system this is not affected by brief current fluctuations. The bimetallic system is provided with a red maximum-reading pointer. This pointer can be reset by means of a knob on the front of the instrument.

Technical specifications

Accuracy:	Bimetallic system: class 3.0, moving iron system: class 1.5. (-10...15...30...55°C) to EN 60051 and IEC 51.
Scale:	Exchangeable scale, with separate divisions for the moving iron and bimetallic systems. For both systems the scale range corresponds to 0...120% of the rated primary current of the current transformer. End values: 6-12-18-24-30-36-48-60-72-90-96 and multiples of 10 thereof.
Setting time:	Bimetallic system: 8 or 15 min.
Measuring range:	0..120% of I_N . I_N : 1A AC or 5A AC, 16...65Hz, for connection to C.T., -/1A or -/5A.
Overload:	Ammeters are designed according to EN60051-2 (Item 6.4.1 and 6.4.2) Continuous overload: $I_N \times 1,2$. Short duration overload: $I_N \times 5$ for 5 sec. $I_N \times 10$ for 0,5sec. Valid for -/1A, -/5A and direct connections. (both for moving iron and bimetallic)
Consumption:	BEQ72-x: 1A: approx. 1.5VA, 5A: approx. 2.5VA. BEQ96-x: 1A: approx. 1.8VA, 5A: approx. 2.8VA.
Ambient temperature:	-10...55°C (nominal), -25...60°C (operating), -25...65°C (storage).
EMC:	To EN 50081-1/2 and EN 50082-1/2. CE marked for residential, commercial and light industry plus industrial environment.
Materials:	Self-extinguishing plastic, to UL94 (V0).
Protection:	IP52, to IEC 529 and EN 60529.

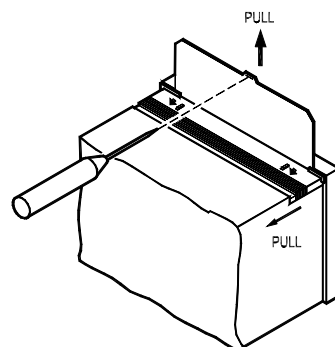
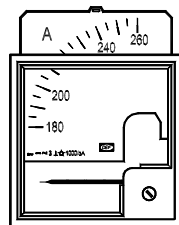
Dimensional details

All dimensions in mm.



1) Protective cover

Scale exchange



- 1) Press cover at top of instrument as shown.
- 2) Remove scale by means of a suitable tool (e.g. screwdriver).
- 3) After scale change: refit cover. (Press till it snaps into place).

Note: Interrupt signal to terminals before exchanging the scale.

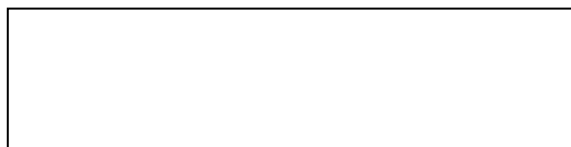
BEQ

Type	A	B	C	D
BEQ72-x	72 x 72	66.5 x 66.5	68 x 68 +0.7	Approx. 0.150 kg
BEQ96-x	96 x 96	90 x 90	92 x 92 +0.8	Approx. 0.230 kg

Order specifications

Example:	Type	Setting time	Scale	Current transformer
	BEQ72-x	8 min.	0..600A	500/1A

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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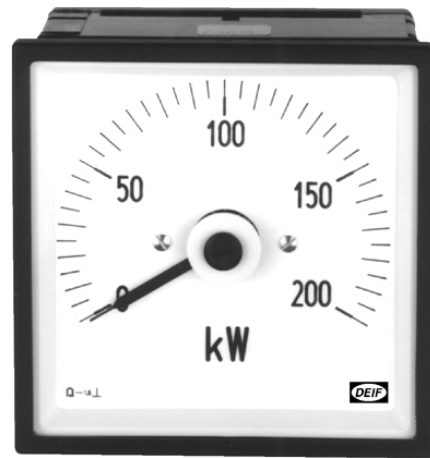
Watt and var meters

Type WQ

4921210005H



WQ -x



WQ -c

- *Self-contained meters*
- *Exchangeable scale (type WQ -x)*
- *Accuracy: Class 1.5*
- *High transient protection*
- *Compact design: Q96 and Q144*

Available types

Size	Scale deflection 90°	Scale deflection 240°
96 x 96 mm	WQ96-x	WQ96-c
144 x 144 mm	WQ144-x	WQ144-c

Construction

The meters type WQ consist of a moving coil movement and a built-in electronic watt or var transducer P.C.B., housed in a standard case.

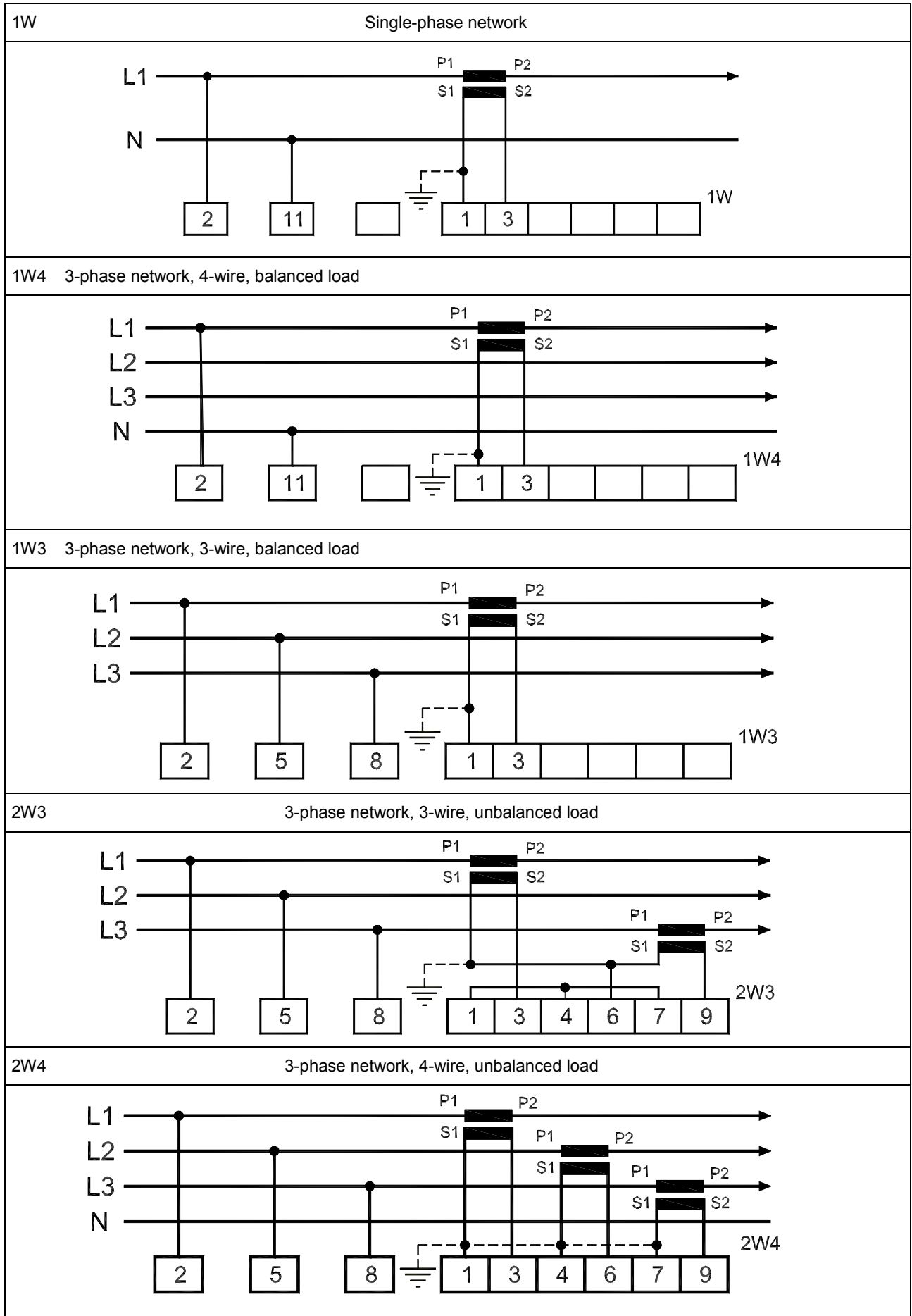
The transducer P.C.B. measures the power in a single-phase or three-phase network, converting the signal into a DC current, which is fed to the moving coil instrument.

The watt and var meters type WQ are CE marked for residential, commercial and light industry plus industrial environment.

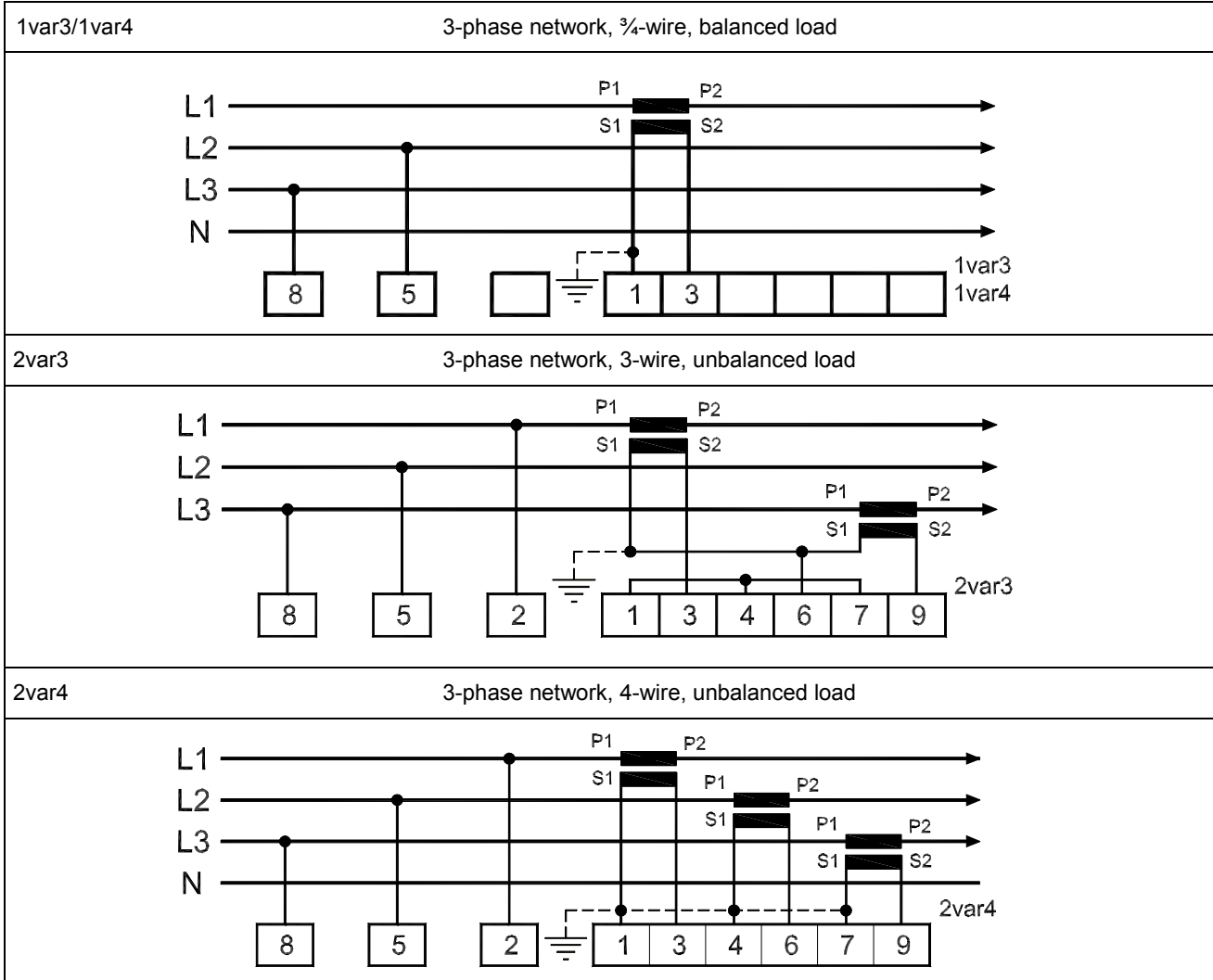
Technical specifications

Accuracy:	Class 1.5 (-10...15...30...55°C), to EN/IEC 60051
Wave form distortion:	Does not affect the measurement for crest factor ≤ 2
Frequency:	45...65Hz
Measuring current:	Direct or from current transformer -/1A or -/5A. Load $\leq 0.5VA$
Measuring voltage/supply:	100-110-115-127-220-230-240V AC +/-20% (all connections) 380-400-415-440-450V AC +/-20%, 480V AC +10%/-30% (1W3, 2W3, 2W4, 1var3, 2var3 and 2var4) Max. 515V derived from voltages with max. 300V to earth (300V – Cat. III/600V Cat. II) Consumption: Max. 3VA
Lowest measuring range (for a given configuration)	Single-phased network: $0.5 \times V \times I$ Three-phased network: $0.5 \times \sqrt{3} \times V \times I$
Highest measuring range (for a given configuration)	Single-phased network: $1.2 \times V \times I$ Three-phased network: $1.2 \times \sqrt{3} \times V \times I$
Temperature:	-10...55°C (nominal) -25...60°C (operating) -40...65°C (storage)
Temperature drift:	Typically 0.15%. Max. 0.2% per 10°C
Shock test:	To EN/IEC 60068-2-27 test Ea 15g - 6 times - 3 directions 50g/6ms 22g/20ms
Climate:	90% RH To EN/IEC 60068-2-30 test Db
EMC:	To EN/IEC 61000-6-1/2/3/4
Test voltage:	2kV - 50Hz - 1 min. All circuits mutually and to earth
Materials:	All plastic materials are self-extinguishing to UL94 (V0)
Connections:	Max. 2.5 mm ² (multi-stranded) Max. 4.0 mm ² (single-stranded)
Protection:	Front: IP52 (IP54 on request), terminals: IP20, to EN/IEC 60529
Safety:	To EN/IEC 61010-1

Connections • watt meters

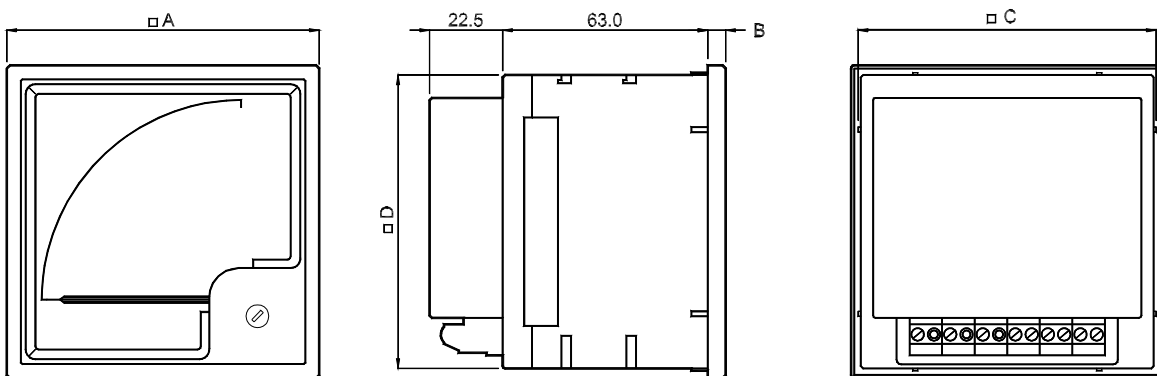


Connections • var meters



Dimensions

All dimensions in mm



Type	A	B	C	D	Weight (approx.)
WQ96-x/WQ96-c	96 x 96	5.0	92 x 92	90 x 90	0.400 kg
WQ144-x/WQ144-c	144 x 144	8.0	138 x 138	136 x 136	0.700 kg

Order specifications

	Type	Connection	Meas. range	Meas. current (CT)	Meas. voltage (VT)
Example:	WQ96-x	2W4	0...10MW	500/1A	10kV/100V

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Power factor meters

Type PFQ

4921210002F



- *Self-contained meter*
- *Compact design (DIN sizes)*
- *Scale deflection 90° and 240°*
- *Accuracy: Class 1.5*
- *Linear to phase angle*

Available types

Size	Scale deflection 90°	Scale deflection 240°
96 x 96 mm	PFQ96-x	PFQ96-c
144 x 144 mm	PFQ144-x	PFQ144-c

The meter consists of a moving coil movement and an electronic transducer, housed in a standard case. The transducer measures the phase angle between an AC voltage and the corresponding AC current, converting the signal into a proportional DC current, which is fed to the moving coil instrument. The PFQ is CE classified for residential, commercial and light industry plus industrial environment.

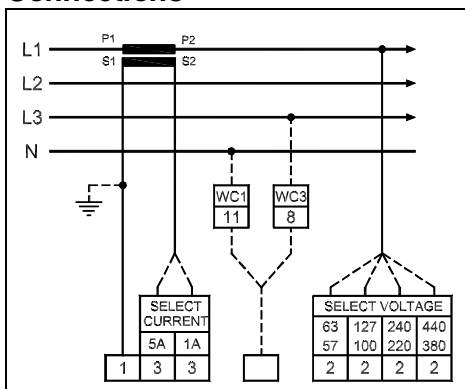
The measuring is principally single-phase (connection WC1), however, in a three-phase network without neutral the voltage is measured between 2 phases. The measurement can in principle not be made, if either the voltage or the current is zero. The pointer will indicate the mechanical zero (always placed at scale start) when the voltage is disconnected. At current signals below 5% of I_n , the pointer can be adjusted to indicate a required value by means of a potentiometer (placed on the rear).

Note: At heavy non-linear loads (e.g. thyristor controlled engines and rectifiers) the zero crossing of the current is delayed, and a power factor measurement is thus not possible. Measurement of var/watt is recommended in these cases (var/watt = $\tan\phi$).

Technical specifications

Accuracy:	Class 1.5, (-10...15...30...55°C) to IEC 51 and EN 60051
Standard measuring ranges:	0.5 cap. ...1... 0.5 ind., 0.7 cap. ...1...0.3 ind., 0...1 cap., 0...1 ind.
Measuring voltage ($V_{nom.}$):	57.7-63.5-100-110-127-220-230-240V AC $\pm 20\%$ (WC1 and WC3) 380-400-415-440V AC $\pm 20\%$ (WC3 only) Max. 515V derived from voltages with max. 300V to earth (300V – Cat. III / 600V Cat. II) (Burden: Approx. 10mA)
Effective voltage range:	80...120% of V_{nom}
Measuring current ($I_{nom.}$):	-1A and -5A from external current transformer
Effective current range:	5...200% of I_{nom}
Frequency drift:	45...65Hz: Max. $\pm 0.5\%$ (accuracy: Class 1.5%) 300...500Hz: Max. $\pm 0.5\%$ (accuracy: Class 2.0%)
Ambient temperature:	-10...55°C (nominal), -25...60°C (operating), -25...70°C (storage)
Temperature drift:	Typically 0.1%. Max. 0.15% per 10°C
Shock test:	15g – 6 times – 3 directions, 50g/6ms, 22g/20ms
Climate:	Class HUE, to DIN 40040
EMC:	To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-22-1 (class 3)
Test voltage:	2.2kV – 50Hz – 1 min. All circuits mutually and to earth
Materials:	All plastic parts are self-extinguishing, to UL94 (V0)
Terminals:	Max. 2.5 mm ² (multi-stranded). Max. 4.0 mm ² (single-stranded)
Protection:	Front: IP52 (IP54 on request). Terminals: IP20. To EN 60529, IEC 529

Connections



Dimensions

Type	A	B	C	D	Weight (kg)
PFQ96-x/-c	96 x 96	5	91.5	90	Approx. 0.400
PFQ144-x/-c	144 x 144	8	137.5	136	Approx. 0.700

Order specifications

Example:	Type	Connection	Measuring range	Measuring voltage
	PFQ96-x	WC3	0.5...1...0.5COS ϕ	380V AC

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Pt100 Ω temperature meters

Type PTQ

4921210021F






- *Self-contained meter in DIN sizes: Q96 and Q144 mm*
- *90° and 240° linear scales*
- *Built-in lead compensation (2 wire)*
- *Highly resistant to transients and vibrations*

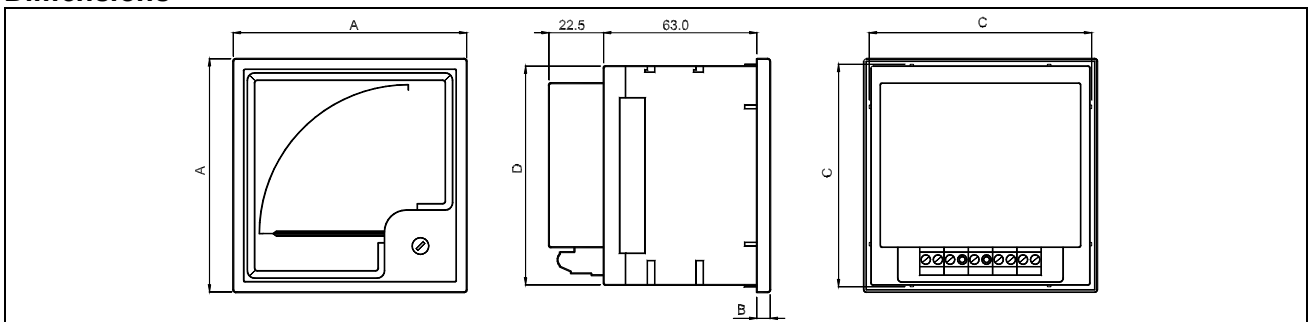
Technical specifications

Types	PTQ96-x, PTQ144-x (90°) PTQ96-c, PTQ144-c (240°)				
Accuracy	Class 1.5 (-10...15...30...55°C), to EN 60051 and IEC 51				
Standard ranges (°C)	0...40 0...150	0...50 0...200	0...60 0...250	0...80 0...300	0...100 0...400
Pt100 sensor 2 or 3 wire	20...120 250...500	50...150 300...600	50...250 0...500	100...200 0...600	200...400 0...800
Min. temperature difference	25°C				
Min./max. temperature	-200°C/+800°C				
Auxiliary supply	24-48-110-220V AC/DC (AC: 3VA, DC: 15mA) Use external surge protection if you use DC supply with supply cable longer than 10 m With galvanic separation between auxiliary supply and sensor: 110-220-380/440V AC (3VA) (on request) Not to be connected to systems where phase-zero or phase-earth exceeds 300V				
Auxiliary voltage influence	Max. 0.1% per 10% variation				
Temperature coefficient	Max. 0.2% per 10°C, typically 0.05% per 10°C				
Ambient temperature	-10...55°C (nominal), -25...60°C (operating), -40...65°C (storage)				
Shock test	15g – 6 times – 3 directions, 50g/6ms, 22g/20ms				
EMC	To EN 50081-1/2 and EN 50082-1/2. CE marked for residential, commercial and light industry plus industrial environment				
Climate	Class HUE, to DIN 40040				
Protection	Front: IP52 (IP54 on request). Terminals: IP20. To EN 60529 and IEC 529				
Max. lead resistance	3 wire: 3 x 5Ω 2 wire: 10Ω at ΔT = 51...600°C, 5Ω at ΔT = 50°C, 2Ω at ΔT = 25...49°C				

Connections

DEIF TYPE	ORDER No.														
○ L.C.	LOT No.														
 3 WIRE	AC SUPPLY														
 2 WIRE	AC/DC SUPPLY														
 LC CHECK 2 WIRE ONLY	X1-X2														
	<table border="1"> <tr> <td>P</td><td>I</td><td>0</td><td>0</td><td>100</td><td>200</td><td>400</td> </tr> <tr> <td>B3</td><td>B2</td><td>B1</td><td>X1</td><td>X2</td><td>X3</td><td>X4</td> </tr> </table>	P	I	0	0	100	200	400	B3	B2	B1	X1	X2	X3	X4
P	I	0	0	100	200	400									
B3	B2	B1	X1	X2	X3	X4									

Dimensions



Type	A	B	C	D	Weight
PTQ96-x/-c	96 x 96 mm	5.0 mm	92 x 92 mm	90 x 90 mm	Approx. 0.400 kg
PTQ144-x/-c	144 x 144 mm	8.0 mm	138 x 138 mm	136 x 136 mm	Approx. 0.700 kg

Order specifications

	Type	Scale	2 or 3 wire	Aux. voltage
Example:	PTQ96-c	0...150°C	3 wire	24V AC/DC

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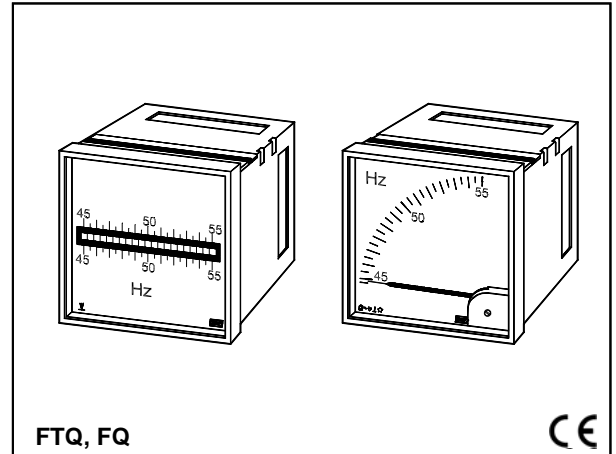


Types FQ, FTQ

Single frequency meters

4921210047K

- **Robust and thoroughly tested construction**
- **DIN size compact design: Q72, Q96**
- **High immunity to 3rd harmonics**
- **Suitable for all types of generating sets**



Available types

Size	Pointer frequency meters (90°)	Reed frequency meters
72 x 72 mm	FQ72-x	FTQ72-x
96 x 96 mm	FQ96-x	FTQ96-x

Construction

FQ:

Pointer frequency meter consisting of a moving coil instrument with built-in electronics for converting the frequency to a voltage signal. Accurate and linear read-out. Exchangeable scale.

FTQ:

Reed frequency meter with one row of metal reeds vibrating at the applied frequency (resolution: 1/4 Hz). Available with 13 reeds (typically 47...53 Hz) or 21 reeds (typically 45...55 Hz). Exchangeable scale. Note FTQ72-x only 47...53 Hz and 57...63 Hz.

Technical specifications

Type: Pointer frequency meters FQ

Accuracy ¹⁾ :	Class 0.5
Scale/measuring range:	45...55 Hz 55...65 Hz 45...65 Hz 360...440 Hz (others on request)
Measuring voltage:	100...230V AC ±15% 400...440V AC ±15%
Consumption:	3...9 mA
Temperature:	-10...55°C (nominal) -25...60°C (operating) -25...65°C (storage)

Shock test: 15 g - 6 times - 3 directions
50 g/6 ms
22 g/20 ms

EMC: IEC/EN 61000-6-2/3

CE-marked for residential, commercial and light industry plus industrial environment

Protection: IP52²⁾ To IEC/EN 60529

Type: Reed frequency meters FTQ

Accuracy¹⁾: Class 0.5

Scale/measuring range: 45...55 Hz - 55...65 Hz -
47...53 Hz - 57...63 Hz

Measuring voltage: 100-110-220-230-240-380-400-
415-440V AC ±15%

Consumption: Max. 15 mA

Temperature: -10...55°C (nominal)
-25...60°C (operating)
-25...65°C (storage)

EMC: IEC/EN 61000-6-2/3

CE-marked for residential, commercial and light industry plus industrial environment

Protection: IP52²⁾ To IEC/EN 60529

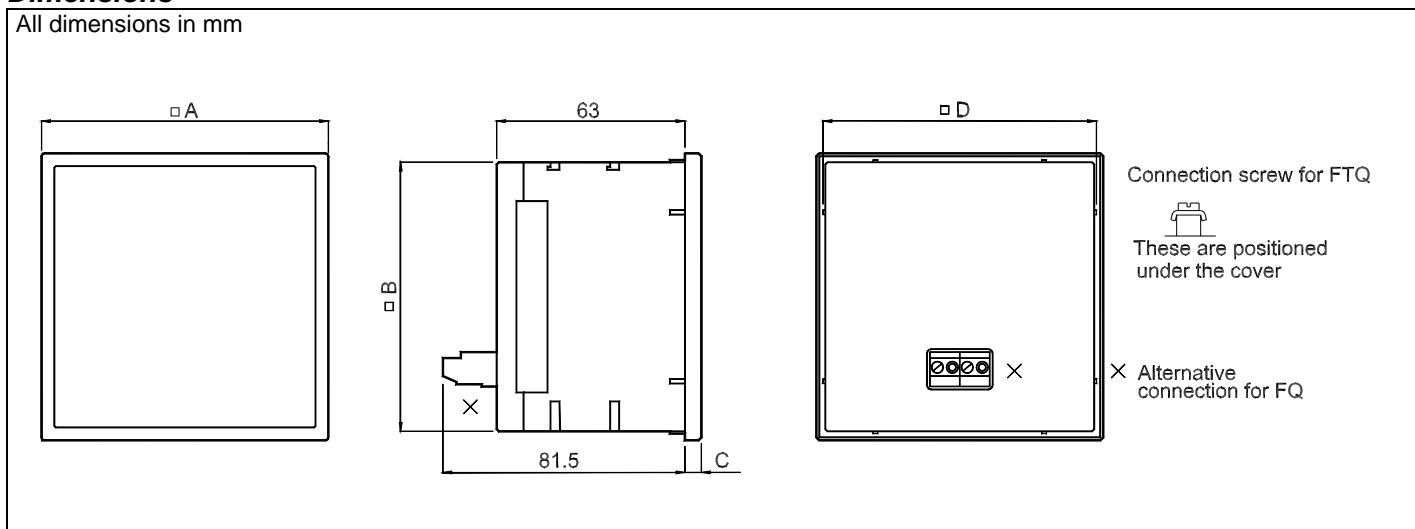
¹⁾ -10...15...30...55°C, to IEC/EN 60051-1
²⁾ IP54 from front with gasket

Further technical specifications:
See data sheet No. 4921210012.

Types FQ, FTQ

Dimensions

All dimensions in mm

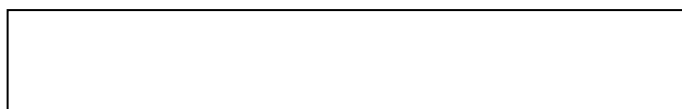


Type	A	B	C	D	Weight (approx. kg)
FQ72-x	72 x 72	66.5 x 66.5	5.5	68 x 68 + 0.7	0.189
FQ96-x	96 x 96	90 x 90	5.5	92 x 92 + 0.8	0.240
FTQ72-x	72 x 72	66.5 x 66.5	5.5	68 x 68 + 0.7	0.210
FTQ96-x	96 x 96	90 x 90	5.5	92 x 92 + 0.8	0.280

Order specifications

	Type	Scale/Measuring range	Measuring voltage
Example:	FQ96-x	45...55 Hz	230V AC

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-power in control-



Shunt resistors

Ranges 1...2500A 60/150mV

4921210042G



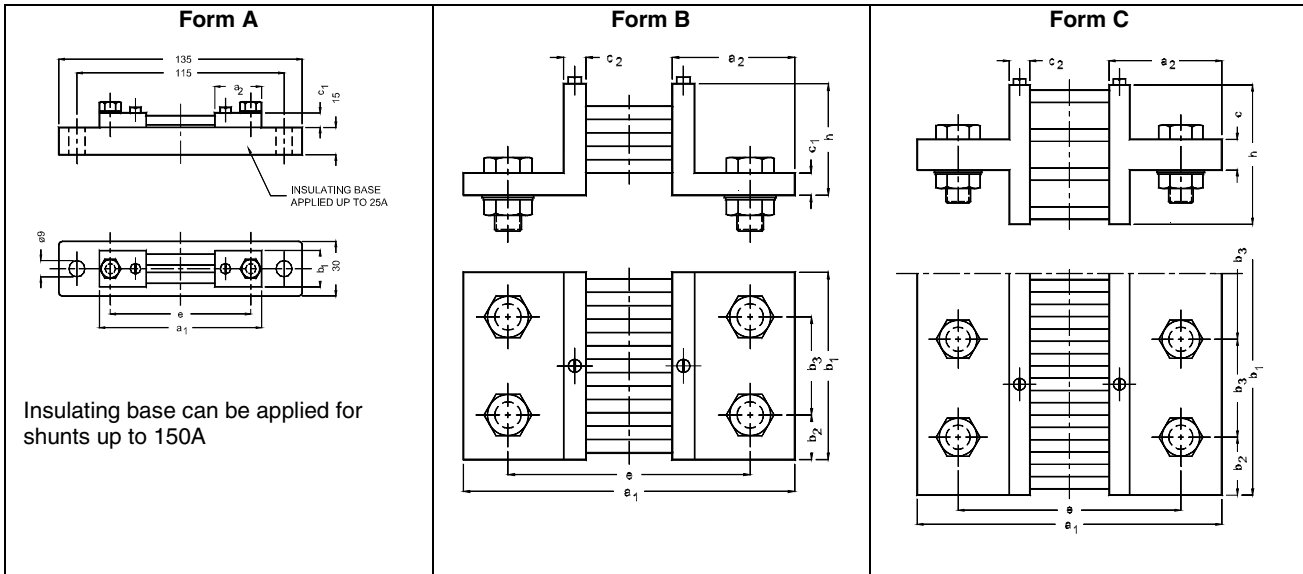
Shunts 1...25A



Shunts >25A

- *Dimensions to DIN 43703*
- *Class 0.5*
- *Extensive program*
- *Standard versions on stock*

Dimensions



Insulating base can be applied for shunts up to 150A

Voltage drop	Dimensions in mm	Amps							
		1-1.5-2.5-4-5-6-8-10-15-25	30-40-50-60-80-100-150	200-250		400-500-600-800	1000	1500	2500
60mV		Form A			Form B				
	a1	90	100	145		165			
	a2	28	33	55		65			
	b1	20		30	40	60	90	120	
	b2			15	20	30	21	30	
	b3						48	60	
	c1	8				10			
	c2					10			
	e	78	80	105		115			
h			30						
Weight kg (max.)	0.12...0.13		0.13	0.61	0.83 0.85 0.9		1.45	1.96	2.9
150mV		Form A		Form B			Form C		
	a1	90	225	270			290		
	a2	26	33	55			65		
	b1	20	25	30	40	70	90	120	
	b2			15	20	35	21	30	
	b3						48	60	
	c1	8		10			15		
	c2			10					
	e	78	205	230			240		
h			50			60			
Weight kg (max.)	0.12 0.12...0.13 0.13...0.14	0.16...0.17 0.18...0.20 0.23	0.26...0.68		1.05...1.151.1 1.16...1.30		2.15	3.10	5.20
End block bolts	2 x 1				2 x 2				
Bolt size	M5 x 12	M8 x 15	M12 X 40	M16 x 45	M20 x 50	M16 x 45	M20 x 50		
Bolt nut			M12	M16	M20	M16	M20		
Voltage screws	5MG X 8CHM with washer								

Accuracy:

Class 0.5 (-10...15...30...55°C) to IEC 51 and EN 60051.

EMC:

To EN 50081-1/2 and EN 50082-1/2.

CE marked for residential, commercial and light industry plus industrial environment.

Temperature coefficient:

0.05%/10°C. The shunt is calibrated at 75% of I_n .

Overloads:

≤250A 10 x I_n for 5 sec.

250A < ... ≤2000A 5 x I_n for 5 sec.

>2000A 2 x I_n for 5 sec.

Order specifications

Example:	Shunt resistor	Amps/mV
	Shunt resistor	250A/60mV

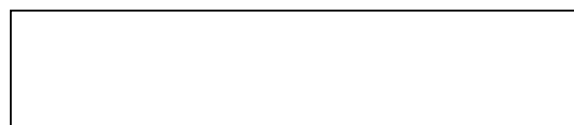
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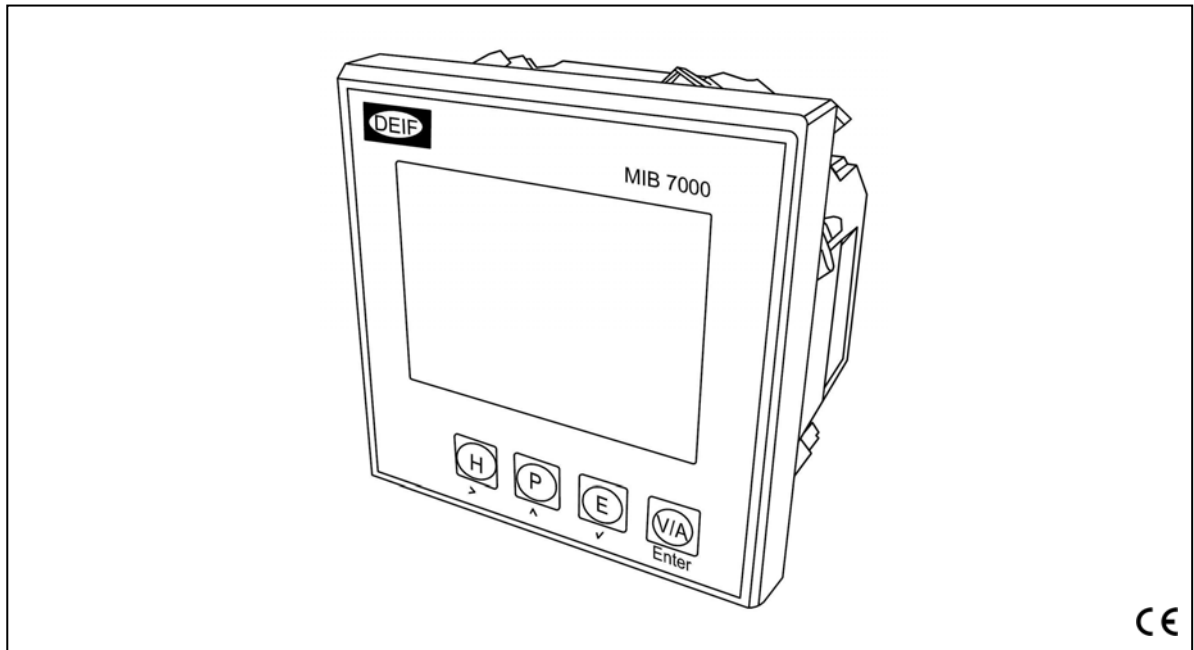


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Features

Measurements

- All 3-phase AC measurements
- True RMS
- Replaces analogue meters
- Demand on each phase current

Accuracy

- U, I and F class 0.5
- Other values class 1.0

Installation

- Compact dimensions
- Simple wiring

Display

- 4 display rows
- 58 x 66mm
- White backlight

Intelligent

- Suitable for all 3-phase network topologies
- Replaces transducers

Models

- MIB 7000: Basic
- MIB 7000C: Basic + RS485 Modbus communication
- MIB 7020: Basic + 2 digital outputs

Application

The MIB multi-instrument is a microprocessor-based measuring unit providing measurement of most electrical quantities on a 3-phase electric energy distribution network. The measurements are shown on the built-in display.

The product family includes three versions:

- MIB 7000 (basic)
- MIB 7000C (basic + RS485 Modbus communication)
- MIB 7020 (basic + 2 digital outputs)

True RMS values on all 3-phase network topologies are measured with/without neutral and with both balanced and unbalanced load.

