Metering Devices, Protective Relays & Communications

Contents

Power Management Devices

Product Description

Eaton's metering products provide solutions needed to monitor and manage all aspects of an electrical distribution system.

When seeking greater reliability, increased productivity and significant cost savings to remain competitive in today's market, Eaton's metering products fit the bill. These innovative meters and communications systems, along with Power Management software, make it possible to successfully take control of the electrical distribution system.

Power Xpert® Meters

Power Xpert Meters are the benchmark for intelligent Web-enabled top-quality metering devices for the power chain. Power Xpert Meters provide measurement of the critical elements found in the power chain, whether that be voltage, power, current, transients, harmonics or even time. Power Xpert Meters provide Web-enabled high-definition communications for use with the Power Xpert Software. All Power Xpert Meters provide a standard communications protocol for easy integration into other systems.

Greater Reliability

Eaton's metering products permit receiving an early warning of potential problems, eliminate unnecessary trips, isolate faults to ensure minimum downtime and shed or equalize loads while a problem is being corrected.

Increased Productivity

Equipment downtime resulting from voltage or frequency variations can be very costly to an operation. Monitoring power quality with Eaton's metering products throughout the electrical distribution system provides data to identify, isolate and correct problems quickly and efficiently.

Metering Products Family

Reduced Energy and Operating Costs

When we think about meters and power quality, the common thread throughout the basket of solutions is information. Collecting, monitoring and managing data from the electrical distribution system can help reduce costs for those facilities prepared to define and analyze present electrical energy usage levels and patterns. Data provided by Eaton's metering products comprise the data for verifying utility bills for energy management and lowering operating costs. Deregulation in some geographical locations permits energy users to select a utility provider and negotiate rate structures. For large users with heavy utility bills, this may be an incentive to verify the utility bill, identify an opportunity for savings, negotiate a better utility rate and apply the savings directly to the bottom line. Users are also empowered to decrease energy consumption, thereby lowering peak demand charges and decreasing operating costs.

When an Eaton meter is used with Eaton trip units and relays incorporating built-in metering capabilities, the entire electrical distribution system can be cost-effectively managed.

Eaton is an industry leader offering a complete integrated solution to oversee your entire electrical distribution system. As a global manufacturer of low and medium voltage electrical distribution system equipment and components, Eaton is an experienced innovator of metering products that incorporate cutting-edge technology. These innovations result from our scientific and engineering expertise, physical resources and the ongoing R&D programs at our four technology centers.

Table 56-1. Metering Selection Chart — Dimensions in Inches (mm)

Device Name Accessories See Page 56-66	Power Xpert 4000/6000/8000 	Power Xpert 2000 	IQ 250/260 Series 
Section Page Number	**56-6**	**56-22**	**56-33**
Electrical Parameters			
Volts Amperes Current Range (% of Nominal)	0.1% of reading + 0.02% FS 0.05% of reading + 0.01% FS 0.005 – 20 A (400%)	0.1% of Reading 0.1% of Reading 0.1 – 200%	0.1% of Reading 0.1% of Reading 0.1 – 200%
Watts Vars VA	0.1% of Reading + 0.0025% FS 0.1% of Reading + 0.0025% FS 0.1% of Reading + 0.0025% FS	0.2% of Reading 0.2% of Reading 0.2% of Reading	0.2% of Reading 0.2% of Reading 0.2% of Reading
PF-Apparent PF-Displacement Frequency	0.1% 0.1% ± 0.01 Hz	0.2% of Reading — ± 0.03 Hz	0.2% of Reading — ± 0.03 Hz
THD-Voltage THD-Current Watthours	1% 1% ANSI C12.20 0.2 Class ①	40th ②③ 40th ②③ ± 0.2% Per ANSI C12.20 0.2 Class	40th ④ 40th ④ ± 0.2% Per ANSI C12.20 0.2 Class
Varhours VA-Hours Ampere-Demand	ANSI C12.20 0.2 Class ① ANSI C12.20 0.2 Class ① 0.05% of reading + 0.01% FS	± 0.2% Per ANSI C12.20 0.2 Class ± 0.2% Per ANSI C12.20 0.2 Class ± 0.1% Per ANSI C12.20 0.2 Class	± 0.2% Per ANSI C12.20 0.2 Class ± 0.2% Per ANSI C12.20 0.2 Class ± 0.1% Per ANSI C12.20 0.2 Class
Watt-Demand Var-Demand VA-Demand	ANSI C12.20 0.2 Class ① ANSI C12.20 0.2 Class ① ANSI C12.20 0.2 Class ①	± 0.2% Per ANSI C12.20 0.2 Class ± 0.2% Per ANSI C12.20 0.2 Class ± 0.2% Per ANSI C12.20 0.2 Class	± 0.2% Per ANSI C12.20 0.2 Class ± 0.2% Per ANSI C12.20 0.2 Class ± 0.2% Per ANSI C12.20 0.2 Class
Revenue Accuracy Individual Ampere Harmonics Individual Voltage Harmonics	ANSI C12.20 0.2 Class ① 85th ⑤ 85th ⑤	ANSI C12.20 (0.2%) 40th ③ 40th ③	ANSI C12.20 (0.2%) — —
Interharmonics	Yes	—	—
Minimum and/or Maximum Values			
Volts Current Power	L-L, L-N, VAUX L-L A, B, C, N, G Watt, Var, VA	L-L, L-N A, B, C, N Watt, Var, VA	L-L, L-N A, B, C Watt, Var, VA
Power Factor Frequency THD	Apparent/Displacement Hertz Amperes/Volts (L-L, L-N, AUX L-L)	Apparent Hertz Amperes/Volts ②③	Apparent Hertz Amperes/Volts ④
Demand Values Trend Analysis Event Logging Disturbance Recording	kW, kvar, kVA, Amperes Limited to size of CompactFlash Limited to size of CompactFlash CompactFlash 512 MB Standard/ 1GB Option 60 Cycles Per Event	kW, kvar, kVA, Amperes 240 MB 50,000 Events with Timestamp —	kW, kvar, kVA, Amperes ⑥ ⑥ —
Other Features			
Storage	512 MB Standard/1GB Option	256 MB Standard	—
PG Output Relays PG Analog Outputs Discrete Contact Inputs Analog Inputs	5 Maximum — 8 —	Optional (2) Form C, 5 A or (4) Form A, 120 mA Optional (4) 4 – 20 mA or (4) 0 – 1 mA Optional (2) or (4) —	Optional (2) Form C, 5 A or (4) Form A, 120 mA Optional (4) 4 – 20 mA or (4) 0 – 1 mA Optional (2) or (4) —
Synch-Input kW Utility	Via Status Input	Via End of Interval Pulse with Optional Digital Inputs	Via End of Interval Pulse with Optional Digital Inputs
Auxiliary Voltage ⑦	Yes	—	—
kWh Pulse Initiator Waveform Display Waveform Capture Frequency Distribution Display	Yes Local/Computer Yes —	Yes ⑥ — —	Yes — — —
Display Type Display Lines/Character Display Character Height	LCD Graphic (320 x 240 Pixels) 5.5 mm H x 4 mm W	Red LED 3 Lines, 4 Characters .56 (14.2) H	Red LED 3 Lines, 4 Characters .56 (14.2) H
Communications	Modbus RTU, Modbus ASCII, Modbus TCP, Ethernet TCP/IP, HTML, FTP	Serial: Modbus RTU, Modbus ASCII, DNP 3.0 Network: Modbus TCP, Ethernet TCP/IP, HTTP, HTTPS, SNMP, Email	Eaton's Power Xpert Software via Power Xpert Gateway, RS-485
Setup Configuration	Via Web Browser/Display	Via Web Browser/Display	—
Dimensions Operating Temperature Range	Meter (8.82 H x 8.22 W x 6.72 D) ⑧ Display (9.02 H x 7.80 W x 2.49 D) ⑨ -20° – 60°C Display Unit -20° – 70°C Meter Base Unit ⑩	Refer to IM02601001E (see **Page 3.1-23**) -20° – 70°C	Refer to IB02601006E (see **Page 3.1-30**) -20° – 70°C

① Under typical operating conditions.
② PXM 2260 only.
③ PXM 2270 only.
④ IQ 260 only.
⑤ Individual values reported to 85th harmonic; anti-alias filtering prevents higher frequencies from distorting readings (see IEC61000-4-7).
⑥ At computer only.
⑦ The auxiliary voltage option adds 3 additional voltage input channels to Power Xpert meters.
⑧ Dimensions in mm = 224.0 H x 208.8 W x 170.7 D.
⑨ Dimensions in mm = 229.1 H x 198.1 W x 63.2 D.
⑩ Using < 10 VA meter sourced 24 V power.

Legend: PG = Programmable
FS = Full Scale
RV = Read Value
Auxiliary Voltage (Optional) = Provides 3 Additional Voltage Inputs to the Meter: Va2, Vb2, Vc2.
Interharmonics = Power Xpert 6000/8000 Supported.

Table 56-1. Metering Selection Chart — Dimensions in Inches (mm) (Continued)

Device Name Accessories See Page 56-66	IQ Analyzer 6000 Series 	IQ DP-4000 Series 	IQ 210/220/230 Series 
Section Page Number	**56-36**	**56-44**	**56-48**
Electrical Parameters			
Volts Amperes Current Range (% of Nominal)	± 0.2% FS ① ± 0.2% FS ① 3 – 800%	± 0.3% FS ± 0.3% FS 10 – 250%	± 0.5% FS ± 0.5% FS 1 – 200%
Watts Vars VA	0.4% FS, 6 Reading ② 0.4% FS, 6 Reading ③ 0.4% FS, 6 Reading ②	± 0.6% FS ± 0.6% FS ± 0.6% FS	± 1.0% FS ± 1.0% FS ± 1.0% FS
PF-Apparent PF-Displacement Frequency	0.8% FS ① 0.8% FS ① 0.04% ① or 0.01 Hz	± 1.0% FS ± 1.0% FS ± 0.17% FS	± 2.0% FS ± 2.0% FS ± 0.1% Hz
THD-Voltage THD-Current Watthours	50th 50th 0.5% Reading ②	31st 31st ± 0.6% FS	— — ± 1.0% Per ANSI C12
Varhours VA-Hours Ampere-Demand	1% Reading ③ 0.5% Reading ② ± 0.2% FS ①	± 0.6% FS ± 0.6% FS ± 0.3%	± 1.0% Per ANSI C12 ± 1.0% Per ANSI C12 ± 0.5% Per ANSI C12
Watt-Demand Var-Demand VA-Demand	± 0.4% FS ① ± 0.4% FS ① ± 0.4% FS ①	± 0.6% ± 0.6% ± 0.6%	± 1.0% Per ANSI C12 ± 1.0% Per ANSI C12 ± 1.0% Per ANSI C12
Revenue Accuracy Individual Ampere Harmonics Individual Voltage Harmonics	ANSI C12.20 (0.5%) 50th 50th	— — —	ANSI C12.1 (1%) — —
Interharmonics	—	—	—
Minimum and/or Maximum Values			
Volts Current Power	L-L, L-N A, B, C, N, G Watt, Var, VA	L-L, L-N A, B, C Watt, Var, VA	L-L, L-N A, B, C Watt, Var, VA
Power Factor Frequency THD	Apparent/Displacement Hertz Amperes/Volts	Apparent/Displacement Hertz Amperes/Volts	Apparent/Displacement Hertz —
Demand Values Trend Analysis Event Logging Disturbance Recording	All Time/Date 504 Events w/Timestamp 10 Waveform Events	All 2 Alarms ④ —	All ④ ④ —
Other Features			
Storage	90 kB	15 Parameters	—
PG Output Relays PG Analog Outputs Discrete Contact Inputs Analog Inputs	(4) 10 A Form C ⑤ (4) 0 – 10/4 – 20 mA (3) + 30 Vdc Differential (1) 0 – 20/4 – 20 mA	(3) 10 A Form C ⑥ (— (1) kW Demand ⑥ —	(2) 100 mA Form A ⑦ — (2) +30 Vdc differential ⑦ (1) 4 – 20 mA ⑦
Synch-Input kW Utility	At Device or via Communications	At Device or via Communications ⑥	Via Communications Only ⑧
Auxiliary Voltage ⑨	—	—	—
kWh Pulse Initiator Waveform Display Waveform Capture Frequency Distribution Display	Yes Local ⑥/Computer Yes Local ⑥/Computer	Yes ⑥ — — —	Yes ⑧ — — —
Display Type Display Lines/Character Display Character Height	Graphic LCD with LED Backlight 7 Lines, 147 Characters Up to 7 Lines	7 Segment LED 1 Line, 7 Characters 1 Line	Backlit LCD 4 Lines, 20 Characters 1.60 (40.6) H x .09 (2.3) W
Communications	Eaton's Power Xpert Software ⑩	Eaton's Power Xpert Software ⑩	Eaton's Power Xpert Software ⑧, RS-485 ⑪
Setup Configuration	—	—	—
Dimensions Operating Temperature Range	6.70 (170.2) W x 10.30 (261.6) H x 5.40 (137.2) D -20° – 70°C	6.70 (170.2) W x 10.30 (261.6) H x 5.40 (137.2) D -20° – 70°C	Refer to TD.17.06.T.E. (see **Page 3.2-18**) 0° – 50°C

① From 3 – 300% of FS.
② At unity power factory and 5 – 300% of FS.
③ At a power factor <±0.5 and 5 – 300% of FS.
④ At computer only.
⑤ Relays programmable to operate on any measured function.
⑥ Optional.
⑦ IQ 230/230M only.
⑧ IQ 220 and IQ 230 models only.
⑨ The auxiliary voltage option adds 3 additional voltage input channels to Power Xpert meters.
⑩ An IPONI is required.
⑪ IQ 230M only.

Legend: PG = Programmable
FS = Full Scale
RV = Read Value
Auxiliary Voltage (Optional) = Provides 3 Additional Voltage Inputs to the Meter: Va2, Vb2, Vc2.
Interharmonics = Power Xpert 6000/8000 Supported.

Table 56-1. Metering Selection Chart — Dimensions in Inches (mm) (Continued)

Device Name Accessories See Page 56-66	IQ 100 	IQ Multipoint Energy Submeter II 	IQ Energy/ Power Sentinel 
Section Page Number	**56-51**	**56-54**	**56-59**
Electrical Parameters			
Volts Amperes Current Range (% of Nominal)	± 0.5% FS ± 0.5% FS 5 – 120%	±0.5% FS — —	±0.5% FS ① ±0.5% FS ① —
Watts Vars VA	— — —	±1.0% FS — —	±1.0% FS ±1.0% FS ① ±1.0% FS ①
PF-Apparent PF-Displacement Frequency	— — ± 0.1% Hz ②	— — —	±2.0% FS ① ±2.0% FS ① ±0.1% FS ①
THD-Voltage THD-Current Watthours	— — —	— — ±1.0% Per ANSI C12	— — ±1.0% FS
Varhours VA-Hours Ampere-Demand	— — —	— — —	— — —
Watt-Demand Var-Demand VA-Demand	— — —	± 1.0% Per ANSI C12 — —	± 1.0% FS — —
Revenue Accuracy Individual Ampere Harmonics Individual Voltage Harmonics	— — —	ANSI C12.1 (1%) — —	— — —
Interharmonics	—	—	—
Minimum and/or Maximum Values			
Volts Current Power	— — —	— — —	— — —
Power Factor Frequency THD	— — —	— — —	— — —
Demand Values Trend Analysis Event Logging Disturbance Recording	— — — —	— ③ ③ —	— ③ ③ —
Other Features			
Storage	—	—	—
PG Output Relays PG Analog Outputs Discrete Contact Inputs Analog Inputs	— — — —	— — — —	— — — —
Synch-Input kW Utility	—	Via Communications Only	Via Communications Only
Auxiliary Voltage ④	—	—	—
kWh Pulse Initiator Waveform Display Waveform Capture Frequency Distribution Display	— — — —	— — — —	— — — —
Display Type Display Lines/Character Display Character Height	Red LED 3 Lines, 4 Characters 2.25 (57.2) H x 2.00 (50.8) W	— — —	— — —
Communications	—	Eaton's Power Xpert Software	Eaton's Power Xpert Software
Setup Configuration	—	—	—
Dimensions Operating Temperature Range	Refer to TD02601003E (see **Page 3.2-21**) -20° – 70°C	Refer to TD02601004E (see **Page 3.2-25**) -25° – 70°C	Refer to TD.17.07.T.E. (see **Page 3.2-32**) -25° – 70°C

① IQ Power Sentinel only.
② IQ 115 only.
③ At computer only.
④ The auxiliary voltage option adds 3 additional voltage input channels to Power Xpert meters.

Legend: PG = Programmable
FS = Full Scale
RV = Read Value
Auxiliary Voltage (Optional) = Provides 3 Additional Voltage Inputs to the Meter: Va2, Vb2, Vc2.
Interharmonics = Power Xpert 6000/8000 Supported.

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Power Xpert 4000/6000/8000 Series

Power Xpert 4000/6000/8000 Series Display and Meter

Product Description

The Power Xpert 4000/6000/8000 Series Meter monitors the critical aspects of an electrical distribution system. This premier power quality metering instrument is simple to use, powerful, scalable and highly flexible.

The Power Xpert 4000/6000/8000 Meters offer a new level of intuitive user interface design, presenting critical electrical distribution system information in simple-to-navigate and easy-to-understand information architecture. The Power Xpert 4000/ 6000/ 8000's Graphic Display visualizes the information from up to 16 meter modules. The embedded Web server displays complex power quality data using standard Internet browsers and allows for device configuration from the browser.

Both the local graphic display and the embedded Web server present real time, historical and event information in a browser-style graphical format to help the user interpret key circuit information, such as:

- Current loading
- Voltage and power levels
- Power factor
- Energy usage
- I/O status
- Power quality measurements
- Harmonic plots
- Disturbance and transient waveforms
- ITIC disturbance summary screen.

The Power Xpert 4000/6000/8000 Graphic Display uses a simple "twist and click" navigation control dial to easily navigate the menus and drill down into increasing levels of important detail. A "back" key enhances the browser-like navigation of the graphic display.

The Web server provides the energy and demand readings required to help manage the cost of energy. It also provides critical information regarding power quality, such as harmonic distortion, flicker, crest factor, K-Factor and more. For more details of the Power Xpert 4000/6000/8000 Meter Series, refer to **Section 3**.

Note: Features and functionality may vary depending on the meter model and options being used. Review the Features and Benefits chart in **Table 56-3** for details.

Application Description

Identify Power Quality Problems to Help

- Identify harmonics, sags, swells and transients damaging or disrupting sensitive, mission-critical IT equipment.
- Boost IT equipment's service life to the maximum.
- Analyze sequence of events up to 1 millisecond time resolution.
- Protect motors from damage.
- Preserve the integrity of processes and batches.
- Prevent blown capacitor bank fuses.
- Protect transformers and conductors from overheating.

Detect and Record High-Speed Transients to Help

- Avoid equipment damage and disruption.
- Identify equipment malfunction.

Monitor Circuit Loading to Help

- Avoid overloads and nuisance overload trips.
- Maximize equipment utilization.
- Manage emergency overloads.

Manage Energy Utilization to Help

- Reduce peak demand charges and power factor penalties.
- Identify excessive energy consumption.

Metered/Monitored Parameters

Note: See **Table 56-3**.

- Volts: L-L, L-N, Avg. L-L, Avg. L-N, N-G.
- Phase neutral and ground currents.
- Power: real, reactive and apparent.
- Frequency.
- Power factor: apparent and displacement.
- Energy.
- Demand.
- % THD.
- Minimum and maximum values.
- Harmonics.
- Flicker.
- Individual harmonics.
- Interharmonics.
- % TDD.
- ITIC events plot, duration, magnitude.
- Energy comparisons.
- Demand comparisons.
- Event calendar.
- Event timeline and sequence.
- Number of 9's of availability.
- Phasors.
- Sequence components.
- Crest factor.
- K-factor.
- PQ Index.

Accuracy

- Currents: 0.05% reading + 0.025%FS.
- Voltage: 0.1% reading + 0.025% FS.
- Energy, and demand power: 0.2% in accordance with ANSI C12.20.
- Frequency: +/- 0.01 Hertz.
- Power factor:
  - 0.10% at Unity PF
  - 0.30% at 0.5 PF

Communications

Multiple communications ports including:

Standard

- RS-485 remote display port.
- RS-485 Modbus RTU Slave port.
- RJ-45 10/100Base-T Local Configuration Port (Local browser connection).

Optional

- Selectable 100FX or 10/100Base-T Ethernet network port.
- RS-485 Modbus RTU Selectable Master/Slave port.
- RS-232 Modbus RTU Slave port.

Graphic Display

Note: Display ports restrict access to up to 16 Power Xpert 4000/6000/8000 meter modules located on the display RS-485 network.

- RS-485 meter display network port.
- RJ-45 10/100Base-T for access to Local Display Power Xpert network.

Communication Protocols Supported

- Modbus RTU
- Modbus TCP
- Ethernet TCP/IP
- HTML
- NTP (Network Time Protocol)
- FTP (File Transfer Protocol)
- SMTP (Simple Mail Transfer Protocol)
- SNMP (Simple Network Management Protocol)
- COMTRADE (-99)

Physical Characteristics

2-Piece Design

- Power Xpert 4000/6000/8000 Meter Module.
- Power Xpert 4000/6000/8000 Graphic Display 320 x 240 pixel backlight LCD remote graphics display (supports up to 16 Power Xpert 4000/6000/8000 meter modules).

Display/Meter Mounting Options

- Display remotely mounted up to 2000 ft. (1219 m) away from up to 16 Power Xpert meter modules.
- Display and Power Xpert meter modules mounted together on opposite sides of a panel (15 additional meter modules can still be remotely mounted).

Meter Base Unit Characteristics

- Height: 8.82 inches (224.1 mm).
- Width: 8.20 inches (208.3 mm).
- Depth: 6.72 inches (170.8 mm) including optional wall mounting brackets.
- NEMA rating: NEMA 1, IP3Ø.

Display Unit Characteristics

- Height: 9.02 inches (229.0 mm).
- Width: 7.80 inches (198.1 mm).
- Depth:
  - 1.45 inches (36.8 mm) behind panel surface
  - 1.04 (26.3 mm) projection in front of panel surface
- NEMA rating: NEMA 12, IP42 front of panel rating.

Listings/Certifications

- Safety: EN61010-1, UL/cUL 61010A-1.
- Accuracy: IEC/EN60687 0.2 class, ANSI C12.20 0.2 Class.
- EMC: FCC Part 15 Subpart B Class A EN55011 Class A.
- Measurement Canada Approval No. AE-1582.
- Immunity IEC 61000-6-2.
- CE Mark.

Ease-of-Use — Power Xpert 4000/6000/8000 Graphic Display (Option)

The Power Xpert 4000/6000/8000 display features a large easy-to-read white backlit graphic LCD. The information presented by the display is organized into an information architecture that is easy-to-navigate and organized for simplicity. Screen navigation is accomplished using a navigation control dial and a “back” button. The user simply twists the knob on the navigation control dial to move between menu selections and drill down links on the screen. When the selection is highlighted, pressing the dial makes the selection. Information is displayed from a single meter or an RS-485 daisychain of up to 16 meters. The display features a rich set of screens including real-time data, trend plots, waveform views and an ITIC Plot. The graphic display allows basic device setup and password protected resets. An audible alarm is available to annunciate alarm conditions.

Power Xpert 4000/6000/8000 Embedded LAN/WAN Web Server (Option)

The Power Xpert 4000/6000/8000 Meter’s embedded Web server offers Eaton customers a new level of accessibility to the critical information required to manage their electrical distribution system. The Web server includes real-time circuit information in both numeric and graphical visual formats to help monitor circuit parameters such as current loading, voltage and power levels, power factor, THD, Flicker and more. The Web server also provides energy and demand readings with graphic usage plots to help analyze energy usage patterns. Energy readings include kWh, kvarh, delivered and received and kVAh with time of use and RTP displays. The interval energy usage plot includes the ability to do week-to-week and month-to-month energy consumption graphical comparisons for benchmarking purposes.

Both the Power Xpert 4000/6000/8000 embedded Web server and the local graphic display support graphical trend charts of key circuit measurements such as current, voltage, power and energy. The trend chart supports a zoom feature that allows the user to view data over a short period of 16 hours up to 4 years. The trend chart includes zoom in/out buttons and a horizontal slider bar control to manage scrolling forward and backward through the data. Trend charts of basic readings include minimum, maximum and average readings. Trend charts of interval by interval energy data also display peak demand.

Sag/Swell/Transient Capture and Recording

60 cycles of waveform are oversampled at 1024 samples per cycle (Power Xpert 4000/6000), filtered through anti-aliasing and recorded at 256 samples per cycle and post event data. The Power Xpert 8000 samples at a rate of 100,000 samples per cycle. Embedded Web server supports viewing of triggered waveforms one channel at a time and includes the ability to zoom and to scroll horizontally using a slider bar.

The Power Xpert 6000/8000 Series Meters have preconfigured (600 volts and below) trigger settings for sags, swells and transients, and do not require additional setup by the user. Waveforms are stored in non-volatile flash memory using an industry standard COMTRADE format. Waveforms can be automatically sent out as COMTRADE attachments to an e-mail following an event, or can be retrieved from an FTP (File Transfer Protocol) directory structure in the Power Xpert meter module’s memory.

Historical Trend Logging

The Power Xpert 4000/6000/8000 Meter records historical data for graphical viewing from the Local display or the embedded Web server. Graphical views of historical data support pan and zoom. 145 standard metering parameters are logged as part of the standard meter functionality including min./max. and average for each parameter. The averages are calculated over the interval period. The minimum and maximum readings are based on 200 ms calculations.

Storage capacity for standard trend plots includes all of the following intervals:

- Every 5 minutes for 48 hours.
- Every 15 minutes for 192 hours.
- Every hour for 28 days.
- Every 8 hours for 565 weeks.
- Every week for 44 months.

Note: Trend plot data can be easily exported to third-party applications, such as Microsoft Excel in csv-file format.

Energy Profile Data

The Power Xpert 4000/6000/8000 Meter records Real and Reactive energy forward, reverse, net and absolute sum, as well as Apparent energy (kVAH). Up to 8 status inputs can be configured as energy accumulators for counting KYZ pulse inputs (option). These readings are stored over a configurable interval from 1 to 60 minutes, as well as in daily and weekly totals.

With the optional LAN/WAN Ethernet Communication Expansion Card, users can easily configure the meters to send periodic e-mails at user-defined intervals of energy consumption and power demand. E-mails contain a summary of readings per rate structures and also have the actual measurements attached to the E-mail's body as a SCV file in a ZIP container.

In addition, metered parameters are automatically stored on the built-in FTP Server, where they can be easily copied and imported into third-party applications for benchmarking and analysis. Logs on the FTP Server include energy consumption logs, one for every month in CSV file format, trended measurement logs also in CSV file format and waveform captures in COMTRADE file format.

Storage capacity for energy profile data:

- 62 days of 15 minute interval energy and pulse interval data.
- Fixed interval capacity = 5952 intervals. Configurable intervals from 1 to 60 min.
- 372 days of 1 day accumulated energy and pulse interval data.
- 208 weeks of 1 week accumulated energy and pulse interval data.

Energy and Demand Comparisons

Energy and demand usage patterns can be analyzed with the month-to-month, week-to-week comparison chart built into the meter. Raw data can be exported with the "Save Table" option to other applications, such as Excel, for further analysis and graphing.

Event Triggers

The Power Xpert 4000/6000/8000 Meter supports five types of configurable event triggers:

- Out of limits (4000/6000/8000).
- Demand overload (4000/6000/8000).
- Sub-cycle disturbance (4000/6000/8000).
- ITIC (6000/8000).
- Fast transient (8000).

These triggers permit pickup, reset and pickup delay to be configured by the user. When a trigger occurs, actions include Performance Monitoring (#9's analysis), Capturing Waveform, Capture Parameters, Send E-mail and Operate a Relay Output. The Graphic Display flashes an LED to annunciate the alarm condition. An audible alarm is also available.

Trigger options include:

- Out of limits: over 100 triggers.
- Demand overload: 10 triggers.
- ITIC: 8 triggers.
- Fast transient: dV/dT and absolute per phase.
- Sub-cycle disturbance — dV/dT and absolute.

Event Logging

The Power Xpert 4000/6000/8000 Local graphic display or the embedded Web server both allow the user to view a list of triggered events along with any captured parameters, event details, and triggered waveforms. In addition, a separate event log includes a variety of activities including acknowledged triggers, new min. and max. events, and system operations such as resets. The size of the event log is virtually unlimited based only on the memory option selected.

E-mail Notification

With the optional LAN/WAN Ethernet Communication Expansion Card attached to the Power Xpert 4000/6000/8000's, the users can easily configure the meters to send periodic e-mails at user-defined intervals for energy consumption and power demand. E-mails contain a summary of readings per rate structures and also have the actual measurements attached to the E-mail's body as a SCV file in a ZIP container. Prompt alarm e-mails can also be sent for any event condition either standard in the meter or ones set up by the user based on thresholds, dV/dt triggers or IO status changes with the optional IO Card. Alarm e-mails can be configured to have the COMTRADE waveform capture attached to the e-mail's body.

Periodic E-mail Message

ITIC Analysis Plot

The Power Xpert graphic display (option) and Web server (option) include a graphic representation of the ITIC plot (Power Xpert 6000/8000) with counts of disturbances and transients that have occurred. The ITIC plot organizes events into 8 distinct disturbance zones corresponding to severity and a 9th zone for transients. A pass/fail count is displayed to indicate how many events are outside the ITIC limits. Clicking on any counter in the ITIC Web page will link the user to the event view and display all triggered events in the selected zone. This makes it simple to view disturbance waveforms associated with the ITIC plot.

A separate ITIC graph is available to review individual ITIC events. This graph will show the user the event hit position on the graph and the event duration and magnitude.

Inputs and Outputs

Power Xpert 4000/6000/8000 is available with an optional digital I/O card, which includes:

- Eight digital inputs — self sourced 24 Vdc.
- Three relay outputs — 5 A max. continuous, 240 Vac max., 30 Vdc max.
- Two solid-state outputs — 80 mA max. continuous, 30 Vdc max.

Each of the 8 inputs are interrupt driven, allowing for 1 ms accuracy of digital events time stamps (1 ms accuracy requires local Power Xpert NTP TimeServer). Inputs can also be configured for demand synch, and pulse counting. Inputs selected for pulse counting can be scaled. Interval by interval pulse recordings are maintained in profile memory and can be displayed graphically. Outputs can be used for KYZ, or alarm annunciation.

Ratings

- Application to 500 kV, no PTs to 600 V.
- CT ratios selectable from standard 120/600 Vac line.
- CT inputs accept 5 amp secondary.
- Power supply:
  - Standard 120/240 Vac or 110/250 Vdc
  - Low voltage 24 – 48 Vdc (Contact Eaton for availability)

Storage Capacity

Table 56-2. Power Xpert 4000/6000/8000 Meters Estimated Memory and Storage Capacity with 512 MB Standard and 1 GB Optional CompactFlash

Model	Event	File Size (KB)	Occurrence Per Month ①		Memory Usage (MB)		Months of Capacity with 512 MB CompactFlash ②		Months of Capacity with 1 GB CompactFlash ③	
			Typical	Server	Typical	Server	Typical	Server	Typical	Server
PX-4000	Sub-Cycle Disturbance	483	10	60	4.7	28.3	100	17	209	35
PX-6000	ITIC Event	483	5	20	2.4	9.4	200	50	417	104
	Sub-Cycle Disturbance	483	10	60	4.7	28.3	100	17	209	35
	ITIC and Sub-Cycle Disturbance Combined	Total	15	80	11.8	66.0	40	7	83	15
PX-8000	ITIC Event	483	5	20	2.4	9.4	200	50	417	104
	Sub-Cycle Disturbance	483	10	60	4.7	28.3	100	17	209	35
	Transients	2048	3	30	6.0	60.0	79	8	164	16
	ITIC, Sub-Cycle and Transients Combined	Total	18	110	13.1	95.2	36	5	75	10

① The typical and server power quality event occurrences are estimates and may vary depending on the electrical environment.
② With 512 MB standard CompactFlash Card; memory is not allocated by event category; memory is used first come, first served.
③ With 1 GB optional CompactFlash Card; memory is not allocated by event category; memory is used first come, first served.

Power Xpert 4000

- Harmonics.
- Disturbance capture.
- Low frequency transient detection and capture.
- Standard power quality index.

Power Xpert 6000

- Harmonics, including individual harmonics.
- Flicker calculations.
- ITIC performance curve.
- Event calendar view.
- Events timeline view.
- Sequence of events waveform plot.
- Enhanced power quality index.

Power Xpert 8000

- Impulsive transient capture at 6 MHz.
- 100,000 samples per cycle.
- Premium power quality index.

Table 56-3. Power Xpert 4000/6000/8000 Meters — Features and Benefits

Feature	Power Xpert			Benefit
	4000	6000	8000	
General				
Embedded Web Server	■	■	■	Use a standard Web browser to monitor and manage the meter over the network, Internet.
TOU Metering Support	■	■	■	Time of usage can be set up to support 4 different schedules.
Firmware Flash Upgrade Support	■	■	■	Enables you to flash the meter with the latest firmware upgrades.
Self-Learning Capability (characterizes "normal" per circuit)	■	■	■	The meter can automatically adjust to the environment and alarm only when "real" events occur.
Power, Energy & Demand				
Voltage, Current: per Phase Minimum, Maximum, Average, Trend Graph Analysis, Export, Print	■	■	■	Review voltage and current trends, export, print and analyze parameters right on the meter or external software.
Energy and Demand Plot Comparisons Month-to-Month, Week-to-Week	■ ①	■ ①	■ ①	Plot two months or two weeks for vivid energy or demand comparison.
Power: Power Factor, Apparent, Real, Reactive, Frequency	■	■	■	Review power usage and power factor and avoid potential PF penalties.
Energy, Demand: Forward, Reverse, Net, Sum, TOU, Profile, Previous Month Comparison, Graph Analysis, Export, Print	■	■	■	Keep track of your energy usage, compare time of usage and usage against previous month, identify peaks to conserve energy usage.
Power Quality Analysis				
Statistical Analysis (min, max, average)	■	■	■	Review statistical trends, identify past and future problem areas.
Sag and Swell Monitoring, Management and Recording	■	■	■	Capture electrical sags and swells and analyze the waveforms.
Symmetrical Components: Zero, Negative, Positive	■	■	■	Analyze possibly unbalanced three-phase power systems.
Low Frequency Transient Detection and Capture	■	■	■	Capture lower frequency transient waveforms for retrospective analysis or e-mailing.
Sampling Rate, Maximum Samples/Cycle	1024 ②	1024 ②	100,000	Extremely high sampling rate will effectively capture impulsive transients.
"Number of Nines" Uptime Data (e.g. 6 nines=99.9999%)	■	■	■	Review uptime availability per cent.
K-Factor	■ ①	■	■	Review the ratio of eddy current losses e.g. when driving non-linear and linear loads.
Crest Factor	■ ①	■	■	Review the peak-to-average ratio of the waveform.
Security				
Secure 5 Level User Access Privileges	■	■	■	Define appropriate security access level per user.
Communications and I/O				
Modbus TCP	■	■	■	Easy integration with standard protocol to power management and other software.
Modbus RTU	■	■	■	Integrate meters to existing Modbus networks, daisy chain several (1 – 16) meters together.
HTML	■	■	■	Communicate to the meter over the Internet via standard Web browser.
SNMP (Simple Network Management Protocol)	■	■	■	Communicate with the meter via Simple Network Protocol; hook to existing NMS system.
SMTP (Simple Mail Transfer Protocol)	■	■	■	Send e-mail messages via standard Simple Mail Transfer Protocol.
FTP (File Transfer Protocol)	■	■	■	Access, copy, paste, cut waveform capture files on the meter with an FTP Client.
NTP (Network Time Protocol)	■	■	■	Network Time Protocol support enables the meter to synchronize time over the network up to the 1 millisecond resolution.
COMTRADE, Open IEEE Standard File Format for Waveform Capture Export	■	■	■	Import waveform captures in standard IEEE (C37.111-1999) COMTRADE file format to third-party software.

① These features are included with firmware release v. 12.x.x or higher.

② Delta-Sigma A/D oversampling rate.

Note: These specifications are subject to change without notice and represent the maximum capabilities of the product with all options installed. This is not a complete feature list. Features and functionality may vary depending on selected options, firmware version and product model. Please refer to the technical data sheet and User Manual for detailed specifications.

Table 56-3. Power Xpert 4000/6000/8000 Meters — Features and Benefits (Continued)

Feature	Power Xpert			Benefit
	4000	6000	8000	
Communications and I/O (Continued)				
Trend Measurements CSV File Export	■	■	■	Easily export trend measurements to third-party applications, e.g. Microsoft Excel in standard CSV file format.
I/O (8 Digital Inputs, 3 Relay Outputs, 2 Solid State KYZ Outputs)	■	■	■	The Power Xpert I/O Card is extremely flexible and can be used in a large variety of different applications. Digital inputs and relay outputs can be programmed to interact during various conditions defined by the user. Various third party devices, such as alarm, pulse meters, trip units, sensors can be easily integrated to the Power Xpert meter. Triggers and events can be tied to the meters standard functions such as e.g. e-mail, logs and trends.
Time Synchronization				
NTP Time Synchronization up to 1 Millisecond Accuracy	■	■	■	Network Time Protocol support enables the meter to synchronize time over the network up to the 1 millisecond resolution
GPS Time Synchronization up to 1 Millisecond Accuracy	■ ②	■ ②	■ ②	The GPS option allows the meter to synchronize time over the GPS satellite positioning system up to the 1 millisecond resolution
Logs				
Trend Logging	■	■	■	Log trend information for easy statistical analysis.
Load Profile	■	■	■	Review the load profile graph to get a better understanding of your electrical load versus time.
Event Logging	■	■	■	Log events for retrospective event analysis.
Memory and Storage				
512 MB Standard Memory	■	■	■	Store large amounts of waveform captures and events for historical analysis.
1 GB Optional Memory	■	■	■	Store massive amounts of waveform captures and events for historical analysis.
Harmonics				
Harmonic levels	127	127	127	Provides extremely fast, high resolution D/A conversion.
Total Harmonic Distortion (THD)	■	■	■	Review the total harmonic distortion level directly on the meter.
Delta-Sigma D/A Conversion Technology	■	■	■	Provides extremely fast, high resolution D/A conversion.
Harmonics over-sampling (1024 samples per cycle)	■	■	■	Over-sampling enables the usage of Anti-Aliasing technology, increasing accuracy.
Anti-Alias Filtering	■	■	■	Technology to remove out-of-band signal components resulting in more accurate data.
Individual Harmonics	■ ①	■	■	Review individual harmonic levels directly on the meter.
Total Demand Distortion (TDD)	■ ①	■	■	Identify harmful harmonics in e.g. lightly loaded variable-speed drive environments where THD may be high but not relative.
Interharmonics		■ ①	■ ①	Interharmonics allow you to see what is going on between the integer multiples of the fundamental. Zoom in on the harmonics trend graph and review frequency content every 5 Hz instead of every 60 Hz.
Highlights				
Sub-Cycle Disturbance Capturing	■	■	■	Capture fast voltage changes/low frequency transient (e.g. capacitor switching transient).
dV/dt Triggers for Sub-Cycle Oscillatory Transients	■	■	■	Detect and record a large magnitude oscillation transient resulting in equipment damage.
Absolute Threshold and dV/dt Triggering	■	■	■	Detect and record if a surge suppressor is necessary.
Power Quality Index — Standard (at-a-glance "thermometer" view of power quality)	■ ①	■	■	Complex power quality data put into simple graphic format.
Power Quality Index — Enhanced (at-a-glance "thermometer" view of power quality)		■ ①		Complex power quality data put into simple graphic format (includes ITIC events and flicker calculations).
Flicker Calculations		■	■	Detect and quantify low frequency RMS voltage variations causing incandescent lighting flicker.
Automatic Trigger Setting		■	■	Trigger thresholds are automatically set according to ITIC (CBEMA) standard, no need to figure this out by yourself.
Automatic Event Severity Analysis		■	■	Automatically analyze the severity of the event with the ITIC (CBEMA) performance curve plot, see where the event actually hit.

① These features are included with firmware release v. 12.x.x or higher.

② When used with 3rd party device and I/O option.

Note: These specifications are subject to change without notice and represent the maximum capabilities of the product with all options installed. This is not a complete feature list. Features and functionality may vary depending on selected options, firmware version and product model. Please refer to the technical data sheet and User Manual for detailed specifications.

Table 56-3. Power Xpert 4000/6000/8000 Meters — Features and Benefits (Continued)

Feature	Power Xpert			Benefit
	4000	6000	8000	
Highlights (Continued)				
Event Severity Counters		■	■	An ITIC (CBEMA) event counter keeps track of the number of all sags, swells and transients.
ITIC (Information Technology Industry Council), Previously CBEMA Performance Curve		■	■	ITIC (Information Technology Industry Council), previously CBEMA performance curve for easy power problem evaluation.
Custom ITIC (CBEMA) Plot with Individual Event Magnitude and Duration		■	■	Review custom ITIC (CBEMA) plots of individual events showing you the actual magnitude, duration and hit are in a simple graphical representation.
Event Calendar View		■ ①	■ ①	The Events Timeline calendar view provides instant insight to the frequency of power events and helps detect reoccurring problems.
Events Timeline View		■ ①	■ ①	View and understand the sequence of events that have occurred during a period of time.
Sequence of Events and Events Plot on Waveform		■ ①	■ ①	Plot color-coded events on a captured waveform to gain insight into the sequence of events cycle per cycle.
Power Quality Index — Premium (at-a-glance "thermometer" view of power quality)			■ ①	Complex power quality data put into simple graphic format (includes ITIC events and flicker calculations).
High-Speed Transient Capture and Detection				
6 MHz Capture of Impulsive Transients			■	Capture impulsive transients by taking 6 samples every millionth of a second.
Transient Capture Duration: ~20ms/6MHz ~120ms/1MHz			■	Record and analyze transients during a longer timeframe.
Waveform Recorded at 100,000 Samples per Cycle			■	High-speed ensures impulsive transients are correctly captured (fast rise time).
Three-phase Voltage and Neutral-to-Ground Fast Transient Capture			■	Capture impulsive transients on all 4 channels.

① These features are included with firmware release v. 12.x.x or higher.

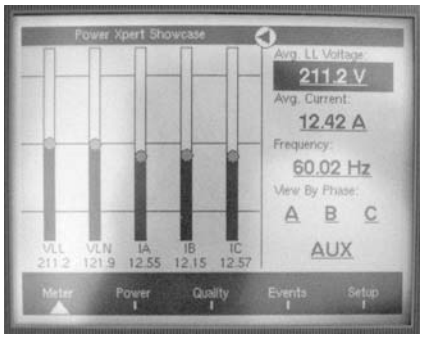
Note: These specifications are subject to change without notice and represent the maximum capabilities of the product with all options installed. This is not a complete feature list. Features and functionality may vary depending on selected options, firmware version and product model. Please refer to the technical data sheet and User Manual for detailed specifications.

Power Xpert 4000/6000/8000 Graphic Display (Option) Features

A menu-driven graphical display with information organized into a user-friendly information architecture.

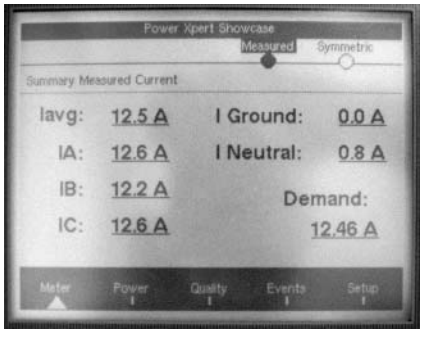
The Homepage (see below) offers:

- Graphical level indicator based on a statistical analysis for 3-phase Line-to-Line and Line-to-Neutral Voltage and per phase currents to quickly indicate out of normal readings.
- Large easy-to-read average L-L voltage average Phase currents and System Frequency can be highlighted and selected using the navigation control dial to drill down for additional detail.
- Menu selections for Meter, Power, Quality, Events and Setup are shown for ease of navigation into display for more detail, or basic device setup.



Homepage

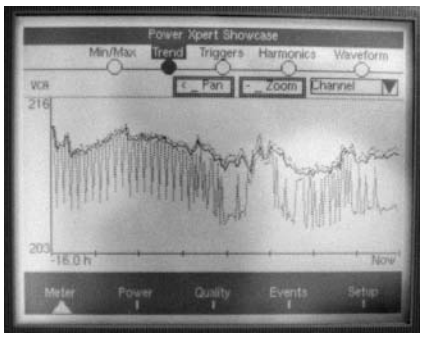
Highlighting a field such as the Avg. Current value and pressing the navigation control dial brings up a detail screen like the one below.



Current Summary

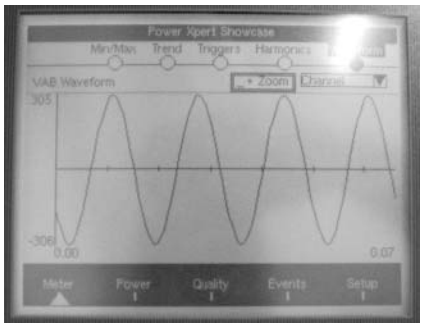
Highlighting an individual reading on the detail summary level screen and selecting it drills down to a level including links to Min./Max., Historical Trend Plots, Triggers, Harmonic spectral data, and waveform viewing.

Selecting the trend plot for a given parameter displays a historical graph of the selected parameter over the last 16 hours. The zoom buttons change the time scale to one of several data views based on historical averages with Min./Max. The Pan button allows scrolling within the selected view.



Trend Plot

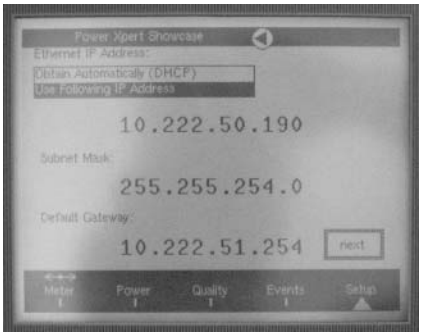
Waveforms can be displayed for currents and voltages. The waveforms can be viewed on demand for steady-state conditions. Triggered waveforms can also be displayed to view sag/swell or transient data.



Waveform Viewer

Harmonic Spectrum

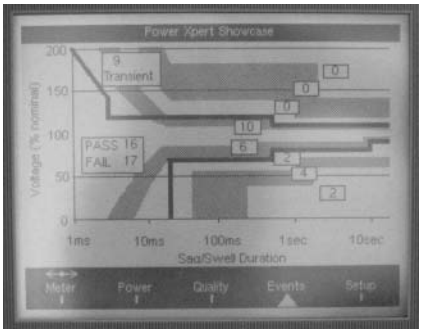
The Power Xpert Meter classifies disturbances and summarizes the results graphically using the ITIC plot.



Ethernet Settings

Ethernet and other settings can be input or verified via the Power Xpert LCD Display.

Note: Some of the other settings are specific only to the Web Browser GUI.



ITIC Plot (Power Xpert 6000/8000)

The number of ITIC Sags and Swells are indicated for each of 9 severity levels. A Pass/Fail summary is shown to indicate how many events are outside the ITIC pass zone.

Power Xpert Graphic Display (Option) Screens

Meter Top Level Screen

V-LL avg, V-LN avg, IA, IB, IC, Iavg, Freq.

Meter Detail Screens

Per phase detail L-L, L-N, Symmetrical Comp, Aux. Channels, Min./Max. with date/time of occurrence, Trend Plots, Triggers, Phasors.

Power Top Level Screen

3-Phase Power Factor, kWHr, kWd, Real-Time kW, kvar, kVA, Load Profile Link.

Power Detail Screens

Per phase detail, kVA, kvar, kW, Min./Max. with date/time of occurrence, Trend Plots, Triggers.

Quality Top Level Screen

10 min. & 24 hr. PQIndex, THDI, THDV, K-factor, Crest Factor, Flicker Pst, %9's of Reliability.

Quality Detail Screens

Per phase detail L-L, L-N,V aux, Odd, Even, Interharmonics, Present, Min/Max, Trend Plots, Harmonic spectrum plots, waveform plots.

Events Top Level Screen

Active/Acknowledged Event list, Trigger List, System Log, ITIC Curve Link.

Event Detail Screens

Event List, Condition, Acknowledge Button, Trigger Date/Time, Trigger description.

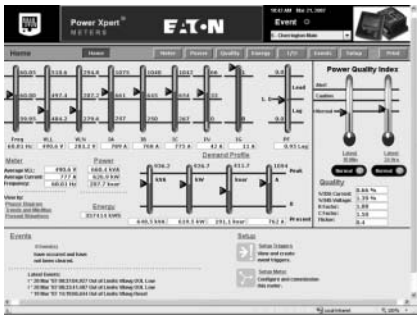
Setup Top Level Screen

View setup, Edit setup, Login, Logout.

Setup Detail Screens

Quick Setup, Trigger setup, Detail setting.

Power Xpert 4000/6000/8000 Web Browser Views

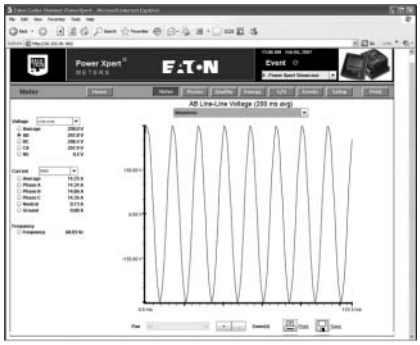


Power Xpert 4000/6000/8000 Web Browser Homepage (Note: 4000 does not include flicker, ITIC)

Power Xpert 4000/6000/8000's embedded Web server offers Eaton customers a new level of accessibility to the critical information required to manage the electrical distribution system. The embedded Web server includes real-time circuit information in both numeric and graphical formats to help monitor circuit parameters such as current loading, voltage and power levels, power factor.

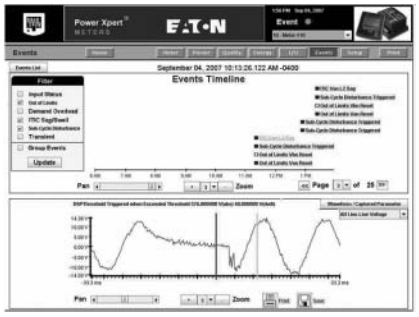
The Web server also provides the energy and demand readings required to help manage the cost of energy. Readings include kWh, kvarh, delivered and received and kVAh with time-of-use and separate status input controlled energy accumulation to account for energy during special times such as rate alert periods or stand-by generator times of operation.

The Web server also includes critical information regarding Power Quality such as harmonic distortion, flicker (Power Xpert 6000/8000), crest factor, K-Factor and more.



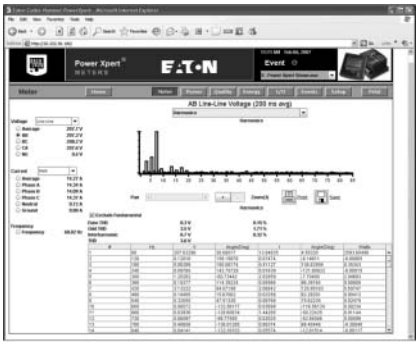
Steady-State Waveform

The Web server allows the user to view waveforms of the voltage and current to spot power quality problems such as notching.



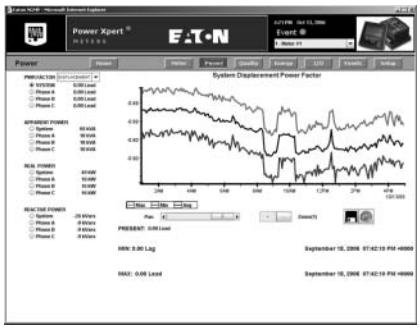
Events Timeline (Power Xpert 6000/8000)

View and understand the sequence of events that have occurred during a period of time. Plot color-coded events on captured waveforms to gain insight into the sequence of events from one single cycle to the next one. This provides the user an excellent vantage point to review and compare multiple events at an unprecedented resolution.



Harmonic Spectral Plot

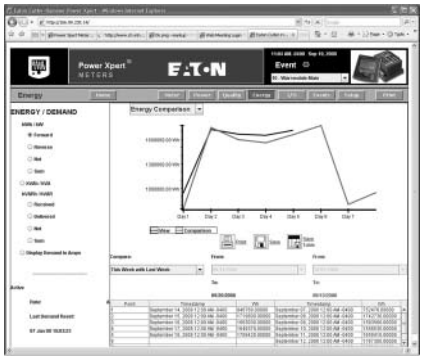
The harmonic spectral plot displays both harmonics and interharmonics up to the 85th order. A detailed table also includes individual magnitudes and angles of current and voltage harmonics, as well as a harmonic power calculation at each frequency. Even, odd and total THD are displayed for diagnostic purposes. In addition, the Power Xpert 6000/8000 provides interharmonics, which allow users to see what is going on between the integer multiples of the fundamental.



Historical Trend Plot

Graphical Trending of Data

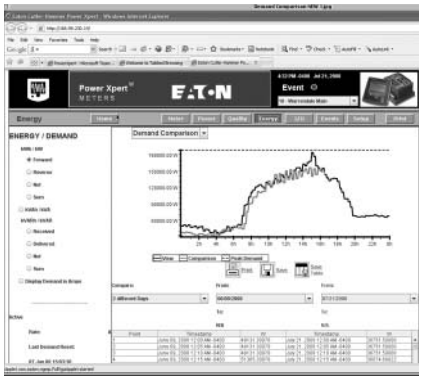
The Power Xpert 4000/6000/8000 embedded Web server supports graphical trend charts of key circuit measurements such as current, voltage, power and energy. The trend chart supports a zoom feature that allows the user to view data over a short period of 16 hours or a longer period of 48 months. The trend chart has a horizontal slider bar control to manage scrolling forward and backward through the data. Trend charts of basic readings include minimum, maximum and average readings. Trend charts of energy data also display demand values.



Energy Comparison

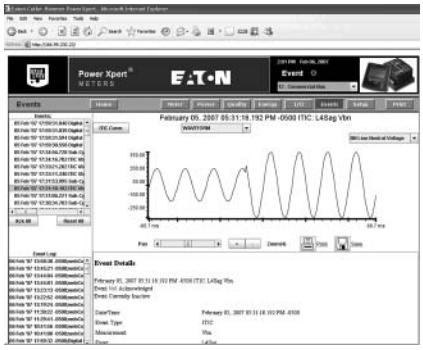
Energy usage patterns can be effortlessly analyzed with the month-to-month, week-to-week comparison chart. Raw data can be easily exported with the "Save Table" option to other applications such as Excel for further analysis or graphing (firmware version 12.x.x and higher only).

Note: All data logging for trend plotting is automatically preconfigured in all of the Power Xpert 4000/6000/8000 Meters. In addition, the 6000 and 8000 Series Meters have sag, swell and transient triggers built-in according to the ITIC (CBEMA) standard.



Demand Comparison

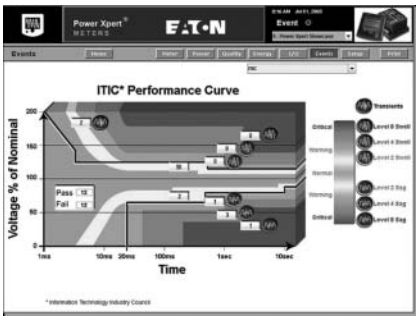
Demand comparison compares power consumption day-to-day, month-to-month or week-to-week. Power Xpert meters can set to measure demand at 1 to 60 minute intervals. Both sliding and fixed interval windows are supported for maximum flexibility.



Disturbance Recording

Sag/Swell Recording

60 cycles of waveform are recorded at 256 samples per cycle including 30 cycles of pre- and post-trigger data. The Power Xpert 4000/6000/8000 embedded Web server supports viewing of triggered waveforms one channel at a time including the ability to zoom and to scroll horizontally using a slider bar. Waveforms are stored in Power Xpert 4000/6000/8000 meter module's non-volatile flash memory using an industry standard Comtrade format. Waveforms can be automatically sent out by e-mail following an event, or can be retrieved from an FTP directory structure in the meter module's memory.



ITIC Analysis Plot (Power Xpert 6000/8000)

The ITIC Web page includes counters to track the occurrence of disturbances and a pass/fail summary. In addition, selecting any disturbance counter links to a detailed event view of the disturbances in that ITIC category. Disturbance waveforms can be viewed from the browser.

Web Server Device Configuration

Special software is not required to configure a Power Xpert 4000/6000/8000 Meter. The embedded Web server includes comprehensive device set-up capability.

Events Calendar (Power Xpert 6000/8000)

The Events Timeline calendar view provides instant insight to the frequency of power events and helps detect reoccurring problems. Color-coded events can be filtered to detect specific issues.

Discrete Contact Inputs

The optional PXIO-B expansion card offers 8 digital inputs that are useful for a variety of applications such as:

- Status indication with time stamping of transitions (1 ms precision).
- Pulse Counting of KYZ or other utility pulses such as air, water or gas.

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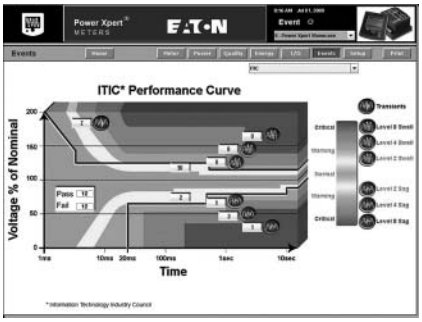
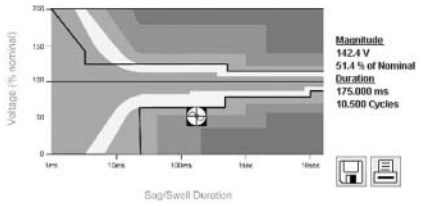
ITIC (Formerly CBEMA) Analysis (Power Xpert 6000/8000)

The ITIC (Information Technology Industry Council) Web page includes counters to track the occurrence of disturbances and a pass/fail summary. In addition, selecting any disturbance counter links to a detailed event view of the disturbances in that ITIC category. Disturbance waveforms can be viewed from the browser.



ITIC Analysis Plot (Power Xpert 6000/8000)



ITIC Individual Event Plot with Duration and Magnitude (Power Xpert 6000/8000)

PQ Index

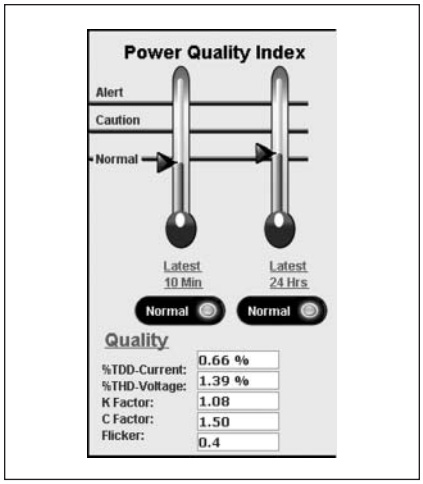


Figure 56-1. PQ Index

A statistical analysis comparing the last 10 minute and 24 hour periods' Power Quality to the historical norm for the circuit.

The PQ Index score results in a Power Quality rating of Normal, Caution and Alert for the period.

Health Monitor

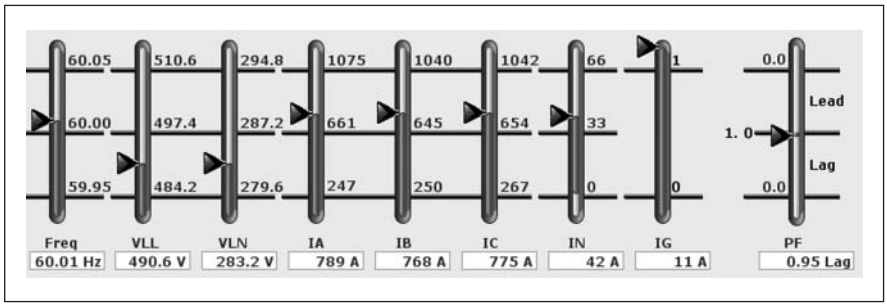


Figure 56-3. Health Monitor

Eaton is proud to offer a new and unique feature for existing Power Xpert 4000 Meter users with firmware version 12.x.x release — the ability to seamlessly upgrade to a more powerful feature set that has earlier been available only on the Power Xpert 6000 meters. Upgrades can be purchased directly from the homepage by clicking on the "Upgrade to series 6000" button.

Easily Upgrade Your Power Xpert 4000 Meter to a 6000

Eaton understands that our customers' needs change over time. That's why we've developed meters that can grow with you. Once a Power Xpert 4000 Meter is purchased, you have the ability to upgrade to a Power Xpert 6000, with no intervention from Eaton, when needed. All the features of the Power Xpert 4000 Meter that you have been using and depend on remain, however, once updated, all the additional features of the Power Xpert 6000 Meter are available. The self-upgrade is available on Eaton's Web site. You'll need a credit card, your Power Xpert 4000 Meter serial number and data code (you will be presented with this information if you are using the upgrade link directly from your Power Xpert Meter) and your e-mail address. Once you have completed the purchase, we will send you your new license key information via e-mail that will allow you to complete the upgrade.

Flicker (EN61000-4-15; Power Xpert 6000/8000)

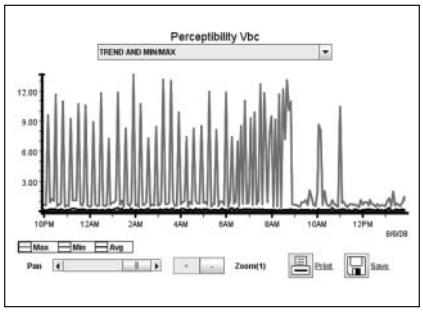


Figure 56-2. Flicker

Flicker values for Perceptibility, PST and PLT are calculated based on EN61000-4-15 guidelines.

- High-speed triggering of waveforms based on events such as breaker trips or static transfers.
- Demand interval timing taken from a master utility meter end of interval pulse.

Status inputs are self sourced providing a nominal 24 Vdc (20 – 30 Vdc) across the circuit.

Names can be configured for each input for ease of use.

Relay Outputs

The optional PXIO-B card includes three 5 A form C relay outputs rated for 240 Vac or 30 Vdc. These outputs can be used for applications such as:

- Alarm annunciation.
- KYZ pulse output.

Alarm outputs can be driven from triggers based on metering values. Output modes include:

- Normal — relay energized during alarm condition.
- Latched — relay energized by event trigger, de-energized by acknowledgement.
- Timed — relay energized by event trigger, maintained for a programmed interval.

Communications Expansion Card (CEC)

The optional CEC Card offers two Ethernet connection options, 10/100Base-T and a fiber-optic port that can be used for the following applications:

- Monitoring, managing and configuring the meter remotely using a standard Web Browser interface like Microsoft Internet Explorer.
- Alarm notifications via e-mail, SMTP.
- Enabling access to the meter's FTP server (energy, trend and waveform logs).
- Providing Modbus TCP/IP or RTU communications to BMS systems.
- Providing SNMP communications to NMS systems.
- Synchronizing with an NTP server for 1ms timestamping resolution.
- Asset management via SNMP to Network Management Systems.
- Updating firmware on the meter.

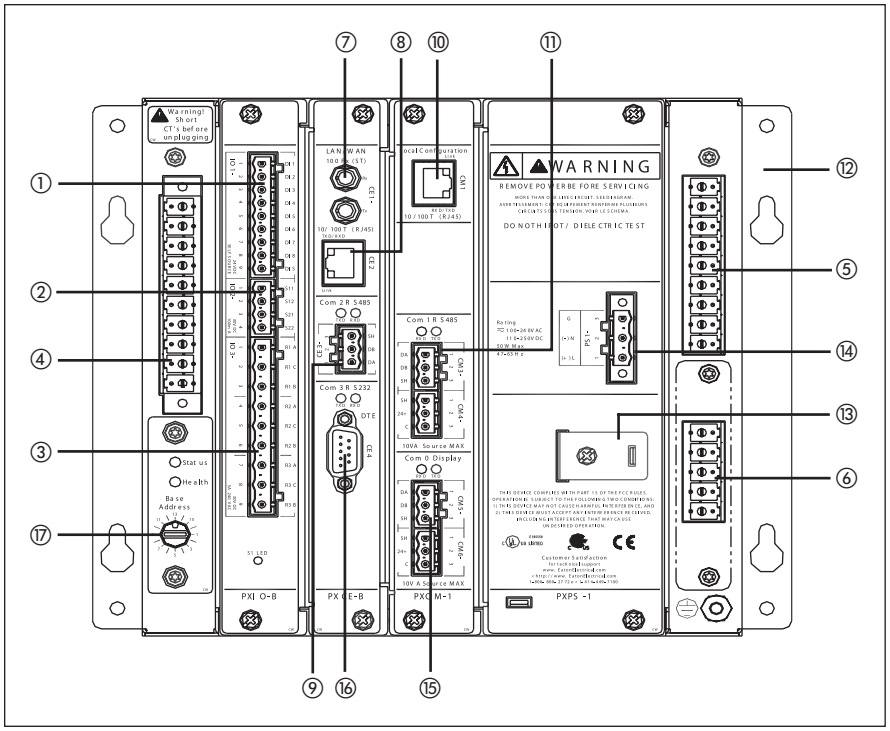


Figure 56-4. Power Xpert 4000/6000/8000 Meter Module Layout

I/O Card

① Digital Inputs 1-8 (option).
② Solid-State Outputs 1-2 (option).
③ Relay Outputs 1-3 (option).

CT and Voltage Connections

④ CT Input Connections.
⑤ Standard 3-Phase Voltage Phase Inputs.
⑥ Aux Channel Voltage Inputs (option).

Communication Expansion Card (LAN/WAN Ethernet Networking)

⑦ 100FX ST-type Ethernet (multi-mode) (option).
⑧ 10/100Base-T Ethernet (option).
⑨ RS-485 (2-wire w/shield) — 24 V accessory power (Com 2).

Standard Features

⑩ Local RJ-45 Config Port (non-networkable Ethernet)
⑪ RS-485 (2-wire w/shield) Modbus RTU (Com 1).
⑫ Meter Mounting Brackets.
⑬ Sealable Mode Switch cover.
⑭ Control Power (100 – 240 Vac & 110 – 250 Vdc) (+/- 20%).
⑮ Display RS-485 Network Port (up to 15 meters) — 24 V accessory power (Com 0).
⑯ RS-232 (Tx Rx) Modbus RTU (Com 3).
⑰ Meter Base Address.

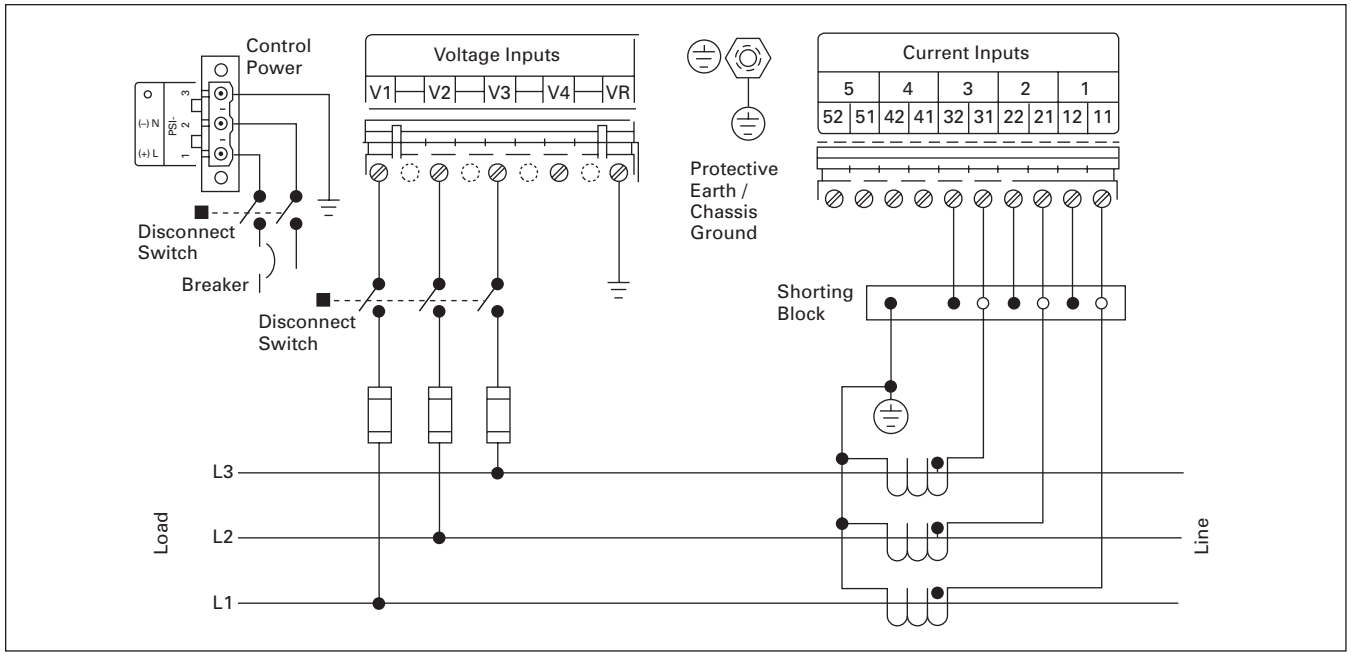


Figure 56-5. 3-Phase 3-Wire Delta (Up to 600 Volts)

Note: Based upon the voltage rating, you may need a control power transformer for the control power.

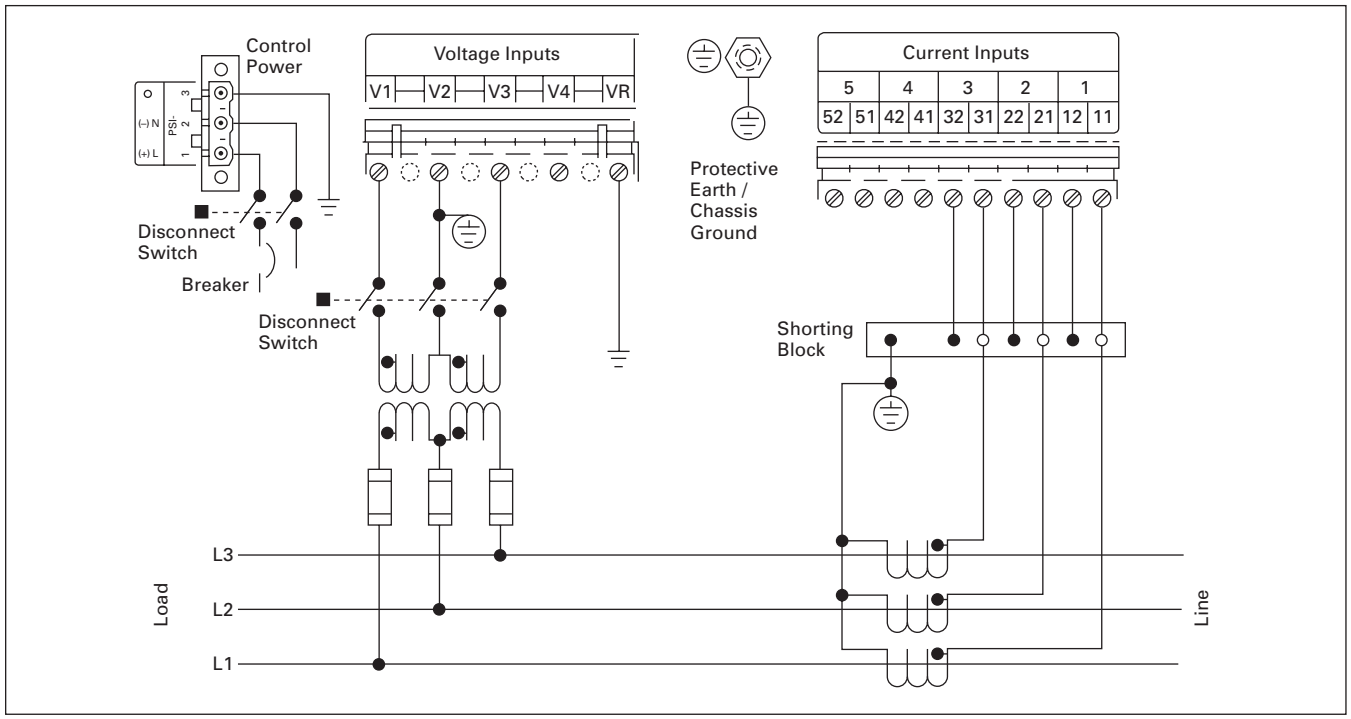


Figure 56-6. 3-Phase 3-Wire Delta (Above 600 Volts)

Note: Based upon the voltage rating, you may need a control power transformer for the control power.

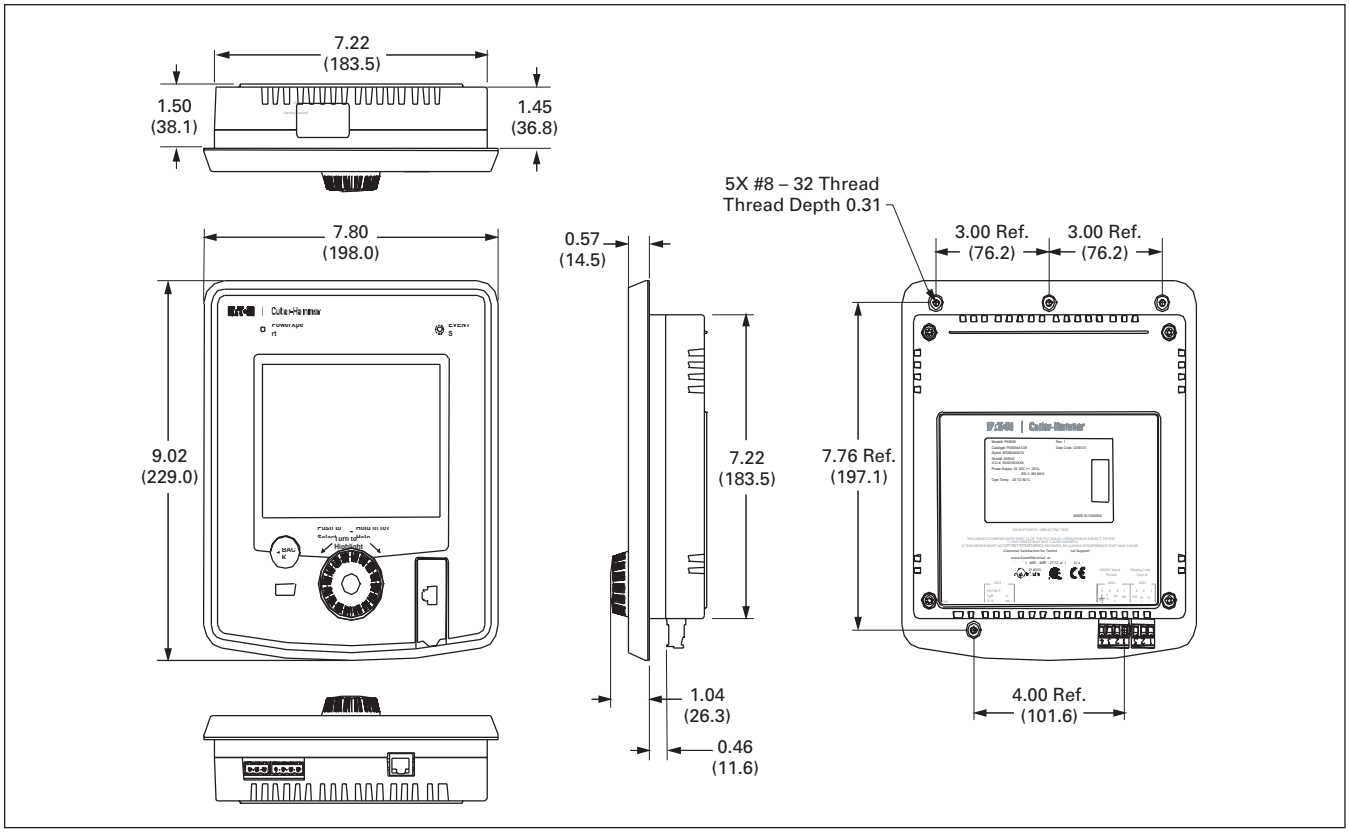


Figure 56-7. Power Xpert 4000/6000/8000 Multimeter Graphic Display (PXD-MMG) — Sold Separately, Supports up to 16 Power Xpert 4000/6000/8000 Meter Modules

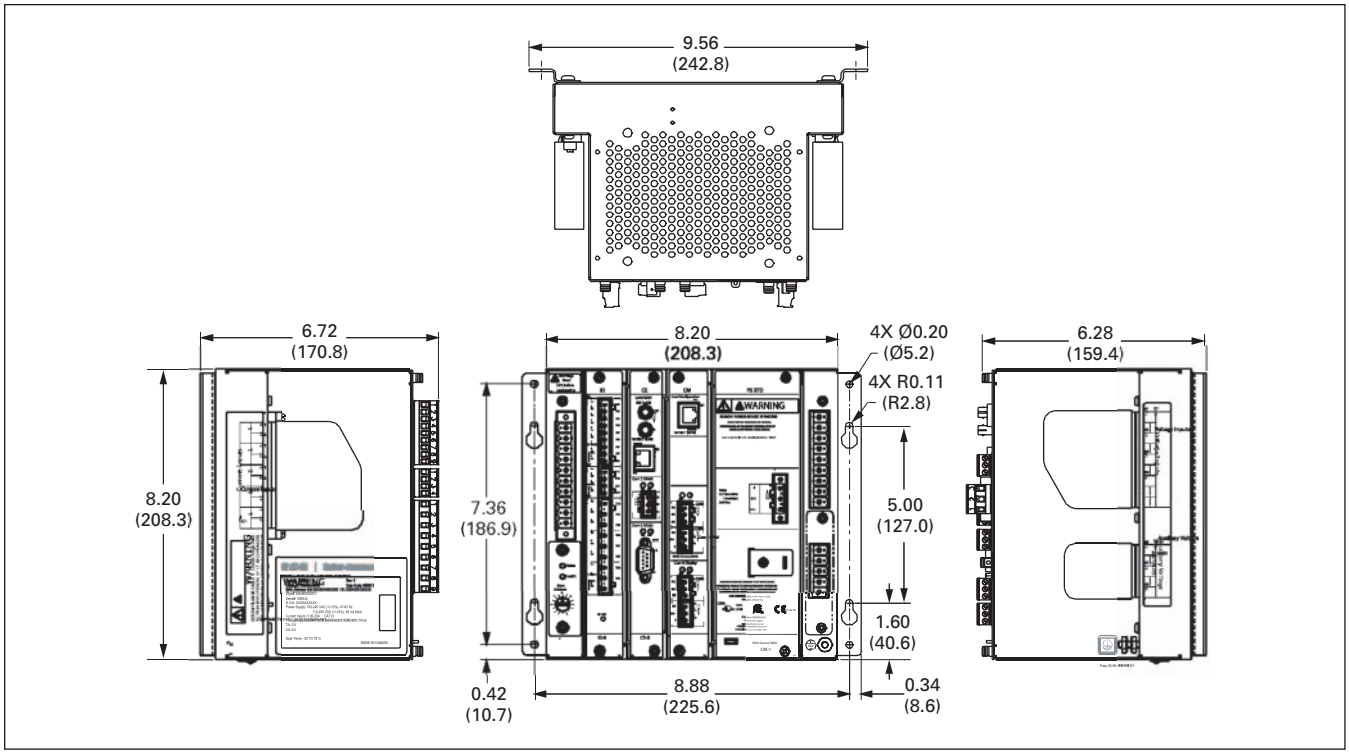


Figure 56-8. Power Xpert 4000/6000/8000 Meter Module

Power Xpert Meters Configuration and Wiring Examples

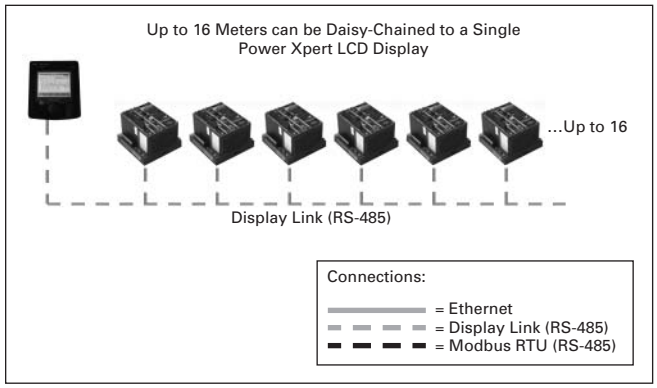


Figure 56-9. Display Link

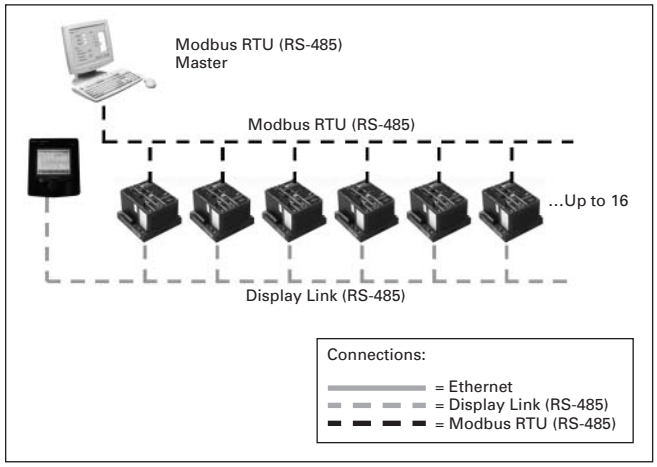


Figure 56-10. Modbus RTU (RS-485) — Non-Web Enabled

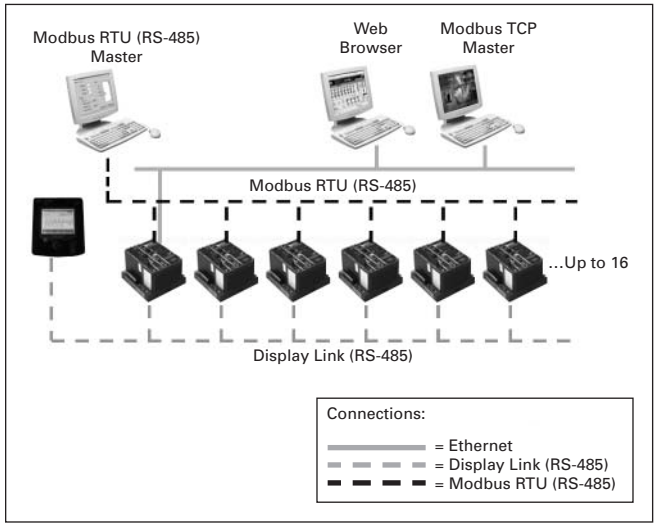


Figure 56-11. Web Enabled — Browser and Modbus TCP

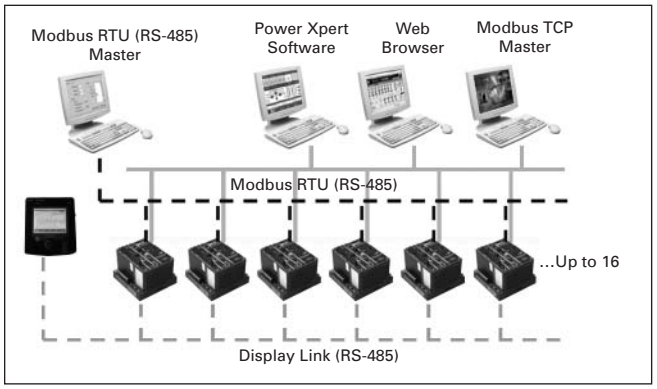


Figure 56-12. Web Enabled — Advanced System Functionality

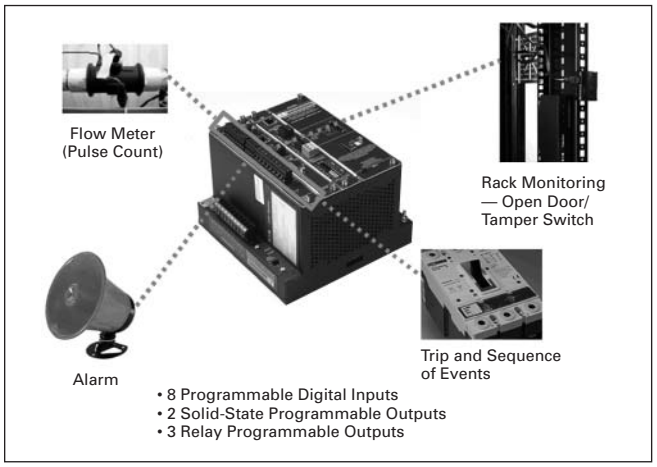


Figure 56-13. Accessories — I/O Card (Option)

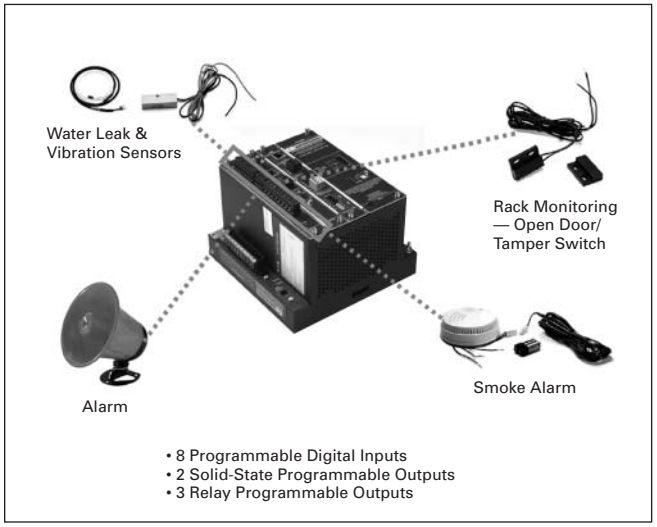


Figure 56-14. IT Configuration Examples — Accessories — I/O Card (Option)

Ordering Information

To order a Power Xpert 4000/6000/8000 Meter, the catalog number should be determined using the chart shown in **Table 56-4**. The chart illustrates how to include the desired factory options as part of a catalog number. Option cards that are selected at time of order entry will be installed at the factory. Option cards are also field installable for field upgrades.

If a display is required, it should be ordered separately. The Multi-Meter Graphic Display is capable of displaying data from an RS-485 daisychain of up to 16 Power Xpert 4000/6000/8000 meter modules over a distance of up to 1000 ft. Power Xpert meter modules include panel mounting brackets. The Multi-Meter Graphic Display is designed to mount separately. If back-to-back meter to display panel mounting is desired, a mounting bracket kit is available (**PX-PMBA**).

Example 1: PX8251A5BB
(PX 8000 Meter, w/ VAUX, Std. Pwr, 512MB CF, Com. Exp. & I/O Cards)

Example 2: PX6251A6BA
(PX 6000 Meter, w/ VAUX, Std. Pwr, 1GB CF, Com. Exp. Card)

Table 56-4. Power Xpert 4000/6000/8000 Meter Catalog Numbering System

PX 8 0 5 1 A 5 B B

Model Series
4 = 4000 (Standard Power Quality)
6 = 6000 (Enhanced Power Quality)
8 = 8000 (Premium PQ w/ Transient Capture)

Voltage Input Configuration
0 = Standard (V_1, V_2, V_3, V_4)
2 = Standard Plus Auxiliary (V_6, V_7, V_8)

Power Supply Configuration
1 = Standard 100 – 240 Vac or 110 – 250 Vdc Power Supply
4 = 24 – 48 Vdc Option (Future Option)

Card Slot 3 Configuration
A = No Card Option
B = I/O Option Card (8 Digital Inputs, 2 Solid-State Outputs, 3 Relay Outputs)

Card Slot 2 Configuration
A = No Card Option
B = Communication Expansion Card for LAN/WAN Ethernet networking w/10/100Base-T, 100F, RS-485, RS-232 Ports

Card Slot 1 Configuration
5 = Standard Communications Main Board w/512 MB PowerArmor™ Industrial CompactFlash Card
6 = Standard Communications Main Board w/1GB CompactFlash

Example 1: **PX8251A5BB** (PX 8000 Meter, w/ VAUX, Std. Pwr, 512MB CF, Com. Exp. & I/O Cards)
Example 2: **PX6251A6BA** (PX 6000 Meter, w/ VAUX, Std. Pwr, 1GB CF, Com. Exp.Card)

Table 56-5. Power Xpert 4000/6000/8000 Meter Accessories

Description	Catalog Number
Digital I/O Card: 8 Digital Input, 2 Solid-State Output, 3 Relay Output	**PXIO-B**
Communication Expansion Card for LAN/WAN Ethernet networking: 100FX Fiber-optic, 10/100T, RS-485, RS-232	**PXCE-B**
Graphic Display Module	**PXD-MMG**
Panel Mounting Bracket Assembly for Back-to-Back Meter to Graphic Display Mounting	**PX-PMBA**
Panel Mounting Bracket Assembly for Retrofitting a Graphic Display to an IQ Analyzer Cutout	**PX-PMBB**
Panel Mounting Bracket Assembly for Reduced Graphic Display Rear Clearance	**PX-PMBC**
1 GB PowerArmor Industrial CompactFlash Card	**PX-1GBCF**
Power Xpert 4000 to 6000 Meter License Upgrade Key	**PXM-4KUPG**

Note: Communication cable (standard Modbus RTU) is not included in the package for meter module connection.

Technical Application Data

Environmental Conditions

- Operating temperature:
  - Meter: -20 to +60°C
  - Display: -20 to 60°C Operating
  - Storage temperature: -40 to 85°C
  - Operating humidity: 5% to 95% condensing
  - Device weight: 7.1 lbs — meter 2.1 lbs — display
  - Meter and back of display are pollution degree 2
  - Elevation to 6,562 ft. (2,000 m)

Current Inputs (Each Channel)

- Conversion: 1024 samples per cycle delta-sigma converter digitally filtered down to 256 samples per cycle.
- CT Input: 1024 rms samples per cycle delta-sigma converter digitally filtered down to 256 samples per cycle for anti-aliasing.
- Burden: less than 10 milliohms.
- Overload withstand: 500 A for 1 second, non-repeating.
- Range: 0.005 – 20 amperes continuous.
- Accuracy: 0.05% or reading plus 0.01% of full scale (from 50 milliamps to 20 amperes).

Voltage Inputs (Each Channel)

- Conversion: 1024 rms samples per cycle delta-sigma converter digitally filtered down to 256 samples per cycle for anti-aliasing.
- PT input: 120 V – 500,000 V primary.
- Input range: 600 V L-L, 347 L-N direct connect.
- Nominal full scale: 1000 V rms.
- Input impedance: 2 mega ohms.

Frequency Range

- 47 – 63 hertz.

Harmonic Response (Voltage, Current)

- 127th harmonic.

Accuracy

- ANSI C12.20 0.2 Class.
- IEC 687 0.2 Class.

Discrete Inputs

- Self sourced: 24 Vdc.

Relay Output Contacts

- 5A maximum, 240 Vac maximum, 30 Vdc maximum.
- Lifetime: 1,000,000 no load operations.
- 100,000 under rated voltage and load.

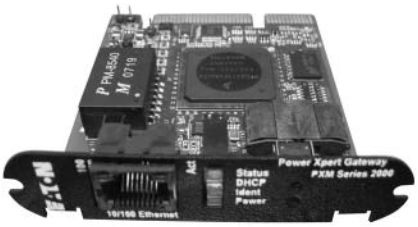
Solid-State Outputs

- Maximum load: 100 milliamps.
- Max. voltage: 30 V (externally sourced).

Control Power Input

- Input range ac: 100 – 240 Vac (+/- 20%).
- Frequency range: 47 – 63 hertz.
- Input range dc: 110 – 250 Vdc +/- 20%.
- Burden 50 VA.
- Ride-through: 1 – 5s.

Power Xpert 2000 Series



Power Xpert 2000 Series

General Description

The Power Xpert 2000 Series Meter power quality instrument monitors the most critical aspects of an electrical distribution system. This premier power quality metering instrument uses the latest in advanced technology to make it simple to use, powerful, scalable and highly flexible. The Power Xpert 2000 offers the same level of intuitive user interface design as the Power Xpert 4000/6000/8000 Meter, presenting critical electrical distribution system information in a simple to navigate and easy-to-understand information architecture.

The embedded Web server displays comprehensive power quality data using standard Internet browsers and allows for device configuration from the browser. The embedded Web server presents real time, historical, and event information in a browser-style graphical format to help the user interpret information such as current loading, voltage and power levels, power factor, energy usage, I/O status, power quality measurements, as well as harmonic plots. The embedded Web server also offers a waveform view to visualize steady-state harmonic content which is critical for power quality analysis.

The Web server provides the energy and demand readings required to help manage the cost of energy.

Applications

Identify Power Quality Problems to Help:

- Protect motors from damage.
- Preserve the integrity of processes and batches.
- Prevent blown capacitor bank fuses.
- Protect transformers and conductors from overheating.

Monitor Circuit Loading to Help:

- Avoid overloads and nuisance overload trips.
- Maximize equipment utilization.
- Manage emergency overloads.

Manage Energy Utilization to Help:

- Reduce peak demand charges and power factor penalties.
- Identify excessive energy consumption.

Metered/Monitored Parameters

Note: See **Table 56-8**.

- Volts: L-L, L-N, Avg. L-L, Avg. L-N.
- Phase and neutral currents.
- Power: real, reactive and apparent.
- Frequency.
- Power factor: apparent.
- Energy: real, forward, reverse, sum.
- Demand: peak with date and time.
- % THD.
- Minimum and maximum values.
- Harmonics.
- Individual Harmonics.
- Demand comparisons.
- Phasors.

Accuracy

Note: Under typical operating conditions.

- Currents: 0.1% reading.
- Voltage: 0.1% reading.
- Energy, and demand power: 0.2% in accordance with ANSI C12.20.
- Frequency: +/- 0.03 Hertz.
- Power factor: 0.2% reading.

Communications

Multiple communications ports including:

Standard

- RS-485 Modbus RTU Slave port.
- 10/100Base-T Ethernet network port.

Communication Protocols Supported

- Modbus RTU
- Modbus TCP
- Ethernet TCP/IP
- HTTP, HTTPS
- NTP (Network Time Protocol)
- SMTP (Simple Mail Transfer Protocol)
- SNMP (Simple Network Management Protocol) v1, v3
- DNP 3.0

Physical Characteristics

Format

- Power Xpert 2000 meter with integral display.
- Power Xpert 2000 transducer only (no display) meter module.
- NEMA rating: NEMA 12, IP42 front of panel rating.

Meter with Integral Display Dimensions

- Height: 4.85 inches (123.2 mm).
- Width: 4.85 inches (123.2 mm).
- Depth:
  - 3.96 inches (100.5 mm) behind panel surface
  - 1.01 (25.6 mm) projection in front of panel surface

Listings/Certifications

- UL/cUL Electrical and Electronic Measuring and Test Equipment 22CZ.
- Accuracy: IEC/EN60687 0.2 class, ANSI C12.20 0.2 Class.
- ANSI C62.41 Burst.
- CE Mark.

Power Xpert 2000 Embedded Web Server

The Power Xpert 2000 Meter's embedded Web server offers Eaton customers a new level of accessibility to the critical information required to manage their electrical distribution system. The Web server includes real-time information in both numeric and graphical visual formats to help monitor parameters such as current loading, voltage and power levels, power factor, THD, and more. The Web server also provides energy and demand readings with graphic usage plots to help analyze energy usage patterns. Energy readings include kWh, kvarh, delivered and received and kVAh with time.

The Power Xpert 2000 embedded Web server supports graphical trend charts of key measurements such as current, voltage, power and energy. The trend chart supports a zoom feature that allows the user to view data over predefined ranges from as little as 16 hours to as much as 4 years. The trend chart includes zoom in/out buttons and a horizontal slider bar control to manage scrolling forward and backward through the data. Trend charts of basic readings include minimum, maximum and average readings. Trend charts of interval by interval energy data also display peak demand.

Waveform Display

60 cycles of waveform are sampled at 400 samples per cycle. The Power Xpert 2000 embedded Web server offers a waveform view to visualize steady-state harmonic content.

Historical Trend Logging

The Power Xpert 2000 Meter records historical data for graphical viewing from the embedded Web server. Graphical views of historical data support pan and zoom. Over 100 standard metering parameters are logged as part of the standard meter functionality including min./max. and average for each parameter. The averages are calculated over the interval period.

Energy Profile Data

The Power Xpert 2000 Meter records Real and Reactive energy forward, reverse, net and absolute sum, as well as Apparent energy (kVAH). These readings are stored on a fixed 5 minute interval. Up to 4 status inputs can be configured as energy accumulators for counting KYZ pulse inputs.

Demand Comparisons

Demand usage patterns can be analyzed with the month-to-month, week-to-week comparison chart built into the meter. Raw data can be exported as a .csv file with the "Save Table" option to other applications for further analysis and graphing.

