

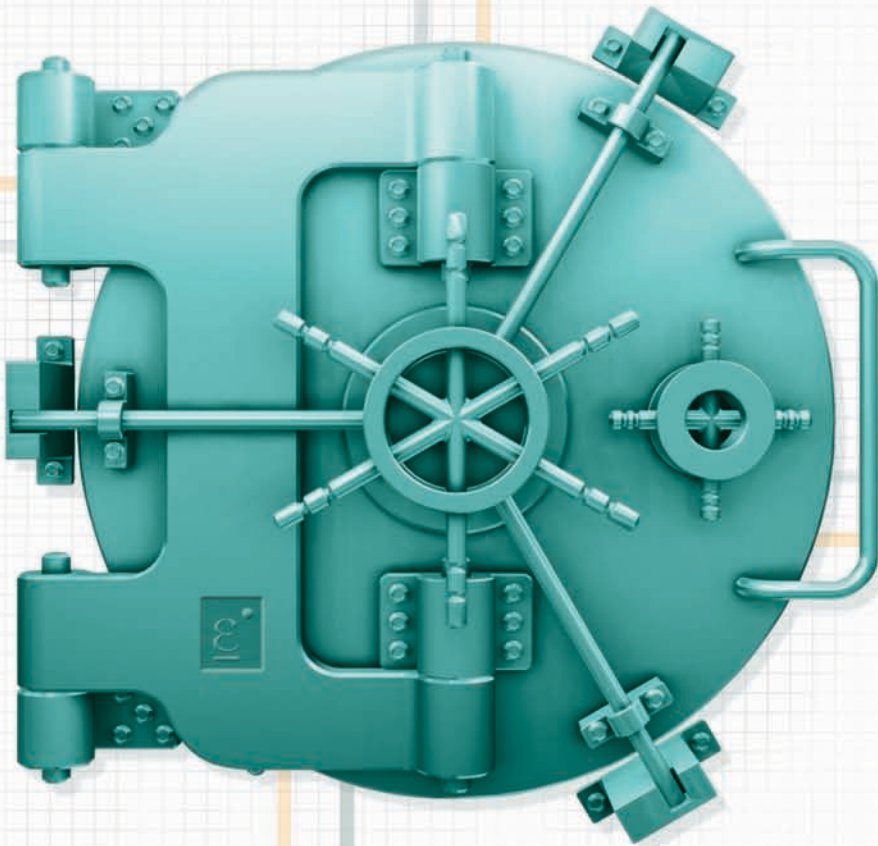
# Action Instruments

PROTECTING THE INTEGRITY OF YOUR PROCESS SIGNAL



invensys

**EUROTHERM**  
*action instruments*



**Product Handbook: VOLUME 18**

[www.eurotherm.com/actionio](http://www.eurotherm.com/actionio)

## *Eurotherm: a company that understands signal conditioning and isolating.*

For over 35 years Eurotherm has built an international reputation for developing premium quality “fit for purpose” products and solutions. The Eurotherm brands (Action Instruments, Barber-Colman, Chessell, Continental and Eurotherm) have long been recognized as the leaders in the industrial automation market.

Action Instruments provides the signal conditioning industry the highest quality, most innovative solutions to remote signal conditioning and isolation applications. Action defined the standard for accuracy and reliability and our focus on technological innovation continues to raise that standard. The people behind the Action Instruments brand are devoted to understanding your needs and overcoming obstacles to the collection and transmission of industrial automation process signals.

### **Easy Solutions to Tough Problems**

Every Action product is designed for easy installation, operation and maintenance. Whether you are amplifying or splitting signals, conditioning sensor outputs, isolating grounding problems, or adding more drive to current loops, Action’s complete product selection provides simple, convenient solutions to any analog signal conditioning need.

### **High Performance and Proven Reliability**

Reliable signal processing under harsh conditions. That’s what Action’s products deliver. Nearly three decades of proven success can assure you of our adherence to the highest quality standards and the best in manufacturing techniques.

### **Real World Ruggedness**

Action products are in tune with the industrial environment - the real world of hard-hats, forklifts, and EMI/RFI - they are ruggedized to survive the extremes of vibration, shock, temperature and humidity that are common to the manufacturing arena.

### **Action’s Personal Commitment to Your Success**

We know how tough it is on the plant floor and we realize that every application has different requirements. That’s why Action’s solutions are tailored to your problems.

### **Best Engineering Support in the Industry**

Experienced, knowledgeable and friendly engineers are available throughout the world to answer your questions.

### **Think Reliable, Think Smart, Think Action**

Our goal is to be your exclusive supplier for industrial measurement and control products. What can we offer you? Plenty.

## *What do Action Products Do?*

### **Isolation**



A ground loop can occur if more than one ground connection is made to a single control signal. Because grounds are seldom at the same potential, an unwanted current will be generated and interfere with the control signal. Signal isolators break the ground loop current path and maintain the integrity of the measurement.

### **Signal Conversion**



Industrial applications use a wide array of sensors to measure temperature, flow, length, speed, frequency, etc. These signals may then need to be converted into a form usable by the instrumentation to which they are connected. Any sensor signal (thermocouple, RTD, DC voltage, DC current, AC voltage, frequency, resistance, etc.) can be converted to any standard process signal.

### **Noise Filtering**



Isolators incorporate low pass filters that eliminate high frequency EMI/RFI and unwanted signals from power lines, generators and motors.

### **Linearization**



Many sensors output a signal that is not linearly related to the engineering value being measured. For example, a thermocouple used to measure temperature has a nonlinear millivolt output. A thermocouple input signal isolator translates this to a standard, robust linear signal such as 4 to 20 mA.

### **Limit Alarms**



Limit alarm units take in a process signal and compare it to one or more setpoints. They then provide an output signal, usually a relay contact, when the signal crosses the setpoint.

### **Math**



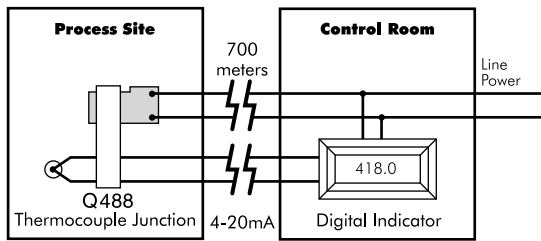
Isolators that can perform addition, subtraction, multiplication, division, square root, and averaging.

# What is Signal Conditioning?

Signal conditioners are electronic instruments used in factory or machine automation. They can amplify, convert, boost, transform, buffer, filter, alarm and isolate process control signals. There seems to be no limit to the variety of things control engineers want to do with control signals. Signal conditioners are known by many names: converters, transducers, isolators, transmitters, and black boxes. Conventionally, most signal conditioners and isolators fall into two categories based on the number of wires required for power and signal.

## Four-wire Transmitters

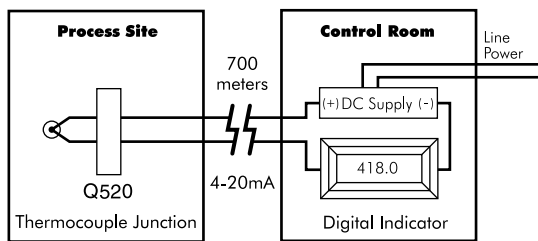
A four-wire transmitter has two wires for power and two wires for the signal output. A four-wire transmitter can be either AC or DC powered. Four-wire transmitters provide a powered output, either a voltage signal (e.g., 0-10V, 1-5V); a current signal (e.g., 4-20mA, 10-50mA); or in some cases a relay (e.g., solid state or contact closure). Four-wire transmitters require a power supply - they do not use power from the input or output signal lines. The power supply allows four-wire transmitters to power their output signal. Because of this, they are often used to boost signal strength for retransmission.



Four-wire Transmitter

## Two-wire Transmitters

A two-wire transmitter is powered by the same two wires that carry the output signal. A two-wire transmitter is always DC powered and the output can only be a current signal, typically 4-20mA, or sometimes 10-50mA. The two-wire transmitter is considered a field device and requires very little power (milliwatts). It is therefore appropriate for hazardous (explosive) environments, such as chemical refineries and pharmaceutical plants. The low DC power requirement, which ranges from 10-48VDC at currents as low as 4mA, reduces the chances of an electrical spark causing ignition of flammable vapors or dust. Additionally, two-wire



Two-wire Transmitter

transmitters save on wire costs since both the signal and power are on the same wires. Locating a two-wire transmitter as far as 2000 feet from the control room is possible and at half the wiring cost

of a four-wire transmitter. It is important to note that two-wire transmitters can be isolated or non-isolated. Many low cost two-wire transmitters are not isolated, which makes it important to ensure that the input sensor is not grounded. All of Action's two-wire transmitters are fully isolated. Members of this group include the TransPak series and most of the Q5xx products.



WV408 Ultra SlimPak II

## Limit Alarms

Limit alarms are considered a four-wire transmitter since they have two wires for power and at least two wires for the relay signal output. Limit alarms are similar to a thermostat. On your thermostat at home you may have the temperature set to a cozy 72°F or 23°C. If the room temperature falls below that "setpoint" the heater will turn on. This is an example of on/off control. A limit alarm performs the same function. It has a setpoint which is compared to a process signal. If the temperature gets too high, the limit alarm is used to alert an operator or shut down the process. Other applications include limit alarms that can also act as backup for a control system to perform a controlled shutdown process in order to prevent damage or other hazards.

## Digital Indicators

Digital indicators (or panel meters) will also accept direct sensor inputs. For the most part, AC powered indicators can be considered a four-wire transmitter if they are configured with an analog or relay output. Indicators are most commonly used to display process variables, however some have secondary functions, such as a 4-20mA transmitter output, limit alarm, or relay contact closure output.

Loop powered indicators such as Action's V560 are an important type of digital indicator. These indicators are designed for field use and have operating characteristics similar to a two-wire transmitter. They use a 4-20mA signal for power and therefore, as low power devices, are ideal for use in hazardous environments.



VisiPak, 1/8 DIN Rail Mount Indicator

# Product Selection Guide

Input Type	Ultra SlimPak™ II		Ultra SlimPak™		ActionPak™	
	Limit Alarms	Signal Conditioners	Limit Alarms	Signal Conditioners	Limit Alarms	Signal Conditioners
DC Volts DC Current	WV108	WV408	G108	G408	AP1080 AP1090	AP4380, AP4382 AP4390, 4391, 4392 AP750x
RTD	WV118	WV418	G118	G418		AP4151
Thermocouple	WV128	WV428	G128	G428	AP1280 AP1290	AP4351
Potentiometer		WV438		G438		AP4003
Strain Gauge		WV448		G448		AP4081
AC Volts AC Current	WV168	WV468	G168	G468	AP1690	AP6380
Frequency		WV478		G478		AP7380 AP7510
Accessories	Configuration Tools available	Configuration Tools available				
24VDC Power Supplies	WV905	WV905	H910 H915	H910 H915	AP9046	AP9046
Other	Ethernet Connectivity PC and Button Setup Removable Connectors		Fixed Connectors		Most Complete Range of Legacy Models	

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**ActionIQ™**



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**I/P**



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**TransPak™**



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**VisiPak™**



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AC Limit Alarms and Signal Conditioners	DC Limit Alarms and Signal Conditioners	Loop Powered 2/3 Wire Transmitters & Signal Conditioners	Current to Pressure Transducers	2 Wire Transmitters	Digital Displays
Q106 Q403, Q406	Q108 Q404, Q408 Q498	Q500 Q501	IP51 IP61	T280, T287 T700, T703	V108, V116, V132 V408, V430, V438 V560, V561, V565 V3200i
Q116 Q486	Q488	Q510		T713 T280, T287 T797, T798	V108, V116, V132 V408, V432 V3200i
Q126 Q486	Q488	Q425 Q520		T280, T287 T723 T797, T798	V108, V116, V132 V408, V432 V3200i
Q436	Q438			T287 T752	V408, V438
Q446	Q448				V408, V434 V3200i
Q466	Q468			T761	
Q476	Q478 Q498			T773	V437
IQRL-2xxx required for AC power distribution. Config Tools available	IQRL-Dxxx for DC power distribution. Config Tools available			T287 requires C680-0001 Software and Adapter	Configuration Tools available for V3200i
				T609	
	Wide Ranging Input Math Capability		Ideal for Hazardous Environments	Intrinsic Safety Models	Intrinsic Safety Models

**Miscellaneous**

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7EC  
1/8 DIN Temperature Controller



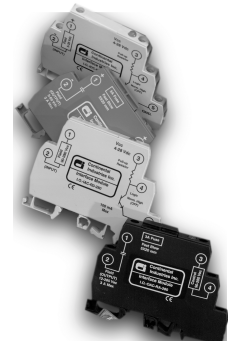
75C  
1/16 DIN Temperature Controller



MEMOCAL  
Hand-held Calibrator



RFS  
DIN Rail Mount  
Temperature Controller



Mini DIN  
I/O Modules

# Action Product Handbook Volume 18

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# ULTRA SLIMPAK™ II

## Description

The Ultra SlimPak II is an exciting new line of isolating signal conditioners from Action Instruments with greater accuracy and better stability than virtually any other signal conditioners on the market today.

## Smart Power

The Ultra SlimPak II modules use Smart Power for their output power supplies, providing a potential power savings of almost 1/2 Watt per unit. Previous technology allowed only for a single supply at the highest voltage required to drive the highest impedance load. Smart Power adjusts its output voltage and power, depending on the power output required to drive the current load. A low impedance current loop will now use less power than a high impedance current loop. For example, a low impedance load requires a supply voltage of only 5 volts. With a 20mA current, this consumes only 100mW of power. In comparison, a high impedance load (using an older style supply) would require a 26 volt supply, which at 20mA would consume 520mW of power.