A large number of standard analogue instruments can be replaced by the MIB in all electrical measuring applications. The MIB contains all necessary measuring circuits and presents all values on a display with white backlight. The display has 4 digits resolution for all measurements. The backlight on-time is selectable.

Operating the MIB is very easy. It is a flexible and logical measuring unit that enables the user to easily adapt the instrument to the individual application. Counter reset and change of settings can be password protected.

Measured and calculated values

Voltage

True RMS – each phase and line-to-line voltage.

Current

Each phase, average and neutral.

Active power (P)

Active, total and demand – power.

Reactive power (Q)

Reactive, total and demand reactive – power.

Apparent power (S)

Apparent and total apparent power.

Power factor

Power factor and total power factor.

Frequency

Actual frequency of L1.

Load nature

L/C/R.

Digital output (DO)

For alarm output or energy pulse output.

Min./max.

Min./max. of voltage – max. of current and demand.

Energy pulse output

Two ports of pulse output (assign to any energy and reactive energy).

THD (up to 15th harmonics)

Voltage THD of each phase and total, current THD of each phase and total.

Demand

Demand of each phase current, power and reactive power.

Energy

Import and export of energy, inductive and capacitive of reactive energy.

Alarm

Alarm can be related to any metering parameters.

Running hour

Meters the duration of the operation.

Unbalance factor

Voltage and current.

Connection

The MIB can be used in almost all 3-phase network topologies with/without neutral and with both balanced and unbalanced load. The voltage and current input wiring modes are set separately in the parameter setting process. The voltage wiring mode can be:

- 3LN 3-phase 4-line Y
- 2LN 3-phase 4-line Y with 2 VT
- 1LN 1-phase 2-line
- 2LL 3-phase 3-line open delta
- 3LL 3-phase 3-line direct connection

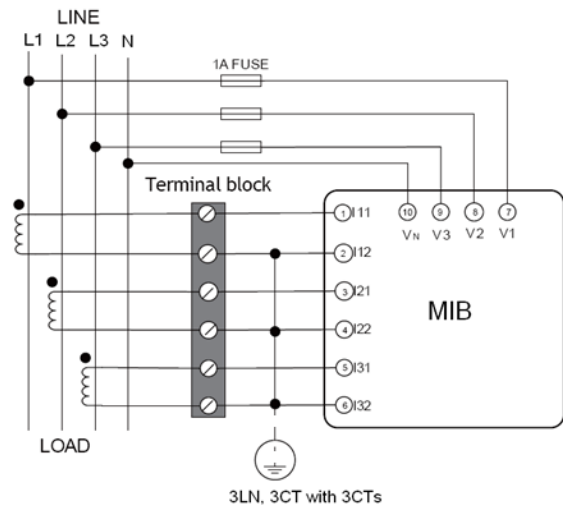
The current input wiring mode can be:

- 3CT Unbalance system
- 2CT Unbalance system without N
- 1CT Balance system

Any voltage mode can be grouped with any of the current modes. The MIB is supplied configured in 3-phase 4-wire unbalanced mode, i.e. voltage wiring mode 3LN and current input mode 3CT (3W4).

Communication (optional)

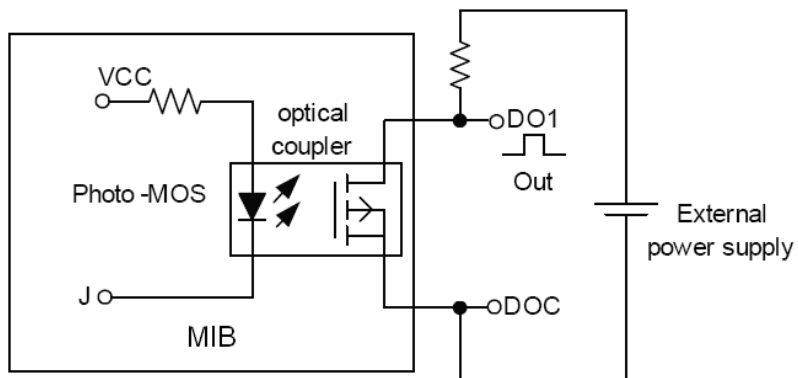
- Suitable for SCADA systems
- RS485 serial output
- Modbus RTU protocol



Digital output

MIB 7020

MIB 7020 has two digital outputs that can be used either as pulse outputs for active/reactive energy or as over/under limit alarm signals. The digital outputs are suitable for driving tariff devices or AC/DC relays.



Digital output circuit (pulse)

Technical specifications

Voltage inputs

Nominal voltage U_N	L-N 400V AC L-L 690V AC
Measuring range	0 to 1.2 x U_N
Overload capacity	2 x U_N continuously 2500V for 1s
VT primary	50V...1000kV
VT secondary	50V...400V
Fuse	1A/230V

Current inputs

Nominal current I_N	1 or 5A AC
Measuring range	0 to 1.2 x I_N
Overload capacity	10A continuously 100A for 1s
CT primary	5A...50kA

Frequency

Nominal frequency f_N	50/60Hz
Measuring range	45Hz to 65Hz
Measuring point	V1 phase voltage

Accuracy

Voltage	0.5% of range
Current	0.5% of range
Power	1.0% of reading
Power factor	1.0% of range
Frequency	0.5% of range
Energy	1.0% of range
Harmonic	2.0% of range

Auxiliary power supply

Universal AC/DC power supply	
Supply voltage AC:	100...415V AC +/-10% 50/60Hz/100...300V DC
Consumption	≤ 2VA
Fuse	1A/250V AC
Power consumption	3VA@230V AC

Digital output (optional)

Output form	Digital output NE (normally energised) NC (normally closed) circuit form is Photo-MOS
Optical isolation	4kV AC rms
Voltage max.	250V AC/300V DC
Current max.	50mA
Pulse rate	0.1...600kWh/pulse 0.1...600kVAh/pulse
Pulse duration	20ms...1s

Communication (optional)

Signal levels	RS485
Connection type	Multi-drop
Devices per link	Max. 32 units
Cable type	Belden 3105A or equivalent (twisted pair)
Maximum cable length	up to 1000m
Transmission mode	Asynchronous
Message format	Modbus RTU
Data rate	1 200 to 38 400 bits/s

Environmental conditions

Working temperature, display	-10...55°C
Storage temperature	-40...85°C
Humidity, relative	0-95% non-condensing
Temperature drifts Standard	<100ppm/°C EN 60068-2/-1,-2

Connections

Measuring inputs	Firm terminal block
Wire max.	5mm ² /AWG10
Screw torque	0.5Nm/5.5 lb-inch
Other	Pluggable block
Wire max.	1.5mm ² /AWG16
Screw torque	0.25Nm/2.5 lb-inch

Mounting

Panel mounted	Max. 6mm thick
Panel cutout	92 x 92mm +0.8mm (3.62" x 3.62") or 4" round

Protection

Front	IP52 (EN 60529)
Rear	IP30 (EN 60529)

Weight

350g (0.8 lbs.)

Material

Environmental	IEC 60068-2
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EMC

EN 61000-6-1/2/3/4

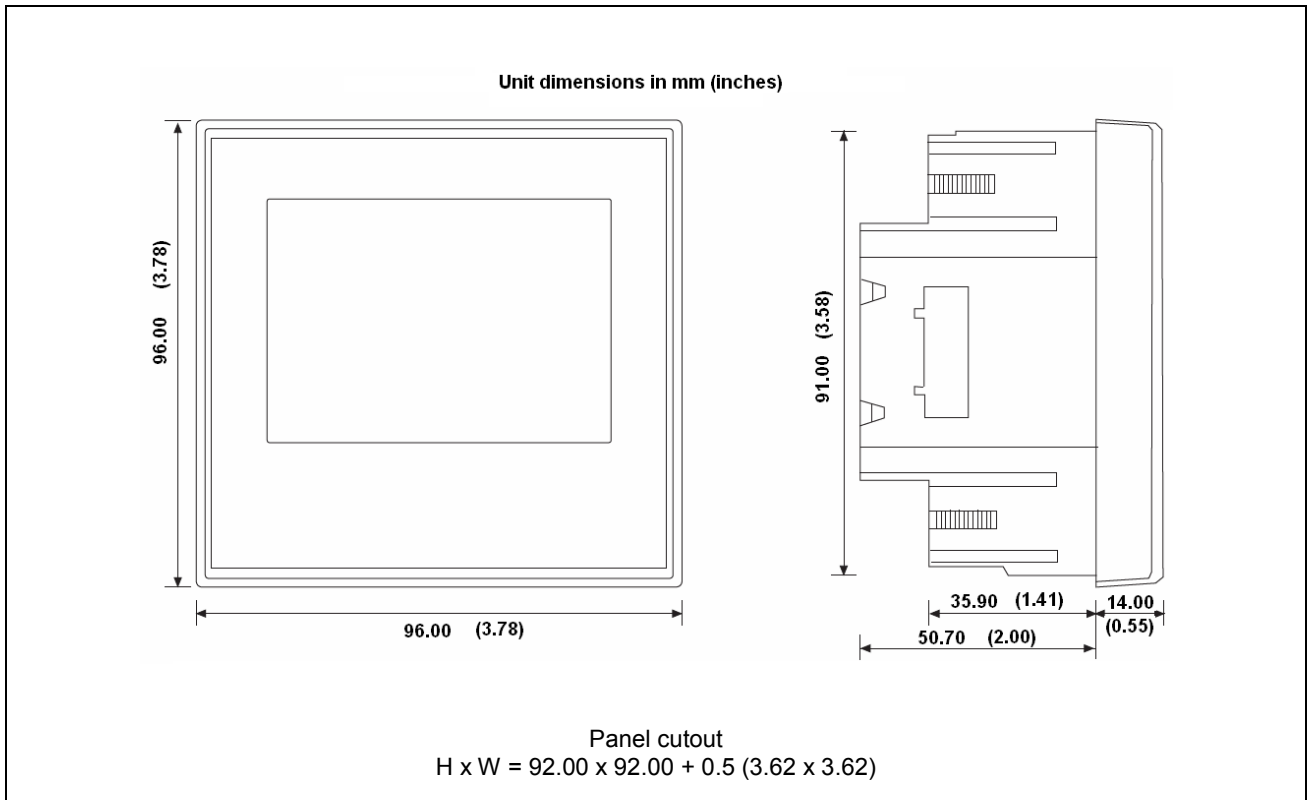
Safety

EN 61010-1/UL
61010-1
Cat. III, pollution degree 2

Test voltage

2.2kV according to
EN 61010-1

Unit dimensions in mm (inches)



Order specifications

<u>MIB 7000</u>	<u>MIB 7000C</u>	<u>MIB 7020</u>
690V AC (L-L) 5A No digital output	690V AC (L-L) 5A No digital output RS485 Modbus communication	690V AC (L-L) 5A 2 digital outputs
Aux. supply: 100...415V AC 100...300V DC	Aux. supply: 100...415V AC 100...300V DC	Aux. supply: 100...415V AC 100...300V DC
DEIF no. 1211020007 EAN no. 5703727106882	DEIF no. 1211020011 EAN no. 5703727108564	DEIF no. 1211020008 EAN no. 5703727106899

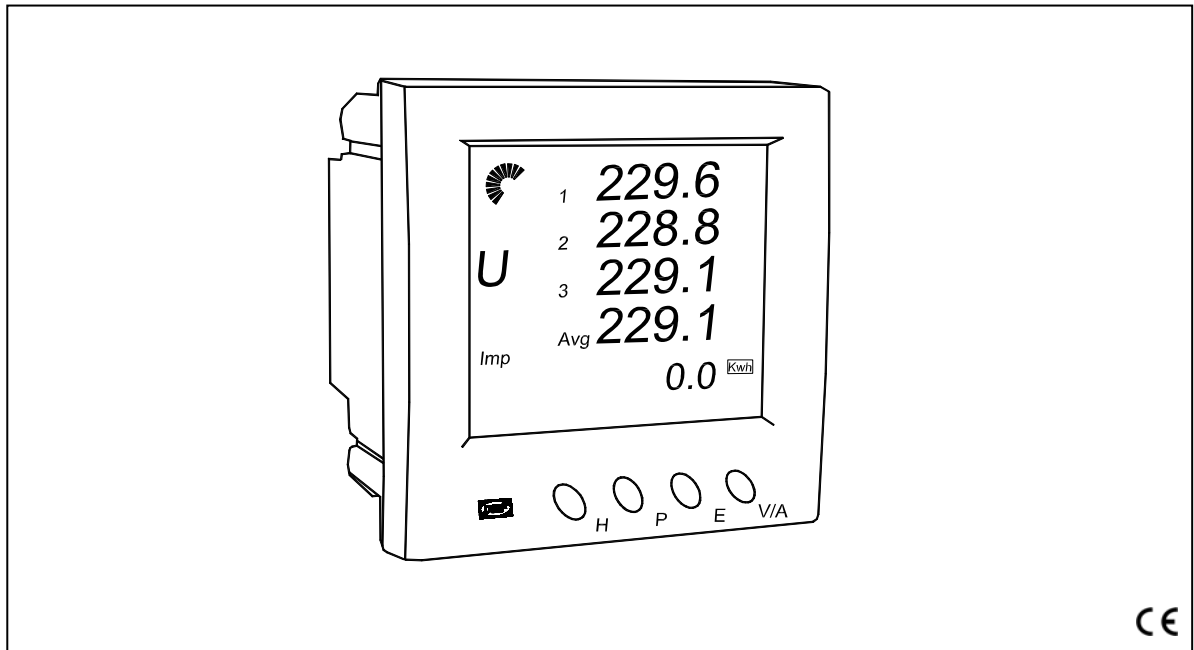
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Features

Measurements

- All 3-phase AC measurements
- True RMS
- Replaces analogue meters

Intelligent

- Suitable for all 3-phase network topologies
- Replaces transducers

Communication

- Suitable for SCADA systems
- RS485 serial output
- Modbus RTU protocol

Accuracy

- U, I and F class 0.2
- Other values class 0.5

Installation

- Compact dimensions
- Simple wiring

Display

- 5 display rows
- 58 x 66mm
- Blue backlight

Application

The MIC multi-instrument is a microprocessor-based measuring unit providing measurement of all electrical quantities on a 3-phase electric energy distribution network. The measurements are shown on the built-in display. The MIC also has an RS485 interface that supports data exchange with a control system via Modbus RTU.

The MIC product family includes two versions:

- MIC 4002 (basic)
- MIC 4224 (additional functionality)

The MIC measures true RMS values on all 3-phase network topologies with/without neutral and with both balanced and unbalanced load.

The MIC can replace a large number of standard analogue instruments in all electrical measuring applications. It can be applied both as a regular instrument and as a remote value-reading and control unit, where all measured values are transmitted to the remote control system via the serial interface. The MIC contains all necessary measuring circuits and presents all values on a display with blue backlight. The display has 4 digits resolution for all measurements with the exception of the energy counter values (9 digits). The backlight "on"-time is selectable.

The MIC is a flexible measuring unit that enables the user to easily adapt the instrument to the individual application. Counter reset and change of the instrument settings can be password protected.

Measured and calculated values

Voltage (phase-neutral)

Actual voltage of each phase and average voltage.

Voltage (phase to phase)

Actual voltage of each line and average voltage.

Current

Actual current of each phase, average current and neutral current.

Active power

Actual active power of each phase and total power.

Reactive power

Actual reactive power of each phase and total reactive power.

Apparent power

Actual apparent power of each phase and total apparent power.

Power factor

Actual power factor of each phase and system average power factor.

Frequency

Actual frequency of L1.

Power quality

Voltage/current unbalance factor, total harmonics distortion of voltage/current of each phase and total harmonics distortion of average voltage/current.

Energy counter

The MIC has 8 counters: Export/import kWh, export/import kVAh, absolute sum of export/import kWh, algebraic sum of export/import kWh, absolute sum of export/import kVAh, algebraic sum of export/import kVAh.

Statistics data

Max./min. values of voltage, current, total power, total reactive power, total apparent power, power demand, power factor and frequency.

Running hour

Meters the duration of the operation.

Real time clock

Date and time.

Connection

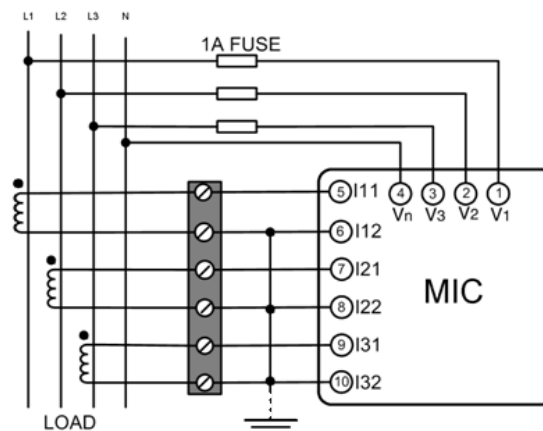
The multi-instrument MIC can be used in almost all 3-phase network topologies with/without neutral and with both balanced and unbalanced load. The voltage and current input wiring modes are set separately in the parameter setting process. The voltage wiring mode can be:

3LN	3-phase 4-line Y
2LN	3-phase 4-line Y with 2 PT
2LL	3-phase 3-line open delta

The current input wiring mode can be:

3CT	Unbalance system
2CT	Unbalance system without N
1CT	Balance system

Any voltage mode can be grouped with any of the current modes. The MIC is supplied configured in 3-phase 4-wire unbalanced mode, i.e. voltage wiring mode 3LN and current input mode 3CT (3W4).



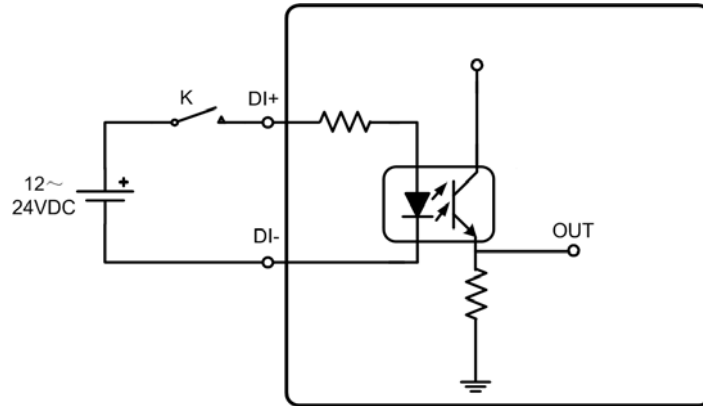
Principle diagram for 3LN, 3CT Connection (3W4)

I/O

MIC 4002

Digital input

MIC 4002 has two digital inputs that can be used to show the status of the switches in the power system:



Digital input circuit

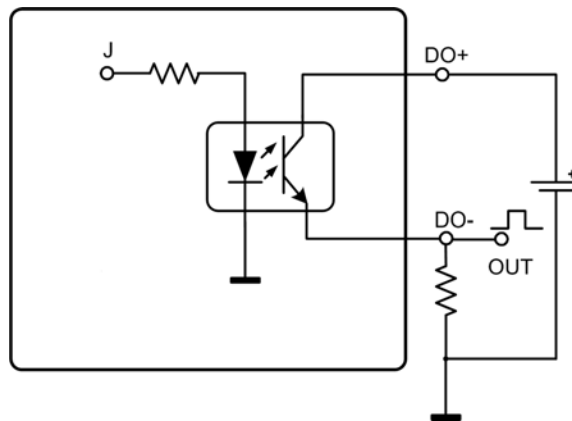
MIC 4224

Relay output

The two relay outputs are used to control electric switches in the power system via the Modbus RTU communication.

Digital output

MIC 4224 has two digital outputs that can be used either as pulse outputs for actual and reactive energy or as over/under the limit alarm signals. The digital outputs are suitable for driving tariff devices or 24V DC relays:



Digital output circuit (pulse)

Digital input

MIC 4224 has four digital inputs that can be used for status of switches in the power system.

Technical specifications

Voltage inputs

Nominal voltage U_N	Ph-N 230V AC Ph-Ph 400V AC
Measuring range	10...480V AC
Overload capacity	2 x U_N continuously 2500V for 1s
PT primary	100V...500kV
PT secondary	100V...400V
Consumption	≤ 0.2VA/phase
Fuse	1A/230V

Current inputs

Nominal current I_N	5A AC
Measuring range	0 to 1.2 x I_N
Overload capacity	10A continuously 100A for 1s
CT primary	5A...10kA
Max. current	9999A
Consumption	≤ 0.5VA/phase

Frequency

Nominal frequency f_N	50/60Hz
Measuring range	45Hz to 65Hz
Measuring point	V1 phase voltage

Accuracy

Ph-N voltage	0.2% of range
Ph-Ph voltage	0.2% of range
Ph current	0.2% of range
Frequency	0.2% of reading
Neutral current	0.5% of range
Active power	0.5% of range
Reactive power	0.5% of range
Apparent power	0.5% of range
Power factor	0.5% of range
Active energy	EN 61036 class 1
Reactive energy	EN 61268 class 2
Demand power	1.0% of range
THD	1.0% of reading

Response time

Metering data	300ms
Power quality	3s

Auxiliary power supply

Universal AC/DC power supply	
Supply voltage	24...48, 100...280V DC 85...264V AC 50/60Hz
Consumption	≤ 2VA
Fuse	1A/250V AC

Digital input

Optical isolation	4000V AC rms
Input resistance	2k Ω
Input voltage	5...30V DC
Input current	Max. 20mA

Digital output

Output form	Open collector, NO
Optical isolation	4kV AC rms
Voltage	+40V DC to -6V DC
Current	Max. 30mA
Pulse rate	0.1...600kWh/pulse 0.1...600kVArh/pulse
Pulse duration	20ms...1s

Relay output

Type	Normally open contact
AC rating (resistive load)	250V-3A-750VA
DC rating (resistive load)	30V-3A-90W
Mechanical life	5x10 ⁶ operations
Electrical life at rated load AC	1x10 ⁵ operations
Electrical life at rated load DC	2x10 ⁵ operations
Dielectric strength	750V AC for 1min.
Isolation contact/coil	4kV AC rms

Communication

Signal levels	RS485
Connection type	Multi-drop
Devices per link	Max. 32 units
Cable type	Belden 3105A or equivalent (twisted pair)
Maximum cable length	up to 1000m
Transmission mode	Asynchronous
Message format	Modbus RTU
Data rate	1 200 to 38 400 bits/s

Environmental conditions

Working temperature, display	-5...55°C
Working temperature, RS485	-25...55°C
Storage temperature	-40...70°C
Humidity, relative	0-95% non condensing
Temperature drifts	100ppm/°C
Standard	EN 60068-2-1, EN 60068-2-2, EN 60068-2-3

Connections

Measuring inputs	Firm terminal block
Wire max.	5mm ² /AWG10
Screw torque	0.5Nm/5.5lb-inch
Other	Pluggable block
Wire max.	1.5mm ² /AWG16
Screw torque	0.25Nm/2.5lb-inch

Mounting

Panel mounted	Max. 6mm thick
Panel cutout	92 x 92mm +0.8mm (3.62" x 3.62")

Protection

Front	IP40 (EN 60529)
Rear	IP20 (EN 60529)

Weight

350g (0.8lbs.)

Material

Plastic housing	According to UL94 (V0)
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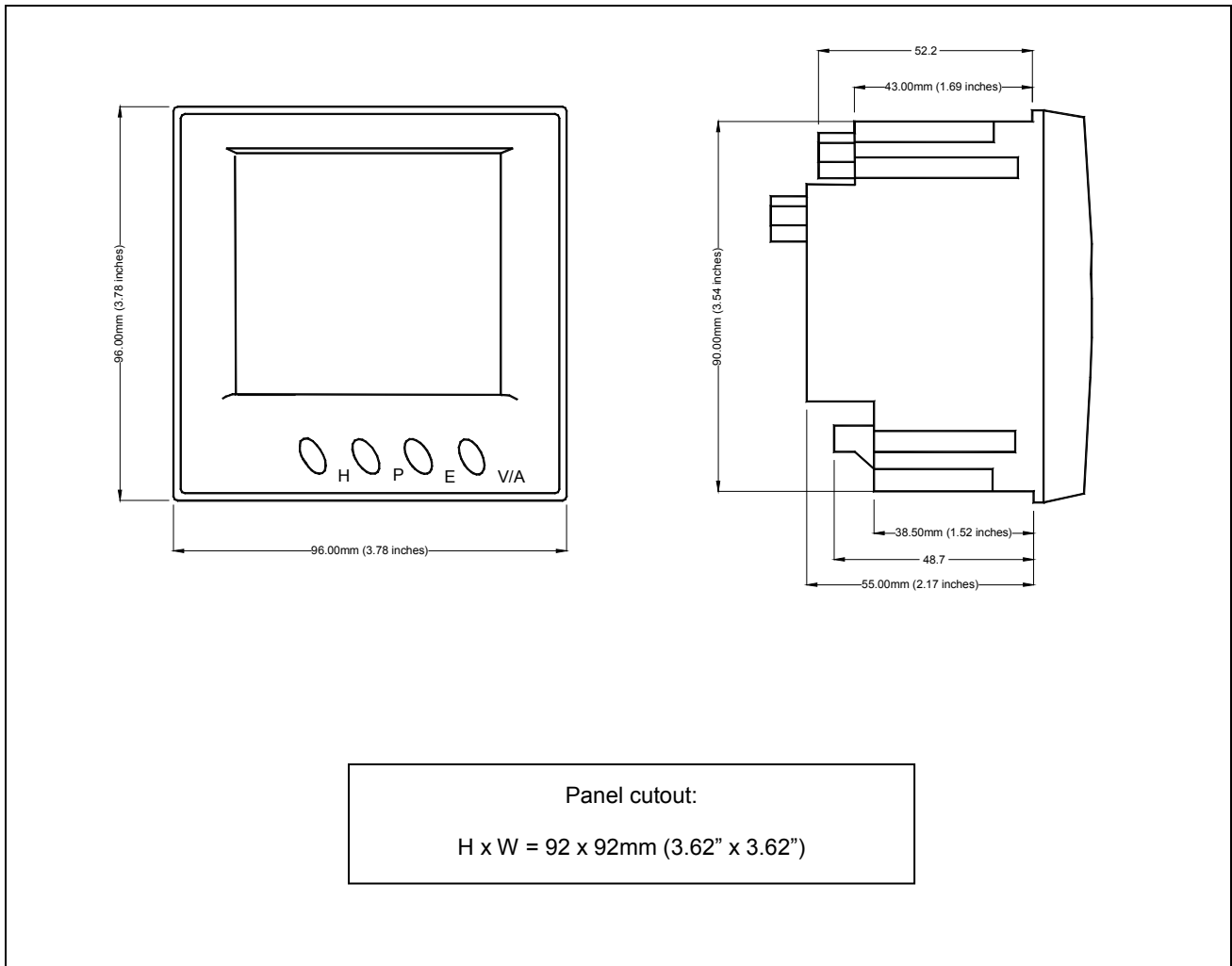
EMC

EN 61000-6-1/2/3/4

SafetyEN 61010-1
Cat. III, pollution degree 2**Test voltage**

2.2kV according to EN 61010-1

Unit dimensions in mm (inches)



Order specifications

MIC 4002	MIC 4224
400V Ph-Ph, 5A, no relay output, no digital output, 2 digital inputs Aux. supply: 100-280V DC/85-264V AC DEIF no. 1211020002 EAN no. 5703727105960 Aux. supply: 24-48V DC DEIF no. 1211020005 EAN no. 5703727106868	400V Ph-Ph, 5A, 2 relay outputs, 2 digital outputs, 4 digital inputs Aux. supply: 100-280V DC/85-264V AC DEIF no. 1211020004 EAN no. 5703727105953 Aux. supply: 24-48V DC DEIF no. 1211020006 EAN no. 5703727106875

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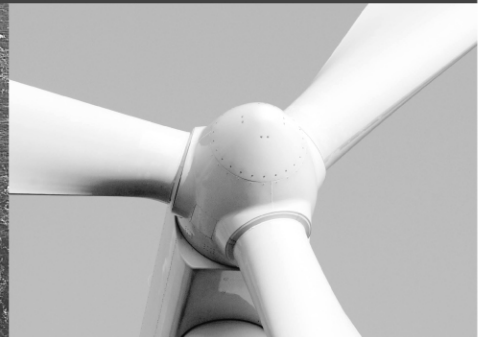




-power in control



MIC-2 Multi-instrument DATA SHEET



Measurements

- All 3-phase AC measurements
- True RMS
- 4-Quadrant energy
- Power Quality Analysis
- Replaces analogue meters

Communication

- RS-485 Modbus RTU protocol
- TCP/IP Modbus (optional)
- Profibus DP (optional)

I/O modules optional

- Analogue Input/Output
- Digital Input/Output
- Relay

Accuracy

- U, I and f class 0.2
- Other values class 0.5

Display

- 5 display rows
- 96 x 96 mm
- White backlight

Intelligent

- Suitable for 2 and 3-phase network topologies

Installation

- Compact dimensions
- Simple wiring

Utility software

- Data logging
- Remote reading
- Easy setting up

Alarms

- Up to 16 configurable alarms



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Document no.: 4921210130B

Application

The MIC-2 multi-instrument is a microprocessor-based measuring unit providing measurement of most electrical quantities on a 2- or 3-phase electric energy distribution network. The measurements are shown on the built-in display.

MIC-2 can be used as a data logging device for an intelligent Power Distribution System or Plant Automation System. All measurements are monitored and data is available via the RS-485 Modbus port. Other communication types as Ethernet (Web page, TCP/IP Modbus and emails transfer) and Profibus DP are available options.

True RMS values are measured with/without neutral and with both balanced and unbalanced load.

A large number of standard analogue instruments can be replaced by the MIC-2 in all electrical measuring applications. The MIC-2 contains all necessary measuring circuits and presents all values on a display with white backlight. The display has 4-digits resolution for all measurements. The backlight duration is selectable.

Operating the MIC-2 is very easy. It is a flexible and logical measuring unit that enables the user to easily adapt the instrument to individual applications. Password protection of KWh counter reset and change of settings is possible.

Measured and calculated values

Voltage

True RMS – each phase, line-to-line voltage and average.

Current

Each phase, average and neutral.

Active power (P)

Each phase, total power.

Reactive power (Q)

Each phase, total power.

Apparent power (S)

Each phase total power.

Power factor

Each phase and total power factor.

Frequency

Actual frequency

Load nature

Inductive/Capacitive/Resistive.

THD (up to 31st harmonics)

Voltage THD of each phase, current THD of each phase.

Maximum Demand

Demand of Active (P), Reactive (Q) and Apparent (S) power.

Energy counter

Import and export of energy, inductive and capacitive of reactive energy. Apparent energy

Energy pulse output (optional)

Two ports of pulse output (assign to any energy (P, Q and S) counter.

Statistics

Max/min of voltage, current, Power (P, Q, S) total, PF total, Frequency, Unbalance factor and THD values with time stamps.

Running hour indication.

Unbalance factor

Voltage and current.

Based on the positive and the negative sequence

Connection

The MIC-2 can be used in 2- and 3-phase network topologies with/without neutral and with both balanced and unbalanced load, including the US split phase system. The voltage and current input wiring modes are set separately in the parameter setting process. The voltage wiring mode can be:

- 3LN 3-phase 4-line Y and 3-line (split phase)
- 2LN 3-phase 4-line Y with 2 VT
- 2LL* 3-phase 3-line open delta
- 3LL 3-phase 3-line delta

*Preferred on an IT network e.g. ships. Notice max. 400 V phase-to-phase voltage using coupling 2LL.

The current input wiring mode can be:

- 3CT Unbalance system (split phase)
- 2CT Unbalance system without N
- 1CT Balance system

Any voltage mode can be grouped with any of the current modes.

Options

Communication

- Ethernet - TCP/IP Modbus
- Profibus DP/VO

Input/Output

- Analogue input (AI)
- Analogue output (AO)
- Digital input/output (DI/DO)
- Relay output (RO)

I/O Module	DI	DO	DO	AI	AO
AXM-IO1	6		2		
AXM-IO2	4	2			2
AXM-IO3	4		2	2	

AXM-IO1 has a 24V DC power supply for DI. A maximum of 1 communication and 2 input/output modules can be used for each MIC-2.

Technical specifications

Voltage inputs

Nominal voltage U_N	L-N 400V AC L-L 690V AC
Measuring range	0 to 1.2 x U_N
Overload capacity	1500 V continuous 3250 V for 1min
VT primary	220 V...500 kV
VT secondary	100 V...400 V
Fuse	1 A slow blow

Current inputs

Nominal current I_N	5A AC
Measuring range	0 to 10 A
Overload capacity	20 A continuous 100 A for 1 s
CT primary	5 A...50 kA
CT secondary	1 A...5 A
Load	0.5 VA

Frequency

Nominal frequency f_N	50/60 Hz
Measuring range	45 Hz to 65 Hz
Measuring point	V1 phase voltage

Accuracy

Voltage	0.2%
Current	0.2%
Power	0.5%
Power factor	0.5%
Frequency	0.2%
Energy	0.5%
Harmonic	2.0%

Standard

IEC 60051

Auxiliary power supply

Universal AC/DC power supply	
Supply voltage	100...415V AC +/-10% 50/60 Hz/ 100...300V DC +/-10%
Consumption	≤ 5 VA
Fuse	1 A slow blow

Communication**RS 485 Modbus RTU**

Number of devices	Max. 32 units
Cable type	Belden 3105 A or equivalent (twisted pair and shielded)
Maximum cable length	up to 1000 m
Data rate	1200 to 38400 bits/s

Vibration

3...13.2 Hz: 2 mmpp
13.2...100 Hz: 0.7 g
To IEC 60068-2-6
To IACS UR E10

Environmental conditions

Operation temperature	-25...70°C
Storage temperature	-40...85°C
Humidity, relative	5-95% non-condensing IEC 60068-2
Standard	

Connections

Measuring inputs	Current input fixed block, Wire max. 5mm ² 0.5 Nm/5.5 lb-inch Pluggable block 1.5 mm ² Screw torque 0.25 Nm/2.5 lb-inch
Screw torque	
Other	
Wire max.	
Screw torque	

Mounting

Panel mounted	Max. 6 mm thick
Panel cutout	92 x 92 mm +0.8 mm (3.62" x 3.62") or 4" round

Protection

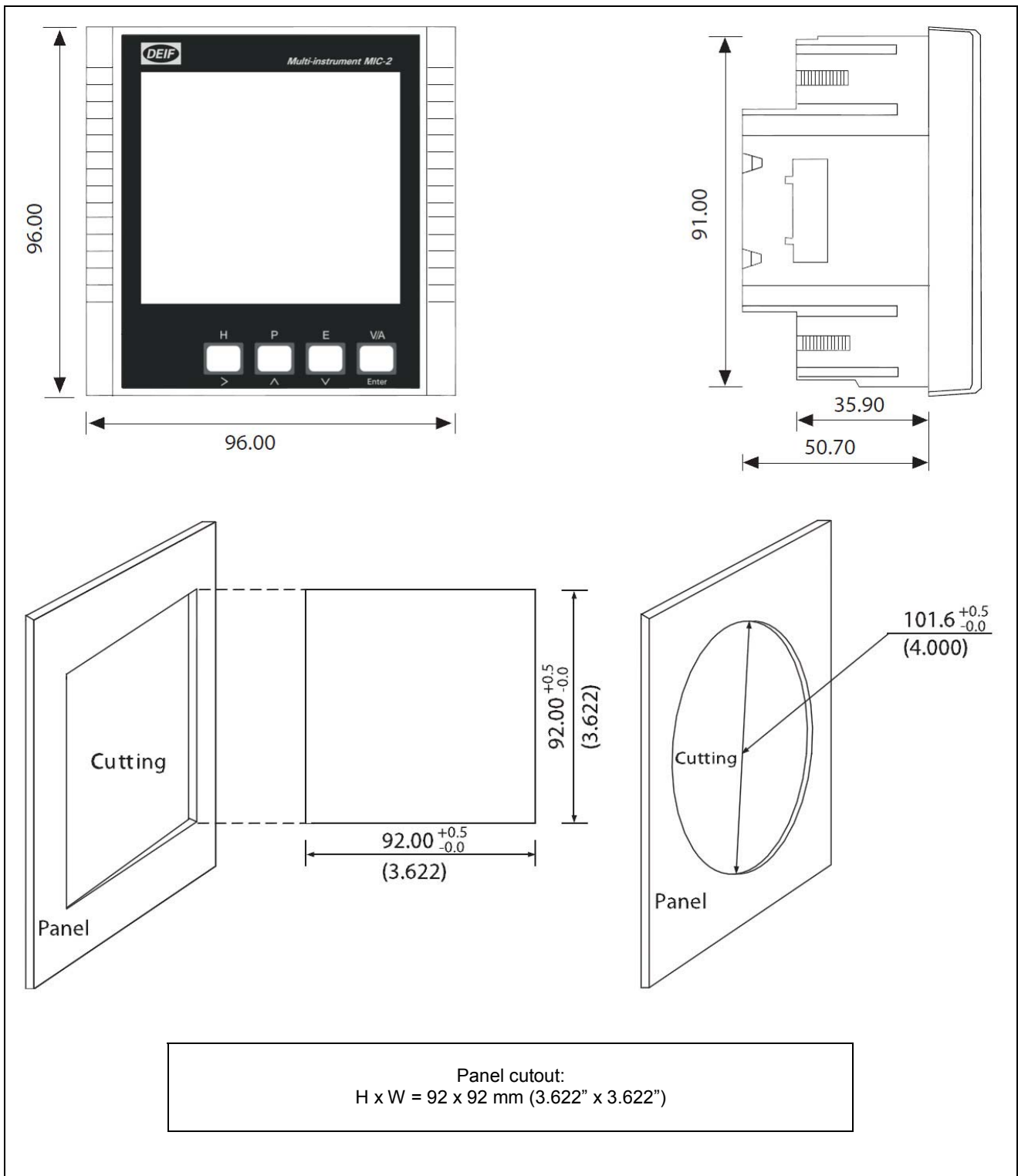
Front	IP52 (EN 60529)
Rear	IP30 (EN 60529)

SafetyIEC 61010-1,
UL 61010-1**Weight**

350 g (0.8 lbs)

EMCIEC 61000-4/-2-3-4-5-6-8-11
CISPR 16

Unit dimensions in mm (inches)



Technical specifications – optional modules

Communication modules

Ethernet TCP/IP module – AXM-NET

10 M/100 M self-adaptable,
RJ45 Jack
TCP/IP Modbus Protocol,
HTTP Web page browse
E-mail sending on time interval or on event.