Event Triggers

The Power Xpert 2000 Meter has two levels of configurable event triggers:

- On-board meter limits (PXM 2260 and PXM 2270 only).
- On-board gateway card limits.

The on-board meter limits can be set for any measured parameter, for up to 16 limits. If either of the 16 limits are exceeded, an alarm condition will be present and illuminate one of the LEDs on the meter faceplate. The on-board meter out of limits can also be used to energize a relay output, if so equipped.

The on board gateway limits can trigger an alarm off of any measured parameter on any of the PXM 2000 model series. These triggers permit pickup, reset and pickup delay to be configured by the user.

Event Logging

The Power Xpert 2000 embedded Web server allows the user to view a list of triggered events. In addition, a separate system log records system operations such as resets.

Email

The Power Xpert 2000 contains the ability to send emails based on an event that has been triggered or cleared along with the option to send an event or data log file. The Power Xpert 2000 also has the ability to send a configurable periodic email with meter information.

Inputs and Outputs

Power Xpert 2000 is available with a standard KYZ output and optional digital I/O cards which includes:

- 2 Relay Outputs/2 Status Inputs.
- 4 KYZ Pulses/4 Status Inputs.
- 4 Analog Outputs 0 – 1 mA.
- 4 Analog Outputs 4 – 20 mA.

Inputs can also be configured for demand synch and pulse counting. Inputs selected for pulse counting can be scaled. Accumlated pulse recordings are maintained in profile memory. Outputs can be used for alarm annunciation.

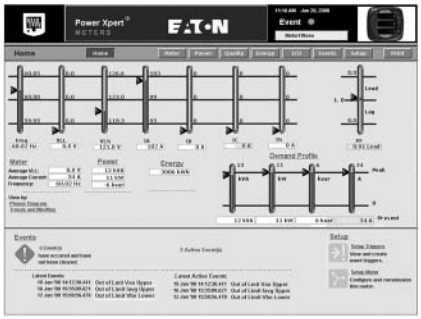
Ratings

- Application to any PT ratio, no PTs required to 600 Vac.
- CT ratios to any CT ratio.
- CT inputs available as 5 or 1 amp secondary.
- Separate Source Control Power Input:
  - 90 – 265 Vac or 100 – 370 Vdc
  - Low voltage 18 – 60 Vdc

Displayed Information

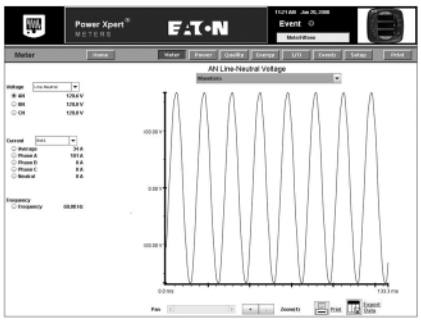
- Monitored information is available locally through the display, the Web browser or system power management software.
- True rms values through 40th harmonic.
- ANSI C12.20 Class .2% revenue metering specification.

Power Xpert 2000 Web Browser Views



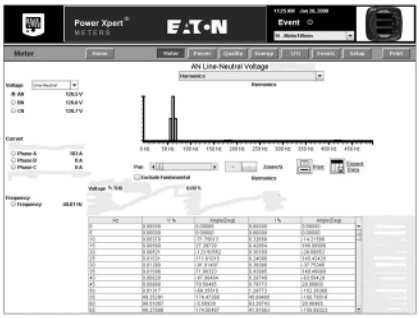
Power Xpert 2000 Web Browser

Power Xpert 2000's embedded Web server offers Eaton customers a new level of accessibility to the critical information required to manage the electrical distribution system. The embedded Web server includes real time circuit information in both numeric and graphical formats to help monitor parameters such as current loading, voltage and power levels and power factor. The Web server also provides the energy and demand readings required to help manage the cost of energy. Readings include kWh, kvarh, delivered and received and kVAh. The Web server also includes critical information regarding Power Quality such as harmonic distortion.



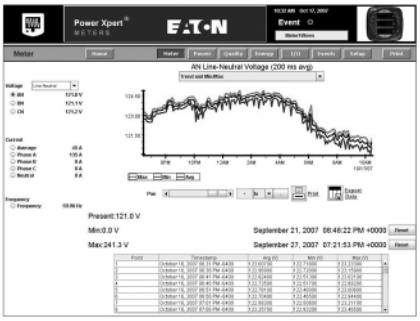
Real-Time Visualization of Harmonic Content

The Web server offers a waveform view to visualize steady-state harmonic content of the voltage and current to spot power quality problems.



Harmonic Spectral Plot

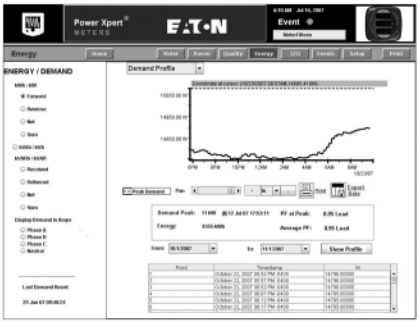
The harmonic spectral plot displays harmonics up to the 40th order. A detailed table also includes individual magnitudes and angles of current and voltage harmonics, at each frequency. Individual and total THD are displayed for diagnostic purposes.



Historical Trend Plot

Graphical Trending of Data

The Power Xpert 2000 embedded Web server supports graphical trend charts of key circuit measurements such as current, voltage, power and energy. The trend chart supports a zoom feature that allows the user to view data over a short period of 16 hours or a longer period of 48 months. The trend chart has a horizontal slider bar control to manage scrolling forward and backward through the data. Trend charts of basic readings include minimum, maximum and average readings. Trend charts of energy data also display demand values.



Energy Demand Profile

Energy Managers can view load profile data compared against the peak demand. The plot allows comparison of present and past months' usage.

Web Server Device Configuration

Special software is not required to configure a Power Xpert 2000 Meter. The embedded Web server includes a comprehensive device configuration engine.

Discrete Contact Inputs

The optional I/O expansion cards offers 2 or 4 digital inputs that are useful for a variety of applications such as:

- Pulse Counting of KYZ or other utility pulses such as air, water or gas.
- Demand interval timing taken from a master utility meter end of interval pulse.

Names can be configured for each input for ease of use.

Relay Outputs

The optional I/O card includes two 5 A form C relay outputs rated for 240 Vac or 30 Vdc or 4 Form A solid-state outputs. These outputs can be used for applications such as:

- Alarm annunciation.
- KYZ pulse output.

Alarm outputs can be driven from triggers based on metering values.

Analog Outputs

The optional IO card includes either four 4 – 20 mA outputs or 0 – 1 mA outputs. These outputs can be used for applications such as:

- Input to BMS or PLC systems for tracking a measured meter parameter.

Standard Communications Card

The standard communications card provides one Ethernet connection and 10/100Base-T port (copper only) that can be used for the following applications:

- Monitoring, managing and configuring the meter remotely using a standard Web Browser interface.
- Alarm notifications via email, SMTP.
- Providing Modbus TCP/IP or RTU communications to BMS systems.
- Providing SNMP communications to NMS systems.
- Synchronizing with an NTP server.
- Asset management.
- Updating firmware on the meter.

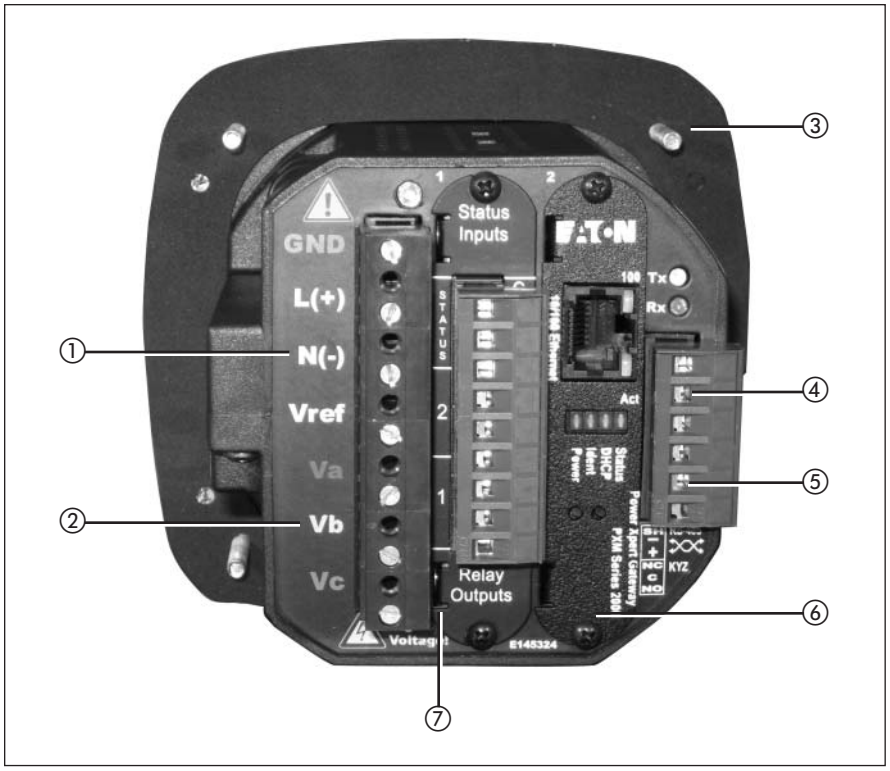


Figure 56-15. PMX 2000 Rear View

① Power Supply Inputs
② System Voltage Inputs
③ NEMA 12 Gasket
④ RS-485
⑤ KYZ Out
⑥ Meter Gateway Card
⑦ I/O Slot

Easily Upgrade Your Power Xpert 2000 Meter (Future, Contact Factory for Availability)

Eaton understands that our customers' needs change over time. That's why we've developed meters that can grow with you. Once a Power Xpert 2000 Meter is purchased, you have the ability to upgrade to a higher feature set Power Xpert 2000, with no additional assistance required from Eaton, when needed. When the Power Xpert 2000 Meter is updated, all the features previously used will remain intact.

The self-upgrade is available on Eaton's Web site. You'll need a credit card, your Power Xpert 2000 Meter serial number (you will be presented with this information if you are using the upgrade link directly from your Power Xpert Meter) and your e-mail address. Once you have completed the purchase, we will send you your new license key information via e-mail that will allow you to complete the upgrade. See **Table 56-8** for the list of features available with each model.

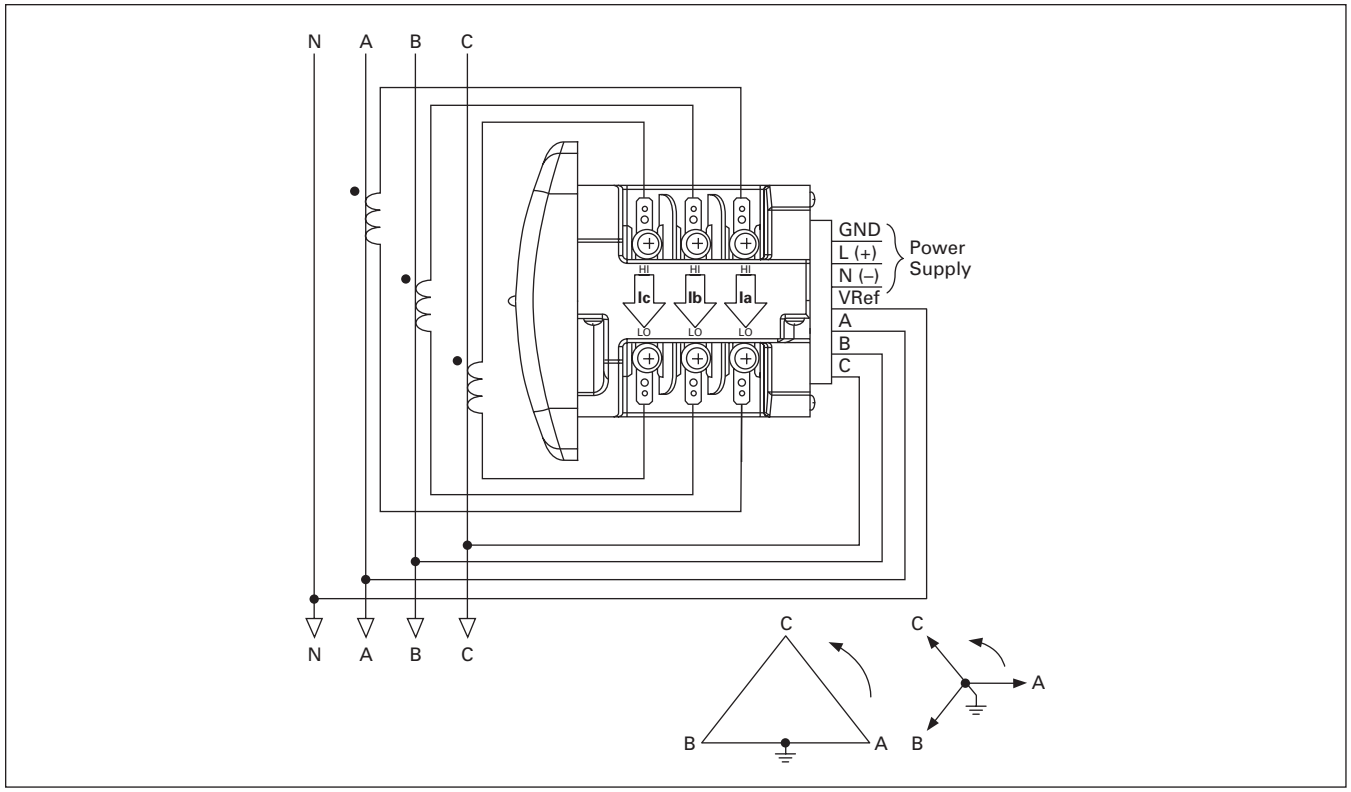


Figure 56-16. Service: WYE or Delta, 4-Wire with No PTs, 3 CTs

Note: Based upon the voltage rating, you may need a control power transformer for the control power.

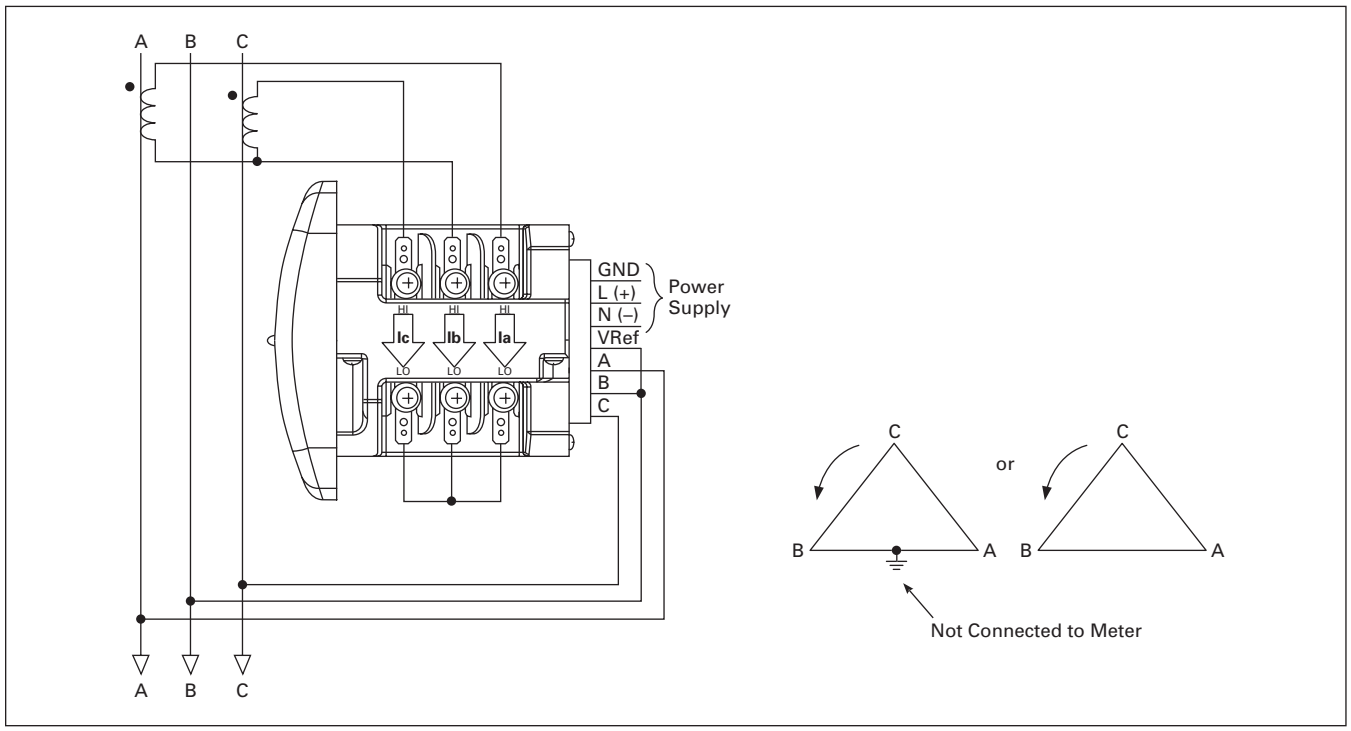


Figure 56-17. Service: Delta, 3-Wire with No PTs, 2 CTs

Note: Based upon the voltage rating, you may need a control power transformer for the control power.

Power Xpert Meters Configuration and Wiring Examples

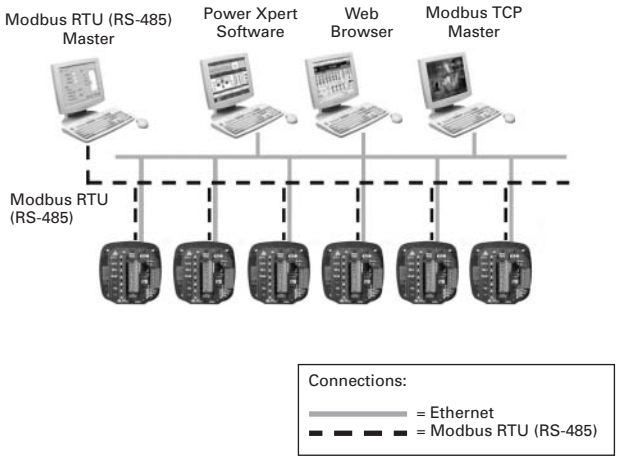


Figure 56-18. Web Enabled — Advanced System Functionality

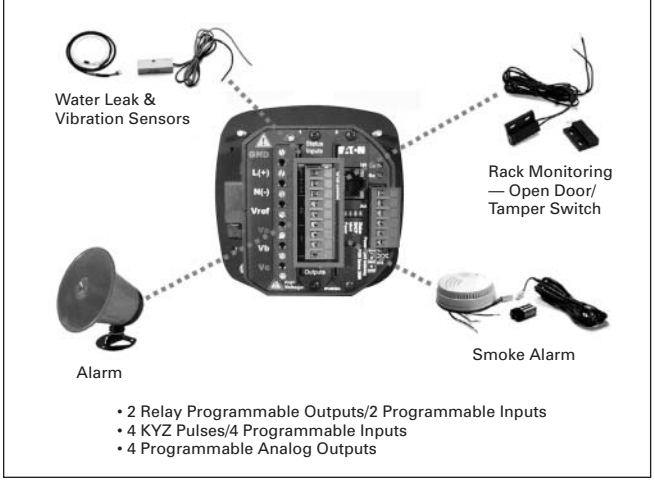


Figure 56-20. IT Configuration Examples — Accessories — I/O Cards (Option)

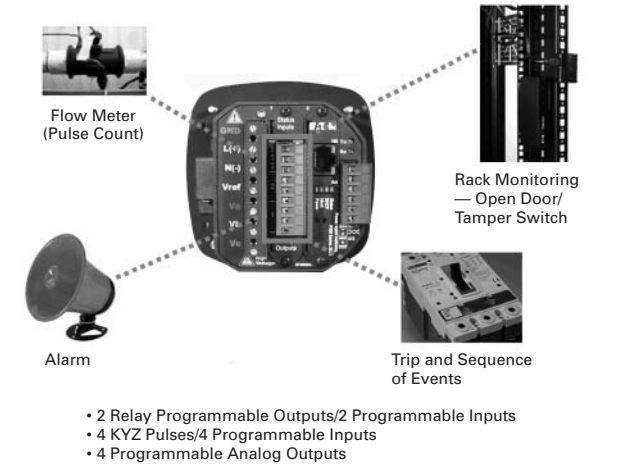


Figure 56-19. Accessories — I/O Cards (Option)

PXM 2000 Meter Dimensions

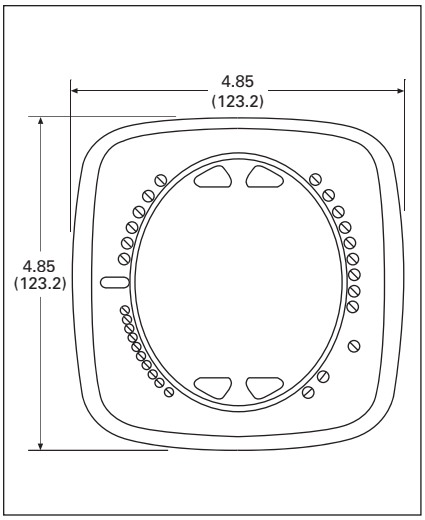


Figure 56-21. PXM 2000 Display Front View

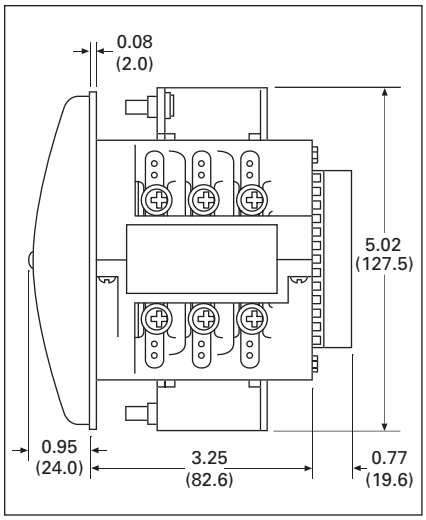


Figure 56-22. PXM 2000 Meter/Display Side View

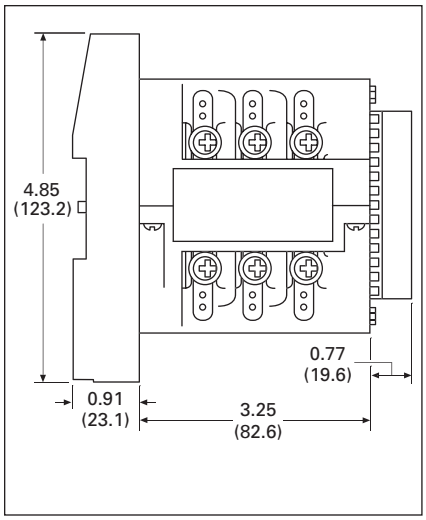


Figure 56-23. PXM 2000 Transducer Only Side View

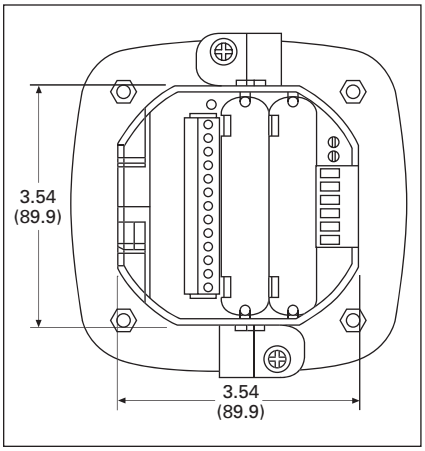


Figure 56-24. PXM 2000 Rear View

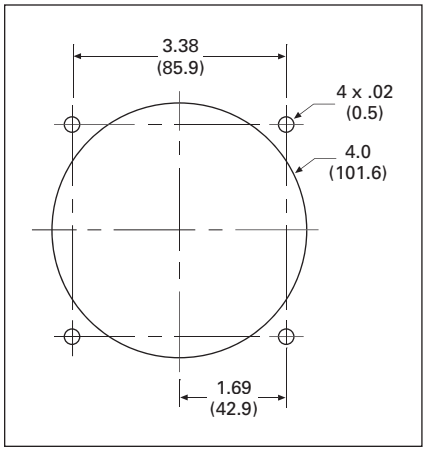


Figure 56-25. ANSI Mounting Panel Cutout

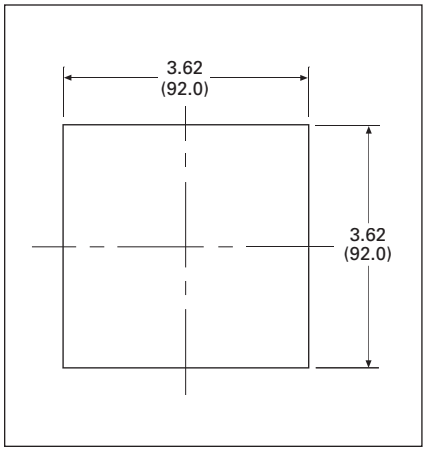


Figure 56-26. DIN Mounting Cutout

Ordering Information

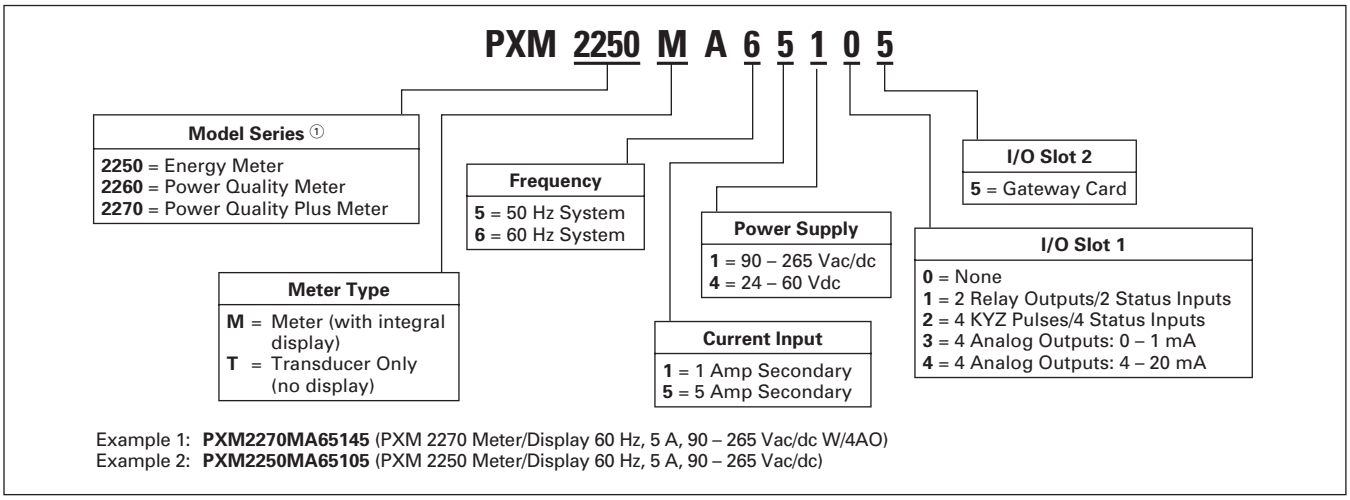
To order a Power Xpert 2000 Meter, the catalog number should be determined using the chart shown in **Table 56-6**. The chart illustrates how to include the desired factory options as part of a catalog number. Option cards that are selected at time of order entry will be installed at the factory. Option cards are also field installable for future upgrades.

Power Xpert meter modules include panel mounting brackets.

Example 1: PXM2270MA65145 (PXM 2270 Meter/Display 60 Hz, 5 Amp, 90 – 265 Vac/dc W/4AO).

Example 2: PXM2250MA65105 (PXM 2250 Meter/Display 60 Hz, 5 Amp, 90 – 265 Vac/dc).

Table 56-6. Power Xpert 2000 Meter Catalog Numbering System



Example 1: **PXM2270MA65145** (PXM 2270 Meter/Display 60 Hz, 5 A, 90 – 265 Vac/dc W/4AO)
Example 2: **PXM2250MA65105** (PXM 2250 Meter/Display 60 Hz, 5 A, 90 – 265 Vac/dc)

① Refer to **Table 56-8** for model-specific features.

Table 56-7. Power Xpert 2000 Meter Accessories

Description	Catalog Number
Panel Mounting Bracket Assembly for Retrofitting a PXM 2000 to an IQ Analyzer/IQ DP4000/IQ Data Cutout	**Consult Factory**
PXM 2000 Gateway Card Kit to Upgrade an IQ 250/260 to a PXM 2000	**PXM2000-GCK**

Technical Data

PXM 2250/2260/2270 Electronic Power Meter Technical Information

Current Inputs

- Class 10: 5 amp nominal, 10 amp maximum.
- Class 2: 1 amp nominal, 2 amp maximum.
- Fault current withstand:
  - 100 amps for 10 seconds
  - 300 amps for 3 seconds
  - 500 amps for 1 second
- Continuous current withstand: 20 amps for screw terminated or pass-through connections.
- Programmable current: full scale to any CT ratio.
- Burden: 0.005 VA per phase maximum at 11 amps.
- Pickup Current: 0.1% of Nominal
  - Class 10: 5 mA
  - Class 2: 1 mA
- Connections:
  - Pass-through Wire Gauge Dimension: 0.177 Inches (4.5 mm)
  - Quick Connect: 0.25-Inch (6.35 mm) Male Tab

Voltage Inputs

- Range:
  - Line-to-Neutral 20 – 576 Vac
  - Line-to-Line 0 – 721 Vac
- Programmable voltage range: full scale to any PT ratio.
- Supported Systems:
  - 3 element Wye, 2.5 element Wye
  - 2 element Delta, 4-wire Delta systems
- Input impedance: 1 meg ohm/phase.
- Burden: 0.36 VA/phase maximum at 600 V; 0.014 VA at 120 volts.
- Connection: 7-pin 0.400-inch pluggable terminal block, AWG #12 – 26 (0.129 – 3.31 mm^2).

Isolation

- All inputs and outputs are galvanically isolated to 2500 volts.

Environmental Ratings

- Operating temperature: -20ºC to +70°C.
- Storage temperature: -20ºC to +70°C.
- Operating humidity: to 95% RH non-condensing.
- Faceplate rating:
  - NEMA 12
  - Mounting gasket included

Sensing Method

- Voltage, current: true rms.
- Power: sampling at over 400 samples per cycle on all channels.
- Harmonics Resolution: 40th order.

Update Rate

- Watts, Var and VA: 100 msec at 60 Hz.
- All other parameters: 1 second at 60 Hz.

Power Supply

- AC/DC voltage option: 90 – 265 Vac at 50/60 Hz or 100 – 370 Vdc, universal AC/DC supply.
- DC voltage option: 18 – 60 Vdc.
- Burden: 10 VA Maximum.

Serial Communications Format

- Connection type: RS-485 (through back plate).
- Com port baud rate: 9600 – 57,600 bauds.
- Com port address: 01 – 247.
- Data format: 8-bit, no parity.
- Protocols: Modbus ASCII, RTU or DNP 3.0.

Network Communications Format

- Connection type: RJ-45 10/100Base-T Ethernet Network port.
- Protocols: Ethernet TCP/IP, Modbus TCP, HTTP, HTTPS, NTP, SMTP, SNMP.

KYZ Pulse

- Contacts: 1 Form A.
- On resistance, maximum: 35 ohms.
- Peak switching voltage: 350 Vdc.
- Continuous load current: 120 mA.
- Peak load current: 350 mA (10 ms).
- Off-state leakage current at 350 Vdc: 1 uA.
- Opto-isolation: 3750 Vac.

Dimensions and Shipping

- Weight: 2 lbs. (0.91 kg).
- Basic Unit: H 5.00 x W 4.90 x L 5.00 Inches (H 127.0 x W 124.5 x L 127.0 mm).
- PXM 2250/2260/2270: mounts in 3.62-inch (92.0 mm) DIN and ANSI C39.1 round cut-outs.
- Shipping container dimensions: 6-inch cube.
- Tolerance: +/-0.1 inches (2.54 mm).

Compliance

- IEC/EN60687: 0.2% accuracy.
- ANSI C12.20: 0.2% accuracy.
- ANSI C62.41: burst.
- UL/cUL: Electrical & Electronic Measuring & Test Equipment 22CZ.
- CE.

Power Xpert Meter 2250

- Measures basic meter parameters.
- Data logging.
- Ethernet.
- On-board gateway card limits/alarms.

Power Xpert Meter 2260

Features of PXM 2250 plus:

- Harmonics.
- On-board meter hardware limits to activate optional relay outputs.
- Visual indication of limits exceeded at meter face.

Power Xpert Meter 2270

Features of PXM 2260 plus:

- Harmonics, including individual.
- Waveform view to visualize steady-state harmonic content.

Table 56-8. Power Xpert Meters 2250/2260/2270 — Features and Benefits

Feature	Power Xpert Meter			Benefit
	2250	2260	2270	
General				
Embedded Web Server	■	■	■	Use a standard Web browser to monitor and manage the meter over the network, Internet.
Firmware Flash Upgrade Support	■	■	■	Enables you to flash the meter with the latest firmware upgrades.
Power, Energy & Demand				
Voltage, Current: per Phase Minimum, Maximum, Average, Trend Graph Analysis, Export, Print	■	■	■	Review voltage and current trends, export, print and analyze parameters right on the meter or external software.
Demand Plot Comparisons Month-to-Month, Week-to-Week	■	■	■	Plot two months or two weeks for vivid demand comparison.
Power, Apparent, Real, Reactive, Power Factor	■	■	■	Review power usage and power factor and avoid potential PF penalties.
Energy, Demand: Forward, Reverse, Net, Sum, TOU, Profile, Export, Print	■	■	■	Keep track of your energy usage, identify peaks to conserve energy usage.
Power Quality Analysis				
Statistical Analysis (min, max, average)	■	■	■	Review statistical trends, identify past and future problem areas.
Sampling Rate, Maximum Samples/Cycle	400	400	400	High sampling rate resulting in high accuracy.
Security				
Secure 2 Level User Access Privileges	■	■	■	Define appropriate security access level per user.
Communications				
Modbus TCP	■	■	■	Easy integration with standard protocol to power management and other software.
Modbus RTU	■	■	■	Integrate meters to existing Modbus networks, daisy chain several (1 – 32) meters together.
HTTP, HTTPS	■	■	■	Communicate to the meter over the Internet via standard Web browser.
SNMP (Simple Network Management Protocol)	■	■	■	Communicate with the meter via Simple Network Protocol; hook to existing NMS system.
SMTP (Simple Mail Transfer Protocol)	■	■	■	Send e-mail messages via standard Simple Mail Transfer Protocol.
NTP (Network Time Protocol)	■	■	■	Network Time Protocol support enables the meter to synchronize time over the network.
DNP 3.0	■	■	■	Easy integration with DNP networks.
Trend Measurements CSV File Export	■	■	■	Easily export trend measurements to third-party applications, in standard CSV file format.

Note: These specifications are subject to change without notice and represent the maximum capabilities of the product with all options installed. This is not a complete feature list. Features and functionality may vary depending on selected options, firmware version and product model. Please refer to the technical data sheet and User Manual for detailed specifications.

Table 56-8. Power Xpert Meters 2250/2260/2270 — Features and Benefits (Continued)

Feature	Power Xpert Meter			Benefit
	2250	2260	2270	
Logs				
Trend Logging	■	■	■	Log trend information for easy statistical analysis.
Load Profile	■	■	■	Review the load profile graph to get a better understanding of your electrical load versus time.
Event Logging	■	■	■	Log events for retrospective event analysis.
Memory and Storage				
256 MB Standard Memory	■	■	■	Store trend data and events for historical analysis.
Harmonics				
Harmonic levels		40th	40th	Allows you to identify potential harmful harmonics.
Total Harmonic Distortion (THD)		■	■	Review the total harmonic distortion level directly on the meter.
Individual Harmonics			■	Provides simple metric for power quality viewable from the embedded Web server.
Waveform				
Waveform Display			■	Waveform view on a PC to visualize steady-state harmonic content through embedded Web server to identify power quality issues.
I/O				
I/O (2 Relay Outputs/2 Status Inputs, 4 KYZ Pulses/ 4 Status Inputs, 4 Analog Outputs 0 – 1 mA, 4 Analog Outputs 4 – 20 mA)	Opt	Opt	Opt	The Power Xpert Meter 2000 I/O Cards are extremely flexible and can be used in a large variety of different applications. Digital inputs and relay outputs can be programmed to interact during various conditions defined by the user. Various third-party devices, such as alarms, pulse meters, trip units and sensors, can be easily integrated to the Power Xpert Meter 2000. Triggers and events can be tied to the meter's standard functions such as e-mail, logs and trends. Analog outputs can be programmed to output meter parameters to BMS or PLC systems.

Note: These specifications are subject to change without notice and represent the maximum capabilities of the product with all options installed. This is not a complete feature list. Features and functionality may vary depending on selected options, firmware version and product model. Please refer to the technical data sheet and User Manual for detailed specifications.

IQ 250 and 260 Electronic Power Meters

IQ 250/260 Electronic Power Meter

Product Description

The IQ 250 and IQ 260 meters provide capabilities you would not normally expect in affordable, ultra-compact meters, such as fast sampling rate and accurate metering for a full range of power attributes. Providing the first line of defense against costly power problems, Eaton's IQ 250 and IQ 260 electronic power meters can perform the work of an entire wall of legacy metering equipment utilizing today's technology.

When space is at a premium, yet you need ANSI C12.20 accuracy, the IQ 250/260 series fit the bill. These meters are ideal for electrical equipment assemblies, machine control panels, such as panelboard and switchboard mains and feeders, low voltage metal-enclosed switchgear feeders and motor control centers. Requiring far less space than other meters with similar functionality, IQ 250/260 series fit into a standard ANSI or IEC cutout on a panelboard or other electrical equipment, and therefore fit easily into retrofit applications.

Typical Applications

- Utility and commercial metering.
- Substations, industrial facilities, power generation sites and campuses.
- Sub-metering.
- Load studies and voltage recording.
- Analog meter replacement.

Features and Benefits

- Measure and display real-time information about critical power parameters with a sampling rate of 400 samples per cycle.
- Monitor power utilization and quality with ANSI C12.20 accuracy (0.2 percent).
- Verify meter accuracy with KYZ test pulse self-certification capabilities.
- Standard Modbus® RTU communications.
- Available as transducer only or with display.
- "Prepared for the future" — The meters are designed to accommodate upgrades and capabilities not yet conceived.
- Integrate into Eaton's Power Xpert® Architecture for a holistic system-level view.

Additional Features

Table 56-9. Features of IQ 250 and IQ 260 Electronic Power Meters

Features	IQ 250	IQ 260
Instrumentation		
Current, per Phase	■	■
Current Demand	■	■
Calculated Neutral Current	■	■
Voltage, per Phase (L-L, L-N)	■	■
Frequency	■	■
Power, Energy and Demand		
Real, Reactive and Apparent Power, Total and per Phase (kW, kvar, kVA)	■	■
Real, Reactive and Apparent Energy, Total and per Phase (kWh, kvarh, kVAh)	■	■
Real, Reactive and Apparent Power Demand	■	■
Power Factor, Total and per Phase	■	■
Min./Max. Readings, I, V, PF, F, THD (IQ 260), kW, kvar, kVA	■	■
Demand Methods		
Block Interval (Sliding, Fixed)	■	■
Communications		
RS-485	■	■
KYZ Output	■	■
Modbus RTU	■	■
Modbus ASCII	■	■
DNP 3.0	■	■
I/O		
2 Digital In / 2 Digital Out ①	Opt.	Opt.
4 Digital In / 4 KYZ Out	Opt.	Opt.
4 Analog Output (4 – 20 mA) ②	Opt.	Opt.
4 Analog Output (0 – 1 mA)	Opt.	Opt.
Power Quality Analysis		
Total Harmonic Distortion (THD) Voltage and Current per Phase		■
Alarming		
Set Point Driven Alarm		■

① Digital Out with IQ250 requires external command.
② Requires external power supply.

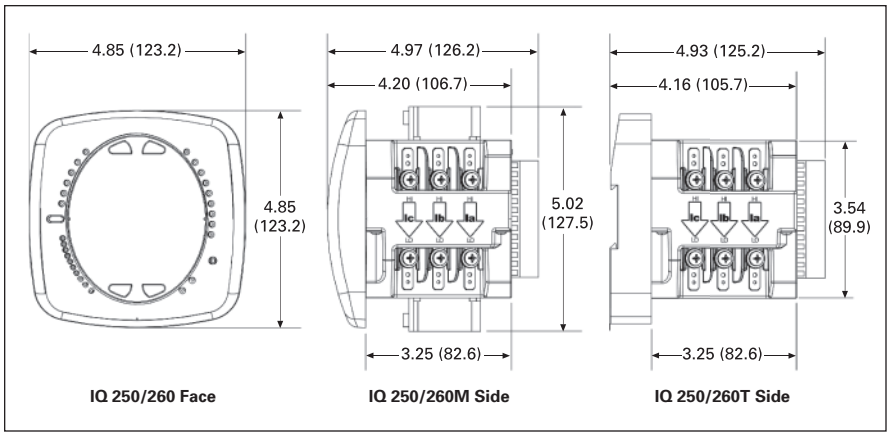
Technical Data and Specifications

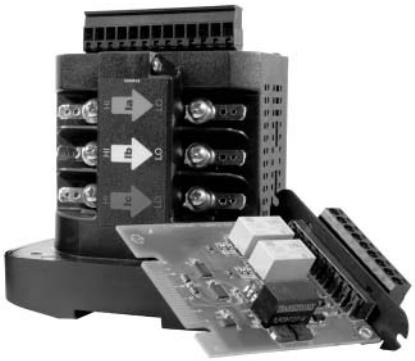
Table 56-10. IQ 250/260 Electronic Power Meter Technical Information

Description	Specifications
Current Inputs	
Class 10	5 Amp Nominal, 10 Amp Max.
Class 2	1 Amp Nominal, 2 Amp Max.
Fault Current Withstand 100 Amps for: 300 Amps for: 500 Amps for:	 10 Seconds 3 Seconds 1 Second
Continuous Current Withstand	20 Amps for Screw Terminated or Pass-through Connections
Programmable Current	Full Scale to Any CT Ratio
Burden	0.005 VA per Phase Max. at 11 Amps
Pickup Current Class 10 Class 2	0.1% of Nominal 5 mA 1 mA
Connections Pass-through Wire Gauge Dimension Quick Connect	 0.177 Inches (4.5 mm) 0.25-Inch Male Tab
Voltage Inputs	
Range Line-to-Neutral Line-to-Line	 20 – 576 Vac 0 – 721 Vac
Programmable Voltage Range	Full Scale to Any PT Ratio
Supported Systems	3 Element Wye, 2.5 Element Wye, 2 Element Delta, 4-Wire Delta Systems
Input Impedance	1 Meg Ohm/Phase
Burden	0.36 VA/Phase Max. at 600 V; 0.014 VA at 120 Volts
Connection	7-Pin 0.400-Inch Pluggable Terminal Block, AWG #12 – 26 (0.129 – 3.31 mm^2)
Isolation	
All inputs and outputs are galvanically isolated to 2500 volts.	
Environmental Ratings	
Operating Temperature	-20°C to +70°C
Storage Temperature	-20°C to +70°C
Operating Humidity	To 95% RH Non-condensing
Faceplate Rating	NEMA 12 Water-resistant Mounting Gasket Included

Description	Specifications
Sensing Method	
Voltage, Current	True RMS
Power	Sampling at Over 400 Samples per Cycle On All Channels
Harmonics Resolution	40th Order
Update Rate	
Watts, Var and VA	100 msec at 60 Hz
All Other Parameters	1 Second at 60 Hz
Power Supply	
ac/dc Voltage Option	90 – 265 Vac at 50/60 Hz or 100 – 370 Vdc, Universal ac/dc Supply
dc Voltage Option	18 – 60 Vdc
Burden	10 VA Max.
Standard Communications Format	
Connection Type	RS-485 (Through Back Plate)
Com Port Baud Rate	9600 – 57,600 Bauds
Com Port Address	01 – 247
Data Format	8-Bit, No Parity
Protocols	Modbus ASCII, RTU or DNP 3.0
KYZ Pulse	
Contacts	1 Form A
On Resistance, Max.	35 Ohms
Peak Switching Voltage	350 Vdc
Continuous Load Current	120 mA
Peak Load Current	350 mA (10 ms)
Off-state Leakage Current at 350 Vdc	1 uA
Opto-isolation	3750 Vac
Dimensions and Shipping	
Weight	2 lbs.
Basic Unit	H 5.00 x W 4.90 x L 5.00 Inches
IQ 250/260	Mounts in 92 mm DIN and ANSI C39.1 Round Cut-outs
Shipping Container Dimensions	6-Inch Cube
Tolerance	+/-0.1 Inches (2.54 mm)
Compliance	
IEC 687	0.2% Accuracy
ANSI C12.20	0.2% Accuracy
ANSI C62.41	Burst
UL/cUL	Electrical & Electronic Measuring & Test Equipment 22CZ

IQ 250/260 Meter Dimensions





Expandable IQ Componentry

Figure 56-27. IQ 250/260 Meter Dimensions — Face and Side Views

Ordering Information

Table 56-11. IQ 250/260 Meter Catalog Numbering System

IQ 250 M A 6 5 1 1 0

Model Series	Meter Type	Frequency	Current Input	Power Supply	I/O Slot 1	I/O Slot 2
250 = Power **260** = Power Quality	**M** = Meter (with integral display) **T** = Transducer Only (no display)	**5** = 50 Hz System **6** = 60 Hz System	**1** = 1 Amp Secondary **5** = 5 Amp Secondary	**1** = 90 – 265 Vac/dc **4** = 24 – 48 Vdc	**0** = None **1** = 2 Relay Outputs/ 2 Status Inputs **2** = 4 KYZ Pulses/ 4 Status Inputs **3** = 4 Analog Outputs: 0 – 1 mA **4** = 4 Analog Outputs: 4 – 20 mA	**0** = None **1** = 2 Relay Outputs/ 2 Status Inputs **2** = 4 KYZ Pulses/ 4 Status Inputs **3** = 4 Analog Outputs: 0 – 1 mA **4** = 4 Analog Outputs: 4 – 20 mA

Table 56-12. IQ 250/260 Meter Accessories

Description	Catalog Number
Panel Mounting Adapter for retrofiting an IQ 250/260 to an IQ Analyzer/IQ DP-4000/IQ Data Cutout	**Consult Factory**
PXM 2000 Gateway Card Kit to upgrade an IQ250/260 to a PXM 2000	**PXM2000-GCK**

IQ Analyzer 6400/6600 Series

IQ Analyzer

Product Description

IQ Analyzer-Comprehensive Electrical Distribution Monitoring

Eaton's IQ Analyzer is a complete solution for users who want to monitor and manage all aspects of their electrical distribution system. Based on input from customers and consultants, it provides extensive metering, power quality analysis, remote input monitoring, control relaying, analog input/outputs and communications capability.

Its high performance metering exceeds ANSI C12.16 (1%) specification for revenue meters and meets ANSI C12.20 Class 0.5%, provides quality true rms readings through the 50th harmonic, accurately measures nonsinusoidal waveforms up to a 3.0 crest factor, and displays even and odd multiples of the fundamental current and voltage through the 50th harmonic. Both magnitude and phase angle of the harmonics are displayed.

The unique operator interface, which includes a reverse mode LCD display, easy to use *Meter Menu* screens and detailed *Analysis* screens, is designed to allow a wealth of real-time and recorded information to be accessed easily by an operator. All programming can be accomplished through the faceplate or the communications port. The comprehensive on-line Help feature provides useful information on device operation, programming and troubleshooting.

Metered and Monitored Parameters

- rms sensing.
- Phase neutral, and ground currents.
- Volts: L-L, L-N, Avg. L-L, Avg. L-N, N-G.
- Power: real, reactive, apparent (system and per phase).
- Frequency.
- Power factor: apparent and displacement (system and per phase).
- Energy and demand (forward, reverse, net) real, reactive apparent at four different utility rates.
- Individual current and voltage harmonics: magnitude, phase angle.
- % THD: current and voltage.
- Waveform capture.
- Minimum and maximum values.
- Event logging/disturbance recording.
- ANSI C12.20 Class 0.5% revenue metering accuracy, IEC687 Class 0.5%.
- Industry Canada 0.5% revenue accuracy.

Communications

- Optional interface capability to computer network for data collection, storage and/or printout via Eaton's Power Management Software.

Physical Characteristics

- Graphical reverse mode LCD display with LED backlight.
- Up to seven lines of information.
- Height: 10.25 inches (260.4 mm).
- Width: 6.72 inches (170.7 mm).
- Depth:
  - 4.70 inches (119.4 mm) without PONI
  - 5.83 inches (148.1 mm) with PONI
- Membrane faceplate NEMA 3R and 12 rated.

Application Description

- Monitoring of over 150 electrical parameters.
- Power quality management.
- Energy management.

Features, Benefits and Functions

Disturbance Information

With the communications option and Eaton's Power Management Software and Waveform Display software, a *Waveform Analysis* will construct waveforms of up to 56 cycles of all currents and voltages (including neutral and ground) to help troubleshoot undervoltage/sag and overvoltage/swell conditions. (See CBEMA Trend Logging section, next page.) By programming a reset threshold, the duration of the voltage disturbance can also be indicated.

The IQ Analyzer 6600 series with Graphic Waveform Display offers the ability to view the captured waveform right at the device. The 6600 series also offers the ability to detect and capture sub-cycle voltage disturbances.

Extensive Harmonic Distortion Analysis

Current *and* voltage distortion data are displayed at the device and accessible through the communications port. This includes % THD, K-Factor, Crest Factor, CBEMA factor, and both magnitudes and phase angles of all harmonics through the 50th. A snapshot sample of this information may be activated by user commands, discrete inputs or programmable thresholds to capture distortion data during conditions of real interest. To help eliminate nuisance alarms, harmonic distortion information can be captured and relay outputs activated when THD exceeds a programmable percentage of fundamental or a programmable magnitude (e.g., amperes) threshold.

Time-of-Use Metering

The IQ Analyzer offers the ability to store energy usage data for time of use revenue metering. It can be programmed for any combination of weekday, Saturday, Sunday, 22 holidays, 8 seasons, 32 schedules, and 10 time periods per schedule. The IQ Analyzer will keep track of the following parameters for four different utility rates:

- Watthours.
- Var hours.
- VA hours.
- Current demand.
- Watt demand.
- VA demand.
- Var demand.

Historical Trend Logging

The IQ Analyzer is equipped with onboard logging capability, which includes the ability to log a total of 24 parameters with intervals ranging from 0.13 seconds (every 8 cycles) to twice a week (5040 minutes). The trending function can begin immediately or can be triggered upon receipt of a discrete input into the IQ Analyzer. Onboard logging provides a cost-effective means of distributed data storage where real-time communications may not be feasible or for applications where data storage redundancy is desired. Four trend data logs are stored in non-volatile memory aboard the IQ Analyzer and can be retrieved at the display or via communications for viewing using Eaton's Power Management Software.

- Up to 24 parameters with storage capacity for up to 90,000 data points.
- Up to 234 days of data can be stored when recording a parameter every 15 minutes.
- Trends 1, 2 and 3 can save data on a discrete contact input.
- Trend 4 can save data on a power quality or meter event.
- Minimum and maximum recording (minimum and maximum 3-phase average current, maximum I_G, minimum and maximum 3-phase average V_{LL} and V_{LN}, maximum V_{NG}, maximum system Watts, vars, and VA, minimum and maximum apparent and displacement PF). Using this feature, minimum and maximums reached during each trend interval are recorded.

CBEMA Trend Logging

The IQ Analyzer can be configured to store the necessary data so that the software can display a sag or swell voltage event on the industry standard CBEMA (now ITIC) curve for predictive maintenance and troubleshooting. This application utilizes the IQ Analyzer waveform capture for high-0speed events along with historical trend logging for longer term voltage disturbances. Once this data is uploaded to a PC running the Power Management Software's Event Viewer the information is analyzed, displayed and stored. Automatic uploading of CBEMA events can be selected in the software. A three-phase event will be correctly displayed as a single point on the CBEMA curve.

Event Logging

The IQ Analyzer will store in non-volatile memory the time and reason for last 504 events. These events can be viewed from the graphical display or accessed via communications. In addition to all of the meter events listed in the Event Conditions section (**Page 56-38**), the following events are entered into the event log:

Time and date of:

- Alarms.
- Meter power up.
- All resets.
- All setting changes.
- Communications established or lost.

Event logging is another powerful troubleshooting tool within the IQ Analyzer.

Extensive I/O and Communications Capability

One analog and three digital inputs are provided to interface with sensors and transducers. Three analog outputs and four relay contacts are furnished to share data with PLCs and control systems and to actuate alarms and control relays. Terminals are captive clamp type and finger safe. With the communications option, the device can be remotely monitored, controlled and programmed.

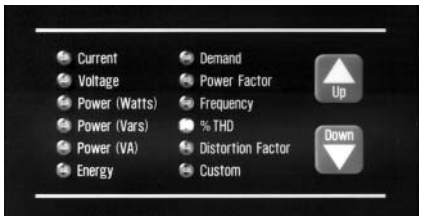
Ratings

- Application to 500 kV, no PTs to 600 volts.
- CT ratios selectable from 5:5A to 10,000:5A.
- Standard 120/600 Vac line.
- 3-phase power supply module, 100 – 600 Vac. Separate source power supply module available, 100 – 240 Vac or 100 – 250 Vdc.
- dc only separate source power module also available, 24 – 48 Vdc.

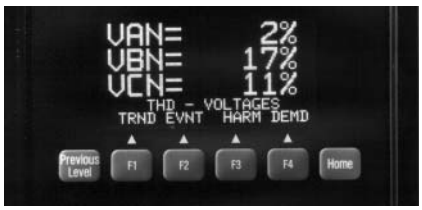
Displayed Information Features

- All information accessible at device or through communications port via Eaton's Power Management Software.
- Quality true rms readings through 50th harmonic.
- Complies with the accuracy portion of ANSI C12.20 Class 0.5% revenue metering specification.
- Accurate readings for nonsinusoidal waveforms with up to 3.0 crest factor.
- Screens display auto ranging units, kilo units, mega units as needed.
- 10-digit energy readings.
- Displays multiple parameters at the same time.
- Programmable custom screens.

Meter Menu Screens



Meter Menu



Examples of Meter Menu

Custom Screen

Custom Screen

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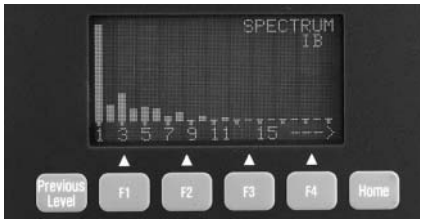
The IQ Analyzer allows a user to view commonly used parameters by scrolling through its LED indicator Meter Menu.

Meter Menu Displayed Information

- Current:
  - Phases A, B, C, Average
  - Neutral
  - Ground (Separate CT)
- Voltage:
  - Phases A-B, B-C, C-A, Average
  - Phases A-N, B-N, C-N, Average
  - Neutral-Ground
- Power:
  - Real (Watts)
  - Reactive (Vars)
  - Apparent (VA)
  - Phases A, B, C and System
- Energy (Forward, Reverse and Net):
  - Real (kWh)
  - Reactive (kvarh)
  - Apparent (kVAh) — no reverse or Net
- Frequency, Time and Date.
- Demand:
  - System Current (amperes)
  - Systems Real Power (kW)
  - System Reactive Power (kvar)
  - System Apparent Power (kVA)
- Power Factor (Phases A, B, C and System):
  - Displacement
  - Apparent
- %THD Current:
  - Phases A, B, C, N
- %THD Voltage:
  - Phases A-B, B-C, C-A
  - Phases A-N, B-N, C-N
- K-Factor.
- CBEMA (ITIC) Derating Factor (Displayed as "Z").
- Crest Factor.
- Discrete Input and Output Status.
- Analog Input Reading.
- Custom — User may program four screens to show any combination of seven Meter Menu parameters per screen.

Harmonic Analysis Screens



Harmonic Spectrum Available with Model 6600

Minimum and Maximum Values

- Current:
  - Phases A, B, C, N, G
- Voltage:
  - Phases A-B, B-C, C-A
  - Phases A-N, B-N, C-N, N-G
- Power:
  - Real (Watts)
  - Reactive (Vars)
  - Apparent (VA)
  - Phases A, B, C and System
- Power Factor:
  - Apparent and
  - Displacement (3-Phase and System)
- Frequency.
- THD (Amperes, Volts, and %):
  - Current (Phases A, B, C, N)
  - Voltage (Phases A-B, B-C, C-A, A-N, B-N, C-N)

All minimum/maximum values may be reset via reset pushbutton on faceplate, discrete input or communications command. Values are updated at least once every 16 line cycles.

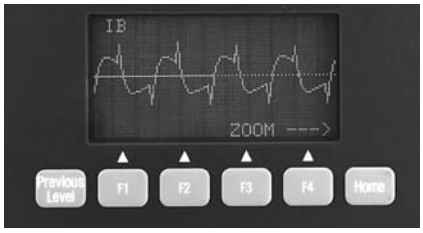
The F3 function key accesses the Harmonic Analysis screens. Two cycles of data sampled at 128 ***samples/cycle*** are ***simultaneously*** recorded for:

- Current:
  - Phases A, B, C, N, G
- Voltage:
  - Phases A-B, B-C, C-A
  - Phases A-N, B-N, C-N
  - Neutral to Ground

Magnitudes (or % of fundamental) of odd ***and even*** multiples of the fundamental from 2nd – 50th are displayed. The phase angle associated with each multiple of the fundamental is also displayed.

Event/Alarm Analysis Screens

Example of Event Analysis Screens



Waveform Screen Available with Model 6600

Pressing the F2 function key accesses the Event Analysis screens. These display the following data for up to ten event/alarm conditions:

- Description, date, and time of event/alarm with 10 millisecond resolution.
- Current, voltages, power readings, demand readings, frequency and % THD at time of event/alarm.
- Current and voltage distortion information available on Harmonic Analysis screens.

Event data is stored in non-volatile memory. If a reset threshold is programmed, the *duration* of the event (e.g., undervoltage) is also displayed. With Eaton's communications option and software, waveforms and harmonic profiles may be displayed on a PC.

Event Conditions

Events may be triggered by up to seven of any of the following conditions:

Voltage Disturbances

- Undervoltage/sag — any V_{L-L}, V_{L-N} (40 – 100%).

Note: 60% minimum for self-powered unit.

- Overvoltage/swell — any V_{L-L}, V_{L-N} (100 – 750%).

If zero time delay is programmed, any disturbance lasting 2 cycles (less if magnitude is sufficient to effect rms readings) will trigger a voltage disturbance event/alarm.

- Sub-cycle transient capture/excess dv/dt on V_{A-N}, V_{B-N}, V_{C-N}

Note: 6600 series only.

- Sub-cycle voltage interruption on V_{A-N}, V_{B-N}, V_{C-N}

Note: 6600 series only.

Maximum Threshold Exceeded

- Currents — Phases A, B, C, Neutral, and Ground.
- Voltage — Neutral to Ground.
- System Power — Watts, VA, Vars.
- System Power Factor — Displacement and Apparent.
- Demand.
- Currents — Phase A, B, C and AVG.
- System Power — Watts, Vars, VA.
- Frequency.
- Percent Total Harmonic Distortion or Magnitude Total Harmonic Distortion:
  - Currents — Phases A, B, C, Neutral
  - Voltage — V_{A-N}, V_{B-N}, V_{C-N}, V_{A-B}, V_{B-C}, V_{C-A}

Minimum Threshold Exceeded

- Currents — Phases A, B, C.
- System Power — Watts, Vars, VA.
- System Power Factor — Displacement and Apparent.
- Frequency.

Voltage Phase Unbalance

- Voltage L-L, L-N.

Current Phase Unbalance

- Current — Phases A, B, C.

Discrete Input Energized

- Input 1, 2, 3.
- Remote command through communications port or front panel.

All trigger conditions have programmable time delays from 0.1 – 60 seconds in 0.1 second increments (except Voltage Disturbances — programmable from 2 – 3600 cycles in 2-cycle increments, and Eaton's Power Management Software commands — no programmable delay).

Demand Recording

Peak Demands are date and time stamped for:

- Current Phases A, B, C and Average.
- System Power:
  - Real (watts)
  - Reactive (Vars)
  - Apparent (VA)

Input/Output

Extensive input/output capability is standard on the IQ Analyzer. In addition to monitoring three-phase currents and voltages, separate inputs are provided for both ground and neutral currents. Voltage of neutral-to-ground is also monitored to indicate the presence of harmonics and potential downstream grounding problems. Analog and digital I/O provide interfaces for transducers, relays, PLCs and control systems.

Current Inputs

Five ampere secondary CT connections for:

- Phases A, B, C.
- Ground.
- Neutral.
- Separate ground and neutral CT inputs.
- CT range 5:5 – 10,000: 5 (any integer).

Voltage Inputs

- Phases A, B, C (from 120 Vac – 500 kV ac).
- 120/240 Vac control power input standard — not required with optional line power module.
- Separate ground-to-neutral voltage reference.
- PT range 120:120 – 500,000:120 (any integer).

External 120-volt secondary PTs are required above 600 Vac, optional from 120 – 600 Vac.

Discrete Contact Inputs

Three dry contact discrete inputs may be programmed by the user to:

- Trigger Event Analysis — the information described in "Event Analysis Screens," including Harmonic Analysis information, can be recorded when external devices trip or change state by wiring their auxiliary contacts into these inputs.
- Act as a synch.-pulse input to synchronize power demand windows with utility provided synch. pulse.
- Actuate a relay output.
- Reset relay output, peak demands, Trend Analysis records and Event Analysis records.
- With communications option, provide remote status indication on Eaton's communication network.
- Status of input contacts is displayed in the Meter Menu Custom screen.

Relay Output Contacts

Four Form-C (NO/NC) relay contacts may be independently programmed to:

- Act as a kWh, kVarh or kVAh pulse initiator output.
- Actuate on one or more event conditions — including discrete input and software commands (through communications port).
- Reverse sequence alarm.

Each Relay may be set for Auto or Manual Reset with 0 – 30 minute release delay (one second increments). Relays are Form-C NO/NC. Relay(s) programmed to actuate on undervoltage also have a programmable 0 – 30 minute delay on power-up for transfer applications.

Analog Input and Outputs

One analog input and four analog outputs may be configured as 0 – 20 or 4 – 20 mA. The analog input is displayed at the device as a percentage and is accessible through the communications port. The analog input provides an interface with gas flow meters, temperature transducers or other analog devices.

The analog outputs may be programmed to reflect any of the following:

- Current — Phases A, B, C, Average, N, G.
- Voltage — L-L, L-N, N-G.
- Power:
  - Real (watts)
  - Reactive (Vars)
  - Apparent (VA)
  - Phases A, B, C and System
- %THD:
  - Current (Phases A, B, C, N)
  - Voltage (L-L, L-N)
- Frequency – System.
- Power Factor:
  - System Displacement PF
  - System Apparent PF

Listings and Certifications

- UL listed, File E62791, NKCR File E185559 (CE versions).
- cUL listed #1010.1 C22.2.
- CE mark EN61010-1 (1993) EN50082-2 (1994).
- Measurement Canada Electricity Meter AE-0782.
- CSA approved.

Options and Accessories

IQ Analyzer Auxiliary Power Supply

The optional IQ Analyzer Auxiliary Power Supply allows set point programming of the IQ meter while the monitored line power is turned off and locked out, thus eliminating the presence of dangerous line voltages. The Auxiliary Power Supply is easy to install and has been specifically designed to connect to the power supply connector on the IQ meter and then plug into a standard electrical wall outlet.

Product Specifications

IQ Analyzer 6400/6600 Series

Fuses

- Self-powered units with IQMSSPM have 3/4 ampere, 600 volts Bus Type KTK-R-3/4 fuses (3 required).
- Separate source dual-voltage units with IQMSSPM have a single 5 x 20 mm 1/4 ampere fuse.
- Separate source dc units with IQMDCPM do not have user replaceable fuses.

Environmental Conditions

- Operating temperature: -20° – 70°C.
- Storage temperature: -30° – 85°C.
- Operating humidity: 5 – 95% relative humidity.

Shipping Weight Lbs. (kg)

- 5.8 (3.6).

Current Inputs (Each Channel)

- Conversion: true rms, 32 sample/cycle (all samples used in all rms calculations).
- CT input: 5 ampere secondary (any integer 5:5 to10,000:5).
- Burden: 0.05 VA.
- Overload withstand: 40 amperes ac continuous, 300 amperes ac 1 second.
- Range: 8 x CT continuous.
- Accuracy: 0.1% of CT primary rating, 0.2% of reading above 150% of rating, sinusoidal (see accuracy below for non-sinusoidal specifications).
- Input impedance: 0.002 ohm.

Voltage Inputs (Each Channel)

- Conversion: True rms, 32 sample/cycle (all samples used in all rms calculations).
- PT input: direct or any integer 120:120 – 500,000:120.
- Range: 30 – 660 Vac (separate source and dc source).
- Nominal full scale: 100 – 600 Vac.
- Burden: 21 VA (self-powered only).
- Overload withstand: 635 Vac, continuous 700 Vac, 1 second.
- Input impedance: 1 megohm.

Frequency Range

- 20 – 66 Hz fundamental (up to 50th harmonic).

Harmonic Response (Voltages, Currents)

- 50th harmonic.

Accuracy (in Percent Full Scale)

Accuracy from 3 – 300% of Full Scale and from -0.5. to 1.00 to 0.5 power factor.

- Current and voltage: ± 0.20%.
- Power, energy and demand: 0.40%.
- Frequency: 0.04%.
- Power factor: 0.80%.
- THD: 1.00%.

Specific Current Accuracies

- ± 0.20% of full scale to 200% of full scale and 150% crest factor.
- ± 0.20% of full scale to 150% of full scale and 200% crest factor.
- ± 0.20% of full scale to 100% of full scale and 300% crest factor.
- ± 0.40% of reading for currents to 800% of full scale.
- Power and Energy: Start recording with an average of 3 mA secondary current.

Discrete Inputs (Dry Contact)

- +30 Vdc differential across each discrete input pair of terminals. Minimum pulse width: 1.6 msec.
- Optically isolated inputs to protect IQ Analyzer circuitry.

Analog Outputs (4)

- 0 – 20 mA/4 – 20 mA into maximum 750 ohm load. Accuracy: 1%.

Analog Input (1)

- 0 – 20 mA/4 – 20 mA into 200 ohm load. Accuracy: 1%.

Relay Output Contacts (4)

- Form C Dry Contact: 10 amperes at 120/240 Vac (Resistive) 10 A at 30 Vdc (Resistive) 30 A make (50 mS) at 240 Vac/240 Vdc.
- Minimum pulse width: 4 cycles (68 mS).
- Withstand rating: 1000 Vac, 1 minute across contacts 5000 Vac (contacts to coil, 1 minute) 10,000 Vac (contacts to coil, surge voltage).

Relay Response Time

(Excluding programmed time delays):

- Two line cycles for Discrete Input, Eaton's software commands (communications port).
- Four to five line cycles for Voltage Disturbance, Voltage Unbalance.
- Nine to 10 line cycles for all others.

IQ Analyzer Auxiliary Power Supply

- Dimensions in inches (mm):
  - Height: 4.00 (101.6)
  - Width: 2.40 (61.0)
  - Depth: 1.11 (28.2)
- Input voltage: 100 – 250 Vac.
- Input frequency: 50/60 Hz.
- Output voltage/current: +24 Vdc at 0 – .45 A.
- Output ripple: 100 mV maximum (peak to peak).
- Rated output power: 10.8 watts.
- Turn on/turn off overshoot 5% maximum.
- Turn on delay: 0.5 second maximum.
- Operating temperature: 0° – 40°C.
- Storage temperature: -40° – 80°C.

Technical Data and Specifications

Wiring Diagram

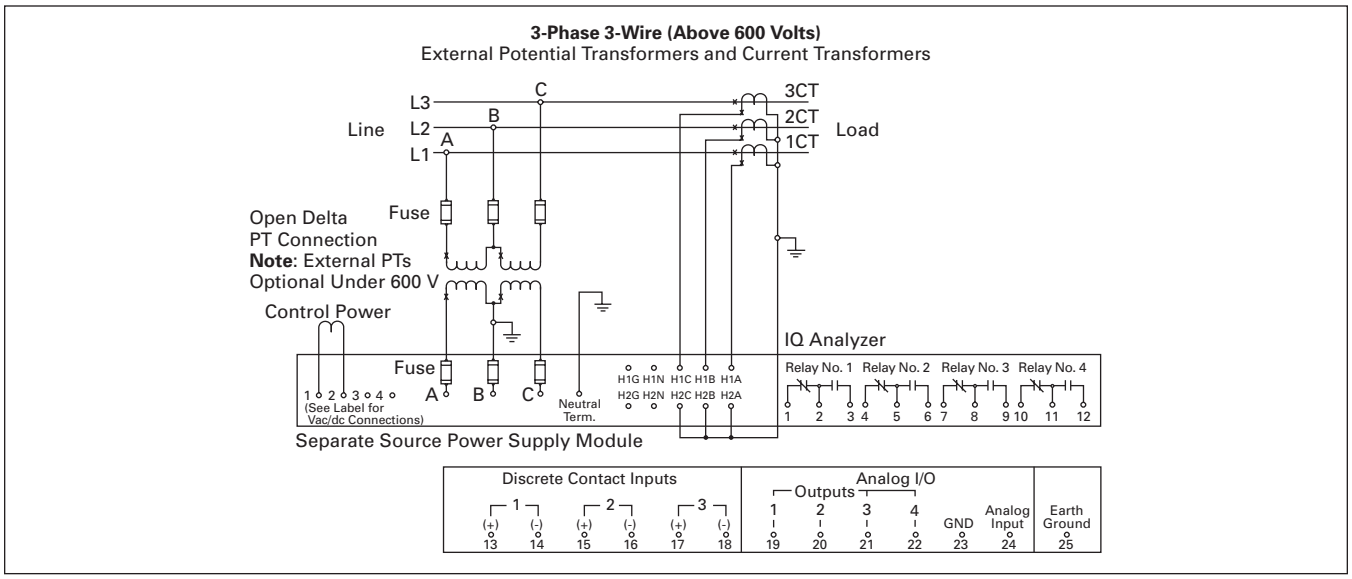


Figure 56-28. Field Wiring Connections — Separate Source Power Supply Shown Here (For 3-Phase Power Supply, No Separate Control Power is Required)

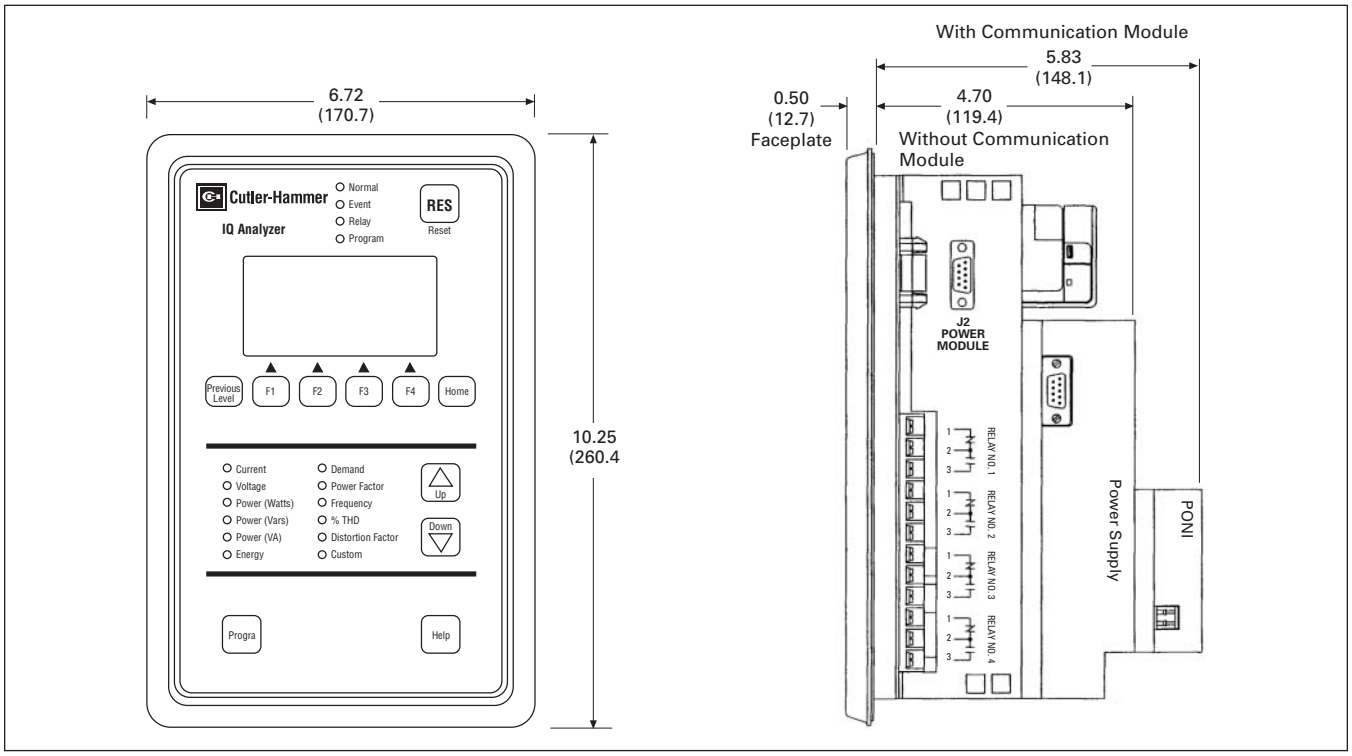


Figure 56-29. Dimensions and Cutout — Dimensions in Inches (mm)

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Table 56-13. Control Power Input

Description	Separate Source	Self Powered ①	dc Source
Input Range, ac	110 – 240 Vac ±10%	110 – 600 Vac ±10%	N/A
Frequency Range	45 – 66 Hz	45 – 66 Hz	N/A
Input Range, dc	110 – 250 Vdc ±10%	N/A	24 – 48 Vdc ±20%
Burden	21 VA	21 VA	21 VA

① When directly wired to 480 Vac, IQ Analyzer can ride through a continuous sag that is 20% of rated voltage.

Dimensions

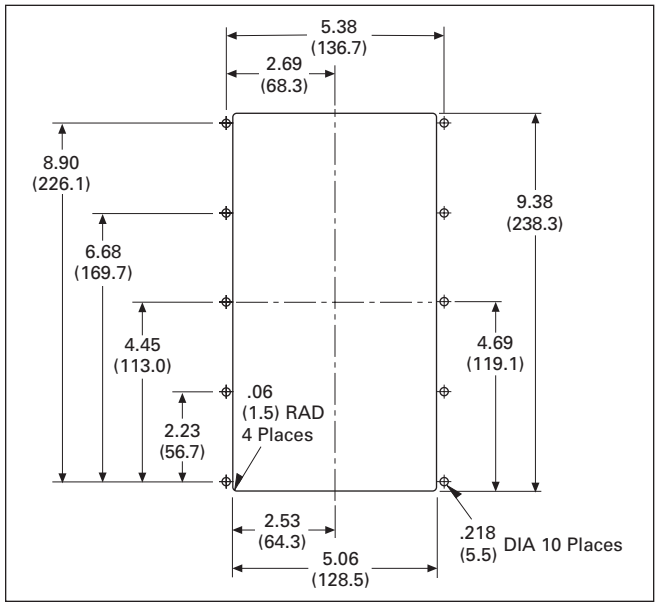


Figure 56-30. Drilling Pattern — Dimensions in Inches (mm)

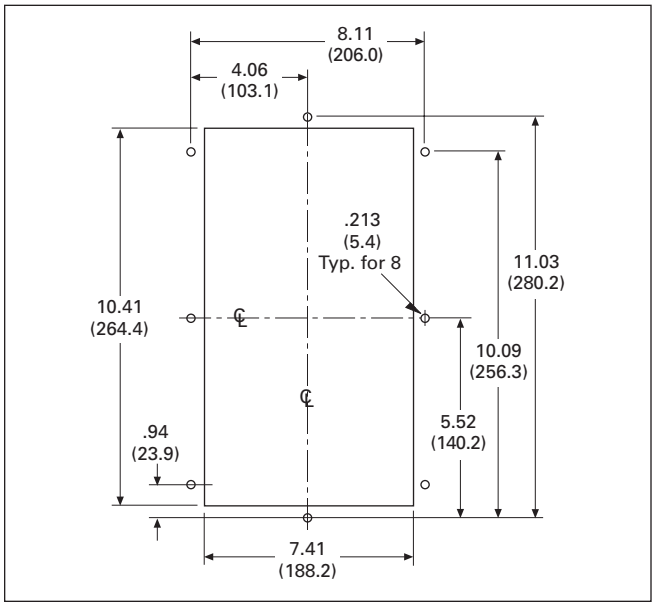


Figure 56-31. Drilling Pattern for Flange Mounting — Dimensions in Inches (mm)

Product Selection

Table 56-14. IQ Analyzer

Description	Catalog Number	Price U.S. $
IQ Analyzer, Separate Source Power Module IQ Analyzer, 24 – 48 Vdc Power Module IQ Analyzer, 3-Phase Power Module	**IQA6410** **IQA6420** **IQA6430**	
IQ Analyzer, Separate Source Power Module with Waveform Display and Sub-Cycle Voltage Disturbance Capture IQ Analyzer, 24 – 48 Vdc Power Module with Waveform Display and Sub-Cycle Voltage Disturbance Capture IQ Analyzer, 3-Phase Power Module with Waveform Display and Sub-Cycle Voltage Disturbance Capture	**IQA6610** **IQA6620** **IQA6630**	
IQ Flange, to Provide Extra Clearance when Mounting 45-inch (1143.0 mm) Extension Cable for Remote Mounting of Power Module	**IQFLANGE** **IQA45CABLE**	
24 – 48 Vdc Separate Source Power Module 100 – 240 Vac and 100 – 250 Vdc Separate Source Power Module 3-Phase, Self-Powered Power Module	**IQMDCPM** **IQMSSPM** **IQM3PPM**	
INCOM Communication Module Ethernet Communications Module (10Base-T) Ethernet Communications Module with Fiber Optic Port (10Base-T and 10Base-FL) Web Server Communications Module (10Base-T) RS-485 Communication Module with Modbus Protocol	**IPONI** **EPONI** **EPONIF** **WEBPONI** **MPONI**	

Discount Symbol **C10-S24**

IQ DP-4000

Product Description

Eaton's IQ DP-4000 is a microprocessor-based monitoring and protective device that provides complete electrical metering and system voltage protection. In one compact, standard package, the IQ DP-4000 will provide an alternative to individually mounted and wired conventional meters and switches. The DP-4000 also monitors Apparent Power (VA), Reactive Energy (Var-Hours), Apparent Energy (VA-Hours), and percent THD to provide the user with basic power quality information. The IQ DP-4000 meets and surpasses UL/CSA/CE standards.

The IQ DP-4000's rugged construction is designed to withstand harsh conditions such as temperature variations, outdoor applications, and industrial environments. The membrane faceplate pushbuttons are easy to use and both the parameter LED and window displays are easily visible.

Protective and Event Alarming

- Undervoltage.
- Overvoltage.
- Current phase loss.
- Voltage phase loss.
- Phase reversal.
- Phase unbalance.
- Optional current and power demand threshold.

Metered and Monitored Parameters

- rms sensing.
- Phase currents.
- Volts: L-L, L-N.
- Power: real, reactive, apparent.
- Energy: real, reactive, apparent.
- Frequency.
- Power factor.
- % THD: current and voltage.
- Minimum and maximum values.
- Fixed or sliding demand windows.

Communications

- Optional interface capability to computer network for data collection, storage and/or printout via Eaton's Power Management Software.

Physical Characteristics

- Large visible LED display.
- Height: 10.25 inches (260.4 mm).
- Width: 6.72 inches (170.7 mm).
- Depth:
  - 4.42 inches (112.3 mm) without PONI
  - 5.40 inches (137.2) with PONI
- Membrane Faceplate NEMA 3R and 12 rated.

Application Description

- Monitoring of all common electrical parameters.
- Optional protective alarm functions.

Retrofit Opportunities

- Retrofit of existing electrical distribution systems with the IQ DP-4000 for power, quality, load, and energy monitoring.
- Mounting flange option for application where additional door mounting space is required. See **Page 56-161**.
- Separate wall mounted enclosure, Enclosed IQ.

Features, Benefits and Functions

Historical Values

- Present Demand Current (per phase) 5, 10, 15, 20, 25, 30, 45 or 60 minute windows.
- Present Demand Watts, Vars, and VA 5, 10, 15, 20, 25, 30, 45 or 60 minute windows:
  - Sliding or fixed window for power Sync pulse input (Model 4100) Eaton's PowerNet broadcast demand sync
- Minimum and maximum values current (per phase):
  - Voltage (per phase, L-L, L-N)
  - Watts, Vars and VA
  - Power Factor (displacement and apparent)
  - Frequency
- Peak values:
  - Percent THD parameters
  - Demand parameters

Alarm and Protective Functions

- Alarm/Protective functions (all models) include:
  - Overvoltage
  - Undervoltage
  - Current phase loss
  - Voltage phase loss
  - Phase unbalance
  - Phase reversal
- User-programmable alarm and reset threshold levels and delay intervals.
- Optional current and power demand threshold.

Description of Protection Functions

Overvoltage
Range 105 – 140% (5% increments).

Undervoltage
Range 60 – 95% (5% increments).

Phase Unbalance
Deviation between any two phases percentage of nominal line voltage preset by DIP switches. Range 5 – 40% (5% increments).

Phase Reversal
Any two phases become reversed for the selected delay.

Voltage Phase Loss
Less than 50% of the nominal line voltage detected.

Current Phase Loss
Smallest phase current is less than 1/16 of the largest phase current.

Delay
Allows a delay before an alarm occurs. (Range 1 – 20 seconds in 1 second increments.)

Note: Unit must be powered for this to occur.

Inputs and Outputs (4100 Model)
- Three Form C relay outputs selectable: Trip, Alarm, kWh pulse initiator.
- One synch input for kW utility demand sync.

Standards and Certifications

Listings and Certifications
- UL/cUL/CSA listed.
- CE mark EN61010-1, EN50082-2.

Ratings
- Application to 500 kV, no PTs to 600 volts.
- CT ratios selectable from 5:5 A to 12800: 5A.
- Standard 120/600 Vac line 3-phase power supply module. Two separate source power supply modules available. One module from 110 – 240 Vac and 110 – 250 Vdc; the other module 24 – 48 Vdc only.

Product Specifications

IQ DP-4000

Accuracy
- Maintained from 10 – 250% of CT primary rating.

Listings and Certifications
- UL/cUL/CSA listed.
- CE mark EN61010-1, EN50082-2.

Current Inputs (Each Channel)
- Nominal full scale current: 5 amperes ac.
- Current range for rated accuracy: 0 – 15 amperes ac.
- Overload withstand: 15 amperes ac continuous 300 amperes ac 1 second.
- Burden: 0.003 VA.

Voltage Inputs (Each Channel)
- Voltage range (nominal): 90 – 600 Vac.
- Nominal full scale voltage: 120 – 600 Vac.
- Overload withstand: 660 Vac continuous 4 kV 1.2/50µs.
- Burden: 3-phase power module 10 VA.

Fuses
(Supplied with three-phase power module only.) 3/4 ampere, 600 volt bus type KTK-R-3/4 (3 required).

Contact Rating (Model 4100)
- 10 amperes at 120/240 Vac (resistive).
- 10 amperes at 30 Vdc (resistive).

Compatible with the Following Systems
- 3-phase, 3-wire.
- 3-phase, 4-wire.

Shipping Weight Lbs. (kg)
- 6.5 (3.0).

Options and Accessories

IQ DP-4000 I/O Module
For applications where field modification to add or change Input/Output (I/O) capability to the IQ DP-4000 is required, Eaton offers I/O cards. These field-installable modules can be easily inserted into an existing IQ DP-4000 where input/output application needs change.

- Power requirements: 10 VA.
- Frequency: 50/60 Hz.
- Operating temperature: 25° – 70°C.
- Operating humidity: 0 – 95% noncondensing.
- Dry contact input: 24 Vdc differential across input pair of terminals; minimum pulse width, 50 mS.

IQ DP-4000 Auxiliary Power Supply
The optional IQ DP-4000 Auxiliary Power Supply allows set point programming of the IQ meter while the monitored line power is turned off and locked out, thus eliminating the presence of dangerous line voltages. The Auxiliary Power Supply is easy to install and has been specifically designed to connect to the power supply connector on the IQ meter and then plug into a standard electrical wall outlet.

- Dimensions in inches (mm):
  - Height: 4.00 (101.6)
  - Width: 2.40 (61.0)
  - Depth: 1.11 (28.2)
- Input voltage: 100 – 250 Vac.
- Input frequency: 50/60 Hz.
- Output voltage/current: +24 Vdc at 0.45A.
- Output ripple: 100 mV maximum (peak to peak).
- Rated output power: 10.8 watts.
- Turn on/turn off overshoot: 5% maximum.
- Turn on delay: 0.5 second maximum.
- Operating temperature: 0° – 40°C.
- Storage temperature: -40° – 80°C.

Technical Data and Specifications

Dimensions

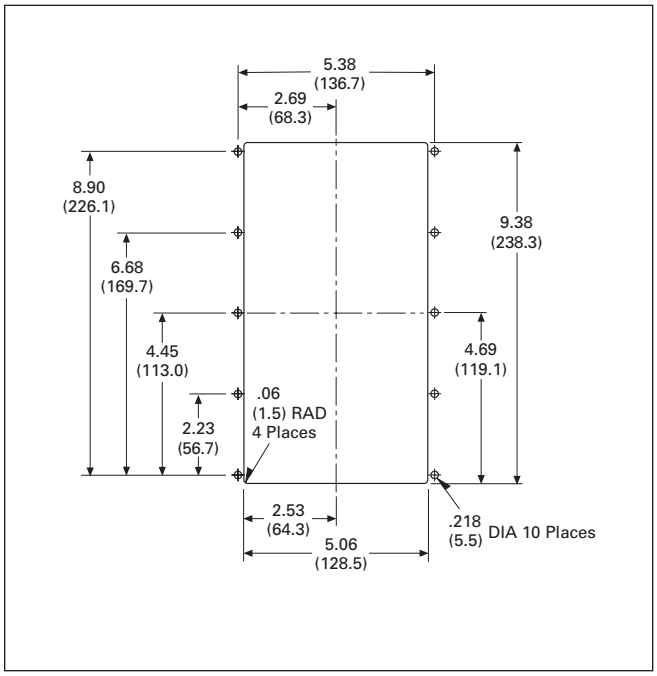


Figure 56-32. Drilling Pattern — Dimensions in Inches (mm)

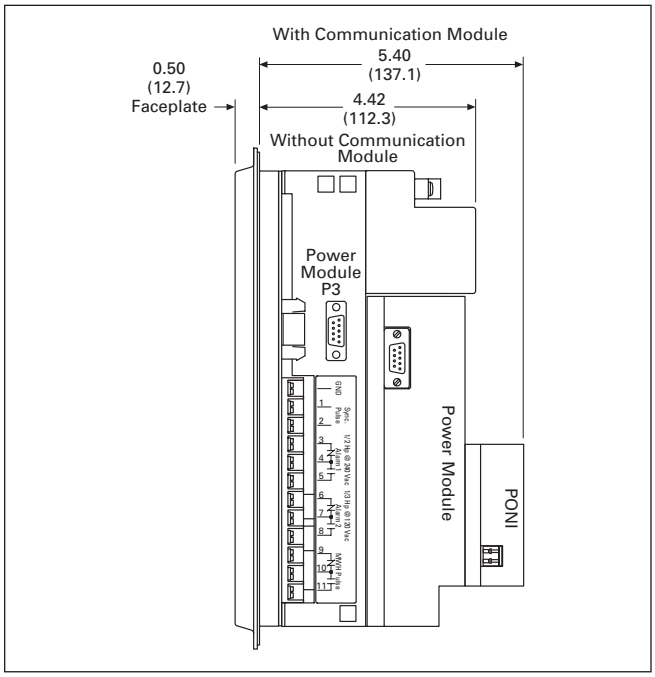


Figure 56-33. IQ DP-4000 Side View — Dimensions in Inches (mm)

Wiring Diagrams

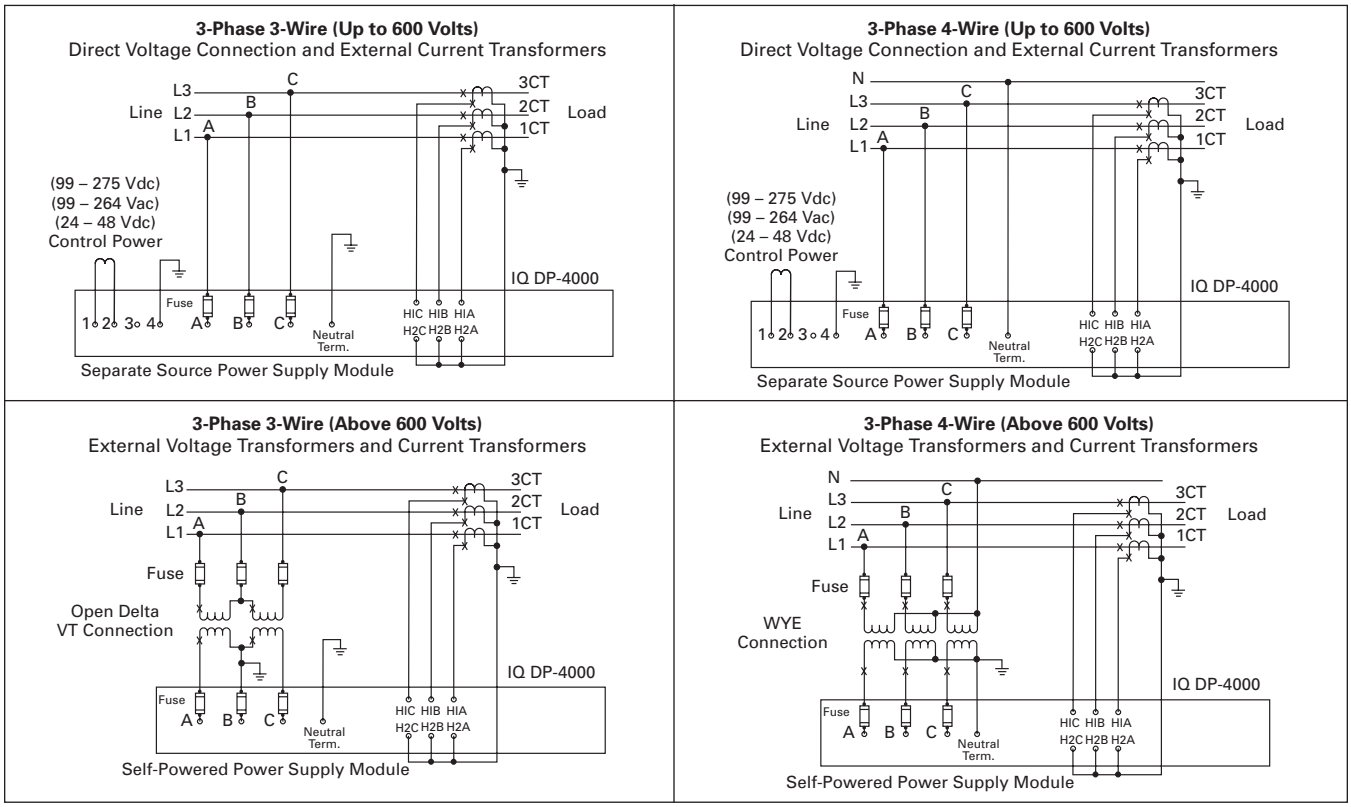


Figure 56-34. Field Wiring Connections

Table 56-15. Model 4100 Input and Output

Model	Input	Output
4000 4100	0 1 Digital (dry contact)	0 3 Relays

Table 56-16. Control Power Input

Description	Separate Source	Self Powered	dc Source
Input Range, ac Frequency Range Input Range, dc Burden	110 – 240 Vac ±10% 45 – 66 Hz 110 – 250 Vac ±10% 10 VA	110 – 600 Vac ±10% 45 – 66 Hz N/A 10 VA	N/A N/A 24 – 48 Vdc ±20% 10 VA

Table 56-17. Displayed Values

Description	Displayed Through Eaton's PowerNet System	Local Display
ac Amperes Phases A, B, C ac Voltage, Phase A-B, B-C, C-A Phase A-N, B-N, C-N	± 0.3% ± 0.3% ± 0.3%	± 0.3% ± 1 digit ± 0.3% ± 1 digit ± 0.3% ± 1 digit
Watts Vars VA	± 0.6% ± 0.6% ± 0.6%	± 0.6% ± 1 digit ± 0.6% ± 1 digit ± 0.6% ± 1 digit
Watt-hours Var-hours VA-hours	± 0.6% ± 0.6% ± 0.6%	± 0.6% ± 1 digit ± 0.6% ± 1 digit ± 0.6% ± 1 digit
Power Factor Frequency % THD	± 1% ± 0.1 Hz Through 31st Harmonic	± 1% ± 0.1 Hz Through 31st Harmonic

Note: All accuracy is measured as a percentage of full scale.

Product Selection

Table 56-18. IQ DP-4000

Description	Catalog Number	Price U.S. $
4 indicates an IQ DP-4000 model x = 0 indicates no I/O; x = 1 indicates I/O y = 1 indicates separate source supply, 110 – 240 Vac and 110 – 250 Vac y = 2 indicates 24 – 48 Vdc power supply, y = 3 indicates Three-phase power supply, 110 – 600 Vac	**IQDP4XY0**	
Separate source control power without I/O Separate source control power without I/O, dc supply Three-phase power supply without I/O	**IQDP4010** **IQDP4020** **IQDP4030**	
Separate source control power with three Form C relay output contacts and one sync pulse input Separate source control power with three Form C relay output contacts and one sync pulse input, dc supply Three-phase power supply with three Form C relay output contacts and one sync pulse input	**IQDP4110** **IQDP4120** **IQDP4130**	
2 Form C relay outputs for protective alarming functions, 1 Form C relay output selectable for KYZ pulse output or load shedding, 1 demand sync pulse input	**DP4IOMOD**	
IQ Flange, to Provide Extra Clearance when Mounting 45-inch (1143.0 mm) Extension Cable for Remote Mounting of Power Module	**IQFLANGE** **IQA45CABLE**	
24 – 48 Vdc Separate Source Power Module 100 – 240 Vac and 100 – 250 Vdc Separate Source Power Module 3-Phase, Self-Powered Power Module	**IQMDCPM** **IQMSSPM** **IQM3PPM**	
INCOM Communication Module Ethernet Communications Module (10Base-T) Ethernet Communications Module with Fiber Optic Port (10Base-T and 10Base-FL) Web Server Communications Module (10Base-T) RS-485 Communication Module with Modbus Protocol	**IPONI** **EPONI** **EPONIF** **WEBPONI** **MPONI**	

Discount Symbol **C10-S24**

IQ 210/220/230 Meters

IQ 220 Digital Meter

Product Description

The IQ 200 is a family of microprocessor-based metering and monitoring devices. Its compact size and flexible mounting capabilities make it suitable for machine control panels such as panelboard and switchboard mains and feeders, low voltage metal-enclosed switchgear feeders, and motor control centers. The IQ 200 series meter includes a base module and a display module. The IQ 200 base module has the flexibility to be directly mounted to the display or separately panel mounted. The display is integrally designed to fit a standard 1/4 DIN or a 100 mm ANSI cutout for new retrofit applications.

The IQ 200 is ideal for individual load monitoring or provides an alternative to multiple ammeters, voltmeters, ammeter and voltmeter switches, wattmeters, varmeters, power factor meters, frequency meters, watthour and demand meters. ANSI C12 Class 10 revenue metering accuracy make the IQ 200 ideal for sub-metering and sub-billing applications. The IQ 200 can be easily programmed from the display keypad, which features a 4 line x 20 character LED backlit LCD display. This menu driven device displays a variety of selectable electrical system values and may be programmed for password protection.

The IQ 200 series includes four variations all containing the same display module. The IQ 210 base module is a reduced function variation, while the IQ 220, IQ 230 and IQ 230M offer additional functionality. The IQ 220 contains a wider ranging power supply, built-in INCOM communications, and a KYZ pulse output. The IQ 230 provides all the same functionality of the IQ 220 but adds digital inputs, digital outputs and an analog input. The IQ 230M includes all the benefits of the IQ 230 but replaces INCOM communication with Modbus®.

Features

- Five different mounting options.
- 1/4 DIN standard 3.60 inches (91.4 mm) x 3.60 inches (91.4 mm) cutout that meets global standards.
- One meter style with multiple mounting choices — mount on panel, DIN rail or back of meter.
- Autoranging power supply; one style for any voltage up to 600 Vac (IQ 220 and IQ 230 only).
- Direct connection up to 600 Vac. PTs are not required.
- ac or dc powered.
- Polarity sensing for errors such as improper wiring or forward and reverse power flow.
- Membrane faceplate designed and tested to meet NEMA® 12 and IP52.
- Nonvolatile storage of all set points and recorded peaks and minimums.
- Built-in INCOM or Modbus® communications capability (IQ 220 and IQ 230 only).
- Digital and analog I/O (IQ 230 only).
- Utility seal provision (IQ 230 only).