## Enhanced LED Diagnostics

Other than when executing the pushbutton calibration routine, the LEDs blink under the following conditions:

### RUN (Green):

- On when unit is powered.
- Flashes at 2Hz when input is under range.
- Flashes at 8Hz when input is over range.

### SETPOINT A (Red):

- On when Setpoint A is tripped.
- On when setting Setpoint A.
- Flashes while calibrating the input level.

### SETPOINT B (Red):

- On when Setpoint B is tripped.
- On when setting Setpoint B.
- On while calibrating the input level.

An Under Range condition exists when the signal is lower than the operational low value minus 6.25% of the operational span. An Over Range condition exists when the signal is higher than the operational high value plus 6.25% of the operational span.

## Configuring Modules

Configuration is accomplished by setting DIP switches and using a pushbutton to calibrate the range. It is also possible to remotely modify parameters using an ethernet connection to the WVC16 and a remote PC-based web browser.

## Options

**C620** Factory calibration of input range, setpoints and output relays.

## WV16 Communications Interface (Optional)

The WVC16 Communications Interface adds functionality never before found in a signal conditioning system. The WVC16 interfaces with Ultra SlimPak II devices via an internal infrared communications link (no programming required) and provides the ability to connect as many as 32 modules to the intranet, allowing the user to view process data on a near real time basis, perform data logging functions on specified modules, calibrate the signal conditioners remotely, and view diagnostic information.

The WVC16 contains a web page server and an e-mail server. Browsers supported include Internet Explorer 5 or later and Netscape Navigator 4.7 or later. The user has the ability to have setpoint trip conditions generate an e-mail message for up to 10 recipients. The module also contains a countdown timer that can be used to notify when routine maintenance is required, such as re-calibration. The internal temperature of the module can also be monitored. All memory to support the signal conditioner's historical data, storage of the web pages and all e-mail messages is contained in the WVC16.

The WVC16 downloads a JAVA applet to the client's computer. The applet provides access to the signal conditioner's data, which includes the following:

- Module configuration summary
- Module configuration editing
- Diagnostic/warning status
- Alarm setup & status
- E-mail setup, editing & address book
- Process variable viewing



# Ultra SlimPak™ II Selection Guide

Input	Typical Application	Description	Model
DC Voltage or Current (V, mV, A, mA)	Voltage/Current scaling, isolation, noise reduction and signal drive	Field configurable DC input isolator	WV408
	DC motor/current limit, level/position control, HI/LO pressure alarm, power demand warning, totalization alarm, 2-channel comparator	Field configurable DC input limit alarm	WV108
Potentiometer (0-100 Ohms, up to 0-100k Ohms)	Tank level control, monitoring, data acquisition, resistance position sensor conditioning	Field configurable potentiometer input signal conditioner	WV438
RTD (Types Pt, Ni, Cu)	Temperature control, monitoring, data acquisition	Field configurable RTD input isolator	WV418
	Heater/cooler control, HI/LO temperature alarm, motor temperature monitor	Field configurable RTD input limit alarm	WV118
Thermocouple (Types B, E, J, K, R, S, T)	Temperature control, monitoring, data acquisition	Field configurable thermocouple input isolator	WV428
	Heater/cooler control, HI/LO temperature alarm, motor temperature monitor	Field configurable thermocouple input limit alarm	WV128
Frequency (0-2Hz to 0-10kHz)	Flow/velocity control or monitoring, motor speed control, scaling, pulse accumulation, integration, totalizing	Field configurable frequency input isolator	WV478
Strain Gauge (0.5, 1, 3, 5, 10, 20, 50mV/V) 1 to 10V Adjustable Excitation	Pressure control, pressure status monitoring, weight, load cell conditioning and data acquisition	Field configurable bridge input isolator	WV448
AC Voltage or Current (V, mV, A, mA)	Voltage/Current scaling, power monitoring, isolation, buffering	Field configurable AC input isolator	WV468
	AC motor/current limit, AC power status monitor	Field configurable AC input limit alarm	WV168
24 Volt DC Power Supplies	Supply 24VDC power to 2, 3 and 4 wire transmitters	24VDC, 500mA	WV905
		24VDC, 1.0A	H910
		24VDC, 2.3A	H915



WV108-2000 (non-latching)  
WV108-2001 (latching)

# ULTRA SLIMPAK® II WV108

## DC Powered DC Input Limit Alarm

Provides Relay Contact Closures  
at a Preset DC Input Level



- Programmable HI or LO, Failsafe or Non-failsafe
- Improved Accuracy
- 24VDC Transducer Excitation
- Bussed Power with Plug-in Power Clips
- Removable Terminals for Easy Service

- Touch Cal for Best Stability and Accuracy
- RoHS Compliant
- Adjustable Deadband
- LED Trip and Input Indicators
- Optional E-mail Notification of Alarms

Ultra Slimpak® II

### Description

The Ultra SlimPak II is an exciting new line of isolating signal conditioners from Action Instruments with greater accuracy and better stability than virtually any other signal conditioners on the market today.

The WV108 is a DC Voltage or Current Input Limit Alarm with dual setpoints and two contact closure outputs. The input type and alarm functions are field configurable, offering maximum flexibility. There are five input voltage ranges between  $\pm 20\text{mV}$  and  $\pm 200\text{V}$ , and two current input ranges,  $\pm 10\text{mA}$  and  $\pm 100\text{mA}$ . Alarm setpoints are fully adjustable throughout the entire range.

The WV108-2000 contains two standard non-latching SPDT relays. When power is removed, the relays revert to their non-powered state. The WV108-2001 contains two latching relays. Whatever position the relays are in when power is removed is where they will remain when power is re-applied (a reset switch is provided to reset the relays after the alarm is no longer true). Both models are configurable as a single or dual setpoint alarm, with HI or LO trips. The WV108-2000 supports failsafe or non-failsafe operation. In failsafe operation the relay coil is energized when the process is below the HI setpoint or above the LO setpoint (opposite for non-failsafe). In the failsafe mode, a power failure results in an alarm state output.

### Operation

Each of the alarm setpoints has a respective HI or LO deadband. Red LEDs will illuminate indicating an alarm condition. The trip will reset only when the process falls below the HI deadband or rises above the LO deadband. (The WV108-2001 requires pressing the reset switch in order to reset the relays after being tripped.) The deadband can be left at the minimum level (the factory default) or can be set to whatever level is desired.

### Options

**C620** Factory calibration of input range, setpoints and output relays.

### Enhanced LED Diagnostics

Other than when executing the pushbutton calibration routine, the LEDs blink under the following conditions:

#### RUN (Green):

- On when unit is powered.
- Flashes at 2Hz when input is under range.
- Flashes at 8Hz when input is over range.

#### SETPOINT A (Red):

- On when Setpoint A is tripped.
- On when setting Setpoint A.
- Flashes while calibrating the input level.

#### SETPOINT B (Red):

- On when Setpoint B is tripped.
- On when setting Setpoint B.
- On while calibrating the input level.

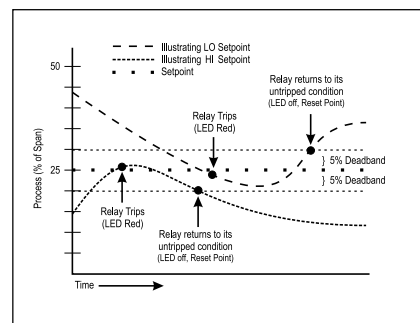


Figure 1: Limit alarm operation and effect of deadband.

An Under Range condition exists when the signal is lower than the operational low value minus 6.25% of the operational span. An Over Range condition exists when the signal is higher than the operational high value plus 6.25% of the operational span.

### Configuring Modules

Unless otherwise specified, the factory presets the Model WV108 as follows:

- Input: Current
- Range: ±100mA
- Output: Dual, SPDT
- Trip: A: HI, B: LO
- Failsafe: No
- Deadband: A, B: minimum
- Remote Cal: No

- For other ranges, refer to the SWITCH SETTINGS table (see Figure 4). Reconfigure switches S1 and S2 for the desired input type and range.
- Set position 1 of S1 to ON if a WVC16 will be utilized and remote calibration capability is desired.
- Set position 2 and 3 of S1 to ON for a Hi trip setpoint or to OFF for a Low trip setpoint.
- Set position 4 of S1 to ON for failsafe operation (e.g. alarm trips upon power failure) or OFF for non-failsafe operation (-2000 only).

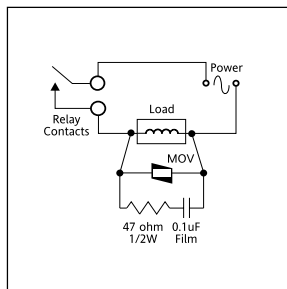
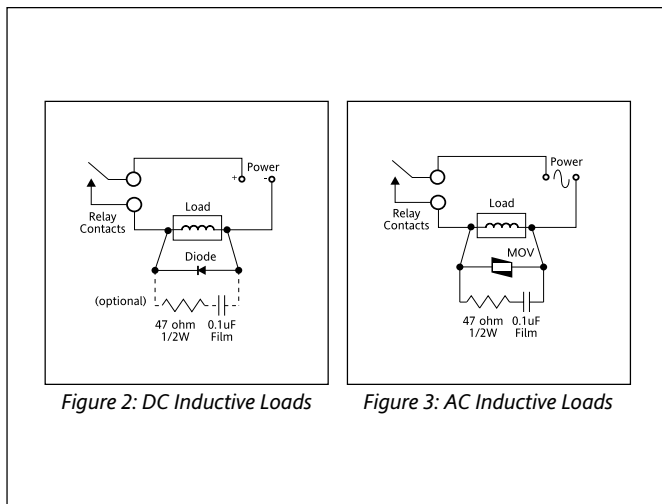
It is also possible to remotely select the setpoints using an Ethernet connection and the optional WVC16 WebView Communications Interface module.

### 24VDC Transducer Excitation

The 24VDC source, which is isolated from line power, is used for transducer excitation. Typical connections for voltage and current are shown in Figure 5.

### Relay Protection and EMI Suppression

When switching inductive loads, maximum relay life and transient EMI suppression is achieved using external protection (see Figures 2 & 3). Place all protection devices directly across the load and minimize all lead lengths. For AC inductive loads, place a properly-rated MOV across the load in parallel with a series RC snubber. Use a 0.01 to 0.1mF pulse film capacitor (foil polypropylene recommended) of sufficient voltage, and a 47ohm, 1/2W carbon resistor. For DC inductive loads, place a diode across the load (PRV > DC supply, 1N4006 recommended) with (+) to cathode and (-) to anode (the RC snubber is an optional enhancement).



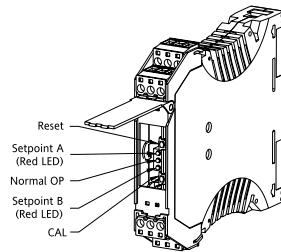
### Calibration

See the calibration flowchart in Figure 7. The complete calibration procedure is contained in the Installation & Calibration Instructions document, which is available on our website ([www.actionio.com](http://www.actionio.com)). You can also obtain it by telephoning Action technical support (703-669-1318).

Note that Custom Calibration (option C620) is available from the factory (settings **MUST** be within the units specifications). For a C620, specify the following:

- Input Type (mA, mV, V).
- Setpoint A trip point and reset point.
- Setpoint B trip point and reset point.
- Failsafe (ON/OFF).

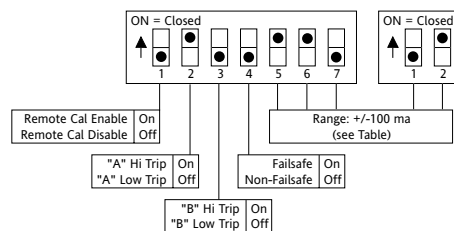
Note that if a deadband entry is not specified, the default setting of 0.25% will be used.