Profibus module – AXM-PROFI

Profibus-DP/V0
Input Byte (typical): 32 bytes
Output Byte (typical): 32 bytes
EN50170 vol.2 compliance
Profibus slave mode, baud rate self-adaptable up to 12M

I/O modules

AXM-IO1	6 digital inputs (DI), 2 relay output (RO), 24V DC isolated voltage output
AXM-IO2	4 digital inputs (DI), 2 digital outputs (DO), 2 analogue output (AO)
AXM-IO3	4 digital inputs (DI), 2 relay output (RO), 2 analogue input (AI)

Digital Input (DI)

Input voltage range 20~250V AC/DC
Input current (max) 2 mA
“1” voltage level 15 V
“0” voltage level 5 V
Switch response time <1 ms
Pulse frequency (max) 100 Hz, 50% duty ratio (5 ms ON and 5 ms OFF)
Power supply for digital Input (DI)
Output voltage 24V DC
Output current 42 mA
Load (max) 21 DI

Digital Output (DO) (Photo-MOS)

Voltage range 0~250V AC/DC
Load current 100 mA (Max)
Output frequency 25 Hz, 50% Duty Ratio (20 ms ON, 20 ms OFF)
Isolation voltage 2500 V

Relay Output (RO)

Switching voltage (Max) 250V AC, 30V DC
Load current 3 A
Set time 10ms (Max)
Contact resistance 100 mΩ (Max)
Isolation voltage 2500 V
Mechanical life 1.5x10⁷

Analogue Input (AI)

Input range, 0~20 mA/4~20 mA
Accuracy 0.2%
Temperature drift 50ppm/°C typical
Isolation voltage 500 V
Impedance: 100 Ω

Analogue Output (AO)

Output range, 0~20 mA/4~20 mA
Accuracy 0.5%
Response time 300 ms
The max load resistance is 500Ω
Temperature drift 50ppm/°C typical
Isolation voltage 500 V

Note: Predefined output, see “Description of options, I/O modules user’s manual”, document no. 4189320032, for more information.

Consumption

AXM-NET: 1 W
AXM-PROFI: 1 W
AXM-IO1: 1 W
AXM-IO2: 1.3 W
AXM-IO3: 0.8 W

Environmental conditions

Operation temperature	-25...70°C
Storage temperature	-40...85°C
Humidity, relative	5-95% non-condensing
Standard	IEC 60068-2

Safety

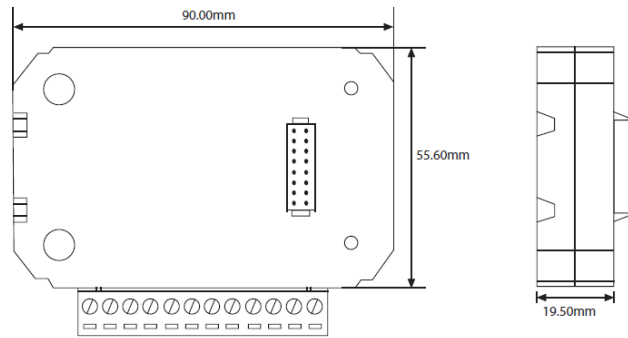
IEC 61010-1,
UL 61010-1

Weight

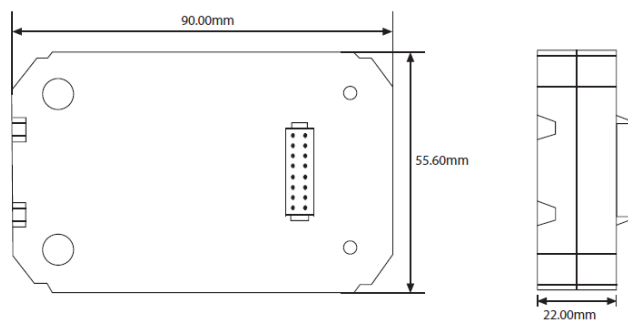
AXM-NET: 65 g
AXM-PROFI: 65 g
AXM-IO1: 90 g
AXM-IO2: 80 g
AXM-IO3: 85 g

EMC

IEC 61000-4/-2-3-4-5-6-8-11
CISPR 16

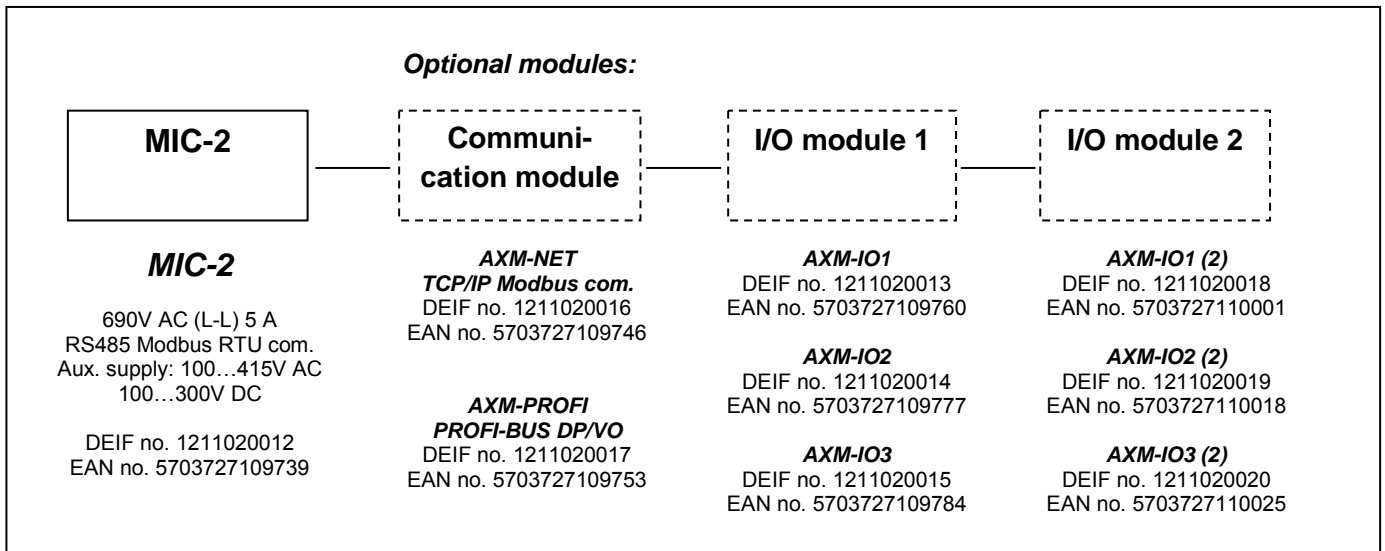


IO Module dimensions



Communication Module dimensions

Order specifications



A maximum of 1 communication and 2 input/output modules can be used for each MIC-2.

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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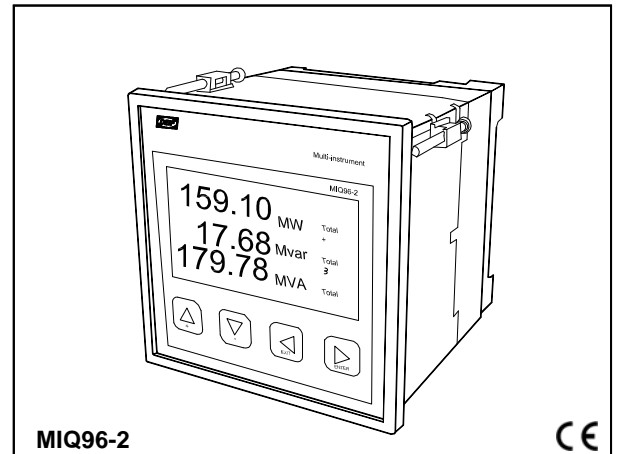


Type MIQ96-2

Multi-instrument

4921210108D

- **All 1 or 3-phase AC measurements, true RMS**
- **Programmable CT and VT ratios**
- **More than 50 displayed parameters (V, A, kW, kVA, kvar, kWh, PF, Hz, MD, THD etc.)**
- **Multi language support**
- **Serial RS485 output for all values**
- **Pulse output for kWh and kvarh or limit switches**
- **Configurable display**



Application

The MIQ96-2 multi-instrument is a microprocessor-based measuring unit providing measurement of all electrical quantities on a single phase or 3-phase electric energy distribution network, showing the measurements on the built-in display and transmitting these as:

- 2 pulse outputs for kWh and kvarh
- A serial output RS485

The MIQ96-2 can replace several instruments in all electrical measuring applications and can be applied both as a normal instrument and as a remote value-reading unit, where all measured values are transmitted to the remote control system via the serial interface.

The MIQ96-2 measures true RMS values on all network topologies with/without neutral and with both balanced and unbalanced load.

The MIQ96-2 contains all necessary measuring circuits and presents all values on a graphic LCD with yellow/green backlight. Messages are presented in clear text, all measuring values in engineering units.

The MIQ96-2 is a flexible and programmable unit, which enables the user to easily adapt the unit to the application in question. Reset of counters and change of parameters can be password protected.

Standard functions

The unit is designed for measurement on a 3-phase or 1-phase network.

Measured and calculated values on a 3W4 connection:

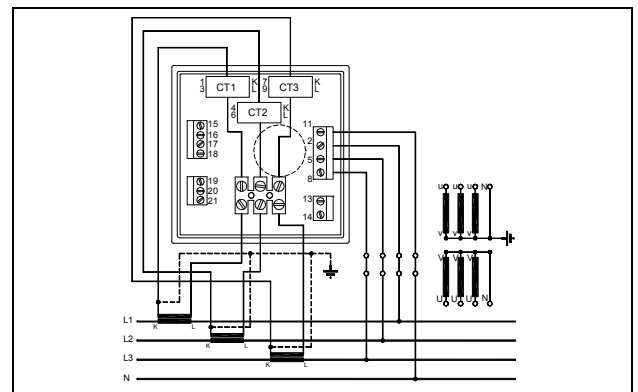
- **Current** (3-phase actual current, neutral current, average current, THD in each phase)
- **Phase to neutral voltage** (3-phase actual voltage, average voltage, THD in each phase, phase angle)
- **Phase to phase voltage** (3-phase actual voltage, average voltage, THD between phase 1, 2 and 3)
- **Active power** (3-phase W total and W for each phase)
- **Reactive power** (3-phase var total and var for each phase)
- **Apparent power** (3-phase VA total and VA for each phase)
- **Power factor PF** (3-phase PF total and PF for each phase)
- **Frequency**
- **Energy measuring counter Export and Import**
4 counters: (1) export kWh, (2) export kvarh (3) import kWh, (4) import kvarh

- **Maximum demands** (load from consumer)
The MIQ96-2 enables measurement of MDs of total active, reactive and apparent power, moreover the sum of currents.
The MIQ96-2 can be set up for one of three different modes for calculation of MDs:
 - a. Thermal (bimetal element)
 - b. Fixed window (average value for one window)
 - c. Sliding window (average value for more windows)

Connection

In the menu "Setting" set up for the following connections are available: 1W, 1W3, 2W3, 1W4, 3W4.

Principle diagram for 3W4 connection:



RS485 serial output

RS485 remote value-reading of all values measured by the MIQ96-2.

RS485 allows remote entering of password, time, MD, reset of counters etc.

Modbus standard telegram: See User's Manual and Serial Interface Manual, can be downloaded from www.deif.com.

Energy measurement by 2 relay outputs

For counter 1 and 2:

The 2 potential free relay outputs can be programmed to transmit any fixed number of pulses per produced kWh (1) or kvarh (2). Alternatively these relays can be configured as limit switches. See Appendix for User's Manual for further information.

Universal AC and DC aux. supply:
48...230V AC 50/60Hz and 24...220V DC.

Type MIQ96-2

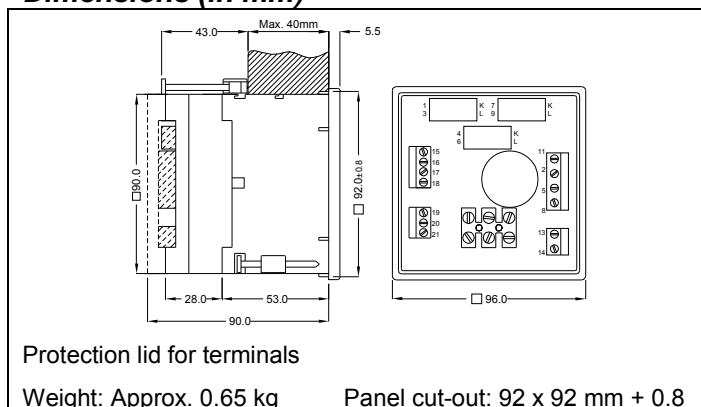
Technical specifications

Meas. voltage Un:	Ph-N 230V AC Ph-Ph 400V AC, range 0.1...1.5 x Un Consumption: < 0.1VA per phase
	Overload capacity: 1.5 x Un continuously 2 x Un for 10s
Meas. current In:	-/1A or -/5A, range 0...1.6 x In Consumption: < 0.1VA per phase
	Overload capacity: 3 x In continuously 25 x In for 3s 50 x In for 1s
Meas. frequency:	50/60Hz, range 45...65Hz
Auxiliary supply:	Working range: 40...276V AC 40...65Hz 19...300V DC
	Overload capacity: 1.2 x Un continuously 1.5 x Un for 10s
	Consumption: < 5VA
Accuracy:	Phase voltage Ph-N 0.5% of range Phase - phase voltage 1.0% of range Current 0.5% of range Neutral current 1.0% of range Active power 0.5% of range Reactive power 0.5% of range Apparent power 0.5% of range Power factor 0.5% of range MD values 1.0% of range Active energy EN61036: 1996 class1 React. energy EN61268: 1995 class2 Frequency 0.05% of reading THD 1.0%
	<u>Note:</u> All measurements are calculated with harmonics present up to 15 th harmonics
Response time:	64 periods ~ 1.28s at 50Hz
Real time clock:	1 minute/month
Back up battery:	Producer: Varta Type: CR 2032 lithium battery
Battery life time:	Approx. 6 years (at 23°C – typical)
Relay outputs	
Contact ratings:	250V - 6A - 1500VA (AC) (250V AC - 6A resistive AC load 100.000 operations) 35V - 6A - 210W (DC) (30V DC - 6A resistive load 500.000 operations)
Contact voltage:	Max. 250V (AC) Max. 100V (DC)
Isolation:	1000V (AC) between open contacts 4000V (AC) between coil and contacts
Pulse:	Max. pulses per hour 4000 Pulse duration 10...300ms
Fuse:	All voltage inputs ought to be protected by a 2A fuse
RS485 port	
Connection type:	Multi-drop (32 connections per link)
Signal levels:	RS485
Cable type:	Belden 3105A or equivalent (twisted pair)
Max. cable length:	up to 1000m
Connector:	Screw terminals
Isolation:	3.7 kV rms for 1 minute between all terminals and all other circuits

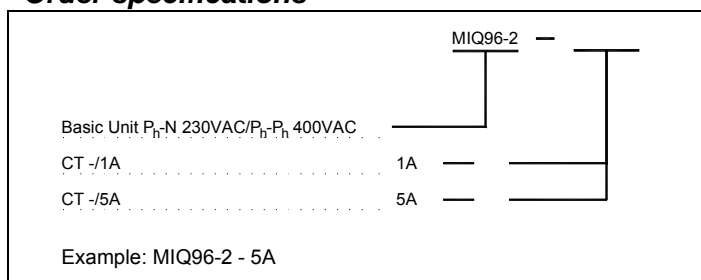
Transmission

Mode:	Asynchronous
Message format:	Modbus RTU
Data rate:	1200 to 115200 bits/s
Safety:	To EN 61010-1 Installation Cat. III, 300V. Pollution degree 2 Installation Cat. II, 600V. Pollution degree 2
Test voltage:	3.7 kV rms according to EN 61010-1
EMC:	To EN 61036 To EN 61326-1: 1997 for mentioned accuracy. (To EN 61000-6-1/2/3/4 for a general 1.0% accuracy on all measurements)
Connections:	Permissible cross section of the connection leads:
Wire:	Multi stranded: 1.5mm ² Single stranded: 2.5mm ²
Protection:	Enclosure: IP52 Terminals: IP20 with cover mounted Terminals: IP00 According to EN 60529: 1989
Climate:	According to EN 61036: 1996 According to EN 61268: 1995 Operating temperature: -10 to +65°C Storage temperature: -25 to +70°C Annual mean relative humidity: ≤ 75% r.h.
Housing:	Plastic, in compliance with UL 94 V0

Dimensions (in mm)



Order specifications



For configuration/communication:

USB – RS485 signal converter

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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Type ADL-111Q96/xxVDC

- **Monitoring of insulation resistance on a DC network**
- **Working voltage, 24V, 110V or 220V DC**
- **Measuring range 50...0k Ω , 250...0k Ω , 500...0k Ω**
- **Alarm on exceeding the adjusted set point**
- **DC auxiliary supply or self-powered**
- **Balanced insulation error included**

Application

The ADL-111Q96/24VDC, ADL-111Q96/110VDC or ADL-111Q96/220VDC is used for supervision of the insulation resistance between an insulated voltage distribution network (IT network) and earth cable/safety cable. The instrument is applicable in conjunction with DC networks of 24V DC, 110V DC or 220V DC.

This type of insulation measurement is only carried out on DC networks where both conductors are isolated from the protective earth/the hull of the ship.

The ADL-111Q96/xxVDC can be used for marine installations and other types of insulated voltage networks, e.g. DC manoeuvre voltages of transformer stations.

Measurement

The insulation is monitored between the negative conductor and the safety cable.

The measurement is carried out by applying a pulsating DC voltage connected through a known resistor (R_i) between a point on the safety cable and the negative pole of the battery or the negative conductor in the network. It is a condition for monitoring of the complete network that the remaining parts are mutually connected.

The instrument needs a DC aux. power supply. This may be selected independently of the monitored network *, or the ADL-111Q96/xxVDC can be supplied by the monitored network (self-powered). If the ADL-111Q96/xxVDC is supplied from a separate voltage source, the network can also be monitored in power-down condition. In this situation, it will be necessary to make a connection between the positive and the negative conductor, e.g. by means of a low ohmic resistor or a lamp.

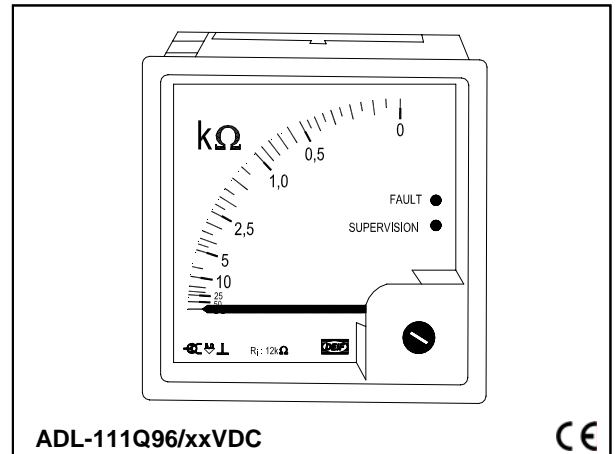
Because of the measuring method used, the ADL-111Q96/xxVDC is able to measure a symmetrical earth fault from the positive and the negative conductor at the same time. This is not possible on traditional instruments based on a Wheatstone measuring bridge.

Note:

Only one insulation monitor can be connected to the same IT power system.

Insulation monitor

4921230021A



*A 24V instrument is only available with a 24V auxiliary supply, a 110V instrument is only available with a 110V auxiliary supply and a 220V instrument is only available with a 220V auxiliary supply.

Measuring principle

The ADL-111Q96/xxVDC is using a pulse superimposition method on the system under supervision. This enables the ADL-111Q96/xxVDC to detect a symmetrical earth fault as well as any earth faults from the positive or the negative conductor respectively.

The internal DC voltage generator is based on a $\pm 12V$ voltage source with an internal resistance $>12k\Omega$ for the 24V version, a voltage source of $\pm 25.5V$ DC with an internal resistance $>55k\Omega$ for the 110V version and a voltage source of $\pm 25.5V$ with an internal resistance $>110k\Omega$ for the 220V version. When this test voltage is superimposed on the power system under supervision, leakages between the power system and earth (safety cable) will induce a current, the size of which expresses the insulation resistance.

If an earth fault is present at the positive and the negative conductor at the same time, the resulting value of the parallel insulation error is indicated on the instrument. This is also the case if the earth fault at the positive and the negative conductor has exactly the same size, e.g. if there is an insulation error from the positive conductor of 2k and at the same time a similar insulation error from the negative conductor, the value on the instrument will be indicated as 1k.

Indicators

The main indicator is the instrument. The actual value of the earth fault will be shown on the front of the instrument as an analogue read-out. In addition to this, the ADL-111Q96/xxVDC is equipped with 2 LED indicators, 1 green and 1 red.

When the instrument is connected to auxiliary supply, the green LED marked "SUPERVISION" will be illuminated, indicating that measuring is taking place.

When an earth fault below the alarm set point is measured, regardless if it is from the positive or the negative conductor or both, the red LED marked "FAULT" will be constantly illuminated.

In the event of a symmetrical earth fault below the alarm set point, the "FAULT" LED will be constantly illuminated.

Note:

If the voltage exceeds the max. allowable value, e.g. 31.2V for the 24V version (printed on the different type labels), the indication on the instrument will be infinite and the green LED starts flashing. The same indication will occur in situations where the insulation error is fluctuating; the infinite indication on the instrument and the flashing LED will remain, until a correct mean value of the fluctuating insulation error can be determined or until the voltage no longer exceeds the max. allowable voltage.

Leakage capacitance

The ADL-111Q96/xxVDC measures the insulation on a power system with a total leakage capacitance of max. 1µF or max. 20µF.

This can be set by means of a switch (S1) located under the rear cover. For further information, please see the installation/operation instructions, available on www.deif.com.

As default, the instrument will be delivered with the total leakage capacitance set to 1µF.

Measuring range/scales

Version	Scale range	Internal resistor Ri
ADL-111Q96/24VDC	50...0kΩ	12k
ADL-111Q96/110VDC	250...0kΩ	55k
ADL-111Q96/220VDC	500...0kΩ	110k

Fig. 1, 50...0kΩ scale

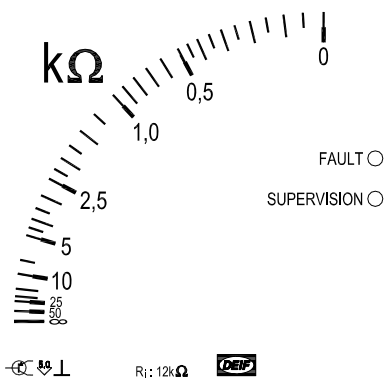


Fig. 2, 250...0kΩ scale

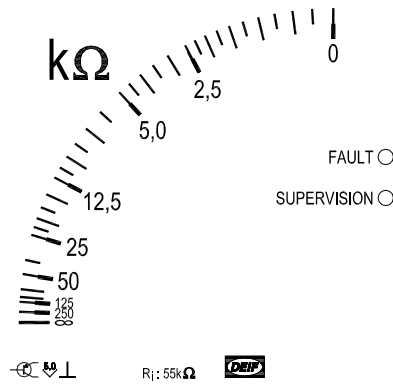
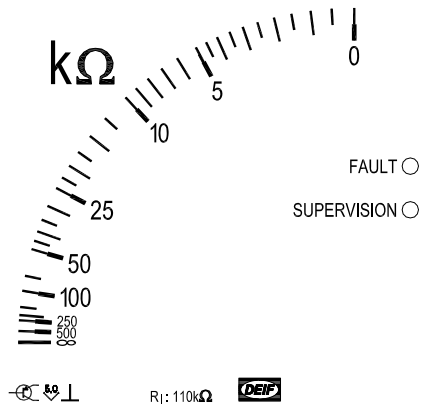


Fig. 3, 500...0kΩ scale



Relay output

The ADL-111Q96 is equipped with one change-over relay contact. By means of a built-in switch (S1), located under the rear cover, the relay can be configured to either:

- NE (normally energised contact), recommended for alarm purposes
- or
- ND (normally de-energised contact), recommended for control purposes.

As default, the instrument will be delivered with the relay set to NE.

Test

If a periodical test function is required, it can be achieved as shown on the connection diagram. If a value less than the preset limit value is selected as test resistance, alarm is obtained by activating the test button.

Warning:

If the installation is to be tested by means of a high-voltage "MEGGER", the measuring wire to the ADL-111Q96 at terminal "L-" must be disconnected before testing is carried out. Omitting this may result in damage to the ADL-111Q96.

Type ADL-111Q96/xxVDC

Set point

The requested alarm limit value is set on an ohm scale on the rear of the instrument (see Fig. 4, 5 and 6).

Fig. 4: Type label for 24V version

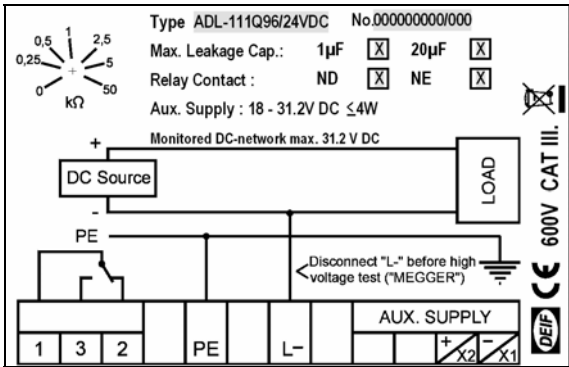


Fig. 5: Type label for 110V version

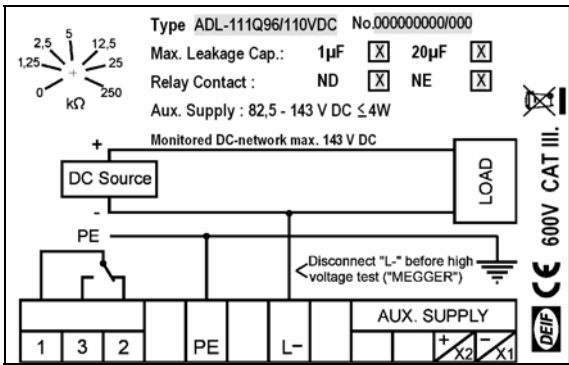
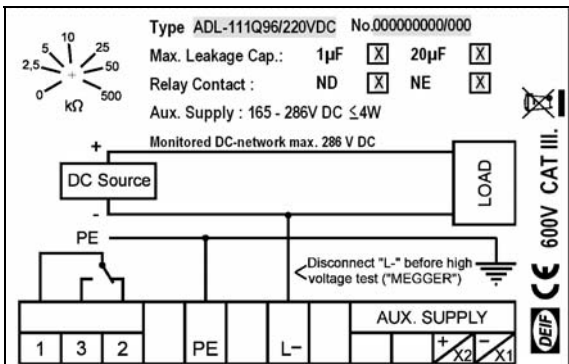


Fig. 6: Type label for 220V version



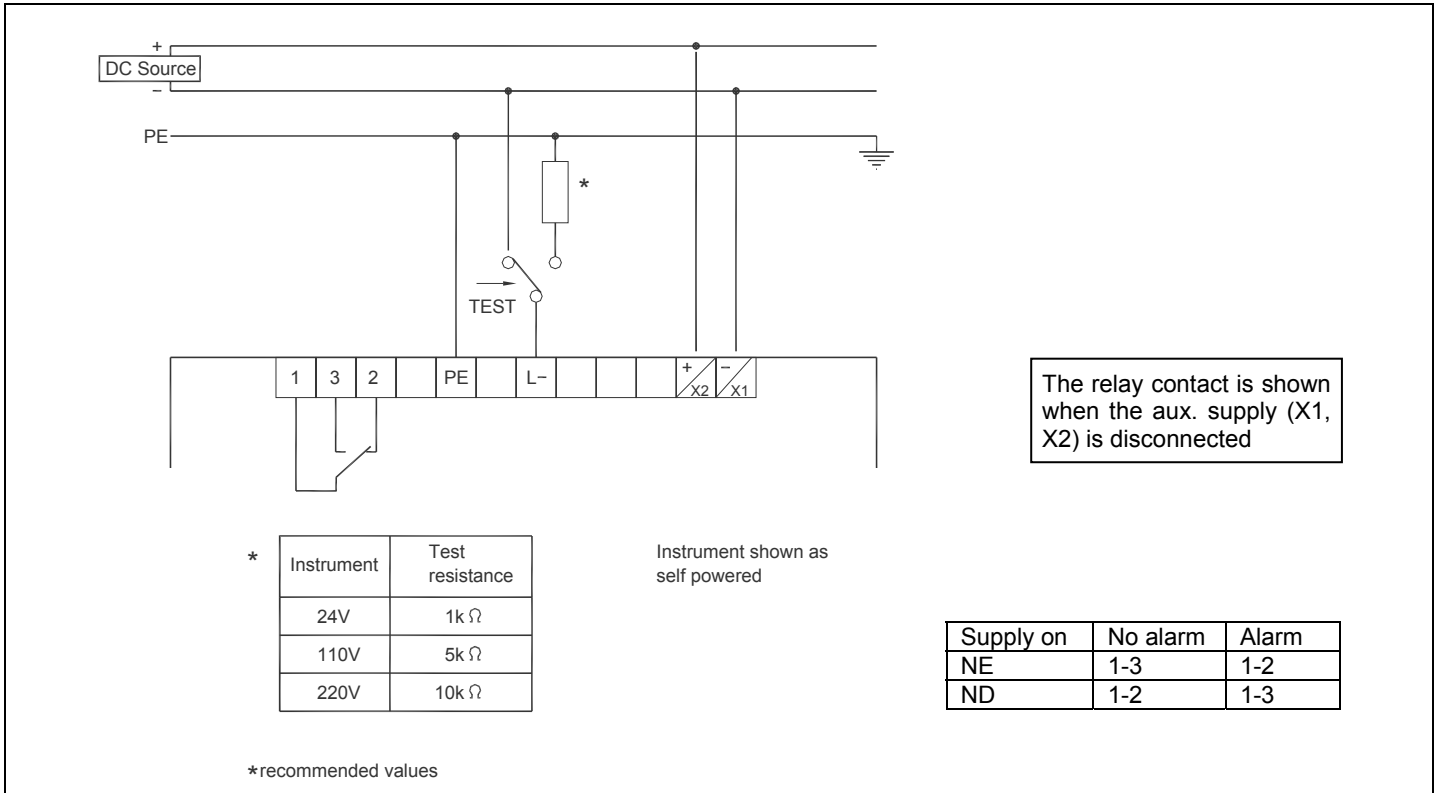
The auxiliary supply should be protected by means of a 2 A fuse.

Technical specifications

Measuring circuit (according to IEC 61557-8)	DC resistance (R_i)	ADL-111Q96/24VDC		12k Ω \pm 1%	
		ADL-111Q96/110VDC		55k Ω \pm 1%	
		ADL-111Q96/220VDC		110k Ω \pm 1%	
	Injection voltage	24V version		\pm 12V DC \pm 5%	
		110/220V version		\pm 25.5V DC \pm 5%	
	Mains voltage and auxiliary supply Corresponding scale	24V DC +30% -25%		50...0k Ω	
110V DC +30% -25%		250...0k Ω			
220V DC +30% -25%		500...0k Ω			
Leakage capacitance	Max. 1 μ F leakage capacitance or 20 μ F leakage capacitance, set by means of the S1 switch located under the cover.				
Instrument	Scale/measuring range	24V instrument		50...0k Ω	
		110V instrument		250...0k Ω	
		220V instrument		500...0k Ω	
	- Accuracy	\pm 5% of scale length			
	- Temperature drift	Max. 0.5% of scale length per 10°C			
	- Aux. supply influence	Max. 0.2% of scale length at U_s +20...-15% Max. 5.0% at scale centre at U_s -15...-20%			
	- Response time	Setting / Type	24VDC	110VDC	220VDC
1 μ F		2.0s	3.2s	5.0s	
20 μ F		11.0s	20.0s	40.0s	
Indicators					
Green LED marked SUPERVISION	The indicator is illuminated when the unit is connected to auxiliary supply, indicating that measuring is taking place. The indicator flashes until a correct value is found, or if the connected voltage is higher than specified (24V DC, 110V DC, 220V DC) +30%.				
Red LED marked FAULT	When an earth fault is measured, regardless if it is from the positive or the negative conductor, the red LED marked "FAULT" will be constantly illuminated. In the event of a symmetrical earth fault, the "FAULT" LED will be constantly illuminated.				
Relay function	Set point	24V		0...50k Ω	
		110V		0...250k Ω	
		220V		0...500k Ω	
	- Accuracy	\pm 5% of scale length for potentiometer			
	- Reproduceability	\pm 1% of scale length for potentiometer			
	- Hysteresis	\pm 2% of scale length for potentiometer			
	- Temperature drift	Max. 0.2% of scale length for potentiometer per 10°C			
	- Voltage drift	Max. 0.2% of scale length for potentiometer at U_s \pm 20%			
	- Response time	Same as instrument			
	Relay output	Change-over contact			
	Contact rating	AC1: 8A, 250V AC – DC1: 8A, 24V DC AC15: 3A, 250V AC – DC13: 3A, 24V DC Life mechanical: 2 x 10 ⁷ operations Life electrical: 1 x 10 ⁵ operations			
Relay coupling	Normally energised NE or normally de-energised ND				
General technical specifications					
EMC (see Note 1)	To IEC 61000-6-1, 61000-6-2, 61000-6-3, 61000-6-4, SS4361503 (PL4), IEC 255-4 (class 3) and IEC 61326-2-4				
Galvanic separation	Between aux. voltage and measuring circuit/relay output: 2200V (max. 1.9mA) Between measuring circuit and aux. voltage/relay output: 2200V (max. 1.9mA) Between relay output and measuring circuit/aux. voltage: 3250V (max. 2.4mA)				
Temperature	-10...55°C (nominal), -25...60°C (operating), -25...65°C (storage)				
Climate	Class HUE, to DIN 40040				
Protection	Instrument: IP52/IP54. Electronics: IP20. Terminals: IP20. To IEC 529 and EN 60529				
Connections	Screw terminals: 2.5 mm ² (multi-stranded), 4 mm ² (single-stranded)				
Materials	All plastic materials are self-extinguishing to UL94 (V0)				

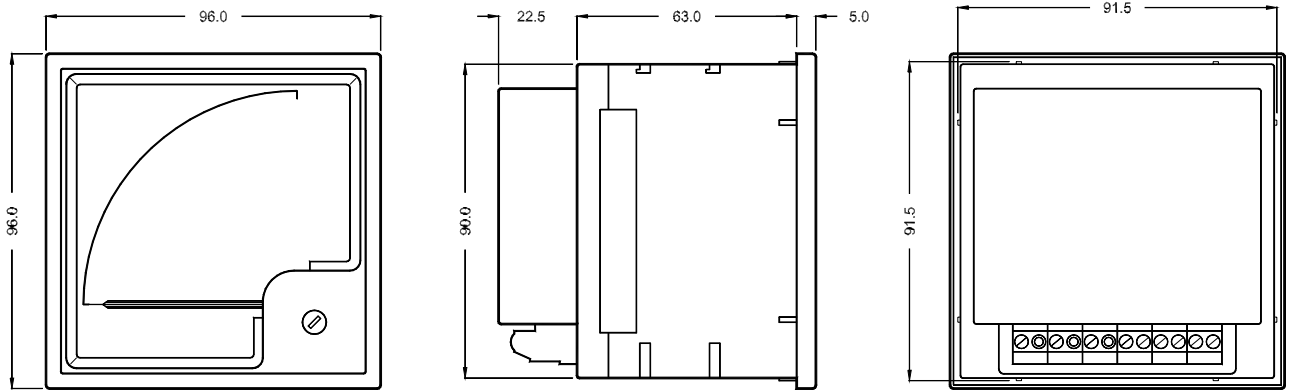
Note 1:
The ADL-111Q96/xxVDC is CE marked for residential, commercial and light industry plus industrial environment. Regarding approvals, please see our homepage, www.deif.com, and search for ADL-111Q96 under the menu Documentation.

Connection diagram



Dimensions

All dimensions in mm



ADL-111Q96/xxVDC

Weight: Approx. 0.390 kg

(Panel cutout: 92.0 x 92.0 +0.8)

Order specifications

Example:

Type

ADL-111Q96/24VDC or ADL-111Q96/110VDC or ADL-111Q96/220VDC

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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Type SIM-Q/SIM-Q LF

- **Monitoring of insulation resistance on ungrounded AC networks (IT network)**
- **Working voltage up to 690V AC, withstands up to 1000V DC**
- **Measuring range 1000...0k Ω or 10...0M Ω**
- **Working frequency down to 5Hz (LF)**
- **Alarm on exceeding the setpoint**
- **3 functions: Monitoring, fault finding, test**
- **AC and DC auxiliary voltage**

Application

The SIM-Q is used for supervision of the insulation resistance between an insulated voltage distribution network (IT network) and earth cable/safety cable. The instrument is applicable in conjunction with single phase networks and 3-phase networks with/without neutral for phase to phase voltages up to 690V AC.

This type of insulation measurement is only carried out on AC networks where the neutral/star point of the generator or supply transformer is **not** earthed.

The SIM-Q can be used for marine installations and other types of insulated voltage networks, e.g. containers. The SIM-Q is not a life guard. The SIM-Q is for protection of the power source so a critical insulation error is located before the power source is interrupted.

An AC or DC auxiliary voltage is required for the instrument. This may be selected independently of the monitored network, or the SIM-Q can be supplied by the monitored network; max. voltage for the supply is 480V. If the SIM-Q is supplied from a separate voltage source, the network can also be monitored in stand-by condition.

Because of the measuring method used, the SIM-Q is able to measure the insulation correctly on an AC power network containing all kinds of loads, such as frequency converters (see the technical specifications for working frequency range), valves with rectifiers, thyristor controlled thrusters, switch mode power supplies, transformers, generators etc. The difficulty regarding some of the above-mentioned loads is that an insulation error in e.g. a frequency converter is often located after the rectifier and before the AC output of the converter. This kind of fault will result in a high DC voltage between the power system and the safety cable, which will interrupt the measurement on an insulation monitor based on traditional ohmic resistance measuring method, see figure 4.

In AC power network installations with frequency converters operating down to 5Hz, the SIM-Q LF is the right choice.

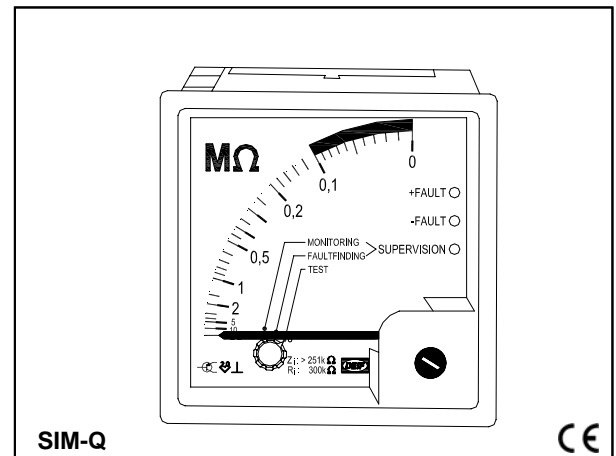
Measurement

The insulation is monitored between the complete AC network - irrespective of number of wires - and a safety cable.

The measurement is carried out by connecting the SIM-Q between the safety cable and a point on the AC

Insulation monitor

4921230020E



network (one of the 3 phases or neutral). So it is a condition for monitoring of the complete network that the remaining parts are galvanically connected. This is normally achieved via the windings in the generator or the supply transformer and also by the connected loads. If measurement of cables disconnected at both ends is required, the individual wires must be connected mutually by means of choke coils.

Measuring principle

The SIM-Q is using a measuring method, where a DC voltage is superimposed on the system under supervision. To be able to eliminate the influence from an external DC voltage, the SIM-Q is performing an automatic DC offset adjustment before every measuring cycle.

This measuring method has the disadvantage that the response time (measuring time) can become very long if the leakage capacitor in the power system is high, because the leakage capacitor has to be discharged and recharged for every measuring cycle. But the method also has the advantage that a sudden increase in leakage capacitor will not result in a false alarm, which is the case in insulation monitors based on traditional measuring methods.