Monitored Values

- Phase currents.
- Voltage, L-L, L-N.
- System and per-phase power including watthours, varhours and VA-hours.
- System demand including watt demand, VA demand and var demand.
- Apparent and displacement power factor.
- Frequency.
- True rms metering of distorted currents and voltages up to the 31st harmonic.
- KYZ pulse output is available for use with a watthour pulse recorder or totalizer (IQ 220 and IQ 230 only).
- Recorded minimums and maximums of most values.

Table 56-19. Catalog Numbers — Dimensions in Inches (mm) and Feet (m)

Description	Catalog Number
IQ 230 Complete Meter Includes Base, Display and 14-inch Cable with INCOM Communications, KYZ Output, Digital Inputs, Digital Outputs, Analog Input, and Utility Seal Provision	**IQ230**
IQ 230M Complete Meter Includes Base, Display and 14-inch Cable with Modbus Communications, KYZ Output, Digital Inputs, Digital Outputs, Analog Input, and Utility Seal Provision	**IQ230M**
IQ 230 Base Module	**IQ230TRAN**
IQ 230M Base Module	**IQ230MTRAN**
IQ 220 Complete Meter Includes Base, Display Module and 14-inch (355.6 mm) Cable with INCOM Communications and KYZ Output	**IQ220**
IQ 210 Complete Meter Includes Base, Display and 14-inch (355.6 mm) Cable	**IQ210**
IQ 220 Transducer Base Only with INCOM Communications and KYZ Output	**IQ220TRAN**
IQ 200D IQ 210/220 Display Module	**IQ200D**
3-foot (.9 m) Category 5 Cable 6-foot (1.8 m) Category 5 Cable 10-foot (3.0 m) Category 5 Cable	**IQ23CABLE** **IQ26CABLE** **IQ210CABLE**

Technical Application Data

Table 56-20. Technical Data

Compatible with the following systems:
- 3-phase, 3-wire
- 3-phase, 4-wire
- 1-phase, 2-wire
- 1-phase, 3-wire

Current Input (Each Channel)
- Current Range: 2 Times
- Nominal Full Scale Current: 5 amperes ac
- Overload Withstand: 10 amperes ac continuous; 150 amperes ac 1 second
- Input Impedance: 0.01 Ohms
- Burden: 0.025 VA

Voltage Input (Each Channel)
- Voltage Range (Nominal) 90 – 600/347 Vac
- Nominal Full Scale Voltage 120 – 600/347 Vac
- Overload Withstand 660 Vac continuous; 800 Vac 1 second
- Input Impedance 2 megaohm

CT (Primary) Settings
Select from 256 values ranging from 5 to 8000 amperes
- PT Primary 256 values with ratios up to 200 kV

Environmental Conditions

	Base	Display
Operating Temperature	-20°C to 50°C	0°C to 50°C
Storage Temperature	-30°C to 85°C	-20°C to 60°C
Operating Humidity	0.0% to 95% Noncondensing	
Maximum Relative Humidity	80% up to 31°C	

Electrical Standards
- UL and cUL® listed
- UL File Number E185559
- CSA certified (Not ANSI revenue certified as a single-phase meter)
- CE mark for applications where European compliance is required

Safety
- IEC 1010-1 (1990) Incl. Amend. 1 and 2 (1995)
- EN61010-1 (1993)
- CSA® C22.2 #1010.1 (1992)
- UL 3111

Frequency Range
50/60 Hz

EMC
- Emissions
  - FCC Part 15 Class A
  - CISPR 11 (1990)/EN55011 (1991) Group 1 Class A
- Immunity
  - Electrostatic Discharge
    - EN61000-4-2 (1995)/EN50082-2 (1995)
      - 4 kV Contact Discharge
      - 8 kV Air Discharge
  - Electrical Fast Transient
    - EN61000-4-4 (1995)/EN50082-2 (1995)
      - 2 kV Power Lines
      - 2 kV Signal Lines
  - Radiated Immunity
    - EN61000-4-3 (1997)/EN50082-2 (1995)
      - 10V/m
  - Conducted Immunity
    - EN61000-4-6 (1996)/EN50082-2 (1995)
      - 10V rms
  - Power Frequency Magnetic Field
    - EN61000-4-8 (1995)
      - 30 A/m

Metered Values and Accuracies at Full Scale

		Accuracy
ac Ampere	Phase A Phase B Phase C	+/– 0.5%
ac Voltage		
Phase A-B Phase B-C Phase C-A	Phase A Phase B Phase C	+/– 0.5%
Watts		+/– 1.0%
Vars		+/– 1.0%
VA		+/– 1.0%
Watthours		+/– 1.0%
Varhours		+/– 1.0%
VA-Hours		+/– 1.0%
Power Factor		+/– 2.0%
Frequency		+/– 0.1%

Control Power Input

	Vac	Vdc
IQ 210	110 – 240 +/-10%	125 – 250 +/-10%
IQ 220	100 – 600 +/-10%	48 – 250 +/-10%
IQ 230	100 – 600 +/-10%	48 – 250 +/-10%
Frequency Range	50 – 60 Hz +/-10%	—
Burden	180 mA	700 W

Communications
INCOM Compatible 1200/9600 Baud
- (IQ 220 only — does not require IPONI)

Modbus Compatible 9600/19200 Baud
- (IQ 230M only — does not require PONI)

Input/Output
KYZ Solid-State Relay Output
- 96 mA at 240 Vac/300 Vdc (IQ 220 and IQ 230 only)
- Digital Input 96 mA at 12 – 48 Vdc (IQ 230 only)
- Digital Output 96 mA at 125 Vac/176 Vdc (IQ 230 only)
- Analog Input 4 – 20 mA (IQ 230 only)

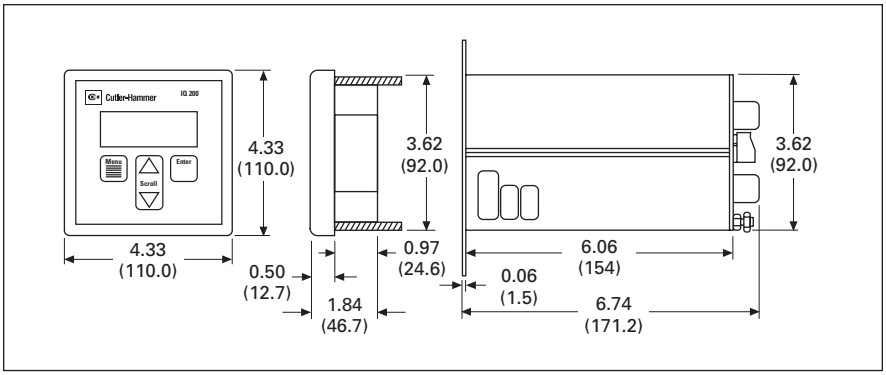
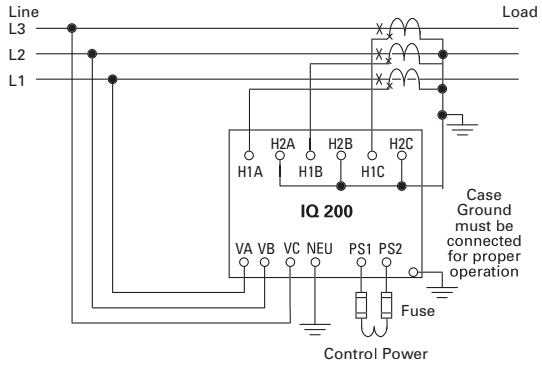


Figure 56-35. IQ 220 — Dimensions in Inches (mm)

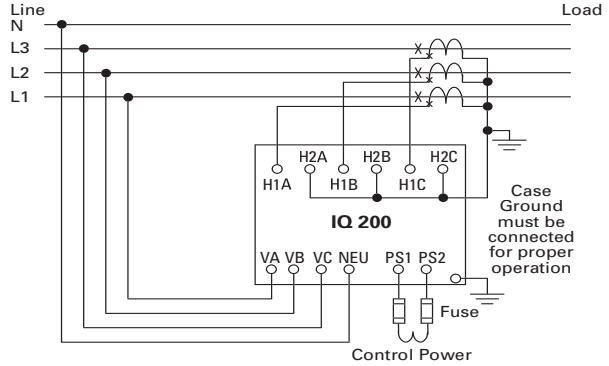
Technical Data and Specifications

3-Phase 3-Wire (up to 600 Volts)
Proper CT polarity is critical to the proper operation of the meter



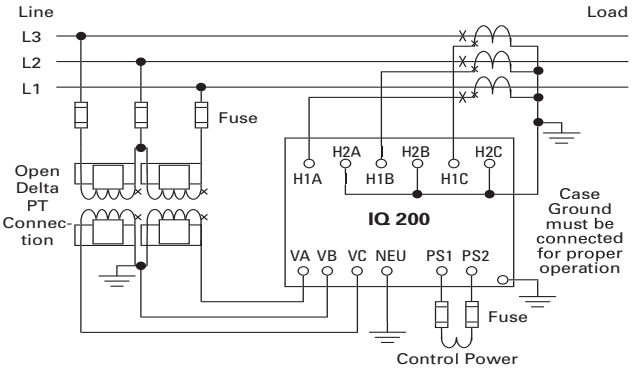
IQ 220	IQ 210
90 – 600 Vac	110 – 240 Vac
48 – 250 Vdc	125 – 250 Vdc

3-Phase 4-Wire (up to 600 Volts)
(Line Powered) Proper CT polarity is critical to the proper operation of the meter



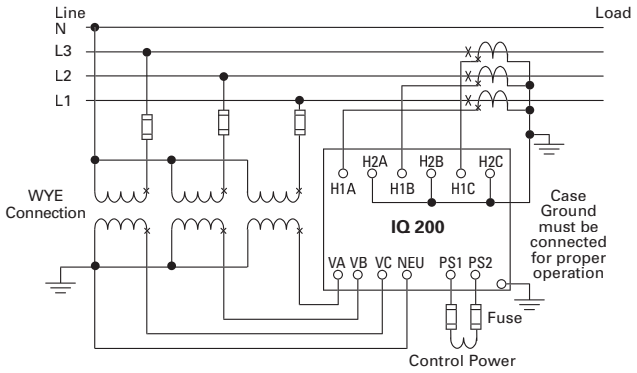
IQ 220	IQ 210
90 – 600 Vac	110 – 240 Vac
48 – 250 Vdc	125 – 250 Vdc

3-Phase 3-Wire (above 600 Volts)
Proper CT polarity is critical to the proper operation of the meter



IQ 220	IQ 210
90 – 600 Vac	110 – 240 Vac
48 – 250 Vdc	125 – 250 Vdc

3-Phase 4-Wire (above 600 Volts)
Proper CT polarity is critical to the proper operation of the meter



IQ 220	IQ 210
90 – 600 Vac	110 – 240 Vac
48 – 250 Vdc	125 – 250 Vdc

Figure 56-36. Typical Field Wiring Connections

56

Technical Data and Specifications (Continued)

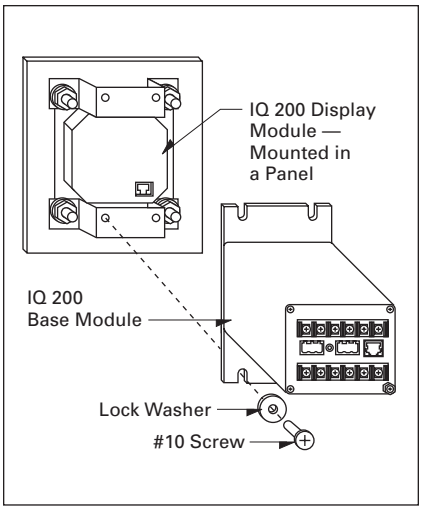


Figure 56-37. Mounting the IQ 200 Base Module to the IQ 200 Display Module

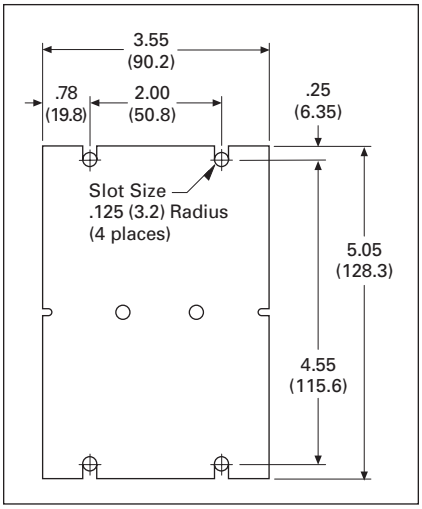


Figure 56-38. Mounting Hole Pattern for the IQ 200 Base Module — Dimensions in Inches (mm)

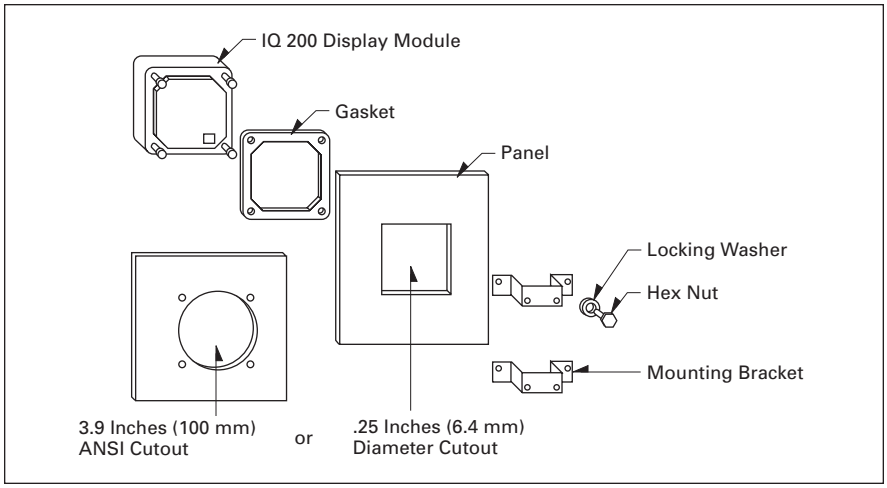


Figure 56-39. Display Mounting Options

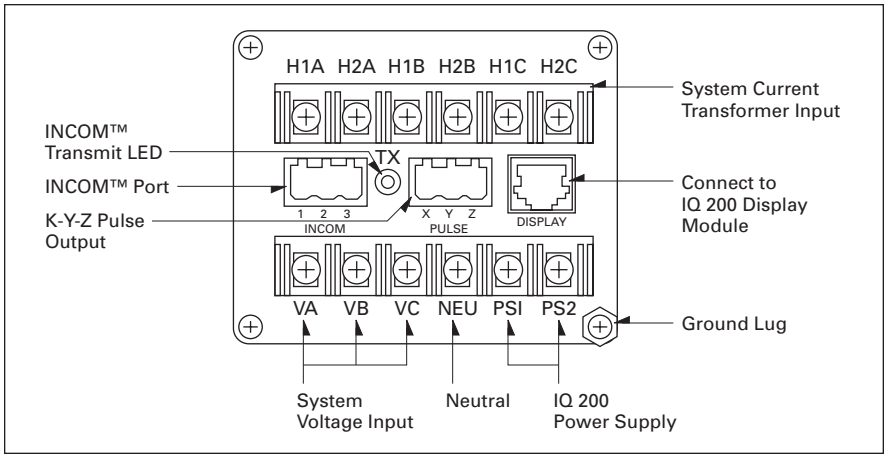


Figure 56-40. IQ 220 Base Connections

IQ 100 Meter

IQ 110

IQ 115

Product Description

Eaton's IQ 100 is designed for basic feeder applications where minimal data is required by the end user. This simple-to-use meter provides accurate measurement and displays up to 12 electrical parameters including average voltage and current for the system, plus line-to-line and line-to-neutral measurements. As an option, frequency can also be monitored. The IQ 100 has programmable voltage and current transformer ratios and true rms indication for accurate measurement of distorted waveforms, which can be viewed through four screens via a high visibility LED display. The IQ 100 is an invaluable tool for all power monitoring applications.

There are two models in the IQ 100 series of meters. The IQ 110 models provide voltage and current measurement only. The IQ 115 models provide frequency monitoring in addition to voltage and current measurement. All other characteristics are identical in all meters in the IQ 100 series.

Low Cost Meter

The IQ 100 family includes a series of simple meters that monitors voltage, current and frequency and is used in a wide variety of applications where the local display of these values is desired.

Application Description

- Local display of 3-phase voltage and current.
- Optional display of system frequency.
- Typical applications can include:
  - Motor control centers
  - Switchboards
  - Panelboards
  - Switchgear
  - Feeder panels
  - Generator sets
  - Control panels

Metered/Monitored Parameters

- True rms measurement.
- System volts.
- System current.
- For 3-phase, 4-wire systems:
  - Voltage, L-L and L-N
  - Phase currents
- For 3-phase, 3-wire systems:
  - Voltage, L-L
  - Phase currents
- Frequency monitoring available on the IQ 115 series.

Physical Characteristics

- High visibility 3-line LED display.
- Optional display of system frequency.
- ANSI style case.
- Simple menu driven interface.
- Dimensions: 4.31-inch H x 4.31-inch W x 6.70-inch D (109.5 mm H x 109.5 mm W x 170.2 mm D).
- Depth behind panel: 6.04 inches (153.4 mm).
- Display size: 4.31 x 4.31 inches (109.5 mm H x 109.5 mm).
- Panel cutout: 3.98-inch (101.1 mm) diameter, 4 stud positions.
- Faceplate rated IP54.

Auxiliary Supply

Ideally, the IQ 100 series of meters should be powered from a dedicated supply, either 100 – 250 Vac or Vdc or 12 – 48 Vdc. However, the device may be powered from the sensing voltage provided the source remains within the working range of the chosen auxiliary supply.

Specifications

Input

- Nominal input voltage: 57.7 – 346 Vac L-N, 100 – 600 Vac L-L in four ranges.
- Maximum continuous input voltage: 120% nominal.
- Maximum short duration input voltage: 2 times for 1 second, repeated 10 times at 10 second intervals.
- System PT ratios: Up to 400 kV (primary).
- Nominal input voltage burden: < 0.2 VA.
- Nominal input current: 5 A (1 A option).
- Standard CT primary values: Up to 9999:5 A.
- Optional CT primary values: Up to 9999:1 A.
- Maximum continuous input current: 120% nominal.
- Maximum short duration current input: 20 x for 1 second, repeated 5 times at 5 second intervals.
- Nominal input current burden: < 0.6 VA.

Auxiliary

- Standard nominal supply voltage 100 V – 250 Vac or Vdc:
  - (85 V – 287 Vac absolute)
  - (85 V – 312 Vdc absolute)
- ac supply frequency range: 45 – 66 Hz.
- ac supply burden: 6 VA.
- Optional auxiliary dc supply 12 V – 48 Vdc:
  - (10.2 V – 60 Vdc absolute)
- dc supply burden: 6 VA.

Measuring Ranges

- Voltage 70 to 120% of nominal:
  - (functional 4 – 120%)
- Current 5 to 120% of nominal:
  - (functional 5 – 120%)
- Frequency 45 to 66 Hz.

Accuracy

- Voltage: ±0.1% of range ±0.4% of reading.
- Current: ±0.1% of range ±0.4% of reading.
- Frequency: 0.15% of mid-frequency.
- Temperature coefficient: 0.013%/°C typical.
- Display update time: 500 ms.

Enclosure

- Enclosure style: ANSI C39.1.
- Compliant with:
  - UL 140758
  - EC 1010/BSEN 61010-1
- Material: Polycarbonate front and base, steel case.
- Terminals: Barrier terminal strip 6-32 binding head screw.
- Dielectric voltage withstand: Test 3.5 kV rms 50 Hz for 1 minute between all electrical circuits.
- Operating temperature: -20 to +70°C.
- Storage temperature: -30 to +80°C.
- Relative humidity: 0 to 95% non-condensing.
- Warm-up time: 1 minute.
- Shock: 30g in 3 planes.
- Vibration: 10 to 55 Hz, 0.15 mm amplitude.
- Enclosure Integrity: IP54 (front face only).
- Dimensions: 4.31-inch H x 4.31-inch W x 6.70-inch D (109.5 mm H x 109.5 mm W x 170.2 mm D).
- Panel Cutout: 3.98-inch (101.1 mm) diameter, 4 stud positions.

Fusing

It is recommended that 1 ampere fuses be installed on all voltage lines.

Safety/Ground Connections

For safety reasons all CT secondary connections should be grounded in accordance with local regulations.

Programming

All IQ 100 meters are easily programmed, and measured values are displayed using the two pushbuttons on the front panel. All configuration screens can be protected by an optional programmable password.

Wiring

Input connections are made to screw clamp terminals. Terminals for both current and voltage connections are sized to accept two #9 AWG (3 mm^2) solid or stranded wires, or ring lugs suitable for 6-32 screws.

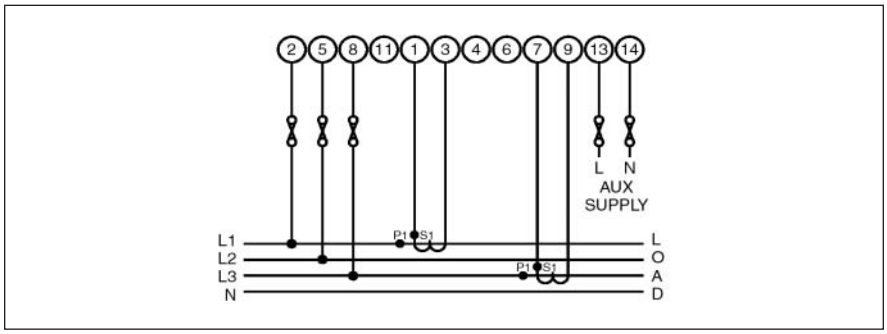


Figure 56-41. Connection Diagram — 3-Phase, 3-Wire Systems

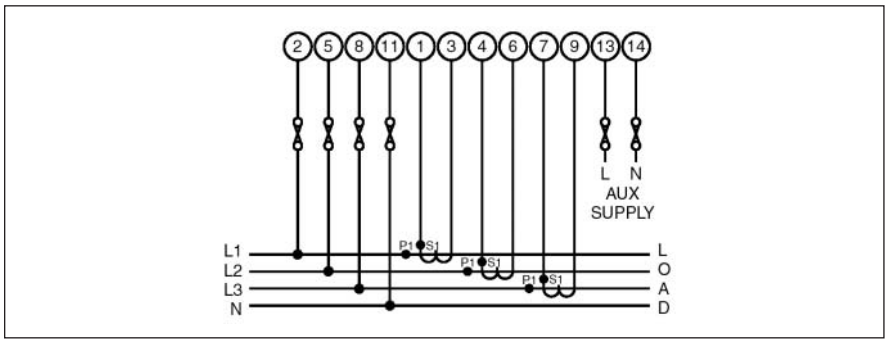


Figure 56-42. Connection Diagram — 3-Phase, 4-Wire Systems

Display Mode

The IQ 100 displays measured parameters on a 3-line, 4-digit LED display. The displayed parameters appear in the following order.

- Screen 1:
  - System volts
  - System current
  - System frequency (IQ 115 only)
- Screen 2:
  - Volts L1 – N (4-wire only)
  - Volts L2 – N (4-wire only)
  - Volts L3 – N (4-wire only)
- Screen 3:
  - Volts L1 – L2
  - Volts L2 – L3
  - Volts L3 – L1
- Screen 4:
  - Current L1
  - Current L2
  - Current L3

Catalog Information

There are four choices that must be made to determine the correct catalog number for an IQ 100 meter:

- Frequency measurement.
- System configuration and voltage level.
- Nominal current input.
- Control power.

Catalog numbers of meters without frequency measurement start with IQ 110, and catalog numbers of meters that read frequency start IQ 115. There are also separate catalog numbers for 3-wire (S3) and 4-wire (S4) systems. There are then four voltage level choices for each type of system. The next choice is the nominal current input, 5 A or 1 A. And finally, the control voltage range is selected; the standard control power supply is dual rated, 100 to 250 volts ac or dc, or the optional dc only power supply that operates on 12 to 48 volts dc.

The following table can be used as a guide to construct a proper catalog number.

How to Construct an IQ 100 Catalog Number

Table 56-21. Catalog Numbering System

IQ1 10 S33 A5 CP2

Model
10 = Volt and Current Measurement **15** = Volt, Current and Frequency Measurement

Nominal Input Current
A1 = 1 A **A5** = 5 A

Sensing Voltage
3-Phase 3-Wire
S31 = 100 – 120 V L-L **S32** = 121 – 240 V L-L **S33** = 241 – 480 V L-L **S34** = 481 – 600 V L-L
3-Phase 4-Wire
S41 = 58 – 69 V L-N **S42** = 70 – 139 V L-N **S43** = 140 – 277 V L-N **S44** = 278 – 346 V L-N

Control Power
CP1 = 12 – 48 Vdc **CP2** = 100 – 250 Vac/Vdc

An example of a valid catalog number is IQ110S33A5CP2 for a IQ 100 series meter that:

- Measures voltage and current only.
- Operates on a 3-phase, 3-wire system from 241 to 480 V L-L.
- Accepts current from a 5 ampere nominal CT.
- Has a standard 100 to 250 Vac/Vdc power supply.

Table 56-22. IQ 100 Series

Description	Catalog Number
Basic IQ 110 Series Meter for Voltage and Current Monitoring	**IQ110xxxxxxxx**
IQ 115 Series Meter with Voltage, Current and Frequency Monitoring	**IQ115xxxxxxxx**

IQ 100 Dimensions in Inches (mm)

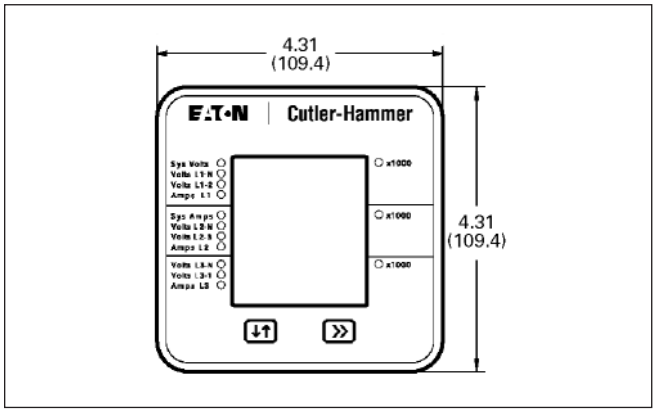


Figure 56-43. IQ 110 Faceplate

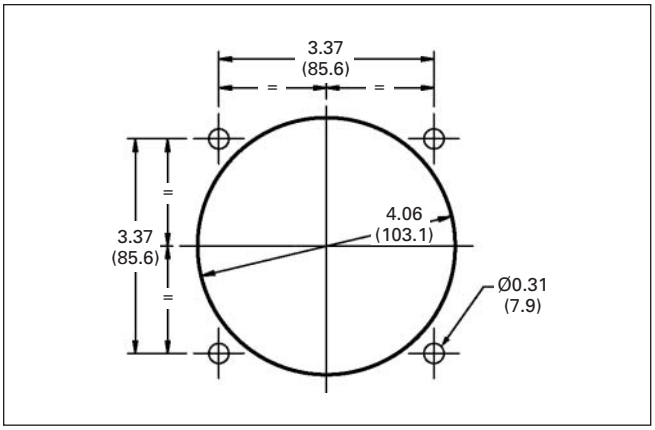


Figure 56-44. IQ 100 Cutout

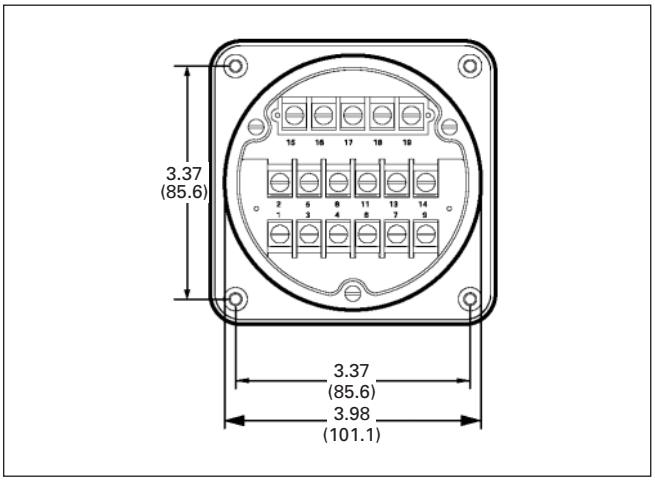


Figure 56-45. IQ 100 Rear View

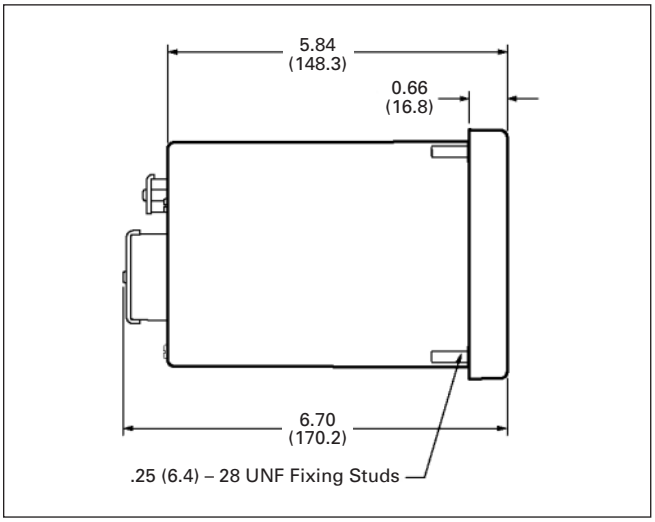


Figure 56-46. IQ 100 Side View

IQ Multipoint Energy Submeter II — Low Cost Multipoint Meter

IQ Multipoint Energy Submeter II

Eaton's IQ Multipoint Energy Submeter II is a revenue class electronic submetering device that can be mounted in panelboards or switchboards. When mounted in a panelboard or switchboard, the IQ Multipoint Energy Submeter II provides customers with an integrated power distribution and energy metering solution that saves space, reduces installation labor and lowers total cost.

Product Description

The IQ Multipoint Energy Submeter II provides a cost-effective solution for residential or commercial metering installations. Typical installations include:

- High-rise buildings.
- Government institutions.
- Universities and campuses.
- Office buildings.
- Medical facilities.
- Apartment and condominium complexes.
- Airports.
- Shopping malls.
- Industrial parks.
- Mixed-use facilities.

General Applications

The IQ Multipoint Energy Submeter II provides cost-effective and space-saving energy submetering for a wide variety of applications. The IQ Multipoint Energy Submeter II is ideally suited for energy metering of multi-tenant buildings. It can also be used to monitor energy to any load up to 600 volts for energy billing or cost allocation. Built-in communication capabilities enable an IQ Multipoint Energy Submeter II to be networked to a local PC or via modem to a remote master PC or energy service provider.

The IQ Multipoint Energy Submeter II is ideal for multi-tenant applications in which property managers are interested in measuring tenant energy usage for the purposes of monthly energy cost allocation. As such, its customers include apartment complex owners, office owners, tenant building managers, and meter reading companies. The IQ Multipoint Energy Submeter II can measure any of the following number of circuits:

- 16 single-phase, 2-wire (single-pole).
- Eight single-phase, 3-wire (2-pole).
- Five 3-phase, 4-wire (3-pole).

Any of the circuits listed can be mixed provided the total number of Current Sensors does not exceed 16. The meter provides instantaneous (kW), demand and cumulative (kWh) measurements for each load. The unit also provides interval energy data logging, time of use energy registers, coincident peak demand storage and scheduled remote meter reading data in non-volatile memory. Bus voltage is also measured.

The IQ Multipoint Energy Submeter II uses highly accurate Current Sensors to monitor each load. Current Sensors can be provided in a number of ratings and are supplied with integral cable and plug-in connector. All Current Sensors are self-protecting in the event of an open circuit condition under load. The IQ Multipoint Energy Submeter II automatically detects the rating of each Current Sensor that is connected.

The IQ Multipoint Energy Submeter II is UL listed as a Class 1 device.

Features

- Multipoint electrical energy metering.
- Built-in communication interface.
- Flexible metering configuration.
- Monitors single-phase and three-phase loads from 120 Vac to 600 Vac in three voltage ranges.
- Monitors power in watts and energy in watthours for up to 16 Current Sensors.
- Very low profile design, less than 1.5 inches (38.1 mm) in height.
- Energy values stored in non-volatile memory.
- Stores extensive energy profile data for each metering point. Can be used to identify coincidental peak demand contribution.
- Space saving stacking design allows two units to be mounted together.
- Supports Time-of-Use energy monitoring.
- Demand interval adjustable from 5 to 60 minutes.
- Measures bus voltage.
- Front panel LEDs provide status of unit and communication activity.
- Meets rigid ANSI C12.1 and IEC 61036 accuracy specifications for revenue meters.
- UL listed under UL 8N83.
- Current Sensors are UL-recognized components.
- Can be directly mounted in a UL-approved panelboard or switchboard.

Communication Capabilities

With the IQ Multipoint Energy Submeter II's built-in communication capabilities, remote meter reading and monitoring functions can be integrated into both new and retrofit applications.

- Eaton's INCOM communications.

Software Compatibility

- The IQ Multipoint Energy Submeter II is fully compatible with Eaton's PowerNet software platform including the E-Bill cost allocation software.
- The IQ Multipoint Energy Submeter II can be utilized as part of an electrical energy monitoring and billing system.
- The IQ Multipoint Energy Submeter II can be remotely monitored via Eaton's FetchIT software package.
- The IQ Multipoint Energy Submeter II is compatible with third-party software platforms and interface devices.

Configuration

- The IQ Multipoint Energy Submeter II is fully configurable using Power Xpert or free PowerPort configuration software.
- PowerPort can be downloaded free from either the Internet or the Eaton Intranet.
- Each IQ Multipoint Energy Submeter II can be configured for up to 16 metering points in any combination of single-phase and three-phase metering points.
- PowerPort is used to assign Current Sensors to metering points.
- Either PowerPort or Power Xpert can be used to configure the built-in data logs for energy profiling.
- Both Power Xpert and PowerPort can be used to set up the Time-of-Use energy registers and the Automatic Meter Reading schedule.

Wiring

- The Current Sensor cable is rated 600 volts and is recognized by UL as Class 1 wiring.
- IMPCABLE used for INCOM communication between devices is rated 600 volts and is recognized by UL as Class 1 wiring.
- Consult TD17513 Wiring Specification Base Rules for detailed information on proper installation and termination of INCOM communications network cable.

Easy to Install

- Approved by UL for mounting inside panelboards and switchboards.
- Stacking design allows two units to be mounted in a panelboard using less that 8 inches (203.2 mm) of vertical space.
- For retrofit applications, the IQ Multipoint Energy Submeter II can be mounted in an external auxiliary enclosure.
- Quick connect terminals for Current Sensors, INCOM communications and bus voltages make wiring the unit quick and easy.

Meets All Standards

- Underwriters Laboratories Inc. listed under file number E166079.
- CSA approved.
- Complies with UL 991 radiated susceptibility requirements.
- Third-party tested for ANSI C12.1 (1%) accuracy.
- Complies with FCC emission standard Part 15, Subpart B.

Specifications

IQ Multipoint Energy Submeter II — Current Sensor

Voltages

Three models are available, each covering a specific voltage range.

- Model 1 — 120/240/208 volts:
  - 120 volt single-phase
  - 120/240 volt single-phase
  - 120/208 volt three-phase Y
- Model 2 — 277/480 volts:
  - 277 volt single-phase
  - 277/480 volt three-phase Y
- Model 3 — 347/600 volts:
  - 347 volt single-phase
  - 347/600 volt three-phase Y

Current Sensors

- 0 to 50 amperes.
- 0 to 70 amperes.
- 0 to 125 amperes.
- 0 to 200 amperes.
- 0 to 400 amperes.
- 0 to 5 amperes for use with an external current transformer with 5 A secondary. (ANSI C12 Class 10.) (Catalog number: **CS005**.)

Metering Accuracy

The IQ Multipoint Energy Submeter II meets the rigid ANSI C12.1 and IEC 61036 — 1.0% metering accuracy requirements.

- <2% error at 1% of full scale.
- <1% error at 1.5% of full scale.
- <1% error at 90% to 110% of rated voltage.
- <1% error at 57 and 63 Hz.
- <2% error at 0.5 lagging PF.

Environmental

- Operating temperature: -20°C to +50°C.
- Humidity: 0% to 95%.

Power

- There are three power supply options:
  - 120 Vac, 57 to 63 Hz, 6 VA
  - 277 Vac, 57 to 63 Hz, 6 VA
  - 347 Vac, 47 to 63 Hz, 6 VA

EMC

- Compliant with FCC rules and regulations, Part 15, Subpart B, Class B equipment.
- Compliant with UL 991 radiated susceptibility requirements.

Communications

- INCOM communication network supports up to 1,000 devices up to distances of 10,000 feet (3,048 m).
- INCOM communication speed of 9600 bps.

Energy Value Storage

- 50 ampere current sensor: 214,748,364 kWh.
- 70 ampere current sensor: 300,647,710 kWh.
- 125 ampere current sensor: 536,870,912 kWh.
- 200 ampere current sensor: 858,993,459 kWh.
- 400 ampere current sensor: 1,717,986,916 kWh.
- 5 ampere external CT sensor: 8,589,934 x CT primary rating in kWh.

Product Feature Overview

The IQ Multipoint Energy Submeter II offers low-cost metering of kW and kWh for multiple tenants of residential and commercial office buildings for one- to three-phase voltage loads not exceeding 347/600 volts. The IQ Multipoint Energy Submeter II contains INCOM networking to chain together multiple meters in locations throughout the facility. See **Figure 56-47** for a typical apartment building layout.

Key Features

Reduced Equipment Space: The IQ Multipoint Energy Submeter II consumes 80% less wall space compared to glass bulb meters that must be individually or group mounted independent of the loadcenter or panelboard. By installing the meter in the loadcenter and providing Current Sensors to each load within the panelboard, less real estate is occupied, not only in the ground floor, but at individual tenant floor spaces. A typical integrated distribution and metering solution using the IQ Multipoint Energy Submeter II uses 45% less wall space than separately mounted submeters.

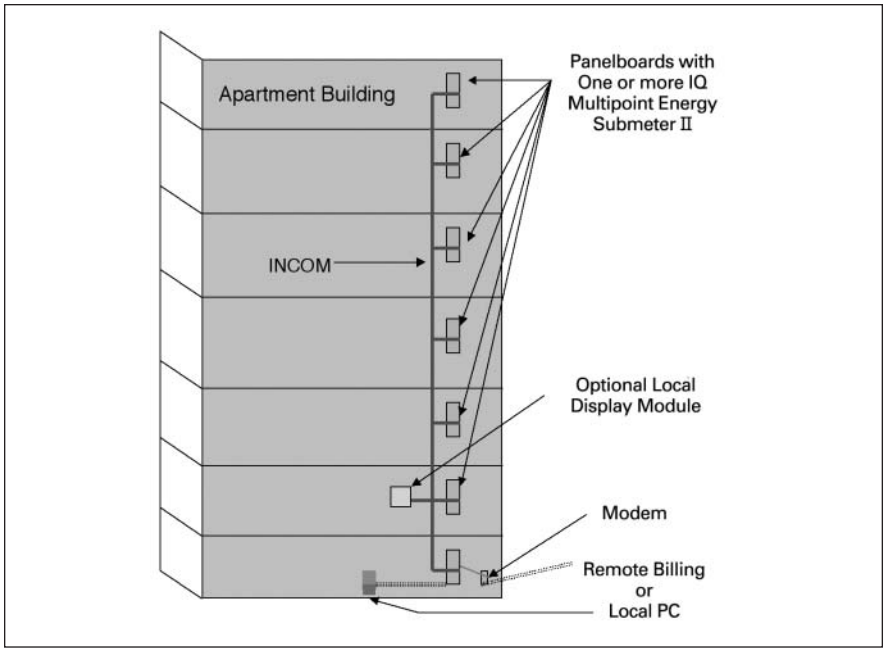


Figure 56-47. Typical Building Installation

Reduced Wiring and Cost: Because Current Sensors are provided with prewired leads and connectors for each load in the panelboard, there is 60% less field wiring to be performed on site, greatly reducing cost, time and potential for errors in the field.

High Accuracy: ANSI and IEC revenue-grade accuracy for each metering point permits the facility owner to charge each tenant confidently.

Communications Capability: INCOM communications is built into each IQ Multipoint Energy Submeter II for chaining them together on a robust, field-proven, communications architecture. INCOM can be used to communicate to the complete line of Eaton's metering products and is also useful for those projects requiring local communications to Power Xpert Power Management system.

In addition **Table 56-24** lists several Gateway products to enable communications to RS-232 Ethernet or RS-485 with Modbus protocol.

Time-of-Use Metering: The IQ Multipoint Energy Submeter II will keep track of four different utility rates for four (4) changes of rate seasons with separate weekday, weekend and holiday rates. The Time-of-Use logging supports eight (8) rate changes per day and also stores the peak demand for each rate period. All Time-of-Use information is stored in non-volatile memory.

Automatic Meter Reading: The IQ Multipoint Energy Submeter II can be configured for easy remote reading by saving just the needed energy information in a separate memory location. This location can be set up to save all of the necessary energy data for a periodic monthly read with a set day of the month and time of that day. Additionally the user can program up to six specific dates and times to save meter readings. The IQ Multipoint Energy Submeter II then stores the total energy and peak demand for each Time-of-Use rate for each meter point so that all of this information can be effortlessly downloaded to a remote system. The IQ Multipoint Energy Submeter II saves all of this data for up to 13 months in non-volatile memory.

Catalog Information

The IQ Multipoint Energy Submeter II, Current Sensors and other accessories can be ordered from Eaton distributors. Refer to the following catalog numbers when ordering.

Table 56-23. IQ Multipoint Energy Submeter II Products

Product Description	Catalog Number
IQ Multipoint Energy Submeter II 120 V with INCOM IQ Multipoint Energy Submeter II 277 V with INCOM IQ Multipoint Energy Submeter II 347 V with INCOM	**IQMESIIN1** **IQMESIIN2** **IQMESIIN3**
Current Sensors — 5 Amperes, Qty. 3 Current Sensors — 50 Amperes, Qty. 6 Current Sensors — 70 Amperes, Qty. 6 Current Sensors — 125 Amperes, Qty. 3	**CS005** **CS050** **CS070** **CS125**
Current Sensors — 200 Amperes, Qty. 3 Current Sensors — 400 Amperes, Qty. 3 Current Sensor Extensions — 4 Feet (1.2 m), Qty. 6 Current Sensor Extensions — 8 Feet (2.4 m), Qty. 3 Current Sensor Extensions — 16 Feet (4.9 m), Qty. 3	**CS200** **CS400** **CSET04** **CSET08** **CSET16**

Note: Total sensor lead length must not exceed 20 ft. (6 m).

Support products for the IQ Multipoint Energy Submeter II include the Digital Input Module (DIM), the Local Display Module, IMPCABLE and a number of communications converters, as described in **Table 56-24** below.

Table 56-24. IQ Multipoint Energy Submeter II Support Products

Product Description	Catalog Number
INCOM Communication Cable, 1,000 feet (305 m), 600 volts Insulation	**IMPCABLE**
Subnetwork Master Local Display allows local access to Energy Information (120 Vac)	**LDISP120**
Subnetwork Master Local Display allows local access to Energy Information (24 Vac/dc)	**LDISP24**
INCOM to RS-232 Communication Gateway	**MINTII**
INCOM to Ethernet (Cat5) Communication Gateway	**EMINT**
INCOM to RS-485 Communication Gateway with Modbus Protocol	**MMINT**
Digital Input Module — supports 4 Pulse Inputs or 8 Status Inputs	**DIM**

All of the gateway products in **Table 56-24** above can support the conversion of multiple IQ Multipoint Energy Submeter II meters to another communication network. The MINT II and the EMINT can support up to 1000 units while the MMINT supports up to 32 units.

The Digital Input Module (DIM) can be used to totalize pulse outputs from water meters, gas meters, steam meters or even old electrical meters with KYZ pulse outputs. The DIM can then be connected to the same INCOM network as the IQ Multipoint Energy Submeter II and this information can then be used in Power Management software packages.

Mounting Dimensions

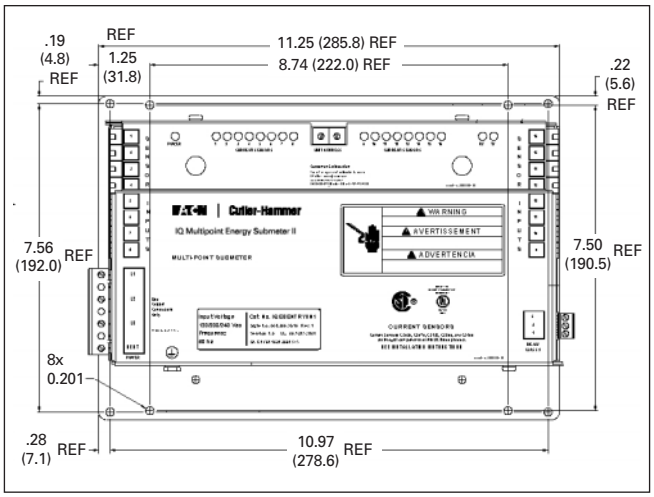


Figure 56-48. Single Unit — Front View

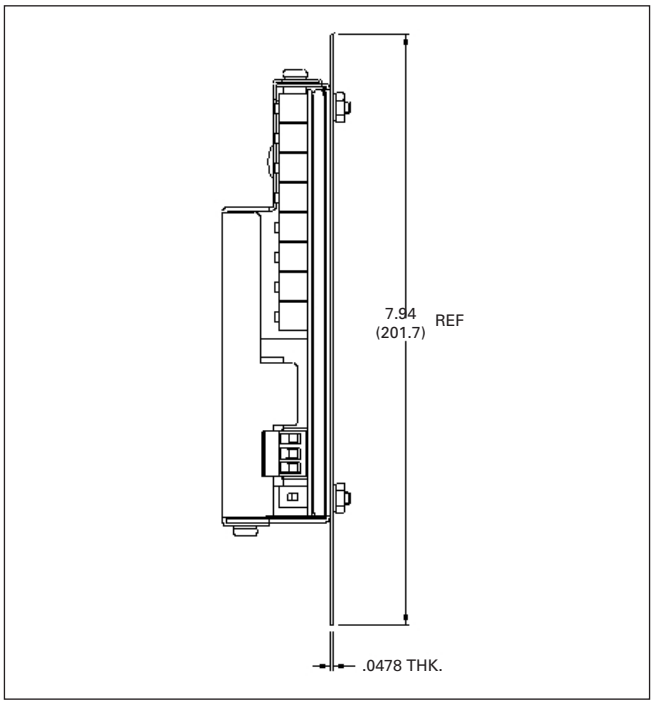


Figure 56-49. Single Unit — Side View

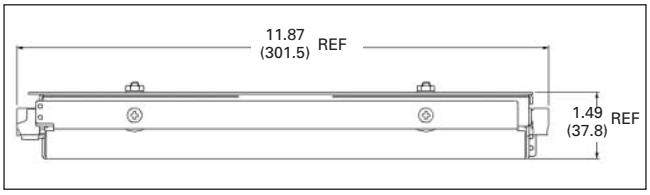


Figure 56-50. Single Unit — Top View

Mounting Dimensions (Continued)

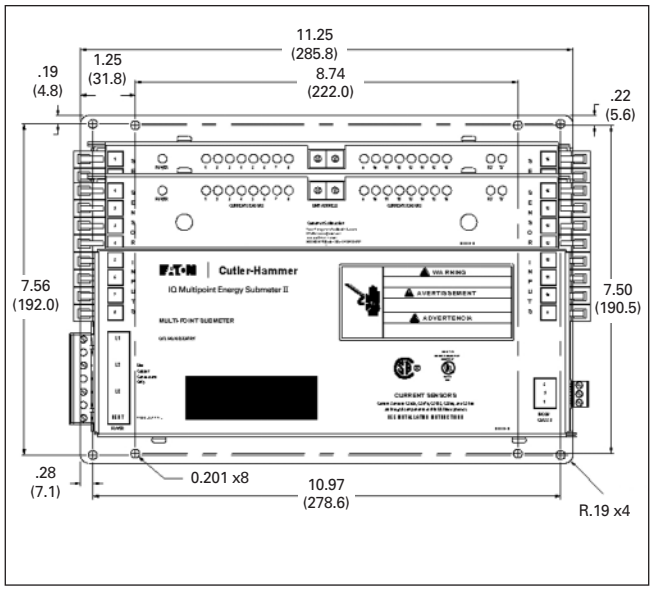


Figure 56-51. Double Unit — Front View

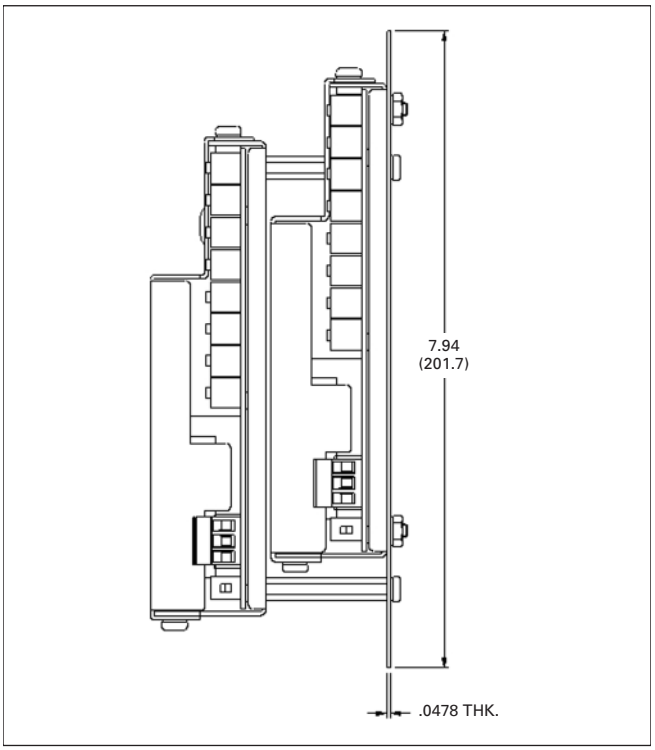


Figure 56-52. Double Unit — Side View

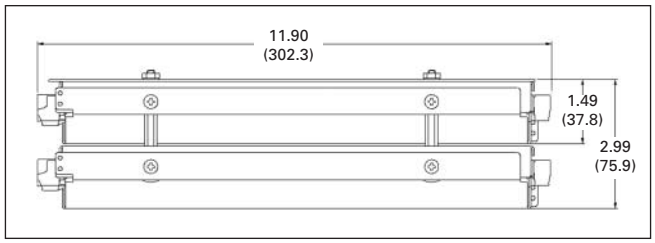


Figure 56-53. Double Unit — Top View

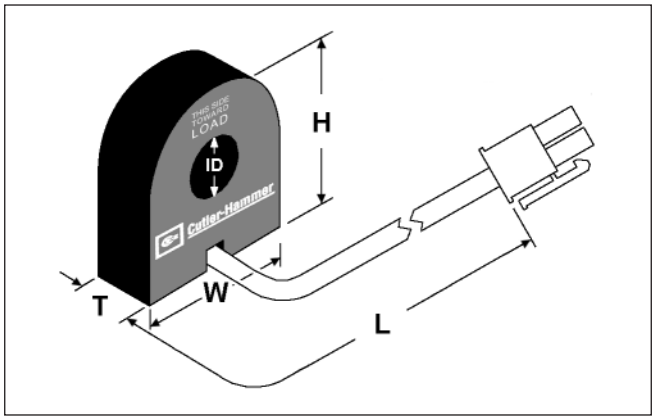


Figure 56-54. Current Sensor Dimensions

Table 56-25. Current Sensor Dimensions in Inches (mm)

Sensor	H	W	T	ID	L
CS005	2.28 (57.9)	0.60 (15.2)	N/A	N/A	2.60 (66.0)
CS050	1.55 (39.4)	1.18 (30.0)	0.50 (12.7)	0.32 (8.1)	36.00 (914.4)
CS070	2.10 (53.4)	1.73 (44.0)	0.58 (14.7)	0.55 (14.0)	36.00 (914.4)
CS125	2.10 (53.4)	1.73 (44.0)	0.58 (14.7)	0.55 (14.0)	45.00 (1143.0)
CS200	3.06 (77.7)	2.69 (68.3)	0.75 (19.1)	1.25 (31.8)	45.00 (1143.0)
CS400	4.33 (110.0)	3.42 (86.9)	1.08 (27.4)	1.50 (38.1)	72.00 (1828.8)

IQ Energy Sentinel™ and IQ Power Sentinel

IQ Sentinel

IQ Sentinels

IQ Sentinels are microprocessor-based submeters, designed to monitor power, energy, currents, voltages, power factor, frequency, apparent power and reactive power. They represent an alternative to installing separate wattmeters, watthour meters, watt demand meters, ammeters, voltmeters, and more.

IQ Sentinels are available with two different capabilities:

- The Energy Sentinel version that monitors watts, watthour and watt demand.
- The Power Sentinel version that monitors watts, watthour, watt demand, currents, voltages, power factor, frequency, apparent power and reactive power.

Key advantages include unmatched savings in space, lower installation costs, and the capability to communicate data readings in a variety of ways.

IQ Sentinels with built-in CTs and communications have the added benefit of greater overall system accuracy. Conventional metering often is less accurate since external CTs and separate transducers may each have inaccuracies of 1% or more.

Table 56-26. IQ Energy and Power Sentinel Features

IQ Energy Sentinel Features	IQ Power Sentinel Features	IQ Sentinel Benefits
■ Monitors (accuracy stated full scale) Kilowatts ±1.0% Kilowatts Demand ±1.0% Kilowatt Hour ±1.0% ■ Built-in CTs version up to 400 amperes or external CTs version up to 4000 amperes ■ Breaker, Panel or DIN-rail mounted ■ Powered directly off the line ■ Built-in communication capability Address set by DIP switches Communication at 9600 baud Noise immune INCOM™ protocol ■ Choice of operator interfaces Subnetwork Master Local Display Breaker Interface Module (BIM) Power Management Energy Billing software Power Management Software ■ UL® and CSA® listed	■ Monitors (accuracy stated full scale) ac line current (each phase) ±0.5% ac line-to-line voltage ±0.5% ac line-to-neutral voltages ±0.5% Watts (each phase and total) ±1.0% Vars (each phase and total) ±1.0% VA (each phase and total) ±1.0% Apparent Power Factor (each phase and total) ±0.5% Displacement Power Factor (each phase and total) ±0.5% Demand (total watts) ±1.0% Frequency ±0.5% Watthours ±1.0% ■ Built-in CTs version up to 400 amperes ■ Panel or DIN-rail mounted ■ Powered directly off the line ■ Built-in communication capability Address set by DIP switches Communication at 9600 baud Noise immune INCOM protocol ■ Choice of operator interfaces Subnetwork Master Local Display Breaker Interface Module Power Management Energy Billing software Power Management Software ■ UL and CSA listed ■ CE mark	■ One device replaces multiple meters and/or transducers ■ Improved system accuracy ■ Savings in product cost ■ Savings in space ■ Savings in installation cost ■ No external power source is needed ■ Permits remote monitoring and interconnection with programmable logic controllers and building management systems. For further information see section on Power Management Software Systems ■ Designed to interface directly with Power Management Software Energy Billing software ■ Flexibility — displays what is needed where it is needed ■ Power Management Software

Note: The Power Sentinel is available only in the Universal Mount version with internal CTs.

IQ Sentinels (Continued)

Eaton's IQ Sentinels provide a unique cost-effective method to implement energy submetering at lower levels in the distribution system.

The ability to monitor power distribution systems down to the machine or process level at an industrial facility has become essential to provide key benefits such as to verify the accuracy of the utility bill, identify and track energy usage to the loads that consume it, develop a facility energy profile to establish a baseline, allocate energy costs to create accountability, etc.

An optional door-mounted interface, the Subnetwork Master Local Display, is available to display the energy parameters monitored by the IQ Sentinels.

Submetering application examples for the IQ Sentinels include energy demand monitoring, product cost analysis, process machine tool efficiency and productivity improvement, and energy cost allocation or tenant billing for commercial, industrial, recreational and residential facilities.

Note: For customer billing applications, consult local utility for metering requirements.

Commercial applications include energy cost allocation within convention halls, office buildings, shopping malls, hospitals, warehouses and storage facilities.

Industrial applications include departmental billing and process/assembly line energy cost analysis. IQ Energy Sentinels may be substituted for watt transducers when monitoring machine tool and equipment performance within plants.

Recreational facilities include sports arenas, camping grounds, trailer parks, and marinas.

The IQ Sentinel may be applied on 3-phase (3- or 4-wire), as well as single-phase (3-wire) systems.

IQ Sentinels may be applied on either 50 or 60 Hz systems.

Universal Mount with Internal CTs

Application

The IQ Energy Sentinel is available in three different package versions: breaker mounted, universal breaker with internal CTs, and universal breaker with external CTs.

Designed for mounting on Eaton's Series C® Circuit Breakers utilized in Eaton assemblies such as:

- Pow-R-Line 4 Panelboards — feeder circuits.
- Pow-R-Line C™ Switchboards — feeder circuits.
- Motor Control Centers and enclosed control with circuit breaker disconnects — starter or feeder circuits.
- Enclosed Motor Control.
- Enclosed Circuit Breakers.
- Pow-R-Way III® Bus Plugs with circuit breaker disconnects.

Breaker Mount Applications New Equipment

F-Frame Breaker with IQ Sentinel

Retrofitting

The space-saving design characteristics of the breaker mount IQ Energy Sentinels allow them to be added to existing Eaton circuit breakers at any time, often with no additional space or modifications required.

Or they may be installed when upgrading from older circuit breakers, often with no additional space or modifications required.

Universal Mount Applications

The universal mount IQ Energy Sentinel with internal CTs includes integral 400 A CTs and may be applied on loads up to 400 A. The universal mount IQ Energy Sentinels with internal CTs may be utilized wherever breaker mounting is not feasible or possible.

The universal mount IQ Energy Sentinel with provisions for external CTs may be applied on loads up to 4000 A. They are usually utilized for monitoring loads larger than 400 amperes, on power cable sizes larger than 500 kcmil or on circuits containing more than one conductor per phase.

IQ Power Sentinel

Like the IQ Energy Sentinel, the IQ Power Sentinel is a highly accurate microprocessor-based submeter designed to monitor power and energy. In addition to watts, watthour, and watt-demand, the IQ power sentinel monitors current, voltage, reactive power (vars), apparent power (VA), power factor and frequency. The IQ Power Sentinel offers an accurate and economic alternative to separate meters and transducers.

The IQ Power Sentinel is only available in the universal mount with internal CTs up to 400 amperes.

Technical Data and Specifications

Table 56-27. Terminal, Cable and Wiring Guidelines

Sentinel	Eaton's Series C Terminal	Wire Size (Single Conductor)	Wire Types
F-Frame	624B100G02, G17, G18, G19	#14 – 1/0, #4 – 4/0, #4 – 4/01, #14 – 1/0	THW, THHN, XHHW
J-Frame	T250KB, TA250KB	AWG	THW, THHN, XHHW
K-Frame	T350K, TA350KB	#4 – 350 kcmil	THW, THHN, XHHW
Universal Energy Sentinel with Internal CTs	T350K, TA350KB	#250 – 500 kcmil	THW, THHN, XHHW
Universal Power Sentinel with Internal CTs	T350K, TA350KB	#250 – 500 kcmil	THW, THHN, XHHW
		#250 – 500 kcmil	
System Voltage Reference Wiring			
Energy Sentinel with Internal or External CTs		#24 – #10 AWG	
Power Sentinel with Internal CTs		#24 – #10 AWG	
Current Transformer Wiring			
Universal with External CTs		#12 AWG (maximum)	
Ground Reference Wiring			
Energy Sentinel with Internal or External CTs		#22 – #12 AWG (minimum 600 volt rated)	
Power Sentinel with Internal CTs		#22 – #12 AWG (minimum 600 volt rated)	
Communications Wiring			
Energy Sentinel with Internal or External CTs		Eaton's IMPCABLE or Belden 9463 family	
Power Sentinel with Internal CTs		Eaton's IMPCABLE or Belden 9463 family	
F-Frame		Eaton's IMPCABLE or Belden 9463 family	
J-Frame		Eaton's IMPCABLE or Belden 9463 family	
K-Frame		Eaton's IMPCABLE or Belden 9463 family	

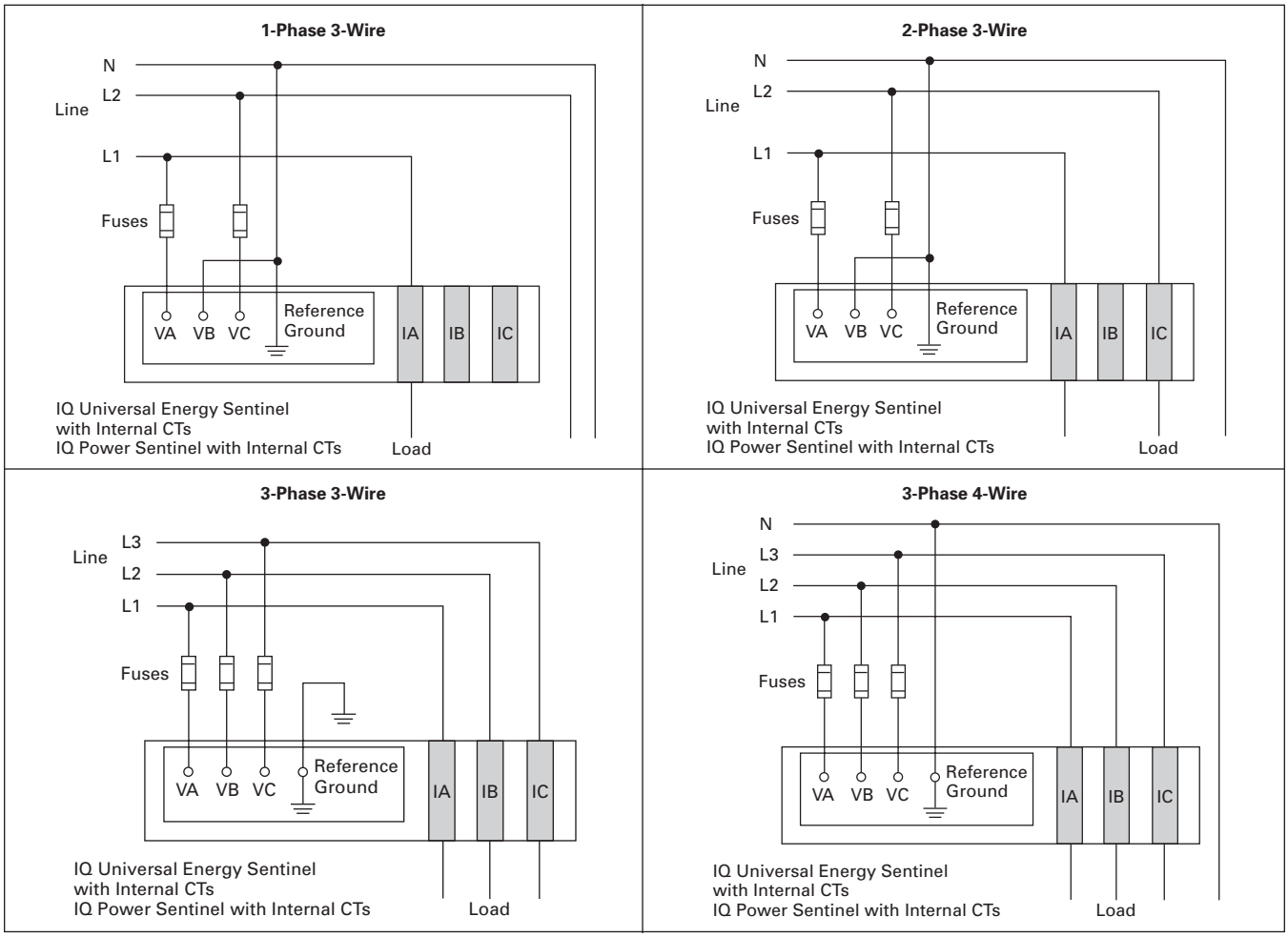
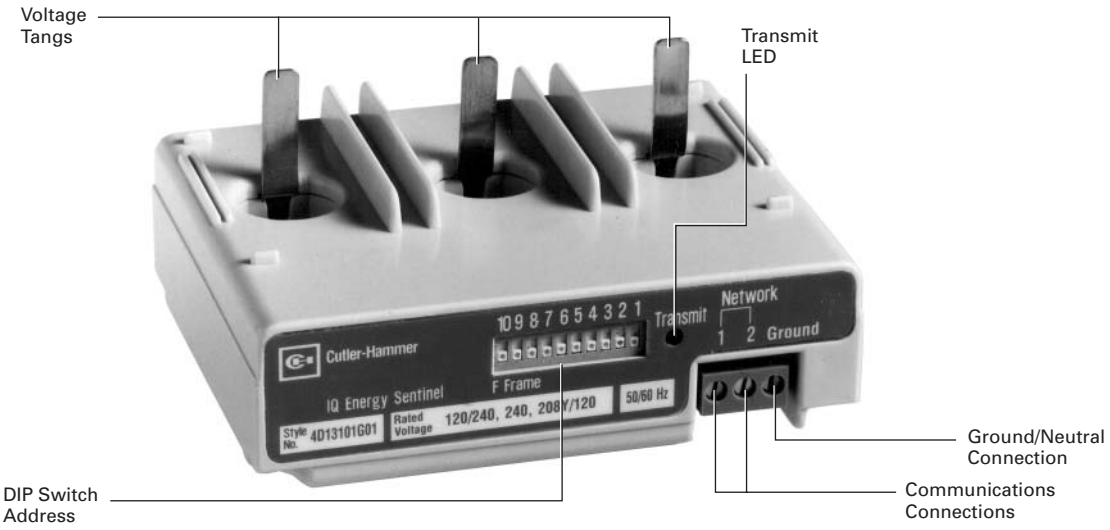


Figure 56-55. Field Wiring — IQ Universal Energy Sentinel with Internal CTs — IQ Power Sentinel with Internal CTs

Eaton's Breaker Mount

Eaton's breaker mount IQ Energy Sentinel installs in less than 10 minutes on the load side of an Eaton F-frame (150 ampere), J-frame (250 ampere), or K-frame (400 ampere) circuit breaker.

Note: The Power Sentinel is available only in the Universal Mount version with internal CTs.



Energy Sentinel Features

Universal Mount with Internal CTs — (UI)

The Universal Mount IQ Energy Sentinel with internal CTs may be panel-mounted or DIN-rail mounted on disconnects or other circuits up to 400 amperes. A pull-apart terminal block is provided on the device for connection of the system voltage reference wiring.

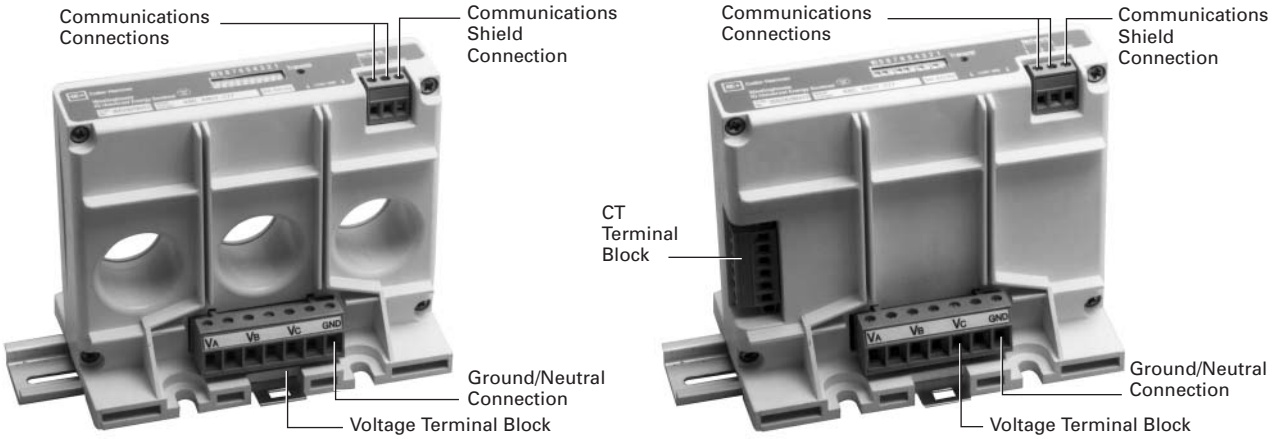
Note: Only the Universal Mount with Internal CTs is available in both IQ Power Sentinel and IQ Energy Sentinel versions. The location of the ground/neutral connection differs on Breaker Mount IQ Energy Sentinels from the location of the ground/neutral connection on Universal Mount IQ Sentinels. Incorrect wiring to the ground/neutral and communications connections may result in accuracy and communication errors.

Universal Mount for External CTs — (UE)

The Universal Mount IQ Energy Sentinel for external CTs may be panel-mounted or DIN-rail mounted on circuits up to 4000 amperes.

A pull-apart terminal block is provided on the device for connection of the system voltage reference wiring as well as another terminal block for connection to the user's existing 5-ampere secondary CTs which may range in standard ratios from 25:5 up to 4000:5.

Note: If the device will be disconnected without interruption of the monitored load, the use of a CT shorting block is advised.



Energy and Power Sentinel Features

Technical Application Data

Table 56-28. Energy Sentinel

Current Input Current Range: 1% to 125% of current rating Burden: 1 VA
Voltage Input Voltage Range: +/-20% of voltage rating
Frequency 50 or 60 Hz
Power Factor Range All (-1 to +1)
Communications Protocol: INCOM Speed: 9600 Baud Compatibility: Power Management Software Compatible
Environmental Conditions Operating Temperature: -25°C to 70°C ① (-13°F to 158°F) Storage Temperature: -40°C to 85°C ① (-40°F to 185°F) Operating Humidity: 5% to 95% relative humidity noncondensing
Dimensions D x W x H in Inches (mm) F 3.20 x 4.12 x 1.30 (81.3 x 104.6 x 33.0); CT window size ② .59 (15.0) J 4.04 x 4.12 x 1.28 (102.6 x 104.6 x 32.5); CT window size ② .77 (19.6) K 4.04 x 5.31 x 1.25 (102.6 x 134.9 x 31.8); CT window size ② .96 (24.4) UI 4.36 x 5.31 x 3.00 (110.7 x 134.9 x 76.2); hole clearance 1.17 (29.7) UE 4.36 x 5.31 x 3.00 (110.7 x 134.9 x 76.2)
Weight in Lbs. (kg): F .65 (.30) J .69 (.31) K .87 (.39) UI 1.10 (.50) UE 1.10 (.50)
Other Specifications UL File No. E64983 CSA File No. LR106359-1

① 40°C (standard) maximum for Series C circuit breakers.

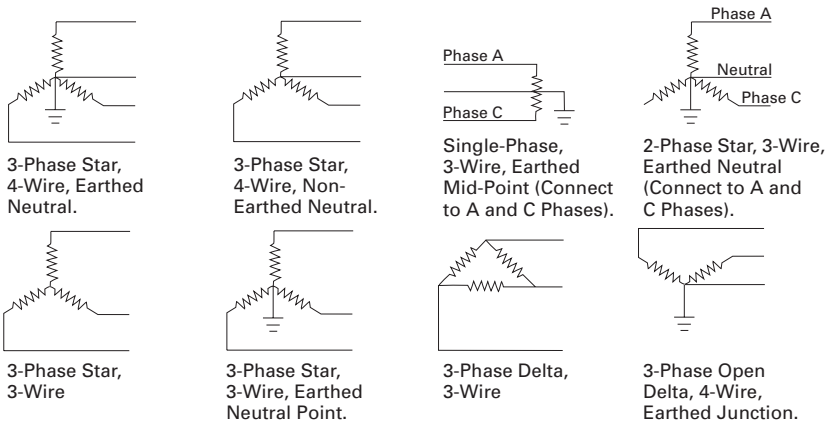
② Acceptable for Universal IQ Energy Sentinels only.

System Voltage Considerations (Application Note)

The Ground (GND) terminal of the IQ Energy Sentinel should be connected to the ground bus or other non-current carrying ground with 600 V rated wire to ensure accuracy.

Table 56-29. Power Sentinel

Nominal Full Scale Current 400 amperes	**Dimensions D x W x H (inches)** 4.36 x 5.31 x 3.00 (110.7 x 134.9 x 76.2)
Current Accuracy Range 1% – 125% of full scale	**Shipping Weight in Lbs. (kg)** 1.10 lbs. (.50 kg)
Current Overload Capability 250% of full scale	**Environment** Indoor use only
Power Factors All	**Maximum Operating Altitude** 2000 meters
Nominal Operating Line-to-Line Voltages G01 208 G03 480 G02 400 G04 600	**Operating Temperatures** -25°C to 70°C -13F° to 158°F
Maximum Operating Voltage Fluctuation G01 ±20% G03 ±10% G02 ±10% G04 ±10%	**Storage Temperatures** -40°C to 85°C -40°F to 185°F
Maximum Power Consumption G01 2 VA G03 5 VA G02 5 VA G04 6 VA	**Maximum Relative Humidity** 80% for temperatures up to 31°C decreasing linearly to 50% at 70°C
Frequency 50/60 Hz	**Transient Overvoltage Category** Overvoltage Category III
Communication Protocol: INCOM Speed: 9600 Baud Compatibility: Power Xpert Power Management Software Compatible	**Pollution Degree** 2 (IEC 664)
	UL File Number E185559



3-Phase Star, 4-Wire, Earthed Neutral.

3-Phase Star, 4-Wire, Non-Earthed Neutral.

Single-Phase, 3-Wire, Earthed Mid-Point (Connect to A and C Phases).

2-Phase Star, 3-Wire, Earthed Neutral (Connect to A and C Phases).

3-Phase Star, 3-Wire

3-Phase Star, 3-Wire, Earthed Neutral Point.

3-Phase Delta, 3-Wire

3-Phase Open Delta, 4-Wire, Earthed Junction.

Note: Acceptable for Universal IQ Energy Sentinels only.

Figure 56-56. Acceptable System Configurations

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Table 56-30. IQ Energy Sentinels Catalog Information

Description	Voltage Rating — Vac	Current Rating Maximum Amperes	Catalog Number
For F-Frame Breakers	120/240, 240, 208Y/120	150	**IQESF208**
For F-Frame Breakers	220/380, 230/400, 240/415	150	**IQESF400**
For F-Frame Breakers	480, 480Y/277	150	**IQESF480**
For F-Frame Breakers	600, 600Y/347	150	**IQESF600**
For J-Frame Breakers	120/240, 240, 208Y/120	250	**IQESJ208**
For J-Frame Breakers	220/380, 230/400, 240/415	250	**IQESJ400**
For J-Frame Breakers	480, 480Y/277	250	**IQESJ480**
For J-Frame Breakers	600, 600Y/347	250	**IQESJ600**
For K-Frame Breakers	120/240, 240, 208Y/120	400	**IQESK208**
For K-Frame Breakers	220/380, 230/400, 240/415	400	**IQESK400**
For K-Frame Breakers	480, 480Y/277	400	**IQESK480**
For K-Frame Breakers	600, 600Y/347	400	**IQESK600**
Universal with Internal CTs	120/240, 240, 208Y/120	400	**IQESUI208**
Universal with Internal CTs	220/380, 230/400, 240/415	400	**IQESUI400**
Universal with Internal CTs	480, 480Y/277	400	**IQESUI480**
Universal with Internal CTs	600, 600Y/347	400	**IQESUI600**
Universal for External CTs	120/240, 240, 208Y/120	4000	**IQESUE208**
Universal for External CTs	220/380, 230/400, 240/415	4000	**IQESUE400**
Universal for External CTs	480, 480Y/277	4000	**IQESUE480**
Universal for External CTs	600, 600Y/347	4000	**IQESUE600**

Table 56-31. IQ Power Sentinels Catalog Information

Description	Voltage Rating — Vac	Current Rating Maximum Amperes	Catalog Number
Universal with Internal CTs	120/240, 240, 208Y/120	400	**IQPSUI208**
Universal with Internal CTs	220/380, 230/400, 240/415	400	**IQPSUI400**
Universal with Internal CTs	480, 480Y/277	400	**IQPSUI480**
Universal with Internal CTs	600, 600Y/347	400	**IQPSUI600**

Table 56-32. Terminal, Cable and Wiring Guidelines

Sentinel	Eaton's Series C Terminal	Wire Size Single Conductor
F-Frame	624B100G02, G17, G18,	#14 – 1/0, #4 – 4/0, #4 – 4/01, #14 – 1/0 AWG
J-Frame	G19	#4 – 350 kcmil
K-Frame	T250KB, TA250KB T350K, TA350KB	#250 – 500 kcmil
Universal with Internal CTs		#250 – 500 kcmil
System Voltage Reference Wiring		#24 – #10 AWG
Current Transformer Wiring		#12 AWG (maximum)
Ground Reference Wiring		#22 – #12 AWG (minimum 600 V rated)
Communications Wiring		Eaton IMPCABLE or Belden 9463 family

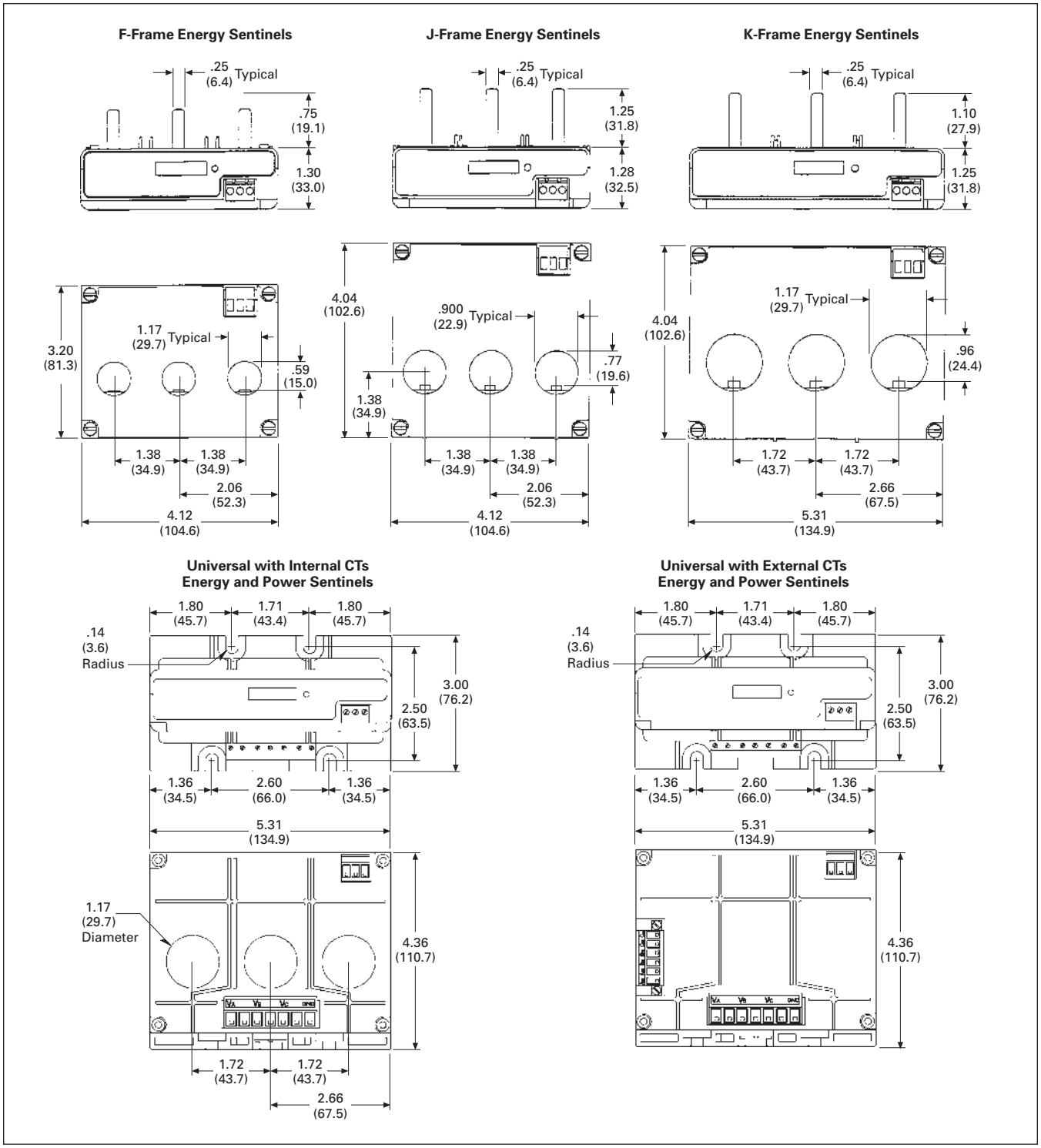

Figure 56-57. IQ Sentinel — Dimensions in Inches (mm)

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Clamp-on CTs

150 A/300 A/600 A Clamp-on CT

500 A/1000 A/1500 A Clamp-on CT
1000 A/2000 A/3000 A Clamp-on CT
(See Figure 56-89 and Figure 56-90 for actual dimensions.)

Product Description

Eaton's optional Clamp-on Current Transformers (CTs) are designed to be used in cases where there are no existing CTs or the existing CTs cannot be accessed, these clamp-on CTs can be used.

These clamp-on CTs are packaged individually. Most applications will require at least three clamp-on CTs, one for each phase.

Application Description

- There are three models that cover current ranges from 150 to 3000 amperes.
- These clamp-on CTs are designed to fit around 600 volt insulated cable and bus bar.

Features, Benefits and Functions

- Each clamp-on CT comes with a 12-foot (3.7 m) cable and twist lock connector.
- All models have a 5 ampere output at three different primary current ratings.

Standards and Certifications

- Meets IEC 1010-1 Category III.
- CE mark for applications where European compliance is required.

Current Ranges

Each of the three models of clamp-on CTs has three primary current ranges. The primary current range is selected at the clamp-on by connecting to the indicated terminals.

- 150, 300 and 600 amperes.
- 500, 1000 and 1500 amperes.
- 1000, 2000 and 3000 amperes.

Product Specifications

- Operating temperature:
  - -10˚C to 50˚C
- Operating humidity:
  - 5 to 90% maximum noncondensing
- Altitude:
  - 10,000 ft. (3048 m)
- Environment:
  - Indoor use only
- Operating voltage:
  - 600 Vac maximum
- Isolation test:
  - 5.55 kV for 1 minute
- Current over range:
  - 200% for 3 minutes
- Connector:
  - Twist-lock

Technical Data and Specifications

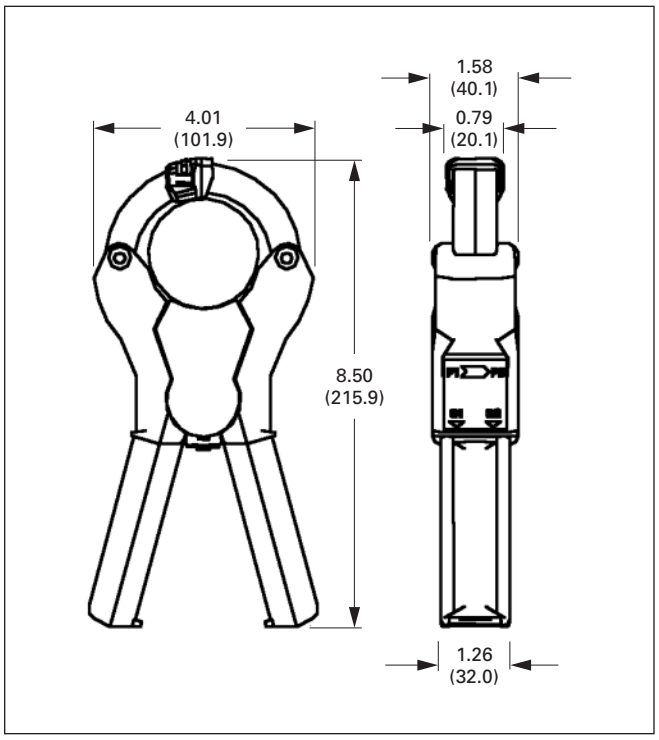

Figure 56-58. 150 A/300 A/600 A Clamp-on CT

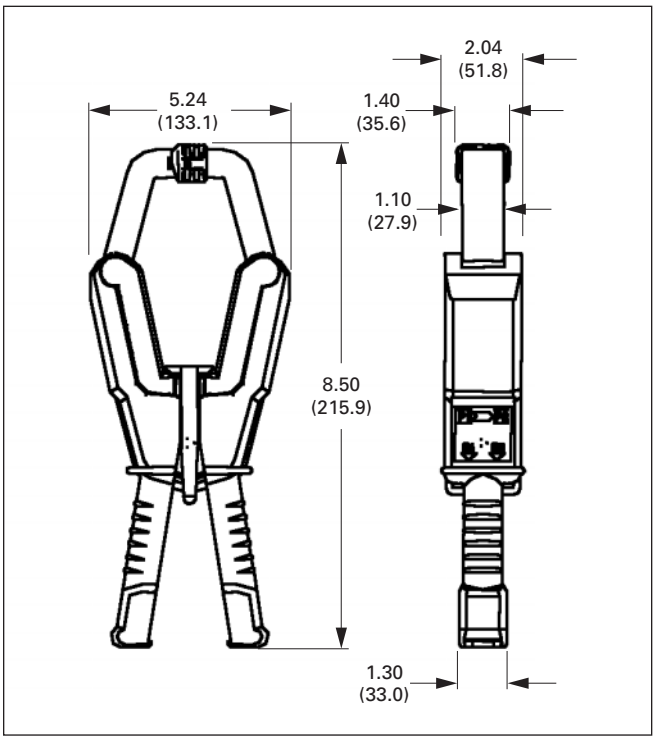

Figure 56-59. 500 A/1000 A/1500 A Clamp-on CT

150 A/300 A/600 A Clamp-on CT Specifications

- Current ratings:
  - 150 to 5 amperes
  - 300 to 5 amperes
  - 600 to 5 amperes
- Maximum cable size:
  - 2.00 inches (50.8 mm)
- Maximum bus bar size:
  - 2.00 x 0.47 inches (50.8 x 12.0 mm)
  - 1.60 x 1.40 inches (40.6 x 35.6 mm)
- Dimensions (without cable):
  - 4.00 x 8.50 x 1.60 inches (101.6 x 215.9 x 40.6 mm)
- Weight (with cable):
  - 2.0 lbs. (.9 kg)

500 A/1000 A/1500 A Clamp-on CT Specifications

- Current ratings:
  - 500 to 5 amperes
  - 1000 to 5 amperes
  - 1500 to 5 amperes
- Maximum cable size:
  - 2.68 inches (68.1 mm)
- Maximum bus bar size:
  - 4.84 x 1.40 (122.9 x 35.6 mm)
  - 4.00 x 1.70 inches (101.6 x 43.2 mm)
- Dimensions (without cable):
  - 5.20 x 13.20 x 2.00 inches (132.1 x 335.3 x 50.8 mm)
- Weight (with cable):
  - 6.0 lbs. (2.7 kg)

Technical Data and Specifications (Continued)

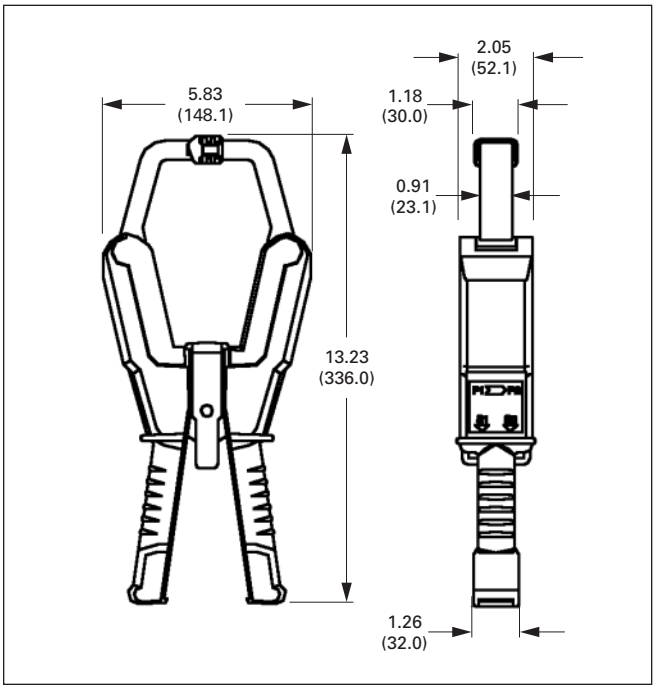

Figure 56-60. 1000 A/2000 A/3000 A Clamp-on CT

1000 A/2000 A/3000 A Clamp-on CT Specifications

- Current Ratings:
  - 1000 to 5 amperes
  - 2000 to 5 amperes
  - 3000 to 5 amperes
- Maximum cable size:
  - 3.27 Inches (83.1 mm)
- Maximum bus bar size:
  - 5.00 x 1.80 inches (127.0 x 45.7 mm)
  - 4.00 x 2.25 inches (101.6 x 57.2 mm)
- Dimensions (without cable):
  - 5.83 x 13.10 x 2.0 inches (148.1 x 332.7 x 50.8 mm)
- Weight (with cable):
  - 5.0 lbs. (2.3 kg)

Electrical Characteristics

Table 56-33. Electrical Characteristics

Current Ranges	Load (ohms)	Phase Shift (Degree)	Frequency Range (3%)	Frequency Range (-3 db)
150 – 600 A	0.10 – 1.0	0.5 – 1.0	40 – 5000	30 – 10,000
500 – 1500 A	0.01 – 4.0	0.5 – 1.0	40 – 2000	30 – 5000
1000 – 3000 A	0.01 – 4.0	0.5 – 1.0	40 – 2000	30 – 5000

Product Selection

Table 56-34. Ordering Information

Current Ranges	Catalog Number	Price U.S. $
150 – 300 – 600 A	**IQAPORT0600CT**	
500 – 1000 – 1500 A	**IQAPORT1500CT**	
1000 – 2000 – 3000 A	**IQAPORT3000CT**	

IQ Flange

IQ Flange

Application Description

Retrofit Applications

For applications where extra door mounting space is required, a flange-mounting unit is available. The IQ Flange provides an extra 2.5 inches (63.5 mm) of clearance for the device. The IQ Flange can be used with any IQ device with a 5.38-inch (136.7 mm) x 9.38-inch (238.0 mm) cutout.

Product Selection

Table 56-35. IQ Flange

Description	Catalog Number	Price U.S. $
IQ Flange	**IQFLANGE**	

Discount Symbol. **C10-S24**

Table 56-36. Protective Relay Selection Chart

Description	IEEE Device Number	Feeder Protection					Motor Protection			Voltage Protection	Differential Protection
		DT-3000	EDR-3000	FP-4000	FP-5000	FP-6000	MP-3000	MP-4000	MD-3000	VR-300	DP-300
Section Page Number		56-116	56-133	56-93	56-86	56-78	56-100	56-109	56-113	56-125	56-129
Protection Functions											
Phase Inst. OC	50	●	●	●	●	●	●	●			
Phase TOC	51	●	●	●	●	●	●	●			
Ground Inst. OC (measured)	50G	●	●	●	●	●					
Ground TOC (measured)	51G	●	●	●	●	●	●	●			
Phase Directional Control ①	67				●	●					
Ground Directional Control ②	67N				●	●					
Phase Voltage Restrained OC	51VR				●	●					
No. of Curves (ANSI/IEC/Thermal)		11		10	10	10					
Zone Interlocking		●	●	●	●	●					
Thermal Overload	49					●	●	●			
Locked Rotor	49S/51					●	●	●			
Jam/Stall	51R					●	●	●			
Loss of Load						●	●	●			
Undervoltage	27			●	●	●		●		●	
Negative Sequence Current Unbalance	46			●	●	●	●	●			
Negative Sequence Voltage	47			●	●	●		●		●	
Power Factor	55			●	●	●		●			
Overvoltage	59			●	●	●		●		●	
Frequency (Over/Under)	81			●	●	●		●		●	
Forward/Reverse Vars	32V					●					
Differential	87	● ③		● ③	● ③	● ③			● ④		● ⑤
Forward/Reverse Power	32				●	●		●			
Sync Check	25				●	●				●	
Reclosing	79					●					
Loss of Potential Block	LOP				●	●					
Cold Load Pickup					●	●					
Breaker Failure	50BF		●	●	●	●					
2nd Harmonic Restrain											●
5th Harmonic Restrain											●
Control Functions											
Remote Open/Close		●	●	●	●	●	(Trip Only)	●	●		
Programmable I/O		●	●	●	●	●	●	●	●		
Programmable Logic Control				●	●	●					
Multiple Settings Groups			4	4	4	4					
Number of Starts Limit							●	●			
Starts per Hour							●	●			
Time Between Starts							●	●			
Emergency Override							●	●			
Reduced Voltage Starting							●	●			
Trip Lock Out		●	●	●	●	●	●	●			
Metering Functions											
Amperes		●	●	●	●	●	●	●	●		● ⑥
Ampere Demand		●	●	●	●	●		●			
Volts				●	●	●		●		●	
Phase Angle (Current and Voltage)				●	●	●		●			
Positive, Negative and Zero Sequence			●	●	●	●		●			
Watts				●	●	●		●			
Watt Demand				●	●	●		●			
Watthour				●	●	●		●			
Vars				●	●	●		●			
Var Demand				●	●	●		●			
Varhour				●	●	●		●			
VA				●	●	●		●			
VA Demand				●	●	●		●			
VA-hour				●	●	●		●			
Frequency				●	●	●		●		●	
Trending (Load Profile)				●	●	●					
Minimum/Maximum Recording			●	●	●	●	Max. Only	●			

① The 50 and 51 protective functions can be controlled for reverse, forward or both directional protection.
② The 50N, 51N, 50G and 51G protective functions can be controlled for reverse, forward or both directional protection.
③ 87B using zone selective interlocking.
④ 87M or 87G (motor or generator differential).
⑤ 87M, 87T or 87G (motor, transformer or generator differential).
⑥ Differential and restrain current only.

Table 56-36. Protective Relay Selection Chart (Continued)

Description	IEEE Device Number	Feeder Protection					Motor Protection			Voltage Protection	Differential Protection
		DT-3000	EDR-3000	FP-4000	FP-5000	FP-6000	MP-3000	MP-4000	MD-3000	VR-300	DP-300
Section Page Number		56-116	56-133	56-93	56-86	56-78	56-100	56-109	56-113	56-125	56-129
Monitoring Functions											
Trip Circuit Monitor			●	●	●	●					
Breaker Wear			●	●	●	●					
Failure to Close			●	●	●	●					
Oscillography			●	●	●	●					
Sequence of Events			●	●	●	●	●	●			
Trip Target Data		●	●	●	●	●	●	●	●		
Clock			●	●	●	●	●	●			
Number of Starts						●	●	●			
Acceleration Time						●	●	●			
RTD Temperature						●	●	●			
Hottest RTD						●	●	●			
Communications											
Local Human Machines Interface		●	●	●	●	●	●	●	●		
Remote Communication Port											
RS-232			●	●	●	●					
RS-485			●	●	●	●					
Frequency Shift Key		●		●	●	●	Optional				
Addressable Protocols		●		●	●	●	●	●			
INCOM		●		●	●	●	●	●			
Modbus		●	●	●	●	●	●	●			
Construction											
Panel Mount Case		●	●	●	●	●	●	●	●	●	●
Drawout		Optional	Removable Terminals	●	Optional	Optional	Optional	Optional	Optional		
Operating Temperature Range		-30° – 55°C	-20° – 60°C	-40° – 60°C	-40° – 60°C	-40° – 60°C	-20° – 60°C	-20° – 60°C	-30° – 55°C	-20° – 70°C	20° – 70°C
Power Supply Options		120 – 240 Vac 24 – 250 Vdc	19 – 300 Vdc 40 – 250 Vac	48 – 125 Vac/dc 100 – 240 Vac/dc	48 – 125 Vac/dc 100 – 240 Vac/dc	48 – 125 Vac/dc 100 – 240 Vac/dc	120 – 240 Vac	120 – 240 Vac	120 – 240 Vac 24 – 250 Vdc	40 – 250 Vac 90 – 250 Vdc	40 – 250 Vac 90 – 250 Vdc
ac Current Inputs		●	●	●	●	●	●	●	●	●	
ac Voltage Inputs				●	●	●		●		●	
Wye PTs				●	●	●		●		●	
Delta/Open Delta PTs				●	●	●		●		●	
Binary Inputs		●	●	●	●	●	●	●	●	●	●
Alarm Outputs		2 Form C	2 Form C	2 Form C	2 Form C	2 Form C	3	●	2 Form C	1 Form C	1 NO
Trip Outputs		2	3	5	5	5	●	●	●	●	●
Analog Outputs							●	●			
Local Display		●	●	●	●	●	●	●	●	●	●
LEDs (Local Targets)		●	●	●	●	●	●	●	●	●	●
Standards											
ANSI		●	●	●	●	●	●	●	●	●	●
IEC		●	●	●	●	●	●	●	●	●	●
UL		●	●	●	●	●	●	●	●	●	●
CE		DT-3030 Only	●	●	●	●					
CSA		●	●	●	●	●	●	●	●		

Current Transformers

Current Transformers

Product Description

Eaton's low voltage current transformers are available in both solid core and split core designs. Engineered for electronic metering applications, all solid core designs and selected split core designs offer ANSI metering quality accuracy. The solid core designs also meet ANSI C57.13 relay accuracy requirements including over-ranging capabilities. The current transformer offering has a 5 ampere secondary at the rated primary current.