Function	S1							S2	
	1	2	3	4	5	6	7	1	2
<b>Voltage Input</b>									
+/-20mV	-	-	-	-	■	■	■	■	■
+/-200mV	-	-	-	-	■	■	■	■	■
+/-2V	-	-	-	-	■	■	■	■	■
+/-20V	-	-	-	-	■	■	■	■	■
+/-200V	-	-	-	-	■	■	■	■	■
<b>Current Input</b>									
+/-10mA	-	-	-	-	■	■	■	■	■
+/-100mA	-	-	-	-	■	■	■	■	■
<b>Remote Cal Enable</b>									
Remote Cal Enable	■	-	-	-	-	-	-	-	-
A Hi/Low (Hi)	-	■	-	-	-	-	-	-	-
B Hi/Low (Hi)	-	■	-	-	-	-	-	-	-
Failsafe	-	-	-	■	-	-	-	-	-

Key: ■ = 1 = ON or Closed; - = n/a

Figure 4: Switch Settings



Default Switch Settings

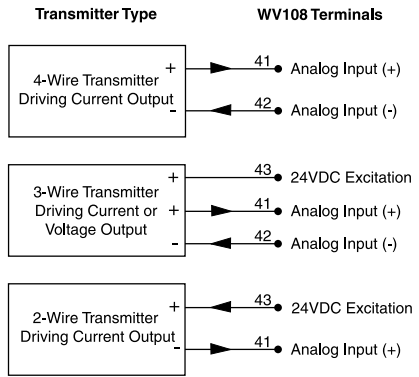
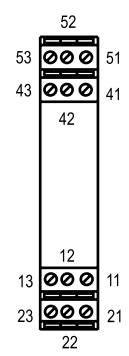
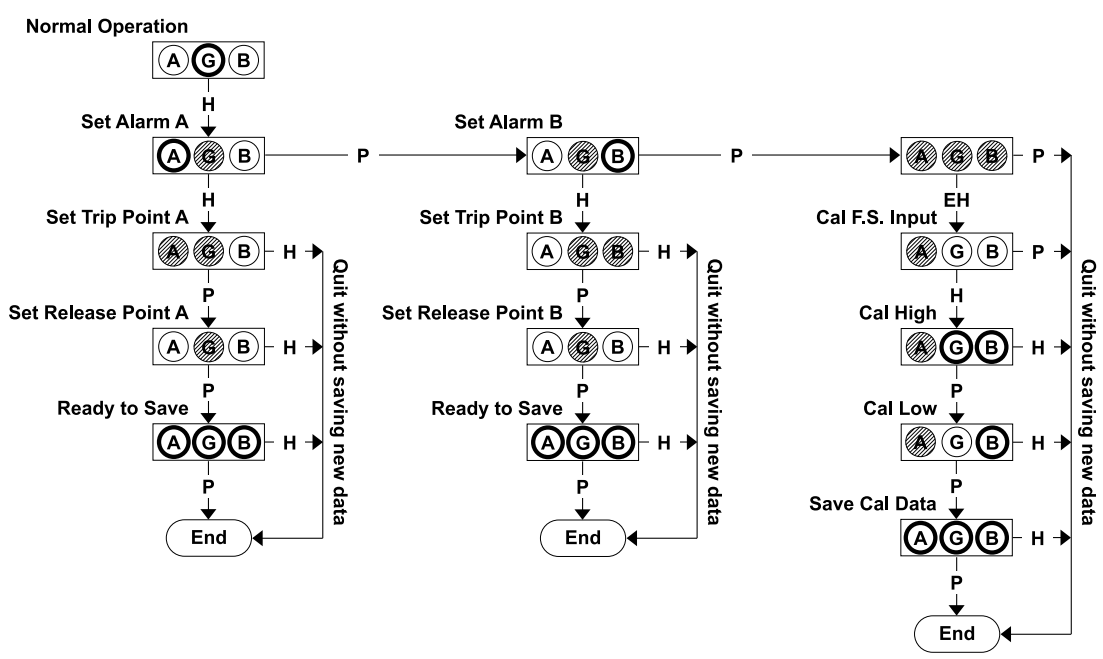


Figure 5: Typical Connections



Pin	Description
11	N.O. Relay B
12	Com. Relay B
13	N.C. Relay B
21	DC Power (+)
22	DC Power (-)
23	No Connection
41	Analog Input (+)
42	Analog Input (-)
43	24VDC Excitation (+)
51	N.O. Relay A
52	Com. Relay A
53	N.C. Relay A

Figure 6: Wiring Connections



**LEGEND**

- Off
- On
- ◐ Flashing (10 Hz)
- P → Press Button
- H → Hold Button (4 Seconds)
- EH → Extended Hold (10 Seconds)

**NOTE:**  
 To reload factory calibration data, hold down the button while the unit powers up. The green LED will flash 10 times and then the red LED will begin to flash. Release the button once the red LED begins flashing and the factory calibration data will be reloaded.

Figure 7: Calibration Flowchart

**Specifications**

**Inputs:**

- Voltage Input Ranges:  $\pm 20\text{mV}$ ,  $\pm 200\text{mV}$ ,  $\pm 2\text{V}$ ,  $\pm 20\text{V}$  &  $\pm 200\text{V}$
- Impedance:  $>100\text{k ohms}$
- Overvoltage:  $200\text{Vrms}$ , max.
- Current Input Range:  $\pm 10\text{mA}$  &  $\pm 100\text{mA}$
- Impedance:  $20\text{ ohms}$ , typical
- Overcurrent:  $170\text{mA rms}$ , max
- Overvoltage:  $60\text{VDC}$

**Minimum Deadband:**

Range	Deadband
$\pm 20\text{mV}$	0.2% (80 microvolts)
$\pm 200\text{mV}$	0.2% (800 microvolts)
$\pm 2\text{V}$	0.1% (40mV)
$\pm 20\text{V}$	0.1% (40mV)
$\pm 200\text{V}$	0.025% (100mV)
$\pm 10\text{mA}$	0.1% (20 microamps)
$\pm 100\text{mA}$	0.025% (50 microamps)

**Response Time:**

- Dynamic Deadband: Relay status will change when proper setpoint/process condition exists for 100mSec or greater
- Normal Mode:  $<250\text{mSec}$  (analog filtering)

**Setpoint:**

Effectivity: Setpoints are adjustable (by pushbutton) over 100% of the selected input span

**Repeatability:**

- $>200\text{mV}/10\text{mA}$ : 0.1% of full scale (constant temperature)
- $<200\text{mV}/10\text{mA}$ : 0.2% of full scale

**Relay Contacts:**

- 2 SPDT (2 form C) Relays
- 1 relay per setpoint
- Current rating (general use)
- 120VAC: 5A; 240VAC: 2A; 28VDC: 5A

**Material:** Gold flash over silver alloy

**Electrical Life:**  $10^5$  operations

**Reset Switch:** For unlatching the relay once the process is no longer in the alarm state (WV108-2001 only).

**Local Range Selection:** By DIP switch

**Stability:**  $\pm 100\text{ppm}$  of FS/ $^{\circ}\text{C}$

**Common Mode Rejection:** 120dB @ DC,  $>90\text{dB}$  @ 60Hz, or better

**Isolation:** 1800VDC or peak AC between contacts, input & power

**ESD Susceptibility:** Capable of meeting IEC 801-2 level 3 (8kV)

**Humidity:** Operating: 15 to 95% RH non-condensing @45 $^{\circ}\text{C}$   
Soak: 90% RH non-condensing for 24hrs @60 $^{\circ}\text{C}$

**Temperature:** Operating: 0 to 60 $^{\circ}\text{C}$   
Storage: -25 to +85 $^{\circ}\text{C}$

**Power:** 9 to 30VDC; 1.2W typ., (2.2W max. with both relays energized)

**Excitation Voltage:** 24VDC @ 20mA

**Host Module Interface:** IR link

**Size:** DIN rail case – refer to Dimensions drawing

**Environmental:**

- Operating Temperature: 0 $^{\circ}\text{C}$  to +60 $^{\circ}\text{C}$  (32 to 140 $^{\circ}\text{F}$ )
- Storage Temperature: -25 $^{\circ}\text{C}$  to +85 $^{\circ}\text{C}$  (-13 to 185 $^{\circ}\text{F}$ )
- Operating Humidity (non-condensing): 15% to 95%RH @45 $^{\circ}\text{C}$
- Storage Humidity (non-condensing): 90%RH @ 60 $^{\circ}\text{C}$  for 24 hrs

**Agency Approvals EMC & Safety:**

- CE: EN61326, EN61010-1
- UL and CSA Combined mark
- RoHS compliant

*Note that detailed installation instructions are available on our website.*

**Ordering Information**

**Specify:**

1. Model: **WV108-2000** (non-latching) or **WV108-2001** (latching)
2. Optional Custom Factory Calibration (specify **C620**, see required settings under "Calibration, page 2).
3. Accessories.

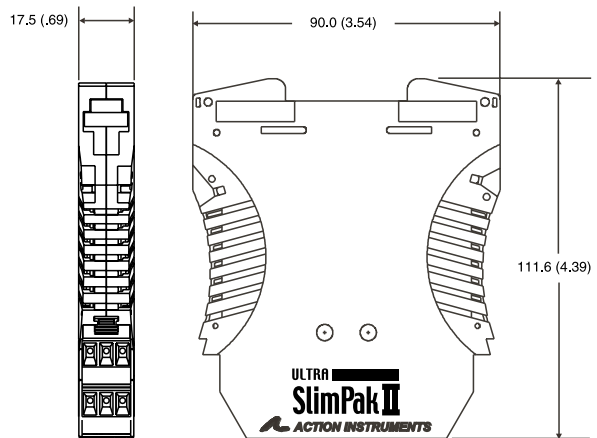
**Accessories**

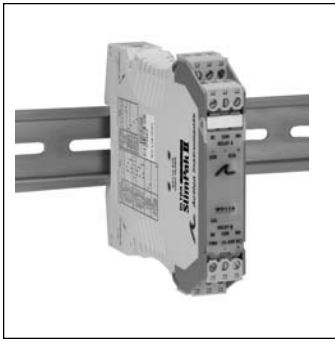
All WV Series modules will mount on standard TS35 (model MD03) DIN rail. In addition, the following accessories are available:

- WVC16** Communications Interface
- MD03** TS35 x 7.5 DIN Rail (2 meters)
- WV905** 24VDC Power Supply (0.5 Amp)
- H910** 24VDC Power Supply (1 Amp)
- H915** 24VDC Power Supply (2.3 Amp)
- MB03** End Bracket for MD03
- C650** Utility software for WVC16

**Dimensions**

Dimensions are in millimeters (inches)





WV118-2000 (non-latching)  
WV118-2001 (latching)

# ULTRA SLIMPAK® II

## WV118

### DC Powered RTD Input Limit Alarm

Provides Relay Contact Closures  
at a Preset Temperature Level



- Programmable HI or LO, Failsafe or Non-failsafe
- Improved Accuracy
- Adjustable Deadband
- Bussed Power with Plug-in Power Clips
- Removable Terminals for Easy Service

- Touch Cal for Best Stability and Accuracy
- RoHS Compliant
- LED Trip and Input Indicators
- Optional E-mail Notification of Alarms
- Supports 2-Wire and 3-Wire RTDs

Ultra SlimPak® II

#### Description

The Ultra SlimPak II is an exciting new line of isolating signal conditioners from Action Instruments with greater accuracy and better stability than virtually any other signal conditioners on the market today.

The WV118 is an RTD Limit Alarm with dual setpoints and two contact closure outputs. The input type and alarm functions are field configurable, offering maximum flexibility. The WV118 supports Pt100, in both 0.00385 and 0.00392 alphas, and Cu10 RTDs. All ranges allow the setpoints to be fully adjustable throughout the entire range.

The WV118-2000 contains two standard non-latching SPDT relays. When power is removed, the relays revert to their non-powered state. The WV118-2001 contains two latching relays. Whatever position the relays are in when power is removed is where they will remain when power is re-applied (a reset switch is provided to reset the relays after the alarm is no longer true). Both models are configurable as a single or dual setpoint alarm, with HI or LO trips. The WV118-2000 supports failsafe or non-failsafe operation. In failsafe operation the relay coil is energized when the process is below the HI setpoint or above the LO setpoint (opposite for non-failsafe). In the failsafe mode, a power failure results in an alarm state output.

#### Operation

Each of the alarm setpoints has a respective HI or LO deadband. Red LEDs will illuminate indicating an alarm condition. The trip will reset only when the process falls below the HI deadband or rises above the LO deadband. (The WV118-2001 requires pressing the reset switch in order to reset the relay after being tripped.) The deadband can be left at the minimum level (the factory default) or can be set to whatever level is desired.

#### Options

**C620** Factory calibration of input range, setpoints, and output relays.

#### Enhanced Diagnostics

Other than when executing the pushbutton calibration routine, the LEDs blink under the following conditions:

##### RUN (Green):

- On when unit is powered.
- Flashes at 2Hz when input is under range.
- Flashes at 8Hz when input is over range.

##### SETPOINT A (Red):

- On when Setpoint A is tripped.
- On when setting Setpoint A.
- Flashes while calibrating the input level.

##### SETPOINT B (Red):

- On when Setpoint B is tripped.
- On when setting Setpoint B.
- On while calibrating the input level.

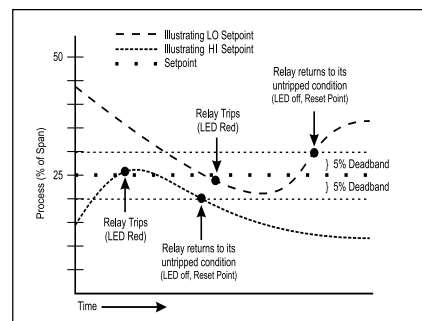


Figure 1: Limit alarm operation and effect of deadband.

An Under range condition exists when the signal is lower than the operational low value by 5°C. An Over Range condition exists when the signal is higher than the operational high value by 5°C.

### Configuring Modules

Unless otherwise specified, the factory presets the Model WV118 as follows:

- Input: Pt100
- Range: -200°C to 600°C
- Output: Dual, SPDT
- Trip: A: HI, B: LO
- Failsafe: No
- Deadband: A, B: minimum
- Remote Cal: No

- For other ranges, refer to the SWITCH SETTINGS table (see Figure 4). Reconfigure switches S1 and S2 for the desired input type and range.
- Set position 1 of S2 to ON if a WVC16 will be utilized and remote calibration capability is desired.
- Set position 2 and 3 of S2 to ON for a Hi trip setpoint or to OFF for a Low trip setpoint.
- Set position 4 of S2 to ON for failsafe operation (e.g. alarm trips upon power failure) or OFF for non-failsafe operation (-2000 only).

It is also possible to remotely select the setpoints using an Ethernet connection and the optional WVC16 WebView Communications Interface module.

### Relay Protection and EMI Suppression

When switching inductive loads, maximum relay life and transient EMI suppression is achieved using external protection (see Figures 2 & 3). Place all protection devices directly across the load and minimize all lead lengths. For AC inductive loads, place a properly-rated MOV across the load in parallel with a series RC snubber. Use a 0.01 to 0.1mF pulse film capacitor (foil polypropylene recommended) of sufficient voltage, and a 47ohm, 1/2W carbon resistor. For DC inductive loads, place a diode across the load (PRV > DC supply, 1N4006 recommended) with (+) to cathode and (-) to anode (the RC snubber is an optional enhancement).