The internal DC voltage generator is based on a 25V voltage source with an internal resistance >251k Ω . When this test voltage is superimposed on the power system under supervision, leakages between the power system and earth (safety cable) will induce a current, the size of which expresses the insulation resistance.

Indicators

The main indicator is the instrument. Besides the instrument the SIM-Q is equipped with 3 LED indicators, 1 green and 2 red LEDs.

Only the green indicator marked SUPERVISION is lit when the unit is connected to auxiliary supply and no insulation error is detected. If the SIM-Q detects a change in the insulation measurement, the SUPERVISION LED starts flashing with a fast rate. If the insulation error detected is fluctuating, the internal integration time is automatically extended, which is indicated by a slower flash rate. As long as the SUPERVISION LED is flashing, the latest measured value is kept and indicated on the instrument until a new value is found, then the reading on the instrument is updated and the LED is going to steady light.

Type SIM-Q

The 2 red LED indicators marked +FAULT and -FAULT are illuminated, if an insulation error below the setpoint is detected. If a DC voltage occurs on the system together with an insulation error, the +FAULT or the -FAULT LED is illuminated, indicating the polarity of the DC voltage. This function will indicate the reason for the insulation error. In case only one red LED is illuminated, the fault is to be found in a load with a built-in rectifier, e.g. a frequency converter.

If a DC voltage is detected, but the alarm limit value is not yet reached, the +FAULT or the -FAULT LED will flash to indicate that there is a DC voltage higher than 50V DC between the power system and earth (PE), but no insulation error below the alarm limit value yet, see Fig. 4.

Function switch

The following functions can be selected by means of the switch available from the front of the SIM-Q: Monitoring, fault finding and test. In normal use the switch is in position "monitoring". Because of the relatively long response time in monitoring mode, the switch is moved to position "fault finding" during location of an insulation fault, see **Note 3**. In this mode the response time is approx. 1 sec. When the switch is moved to position "test", an internal function test of the SIM-Q is carried out. The reading on the scale during the test is 0 ohm, and the relay output is activated.

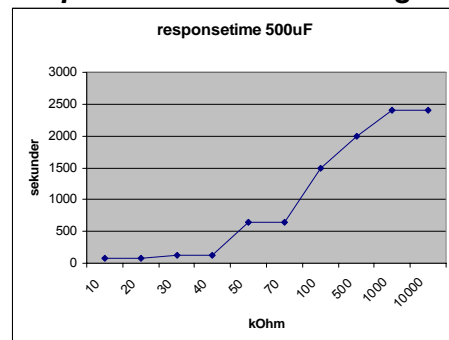
Power-up in monitoring mode

With the switch in monitoring mode, the SIM-Q will run a fast measuring mode the first 15 seconds after a power-up. This mode can be used to perform a switchboard test. When a known resistor is connected for testing, the aux. supply is disconnected and reconnected at the same time. The response time for measuring the known resistor will be approx. 6 sec. The 2 red LEDs will be illuminated, but the relay contact will not be activated. After 15 sec. the SIM-Q automatically changes to normal monitoring mode.

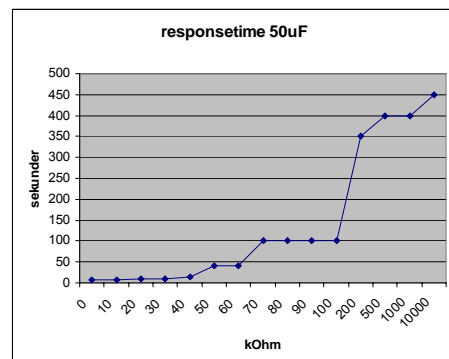
Leakage capacitors

The SIM-Q measures the insulation on a power system with total leakage capacitors (stray earth capacitance) of max. 50µF or of max. 500µF which can be set by means of a switch located under the rear cover. The switch setting for SIM-Q LF is 500µF and must never be changed to 50µF.

Response time in monitoring mode



**SIM-Q
and
SIM-Q LF**



**SIM-Q
(only)**

The response time is based on an average value based on 5 measurements. The leakage capacitor used during the test is 500µF/50µF in accordance with the diagrams.

Note:

If the insulation error is fluctuating, the above response times will be prolonged, however, no longer than the above max. values (450 sec./2400 sec.).

Response time in fault finding mode

In this mode the response time is 1 sec. irrespective of the settings 50µF or 500µF.

Measuring range/scales

1000...0kΩ corresponding to 22kΩ at scale centre.

10...0MΩ corresponding to 0.22MΩ at scale centre.

The range from the lowest permissible insulation resistance to zero is marked with red, see Fig. 1 and Fig. 2.

Scale exchange is possible through a slot in the top of the instrument. By means of a switch located under the rear cover, the SIM-Q is quickly adapted to measuring range 1000...0kΩ or 10...0MΩ.

Standard scales

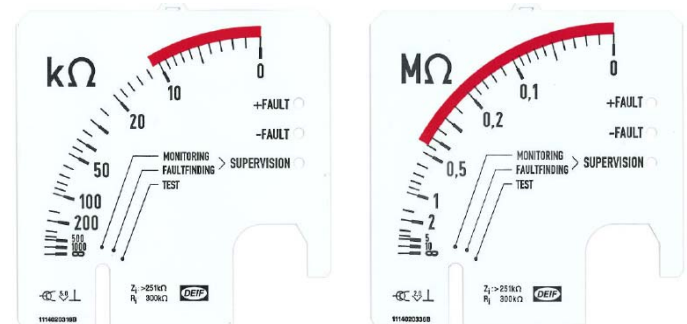


Fig. 1, 1000...0kΩ scale

Fig. 2, 10...0MΩ scale

Examples:

Fig. 1 above shows a standard 1000...0kΩ scale with a standard red section from 11 to 0kΩ.

Fig. 2 above shows a standard 10...0MΩ scale with a standard red section from 0.44 to 0MΩ.

Red section

1000...0kΩ SCALES	10...0MΩ SCALES	TYPICALLY USED FOR MAINS VOLTAGE *)
10...0kΩ	0.100...0MΩ	100V AC
11...0kΩ	0.110...0MΩ	110V AC
22...0kΩ	0.220...0MΩ	220V AC
23...0kΩ	0.230...0MΩ	230V AC
38...0kΩ	0.380...0MΩ	380V AC
40...0kΩ	0.400...0MΩ	400V AC
42...0kΩ	0.415...0MΩ	415V AC
44...0kΩ	0.440...0MΩ	440V AC
45...0kΩ	0.450...0MΩ	450V AC
48...0kΩ	0.480...0MΩ	480V AC
60...0kΩ	0.600...0MΩ	600V AC
66...0kΩ	0.660...0MΩ	660V AC
69...0kΩ	0.690...0MΩ	690V AC
-	1.000...0MΩ	-

*) The scale selected is not limited to a certain mains voltage, but often either 0.1kΩ/V or 1kΩ/V is used.

Relay output

The SIM-Q is equipped with one change-over relay contact. By means of a built-in switch located under the rear cover the relay can be configured to either:

- NE (normally energised contact). Recommended for alarm purposes. In case of an auxiliary supply drop-out the contact is immediately activated. It is recommended to supply the SIM-Q from a separate source, if this type is used.
- ND (normally de-energised contact). Recommended for control purposes. Also recommended if the auxiliary supply for the SIM-Q is taken from the same power system under supervision. An auxiliary supply failure will not result in an unwanted activation of the relay contact.

Limitations

Max. one SIM-Q can be connected for each network. If on the other hand the network is divided into a number of galvanically separated networks, e.g. by means of transformers, one SIM-Q can be installed for each individual group.

Test

If a periodical test function is required, it can be achieved as shown on the connection diagrams Fig. 5. If a value less than the preset limit value set on the potentiometer is selected as test resistance, alarm is obtained upon activation of the shown test button. If the test is carried out in monitoring mode it is recommended to arrange the test button, so the SIM-Q will be reset just before the test is carried out; otherwise the test time can at worst be as long as 450 seconds with a setting of 50µF and 2400 seconds with a setting of 500µF. Please notice that if the reset is performed before the testing is carried out, the relay output is inhibited. This can be useful if no alarm is wanted during the testing; on the other hand, if an alarm is wanted it is recommended to set the switch in fault finding position. No reset of the SIM-Q is needed to obtain fast response (approx. 1 sec.), with the switch in this position the alarm output will be activated during the test. If only a function test of the SIM-Q is needed, just set the switch in test position, and then you can observe that the LEDs are lit, the reading is zero ohm and the alarm is transmitted.

Warning:

If the installation is to be tested by means of a high-voltage "MEGGER", the measuring leads to the SIM-Q at terminal "P" must be disconnected before testing is carried out. Omitting this may result in damage to the SIM-Q, if the test voltage is higher than 1000V AC/DC. Besides the insulation test will be affected by the built-in DC voltage generator impedance (251kΩ).

Setpoint adjustment

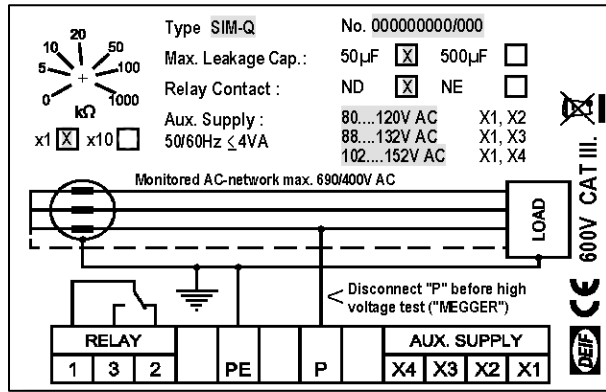
The alarm setpoint can be adjusted by means of the potentiometer with kΩ scale located on the rear of the instrument (see Fig. 3). When range "x10" is marked, the scale values on the kΩ scale are multiplied by 10.

If a known resistor is mounted across the terminals marked P and PE, the setpoint can be adjusted precisely. It is recommended to set the switch in fault finding position to have a fast response time when the adjustment of setpoint is performed.

Typical setting of the alarm limit:

Typically, the alarm limit is adjusted to match the max. insulation resistance value indicated on the red section of the scale.

AC version:



DC version:

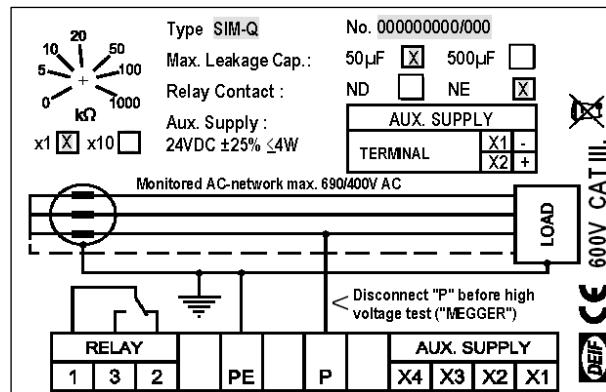


Fig. 3

Illustration of an insulation error in a load with rectifiers

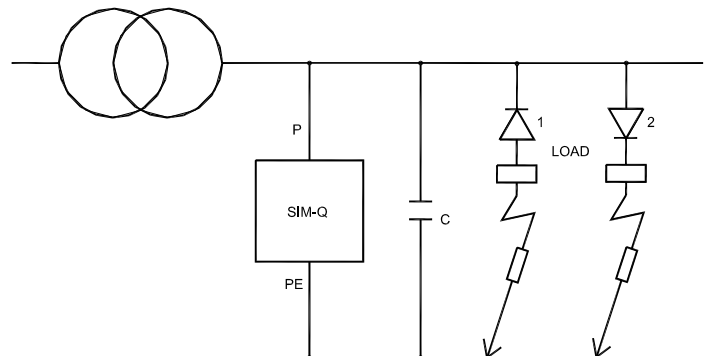


Fig. 4

The capacitor marked C illustrates the leakage capacitor.

The P and PE are connectors on the SIM-Q.

The diodes marked 1 and 2 illustrate the rectifier in the load.

If the situation is as illustrated at diode marked 2, the +FAULT LED is illuminated.

If the situation is as illustrated at diode marked 1, the -FAULT LED is illuminated.

Technical specifications

Measuring circuit	DC resistance (R_i):	300k Ω \pm 1%		
	AC impedance (Z_i):	251k Ω \pm 1% at 50Hz		
	Measuring output voltage:	\pm 25V DC \pm 5%		
	Mains input voltage:	Max. 690V AC +20% continuously/max. 1000V DC continuously		
	Leakage capacitance:	SIM-Q: Selectable max. 50 μ F or max. 500 μ F leakage capacitor	SIM-Q LF: Max. 500 μ F leakage capacitor (fixed setting)	
	Frequency working range:	SIM-Q: 20...500Hz	SIM-Q LF: 5...500Hz	
Instrument	Measuring scale range:	1000k Ω with scale centre at 22k Ω	10M Ω with scale centre at 0.22M Ω	
	- Accuracy monitoring mode:	\pm 5% of scale length (1000k Ω)	\pm 2% of scale length (10M Ω)	
	- Accuracy fault finding mode:	\pm 10% of scale length (1000k Ω)	\pm 5% of scale length (10M Ω)	
	- Temperature drift:	Max. 0.5% of scale length per 10°C/2% in fault finding mode		
	- Aux. supply influence:	Max. 0.2% of scale length at U_s +20...-15% Max. 5.0% at scale centre at U_s -15...-20%		
	- Response time:	Depends on the actual insulation error/leakage capacitor and the function selected (see section <i>Response time</i>)		
	Scale:	Exchangeable, with red section		
Indicators				
Green LED marked SUPERVISION	The indicator is illuminated when the unit is connected to auxiliary supply and no insulation error is detected. If the SIM-Q detects a change in the measurement, the SUPERVISION LED starts flashing with a fast flash rate. If the integration time (measuring time) is changed to a higher value, the LED will flash with a slower and slower rate. As long as the SUPERVISION LED is flashing, the last reading is kept.			
Red LEDs marked +FAULT -FAULT	Both indicators are illuminated, if a DC potential free insulation error below the setpoint is detected. If there is a DC component on the system, the +FAULT LED or the -FAULT LED is illuminated, indicating the polarity of the DC voltage. If a DC voltage >50V DC is detected, but the insulation error is higher than the setpoint, the +FAULT LED or the -FAULT LED will flash to indicate that there is a DC component between the power system and earth (safety cable).			
Function switch				
Monitoring	Normal position of the switch for supervision of the insulation.			
Fault finding	Use this position during location of an insulation error to obtain short response time (see Note 3).			
Test	In this position the SIM-Q is simulating an insulation resistance of 0 ohm, the 2 red LEDs are illuminated and the relay output is activated.			
Relay function	Setpoint:	0...1000k Ω for 1000k Ω scale range	0...10,000k Ω (x10) for 10M Ω scale range	
	- Accuracy:	\pm 5% of scale length for potentiometer		
	- Reproduceability:	\pm 1% of scale length for potentiometer		
	- Hysteresis:	\pm 1% of scale length for potentiometer		
	- Temperature drift:	Max. 0.2% of scale length for potentiometer per 10°C		
	- Voltage drift:	Max. 0.2% of scale length for potentiometer at U_s \pm 20%		
	- Response time:	Same as instrument		
	Relay output:	Change-over contact		
	Contact rating:	AC1: 8A, 250V AC – DC1: 8A, 24V DC AC15: 3A, 250V AC – DC13: 3A, 24V DC Life mechanical: 2 x 10 ⁷ operations Life electrical: 1 x 10 ⁵ operations		
	Relay coupling:	Normally energised NE or normally de-energised ND		
General technical specifications				
Auxiliary voltage:	Select between: 24V DC \pm 25% \leq 4W or 100, 110, 127V AC or 220, 230, 240V AC or 400, 450, 480V AC \pm 20% 40...70Hz, \leq 4VA			
EMC (see Note 1):	To EN 61000-6-1, EN 61000-6-2, EN 61000-6-3, EN 61000-6-4, IEC 60255-22-1			
Galvanic separation:	Relay output/measuring circuit/aux. voltage: 3.25kV - 50Hz - 1 min.			
Temperature:	-10...55°C (nominal), -25...60°C (operating), -25...65°C (storage)			
Climate:	97% RH, IEC 60068-2-30, test Db			
Protection:	Instrument: IP52. Electronics: IP20. Terminals: IP20. To IEC 529 and EN 60529			
Safety (see Note 2):	600V Cat. III Pollution degree 2 according to IEC 61010-1			
Connections:	Screw terminals: 2.5 mm ² (multi-stranded), 4 mm ² (single-stranded)			
Materials:	All plastic materials are self-extinguishing to UL94 (V0)			

Note 1: The SIM-Q is CE-marked for residential, commercial and light industry plus industrial environment. Regarding approvals, please see our homepage, www.deif.com, and search for SIM-Q under the menu Documentation.

Note 2: If PE is disconnected from the SIM-Q, the safety is 300V Cat. III.

Type SIM-Q

Note 3: If the power system is a type where a DC voltage cannot occur between the power system and the PE, the switch can be in position fault finding mode also during supervision. In this mode the SIM-Q is working as a standard ohmic meter and will then indicate the actual insulation with a response time of 1 sec. In fault finding mode the SIM-Q is equipped with an inverter function; this function is activated if a DC voltage is present on the measuring input, securing that the reading on the instrument will be inside the normal scale range. When the function is active the insulation value measured will not be correct. If unexplained insulation errors are detected from time to time in this mode, then set the switch back to monitoring mode and use the fault finding mode only during location of an insulation error.

Connections

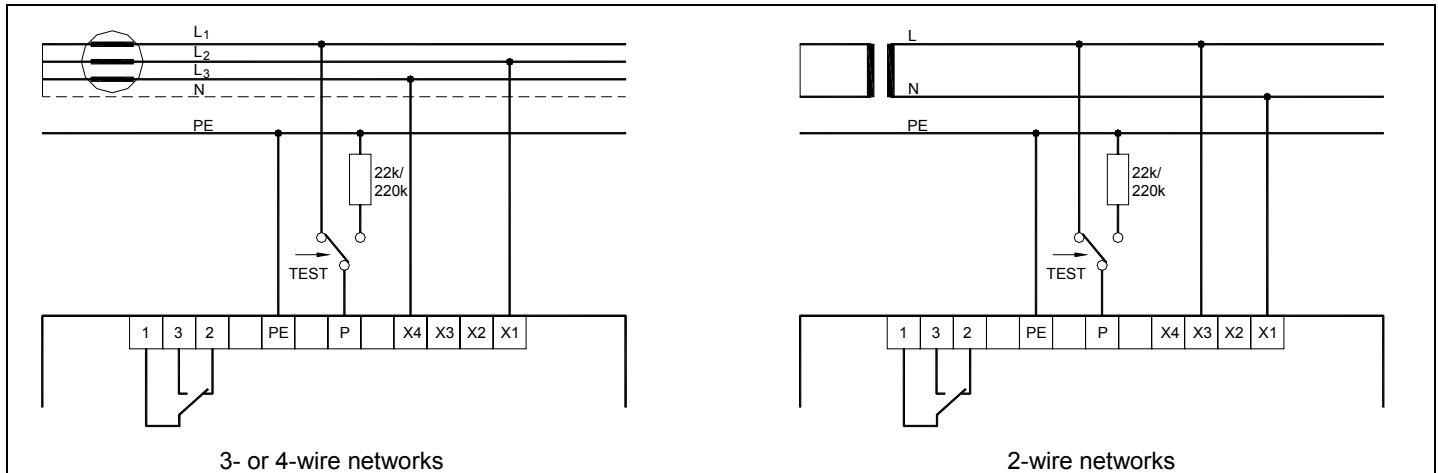
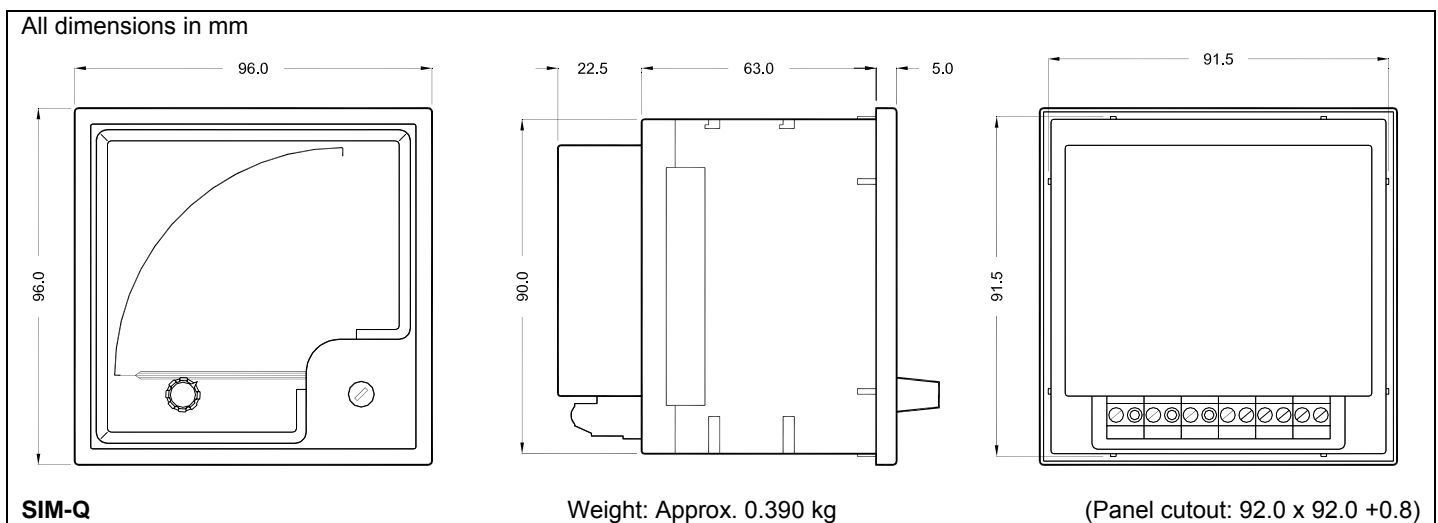


Fig. 5

Dimensions

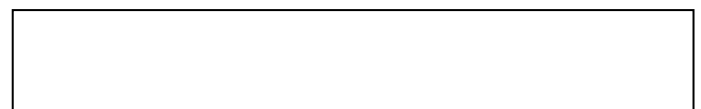


Order specifications

Example 1:					
Type	Scale range	Red section*	Relay NE/ND	Max. leak. cap.	Nominal aux. voltage
SIM-Q	1000...0k Ω	69...0k Ω	NE	50 μ F	400V AC
Example 2:					
Type	Scale range	Red section*	Relay NE/ND	Nominal aux. voltage	
SIM-Q LF	10...0M Ω	0.44...0M Ω	ND	400V AC	

* Please see the table on page 2.

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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Insulation monitors

Type AAL-111Q96

4921230011J



- *Monitoring of insulation resistance*
- *High or low ohms measurement*
- *Alarm on low insulation resistance*
- *Interchangeable scales*
- *AC or DC auxiliary voltage*

Application

The AAL-111Q96 is used for supervision of the insulation resistance between an insulated low-voltage distribution network and earth cable/safety cable. The instrument is applicable in conjunction with single phase networks and 3-phase networks with/without neutral for voltages up to 440V AC. The AAL-111Q96 is CE marked for residential, commercial and light industry plus industrial environment.

This type of insulation measurement is only carried out on AC networks where the neutral/star point of the generator or supply transformer is **not** connected to earth.

The AAL-111Q96 is used for marine installations and other types of insulated low-voltage networks.

An AC or DC auxiliary voltage is required for the instrument. This may be selected independently of the monitored network. The instrument is supplied for either an AC auxiliary voltage with transformer taps for all typical nominal voltages between 100V and 440V or for 24V DC. Instruments for AC auxiliary voltage may be fed by the monitored network. If the instrument is fed by a separate voltage source, the current network may also be monitored in power-down condition.

A high insulation resistance between the mains supply and the hull of a ship is of importance because of safety and counteraction of galvanic corrosion of the hull. Another typical application is monitoring of the insulation resistance of transformer-coupled supply voltages in a control room.

Measurement

The insulation is monitored between the complete AC network - irrespective of number of wires - and an earthed safety cable.

The measurement is carried out by applying a DC voltage between a point on the safety cable and a point on the AC network (see Fig. 2). So it is a condition for monitoring of the complete network that the remaining parts are galvanically connected. This is normally achieved via the windings of the generator or the supply transformer and the connected loads.

If measurement of cables disconnected at both ends is required, the individual wires must be mutually connected by means of choke coils.

Measuring principle

Leakages between the AC network and earth will induce a current, the size of which expresses the insulation resistance. The current is processed in an amplifier circuit, the output signal of which is fed to a relay circuit and an indicating instrument equipped with a scale graduated in ohms. If this exceeds a preset limit, the built-in relay is deactivated (normally energised) and a red LED marked "FAULT" is lit. If the failure current then drops below the limit value, the relay is activated and the LED marked "FAULT" is switched off. The relay circuit is not provided with a hold-on function.

A green LED marked "READY" indicates whether the auxiliary voltage of the instrument is present. If this auxiliary voltage drops out, the built-in relay is deactivated which results in transmission of an alarm signal.

The two LEDs are visible through holes in the scale.

Power up

Notice that during power-up the AAL-111Q96 will indicate a leakage for about 1 sec. depending on the actual leakage capacitor. This will result in activation of the relay and transmission of an alarm.

Measuring ranges

The AAL-111Q96 can be delivered with 2 different measuring ranges, either 1...0M Ω (scale centre 0.022M Ω) or 10...0M Ω (scale centre 0.22M Ω).

Standard scales

The lowest permissible insulation resistance for an insulated network is typically either 0.1k Ω /V or 1k Ω /V (calculated according to nominal phase to phase voltage on 3-phase networks). This lower insulation resistance limit is selected on the basis of varying national standards, or it is determined by a classification society for measurements on marine installations.

This means that for any typical nominal mains voltage, a scale corresponding to both 0.1k Ω /V and 1k Ω /V is available. The range from the lowest permissible insulation resistance to zero is marked in red.

Scale exchange is possible through a slot in the top of the instrument, thereby enabling quick adaption to the mains voltage in use and the required insulation resistance limit.

The following **standard** scales are available:

Standard scales

1...0MΩ SCALES	10...0MΩ SCALES	TYPICALLY USED FOR MAINS VOLTAGE *)
0.010...0MΩ	0.100...0MΩ	100V AC
0.011...0MΩ	0.110...0MΩ	110V AC
0.012...0MΩ	0.120...0MΩ	120V AC
0.022...0MΩ	0.220...0MΩ	220V AC
0.023...0MΩ	0.230...0MΩ	230V AC
0.024...0MΩ	0.240...0MΩ	240V AC
0.038...0MΩ	0.380...0MΩ	380V AC
0.040...0MΩ	0.400...0MΩ	400V AC
0.042...0MΩ	0.415...0MΩ	415V AC
0.044...0MΩ	0.440...0MΩ	440V AC

*) The scale selected is not limited to a certain mains voltage, but often 0.1kΩ/V or 1kΩ/V is used.

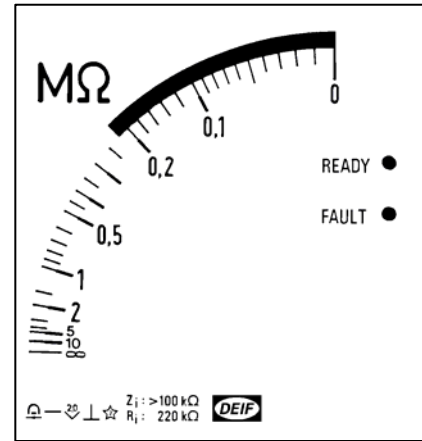


Fig. 1

Limitations

Max. one instrument per insulated network may be connected. If the network on the other hand is divided into a number of insulated networks, e.g. by means of transformers, one measurement may be carried out for each individual group.

Test

If a periodical test function is required, this can be achieved as shown on the connection diagrams. If a value less than the preset limit value is selected as test resistance, alarm is obtained upon activation of the test button.

Warning: If the installation is to be tested by means of a high-voltage "MEGGER", the measuring leads to the AAL-111Q96 at terminal "p" must be disconnected before testing is carried out. Omitting this may result in damage to the AAL-111Q96.

If the installation contains directly connected AC loads with rectifiers such as magnetic valves or frequency converters, an error in this type of loads will result in indication error and error alarm on the AAL-111Q96. It is recommended to use SIM-Q instead of AAL-111Q96 to avoid this problem.

Setpoint

The requested limit value is set on an ohm scale on the rear of the instrument (see Fig. 2).

Range "x1" is marked:

The actual limit value is set directly on the ohm scale.
(For all instrument scales with "22kΩ" at scale centre).

Range "x10" is marked:

The scale values on the ohm scale are multiplied by 10.
(For all instrument scales with "220kΩ" at scale centre).

Typical setting

Insulation resistance corresponding to lower limit of the section marked with red on the scale.

Marking

On the rear of the instrument, blank squares are provided for marking of:

Auxiliary voltage: AC or DC (fixed)
Measuring range: "x1" or "x10" (fixed)

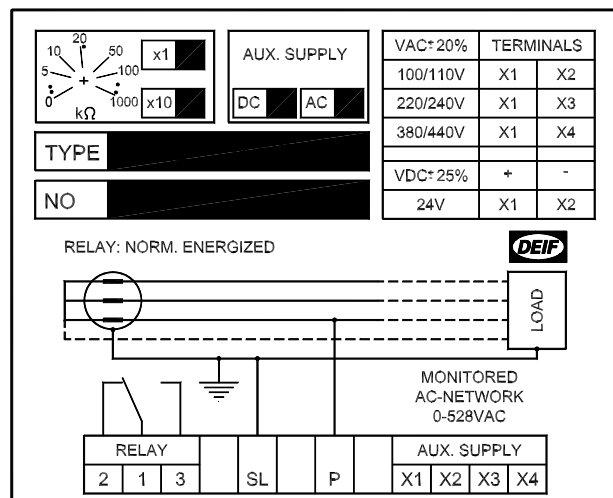


Fig. 2

Technical specifications

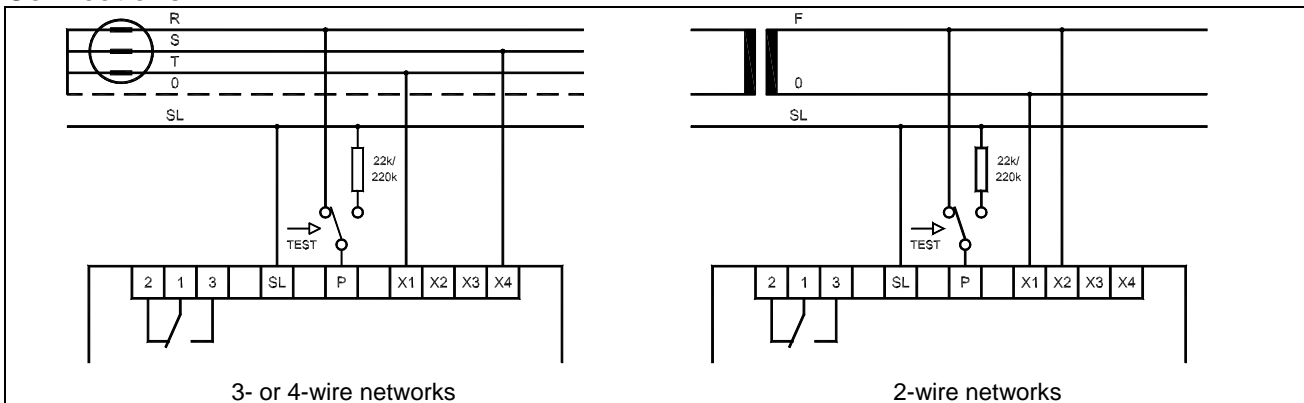
Measuring circuit	DC resistance (R_i):	22kΩ or 220kΩ ±5% (dependent on scale range)
	AC impedance (Z_i):	>100kΩ at 50Hz
	Measuring output voltage:	12V DC ±10%
	Mains input voltage:	Max. 440V AC +20% continuously
Instrument	Measuring scale range:	1MΩ with scale centre at 0.022MΩ or 10MΩ with scale centre at 0.22MΩ
	- Accuracy:	±2% of scale length
	- Temperature drift:	Max. 0.5% of scale length per 10°C
	- Voltage drift:	Max. 0.2% of scale length at U_s ±20%
	- Response time:	0.1kΩ/V: 1 s, 1kΩ/V: 3 s
	Scale:	Exchangeable, with red section

Relay function	Setpoint	0...1000kΩ for 1MΩ scale range	0...10,000kΩ (x10) for 10MΩ scale range
	- Accuracy:	±5% of scale length	
	- Reproduceability	±1% of scale length	
	- Hysteresis:	±2% of scale length	
	- Temperature drift:	Max. 0.2% of scale length per 10°C	
	- Voltage drift:	Max. 0.2% of scale length at U _s ±20%	
	- Response time:	0.1kΩ/V: 1 s, 1kΩ/V: 3 s	
	- Indication:	Red LED is lit when resistance is lower than setpoint	
	Relay output:	Change-over contact	
	Contact rating:	250V - 2A - 400VA (AC). 250V - 1A - 50W (DC)	
Relay coupling:	Normally energised		

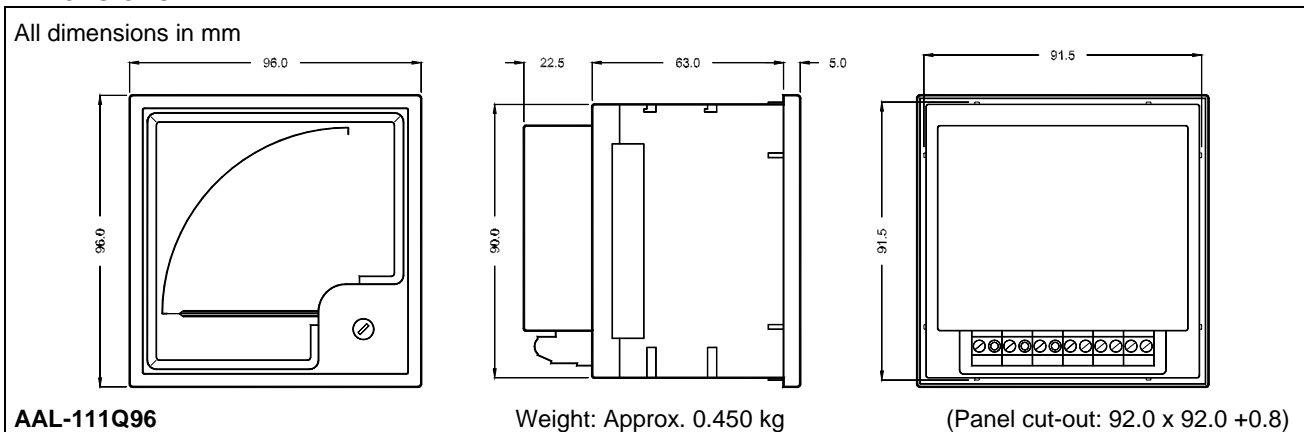
General technical specifications

Auxiliary voltage:	Select between: DC : 24V DC ±25% (ca. 4W) or AC : 100, 110, 220, 230, 240, 380, 415, 440V AC ±20%, 45...65Hz (ca. 4VA)
"READY" indication:	Green LED is lit, when auxiliary voltage is present
EMC:	To EN 61000-6-1, EN 61000-6-2, EN 61000-6-3, EN 61000-6-4, IEC 60255-22-1
Galvanic separation:	Relay output/measuring circuit/aux. voltage: 2kV - 50Hz - 1 min.
Temperature:	-10...55°C (nominal) -25...60°C (operating), -25...65°C (storage)
Climate:	97% RH, IEC 60068-2-30, test Db
Protection:	Instrument: IP52 (IP54 as option). Electronics: IP20. Terminals: IP20. To IEC 529 and EN 60529
Connections:	Screw terminals: 2.5 mm ² (multi-stranded), 4 mm ² (single-stranded)
Materials:	All plastic materials self-extinguishing to UL94 (V0)

Connections



Dimensions



Order specifications

	Type	Scale range	Red section	Auxiliary voltage
Example 1:	AAL-111Q96	1...0MΩ	0.022...0MΩ	DC
Example 2:	AAL-111Q96	10...0MΩ	0.44...0MΩ	AC

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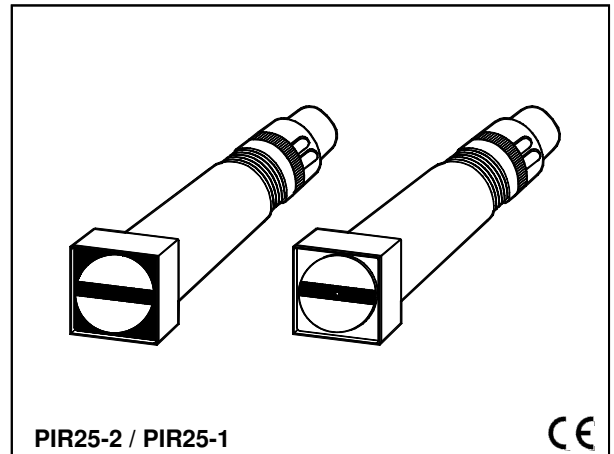


Types PIR25-1, PIR25-2

Remote position indicators

4921210033E

- **PIR25-2: "round" (black focusing screen)**
- **PIR25-1: "square" (white focusing screen)**
- **Indication of circuit breaker position**
- **Indication of tie breaker position**



Application

The position indicators types PIR25-1 and PIR25-2 provide remote indication of the position of switches, circuit breakers, solenoid valves, relays etc. The PIR25-1 and PIR25-2 are CE marked for residential, commercial, light industry plus industrial use.

PIR25-1 and PIR25-2 can be used in mimic diagrams or control panels.

The indicator disc is controlled by a moving magnet system. When no voltage is connected, the indicator disc stays in a diagonal position. When voltage is connected to one coil, the indicator disc rotates clockwise. When the other coil is activated, the indicator disc rotates counter-clockwise.