Split core CTs are specifically designed to be installed around primary conductors without disconnecting wires or breaking the circuit to be monitored. These current transformers are perfect solutions for energy management applications and are manufactured for installation ease.

Application Description

For new construction and retrofit applications where no current transformer exists, Eaton offers a complete selection of low voltage (up to 600V) current transformers. These current transformers can be used in commercial-grade applications, such as control panels and panelboards. Additionally, they can be used for most industrial metering and relaying applications in switchboards, switchgear, and motor control centers.

Ordering Information

Table 56-37. Solid Core ANSI Metering A

Primary Current Rating	ANSI B0.1 Metering Class at 60 Hz (Accuracy in %)	Window Size in Inches (mm) Diameter	Catalog Number	Figure Number for Dimensional Data	Mounting Bracket Catalog Number
300	0.3	1.56 (39.6)	**S050-301**	1	**S050BRAC**
400			**S050-401**		**S050BRAC**
500			**S050-501**		**S050BRAC**
600			**S050-601**		**S050BRAC**
750			**S050-751**		**S050BRAC**
800			**S050-801**		**S050BRAC**
1000			**S050-102**		**S050BRAC**
1200			**S050-122**		**S050BRAC**
50	1.2	1.25 (31.8)	**S060-500**	2	①
100	0.6		**S060-101**		①
150	0.3		**S060-151**		①
200	0.3		**S060-201**		①
400	0.3	3.25 (82.6)	**S080-401**	3	**S080BRAC**
500			**S080-501**		**S080BRAC**
600			**S080-601**		**S080BRAC**
750			**S080-751**		**S080BRAC**
800			**S080-801**		**S080BRAC**
1000			**S080-102**		**S080BRAC**
1200			**S080-122**		**S080BRAC**
500	0.3	4.25 (108.0)	**S090-501**	4	**S090BRAC**
600			**S090-601**		**S090BRAC**
750			**S090-751**		**S090BRAC**
800			**S090-801**		**S090BRAC**
1000			**S090-102**		**S090BRAC**
1200			**S090-122**		**S090BRAC**
1500			**S090-152**		**S090BRAC**
1600			**S090-162**		**S090BRAC**
2000			**S090-202**		**S090BRAC**
2500			**S090-252**		**S090BRAC**
3000			**S090-302**		**S090BRAC**
600	0.3	6.31 (160.3)	**S025-601**	5	**S025BRAC**
750			**S025-751**		**S025BRAC**
800			**S025-801**		**S025BRAC**
1000			**S025-102**		**S025BRAC**
1200			**S025-122**		**S025BRAC**
1500			**S025-152**		**S025BRAC**
1600			**S025-162**		**S025BRAC**
2000			**S025-202**		**S025BRAC**
2500			**S025-252**		**S025BRAC**
3000			**S025-302**		**S025BRAC**
3500			**S025-352**		**S025BRAC**
4000			**S025-402**		**S025BRAC**
25	0.3	Wound Primary	**W190-025**	6	**W190BRAC**
50			**W190-050**		**W190BRAC**

① Contact Eaton for further information.

Table 56-38. Split Core ANSI Metering Accuracy

Primary Current Rating	ANSI B0.1 Metering Class at 60 Hz (Accuracy in %)	Window Size in Inches (mm)	Figure Number for Dimensional Data	Catalog Number
400	2.4	2.00 x 5.50 (50.8 x 139.7)	7	**M000-401**
500	2.4			**M000-501**
600	2.4			**M000-601**
800	1.2			**M000-801**
1000	1.2			**M000-102**
1200	0.6			**M000-122**
1500	0.6			**M000-152**
1600	0.6			**M000-162**
2000	0.6			**M000-202**
600	4.8	4.10 x 7.10 (104.1 x 180.3)	8	**M050-601**
750	4.8			**M050-751**
800	2.4			**M050-801**
1000	2.4			**M050-102**
1200	1.2			**M050-122**
1500	1.2			**M050-152**
2000	0.6			**M050-202**
2500	0.6			**M050-252**
3000	0.6			**M050-302**
3500	0.6			**M050-352**
4000	0.3			**M050-402**

Table 56-39. Split Core Current Transformers

Primary Current Rating	Accuracy at 60 Hz (in %)	Window Size in Inches (mm)	Figure No. for Dimensional Data	Catalog Number
100	5.0	0.80 x 1.95 (20.3 x 49.5)	9	**M030-101**
150	5.0			**M030-151**
200	4.0			**M030-201**
300	2.0			**M030-301**
400	2.0			**M030-401**
100	5.0	1.42 x 1.53 (36.1 x 38.9)	10	**M040-101**
150	4.0			**M040-151**
200	1.5			**M040-201**
300	1.5			**M040-301**
400	1.5			**M040-401**
200	1.0	2.60 x 2.75 (66.0 x 69.9)	11	**M060-201**
300				**M060-301**
400				**M060-401**
500				**M060-501**
600				**M060-601**
750				**M060-751**
800				**M060-801**
1000				**M060-102**
1200				**M060-122**
500	1.0	2.60 x 6.25 (66.0 x 158.8)	12	**M080-501**
600				**M080-601**
800				**M080-801**
1000				**M080-102**
1200				**M080-122**
1500				**M080-152**
1600				**M080-162**
2000				**M080-202**
2500				**M080-252**
3000				**M080-302**

Dimensional Data

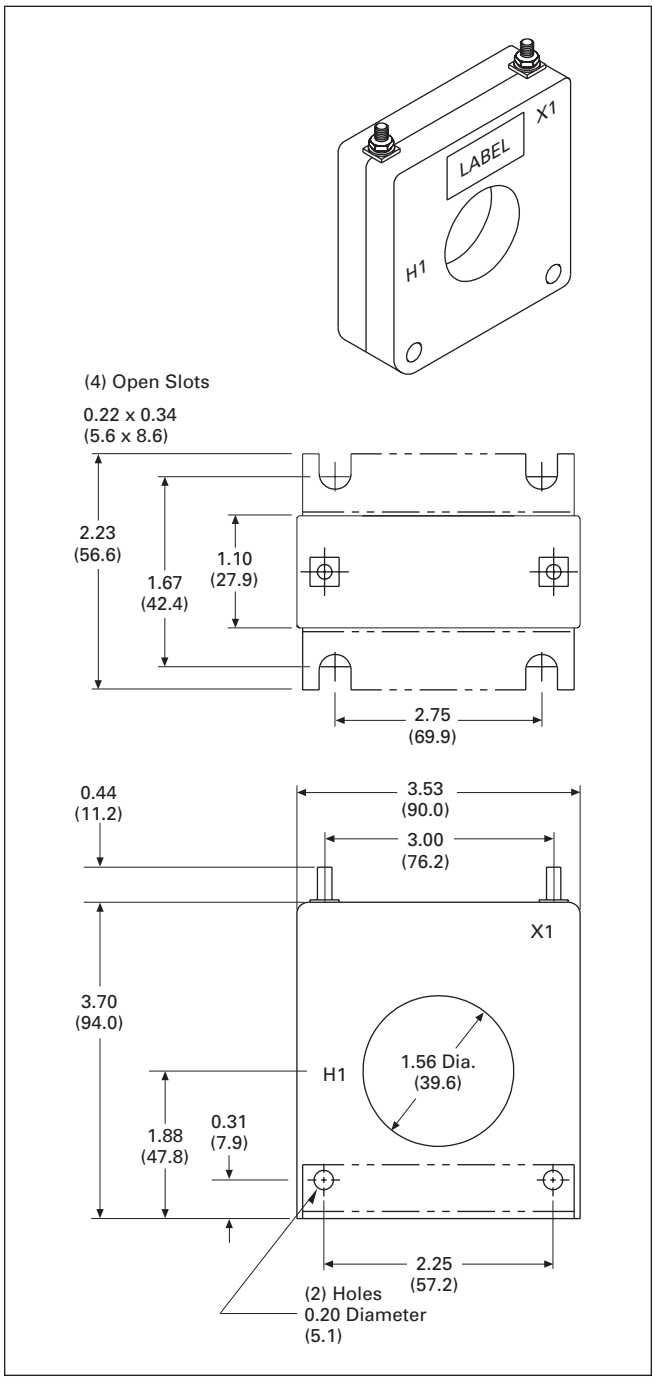

Figure 56-61. S050 Dimensional Data in Inches (mm)

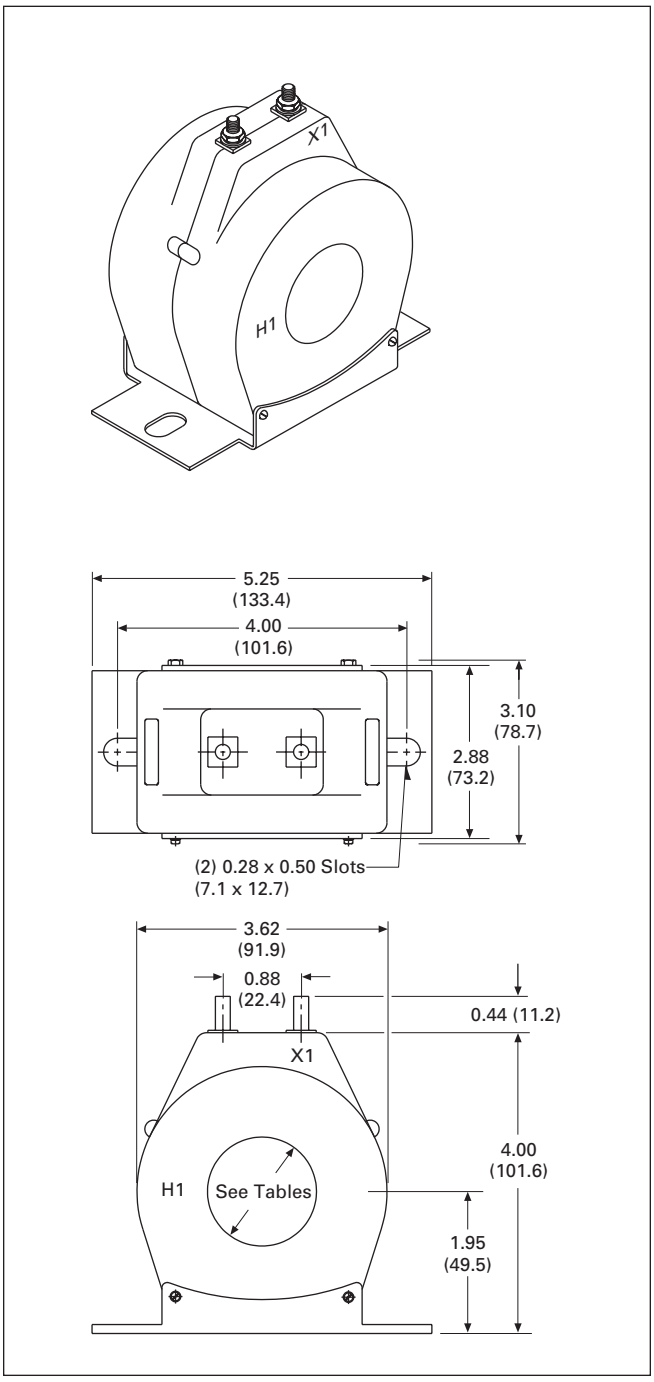

Figure 56-62. S060 Dimensional Data in Inches (mm)

56

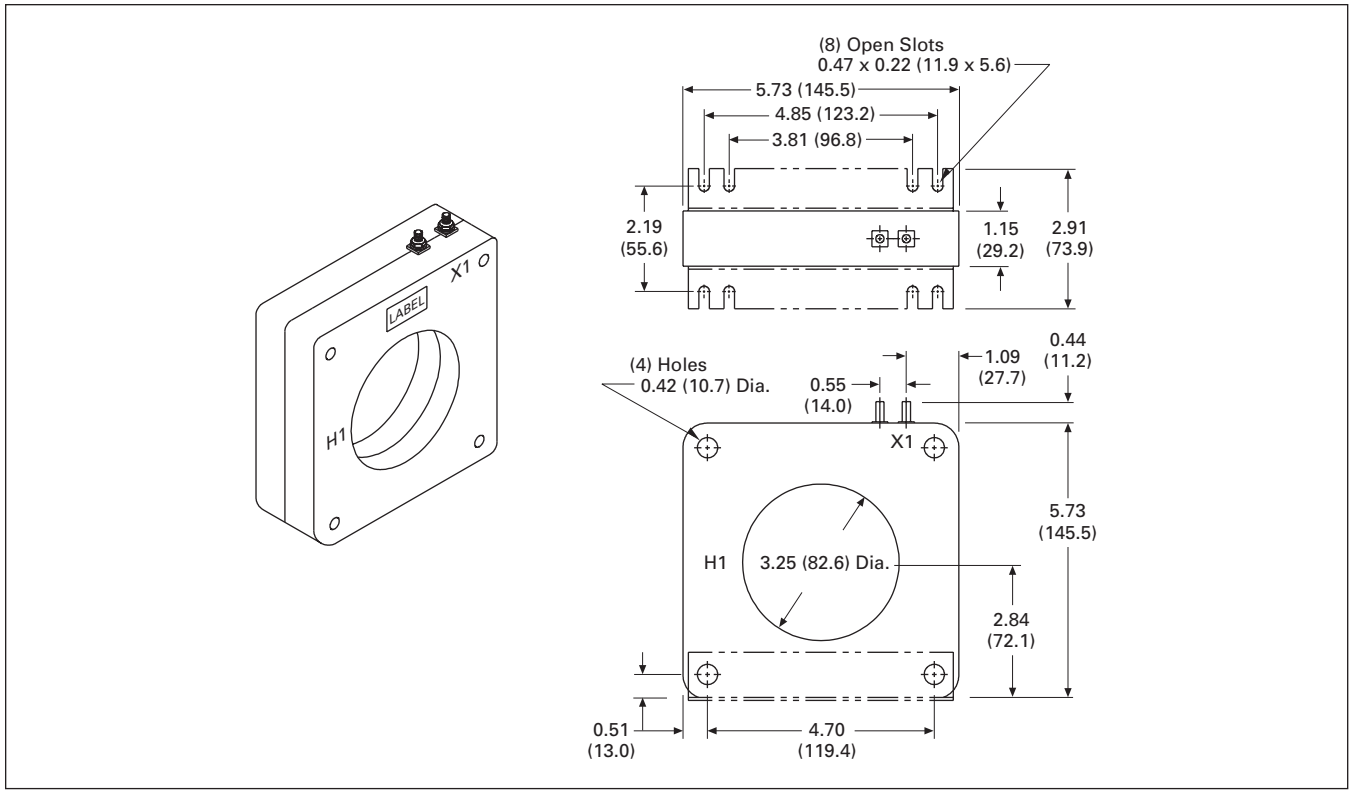

Figure 56-63. S080 Dimensional Data in Inches (mm)

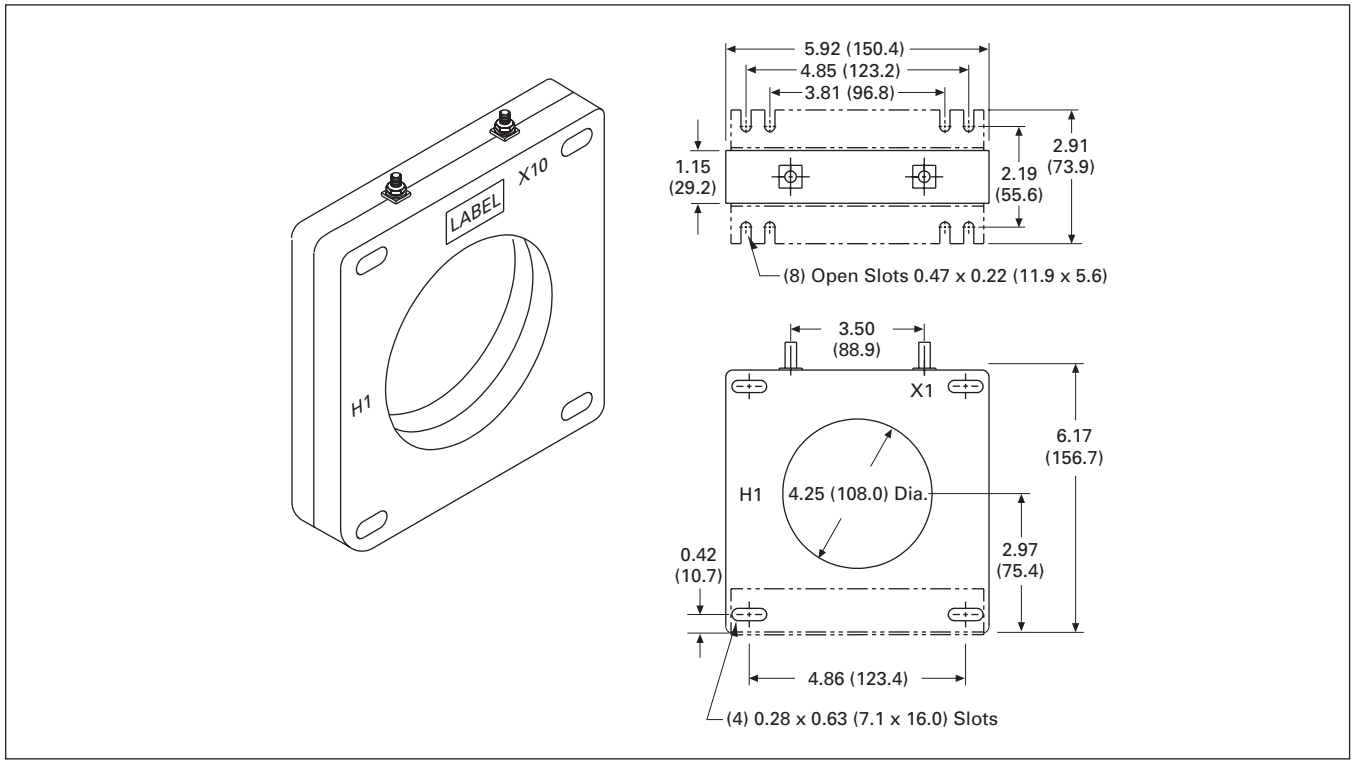

Figure 56-64. S090 Dimensional Data in Inches (mm)

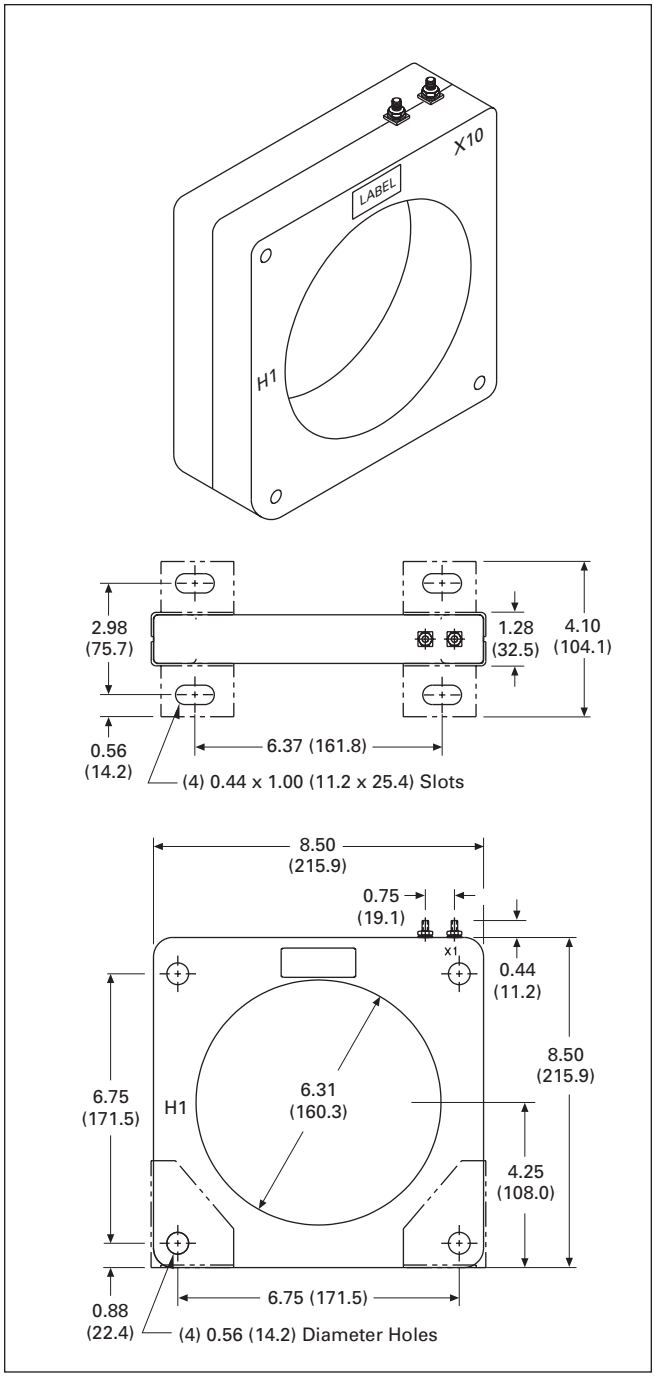

Figure 56-65. S025 Dimensional Data in Inches (mm)

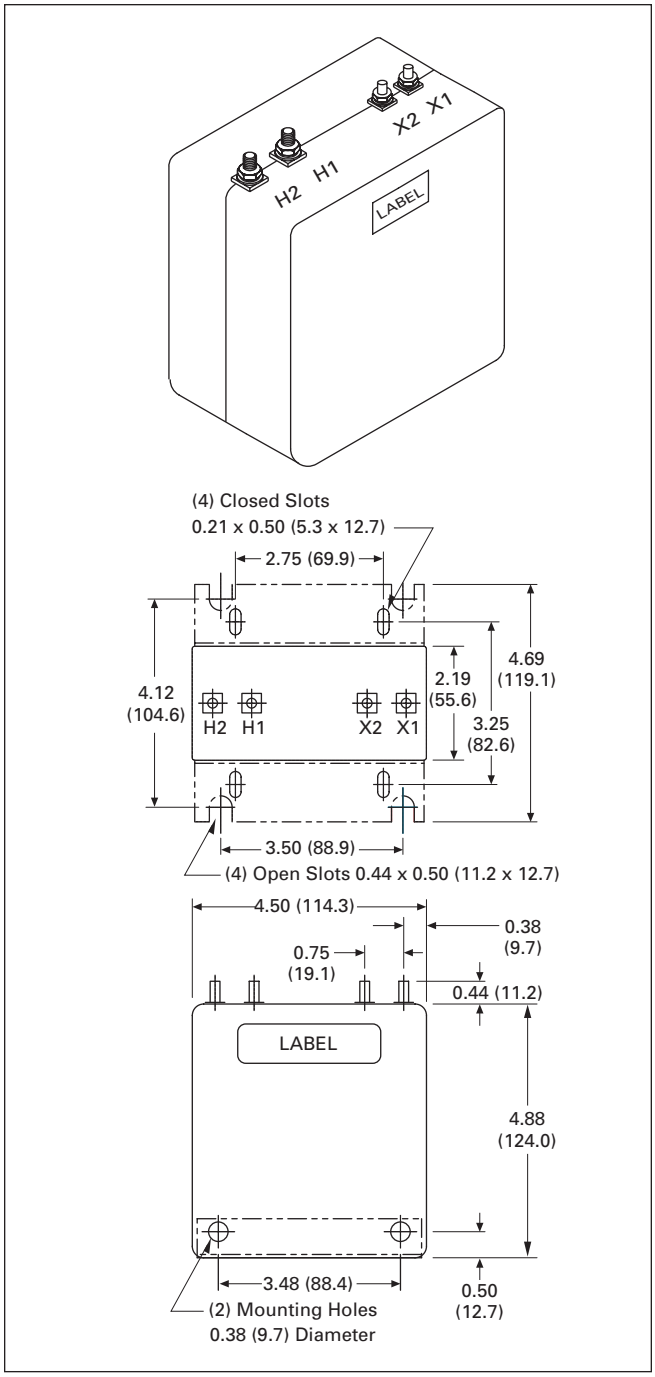

Figure 56-66. W190 Dimensional Data in Inches (mm)

56

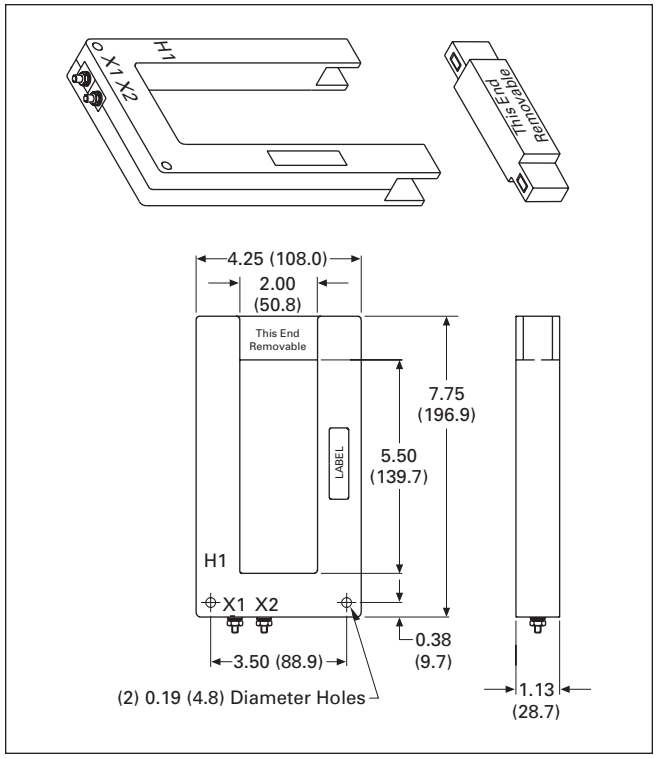

Figure 56-67. M000 Dimensional Data in Inches (mm)

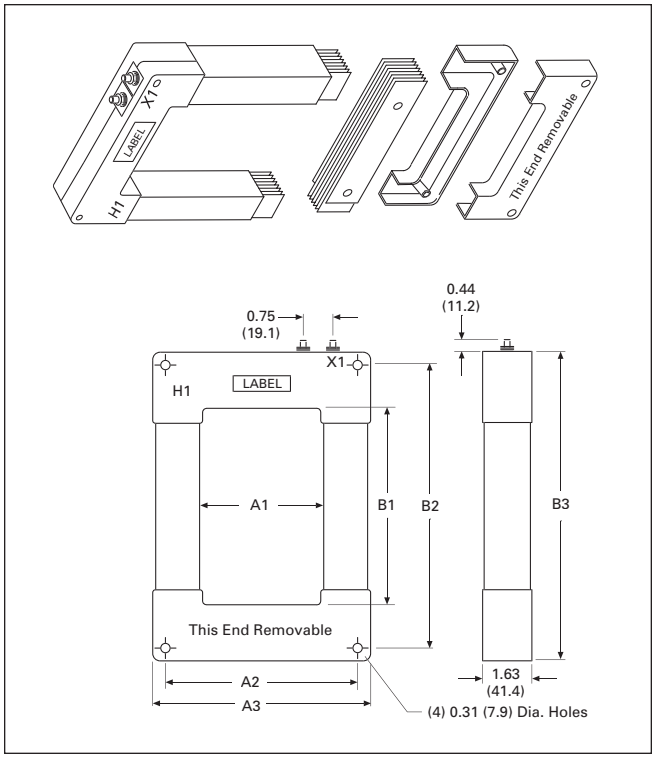

Figure 56-68. M050 Dimensional Data in Inches (mm)

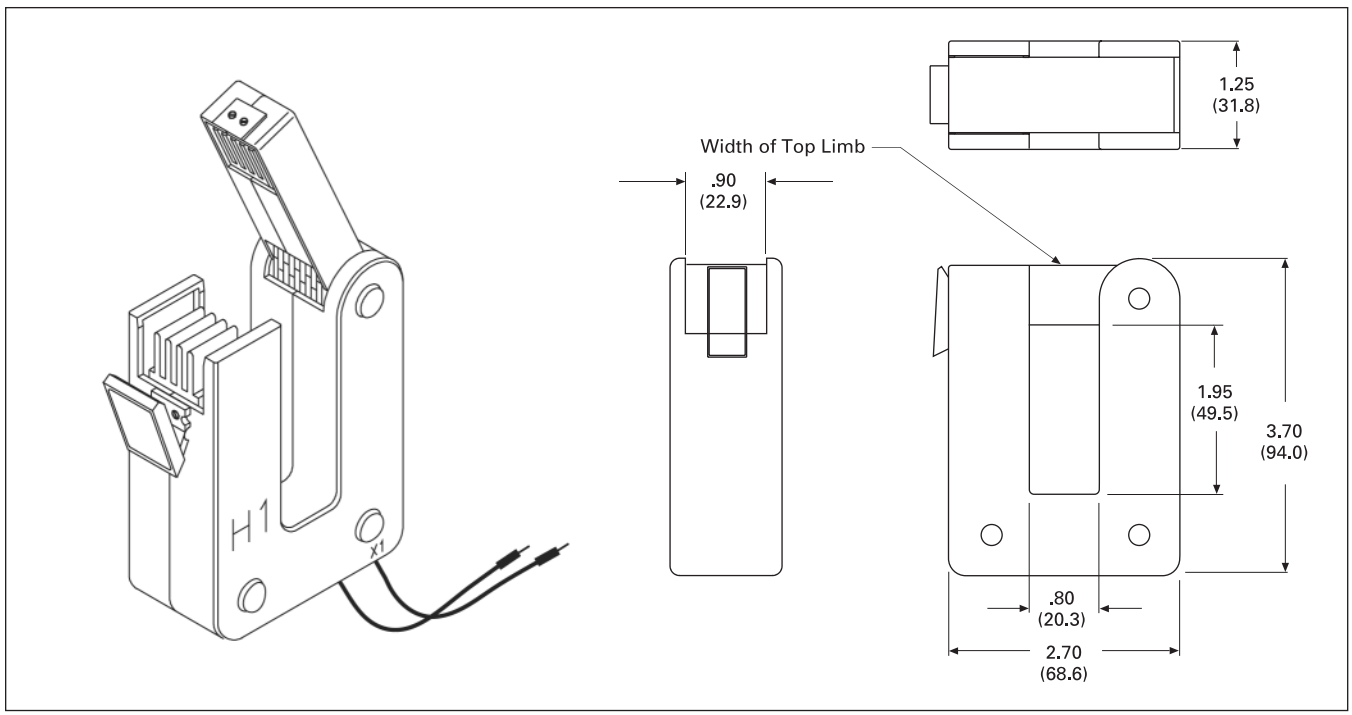

Figure 56-69. M030 Dimensional Data in Inches (mm)

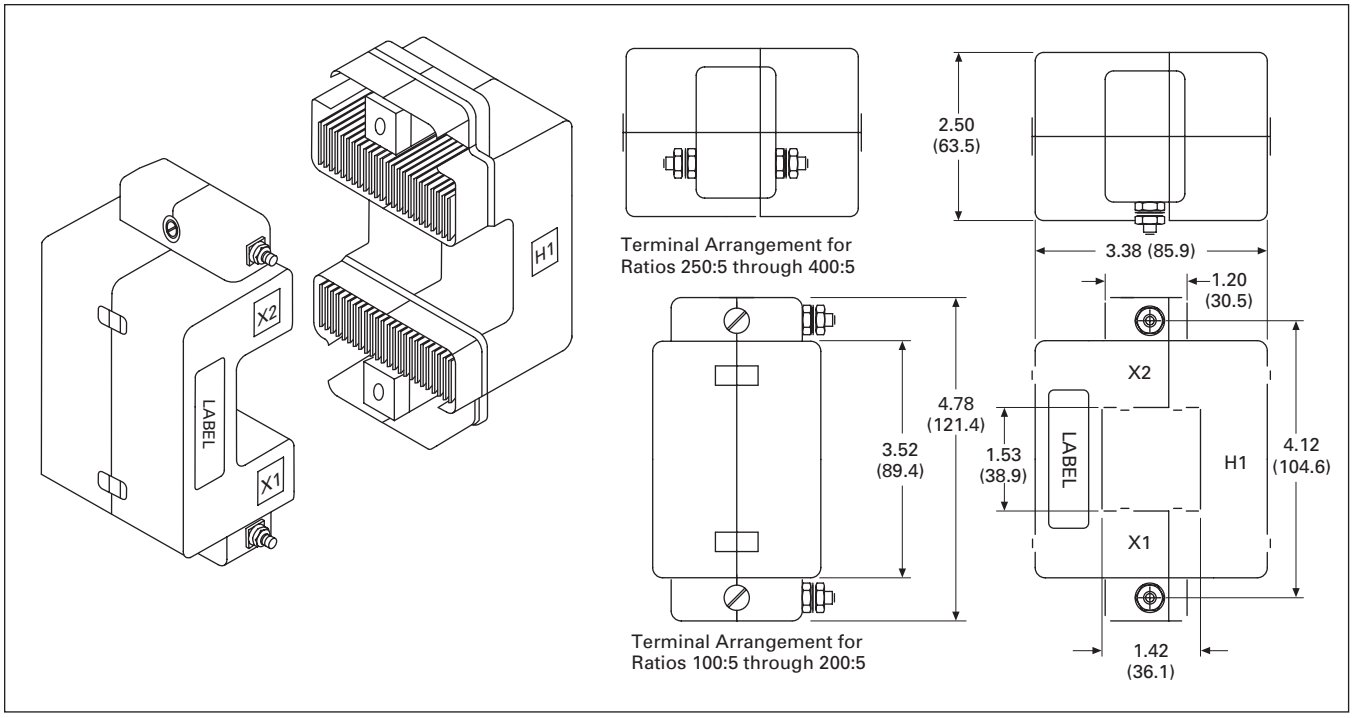

Figure 56-70. M040 Dimensional Data in Inches (mm)

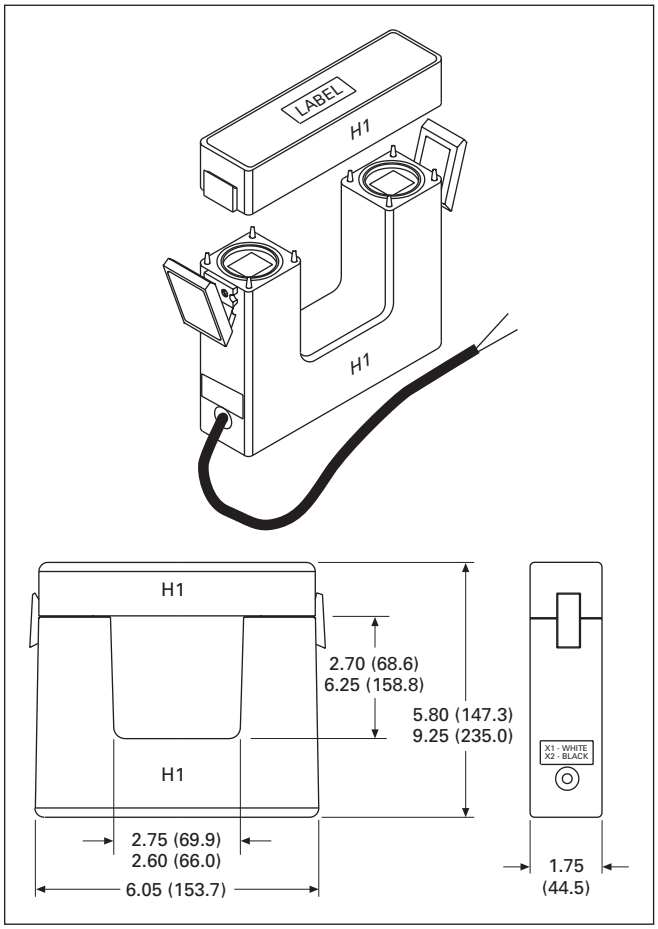

Figure 56-71. M060 Dimensional Data in Inches (mm)

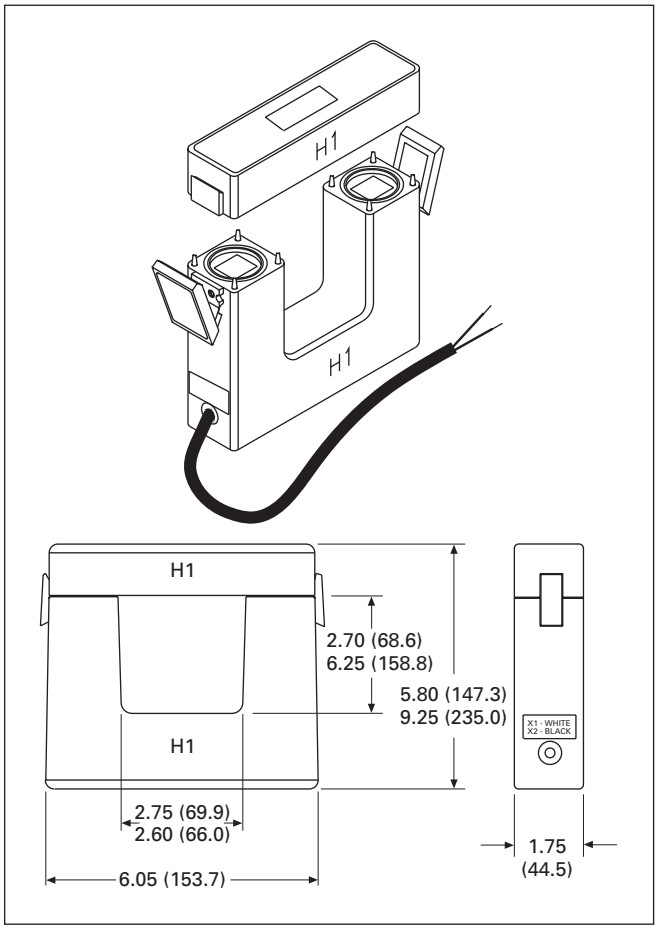

Figure 56-72. M080 Dimensional Data in Inches (mm)

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FP-6000 Feeder Protection

Feeder Protection FP-6000

Product Description

- Microprocessor-based protection with monitoring and control for medium voltage main and feeder applications.
- Current, voltage, frequency and power protection for electric power distribution systems.
- Complete metering of voltage, currents, power, energy, minimum/maximum and demand functions.
- Programmable logic control functions for main-tie-main and main-main transfer schemes.
- Trip logs, event logs and waveform capture for better fault analysis and system restoration.
- Data Logger to provide energy usage profiles for better planning, utilization and energy usage.
- Compact, drawout case design or fixed case design.
- Meets ANSI and UL.

Application Description

Eaton's FP-6000 Protection Relay provides complete 3-phase and ground overcurrent, voltage, frequency and power protection plus metering in a single, compact drawout case. It may be used as a reclosing relay; primary protection on feeders; mains and tie circuit breaker applications; or as backup protection for transformers, high voltage lines and differential protection.

The FP-6000 takes full advantage of its microprocessor technology, providing the user new freedom and a wealth of data-gathering features. The relay performs self-checking of all major hardware and firmware protection elements to ensure their operation in the event of a system or component electrical failure or fault. Protection functions are well suited for main and distribution feeder circuit applications. Programmable logic control functions make the FP-6000 relay ideally suited for main-tie-main and main 1/main 2 transfer schemes.

The FP-6000 is the only relay in its class that offers a flexible, yet simple reclosing control. Its compact design makes it ideal for polemounted recloser controls. The zone interlocking feature can be utilized for bus protection instead of an expensive and complicated bus differential (87B) scheme. The FP-6000 works directly with the FP-5000, FP-4000, Digitrip® 3000 and Digitrip MV relays. The breaker failure protection provides faster remote backup clearing times for stuck breaker operation. In addition to the breaker failure protection, the FP-6000 can be programmed to detect residual current when the breaker is open to detect flashover conditions. The FP-6000 provides trip circuit monitoring and alarming features. It continually monitors the trip circuit for continuity and readiness to trip. Open and close pushbuttons are conveniently located on the front of the relay for local breaker operation.

When an electrical fault or disturbance occurs, the FP-6000 begins to store the following in non-volatile memory:

- Voltage and current sampled data.
- Calculated values.
- Status of internal protection functions, logic, contact inputs and outputs

Retrieval and viewing of the data is easy, aiding in the quick analysis and restoration of your electric power system.

When the FP-6000 isn't responding to disturbances in the power system, it's providing valuable metering information at the relay and remotely. It provides energy usage and demand reading, and can alarm when usage reaches a set value. Power factor measurements can be used for cap bank switching to control kvar demand. Onboard data trending can provide load profiles for up to 40 days.

The protection functions are listed below and shown in **Figure 56-73**.

The FP-6000 provides phase overcurrent (Forward, Reverse or Both):

- Two-stage instantaneous with timers (50P-1 and 50P-2).
- Inverse time overcurrent (51P).
- Directional control (67P).
- 10 standard curves.
- Instantaneous or time delay reset.
- Voltage restrained inverse time overcurrent (51P2).

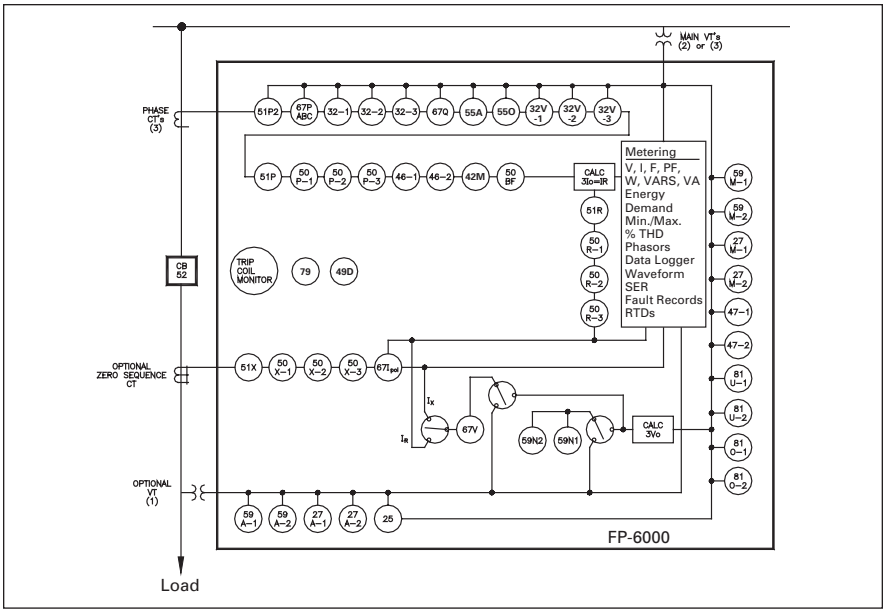


Figure 56-73. FP-6000 One-Line Drawing

The FP-6000 provides two ground overcurrent elements, one measured (IX) and one calculated (IR):

- Independent measured ground or neutral directional overcurrent elements:
  - Two-stage instantaneous with timers (50X-1 and 50X-2)
  - Inverse time overcurrent (51X)
  - Ground directional polarizing (67N) -3vo and negative sequence
  - 10 standard curves
  - Instantaneous or time delay reset
- Independent calculated ground or neutral directional overcurrent elements:
  - Two-stage instantaneous with timers (50R-1 and 50R-2)
  - Inverse time overcurrent (51R)
  - Ground directional polarizing (67N) -3vo, I pol, and negative sequence
  - 10 standard curves
  - Instantaneous or time delay reset

The FP-6000 also provides the following protective features:

- Breaker failure (50BF).
- Phase unbalance negative sequence overcurrent (46-1, 46-2).
- Phase voltage unbalance and sequence protection (47-1, 47-2).
- Main 3-phase under/overvoltage (27M-1, 27M-2, 59M-1, 59M-2).
- Under/overfrequency (81U-1, 81U-2, 81O-1, 81O-2).
- Auxiliary single-phase under/over-voltage (27A-1, 27A-2, 59A-1, 59A-2).
- Neutral voltage (59N-1, 59N-2).
- Apparent and displacement power factor (55A, 55D).
- Forward/reverse power protection (32-1, 32-2, 32-3).
- Forward/reverse VAR protection (32V-1, 32V-2, 32V-3).
- Thermal Protection (49DT, 49MT, 49DA, 49MA).
- Sync check (25).
- Zone interlocking for bus protection (87B). The FP-6000 feeder relay includes a zone selective interlocking feature that can be used with other Eaton devices like the Digitrip 3000 overcurrent relay.

The FP-6000 provides the following metering functions:

- Amperes (rms, phasor and sequence).
- Amperes demand and peak demand.
- Volts (rms, phasor and sequence).
- VA and VA demand.
- Watts and kW demand and peak demand.
- Forward/reverse/net kWh.
- Vars and kvar demand and peak demand.
- Lead/lag/net kvarh.
- Power factor.
- Frequency.
- Voltage and current %THD and magnitude THD.
- RTD.
- Minimum/maximum recording with date/time stamp.
- Trending (load profile over time).

The FP-6000 provides the following monitoring and data recording functions that enhance the security of the protection system and provides useful information for scheduling maintenance:

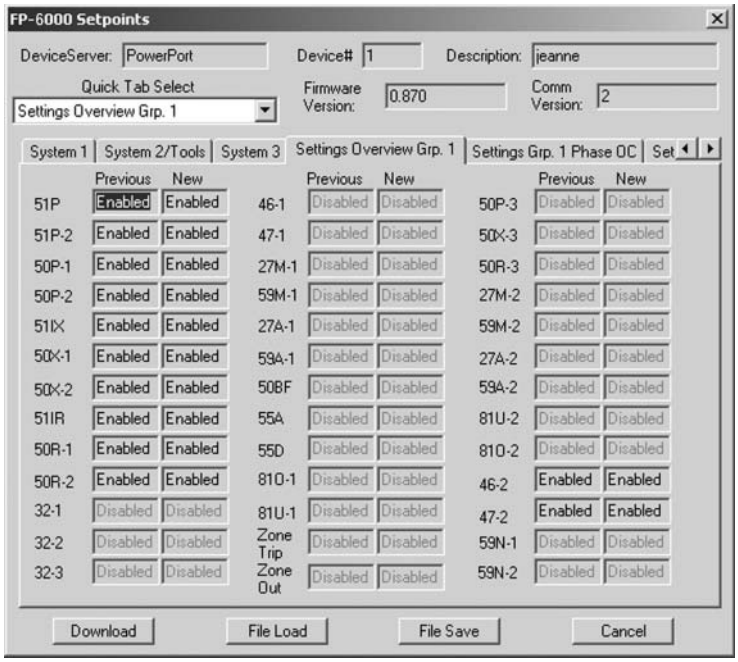
- Trip circuit monitoring.
- Breaker wear (accumulated interrupted current).
- Waveform capture (256 cycles total, up to 16 events).
- Fault data logs (up to 16 events).
- Sequence of events report (up to 100 events).
- Clock (1ms stamping).

The FP-6000 provides standard control functions plus userconfigurable custom control capabilities. This logic can be used for applications such as main-tie-main transfer schemes.

- Remote open/close.
- Optional local open/close.
- Programmable I/O.
- Programmable logic gates and timers.
- Multiple setting groups (up to 4).
- Bus transfer logic.
- Cold load pickup.
- Loss of potential (PT blown fuses).
- Autoreclose Function (79).
- Auto Zone Coordination.

The FP-6000 supports the following communication options:

- Local HMI.
- Password protected.
- Addressable.
- Front RS-232 port.
- Rear RS-485 port.
- Rear FSK port.
- Protocols:
  - INCOM
  - Modbus RTU



PowerPort and PowerNet Protection Overview Screen

Features, Benefits and Functions

- Complete protection, metering and control in a single compact case to reduce panel space, wiring and costs.
- Flexible current, voltage and frequency protection and programmability to cover a broad range of applications while simplifying relay ordering and reducing inventory.
- Integral test function reduces maintenance time and expense.
- Relay self-diagnostics and reporting improves uptime and troubleshooting.
- Breaker trip circuit monitoring improves the reliability of the breaker operation.
- Programmable LEDs and logic control features that can replace and eliminate external auxiliary relays, timers, light and wiring.
- Zone selective interlocking improves coordination and tripping times and saves money compared to a traditional bus differential scheme.
- Trip and event recording in non-volatile memory provides detailed information for analysis and system restoration.
- 256 cycles of waveform capture aids in post fault analysis (viewable using PowerNet and NPWAVE-FORM component.
- Front RS-232 port and PowerPort software provides local computer access and a user-friendly, Windows-based interface for relay settings, and configuration and data retrieval.
- Drawout case design for quick and easy relay removal and replacement.
- Breaker open/close control from relay faceplate or remotely via communications.
- Remote communications to Eaton PowerNet monitoring system or PC.
- Free PowerPort utility software for local PC interface to the FP-6000 for relay settings, monitoring and control.

Standards and Certifications

Compliance

- UL Recognized, File # E154862 (FP6200-00 5A CT model only).
- UL 1053 (1994) Recognized.
- ANSI C37.90 (1989).
- EN 55011 (1991).
- EN 61000-6-2 (1999).

Emission Tests

- EN 55011 (1991): Group 1 Class A (CISPR-11, Class A).
- FCC 47 CFR Chapter 1: Part 15 Subpart b Class A.

Immunity Tests

- ANSI C37.90.1 (1989): Surge Withstand Capability.
- ANSI C37.90.2 (1995): EMI Immunity to 35 V/m.
- EN 61000-4-2 (1995): ESD Rating of 8 kV.
- EN 61000-4-3 (1997): Radiated EM Field at 10 V/m.
- EN 61000-4-4 (1995): Fast Transient Burst at 2 kV.
- EN 61000-4-5 (1995): Surge Immunity Test.
- EN 61000-4-6 (1996): Conducted RF at 10 V/m.
- EN 61000-4-8: Power Frequency Magnetic Field Immunity.
- EN 61000-4-11 (1994): Voltage Dips and Variations.

Control Power

- Control voltage:
  - 48 – 125 Vdc/100 – 120 Vac
  - 100 – 250 Vdc/100 – 240 Vac
- Operating voltage:
  - 38 – 150 Vdc/55 – 132 Vac
  - 80 – 308 Vdc/55 – 264 Vac
- Interruption ride-through time:
  - 83 ms at 120 V, 60 Hz ac
  - 250 ms at 110 Vdc/300 ms at Vac
- Power consumption:
  - 20 VA maximum
  - 22 VA maximum

Current Inputs

- CT rating:
  - 2 x In at 5 amperes continuous
  - 3 x In at 1 ampere continuous
  - 80 x In at 5 amperes for 1 second
  - 100 x In at 1 ampere for 1 second
- CT burdens:
  - < 0.25 VA at 5 A (nominal)
  - < 0.05 VA at 1 A (nominal)

Voltage Transformer Inputs

- Nominal: 0 – 120 Vac Line to common.
- Operating range: 0 – 144 Vac (+20%) Line to common.
- Burden: 1 mega ohm Input Impedance.

Metering Accuracy

- Input signal frequency necessary for accurate operation:
  - 60 Hz Nominal, 57 – 63 Hz (5%)
  - 50 Hz Nominal, 47 – 53 Hz (5%)
- Frequency measurement accuracy:
  - ±0.02 Hz
- Clock accuracy:
  - Free running ±1 minute/month at 25°C (77°F)
  - Automatically updated by PowerNet host when present

Table 56-40. Specifications

Principal Parameters	Range	Accuracy
Current (Amperes) Ia, Ib, Ic, Ir, Ix	0.02 to 20 per Unit	at < 2 + CT Rating: ±0.5% of CT Rating at > 2 + CT Rating: ±0.5% of Reading
Sequence Currents	0.02 to 20 per Unit	±1% of Nominal
Main Voltage	0 to 160 V	±0.5% of Nominal ±0.2 V
Sequence Voltages	0 to 160 V	±1% of Nominal
Auxiliary Voltage	0 to 250 V	±1% of Nominal
Phase Angle for I and V	0 to 360°	±1° at Nominal Voltage
System Frequency	45 to 65 Hz	±0.02 Hz
Ampere Demand	0.02 to 20 per Unit	±0.5%
Watt Demand	0 to 4000 MW	±1.0% FS for PF = Unity ① ±1.5% FS for PF = -0.5 to 0.5 ①
Watts	0 to 4000 MW	
Watthours	0 to 999.999 MWh	
Var Demand	0 to 4000 Mvar	±1.5% FS for PF = -0.5 to 0.5 ①
Vars	0 to 4000 Mvar	
Var-hours	0 to 999.999 Mvarh	
VA Demand	0 to 4000 MVA	±1% FS ①
VA	0 to 4000 MVA	
VA-hours	0 to 999,999 MVAh	
Apparent Power Factor	-1 to +1	±0.02 for Load Currents Above 20% Rated
Displacement Power Factor	-1 to +1	±0.02 for Load Currents Above 20% Rated
Total Harmonic Distortion	0 to 9999	±1%
Other Metering Accuracy		±1%

① FS (Full Scale) = 3 x CT Rating x Nominal L-N Voltage.

Protective Functions

Phase and Ground Overcurrent Protection

- Inverse characteristics: Mod, Very, Extremely, IECA, IECB, IECC, It, I^2t, I^4t, Flat.
- TOC (51) pickup range: 0.02 to 4.0 per unit in 0.01 steps.
- Time multipliers: 0.05 to 10.0 in 0.01 steps.
- IOC (50) pickup range: 0.1 to 20.0 per unit in 0.01 steps.
- Pickup accuracy: ±1% (at 0.1 to 2 per unit).
- Time delay: 0 to 9999 cycles in 1 cycle steps.
- Time accuracy: ±3% or ±30 ms.
- Directional (67, 67N, 67G): forward, reverse or both.

Voltage Unbalance (47)

- Threshold (minimum voltage) 1 to 100 volts in 1 volt steps.
- % V2/V1: 2 to 40% in 1% steps.
- Time delay: 0 to 9999 cycles in 1 cycle steps.

Current Unbalance (46)

- Threshold (minimum current) 0.1 to 20.0 per unit in 0.01 steps.
- % I2/I1: 2 to 40% in 1% steps.
- Time delay: 0 to 9999 cycles in 1 cycle steps.

Under/Overvoltage Protection (27/59)

- Pickup range: 10 to 150 volts in 1 volt steps.
- Time delay: 0 to 9999 cycles in 1 cycle steps.

Neutral Voltage Protection (59N)

- Source: calculated, measure.
- Criterion: phasor, rms.
- Pickup range: 5 to 250 volts in 1 volt steps.
- Time delay: 0 to 9999 cycles in 1 cycle steps.

Under/Over Frequency Protection (81U/O)

- Pickup range: 45 to 65 Hz in 0.01 Hz steps.
- Time delay: 0 to 9999 cycles in 1 cycle steps.

Breaker Failure Protection (50BF)

- Pickup range: 0.02 to 5.0 per unit in 0.01 steps.
- Time delay: 0 to 9999 cycles in 1 cycle steps.

Power Factor (55)

- Trigger/reset threshold: -0.5 to 1 lag; 0.5 to 0.99 lead in 0.01 steps.
- Time delay: 0 to 1000 seconds in 1 second steps.

Power Protection (32)

- Direction: forward/reverse.
- Criterion: over/under.
- Pickup range: 0.02 to 4 pu.

Note: 1pu = 3 x CT secondary rating x VT secondary rating for wye; the square root of 3 x VT secondary rating x CT secondary rating for open delta.

- Pickup accuracy: ±1.0%.
- Trip time accuracy: 0 to 2 cycles or 0.1%, whichever is greater.

VAR Protection (32V)

- Direction: forward/reverse.
- Criterion: over/under.
- Pickup range: 0.02 to 4 pu.

Note: 1pu = 3 x CT secondary rating x VT secondary rating for wye; the square root of 3 x VT secondary rating x CT secondary rating for open delta.

- Pickup accuracy: ±1.0%.
- Trip time accuracy: 0 to 2 cycles or 0.1%, whichever is greater.

Thermal Protection (49)

- Pickup range: 0 to 199°C or 0 to 390°F.
- Time delay: 0.1 to 3600 seg.

Sync Check (25)

- Phase angle: 1 to 60°.
- Slip frequency: 0.1 to 2 Hz.
- Voltage differential: 1 to 100 volts.
- Breaker close time: 0 to 9999 cycles.

Discrete Inputs

- Number of contact inputs: 8.
- Rating: 48 Vdc wetting voltage provided with internal ground only.

Output Contacts

- Number of output contacts: Five Form A and two Form C.

Rating of Output Contacts

- Momentary:
  - Make 30 A ac/dc for 0.25 seconds
  - Break 0.25 A at 250 Vdc (resistive)
  - Break 5 A at 120/240 Vac
- Continuous:
  - 5 A at 120/240 Vac
  - 5 A at 30 Vdc

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Logic and Control Functions

- Six programmable logic gates for AND, OR, NAND, NOR operation.
- Two latching (flip/flop) gates.
- Six timer gates provide on/off delays.

INCOM Communications

- Baud rate: 9600 fixed.
- Maximum distance: 10,000 feet (3,048 m).
- Protocol: INCOM.

RS-232 Communications, Front Panel

- Baud rate: 38.4K, 19.2K, 9.6K.
- Connector standard 9-pin subminiature, 3-wire.
- Protocol: INCOM.

RS-485 Communications, Rear Panel

- Baud rate: 19.2K, 9.6K
- Protocol: Modbus RTU.

Environmental Ratings

- Operating temperature: -40° to +60°C (-40° to +140°F).
- Storage temperature: -40° to +85°C (-40° to +185°F).
- Humidity: 5% to 95% relative humidity (non-condensing).
- Altitude: 0 to 6,350 feet (0 to 1,935 m) above Mean Sea Level.

Dimensions in Inches (mm)

- Behind panel:
  - Height: 6.70 (170.2)
  - Width: 5.30 (134.6)
  - Depth: 6.90 (175.3)
- In front of panel:
  - Height: 11.34 (288.0)
  - Width: 7.72 (196.1)
  - Depth: 0.80 (20.3)

Shipping Weight Lbs. (kg)

- 12.5 (5.7).

Communication Software

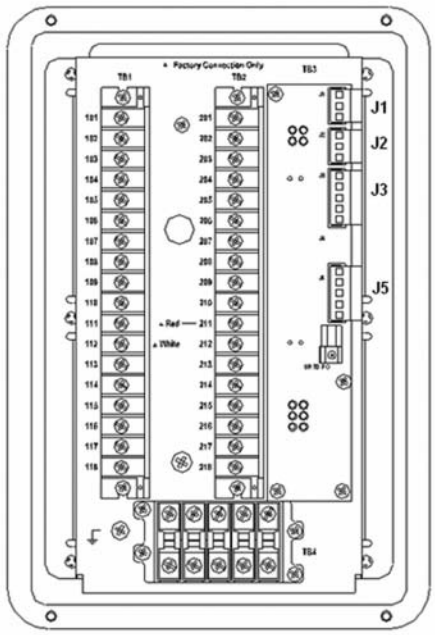
Eaton provides two types of communication software. The first is PowerPort. It runs on a PC or laptop for easy access to a single relay to change set points or configuration and to view metered values and stored data. PowerPort is free and can be downloaded from the Eaton Web site at the following URL: www.eaton.com; search for "PowerPort."

The second package is PowerNet. PowerNet is a power management software package that is designed for continuous, remote monitoring of many devices. It provides all the functionality of PowerPort plus additional functions such as billing, trending and graphics. Contact your local Eaton representative for more information on PowerNet software.

Technical Data and Specifications

Wiring Diagrams

TB1		TB2	
101	Power Supply Input (+)	201	C In 1
102	Power Supply Input (–)	202	C In 2
103	RLY Healthy Com.	203	C In 3
104	RLY Healthy N.O.	204	C In 4
105	RLY Healthy N.C.	205	C In Source 1
106	Alarm Com.	206	C In 5
107	Alarm N.O.	207	C In 6
108	Alarm N.C.	208	C In 7
109	RLY 5 Com.	209	C In 8
110	RLY 5 N.O.	210	C In Source 2
111	RLY 4 Com.	211	Not Used
112	RLY 4 N.O.	212	Not Used
113	RLY 3 Com.	213	VA(+) Main
114	RLY 3 N.O.	214	VB(+) Main
115	Trip 2 Com.	215	VC(+) Main
116	Trip 2 N.O.	216	Vx1 Aux
117	Trip 1 Com.	217	Vx2 Aux
118	Trip 1 N.O.	218	Vg Main



TB3	
J1-1	PowerNet
J1-2	PowerNet
J1-3	PowerNet Shield
J3-1	Zone Out
J3-2	Zone Com.
J3-3	Zone Shield
J3-4	Zone In
J3-5	Zone Com.
J4-1	
J4-2	
J4-3	
J5-1	RS485 (+) *
J5-2	RS485 (-) *
J5-3	RS485 Com. *
J5-4	RS485 Shield *

* Available with Modbus-RTU Communications

A1	B1	C1	X1	N.C.
A2	B2	C2	X2	N.C.

Figure 56-74. FP-6000 Rear View and Terminal Designations

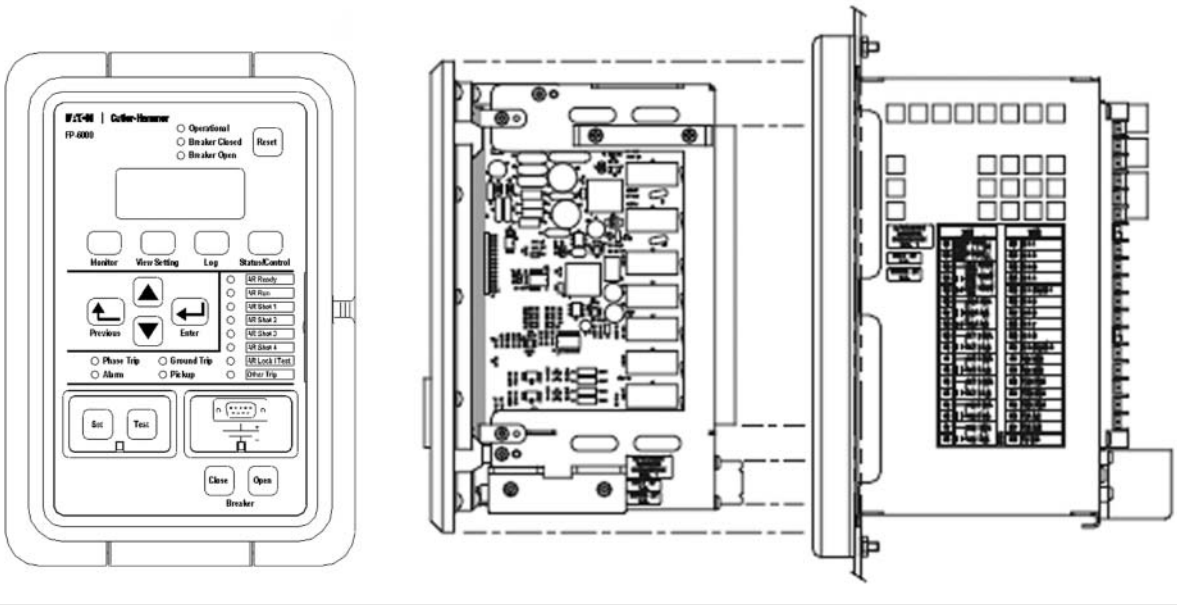


Figure 56-75. FP-6000 Front View and Drawout Case Side View

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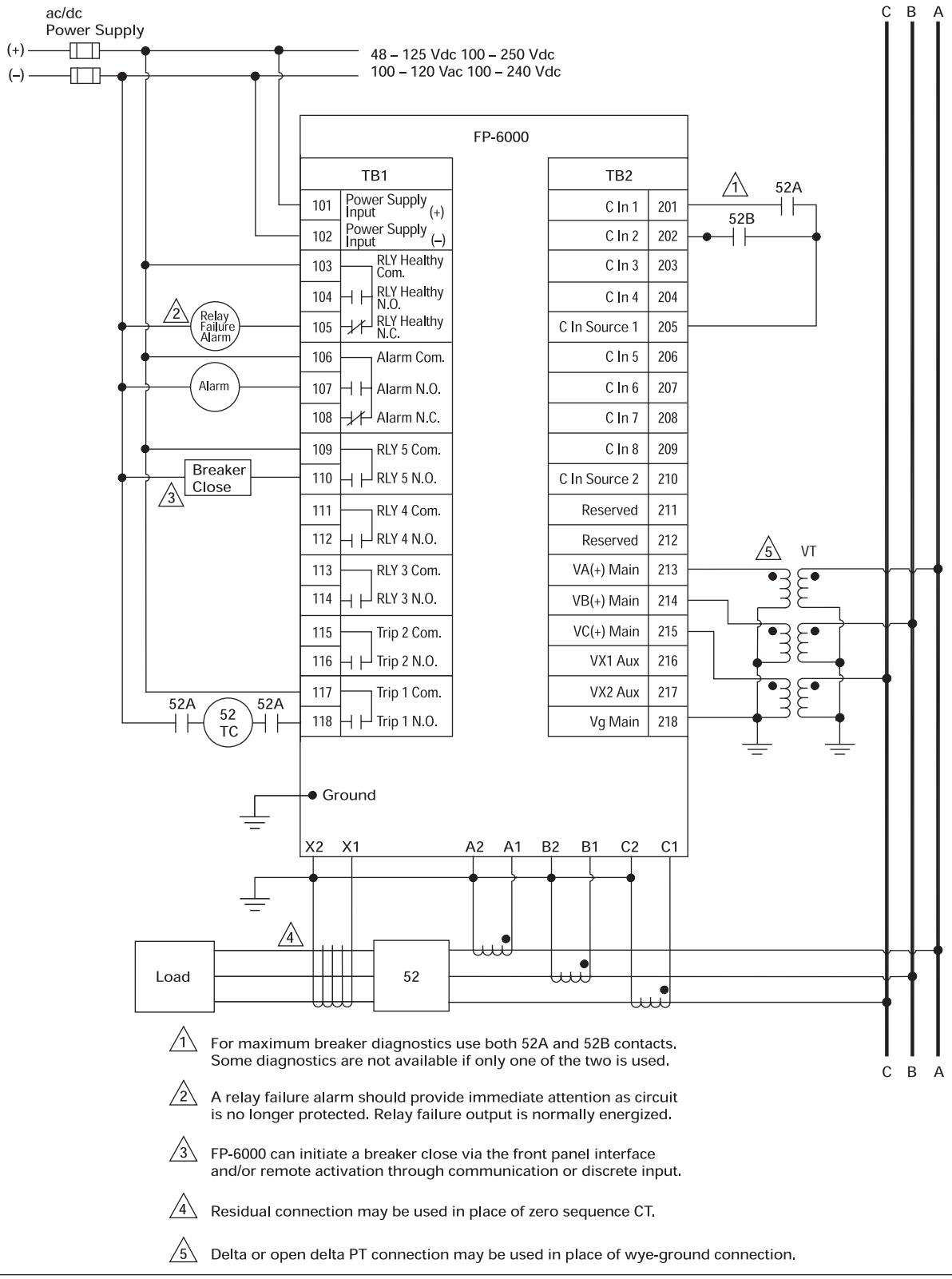


1 For maximum breaker diagnostics use both 52A and 52B contacts. Some diagnostics are not available if only one of the two is used.

2 A relay failure alarm should provide immediate attention as circuit is no longer protected. Relay failure output is normally energized.

3 FP-6000 can initiate a breaker close via the front panel interface and/or remote activation through communication or discrete input.

4 Residual connection may be used in place of zero sequence CT.

5 Delta or open delta PT connection may be used in place of wye-ground connection.

Figure 56-76. FP-6000 Typical Connection Drawing Using Wye PTs

Product Selection

Table 56-41. Catalog Numbering Selection Guide

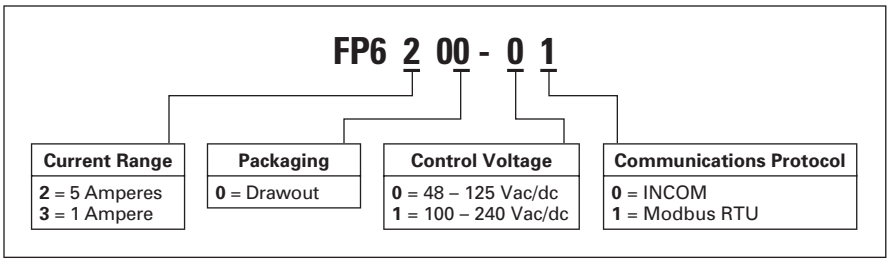


Table 56-42. Catalog Numbers

Option Description	Style Number	Catalog Number
5 A CT 48 – 125 Vdc, 100 – 120 Vac Power Supply Standard Comm. Board	66D2167G01	**FP6200-00**
1 A CT 48 – 125 Vdc, 100 – 120 Vac Power Supply Standard Comm. Board	66D2167G02	**FP6300-00**
5 A CT 100 – 250 Vdc 100 – 240 Vac Power Supply Standard Comm. Board	66D2167G04	**FP6200-10**
1 A CT 100 – 250 Vdc, 100 – 240 Vac Power Supply Standard Comm. Board	66D2167G05	**FP6300-10**
5 A CT 100 – 250 Vdc 100 – 240 Vac Power Supply Modbus Comm. Board	66D2167G06	**FP6200-11**
1 A CT 100 – 250 Vdc, 100 – 240 Vac Power Supply Modbus Comm. Board	66D2167G07	**FP6300-11**
5 A CT 48 – 125 Vdc, 100 – 120 Vac Power Supply Modbus Comm. Board	66D2167G08	**FP6200-01**
1 A CT 48 – 125 Vdc, 100 – 120 Vac Power Supply Modbus Comm. Board	66D2167G09	**FP6300-01**

Table 56-43. Additional Documentation

Description	Style Number	Pub Number
Instruction Booklet	66A2347H01	IB02602004E

FP-5000 Feeder Protection

Feeder Protection FP-5000

Product Description

- Microprocessor-based protection with monitoring and control for medium voltage main and feeder applications.
- Current, voltage, frequency and power protection for electric power distribution systems.
- Complete metering of voltage, currents, power, energy, minimum/maximum and demand functions.
- Programmable logic control functions for main-tie-main transfer schemes.
- Trip logs, event logs and waveform capture for better fault analysis and system restoration.
- Data Logger to provide energy usage profiles for better planning, utilization and energy usage.
- Compact, drawout case design.
- Meets ANSI, CE and CSA standards.
- Multiple settings groups.
- ANSI, IEC and thermal protection curves for greater flexibility.

Application Description

Eaton's FP-5000 Feeder Protection relay provides complete 3-phase and ground overcurrent and voltage protection plus metering in a single, compact drawout case. It may be used as primary protection on feeders, mains and tie circuit breaker applications, and as backup protection for transformers, high voltage lines and differential protection. The relay is most commonly used on medium voltage switchgear applications.

The FP-5000 takes full advantage of its microprocessor technology providing the user new freedoms and a wealth of data-gathering features. The relay performs self-checking of all major hardware and firmware protection elements to ensure their operation in the event of a system or component electrical failure or fault. Protection functions are well suited for main and distribution feeder circuit applications. Programmable logic control functions make the FP-5000 relay ideally suited for main-tie-main and main 1/main 2 transfer schemes.

The Zone Interlocking feature can be utilized for bus protection instead of an expensive and complicated bus differential (87B) scheme. The FP-5000 works directly with Eaton's Digitrip 3000 and Digitrip MV relays. New breaker failure logic provides faster remote backup clearing times for stuck breaker operation.

The multiple settings groups can be utilized for arc flash mitigation when an alternative setting group, set to have instantaneous elements only is activated using a selector switch and the programmable I/O in the FP-5000.

The FP-5000 provides trip and close circuit monitoring and alarming features. It continually monitors the complete trip and close circuits for continuity and readiness to trip. Open and close pushbuttons are conveniently located on the front of the relay for local breaker operation.

Loss-of-vacuum monitoring is activated when the breaker is open. Residual current is monitored and alarmed if detected.

When an electrical fault or disturbance occurs, the FP-5000 begins to store the following in non-volatile memory:

- Voltage and current sampled data.
- Calculated values.
- Status of internal protection functions, logic, contact inputs and outputs.

Retrieval and viewing of the data is easy, aiding in the quick analysis and restoration of your electric power system.

When the FP-5000 isn't responding to disturbances in the power system, it's providing valuable metering information at the relay and remotely. It provides energy usage and demand reading, and can alarm when usage reaches a set value. Power factor measurements can be used for cap bank switching to control kvar demand. Onboard data trending can provide load profiles for up to 40 days.

The protection functions are listed below and shown in **Figure 56-73**.

Phase Overcurrent (Forward, Reverse or Both)

- Two-Stage instantaneous with timers (50P-1 and 50P-2).
- Two inverse time overcurrent (51P-1 and 51P-2).
- Directional Control.
- 10 standard curves.
- Instantaneous or time delay reset.
- Voltage restrained time overcurrent (51VR).

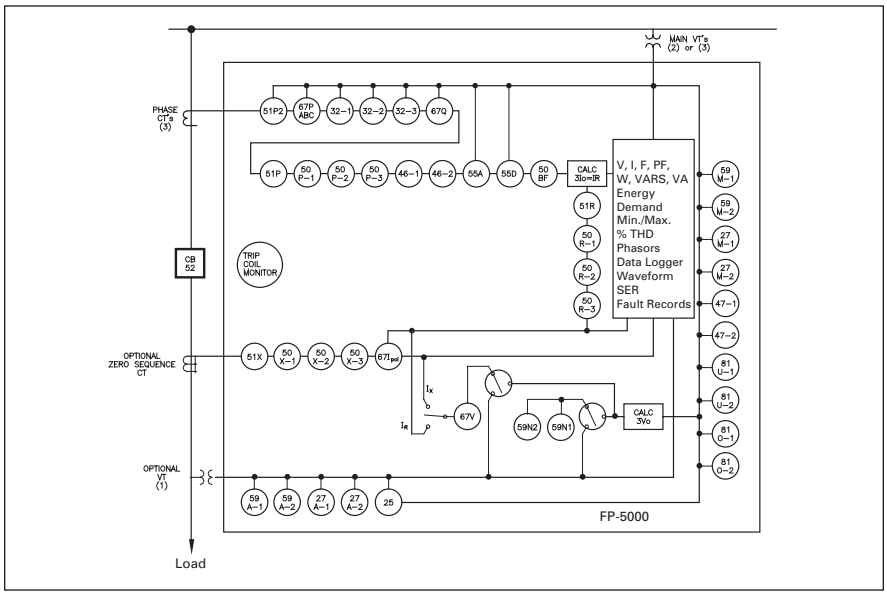


Figure 56-77. FP-5000 One-Line Drawing

- Two independent ground directional overcurrent elements, one measured (IX) and one calculated (IR).
  - Two-Stage instantaneous with timers (50X-1 and 50X-2) (50R-1 and 50R-2)
  - Inverse time overcurrent (51X and 51R)
  - Ground directional polarizing (67N) -3_{VO}, I_{pol}, negative sequence
  - 10 standard curves
  - Instantaneous or time delay reset
  - Voltage restrained time overcurrent (51VR)
- Breaker failure (50BF).
- Phase unbalance negative sequence overcurrent (46-1, 46-2).
- Phase voltage unbalance and sequence protection (47-1, 47-2).
- Main 3-phase under/overvoltage (27M-1, 27M-2, 59M-1, 59M-2).
- Auxiliary single-phase under/overvoltage (27A-1, 27A-2, 59A-1, 59A-2).
- Under/over frequency (81U-1, 81U-2, 81O-1, 81O-2).
- Reverse/forward power (32-1, 32-2).
- Sync check (25).
- Power factor (55).
- Zone interlocking for bus protection (87B). The FP-5000 feeder relay includes a zone selective interlocking feature that can be used with other Eaton devices like the Digitrip 3000 overcurrent relay.

The FP-5000 provides the following metering functions:

- Amperes (rms, phasor and sequence).
- Amperes demand and peak demand.
- Volts (rms, phasor and sequence).
- VA and VA demand.
- Watts and kW demand and peak demand.
- Forward/reverse/net kWh.
- Vars and kvar demand and peak demand.
- Lead/lag/net kvarh.
- Power factor.
- Frequency.
- Voltage and current.
- %THD and magnitude THD.
- Minimum/maximum recording with date/time stamp.
- Trending (load profile over time).

The FP-5000 provides the following monitoring and data recording functions that enhance the security of the protection system and provides useful information for scheduling maintenance.

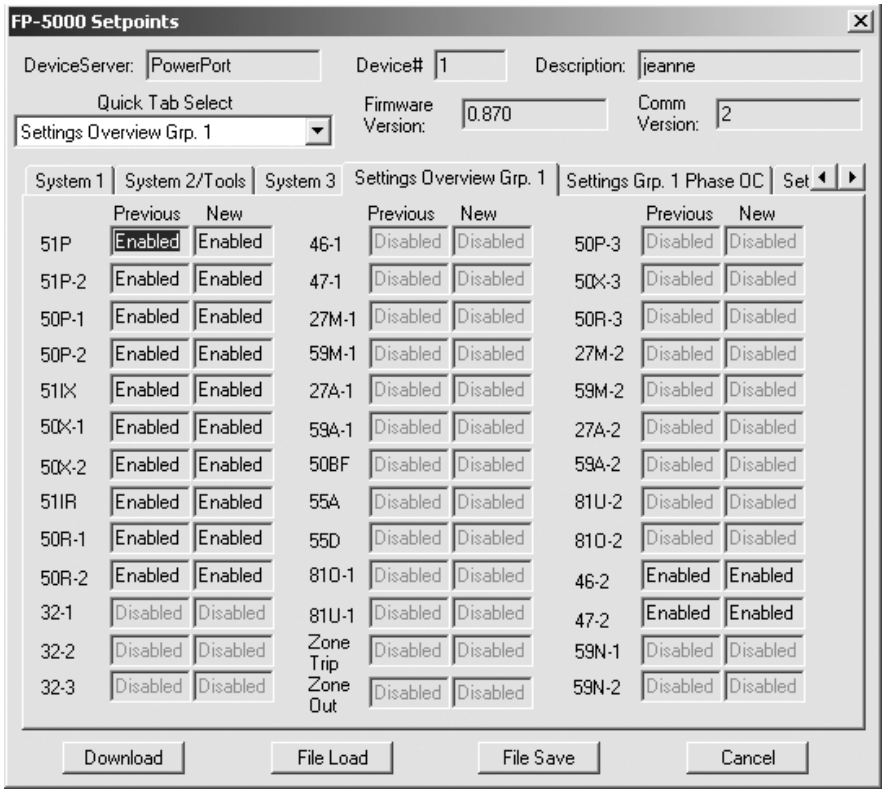
- Trip circuit monitoring.
- Close circuit monitoring.
- Loss-of-vacuum monitoring.
- Breaker wear (accumulated interrupted current).
- Waveform capture (256 cycles total, up to 16 events).
- Fault data logs (up to 16 events).
- Sequence of events report (up to 100 events).
- Clock.

The FP-5000 provides standard control functions plus user-configurable custom control capabilities. This logic can be used for applications such as main-tie-main transfer schemes.

- Remote open/close.
- Programmable I/O.
- Programmable logic gates and timers.
- Multiple setting groups (up to 4).
- Bus transfer logic.
- Cold load pickup.
- Loss of potential (PT blown fuses).

The FP-5000 supports the following communication options:

- Local HMI.
- Password protected.
- Addressable.
- Local communication port.
- Remote communication port:
  - FSK
  - RS-232
  - RS-485
- Protocols:
  - INCOM
  - Modbus
- Configuration software.



PowerPort and PowerNet Protection Overview Screen

Features, Benefits and Functions

- Complete protection, metering and control in a single compact case to reduce panel space, wiring and costs.
- Flexible current, voltage and frequency protection and programmability to cover a broad range of applications while simplifying relay ordering and reducing inventory.
- Integral test function reduces maintenance time and expense.
- Relay self-diagnostics and reporting improves uptime and troubleshooting.
- Breaker trip circuit monitoring improves the reliability of the breaker operation.
- Programmable logic control features that can replace and eliminate external auxiliary relays, timers and wiring.
- Zone-selective interlocking improves coordination and tripping times and saves money compared to a traditional bus differential scheme.
- Trip and event recording in non-volatile memory provides detailed information for analysis and system restoration.
- 256 cycles of waveform capture aids in post fault analysis.
- Front RS-232 port and PowerPort software provides local computer access and a user-friendly, Windows®-based interface for relay settings, and configuration and data retrieval.
- Drawout case design for quick and easy relay removal and replacement.
- Breaker open/close control from relay faceplate or remotely via communications.
- Remote communications to Eaton's PowerNet monitoring system or PC.
- Free PowerPort utility software for local PC interface to the FP-5000 for relay settings, monitoring and control.

Standards and Certifications

Compliance

- UL Recognized, File # E154862.
- UL 1053 (1994) Recognized.
- ANSI C37.90 (1989).
- EN 55011 (1991).
- EN 61000-6-2 (1999).

Emission Tests

- EN 55011 (1991) — Group 1 Class A (CISPR-11, Class A).
- FCC 47 CFR Chapter 1 — Part 15 Subpart b Class A.

Immunity Tests

- ANSI C37.90.1 (1989) — Surge Withstand Capability.
- ANSI C37.90.2 (1995) — EMI Immunity to 35V/m.
- EN 61000-4-2 (1995) — ESD Rating of 8 kV.
- EN 61000-4-3 (1997) — Radiated EM Field at 10V/m.
- EN 61000-4-4 (1995) — Fast Transient Burst at 2 kV.
- EN 61000-4-5 (1995) — Surge Immunity Test.
- EN 61000-4-6 (1996) — Conducted RF at 10V/m.
- EN 61000-4-11 (1994) — Voltage Dips and Variations.
- EN 61000-4-8 — Power Frequency Magnetic Field Immunity.

Control Power

- Control voltage:
  - 48 – 125 Vac/dc
  - 100 – 240 Vac/dc
- Operating voltage:
  - 55 – 264 Vac
  - 38 – 300 Vdc
- Interruption ride-through time: 20 cycle interruption of nominal ac supply.
- Power consumption: 20 VA maximum.

Current Inputs

- Nominal (I_n): 1A or 5A.
- CT rating:
  - 2 x I_n continuous
  - 80 x I_n for 1 second
- CT burdens:
  - < 0.25 VA at 5 A (nominal)
  - < 0.05 VA at 1 A (nominal)

Voltage Transformer Inputs

- Nominal: 120 Vac.
- Operating range: 69 – 150 Vac.
- Burden:
  - <0.015 at 120 Vac
  - 1 megaohm

Metering Accuracy

- Phase current:
  - ±0.5% or ±0.025A from 0.02 – 20 per unit fully offset current waveform
- Ground current:
  - ±0.5% of full scale (I_n) from 0.02 – 2.0 per unit fully offset current waveform
- Phase voltage: ±0.5% or ±0.2V from 0 – 160 Vac.
- Frequency measurement accuracy: ±0.02 Hz.
- Phase angle: ±1°.
- Power metering accuracy: ±1.5%.
- Metering accuracy temperature range: 0° – 50°C.
- Temperature range: ±5% for operation below 0°C and above 50°C.
- Relay Outputs:
  - 2 Form C, NO and NC
  - 5 Form A, NO Only
- Input signal frequency necessary for accurate operation:
  - 60 Hz nominal, 57 – 63 Hz (±5%)
  - 50 Hz nominal, 47 – 53 Hz (±5%)
- Clock accuracy:
  - Free running ±1 minute/month at 25°C
  - Clock automatically updated by PowerNet host when present

Product Specifications

Protective Functions

Phase and Ground Overcurrent Protection

- Inverse characteristics: Mod, Very, Extremely, IECA, IECB, IECC, It, I^2t, I^4t, Flat.
- TOC (51) pickup range: 0.1 – 4.0 per unit in 0.01 steps.
- Time multipliers: 0.05 – 10.0 in 0.01 steps.
- IOC (50) pickup range: 0.1 – 20.0 per unit in 0.01 steps.
- Pickup accuracy: ±1% (at 0.1 – 2 per unit).
- Time delay: 0 – 9999 cycles in 1 cycle steps.
- Time accuracy: ±3% or ±30 ms.
- Directional (67, 67N, 67G): forward, reverse or both.

Voltage Unbalance (47)

- Threshold (minimum voltage) 1 – 100 volts in 1 volt steps.
- % V2/V1: 4 – 40% in 1% steps.
- Time delay: 0 – 9999 cycles in 1 cycle steps.

Current Unbalance

- Threshold (minimum current) 0.1 – 20.0 per unit in 0.01 steps.
- % I2/I1: 4 – 40% in 1% steps.
- Time delay: 0 – 9999 cycles in 1 cycle steps.

Under/Overvoltage Protection

- Pickup range: 10 – 150 volts in 1 volt steps.
- Time delay: 0 – 9999 cycles in 1 cycle steps.

Under/Over Frequency Protection

- Pickup range: 45 – 65 Hz in 0.01 Hz steps.
- Time delay: 0 – 9999 cycles in 1 cycle steps.

Breaker Failure Protection

- Pickup range: 0.1 – 5.0 per unit in 0.01 steps.
- Time delay: 0 – 9999 cycles in 1 cycle steps.

Power Protection (32)

- Forward/reverse: over/under.
- Pickup accuracy: ±1.0%.
- Trip time accuracy: 0 to 12 cycles or 0.1%, whichever is greater.

Sync Check (25)

- Phase angle: 1 to 60°.
- Slip frequency: 0.1 to 2 Hz.
- Voltage differential: 1 to 100 volts.
- Breaker close time: 0 to 9999 cycles.

Power Factor

- Trigger/reset threshold: 0.5 lag to 0.5 lead in 0.01 steps.
- Time delay: 0 – 1000 seconds in 1 second steps.

Discrete Inputs

- Number of contact inputs: 8.
- Rating: 48 Vdc wetting voltage provided with internal ground only.

Output Contacts

- Number of output contacts: Five Form A and two Form C.

Rating of Output Contacts

- Momentary:
  - Make 30 A ac/dc for 0.25 seconds
  - Break 0.25 A at 250 Vdc (resistive)
  - Break 5 A at 120/240 Vac
- Continuous:
  - 5 A at 120/240 Vac
  - 5 A at 30 Vdc

Logic and Control Functions

- Six programmable logic gates for AND, OR, NAND, NOR operation.
- Two latching (flip/flop) gates.
- Six timer gates provide on/off delays.

INCOM Communications

- Baud rate: 9600 fixed.
- Maximum distance: 10,000 feet (3,048 m).
- Protocol: INCOM.

RS-485 Communications, Rear Panel

- Baud rate: 19.2K, 9.6K
- Protocol: Modbus RTU.

RS-232 Communications, Front Panel

- Baud rate: 38.4K, 19.2K, 9.6K.
- Connector standard 9-pin subminiature, 3-wire.
- Protocol: INCOM.

Environmental Ratings

- Operating temperature: -40° to +60°C (-40° to +140°F) Product tested to +85°C.
- Storage temperature: -40° to +85°C (-40° to +185°F).
- Humidity: 5 – 95% relative humidity (non-condensing).
- Altitude: 0 – 6,350 feet (0 – 1,935 m) above Mean Sea Level.

Dimensions in Inches (mm)

- Behind panel:
  - Height: 6.70 (170.2)
  - Width: 5.30 (134.6)
  - Depth: 6.90 (175.3)
- In front of panel:
  - Height: 11.34 (288.0)
  - Width: 7.72 (196.1)
  - Depth: 0.80 (20.3)

Shipping Weight Lbs. (kg)

- 12.5 (5.7).

Communication Software

Eaton provides two types of communication software. The first is PowerPort. It runs on a PC or laptop for easy access to a single relay to change set points or configuration and to view metered values and stored data. PowerPort is free and can be downloaded from www.eaton.com; search for 'PowerPort,' then click the download search result.

The second package is PowerNet. PowerNet is a power management software package that is designed for continuous, remote monitoring of many devices. It provides all the functionality of PowerPort plus additional functions such as billing, trending and graphics. Contact your local Eaton representative for more information on PowerNet software.

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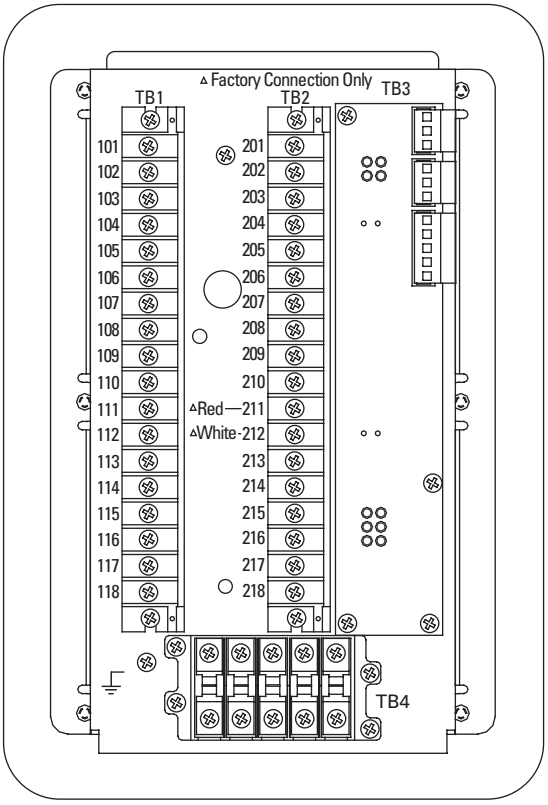
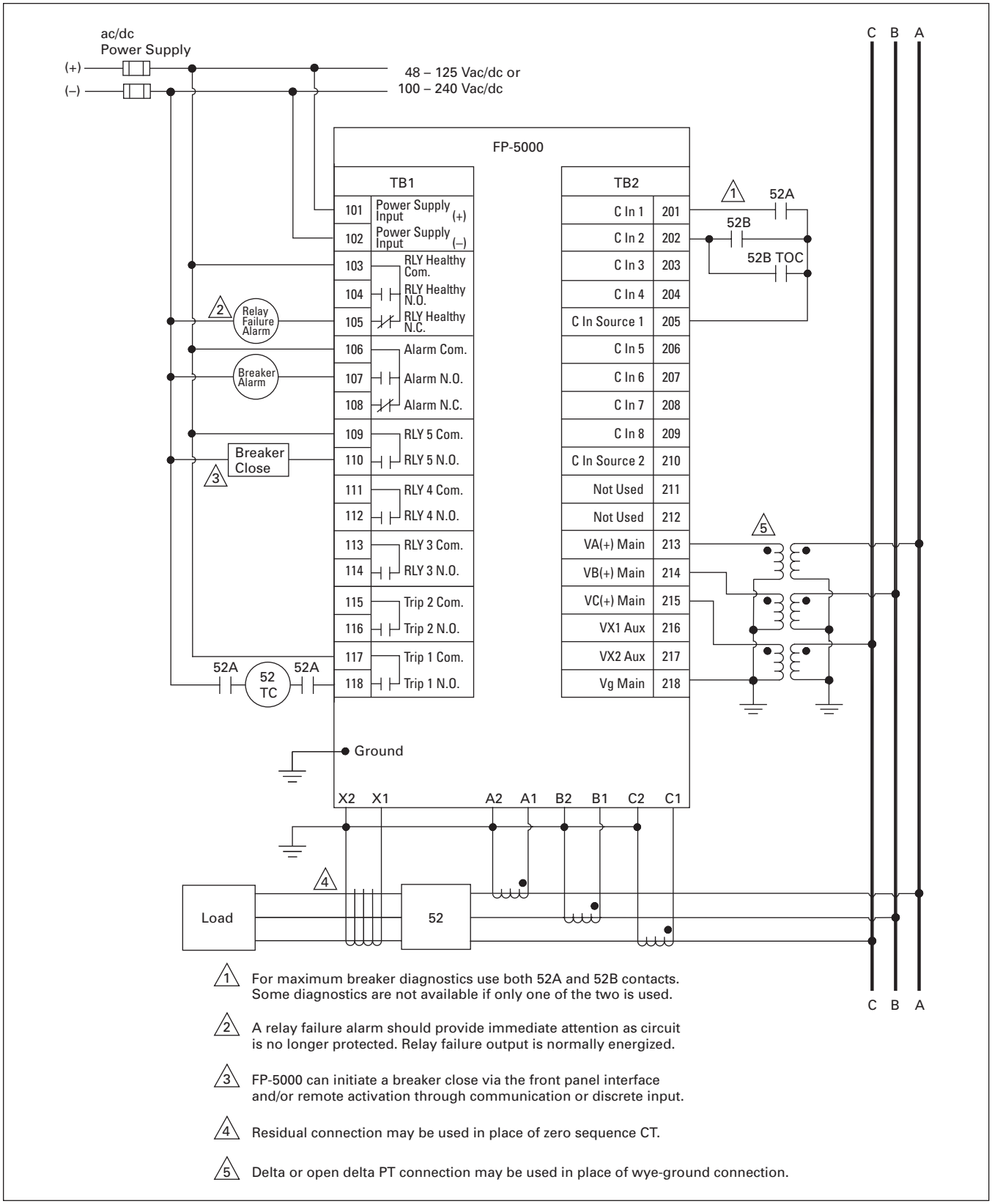
104	RLY Healthy N.O.	204	C In 4
105	RLY Healthy N.C.	205	C In Source 1
106	Alarm Com.	206	C In 5
107	Alarm N.O.	207	C In 6
108	Alarm N.C.	208	C In 7
109	RLY 5 Com.	209	C In 8
110	RLY 5 N.O.	210	C In Source 2
111	RLY 4 Com.	211	Not Used
112	RLY 4 N.O.	212	Not Used
113	RLY 3 Com.	213	VA(+) Main
114	RLY 3 N.O.	214	VB(+) Main
115	Trip 2 Com.	215	VC(+) Main
116	Trip 2 N.O.	216	Vx1 Aux
117	Trip 1 Com.	217	Vx2 Aux
118	Trip 1 N.O.	218	Vg Main



TB3	
J1-1	PowerNet
J1-2	PowerNet
J1-3	PowerNet Shield
J2-1	Accessory Bus
J2-2	Accessory Bus
J2-3	Accessory Bus Shield
J3-1	Zone Out
J3-2	Zone Com.
J3-3	Zone Shield
J3-4	Zone In
J3-5	Zone Com.
J4-1	
J4-2	
J4-3	
J5-1	RS485(+)
J5-2	RS485(-)
J5-3	RS485com
J5-4	RS485shield

A1	B1	C1	X1	N.C. 1
A2	B2	C2	X2	N.C. 2

Figure 56-78. FP-5000 Rear View and Terminal Designations



1 For maximum breaker diagnostics use both 52A and 52B contacts. Some diagnostics are not available if only one of the two is used.

2 A relay failure alarm should provide immediate attention as circuit is no longer protected. Relay failure output is normally energized.

3 FP-5000 can initiate a breaker close via the front panel interface and/or remote activation through communication or discrete input.