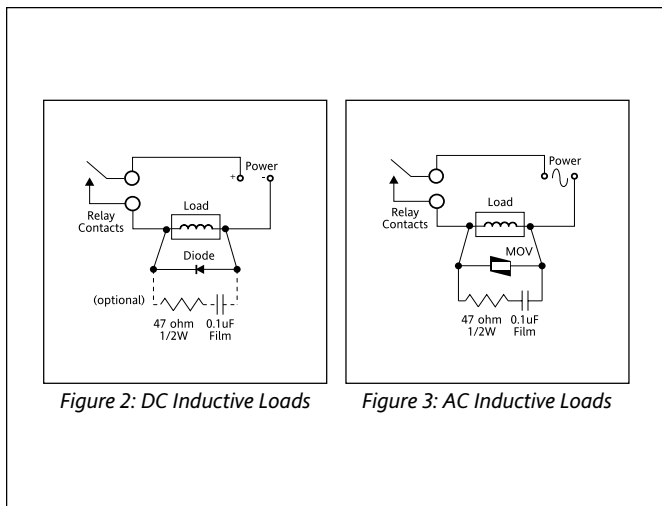


Figure 2: DC Inductive Loads

Figure 3: AC Inductive Loads

### Calibration

See the calibration flowchart in Figure 6. The complete calibration procedure is contained in the Installation & Calibration Instructions document, which is available on our website (www.actionio.com). You can also obtain it by telephoning Action technical support (703-669-1318).

Note that Custom Calibration (option C620) is available from the factory (settings **MUST** be within the units specifications). For a C620, specify the following:

- RTD type and temperature range.
- Setpoint A trip point and reset point.
- Setpoint B trip point and reset point.
- Failsafe (ON/OFF)

Note that if a deadband entry is not specified, the default setting of 0.25% will be used.

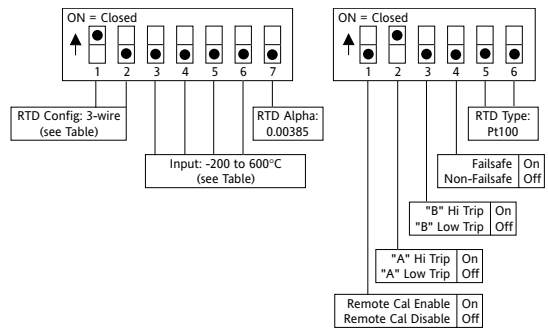
Function	S1						
	1	2	3	4	5	6	7
<b>Pt100 Input</b>							
-200 to 600 C	-	-					
-200 to 260 C	-	-	■				
-200 to -100 C	-	-	■	■			
-50 to 100 C	-	-			■		
-18 to 300 C	-	-	■	■	■		
<b>Cu10 Input</b>							
-200 to 260 C	-	-	■	■			
-200 to 100 C	-	-		■			
-200 to -100 C	-	-	■	■			
-50 to 100 C	-	-			■		
-18 to 260 C	-	-	■	■	■		
<b>RTD Config</b>							
3 Wire	■						
2 Wire		■					
<b>RTD Alpha</b>							
Pt 0.00385	-	-	-	-	-	-	
Pt 0.00392	-	-	-	-	-		■

Function	S2						
	1	2	3	4	5	6	7
<b>RTD Type</b>							
Pt100	-	-	-	-			
Cu10	-	-	-		■	■	
Remote Cal Enable	■	-	-	-	-	-	
Failsafe		-	-	-	■	-	
A Hi/Low (Hi)		-	■	-	-	-	
B Hi/Low (Hi)		-		■	-	-	

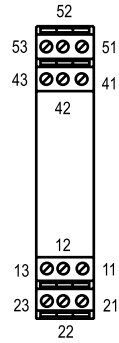
Key: ■ = 1 = ON or Closed; - = n/a

Figure 4: Switch Settings



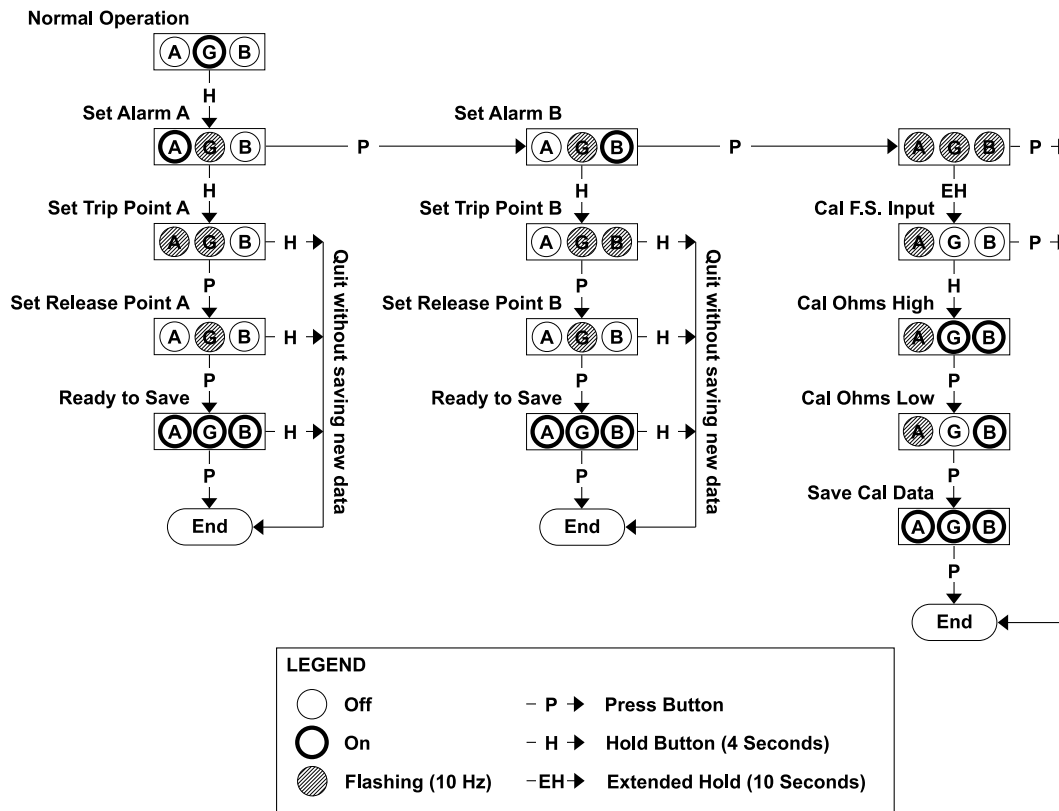
Default Switch Settings





Pin	Description
11	N.O. Relay B
12	Com. Relay B
13	N.C. Relay B
21	DC Power (+)
22	DC Power (-)
23	No Connection
41	RTD Input (+)
42	RTD Input (-)
43	RTD Return
51	N.O. Relay A
52	Com. Relay A
53	N.C. Relay A

Figure 5: Wiring Connections



**NOTE:**  
 To reload factory calibration data, hold down the button while the unit powers up. The green LED will flash 10 times and then the red LED will begin to flash. Release the button once the red LED begins flashing and the factory calibration data will be reloaded.

Figure 6: Calibration Flowchart

**Specifications**

**Inputs:**

Sensor Types: Pt100 0.00385, Pt100 0.00392, Cu10

**Sensor Connection:** 2-wire or 3-wire

**Ranges:**

**Pt100 RTDs:**

°C	°F	alpha	range no.
-200 to 600	-32 to 1112	0.00385	1
-200 to 260	-328 to 500	0.00385	2
-200 to -100	-328 to -148	0.00385	3
-50 to 100	-58 to 212	0.00385	4
-18 to 300	0 to 572	0.00385	5
-200 to 600	-328 to 1112	0.00392	6
-200 to 260	-328 to 500	0.00392	7
-200 to -100	-328 to -148	0.00392	8
-50 to 100	-58 to 122	0.00392	9
-18 to 300	0 to 572	0.00392	10

**Cu10 RTDs:**

°C	°F	range no.
-200 to 260	-328 to 500	11
-200 to 100	-328 to 212	12
-200 to -100	-328 to -148	13
-50 to 100	-58 to 212	14
-18 to 260	0 to 500	15

**RTD Excitation:**

Pt100: 0.45mA, max.; Cu10: 5.0mA, max.

**Lead Wire Resistance:**

40% of the base sensor resistance maximum or 100 ohms (whichever is less)

**Lead Wire Effect:**

Changing from 0 ohm lead resistance (each lead) to maximum allowed lead resistance: Error <1% of largest span PT and Cu ranges; -200 to 600°C for Pt and -200 to 260°C for Cu.

**Pushbutton Adjustment:** Effective zero offset: >95%

(Inputs >10mV): Effective span turn down: >95%

**Local Range Selection:** By DIP switch

**Response Time:**

Dynamic Deadband: Relay status will change when proper setpoint/process condition exists for 100mSec.

Normal Mode: <250mSec (analog filtering)

**Setpoint Effectivity:**

Setpoints are adjustable (by pushbutton) over 100% of the selected input span

**Repeatability:** ±0.05% of FS, ±1°C (constant temp)

**Relay Contacts:** 2 SPDT (2 form C) Relays, 1 relay per setpoint

**Current rating (general use):** 120VAC: 5A; 240VAC: 2A; 28VDC: 5A

**Material:** Gold flash over silver alloy

**Electrical Life:** 10<sup>5</sup> operations at rated load

**Reset Switch:**

For unlatching the relay once the process is no longer in the alarm state (WV118-2001 only).

**Stability:** ±100ppm of full scale/°C (±0.01%/°C)

**Common Mode Rejection:** 120dB @ DC, >90dB @ 60Hz, or better

**Isolation:** >1800VDC or peak AC between input, output and power.

**ESD Susceptibility:** Capable of meeting IEC 801-2 level 3 (8kV)

**Humidity (non-condensing):**

Operating: 15 to 95% RH (@45°C)

Soak: 90% RH for 24hrs (@60°C)

**Temperature:**

Operating: 0 to 60°C

Storage: -25 to +85°C

**Power:** 9 to 30VDC, 1.0W typical, 2.0W max

**Host Module Interface:** IR link, same specs as Phase 1 modules

**Size:** DIN rail case – refer to Dimensions drawing

**Environmental:**

Operating Temperature: 0°C to +60°C (32 to 140°F)

Storage Temperature: -25°C to +85°C (-13 to 185°F)

Operating Humidity (non-condensing): 15% to 95%RH at 45°C

Storage Humidity: 90%RH at 60°C for 24 hours

**Agency Approvals (EMC & Safety):**

CE: EN61326, EN61010-1

UL and CSA Combined mark

RoHS compliant

*Note that detailed installation instructions are available on our website.*

**Ordering Information**

**Specify:**

- Model:  
**WV118-2000** (non-latching) or  
**WV118-2001** (latching)
- Optional Custom Factory Calibration (specify **C620**, see required settings under "Calibration, page 2).
- Accessories.

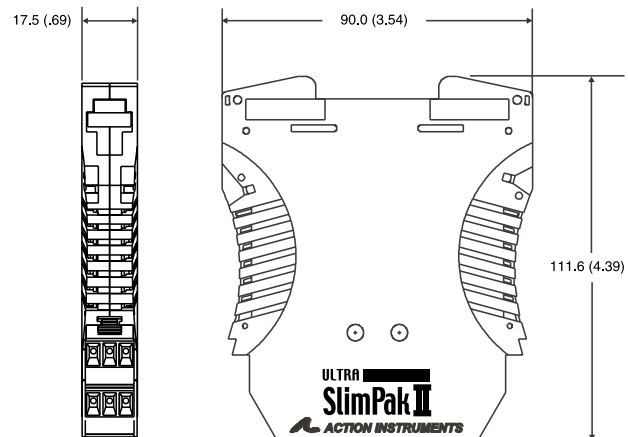
**Accessories**

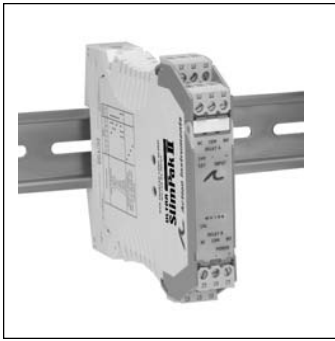
All WV Series modules will mount on standard TS35 (model MD03) DIN rail. In addition, the following accessories are available:

- WVC16** Communications Interface
- MD03** TS35 x 7.5 DIN Rail (2 meters)
- WV905** 24VDC Power Supply (0.5 Amp)
- H910** 24VDC Power Supply (1 Amp)
- H915** 24VDC Power Supply (2.3 Amp)
- MB03** End Bracket for MD03
- C650** Utility software for WVC16

**Dimensions**

Dimensions are in millimeters (inches)





WV128-2000 (non-latching)  
WV128-2001 (latching)

# ULTRA SLIMPAK® II

## WV128

### DC Powered T/C Input Limit Alarm

Provides Relay Contact Closures at a Preset Temperature Input Level



- Programmable HI or LO, Failsafe or Non-failsafe
- Improved Accuracy
- Adjustable Deadband
- Bussed Power with Plug-in Power Clips
- Removable Terminals for Easy Service

- Touch Cal for Best Stability and Accuracy
- RoHS Compliant
- LED Trip and Input Indicators
- Optional E-mail Notification of Alarms

Ultra SlimPak® II

#### Description

The Ultra SlimPak II is an exciting new line of isolating signal conditioners from Action Instruments with greater accuracy and better stability than virtually any other signal conditioners on the market today.

The WV128 is a Thermocouple Input Limit Alarm with dual setpoints and two contact closure outputs. The input type and alarm functions are field configurable, offering maximum flexibility. There are seven thermocouple types (B, E, J, K, R, S and T) from which to choose. Alarm setpoints are fully adjustable throughout the entire range.