Technical specifications

Nominal voltages: 24-48-110-230V AC/DC
(Max. working voltage 300V)

Consumption at nominal voltages: 1.5VA

Materials: Polycarbonate UL94VO

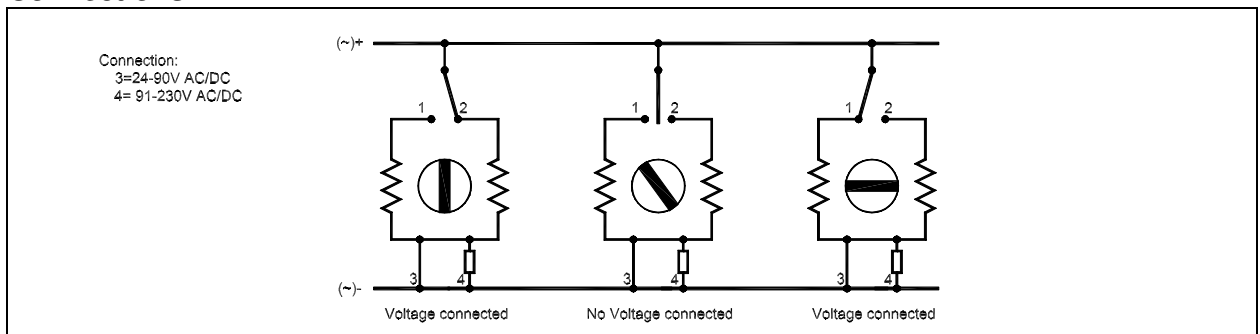
Protection: IP54

Test voltage: To EN 61010-1

EMC: To EN 50081-1/2 + EN 50082-1/2

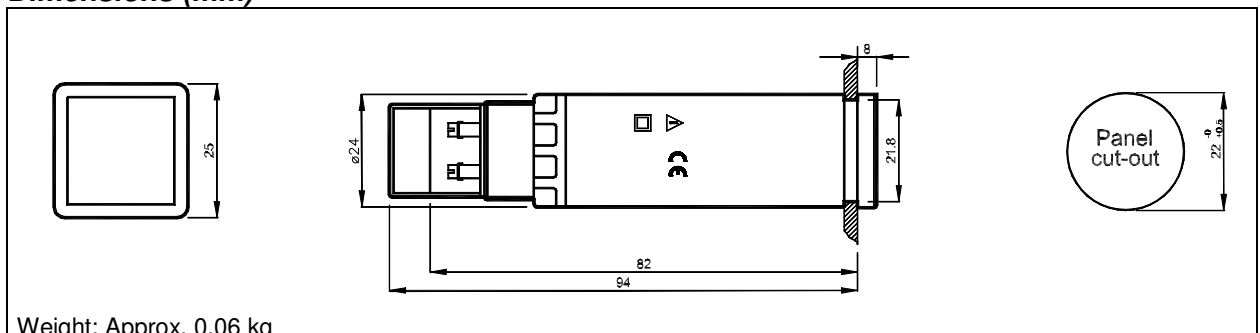
Connections: Screw, max. 1.5 mm² (IP 00)

Connections



Note: When PIR25 is applied for supply 91-230V AC/DC, other indicators (lamps) between terminals 1 + 4 and 2 + 4 must never be connected.

Dimensions (mm)



Types PIR25-1, PIR25-2

Order specifications

Example:	Type PIR25-2
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-power in control-

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Type HC48

- For AC or DC measuring voltage
- AC: Synchronous motor, DC: Step motor
- Standard IP40. Special version IP65
- In DIN size case, 48 x 48 mm, aluminium clamp mounting
- Adapter frames: 55 x 55 mm, 72 x 72 mm

Application

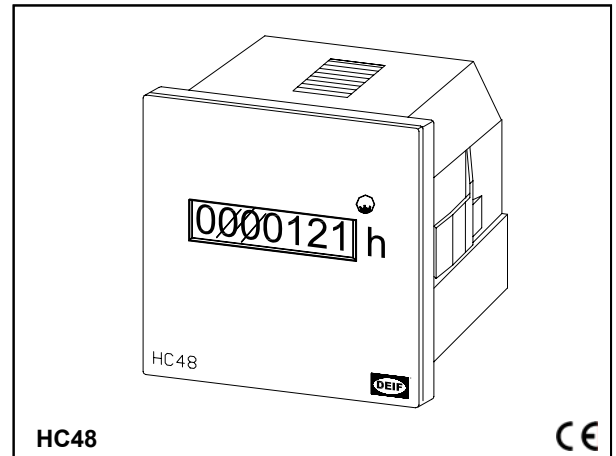
Hour meters HC48 are designed for the determination and monitoring of operating time, warranty period and maintenance intervals on electrically driven machines and devices, mainly in mechanical processing, woodworking, textile and paper industry, on central heating boilers, electrical furnaces, power drives and rectifiers etc. They are available in a variety of mounting techniques, for all common voltages and with a mounting depth of only 32 mm. As a special version, they offer a fully sealed plastic housing. Hour meters are connected in parallel to the control circuit behind the start gear, thus working only during the operation of a machine or device. The hour meters cover a time range from 0 to 99,999.99 h (AC) resp. 999,999.9 (DC). They restart automatically at 0 when leaving the range limit. There is no separate reset facility.

Technical specifications

Connection:	AC and DC: combined - flat pins 6.3 x 0.8 mm with screw terminals simple – flat pins 6.3 x 0.8 mm
Supply voltage:	AC: 24V, 110V, 230V, 400V (±10%) DC: 10-48V, 110V (±10%)
Mains frequency:	AC: 50Hz, 60Hz
Motor:	AC: synchronous motor; DC: step motor
Protection class:	AC and DC: IP40 front side
Operating temp. range:	AC: -25°C....+70°C; DC: -20°C....+55°C
Reading accuracy:	AC: 1/100 hour (36 sec.); DC: 1/10 hour (6 min.)
Counting range:	AC: 99,999.99 hours; DC: 999,999.9 hours
Number of digits:	AC: 5 integers, 2 decimals; DC: 6 integers, 1 decimal

Running hours counters

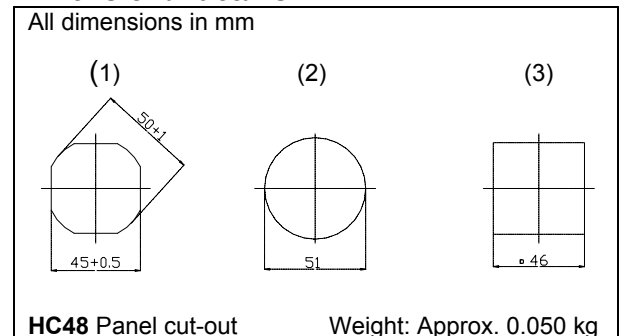
4921210090D



The following data applies for AC and DC:

Digit size:	4 mm
Digit colour:	Integers (white), decimals (red)
Housing colour:	Black
Mounting:	Aluminium clamp A, snap fastener F, DIN-rail D. When ordering mounting type aluminium clamp A or DIN-rail D, it is possible to dismount the aluminium clamp or the adaptor for DIN-rail, thus obtaining mounting type F. Please note that the panel cut-out must be (1) for this application.
Front dimensions:	48 x 48 mm
Adapter frames:	55 x 55 mm, 72 x 72 mm
Special versions:	IP65 (only mounting aluminium clamp A and no frame)
EMC:	EN50081-1 and EN50082-2

Dimensional details



Type HC48

Mounting instructions

Mounting A

x (mm)	y (mm)	Mounting hole
48 x 48	6	1
55 x 55	7	1, 2 or 3
72 x 72	7	1, 2 or 3

Mounting F

x (mm)	y (mm)	Mounting hole
48 x 48 mm	6	1

Mounting D

Order specifications

Type	Measuring voltage	(Frequency)
Examples: HC48	230V AC	50 Hz
HC48	10-48V DC	-
HC48	400V AC	60 Hz
Mounting	Adapter frame	Protection class
D	No	IP40
A	72 x 72 mm	IP40
A	No	IP65

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-power in control-

Running hours counters

Type HC 36/24

4921210080B



- *Compact design (36 x 24 mm)*
- *Synchronous motor (AC version)*
- *Step motor (DC version)*
- *7 digits read-out (whole figures white, decimals red/black)*
- *For flush mounting*

Application

The running hours counters type HC 36/24 are applied for indication of the operating time (running hours) of all electrically driven machines and devices, e.g. electric motors, electric furnaces, central heating boilers, rectifiers.

As the HC 36/24 is connected in parallel to the electric circuit of the equipment to be monitored, its counter only runs when the equipment is started.

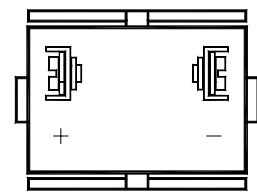
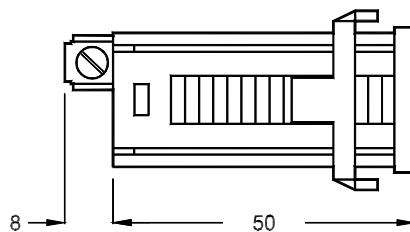
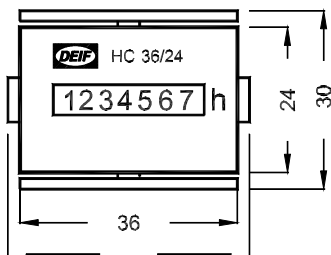
The HC 36/24 is CE marked for residential, commercial and light industry plus industrial environment.

Technical specifications

	AC voltages	DC voltages
Counting range	99999.99 hours The meter then automatically resets to zero	999999.9 hours The meter then automatically resets to zero
Resolution	1/100 hours (36 s)	1/10 hour (6 min.)
Digits	4 mm x 1.7 mm - optical. Figures: white. Decimals: red (AC versions for 60Hz: black)	
Measuring voltage	24-110-230V AC $\pm 10\%$	12...36V DC, 110V DC $\pm 10\%$
Consumption	Approx. 1W at 230V 50Hz	0.04...0.2W at 12...36V DC
Frequency	50Hz or 60Hz	
Motor	Synchronous	Step
Temperature	-10...55°C (nominal) -25...55°C (operating) -25...60°C (storage)	-10...55°C (nominal) -10...55°C (operating) -25...60°C (storage)
Climate	Class HVE, to DIN 40040	Class JVE, to DIN 40040
Test voltage	2kV - 50Hz - 1 min., to EN 61010-1	
EMC	To EN 50081-1/2 and EN 50082-1/2	
Connections	Flat pins: 6.3 x 0.8 mm with screw terminal	
Protection	Housing: IP40. Terminals: IP00. To EN 60529 and IEC 529	

Dimensions

All dimensions in mm



HC 36/24

Panel cut-out: 22 x 33 mm +0.5

Weight: approx. 0.040 kg

Order specifications

Examples:	Type	Measuring voltage	(Frequency)
	HC 36/24	230 V AC	60Hz
	HC 36/24	12...36V DC	

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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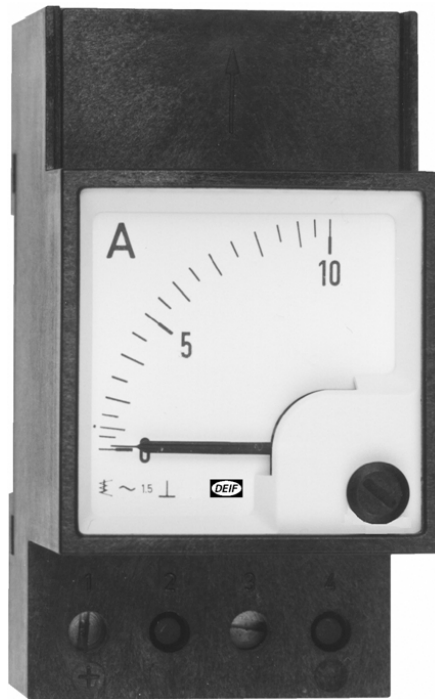
Tel.: +45 9614 9614, Fax: +45 9614 9615
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DIN rail instruments

Type B45-x, D45-x, E45-x

4921210027G



- *AC and DC measurement*
- *Exchangeable scale*
- *For mounting on DIN rail*
- *Compact and robust*

Technical specifications

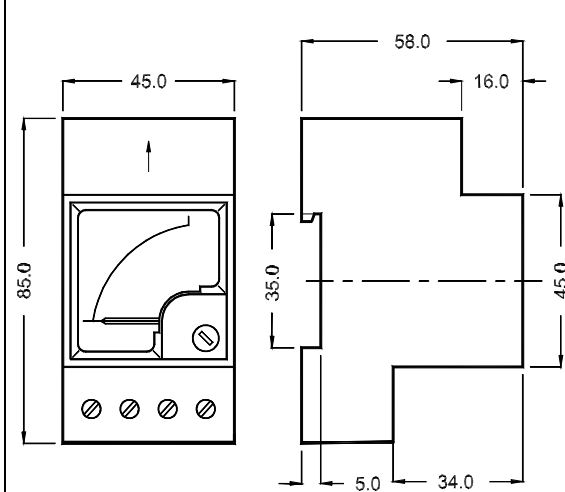
Accuracy:	Class 1.5 (-10...15...30...55°C), to EN 60051 and IEC 51.
Scale length:	Approx. 41 mm.
Standard scale:	Always 120% of the current transformer. Exchangeable scale. End values: 6-12-18-24-30-36-48-60-72-90-96 and multiples of 10 thereof.
Ambient temperature:	-10...55°C (nominal), -25...60°C (operating), -25...65°C (storage).
Test voltage:	2kV.
Working range:	E 45 (moving iron). Ammeters are designed according to EN60051-2 (Item 6.4.1 and 6.4.2). Continuous overload: $I_N \times 1.2$. Short duration overload: $I_N \times 5$ for 5 sec. $I_N \times 10$ for 0.5 sec. Valid for -/1A, -/5A and direct connections. (Both for moving iron and bimetallic).
EMC:	To EN 50081-1/2 and EN 50082-1/2. CE marked for residential, commercial and light industry plus industrial environment.
Protection:	Housing: IP52. Terminals: IP20. To IEC 529 and EN 60529.
Mounting:	Designed for mounting on DIN rail, 35 x 15 mm, to EN 50022.

Type B45-x: bimetallic instruments for AC measurement Type D45-x: moving coil instruments for DC measurement Type E45-x: moving iron instruments for AC measurement		
Type	Measuring range - V	Measuring range - A
B45-x	-	8min/5A
D45-x	1V...300V (incl. 0...60mV/5mA) ¹	1mA...600mA (incl. 4...20mA) ¹
E45-x	6V...400V ²	100mA...25A ²

- 1) Standard measuring ranges: 1 - 1.5 - 2.5 - 4 - 5 - 6 and multiples of 10 thereof.
Cat. III 300V max. (515V ph-ph (300 x $\sqrt{3}$))
- 2) Standard measuring ranges: 1 - 1.5 - 2.5 - 4 - 6 and multiples of 10 thereof.

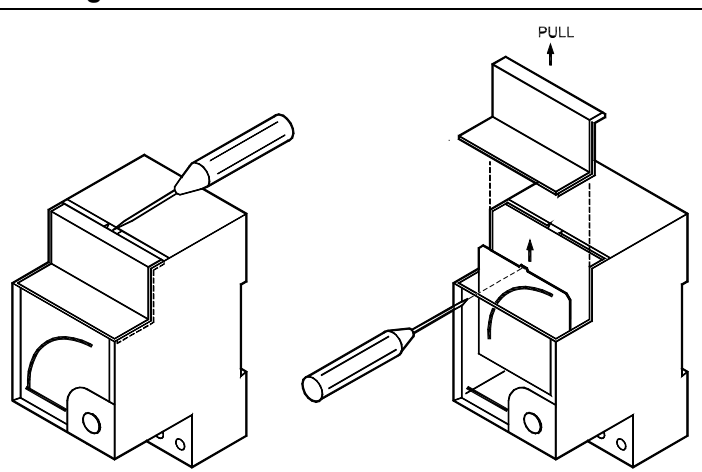
Dimensions

All dimensions in mm



B45-x, D45-x, E45-x Weight approx. 0.1 kg

Exchange of scale



1. Insert a screwdriver into the slot in the cover and pull up the cover.
2. Using the screwdriver, pull up the scale.

Order specifications

Examples:	Type	Scale	Measuring range	Current transformer
	B45-x	0...600A	8min/5A	500/5A
	D45-x	0...200%	4...20mA DC	
	E45-x	0...10A	0...10A AC	

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Alarm panels

Type AL8-2

4921230002D



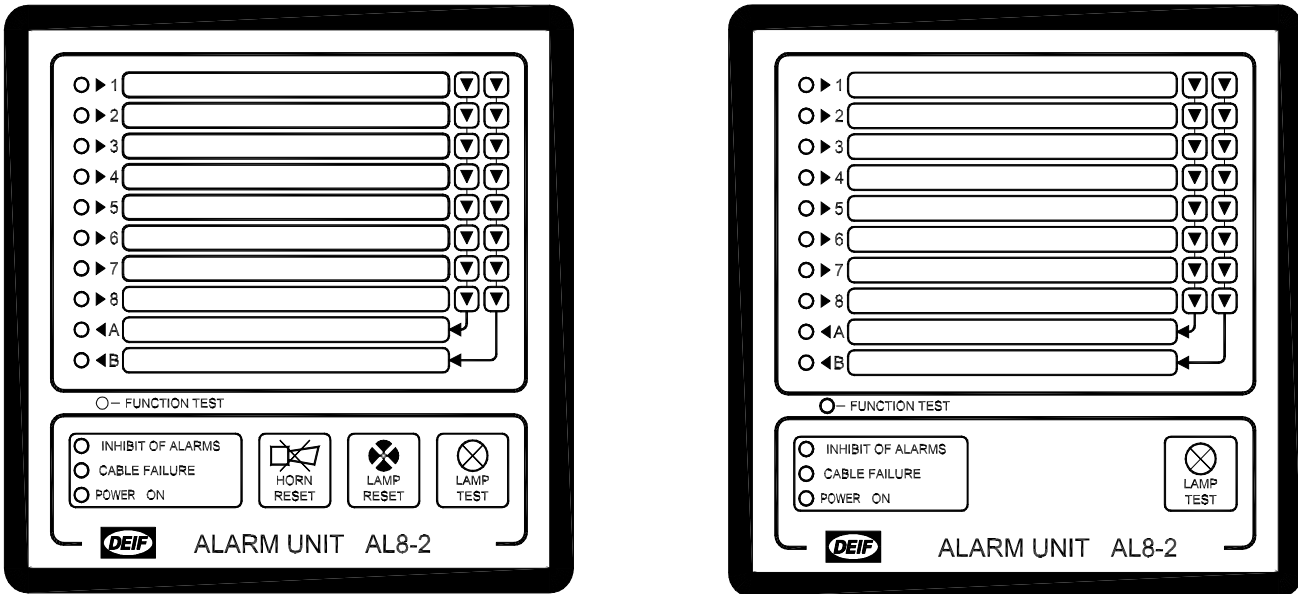
- **Compact Q96 design**
- **Extremely easy push-button programming (no jumpers or the like)**
- **Individual programming of each input:**
- N/O or N/C, time delay, alarm inhibit, output and cable supervision
- **Up to 5 units in master/slave configuration**
- **Clear identification of first alarm received in case of successive alarms**

Application

The alarm panel AL-8 is provided with:

- 8 alarm inputs
- 3 relay outputs:
 - 1 output for connection of horn
 and
 - 2 outputs used for transmission of group alarms, selective disconnection of faulty equipment, etc.

The alarm panel is suitable to switchboards in industrial and marine plants for alarm and control purposes. It is CE marked for residential, commercial and light industry plus industrial environment.



Alarm inputs: The alarm panel is provided with 8 alarm inputs for connection of external mechanical alarm contacts.

These 8 inputs are individually programmable for N/O or N/C alarm contacts.

Time delay: The alarm inputs are individually programmable with a time delay, so that an alarm condition will not be registered until after the preset time.

The time delay is individually programmable by the user within the range 0..40 s in steps of 1 s.

Alarm indicators: The AL8-2 is equipped with 8 LEDs marked 1 to 8 for indication of an alarm condition for the individual alarm inputs.

When an alarm condition occurs, the LED for the relevant input channel will flash with a red light.

If more than one alarm occurs before the push-button "LAMP RESET" is activated, the first alarm LED will flash ahead of the others.

Alarm outputs:	<p>The alarm panel is provided with 3 relay outputs, 1 of which is used for connection to an audible/visual alarm.</p> <p>The remaining 2 relay outputs are <u>individually</u> programmable by the user to follow certain alarm inputs.</p> <p>When the relays of 1 of these 2 outputs are activated, the relevant LED marked "A" or "B" on the front will be lit constantly (red light).</p>
Indicator for auxiliary voltage:	<p>The alarm panel is equipped with a LED marked "POWER ON" which when lit (green light) indicates that auxiliary voltage is connected and that the processor is active.</p>
Indicator for cable failure: (E.g. loose connection)	<p>The user may for <u>each</u> alarm channel determine whether cable failure shall result in an alarm.</p> <p>Cable failure is indicated by means of the LED marked "CABLE FAILURE" (flashing, yellow light). The LED for the faulty channel will simultaneously be lit (constant, yellow light).</p> <p>A cable failure results in activation of the relay output used for audible/visual alarm only.</p>
Reset of alarms:	<p>The alarm indicators and the alarm outputs "A" and "B" are reset by means of the push-button marked "LAMP RESET".</p> <p>On activation of this push-button, the alarm indicators will be lit with a constant red light, until the external alarm conditions are cancelled.</p> <p>When these have been cancelled, the alarm indicators are switched off and the output relays are reset.</p>
Reset of output for horn: (Audible/visual alarm)	<p>The relay output designed for connection of horn is reset by activation of the push-button marked "HORN RESET".</p> <p>This output may be reset even though the external alarm condition prevails.</p>
External reset:	<p>External reset can be achieved by disconnecting the auxiliary voltage for more than 2 s.</p>
Test of indicators:	<p>When the push-button marked "LAMP TEST" is activated, all LEDs of the alarm panel are lit (constant, yellow light).</p> <p>The normal functions of the alarm unit remain unaffected by activation of this push-button, and the lamp test may thus be carried out when the unit is in operation.</p>
Functional test:	<p>The alarm panel is equipped with a test button marked "FUNCTION TEST".</p> <p>For safety reasons this is placed behind a hole in the front plate of the unit. The test button is activated by means of a needle or a thin screwdriver. (Do not use a pencil point).</p> <p>Upon activation of this, all alarm inputs are activated. As a result, all LEDs for alarm inputs will start flashing, and the relay output for connection of horn is activated.</p> <p>The relay outputs "A" and "B" are likewise activated if these are connected (i.e. in the programming cycle) to one or more alarm inputs. If one or more alarm inputs are programmed to time delayed registration, these will not be activated until after the preset time. Inhibited alarms will not be activated until the inhibit has been cancelled.</p> <p>The condition "FUNCTIONAL TEST" will continue, until reset by means of the push-buttons marked "HORN RESET" and "LAMP RESET".</p>

Inhibit of alarms:

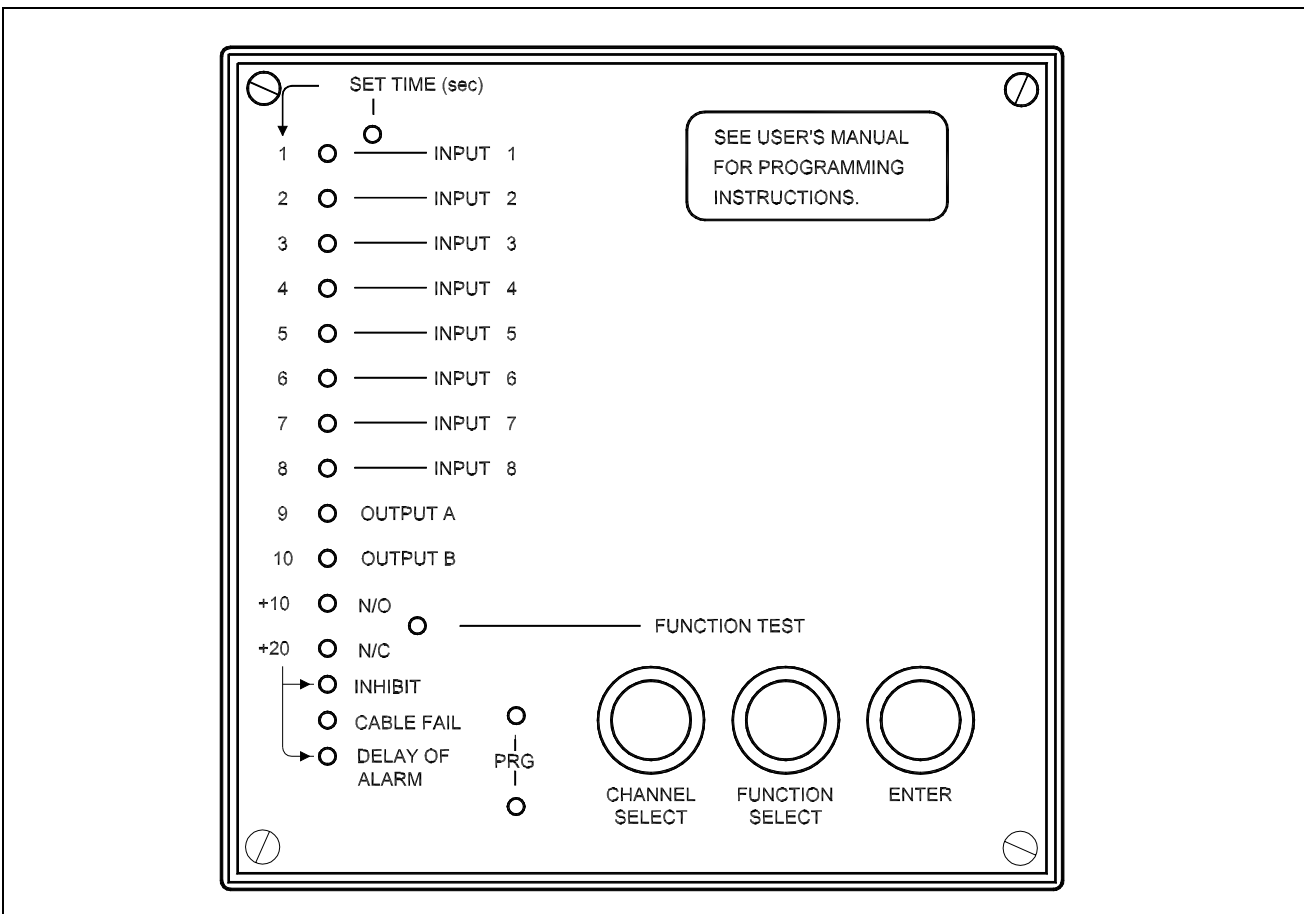
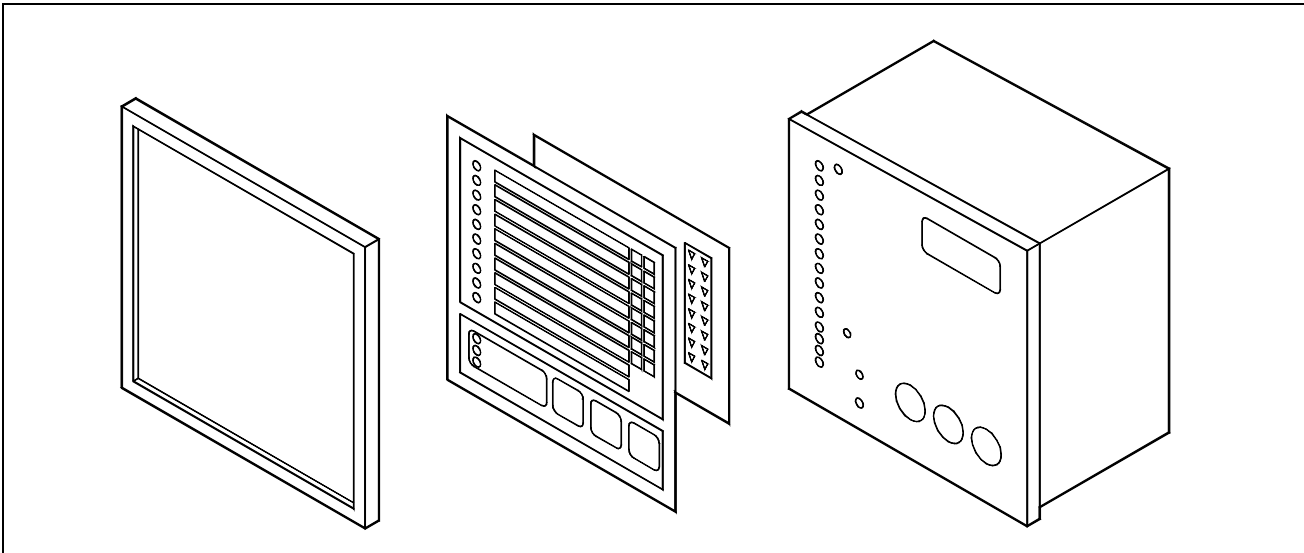
In order to avoid unwanted alarms during normal start and stop of a process, the alarm panel is provided with an inhibit circuit, activated by means of an external contact.

The alarm channels can individually be connected (i.e. in the programming cycle) to the inhibit circuit, implying that new alarms are rejected until the inhibit has been cancelled. The inhibit function does not affect already registered but not yet reset alarms.

The inhibit circuit may be programmed to a time delay, resulting in the inhibit function not being cancelled until after a preset time. This delay is programmable within the range 0..40 s in steps of 1 s.

Programming functions

The programming functions are accessible after removal of the bezel and the front sheet.



By means of the push-buttons marked "CHANNEL SELECT", "FUNCTION SELECT" and "ENTER" and the indication of the LEDs for the individual channels/functions, the alarm panel is programmed. A detailed programming manual is included on delivery.

The following individual functions may be programmed by the user for each individual alarm input (1 to 8):

1	Registration of alarm at open/closed alarm contact - i.e. either N/C or N/O contact
2	Activation of output(s) "A" and/or "B" on an alarm condition
3	Inhibit of incoming alarm
4	Detection and indication of cable failure - e.g. broken wire, or termination
5	Time delayed registration of an alarm condition

The following common functions may be programmed by the user:

1	Activation/deactivation of relay for output "a" on an alarm condition (N/O, N/C)
2	Time limited activation/deactivation of output "A" - the time limit may be set within the range 1..10 s in steps of 1 s
3	Activation/deactivation of relay for output "B" on an alarm condition (N/O, N/C)
4	Time limited activation/deactivation of output "B" - the time limit may be set within the range 1..10 s in steps of 1 s
5	Delayed cancellation of inhibit function - the time delay may be set within the range 0..40 s in steps of 1 s

The programming is initiated by pressing the push-button marked "PRG", resulting in the unit being set to programming status.

The principle of programming is to point at the input channel which is to be programmed by means of the push-button "CHANNEL SELECT".

Repeated activation of the push-button results in successive selection of the channels in the order 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 1 - 2 - 3 ..., etc.

When the required input channel has been selected (LED lit), the push-button "FUNCTION SELECT" is applied to indicate the options for the first function (1 to 5 as shown above), and the required function is entered by means of the push-button "ENTER".

The push-button "FUNCTION SELECT" is then applied to indicate the options for the next function in line, etc.

The two push-buttons are likewise applied to program the common functions.

The programming may be interrupted at any time by pressing the push-button "PRG" again. It is hence always possible for the user to change the programming of a single input channel or a single common function, if required.

For detailed description of the programming, please see the programming manual.

Master/slave configuration

By means of connections for jumper cables on the rear of the alarm panel, up to 5 alarm units may be connected together.

In this configuration the alarm unit with no plug in X2 will act as "master" and the remaining as "slave" units.

Upon registration of an alarm condition in a "slave" unit, the relay outputs for horn of both the "slave" unit and the "master" unit are activated, whereas the relay outputs "A" and "B" are activated locally irrespective of the "master"/"slave" configuration.

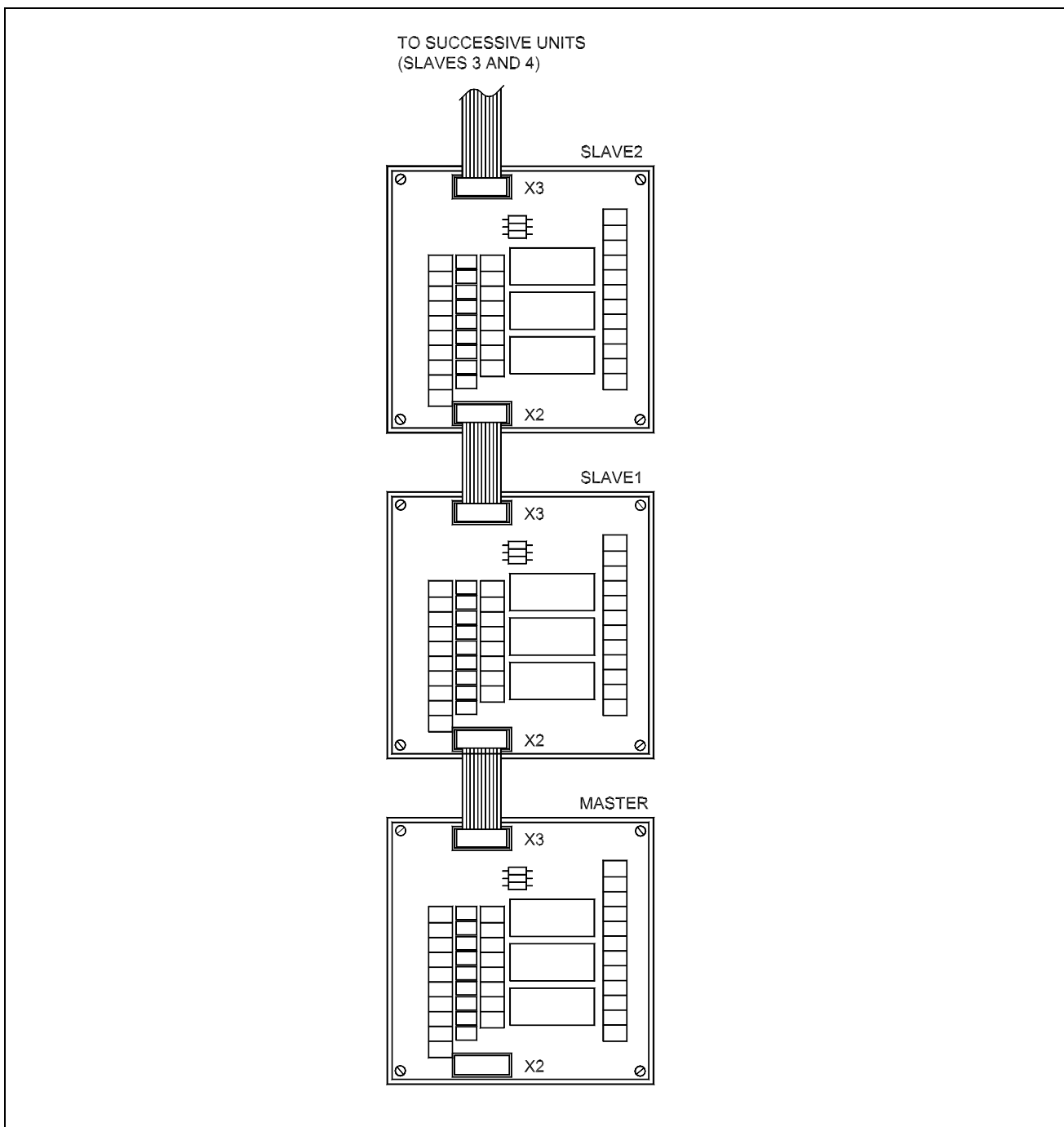
When connected in "master"/"slave" configuration, alarms and relay output for horn may be cancelled centrally by means of the push-buttons marked "LAMP RESET" and "HORN RESET" of the "master" unit.

The "slave" unit is supplied with a special label where the push-buttons marked "LAMP RESET" and "HORN RESET" are left out, if the unit is applied as a "slave" unit.

"Slave" units are likewise supplied with the flat cable applied to couple the units.

The functional test is carried out locally by means of the push-button marked "FUNCTION TEST" but is cancelled centrally on the "master" unit.

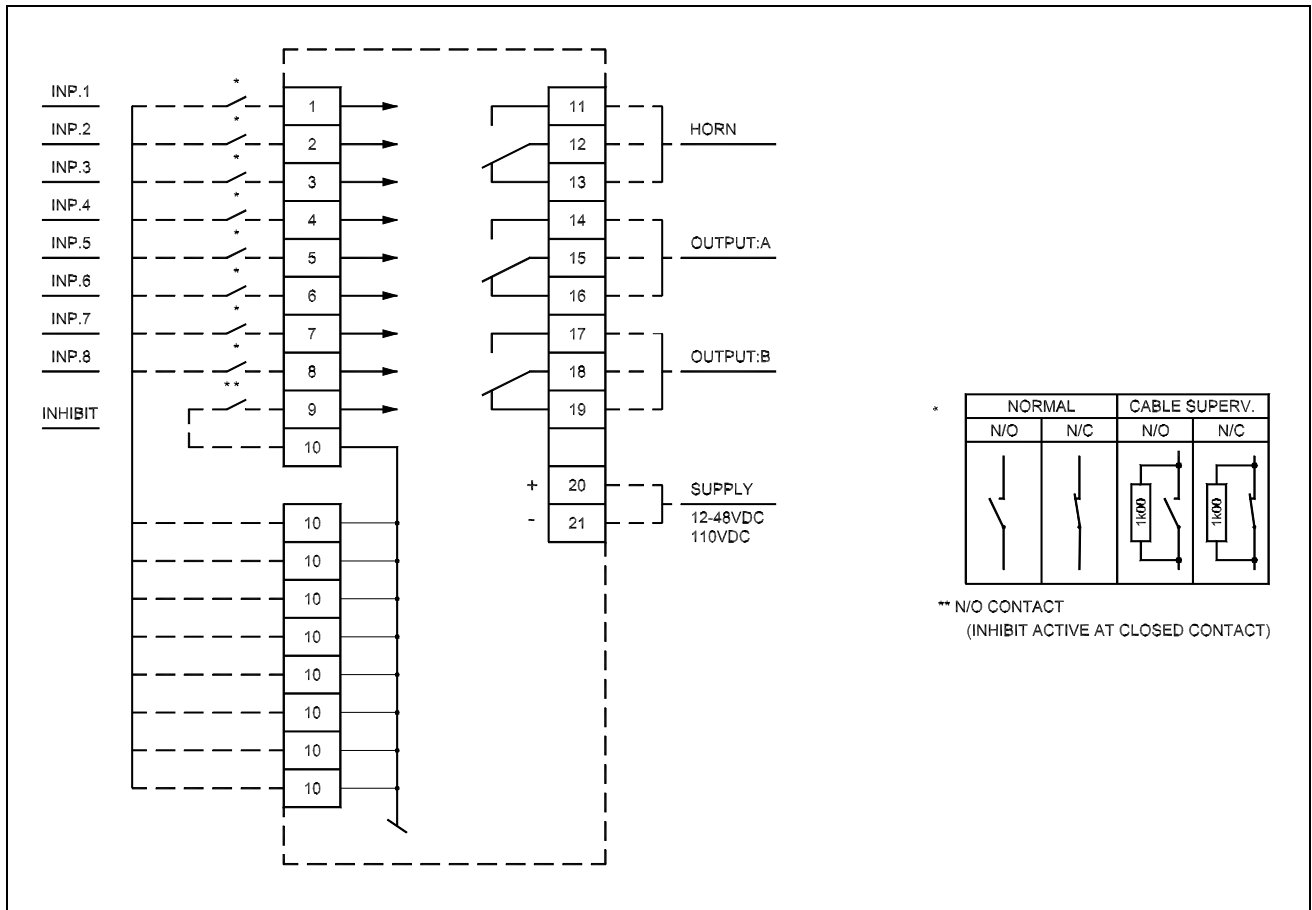
Max. distance between two units: 50 cm.