4 Residual connection may be used in place of zero sequence CT.

5 Delta or open delta PT connection may be used in place of wye-ground connection.

Figure 56-79. FP-5000 Typical Connection Drawing Using Wye PTs

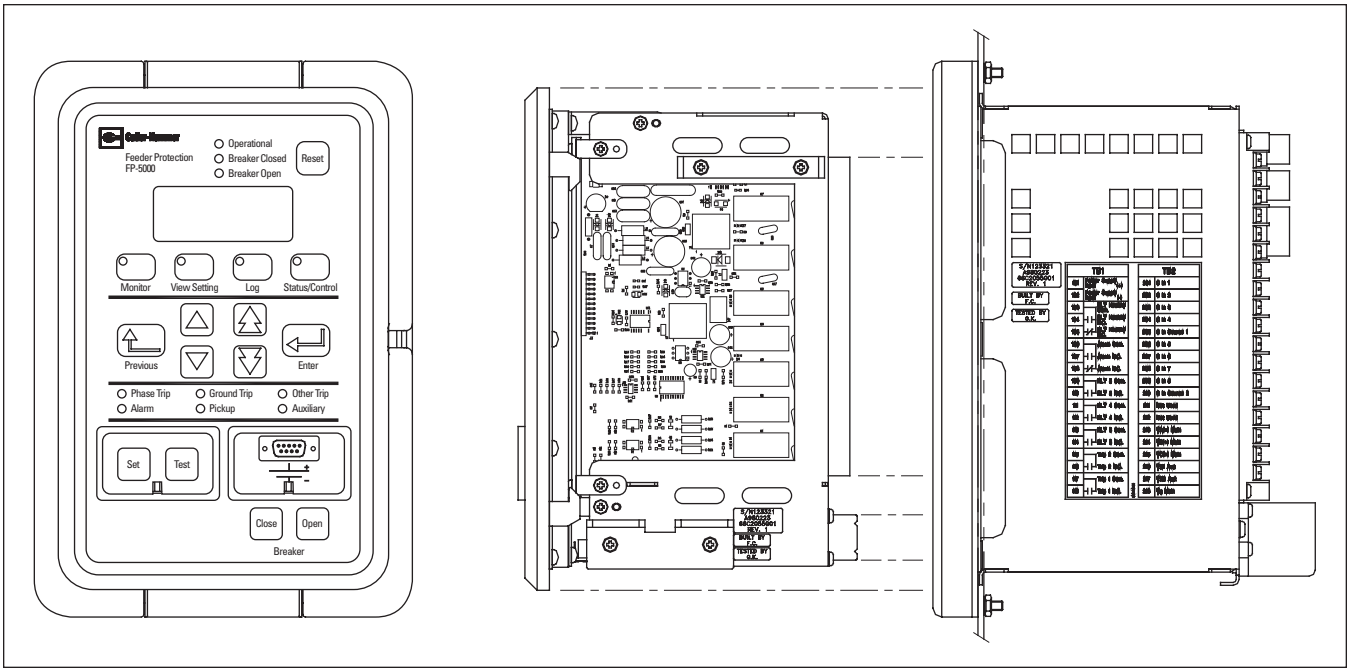


Figure 56-80. FP-5000 Front View and Drawout Case Side View

Product Selection

Table 56-44. Catalog Numbering Selection Guide

FP5 2 00 - 0 1

Current Range	Packaging	Control Voltage	Communications Protocol
2 = 5 Amperes **3** = 1 Ampere	**0** = Drawout **1** = Fixed Case	**0** = 48 – 125 Vac/dc **1** = 100 – 240 Vac/dc	**0** = INCOM **1** = Modbus

FP-4000 Feeder Protection

Feeder Protection FP-4000

Product Description

- Microprocessor-based protection with monitoring and control for medium voltage main and feeder applications.
- Current, voltage, frequency and power protection for electric power distribution systems.
- Complete metering of voltage, currents, power, energy, minimum/maximum and demand functions.
- Programmable logic control functions for main-tie-main transfer schemes.
- Trip logs, event logs and waveform capture for better fault analysis and system restoration.
- Data Logger to provide energy usage profiles for better planning, utilization and energy usage.
- Compact, drawout case design.
- Meets ANSI, CE and CSA standards.
- Multiple settings groups.
- ANSI, IEC and thermal protection curves for greater flexibility.

Application Description

Eaton's FP-4000 Feeder Protection relay provides complete 3-phase and ground overcurrent and voltage protection plus metering in a single, compact drawout case. It may be used as primary protection on feeders, mains and tie circuit breaker applications, and as backup protection for transformers, high voltage lines and differential protection. The relay is most commonly used on medium voltage switchgear applications.

The FP-4000 takes full advantage of its microprocessor technology providing the user new freedoms and a wealth of data-gathering features. The relay performs self-checking of all major hardware and firmware protection elements to ensure their operation in the event of a system or component electrical failure or fault. Protection functions are well suited for main and distribution feeder circuit applications. Programmable logic control functions make the FP-4000 relay ideally suited for main-tie-main and main 1/main 2 transfer schemes.

The Zone-Interlocking feature can be utilized for bus protection instead of an expensive and complicated bus differential (87B) scheme. The FP-4000 works directly with Eaton's Digitrip 3000 and Digitrip MV relays. New breaker failure logic provides faster remote backup clearing times for stuck breaker operation.

The multiple settings groups can be utilized for arc flash mitigation when an alternative setting group, set to have instantaneous elements only is activated using a selector switch and the programmable I/O in the FP-4000.

The FP-4000 provides trip and close circuit monitoring and alarming features. It continually monitors the complete trip and close circuits for continuity and readiness to trip. Open and close pushbuttons are conveniently located on the front of the relay for local breaker operation.

Loss-of-vacuum monitoring is activated when the breaker is open. Residual current is monitored and alarmed if detected.

When an electrical fault or disturbance occurs, the FP-4000 begins to store the following in non-volatile memory:

- Voltage and current sampled data.
- Calculated values.
- Status of internal protection functions, logic, contact inputs and outputs.

Retrieval and viewing of the data is easy, aiding in the quick analysis and restoration of your electric power system.

When the FP-4000 isn't responding to disturbances in the power system, it's providing valuable metering information at the relay and remotely. It provides energy usage and demand reading, and can alarm when usage reaches a set value. Power factor measurements can be used for cap bank switching to control kvar demand. Onboard data trending can provide load profiles for up to 40 days.

The protection functions are listed below and shown in **Figure 56-73**.

Phase Overcurrent

- Two-Stage instantaneous with timers (50P-1 and 50P-2).
- Inverse time overcurrent (51P-1).
- 10 standard curves.
- Instantaneous or time delay reset.

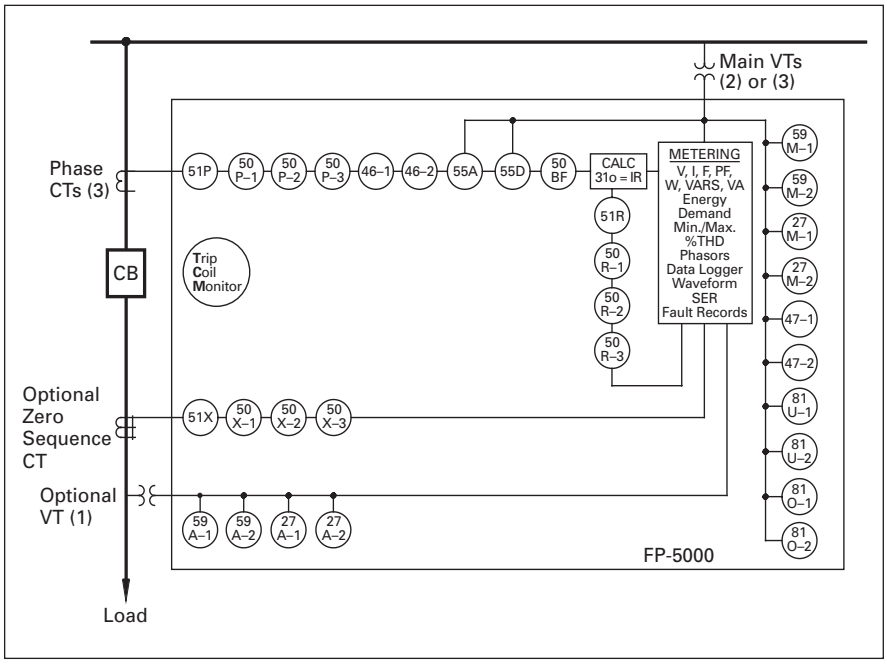


Figure 56-81. FP-4000 One-Line Drawing

- Two independent directional overcurrent elements, one measured (IX) and one calculated (IR).
  - Two-Stage instantaneous with timers (50X-1 and 50X-2) (50R-1 and 50R-2)
  - Inverse time overcurrent (51X and 51R)
  - 10 standard curves
  - Instantaneous or time delay reset
- Breaker failure (50BF).
- Phase unbalance negative sequence overcurrent (46-1, 46-2).
- Phase voltage unbalance and sequence protection (47-1, 47-2).
- Main 3-phase under/overvoltage (27M-1, 27M-2, 59M-1, 59M-2).
- Auxiliary single-phase under/overvoltage (27A-1, 27A-2, 59A-1, 59A-2).
- Under/overfrequency (81U-1, 81U-2, 81O-1, 81O-2).
- Power factor (55).
- Zone interlocking for bus protection (87B). The FP-4000 feeder relay includes a zone selective interlocking feature that can be used with other Eaton devices like the Digitrip 3000 overcurrent relay.

The FP-4000 provides the following metering functions:

- Amperes (rms, phasor and sequence).
- Amperes demand and peak demand.
- Volts (rms, phasor and sequence).
- VA and VA demand.
- Watts and kW demand and peak demand.
- Forward/reverse/net kWh.
- Vars and kvar demand and peak demand.
- Lead/lag/net kvarh.
- Power factor.
- Frequency.
- Voltage and current.
- %THD and magnitude THD.
- Minimum/maximum recording with date/time stamp.
- Trending (load profile over time).

The FP-4000 provides the following monitoring and data recording functions that enhance the security of the protection system and provides useful information for scheduling maintenance.

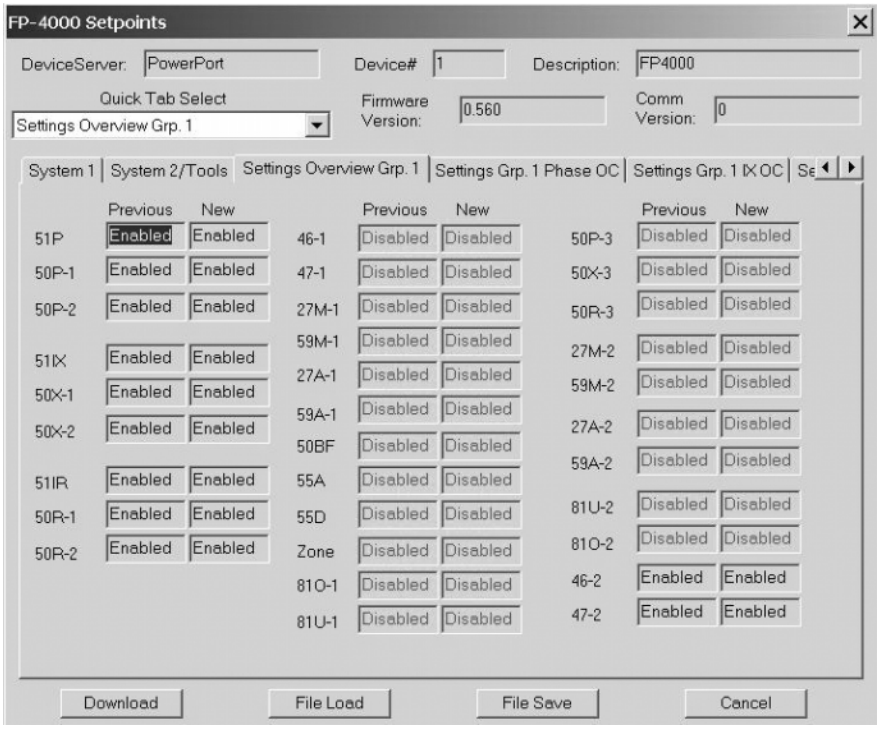
- Trip circuit monitoring.
- Close circuit monitoring.
- Loss-of-vacuum monitoring.
- Breaker wear (accumulated interrupted current).
- Waveform capture (256 cycles total, up to 16 events).
- Fault data logs (up to 16 events).
- Sequence of events report (up to 100 events).
- Clock.

The FP-4000 provides standard control functions plus user-configurable custom control capabilities. This logic can be used for applications such as main-tie-main transfer schemes.

- Remote open/close.
- Programmable I/O.
- Programmable logic gates and timers.
- Multiple setting groups (up to 4).
- Bus transfer logic.

The FP-4000 supports the following communication options:

- Local HMI.
- Password protected.
- Addressable.
- Local communication port.
- Remote communication port:
  - FSK
  - RS-232
  - RS-485
- Protocols:
  - INCOM
  - Modbus
- Configuration software.



PowerPort and PowerNet Protection Overview Screen

Features, Benefits and Functions

- Complete protection, metering and control in a single compact case to reduce panel space, wiring and costs.
- Flexible current, voltage and frequency protection and programmability to cover a broad range of applications while simplifying relay ordering and reducing inventory.
- Integral test function reduces maintenance time and expense.
- Relay self-diagnostics and reporting improves uptime and troubleshooting.
- Breaker trip circuit monitoring improves the reliability of the breaker operation.
- Programmable logic control features that can replace and eliminate external auxiliary relays, timers and wiring.
- Zone selective interlocking improves coordination and tripping times and saves money compared to a traditional bus differential scheme.
- Trip and event recording in non-volatile memory provides detailed information for analysis and system restoration.
- 256 cycles of waveform capture aids in post fault analysis.
- Front RS-232 port and PowerPort software provides local computer access and a user-friendly, Windows®-based interface for relay settings, and configuration and data retrieval.
- Breaker open/close control from relay faceplate or remotely via communications.
- Remote communications to Eaton PowerNet monitoring system or PC.
- Free PowerPort utility software for local PC interface to the FP-4000 for relay settings, monitoring and control.

Standards and Certifications

Compliance

- UL Recognized, File # E154862.
- UL 1053 (1994) Recognized.
- ANSI C37.90 (1989).
- EN 55011 (1991).
- EN 61000-6-2 (1999).

Emission Tests

- EN 55011 (1991) — Group 1 Class A (CISPR-11, Class A).
- FCC 47 CFR Chapter 1 — Part 15 Subpart b Class A.

Immunity Tests

- ANSI C37.90.1 (1989) — Surge Withstand Capability.
- ANSI C37.90.2 (1995) — EMI Immunity to 35V/m.
- EN 61000-4-2 (1995) — ESD Rating of 8 kV.
- EN 61000-4-3 (1997) — Radiated EM Field at 10V/m.
- EN 61000-4-4 (1995) — Fast Transient Burst at 2 kV.
- EN 61000-4-5 (1995) — Surge Immunity Test.
- EN 61000-4-6 (1996) — Conducted RF at 10V/m.
- EN 61000-4-11 (1994) — Voltage Dips and Variations.
- EN 61000-4-8 — Power Frequency Magnetic Field Immunity.

Control Power

- Control voltage:
  - 48 – 125 Vac/dc
  - 100 – 240 Vac/dc
- Operating voltage:
  - 55 – 264 Vac
  - 38 – 300 Vdc
- Interruption ride-through time: 20 cycle interruption of nominal ac supply.
- Power consumption: 20 VA maximum.

Current Inputs

- Nominal (I_n): 1 A or 5 A.
- CT rating:
  - 2 x I_n continuous
  - 80 x I_n for 1 second
- CT burdens:
  - < 0.25 VA at 5 A (nominal)
  - < 0.05 VA at 1 A (nominal)

Voltage Transformer Inputs

- Nominal: 120 Vac.
- Operating range: 69 – 150 Vac.
- Burden:
  - <0.015 at 120 Vac
  - 1 megaohm

Metering Accuracy

- Phase current:
  - ±0.5% or ±0.025A from 0.02 – 20 per unit fully offset current waveform
- Ground current:
  - ±0.5% of full scale (I_n) from 0.02 – 2.0 per unit fully offset current waveform
- Phase voltage: ±0.5% or ±0.2V from 0 – 160 Vac.
- Frequency measurement accuracy: ±0.02 Hz.
- Phase angle: ±1°.
- Power metering accuracy: ±1.5%.
- Metering accuracy temperature range: 0° – 50°C.
- Temperature range: ±5% for operation below 0°C and above 50°C.
- Relay Outputs:
  - 2 Form C, NO and NC
  - 5 Form A, NO Only
- Input signal frequency necessary for accurate operation:
  - 60 Hz nominal, 57 – 63 Hz (±5%)
  - 50 Hz nominal, 47 – 53 Hz (±5%)
- Clock accuracy:
  - Free running ±1 minute/month at 25°C
  - Clock automatically updated by PowerNet host when present

Product Specifications

Protective Functions

Phase and Ground Overcurrent Protection

- Inverse characteristics: Mod, Very, Extremely, IECA, IECB, IECC, It, I^2t, I^4t, Flat.
- TOC (51) pickup range: 0.1 – 4.0 per unit in 0.01 steps.
- Time multipliers: 0.05 – 10.0 in 0.01 steps.
- IOC (50) pickup range: 0.1 – 20.0 per unit in 0.01 steps.
- Pickup accuracy: ±1% (at 0.1 – 2 per unit).
- Time delay: 0 – 9999 cycles in 1 cycle steps.
- Time accuracy: ±3% or ±30 ms.

Voltage Unbalance (47)

- Threshold (minimum voltage) 1 – 100 volts in 1 volt steps.
- % V2/V1: 4 – 40% in 1% steps.
- Time delay: 0 – 9999 cycles in 1 cycle steps.

Current Unbalance

- Threshold (minimum current) 0.1 – 20.0 per unit in 0.01 steps.
- % I2/I1: 4 – 40% in 1% steps.
- Time delay: 0 – 9999 cycles in 1 cycle steps.

Under/Overvoltage Protection

- Pickup range: 10 – 150 volts in 1 volt steps.
- Time delay: 0 – 9999 cycles in 1 cycle steps.

Under/Overfrequency Protection

- Pickup range: 45 – 65 Hz in 0.01 Hz steps.
- Time delay: 0 – 9999 cycles in 1 cycle steps.

Breaker Failure Protection

- Pickup range: 0.1 – 5.0 per unit in 0.01 steps.
- Time delay: 0 – 9999 cycles in 1 cycle steps.

Power Factor

- Trigger/reset threshold: 0.5 lag to 0.5 lead in 0.01 steps.
- Time delay: 0 – 1000 seconds in 1 second steps.

Discrete Inputs

- Number of contact inputs: 8.
- Rating: 48 Vdc wetting voltage provided with internal ground only.

Output Contacts

- Number of output contacts: Five Form A and two Form C.

Rating of Output Contacts

- Momentary:
  - Make 30 A ac/dc for 0.25 seconds
  - Break 0.25 A at 250 Vdc (resistive)
  - Break 5 A at 120/240 Vac
- Continuous:
  - 5 A at 120/240 Vac
  - 5 A at 30 Vdc

Logic and Control Functions

- Six programmable logic gates for AND, OR, NAND, NOR operation.
- Two latching (flip/flop) gates.
- Six timer gates provide on/off delays.

INCOM Communications

- Baud rate: 9600 fixed.
- Maximum distance: 10,000 feet (3,048 m).
- Protocol: INCOM.

RS-485 Communications, Rear Panel:

- Baud rate: 19.2K, 9.6K
- Protocol: Modbus RTU.

RS-232 Communications, Front Panel

- Baud rate: 38.4K, 19.2K, 9.6K.
- Connector standard 9-pin subminiature, 3-wire.
- Protocol: INCOM.

Environmental Ratings

- Operating temperature: -40° to +60°C (-40° to +140°F) Product tested to +85°C.
- Storage temperature: -40° to +85°C (-40° to +185°F).
- Humidity: 5 – 95% relative humidity (non-condensing).
- Altitude: 0 – 6,350 feet (0 – 1,935 m) above Mean Sea Level.

Dimensions in Inches (mm)

- Behind panel:
  - Height: 10.15 (257.9)
  - Width: 7.62 (193.5)
  - Depth: 7.48 (190.0)
- In front of panel:
  - Height: 10.15 (257.9)
  - Width: 7.62 (193.5)
  - Depth: 0.62 (15.7)

Shipping Weight Lbs. (kg)

- 9.0 (4.1).

Communication Software

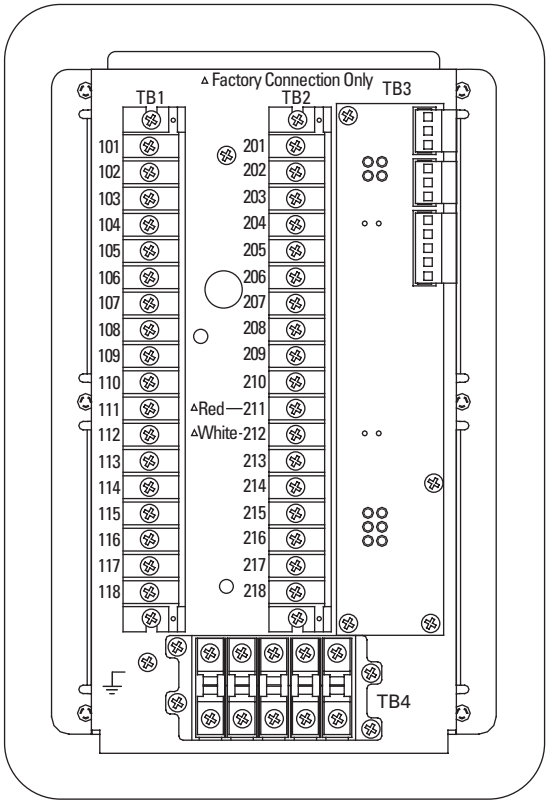
Eaton provides two types of communication software. The first is PowerPort. It runs on a PC or laptop for easy access to a single relay to change set points or configuration and to view metered values and stored data. PowerPort is free and can be downloaded from www.eaton.com; search for 'PowerPort,' then click the download search result.

The second package is PowerNet. PowerNet is a power management software package that is designed for continuous, remote monitoring of many devices. It provides all the functionality of PowerPort plus additional functions such as billing, trending and graphics. Contact your local Eaton representative for more information on PowerNet software.

Technical Data and Specifications

Wiring Diagrams

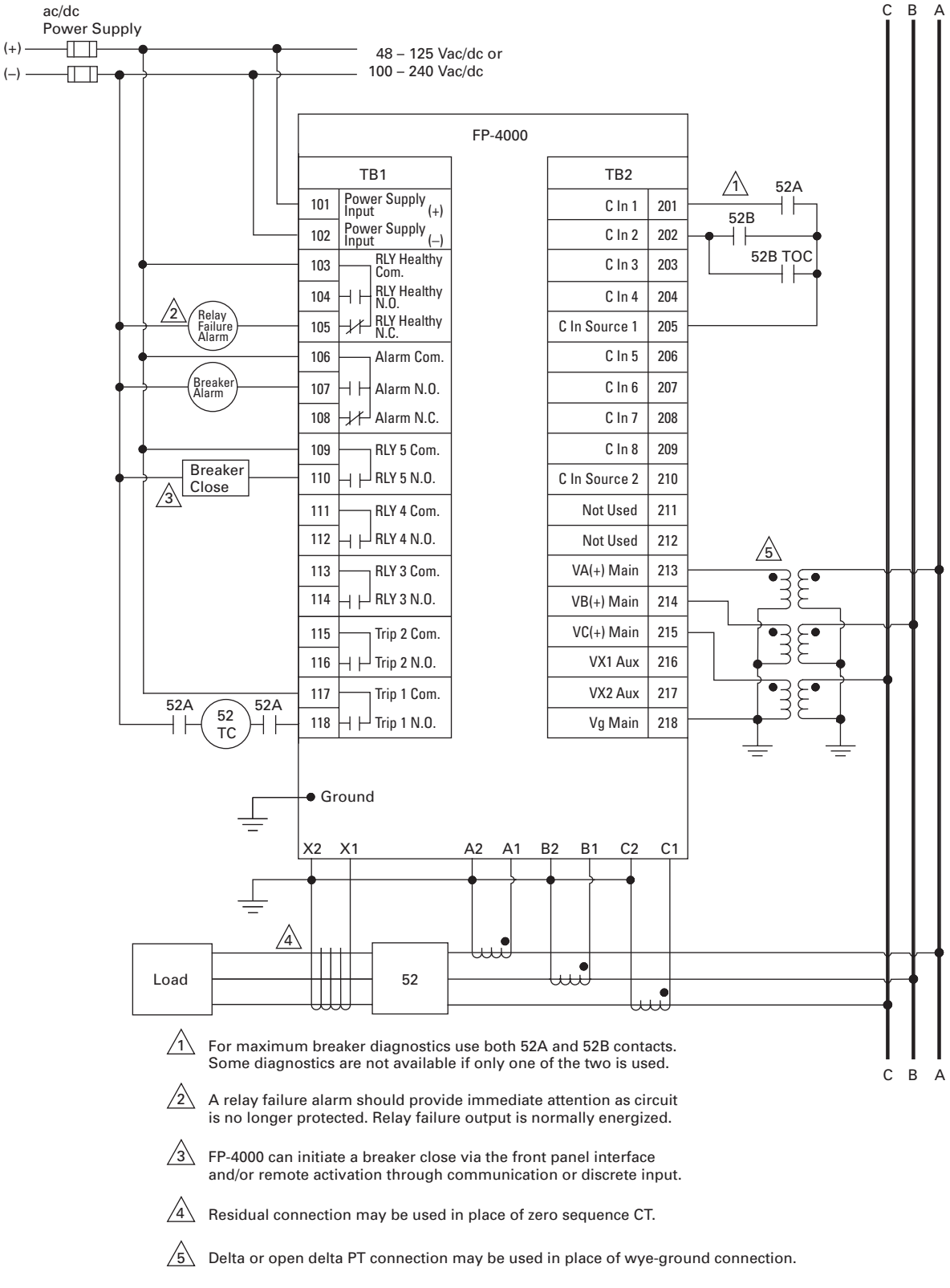
TB1		TB2	
101	Power Supply Input (+)	201	C In 1
102	Power Supply Input (–)	202	C In 2
103	RLY Healthy Com.	203	C In 3
104	RLY Healthy N.O.	204	C In 4
105	RLY Healthy N.C.	205	C In Source 1
106	Alarm Com.	206	C In 5
107	Alarm N.O.	207	C In 6
108	Alarm N.C.	208	C In 7
109	RLY 5 Com.	209	C In 8
110	RLY 5 N.O.	210	C In Source 2
111	RLY 4 Com.	211	Not Used
112	RLY 4 N.O.	212	Not Used
113	RLY 3 Com.	213	VA(+) Main
114	RLY 3 N.O.	214	VB(+) Main
115	Trip 2 Com.	215	VC(+) Main
116	Trip 2 N.O.	216	Vx1 Aux
117	Trip 1 Com.	217	Vx2 Aux
118	Trip 1 N.O.	218	Vg Main



TB3	
J1-1	PowerNet
J1-2	PowerNet
J1-3	PowerNet Shield
J2-1	Accessory Bus
J2-2	Accessory Bus
J2-3	Accessory Bus Shield
J3-1	Zone Out
J3-2	Zone Com.
J3-3	Zone Shield
J3-4	Zone In
J3-5	Zone Com.
J4-1	
J4-2	
J4-3	
J5-1	RS485(+)
J5-2	RS485(-)
J5-3	RS485com
J5-4	RS485shield

A1	B1	C1	X1	N.C. 1
A2	B2	C2	X2	N.C. 2

Figure 56-82. FP-4000 Rear View and Terminal Designations



1 For maximum breaker diagnostics use both 52A and 52B contacts. Some diagnostics are not available if only one of the two is used.

2 A relay failure alarm should provide immediate attention as circuit is no longer protected. Relay failure output is normally energized.

3 FP-4000 can initiate a breaker close via the front panel interface and/or remote activation through communication or discrete input.

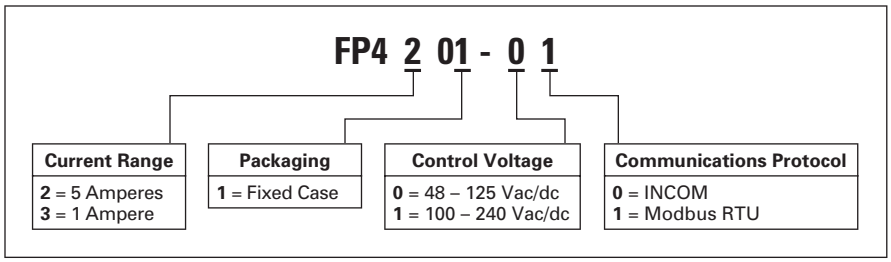
4 Residual connection may be used in place of zero sequence CT.

5 Delta or open delta PT connection may be used in place of wye-ground connection.

Figure 56-83. FP-4000 Typical Connection Drawing Using Wye PTs

Product Selection

Table 56-45. Catalog Numbering Selection Guide



MP-3000 Motor Protection

MP-3000

Product Description

- Microprocessor-based, multi-function motor protection.
- Current only device — no need to add PTs.
- Intel-I-Trip™ overload protection based on motor data.
- Event recording and operational logging.
- Motor Start Profile™.
- Optional Quick Release Drawout Case.
- Used on AMPGARD® and medium voltage assemblies.
- "Help" menu provides user operational assistance.

Application Description

Eaton's MP-3000 motor protection relay is a multifunctional microprocessor-based protective relay for the protection of 3-phase ac motors. The MP-3000 motor relay may be applied to any size motor at any voltage level. It is most commonly used on large, medium voltage 3-phase induction motors. It has also been widely used on important low voltage (480 volt) motor applications and synchronous motors.

The MP-3000 motor relay is a current only device which monitors 3-phase and ground currents. It provides motor overload, stall, short circuit, phase unbalance, single phasing and ground fault motor protection.

It can also be used to provide protection for a load jam or loss of load condition. Please refer to **Figure 56-84**.

The MP-3000 motor relay provides start control logic to protect the motor against excessive starts or starting the motor before it has had sufficient time to cool down. The MP-3000 motor relay may be applied to either across the line starters or reduced voltage starters. On reduced voltage starters, the MP-3000 relay can control the switch from reduced voltage to full voltage based on time and/or motor transition. The MP-3000 can protect the starter against failure to transition to full voltage through contact feedback and an incomplete sequence function.

The MP-3000 motor relay is generally used on a motor starter or a breaker used for a motor load. The MP-3000 motor relay provides the intelligence to protect and control the motor against abnormal operating conditions. It monitors the currents from either a 5 A or 1 A secondary of a CT circuit. Ground current may be obtained from either a ground CT or from the residual connection of the phase CTs. It provides a form C contact output for controlling the starter contacts or breaker operation.

The protection functions are listed below:

- I^2t overload protection (49/51).
- Locked rotor (49S/51).
- Ultimate trip current (51).
- Negative sequence phase unbalance (46).
- Instantaneous overcurrent (50).
- Ground fault protection (50G).
- RTD trip and alarm with URTD module (49/38).
- Underload trip (37).
- Starts per time (66).
- Jam or stall (51R).
- Auto or manual reset (86).
- Fail-safe or non-fail-safe trip modes.

The metering functions are:

- Motor Currents:
  - Average current (Iave)
  - Individual phase and ground current in primary amperes
  - Percent of full load
  - Percent of phase unbalance
- RTD temperatures:
  - Individual winding
  - Motor bearing
  - Load
  - Auxiliary temperatures
- Motor conditions:
  - Percent of I^2t thermal bucket
  - Time before start
  - Remaining starts allowed
  - Oldest start time

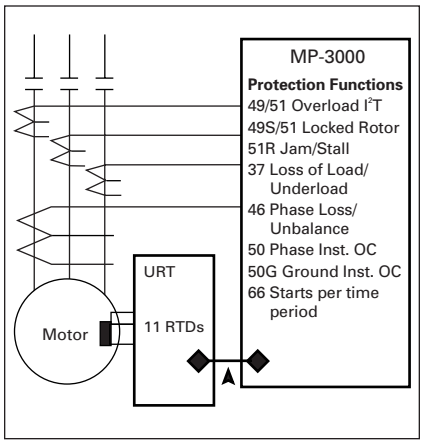


Figure 56-84. MP-3000 Motor Relay Protection Functions

Features, Benefits and Functions

- Complete motor protection and control in a single compact case reduces panel space requirements and wiring costs.
- Microprocessor design with self diagnostics eliminates calibration and reduces installation, commissioning and maintenance.
- Programmable stop 2 – 20% of PCT.
- Intel-I-Trip overload protection develops customized curve from manufacturer's supplied motor data.
- Intel-I-Trip overload protection provides adaptive trip characteristics based on motor temperature when motor RTDs are connected through an optional URTD module.
- Meets UL 1053 ground fault protection standards that eliminates the need for a separate ground relay saving cost, space, wiring and time.
- Voltage dip/loss ride through capability reduces unnecessary trips caused by poor power quality.
- Motor currents, temperatures and conditions are monitored and displayed either locally or remotely.
- Event log provides motor operating records for the most recent 20 Trip or Alarm events with date and time stamping. This information can improve troubleshooting and reduce downtime.
- Log book records the most recent 100 events such as motor START/STOP and set point changes to provide a log of motor operation with date and time stamping.
- RTD diagnostics reduces unnecessary tripping caused by faulty RTD, RTD wiring or communications.
- Arm/Disarm feature improves security for critical motor applications.
- Motor Start profile verifies protection and motor starting coordination. This feature can be used to develop protection settings on old motors where data is not available.
- Optional communication module and Eaton's software simplifies setting, configuration, monitoring, commissioning and data retrieval either locally or remotely.
- Optional Quick Release Drawout Case construction simplifies relay removal and replacement.

Standards and Certifications

The MP-3000 motor protection was designed to meet the industry standards for protective relays. It is recognized under UL 1053 Ground Fault Protection Standard.

- UL recognized (File No. E154862).
- UL 1053 recognized.
- UL 508 recognized.
- ANSI C37.90, C37.90.1.
- cUL.
- CSA.

Options and Accessories

Additional Related Products by Eaton Corporation's Cutler-Hammer® Series

The MP-3000 is available in either a fixed mount or Quick Release Drawout Case. Both mountings use the same panel cutout. **Figure 56-85** shows cutout dimensions. **Figure 56-86** shows a typical fixed mount wiring diagram for a medium voltage motor starter application. **Figure 56-87** shows the fixed mount terminal designation. **Figure 56-88** shows the drawout case panel mounting, and shows the drawout case terminal designation.

The Universal RTD module (URTD) is required when the motor is equipped with RTDs that you wish to monitor and use for protection. The URTD can be mounted near the motor to reduce RTD wiring and costs. **Figure 56-90** shows MP-3000 and URTD interconnection wiring. Please refer to the URTD information described elsewhere in this catalog.

The MP-3000 motor protection is designed to operate from 120 Vac or 240 Vac auxiliary control power. The MP-3000 motor relay can be used with dc control power with the addition of the IQDCPS. The IQDCPS is an inverter from dc to ac.

Product Specifications

Control Power

- Nominal rating:
  - 120 Vac or 240 Vac
  - +10%, -25%
- Operating range:
  - 120 Vac: 90 132 Vac
  - 240 Vac:180 264 Vac
- Frequency: 50 or 60 Hz
- Power use:
  - 20 VA maximum
  - URTD: 6 VA maximum
  - IPONI: 1 VA maximum
- Ride-through time: 30 cycles from nominal Vac.

Current Inputs

- Nominal (I_n): 1A or 5A.
- CT rating:
  - 2 x I_n continuous
  - 50 x I_n for 1 second
- Burdens:
  - < 0.25 VA at 5A
  - < 0.05 VA at 1A

Metering Accuracy

- Phase current: ±1% of I_n (5 – 100%).
- Ground current: ±1.5% of I_n (0 – 55%).

Discrete Inputs

- Number of inputs: 2 programmable.
- Ratings:
  - 1.2 VA at 120 Vac
  - Maximum off = 36 Vac
  - Minimum on = 86 Vac

Output Contacts

- Number of outputs: 4 Form C, programmable.
- Momentary:
  - Make 30 A ac/dc for 0.25 seconds
  - Break 0.25 A at 250 Vdc (Resistive)
  - Break 5 A at 120 240 Vac
- Continuous:
  - 5 A at 120/240 Vac
  - 5 A at 30 Vdc

Analog Output
- Rating: ± 4 – 20 mA programmable.
- Maximum load: 1K ohm.
- Accuracy: 1%.

Motor Overload Protection (I^2t)
- Full load amperes: 10 – 3000 A.
- Locked rotor current: 300 – 1200% FLA.
- Locked rotor time: 1 – 120 seconds.
- Ultimate trip current: 85 – 150% FLA.
- Phase CT ratio: 10 – 4000 (I_n).
- Ground CT ratio: 10 – 4000 (I_n).
- Timing accuracy: ± 2.5% or ±30 mS for I > 1.1x U.T.C.

Trip Setting Range
- Ground fault (GF): Off, 2 – 55% CT ratio.
- GF start time delay: 2 – 60 cycles.
- GF run time delay: 0 – 60 cycles.
- Timer accuracy: ± 20 mS.
- Instantaneous O.C.: Off, 300 – 1600% FLA.
- IOC start time delay: 2 – 60 cycles.
- Timer accuracy: ±20 mS.
- JAM trip: Off, 100 – 1200% FLA.
- Underload trip: Off, 1 – 90% FLA.
- Phase unbalance trip: Off, 4 – 40% I_{neg}/I_{pos}.
- Start delay timers:
  - ❑ 0 – 120 seconds (underload and phase unbalance)
  - ❑ 0 – 1200 seconds (jam)
- Run delay timers: 0 – 240 seconds.
- Timer accuracy: ± .5% + 100 mS.

Alarm Setting Range
- Ground fault: Off, 2 – 55% CT ratio.
- Overload I^2t: Off, 60 – 99% I^2t.
- JAM: Off, 100 – 1200% FLA.
- Underload: Off, 1 – 90% FLA.
- Phase unbalance: Off, 4 – 40% I_{neg}/I_{pos}.
- Run delay timers: 0 – 240 seconds.

Start Control Functions
- Starts per time: 1 – 10 starts.
- Time for starts per time: Off, 1 – 240 minutes.
- Time between starts: Off, 1 – 240 minutes.
- Number of cold starts: 1 – 5 starts.
- Motor transition current: 10 – 300% FLA.
- Time for transition: 0 – 1200 seconds.
- Inc. sequence timer: Off, 1 – 240 seconds.
- Long acceleration timer: Off, 1 – 1200 seconds.
- Anti-Backspin timer: Off, 1 – 3600 minutes.

RTD Inputs (Requires URTD module)
- Sensor types:
  - ❑ 10 ohm copper
  - ❑ 100 ohm nickel
  - ❑ 120 ohm nickel
  - ❑ 100 ohm platinum

URTD Module Communications
- Interface:
  - ❑ Electrical (3-wire)
  - ❑ Fiber optic (preferred)
- Fiber optic cable: Type HBFR-ERS or EUS.

Clock
- Accuracy: ±1 minute/month at 25°C.

IPONI Communications
- Type: 2-wire, FSK.
- Baud rate: 1200 or 9600 baud.
- Protocol: INCOM.
- Functions:
  - ❑ Read/write set points
  - ❑ Read metered values
  - ❑ Read trip/alarms
  - ❑ Read events/history
  - ❑ View starting profile

MPONI Communications
- Type: 5-wire, 485.
- Baud rate: 1200 or 9600 baud.
- Protocol: Modbus RTU.
- Functions:
  - ❑ Read/write set points
  - ❑ Read metered values
  - ❑ Read trip/alarms
  - ❑ Read events/history
  - ❑ View starting profile

DPONI Communications
- Type: J-wire.
- Baud rate: 500k, 250k, 125k.
- Protocol: DeviceNet.
- Functions:
  - ❑ Read metered values
  - ❑ Read trip/alarms

Logging
- Log book: 100 events.
- Log event: 20 trips and alarms.
- Log start: Last 4 starts.
- Start profile: Last 4 starts (communication only).
- History records: Motor, trips, alarms and total records.

Environmental Conditions
- Operating temperature: -20° to +60°C.
- Storage temperature: 45° to +85°C.
- Humidity: 0 – 95% noncondensing.

Dimensions in Inches (mm)
- Height: 10.25 (260.4).
- Width: 6.72 (170.7).
- Depth: 3.70 (94.0).

Shipping Weight Lbs. (kg)
- 7 (3.2).

Technical Data and Specifications

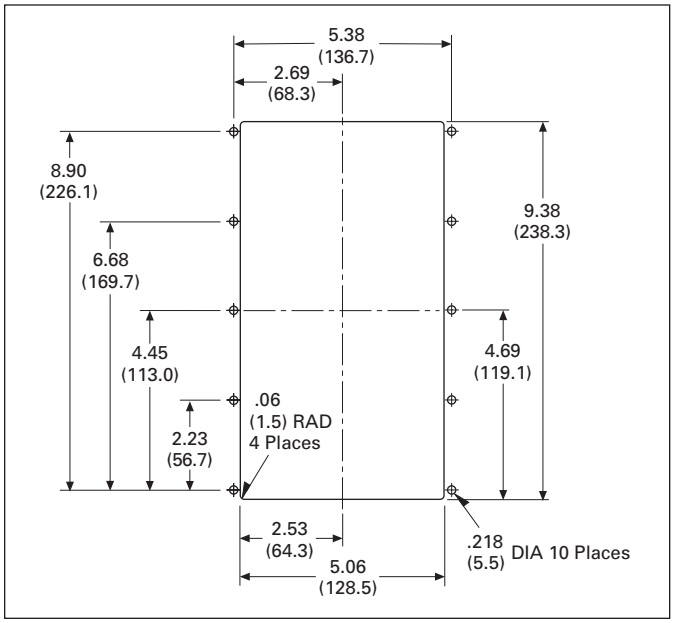


Figure 56-85. Panel Cutout Diagram —Dimensions in Inches (mm)

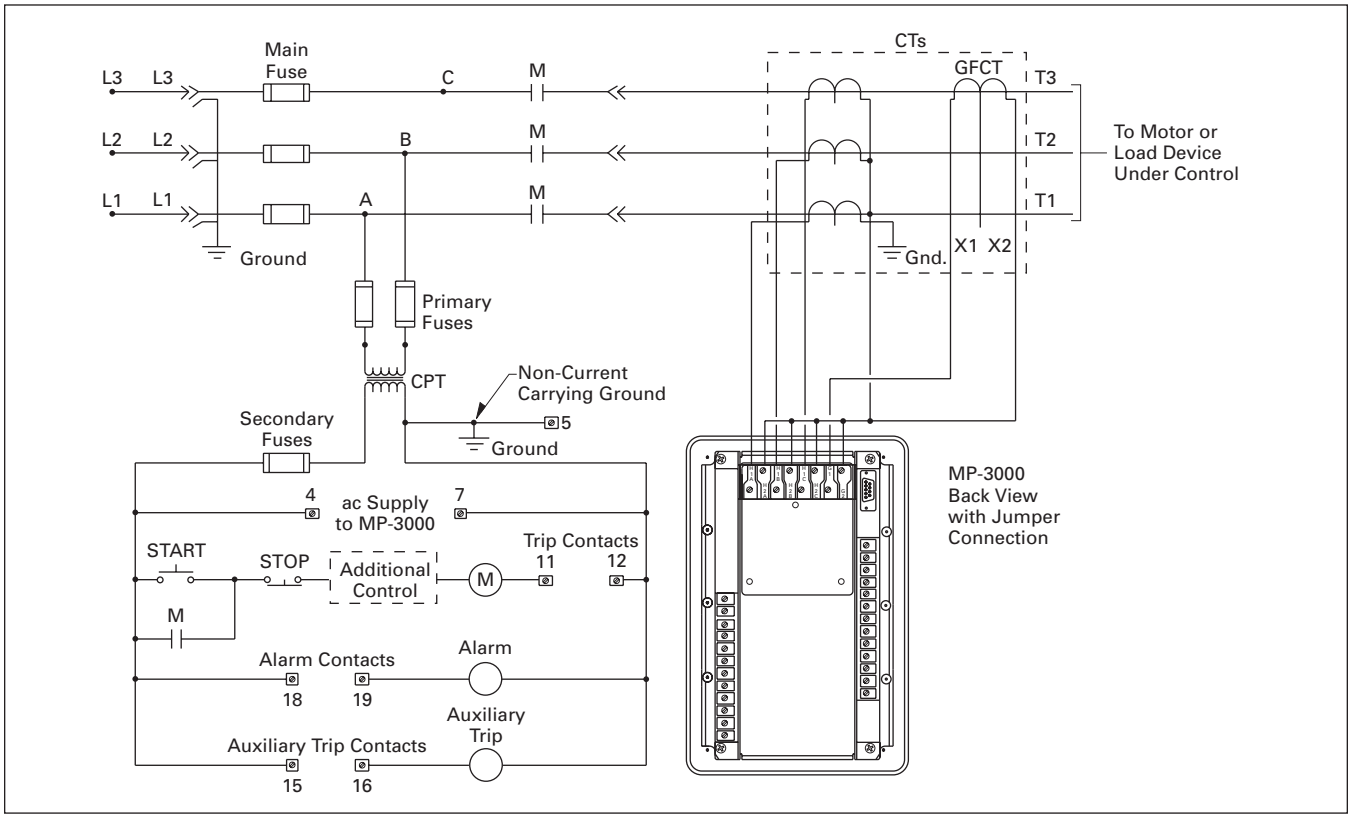


Figure 56-86. MP-3000 Fixed Mount Typical Wiring Diagram

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Wiring Diagram

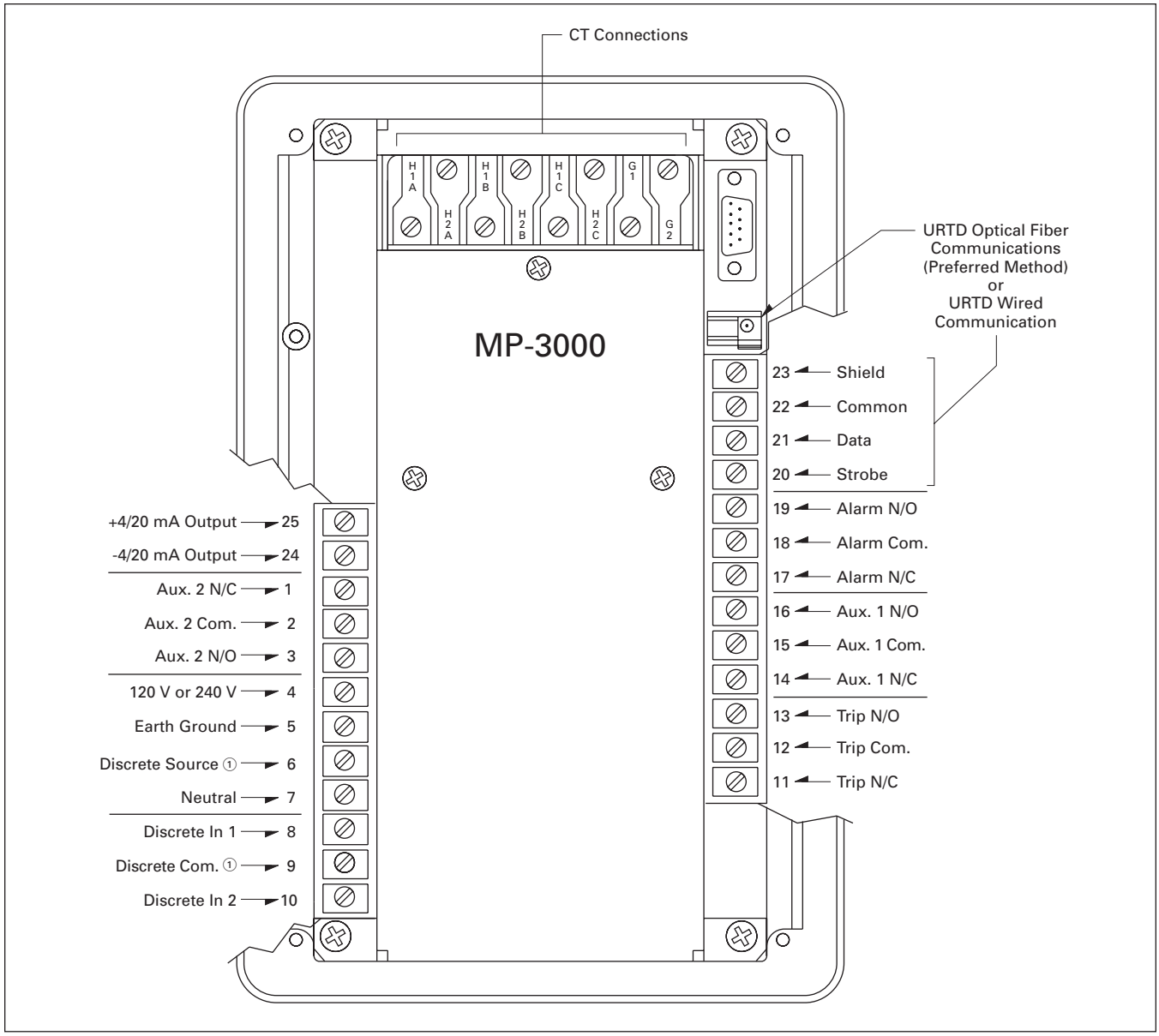


Figure 56-87. MP-3000 Terminal Identification

① **Caution:** Do not connect terminals 6 and 9 together.

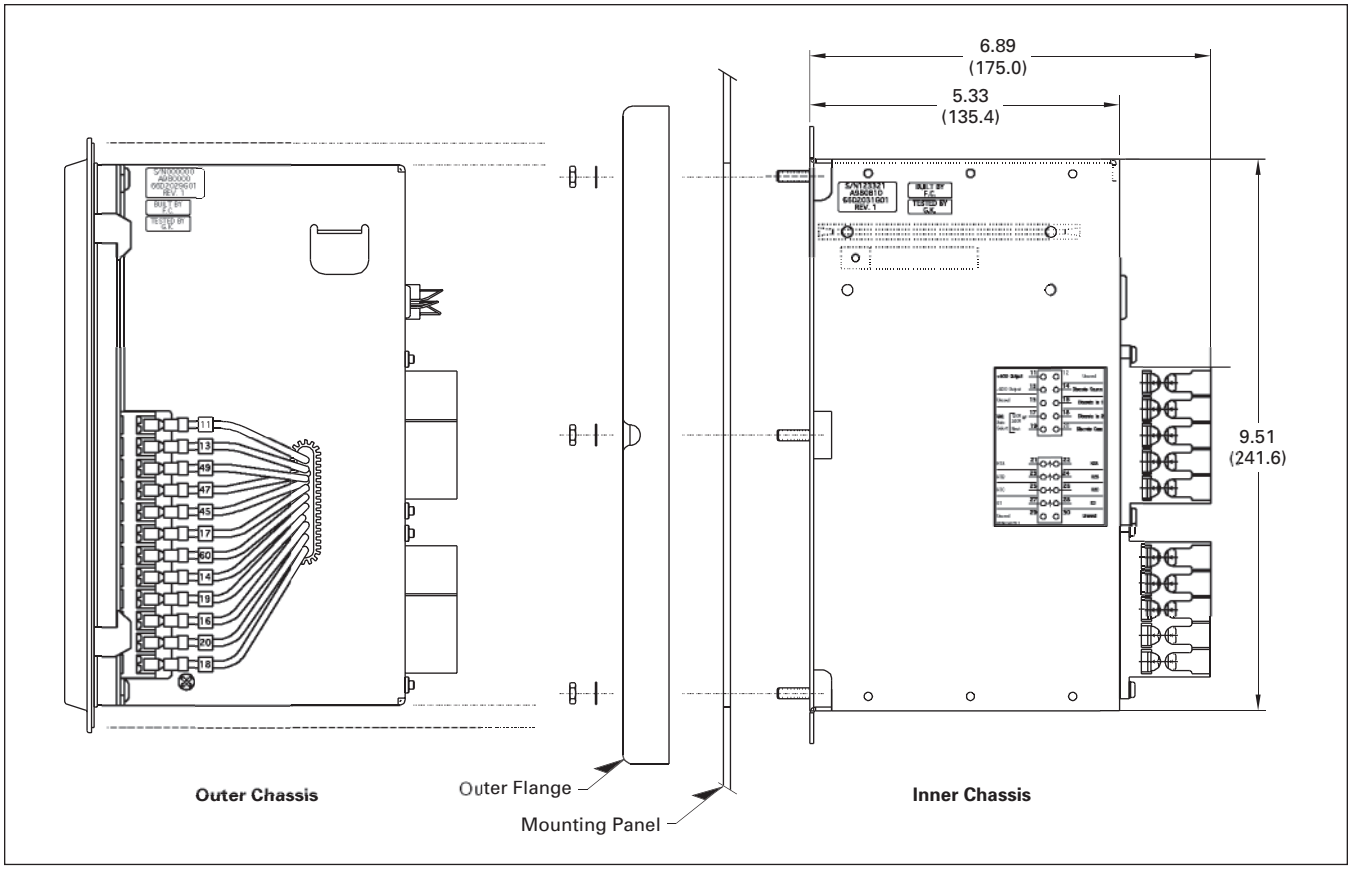


Figure 56-88. MP-3000 Drawout Panel Mounting — Dimensions in Inches (mm)

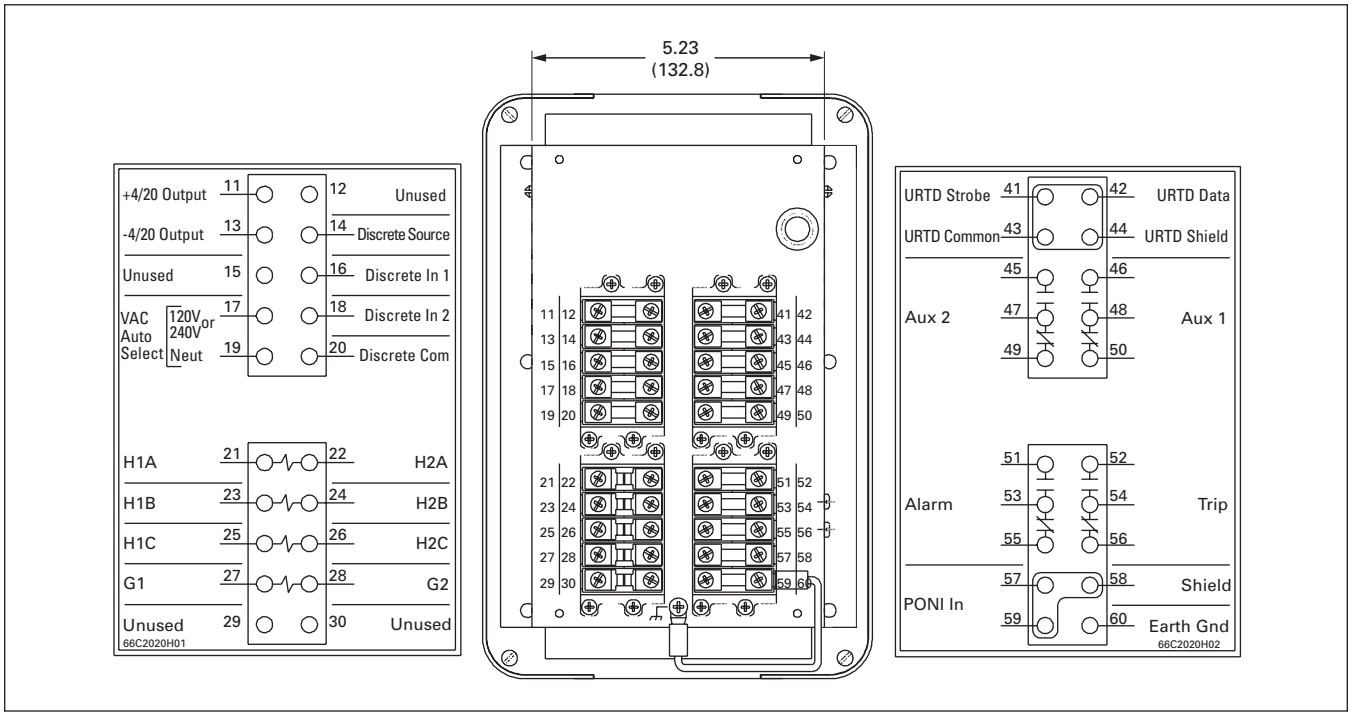


Figure 56-89. Rear View of MP-3000 Drawout Outer Case — Dimensions in Inches (mm)

Wiring Diagram

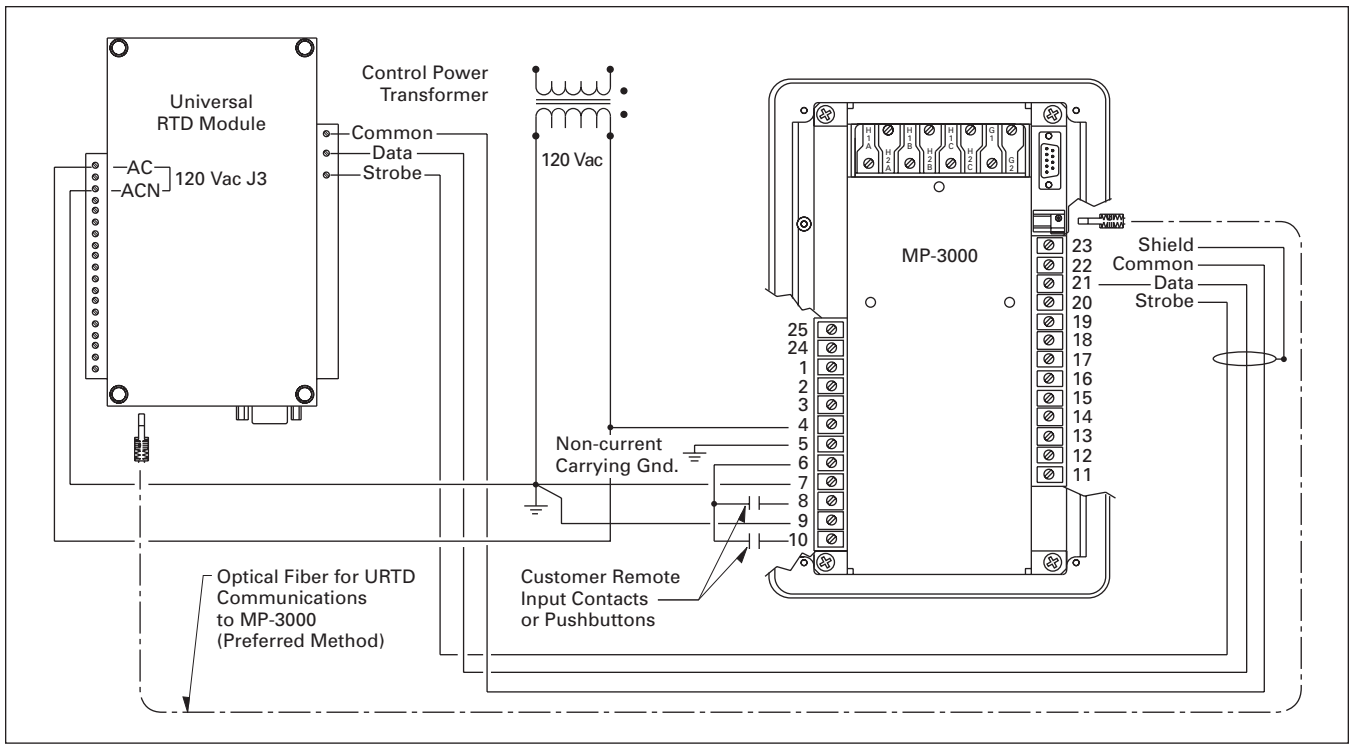
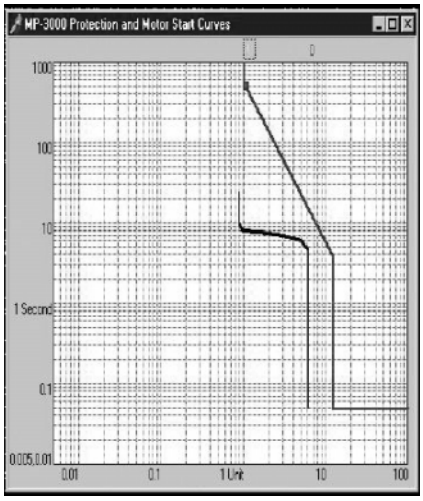


Figure 56-90. MP-3000 Control and URTD Wiring

Technical Data and Specifications

The MP-3000 motor relay records information on the most recent four (4) starts. It records currents, percent of I^2t used, percent unbalance, RTD temperatures and time to transition and run. In addition, a motor start profile can be downloaded and displayed using Eaton's PowerPort or PowerNet Software. The starting profile shows the motor starting current plotted against the relay protection curve. This provides a quick view of the coordination between the protection and actual motor start current.



Motor Starting Profile Time/Current Chart

When communications are desired, an optional communication module or PONI (Product Operated Network Interface) is required. The MP-3000 is compatible with an INCOM (IPONI), Modbus RTU (MPONI) or Ethernet (EPONI). Future communication modules are planned to interface with other systems using other protocols. Please consult factory for availability of other communication options. **Figure 56-91** shows typical mounting of MP-3000 with optional PONI and with URTD module and PONI.

When the MP-3000 is supplied in the optional drawout case, then the INCOM (IPONI) is the only communication option available. The communication option must be selected at the time of order.

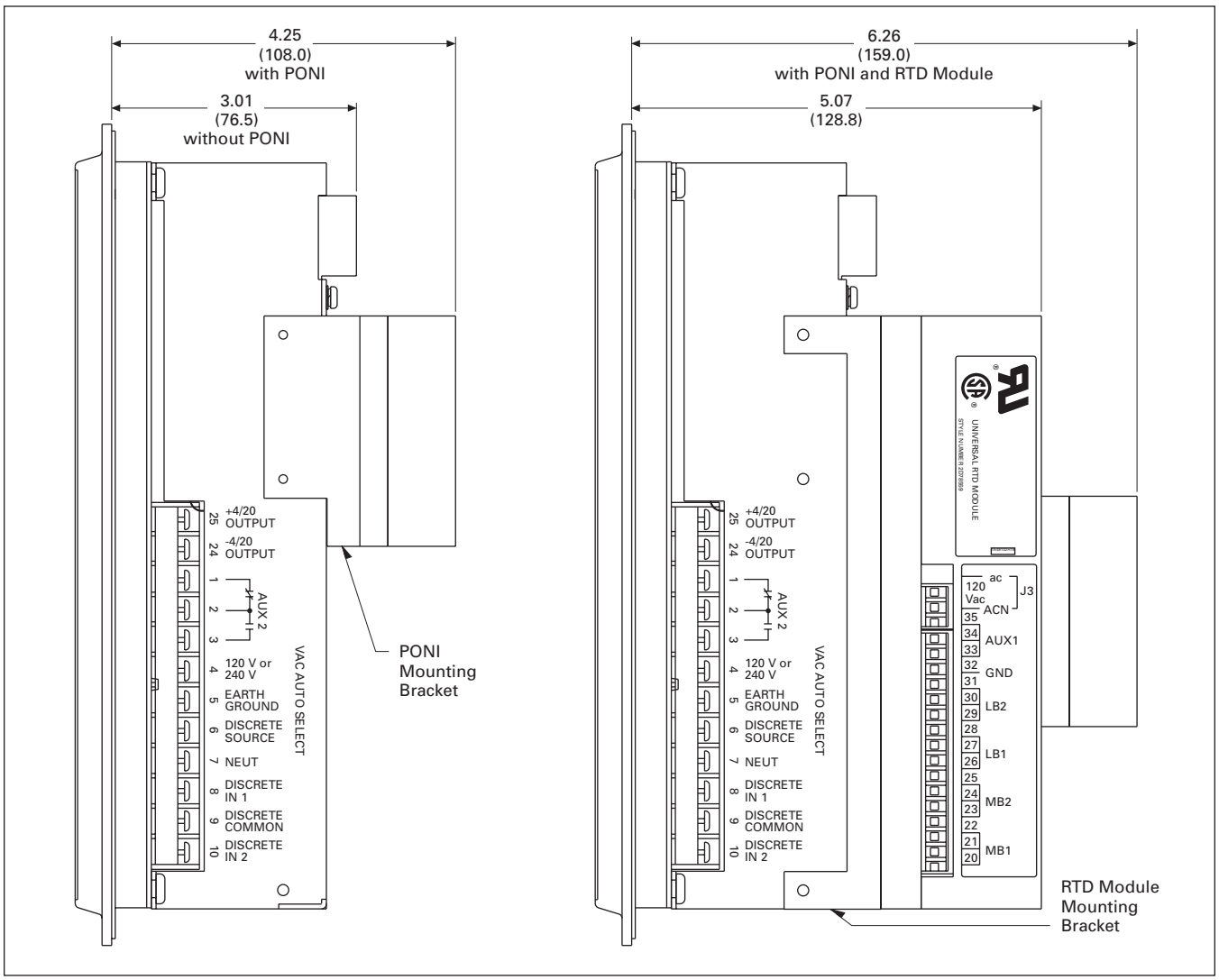


Figure 56-91. MP-3000 PONI and URTD Mounting — Dimensions in Inches (mm)

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Product Selection

Table 56-46. MP-3000

Description	Catalog Number
MP-3000 Drawout, 5A with RS-232	**MP3011**
MP-3000 Drawout, INCOM, 5A with RS-232	**MP3012**
MP-3000 Drawout, Modbus, 5A with RS-232	**MP3013**
MP-3000 Drawout, DeviceNet, 5A with RS-232	**MP3014**
MP-3000 Drawout, 1A with RS-232	**MP3111**
MP-3000 Drawout, INCOM, 1A with RS-232	**MP3112**
MP-3000 Drawout, Modbus, 1A with RS-232	**MP3113**
MP-3000 Drawout, DeviceNet, 1A with RS-232	**MP3114**
MP-3000 Fixed Case, 5A with RS-232	**MP3010**
MP-3000 Fixed Case, INCOM, 5A with RS-232	**MP3010-INCOM**
MP-3000 Fixed Case, Modbus, 5A with RS-232	**MP3010MODBUS**
MP-3000 Fixed Case, DeviceNet, 5A with RS-232	**MP3010DEVICEN**
MP-3000 Fixed Case, 1A with RS-232	**MP3110**
MP-3000 Fixed Case, INCOM, 1A with RS-232	**MP3110-INCOM**
MP-3000 Fixed Case, Modbus, 1A with RS-232	**MP3110MODBUS**
MP-3000 Fixed Case, DeviceNet, 1A with RS-232	**MP3110DEVICEN**
MP-3000 Fixed Case, INCOM, 5A with RS-232, URTD	**MP3010VPI**
MP-3000 Fixed Case, Modbus, 5A with RS-232, URTD	**MP3010VPM**
MP-3000 Fixed Case, DeviceNet, 5A with RS-232, URTD	**MP3010VPD**
MP-3000 Fixed Case, INCOM, 1A with RS-232, URTD	**MP3110VPI**
MP-3000 Fixed Case, Modbus, 1A with RS-232, URTD	**MP3110VPM**
MP-3000 Fixed Case, DeviceNet, 1A with RS-232, URTD	**MP3110VPD**

MP-4000 Motor Protection

MP-4000

Product Description

- Microprocessor-based, multi-function motor protection.
- Intel-I-Trip overload protection based on motor data.
- Event recording and operational logging.
- Motor Start Profile.
- Optional Quick Release Drawout Case.
- Used on AMPGARD and medium voltage assemblies.
- "Help" menu provides user operational assistance.

Application Description

Eaton's MP-4000 motor protection relay is a multifunctional microprocessor-based protective relay for the protection of 3-phase ac motors. The MP-4000 motor relay may be applied to any size motor at any voltage level. It is most commonly used on large, medium voltage 3-phase induction motors. It has also been widely used on important low voltage (480 volt) motor applications and synchronous motors.

The MP-4000 motor relay monitors 3-phase and ground currents, and 3-phase voltages. It provides motor overload, stall, short circuit, phase unbalance, single phasing over/under-voltage, underpower, power factor and ground fault motor protection.

It can also be used to provide protection for a load jam or loss of load condition.

The MP-4000 motor relay provides start control logic to protect the motor against excessive starts or starting the motor before it has had sufficient time to cool down. The MP-4000 motor relay may be applied to either across the line starters or reduced voltage starters. On reduced voltage starters, the MP-4000 relay can control the switch from reduced voltage to full voltage based on time and/or motor transition. The MP-4000 can protect the starter against failure to transition to full voltage through contact feedback and an incomplete sequence function.

The MP-4000 motor relay is generally used on a motor starter or a breaker used for a motor load. The MP-4000 motor relay provides the intelligence to protect and control the motor against abnormal operating conditions. It monitors the currents from either a 5 A or 1 A secondary of a CT circuit. Ground current may be obtained from either a ground CT or from the residual connection of the phase CTs. It provides a form C contact output for controlling the starter contacts or breaker operation.

The protection functions are listed below:

- I^2t overload protection (49/51).
- Locked rotor (49S/51).
- Ultimate trip current (51).
- Negative sequence phase unbalance (46).
- Instantaneous overcurrent (50).
- Ground fault protection (50G).
- Undervoltage (27).
- Overvoltage (59).
- Under power (32).
- Negative sequence voltage unbalance (47).
- Power factor (55).
- RTD trip and alarm with URTD module (49/38).
- Underload trip (37).
- Starts per time (66).
- Jam or stall (51R).
- Auto or manual reset (86).
- Fail-safe or non-fail-safe trip modes.

The metering functions are:

- Metering:
  - Average current
  - Amperes: magnitude and angle in primary values
  - Amperes: positive, negative and zero sequence
  - Average voltage (V ave)
  - Voltage: magnitude and angle
  - Voltage: positive, negative and zero sequence
  - % of full load
  - % current unbalance
  - % voltage unbalance
  - Power, vars and VA
  - Power factor
  - Frequency
  - Energy metering with time and date stamps
- RTD temperatures:
  - Individual winding
  - Motor bearing
  - Load
  - Auxiliary temperatures
- Motor conditions:
  - Percent of I^2t thermal bucket
  - Time before start
  - Remaining starts allowed
  - Oldest start time

Features, Benefits and Functions

- Complete motor protection and control in a single compact case reduces panel space requirements and wiring costs.
- Microprocessor design with self diagnostics eliminates calibration and reduces installation, commissioning and maintenance.
- Programmable stop 2 – 20% of PCT.
- Intel-I-Trip overload protection develops customized curve from manufacturer's supplied motor data.
- Intel-I-Trip overload protection provides adaptive trip characteristics based on motor temperature when motor RTDs are connected through an optional URTD module.
- Meets UL 1053 ground fault protection standards that eliminates the need for a separate ground relay saving cost, space, wiring and time.
- Voltage dip/loss ride through capability reduces unnecessary trips caused by poor power quality.
- Motor currents, temperatures and conditions are monitored and displayed either locally or remotely.
- Event log provides motor operating records for the most recent 20 Trip or Alarm events with date and time stamping. This information can improve troubleshooting and reduce downtime.
- Log book records the most recent 100 events such as motor START/STOP and set point changes to provide a log of motor operation with date and time stamping.
- RTD diagnostics reduces unnecessary tripping caused by faulty RTD, RTD wiring or communications.
- Arm/Disarm feature improves security for critical motor applications.
- Motor Start profile verifies protection and motor starting coordination. This feature can be used to develop protection settings on old motors where data is not available.
- Optional communication module and Eaton's software simplifies setting, configuration, monitoring, commissioning and data retrieval either locally or remotely.
- Optional Quick Release Drawout Case construction simplifies relay removal and replacement.

Standards and Certifications

The MP-4000 motor protection was designed to meet the industry standards for protective relays. It is recognized under UL 1053 Ground Fault Protection Standard.

- UL recognized (File No. E154862).
- UL 1053 recognized.
- UL 508 recognized.
- ANSI C37.90, C37.90.1.
- cUL.
- CSA.

Additional Related Products by Eaton Corporation's Cutler-Hammer Series

The MP-4000 is available in either a fixed mount or Quick Release Drawout Case. Both mountings use the same panel cutout.

The Universal RTD module (URTD) is required when the motor is equipped with RTDs that you wish to monitor and use for protection. The URTD can be mounted near the motor to reduce RTD wiring and costs.

The MP-4000 motor protection is designed to operate from 120 Vac or 240 Vac auxiliary control power. The MP-4000 motor relay can be used with dc control power with the addition of the IQDCPS. The IQDCPS is an inverter from dc to ac.

Options and Accessories

Table 56-47. MP-4000 Ordering Information

Description	Catalog Number
MP-4000 Drawout, 5A with RS-232 MP-4000 Drawout, INCOM, 5A with RS-232 MP-4000 Drawout, Modbus, 5A with RS-232	**MP4011** **MP4012** **MP4013**
MP-4000 Drawout, DeviceNet, 5A with RS-232 MP-4000 Drawout, 1A with RS-232 MP-4000 Drawout, INCOM, 1A with RS-232	**MP4014** **MP4111** **MP4112**
MP-4000 Drawout, Modbus, 1A with RS-232 MP-4000 Drawout, DeviceNet, 1A with RS-232 MP-4000 Fixed Case, 5A with RS-232	**MP4113** **MP4114** **MP4010**
MP-4000 Fixed Case, INCOM, 5A with RS-232 MP-4000 Fixed Case, Modbus, 5A with RS-232 MP-4000 Fixed Case, DeviceNet, 5A with RS-232	**MP4010INCOM** **MP4010MODBUS** **MP4010DEVICEN**
MP-4000 Fixed Case, 1A with RS-232 MP-4000 Fixed Case, INCOM, 1A with RS-232 MP-4000 Fixed Case, Modbus, 1A with RS-232	**MP4110** **MP4110INCOM** **MP4110MODBUS**
MP-4000 Fixed Case, DeviceNet, 1A with RS-232 MP-4000 Fixed Case, INCOM, 5A with RS-232, URTD MP-4000 Fixed Case, Modbus, 5A with RS-232, URTD	**MP4110DEVICEN** **MP4010VPI** **MP4010VPM**
MP-4000 Fixed Case, DeviceNet, 5A with RS-232, URTD MP-4000 Fixed Case, INCOM, 1A with RS-232, URTD MP-4000 Fixed Case, Modbus, 1A with RS-232, URTD MP-4000 Fixed Case, DeviceNet, 1A with RS-232, URTD	**MP4010VPD** **MP4110VPI** **MP4110VPM** **MP4110VPD**

Product Specifications

Control Power

- Nominal rating:
  - 120 Vac or 240 Vac
  - +10%, -25%
- Operating range:
  - 120 Vac: 90 132 Vac
  - 240 Vac:180 264 Vac
- Frequency: 50 or 60 Hz
- Power use:
  - 20 VA maximum
  - URTD: 6 VA maximum
  - IPONI: 1 VA maximum
- Ride-through time: 30 cycles from nominal Vac.

Current Inputs

- Nominal (I_n): 1A or 5A.
- CT rating:
  - 2 x I_n continuous
  - 50 x I_n for 1 second
- Burdens:
  - < 0.25 VA at 5A
  - < 0.05 VA at 1A

Voltage Inputs

- Nominal: 120 Vac.
- Operating range: 69 to 150 Vac.
- Burden: 2 VA.

Metering Accuracy
- Phase current: ±1% of I_n (5 – 100%).
- Ground current: ±1.5% of I_n (0 – 55%).

Discrete Inputs
- Number of inputs: 2 programmable.
- Ratings:
  - 1.2 VA at 120 Vac
  - Maximum off = 36 Vac
  - Minimum on = 86 Vac

Output Contacts
- Number of outputs: 4 Form C, programmable.
- Momentary:
  - Make 30 A ac/dc for 0.25 seconds
  - Break 0.25 A at 250 Vdc (Resistive)
  - Break 5 A at 120 240 Vac
- Continuous:
  - 5 A at 120/240 Vac
  - 5 A at 30 Vdc

Analog Output
- Rating: ± 4 – 20 mA programmable.
- Maximum load: 1K ohm.
- Accuracy: 1%.

Motor Overload Protection (I^2t)
- Full load amperes: 10 – 3000 A.
- Locked rotor current: 300 – 1200% FLA.
- Locked rotor time: 1 – 120 seconds.
- Ultimate trip current: 85 – 150% FLA.
- Phase CT ratio: 10 – 4000 (I_n).
- Ground CT ratio: 10 – 4000 (I_n).
- Timing accuracy: ± 2.5% or ±30 mS for I > 1.1x U.T.C.

Trip Setting Range
- Ground fault (GF): Off, 2 – 55% CT ratio.
- GF start time delay: 2 – 60 cycles.
- GF run time delay: 0 – 60 cycles.
- Timer accuracy: ± 20 mS.
- Instantaneous O.C.: Off, 300 – 1600% FLA.
- IOC start time delay: 2 – 60 cycles.
- Timer accuracy: ±20 mS.
- JAM trip: Off, 100 – 1200% FLA.
- Underload trip: Off, 1 – 90% FLA.
- Current unbalance trip: Off, 4 – 40% I_{neg}/I_{pos}.
- Start delay timers:
  - 0 – 120 seconds (underload and phase unbalance)
  - 0 – 1200 seconds (jam)
- Run delay timers: 0 – 240 seconds.
- Timer accuracy: ± .5% + 100 mS.
- Voltage unbalance: Off, 1 to 100 V.
- % V2/V1: 4% + 40%.
- Voltage unbalance time delay: 0 to 1200 sec.
- Under/overvoltage time delay: Off, 10 to 150 V.
- Under/overvoltage time delay: 0 to 1200 sec.
- Under/overfrequency: Off, 15 to 60 Hz.
- Under/overfrequency time delay: 0 to 60 sec.
- Power protection: Off, 0.06 to .90 + FLA VT.
- Power time delay: 0 to 1200 sec.
- Power factor: Off, 0.05 lag to 0.99 lead.
- Power factor time delay: 0 to 60 sec.

Alarm Setting Range
- Ground fault: Off, 2 – 55% CT ratio.
- Overload I^2t: Off, 60 – 99% I^2t.
- JAM: Off, 100 – 1200% FLA.
- Underload: Off, 1 – 90% FLA.
- Phase unbalance: Off, 4 – 40% I_{neg}/I_{pos}.
- Run delay timers: 0 – 240 seconds.

Start Control Functions
- Starts per time: 1 – 10 starts.
- Time for starts per time: Off, 1 – 240 minutes.
- Time between starts: Off, 1 – 240 minutes.
- Number of cold starts: 1 – 5 starts.
- Motor transition current: 10 – 300% FLA.
- Time for transition: 0 – 1200 seconds.
- Inc. sequence timer: Off, 1 – 240 seconds.
- Long acceleration timer: Off, 1 – 1200 seconds.
- Anti-Backspin timer: Off, 1 – 3600 minutes.

RTD Inputs (Requires URTD module)
- Sensor types:
  - 10 ohm copper
  - 100 ohm nickel
  - 120 ohm nickel
  - 100 ohm platinum

URTD Module Communications
- Interface:
  - Electrical (3-wire)
  - Fiber optic (preferred)
- Fiber optic cable: Type HBFR-ERS or EUS.

Clock
- Accuracy: ±1 minute/month at 25°C.

IPONI Communications
- Type: 2-wire, FSK.
- Baud rate: 1200 or 9600 baud.
- Protocol: INCOM.
- Functions:
  - Read/write set points
  - Read metered values
  - Read trip/alarms
  - Read events/history
  - View starting profile

MPONI Communications
- Type: 5-wire, 485.
- Baud rate: 1200 or 9600 baud.
- Protocol: Modbus RTU.
- Functions:
  - Read metered values
  - Read trip/alarms

DPONI Communications
- Type: J-wire.
- Baud rate: 500k, 250k, 125k
- Protocol: DeviceNet.
- Functions:
  - Read metered values
  - Read trip/alarms

Logging
- Log book: 100 events.
- Log event: 20 trips and alarms.
- Log start: Last 4 starts.
- Start profile: Last 4 starts (communication only).
- History records: Motor, trips, alarms and total records.

Environmental Conditions
- Operating temperature: -20° to +60°C.
- Storage temperature: 45° to +85°C.
- Humidity: 0 – 95% noncondensing.

Dimensions in Inches (mm)
- Height: 10.25 (260.4).
- Width: 6.72 (170.7).
- Depth: 3.70 (94.0).

Shipping Weight Lbs. (kg)
- 7 (3.2).

Cross-Reference

Westinghouse®/Cutler-Hammer

Eaton's Cutler-Hammer MP-3000 motor relay supersedes the Cutler-Hammer (formerly Westinghouse) IQ 1000 II motor relay and can replace the earlier IQ 1000 motor relay version sold under the Westinghouse name. The MP-3000 motor relay fits in the same cut out and provides the protection functions of these older models. The MP-3000 relay provides numerous enhancements and new features over the superseded models. The most notable enhancements are UL 1053 ground fault protection certified, voltage loss ride through capability, data logging, communications features and the addition of a clock for date and time stamping of events.

GE Multilin™

GE Multilin have several product offerings for motor protection. The 269 PLUS is the equivalent model to the MP-3000 with optional URTD module. Eaton offers MP-3000 value packs that include an MP-3000, PONI, URTD module and fiber optic cable at competitive prices.

GE Multilin has both lower and higher end products. The MP-3000 can be used in place of their 239 motor relay. The MP-3000 offers more capabilities than the 239 for a slightly higher price.

GE Multilin 369 and 469 are upgraded end products. The MP-3000 relay offers equivalent overload and current protection functions. It also provides equivalent start control functions. Both the 369 and 469 offer voltage protection and metering functions. An Eaton meter and/or other manufacturers' protective relays may be needed to satisfy the customer's motor protection requirements. The 469 adds differential protection. This function must be supplied by others in addition to the MP-3000 motor relay.

Table 56-48. Cross-Reference

New Eaton's Cutler-Hammer Series	Old Cutler-Hammer (Westinghouse)	GE Multilin
MP-3000 (URTD module) ①	IQ1000 II, IQ1000	269 269+ 239 base 369
MP-4000 (URTD module) ①	—	369 with voltage option
MP-4000 + MP-3000	—	469

① If RTD monitoring required.

MD-3000 Motor/Generator Differential Relay

MD-3000

Product Description

Eaton's MD-3000 Protective Relay is a microprocessor-based sensitive 3-phase instantaneous OC-trip relay designed for both ANSI and IEC applications. The MD-3000 is suitable for use as a motor/generator differential relay.

The MD-3000 Relay operates from the 5 ampere secondary output of standard current transformers. Current transformer ratio information is quickly programmed into the unit via settings. The MD-3000 features a user-friendly operator panel to monitor, program and test the relay. Operating parameters and troubleshooting information are displayed in the two display windows.

Features, Benefits and Functions

- ANSI or IEC applications.
- Phase differential currents.
- Monitoring and reporting of magnitude and phase of current causing trip.
- Relay failure alarm contact.
- Trip alarm contact.
- User-friendly front panel.
- Non-volatile memory.
- View settings any time.
- Set CT ratios.
- Integral test mode (phase and ground).
- Program and test mode security access cover with meter seal provision.
- Continuous internal circuitry self-testing.
- Programmable lockout/self reset after trip.

Table 56-49. Catalog Numbers

Description	Catalog Number
Fixed Case Drawout Case	**MD3000** **MD3001**

System Protection

- Instantaneous sensitive phase overcurrent trip.
- Configurable trip outputs.

Information and Data Delivery

- Displays current transformer ratio.
- Data/information transmission.

Application Description

The MD-3000 microprocessor-based relay provides reliable instantaneous trip protection for all voltage levels. It is most commonly used as motor differential protection relay.

Diagrams

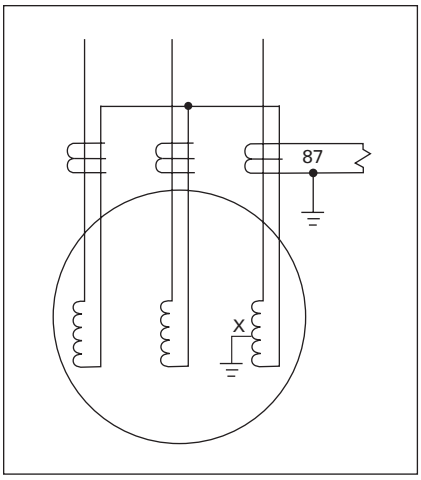

Figure 56-92. Self-Balancing Differential Protection

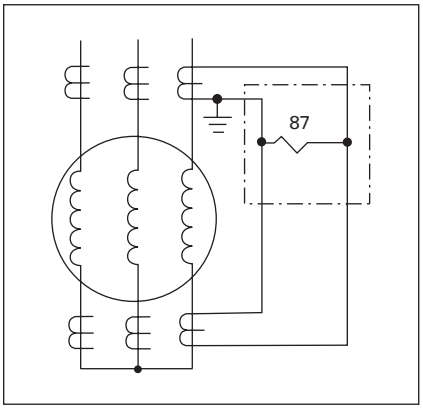

Figure 56-93. Conventional Phase Differential Protection

Product Specifications

Current Inputs

- CTs: 5 A secondary.
- CT Burden:
  - <0.004 ohm at rated current (5 A)
  - <0.1 VA at rated current (5 A)
  - I_n: 5 A (Secondary) or CT (Primary)
- Saturation: 30 x I_n.
- CT thermal ratings:
  - 10 A continuous
  - 500 A for 1 second

CT (Primary) Settings Available

- Phase: 5/10/25/50/75/100/150/200/250/300/400/500/600/630/800/1000 1200/1250/1500/1600/2000/2400 2500/3000/3200/4000/5000.

Input Voltage

- Nominal:
  - 48 – 250 Vdc
  - 120 – 240 Vac 50/60 Hz
- Operating range:
  - 28 – 280 Vdc
  - 90 – 254 Vac 50/60 Hz

Table 56-50. Power Consumption

24	48	125	250	120	240
Vdc 10 W	Vdc 10 W	Vdc 10 W	Vdc 10 W	Vac 10 VA	Vac 18 VA

Output Trip Contacts

- Momentary:
  - Make 30 A ac/dc for 0.25 seconds
  - Break 0.25 A at 250 Vdc
  - Break 5 A at 120/240 Vac
- Continuous:
  - 5 A at 120/240 Vac
  - 5 A at 30 Vdc
  - Meets ANSI C37.90, Paragraph 6.7

Environmental Conditions

- Operating temperature: -30 to +55°C.
- Operating humidity: 0 – 95% relative humidity (non-condensing).
- Storage temperature: -40° to +70°C.

Auxiliary Alarm Contacts

- 5 A Continuous at 120/240 Vac, 30 Vdc.
- 5 A Break at 120/240 Vac, 30 Vdc.

Tests

- Dielectric strength, current inputs:
  - 3000 Vac for 1 minute
  - Phase-to-phase
- Seismic test: Meets requirements for UBC® and California Building Code Zone 4. ZPA = 3.5.
- Standards:
  - ANSI C37.90 (1989), C37.90.1 (1989), C37.90.2 (1995)
  - IEC 255
  - UL 1053

Communications

- Eaton's PowerNet Compatible.
- Built-in INCOM.
- Data rate is 1200 or 9600 baud.

Dimensions — (Fixed Case) in Inches (mm)

- Height: 10.25 (260.4).
- Width: 6.72 (170.7).
- Depth: 2.96 (75.2).

Drawout Case

- Refer to **Figure 56-102** for Drawout Case Dimensions.

Terminal Block

- Make/Break rating:
  - 10 A at 240 Vac nominal
  - 0.25 A at 280 Vdc maximum
- Terminal wire gauge: No. 14 to No. 10 AWG.
- Screw torque requirements: 18-inch-pounds.

Dimensions

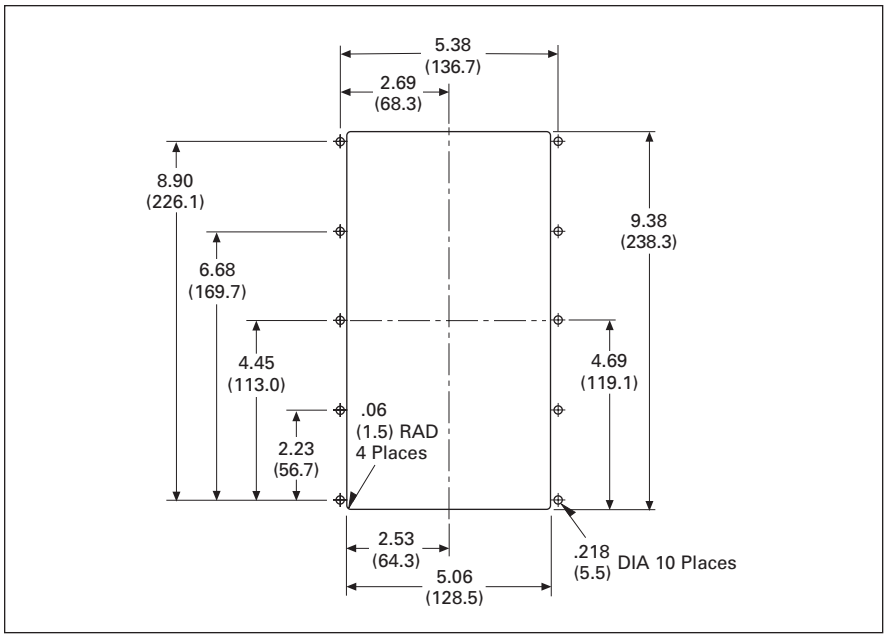

Figure 56-94. Drilling Pattern — Dimensions in Inches (mm)

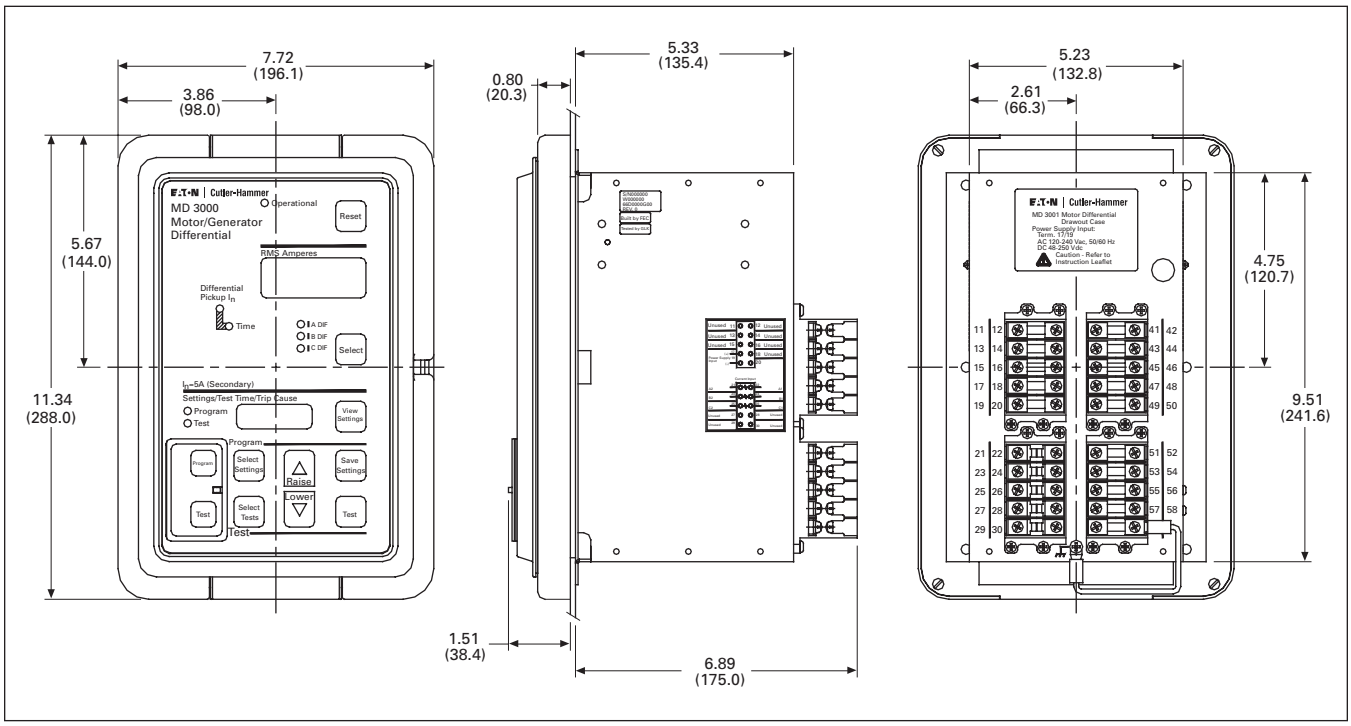

Figure 56-95. MD-3000 — Dimensions in Inches (mm)

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Digitrip 3000

DT-3000

Product Description

- Microprocessor-based, 3-phase and ground overcurrent relay.
- Independent phase and ground measuring circuits and operation.
- Inverse time (51), short delay (50, 2) and instantaneous (50) protection.
- Eleven time overcurrent characters including ANSI, IEC and thermal protection curves.
- Phase and ground ampmeter and peak demand functions.
- INCOM communication port.
- Fixed mount or optional quick release drawout case design.
- Dual-source power supply option for ac control power applications.

Application Description

Eaton's Digitrip 3000 microprocessor-based relay provides reliable 3-phase and ground overcurrent protection for all voltage levels. It can be used for any application where instantaneous and/or time overcurrent protection is required. It is most commonly usedas primary feeder circuit protection, as in **Figure 56-96**.

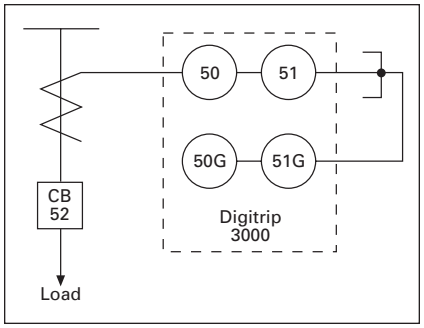


Figure 56-96. Primary Feeder Circuit Protection

The Digitrip 3000 may be applied as the transformer primary protection or as backup to the differential protection, as in **Figure 56-97**.

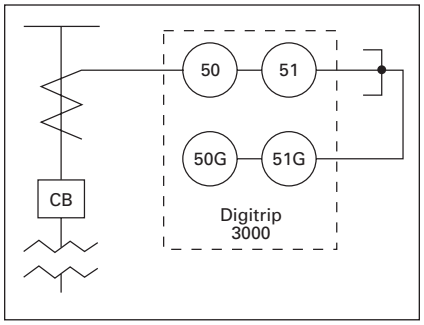


Figure 56-97. Transformer Overcurrent Protection

The Digitrip 3000 may be connected to the secondary side of a Delta-wye grounded transformer with the ground element connected to a separate CT in the neutral connection of the transformer. With this connection, a lower CT ratio and a pickup setting can be used to provide more sensitive ground fault protection especially for resistance grounded systems (see **Figure 56-98**).

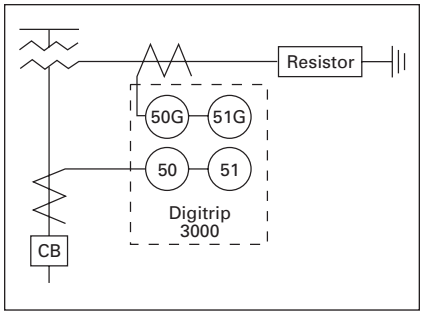


Figure 56-98. Transformer Secondary Protection with Neutral CT Connection

The Digitrip 3000 ground overcurrent element can be connected in the residual circuit of the phase CTs as shown in **Figure 56-99** or to a separate ground CT as shown in **Figure 56-100**.

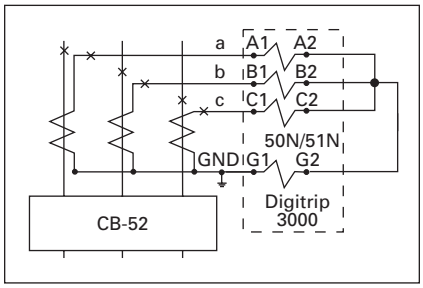


Figure 56-99. Residual Ground Connection

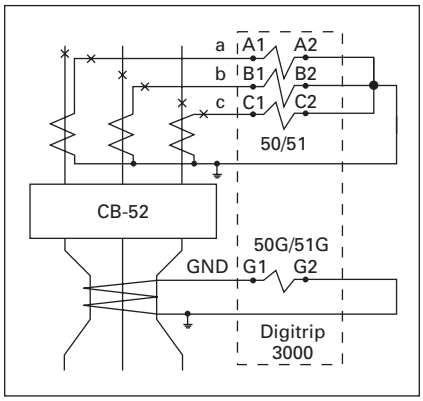


Figure 56-100. Separate Zero Sequence Ground CT Connection

Zone Selective Interlocking (Phase and Ground)

Note: For the phase time overcurrent element, the current sensed by the Digitrip 3000 must exceed 300% (3 x I_n) for the zone selective interlocking to initiate an immediate trip signal.

Zone Selective interlocking is a protection function to minimize equipment damage resulting from a phase or a ground fault in an area where long-time and/or short-time delay is in use.

When the "Ground Zone Interlocking" feature is utilized, an immediate trip is initiated when the fault is in the breaker's zone of protection, regardless of its preset time delay. When the "Phase Zone Interlocking" feature is utilized, the time overcurrent and short delay phase elements work as follows. The short delay phase element will initiate an immediate trip when the fault is in the breaker's zone of protection, regardless of its preset time delay. For the time overcurrent phase element, the current sensed by the Digitrip 3000 must exceed 300% (3 x I_n) for the zone selective interlocking to initiate an immediate trip signal when the fault is in the breaker's zone of protection.

Upstream Digitrip 3000 protected breakers are restrained from tripping immediately by an interlocking signal from the downstream Digitrip 3000 relay. This interlocking signal requires only a pair of wires from the downstream breaker to the upstream breaker. The Upstream Digitrip 3000 provides time delayed standard coordinated tripping when the fault is located outside the zone of protection.

In the sample zone interlocking system shown below, circuit breakers A, B and C are equipped with Digitrip 3000 overcurrent relays.

Fault Location Zone 3

Note: For the phase time overcurrent element, the current sensed by the Digitrip 3000 must exceed 300% (3 x I_n) for the zone selective interlocking to initiate an immediate trip signal.