The WV128-2000 contains two standard non-latching SPDT relays. When power is removed, the relays revert to their non-powered state. The WV128-2001 contains two latching relays. Whatever position the relays are in when power is removed is where they will remain when power is re-applied (a reset switch is provided to reset the relays after the alarm is no longer true). Both models are configurable as a single or dual setpoint alarm, with HI or LO trips. The WV128-2000 supports failsafe or non-failsafe operation. In failsafe operation the relay coil is energized when the process is below the HI setpoint or above the LO setpoint (opposite for non-failsafe). In the failsafe mode, a power failure results in an alarm state output.

#### Operation

Each of the alarm setpoints has a respective HI or LO deadband. Red LEDs will illuminate indicating an alarm condition. The trip will reset only when the process falls below the HI deadband or rises above the LO deadband. (The WV128-2001 requires pressing the reset switch in order to reset the relays after being tripped.) The deadband can be left at the minimum level (the factory default) or can be set to whatever level is desired.

#### Options

**C620** Factory cal of input range, setpoints and output relays.

#### Enhanced LED Diagnostics

Other than when executing the pushbutton calibration routine, the LEDs blink under the following conditions:

#### RUN (Green):

- On when unit is powered.
- Flashes at 2Hz when input is under range.
- Flashes at 8Hz when input is over range.

#### SETPOINT A (Red):

- On when Setpoint A is tripped.
- On when setting Setpoint A.
- Flashes while calibrating the input level.

#### SETPOINT B (Red):

- On when Setpoint B is tripped.
- On when setting Setpoint B.
- On while calibrating the input level.

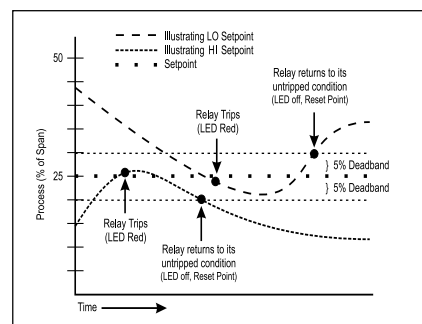


Figure 1: Limit alarm operation and effect of deadband.

An Under Range condition exists when the signal is lower than the operational low value minus 6.25% of the operational span. An Over Range condition exists when the signal is higher than the operational high value plus 6.25% of the operational span.

### Configuring Modules

Unless otherwise specified, the factory presets the Model WV128 as follows:

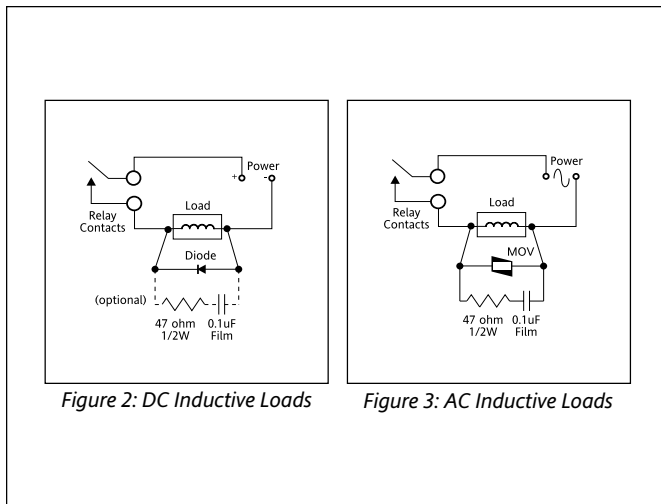
- Input: Type J
- Output: Dual, SPDT
- Trip: A: HI, B: LO
- Failsafe: No
- Deadband: A, B: minimum
- Remote Cal: No

- For other ranges, refer to the SWITCH SETTINGS table (see Figure 4). Reconfigure switches S1 and S2 for the desired input type and range.
- Set position 1 of S1 to ON if a WVC16 will be utilized and remote calibration capability is desired.
- Set position 2 and 3 of S1 to ON for a Hi trip setpoint or to OFF for a Low trip setpoint.
- Set position 4 of S1 to ON for failsafe operation (e.g. alarm trips upon power failure) or OFF for non-failsafe operation (-2000 only).

It is also possible to remotely select the setpoints using an Ethernet connection and the optional WVC16 WebView Communications Interface module.

### Relay Protection and EMI Suppression

When switching inductive loads, maximum relay life and transient EMI suppression is achieved using external protection (see Figures 2 & 3). Place all protection devices directly across the load and minimize all lead lengths. For AC inductive loads, place a properly-rated MOV across the load in parallel with a series RC snubber. Use a 0.01 to 0.1mF pulse film capacitor (foil polypropylene recommended) of sufficient voltage, and a 47ohm, 1/2W carbon resistor. For DC inductive loads, place a diode across the load (PRV > DC supply, 1N4006 recommended) with (+) to cathode and (-) to anode (the RC snubber is an optional enhancement).



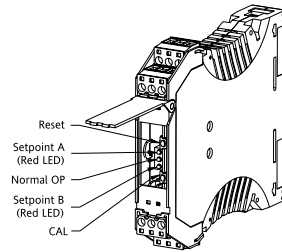
### Calibration

See calibration flowchart in Figure 6. The complete calibration procedure is contained in the Installation & Calibration Instructions document, which is available on our website ([www.actionio.com](http://www.actionio.com)). You can also obtain it by telephoning Action technical support (703-669-1318).

Note that Custom Calibration (option C620) is available from the factory (settings **MUST** be within the units specifications). For a C620, specify the following:

- Input type.
- Setpoint A trip point and reset point.
- Setpoint B trip point and reset point.
- Failsafe (ON/OFF).

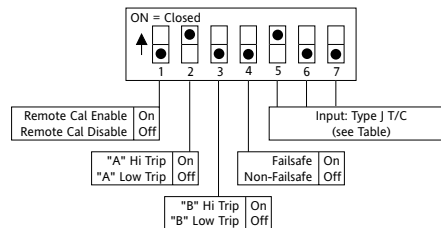
Note that if a deadband entry is not specified, the default setting of 0.25% will be used.



Function	S1							
	1	2	3	4	5	6	7	8
<b>Input</b>								
+80mV/-20mV	-	-	-	■	■			
B I/c	-	-	-	■	■			
E I/c	-	-	-	■	■			
J I/c	-	-	-	■	■			
K I/c	-	-	-			■	■	
R I/c	-	-	-			■	■	
S I/c	-	-	-				■	
T I/c	-	-	-					■
<b>Remote Cal Enable</b>	■	-	-	-	-	-	-	-
A Hi/Low (Hi)	-	■	-	-	-	-	-	-
B Hi/Low (Hi)	-	-	■	-	-	-	-	-
Failsafe	-	-	-	■	-	-	-	-

Key: ■ = 1 = ON or Closed; - = n/a

Figure 4: Switch Settings



Default Switch Settings



## Specifications

### Inputs:

Thermocouples Supported: B, E, J, K, R, S, T

Ranges:

T/C	°C	°F
B	+75 to 1820	+167 to 3308
E	-265 to 1000	-445 to 1832
J	-210 to 760	-346 to 1400
K	-265 to 1372	-445 to 2502
R	-25 to 1760	-13 to 3200
S	-25 to 1760	-13 to 3200
T	-265 to 390	-445 to 734

Overvoltage:  $\pm 10V$  differential

Common Mode: 1800VDC (Input to Ground)

Limit Differential (deadband): 0.2% to 100% of span. Set by Pushbutton Adjustment.

### Response Time:

Dynamic Deadband: Relay status will change when proper setpoint/process condition exists for 100mSec.

Normal Mode: <250mSec (analog filtering)

### Setpoint:

Effectivity: Setpoints are adjustable (by pushbutton) over 100% of the selected input span.

Repeatability:  $\pm 0.05\%$  of FS,  $\pm 1^\circ C$  (constant temp)

### Relay Contacts:

2 SPDT (2 form C) Relays

1 relay per setpoint

Current rating (general use):

120VAC: 5A; 240VAC: 2A; 28VDC: 5A

Material: Gold flash over silver alloy

Electrical Life:  $10^5$  operations

### Reset Switch:

For unlatching the relay once the process is no longer in the alarm state. (WV128-2001 only)

**Local Range Selection:** By DIP switch

**Stability:**  $\pm 100$ ppm of FS/ $^\circ C$

**Common Mode Rejection:** 120dB @ DC, >90dB @ 60Hz, or better

**Isolation:** 1800VDC or peak AC between contacts, input & power.

**ESD Susceptibility:** Capable of meeting IEC 801-2 level 3 (8kV)

**Power:** 9 to 30VDC; 1.2W typ., (3.25W max both relays energized)

**Host Module Interface:** IR link

**Wire Terminations:** Screw terminations for 12-22 AWG

**Size:** DIN rail case – refer to Dimensions drawing

### Environmental:

Operating Temperature:  $0^\circ C$  to  $+60^\circ C$  (32 to  $140^\circ F$ )

Storage Temperature:  $-25^\circ C$  to  $+85^\circ C$  (-13 to  $185^\circ F$ )

Operating Humidity (non-condensing): 15% to 95% at  $45^\circ C$

Storage Humidity (non-condensing): 90% at  $60^\circ C$  for 24 hours

### Agency Approvals (EMC & Safety):

CE: EN61326, EN61010-1

UL and CSA Combined mark

RoHS compliant

Note that detailed installation instructions are available on our website.

### Ordering Information

Specify:

1. Model:  
**WV128-2000** (non-latching) or  
**WV128-2001** (latching)
2. Optional Custom Factory Calibration (specify **C620**, see required settings under "Calibration, page 2).
3. Accessories.

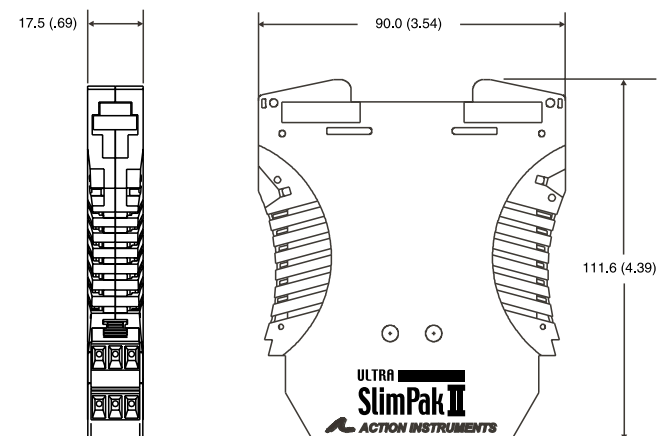
### Accessories

All WV Series modules will mount on standard TS35 (model MD03) DIN rail. In addition, the following accessories are available:

<b>WVC16</b>	Communications Interface
<b>MD03</b>	TS35 x 7.5 DIN Rail (2 meters)
<b>WV905</b>	24VDC Power Supply (0.5 Amp)
<b>H910</b>	24VDC Power Supply (1 Amp)
<b>H915</b>	24VDC Power Supply (2.3 Amp)
<b>MB03</b>	End Bracket for MD03
<b>C650</b>	Utility software for WVC16

### Dimensions

Dimensions are in millimeters (inches)





WV168-2000 (non-latching)  
WV168-2001 (latching)

# ULTRA SLIMPAK® II

## WV168

### DC Powered AC Input Limit Alarm

Provides Relay Contact Closures  
at a Preset AC Input Level



- Programmable HI or LO, Failsafe or Non-failsafe
- Improved Accuracy
- Adjustable Deadband
- Bussed Power with Plug-in Power Clips
- Removable Terminals for Easy Service

- Touch Cal for Best Stability and Accuracy
- RoHS Compliant
- LED Trip and Input Indicators
- Optional E-mail Notification of Alarms

Ultra SlimPak® II

#### Description

The Ultra SlimPak II is an exciting new line of isolating signal conditioners from Action Instruments with greater accuracy and better stability than virtually any other signal conditioners on the market today.

The WV168 is an AC Voltage or Current Input Limit Alarm with dual setpoints and two contact closure outputs. The input type and alarm functions are field configurable, offering maximum flexibility. There are eight input voltage ranges between 50mV and 250V, and two current input ranges, 20mA and 100mA. Alarm setpoints are fully adjustable throughout the entire range.

The WV168-2000 contains two standard non-latching SPDT relays. When power is removed, the relays revert to their non-powered state. The WV168-2001 contains two latching relays. Whatever position the relays are in when power is removed is where they will remain when power is re-applied (a reset switch is provided to reset the relays after the alarm is no longer true). Both models are configurable as a single or dual setpoint alarm, with HI or LO trips. The WV168-2000 supports failsafe or non-failsafe operation. In failsafe operation the relay coil is energized when the process is below the HI setpoint or above the LO setpoint (opposite for non-failsafe). In the failsafe mode, a power failure results in an alarm state output.

#### Operation

Each of the alarm setpoints has a respective HI or LO deadband. Red LEDs will illuminate indicating an alarm condition. The trip will reset only when the process falls below the HI deadband or rises above the LO deadband. (The WV168-2001 requires pressing the reset switch in order to reset the relay after being tripped.) The deadband can be left at the minimum level (the factory default) or can be set to whatever level is desired.

#### Options

**C620** Factory cal of input range, setpoints and output relays.

#### Enhanced LED Diagnostics

Other than when executing the pushbutton calibration routine, the LEDs blink under the following conditions:

##### RUN (Green):

- On when unit is powered.
- Flashes at 2Hz when input is under range.
- Flashes at 8Hz when input is over range.

##### SETPOINT A (Red):

- On when Setpoint A is tripped.
- On when setting Setpoint A.
- Flashes while calibrating the input level.