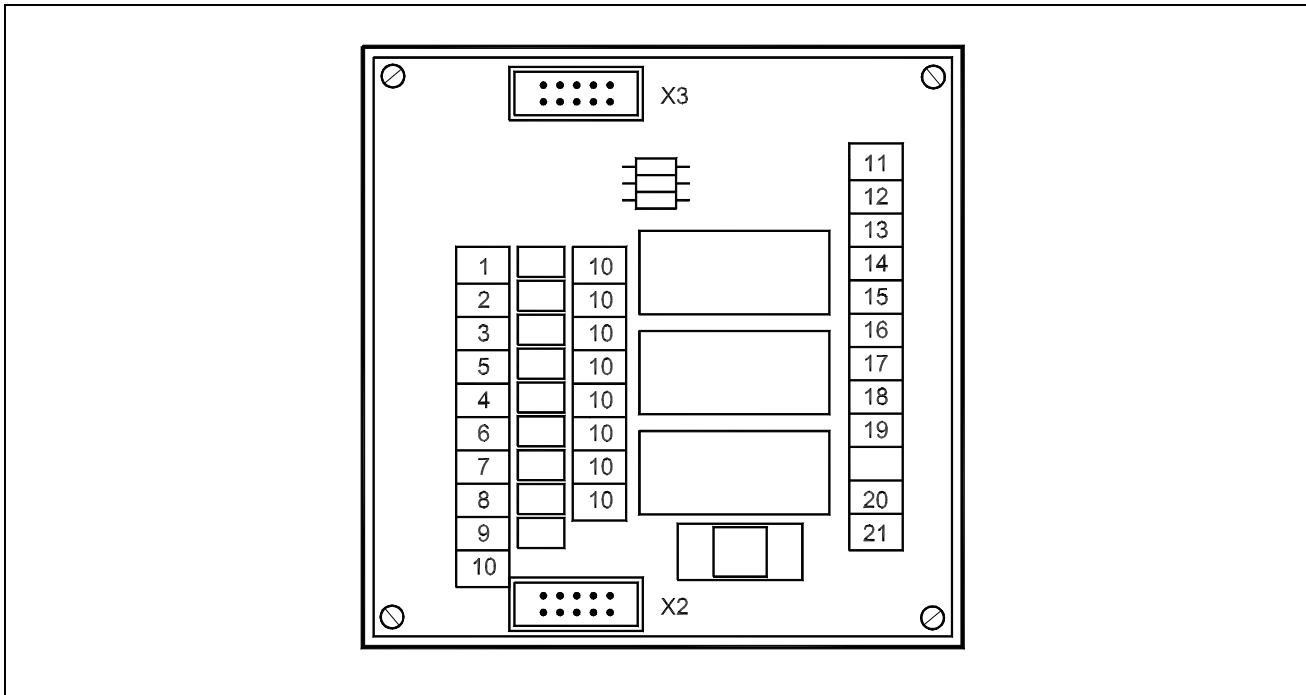
Technical specifications

Input	Alarm:	8 channels for connection of potential-free signal contacts (N/O or N/C).
	Inhibit:	1 channel for connection of potential-free signal contact (N/O). Inhibit at closed contact
	Max. signal voltage/current	6V (open contact), 6mA (closed contact)
Output	A, B and horn:	Relay output, 1 change-over switch for each
	Contact rating:	250V - 2A - 400W (AC). 250V - 1A - 50W (DC)
General technical specifications		
Auxiliary voltage	12 - 24 - 48 - 110V DC $\pm 25\%$ (min. 10V DC). Consumption: approx. 6W Max. ripple: 10% pp, to IEC 688 Recommended fuses: 12 - 24 - 48V: 1A T, 110V: 150mA T	
Galvanic separation	Between alarm inputs/"INHIBIT":	None
	Between alarm inputs and remaining circuits:	2kV - 50Hz - 1 min.
	Between alarm outputs and alarm inputs/"INHIBIT":	2kV - 50Hz - 1 min.
	Between alarm outputs and remaining circuits:	2kV - 50Hz - 1 min.
	Between aux. voltage and remaining circuits:	2kV - 50Hz - 1 min.
Temperature:	-10...55°(nominal). -25...70°C (operating). -40...70°C (storage)	
Climate:	Class HSE, to DIN 40040	
EMC:	To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-4 (class 3)	
Materials:	All plastic materials fire retarding and self-extinguishing to UL94 (V0)	
Connections:	Max. 1.5 mm ²	
Protection:	Front: IP54. Terminals: IP20, to IEC 529 and EN 60529	

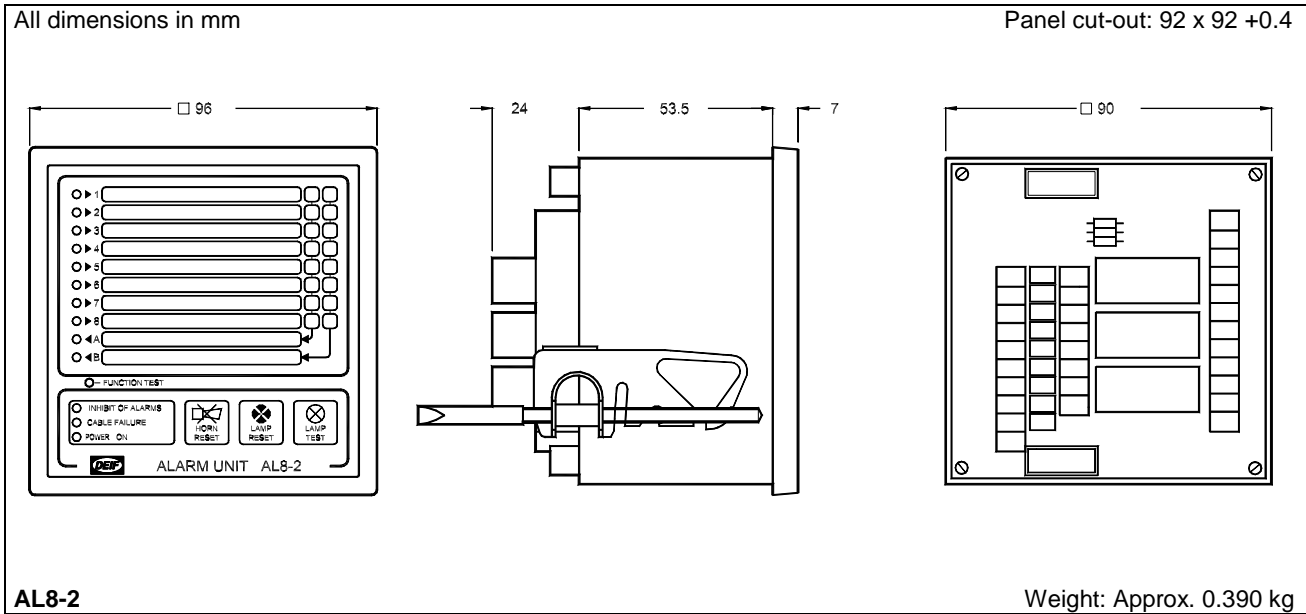
Connections



Rear view



Dimensional details



Order specifications

	Type	"Master"/"Slave"	Auxiliary voltage
Example:	AL8-2	Master	24V DC



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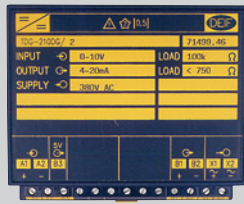


	Current Transducers, TAC-311DG 	Current Transducers, TAC-321DG 	
Size, DIN rail (mm):	55 × 75	55 × 75	
Accuracy class:	0.5	0.5	
Connection:	Single phase	Single phase	
Measuring principle:	Average measurement	Average measurement	
Measuring current:	1.0...7.25A AC ($\leq 1.2VA$)	0...1A AC ($\leq 2.0VA$) 0...5A AC ($\leq 2.3VA$)	
Measuring voltage:	–	–	
Measuring range:	0...100% I nom	0...100% I nom	
Meas. frequency:	45...65Hz	45...65Hz	
Output (0...100%):	0...5, 0...10, 0...20mA DC, 0...10V DC Span adjustment $\pm 20\%$ of FS output Zero adjustment for all span adjustments	0...10, 0...20mA DC Span adjustm. +10% -20% of FS output	
Output (20...100%):	4...20mA, Output limit $< 22mA$ Span adjustm. $\pm 20\%$, Zero adjustm. $\pm 20\%$	–	
Output ($\pm 100\%$):	–	–	
Auxiliary supply:	110/230/440V AC $\pm 20\%$ $\leq 2.5VA$ 24V DC -25/+30% $\leq 2W$ 48...110, 88...220V DC -25/+30% $\leq 2W$	No separate auxiliary supply	

	Voltage Transducers, TAV-311DG 	Voltage Transducers, TAV-321DG 	
Size, DIN rail (mm):	55 × 75	55 × 75	
Accuracy class:	0.5	0.5	
Connection:	Single phase	Single phase	
Measuring principle:	Average measurement	Average measurement	
Measuring voltage:	57.7...500V AC ($\leq 0.3VA$) 88...132V AC ($\leq 0.3VA$)	57.7-500V AC ($\leq 2.8VA$)	
Measuring range:	0...100% U nom/67...100% U nom	0-100% U nom	
Meas. frequency:	45...65Hz	45-65Hz	
Output (0-100%):	0...5, 0...10, 0...20mA DC, 0...10V DC Span adjustment $\pm 20\%$ of FS output Zero adjustment for all span adjustments	0...10, 0...20mA DC 0...10V DC Span adjustm. +10% -20% of FS output	
Output (20-100%):	4...20mA, Output limit $< 22mA$ Span adjustm. $\pm 20\%$, Zero adjustm. $\pm 20\%$	–	
Auxiliary supply:	110/230/440V AC $\pm 20\%$ $\leq 2.5VA$ 24V DC -25/+30% $\leq 2W$ 48...110, 88...220V DC -25/+30% $\leq 2W$	No separate auxiliary supply	

	Selectable AC-transducers, TAS-331DG 	Selectable AC-transducers, TAS-311DG 
Size, DIN rail (mm):	99.7 × 75	99.7 × 75
Accuracy class:	0.5	0.5
Connection:	Single phase and 3 phase network	Single phase
Measuring principle:	RMS	RMS
Measuring voltage:	57...690V AC <1VA	57...690V AC <1VA
Measuring range:	0...P/Q - P/Q...0...P/Q	0...57V/690V, 0...0.5A/8A, 20...80Hz
Meas. frequency:	20...80Hz	20...80Hz
Output (0...100%):	0...1mA, 0...5mA, 0...10mA, 0...20mA 0...1V, 0...5V 0...10V	0...1mA, 0...5mA, 0...10mA, 0...20mA 0...1V, 0...5V 0...10V
Output (20...100%):	0.2...1mA, 1...5mA, 2...10mA, 4...20mA 0.2...1V, 1...5V, 2...10V	0.2...1mA, 1...5mA, 2...10mA, 4...20mA 0.2...1V, 1...5V, 2...10V
Output (±100%):	±1mA, ±5mA, ±10mA, ±20mA, ±1V, ±5V, ±10V	±1mA, ±5mA, ±10mA, ±20mA ±1V, ±5V, ±10V
Output (±10...100%):	0.1...1mA, 0.5...5mA, 1...10mA, 2...20mA 0.1...1V, 0.5...5V, 1...10V	0.1...1mA, 0.5...5mA, 1...10mA, 2...20mA 0.1...1V, 0.5...5V, 1...10V
Auxiliary supply:	57...690V AC/24...220V DC	57...690V AC/24...220V DC
	Selectable AC-transducers, TAS-321DG 	Temperature transducers, TEMAX-3 
Size, DIN rail (mm):	99.7 × 75	200 × 190, base mounting
Accuracy class:	0.5	1.0
Connection:	Single phase and 3 phase network	2-wire transducer for remote monitoring of 2, 3 or 4 temperatures
Measuring principle:	RMS current with sign	PT100Ω sensors, 2-wire
Measuring voltage:	57...690V AC <1VA	–
Measuring range:	-8/-0.5A...0.5/8A, 0...P/Q -P/Q...0...P/Q	0...150°C/0...200°C (other ranges on request)
Meas. frequency:	20...80Hz	–
Output (0-100%):	0...1mA, 0...5mA, 0...10mA, 0...20mA 0...1V, 0...5V 0...10V	4...20mA
Output (20-100%):	0.2...1mA, 1...5mA, 2...10mA, 4...20mA 0.2...1V, 1...5V, 2...10V	–
Output (±100%):	±1mA, ±5mA, ±10mA, ±20mA, ±1V, ±5V, ±10V	–
Output (±10-100%):	0.1...1mA, 0.5...5mA, 1...10mA, 2...20mA 0.1...1V, 0.5...5V, 1...10V	–
Auxiliary supply:	57...690V AC/24...220V DC	13...36V DC
Protection:	–	IP65

DC/DC Insulation Amplifiers, TDG-210DG



Main function:	Converting one type of DC signal into another DC signal, separating a number of earthing points, galvanic separation of current signals, conversion of measuring signal, adaption of measuring range, separation of measuring circuits, measuring on DC shunts or measuring of DC voltages.
Size, DIN rail (mm):	108 × 98.4
Accuracy class:	0.5
Connection:	–
Measuring principle:	–
Measuring voltage:	–
Current standard input:	Different ranges available within the limit of ±1-50mA
Voltage input:	Different ranges available within the limit of ±60mV-400V
Measuring range:	–
Meas. frequency:	–
Output (0...100%):	0...1mA, 0...5mA, 0...10mA, 0...20mA 0...1V, 0...10V
Output (20...100%):	0.2...1mA, 1...5mA, 2...10mA, 4...20mA 0.2...1V, 2...10V
Output (-100...0...100%):	±1mA, ±5mA, ±10mA, ±20mA, ±1V, 10V
Auxiliary supply, DC:	24...48...110...220V DC (2.5W) DC/DC
Auxiliary supply, AC:	57.7...440V AC ±20%, 3.5VA (45...65Hz)

Multi-Transducers, MTR-2, MTR-2F



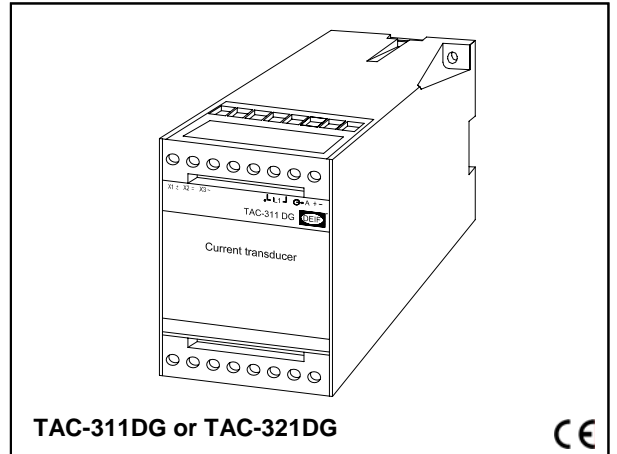
Size (mm):	100 × 75 (35 mm DIN-rail)
Main function:	Measurement of voltage, current, directional current, active-, reactive- and apparent power, CosPhi, frequency, THD, demand functions
Connection:	Single phase, 3-phase 3-wire balanced load, 3-phase 4-wire balanced load, 3-phase 3-wire unbalanced load, 3-phase 4-wire unbalanced load
Accuracy class:	0.5
Output:	0 analogue, RS485 Modbus (MTR-2-015) 2 analogue, RS485 Modbus (MTR-2F-215) 3 analogue, RS485 Modbus (MTR-2-315) 4 analogue, RS485 Modbus (MTR-2-415)
Measuring current:	-1A or -5A
Measuring voltage:	87...866V AC phase - phase
Auxiliary voltage, DC:	19...300V DC
Auxiliary supply, AC:	40...276V AC
Response time:	MTR-2 <300 ms, MTR-2F <50 ms
Output types:	All between -20...20mA and between -10...10V Example: 4...12...20mA or 0...1V

Type TAC-311DG/TAC-321DG

AC current single function transducer

4921220034G

- **Wide range of standard measuring/output ranges**
- **Compact design, 55 x 75 mm**
- **Easily accessible terminals**
- **Easy identification of unit/function**
- **Accuracy class 0.5**
- **35 mm DIN rail or base mounting**



TAC-311DG or TAC-321DG

Application

The current transducers type TAC-311DG or TAC-321DG are transducers for measurement of a sinusoidal AC current converted into a DC current signal proportional to the measured value on a single phase or 3 phase network.

PLCs, PCs, microprocessor control, indicators, alarm units etc. can be operated by the output signal.

Measuring principle

Average measurement.

The transducer consists of a transformer, which gives galvanic insulation between input and output.

The signal is rectified, smoothed and amplified into an A DC output.

The TAC-311DG with zero adjustment needs a constant aux. supply voltage, which also is insulated from output by a transformer.

Type TAC-311DG/TAC-321DG

Available transducers

Order no. Output

TAC-311DG, aux. supply 24V DC				
Input, std.	Input, span	0-5mA DC	0-20mA DC	4-20mA DC
0-1.0A AC	0-0.85/1.2A			1207000005
0-1.3A AC	0-1.10/1.6A			1207000015
0-5.0A AC	0-4.25/6.2A	1207000011		1207000006
0-6.0A AC	0-5.00/7.5A		1207000023	
0-6.5A AC	0-5.50/8.1A			1207000020

TAC-311DG, aux. supply 48-110V DC						
Input, std.	Input, span	0-5mA DC	0-10mA DC	0-20mA DC	4-20mA DC	0-10V DC
0-1.00A AC	0-0.85/1.2A				1207000013	
0-1.00A AC	0-1.00/1.1A					1207000029
0-1.20A AC	0-1.00/1.5A		1207000028			
0-1.30A AC	0-1.10/1.6A				1207000016	
0-5.00A AC	0-4.25/6.2A	1207000012	1207000025		1207000018	
0-6.25A AC	0-5.30/7.8A		1207000026			
0-6.50A AC	0-5.50/8.1A			1207000024	1207000021	
0-7.25A AC	0-6.10/9.0A		1207000027			

TAC-311DG, aux. supply 88-220V DC		
Input, std.	Input, span	4-20mA DC
0-1.0A AC	0-0.85/1.2A	1207000014
0-1.3A AC	0-1.10/1.6A	1207000017
0-5.0A AC	0-4.25/6.2A	1207000019
0-6.5A AC	0-5.50/8.1A	1207000022

TAC-311DG, aux. supply 110/230V AC			
Input, std.	Input, span	0-5mA DC	4-20mA DC
0-1.0A AC	0-0.85/1.2A	1207000009	1207000001
0-5.0A AC	0-4.25/6.2A	1207000010	1207000002

TAC-311DG, aux. supply 440V AC		
Input, std.	Input, span	4-20mA DC
0-1.0A AC	0-0.85/1.2A	1207000003
0-5.0A AC	0-4.25/6.2A	1207000004

TAC-321DG, without aux. supply				
Input, std.	Input, span	0-5mA DC	0-10mA DC	0-20mA DC
0-1.0A AC	0-0.91/1.2A			1207000103
0-5.0A AC	0-4.60/6.2A	1207000104	1207000102	1207000101

Type TAC-311DG/TAC-321DG

Technical specifications

Measuring current (I_{nom}):

TAC-311DG: 1.0...7.25A AC ($\leq 1.2VA$)

TAC-321DG: 0...1A AC ($\leq 2.0VA$)
0...5A AC ($\leq 2.3VA$)

Overload: 2 x I_{nom} continuously
10 x I_{nom} for 10s
40 x I_{nom} for 1s

Frequency range: 45...65Hz

Range:

Output TAC-311DG
(20...100%):

4...20mA DC
Span adjustment $\pm 20\%$ of FS
Zero adjustment $\pm 20\%$ of 4mA
Output limit < 22.0mA DC

Output TAC-311DG
(0...100%):

0...5mA, 0...10mA, 0...20mA DC
0...10V DC
Span adjustment $\pm 20\%$ of FS
output
Zero adjustment for all span
adjustments

Output TAC-321DG
(0...100%):

0...10mA, 0...20mA DC
Span adjustment +10/-20% of
FS output

Output load current: Max. 12V

Output load voltage: Max. 1mA

Accuracy: Class 0.5 (-10...15...30...55°C)
according to IEC 688

For output 0...10V DC: Class 0.5 (-10...15...30...55°C)
at load $\geq 100k\Omega$
Class 1.0 (-10...15...30...55°C)
at load $\geq 10k\Omega$

Response time/ripple: < 300ms/0.5%pp

Temp. coefficient: Max. 0.1% of full scale per 10°C

TAC-311DG

$\Delta out / \Delta U_{aux} / \Delta F_{aux} / \Delta R_{load}$: Max.
0.1% / $\Delta 10\% U_{aux}$ / 0.1% (45...65Hz)
/ 0.1% R_{load} max.

TAC-321DG

$\Delta out / \Delta R_{load}$: 0.5% R_{load} max.

Ambient temperature: -10...+55°C (normal)
-25...+70°C (operating)
-40...+70°C (storage)

Galvanic separation: Between inputs, outputs and
aux. voltage:
2200V - 50Hz - 1min.

Aux. supply voltage (U_n)

only TAC-311DG: 110/230/440V AC $\pm 20\%$ (max. 2.5VA)
35...45Hz max. 1 minute
45...65Hz continuously

24, 48...110, 88...220V DC -25/+30%
(max. 2W)

Connections:

Max. 4.0mm² (single-stranded)
Max. 2.5mm² (multi-stranded)

Materials:

All plastic parts are self-extinguishing to
UL94 (V1)

Protection:

Case: IP40. Terminals: IP20,
to IEC 529 and EN60529

EMC:

EN50081-1/2, EN50082-1/2

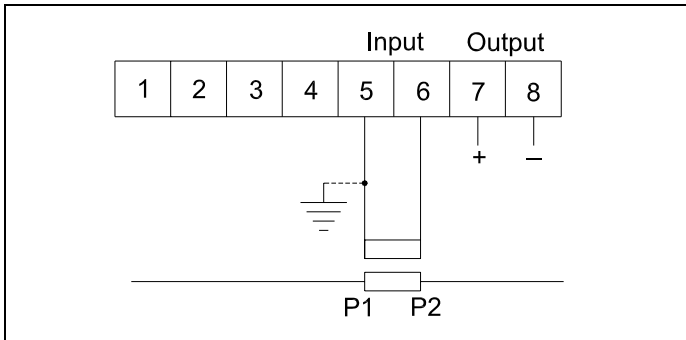
Type TAC-311DG/TAC-321DG

Connections – TAC-311DG

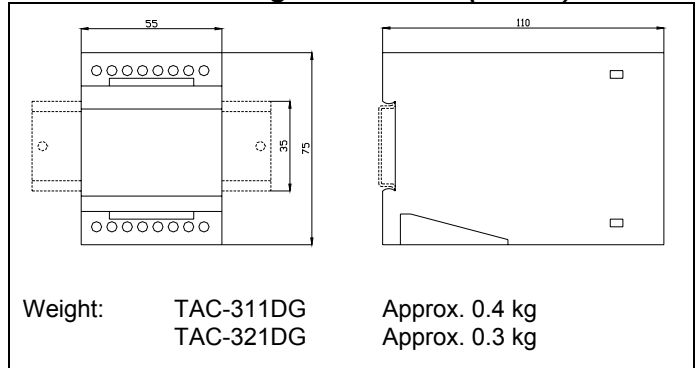
Recommended fuse 2A on aux. supply.

	<p>For aux. supply 110V AC</p> <p>(Please note that transducers with 110V AC supply can also be connected to 230V AC)</p>
	<p>For aux. supply 230V AC</p> <p>(Please note that transducers with 230V AC supply can also be connected to 110V AC)</p>
	<p>For aux. supply 440V AC</p>
	<p>For aux. supply V DC</p>

Connection – TAC-321DG



Mechanical drawing/dimensions (in mm)



Order specifications

To order a transducer with a standard input, only quote the type and order no.:

Type – Order no.

Example:

TAC-311DG – 1207000018 (see the tables on page 2)

To order a TAC-311DG transducer with a customised input:
Type – Measuring current – Output – Supply

Example:

TAC-311DG – 0...4.5A – 4...20mA – 48...110V DC

To order a TAC-321DG transducer with a customised input:
Type – Measuring current – Output

Example:

TAC-321DG – 0...6A – 0...10mA

Please note that some combinations of input, output and aux. supply are not available as standard.

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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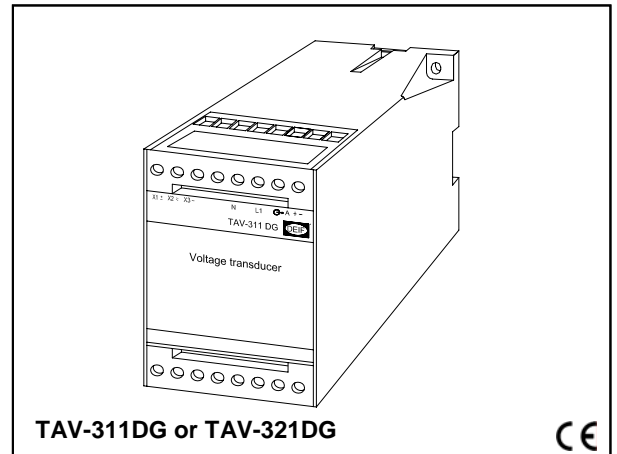


Type TAV-311DG/TAV-321DG

AC voltage single function transducer

4921220032G

- **Wide range of standard measuring/output ranges**
- **Compact design, 55 x 75 mm**
- **Easily accessible terminals**
- **Easy identification of unit/function**
- **Accuracy class 0.5**
- **35 mm DIN rail or base mounting**



TAV-311DG or TAV-321DG

**Application**

The voltage transducers type TAV-311DG or TAV-321DG are transducers for measurement of a sinusoidal AC voltage converted into a DC current or DC voltage signal proportional to the measured value on a single phase or 3 phase network.

PLCs, PCs, microprocessor control, indicators, alarms units etc. can be operated by the output signal.

Measuring principle

Average measurement.

The transducer consists of a transformer, which gives galvanic insulation between input and output.

The signal is rectified, smoothed and amplified into a V DC or an A DC output.

The TAV-311DG with zero adjustment needs a constant auxiliary supply voltage, which also is insulated from output by a transformer.

Type TAV-311DG/TAV-321DG

Available transducers

Order no.

Output

TAV-311DG, aux. supply 24V DC				
Input, std.	Input, span	0-5mA DC	0-20mA DC	4-20mA DC
0-120V AC	0-105/145V	1207010013		
0-120V AC	0-100/150V			1207010004
0-132V AC	0-110/165V		1207010023	1207010019
0-230V AC	0-192/285V			1207010005
0-440V AC	0-370/550V			1207010006
88-132V AC	88-125/185V	1207010016		
88-132V AC	88-125/143V			1207010007

TAV-311DG, aux. supply 48-110V DC						
Input, std.	Input, span	0-5mA DC	0-10mA DC	0-20mA DC	4-20mA DC	0-10V DC
0-120V AC	0-105/145V	1207010014				
0-120V AC	0-110/133V					1207010027
0-132V AC	0-100/165V		1207010026			
0-132V AC	0-110/165V			1207010024	1207010020	
0-500V AC	0-420/580V				1207010022	
88-132V AC	88-125/185V	1207010017				

TAV-311DG, aux. supply 110/230V AC			
Input, std.	Input, span	0-5mA DC	4-20mA DC
0-100V AC	0-85/125V		1207010018
0-120V AC	0-105/145V	1207010012	
0-120V AC	0-100/150V		1207010001
0-230V AC	0-192/285V		1207010002
0-300V AC	0-250/375V		1207010025
0-440V AC	0-370/550V		1207010003
0-500V AC	0-420/580V		1207010028
88-132V AC	88-125/185V	1207010015	
88-132V AC	88-125/143V		1207010008

TAV-311DG, aux. supply 88-220V DC		
Input, std.	Input, span	4-20mA DC
0-132V AC	0-110/165V	1207010021
0-230V AC	0-192/285V	1207010030
0-500V AC	0-420/580V	1207010029

TAV-311DG, aux. supply 440V AC		
Input, std.	Input, span	4-20mA DC
0-440V AC	0-370/550V	1207010009

TAV-321DG, without aux. supply				
Input, std.	Input, span	0-10mA DC	0-20mA DC	0-10V DC
0-100V AC	0-91/125V		1207010102	
0-120V AC	0-110/150V	1207010101	1207010103	1207010106
0-230V AC	0-210/287V		1207010104	1207010107
0-440V AC	0-400/550V		1207010105	1207010108

Type TAV-311DG/TAV-321DG

Technical specifications

Meas. voltage (U_{nom}):

TAV-311DG: 100...500V AC ($\leq 0.3VA$)

TAV-321DG: 100...440V AC ($\leq 2.8VA$)

Overload: 1.2 x U_{nom} continuously,
2 x U_{nom} for 10s

Frequency range: 45...65Hz

Range:

Input TAV-321DG: 0...30...120%
0...30% U_n output not linear

Output TAV-311DG
(20...100%):

4...20mA DC
Span adjustment $\pm 20\%$ of FS
Zero adjustment $\pm 20\%$ of 4mA
Output limit < 22.0mA DC

Output TAV-311DG
(0...100%):

0...5mA, 0...10mA, 0...20mA DC
0...10V DC
Span adjustment $\pm 20\%$ of FS
output
Zero adjustment for all span
adjustments

Output TAV-321DG
(0...100%):

0...10mA, 0...20mA DC
0...10V DC
Span adjustment +10/-20% of
FS output

Output load current: Max. 12V TAV-311DG
Max. 8V TAV-321DG

Output load voltage: Max. 1mA

Accuracy: Class 0.5 (-10...15...30...55°C)
according to IEC 688
Class 1.0 at $U_n \leq 25\%$

For output 0...10V DC: Class 0.5 (-10...15...30...55°C)
at load $\geq 100k\Omega$
Class 1.0 (-10...15...30...55°C)
at $10k\Omega \leq$ load < $100k\Omega$

Response time/ripple: < 300ms/0.5%pp

Temp. coefficient: Max. 0.1% of full scale per
10°C

TAV-311DG

$\Delta out / \Delta U_{aux} / \Delta F_{aux} / \Delta R_{load}$: Max.
0.1% / $\Delta 10\% U_{aux} / 0.1\%$ (45...65Hz)
/ 0.1% R_{load} max.

TAV-321DG

$\Delta out / \Delta R_{load}$: 0.5% R_{load} max.

Ambient temperature: -10...+55 °C (nominal)
-25...+70 °C (operating)
-40...+70 °C (storage)

Galvanic separation: Between inputs, outputs and
aux. voltage: 2200V - 50Hz -
1min.

Aux. supply voltage (U_n)

only TAV-311DG: 110/230-440V AC $\pm 20\%$ (max. 2.5VA)
35...45Hz max. 1 minute
45...65Hz continuously

24, 48...110, 88...220V DC -25/+30% (max.
2W)

Connections: Max. 4.0mm² (single-stranded)
Max. 2.5mm² (multi-stranded)

Materials: All plastic parts are self-extinguishing to
UL94 (V1)

Protection: Case: IP40. Terminals: IP20,
to IEC 529 and EN60529

EMC: EN50081-1/2, EN50082-1/2

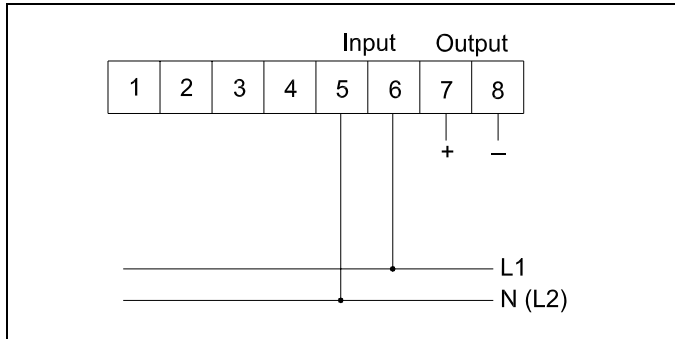
Type TAV-311DG/TAV-321DG

Connections – TAV-311DG

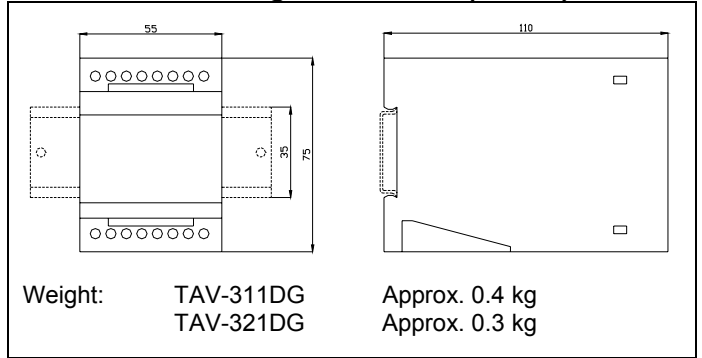
Recommended fuse 2A on aux. supply.

	<p>For aux. supply 110V AC</p> <p>(Please note that transducers with 110V AC supply can also be connected to 230V AC)</p>
	<p>For aux. supply 230V AC</p> <p>(Please note that transducers with 230V AC supply can also be connected to 110V AC)</p>
	<p>For aux. supply 440V AC</p>
	<p>For aux. supply V DC</p>

Connection – TAV-321DG



Mechanical drawing/dimensions (in mm)



Order specifications

To order a transducer with a standard input, only quote the type and order no.:

Type – Order no.

Example:

TAV-311DG – 1207010022 (see the tables on page 2)

To order a TAV-311DG transducer with a customised input:

Type – Measuring voltage – Output – Supply

Example:

TAV-311DG – 0...450V – 4...20mA – 48...110V DC

To order a TAV-321DG transducer with a customised input:

Type – Measuring voltage – Output

Example:

TAV-321DG – 0...220V – 0...10V

Please note that some combinations of input, output and aux. supply are not available as standard.

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



-power in control-

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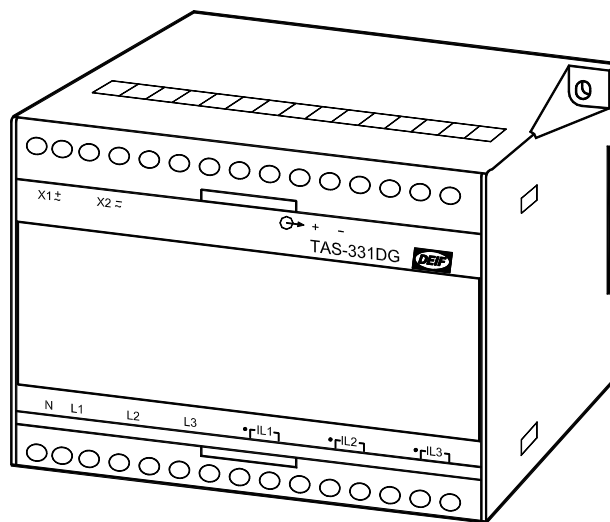
E-mail: deif@deif.com, URL: www.deif.com



Selectable AC-transducer

Type TAS-331DG

4921220036G



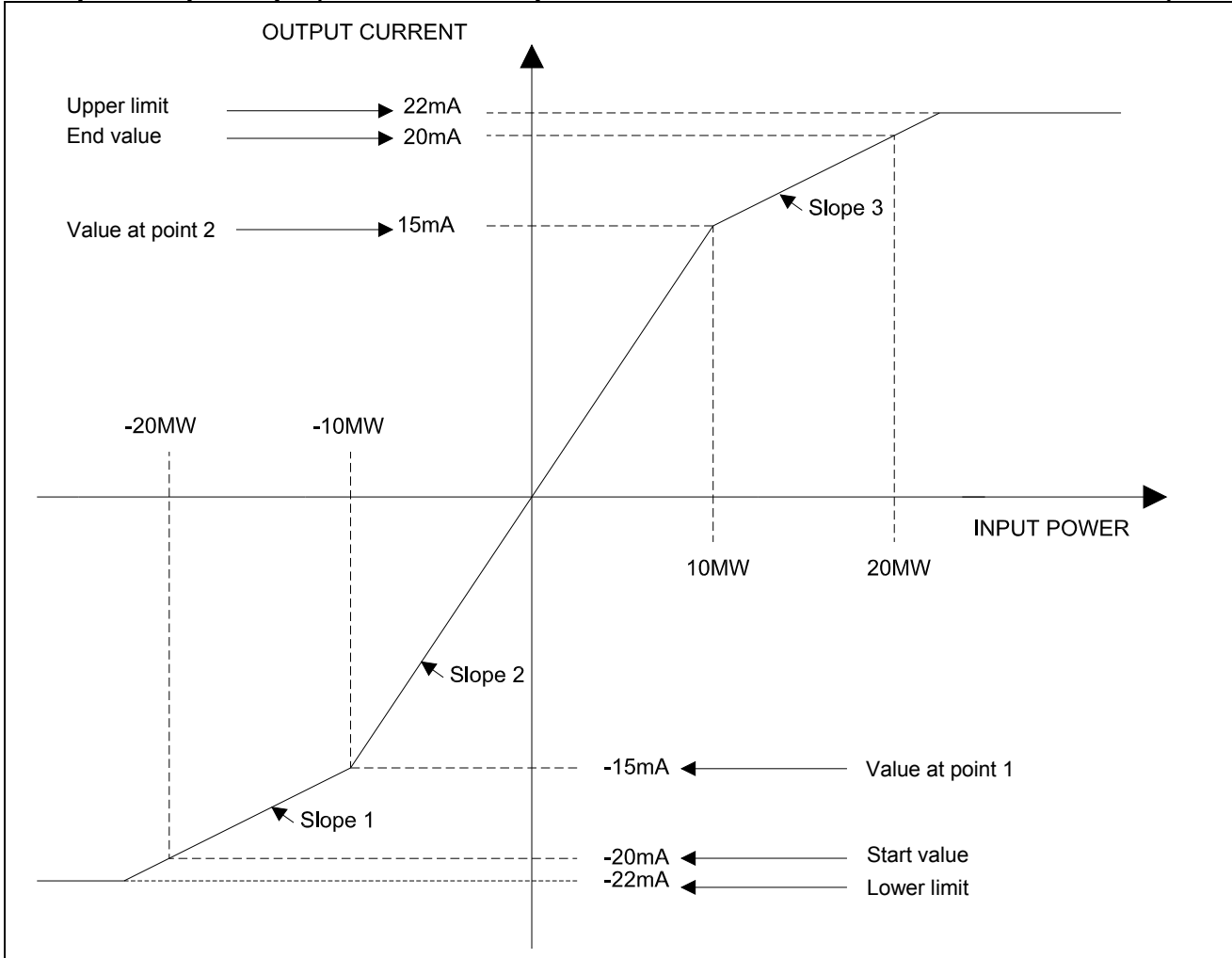
- *Measures power or reactive power on 3-phase AC networks*
- *Class 0.5 (IEC-688) measurement*
- *Supply and measuring voltage up to 690V*
- *Easy configuration via PC-interface possible*
- *Non-linear output characteristics possible*

Application

TAS-331DG is a micro-controller based AC-transducer with 1 analogue output for measurement of power or reactive power on an AC-network. TAS-331DG can be delivered pre-configured to the desired measuring value and range or it can be delivered un-configured for customer configuration through the PC-interface. The PC-configuration makes free adjustment of the full input range and output range possible without any mechanical settings or adjustments inside the transducer. The transducer holds no mechanical moving parts like potentiometers and therefore the calibration stability is excellent. TAS-331DG will check the wiring for faults when starting up and indicate possible faults on a LED.