If a fault occurs at a point in Zone 3, the Digitrip 3000 of Downstream Breaker C senses the fault and sends a restraining signal to the upstream Digitrip 3000 of Feeder Breaker B.

Having received this signal, the Digitrip 3000 of Feeder Breaker B begins timing for normal final delay tripping. As a result, only Downstream Breaker C is tripped.

Fault Location Zone 2

Note: For the phase time overcurrent element, the current sensed by the Digitrip 3000 must exceed 300% (3 x I_n) for the zone selective interlocking to initiate an immediate trip signal.

If a fault occurs at a point in Zone 2, the Digitrip 3000 of Feeder Breaker B senses the fault and sends a restraining signal to the upstream Digitrip 3000 of Main Breaker A.

The Digitrip 3000 of the Downstream Breaker C does not see this fault since it is situated on the downstream side of the fault. As a result, the Digitrip 3000 of Downstream Breaker C does not send a restraining signal to the Digitrip 3000 of Feeder Breaker B.

Since there is no restraining signal from the Digitrip 3000 of Downstream Breaker C, the Digitrip 3000 of Feeder Breaker B identifies that the fault is in Zone 2 and immediately trips Feeder Breaker B, regardless of its time setting.

Fault Location Zone 1

Note: For the phase time overcurrent element, the current sensed by the Digitrip 3000 must exceed 300% (3 x I_n) for the zone selective interlocking to initiate an immediate trip signal.

If a fault occurs in Zone 1, no restraining signal is received by the Digitrip of Main Breaker A. As a result, Main Breaker A is immediately tripped by its Digitrip overcurrent relay, regardless of its time setting.

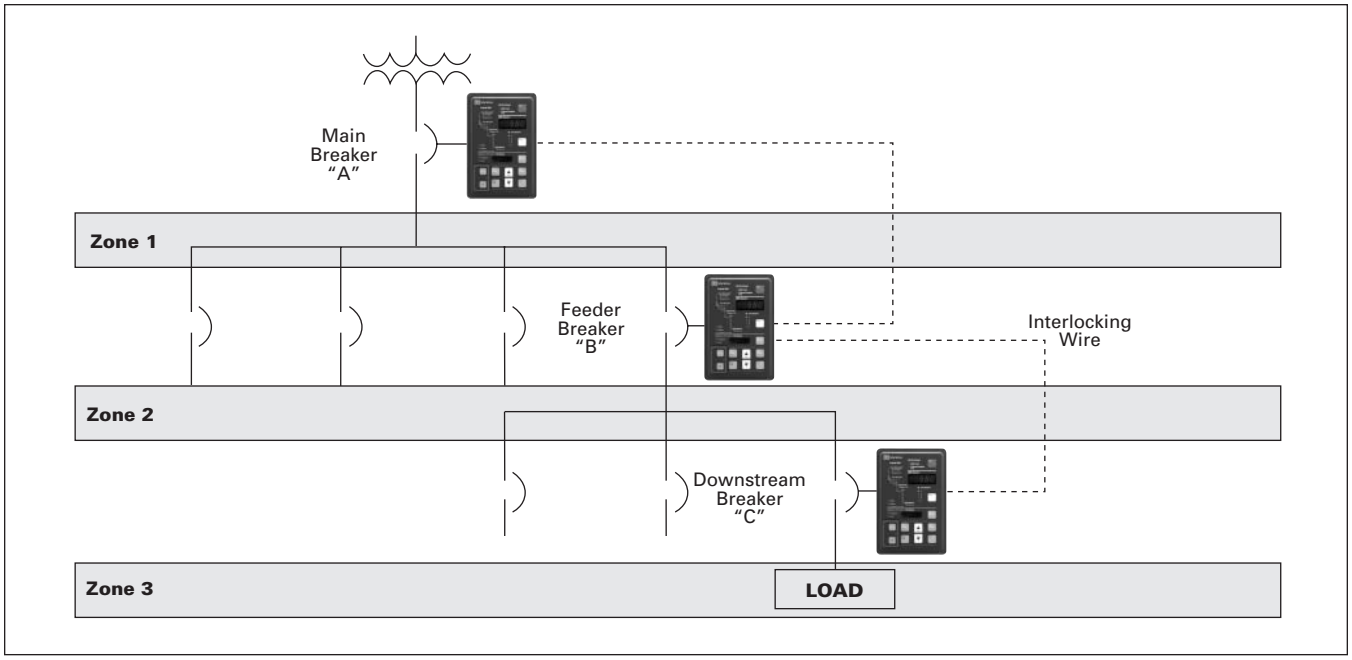


Figure 56-101. Sample Zone Selective Interlocking System

Features, Benefits and Functions

- Complete current protection and metering in a single compact case reduces panel space, wiring and cost.
- Selectable trip characteristics simplify ordering and reduces inventory.
- Optional drawout case provides easy and quick removal and replacement of the relay.
- Optional dual-source power supply provides reliable protection when applied with ac control power, eliminating the need for batteries or UPS.
- Integral ampmeter and display replaces separate meter and switch, saving panel space, wiring and money.
- Zone selective interlocking improves coordination and tripping times and can save money by using in place of traditional bus differential.
- Integral test function and microprocessor design can reduce maintenance time and expense.

Standards and Certifications

- UL recognized.
- UL 1053 recognized.
- ANSI C37.90.
- ANSI C37.90.1 (1989).
- ANSI C37.90.2 (1995).

Note: Fixed case versions meet 35V/m. Drawout case versions meet 28V/m.

- IEC 255.
- CE (DT3030/3031 version only).

Options and Accessories

Additional Products by Eaton Corporation's Cutler-Hammer Series

Dual-Source Power Supply Option

The Digitrip 3000 with Dual-Source Power Supply (DSPS) is available in two versions, DT-3010 and DT-3020. They include an integral power supply module that:

- Powers the relay from nominal 120 Vac, 50/60 Hz (DT-3010 model) or 240 Vac, 50/60 Hz (DT-3020 model) auxiliary power, which is normally connected and available.
- Operates solely from the main current transformers (CTs) during a fault if the normally connected auxiliary ac voltage is not available, like an electromechanical relay or an electronic "self-powered" relay.

Functional Description

The integral Dual-Source Power Supply (DSPS) contains 1 ac voltage transformer and 3 ac current transformers. The ac voltage transformer is used to supply nominal ac control power to the unit. The current transformers are used to power the unit from the line current. Normally, the unit will operate from the ac auxiliary voltage. Because this voltage is usually obtained from the system containing the circuit that the relay is protecting, a fault on the protected line could cause the ac voltage to drop below an acceptable operating level. Below approximately 70 volts for DT-3010 or 140 volts for DT-3020, the DSPS switches over to current powering. All three current transformer secondaries are connected in series to supply this power. The DSPS will supply enough power to operate the Digitrip 3000 overcurrent relay in the tripped state with currents greater than 1.8 per unit rated secondary current, or 9 A, in a single-phase. The DSPS will operate with 3-phase currents in a tripped state with currents greater than 1.2 per unit or 6A rated secondary current.

Note: There will be no effect to the DT-3000 relay trip time accuracy when the Dual-Source Power Supply switches from normal ac voltage to fault-current power.

Burden Data

In normal operating conditions, the burden is <0.08 ohms with 3-phase 1 A CT current, or 0.2 per unit, and drops to less than 0.04 ohms at high current levels. **Figure 56-103** and **Figure 56-104** present CT burden data in ohms and volt-amperes. In these cases, the burden shown is the total CT terminal value, which is the DSPS plus the relay measuring circuits, for the indicated operating condition.

Figure 56-104 shows burden impedance magnitude in ohms. The two lower curves are the values with ac power applied; the upper two are with CT powering only. For each of these pairs, one curve shows the burden for a
single-phase current (representing a single-phase-to-ground fault) and the other for three balanced phases with normally arrayed 120-degree phase angle increments. There is no phase sequence sensitivity.

Figure 56-103 shows the burden in volt-amperes for the same four cases.

Digitrip 3000 Optional Drawout Case

The Digitrip 3000 overcurrent protective relay is available in a new drawout case for quick release, removal and replacement of the unit without disruption of the wiring. The CT circuits are self-shortening to prevent damaging voltages from existing across-the-current transformer windings. All voltage inputs, discrete inputs and contact inputs are disconnected while maintaining security against false tripping.

The terminal blocks feature a 2-stage disconnect operation. Removal of the DT-3000 Inner Chassis will disconnect the trip circuits and short the CT secondaries before the unit control power is disconnected. Upon insertion of the Inner Chassis, the control power connections are made before the trip circuits are activated. **This feature provides added security against false tripping.**

Product Specifications

Current Inputs

- CTs: 5 A secondary.
- CT Burden:
  - <0.004 ohm at rated current (5 A)
  - <0.1 VA at rated current (5 A)
  - I_n: 5 A (Secondary) or CT (Primary)
- Saturation: 30 x I_n.
- CT thermal ratings:
  - 10 A continuous
  - 500 A for 1 second

CT (Primary) Settings Available

- Phase and ground: 5/10/25/50/75/100/150/200/250/300/400/500/600/630/800/1000 1200/1250/1500/1600/2000/2400 2500/3000/3200/4000/5000.

Input Voltage DT-300X

- Nominal:
  - 48 – 250 Vdc
  - 120 – 240 Vac 50/60 Hz
- Operating range:
  - 28 – 280 Vdc
  - 90 – 254 Vac 50/60 Hz

Table 56-51. Power Consumption

24	48	125	250	120	240
Vdc 10 W	Vdc 10 W	Vdc 10 W	Vdc 10 W	Vac 10 VA	Vac 18 VA

Table 56-52. Input Voltage Digitrip 3030/3031

Description	DT-3010	DT-3020
Nominal	120 Vac	240 Vac
Operating Range	70 – 132 Vac	140 – 264 Vac
Power Consumption	15 VA	15 VA

Output Trip Contacts (Trip OC/Comm., Trip Inst., and Comm. Close)

- Momentary:
  - Make 30 A ac/dc for 0.25 seconds
  - Break 0.25 A at 250 Vdc
  - Break 5 A at 120/240 Vac
- Continuous:
  - 5 A at 120/240 Vac
  - 5 A at 30 Vdc
  - Meets ANSI C37.90, Paragraph 6.7

Environmental Conditions

- Operating temperature: -30 to +55°C.
- Operating humidity: 0 – 95% relative humidity (non-condensing).
- Storage temperature: -40° to +70°C.

Auxiliary Alarm Contacts

- 5 A Continuous at 120/240 Vac, 30 Vdc.
- 5 A Break at 120/240 Vac, 30 Vdc.

Tests

- Dielectric strength, current inputs:
  - 3000 Vac for 1 minute
  - Phase-to-phase
- Seismic test: Meets requirements for UBC® and California Building Code Zone 4. ZPA = 3.5.
- Standards:
  - ANSI C37.90 (1989), C37.90.1 (1989), C37.90.2 (1995)
  - IEC 255
  - UL 1053
  - CE (DT3030 and DT3031 versions only)

Phase and Ground Time-Current Curves

- Thermal:
  - It (Moderately Inverse)
  - I^2t (Very Inverse)
  - I^4t (Extremely Inverse)
  - FLAT (Definite Time)
- ANSI (Per ANSI C37.112, 1996):
  - Moderately Inverse
  - Very Inverse
  - Extremely Inverse
- IEC (Per IEC 255-3, 1989):
  - IEC-A (Moderately Inverse)
  - IEC-B (Very Inverse)
  - IEC-C (Extremely Inverse)
  - IEC-D (Definite Time)

Overcurrent Functions and Pickup Ranges

Note: Consult factory for sensitive ground fault

- Long Delay or Inverse Time Overcurrent:
  - Phase: (0.2 – 2.2) x I_n (29 settings)
  - Ground: (0.1 – 2.0) x I_n, None (26 settings)
- Short Delay:
  - Phase: (1 – 11) x I_n, None (25 settings)
  - Ground: (0.1 – 11) x I_n, None (45 settings)
- Instantaneous:
  - Phase: (1 – 25) x I_n, None (30 settings)
  - Ground: (0.5 – 11) x I_n, None (33 settings)

Time Delay Settings

- Inverse Time Overcurrent Time Multiplier:
  - Thermal: 0.2 – 40 (47 settings)
  - FLAT: 0.2 – 2 (21 settings)
  - ANSI (all): 0.1 – 5.0 (50 settings)
  - IEC (all): 0.05 – 1.00 (20 settings)
- Short Delay Time: 0.05 – 1.5 seconds (22 settings).

Current Monitoring

Note: Consult factory for sensitive ground fault.

- True rms sensing: 3-phase and ground.
- Display accuracy:
  - ±1% of Full Scale [I_n] from 0.04 x I_n to 1 x I_n
  - ±2% of Full Scale [I_n] from 1 x I_n to 2 x I_n
- Ampere demand: Average demand over 5 minute sampling window.
- High load (with selectable output): 85% of Inverse Time Overcurrent setting.

Timing Accuracy

- Inverse Time Overcurrent: ±10% at >1.5 x Pickup.
- Short Delay Time: ±50 mS.

Communications

- Eaton's PowerNet Compatible.
- Built-in INCOM.
- Data rate is 1200 or 9600 baud.

Dimensions — (Fixed Case) in Inches (mm)

- Height: 10.25 (260.4).
- Width: 6.72 (170.7).
- Depth: 2.96 (75.2).

Drawout Case

- Refer to **Figure 56-102** for Drawout Case Dimensions.

Terminal Block

- Make/Break rating:
  - 10 A at 240 Vac nominal
  - 0.25 A at 280 Vdc maximum
- Terminal wire gauge: No. 14 to No. 10 AWG.
- Screw torque requirements: 18-inch-pounds.

Technical Data and Specifications

Dimensions

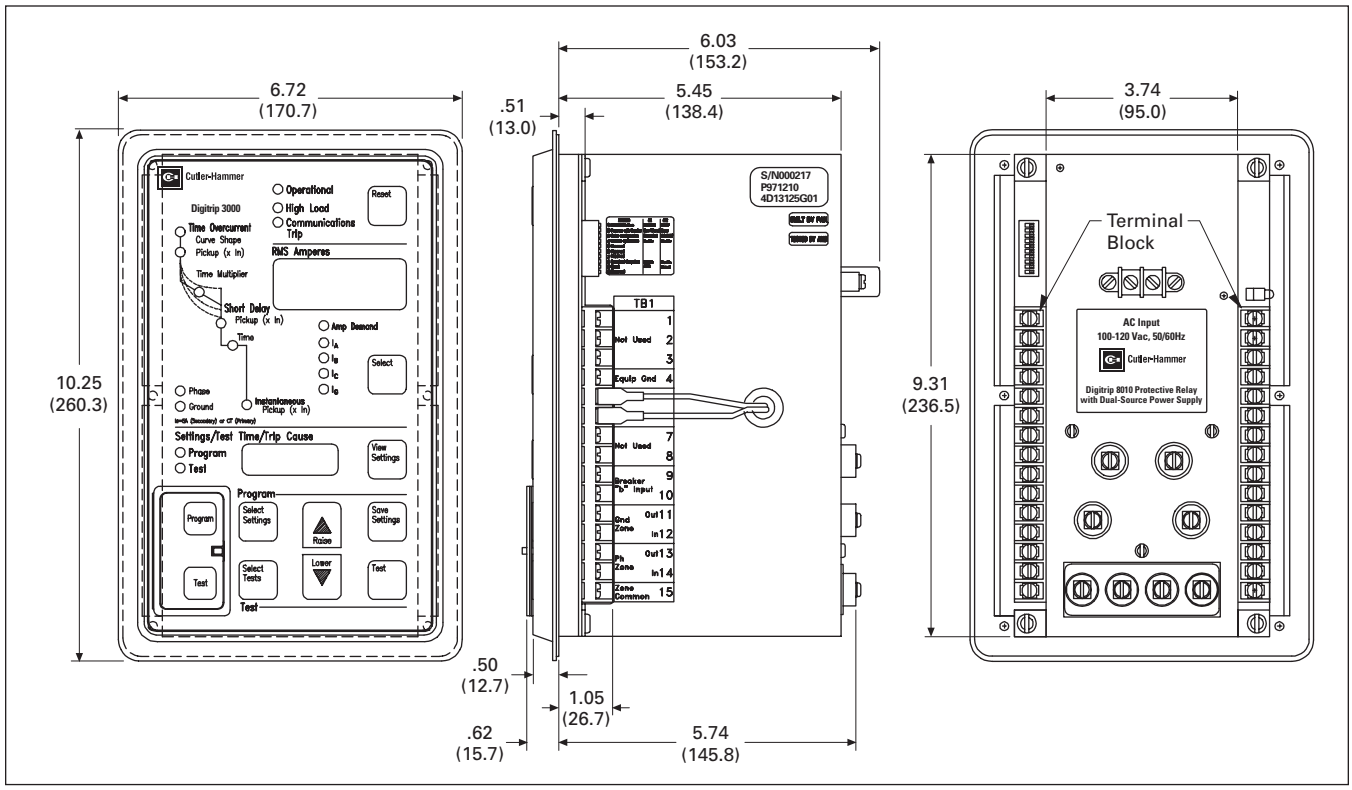


Figure 56-102. Digitrip 3010/3020 — Dimensions in Inches (mm)

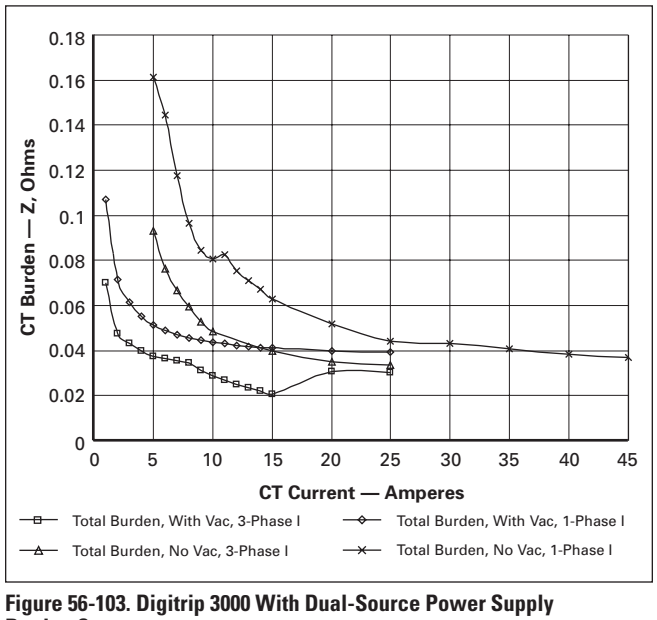


Figure 56-103. Digitrip 3000 With Dual-Source Power Supply Burden Curves

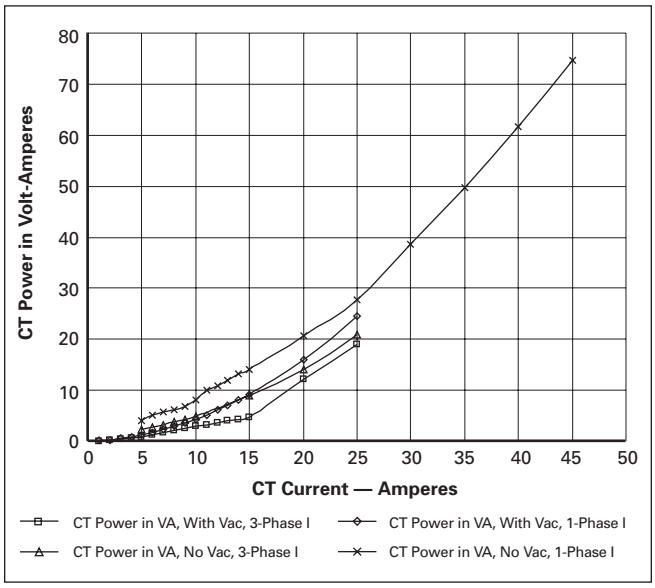


Figure 56-104. Digitrip 3000 With Dual-Source Power Supply CT Power Volt-Ampere Curves

Dimensions

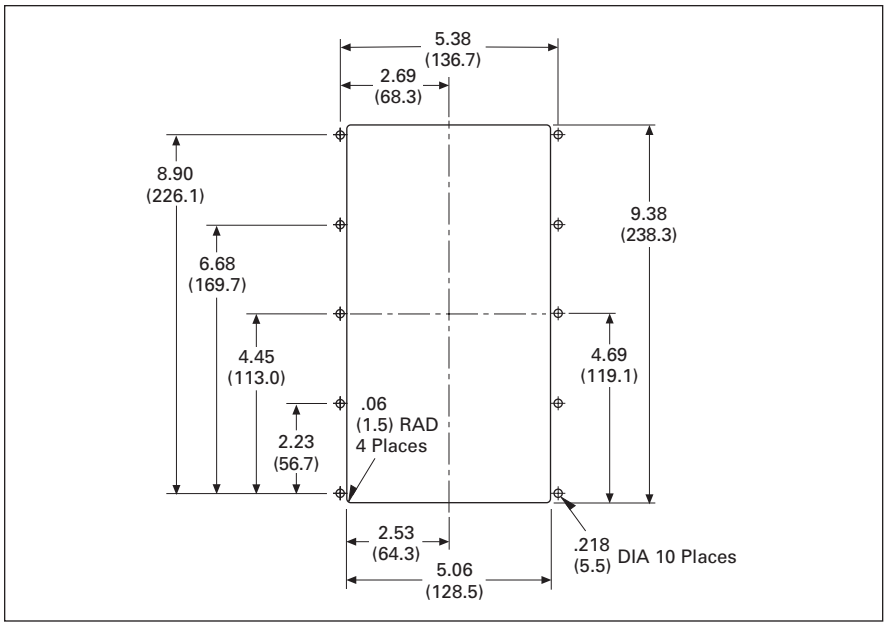


Figure 56-105. Drilling Pattern — Dimensions in Inches (mm)

Figure 56-105 shows the panel cutout dimensions for all versions of the Digitrip 3000 relay. **Figure 56-106** shows the Digitrip 3000 dimensions and **Figure 56-107** shows the typical wiring diagram for the fixed mount version.

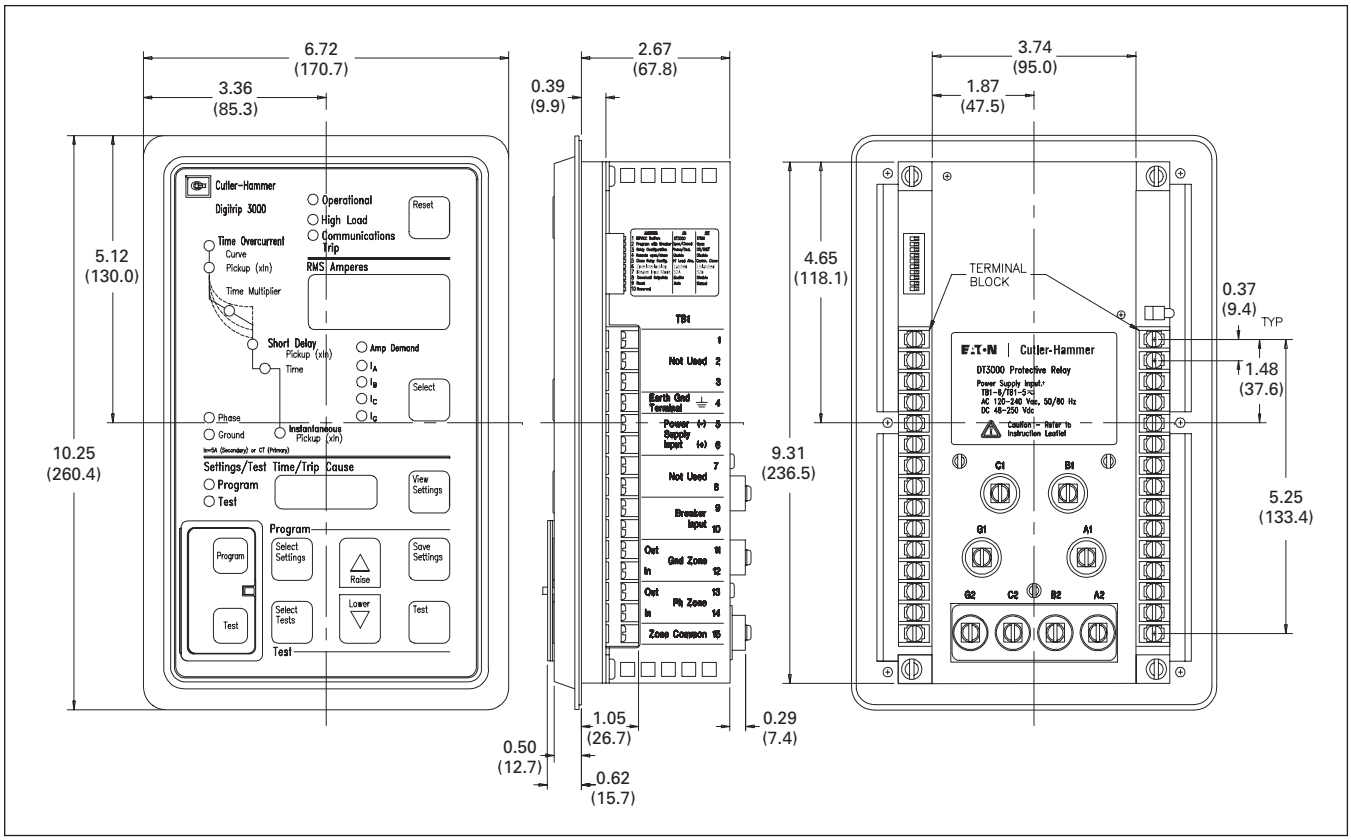


Figure 56-106. Digitrip 3000 — Dimensions in Inches (mm)

Wiring Diagrams

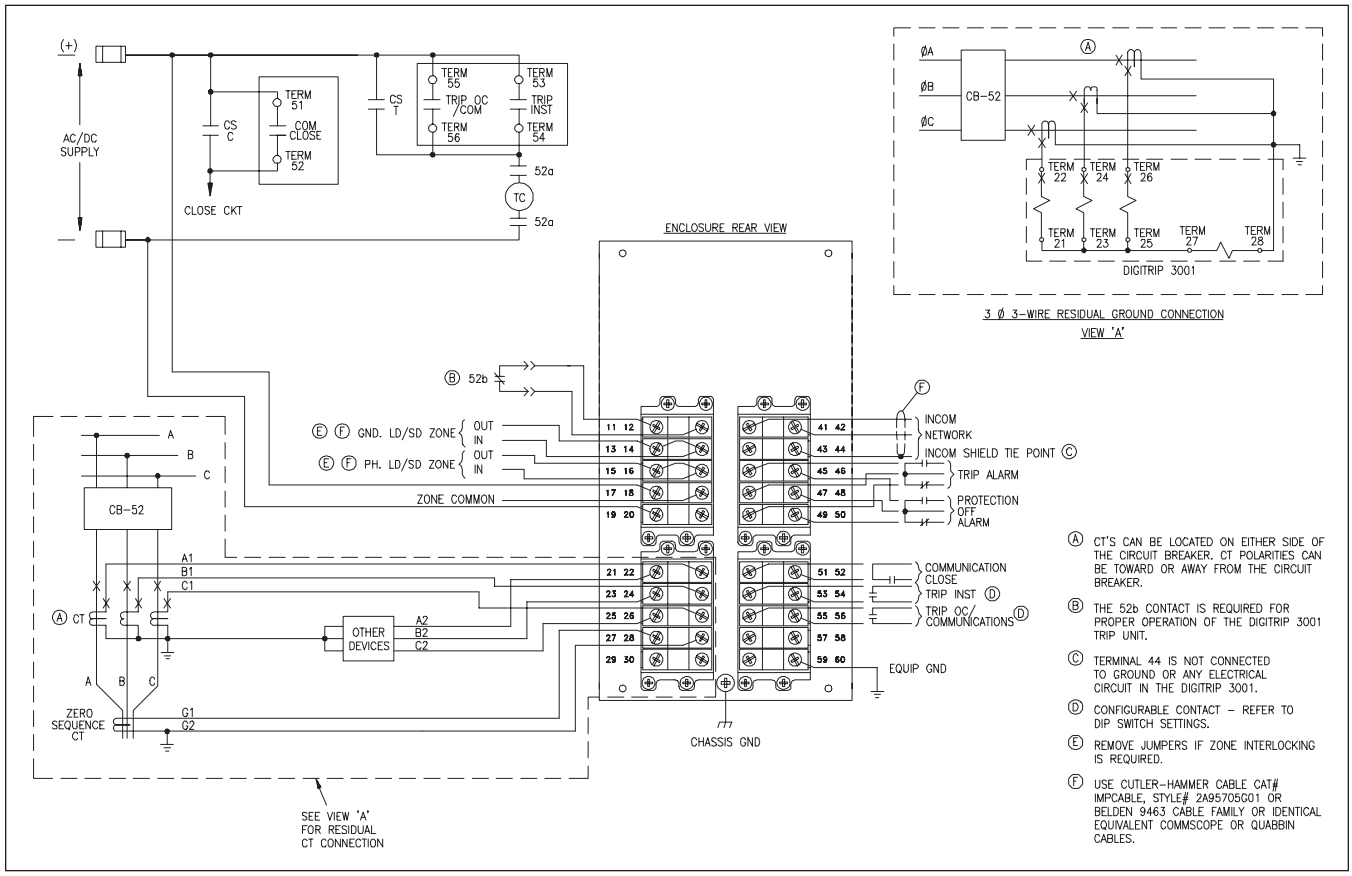


Figure 56-107. Digitrip 3001 Typical Wiring Diagram

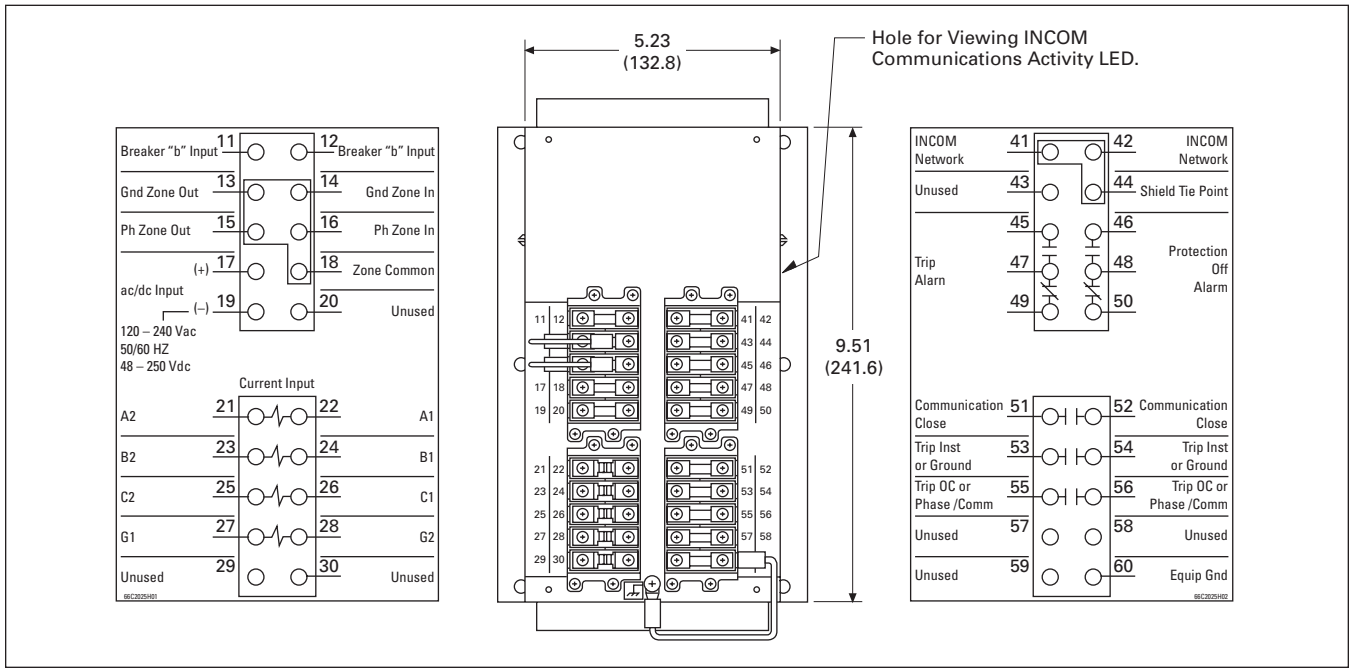


Figure 56-108. Rear View of Digitrip 3001 Drawout Outer Case Terminal Layout — Dimensions in Inches (mm)

Wiring Diagrams

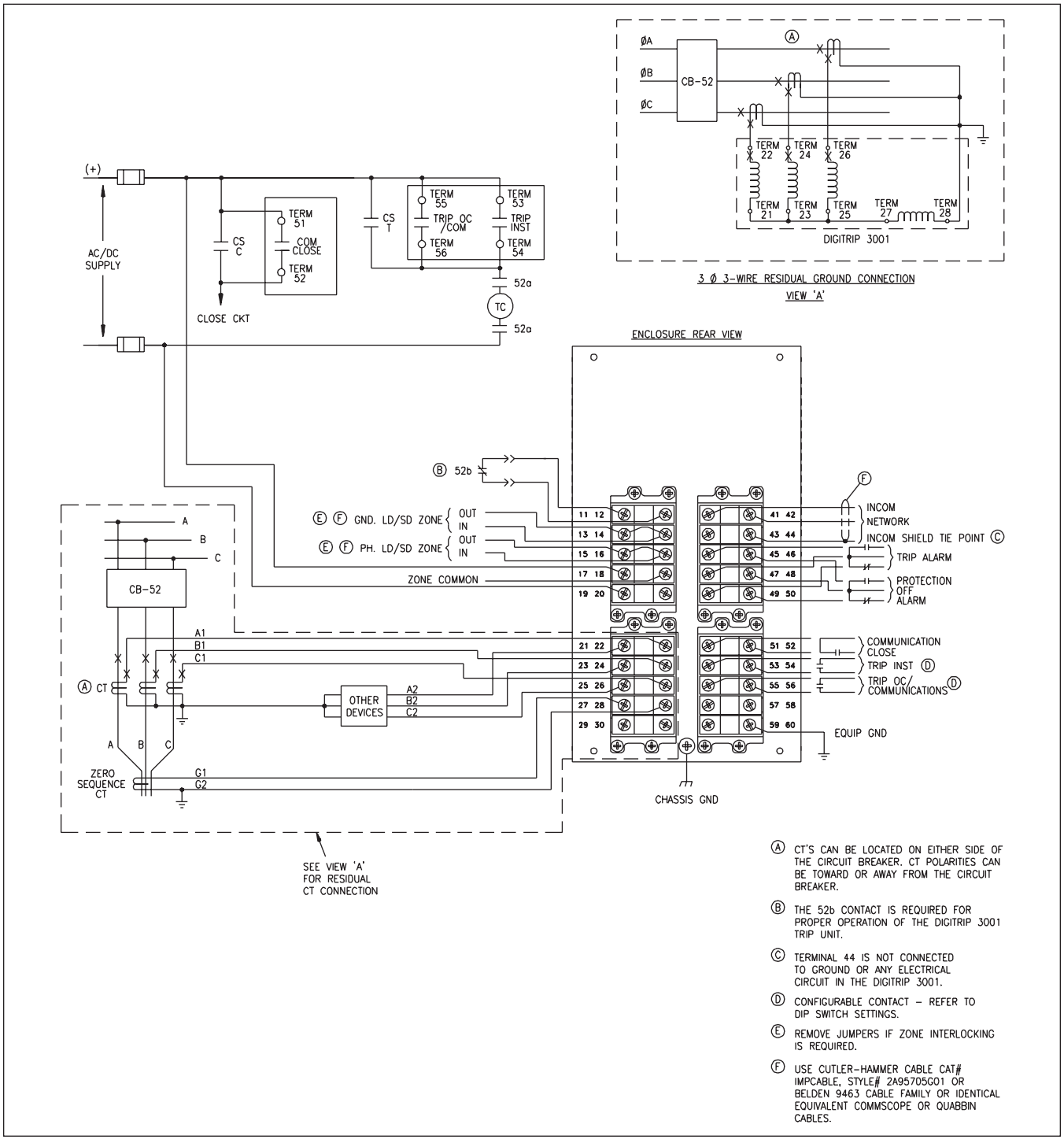


Figure 56-109. Digitrip 3000 Typical Wiring System

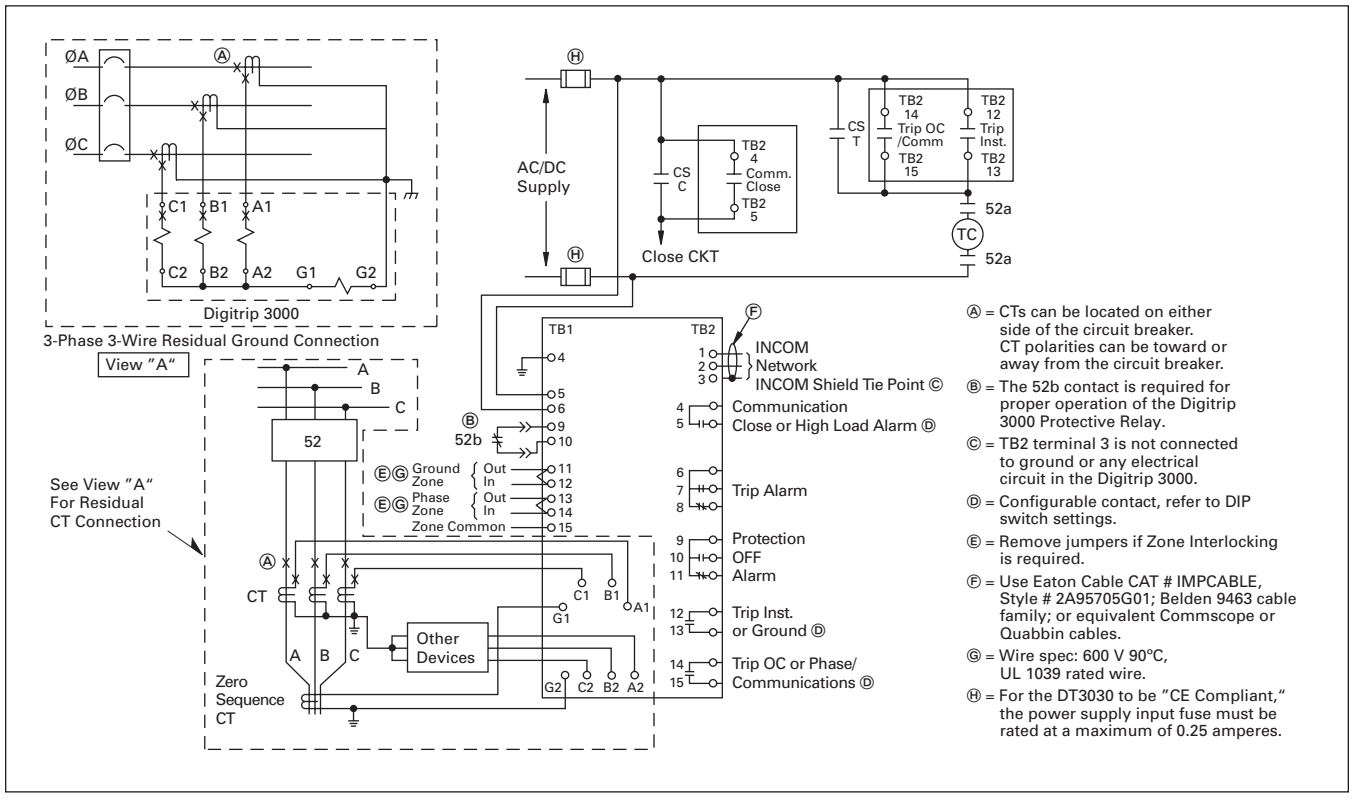


Figure 56-110. Digitrip 3000 Typical Wiring Diagram

Product Selection

Table 56-53. DT-3000

Description	Catalog Number
DT-3000 Protective Relay	**DT3000**
DT-3000 Protective Relay Chicago Version	**DT3100**
DT-3030 Protective Relay (24 – 48 Vdc CE Mark Version)	**DT3030**
DT-3000 Drawout Case Protective Relay	**DT3001**
DT-3000 Chicago Version Drawout Case Protective Relay	**DT3101**
DT-3030 Drawout Case Protective Relay (24 – 48 Vdc CE Mark Version)	**DT3031**
DT-3000 Protective Relay with 120 Vac Dual-Source Power Supply	**DT3010**
DT-3000 Protective Relay with 240 Vac Dual-Source Power Supply	**DT3020**

Cross-Reference

There are several products that are equivalent to the Digitrip 3000. The following lists the competitor's name and equivalent product to the Digitrip 3000. In general, the Digitrip 3000 can be used in place of the competitive product.

- ABB® MMCO, 51.
- Basler Electric® BEI-51.
- GE Multilin MDP, 735, 737.
- Siemens® 7SJ 511, 7SJ 60.

VR-300 Multifunctional Voltage Relay

VR-300

Product Description

The VR-300 is an industrial grade protective relay that offers multiple protective features in a single package, ideal for stand-alone protection or for the implementation of transfer schemes.

Using a digital processor to measure true rms values enables a high degree of measuring accuracy regardless of harmonics, transients or disturbing pulses.

The compact size and multiple functions of the VR-300 help to simplify switchgear design. The digital display offers a user-friendly interface to set up the unit as well as monitor the operation and display any alarms.

Features, Benefits and Functions

- Over-/undervoltage monitoring (59/27).
- Over-/underfrequency monitoring (81O/U).
- Voltage asymmetry monitoring (47).
- Synch-check (25)- fixed to relay 3.
- Zero voltage monitoring: dead bus start functionality (close CB to dead bus).
- Two configurable relays.
- Discrete input for blocking of protective functions or remote acknowledgment.

Product Specifications

Measuring Voltage

- Standard (V_{rated}) λ △: 66/115 Vac.
- Maximum value V_{ph-ph} max., (UL/cUL): Max. 150 Vac.
- Rated voltage $V_{ph-ground}$: 50 Vac/ 2.5 kV.
- Rated surge voltage: 2.5 kV.
- Measuring frequency: 40.0 to 80.0 Hz.
- Accuracy: Class 1.
- Linear measuring range: 1.3 x V_{rated}.
- Input resistance: 0.21 MΩ.
- Maximum power consumption per path: < 0.15 W.

Ambient Variables

- Wide range power supply: 90 to 250 Vac/dc.
- Intrinsic consumption: Max. 12 VA.
- Ambient temperature:
  - Storage: -30 to 80°C (-22° to 176° F)
  - Operational: -20° to 70°C (-4° to 158° F)
- Ambient humidity: 95%, Non-condensing.
- Maximum altitude: 6562 ft. (2000 m).
- Degree of pollution: 2.

Discrete Inputs — Isolated

- Input range ($V_{Cont, Discrete Input}$): Rated voltage 18 to 250 Vac/dc.
- Input resistance: Approximately 68 KΩ.

Relay Outputs — Potential Free

- Contact material: AgCdO
- General purpose (GP) ($V_{Cont, Relay Output}$):
  - ac: 2.00 Aac @ 250 Vac
  - dc: 2.00 Adc @ 24 Vdc, 0.22 Adc @ 125 Vdc, 0.10 Adc @ 250 Vdc
- Pilot duty (PD) ($V_{Cont, Relay Output}$):
  - ac: B300
  - dc: 1.00 Adc @ 24 Vdc, 0.22 Adc @ 125 Vdc, 0.10 Adc @ 250 Vdc

Housing

- Type: APRANORM DIN 43 700.
- Dimensions (W x H x D): 3.78 x 2.84 x 5.20 in. (96 x 72 x 132 mm).
- Front panel cutout (W x H): 92 [+0.8] x 68 [+0.7] mm (3.62 [+0.03) x 2.68 [+0.03] in.)
- Wiring: Screw-type, terminals 2.5 mm^2 (0.0039 $in.^2$).
- Recommended tightening torque: 0.5 Nm (0.369 ft/lbs). Use 60/75°C (140/167°F) Copper Wire Only. Use Class 1 Wire Only (or Equivalent).
- Weight: Approximately 2.14 lbs. (800 g).

Protection

- Protection system: IP42 from front with correct mounting.
  - IP54 from front with gasket
  - (Gasket: P/N 8923-1036) IP20 from back.
- Front foil: Insulating surface.
- EMC-Test (CE): Tested according to applicable EN guidelines.
- Listings: CE Marking; UL listing for ordinary locations, UL/cUL listed, ordinary locations, File No.: E231544.
- Additional approvals: IEEE C37.90.1 and C37.90.2

Technical Data and Specifications

Dimensions

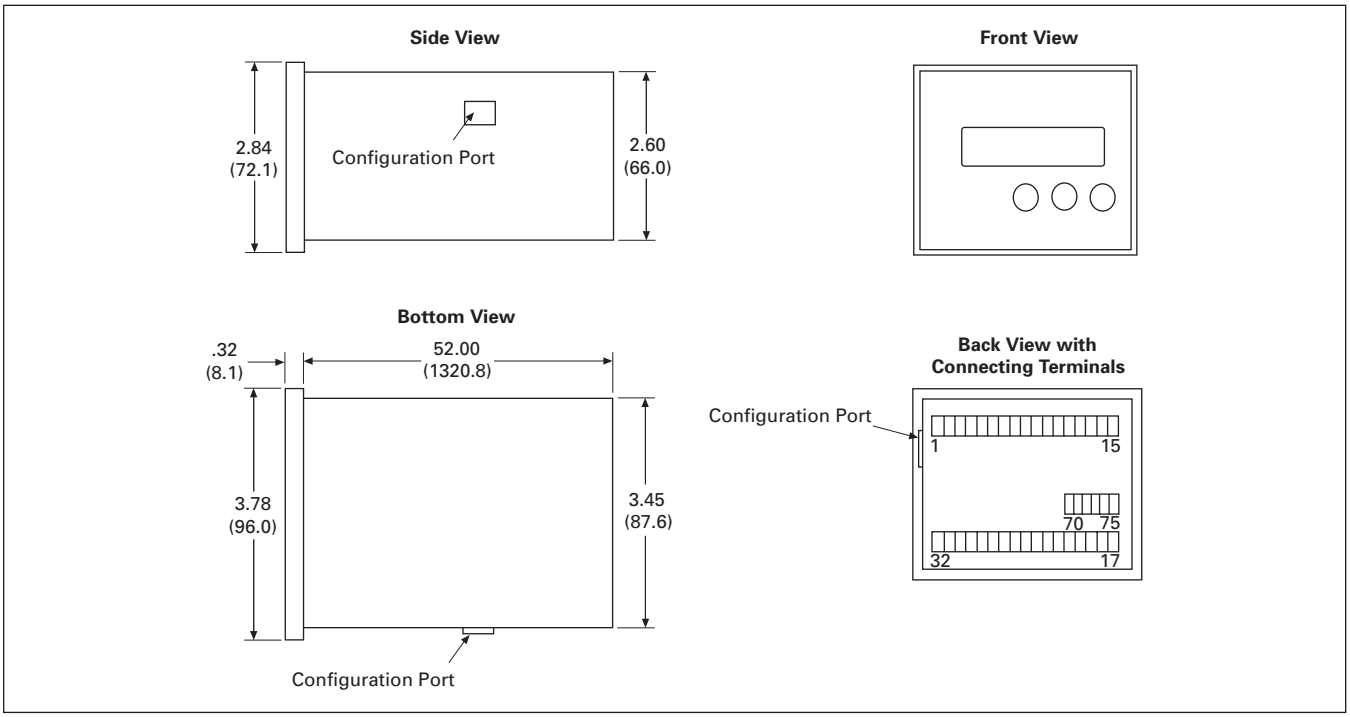
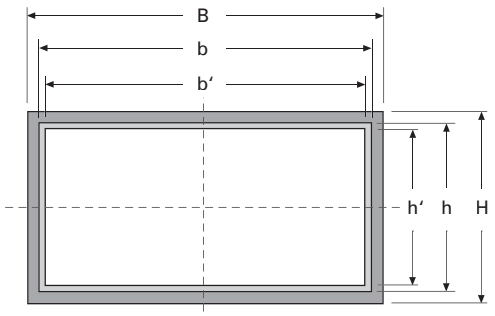


Figure 56-111. VR-300 — Dimensions in Inches (mm)

Panel Cutout



Measure	Description	Dimensions in Inches (mm)	Tolerance in Inches (mm)
Height			
H	Total	2.83 (71.9)	—
h	Panel Cutout	2.68 (68.1)	.03 (+0.7)
h′	Housing Dimension	2.60 (66.0)	—
Width			
B	Total	3.78 (96.0)	—
b	Panel Cutout	3.62 (91.9)	.03 (+0.8)
b′	Housing Dimension	3.54 (89.9)	—
Depth (Including Terminals)			
	Total	6.30 (160.0)	—

The maximum permissible corner radius for cutout is .08 inches 2.0 mm.

Figure 56-112. VR-300 Panel Cutout

Wiring Diagram

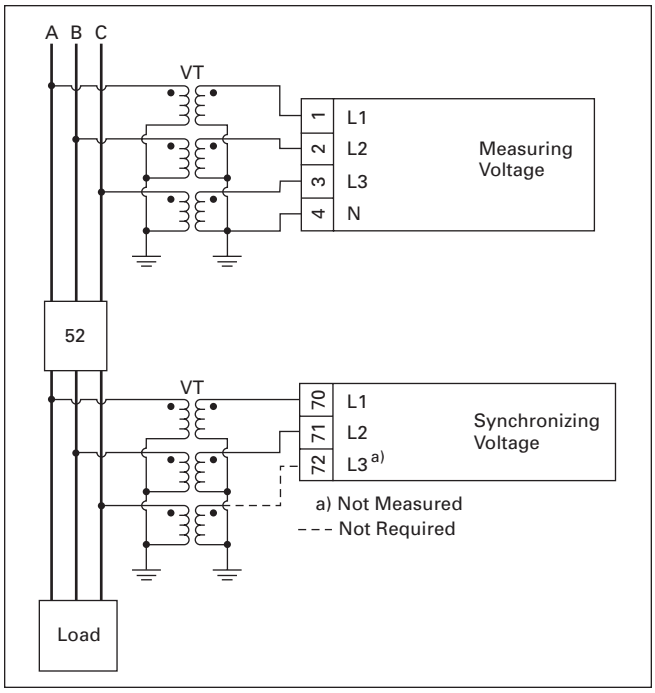


Figure 56-113. Three-Line WYE Wiring Diagram

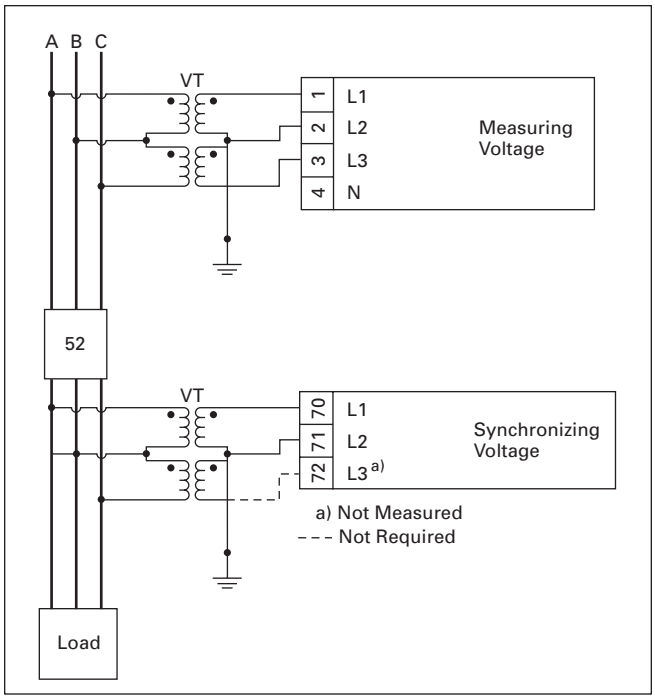


Figure 56-114. Three-Line Delta Wiring Diagram

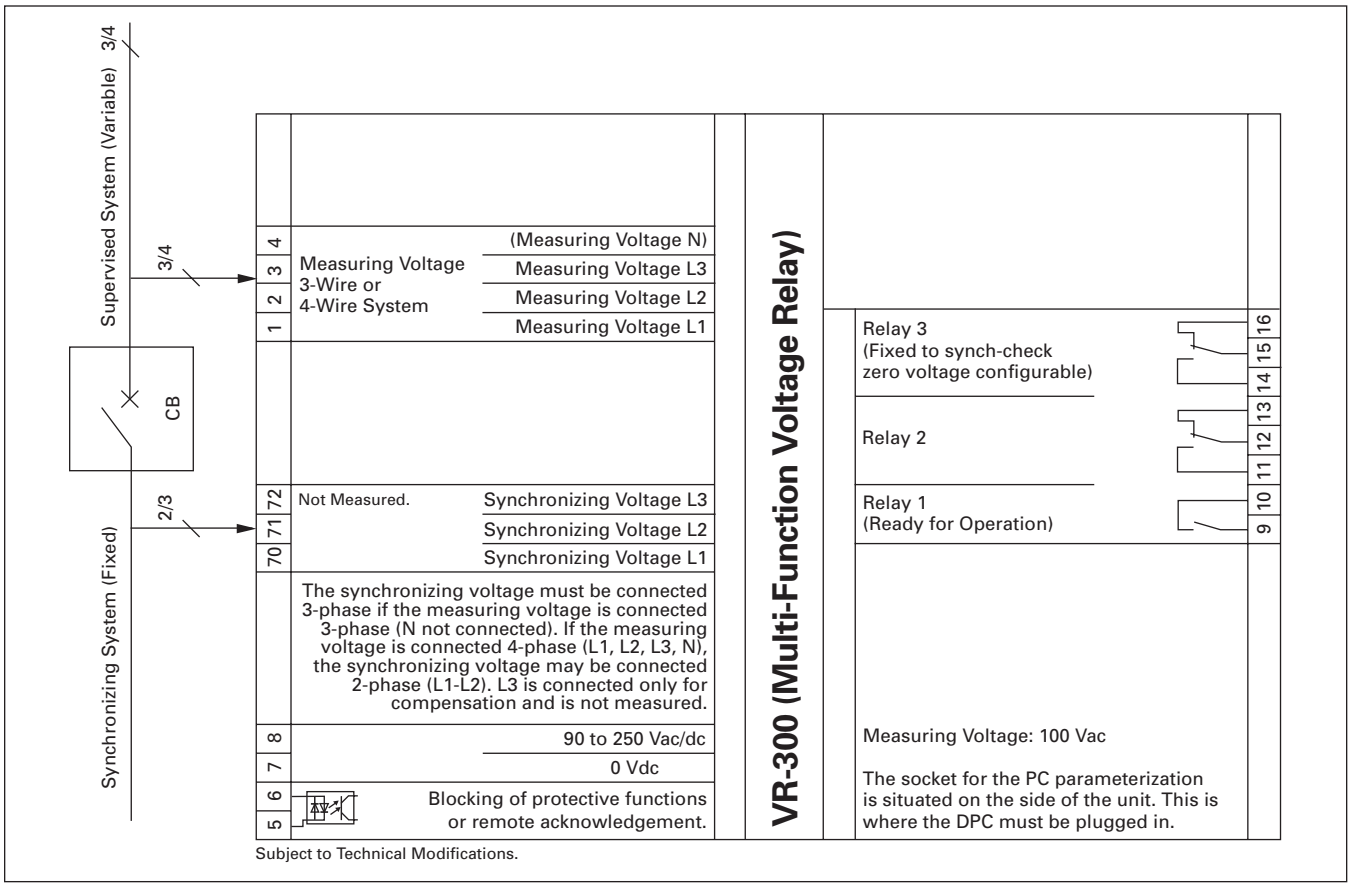
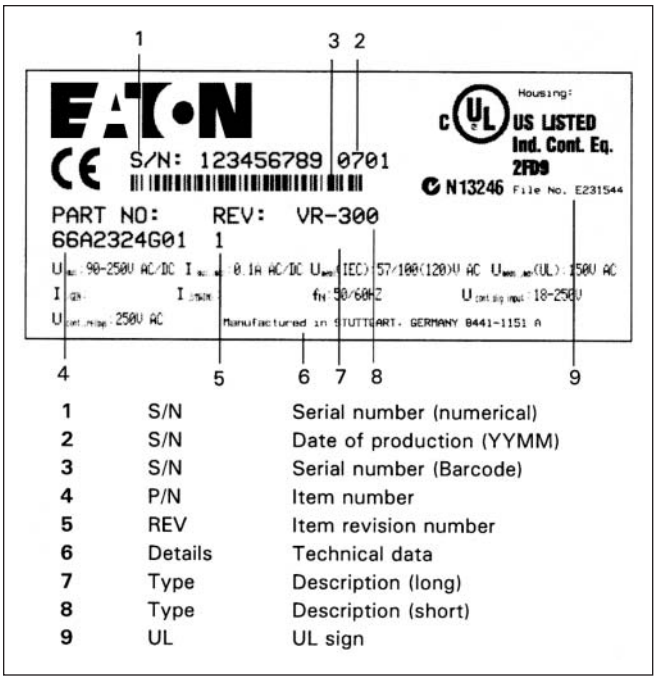


Figure 56-115. VR-300 Wiring Diagram

Typical Nameplate



1	S/N	Serial number (numerical)
2	S/N	Date of production (YYMM)
3	S/N	Serial number (Barcode)
4	P/N	Item number
5	REV	Item revision number
6	Details	Technical data
7	Type	Description (long)
8	Type	Description (short)
9	UL	UL sign

Figure 56-116. Typical VR-300 Nameplate

Table 56-54. Reference Conditions

Measuring Value	Display Range	Accuracy
Frequency		
fL1, fL2, fL3	40.0 to .80.0 Hz	0.05 Hz
Voltage		
VL1, VL2, VL3, VL12, VL23, VL31	0 to 520, 0 to 65 kV	1% ①

① Accuracy depending on the configured transformer ratio.

Reference Conditions

The data apply to the following reference conditions:

- Input voltage = Sinusoidal rated voltage.
- Frequency = Rated frequency ± 2%.
- Power supply = Rated voltage ± 2%.
- Power factor cos ϕ = 1.
- Ambient temperature 23°C ± 2K.
- Warm-up period = 20 minutes.

DP-300 Current Differential Protection Relay

DP-300

Product Description

The current flowing in the individual conductors is measured by means of current transformers installed on both sides of the protection zone. These transformers form the limits of the protection zone. By means of freely configurable relays, the unit will indicate if any of the adjusted fault current limits have been exceeded. The unit counts with a slope characteristic to prevent operation due to CT ratio mismatches, CT ratio errors, CT saturation, and errors because of tap changes.

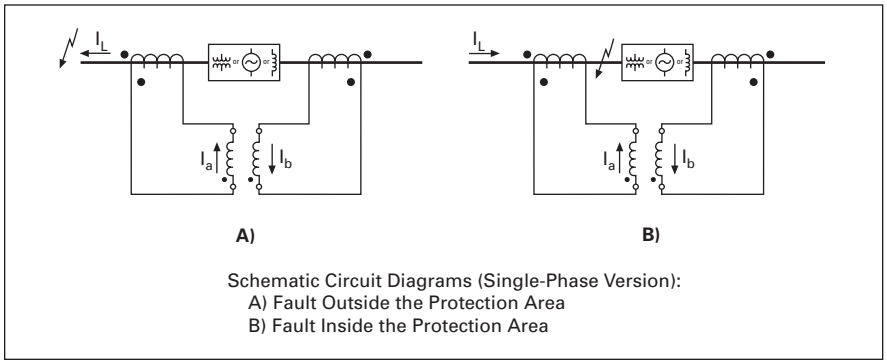
For transformer applications, the unit has 2nd and 5th harmonic restraints to prevent misoperation in case of inrush currents caused for energization or over excitation of the transformer.

When used in transformer applications, the DP-300 allows you to change the phase shift of the transformer, without having to worry about changing the connection of the external CTs, via selecting the vector group in the display. The different nominal currents of the high and low voltage side of the transformer, as well as the transformer ratio, may be configured. Every measuring point may be set separately. These features permit the DP-300 to be universal in its applications.

The DP-300 permits design simplification of the switchgear cabinet, facilitates the commissioning, ensures the operation of the system, is user friendly, and increases the availability of the system.

Application Description

The DP-300 offers a three-phase current differential protection for generators, motors and two winding transformers.



Schematic Circuit Diagrams (Single-Phase Version):
A) Fault Outside the Protection Area
B) Fault Inside the Protection Area

Figure 56-117. Protected Area Principle — Fault "A" Outside = No Alarm, Fault "B" Inside = Alarm

Features, Benefits and Functions

- True rms 6 x current measurement, three-phase system on both sides of the protected zone.
- Secondary current transformer output available as: /1 A or /5 A.
- Configurable trip set points for:
  - Differential current (Id)
  - Restrain current (Is)
- Configurable delays.
- Four alarm relays.
- Three discrete inputs (for blocking, acknowledgment, and configuration).
- Two-line LC display.
- Configurable transformer ratio.
- Configurable vector group.
- Transformer inrush detection/ suppression.
- Individual configuration of the nominal current for the high- and low-voltage side of the transformer.
- Configurable transformer ratio separated for currents of high- and low-voltage side of the transformer.

Product Specifications

Measurements, Currents — Isolated

- Measured currents (Nominal value IN): /5 A.
- Measuring frequency: 40.0 to 70.0 Hz.
- Accuracy: Class 1.
- Linear measuring range: 5.0 x IN.
- Maximum power consumption per path: < 0.15 VA.
- Rated short time current (1 s): 30.0 x IN.

Ambient Conditions

- Voltage supply: 90 to 250 Vac/dc.
- Intrinsic consumption: Max. 10 VA.
- Ambient temperature storage: -30° to 80°C (-22° to 176°F).
- Operational: 20° to 70°C (-4° to 158°F).
- Ambient humidity: 95%, Non-condensing.
- Maximum altitude: 6562 ft. (2000 m).
- Degree of pollution: 2.

Digital Inputs — Isolated

- Input range ($V_{Cont, Digital Input}$):
  - Nominal voltage
  - 18 to 250 Vac/dc
- Input resistance: Approximately 68 KΩ.

Relay Outputs — Isolated

- Contact material: AgCdO.
- Resistive load (GP) ($V_{Cont, Relay Output}$):
  - ac: 2.00 Aac @ 250 Vac
  - dc: 2.00 Adc @2 4 Vdc, 0.36 Adc @ 125 Vdc, 0.18 Adc @ 250 Vdc
- Inductive load (PD) ($V_{Cont, Relay Output}$):
  - ac: B300
  - dc: 1.00 Adc @ 24 Vdc, 0.22 Adc @ 125 Vdc, 0.10 Adc @ 250 Vdc

Protective Functions

- Operating Time: Minimum 100 ms.
- Differential current: Minimum 10%.

Housing

- Type: APRANORM DIN 43 700.
- Dimensions (W x H x D): 5.67 x 3.78 x 5.20 inches (144 x 96 x 132 mm).
- Front panel cutout (W x H): 5.43 [+0.039] x 3.63 [=0.031] inches (138 [+1.0] x 92 [+0.8] mm).
- Terminals: Screw-type, terminals depending on connector, 0.00388 in.^{2} (2.5 mm^2) or 0.00620 in.^{2} (4.0 mm^2).
- Recommended tightening torque:
  - [2.5 mm^2] 0.5 Nm / [4.0 mm^2] 0.6 Nm ([0.00388 in.2]
  - 4.43 in./lbs / [0.00620 in.^{2}] 5.3 in./lbs)
  - Use 60°/75°C (140°/167°F) copper wire only
  - Use Class 1 wire only (or equivalent)
- Weight: Approximately 2.2 lbs. (1,000 g).

Housing Protection

- Protection system:
  - IP42 from front with correct mounting
  - IP54 from front with gasket
  - Gasket: P/N 8923-1038)
  - IP20 from back
- Front foil: Insulating surface.
- EMC-Test (CE): Tested according to applicable EN guidelines.
- Listings: CE marking; UL listing for ordinary locations, UL/cUL listed, ordinary locations, File No.: E231544.
- Additional Approvals: IEEE C37.90.1 and C37.90.2.

Technical Data and Specifications

Dimensions

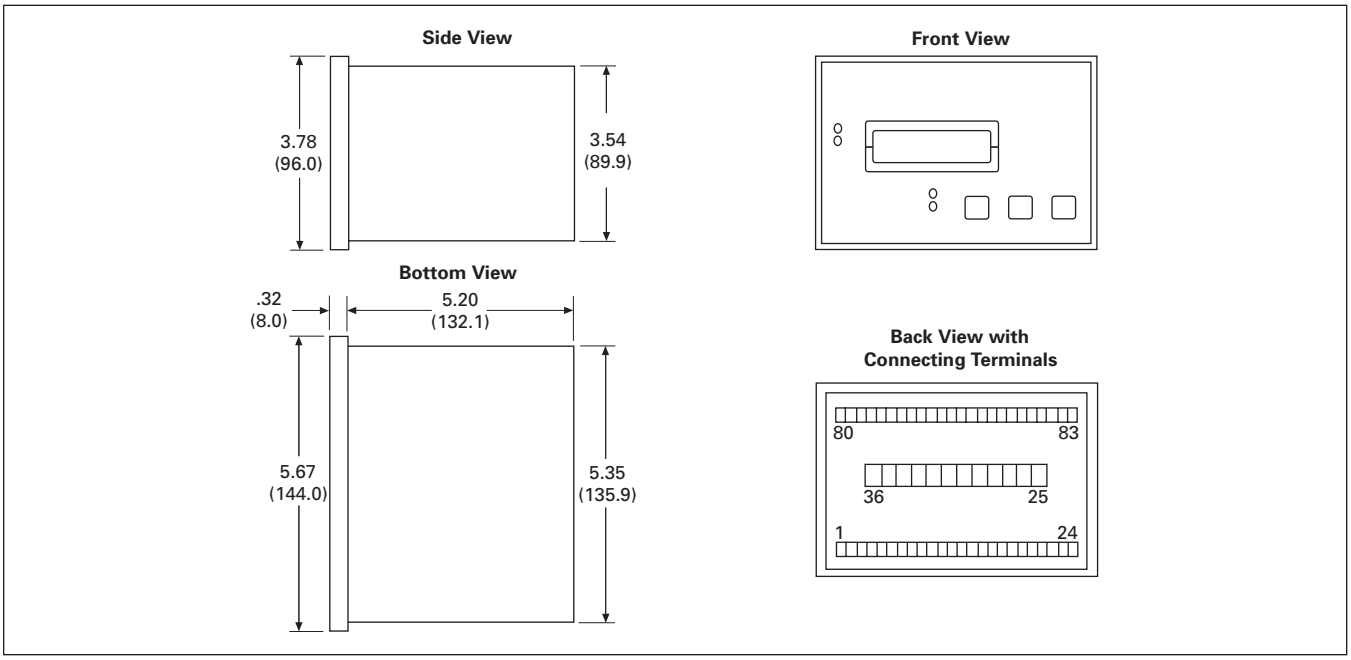
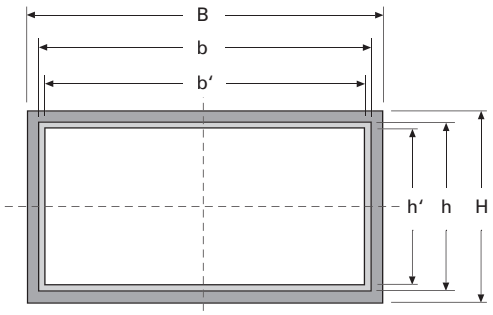


Figure 56-118. DP-300 Dimensions

Panel Cutout



Measure	Description	Dimensions in Inches (mm)	Tolerance in Inches (mm)
Height			
H	Total	3.78 (96.0)	—
h	Panel Cutout	3.62 (91.9)	.03 (+0.8)
h'	Housing Dimension	3.54 (89.9)	—
Width			
B	Total	5.67 (144.0)	—
b	Panel Cutout	5.43 (137.9)	.04 (+1.0)
b'	Housing Dimension	5.35 (135.9)	—
Depth (Including Terminals)			
	Total	6.30 (160.0)	—

The maximum permissible corner radius for cutout is .08 inches 2.0 mm.

Figure 56-119. DP-300 Panel Cutout

Wiring Diagram

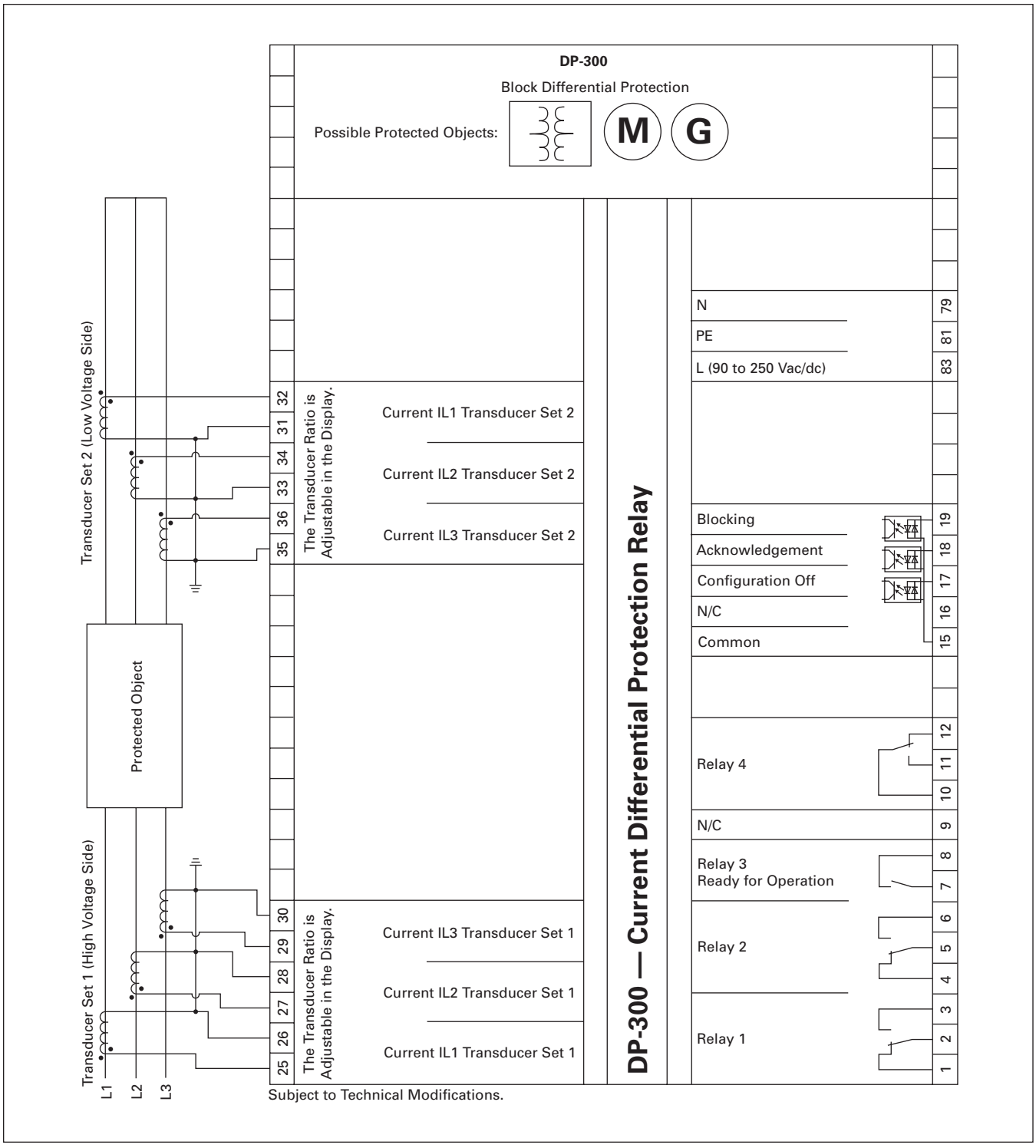


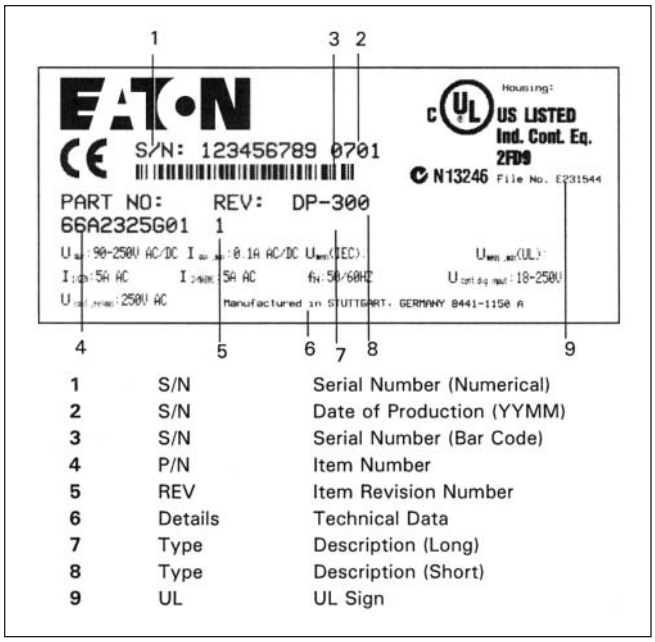
Figure 56-120. DP-300 Wiring Diagram

Transformer Vector Groups

Table 56-55. Transformer Vector Groups

Vector Group	Description
Yd5 Yy0 Dy5	HV: λ-Circuit Arrangement, LV: △-Circuit Arrangement, 5 x 30° = 150° HV: λ-Circuit Arrangement, LV: λ-Circuit Arrangement, 0° HV: △-Circuit Arrangement, LV: λ-Circuit Arrangement, 5 x 30° = 150°
Dd0 Yz5 Dz0	HV: △-Circuit Arrangement, LV: △-Circuit Arrangement, 0° HV: λ-Circuit Arrangement, LV: Z-Circuit Arrangement, 5 x 30° = 150° HV: △-Circuit Arrangement, LV: Z-Circuit Arrangement, 0°
Yd11 Yy6 Dy11	HV: λ-Circuit Arrangement, LV: △-Circuit Arrangement, 11 x 30° = 330° HV: λ-Circuit Arrangement, LV: λ-Circuit Arrangement, 6 x 30° = 180° HV: △-Circuit Arrangement, LV: λ-Circuit Arrangement, 11 x 30° = 330°
Dd6 Yz11 Dz6	HV: △-Circuit Arrangement, LV: △-Circuit Arrangement, 6 x 30° = 180° HV: λ-Circuit Arrangement, LV: Z-Circuit Arrangement, 11 x 30° = 330° HV: △-Circuit Arrangement, LV: Z-Circuit Arrangement, 6 x 30° = 180°

Typical Nameplate



1	S/N	Serial Number (Numerical)
2	S/N	Date of Production (YYMM)
3	S/N	Serial Number (Bar Code)
4	P/N	Item Number
5	REV	Item Revision Number
6	Details	Technical Data
7	Type	Description (Long)
8	Type	Description (Short)
9	UL	UL Sign

Figure 56-121. Typical DP-300 Nameplate

Tripping Characteristics

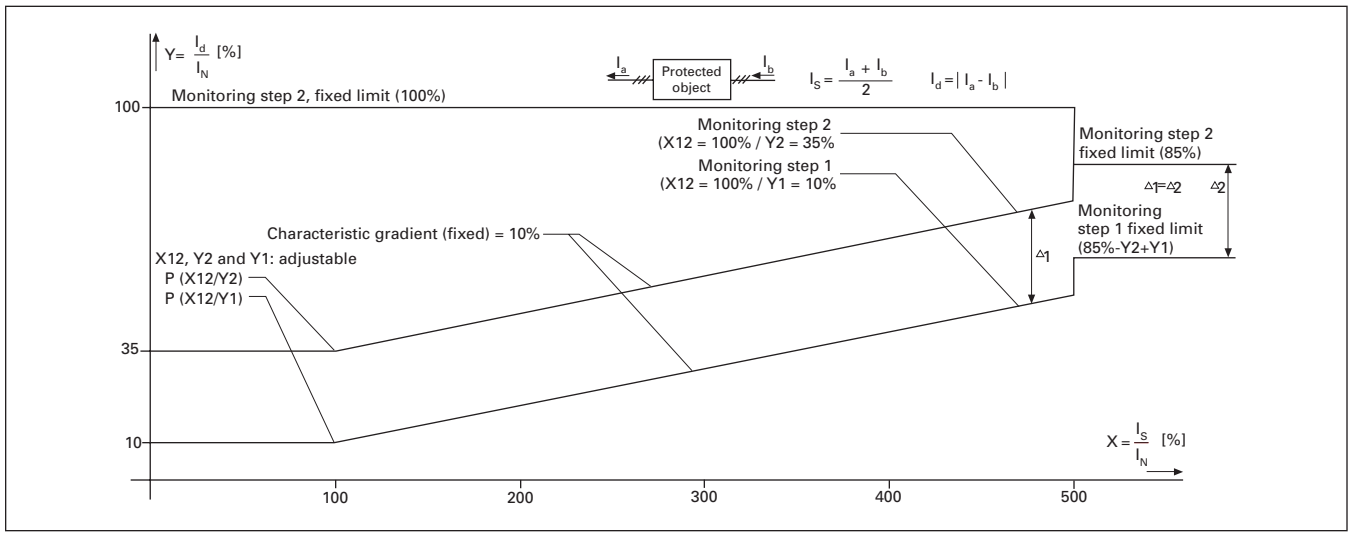


Figure 56-122. DP-300 Tripping Characteristics

EDR-3000 Feeder Protection

Feeder Protection EDR-3000

Product Description

The EDR-3000 Protective Relay is a multifunction, microprocessor-based overcurrent relay designed for both ANSI and IEC applications. It is a panel-mounted, self-contained unit that operates from either ac or dc control power. The EDR-3000 design provides true rms and fundamental sensing of each phase and ground current. Only one unit is required for each 3-phase circuit.

Current monitoring and operator selectable protective functions are integral to each relay. The EDR-3000 relay operates from the 5 A or 1 A secondary output of standard current transformers. Current transformer ratio information is quickly programmed into the unit via settings. This enables the relay to display metered current in primary amperes, secondary amperes or per unit values. The EDR-3000 features a user-friendly operations panel to monitor and program the relay. Operating parameters and troubleshooting information are displayed in the 128x64 LCD. In addition, all data and information can be communicated to a host computer equipped with PowerPort-E™. A "Communication Trip" and "Communication Close" control command can also be initiated by a host computer with an authorized access code for remote breaker operation.

Applications

- Provides reliable 3-phase and ground overcurrent protection for all voltage levels.
- Primary feeder circuit protection.
- Primary transformer protection.
- Backup to differential protection.
- May be used where instantaneous and/or time overcurrent protection is required.
- Ground element capable of residual, zero sequence or external source connections.

Protection Functions

- Breaker failure (50BF).
- Phase overcurrent protection per time-current curve (51-1, 51-2, 51-3).
- Calculated ground fault protection per time-current curve (51R-1, 51R-2).
- Independent measured ground or neutral fault protection per time-current curve (51X-1, 51X-2).
- Phase instantaneous overcurrent (50-1, 50-2, 50-3).
- Calculated ground or neutral instantaneous overcurrent (50R-1, 50R-2).
- Independent measured ground or neutral instantaneous overcurrent (50X-1, 50X-2).
- Curve shapes: ANSI, IEC, or thermal curves (11 thermal curves).
- Instantaneous or time delay reset.
- True RMS or fundamental sensing of each phase and ground current.
- Zone selective interlocking (phase and ground) or reverse blocking for bus protection.

Note: Refer to the Ordering Information and **Table 56-57** (Catalog Ordering Information) for optional features.

Metered Values

- rms and fundamental phase currents.
- rms and fundamental ground currents.
- Maximum, minimum and average rms and fundamental phase currents.
- Maximum, minimum and average rms and fundamental ground currents.

Monitored and Data Recording Values

- Trip circuit monitoring.

Note: Refer to the Ordering Information and **Table 56-57** (Catalog Ordering Information) for optional features.

- Breaker wear (accumulated interrupted current).
- Fault data logs (up to 20 events).
- Sequence of event recorders (up to 300 events).
- Waveform capture (3600 cycles total).
- CT supervision.

Control Functions

- Remote open/close.
- Programmable I/O.
- Programmable LEDs.
- Multiple setting groups (up to 4).

Communication

- Local HMI.
- Front RS-232 port.
- Rear RS-485 port.
- IRIG-B11.
- Protocols
  - Modbus RTU

Physical Characteristics

- Optional removable terminal blocks.
- Height: 8.62 in. (218.9 mm).
- Width: 6.82 in. (173.2 mm).
- Depth: 7.49 in. (190.2 mm), 5.56 in. (141.2 mm).

Note: Depth behind panel with projection mounted enclosure

Listings/Certification

- UL, CSA, CE.

Application Description

The EDR-3000 microprocessor-based relay provides reliable 3-phase and ground overcurrent protection for all voltage levels. It can be used for any application where instantaneous and/or time overcurrent protection is required. It is most commonly used as primary feeder circuit protection, as in **Figure 56-123**.

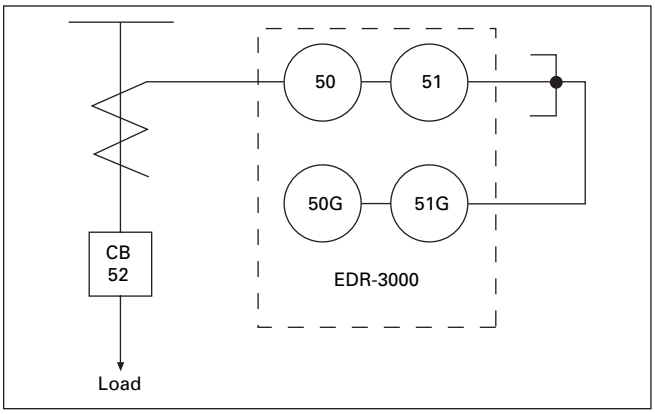


Figure 56-123. Primary Feeder Circuit Protection

The EDR-3000 may be applied as the transformer primary protection or as backup to the differential protection, as in **Figure 56-124**.

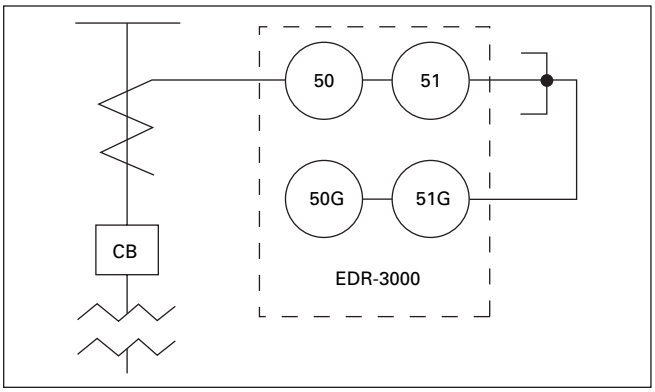


Figure 56-124. Transformer Overcurrent Protection

The EDR-3000 may be connected to the secondary side of a Delta-Wye grounded transformer with the ground element connected to a separate CT in the neutral connection of the transformer. With this connection, a lower CT ratio and a pickup setting can be used to provide more sensitive ground fault protection especially for resistance grounded systems (see **Figure 56-125**).

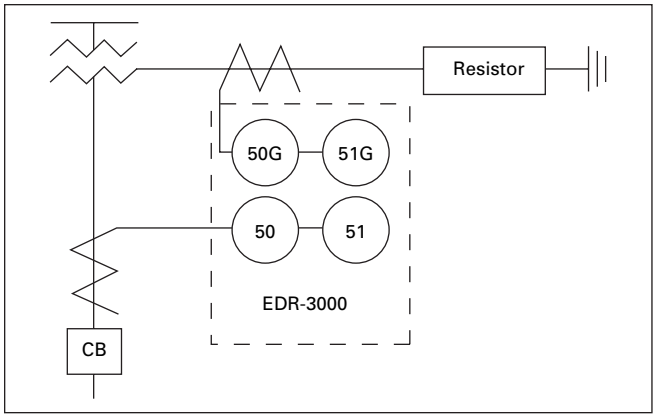


Figure 56-125. Transformer Secondary Protection with Neutral CT Connection

The EDR-3000 relay has special provisions for connection in a Zone Interlocking scheme that can be used for bus protection or to improve protection coordination in a tight or close system. Zone Interlocking is described in following sections. In addition the EDR-3000 has multiple setting groups that can be used to reduce arc flash hazard with instantaneous elements.

Overcurrent Protection

The EDR-3000 provides complete 3-phase and ground protection with separate elements and settings. The relay can be used with CTs from 1 to 50,000 A of primary current and 1 or 5 A of secondary current. The CT ratio can be set independently for phase and ground, allowing the ground element to be connected in either the residual or the separate ground CT configuration, as in **Figures 56-126** and **56-127**.

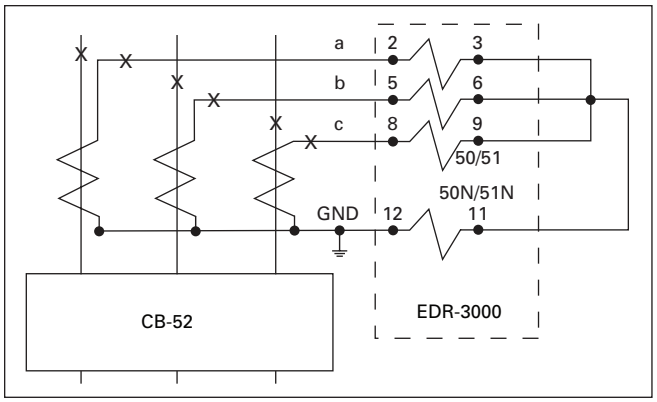


Figure 56-126. Residual Ground Connection

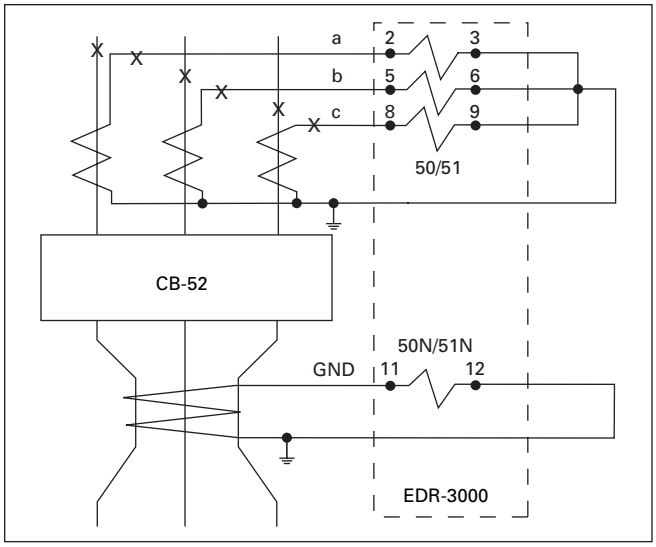


Figure 56-127. Separate Zero Sequence Ground CT Connection

Zone Selective Interlocking (Phase and Ground)

Note: Refer to the Ordering Information and **Table 56-57** (Catalog Ordering Information) for optional features.

Zone Selective interlocking is a protection function to minimize equipment damage resulting from a phase or a ground fault in an area where long time and/or short time delay is in use.

When the "Ground Zone Interlocking" feature is utilized, an immediate trip is initiated when the fault is in the breaker's zone of protection, regardless of its preset time delay. When the "Phase Zone Interlocking" feature is utilized, the time overcurrent elements work as follows. The instantaneous phase element will initiate an immediate trip when the fault is in the breaker's zone of protection, regardless of its preset time delay. For the time overcurrent phase element, the current sensed by the EDR-3000 must exceed 1.5 times the pickup setting for the zone selective interlocking to initiate an immediate trip signal when the fault is in the breaker's zone of protection.

Upstream EDR-3000 protected breakers are restrained from tripping immediately by an interlocking signal from the downstream EDR-3000 relay. This interlocking signal requires only a pair of wires from the downstream breaker to the upstream breaker. It provides standard coordinated tripping when the fault is located outside the zone of protection.

In the sample zone interlocking system shown in **Figure 56-128**, circuit breakers A, B and C are equipped with EDR-3000 overcurrent relays.

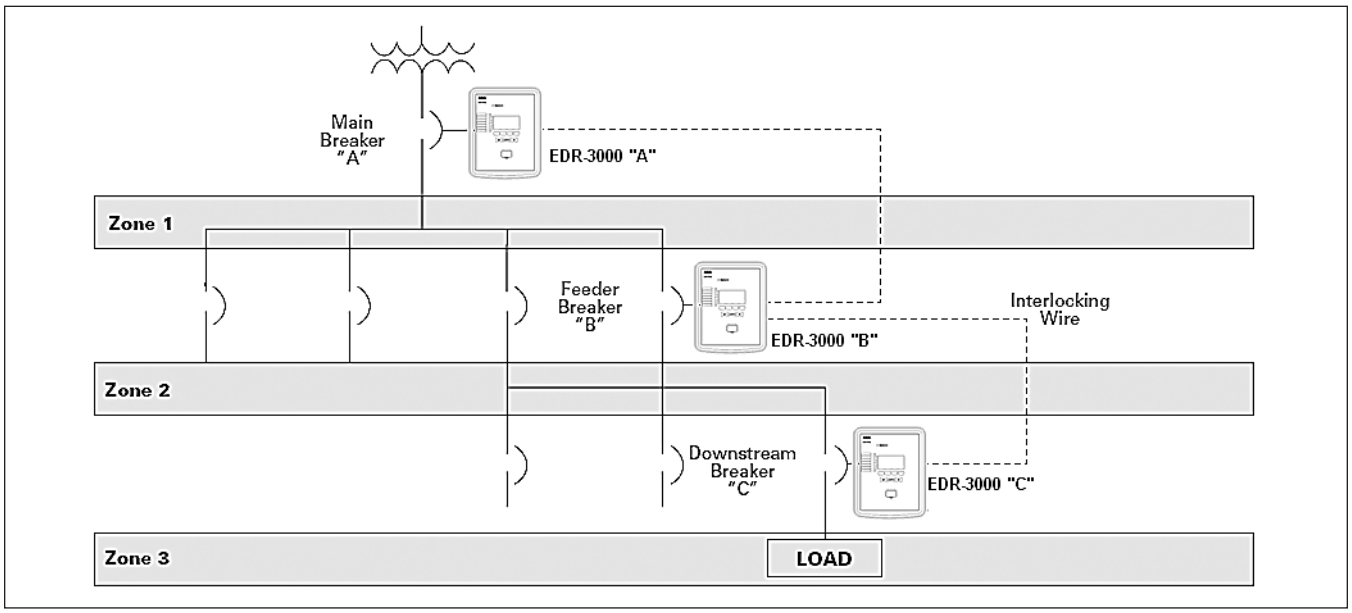


Figure 56-128. Sample Zone Selective Interlocking System

Fault Location Zone 3

Note: For the time overcurrent phase element, the current sensed by the EDR-3000 must exceed 1.5 times the pickup setting for the zone selective interlocking to initiate an immediate trip signal when the fault is in the breaker's zone of protection.

If a fault occurs at a point in Zone 3, the EDR-3000 of downstream breaker C senses the fault and sends a restraining signal to the upstream EDR-3000 of feeder breaker B. Having received this signal, the EDR-3000 of feeder breaker B withholds its trip command. As a result, only downstream breaker C is tripped.

Fault Location Zone 2

Note: For the time overcurrent phase element, the current sensed by the EDR-3000 must exceed 1.5 times the pickup setting for the zone selective interlocking to initiate an immediate trip signal when the fault is in the breaker's zone of protection.

If a fault occurs at a point in Zone 2, the EDR-3000 of feeder breaker B senses the fault and sends a restraining signal to the upstream EDR-3000 of main breaker A. The EDR-3000 of the downstream breaker C does not see this fault since it is situated on the downstream side of the fault. As a result, the EDR-3000 of downstream breaker C does not send a restraining signal to the EDR-3000 of feeder breaker B. Since it did not receive a restraining signal from the EDR-3000 of downstream breaker C, the EDR-3000 of feeder breaker B identifies that the fault is in Zone 2 and immediately trips feeder breaker B, regardless of its time setting.

Fault Location Zone 1

Note: For the time overcurrent phase element, the current sensed by the EDR-3000 must exceed 1.5 times the pickup setting for the zone selective interlocking to initiate an immediate trip signal when the fault is in the breaker's zone of protection.

If a fault occurs in Zone 1, no restraining signal is received by the Digitrip of main breaker A. As a result, main breaker A is immediately tripped by its EDR-3000 overcurrent relay, regardless of its time setting.

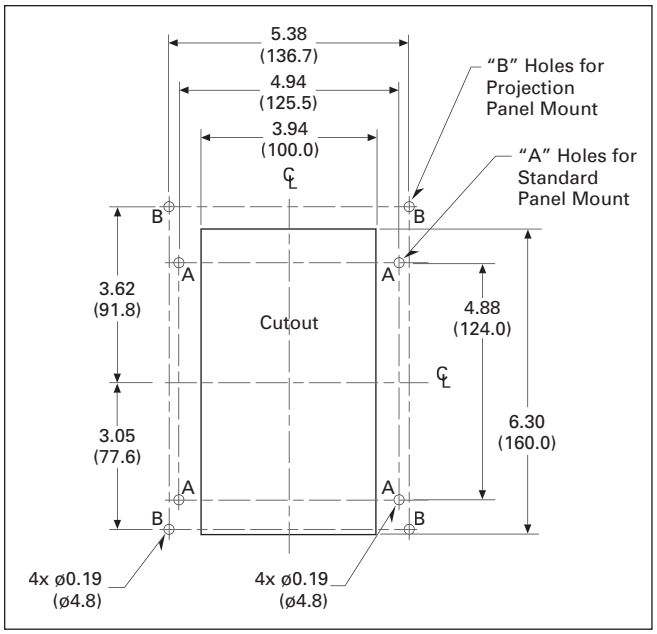


Figure 56-129. Drilling Pattern

Dimensions

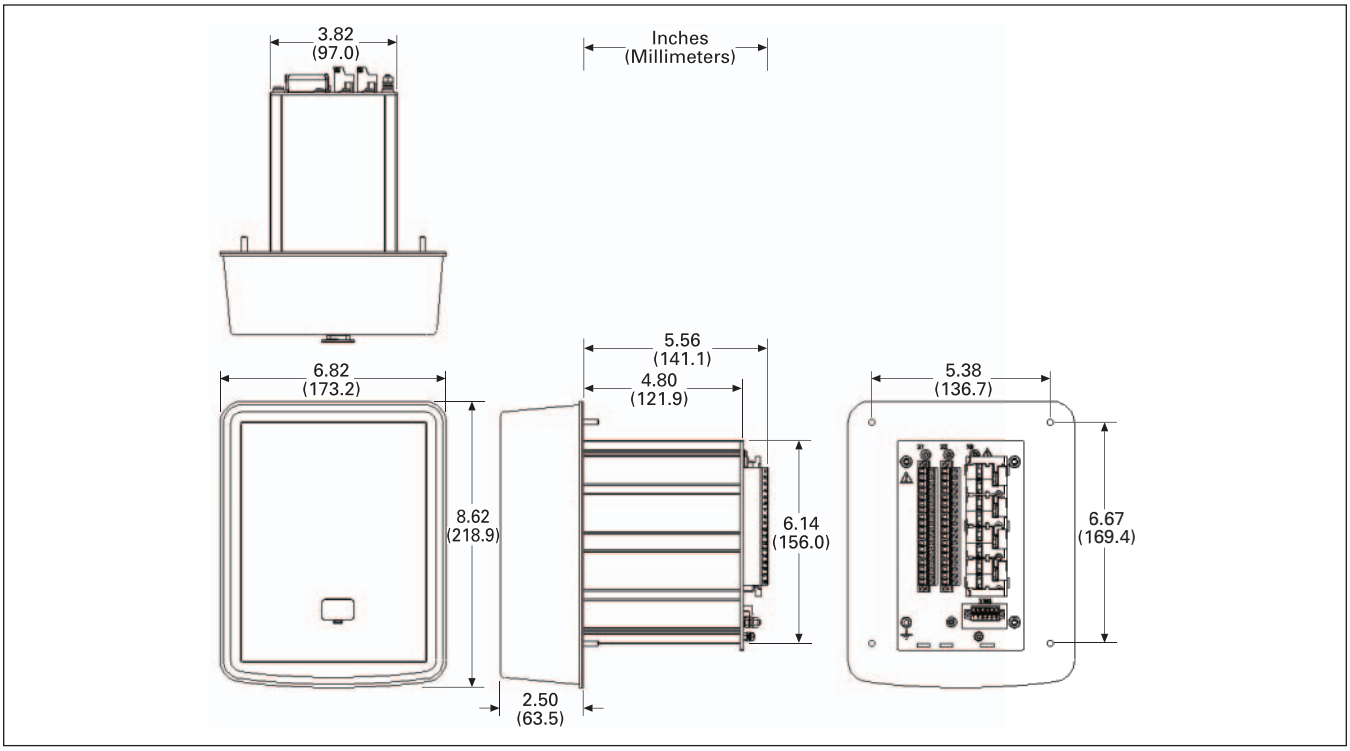


Figure 56-130. Projection Mounting

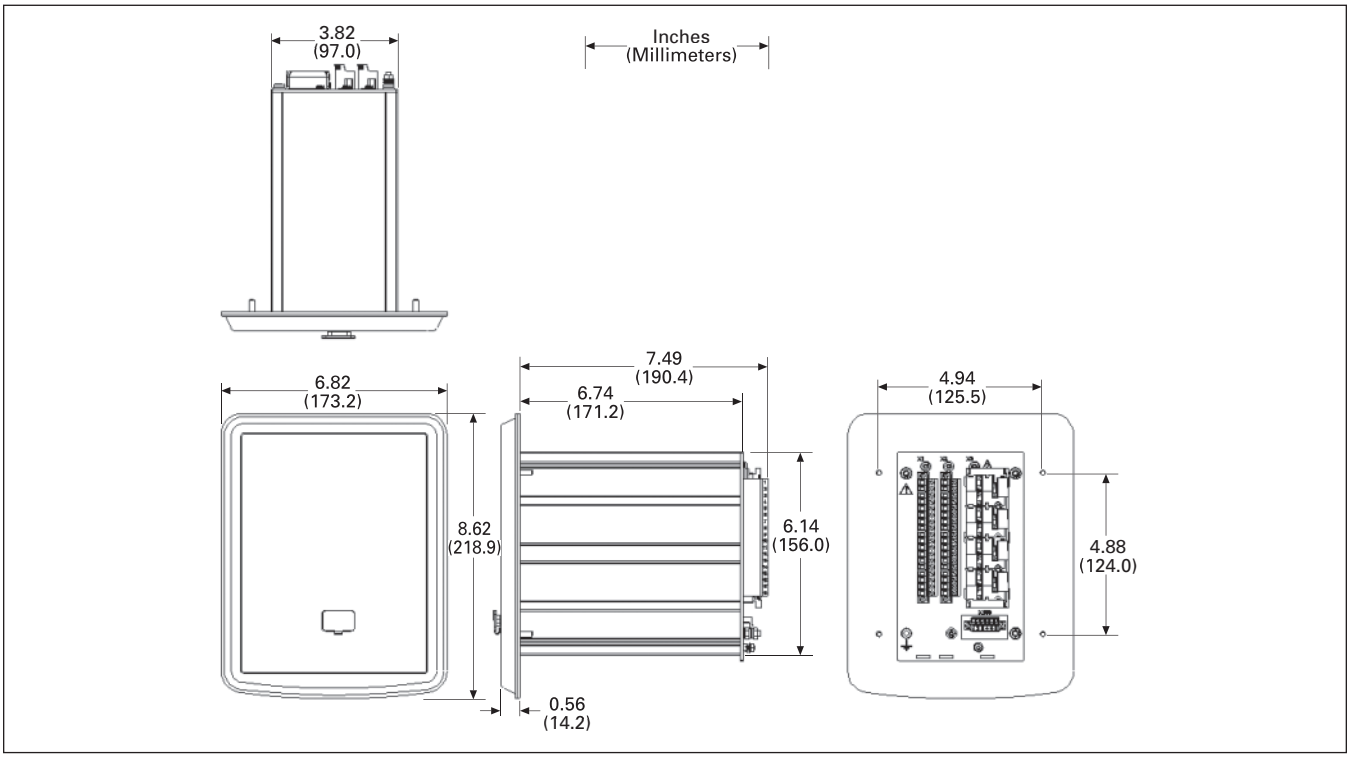


Figure 56-131. Standard Mounting

Product Specifications

Climatic Environmental Conditions

- Storage Temperature: -25°C up to +70°C (-13°F to 158°F).
- Operating Temperature: -20°C up to +60°C (-4°F to 140°F).
- Permissible Humidity at Ann. Average: <75% rel. (on 56d up to 95% rel.).
- Permissible Installation Altitude: <2000 m (6561.67 ft) above sea level.
- If 4000 m (13123.35 ft) altitude apply, a changed classification of the operating and test voltages may be necessary.