##### SETPOINT B (Red):

- On when Setpoint B is tripped.
- On when setting Setpoint B.
- On while calibrating the input level.

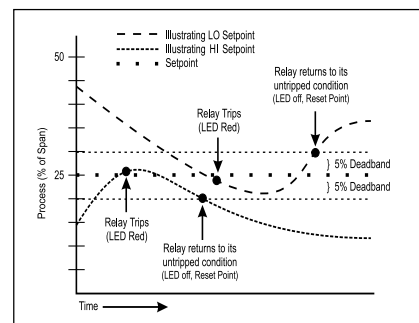


Figure 1: Limit alarm operation and effect of deadband.

An Under Range condition exists when the signal is lower than the operational low value minus 6.25% of the operational span. An Over Range condition exists when the signal is higher than the operational high value plus 6.25% of the operational span.



### Configuring Modules

Unless otherwise specified, the factory presets the Model WV168 as follows:

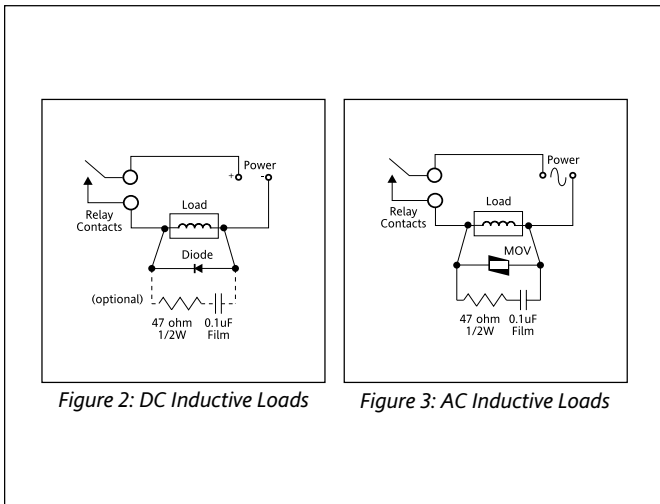
- Input: mVAC
- Range: 0-500mV
- Output: Dual, SPDT
- Trip: A: HI, B: LO
- Failsafe: No
- Deadband: A, B: minimum
- Failsafe: Off

1. For other ranges, refer to the SWITCH SETTINGS table. Reconfigure switches S1 and S2 for the desired input type and range.
2. Set position 1 of S1 to ON if a WVC16 will be utilized and remote calibration capability is desired.
3. Set position 2 and 3 of S1 to ON for a Hi trip setpoint or to OFF for a Low trip setpoint.
4. Set position 4 of S1 to ON for failsafe operation (e.g. alarm trips upon power failure) or OFF for non-failsafe operation (-2000 only).

It is also possible to remotely select the setpoints using an Ethernet connection and the optional WVC16 WebView Communications Interface module.

### Relay Protection and EMI Suppression

When switching inductive loads, maximum relay life and transient EMI suppression is achieved using external protection (see Figures 2 & 3). Place all protection devices directly across the load and minimize all lead lengths. For AC inductive loads, place a properly-rated MOV across the load in parallel with a series RC snubber. Use a 0.01 to 0.1mF pulse film capacitor (foil polypropylene recommended) of sufficient voltage, and a 47ohm 1/2W carbon resistor. For DC inductive loads, place a diode across the load (PRV > DC supply, 1N4006 recommended) with (+) to cathode and (-) to anode (the RC snubber is an optional enhancement).



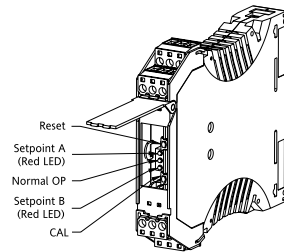
### Calibration

See the calibration flowchart in Figure 6. The complete calibration procedure is contained in the Installation & Calibration Instructions document, which is available on our website ([www.actionio.com](http://www.actionio.com)). You can also obtain it by telephoning Action technical support (703-669-1318).

Note that Custom Calibration (option C620) is available from the factory (settings **MUST** be within the units specifications). For a C620, specify the following:

- a) Input type.
- b) Setpoint A trip point and reset point.
- c) Setpoint B trip point and reset point.
- d) Failsafe (ON/OFF).

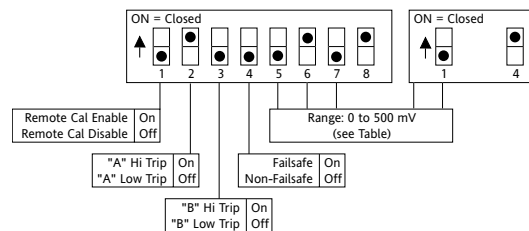
Note that if a deadband entry is not specified, the default setting of 0.25% will be used.



Function	S1								S2	
	1	2	3	4	5	6	7	8	1	4
<b>Voltage Input</b>										
250V	-	-	-	-	■	■	■	■	■	■
150V	-	-	-	-	■	■	■	■	■	■
50V	-	-	-	-	■	■	■	■	■	■
20V	-	-	-	-	■	■	■	■	■	■
5V	-	-	-	-	■	■	■	■	■	■
500mV	-	-	-	-	■	■	■	■	■	■
150mV	-	-	-	-	■	■	■	■	■	■
50mV	-	-	-	-	■	■	■	■	■	■
<b>Current Input</b>										
20mA	-	-	-	-	■	■	■	■	■	■
100mA	-	-	-	-	■	■	■	■	■	■
Remote Cal Enable	■	-	-	-	-	-	-	-	-	-
A Hi/Low (Hi)	-	■	-	-	-	-	-	-	-	-
B Hi/Low (Hi)	-	-	■	-	-	-	-	-	-	-
Failsafe	-	-	-	■	-	-	-	-	-	-

Key: ■ = 1 = ON or Closed; - = n/a

Figure 4: Switch Settings



Default Switch Settings

# Action Product Agency Approvals

## Approval Agencies

CE	Conformite Europeenne, European Union
CSA	Canadian Standards Association, Canada
CUL	Canadian Safety Approval from UL
FM	Factory Mutual Research Corporation, USA
NEC	National Electronics Council, USA
NEMA	National Electrical Manufacturer's Association, USA
UL	Underwriters Laboratories, USA

## CE Mark (CE)

CE mark approval for the Ultra SlimPak, the Ultra SlimPak II, VisiPak and ActionI/Q are defined by European Norms (EN#50081-1 and EN# 50082-2). Consult Action Technical Support for more details.

## CSA Certification

The CSA certification of the Action Pak series, Ultra SlimPak, Ultra SlimPak II and ActionI/Q complies with CSA standard C22.2 No. 0-M1982: General Requirements/Canadian Electrical Code, Part II, and No. 0-M1983: Process Control Equipment/Industrial Products, Certificate No. LR 42272. The only Action Paks to qualify are those with an 8 or 11-pin base.

### Action Pak®

- AP1000 Series: All models except those with 20 pin base.
- AP4000 Series: All models.
- AP4400 Series: AP4440 only.
- AP4500 Series: AP4570 and AP4580 only.
- AP6000 Series: AP6380 only.
- AP7000 Series: AP7380 only.
- AP7500 Series: AP7500 and AP7501 only.
- AP9000 Series: AP9046 only.

### Ultra SlimPak®

- G100 Series: All models.
- G400 Series: All models.

### Ultra SlimPak® II

- WV100 Series: All models.
- WV400 Series: All models.

### ActionI/Q™

- Q400 Series: All models.
- Q500 Series: All models.

### TransPak™

The CSA certification of the T700 series allows intrinsically safe installations in Class I, Division 1, Groups A-D hazardous locations. All installations require approved intrinsic barriers per manufacturer's drawing 790-0025-00. Certificate No. LR 42272.

The CSA certification of the T797-1 and T798-1 allows intrinsically safe installations in Class I, Division 1, Groups A-D; Class II, Division 1, Groups E, F and G; and Class III, Division 1, when installed in accordance with drawing 732-0220-00 or 732-0221-00.

- T700 Series: T703-2000, T761, and T773.
- T797 & T798: All models.

### VisiPak™

The CSA certification of the V508/V509 complies with CSA Standard C22.2 No. 0-M1982: General Requirements/Canadian Electrical Code, Part II, and No. 0-M1983: Process Control Equipment/Industrial Products. Certificate No. LR 42272. V508 and V509 only.

The CSA certification of the V560 series allows intrinsically safe installations in Class I, Division 1, Groups A-D hazardous locations. All installations require approved intrinsic barriers per manufacturer's drawing 790-0027-00. Certificate No. LR 42272-10. V560, V560C and V565. See enclosure ratings for V560EP and V561.

## Factory Mutual (FM)

### TransPak™

The FM approval of the T600/T700 series allows intrinsically safe installations in Class I, Division 1, Groups A-D hazardous locations. All installations require approved intrinsic barriers per manufacturer's drawing 790-0024-00.

The T700 series (except the T700-0001 and T703-2000) is also permitted in non-incendive Class I, Division 2, Groups A-D; and Class II and III, Division 2, Group G areas. Division 2 locations do not require barriers. Certificate No. J.I.2M2A5.AX(3611).

The T703-2000 is approved Intrinsically Safe, Entity, Class I, II, III, Division 1, Groups A-G hazardous locations per drawing 790-0028-00; and non-incendive Class 1, Division 2, Groups A-D hazardous indoor locations per manufacturer's drawing 790-0028-00. Certificate No. J.I.1V4A5.AX.

- T700 Series: All models except T700, T761, and T773.
- T797 & T798: All models.

### VisiPak™

The FM approval of the V560/V565 series permits intrinsically safe installations in Class I, Division 1, Groups A-D hazardous locations and non-incendive Class I, II, III, Division 2, Groups A-D and G areas. All Division 1 installations require approved intrinsic barriers per manufacturer's drawing 790-0024-00. Division 2 installations do not require a barrier. Certificate No. J.I.2M2A5.AX (3611). V565 is Entity Approved, drawing 790-0029-00, Certificate No. J.I.3V1A5.AX. V560, V560C, V565 and V565C only.

## Underwriters Laboratories (UL and CUL)

UL recognition for Action Pak, Ultra SlimPak, Ultra SlimPak II, ActionI/Q and VisiPak complies with UL standard 508 for Industrial Equipment. Canadian safety requirements C22.2 are met with CUL (as indicated).

### Action Pak®

AP1080/1090-2000  
 AP1280/1290-2000  
 AP1680/1690-2000  
 AP4351  
 AP4380-2000  
 AP4382, AP4390, AP4391, AP4392, AP6380, AP7380

### Ultra SlimPak®

G100 Series: All models.  
 G400 Series: All models.

### Ultra SlimPak® II

WV100 Series: All models.  
 WV400 Series: All models.

### ActionI/Q™

Q400 Series: All models.  
 Q500 Series: All models.

### VisiPak™

V108, V116, V132, V408: UL and CUL listed.  
 V430 Series: All UL and CUL listed except V436.  
 V508-5000 Series only.  
 V509-5000 Series only.

M Series Sockets: All except M020.

## Explosion Proof Ratings for Enclosures

### Action Pak®

C008: NEC, NEMA 4, CSA.  
 C011: NEC, NEMA 4, CSA.

### TransPak®

T690/691EP: NEC, NEMA 4.  
 T79E (except T79E-1): NEMA 4X and 7, CSA, FM  
 T800: NEC, NEMA 4, CSA  
 T805: NEC, NEMA 4, CSA, FM

### VisiPak™

V560EP: NEC, NEMA 4, CSA, FM  
 V561: NEC, NEMA 4, CSA, FM  
 V960: NEC, NEMA 4, CSA, FM

### FieldPak™

Housing and transmitter are approved separately. Refer to the T805 housing and the T700 TransPak series.

## NOTES:

The NEC and CSA approvals for the C008, C011, T690EP, T691EP and T800 enclosures permit installations in Class I, Group D (also Group C with approved 3/4" or smaller reducer); Class I, Groups E and G; Class III hazardous locations per Articles 500 through 517 (1987 edition). The above enclosures are equipped with 3/4" NEC approved reducers for Group C rating and a gasket for NEMA 4 protection against liquids. The use of the supplied gasket does not void the hazardous rating.

The NEC, CSA and FM approvals for the T805 and F700 enclosures permit installations in Class I, Groups B, C, D; and Class II, Groups E, F, G hazardous locations. All enclosures are equipped with a gasket for NEMA 4 protection against washdowns. The use of the supplied gasket does not void the hazardous rating.

The CSA and FM approvals for the T79E explosion proof housings, available with and without windows, permit installations in Class I, Divisions 1 and 2, Groups B, C and D; Class II, Divisions 1 and 2, Groups E, F and G; and Class III, and are rated for NEMA 4X and NEMA 7 environments.

The NEC, CSA and FM approvals for the V560EP and V960 enclosures permit installations in Class I, Groups C and D; and Class II, Groups E, F and G hazardous locations. Both enclosures are NEMA 4 rated.

The NEC, CSA and FM approvals for the V561 enclosure permits installations in Class I, Groups B, C and D; and Class II, Groups E, F and G hazardous locations. The V561 enclosure is NEMA 4 rated.



WV408-2000

# ULTRA SLIMPAK® II WV408

## DC Powered DC Voltage/Current Input Isolating Signal Conditioner

High Accuracy Signal Conditioner with an  
Isolated DC Voltage or Current Output



- Lower Power Requirements with SmartPower
- Improved Accuracy
- Bussed Power with Plug-in Power Clips
- Removable Terminals for Easy Service
- Approved for use in Class I Div 2 Group A, B, C, D areas

- RoHS Compliant
- Touch Cal for Best Stability and Accuracy
- DIP Switch Configuration
- Optional E-mail Notification of Alarms

Ultra Slimpak® II

### Description

The Ultra SlimPak II is an exciting new line of isolating signal conditioners from Action Instruments with greater accuracy and better stability than virtually any other signal conditioners on the market today. The Ultra SlimPak II features Smart Power, which eliminates wasted power for low loop resistance loads in the current output mode.