TAS-331DG can be configured as a normal linear transducer or with up to three slopes giving the possibility for a higher resolution in one or two ranges of the measurement. See figure below for an example of three slopes. Upper and lower output limitations can also be configured.

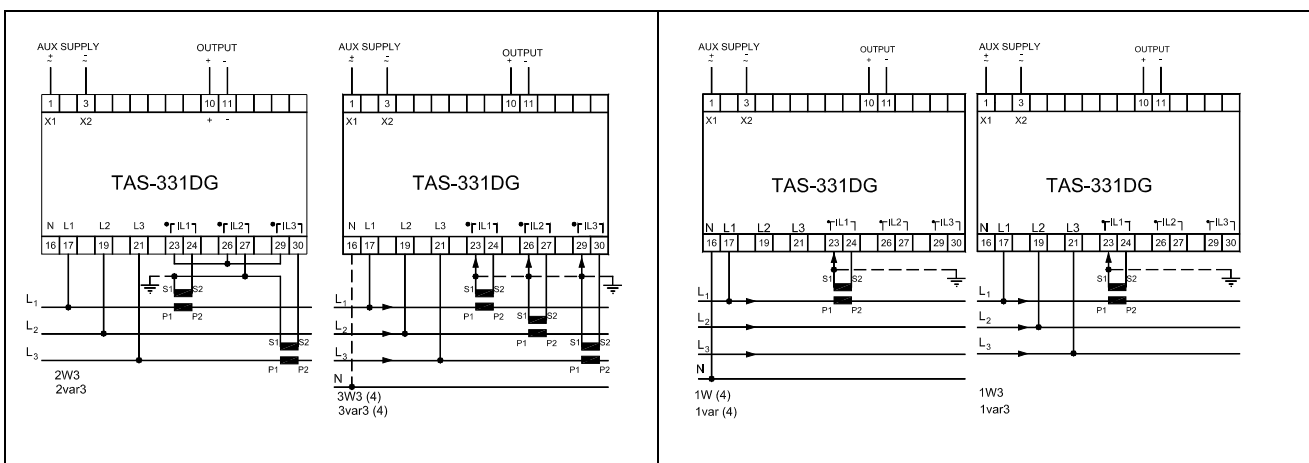
Example of triple slope (for further examples see data sheets for TAS-311DG/TAS-321DG)



Connection diagram



With voltages above 480V phase-phase. The secondary side of the current transformer **must** be connected to earth. Alternatively a double insulated current transformer can be used.



Technical specifications

Accuracy:	Class 0.5 (-10... <u>15</u> ... <u>30</u> ...55°C) according to IEC 688	
Influence, phase angle:	$\leq \pm 0.75^\circ$	
Meas. current (In):	0.75/1.5/3.0/6.0A Meas. range (In): 0...200%	
Overload, currents:	20A max., continuously 75A max. for 10 s 240A max. for 1 s	
Load:	Max. 0.5VA per phase	
Meas. voltage (Un):	73/140/254/400V phase to neutral 127/240/440/690 phase to phase	Meas. range: 30...120%Un (57...400V) Meas. range: 30...120%Un (100...690V)
Overload, voltages:	1.2 x Un max., continuously 2 x Un max. for 10 s	
Load:	Min. 480k Ω	
Frequency range:	30... <u>45</u> ... <u>65</u> ...80Hz Note: For fundamental frequency (1. harmonic) outside 20Hz...80Hz the input is fixed to 0	
Indication:	Red LED function: (The LED is located behind the front plate) Incorrect wiring = constant light, only active for coupling 1W3, 2W3, 3W3(4) and 1var3, 2var3, 3var3(4). Check at power up, in case of doubt disconnect supply and reconnect Calibration error = flash frequency 5Hz Configuration error = flash frequency 1Hz	
Output:	1 analog output	
Standard range:	Output (0...100%): 0...1mA, 0...5mA, 0...10mA, 0...20mA, 0...1V, 0...5V, 0...10V Output (10...100%): 0.1...1mA, 0.5...5mA, 1...10mA, 2...20mA, 0.1...1V, 0.5...5V, 1...10V Output (20...100%): 0.2...1mA, 1...5mA, 2...10mA, 4...20mA, 0.2...1V, 1...5V, 2...10V Output (-100...0...100%): -1...0...1mA, -5...0...5mA, -10...0...10mA, -20...0...20mA, -1...0...1V, -5...0...5V, -10...0...10V	
	Other ranges possible	
Limit:	Max. $\pm 120\%$ of nominal output	
Output load:	Current: Max. 10V (max. 1k Ω) Voltage: Max. 20mA	
Output cable:	Max. length 30m	
$\Delta_{out}/\Delta R_{load}$:	10V, 5V, 1V, 20mA ranges according to IEC 688 10mA, 5mA, 1mA ranges $\pm 0.5\%$	
Ambient temperature:	-10...55°C (nominal) -25...70°C (operating) -40...70°C (storage)	
Temperature coefficient:	Max. $\pm 0.2\%$ of full scale per 10°C	
Response time:	Coupling 2W3/2var3, 3W3/3var3, 3W4/3var4 <225ms, typically 200ms Coupling 1W/1var, 1W4/1var4 <150ms, typically 125ms Coupling 1W3/1var3 <125ms, typically 100ms	
Ripple:	Twice the class index (peak to peak measurement) according to IEC 688	
Galvanic separation:	AC aux. supply models: Between inputs, outputs and aux. supply: 3750V-50Hz-1 min. DC aux. supply models: Between inputs and outputs: 3750V-50Hz-1 min. Between inputs and supply: 3750V-50Hz-1 min. Between supply and outputs: 1500V-50Hz-1 min.	
Supply voltage:	57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-480-660-690V AC $\pm 20\%$ 24-48-110-220V DC -25/+30%	
Consumption:	(Aux. supply) 3.5VA/2W	
Climate:	HSE, to DIN 40040	
EMC:	According to EN 61000-6-1/2/3/4	
Protection:	Housing: IP40. Terminals: IP20 to IEC 529 and EN 60529	
Connections:	Max. 2.5mm ² multi-stranded Max. 4.0mm ² single-stranded	
Materials:	All plastic parts are self-extinguishing to UL94 (V1)	

Order specifications (examples)

The examples below are order specifications for pre-configured transducers. For un-configured transducers only auxiliary voltage must be specified.

	Example of active power transducer:	Example of reactive power transducer:
Type	TAS-331DG	TAS-331DG
Measuring range:	0...2MW	0...1Mvar (2Mvar) ¹⁾
Coupling ²⁾ :	1W3	1var3
VT ratio:	10kV/100V	10kV/100V
Measuring voltage:	100V	100V
CT ratio:	100/5A	100/5A
Transfer curve:	Single slope	Dual slope
Output start value:	4mA	4mA
Value at point 1:	-	20mA corresponding to 1Mvar ¹⁾
Output end value:	20mA	20mA corresponding to 2Mvar ¹⁾
Output lower limit:	4mA	4mA
Output upper limit:	21.5mA	20mA must be equal to end value ¹⁾
Auxiliary voltage:	110V DC	110V DC

1) As the transducer for measurement of reactive power is configured at 50% var in proportion to the active power, the function "dual slope" is activated. This method can be used to ensure that the dynamic range of the current input is not exceeded on the var transducer.

2) At coupling 1W4/1var4 L-L voltage must be stated when ordering.

Check of the chosen measuring range is within the configuration range of the transducer.

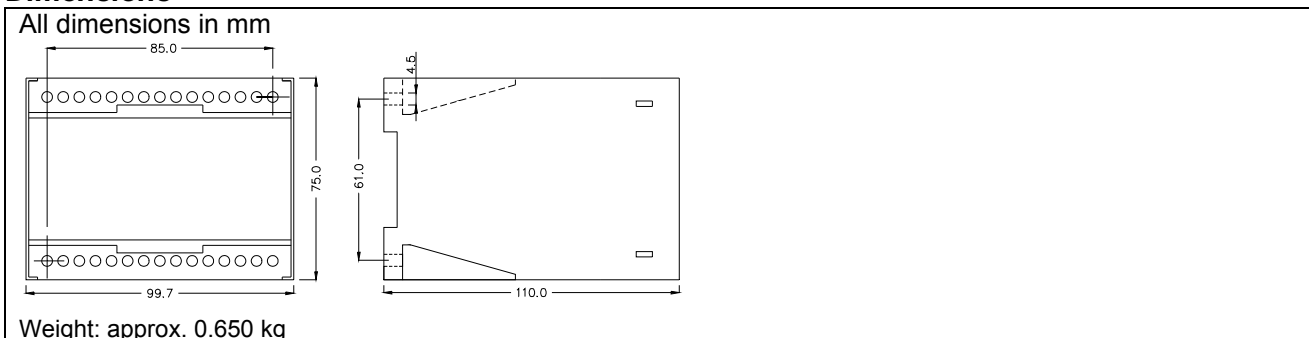
$$0.375A = < \frac{\text{Primary power}}{1.73 \times \text{measuring voltage} \times V_t \text{ ratio} \times C_t \text{ ratio}} = < 6A$$

At 1W/1var coupling the factor 1.73 is left out of the above calculation.

If I (current) is beyond 0.375A...6A another Ct with a larger or smaller ratio is chosen.

PC-configuration kit containing connection cable and software for customer configuration must be ordered separately.

Dimensions



Mounting instructions

TAS-331DG is designed for panel mounting, being mounted on a 35 mm DIN rail, or by means of two 4 mm screws.

The design of the transducer makes mounting of it close to similar equipment possible, however make sure there is min. 50 mm between the top and bottom of the transducer and other equipment. The DIN rail must always be placed horizontally when several transducers are mounted on the same rail.

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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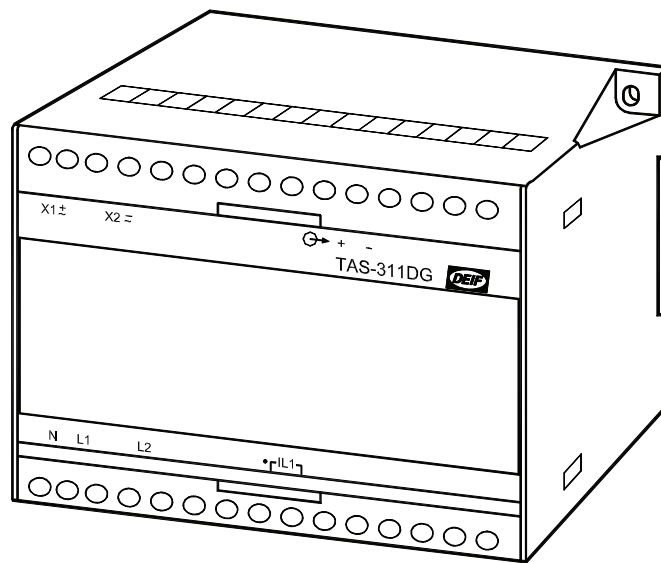
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E-mail: deif@deif.com, URL: www.deif.com



Selectable AC-transducer

Type TAS-311DG

4921220038G



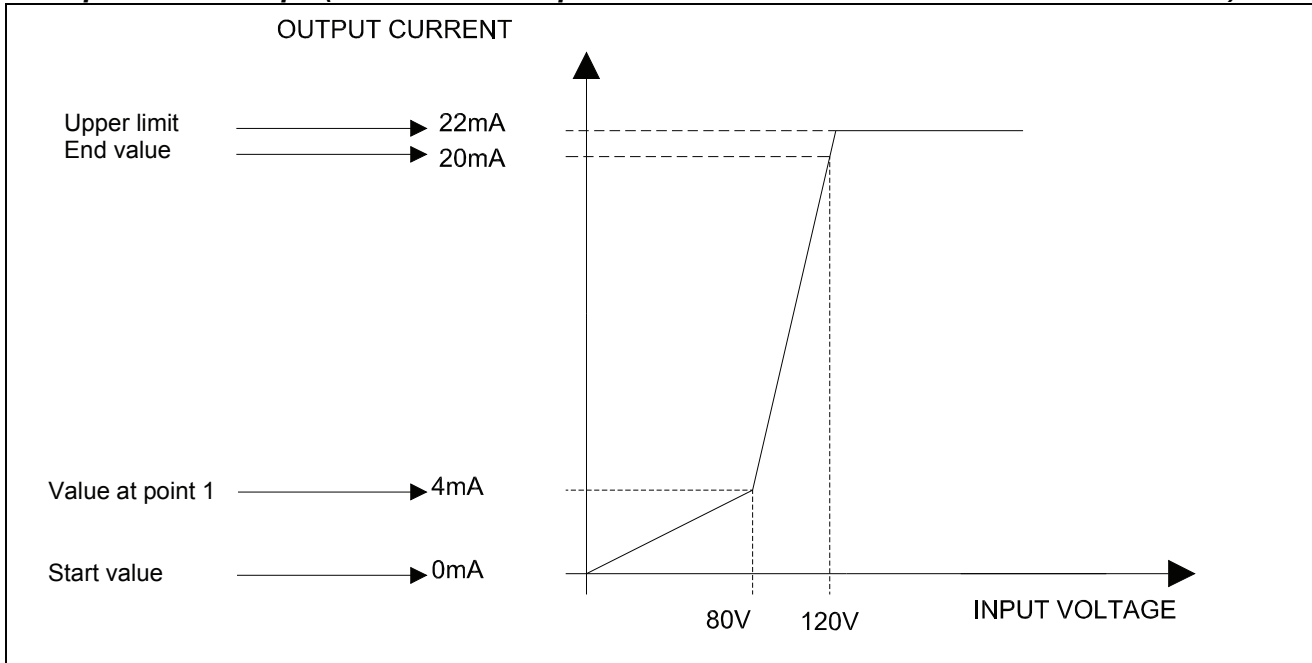
- *Measures voltage, current, frequency or phase angle on AC networks*
- *Class 0.5 (IEC-688) measurement*
- *Supply and measuring voltage up to 690V*
- *Easy configuration via PC-interface possible*
- *Non-linear output characteristics possible*

Application

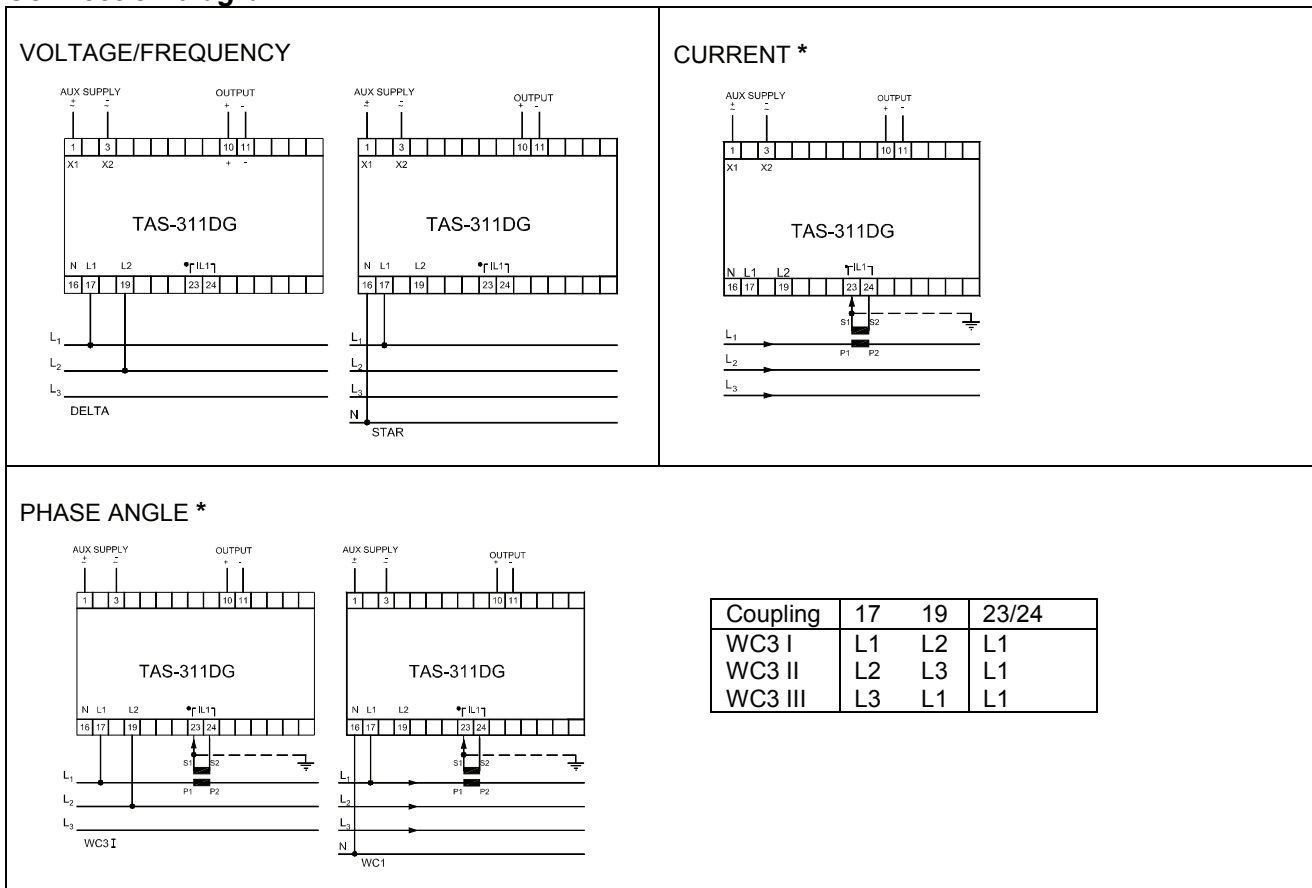
TAS-311DG is a micro-controller based AC-transducer with 1 analogue output for measurement of RMS-voltages, RMS-current, phase angle or frequency on an AC-network. TAS-311DG can be delivered pre-configured or it can be delivered un-configured for customer configuration through the PC-interface. The PC-configuration software allows free choice of voltage, current, phase angle or frequency measurement including configuration of the measuring range and output range without any mechanical settings or adjustments inside the transducer. The transducer holds no mechanical moving parts like potentiometers and therefore the calibration stability is excellent.

TAS-311DG can be configured as a normal linear transducer or with up to three slopes giving the possibility for a higher resolution in one or two ranges of the measurement. See figure below for an example of two slopes. Upper and lower output limitations can also be configured.

Example of dual slope (for further examples see data sheets for TAS-331DG/TAS-321DG)



Connection diagram



With voltages above 480V phase-phase. The secondary side of the current transformer must be connected to earth. Alternatively a double insulated current transformer can be used.

General technical specifications

Accuracy:	Voltage/current: Class 0.5 (-10...15...30...55°C) according to IEC 688 Frequency: Class 0.2 of f max. (-10...15...30...55°C) according to IEC 688 Phase angle: Class 1.0 (-10...15...30...55°C) according to IEC 688
Meas. current (In):	0.75/1.5/3.0/6.0A Meas. range (In): 0...200%
Overload, currents:	20A max., continuously 75A max. for 10 s 240A max. for 1 s
Load:	Max. 0.5VA
Meas. voltage (Un):	73/140/254/400V phase to neutral Meas. range (Un): 1...120% 127/240/440/690 phase to phase Meas. range (Un): 1...120%
Overload, voltages:	1.2 x Un max., continuously 2 x Un max. for 10 s
Load:	Min. 480kΩ
Frequency range:	30...45...65...80Hz
Indication:	Red LED function: (The LED is located behind the front plate) Calibration error = flash frequency 5Hz Configuration error = flash frequency 1Hz
Output:	1 analogue output
Standard range:	Output (0...100%): 0...1mA, 0...5mA, 0...10mA, 0...20mA, 0...1V, 0...5V, 0...10V Output (10...100%): 0.1...1mA, 0.5...5mA, 1...10mA, 2...20mA, 0.1...1V, 0.5...5V, 1...10V Output (20...100%): 0.2...1mA, 1...5mA, 2...10mA, 4...20mA, 0.2...1V, 1...5V, 2...10V Output (-100...0...100%): -1...0...1mA, -5...0...5mA, -10...0...10mA, -20...0...20mA, -1...0...1V, -5...0...5V, -10...0...10V
Limit:	Other ranges possible Max. ±120% of nominal output
Output load:	Current: Max. 10V (max. 1kΩ) Voltage: Max. 20mA
Output cable:	Max. length 30m
$\Delta_{out}/\Delta R_{load}$:	10V, 5V, 1V, 20mA ranges according to IEC 688 10mA, 5mA, 1mA ranges ±0.5%
Ambient temperature:	-10...55°C (nominal) -25...70°C (operating) -40...70°C (storage)
Temperature coefficient:	Max. ±0.2% of full scale per 10°C
Response time:	Current/voltage: <105ms in the range 0...90% of nominal input according to IEC 688 <300ms in the range 0...30% of nominal input <85ms in the range 30...100% of nominal input Frequency: <75ms, typical value 50ms Phase angle: <275ms, typical value 200ms
Ripple:	Twice the class index (peak to peak measurement) according to IEC 688
Galvanic separation:	AC aux. supply models: Between inputs, outputs and aux. supply: 3750V-50Hz-1 min. DC aux. supply models: Between inputs and outputs: 3750V-50Hz-1 min. Between inputs and supply: 3750V-50Hz-1 min. Between supply and outputs: 1500V-50Hz-1 min.
Aux. supply voltage:	57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-480-660-690V AC ±20% 24-48-110-220V DC -25/+30%
Consumption:	(Aux. supply) 3.5VA/2W
Climate:	HSE, to DIN 40040
EMC:	According to EN 61000-6-1/2/3/4
Protection:	Housing: IP40. Terminals: IP20 to IEC 529 and EN 60529
Connections:	Max. 2.5mm ² multi-stranded Max. 4.0mm ² single-stranded
Materials:	All plastic parts are self-extinguishing to UL94 (V1)

Specific technical specifications

Voltage:	Measuring voltage: 57...690V AC Start value: 0...67% of end value End value: 100...120% of measuring voltage Connection: Star connection (UL1-N): 57V...400V AC Delta connection (UL1-L2): 100V...690V AC
Current:	Measuring current: 0.5...8A Start value: 0...67% of end value End value: 100% of measuring current

Specific technical specifications, continued

Frequency:	Measuring range: 20Hz...80Hz Start value: 20Hz...76Hz End value: 40Hz...80Hz Measuring span: 4Hz ≤ end value - start value Connection: Star connection (UL1-N): 57V...400V AC Meas. range (Un): 30...120% Delta connection (UL1-L2): 100V...690V AC Meas. range (Un): 30...120%
Phase angle:	Reference: Delta phi = 180°, Sine wave Un and Inom (Inom = 1A or 5A) Voltage influence 1.5% between 50...120% Un Current influence 1.5% between 50...150% Inom 2.5% between 20...50% Inom Measuring range: 0°...60° / 360° electrical degrees Start value: -359.9°...360° End value: -359.9°...360° Measuring span: 60° ≤ difference between start and end values ≤360° Connection: WC1: (IL1 and UL1-N) or (IL2 and UL2-N) or (IL3 and UL3-N): 57...400V AC WC3 I: (IL1 and UL1-L2): 100...690V AC WC3 II: (IL1 and UL2-L3): 100...690V AC WC3 III: (IL1 and UL3-L1): 100...690V AC Meas. range (Un): 30...120%

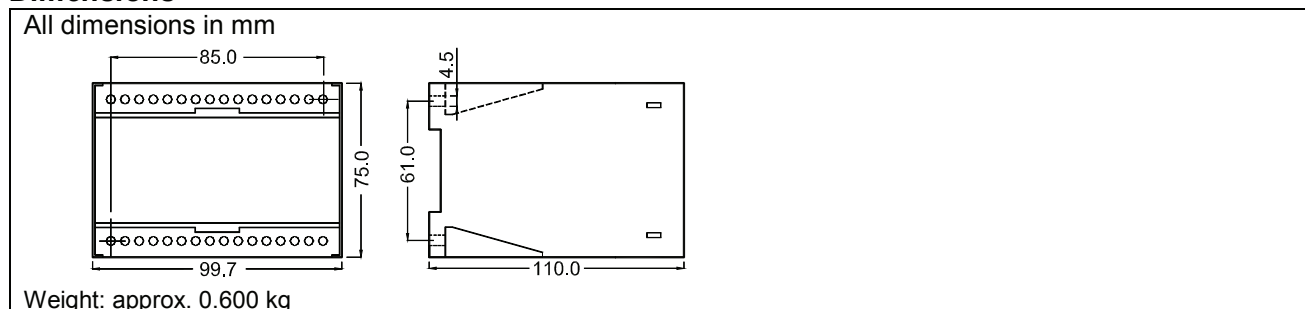
Order specifications (examples)

The examples below are order specifications for pre-configured transducers. For un-configured transducers only auxiliary voltage must be specified.

Type	TAS-311DG			
Measurement:	Voltage	Current	Frequency	Phase angle
Measuring range:	0kV...8kV...12kV	0...120A	45...50...55Hz	-90°...-60°...0°...60°...90° 0...0.5cap...1...0.5...0ind
Connection:	Delta (phase-phase)	NA	Star (phase-neutral)	WC3 I
VT ratio:	10kV/100V	NA	-	-
Input voltage:	0...80...120V	NA	400V AC	400V
CT ratio:	NA	100/1A	NA	500/5A
Input current:	NA	1.2A	NA	5A
Transfer curve:	Dual slope	Single slope	Single slope	Triple slope
Output start value:	0mA	4mA	4mA	-10V
Threshold 1:	4mA	-	-	-8V
Mid value:	12mA	-	12mA	0V
Threshold 2:	-	-	-	8V
Output end value:	20mA	20mA	20mA	10V
Output lower limit:	0mA	0mA	4mA	-12V
Output upper limit:	22mA	24mA	21.5mA	12V
Auxiliary voltage:	100V AC	110V DC	400V AC	220V DC

PC-configuration kit containing connection cable and software for customer configuration must be ordered separately.

Dimensions



Mounting instructions

TAS-311DG is designed for panel mounting, being mounted on a 35 mm DIN rail, or by means of two 4 mm screws.

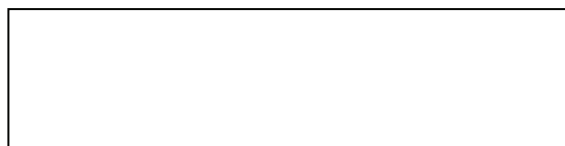
The design of the transducer makes mounting of it close to similar equipment possible, however make sure there is min. 50 mm between the top and bottom of the transducer and other equipment. The DIN rail must always be placed horizontally when several transducers are mounted on the same rail.

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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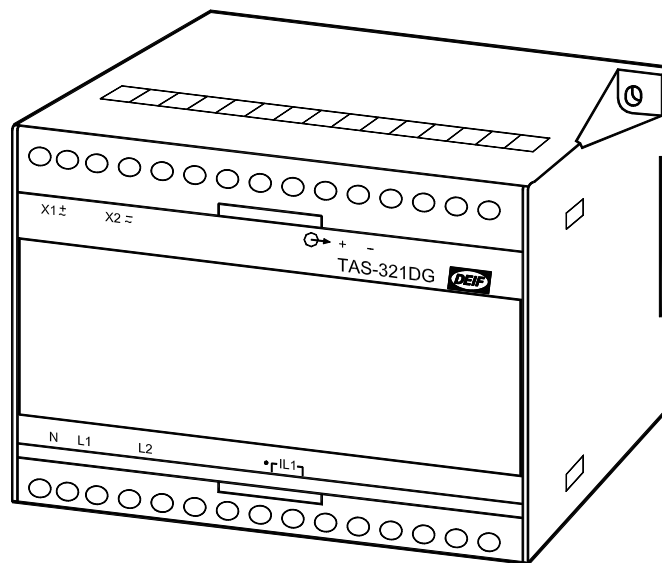
Tel.: +45 9614 9614, Fax: +45 9614 9615
E-mail: deif@deif.com, URL: www.deif.com



Selectable AC-transducer

Type TAS-321DG

4921220040F



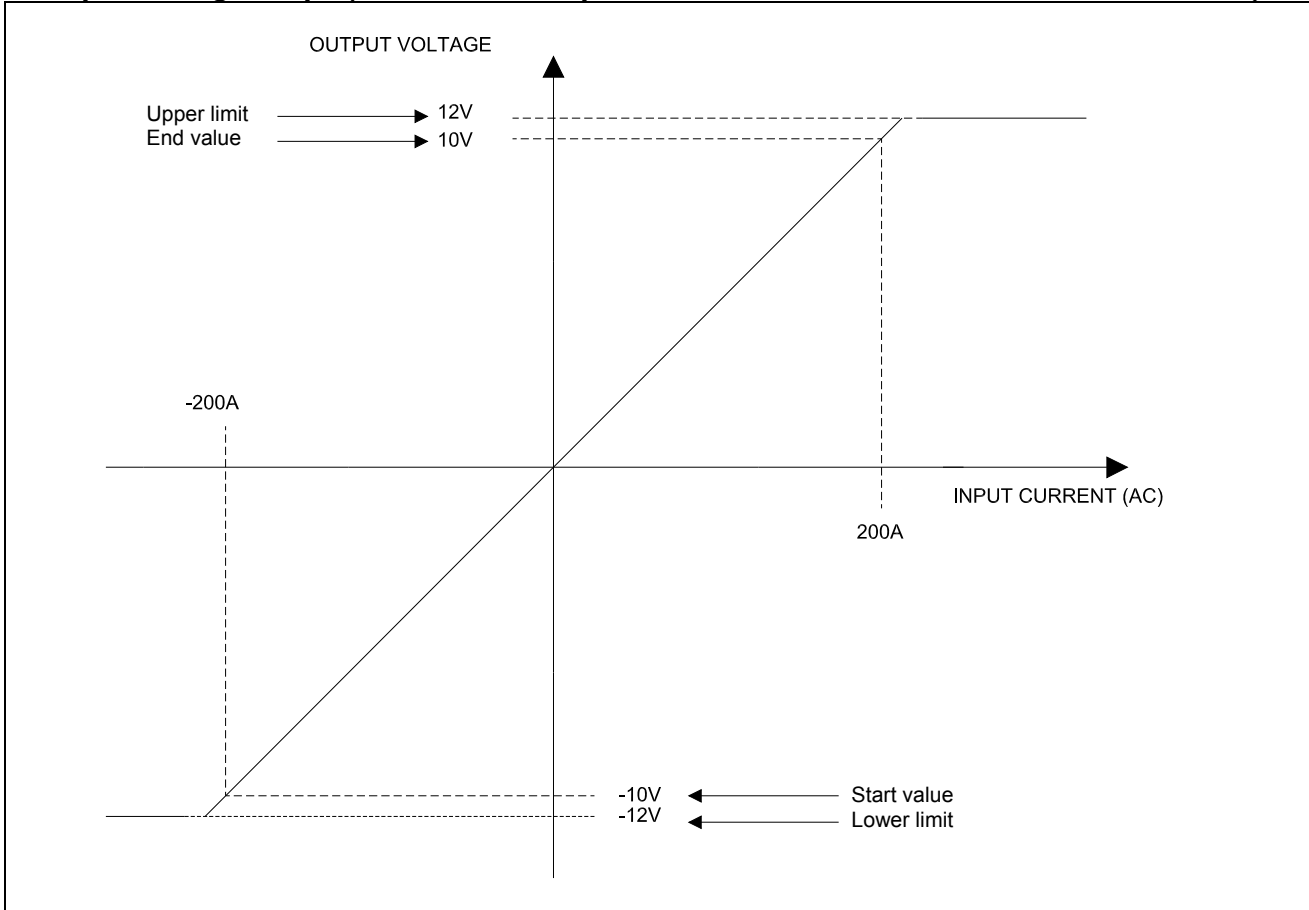
- *Bi-directional current measurement on AC networks*
- *Power measurement using 2 phases on 3-phase networks*
- *Class 0.5 (IEC-688) measurement*
- *Supply and measuring voltage up to 690V*
- *Easy configuration via PC-interface possible*
- *Non-linear output characteristics possible*

Application

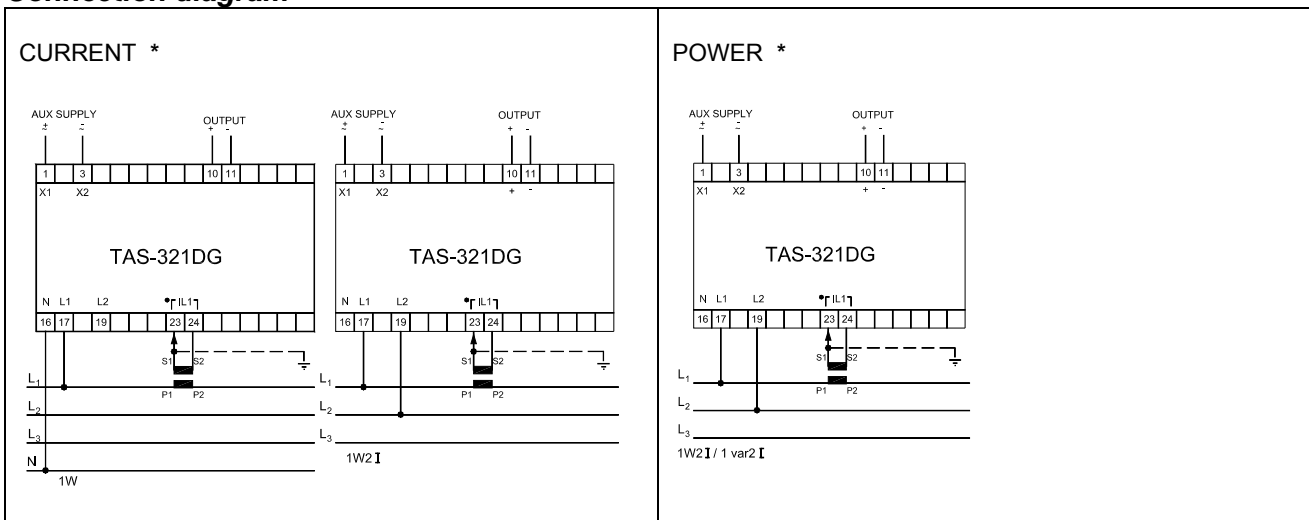
TAS-321DG is a micro-controller based AC-transducer with 1 analogue output for measurement of bi-directional current. The sign for current direction is based on the measured power direction. Furthermore the transducer can be used for measurement of active power or reactive power on a 3-phase network where only 2 phases are available for the measurement. TAS-321DG can be delivered pre-configured or it can be delivered un-configured for customer configuration through the PC-interface.

TAS-321DG can be configured as a normal linear transducer or with up to three slopes giving the possibility for a higher resolution in one or two ranges of the measurement. Upper and lower output limitations can also be configured.

Example of single slope (for further examples see data sheets for TAS-311DG/TAS-331DG)



Connection diagram



With voltages above 480V phase-phase. The secondary side of the current transformer must be connected to earth. Alternatively a double insulated current transformer can be used.

Coupling	17	19	23/24
1W2 I / 1var2 I	L1	L2	L1
1W2 II / 1var2 II	L2	L3	L1
1W2 III / 1var2 III	L3	L1	L1

General technical specifications

Accuracy:	Current/power:	Class 0.5 (-10... <u>15...30</u> ...55°C) according to IEC 688
Influence, phase angle:		$\leq \pm 0.75^\circ$
Meas. current (In):	0.75/1.5/3.0/6.0A	Meas. range (In): 0...200%
Overload, currents:		20A max., continuously 75A max. for 10 s 240A max. for 1 s
Load:		Max. 0.5VA
Meas. voltage (Un):	73/140/254/400V phase to neutral 127/240/440/690V phase to phase	Meas. range (Un): 30...120% (57...400V) Meas. range (Un): 30...120% (100...690V)
Overload, voltages:		1.2 x U_n max., continuously 2 x U_n max. for 10 s
Load:		Min. 480k Ω
Frequency range:	30... <u>45...65</u> ...80Hz	Note: For fundamental frequency (1. harmonic) outside 20Hz...80Hz the input is fixed at 0
Indication:	Red LED function:	(The LED is located behind the front plate) Calibration error = flash frequency 5Hz Configuration error = flash frequency 1Hz
Output:		1 analogue output
Standard range:	Output (0...100%): Output (10...100%): Output (20...100%): Output (-100...0...100%):	0...1mA, 0...5mA, 0...10mA, 0...20mA, 0...1V, 0...5V, 0...10V 0.1...1mA, 0.5...5mA, 1...10mA, 2...20mA, 0.1...1V, 0.5...5V, 1...10V 0.2...1mA, 1...5mA, 2...10mA, 4...20mA, 0.2...1V, 1...5V, 2...10V -1...0...1mA, -5...0...5mA, -10...0...10mA, -20...0...20mA, -1...0...1V, -5...0...5V, -10...0...10V
		Other ranges possible
Limit:		Max. $\pm 120\%$ of nominal output
Output load:		Current: Max. 10V (max. 1k Ω) Voltage: Max. 20mA
Output cable:		Max. length 30m
$\Delta_{out}/\Delta R_{load}$:		10V, 5V, 1V, 20mA ranges according to IEC 688 10mA, 5mA, 1mA ranges $\pm 0.5\%$
Ambient temperature:		-10...55°C (nominal) -25...70°C (operating) -40...70°C (storage)
Temperature coefficient:		Max. $\pm 0.2\%$ of full scale per 10°C
Response time:		<150ms, typically 125ms
Ripple:		Twice the class index (peak to peak measurement) according to IEC 688
Galvanic separation:	AC aux. supply models: DC aux. supply models:	Between inputs, outputs and aux. supply: 3750V-50Hz-1 min. Between inputs and outputs: 3750V-50Hz-1 min. Between inputs and supply: 3750V-50Hz-1 min. Between supply and outputs: 1500V-50Hz-1 min.
Aux. supply voltage:		57.7-63.5-100-110-127-200-220-230-240-380-400-415-440-450-480-660-690V AC $\pm 20\%$ 24-48-110-220V DC -25/+30%
Consumption:		(Aux. supply) 3.5VA/2W
Climate:		HSE, to DIN 40040
EMC:		According to EN 61000-6-1/2/3/4
Protection:		Housing: IP40. Terminals: IP20 to IEC 529 and EN 60529
Connections:		Max. 2.5mm ² multi-stranded Max. 4.0mm ² single-stranded
Materials:		All plastic parts are self-extinguishing to UL94 (V1)

Specific technical specifications

Current: Measuring current: 0.5...8A
 Start value: -100...+67% of end value
 End value: 100% of measuring current

Current/power: Connection 1W note only current: (IL1 and UL1-N) or (IL2 and UL2-N) or (IL3 and UL3-N): 57...400V AC
 1W2 I: (IL1 and UL1-L2): 100...690V AC
 1W2 II: (IL1 and UL2-L3): 100...690V AC
 1W2 III: (IL1 and UL3-L1): 100...690V AC

Order specifications (examples)

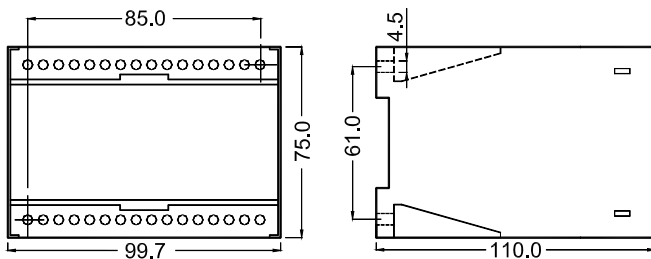
The examples below are order specifications for pre-configured transducers. For un-configured transducers only auxiliary voltage must be specified.