Degree of Protection EN 60529

- HMI front panel with seal IP54.
- Rear side terminals IP30.

Routine Test

- Insulation test acc. to IEC60255-5: All tests to be carried out against ground and other input and output circuits.
- Aux. voltage supply, digital inputs, current measuring inputs, signal relay outputs: 2.5 kV (eff)/50 Hz.
- Voltage measuring inputs: 3.0 kV (eff) / 50 Hz.
- All wire-bound communication interfaces: 1.5 kV dc.

Housing

- Housing B1: height/-width 183 mm (7.205 in.)/ 141.5 mm (5.571 in.).
- Housing depth (incl. terminals): 208 mm (8.189 in.).
- Material, housing: Aluminum extruded section.
- Material, front panel: Aluminum/ foil front.
- Mounting position: Horizontal (±45° around the X-axis must be permitted)
- Weight: EDR-3000 housing B1: approx. 2.4 kg (5.291 lb).

Plug-in Connector with integrated Short-Circuiter (Conventional Current Inputs)

- Nominal current: 1 A and 5 A.
- Continuous loading capacity: 4 x In/continuously.
- Overcurrent withstand: 30 x In/ 10 s.
- 100 x In/1 s.
- 250 x In/10 ms (1 half-wave).
- Screws: M4, captive type acc. to VDEW.
- Connection cross-sections:
  - 2 x 2.5 mm2 (2 x AWG 14) with wire end ferrule
  - 1 x or 2 x 4.0 mm2 (2 x AWG 12) with ring cable sleeve or cable sleeve
  - 1 x or 2 x 6 mm2 (2 x AWG 10) with ring cable sleeve or cable sleeve

Voltage Supply

- Aux. Voltage: 19 – 300 Vdc/ 40 – 250 Vac.
- Buffer time in case of supply failure: >= 50 ms at minimal aux. voltage communication is permitted to be interrupted.
- Max. permissible making current:
  - 18 A peak value for <0.25 ms
  - 12 A peak value for <1 ms
- The voltage supply must be protected by a fuse of:
  - 2.5 A time-lag miniature fuse 5 x 20 mm (approx. 1/5 in. x 0.8 in.) according to IEC 60127
  - 3.5 A time-lag miniature fuse 6. 3 x 32 mm (approx. 1/4 in. x 1 1/4 in.) according to UL 248-14

Power Consumption

- Power supply range: Power consumption in idle mode.
- Max. power consumption.
- 19 – 300 Vdc: 6 W 8.5 W.
- 40 – 250 Vac.
- For frequencies of 40-70 Hz: 6 W 8.5 W.

Real Time Clock

- Running reserve of the real time clock: 1 year min.

Display

- Display type: LCD with LED background illumination.
- Resolution graphics display: 128 x 64 pixel.
- LED-Type: Two colored: red/green.
- Number of LEDs, Housing B1: 8.

Digital Inputs

- Max. input voltage: 300 Vdc/270 Vac.
- Input current: <4 mA.
- Reaction time: <20 ms.
- Fallback time: <30 ms (safe state of the digital inputs).
- Four switching thresholds: Un =24 Vdc, 48 Vdc, 60 Vdc, 110 Vac/dc, 230 Vac/dc Un = 24 Vdc
  - Switching threshold 1 ON
    - Switching threshold 1 OFF
    - Min. 19.2 Vdc
    - Max. 9.6 Vdc
    - Un = 48 V/60 Vdc
  - Switching threshold 2 ON
    - Switching threshold 2 OFF
    - Min. 42.6 Vdc
    - Max. 21.3 Vdc
    - Un = 110/120 Vac/dc
  - Switching threshold 3 ON
    - Switching threshold 3 OFF
    - Min. 88.0 Vdc/88.0 Vac
    - Max. 44.0 Vdc/44.0 Vac
    - Un = 230/240 Vac/dc
  - Switching threshold 4 ON
    - Switching threshold 4 OFF
    - Min. 184 Vdc/184 Vac
    - Max. 92 Vdc/92 Vac
- Terminals: Screw-type terminal.

Current and Ground Current Measurement.

- Nominal currents: 1 A / 5 A.
- Max. measuring range:
  - up to 40 x In (phase currents)
  - up to 25 x In (ground current standard)
  - up to 2.5 x In (ground current sensitive)
- Continuous loading capacity: 4 x In/continuously.
- Overcurrent proof:
  - 30 x In/10 s
  - 100 x In/1 s
  - 250 x In/10 ms (1 half-wave)
- Power consumption: Phase current inputs
  - at In = 1A S = 0.15 mVA
  - at In = 5A S = 0.15 mVA
- Ground current input
  - at In = 1A S = 0.35 mVA
  - at In = 5A S = 0.35 mVA
- Frequency range: 50 Hz /60 Hz ±10%.
- Terminals: Screw-type terminals with integrated short-circuiters (contacts).

Binary Output Relays

- Continuous current: 5 A ac/dc.
- Switch-on current: 25 A ac/dc for 4 s.
- Max. breaking current: 5 A ac up to 125 Vac.
- 5 A dc up to 50 V (resistive).
- 0.2 A dc at 300 V.
- Max. switching voltage: 250 Vac/300 Vdc.
- Switching capacity: 2000 VA.
- Contact type: 1 changeover contact.
- Terminals: Screw-type terminals.

Front Interface RS-232

- Baud rates: 115200 Baud.
- Handshake: RTS and CTS.
- Connection: 9-pole D-Sub plug.

RS-485

- Master/Slave: Slave.
- Connection: 6 screw-clamping terminals RM 3.5 mm (138 MIL) (terminating resistors internal).

Design Standards

- Generic standard:
  - EN 61000-6-2
  - EN 61000-6-3
- Product standard:
  - EC 60255-6
  - EN 50178
- UL 508 (Industrial Control Equipment).
- CSA C22.2 No. 14-95 (Industrial Control Equipment).
- ANSI C37.90.

Tolerances of the Real Time Clock

- Resolution: 1 ms.
- Tolerance: <1 minute/month (+20°C).

Measuring Accuracy

- Max. measuring range: up to 40 x In (phase currents) up to 25 x In (ground current standard).
- Frequency range: 50 Hz / 60 Hz ± 10%.
- Accuracy: Class 0.5.
- Amplitude error if I < In: ±0.5% of the rated value.
- Amplitude error if I > In: ±0.5% of the measured value.
- Amplitude error if I > 2 In: ±1.0% of the measured value.
- Resolution: 0.01 A.
- Harmonics up to 20% 3rd harmonic ±2% up to 20% 5th harmonic ±2%.
- Frequency influence < ±2% / Hz in the range of ±5 Hz of the parameterized nominal frequency.
- Temperature influence <±1% within the range of 0°C up to +60°C.

Protection Stages Tolerances

Note: The tripping delay relates to the time between pickup and trip. The tolerance of the operating time relates to the time between the measured value has exceeded the threshold until the protection stage is alarmed.

Table 56-56. Protection Stages Tolerances

Description		Range	Step	Tolerance
Overcurrent Protection Stages 50P(X), 51P(X)				
Pickup	If the Pick-up Value is Exceeded, the Module/Stage is Started.	0.01...40.00 x In	0.01 x in	±1.5% of the Setting Value Resp. 1% In
Resetting Ratio		97% or 0.5% x In		
t	Tripping Delay	0.00...300.00 x s	0.01 x s	DEFT ±% resp..±10 ms
Operating Time	Starting from I Higher than 1.1 x I>			<+35 ms
Disengaging Time				<+45 ms
t-Multiplier	Time multiplier/tripping characteristic factor IEC NINV IEC VINV IEC EINV IEC LINV ANSI MINV ANSI VINV ANSI EINV Flat It I^2t I^4t	0.05...2.00	0.01	±5%
Reset Mode	Only Available if IEC Characteristics IEC NINV IEC VINV IEC EINV IEC LINV	0.00...60.00	0.01 x s	±1% resp. ±10 ms
	Reset Curves if ANSI Characteristics ANSI MINV ANSI VINV ANSI EINV Flat It ANSI MINV I^2t I^4t			5%

Table 56-56. Protection Stages Tolerances (Continued)

Description		Range	Step	Tolerance
Ground Current Stages 50G(X), 50N(X), 51G(X), 51N(X)				
Pickup	If the Pick-up Value is Exceeded, the Module/Stage is Started.	0.01...40.00 x In	0.01 x in	±1.5% of the Setting Value Resp. 1% In
Resetting Ratio		97% or 0.5% x In		
t	Tripping Delay	0.00...300.00 x s	0.01 x s	DEFT ±% resp..±10 ms
Operating Time	Starting from IG Higher than 1.1 x I>			<+35 ms
Disengaging Time				<+45 ms
t-Multiplier	Tripping Characteristic Factor IEC NINV IEC VINV IEC EINV IEC LINV ANSI MINV ANSI VINV ANSI EINV Flat It I^2t I^4t	0.05...2.00	0.01	±5%
Reset Mode	Only Available if IEC Characteristics IEC NINV IEC VINV IEC EINV IEC LINV	0.00...60.00	0.01 x s	±1% resp. ±10 ms
	Reset Curves if ANSI Characteristics ANSI MINV ANSI VINV ANSI EINV Flat It I^2t I^4t			5%
Circuit Breaker Failure Protection 50BF				
I-CBF>	If the Pick-up Value is Exceeded, the Module/ Stage Will Be Started.	0.0...0.1 × 1	0.01 × In	±1.5% of the Setting Value Resp. 1% In
Resetting Ratio		0.5% × In		
t-CBF	If the delay time is expired, an CBF alarm is given out.			<+40 ms
Operating Time	Starting From I Higher than 1.3 × I-CBF>			<+40 ms
Disengaging Time				<+40 ms

Wiring Diagram

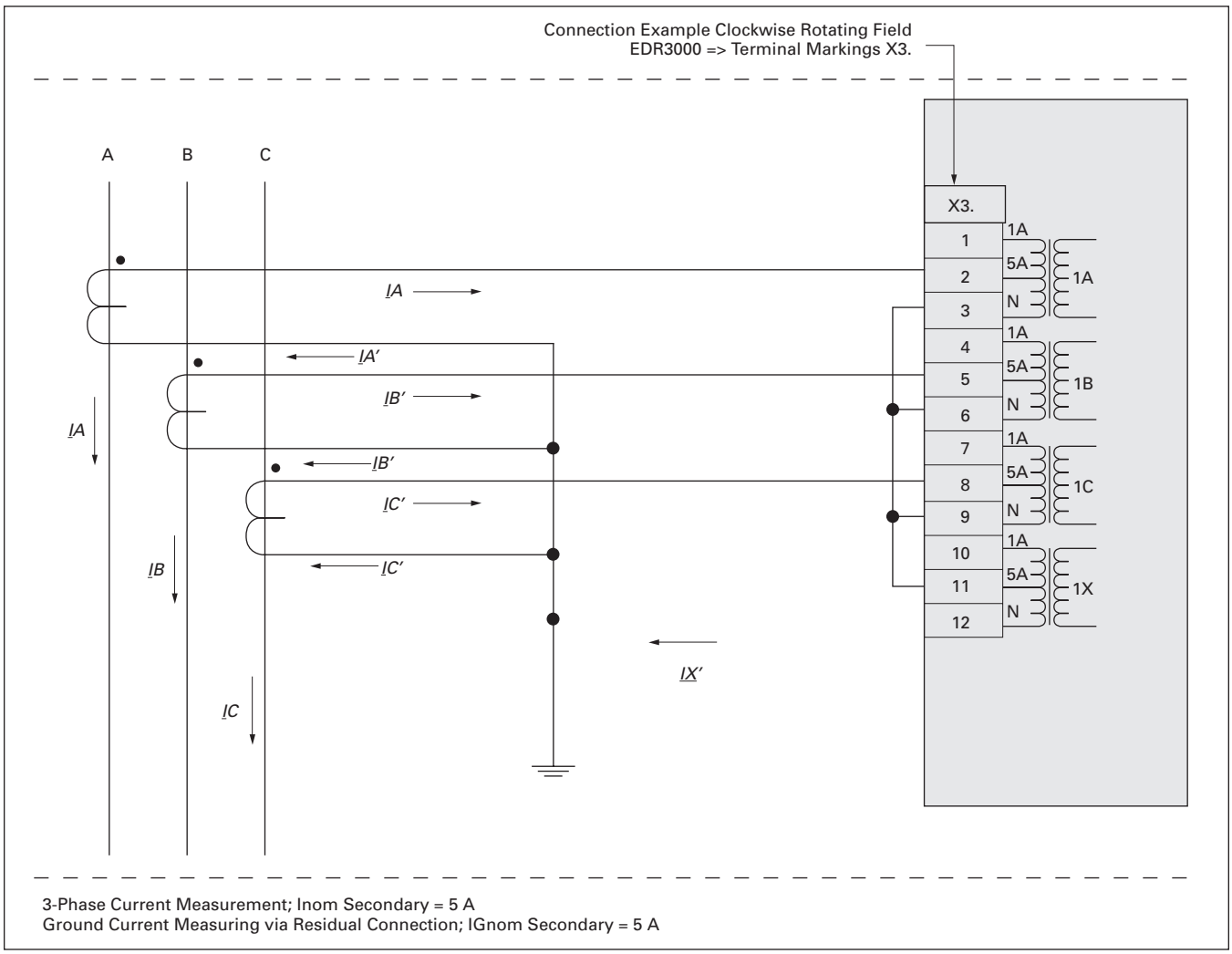


Figure 56-132. EDR-3000 Typical Wiring Diagram

Product Selection

The catalog number identification chart defines the electrical characteristics and operation features included in the EDR-3000. For example, if the catalog number were EDR3000-A0BA1, the device would have the following:

EDR-3000

(A) – 4 Digital Inp
0uts, 4 Output Relays

(0) – Phase Current 5 A/1 A, Ground Current 5A/1 A, Power Supply: 19 – 300 Vdc, 40 – 250 Vac

(B) – Modbus-RTU (RS-485)

(A) – Without Conformal Coating

(1) – Projection Panel Mount

Table 56-57. Catalog Numbering Selection Guide for Relay Removable Terminals

EDR3000 A 0 B A 1

Hardware Option 1
- **A** = 4 Digital Inputs, 4 Outputs, Removable Terminals
- **B** = 8 Digital Inputs, 6 Outputs, Removable Terminals, Trip Coil Monitor ①
- **C** = 4 Digital Inputs, 4 Outputs, Removable Terminals, Zone Interlocking ①, and IRIG-B ①

Hardware Option 2
- **0** = Phase Current 5 A/1 A, Ground Current 5 A/1 A, Power Supply Range: 19 – 300 Vdc, 40 – 250 Vac

Communication Options
- **B** = Modbus-RTU (RS-485)
- **C** = Modbus-TCP ① (RJ-45)

Conformal Coating Options
- **A** = None
- **B** = Conformal Coated Circuit Boards

Mounting Options
- **0** = Standard Mount
- **1** = Projection Panel Mount

① Consult factory for the availability of eight digital inputs, six outputs, trip coil monitor, zone interlocking, IRIG-B and Modbus-TCP.

Table 56-58. Catalog Numbering Selection Guide for Relay Fixed Terminals ②

EDR3000 E 0 B A 1

Hardware Option 1 ②
- **E** = 4 Digital Inputs, 4 Outputs, Fixed Terminals
- **F** = 4 Digital Inputs, 4 Outputs, Fixed Terminals, Zone Interlocking, and IRIG-B

Hardware Option 2 ②
- **0** = Phase Current 1 A, Ground Current 1 A, Power Supply Range: 19 – 72 Vdc
- **1** = Phase Current 5 A, Ground Current 5 A, Power Supply Range: 19 – 72 Vdc
- **2** = Phase Current 1 A, Sensitive Ground Current 0.1 A, Power Supply Range: 19 – 72 Vdc
- **3** = Phase Current 5 A, Sensitive Ground Current 0.5 A, Power Supply Range: 19 – 72 Vdc
- **4** = Phase Current 1 A, Ground Current 1 A, Power Supply Range: 85 – 300 Vdc, 85 – 250 Vac
- **5** = Phase Current 5 A, Ground Current 5 A, Power Supply Range: 85 – 300 Vdc, 85 – 250 Vac
- **6** = Phase Current 1 A, Sensitive Ground Current 0.1 A, Power Supply Range: 85 – 300 Vdc, 85 – 250 Vac
- **7** = Phase Current 5 A, Sensitive Ground Current 0.5 A, Power Supply Range: 85 – 300 Vdc, 85 – 250 Vac

Communication Options
- **B** = Modbus-RTU (RS-485)
- **C** = Modbus-TCP ② (RJ-45)

Conformal Coating Options
- **A** = None
- **B** = Conformal Coated Circuit Boards

Mounting Options
- **0** = Standard Mount
- **1** = Projection Panel Mount

② Consult factory for the availability of fixed terminals.

Ground Fault Relay

Ground Fault Relay

Product Description

Eaton's GFR Ground Fault Relays, current sensors, test panels and accessory devices are UL listed by Underwriters Laboratories in accordance with their standard for Ground Fault Sensing and Relaying Equipment, UL 1053, under File No. E48381.

Note: Suitable for either surface or semi-flush mounting.

A Type GFR ground fault protection system, when properly installed on a grounded electrical system, will sense phase-to-ground fault currents. When the level of fault current is in excess of the pre-selected current pickup and time delay settings, the GFR relay will initiate a trip action of a disconnect device which will open the faulted circuit and clear the fault.

The GFR devices are UL Class 1 devices designed to protect electrical equipment against extensive damage from arcing ground faults.

A basic Type GFR ground fault protection system consists of a ground fault relay, a ground fault current sensor, and a disconnect device equipped with a shunt trip device. This disconnect device can be a molded case circuit breaker, a power circuit breaker, a bolted pressure switch or other fusible disconnect device, suitable for application with UL Class 1 Ground Fault Sensing and Relaying equipment.

Note: Relays are also listed with CSA under File No. 43357.

Options and Accessories

Options

Additional optional equipment can be added to the protection system to meet the requirements of the specifying engineer, including:

- Ground fault test panel.
- Ground fault warning indicator relay.
- Ground fault indicating ammeter.

GFR relays are available with zone selective interlocking circuitry to interlock several relays within the same system. This allows the relay, which detects a ground fault, to instantly clear the fault by tripping the disconnect device. The relay simultaneously sends a signal to relay units "upstream" from the fault to time delay or to block their operation completely. Current sensors in various designs provide a range of "window" sizes to accommodate standard bus and cable arrangements.

Shunt trip attachments may be ordered for field mounting in Eaton's molded case circuit breakers, or may be ordered factory installed in the breaker.

Accessories

Test Panel (120 Vac)

Used to test the ground fault system, to give an indication the relay has tripped the breaker, and to reset the relay after tripping. These functions may be separately mounted pilot devices.

Note: When a mechanically reset relay is used with a test panel, both the relay and test panel must be reset following either a simulated ground fault test or actual ground fault. Not UL listed.

Table 56-59. Optional Test Panel

Control	Test	Catalog Number	Price U.S. $
120 volt 50/60 Hz	120 volt 50/60 Hz	**GFRTP**	

Ground Fault Warning Indicator

This is an accessory item for use with GFR relays with interlocking circuitry. At approximately 30 – 50% of the relay pickup setting, the indicator switches separate 120 Vac control power to a lamp or relay (not included) to give an indication of a ground fault. The indicator is rated 110/120 Vac 50/60 Hz for a maximum indicator load of .5 amperes.

Table 56-60. Ground Fault Warning Indicator

Description	Catalog Number	Price U.S. $
Manual Reset Self-Resetting	**1234C67G01** **1234C67G02**	

Indicating Ammeter

The optional indicating ammeter connects to the sensor terminals through a momentary contact pushbutton, and will indicate (in amperes) any ground fault current flowing through the sensor. Kit includes the ammeter and pushbutton.

Note: Not UL listed.

Table 56-61. Ammeter Kit

GFR System Used with	Kit Catalog Number	Price U.S. $
1 – 12 Amperes 5 – 60 Amperes 100 – 1200 Amperes	**752B820G01** **752B820G02** **752B820G03**	

Shunt Trip Attachments

Use 120 Vac shunt trips.

Face Plate

Recommended when these relays are semi-flush mounted, to close the door cutout opening.

Table 56-62. Face Plate

Description	Catalog Number	Price U.S. $
Face Plate	**752B410G01**	

Product Specifications

GFR Relay

- Ground fault detection ranges:
  - 1 – 12 amperes
  - 5 – 60 amperes
  - 100 – 1200 amperes
- Output contacts:
  - 240 Vac, 50/60 Hz: 3 amperes
  - 120 Vac, 50/60 Hz: 6 amperes
  - 28 Vdc: 3 amperes
  - 125 Vdc: .5 amperes
- Control power requirements:
  - 120 V, 50/60 Hz: .125 amperes, or 125 Vdc (optional)

Current Sensor

- 600 volt, 50/60 Hz maximum system voltage.

Discount Symbol **C10-S24**

Product Selection

Each installation requires:

- One relay unit (select trip ampere as required).
- One current sensor (select configuration required).
- One circuit breaker or disconnect device with shunt trip, or a shunt trip attachment for mounting in existing breaker.
- Test panel (optional).

Table 56-63. GFR Relay

GFR Relay Types	Ground Fault Pickup Amperes					
	1 – 12		5 – 60		100 – 1200	
	Catalog Number ①	Price U.S. $	Catalog Number ①	Price U.S. $	Catalog Number ①	Price U.S. $
For 120 Volt 50/60 Hz Control						
Electrical Reset with Zone Interlocking	**GFR12EI**		**GFR60EI**		**GFR1200EI**	
Electrical Reset without Zone Interlocking	**GFR12E**		**GFR60E**		**GFR1200E**	
Mechanical Reset with Zone Interlocking	**GFR12MI**		**GFR60MI**		**GFR1200MI**	
Mechanical Reset without Zone Interlocking	**GFR12M**		**GFR60M**		**GFR1200M**	
For 120 Vdc Control						
Mechanical Reset without Zone Interlocking	—		—		**GFR1200MD**	

① Suitable for either surface or semi-flush mounting.

Table 56-64. Current Sensor

Window Size in Inches (mm)	Catalog Number	Price U.S. $
Used with Relays Rated 1 – 12 Amperes		
5.50 (139.7) Inside Diameter	**1283C45G01**	
Used with Relays Rated 5 – 60 Amperes		
2.50 (63.5) Inside Diameter	**179C768G01**	
5.50 (139.7) Inside Diameter	**1256C13G01**	
7.81 x 11.00 (198.4 x 279.4) Rectangular ②	**1257C88G04**	
3.31 x 24.94 (84.1 x 760.5) Rectangular ②	**1257C92G03**	
Used with Relays Rated 100 – 1200 Amperes		
2.50 (63.5) Inside Diameter	**179C768G02**	
5.50 (139.7) Inside Diameter	**1256C13G02**	
8.25 (209.6) Inside Diameter	**179C767G02**	
7.81 x 11.00 (198.4 x 279.4) Rectangular ②	**1257C88G03**	
9.94 x 16.94 (252.5 x 430.3) Rectangular ②	**1257C90G02**	
9.94 x 23.94 (252.5 x 608.1) Rectangular ②	**1257C91G02**	
15.94 x 19.94 (404.9 x 506.4) Rectangular ②	**1257C89G02**	
3.31 x 24.94 (84.1 x 633.5) Rectangular ②	**1257C92G04**	
6.75 x 29.64 (171.5 x 752.9) Rectangular ②	**1255C39G03**	

② One end removable for installation.

Note: Instruction Leaflet 15321 available as a PDF at **www.eaton.com** (Go to Advanced Search and enter 15321).

Universal RTD Module

Universal RTD Module

Product Description

- Electronic Resistance Temperature Detector (RTD) provides motor temperature interface for the MP-3000 Motor Protection Relay.
- Monitors up to 11 RTDs consisting of six motor windings, two motor bearings, two load bearings and one auxiliary.
- Works with 10 ohm copper, 100 ohm platinum, 100 ohm nickel and 120 ohm nickel type RTDs.
- Include fiber optic and electrical communication interfaces to the MP-3000 Motor Protection Relay.

Application Description

Eaton's URTD Module is most commonly used to provide motor temperature information to the MP-3000 Motor Protection Relay. The MP-3000 Motor Protection uses this information for monitoring, tripping and alarming. The MP-3000 Intel-I-Trip overload algorithm will adjust its trip characteristics based on the actual motor temperature reported by the URTD Module. This improves the protection by using an actual temperature value instead of the assumed NEMA Standard Ambient Temperature.

The URTD Module may be mounted close to the motor or at the protective relay. Both electrical and fiber optic interface ports are provided to communicate temperature information to the MP-3000 relay. The electrical interface can transmit information using a three conductor shielded cable with a maximum cable distance of 500 feet (152 m). The fiber optic link has a maximum distance of 400 feet (122 m).

The URTD Module may be used with the IQ-1000 and IQ-1000 II motor relays. It may also be applied as a stand-alone temperature monitoring device communicating, for example, transformer temperature information back to a remote computer or PLC. An optional PONI (Product Operated Network Interface) is required for stand-alone applications.

Features, Benefits and Functions

- Universal design works with any RTD type simplifying installation and operation and reducing inventory.
- Stand-alone design permits mounting the module close to the motor reducing RTD wiring costs.
- RTD diagnostics detects faulty RTDs and wiring, reducing unnecessary tripping and alarming.

Product Specifications

- Input power requirements: 120 Vac (±15%).
- Frequency: 50/60 Hz.
- Power consumption: 6 VA.
- Operating temperature: 0° – 70°C (32° – 158°F).
- Storage temperature: -20° – 85°C (-4° – 185°F).
- Humidity: 0 – 95% R.H. noncondensing.
- Enclosure: Type 1.

Physical Characteristics

Dimensions in Inches (mm)

- Height: 7.67 (194.8).
- Width: 4.32 (109.7).
- Depth: 2.00 (50.8).

Options and Accessories

Additional Related Products from Eaton Corporation's Cutler-Hammer Series

The URTD Module must be operated with an MP-3000 Motor Protection Relay, computer or programmable controller. Please refer to the MP-3000 Motor Protection, PONI and PowerNet sections for additional related product information.

Eaton provides fiber optic cables for connecting to the MP-3000 or IQ-1000 II Motor Protection Relays.

Product Selection

Table 56-65. Universal RTD Module

Description	Catalog Number	Price U.S. $
Universal RTD Module	**URTD**	

Discount Symbol **C10-S24**

Technical Data and Specifications

Figure 56-133 shows the URTD Module dimensions and terminal designations.

Figure 56-134 shows a typical 3-lead type RTD wiring connection.

Dimensions

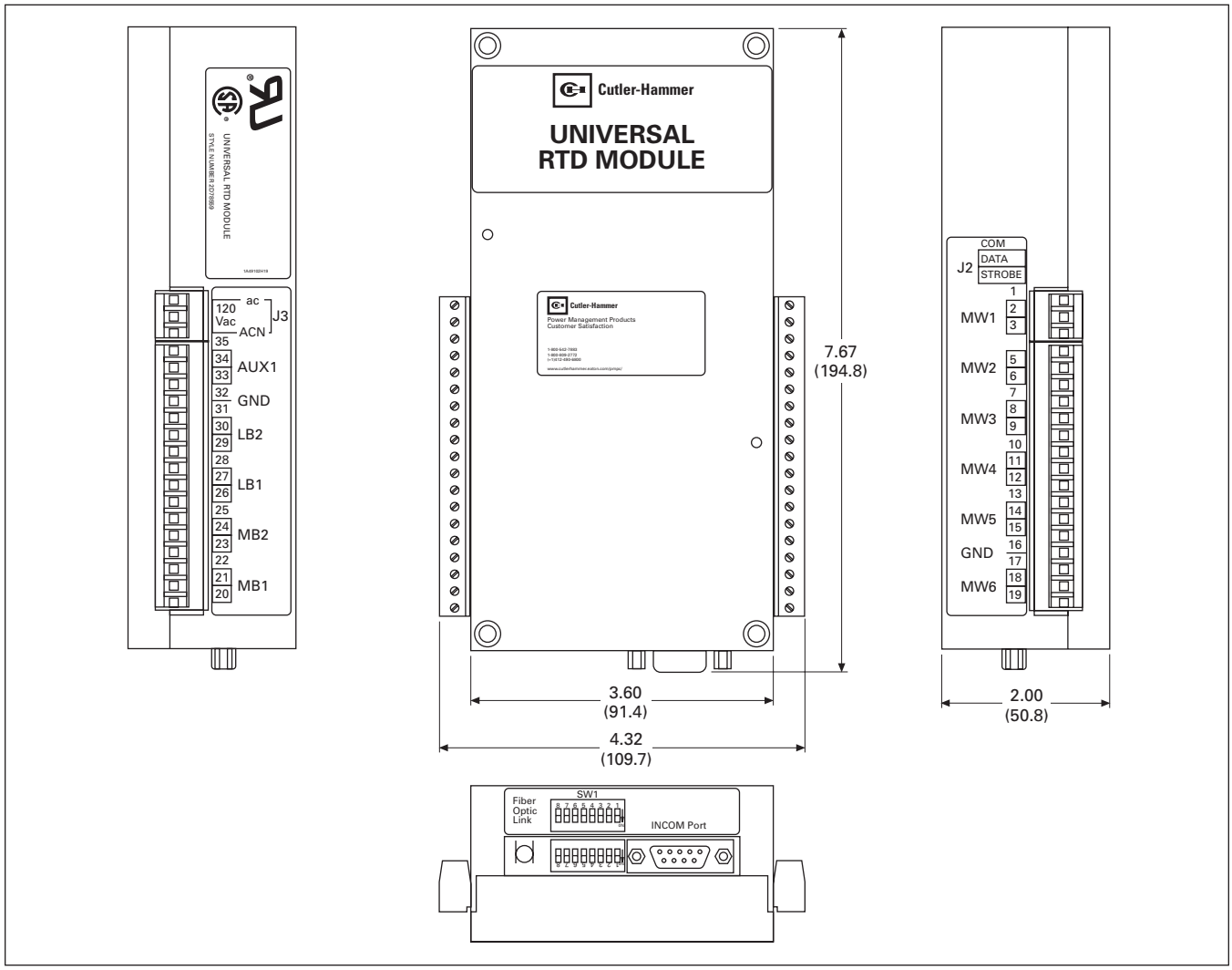
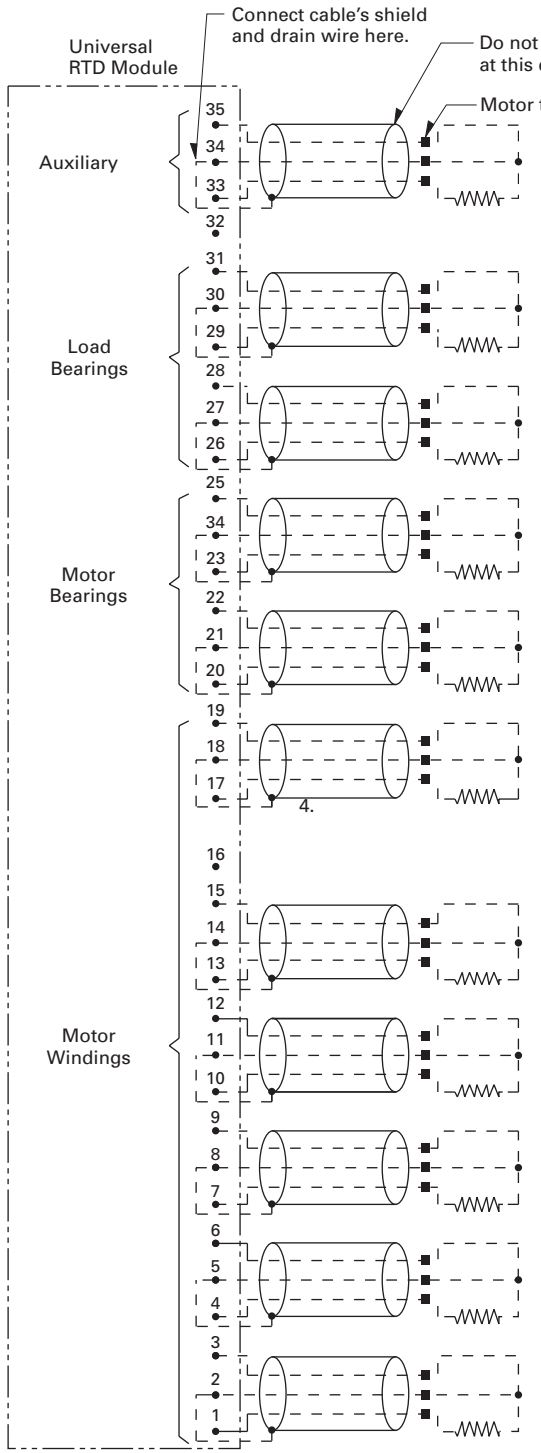


Figure 56-133. Universal URTD Module — Dimensions in Inches (mm)

Wiring Diagrams



Note: Wiring between motor RTDs and RTD Module must be 3-wire shielded cable. Unused channels should be shorted.

1. Each shielded cable's conductors must be connected on Universal RTD Module as shown.
2. Use of 3-lead RTDs is recommended.
3. RTDs must not be grounded at the motor, and no common connections between RTDs should be made at the Universal RTD Module or the motor.
   Terminal 16 or 32 should be connected to a suitable earth ground.

Figure 56-134. RTD Wiring (3-Lead Type)

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IQ 125 Volt DC Power Supply

IQ DC Power Supply

Product Description

Eaton's IQ DC Power Supply is a dc to ac inverter module intended for use where dc power is available, but some ac is required. The unit will operate Eaton's MP-3000, or other ac powered IQ devices requiring no more than 75 VA of power at any power factor.

The IQ DC power supply is available in two styles, one to be used with the MP-3000, and one for all other products.

Product Selection

Table 56-66. IQ DC Power Supply

Description	Catalog Number	Price U.S. $
IQ DC Power Supply Module	**IQDCPS**	

Features, Benefits and Functions

- Input voltage ranges from 105 Vdc to 140 Vdc.
- Single, 2-wire input — no need to set switches or adjust jumpers.
- Four connections — two for dc in, two for ac out.
- ac output is isolated from the incoming power.
- Built-in protection features protect against short circuits while providing ample power to start loads.
- Rated power output — 75 VA at any power factor.
- Operating temperature — -20°C to 60°C.
- Sinusoidal wave.

Discount Symbol **C10-S24**

Table 56-67. PowerNet Selection Chart

Description	Metering Devices								Low Voltage Trip Units							Protective Relays									Motor Starters		Input/Output Products			
	Power Xpert 4000/6000/8000 Series Meter	IQ Analyzer	IQ DP-4000/IQ DP-4130	IQ 200	IQ 200M	Power Sentinel	Energy Sentinel	IQ Multipoint Energy Submeter II	Digitrip 1150	Digitrip RMS 910	Digitrip RMS 810	Digitrip OPTIM 1050	Digitrip OPTIM 750	Digitrip OPTIM 550	Digitrip OPTIM 520mc	Network Protector Relay	Digitrip 3000	MP-3000	MP-4000	FP-4000	FP-5000	FP-6000	EDR-3000	Universal RTD Module	Advantage Starters	IT Starters	Addressable Relay	Analog Input Module	Digital Input Module	Other — IQ Transfer Switch
Voltage (Phase-phase)	●	●	●	●	●	●			●	●		●				●			●	●	●	●							
Voltage (Phase-neutral)	●	●	●	●	●	●		●	●	●		●				●			●	●	●	●							●
Current Phases	●	●	●	●	●	●			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●					
Current Ground	●	●								●	●	●	●	●	●	●	●	●	●	●	●	●								
Power																														
kW	●	●	●	●	●	●	●	●	●	●	●	●				●			●	●	●	●							
kWh	●	●	●	●	●	●	●	●	●	●	●	●							●	●	●	●							
kVA	●	●	●	●	●	●			●										●	●	●	●							
kVAh	●	●	●	●	●				●										●	●	●	●							
Vars	●	●	●	●	●	●			●							●			●	●	●	●							
Varh	●	●	●	●	●				●										●	●	●	●							
PF	●	●	●	●	●	●			●	●		●				●			●	●	●	●							
Demand																														
kW Demand	●	●	●	●	●				●			●					●			●	●	●								
kVA Demand	●	●	●	●	●				●			●					●			●	●	●								
Ampere Demand	●	●	●	●	●				●			●	●				●		●	●	●	●	●							
kvar Demand	●	●	●	●	●				●			●	●				●			●	●	●								
Power Quality																														
THD	●	50	30		●					31		31								●	●	●								
Current THD	●	●	●						●	●										●	●	●								
Voltage THD	●	●	●							●										●	●	●								
CBEMA (ITIC)		●																												
Frequency	●	●	●	●	●	●			●										●	●	●	●								
Current Waveform		●							●	●										●	●	●								
Voltage Waveform		●																		●	●	●								
Other Features																														
Download Set Points		●	●	●				●	●			●	●		●		●	●	●	●	●	●						●		●
Operations Count									●	●	●	●	●		●		●	●	●	●	●	●								●
High Load									●	●	●	●	●		●		●								●					
Trip Target Data									●	●	●	●	●		●		●	●	●	●	●	●	●		●					●
Remote Open/Close									●	●	●	●	●		●	●	●	●	●	●	●	●			●	●				
Start Profile																		●												
Auxiliaries																●														
Input/Output																														
Digital Input	8	3	1														2	2	4	4	8	6	8	6	8	6	4	4	2	1	①		
Digital Output		4 (3)	3														2	4	4	6	6	6	4	4						
Analog Input		1																												
Analog Output		3																												
Communication Modules																														
Embedded Protocols																														
Embedded INCOM				●		●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●			●	●	●	
Embedded Modbus RTU	●				●															●	●	●	●	●						
Embedded Modbus IP	●																							●						
Product Operated Network Interface (PONI) Modules																														
WPONI																			●						●					
IPONI		●	●																●	●										●
BPONI																								●						
DPONI			●																●	●										
EPONI		●	●																●	●										
Web PONI		●	●																●	●										●
RS485 PONI		●	●																●	●										

① 8 DI /4 KYZ

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Table 56-67. PowerNet Selection Chart (Continued)

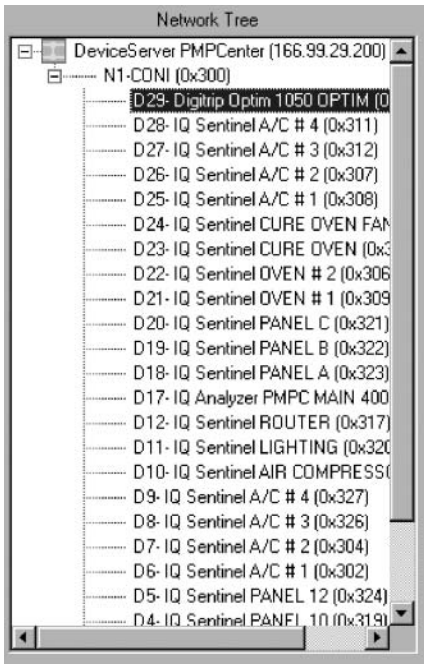
Description	Metering Devices								Low Voltage Trip Units							Protective Relays									Motor Starters		Input/Output Products			
	Power Xpert 4000/6000/8000 Series Meter	IQ Analyzer	IQ DP-4000/IQ DP-4130	IQ 200	IQ 200M	Power Sentinel	Energy Sentinel	IQ Multipoint Energy Submeter II	Digitrip 1150	Digitrip RMS 910	Digitrip RMS 810	Digitrip OPTIM 1050	Digitrip OPTIM 750	Digitrip OPTIM 550	Digitrip OPTIM 520mc	Network Protector Relay	Digitrip 3000	MP-3000	MP-4000	FP-4000	FP-5000	FP-6000	EDR-3000	Universal RTD Module	Advantage Starters	IT Starters	Addressable Relay	Analog Input Module	Digital Input Module	Other — IQ Transfer Switch
Protocol Converters																													
Modbus MINT (RTU) NetLink Modbus (RTU) Modbus EMINT (IP) JMI (N2) WEB EMINT (HTML) Ethernet Network Adapter (ENA)	●	● ● ●	● ● ●	● ● ●	●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●		● ● ●	● ● ●	● ● ●	● ● ●		● ● ●			● ● ●	● ● ●	● 	● ● ●	● ● ●	● ● ●	● ● ●
Media Converters																													
Ethernet NetLink MINTII EMINT IRMINT	●	● ● ●	● ● ●	● ● ●	●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●		● ● ●	● ● ●	●	● ● ●	● ● ●	● ● ●	● ● ●

Product Description

PowerNet Software Suite

Eaton's PowerNet software suite is a family of software applications, client/server configuration, that helps provide a window into an electrical distribution system. Monitoring and controlling capabilities are included in a single CD installation on any Windows NT, 98, 2000 or XP and above operating systems.

Connectivity Bundle



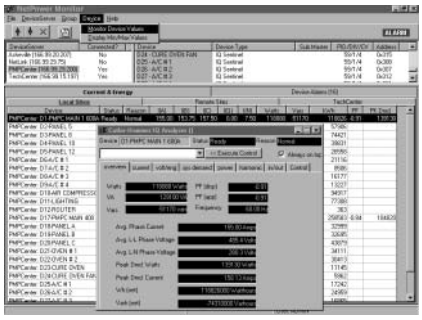
Network Tree

The Connectivity collection of software functionality opens the doors to an electrical distribution system by providing the foundation for communications with metering, relaying, multi-functional trip units, and input/output devices. The Connectivity bundle supports up to 1000 Eaton INCOM devices. Various combinations of Ethernet MINTs, NetLinks, or individual device-mounted Ethernet PONIs may be used to convert from the dedicated twisted pair fieldbus to an Ethernet TCP/IP network. The software enables communications over the Ethernet TCP/IP network providing the PowerNet client applications with real-time data, device event information, device waveforms, historical data and many other features. The Connectivity bundle stores its data in an MSDE/SQL database for maximum data security and reliability.

The Connectivity Bundle includes the following functionality:

- Communication to 5, 10, 34, 100, 200 and 1000 INCOM devices.
- Auto learn of all connected devices for maximum usability.
- Security configuration.
- Trending/Logging configurations.
- Device setpoint editing/printing/viewing.
- MSDE/SQL data storage.
- Dynamic Data Exchange (DDE) server.
- OLE for Process Control (OPC) server.
- Modbus RTU Gateway to data from Eaton INCOM communicating devices.

Facility Monitoring



NetPower Monitor

Building on the foundation that the Connectivity bundle provides, the Facility Monitoring bundle provides real-time data, historical trending data, and alarming information that is required to ensure maximum uptime and reliability, as well as efficient panel loading and proper maintenance activity.

The Facility Monitoring bundle enables the following functionality:

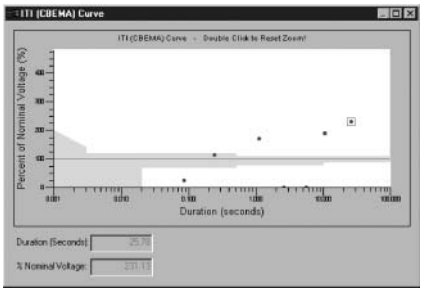
- Real-time data display in spreadsheet format with drag and drop experience.
- Alarm annunciation and viewing with complete traceability.
- OPC and DDE connectivity solutions for remote client PC installations.
- Drag and drop configuration.
- Multiple views/customization.
- ActiveX® monitor and control screens for all configured devices.

Power Quality Bundle

For the engineer, the PowerNet Power Quality bundle includes the functionality that engineers need to analyze events, determine root causes or perform accurate power quality studies for electrical distribution systems.

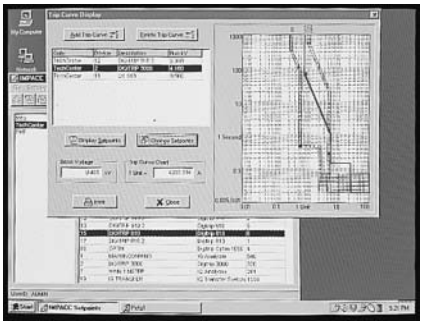
The Power Quality bundle includes the following functionality:

- Viewing of captured waveforms.
- Up to eight cycles of actual waveform.
- Zoomed-in view of high speed waveform samples.
- Spectrum chart showing frequency content and magnitude (Fourier analysis).



CBEMA/ITIC Plot

- CBEMA/ITIC representation of events.
- Top down access to specific waveform events from event lists and CBEMA/ITIC curves.



Trip Curve Display

Trip Curve

- Trip curve display for coordination and selectivity needs.
- Log-log coordination curve plotted on-screen for trip units and motor protective relays with the click of a button.
- Online modification of trip curve pickups and time delays; instant verification of coordination with an updated trip curve.
- Automatic scale adjustment based on device pickup level.
- Addition or removal of trip curves directly from the display screen.
- Color-coded curves tied to the device description for added clarity.
- Overlay multiple curves.
- View motor start profiles next to motor protection relay trip curve.

Customer: Franks Sporting Goods, Level One #107

Payment To: The Century Mall, Century Boulevard, Pittsburgh, PA 15234-5678

Billing Period From: 1/1/98 00:00 AM **To:** 1/31/98 23.59 AM

Billing Date: 2/1/98 **Due Date:** 2/10/98

Demand Charge – Based on Peak

Rate Period	Peak At	kW		Charge $
On-Peak	8:00:00 AM	34.22		41.66
Part-On-Peak	9:30:00 AM	336.26		275.40
			Subtotal:	**317.06**

kWh Charge

Rate Period	kWh		Charge $
On-Peak	490.66		1,569.33
Part-On-Peak	140.47		934.43
		Subtotal:	**2,503.75**

Your Common Shared Costs

Common Usage	Method	Shares
On-Peak		
HVAC I	Weight Points	30.6%
Lighting	Common Share	35.5%
Part-On-Peak		
HVAC I	Weight Points	30.6%
Lighting	Common Share	35.5%

Various Utility Related Costs

Description	Method	Shares	Unit $	Charge $
Customer Charge	Equal Share	50.5%		155.00
Peak-Period Rate Limiter Adj.	% of Total kWh	46.2%		19.86
Average Rate Limiter Adj.	% of Total kWh	46.2%		5.54
Economic Stimulus Credit	% of Total kWh	46.2%		(762.60)
Power Factor Adj.	% of Total kWh	46.2%		908.82
State Surcharge	Weight Points	57.7%		475.96
Connection Charge	Weight Points	64.5%		(214.19)
Special Charge	Per kW: On-Peak	34.22 kW	0.12345	4.22
Change Meter Labor	Per kWh: Maximum	490.66 kWh	0.22222	109.03
			Subtotal:	**701.64**
			Total Charge:	**3,522.46**

Figure 56-135. Typical Tenant Bill

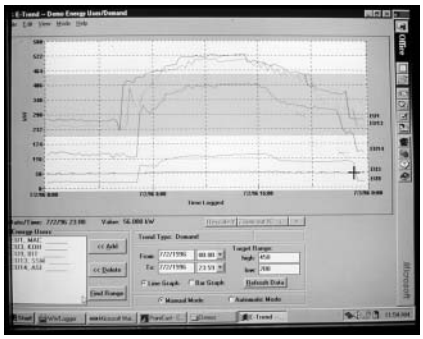
PowerNet Bill

The PowerNet software suite maximizes the usefulness of the stored data collected by the PowerNet system with a bundle of tools that generate trends of energy data and reports for cost allocation or billing for energy usage.

The PowerNet Bill bundle provides the following functionality:

- Support for electrical energy, as well as gas, water or any other utility that can be measured by the Digital Input Module.
- Accurate coincident peak demand calculations by patented broadcast capabilities.
- Time of day allocation.
- Holiday and weekend charges.
- Common usage allocation.
- DDE data billing.

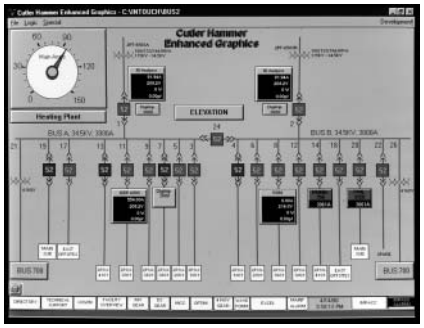
Energy Trend



Energy Trending of Multiple Metering

- Energy trending.
- Automatic scheduled generation of trends.
- Trending of individual meters and energy users.
- Zoom and pan for detailed analysis.
- Target flags for quick wasteful practice identification.

PowerNet Graphics



PowerNet Graphics

Eaton offers the ICONICS GENESIS32® software application which brings the power of the OPC to the core philosophy to the PowerNet family of solutions. This powerful HMI brings ease of use to the creation and implementation of comprehensive one-line diagrams, elevation drawings, system alarms and events, and trending to the table for a complete system solution. The ICONICS WebHMI application takes this window of your distribution system one step further by providing access to this information from any where, any time, and by any one. Standard Windows Explorer® browsers are supported. HMI applications such as these enable the customer to configure and present monitored data the way they want to see it. Pull data together from various manufacturer's devices and metering equipment including PLCs and even other Building Management Systems.

Application Description

- Energy management.
- Power quality.
- Reliability and uptime management.
- Information systems integration.

Architecture

Flexibility is a key feature of Eaton's PowerNet open design network. Multiple users and vendors may use the same PowerNet network, eliminating the need for a proprietary network dedicated to a single vendor. Your existing plant Ethernet network can be used as the backbone for your PowerNet monitoring system, avoiding the cost of installing dedicated network wiring or hardware.

In addition, power management data can be shared across the facility or across the world. The high-speed Ethernet architecture of the PowerNet is the same architecture that moves gigabits of data to millions of Internet and e-mail users.

IMPACC Compatibility

PowerNet is Backward compatible with existing IMPACC systems on a dedicated network or twisted pair network.

Connectivity

The PowerNet system has tools that every integrator should have in their pouch. PowerNet supports OLE for Process Control (OPC), Dynamic Data Exchange (DDE), and Modbus Gateway protocols as well as logging to an ODBC database structure. These integration solutions provide the ability to integrate the electrical distribution system seamlessly into an existing Building Management System, Distribution Control System, or any other type of HMI that could even include a simple Excel spreadsheet. These types of solutions and integration techniques extend monitored data to yet more appropriate eyes maximizing your investment.

Engineering Services

Supplementing the hardware and software, Eaton Electrical Services & Systems can provide local startup and integration services to customize Eaton's PowerNet system to your specific business needs. Basic field startup, integration of PowerNet into other plant systems, and remote monitoring of the plant with industry experts in energy and power quality are all services provided by our local field representatives. These services will ensure that you get maximum return on all of your system investments.

Flexible Network Architecture

The PowerNet network can be built in a variety of configurations. Systems can be built using existing Ethernet networks as the backbone as well as on a dedicated twisted shielded pair running throughout a facility. The most flexible, highest performance network architecture includes a dedicated twisted shielded pair network within the switchboard or equipment room connecting into a high speed Ethernet backbone. For a layout of a typical facility network, please refer to Eaton's PowerNet network overview on **Pages 56-156 and 56-157**.

Ethernet Backbone

TCP/IP Ethernet networks have become the worldwide standard for moving information. Industry has recognized Ethernet as a high speed, flexible, low-cost network that is not vendor dependent. Multiple vendors and users can share Ethernet backbone networks. Eaton's PowerNet network uses a standard TCP/IP Ethernet as the high speed backbone for carrying information to clients across the plant or across the world.

Eaton's communication hardware offerings in the Ethernet world include such products as the following:

- **Ethernet PONI:** designed to get a single device on the network and into the PowerNet system.
- **WEBPONI:** designed to provide access to a single device to anyone with a Web browser on the same Ethernet LAN or WAN.
- **Ethernet MINT:** designed to place a group of INCOM devices on to an existing Ethernet LAN.
- **NetLink:** designed to connect a group of INCOM devices to an existing Ethernet LAN or WAN with local storage and embedded communication firmware to ride through Ethernet downtime.

Note: Ethernet PONI and Ethernet MINT will not operate on shared Ethernet LANs. Designed for use on dedicated Ethernet only.

Dedicated Twisted Shielded Pair

Customers who desire a top performing reliable and fast monitoring system, and want to run a dedicated network for the power monitoring network, have a choice between a dedicated Ethernet network or running a twisted shielded pair. A network of 1000 INCOM devices running up to 10,000 feet (3048 m) can be networked through one twisted shielded pair of wire.

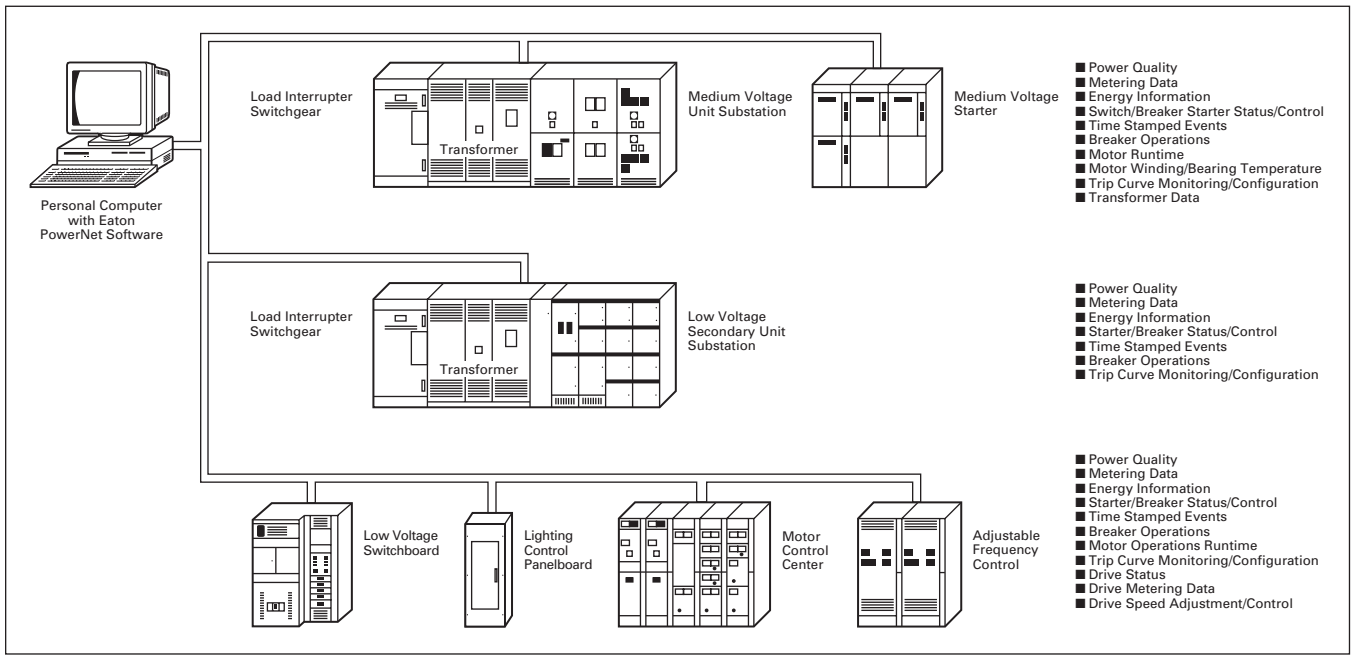


Figure 56-136. Eaton's PowerNet System

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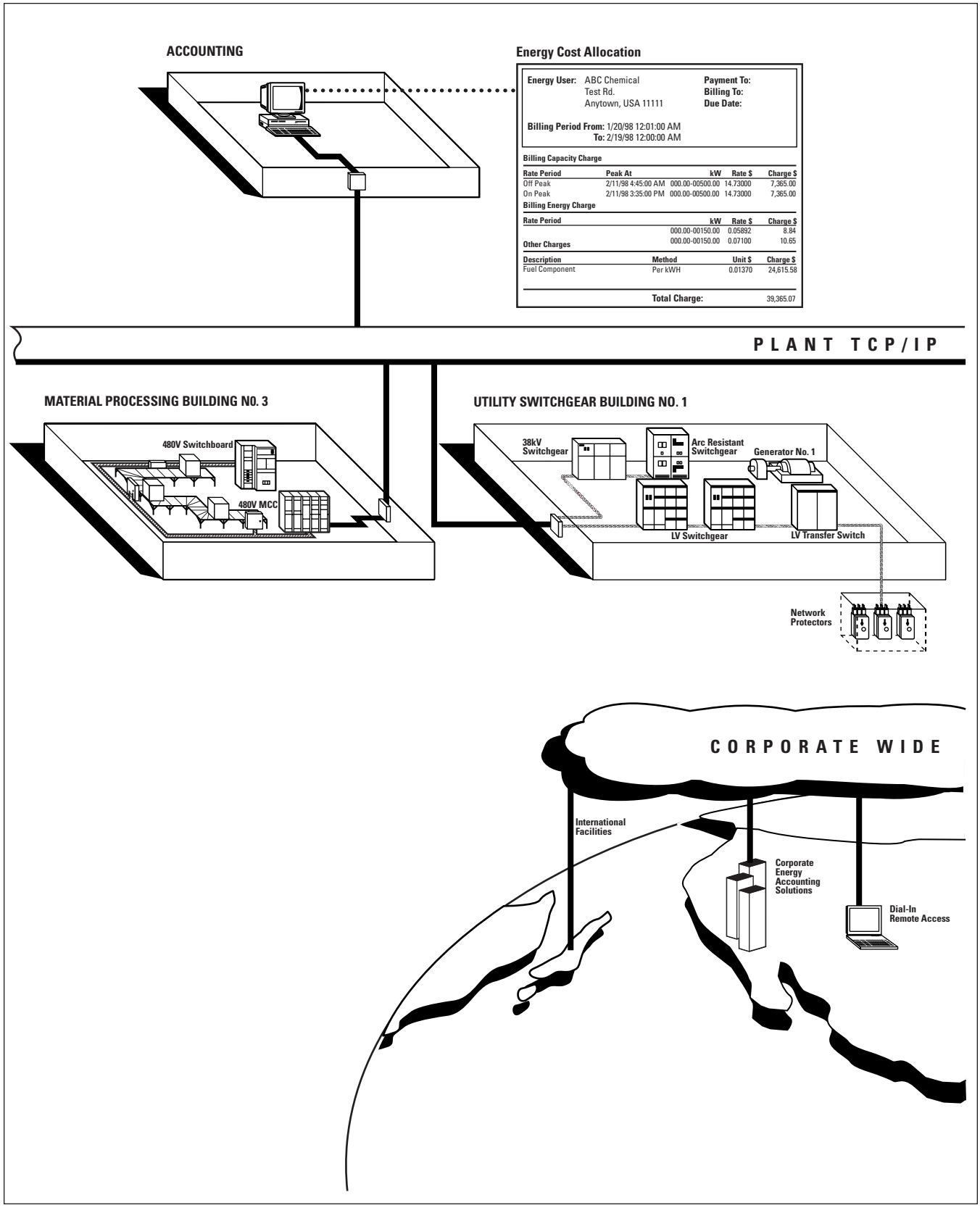

Figure 56-137. PowerNet Network System Overview

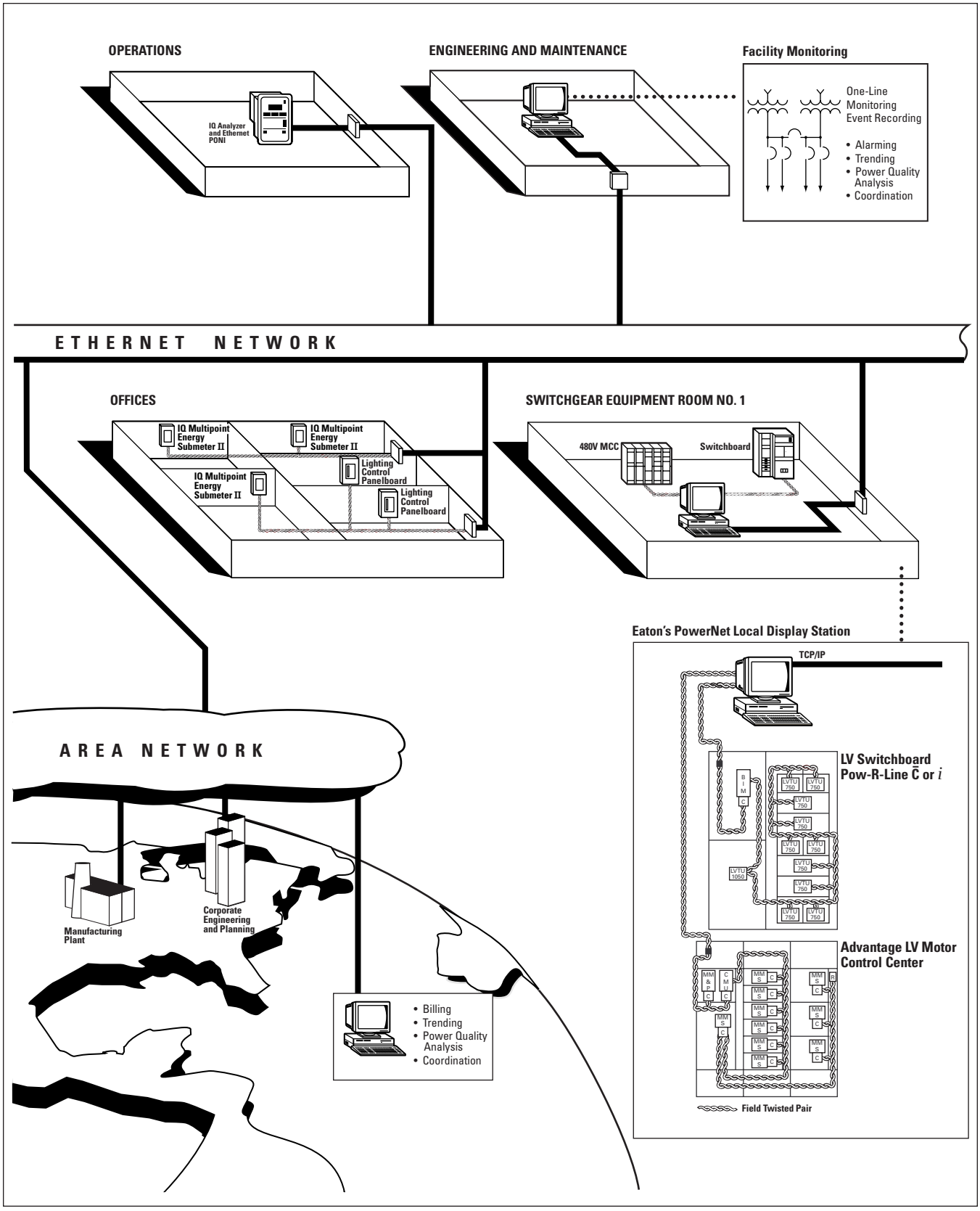

Figure 56-137. PowerNet Network System Overview (Continued)

56

PowerNet System Management Issues

Eaton's PowerNet™ Suite of client/server software products monitors critical components in a power distribution system. Metering devices, protective relays, circuit breaker trip units and motor starters communicate vital information to PowerNet clients for remote monitoring, alarming, trending and control. The PowerNet system provides the capability to analyze power quality, manage power costs, track and schedule maintenance, receive an early warning about potential problems, troubleshoot and increase productivity. The PowerNet system maintains backward compatibility with existing IMPACC systems and adds the capability to move data over the high speed Ethernet network.

Analyzing Power Quality

Electrical power quality is becoming ever more important with the continuing increase of nonlinear loads in industrial and commercial facilities. Voltage or frequency variances can disrupt many industrial processes, resulting in costly downtime and equipment losses. The PowerNet system provides historical profiles, or record of events for internal and utility verification, as well as real-time information that allows the user to isolate the source, magnitude, time and direction of power quality problems, including the following:

Voltage Disturbances

The most common power quality problem, voltage sags and swells, occurs because of utility supply variations, system faults or the concurrent starting of large motor loads.

Harmonics

Harmonic distortion appears on the distribution system because of such things like variable frequency drives and other non-sinusoidal loads where ac/dc conversion is present (UPS systems, computer power supplies, etc.).

Power Factor

The ability to monitor power factors throughout the facility ensures delivery of power at optimal efficiency, allows 100% usage of transformers and prevents costly power factor penalties.

Managing Power Costs

Power management is essential for an industrial or commercial facility. Electricity costs account for between 10 and 30% of total facility operating costs. Despite being often considered overhead, energy costs are manageable.

Manage When Energy is Used

Manage your energy costs by accurately measuring and quantifying energy patterns and usage within the facility.

Track Use Patterns

Efficiently schedule processes during non-peak usage times by being able to identify where and when energy is being consumed. Verify the effectiveness of energy reduction methods.

Purchase Energy

Make informed energy purchasing decisions by comparing how the rate structures offered by various suppliers impact your bottom line.

Allocate Energy Costs

Establish accountability and enable incentives for energy conservation by accurately allocating usage and costs to each process or department.

Verify Bill

Confirm the accuracy of your energy bill using the detailed data supplied by PowerNet.

Track and Schedule Maintenance

Coordination problems can be identified by overlaying coordination curves of active devices identifying problems before an unnecessary outage occurs. Maintenance schedules can be created on real-time mechanical and electrical equipment usage avoiding unnecessary preventive maintenance. Equipment benefiting from usage-based maintenance can have maintenance alarms initiated based on equipment lifetime deteriorators rather than simply time schedules.

Problem Avoidance and Troubleshooting

Operators receive alerts to potential problems before they occur, such as a breaker timing out to trip. Loads can be shed or switched to alternate sources to prevent critical upstream breakers from unnecessarily tripping on an overload condition.

Crucial electrical distribution information is instantaneously available to identify which breaker has tripped along with the cause and magnitude of the problem. Event sequence information narrows the list of possible causes to a trip. Immediate identification of problems can shorten downtime from hours to minutes saving production losses.

Increased Productivity

Increased productivity by eliminating the need for time consuming data collection. Personnel are freed to perform actual maintenance functions that keep facilities operating.

Historical archive records and software tools provide simple-to-use tools for collecting energy data for internal and tenant energy billing without manual meter reading or monthly bill calculating. Load profiles are immediately available for analysis when considering expansion. Spare capacity on existing feeders can be identified through historical load profiling avoiding trips due to seasonal peaks. Correct determination of transformer spare capacity can help avoid unnecessary substation purchases. Double-ended substations designed for redundancy can have their ability to carry loads through a single transformer's outage verified.

Product Selection

Table 56-68. PowerNet Software

Description	Style Number	Catalog Number	Price U.S. $
PowerNet Connectivity bundle includes support for n number of devices for DDE, OPC, Modbus and connectivity to other PowerNet client applications. Includes additional ability to trend data to MSDE/SQL Server database files.			
n = 5 Devices	66A2165G01	**PNCONNECT5**	
n = 10 Devices	66A2165G02	**PNCONNECT10**	
n = 34 Devices	66A2165G03	**PNCONNECT34**	
n = 100 Devices	66A2165G04	**PNCONNECT100**	
n = 200 Devices	66A2165G05	**PNCONNECT200**	
n = 1000 Devices	66A2165G06	**PNCONNECT1000**	
PowerNet facility monitoring for Reliability and Uptime customer needs includes real-time monitoring of all devices connected via PNCONNECT PowerNet software with Trending, control, and alarm notification, viewing, and acknowledging capabilities. When applied as stand-alone on remote computers, DDE and OPC functionality is included.	66A2165G07	**PNSTD** ①	
PowerNet's Power Quality bundle includes historical alarm viewing access with Waveform Display, Trip Curve Display, CBEMA/ITIC plotting, and High Speed Trending.	66A2165G08	**PNPQ** ①	
PowerNet's Energy management bundle includes the Energy Billing software application and the Energy Trending software application.			
n = 32 Energy Users	66A2165G09	**PNBILL32**	
n = 100 Energy Users	66A2165G10	**PNBILL100**	
n = 200 Energy Users	662165G11	**PNBILL200**	
n = 1000 Energy Users	66A2165G12	**PNBILL1000**	

① Requires PNCONNECT software for communication to INCOM devices.

Table 56-69. PowerNet HMI Solutions

Description	Catalog Number	Price U.S. $
GraphWorX32™, TrendWorX32™, AlarmWorX32™, WebHMI, Modbus OPC,	**PNGENC**	
WebHMI for 5 Browsers (Requires PNGENC on same PC)	**PNGENWEB5**	
GENESIS32® – Unlimited I/O Point Count Browser System. Full GENESIS32 capabilities, but no local OPC data and no local DataWorX32. May be purchased only in combination with a GENESIS32 Run-time License.	**PNGENBROWSER**	
GraphWorX32 supporting n point I/O		
n = 75	**PNGWORX75**	
n = 150	**PNGWORX150**	
n = 300	**PNGWORX300**	
n = 500	**PNGWORX500**	
n = 1500	**PNGWORX1500**	
n = ENT	**PNGWORXENT**	
TrendWorX supporting n point I/O		
n = 75	**PNGWORX75**	
n = 150	**PNGWORX150**	
n = 300	**PNGWORX300**	
n = 500	**PNGWORX500**	
n = 1500	**PNGWORX1500**	
n = ENT	**PNGWORXENT**	
AlarmWorX supporting n point I/O		
n = 75	**PNGWORX75**	
n = 150	**PNGWORX150**	
n = 300	**PNGWORX300**	
n = 500	**PNGWORX500**	
n = 1500	**PNGWORX1500**	
n = ENT	**PNGWORXENT**	
Development and Run Time for 60,000 Tags	**NPID60K**	
Development and Run Time for 60,000 Tags, with hardware key	**NPID60KD**	
Run Time for 60,000 Tags	**NPIR60K**	
View Only for 60,000 Tags, with hardware key	**NPIR60KD**	
View Only for 60,000 Tags	**NPIV60K**	
View Only for 60,000 Tags, with hardware key	**NPIV60KD**	
Development and Run Time for 500 Tags	**NPID500**	
Development and Run Time for 500 Tags, with hardware key	**NPID500D**	
Wonderware Graphics CD Only	**NP60CD**	

Discount Symbol **C10-S24**

Product Selection (Continued)

Table 56-70. PowerNet Software Upgrades

Description	Style Number	Catalog Number	Price U.S. $
PowerNet Connectivity bundle includes support for n number of devices for DDE, OPC, Modbus and connectivity			
n = 1 (Upgrade to 10 Devices)	66A2165G13	**PNCONUPG1**	
n = 2 (Upgrade to 34 Devices)	66A2165G14	**PNCONUPG2**	
n = 3 (Upgrade to 100 Devices)	66A2165G15	**PNCONUPG3**	
n = 4 (Upgrade to 200 Devices)	66A2165G16	**PNCONUPG4**	
n = 5 (Upgrade to 1000 Devices)	66A2165G17	**PNCONUPG5**	
PowerNet's Energy management bundle includes the Energy Billing software application and the Energy Trending			
n = 1 (Upgrade to 100 Energy Users)	66A2165G18	**PNBILLUPG1**	
n = 2 (Upgrade to 200 Energy Users)	66A2165G19	**PNBILLUPG2**	
n = 3 (Upgrade to 1000 Energy Users)	66A2165G20	**PNBILLUPG3**	

Table 56-71. PowerNet Software Updates to Latest Version

Description	Style Number	Catalog Number	Price U.S. $
Update PowerNet system to the latest version	66D2052G01	**PNUPDATE**	
Update to latest version of ICONICS Genesis software including GraphWorX32, TrendWorX32, AlarmWorX32, WebHMI, Modbus OPC,	—	**PNGENCUP**	
Update to latest version of WebHMI for 5 Browsers (Requires PNGENC on same PC)	—	**PNGENWEB5UP**	
Update to latest Development and Run Time	2107A07G25	**NPID60KUP**	
Update to latest Run Time	2107A07G26	**NPIR60KUP**	
Update to latest Development and Run Time, with Key	2107A07G75	**NPID60KUPD**	
Update to latest Run Time, with Key	2107A07G76	**NPIR60KUPD**	
PowerNet Upgrade from Series III 20 (PNSTD and PNCONNECT34)	—	**NP20UP**	
PowerNet Upgrade from Series III 200 (PNSTD and PNCONNECT200)	—	**NP200UP**	
PowerNet Upgrade from Series III 20 (PNSTD and PNCONNECT1000)	—	**NP1000UP**	
Series III Waveform Update (PNPQ)	—	**NPWAVEUP**	
Series III Energy Billing 20 User Upgrade to PowerNet Bill (PNBILL3)	—	**S3BILL202PN**	
Series III Energy Billing 200 User Upgrade to PowerNet Bill (PNBILL)	—	**S3BILL2002PN**	
Series III Energy Billing 1000 User Upgrade to PowerNet Bill (PNBIL)	—	**S3BILL10002PN**	

Ethernet/Modbus NetLink

Ethernet/NetLink

Product Description

Communications

- Ethernet-Based (TCP/IP via 10Base-T).
- INCOM.
- E-PONI.
- Modbus RTU slave communications through RS-232 port.

Physical Characteristics

- Suitable for panel mounting.
- Powered via 120/240 Vac.
- 10Base-T connection.

Dimensions

- Height: 7.8 inches (198 mm).
- Width: 4.5 inches (114 mm).
- Depth: 9.6 inches (244 mm).
- Weight: 6 lbs. (2.7 kg.).

Application Description

Applications

- Bridge multiple Cutler-Hammer Power Management Software devices to an Ethernet network.
- Modbus RTU output for multiple Eaton Power Management Software devices.
- Historical data logging.
- Event storage.

Metered/Monitored Parameters

Provides remote access over Ethernet or Modbus to the protective and monitoring parameters of any supported communicating Eaton meter, protective relay, breaker or motor starter.

Features, Benefits and Functions

General Description

The NetLink translates INCOM Frequency Shift Key (FSK) to standard Ethernet TCP/IP messages or Modbus RTU or to both.

Ethernet NetLink

The Ethernet NetLink allows connection of 200 meters and protective relays to an Ethernet Network. Configuration can be done remotely and is stored in non-volatile RAM. The NetLink can be applied on dedicated or shared facility Ethernet Networks.

The Ethernet NetLink is a server for device information to Eaton Power Management Software clients on local or enterprise networks.

The Ethernet NetLink enables the following functionality:

- Connection of up to 200 Eaton meters and protective relays to an Ethernet Network.
- Localized data collection at the substation or equipment building level.
- Data logger capabilities to store event and trend information from attached Eaton devices.
- Flexible system placement on dedicated or shared facility Ethernet Networks.
- A 10Base-T port for communications at 10 Mbps on any Ethernet network supporting TCP/IP packets.
- Remote configuration that is kept safe in non-volatile memory.
- Available for purchase with either one or two INCOM ports.

The Ethernet NetLink comes with a 10Base-T communications of 10 Mega-baud on any network supporting TCP/IP packets. The NetLink is typically located at the substation or equipment building level. It serves as a distributed data logger for attached devices.

Modbus NetLink

The Modbus NetLink (NetLink M) converts data from as many as 200 meters and protective relays into Modbus RTU registers. Configuration can be done remotely and is stored in non-volatile RAM. The Modbus NetLink uses a register mapping technique to map up to 10,000 read registers for real-time data and read/write registers for control commands for 200 devices.

The Modbus NetLink is a server for Eaton device information to Modbus master equipment via Modbus RTU registers over an RS-232 communication medium.

The Modbus NetLink enables the following functionality:

- Connection of up to 200 Eaton meters and protective relays into Modbus RTU registers.
- A register mapping technique to map up to 10,000 read registers for real-time data and read/write registers for control commands.
- A 10Base-T port for direct configuration that is stored in non-volatile memory.
- Available for purchase with either one or two INCOM ports.

Dual Ethernet/Modbus NetLink

The Dual Ethernet/Modbus NetLink combines the functionality of the Ethernet and Modbus NetLinks into one package.

This enables remote monitoring of all connected equipment via the Power Management Software suite, as well as local communications to a Modbus master sharing the available information for two completely separate and independent functions.

Mounting Information

The most common location for the NetLink is in a wall-mounted enclosure near a patch panel, a network hub, or a wall-mounted network port. Modbus NetLinks should be mounted in close proximity to the Modbus Master. The distance between the Modbus Master and the RS-232 output should not exceed 50 feet (15 m) without the use of external line drivers between serial ports. The NetLink may be equipped with up to two INCOM device network ports. There will be an additional RJ11 jack and terminal for each INCOM device network. Each additional port will increase network performance in a linear fashion. A 2-port NetLink will deliver the same amount of data from a fixed number of devices in half the time of a 1-port NetLink. NetLinks will communicate with 200 devices regardless of the number of ports.

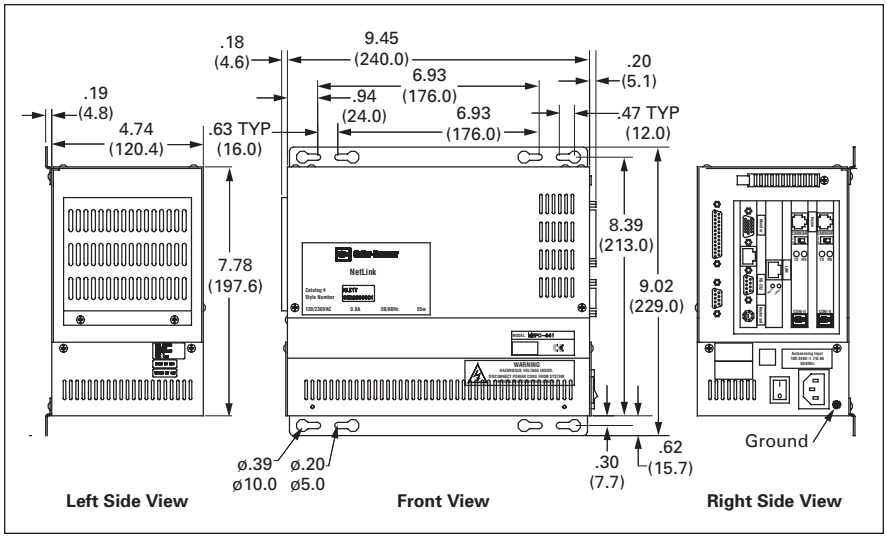

Figure 56-138. Ethernet NetLink and Mounting — Dimensions in Inches (mm)

Catalog Information

Table 56-72. Building the NetLink Catalog Numbering System

N L _ _ _

Output	Port Type	Number of Ports
E = Ethernet Output **M** = Modbus Output **D** = Dual Communications Ethernet and Modbus ($1000 Adder)	**T** = 10Base-T Ethernet Port/AUI (standard)	**1** = 1 INCOM Port Communications Network (standard) **2** = 2 INCOM Ports

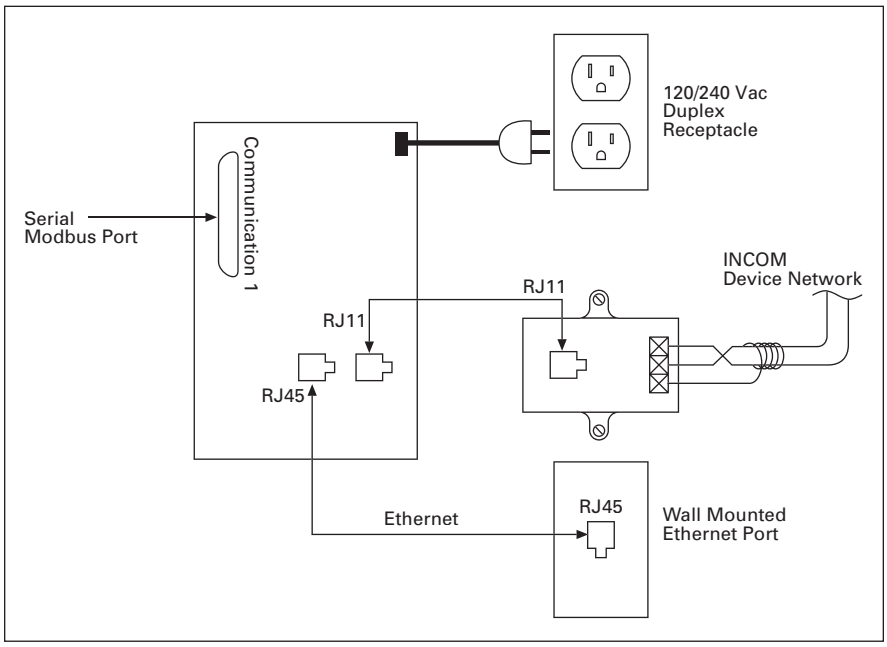

Figure 56-139. Ethernet NetLink Wiring Instructions

MINTII RS-232 Converter

Applications

Converts a network of Power Management Software devices to ASCII RS-232 format for access through a serial port of a personal computer, laptop, or Programmable Logic Controller.

Displayed Parameters

- Eaton's MINTII provides access to all parameters monitored over the Power Management Software network.
- Supports INCOM networks up to 8,500 feet (2,590 m) in distance and device counts up to 1,000.

Physical Characteristics

MINTII

- Suitable for panel mounting or desktop use.
- 120 Vac power cord included for plug-in to standard duplex receptacle.
- Height: 2.25 inches (57.2 mm).
- Width: 11.5 inches (292.1 mm).
- Depth: 4.25 inches (108.0 mm).

MINTII Technical Data

Temperature

- 0°C to 60°C.

Humidity

- 0% to 95%.

Power

- 120 V.

Speed

- 1200, 2400 and 9600 baud (INCOM), 19.2K baud (RS-232).

Communications

- INCOM, RS-232.

Catalog Information

Table 56-73. MINTII RS-232 Converter

Description	Catalog Number
Master INCOM Network Translator II	**MINTII**

MINTII RS-232 Converter

Master INCOM Network Translator II

The Master INCOM Network Translator II (MINTII) converts the twisted shielded pair network of INCOM devices to an RS-232 signal. This signal can be accessed by PLCs, computer serial ports, building management system serial interface cards. The MINTII is also often applied as an interface to standard line drivers and converters to allow communication through dedicated telephone lines, dial-up modems, fiber-optic line drivers, radio frequency or wireless modems.

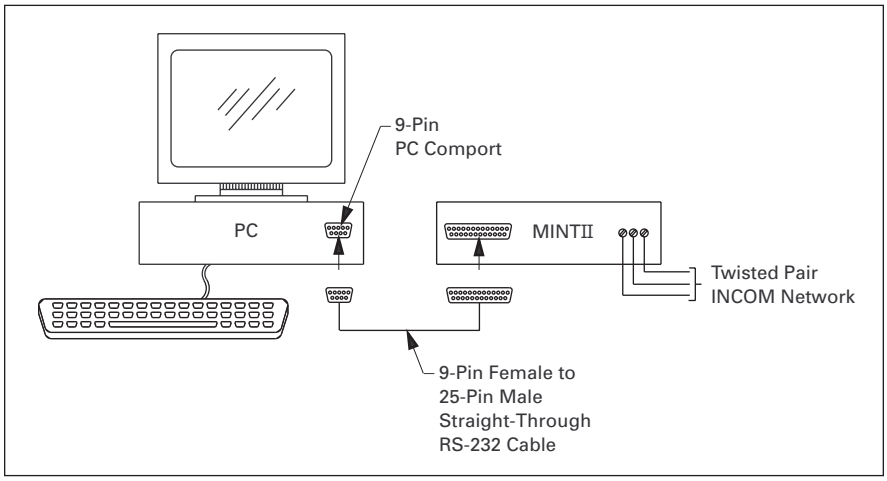

Figure 56-140. MINTII Connection Diagram for Use with a PC

EMINT

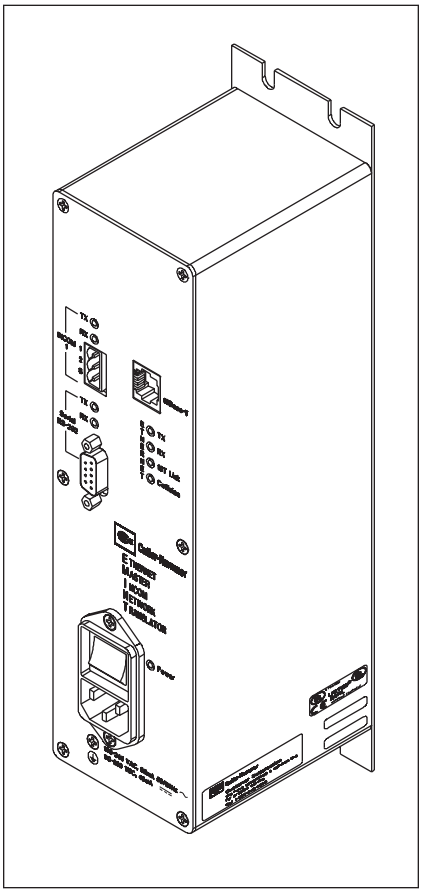

Figure 56-141. EMINT

Product Description

Eaton's Ethernet MINT (Ethernet Master INCOM Network Translator) enables Ethernet TCP/IP communications for hundreds of Eaton devices. This allows industrial customers to utilize energy monitoring, power quality analysis and other information over an existing Ethernet infrastructure. Ethernet is high speed and very simple to use, which has resulted in its widespread use. The EMINT product allows users to take advantage of their investment in Ethernet and use this as the backbone or their Power Monitoring system.

Up to 200 INCOM compatible devices are supported by each EMINT, allowing wire distances of up to 10,000 feet (3,048 m) from the EMINT device. The Installation must comply with INCOM wiring specification base rules document, TD 17513. The Ethernet MINT will offer one INCOM communication port, as well as one 10Base-T Ethernet Port.

Application Description

There are many possible applications for the EMINT. Some of these applications include the following:

- **Metering Cabinet or Switchgear Installation:** The EMINT can be easily mounted in the metering cabinet of a switchgear lineup or mounted in a substation near electrical distribution gear. Many EMINTs can be utilized in a system to fully take advantage of the customer's existing Ethernet backbone, thus reducing overall wiring costs to the customer.
- **Communications or Local Installation:** The EMINT can be mounted in a communications cabinet or simply placed or mounted at or near the energy management computer.

CAUTION: The performance of your communication network over an existing Ethernet Local Area Network is affected by the available band width of this LAN. Good networking practices can positively affect the performance of your communication network.

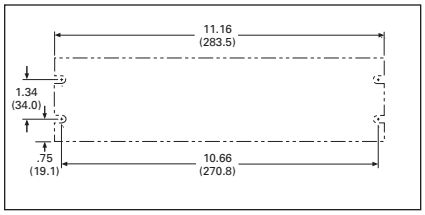

Figure 56-142. Mounting Details

Features, Functions and Benefits

- INCOM Communications over standard high speed Ethernet TCP/IP networks.
- Fully TCP/IP compliant.
- One Standard 10Base-T Ethernet port (RJ-45).
- One INCOM port to communicate with all INCOM compatible devices.
- The EMINT is powered from either ac or dc supply:
  - ❑ 100 – 240 Vac
  - ❑ 110 – 250 Vdc
- Small footprint, easy mounting.
- Easy-to-use RS-232 configuration port.
- Transmit and receive LEDs for instantaneous network feedback.
- Passthrough device only with no local data storage.
- DIN rail mountable.

Standards, Specifications and Certifications

System Ratings

Power Connector Ratings

The input connectors rating is 250 Vac at 10 A.

Table 56-74. ac/dc Power Supply

Nominal	ANSI C37.8 Operating Range
100 to 125 Vdc 100 to 125 Vac	85 to 138 Vdc 85 to 132 Vac
220 to 250 Vdc 220 to 240 Vac	187 to 275 Vdc 187 to 264 Vac

Table 56-75. Environmental Rating

Parameter	Value
Operating Temperature Storage Temperature Altitude	-20°C to 60°C -20°C to 70°C 10,000 ft. (3048 m)
Operating Humidity Environment Transient Overvoltage	5 to 90% Maximum Noncondensing Indoor Use Only Category 1
Pollution Degree Communication Rate Equipment Class	2 10 Mbps 1

Safety Standards

- UL 1950.
- CSA® C22.2.950.
- EN 60950.

Note: The ac version of this product is UL and CSA and not the dc version of this product.

EMC Susceptibility Standards:

- IEC 1000-4-2; 1995 Electrostatic Discharge.
- IEC 1000-4-3; 1995 Radiated RF Immunity.
- IEC 1000-4-4; 1995 EFT and Burst.
- IEC 1000-4-5; 1995 Surge Withstand.
- IEC 1000-4-6; 1996 Conducted RF Immunity.
- IEC 1000-4-11; 1994 Voltage Dip and Interruption.
- ANSI/IEEE C37.90.0; 1989 Hi Pot.
- ANSI/IEEE C37.90.1/D6; 2000 Surge Withstand Capability.

EMC Emissions Standards:

- FCC Part 15 Class A (10 meters) Radiated Emissions.
- CISPR 22, Class A (30 meters) 1991 Radiated Emissions.
- CISPR 22, Class A; 1991 Conducted Emissions (Power Port).

Catalog Ordering Information

- Catalog Number: EMINT.
- Style Number: 66D2051G01.

mMINT

mMINT Module

Product Description

The mMINT (Modbus Master INCOM Network Translator) Module is an Eaton accessory product that will provide communication between a Modbus RTU network and an INCOM (INdustrial COMmunications) network (see **Figure 56-143**). This module is transparent to the Modbus network. It communicates to a master on the Modbus network using the Modbus RTU (Remote Terminal Unit) protocol. It communicates to slave devices on the INCOM network using the IMPACC (Integrated Monitoring, Protection, And Control Communication) protocol. The catalog number of this product is mMINT.

Features

The mMINT module is a slave device on the Modbus network and as such requires a master that will exchange register objects with the mMINT module.

- Handles generic pass-through commands (Modbus/INCOM/Modbus).
- Capable of passing Modbus register objects from Eaton's existing products and newer PnP (Plug-'n-Play) products to a Modbus RTU master.
- Data in IEEE Floating Point format and fixed point.
- Modbus RTU communications data transfer rates of 1200, 9600, or 19200 baud with 1 start bit, 8 data bits, no parity and either one or two stop bits.
- Up to 32 products connected to INCOM network port (246 unique addresses maximum).
- Flashing Status LED to indicate an active module.
- LED indicators for INCOM transmit and receive communications exchanges.
- LED indicators for Modbus RS-485 transmit and receive communications exchanges.
- Input power for the module from either 120 Vac or 24 to 125 Vdc.
- DIN-rail mount package.
- 0ºC to 60ºC ambient operation.

Module Mounting

When mounting the mMINT verify that an 11 mm H x 28 mm W DIN rail is used and that it is within an enclosed space.

Simplified Wiring Rules

INCOM Network

The following simplified rules apply to a given system consisting of a single daisy chained main cable link between master and slave devices (see **Figure 56-143**). For more complex considerations including star configurations, please refer to the IMPACC wiring specification T.D. 17513.

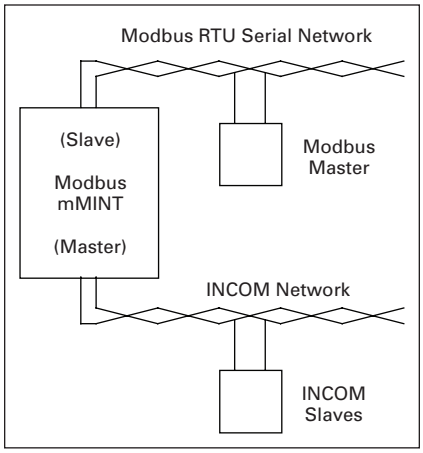

Figure 56-143. mMINT in a Communications Network

- Recommended INCOM cable styles are Belden 9463 or C-H style 2A957805G01.
- The maximum system capacity is 10,000 feet of communications cable and 32 slave devices on the INCOM network under the mMINT.
- Non-terminated taps, up to 200 feet in length, off the main link are permitted, but add to the total cable length.
- Make sure that there is twisted-pair wire that is recommended for IMPACC network use. Use shielded twisted-pair wire to connect each slave to the INCOM network, daisy-chain style. The polarity of the twisted pair is not important.

Modbus RS-485 Network

The following simplified rules apply to a given system consisting of a cable link between master and slave devices (see **Figure 56-144**). For more complex configurations, please refer to standard Modbus RTU wiring specification rules for the RS-485 network.

- The recommended Modbus cable has twisted-pair wires (24 AWG stranded 7x32 conductors with PVC insulation) having an aluminum/mylar foil shield with drain wire.
- The maximum system capacity is 4,000 feet of communications cable and 247 devices on the Modbus RTU network.
- Make sure that there is twisted-pair wire that is recommended for Modbus RTU network use. Use shielded twisted-pair wire to connect each slave to the Modbus RTU network, daisy-chain style. The polarity of the twisted pair is critically important.