The WV408 has both voltage and current input ranges. Four voltage input ranges ( $\pm 150\text{mV}$ ,  $\pm 1.5\text{V}$ ,  $\pm 15\text{V}$  and  $\pm 150\text{V}$ ) are DIP switch selectable. Each of these ranges has at least 95% zero and span adjustment, which, for example, would allow you to set a 0-20mV user range on the  $\pm 150\text{mV}$  full scale range. Two current input ranges ( $\pm 2.5\text{mA}$  and  $\pm 25\text{mA}$ ) are also DIP switch selectable. "Sigma-Delta" conversion produces an effective resolution of 15 bits. Both voltage and current have input accuracies of 0.015% of full scale. Outputs include 0-10V, 0-20mA and 4-20mA. The WV408 also supports reverse output. The WV408 is recognized for use in Class 1, Division 2, Groups A, B, C, D hazardous locations.

### Smart Power

The Ultra SlimPak II uses Smart Power to control its output supply. Smart Power automatically adjusts the the voltage to drive the output loop to the required current. A low impedance current loop will subsequently require less voltage than a loop with higher impedance. Previous designs provided only a single supply at the highest voltage required to drive the highest impedance load. Using Smart Power results in power savings and reduces the operating temperature of the signal conditioner.

### Approved for use in Class I Div 2 Group A, B, C, D areas

Users can now enjoy significant labor savings over traditional protection methods since there is no need for explosion proof enclosures and conduits.

A Class I hazardous location is one in which flammable gases or vapors may be present in the air to be ignitable or explosive (typical applications include petroleum refineries, spray finishing areas, utility gas plants and fuel servicing areas).

A Division 2 area is one in which the flammable gases or vapors are normally not present in an explosive concentration, but could accidentally exist.

Group A is acetylene; Group B includes hydrogen; Group C includes ether; and Group D includes hydrocarbons, fuels and solvents.

### Enhanced LED Diagnostics

Other than when executing the pushbutton calibration routine, the LEDs blink under the following conditions:

#### GREEN:

Flashes at 2Hz when the input is under range.  
Flashes at 8Hz when the input is over range.

#### RED:

Flashes at 2Hz when the output is under range.  
Flashes at 8Hz when the output is over range.

An Under Range condition exists when the signal is lower than the operational low value minus 6.25% of the operational span. An Over Range condition exists when the signal is higher than the operational high value plus 6.25% of the operational span.

A voltage output short circuit may cause an under range condition (RED blinking at 2Hz rate). A current output open circuit may cause an over range condition (RED blinking at an 8Hz rate).

There could be two or more LEDs blinking at the same time, which means the module has more than one error condition. Only when all error conditions have been removed, will the LEDs be back to normal (Green ON, Red and Yellow Off).

### Configuring Modules

Unless otherwise specified, the factory presets the Model WV408 as follows:

Input: Current  
 Range: 4-20mA  
 Output: Current  
 Range: 4-20mA  
 Reverse Out: Off  
 Remote Cal: Off

- For other ranges, refer to the SWITCH SETTINGS table. Reconfigure switches S1 and S2 for the desired input type and range.
- Set position 1 of S1 to ON if a WVC16 will be utilized and remote calibration capability is desired.
- Set position 2 and 3 of S1 for the desired output type.
- Set position 4 of S1 to ON for reverse output operation.
- Set positions 5-7 of S1 and positions 1 and 2 of S2 for the desired input range.

It is also possible to remotely select the setpoints using an Ethernet connection and the optional WVC16 WebView Communications Interface module.

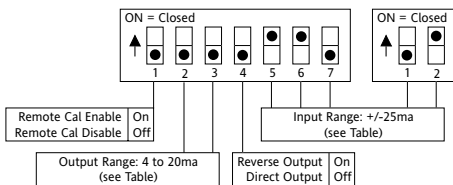
### Calibration

See the calibration flowchart in Figure 3. The complete calibration procedure is contained in the Installation & Calibration Instructions document, which is available on our website ([www.actionio.com](http://www.actionio.com)). You can also obtain it by telephoning Action technical support (703-669-1318).

Note that Custom Calibration (option C620) is available from the factory (settings **MUST** be within the units specifications). For a C620, specify the following:

- Input Type, Range & Units (mA, mV, V).
- Output Type, Range & Units (ma, mV, V).
- Reverse Output (ON/OFF)

Function	S1	Function	S1	Function	S1	S2	
	1 4		2 3		5 6 7 8	1 2	
Remote Cal Enable	■						
Reverse Out							
Key: ■ = 1 = ON or Closed							
<b>Output Ranges</b>							
0 to 10V	■	■					
0 to 20mA			■				
4 to 20mA							
Key: ■ = 1 = ON or Closed							
<b>Input Ranges</b>							
+/-150mV	■	■	■				
+/-1.5V	■			■			
+/-15V				■	■		
+/-150V						■	
+/-2.5mA	■	■	■			■	
+/-25mA	■	■				■	
Key: ■ = 1 = ON or Closed							



Default Settings

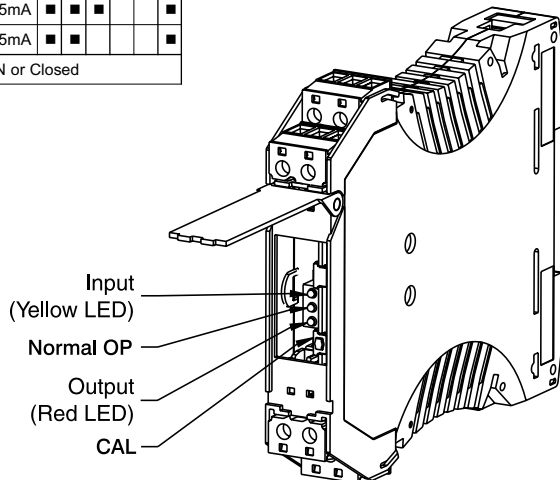
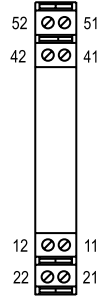
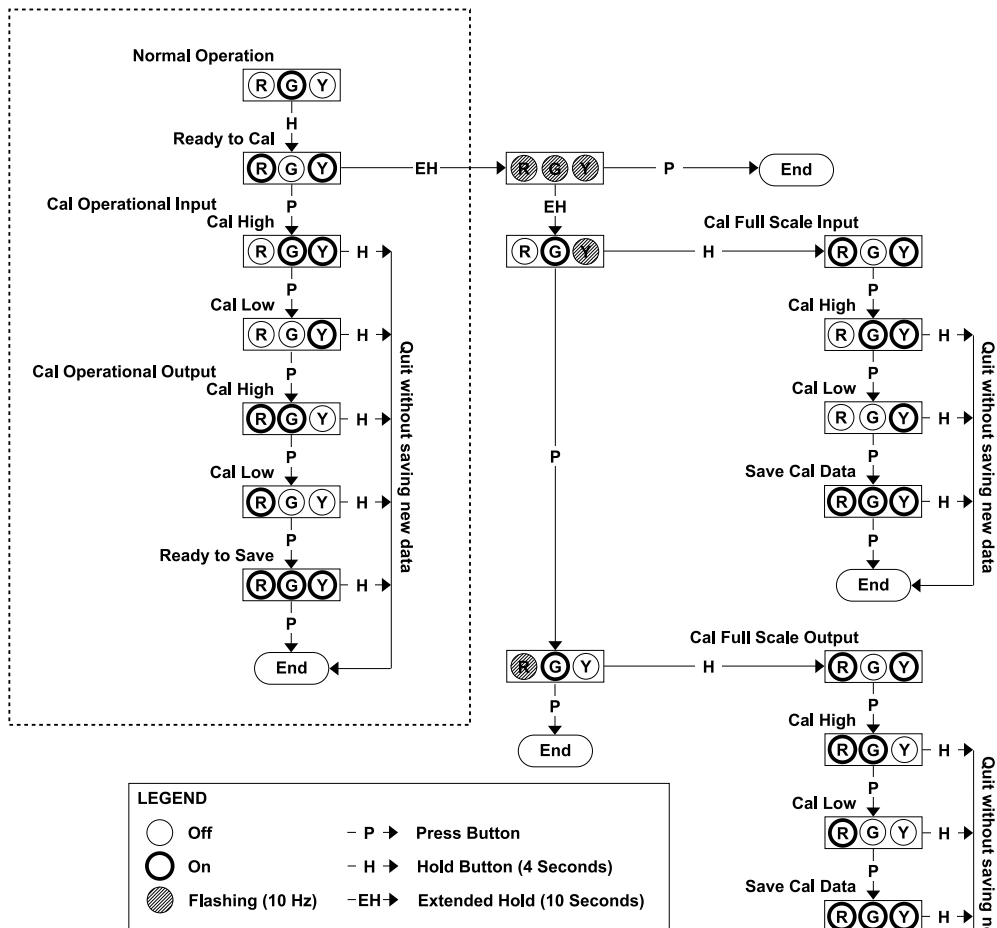


Figure 1: Switch Settings



Pin	Description
11	DC Power (+)
12	DC Power (-)
21	DC Power (+)
22	DC Power (-)
41	Input (+)
42	Input Common
51	Output (+)
52	Output Common

Figure 2: Wiring Connections



**NOTE:**  
 To reload factory calibration data, hold down the button while the unit powers up. The green LED will flash 10 times and then the red LED will begin to flash. Release the button once the red LED begins flashing and the factory calibration data will be reloaded.

Figure 3: Calibration Flowchart

**Specifications****Inputs:****Voltage:**

±150mV, ±1.5V, ±15V or ±150VDC  
 Impedance: >100k Ohms  
 Over voltage: 180Vrms

**Current:**

±2.5mA or ±25mA  
 Impedance: <75 Ohms  
 Over current: 170mA, protected by resetting fuse  
 Over voltage: 60V

**Zero & Span Adjustment:** ±95% of Full Scale**Input Accuracy:** ±0.015% of Full Scale**Outputs:**

Voltage: 0 to 10VDC  
 Source Impedance: <10 Ohms  
 Drive: 10mA  
 Current: 0 to 20mA  
 Source Impedance: >100k Ohms  
 Compliance: 20V@20mA (1k Ohms max)

**Output Accuracy:** ±0.05% of Full Scale Local Range**Selection:** By DIP switch**Response Time:** 100mSec (10 to 90%)**Stability:** ±100ppm of full scale/°C (±0.01%/°C)**Common Mode Rejection:** 120dB @ DC,  
>90dB @ 60Hz, or better**Isolation:** 1800VDC or peak AC between input, output & power**ESD Susceptibility:** Capable of IEC 801-2 level 3 (8kV)**Power:** 9-30VDC; 1.0W typ., 2.0W max.**Host Module Interface:** IR Link**Size:** DIN rail case – refer to Dimensions drawing**Operating Temperature:** 0 to +60°C (32 to 140°F)**Storage Temperature:** -25 to +85°C (-13 to 185°F)**Operating Humidity:** 15% to 95% RH, non-condensing @ 45°C**Storage Humidity:** 90% RH, non-condensing @ 60°C for 24 hours**Agency Approvals (EMC & Safety):**

CE: EN50081-1, EN50082-2, EN61010

CSA C22.2, No. 0-M91, 142-M1987

UL508

RoHS compliant

*Note that detailed installation instructions are available on our website.***Ordering Information**

Specify:

1. Model:  
**WV408-2000**
2. Optional Custom Factory Calibration (specify **C620**, see required settings under "Calibration, page 2).
3. Accessories.

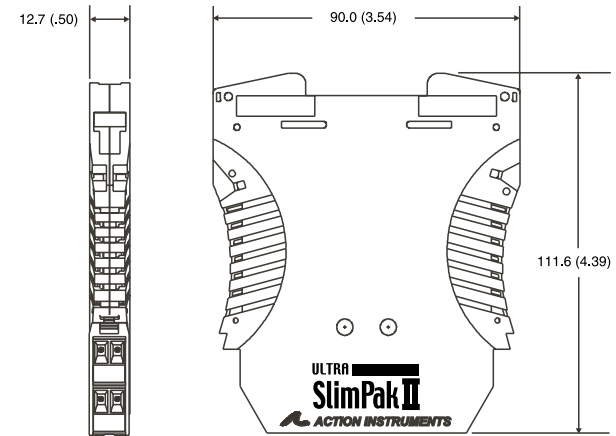
**Accessories**

All WV Series modules will mount on standard TS35 (model MD03) DIN rail. In addition, the following accessories are available:

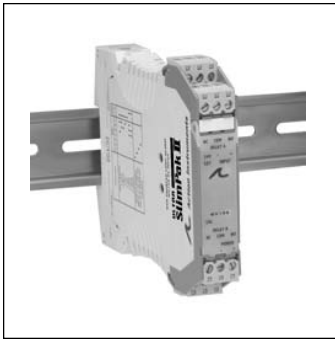
<b>WVC16</b>	Communications Interface
<b>MD03</b>	TS35 x 7.5 DIN Rail (2 meters)
<b>WV905</b>	24VDC Power Supply (0.5 Amp)
<b>H910</b>	24VDC Power Supply (1 Amp)
<b>H915</b>	24VDC Power Supply (2.3 Amp)
<b>MB03</b>	End Bracket for MD03
<b>C650</b>	Utility software for WVC16

**Dimensions**

Dimensions are in millimeters (inches)







WV418-2000

# ULTRA SLIMPAK® II WV418

## DC Powered RTD Input Isolating Signal Conditioner

High Accuracy Signal Conditioner with an  
Isolated DC Voltage or Current Output



- Lower Power Requirements with SmartPower
- Improved Accuracy
- Bussed Power with Plug-in Power Clips
- Removable Terminals for Easy Service

- RoHS Compliant
- Touch Cal for Best Stability and Accuracy
- DIP Switch Configuration
- Supports 2, 3 or 4 Wire RTD's

Ultra SlimPak® II

### Description

The Ultra SlimPak II is an exciting new line of isolating signal conditioners from Action Instruments with greater accuracy and better stability than virtually any other signal conditioners on the market today. The Ultra SlimPak II features Smart Power, which eliminates wasted power for low loop resistance loads in the current output mode.