Type	TAS-321DG	
Measurement:	Bi-directional current	Power
Measuring range:	-120...0...120AAC	0...20MW
Coupling:	1W	1W2 II
VT ratio:	-	10kV/100V
Input voltage:	400V AC	100V AC
CT ratio:	100/1A	100/5
Input current:	-1.2...0...1.2A	NA
Transfer curve:	Single slope	Single slope
Output start value:	-10V	4mA
Threshold 1:	-	-
Mid value:	0	12mA
Threshold 2:	-	-
Output end value:	10V	20mA
Output lower limit:	-12V	4mA
Output upper limit:	12V	21.5mA
Auxiliary voltage:	110V DC	400V AC

PC-configuration kit containing connection cable and software for customer configuration must be ordered separately.

Dimensions

All dimensions in mm



Weight: Approx. 0.600 kg

Mounting instructions

TAS-321DG is designed for panel mounting, being mounted on a 35 mm DIN rail, or by means of two 4 mm screws.

The design of the transducer makes mounting of it close to similar equipment possible, however make sure there is min. 50 mm between the top and bottom of the transducer and other equipment. The DIN rail must always be placed horizontally when several transducers are mounted on the same rail.

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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Temperature transducers

Type TEMAX-3

4921220022C



TEMAX-3.4B

- *2 wire transducer for remote monitoring of 2, 3 or 4 temperatures*
- *Protected against R.F. magnetic fields*
- *Read-out of highest output*
- *Plug-in PCBs*
- *Protection: IP65*

Available types

Type	TEMAX-3.2B	TEMAX-3.3B	TEMAX-3.4B
For sensors	2 Pt100Ω sensors	3 Pt100Ω sensors	4 Pt100Ω sensors

Introduction

TEMAX-3 is intended for monitoring of 2 to 4 temperatures. TEMAX-3.2B and TEMAX-3.3B may later on at our factory be upgraded to 3 or 4 measuring points (type TEMAX-3.3B and TEMAX-3.4B respectively). The temperature transducers type TEMAX-3 are CE classified for residential, commercial and light industry plus industrial environment.

Application

TEMAX-3 is applied to monitor inputs from 2, 3 or 4 Pt100Ω resistance sensors, indicating the highest temperature on its built-in 240° indicating instrument.

Operating principle

TEMAX-3 is a 2 wire transducer with an output signal of 4...20mA.

The term "2-wire transducer" refers only to the output signal as the power for the electronics is transmitted through the two output wires and not by means of a separate auxiliary voltage (4 wire principle). TEMAX-3 is placed near the measuring points and the two output wires carry the power to supply the electronics as well as the output signal.

The output current can be considered as two components: a constant 4mA for the amplifier etc. of the transducer and a variable signal of 0...16mA, which changes proportionally to the measured input signal. The input signal corresponds to the output 4...20mA.

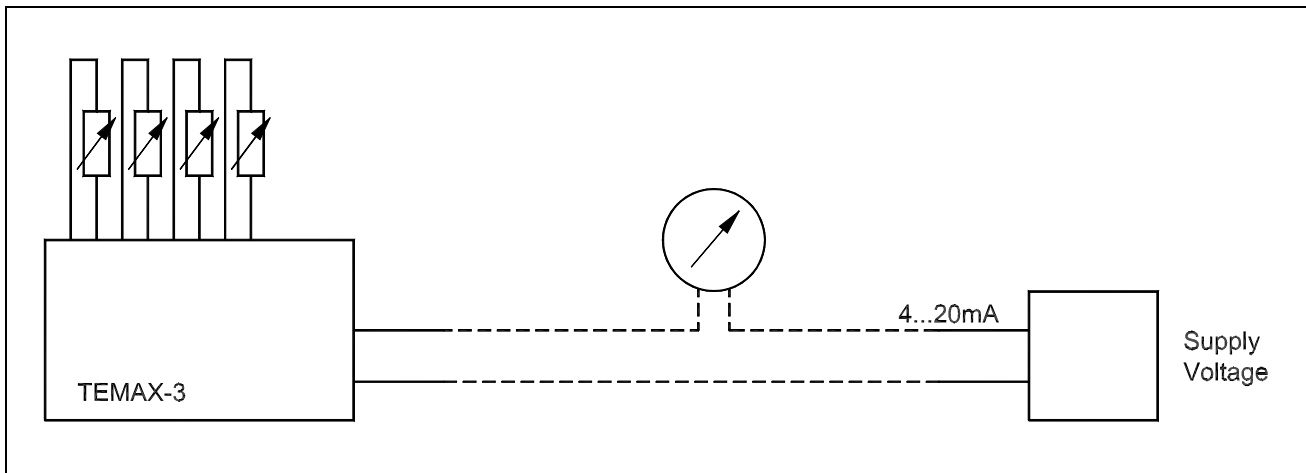


Fig. 1

Indicating instruments, recorders, controllers etc. can be connected as shown in series with the output circuit and the supply voltage.

The output current is proportional to the temperature and independent of varying supply voltage, lead resistance and load within the specified limits.

The 2, 3 or 4 temperatures are measured by means of Pt100Ω sensors connected in 2 wire couplings. Each sensor forms part of a wheatstone bridge, whose diagonal voltage is amplified by an operational amplifier.

The 2, 3 or 4 amplifier outputs are compared and the signal representing the highest temperature is selected. This signal controls an output amplifier which converts the signal into the 4...20mA constant current output.

Output under fault conditions

If one of the sensors or its leads is/are broken, TEMAX-3 will give an output higher than 20mA (max. 32mA).

In this case there will be no temperature measurement but a clear indication of fault.

If one of the sensors or the input leads is/are short-circuited, the other measurements remain unaffected but no typical change of the output signal will occur. However, such faults are not typical. Pt100Ω sensors are very reliable, and if they do fail, it is usually caused by physical damage resulting in an open circuit condition.

A short-circuit fault can only be detected by periodical activation of the push-buttons. At the actual point the meter will indicate less than 0°C.

Installation

In order to fully utilize the 2-wire system, the transducer should be placed near the measuring points to gain the following advantages:

- Noise suppression The signal is transmitted at a high level and a relative insensitivity to noise and interference is thus achieved.
- Simple wiring Only 2 wires are to be drawn from the transducer to the switchboard.

The Pt100Ω sensors are connected to the TEMAX-3 in "2-wire couplings". The resistance in the sensor leads is in series with the Pt100Ω sensor, and an error would consequently occur, if not allowed for. To avoid this error, the TEMAX-3 is adjusted to a fixed resistance of 0.35Ω for each sensor.

The mentioned 0.35Ω corresponds to 2 x 15 m - 1.5 mm² or 2 x 10 m - 1.0 mm² wires, etc.

In order to simplify the TEMAX-3, it is not provided with variable lead compensations and check resistors. The lead resistance should be as close as possible to the mentioned 0.35Ω to ensure highest achievable accuracy.

Deviations from the 0.35Ω will cause an error of +1°C per +0.38Ω, without recalibration.

Mechanical construction

The transducer is housed in a polycarbonate case (to IP65, i.e. protected against water jets) with a transparent cover and 4 watertight push-buttons.

The case is fitted with 5 PG9 cable glands and has an internal terminal block for connection of up to 4 mm² wires.

All electrical components are protected against mechanical damage and dust by means of the thermoplastic case with plug-in PCBs and a metal cover plate.

The transducer is furthermore equipped with a built-in indicating instrument, 48 x 48 mm with 240° scale.

Electrical construction

TEMAX-3 consists of a base board plus 4-6 plug-in PCBs, which are individually calibrated, facilitating service and repair in the event of faulty function:

- Amplifiers for the Pt100Ω sensors (2-4 PCBs)
- Voltage supply and output amplifier (1 PCB)
- Built-in push-button function (1 PCB)

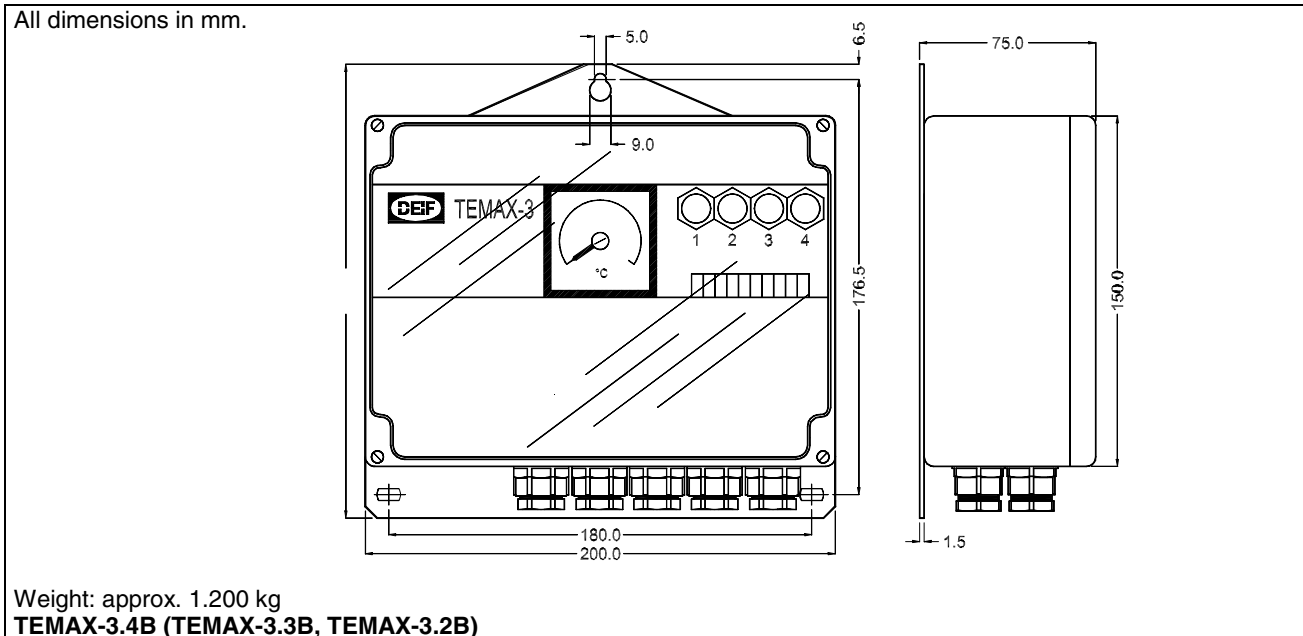
General technical specifications

Temperature:	-10...55°C (nominal) -25...70°C (operating) -40...70°C (storage).
Temperature drift:	Max. 0.2% per 10°C.
Test voltage:	2000V AC - 50Hz - 1 min. between mounting plate and input/output. 500V AC - 50Hz - 1 min. between inner screen and input/output.
R.F. electromagnetic fields:	To IEC 801-3 (27...1000MHz, 10V per meter).
Climate:	Class HSE, to DIN 40040.
EMC:	To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4) and IEC 255-22-1 (class 3).
Protection:	Case: IP65, to IEC 529 and EN 60529.
Materials:	Case: light grey polycarbonate. With 5 PG9 glands and internal terminal block.
Connections:	Cable diameter: 4...10 mm. Wire diameter: max. 4 mm ² . Extra terminals are provided for looping of any screens from the input/output cables.
Mounting:	For base mounting. Position as required, however, vertical mounting recommended to reduce any ingress of liquid and dust etc. via the cable glands.

Technical specifications

Measuring range:	0...150°C or 0...200°C (other ranges on request).	
Temperature sensor:	Pt100Ω, 2 wire.	
Lead compensation:	Adjusted for lead resistance 0.35Ω corresponding to a pair of 15 m - 1.5 mm ² or 10 m - 1 mm ² copper connecting leads.	
Lead compensation resistance:	None.	
Maximum continuous overload:	Max. 36V DC (refers to all inputs and output).	
Output:	4...20mA constant current. The temperature of any input can be read on the built-in instrument.	
Maximum output:	32mA on extended input (e.g. open circuit or disconnected sensor).	
Ripple on output:	Max. 0.5% pp at $V_S = 2 V_{pp}$ (10...400Hz).	
Output non-linearity:	Max. 0.1%.	
Accuracy:	Class 1.0 (1%) $\pm 0.5^\circ\text{C}$ (-10...15...30...55°C), to IEC 688 and EN 60688.	
Comparison accuracy:	0.5°C.	
Auxiliary voltage (V_S):	13...36V DC at 0.1 V_{pp} ripple. 14...36V DC at 2 V_{pp} ripple.	
Max. ripple (V_R):	5 V_{pp} .	
Load on output (R_L):	Depends on the aux. voltage V_S :	$ax . R = \frac{V - (0.5 V + 13)}{0.02} \quad (OHMS)$
Aux. voltage influence:	Max. 0.1% from 13...36V DC at 0.1 V_{pp} ripple.	
Response time:	Approx. 1 s for 100% change of input, approx. 2.5 s on initial energisation (for deviation 0.5%).	

Dimensions



Order specifications

	Type	Measuring range
Example:	TEMAX-3.3B	0...200°C

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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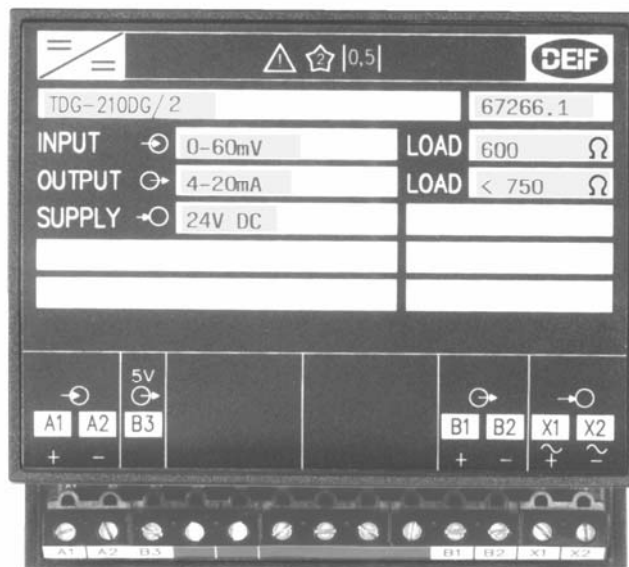
Tel.: +45 9614 9614, Fax: +45 9614 9615
 E-mail: deif@deif.com, URL: www.deif.com



Insulation amplifiers DC/DC amplifiers

Type TDG-210DG

4921220011F



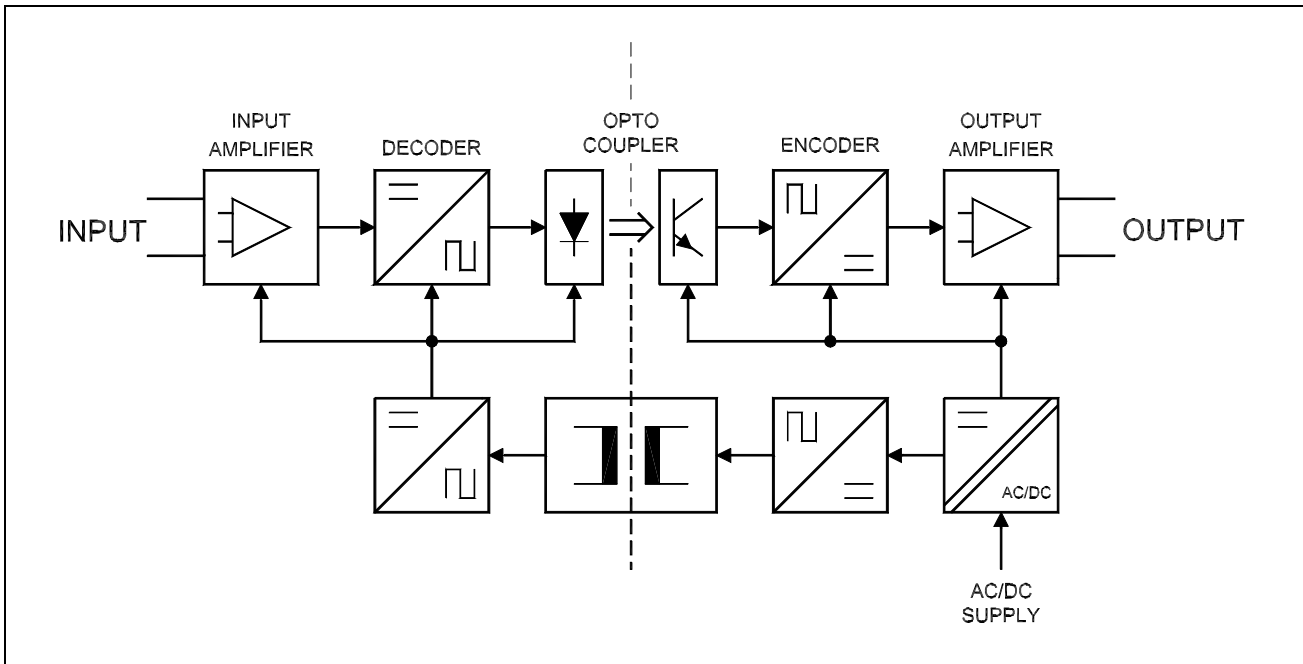
- **Conversion of measuring signal possible**
(E.g. $-10...0...10\text{mA}$ into $4...20\text{mA}$)
- **Suppression of negative input signals possible**
- **Aux. voltage: 57.7...440V AC or 24...220V DC**
- **For mounting on DIN rail**

Application

TDG-210DG is a CE marked DC/DC amplifier with galvanic separation between input and output. It is typically used for:

- **Converting one type of DC signal into another DC signal**
(E.g. from -10...0...10mA into 4...20mA)
- **Converting potentiometer input into a DC signal**
(E.g. from 0...1k Ω into 0...10V)
- **Separating a number of earthing points**
If a cable is connected to earth at more than one point, a measuring error may develop or noise problems may arise if the earth potentials of these vary.
- **Galvanic separation of current signals**
As measuring equipment connected to the current output of a transducer is connected in series, simultaneous earthing of more than one input of connected measuring equipment will result in short-circuit of the input of intermediate measuring units.
- **Conversion of measuring signal**
If increasing output is requested at decreasing input, this may be achieved by means of the insulation amplifier, at the same time providing galvanic separation between the 2 measuring circuits.
(E.g. from 10...0V DC into 0...5mA).
- **Adaption of measuring range**
The input may be suppressed, i.e. only a part of the range is used.
(E.g. from 10...20mA to 0...10V DC).
- **Separation of measuring circuits**
In case of remote transmission of a DC signal - typically a 4...20mA signal to a number of measuring points situated well away from each other - separation into galvanically separated measuring circuits is often requested to isolate a possible fault and confine this to the faulty circuit.
- **Measuring on DC shunts**
The potential of a DC measuring shunt (0...60mV) is sometimes high when compared to earth. A leakage between the measuring cable and earth will result in a measuring error. The galvanic separation at the same time provides protection against accidental contact to the high potential.
- **Measuring of DC voltages**
Especially when measuring high DC voltages, galvanic separation between input and output is an absolute necessity for safety purposes and due to differences in the potentials of input and output. TDG-210DG is available for measuring of voltages up to 500V DC.

Construction



TDG-210DG requires auxiliary voltage and is fed through a transformer or a 24/48/110/220V DC inverter. The secondary voltage is rectified and fed to the encoder and output amplifier shown to the right of the galvanic interface. The input amplifier and the decoder are fed through a DC/DC inverter. The input signal is amplified and is, through optocouplers, transmitted to the output amplifier.

This measuring method combines high accuracy of measurement with long-term stability.

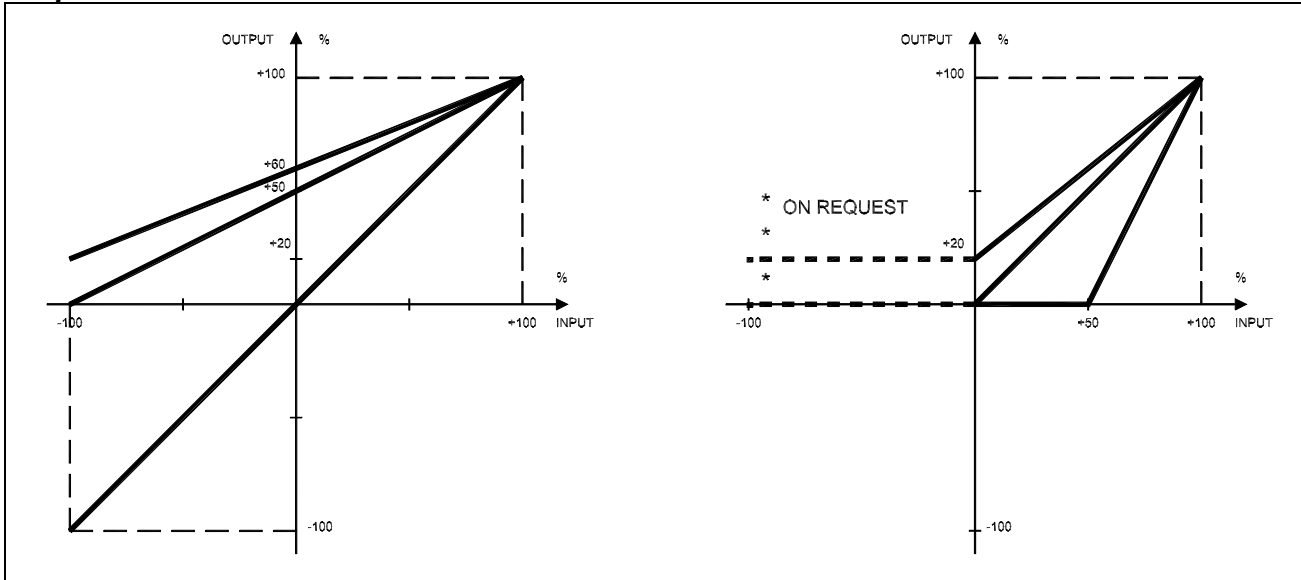
Standard input and output may be set by means of jumpers, whereas special input is factory calibrated.

Technical specifications

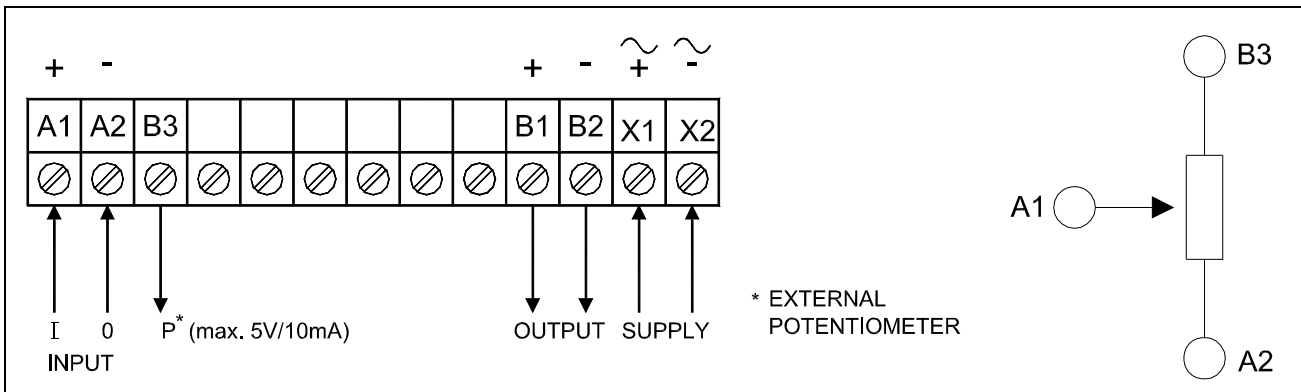
Current input	Standard	0...1mA	0.2...1mA	0...0.5...1mA	-1...0...1mA
	Standard	0...5mA	1...5mA	0...2.5...5mA	-5...0...5mA
	Standard	0...10mA	2...10mA	0...5...10mA	-10...0...10mA
	Standard	0...20mA	4...20mA	0...10...20mA	-20...0...20mA
	Special - min.	0...0.1mA	0.02...0.1mA	0...0.05...0.1mA	-0.1...0...0.1mA
	Special - max. ¹	0...50mA	10...50mA	0...25...50mA	-50...0...50mA
	Load	0...1V voltage drop for all current inputs			
Voltage input	Standard	0...1V	0.2...1V	0...0.5...1V	-1...0...1V
	Standard	0...10V	2...10V	0...5...10V	-10...0...10V
	Special - min.	0...60mV	12...60mV	0...30...60mV	-60...0...60mV
	Special - max. ¹	0...400V	80...400V	0...200...400V	-400...0...400V
	Load	0...0.1mA input current for all voltage inputs (10kΩ/V)			
Potentiom. input		0...50Ω/10kΩ			
Current output	Standard	(See standard current inputs above)			
	Load	Max. 15V/±15V above output			
	Overload	Max. 200% output current			
	Protection	Protected against open output (max. 25V)			
Voltage output	Standard	(See standard voltage inputs above)			
	Load	Max. 20mA/±20mA from output			
	Overload	Max. 150% output voltage			
	Protection	Protected against short-circuited output (max. 45mA)			
Output (General)	Ripple	Max. 0.5% P-P to IEC 688			
	Response time	Max. <10ms to IEC 688			
	Characteristic	(See back page ¹)			
Insulation	Test voltage	2500V AC - 50Hz - 1 min.: between input/output/aux. voltage			
	Operating voltage	600V AC - 50Hz - 850V DC: between input/output/aux. voltage			
Auxiliary voltage	V AC ±20% 45...65Hz	57.7-63.5-100-110-120-127-220-240-380-400-415-440V AC (3.5VA)			
	V DC -20/+30%	24-48-110-220V DC (2.5W) DC/DC inverter built in			
Environments	Temperature	-10...55°C (nominal) -25...70°C (operating), -40...70°C (storage)			
	Climate	Class HSE to DIN 40040			
	EMC	To EN 50081-1/2, EN 50082-1/2, SS4361503 (PL4), IEC 255-22-1 (class 3)			
	Protection	Front: IP53. Terminals: IP20 to IEC 529			
Accuracy	Input/output	Class 0.5% (-10...15...30...55°C) to IEC 688			
Drift	Temperature	Typ. 0.15% per 10°C, max. 0.2% per 10°C			
	Load/output	Max. 0.1% for max. variation of output load			
	Auxiliary voltage	Max. 0.1% per 10% variation of auxiliary voltage			
Connection	Screw terminals	Multi-stranded: Max. 2.5 mm ² . Single-stranded: Max. 4 mm ²			
Materials	Flammability	All plastic materials self-extinguishing to UL94 (V0)			

1) Further ranges within the stated minimum and maximum ranges available on request.

Output characteristics

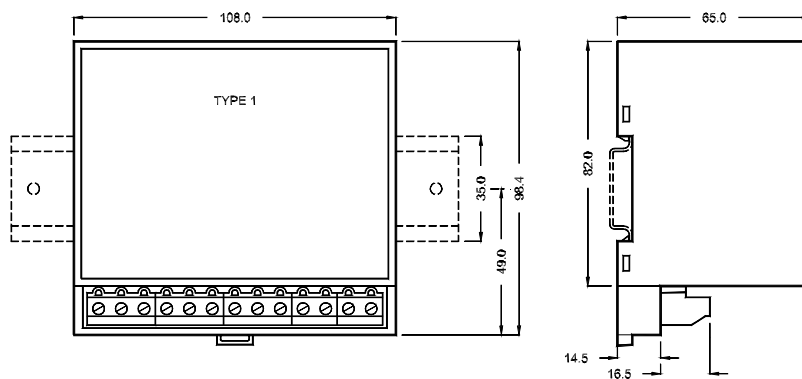


Connections



Dimensions

All dimensions in mm



TDG-210DG

Weight: Approx. 0.370 kg

Order specifications

Example:	Type	Input	Output	Aux. voltage
	TDG-210DG	-10...0...10V DC	4...20mA	24V DC

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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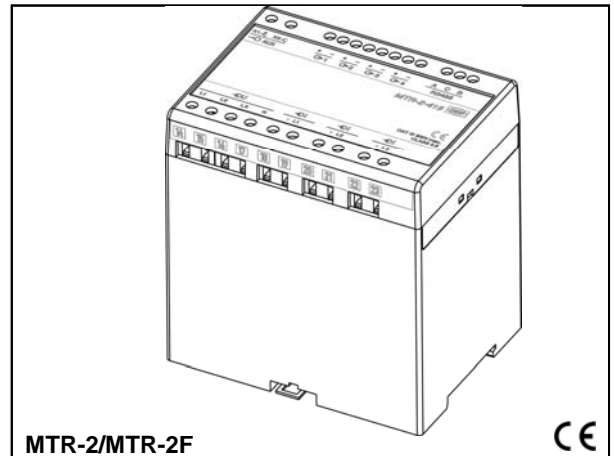


Type MTR-2, MTR-2F

Multi-transducer

4921220046F

- **Up to 4 analogue outputs**
- **RS485 serial communication**
- **Class 0.5 accuracy**
- **Wide range aux. supply**
- **Measures more than 50 parameters**
- **Response time <50ms type MTR-2F**



Application

The MTR-2/MTR-2F is a configurable multi-output transducer for measurement of values on a three-phase network.

The MTR-2 features up to 4 analogue outputs, serial communication. The standard versions are the following:

Type	Analogue outputs	Serial output*	Accuracy class
MTR-2-015	-	X	0.5
MTR-2-315	3	X	0.5
MTR-2-415	4	X	0.5
MTR-2F-215	2	X	0.5

*: RS485 Modbus.

Measurements

The following parameters are measured by the MTR

- AC voltage
- AC current
- Active/reactive/apparent power
- ϕ , power factor
- Frequency
- THD
- Dynamic demands
- Maximum demands

Configurable parameters

By means of the free utility software, the following parameters of the MTR can be programmed:

- Analogue outputs (which measurements are presented on the different outputs)
- Curve form of analogue outputs (linear or with up to five cross points)

By means of the utility software, the analogue outputs can be configured to:

- All between -20...20 mA, burden voltage 15 V
Example: 0...1 mA or 4...12...20 mA
- All between -10...10 V, burden current 20 mA
Example: 0...1 V or 0...10 V

General output characteristics

Response time/ripple

MTR-2-315
MTR-2-415 < 300 ms
Ripple: < 1% p.p.

MTR-2F-215 < 50 ms
Ripple <2% p.p.

Accuracy (according to EN 60688)

- Current: 0.5
- RMS voltage: 1.0
- Phase to neutral voltage and average phase to neutral voltage: 0.5
- Phase to phase voltage and average phase to phase voltage: 1.0
- Frequency: 0.2
- Active, reactive and apparent power: 0.5
- Power factor: 0.2
- Phase angle: 0.2
- Dynamic demand values: 1.0
- Maximum demand values: 1.0

Reference conditions:

Ambient temperature: 15...30°C

Input: 0...100% I/Un

Active/reactive factor: $\cos\phi/\sin\phi = 1$

Waveform: Sinusoidal, form factor 1.1107

Measuring input

Voltage: 50 to 500V AC phase to neutral
87 to 866V AC phase to phase

Current: 5 A

Frequency: 50/60 Hz (45...65Hz)

Overload tolerance (according to EN 60688):

Value	No. of instances	Duration	Interval
Current			
2 x In	-	Continuous	-
20 x In	5	1s	300 s
Voltage			
1.5 x Un	-	Continuous	-
2 x Un	10	1s	100 s

Type MTR-2/MTR-2F

Power supply

Rated voltage:	19...300V DC 40...276V AC
Frequency:	40...70 Hz
Supply burden:	< 3 VA

Communication

Message format:	Modbus RTU
Data rate:	1,200-115,200 bits/s

RS485:

Connection:	Multi-drop
Signal levels:	RS485
Cable type	Belden 3105A or equivalent (twisted pair)
Maximum cable length:	up to 1000 m
Connection:	Screw terminals
Message format:	Modbus RTU
Data rate:	1,200-115,200 bits/s

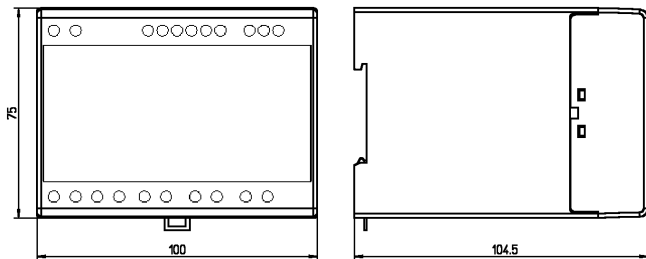
Ambient temperature

Ambient temperature:	-10...55°C (nominal) -25...70°C (operating) -40...70°C (storage)
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Temperature coefficient: Max. $\pm 0.2\%$ of full scale per 10°C

Housing

Mounting:	DIN-rail
Enclosure:	IP50
Weight:	600g
Connection:	< 4.0 mm ² single-core 2 x 2.5 mm ² multi-core



All dimensions in mm

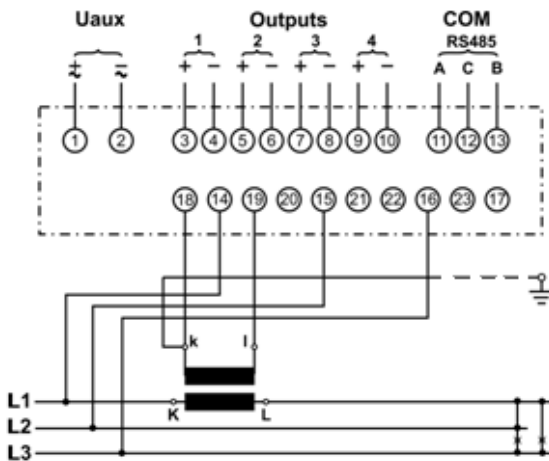
General compliance with specifications

Performance:	EN/IEC 60688, according to specification
Safety:	EN/IEC 60688 EN/IEC 61010-1 EN/IEC 60695-2-2, flammability
EMC:	Generic standards: EN/IEC 61000-6-1 EN/IEC 61000-6-2 EN/IEC 61000-6-4

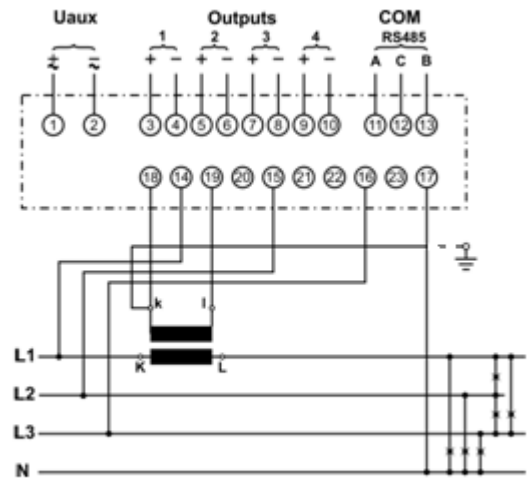
Plus basic EN/IEC standards referred to from the generic standards above.

Climate:	IEC 60068-2-1, according to specification IEC 60068-2-2, according to specification IEC 60068-2-2, 2 x 24 h
Vibration:	IEC 60068-2-6, ± 1 mm/0.7 g
Shock:	IEC 60068-2-27, 50 g
Galvanic separation:	500 V between outputs 4 kV between inputs and outputs 4 kV between inputs and aux. supply 4 kV between aux. supply and outputs

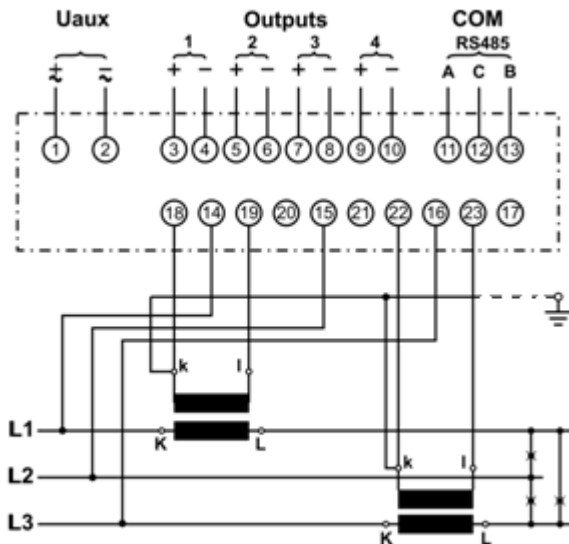
Connection options



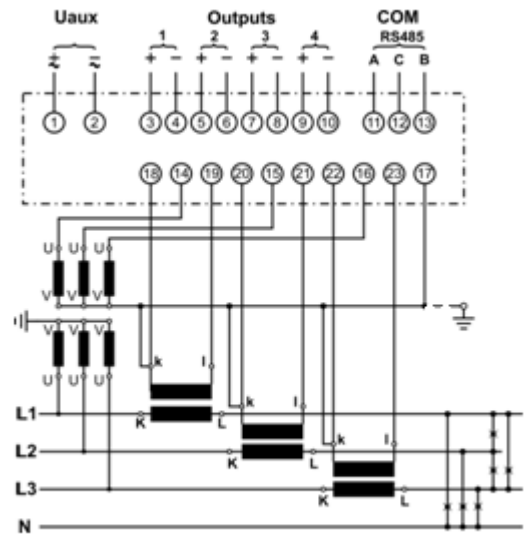
Three-phase three-wire balanced (1W3/3b)



Three-phase four-wire balanced (1W4/4b)

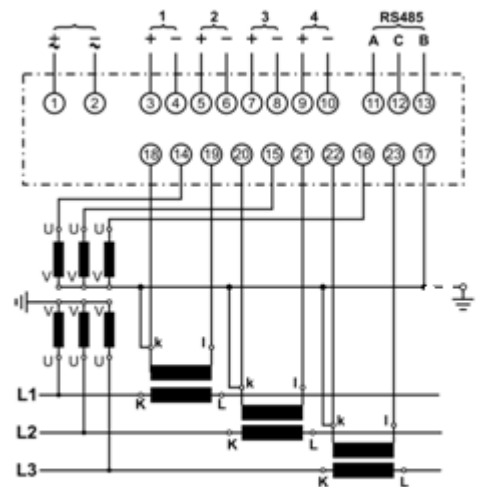


Three-phase three-wire unbalanced (2W3/3u)



Three-phase four-wire unbalanced (3W4/4u)

Note:
If the transducer is connected as a 3-wire coupling, e.g. when used on a three-phase net without neutral, the connection mode 3b (balanced = 1W3) or 3u (unbalanced = 3W3) should be selected in the utility software.



Three-phase 3-wire unbalanced (3W3)

Type MTR-2/MTR-2F

Order specifications

To order a transducer, quote the type.

Examples:

Transducer without output:
MTR-2-015

Transducer with 3 outputs:
MTR-2-315

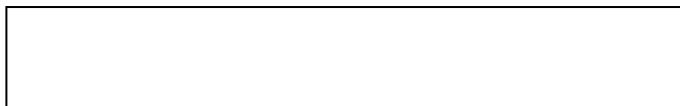
Transducer with 4 outputs:
MTR-2-415

Transducer with 2 outputs and fast response:
MTR-2F-215

For configuration/communication:

USB – RS485 signal converter

Due to our continuous development we reserve the right to supply equipment which may vary from the described.



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