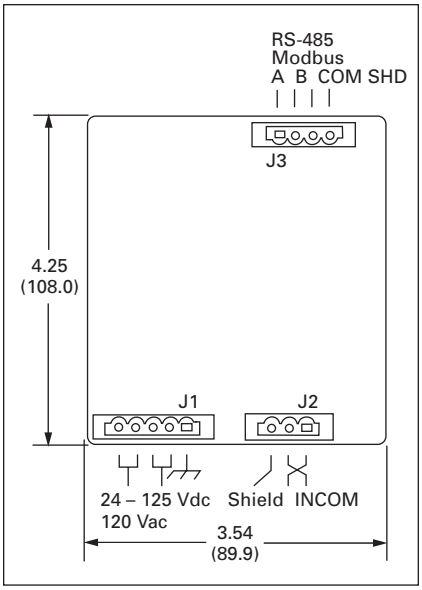

Figure 56-144. mMINT Module Dimensions

Burden

- 24 Vac/dc 3 VA

Safety Standards

- UL
- CSA
- CE mark

Communications Speed

- INCOM: 1200, 9600 Baud
- N2 Bus: 9600 Baud

Note: Contact Eaton for availability and support for the N2 Gateway.

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PONI Communication Modules

Applications

The Product Operated Network Interface (PONI) cards attach to Eaton devices to enable communications. These cards serve various functions from Ethernet type applications to non-Ethernet type applications ultimately playing a key role in facilitating the access to information that each of the Eaton devices offer.

Metered Parameters/Communications

A PONI enables communication of the metered parameters and set points consistent with those of the device to which it is attached.

Physical Characteristics

Each PONI attaches to its associated product. No other mounting or enclosure is required. When mounted to the back of the meter or relay or other communicating device, the PONI gets its power from the device to which it is attached. The connection to the device is via a 9-Pin connector.

Certifications/Listings

- **IPONI:** UL/cUL.
- **EPONI:** UL/cUL (EN61010-1).
- **WEBPONI:** UL/cUL (EN61010-1).
- **RS485PONI:** UL/cUL (EN61010-1).

Communications

The IPONI and the BPONI enable communications over a twisted shielded pair INCOM device network. Wiring communications to these devices adhere to the Wiring Guidelines (see *Consulting Application Guide* **Pages 2.2-1** *and* **2.2-2**). The Ethernet PONI (EPONI) enables device communications over a 10 Mbps Ethernet network.

IPONI Communication Module

Product Description

Eaton's electrical business offers a selection of (PONI) modules that can be used as solutions for various applications. There are two basic groups that include the Ethernet-enabled products and the non-Ethernet enabled products.

The non-Ethernet product offerings include the IPONI and the BPONI. These devices are typically applied where there are more than one device connected in a network of devices by a dedicated twisted shielded pair of conductors (Ref. IMPCABLE). The communications medium is a format that enables clean noise-immune communications even when routed around those areas of high noise and typical electrical communication disrupting equipment. The IPONI and BPONI daisy chain is of the exact same format used in those devices that have built-in communications such as the Digitrip trip units and can be used in series with these communication network wiring.

The Ethernet product offerings enable a facility to leverage and strategically utilize the ever growing presence of Ethernet Local Area Networks, and include the EPONI, EPONIF and the WEBPONI. The EPONI and the EPONIF differ only by the wiring method used to connect to an existing Ethernet LAN. The EPONI connects to an existing Ethernet LAN via 10Base-T and the EPONIF connects via fiber. These PONIs are used in those applications where an existing Ethernet Infrastructure can be utilized to access a small number of devices in remote locations where a common Ethernet LAN is accessible.

The WEBPONI Ethernet product offering puts an Eaton metering product on the Web. No other software is required when specifying the WEBPONI. All software needed to enable any Internet browser program such as Internet Explorer® or Netscape Navigator® is packed into the WEBPONI. The data can be viewed directly from any Internet browser program such as Microsoft Internet Explorer and/or Netscape Navigator. The WEBPONI provides live updating data for the meter being monitored as well as waveform display capabilities and e-mail direct from the device to defined key e-mail addresses that need to know when an event occurs.

The RS-485 PONI product enables Modbus RTU communications via the RS-485 medium to any Modbus RTU master device.

Table 56-76. PONI Selection Chart

Description	IPONI	BPONI	EPONI	INCOM on Product	EPONIF	WEBPONI	RS485 PONI
IQ Analyzer	≥1.06	≤1.05	●	—	●	●	●
IQ DP-4000	●	●	●	—	●	●	●
IQ 200	—	—	—	●	—	—	—
IQ Multipoint Energy Submeter II	—	—	—	●	—	—	—
Energy Sentinel	—	—	—	●	—	—	—
Power Sentinel	—	—	—	●	—	—	—
IQ Generator	●	●	—	—	—	—	—
IQ Data	●	●	—	—	—	—	—
IQ Data Plus II	—	●	—	—	●	—	—
IQ 500	—	●	—	—	—	—	—
IQ Transfer	●	●	—	—	—	—	—
AEMII	●	●	—	—	—	—	—
BIM II	●	●	—	—	—	—	—
CMU	●	●	—	—	—	—	—
CED	●	●	—	—	—	—	—
MP-3000	●	—	●	—	—	●	●
Digitrip 3000	—	—	—	●	—	—	—
FP-5000	—	—	—	●	—	—	—

EPONI

The Ethernet PONI is ideal for those remote locations that have a few devices where there exists Ethernet existing infrastructure. You don't have to pull all new wire out to that remote location, use the existing Ethernet infrastructure to perform this task and leverage your investment for maximum payback. The EPONI attaches directly to the back of the following devices:

- IQ Analyzer.
- IQ DP-4000.
- MP-3000.
- IQ Transfer (Communication Versions 2 to 9 or 11 to 15).

A fiber version of this product does exist for maximum immunity in noisy industrial environments.

CAUTION: The performance of your communication network over an existing Ethernet Local Area Network is affected by the available band width of this LAN. Good networking practices can positively affect the performance of your communication network. The EPONI is also a pass-through device and does no data logging.

Technical Data

Temperature
- -20ºC to 70ºC.

Humidity
- 5% – 90% non-condensing.

Power
- 20 – 30 Vdc maximum, 150 mA maximum.

Speed
- 10M baud.

Communications
- 10Base-T (RJ45) AUI port.

EPONIF

The EPONIF attaches directly to the back of the following devices:

- IQ Analyzer.
- IQ DP-4000.
- MP-3000.
- IQ Transfer (Communication Versions 2 to 9 or 11 to 15).

It supports TCP/IP communications at 10 Mbps. It has a 10Base-T and a 10Base-FI port enabling Ethernet communications of standard CAT5 or multimode fiber cable. The EPONIF is ideally suited for industrial environments due to its complete immunity from noise generated in and around electrical distribution equipment.

Technical Data

Temperature
- -20°C to 70°C.

Humidity
- 5% – 90% non-condensing.

Power
- 20 – 30 Vdc maximum, 150 mA maximum.

Speed
- 10M baud.

Communications
- 10Base-T (RJ45) AUI port.

IPONI

The INCOM Product Operated Network Interface card, or IPONI card, adds communication capability to various Eaton products. Each IPONI has three 16-digit address switches to uniquely identify each device on the network. IPONIs are designed to be daisy-chained throughout a unit substation or equipment room to a master device such as a NetLink, MINTII or Power Xpert Gateway. From the NetLink or a master computer, information is distributed through the facility's TCP/IP Ethernet network. A twisted shielded pair network connecting IPONIs may extend up to 10,000 feet (3,048 m) before terminating in a NetLink, computer, or another master device. The IPONI comes with mounting hardware and attaches to the back of its associated device.

Technical Data

Temperature
- -20°C to 70°C.

Humidity
- 5% – 95% non-condensing.

Power
- 20 – 30 Vdc maximum, 50 mA nominal, 100 mA maximum.

Speed
- 1200 and 9600 baud.

Communications
- 3-position removable terminal block for twisted shielded pair INCOM.

Catalog Information

Table 56-77. PONI Communication Modules

Description	Catalog Number
INCOM PONI	**IPONI**
Buffered PONI	**BPONI**
Ethernet PONI	**EPONI**
WEBPONI	**WEBPONI**

BPONI

The Buffered Operated Network Interface card, or BPONI card, adds communication capability to various Eaton products. It provides the same functionality as the IPONI but is recommended for different devices. Each BPONI has three 16-digit address switches to uniquely identify each device on the network. BPONIs are designed to be daisy-chained throughout a unit substation or equipment room to a master device such as a NetLink, MINTII, EMINT or a CONI in a master computer. From the NetLink or a master computer, information is distributed through the facility's TCP/IP Ethernet network. A twisted shielded pair network connecting BPONIs may extend up to 8,500 feet (2,590 m) before terminating in a NetLink, computer, or another master device. The BPONI comes with mounting hardware and attaches to the back of its associated device.

Note: The BPONI must be mounted on the load end of the IQ 500.

BPONIs and IPONIs may be daisy-chained together with other IMPACC or Power Management Software communicating devices on a common twisted shielded pair network.

Technical Data

Temperature
- -20°C to 70°C.

Humidity
- 5% – 95% non-condensing.

Power
- 20 – 30 Vdc minimum, 150 maximum.

Speed
- 1200 and 9600 baud.

Communications
- 2-position removable terminal block, twisted shielded pair INCOM.

DPONI

The DeviceNet Product Operated Network Interface (DPONI) enables communication between a DeviceNet network master station and a host device in a Master/Slave format over a DeviceNet network. The DPONI is compatible with the MP-3000 and the MP-4000. The DPONI is powered both by the host product to which it is attached and by the DeviceNet network. The DPONI uses opto-couplers to isolate the two power systems.

The DPONI communicates at 125, 250 or 500 Kbps selected via a front panel DIP switch. All products on the DeviceNet network must be set at the same communication rate.

The DPONI has a bi-color network/ module status LED which functions in accordance with the DeviceNet specification. An additional monocolor LED flashes while the DPONI is receiving a message from the host device.

Technical Data

Temperature
- -20ºC to 70ºC.

Humidity
- 5% – 90% non-condensing.

Power
- 11 – 27 Vdc, 40 mA maximum.

Speed
- 125, 250 or 500 Kbps.

Communications
- Standard 5-wire CAN connection.

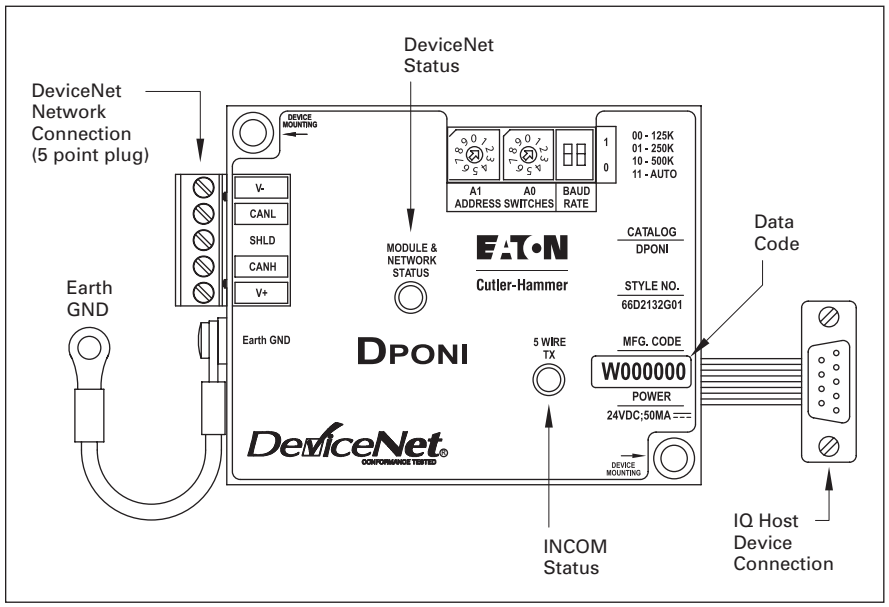

Figure 56-145. Eaton's DPONI

WEBPONI

The WEBPONI attaches directly to the back of an IQ Analyzer, IQ DP-4000 or MP-3000. Based on the EPONI hardware platform, this device responds to the standard Internet browser such as Microsoft Internet Explorer and/or Netscape Navigator programs with HTML pages. Data is updated automatically and such information as waveforms and event information is readily available. The WEBPONI supports access to electrical parameter data through XML and provides the ability to configure automated e-mails at the time of events on the device.

Via a simple switch, the user can utilize existing hardware and the WEBPONI can be told to operate as a standard EPONI, thus enabling quick functionality expansion with the installation of a Power Xpert Software system.

Technical Data

Temperature
- -20°C to 70°C.

Humidity
- 5% – 90% non-condensing.

Power
- 20 – 30 Vdc maximum, 150 mA maximum.

Speed
- 10M baud.

Communications
- 10Base-T (RJ45) AUI port.

RS-485 PONI

The RS-485 Product Operated Network Interface card, or MPONI card, enables Modbus communication capability to various Eaton products. Each MPONI contains two rotary address switches to uniquely identify each device on the network and a baud rate DIP switch. A 5-pin connector is provided for wiring to the RS-485 network. Various baud rates are available for networking flexibility, and onboard LEDs indicate operation, error and communication status. The MPONI is applied where a device network exists connected by a dedicated shielded twisted pair conductor. Modbus RS-485 allows a single device or multiple units in a daisy-chain configuration to communicate with another local or remote device and may extend up to 4,000 feet (1,219 m) without a repeater. The MPONI comes with mounting hardware and attaches to the back of its associated device.

Note: Please see IL for detailed register support information for each supported product. Not all device functionality is supported with the RS-485 PONI over the Modbus Protocol.

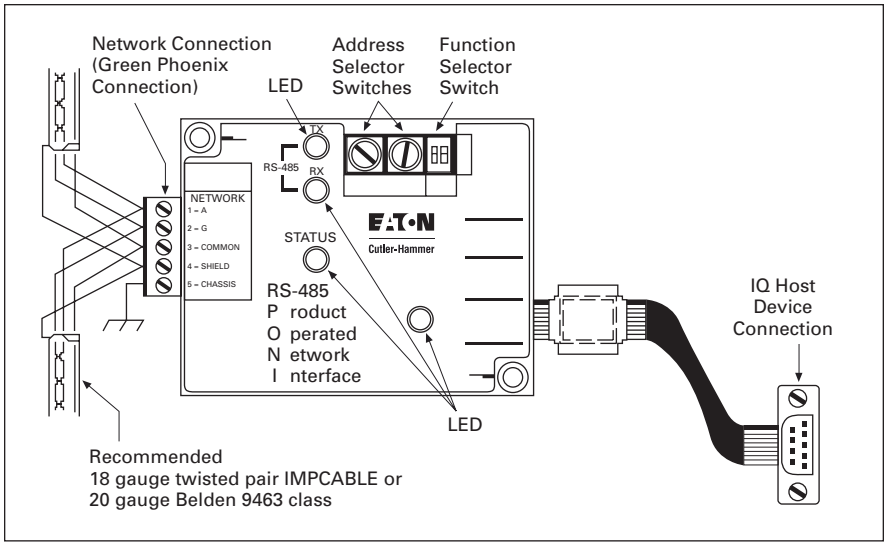

Figure 56-146. RS-485 PONI

Product Selection

Table 56-78. PONI Communication Modules

Description	Catalog Number	Price U.S. $
INCOM PONI	**IPONI**	
Buffered PONI	**BPONI**	
DPONI	**DPONI**	
Ethernet PONI	**EPONI**	
Ethernet PONI Fiber	**EPONIF**	
WEBPONI	**WEBPONI**	
RS-485	**MPONI**	

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Discount Symbol **C10-S24**

I/O Devices Digital Input Module (DIM)

Digital Input Module (DIM)

Product Description

Eaton's Digital Input Module is a device that interfaces with up to four standard utility (electric, gas, water) meters or monitors eight digital inputs. It translates KYZ pulses from meters into a register count that is maintained and compiled within the DIM module in non-volatile memory. The pulse count can be accessed from the DIM module remotely using Eaton Power Management Software including the Energy Billing application.

The DIM can also be used to monitor eight digital inputs from switch closures.

Application Description

- Reads four separate KYZ equipped utility meters.
- Pulse counts stored in non-volatile memory.
- Each channel independently monitors KYZ counts, pulse counts, or digital indications.
- Monitors a maximum of eight individual digital inputs.
- Input channels are isolated.
- Isolated 24 Vdc power is provided on the I/O connector.
- LED indicators on the input channels indicate when the unit is counting.

Physical Characteristics

- Height: 4.25 inches (107.9 mm).
- Width: 3.54 inches (89.9 mm).
- Depth: 3.50 inches (88.9) (does include DIN rail).
- 10 LED status indicators, 100 ohm termination DIP switch, address selector switches.
- DIN rail mounting.

Listings/Certification

- UL 873.
- CE mark (48 Vdc operation).
- FCC Part 15, Class A.
- IEC 1000-4-x.
- CISPR 22, Class A.
- IEC 1000-4-2; 1995, Electro Static Discharge.
- IEC 1000-4-3; 1995, Radiated RF Immunity.
- IEC 1000-4-6; 1996, Conducted RF Immunity.
- FCC Part 15 Class A (10 meters) Radiated Emissions.
- CISPR 22, Class A (30 meters); 1991, Radiated Emissions.
- CISPR 22, Class A; 1991, Conducted Emissions (PowerPort).

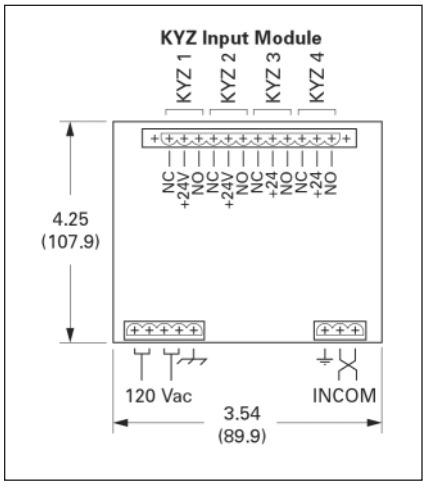


Figure 56-147. KYZ Input Module

Frequency Range

- 50/60 Hz.

Power

- 85 to 138 Vac (120 Vac nominal) 50/60 Hz; 100 mA.
- 48 – 128 Vdc (48 Vdc nominal); 100 mA.
- Brownout operation at 50% and 80% of nominal ac and dc ratings.
- Power input is provided from a limited source, isolated from the mains by double isolation.
- Power for all inputs is supplied from an internal, isolated 24 Vdc power source.

Table 56-79. Specifications

Description	Rating
Operating Temperature	-20°C to 60°C
Storage Temperature	-20°C to 70°C
Operating Humidity	5 to 90% Maximum Noncondensing
Altitude	10,000 ft. (3,048 m)
Environment	Indoor Use Only
Transient Overvoltage	Category 2
Pollution	1°
Equipment	Class 1

Mounting Information

The DIM module is designed to be DIN rail mountable. DIN rail must be 1/3 inches H X 1-3/8 inches W (8.5 mm H x 34.9 mm W).

Communications

The DIM is a fully compatible Power Management Software communicating device with built-in INCOM™ communications. The DIM comes complete with a 3-pin connector to receive the shielded twisted pair conductor.

All wiring must be complete as per Instruction Leaflet TD17513, Wiring Specification Base Rules.

Table 56-80. Ordering Information

Catalog Number	Description
DIM	Digital Input Module

Analog Input Module (AIM)

Applications

- Real-time usage measurement and verification by utility.
- Energy conversion.
- Cost allocation to individual departments.
- Establish baseline load profiles for verification of actual results.

Monitors Real-Time Usage through Pulse Inputs of:

- Gas
- Steam
- Temperature
- Pressure
- Water
- Compressed air
- BTUs
- Run-time
- Instantaneous and demand values for any other 0 – 20 or 4 – 20 mA transducer or digital signal.

Communications

Communicates as a single device in a Power Management Software system network via an IPONI communications card, included as standard.

Certifications

- UL

Physical Characteristics

Suitable for panel mounting, for use with external terminal blocks and power supply.

Product Description

The Analog Input Module (AIM) is a microprocessor-based analog input data acquisition device designed for use with Power Management Software networks. It is intended to record customer utility information by monitoring signals from primary measurement devices such as gas and water flow transducers, pulse output contacts, BTU and steam flow meters, temperature and pressure sensors, equipment run-time and other devices.

The Analog Input Module monitors 0 – 20 mA or 4 – 20 mA conventional transducer signals, counts pulses and tracks run-time hours. The device scales, identifies units, performs BTU calculations and tracks run-time hours within the unit.

Analog Input Module (AIM)

In addition to its 32 input channels, the Analog Input Module has two output relays that can be controlled through the Power Management Software.

The Analog Input Module bridges information from devices without inherent communications capability into the facility-wide Power Management Software network. Analog Input Modules can be daisy-chained together on a twisted shielded pair network with other Power Management Software devices to a NetLink, Ethernet Gateway, or central monitoring computer running Power Management Software. An IPONI communications card is included as standard and allows AIM to communicate as a single device on a Power Management Software network.

Users can configure alarms on the first 24 sensors' present value and first *x* minute average value with Series III or an unlimited number using Net InTouch and Power Management Software and trend the data for historical analysis. Two contact outputs can be configured to close contact on an alarm condition for use as a load alarm.

(Contact Eaton for availability of Power Management Software support for the Analog Input Module.)

General Purpose — Configurable to 0 – 20 mA or 4 – 20 mA signals scaled in non-volatile RAM to engineering units. Instantaneous value is displayed along with average value over two user-definable time periods.

Pulse Input — The AIM counts form "A" pulses. The count is then multiplied by a scaling factor associated with the measured input. For example, one pulse may indicate 400 ft^3. The demand windows would then indicate the ft^3/min. The running total is stored in non-volatile RAM in engineering units. Two demand windows of user-configurable duration store the total pulses recorded in the last *x* minutes. The running total may be reset through software with password authorization. The time of reset of the running total and the time of a meter rollover are recorded in the Analog Input Module in non-volatile RAM.

Run-Time — Run-time inputs report current on/off status of the monitored point, the total on-time, total off-to-on transitions, run-time in the last *x* minutes, and off-to-on transitions in the last *x* minutes. The running total may be reset through software with the correct password authorization. The time of reset of the running total, time of total run-time rollover, time of last off-to-on transition and time of last on-to-off transition are all recorded.

BTU Sensor — A BTU sensor requires three inputs from the Analog Input Module. One input monitors flow from an incompressible fluid, another from the high temperature side of the cycle, and the third from the low temperature side of the cycle. Running totals are reported for forward BTUs, reverse BTUs and net BTUs. *X* minute averages are provided for forward, reverse and net BTUs. Present flow, high temperature and low temperature are provided, as well as two user-definable averages.

Applications

- Monitor analog or digital signals as a drop on the Power Management Software network, including real-time usage of gas, steam, temperature, pressure, water, sewer, compressed air, BTUs and run-time.
- Monitor building pressures, temperature and humidity in real-time.
- Record utility costs such as water and gas for allocating usage costs to individual departments.
- Create current usage load profiles to verify cost reductions on energy-saving projects such as lighting, chiller and boiler retrofits; and steam and compressed air-line upgrades.
- Establish baseline load profiles before enacting energy-saving retrofit projects, then verify actual savings by tracing new load profiles.

External Termination Box

Eaton recommends using the AIM with a separate termination box. The termination box allows for the mounting of required resistors when used as a digital input module and serves to house terminal blocks and a suggested 120/240 ac/dc to 24 Vdc power supply for powering both digital inputs and 4 – 20 or 0 – 20 mA transducers.

A list of components suggested for mounting in a custom termination box, is given in **Table 56-81** Actual quantities of individual components will vary by application.

Table 56-81. AIM Custom Components

Manufacturer	Description	Catalog Number
Phoenix Contact Phoenix Contact Phoenix Contact	Insulated Power Rail DIN-Rail Mountable Terminal Block, 300 Vac, 15A Resistor Adapter. Plugs into DOK 1,5-TG Terminal Block	**EB80-DIK WH** **DOK 1,5-TG** **ST-BE**
Yaego	1K, 1W 5% Metal Film Resistor	**RSF-1 1W**
Phoenix Contact	Power Supply 100 – 240 Vac, 47 – 63 Hz Input (0.7 – 1.2A), 24 Vdc Output at 2.5A	**CM50-PS-120-230 ac/ 24 Vdc/2.5A**

Technical Data

- 32 input channels, non-isolated, ±10 volts maximum 499 ohm input impedance capacitor backed-up RAM.

Current Input

- 0 – 20 mA dc accuracy ±0.02 mA from 0.2 – 20 mA (excludes sensor error) resolution 0.01 mA.

Pulse Input

- Form "A" contact closure 10 Hz maximum, 50% duty cycle 10 mS de-bounce.

Run-Time Input

- Form "A" contact closure.

Power Supply

- 120 Vac/24 Vac UL listed transformer 24 VA.

Power Consumption

- 8 VA including IPONI.

Auxiliary Power

- 8 Vdc and 24 Vdc 16 VA total, maximum.

Operating Environment

- 32°F – 125°F (0°C – 50°C) 20% – 80% RH noncondensing.

Enclosure

- NEMA® 1 12-inch H x 10-inch W x 6-inch D (304.8 mm H x 254.0 mm W x 152.4 mm D).

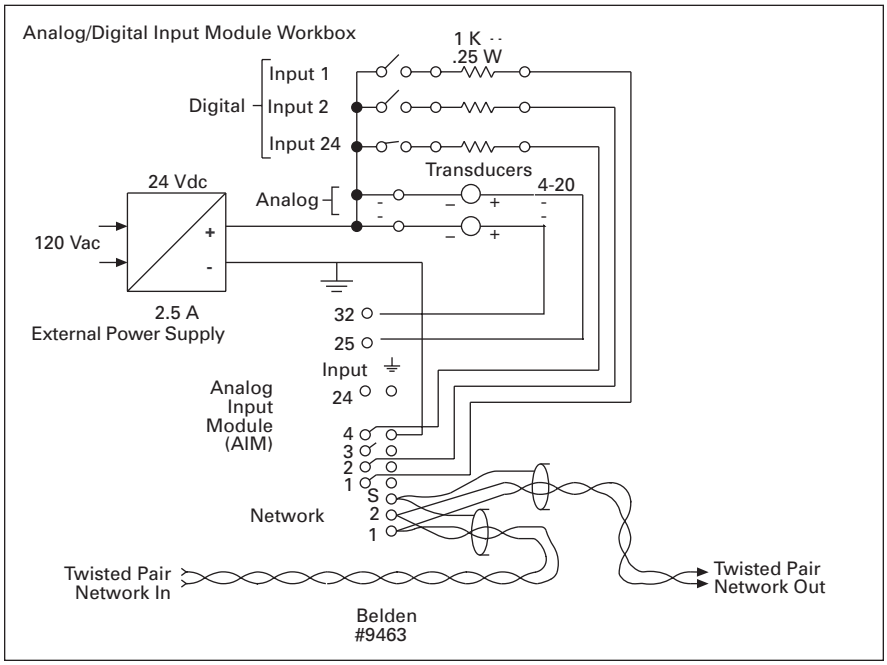


Figure 56-148. AIM Wiring with External Termination Box and Digital Input Use

The above illustrates the application of the Analog Input Module with external power supply, terminal blocks and resistors. Resistors are used to enable the AIM for digital input module. The external power supply is used to power remote transducers and the Analog Input Module.

Catalog Information

Table 56-82. Analog Input Module

Description	Catalog Number
AIM	**4D13140G01**

Addressable Relay II

Addressable Relay II

Product Description

The Addressable Relay II is designed for use where information or control of non-communicating devices is required remotely. The relays communicate at 9600/1200 baud on the INCOM network. Devices are assigned a three-digit address to uniquely identify them on the daisy-chained twisted shielded pair network.

The Addressable Relay II is a Form C relay on terminals 1, 2 and 3, with output contact ratings as shown in the specifications table. The Addressable Relay II may be powered by 48 – 120 Vac or 48 – 125 Vdc through terminals 11 and 12 of the terminal block. dc polarity is not significant. The operating temperature range of the Addressable Relay II is 0° – 70°C.

Each Addressable Relay II includes two status indicating circuits (IN1 and IN2) which can be used to transmit the contact status of devices external to the Addressable Relay II. Each input is isolated with its own return. A typical installation using these report-back inputs to the Eaton PowerNet system is shown in the wiring example. Terminals 4 and 5 connect to the status input 1 circuit (IN1) and terminals 6 and 7 connect to the status input 2 circuit (IN2). These status indicating circuits operate with input voltages of 48 – 120 Vac or 48 – 125 Vdc circuits.

The Addressable Relay II includes a feature called the "communications watchdog." The communications watchdog monitors communications between the Addressable Relay II and the computer control station. If communications are lost, the communications watchdog will reset the relay to the de-energized (OFF) state. The Addressable Relay II must be updated every 10 seconds when the communications watchdog is enabled or else communications are assumed to be lost. The communications watchdog is enabled when DIP switch 3 is set to the ON position. When the communications watchdog is not enabled, the relay will remain in the state set by the last command issued. See **Figure 56-153** for DIP switch configuration.

Features, Benefits and Functions

Monitored Parameters

- Output relay energized/de-energized.
- Input 1 status.
- Input 2 status.
- Breaker status open/closed.
- Protective relay status normal/tripped.

Communications

- Built-in INCOM communications for monitoring in Eaton's PowerNet system.

Dimensions in inches (mm):

- Height: 3.00 (76.2).
- Width: 1.75 (44.5).
- Depth: 4.00 (101.6).

The Addressable Relay II also includes a feature called "relay pulse." The relay pulse feature sets the Addressable Relay II to a pulse mode where the relay is energized (ON) for 10 seconds and then is de-energized (OFF). The relay pulse is enabled when DIP switch 2 is set to the ON position and disabled when DIP switch 2 is set to the OFF position. If this feature is not enabled, the relay will remain in the state set by the last command.

Application Description

- Enables remote control of non-communication capable devices on Eaton's PowerNet system.
- Monitors two digital status inputs on the PowerNet system.

Product Specifications

- Power: 48 – 120 Vac; 48 – 125 Vdc.

Table 56-83. Contact Ratings

Contact Ratings	Make	Break
120 – 240 Vac 24 – 120 Vac 30 Vdc	4960 VA 43 A 10 A	828 VA 7.2 A 10 A

Technical Data and Specifications

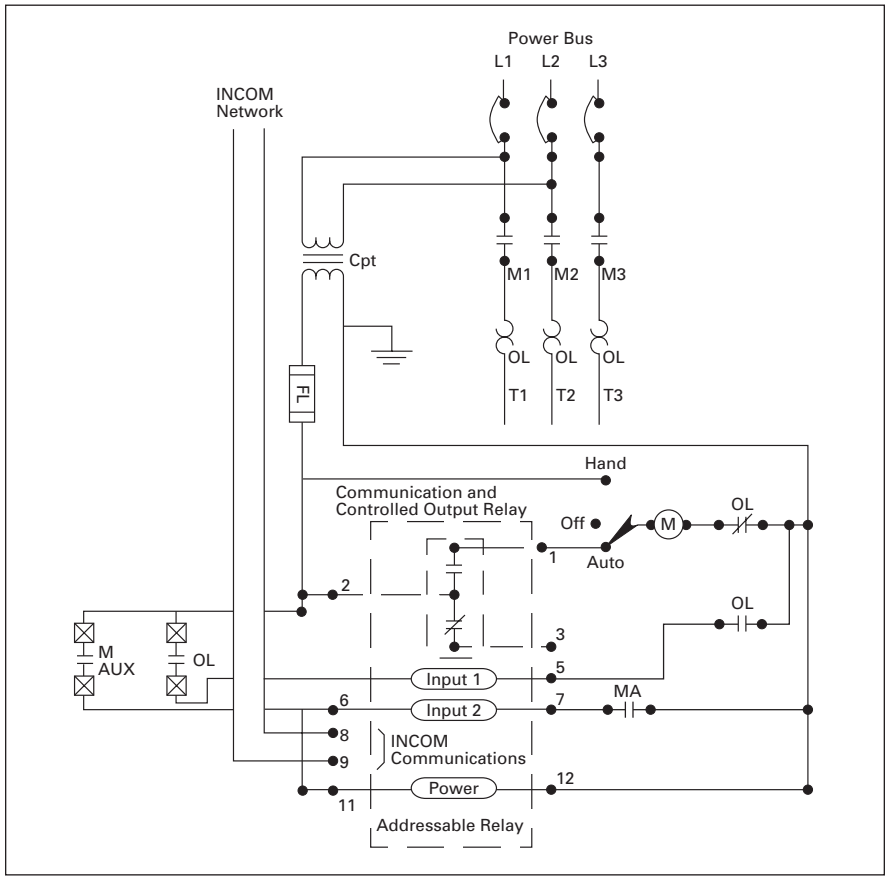


Figure 56-149. Wiring Diagram

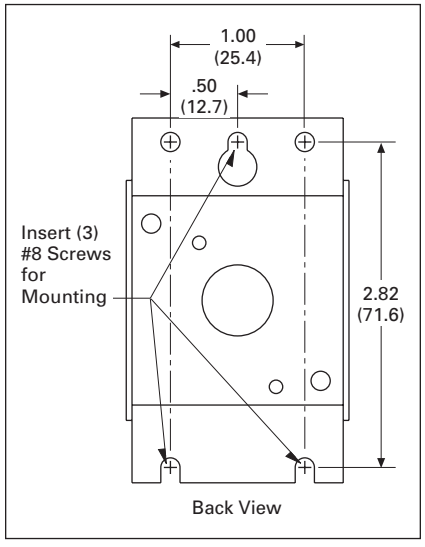
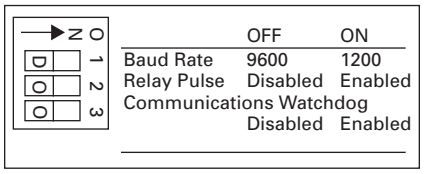


Figure 56-150. Mounting — Dimensions in Inches (mm)



	OFF	ON
Baud Rate	9600	1200
Relay Pulse	Disabled	Enabled
Communications Watchdog	Disabled	Enabled

Figure 56-151. DIP Switch Functions

Product Selection

Table 56-84. Addressable Relay

Description	Catalog Number	Price U.S. $
Addressable Relay II	**ARII**	

Discount Symbol **C10-S24**

Breaker Interface Module II (BIM II)

Breaker Interface Module

Product Description

Displayed Parameters

- Phase current.
- Energy.
- Present demand watts.
- Peak demand watts.
- Average demand current.
- Cause and magnitude of trip.
- Trip history.
- % Total Harmonic Distortion (THD) for each phase.
- % Harmonic Content for each phase (1st – 27th harmonic).
- Custom circuit description.

Note: The Breaker Interface Module displays only a portion of the information it receives from the Digitrip RMS 910, 1150 and Power Sentinels. The balance of the information (such as Waveform Analysis and Power Factor) can be passed through the unit to a master computer, where it can be viewed.

Physical Characteristics

- Graphical, glass plasma display.
- Up to seven lines of information.
- Membrane faceplate NEMA 3R and 12 rated.

Application Description

- 810, 910, 750, 1050, 550, 1150, 520MC, IQ Energy Sentinels and Power Sentinels.
- Event logging.
- Alarming.
- High load indication.
- Peak exceeded alarm.
- Grouping of meters.

Features, Benefits and Functions

General Description

Eaton's Breaker Interface Module by Eaton Corporation is a panel-mounted device that performs the following functions:

- Monitors and displays parameters (see list at left) from any combination of Digitrip RMS 810, 910, 1150 and Digitrip OPTIM Trip Units, F-/J-/K-Frame Energy Sentinels, and Universal Energy Sentinels, supporting as many as 50 of these devices up to 10,000 feet (3048 m) away.
- Communicates the information from these protective and energy monitoring devices over Eaton INCOM network to a computer or PLC.
- Continuously monitors breakers recording and time-stamping trip events along with approximate fault currents. Events are logged into non-volatile RAM.

Communications

Depending upon the type of communication protocol used by the main network, an appropriate PONI module can be easily field-mounted to the back of the Breaker Interface Module, enabling the unit to pass the information from its subnetwork to a remote master control unit up to 10,000 feet (3048 m) away. No reprogramming of the unit is required when the PONI is added.

The Breaker Interface Module can be mounted directly on the assembly or at a remote location and can be used to access and configure and display information from OPTIM Trip Units.

An operator can use the Breaker Interface Module to:

- Complete Initial System Setup:
  - Select system frequency (50/60 Hz.)
  - Set password
- Configure OPTIM Protective Settings.
  - Select protection options
  - Select alarm levels
- Display Information:
  - Metered values
  - Trip event information
  - Breaker information
  - Time-current set points
- Test OPTIM Trip Unit Performance:
  - Phase and ground
  - Trip/no trip
- Expanded Energy Monitoring:
  - Set addresses for group energy monitoring
  - Group energy readings
- Local and Remote Indication:
  - Remote indication/alarming
  - Breaker status LED indication
- Expanded Communications:
  - Communicate with:
    - OPTIM Trip Units
    - Digitrip RMS 810, 910 and 1150 Trip Units
    - IQ Energy Sentinels and Universal IQ Energy Sentinels
    - A total of 50 devices.

Password Protection

A user-defined password is included for added security when changing settings or performing breaker tests.

Non-Volatile Memory

The programmed functions, addresses and circuit descriptions are stored in non-volatile memory.

External Power

A 24 Vdc supply is required for the BIM II. (No external power supply is required for the PONI Card.) A 120 or 240 Vac supply is required for the BIMPS.

Rear Access Area

All wiring connections to the Breaker Interface Module are made at the chassis' rear and include:

- Relay connection for "alarm" condition, "high load" condition, "peak exceed" for device or group, and watthour pulse.
- Initiator.
- 24 Vdc input — BIM II
- 120 or 240 Vac input — BIMPS.
- DIP switches for selecting an operating mode.
- Three-contact connector with subnetwork.
- Connector for PONI card for remote communications Local Display Units.

Technical Data

Power Requirement
- 15 VA maximum.

Input Voltage
- 24 Vdc ±5% — BIM II.
- 120 or 240 Vac ±10% — BIMPS.

Operating Temperature
- 0°C to 70°C (32°C to 158°F).

Humidity
- 5% to 95% R.H. (non-condensing).

Alarm Contact Ratings
- 10 A at 277 Vac (resistive).
- 10 A at 30 Vdc (resistive).
- 1/3 hp at 125, 250 Vac.

Dimensions in Inches (mm)
- 6.72 H x 10.25 W x 2.60 D (170.7 H x 260.4 W x 66.0 D).
- 6.72 H x 10.25 W x 3.85 D (170.7 H x 260.4 W x 97.8 D) (with communications card).

Technical Data and Specifications

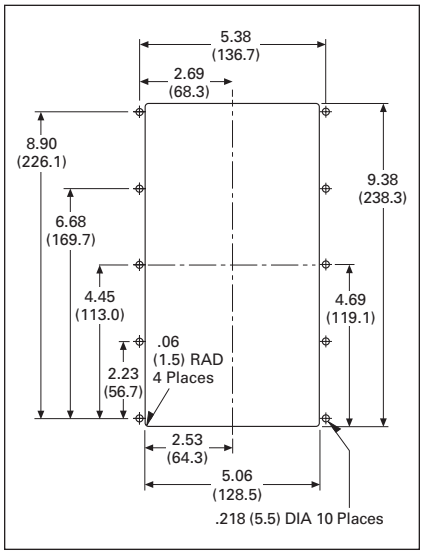


Figure 56-152. Drilling Pattern — Dimensions in Inches (mm)

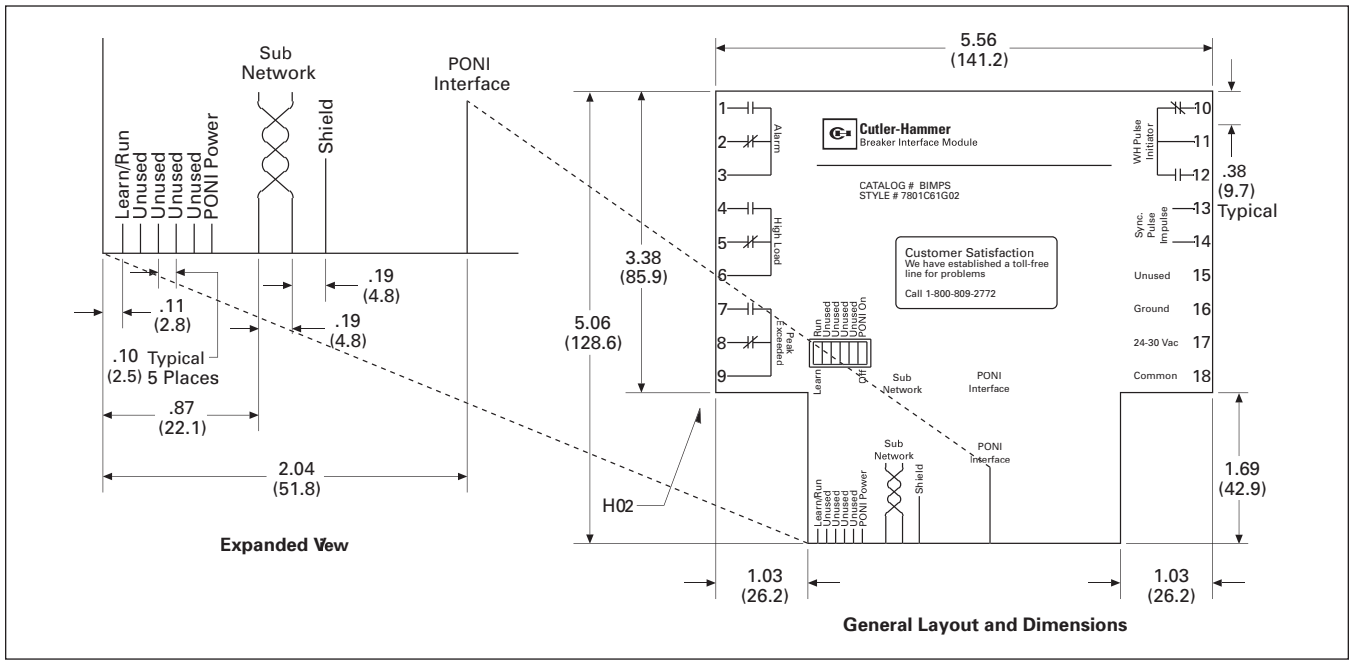


Figure 56-153. Connections and DIP Switch Rear Label Diagram — Dimensions in Inches (mm)

56 Product Selection

Table 56-85. Breaker Interface Module

Description	Catalog Number	Price U.S. $
Breaker Interface Module	**BIMII** **BIMPSII**	

Discount Symbol **C10-S24**

Sub-Network Master Local Display (SMLD)

Sub-Network Master Local Display

Product Description

Eaton's Sub-Network Master Local Display (SMLD) is an electronic sub-metering device that provides users the ability to view information from sub-network connected devices locally at switchgear, switchboards, panelboards, motor control centers and control panels, nearby or thousands of feet away. The SMLD has a built-in LCD display with navigations for configuring, as well as monitoring. Auto-learn capabilities complete the configuration requirements, enabling customization by use of user-defined descriptions, as well as adding and deleting meters.

The SMLD can be operated stand-alone or in parallel with the new FetchIT™ software application or the Power Xpert complete energy monitoring system solution software.

Application Description

- Acquire and display data (no control) from up to 100 devices that can communicate on Eaton's INCOM network, used in the PowerNet monitoring system.
- Auto-learn connected devices.
- Configuration stored in non-volatile memory.
- Host communications arbitration algorithm enables seamless integration into existing communication networks.
- Functions stand-alone or networked.
- Following devices are supported:
  - IQ 200
  - IQ Multipoint Energy Submeter II
  - IQ Energy Sentinel (F, J, K Frames)
  - Universal Internal Energy Sentinel
  - Universal External Energy Sentinel
  - IQ Power Sentinel
  - Digitrip OPTIM 1050L

Physical Characteristics

- 4.37 H x 4.37 W x 1.50 D inches (111.0 H x 111.0 W x 38.1 D mm).
- Keypad functions:
  - Menu
  - Scroll up
  - Scroll down
  - Enter
- Backlit LCD, 4-line x 20 character

Listings/Certification

Safety Standards — UL 61010B-1.

EMC Susceptibility Standards — IEC 1000-4-3, 1995 Radiated RF Immunity.

EMC Emissions Standards — FCC Part 15, Class B Radiated Emissions.

Technical Data

Frequency Range

- 50/60 Hz.

Power

- Power consumption: 200 mA (maximum) at 24 Vac, 24 Vdc.
- Power connector rating: 24 Vac or 24 Vdc at 1 ampere.
- Power source: 120 Vac or 24 Vdc, UL Class 2 or CSA Class III SELV transformer in accordance with C22.2 No. 1010-1. The voltage range is 18 to 24 Vac or Vdc, 200 mA (maximum).

Ratings

- Operating temperature: 0°C to 60°C.
- Storage temperature: -20°C to 70°C.
- Operating humidity: 5 to 90% maximum non-condensing.
- Altitude: 10,000 feet (3,048 m).
- Environment: indoor use only.

Mounting Information

- DIN (92 mm x 92 mm) access cutout.
- 4.37 H x 4.37 W x 1.50 D inches (111.0 H x 111.0 W x 38.1 D mm).
- Door mount or panel mount.

Communications

- INCOM Frequency Shift Key (FSK) network compatible 9600 baud.
- Non-intrusive arbitration algorithm.
- Passive monitoring automatically enabled by arbitration algorithm while host PC is communicating.
- Master on INCOM network upon data request from front panel if host PC is not communicating.
- Addresses for sub-network devices can be 001 – 044 hex (1 – 255 decimals).

Product Selection

Table 56-86. Ordering Information

Description	Catalog Number
Local Display (120 Vac)	**LDISP120**
Local Display (24 Vac or Vdc)	**LDISP24**

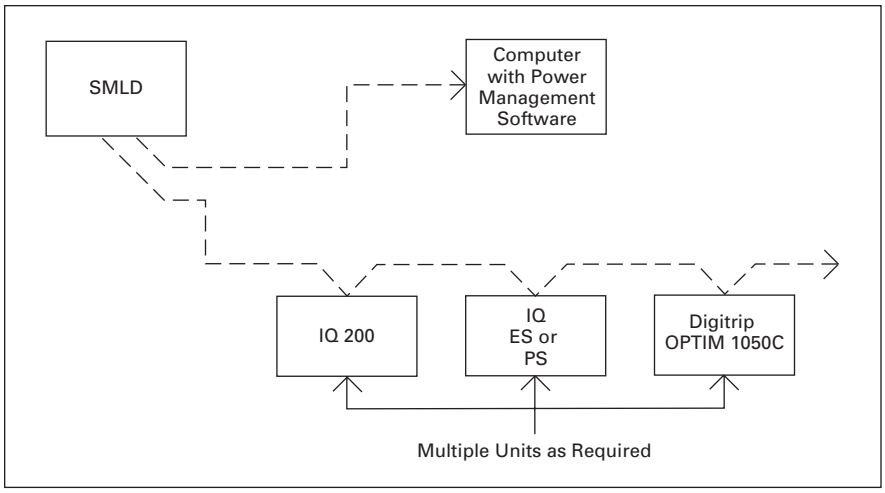


Figure 56-154. Typical Use Diagram of SMLD

Advantage Central Monitoring Unit

Central Monitoring Unit

Product Description

Eaton's Advantage™ Central Monitoring Unit is a communications center that transmits to and receives data from up to 99 Advantage starters or contactors or IQ 500s equipped with PONI cards. The CMU can be mounted on the door of a motor control center or custom panel using the existing IQ cutout dimensions.

The 8-digit alphanumeric display monitors active data, trip data or set points. The group of data being displayed is indicated by one of three LEDs and is selected by the user. The 2-digit alphanumeric display indicates the address of the device about which the data is being displayed. This address is also selected by the user.

The CMU continuously monitors its sub-network of low voltage solid-state motor protectors. By continuously monitoring these devices, trip events are captured, time stamped and fault currents are logged. Motor run times are recorded along with operations count. Historical values are recorded into non-volatile memory.

Five LEDs are provided and indicate the present status of the selected starter. Two additional LEDs are also provided at the top of the panel; one that indicates that the CMU is "operational," and another that indicates "alarm" status. An acknowledge/reset button permits the user to reset the CMU following a device trip.

The CMU can be interfaced into a larger Eaton INCOM network with the addition of a PONI Communications Module.

Parameters Displayed

- Monitored values:
  - Device description
  - IA, IB, IC currents
  - Control voltage (excluding IQ 500)
  - Present time, date
  - Resettable Operation Counter unit
  - Run time, hours
- Trip data — same as current values with cause of trip:
  - Set points:
    - Device size
    - OL trip current setting (FLA setting)
    - OL trip class
    - Ground fault protection — ON/OFF
    - Phase loss/unbalance protection — ON/OFF
    - Reset mode — Auto/Manual
    - Frequency
    - Ground fault trip level (IQ 500 only)
    - Ground fault trip delay time (IQ 500 only)
    - Phase unbalance % (IQ 500 only)
- IQ 500M — special functions — module set points:
  - If load control selected:
    - Load shed level
    - Load shed delay time
    - Load resume level
    - Load resume delay time
    - Long acceleration time
  - If underload/jam selected:
    - Jam trip level
    - Jam trip delay time
    - Jam start delay time
    - Underload trip level
    - Underload trip delay time
    - Underload start delay time
    - Long acceleration time
    - Relay control

Non-Volatile Memory

There is no need to reload or re-enter the Learn Mode after an ac power loss. The programmed functions, addresses and descriptions are stored in non-volatile memory.

External Power

A 120 or 240 Vac, 50 or 60 Hz supply is required. (No external power supply is required for the PONI card.)

Rear Access Area

All wiring connections to the CMU are made at the chassis' rear, which includes:

- Connection for the Alarm Relay, which energizes on a pre-programmed "overload" condition.
- Connection for the Trip Relay, which energizes on a "trip" or "no response" conditions.
- 120 or 240 Vac input.
- DIP switches for selecting Learn Mode.
- Three-contact connector with CMU's sub-network.
- Three-contact connector with PONI card for remote communications.

Technical Data

Power Requirement

- 10 VA maximum.

Input Voltage

- 120 or 240 Vac (±20%).
- Auto selecting.

Frequency

- 50 or 60 Hz.

Operating Temperature

- 0°C to 70°C (32°F to 158°F).

Storage Temperature

- -20°C to 85°C (-40°F to 185°F).

Humidity

- 5% to 95% R.H. (non-condensing).

Alarm Contact Ratings

- 10 A at 277 Vac (resistive).
- 10 A at 30 Vdc (resistive).
- 1/3 hp 125, 250 Vac.

Dimensions in Inches (mm)

- 6.72 H x 10.25 W x 2.60 D (170.7 H x 260.4 W x 66.0 D).
- 6.72 H x 10.25 W x 3.85 D (170.7 H x 260.4 W x 97.8 D) (with communications card).

Table 56-87. Catalog Information

Description	Catalog Number
Advantage Central Monitoring Unit	**WCMU**

IMPCABLE

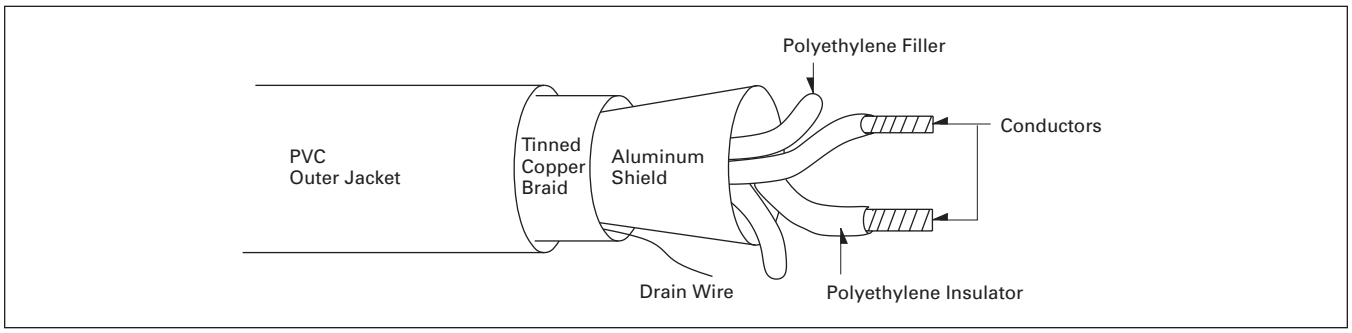


Figure 56-155. IMPCABLE

Product Description

Eaton's IMPCABLE was designed to be run in switchgear where codes require a 600 volt insulation rating. Typical "blue hose" cables are rated at 300 volts. The IMPCABLE is an 18 AWG cable with a 100 ohm impedance at 100 kHz tuned to work optimally with the FSK signal from Eaton's devices. The cable has been designed with characteristics that allow up to 1,000 devices or distances up to 10,000 feet (3048 m) from the master. Please refer to Eaton's wiring specification for instructions on cable runs and calculating maximum distances and devices on a given network.

Physical Characteristics

- Twisted shielded pair with drain wire.
- 600 volt at 80°C.
- 18 AWG, 20 AWG drain UL AWM 20253.

INCOM Signal

- Attenuation 1.6 db/1,000 feet (305 m).

Application Description

- Long communication runs.
- 600 volt required ratings.

Standards and Certifications

Listings and Certifications

- UL AWM 20253.
- NEC® CM.
- CSA.
- PCC-FT1.
- P-MSHA.

Product Selection

Table 56-88. IMPCABLE

Description	Catalog Number	Price U.S. $
IMPCABLE	**IMPCABLE**	

56

Discount Symbol **C10-S24**

Enabling PowerChain Management Solutions

Electrical power is the life blood of any facility. From the point that it enters a building, power is fed through a labyrinth of wires, protective circuit disconnecting devices and distribution equipment before it fans out to feed critical loads and processes. An enterprise's electrical distribution system is, in effect, a power chain.

Each element in the electrical infrastructure is a critical link in the chain bringing power from the source, through the facility, to the point where the energy is transformed into a viable product or service. The goal of PowerChain Management solutions is to ensure that electrical power flows reliably and cost effectively to its end point of utilization.

Key components of a facility's power chain consist of devices such as: meters, protective relays, circuit breaker trip units, motor starters, generator paralleling switchgear and uninterruptible power supplies. Eaton Corporation offers a complete range of hardware, software and customer specific solutions that all work together to enable comprehensive management of one of an enterprise's most critical of investments — its power chain.

PowerNet Software

Eaton has been a leader in Power Monitoring Software and hardware for the past 20 years. Eaton's PowerNet Software provides an extension of the range and functionality of previous IMPACC (Integrated Monitoring Protection & Control Communications), dedicated twisted pair systems to a high-performance TCP/IP Ethernet network-based Client-Server Architecture.

Eaton's PowerNet network can be built in a variety of configurations. These systems can be constructed using existing Ethernet networks as the high-speed backbone for carrying information from Meters, Protective Relays, Microprocessor Trip Units, Motor Starters and other communicating devices, to clients across the plant or across the world. Alternately, a PowerNet network can connect to multiple devices throughout a facility using a simple dedicated twisted shielded pair running our robust noise immune INCOM (Frequency Shift Key) communications protocol.

The most flexible, highest performance network architecture includes a dedicated twisted shield pair network within the switchboard or equipment room connecting into a high-speed Ethernet backbone.The two main products designed for interfacing multiple devices from dedicated twisted shielded pair wiring directly to a TCP/IP Ethernet network are the Ethernet MINT and the NetLink.

Power Xpert Architecture

In our long tradition of industry-leading and highly reliable electronic metering, communications and monitoring systems, Eaton is proud to introduce our new Power Xpert Architecture. The Power Xpert Architecture is designed to interface to those existing IMPACC and PowerNet devices and connect them to current and future technologies.

Eaton's Power Xpert Architecture provides a fully scalable set of hardware/software solutions that can be applied in varying levels of sophistication depending upon a customer's needs. This new architecture permits backward communication compatibility to existing Eaton and other third-party equipment, as well as expanded functionality for new devices.

The Power Xpert Architecture utilizes embedded Web server technology for ease of connectivity to Ethernet Local and Wide Area Networks. The architecture includes Eaton's Power Xpert Meter, Power Xpert Gateways, and Power Xpert Software. Eaton's selection matrix includes a number of deployment levels, from Web browser based monitoring of a single Power Xpert Meter, through fully customized monitoring of Eaton and third-party devices in a multi-site environment.

Power Xpert Architecture Deployment Levels

0. Web Browser monitoring for a single device
1. Web Browser monitoring for multiple devices
2. Web Browser monitoring with centralized management
3. Customized Web-based graphics and third party device support

Power Xpert Architecture (Hardware/Software Products)

Power Xpert hardware/software products were developed to provide a highly intuitive local user interface that simplifies complex real-time data into meaningful information. At a glance, a user can quickly determine if a critical parameter in their power chain, (such as voltage, current or kWH), falls within or outside of an acceptable operational range.

Power Xpert devices provide the intelligent hardware connectivity layer to allow Web-enabled communications over an Ethernet TCP/IP network. These devices can act as stand-alone Web servers or as part of a coordinated system with Power Xpert Software consolidating and analyzing the combined system data. The Power Xpert Meter family and the Power Xpert Gateway family are two of the new categories of microprocessor based, Web-enabled, communicating devices from Eaton Corporation.

Power Xpert Meters

Power Xpert 4000/6000/8000 Meters offer Eaton customers a new level of accessibility to the critical information required to manage their electrical distribution system. The meter's embedded Web server includes real-time circuit information in both numeric and graphical visual formats that can be viewed on its local display or through a Web browser via the Internet or a customer's intranet.

Eaton's new Power Xpert 4000/6000/8000 Series Meters are the benchmark for intelligent Web-enabled power quality metering instruments. The meters include high-speed sampling and measurement of the critical elements, (i.e., voltage, power, current, transients, or harmonics), in a facility's power chain.

The meter's measured values are internally compared to "normal system thresholds" for routine health checks. The Power Xpert Meter's definition of "normal" system operating characteristics can be user pre-set. Alternately, the meter includes a user selectable "auto learn" feature that monitors activity on the circuit and statistically derives proper limits.

When the Power Xpert Meter determines that these "normal" operating parameters have been exceeded, it triggers an oscillographic waveform capture and generates an alarm. Waveforms are stored in Power Xpert's non-volatile flash memory using an industry standard Comtrade format. Waveforms can be automatically sent out by e-mail following an event, or can be retrieved from an FTP directory structure in the meter's memory.

All Power Xpert Meters provide a standard communications protocol for easy integration into other systems.

Power Xpert Gateways

Power Xpert Gateways are intelligent communication devices that Web-enable one or more electrical devices so they become visible to a browser on an Ethernet network. The Power Xpert Gateways are capable of providing communications conversion from one network field bus protocol to an other — for example INCOM to Ethernet.

Power Xpert Gateway devices are a key component in the Power Xpert Architecture. They allow a user to optimize their existing investment in Eaton's communicating devices such as IQ Meters, Digitrip Breaker Trip Units, Protective and Overload Relays and ***IT.*** Motor starters. They can also extend state-of-the-art connectivity to third party devices that communicate using Modbus RTU protocol over an RS-485 field bus.

Power Xpert Software

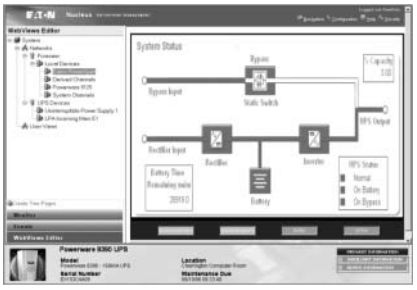
Power Xpert Software is the fusion of key components of our PowerNet, as well as Powerware's PowerVision and Foreseer Software into a single Power Monitoring Software package and includes ease of interconnectivity to a wide range of Eaton and third-party communicating devices. This new software provides an easy upgrade path to allow existing PowerNet customers to enjoy the benefits of power monitoring through a simple Web browser interface.

The Power Xpert Software provides a complete software solution to manage your power chain. Critical components such as metering devices, protective relays, circuit breaker trip units, motor starters and uninterruptible power supplies communicate vital information about the health and status of the power chain to the Web-enabled Power Xpert Software.

Alarming and Monitoring

Alarming, monitoring and Web-enabled displays are standard in the Power Xpert Software. The Power Xpert Software also provides the capability to analyze power quality, manage costs, track and schedule maintenance and receive early warning about potential problems. The Power Xpert Software extends support to Uninterruptible Power Supplies (UPSs) and can initiate computer server shutdown in the event of UPS low-battery conditions due to an extended utility power outage.

Device Monitoring — Summary



Device Monitoring — One-line

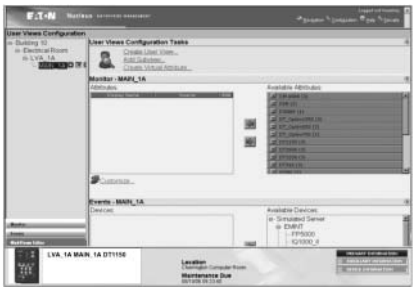
Device Monitoring — Alarms

E-mail Configuration

Data Trend Analysis

User-Defined Equipment Grouping

The Power Xpert Software's Web-enabled graphical user interface allows for the customized grouping of communicating equipment into user defined views, such as "Building A" or "North Campus."



Device Monitoring — Alarms

Expansion with Optional Software Licensed Modules

By adding optional licensed software modules, a user can further extend Power Xpert Software functionality to allocate energy costs, do waveform analysis or view their system via customized graphics. Other manufacturer's communicating equipment can also be monitored. This permits coverage for mixed hardware environments making Power Xpert Software the industry choice for Enabling PowerChain Management.

Power Xpert Architecture

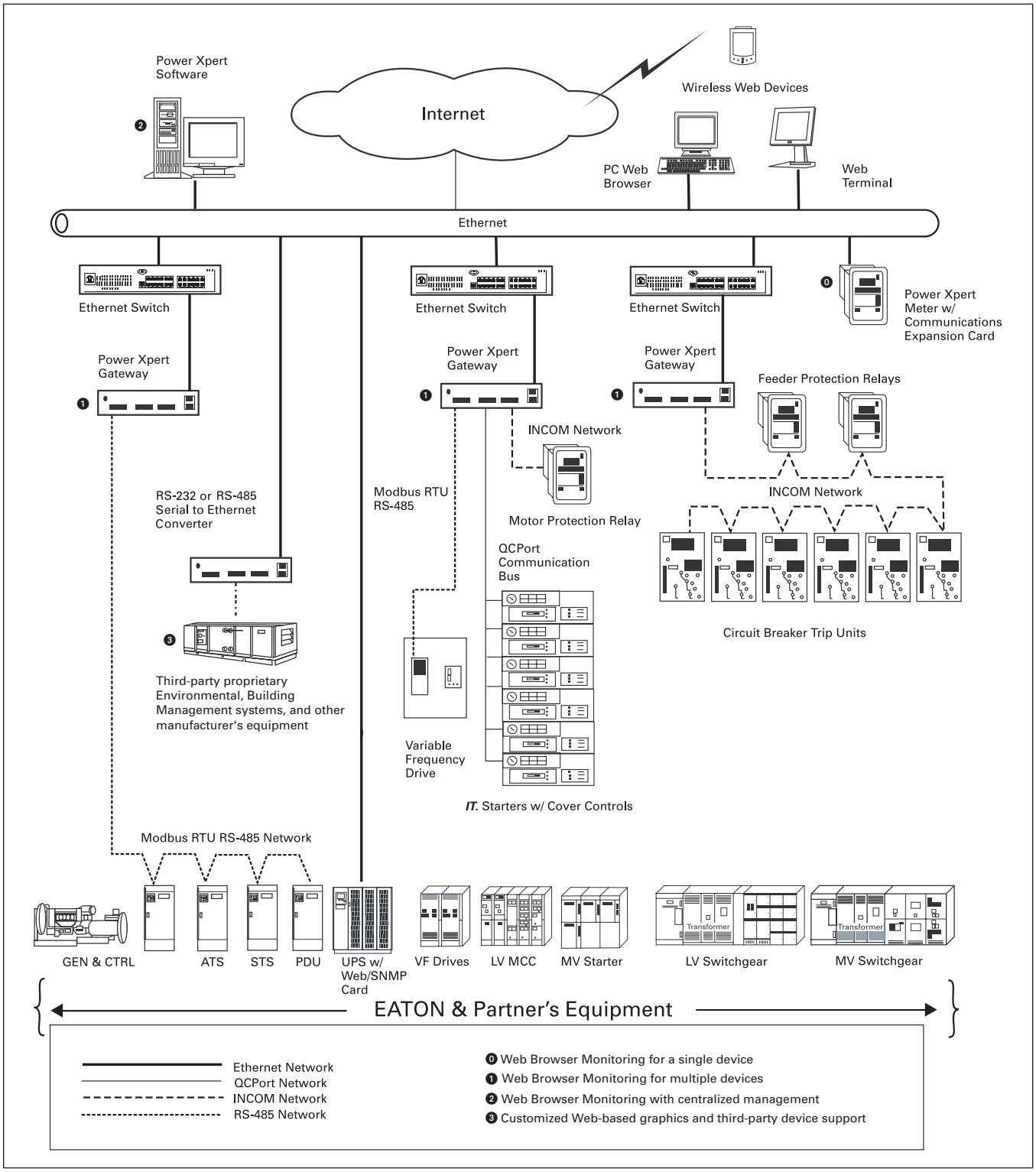


Figure 56-156. Power Xpert Architecture

Power Xpert System Configuration Guidelines

With Power Xpert devices (sophisticated, Web-enabled, high-definition communications) and a simple Web browser, users can interrogate single devices directly, groups of devices connected through gateways, or connect through software managing multiple devices and gateways. Using the Eaton system, users are free to combine ways in which they view their devices. Applications generally fall into four primary categories. Eaton has developed an easy way to provide the preferred solution, using the following configuration deployment strategies as example application categories. See **Table 56-89**.

Table 56-89. Configuration Guidelines

Application Categories	Level	Description	Implementation Details
Small Installation	❶	Web browser access directly to an individual Power Xpert device, i.e., Power Xpert Meter w/ optional Ethernet card or Powerware UPS w/ optional Web/SNMP card installed.	Easy configuration to enable Web browser monitoring for a single Eaton device, without coordination between devices.
Medium Installation	❷	Web browser access to multiple Eaton devices and third-party Modbus® RTU devices through the Power Xpert Gateway.	Easy setup to enable web browser monitoring for multiple Eaton devices, as well as third-party devices that support Modbus RTU. Each Power Xpert Gateway acts as a stand-alone Web server.
Sophisticated Installation	❸	Web browser access to multiple Eaton devices through Power Xpert Software. Devices connect to Power Xpert Software by means of either direct Web-enabled cards installed inside or via Power Xpert Gateways. Includes device views for Eaton equipment as standard.	Full suite of tools available to monitor overall system health. Power Xpert provides complete control over centralized alarm notification, reporting and escalation.
Tailored Solution	❹	Custom Web interface design using Eaton Electrical Services group	Integration of third-party devices and custom screens.

Power Xpert System

Level 0 — Built-in Network Communications Card

Example Applications

Power Xpert Meter in low voltage switchgear and UPS.

Description

Configuration Level 0 offers an easy means to Web-enable a single Eaton device provided that it is supported by an optional Web communications card that can be installed directly into the device. See the Connectivity Matrix on **Page 56-192**. for compatibility details.

Standard Features

- Real-time monitoring of metered and alarm points.
- Alarm history.
- E-mail notification.
- Communications settings via the Web.

Table 56-90. Functions/Devices

Drawing Symbol	Function Description	Eaton Device
Monitoring Equipment		
MM6GWP	Power Quality Meter Analyzer	Power Xpert Meter 4000/6000/8000
MM4&P	Meter Monitor and Protection	IQ DP-4000
MM	Meter Monitor	IQ100/IQ200
SMM	Sub-Metering Module	IQ Energy Sentinel
Overcurrent/Short Circuit Protection		
MVTU	Medium Voltage Relay (> 600 V)	DT-3000, FP-5000
LVTU	Low Voltage Trip Unit (≤ 600 V)	Digitrip RMS-810, 910, 520 MC or 1150
		Digitrip OPTIM™ 750 or 1050
Motor Protection and Control		
MPR	Motor Protective Relay	MP-3000
MMS	Microprocessor Motor Starter	*IT.* Starter
VFD	Variable Frequency Drive	SVX9000
Central Monitoring Panels		
BIM II	Breaker Interface Module II	BIM II (used with Digitrip OPTIM or Digitrip RMS)
LDISP	Local Display and Sub-network Master	Used with IQ Multipoint Energy Submeter II or with Energy/Power Sentinels
Other Devices		
ATS	Automatic Transfer Switch	IQ Transfer
RTD	Resistance Temperature	Universal RTD Module
ADR	Addressable Relay	ADRII
C	Product Communication	IPONI
R	Device	Resistor
■	Resistor-End of Line	IP, IN, IS Terminal Designation
----------	Terminal Block	IMPCABLE or
	Factory Twisted Pair Wiring	Belden YR29090 or Belden 9463 Family
▪▪▪▪▪▪▪▪	Field Twisted Pair Wiring	IMPCABLE or Belden YR29090 or Belden 9463 Family
———	Field Ethernet Backbone	CAT5 or multimode fiber

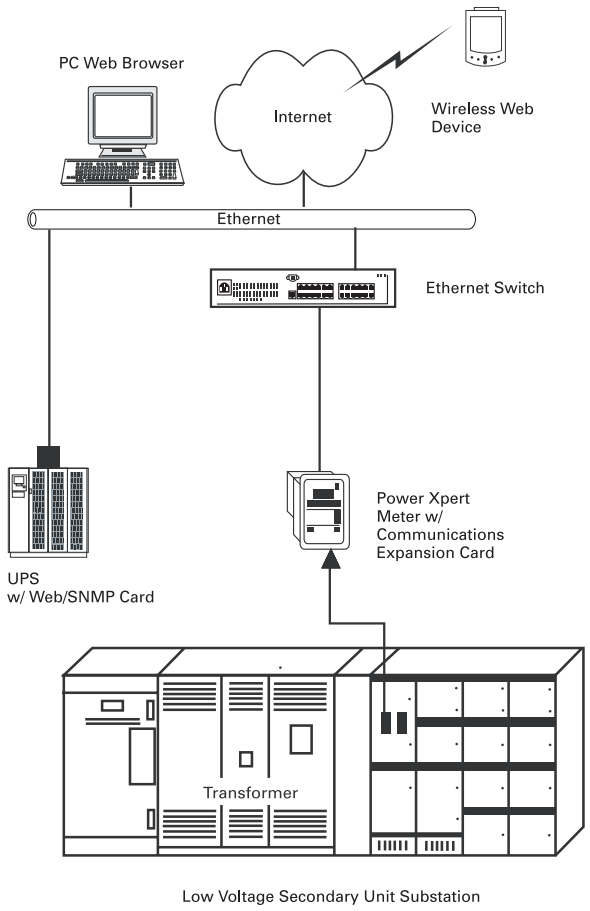


Figure 56-157. Built-in Network Communications Card

Level ❶ — Power Xpert Gateway

Example Applications

Low and medium voltage switchgear, motor control centers, and third-party equipment via Modbus RTU. Recommendation: Use one Power Xpert Gateway device per electrical assembly or switchgear sub-section.

Description

Configuration Level 1 offers an easy means to Web-enable multiple Eaton devices and third-party devices that support Modbus RTU. See the Connectivity Matrix on **Page 56-192** for compatibility details.

Standard Features

- Real-time monitoring of metered and alarm points.
- Communications settings via the Web.
- Alarm history (available on PXG600 and up).
- E-mail notification (available on PXG600 and up).

Table 56-91. Functions/Devices

Drawing Symbol	Function Description	Eaton Device
Monitoring Equipment		
MM6GWP MM4&P MM SMM	Power Quality Meter Analyzer Meter Monitor and Protection Meter Monitor Sub-Metering Module	Power Xpert Meter 4000/6000/8000 IQ DP-4000 IQ100/IQ200 IQ Energy Sentinel
Overcurrent/Short Circuit Protection		
MVTU LVTU	Medium Voltage Relay (> 600 V) Low Voltage Trip Unit (≤ 600 V)	DT-3000, FP-5000 Digitrip RMS-810, 910, 520 MC or 1150 Digitrip OPTIM™ 750 or 1050
Motor Protection and Control		
MPR MMS VFD	Motor Protective Relay Microprocessor Motor Starter Variable Frequency Drive	MP-3000 *IT.* Starter SVX9000
Central Monitoring Panels		
BIM II LDISP	Breaker Interface Module II Local Display and Sub-network Master	BIM II (used with Digitrip OPTIM or Digitrip RMS) Used with IQ Multipoint Energy Submeter II or with Energy/Power Sentinels
Other Devices		
ATS	Automatic Transfer Switch	IQ Transfer
RTD	Resistance Temperature	Universal RTD Module
ADR	Addressable Relay	ADRII
C	Product Communication	IPONI
R	Device	Resistor
■	Resistor-End of Line	IP, IN, IS Terminal Designation
----------	Terminal Block	IMPCABLE or
	Factory Twisted Pair Wiring	Belden YR29090 or Belden 9463 Family
- - - - -	Field Twisted Pair Wiring	IMPCABLE or Belden YR29090 or Belden 9463 Family
———	Field Ethernet Backbone	CAT5 or multimode fiber

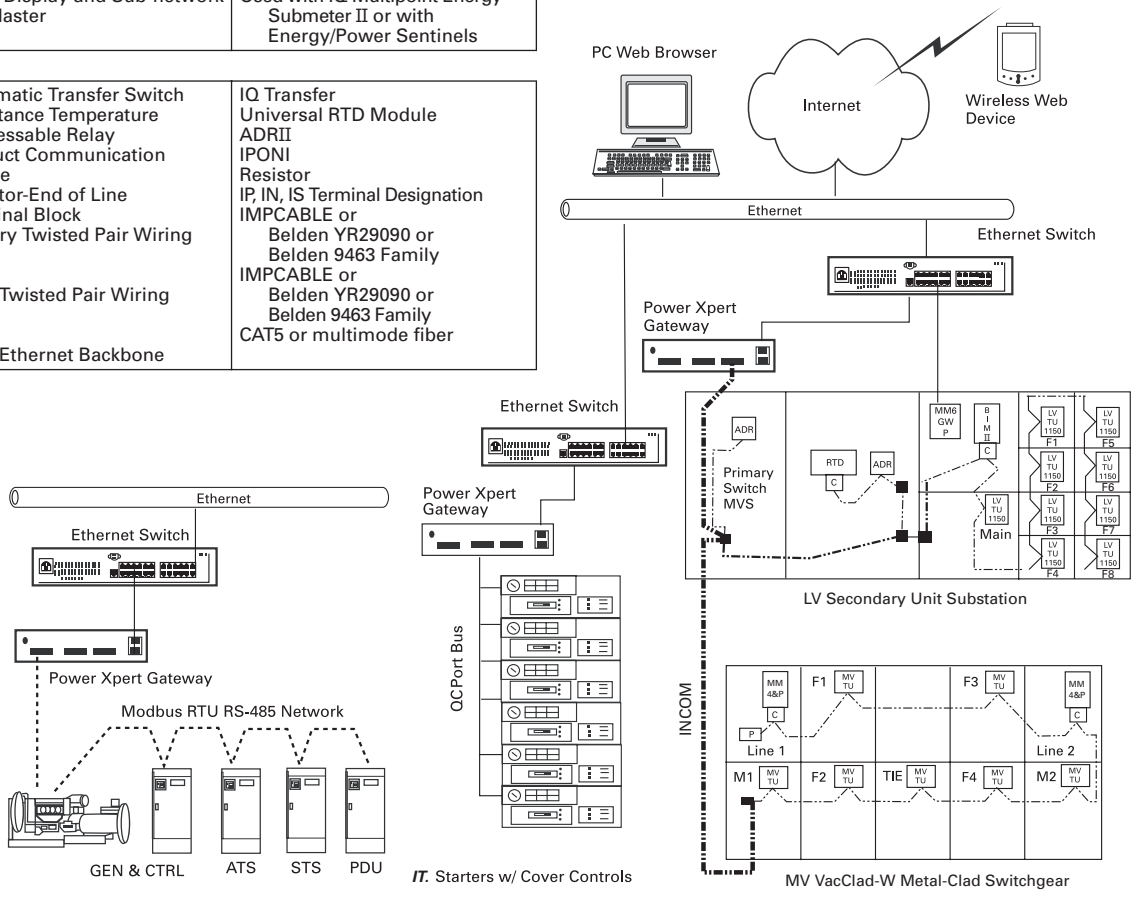


Figure 56-158. Power Xpert Gateway

Level ❷ — Power Xpert Software

Example Applications

All Eaton devices and third-party devices that support Modbus TCP and SNMP in addition to third-party Modbus RTU devices via the Power Xpert Gateway.

Description

Configuration Level 2 offers an easy means to Web-enable and centrally manage all Eaton devices that can be connected directly to an Ethernet network or via a Power Xpert Gateway device. Power Xpert Software provides a rich set of standard features, as well as premier value add-on option modules.

Standard Features

- Real-time monitoring of metered and alarm points.
- Full color Web-based graphics package with standard views for all Eaton devices.
- E-mail notification.
- Data trending and graphing.

Optional Add-on Features

- Web-based graphics editor to design floor plan and third-party device views.
- Energy consumption analysis and tenant billing.
- Power quality analysis and waveform viewing.
- Modbus TCP tool to import register maps from various third-party devices.
- SNMP tool to compile SNMP MIB (Management Information Base) files from various 3rd party devices.

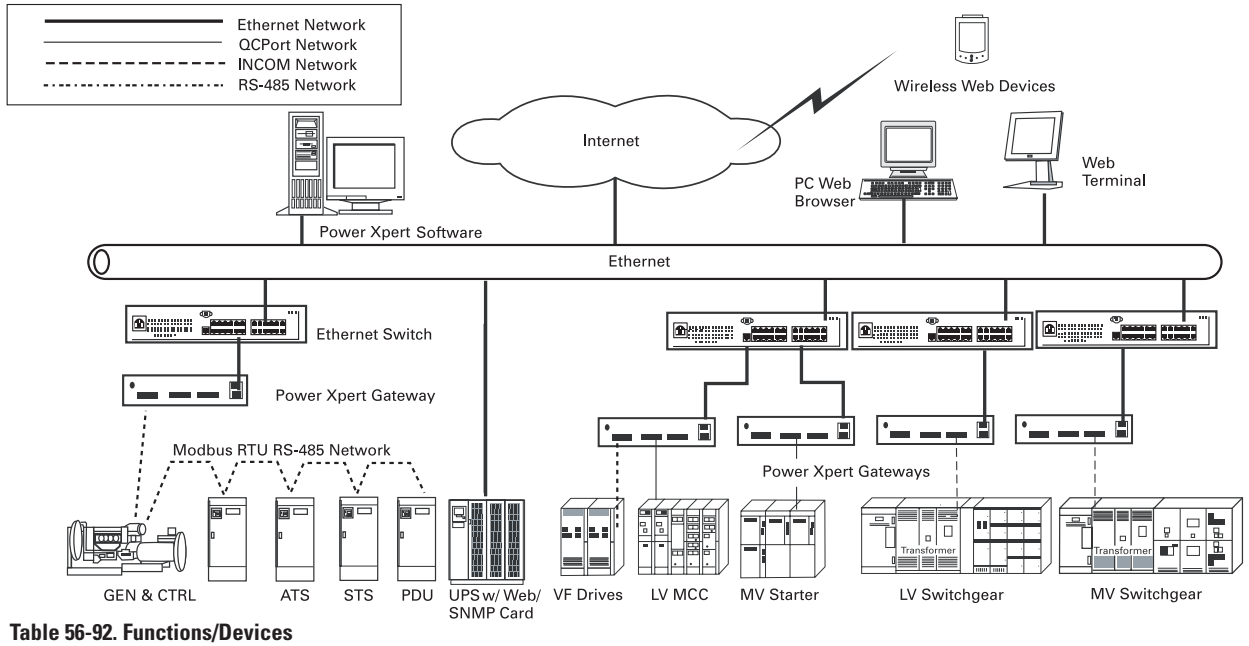


Table 56-92. Functions/Devices

Drawing Symbol	Function Description	Eaton Device
Monitoring Equipment		
MM6GWP	Power Quality Meter Analyzer	Power Xpert Meter 4000/6000/8000
MM4&P	Meter Monitor and Protection	IQ DP-4000
MM	Meter Monitor	IQ100/IQ200
SMM	Sub-Metering Module	IQ Energy Sentinel
Overcurrent/Short Circuit Protection		
MVTU	Medium Voltage Relay (> 600 V)	DT-3000, FP-5000
LVTU	Low Voltage Trip Unit (≤ 600 V)	Digitrip RMS-810, 910, 520 MC or 1150/Digitrip OPTIM™ 750 or 1050
Motor Protection and Control		
MPR	Motor Protective Relay	MP-3000
MMS	Microprocessor Motor Starter	*IT.* Starter
VFD	Variable Frequency Drive	SVX9000
Central Monitoring Panels		
BIM II	Breaker Interface Module II	BIM II (used with Digitrip OPTIM or Digitrip RMS)
LDISP	Local Display and Sub-network Master	Used with IQ Multipoint Energy Submeter II or with Energy/Power Sentinels
Other Devices		
ATS	Automatic Transfer Switch	IQ Transfer
RTD	Resistance Temperature	Universal RTD Module
ADR	Addressable Relay	ADRII
C	Product Communication Device	IPONI
R	Resistor-End of Line	Resistor
■	Terminal Block	IP, IN, IS Terminal Designation
----------	Factory Twisted Pair Wiring	IMPCABLE or Belden YR29090 or Belden 9463 Family
– – – – – – – – –	Field Twisted Pair Wiring	IMPCABLE or Belden YR29090 or Belden 9463 Family
———	Field Ethernet Backbone	CAT5 or multimode fiber

Figure 56-159. Power Xpert Software

Level ❸ — Eaton Electrical Services & Systems (EESS) Customized Software Solutions

Available Applications

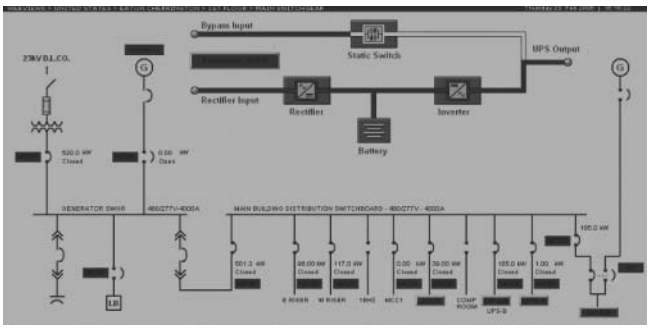
Any manufacturer's equipment that is supported by the EESS extensive device driver support list or request a custom quotation to obtain support.

Description

Configuration Level 3 offers an extensive service offering for the delivery of customized graphics and support for third-party proprietary device driver support.

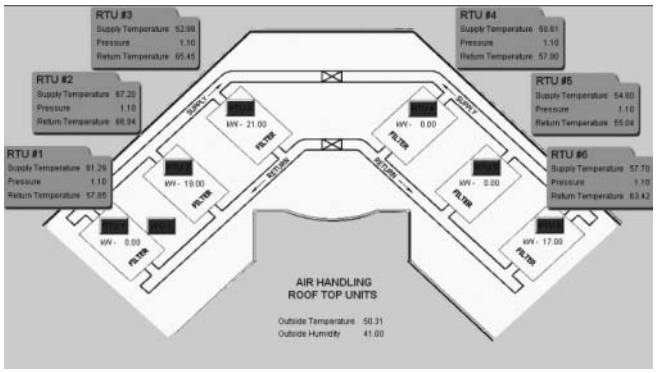
Enhanced Features

- Customized one-line diagrams to portray realistic operation of the complete power chain distribution system.



Power Distribution System One-Line Diagram

- Customized navigation systems to allow the operator to navigate the software in a similar paradigm that is consistent with the way they would describe their organization from a functional or departmental standpoint.



Customized Navigation System

Extensive List of Previously Developed Device Drivers

Device Drivers for Eaton Corporation Product Brands

Uninterruptible Power Systems

- Best Ferrups UPS
- Best Power Unity I UPS
- Borri B5000 UPS
- Borri S4000 UPS
- Exide MPD UPS
- IPM BP II UPS
- IPM BP III UPS
- IPM BP Plus UPS, P-Record
- Powerware 10,20,50
- Powerware 80-375
- Powerware 5115 UPS
- Powerware 9104 UPS
- Powerware 9120 UPS
- Powerware 9125
- Powerware 9150 UPS
- Powerware 9155 UPS
- Powerware 9170 Plus UPS
- Powerware 9315 UPS
- Powerware 9315 SBM
- Powerware 9315 Parallel Module (UPM)
- Powerware 9320 UPS
- Powerware 9330 UPS
- Powerware 9330 UPS
- Powerware 9335 UPS
- Powerware 9355 UPS
- Powerware 9390 UPS
- Powerware Plus 6 UPS
- Powerware Plus 18-36
- Powerware Plus 40-500 kVA UPS
- Powerware Plus SBM & UPM
- Powerware PF2 Flywheel
- Powerware Prestige
- Powerware ScanTek Megaware

Static Transfer Switch/Auto Transfer Switch

- Obsolete Exide BTA
- IQ Transfer II
- ATC 400

Device Drivers for Other Manufacturers' Brands

Note: Device drivers shown are in addition to the Optional Add-on Features, the Modbus TCP tool and SNMP tool, that are available with Level ❷ for importing data for third-party devices.

Note: Contact Eaton for most current list of third-party device drivers. This list is constantly expanding. Also contact Eaton for custom device driver development.

Computer Room Air Conditioning

- Air Flow Dataguard 3.2
- Air Flow Dataguard 4.0
- Air Flow Dataguard 5.0
- Air Flow DG5.0 w/ Setpoints
- Air Flow DG5.0 w/ Control
- ATS AC
- Canatal AC
- Carrier CCN Dataport
- Carrier CCN DataLink
- CompuAire AC
- DART Aire Dart200 Site License
- Data Aire/Air Conditioner
- Data Aire AC w/ Setpoints
- Data Aire AC w/ Control
- DataAire Plus
- Dectron ECOSaire AC
- Edpac AC
- Hiross ECOSaire AC w/Microtrac
- Liebert Air Conditioner
- Liebert AC w/ Setpoints
- Liebert AC w/ Control
- Liebert Atlas AC
- Liebert MPU3000
- Liebert CSU 3000
- Liebert Hiross WXG AC w/hiroli
- Multi-Stack Chiller
- Stultz C5000 AC
- Stulz C6000 AC
- York Chiller w-XL Translator

Power Distribution Units

- EPE MGE PDU w/Power Logic
- Liebert PDU
- MGE PDM w/Veris H8238 MCM
- MGE PDU w/RDU
- Obsolete united power pdu
- PDI BCM
- PDI PDU Modbus
- United Power PDM PDU 4-Wire
- United Power PDU (Wye) Modbus

Uninterruptible Power Systems

- APC Symetra UPS
- APC Silcon UPS
- APC Smart UPS 400-750 kVA UPS
- Generic SNMP
- GE SG Series UPS
- Gutor UPS
- HiTec Control Panel UPS
- Liebert SMS Series 300 UPS
- Liebert Npower UPS
- Liebert Series 300 UPS
- Liebert SM3 UPS
- Liebert UPStation UPS
- Liebert System Control Cab.
- Liebert 600 Multimodule UPS
- MGE Epsilon STS
- MGE Galaxy UPS
- MGE Comet UPS
- MGE EPS 6000 UPS
- MGE EPS8000 Sys Ctrl Cabinet
- Mitsubishi 2033A&D UPS
- Mitsubishi 2033C UPS
- Mitsubishi 9700 UPS
- Mitsubishi 9800 UPS
- Piller UPS
- Piller Uniblock III UPS
- Silcon UPS
- Socomec Delphys UPS
- Thycon UPS
- UPS Ltd. Powerwave 9000 UPS

Standby Backup Generator

- Basler DGC2000 Genset
- Caterpillar Generator Set
- Caterpillar Generator Expanded
- Kadolite Generator
- Katolight KDGC2001 Genset Ctrl
- Kohler Gernerator Modbus
- Kohler Generator VI
- Magnetek Generator
- MTU Generator
- Obsolete Generator Remote Star
- Onan Generators
- Onan Generator VIS RS232
- Onan Modlon Generator
- Simpson SimPower Generator TCP
- Synergy Generator
- Wexler Generator Controller

Power Xpert Gateways

Power Xpert Gateways provide a cost-effective method to easily Web-enable Eaton and third-party products. The Gateway consists of an embedded Web server that allows the user to connect to Eaton products such as breakers, meters and relays found in MCCs, LV and MV Switchgear, Lighting Controllers — to name a few — that communicate via Eaton protocols INCOM and QCPort, in addition to third-party products that communicate via Modbus RTU. The Gateway provides the central connection point for the power distribution and control devices, allowing their parameters to be browsed and controlled (depending upon model) via the Web.

The Gateway eliminates the need for the user to think about the array of disparate communication protocols across the power chain when converted to the Ethernet network via the Gateway. Additionally, Power Xpert Gateways provide data communications to our new Power Xpert Software as an easy means of centralizing and gathering data for long-term data archival, analysis, and trending features.

Additionally, the PXG is compatible with and facilitates integration with many third-party building and factory automation systems via Modbus TCP and Web Services.

Information is presented in organized, user-friendly Web pages and includes, but is not limited to, the following:

- Login page
- Home page
- System pages including:
  - Equipment Status
  - Current
  - Peak Current Demand
  - Voltage
  - THD
  - Power
  - Power Quality
  - Energy
  - Transformer Temp and Fan Status

Power Xpert Gateway Screenshots

There are 4 models:

Power Xpert Gateway 400 — provides protocol translation for INCOM and QCPort or Modbus RTU to Modbus TCP on Ethernet and Web interface for viewing real-time data. Also supports Modbus TCP, Web Services and SNMP on the Ethernet port for third-party devices.

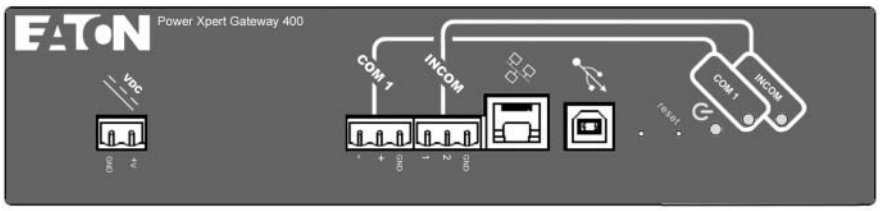
Power Xpert Gateway 600a — includes all of the PXG 400 features PLUS alarm notification, set point management, historical data using only a Web browser and e-mail.

Power Xpert Gateway 600b — includes all of the PXG 600a features PLUS iDEN cellular communications.

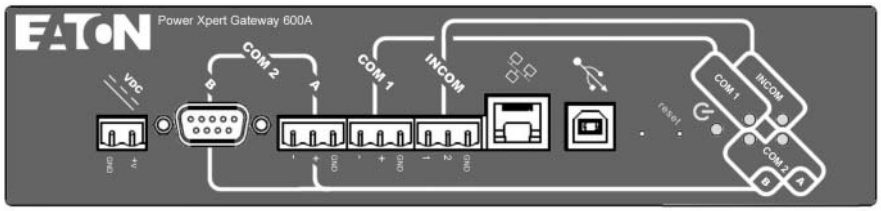
Power Xpert Gateway 1000 — specifically targeting lighting control; future details to be announced by Eaton.

Table 56-93. Power Xpert Gateway Selection Chart

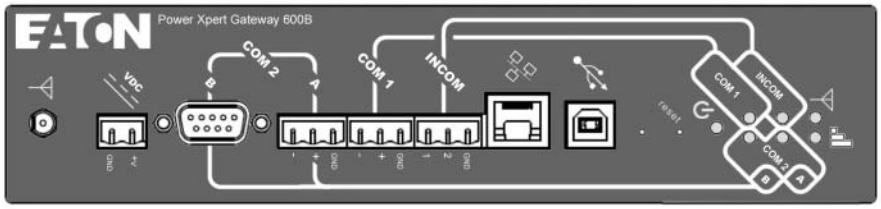
Description	PXG400	PXG600a	PXG600b
Number of Input Ports	2	3	3
Maximum No. devices supported per Gateway	64	96	96
INCOM devices supported	✔	✔	✔
QCPort or Modbus RTU devices supported	✔		
QCPort and Modbus RTU devices supported		✔	✔
Web-based configuration	Y	Y	Y
Auto-discovery of INCOM and QCPort devices	Y	Y	Y
Web display of device data	Y	Y	Y
Modbus TCP Output	Y	Y	Y
Historical Data Logging	N	Y	Y
Alarm Notification	N	Y	Y
E-Mail Notification	N	Y	Y
Web Services/XML Data	Y	Y	Y
iDEN Cellular	N	N	Y
SNMP Status	Y	Y	Y
Configuration via USB port	Y	Y	Y
Local data view via USB port	Y	Y	Y



Power Xpert Gateway 400



Power Xpert Gateway 600a



Power Xpert Gateway 600b

Table 56-94. Connectivity Matrix

Eaton Equipment	Power Xpert Software Ready															Third-Party Ready						Web Browser Ready		
	Ethernet					Serial RS-232 — MINT II	Fieldbus Subnetwork Master			Fieldbus Interface					Native Comms.		Modbus TCP		Modbus RTU			Native Comms.	Web Servers		
	Direct	Power Xpert Gateway	EPONI	EMINT	Ethernet NETLINK		BIM	CMU	SMLD	IPONI	WPONI	BPONI	DPONI	OSNAP	INCOM STD	OCPORT STD	Direct	Power Xpert Gateway	Modbus PONI	Modbus MINT	Modbus NetLink	Modbus RTU STD	Power Xpert Gateway	WEBPONI	Direct
Power Xpert Meters																									
Power Xpert 4000		■															■	■				■	■		■
Power Xpert 6000		■															■	■				■	■		■
Power Xpert 8000		■															■	■				■	■		■
IQ Meters																									
IQ Analyzer		■	■	■	■	■				■								■	■	■	■		■	■	
IQ DP-4000		■	■	■	■	■				■								■	■	■	■		■	■	
IQ 200		■		■	■	■			■						■			■		■	■		■		
IQ 200M		■																■				■	■		
IQ Power Sentinel		■		■	■	■	■		■						■			■		■	■		■		
IQ Energy Sentinel		■		■	■	■	■		■						■			■		■	■		■		
IQ Multipoint Energy Submeter II		■		■	■	■			■						■			■		■	■		■		
Circuit Breaker Trip Units																									
Digitrip 1150		■		■	■	■	■								■			■		■	■		■		
Digitrip 520MC		■		■	■	■	■								■			■		■	■		■		
Digitrip RMS 810/910		■		■	■	■	■								■			■		■	■		■		
Digitrip OPTIM 1050		■		■	■	■	■		■						■			■		■	■		■		
Digitrip OPTIM 550		■		■	■	■	■								■			■		■	■		■		
Protective Relays																									
EDR-3000		■															■	■				■			
FP-4000		■		■	■	■									■			■		■	■	■	■		
FP-5000		■		■	■	■									■			■		■	■	■	■		
FP-6000		■		■	■	■									■			■		■	■	■	■		
MP-4000		■	■	■	■	■				■			■					■	■		■		■		
DT-3000		■		■	■	■									■			■		■	■		■		
MP-3000		■	■	■	■	■				■	■	■	■					■	■	■	■		■		
Universal RTD		■		■	■	■						■						■		■	■		■		
Spot Network Equipment																									
MPVC Network Protector Relay		■		■	■	■									■			■	■	■			■		
Motor Starters																									
Advantage Starters								■			■							■					■		
IT. S752 Soft Start														■				■					■		
IT. S811 Soft Start																■		■					■		
IT. Electromechanical Starters														■				■					■		
Surge Protection and Power Conditioning																									
PFCC																		■				■	■		
NetVisor TVSS																		■				■	■		
Automatic Transfer Switch																									
IQ Transfer		■		■	■	■				■								■					■		

Note: Visit www.eaton.com for latest up-to-date details on connectivity.

Table 56-94. Connectivity Matrix (Continued)

Eaton Equipment	Power Xpert Software Ready																Third-Party Ready						Web Browser Ready		
	Ethernet					Serial RS-232 — MINT II	Fieldbus Subnetwork Master			Fieldbus Interface					Native Comms.		Modbus TCP		Modbus RTU			Native Comms.	Web Servers		
	Direct	Power Xpert Gateway	EPONI	EMINT	Ethernet NETLINK		BIM	CMU	SMLD	IPONI	WPONI	BPONI	DPONI	QSNAP	INCOM STD	QCPORT STD	Direct	Power Xpert Gateway	Modbus PONI	Modbus MINT	Modbus NetLink	Modbus RTU STD	Power Xpert Gateway	WEBPONI	Direct
Variable Frequency Drive																									
SVX																		■					■		
MVX																		■				■	■		
Remote I/O Products																									
Addressable Relay		■		■	■	■									■			■					■		
Analog Input Module		■		■	■	■									■			■					■		
Digital Input Module		■		■	■	■									■			■					■		
UPS																									
Powerware UPS																		■							①

① With appropriate Web card or SNMP card.

Note: Visit www.eaton.com for latest up-to-date details on connectivity.

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