The WV418 supports 2-wire, 3-wire or 4-wire Pt100 RTDs with alphas of either 0.00385 or 0.00392, as well as Cu10. Ranges are DIP switch selectable or (optionally) PC programmable. Outputs include 0-10V, 0-20mA and 4-20mA.

### Smart Power

The Ultra SlimPak II uses Smart Power to control its output supply. Smart Power automatically adjusts the the voltage to drive the output loop to the required current. A low impedance current loop will subsequently require less voltage than a loop with higher impedance. Previous designs provided only a single supply at the highest voltage required to drive the highest impedance load. Using Smart Power results in power savings and reduces the operating temperature of the signal conditioner.

### Enhanced LED Diagnostics

Other than when executing the pushbutton calibration routine, the LEDs blink under the following conditions:

#### GREEN:

Flashes at 2Hz when the input is under range.  
Flashes at 8Hz when the input is over range.

#### RED:

Flashes at 2Hz when the output is under range.  
Flashes at 8Hz when the output is over range.

An Under Range condition exists when the signal is lower than the operational low value minus 6.25% of the operational span. An Over Range condition exists when the signal is higher than the operational high value plus 6.25% of the operational span.

A voltage output short circuit may cause an under range condition (RED blinking at 2Hz rate). A current output open circuit may cause an over range condition (RED blinking at an 8Hz rate).

There could be two or more LEDs blinking at the same time, which means the module has more than one error condition. Only when all error conditions have been removed will the LEDs be back to normal (Green ON, Red and Yellow Off).

### Configuring Modules

Unless otherwise specified, the factory presets the Model WV418 as follows:

- Input: Pt100, 3-wire, alpha = 0.00385
- Range: -200 to 600°C
- Output: 4-20mA
- Reverse Out: Off
- Remote Cal: Off

1. For other ranges, refer to the SWITCH SETTINGS table. Reconfigure switches S1 and S2 for the desired input type and range.
2. Set position 1 of S2 to ON if a WVC16 will be utilized and remote calibration capability is desired.
3. Set position 2 and 3 of S2 for the desired output type and range.
4. Set position 4 of S2 to ON for reverse output operation.
5. Set positions 1-7 of S1 and positions 5 & 6 of S2 for the desired input range.

It is also possible to remotely select the setpoints using an Ethernet connection and the optional WVC16 WebView Communications Interface module.

### Calibration

See the calibration flowchart in Figure 3. The complete calibration procedure is contained in the Installation & Calibration Instructions document, which is available on our website ([www.actionio.com](http://www.actionio.com)). You can also obtain it by telephoning Action technical support (703-669-1318).

Note that Custom Calibration (option C620) is available from the factory (settings **MUST** be within the units specifications). For a C620, specify the following:

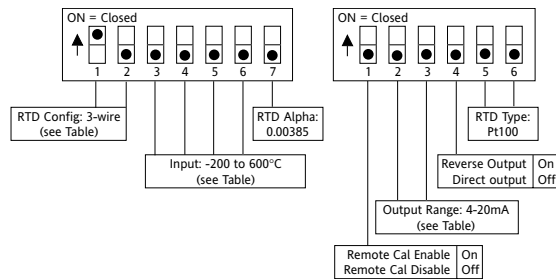
- a) Input Type, Range and Units.
- b) Output Type, Range and Units.
- c) Reverse Output (ON/OFF)

Function	S1						
	1	2	3	4	5	6	7
<b>Pt100 Input Range</b>							
-200 to 600 C	-	-					-
-200 to 260 C	-	-	■	■			-
-200 to -100 C	-	-	■	■			-
-50 to 100 C	-	-				■	-
-18 to 300 C	-	-	■	■		■	-
<b>Cu10 Input Range</b>							
-200 to 260 C	-	-	■	■			-
-200 to 100 C	-	-			■		-
-200 to -100 C	-	-	■	■			-
-50 to 100 C	-	-				■	-
-18 to 260 C	-	-	■	■		■	-
<b>RTD Configuration</b>							
4 Wire			-	-	-	-	-
3 Wire	■		-	-	-	-	-
2 Wire	■		-	-	-	-	-
<b>RTD alpha</b>							
Pt 0.00385	-	-	-	-	-	-	-
Pt 0.00392	-	-	-	-	-	-	■

Key: ■ = 1 = ON or Closed; - = n/a

Function	S2					
	1	2	3	4	5	6
<b>RTD Type</b>						
Pt100	-	-	-			
Cu10	-	-	-	■	■	
<b>Reverse Output</b>				■		
<b>Remote Cal</b>	■	-	-	-	-	-
<b>Output Range</b>						
0 to 10V	-	■	■	-	-	-
0 to 20 mA	-	■	■	-	-	-
4 to 20 mA	-	-	-	-	-	-

Key: ■ = 1 = ON or Closed; - = n/a



Default Switch Settings

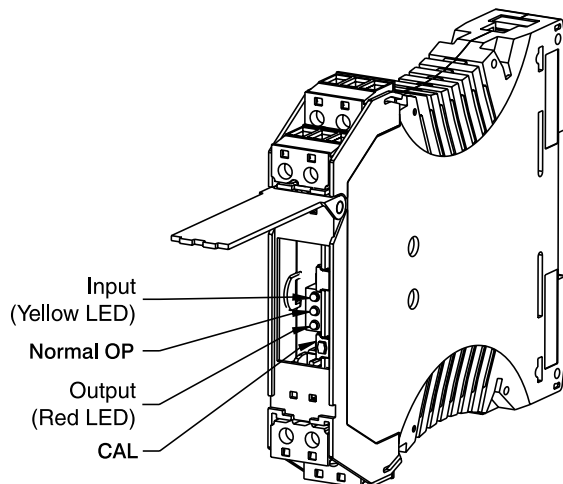
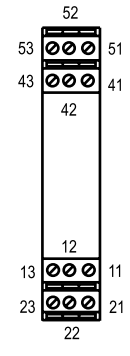
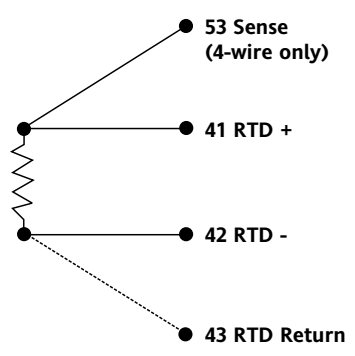


Figure 1: Switch Settings



Pin	Description
11	DC Power (+)
12	DC Power (-)
13	No Connection
21	DC Power (+)
22	DC Power (-)
23	No Connection
41	RTD Input (+)
42	RTD Input (-)
43	RTD Return
51	Output (+)
52	Output (-)
53	RTD Sense (+)

Figure 2: Wiring Connections

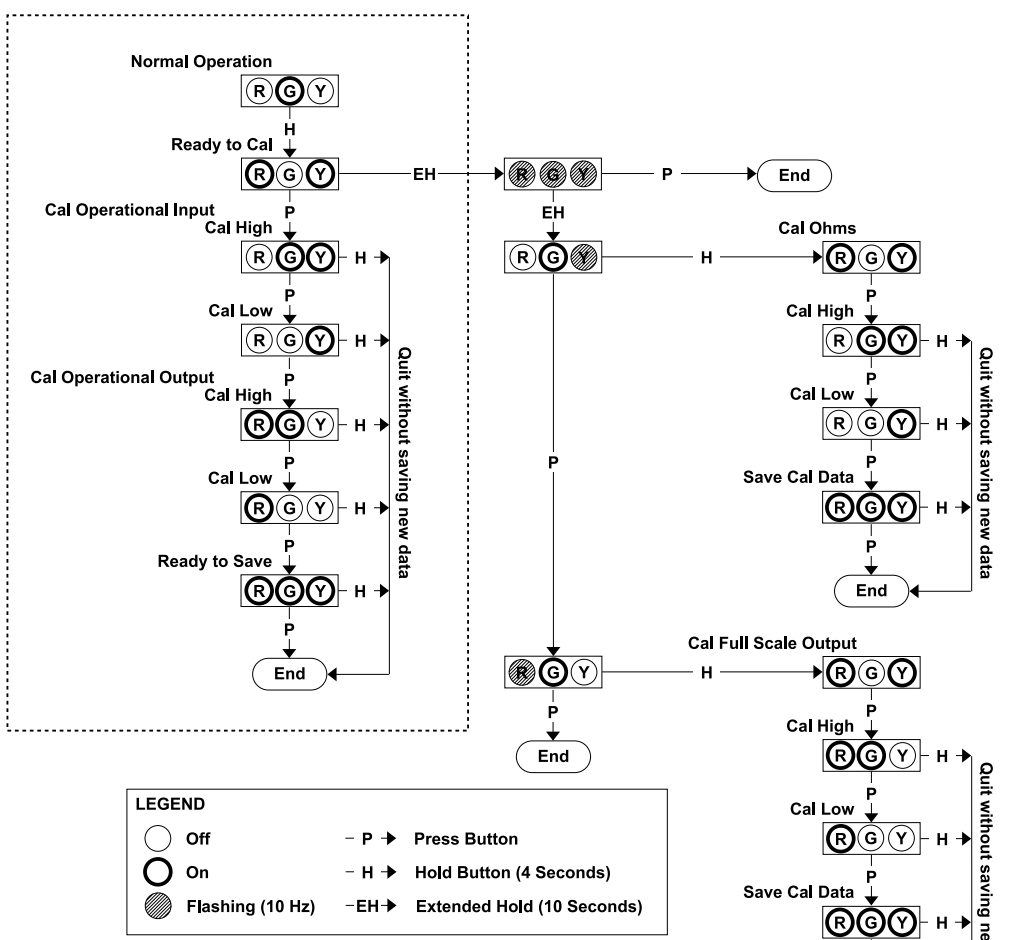


Figure 3: Calibration Flowchart

**Specifications**

**Inputs:**

**Sensor Types:**

Pt100, 0.00385 alpha & 0.00392 alpha  
Cu10

**Sensor Connection:** 2-wire, 3-wire or 4-wire RTD

**Ranges:**

**Pt100 RTDs:**

°C	°F	alpha	Range Number
-200 to 600	-328 to 1112	0.00385	1
-200 to 260	-328 to 500	0.00385	2
-200 to -100	-328 to -148	0.00385	3
-50 to 100	-58 to 212	0.00385	4
-18 to 300	0 to 572	0.00385	5
-200 to 600	-328 to 1112	0.00392	6
-200 to 260	-328 to 500	0.00392	7
-200 to -100	-328 to -148	0.00392	8
-50 to 100	-58 to 122	0.00392	9
-18 to 300	0 to 572	0.00392	10

**Cu10 RTDs:**

°C	°F	Range Number
-200 to 260	-328 to 500	11
-200 to 100	-328 to 212	12
-200 to -100	-328 to -148	13
-50 to 100	-58 to 212	14
-18 to 260	0 to 500	15

**RTD Excitation:**

Pt100: 0.45mA, max  
Cu10: 5.0mA, max

**Lead Wire Resistance:** 40% of the base sensor resistance maximum or 100 ohms (whichever is less)

**Lead Wire Effect:** Changing from 0 ohm lead resistance (each lead) to maximum allowed lead resistance: Error <1% of largest span PT and Cu ranges; -200 to 600°C for Pt and -200 to 260°C for Cu.

**Pushbutton Adjustment (Inputs >10mV):**

Effective zero offset: ≥95%  
Effective span turn down: ≥95%

**Local Range Selection:** By DIP switch

**Output:**

**Voltage:** 0 to 10V

**Source Impedance:** <10 ohms

**Drive:** 10mA

**Current:** 0 to 20mA

**Source Impedance:** >100k ohms

**Compliance:** 20V

**Output Accuracy:** 0.05% of Full Scale

**Response Time:** 100mSec (10 to 90%)

**Stability:** ±100ppm of full scale/°C (±0.01%/°C)

**Common Mode Rejection:** 120dB @ DC, >90dB @ 60Hz, or better

**Isolation:** ≥1800VDC or peak AC between input, output & power.

**ESD Susceptibility:** Capable of meeting IEC 801-2 level 3 (8kV)

**Humidity (non-condensing):**

Operating: 15 to 95% RH @45°C

Soak: 90% RH for 24hrs @60°C

**Temperature:**

Operating: 0 to 60°C

Storage: -25 to +85°C

**Power:** 9 to 30VDC; 1.0W typical, 2.0W max

**Host Module Interface:** IR link

**Size:** DIN rail case – refer to Dimensions drawing

**Agency Approvals (EMC & Safety):**

CE: EN61326, EN61010-1

UL & CSA combined mark

RoHS compliant

*Note that detailed installation instructions are available on our website.*

**Ordering Information**

Specify:

1. Model:  
**WV418-2000**
2. Optional Custom Factory Calibration (specify **C620**, see required settings under "Calibration, page 2).
3. Accessories.

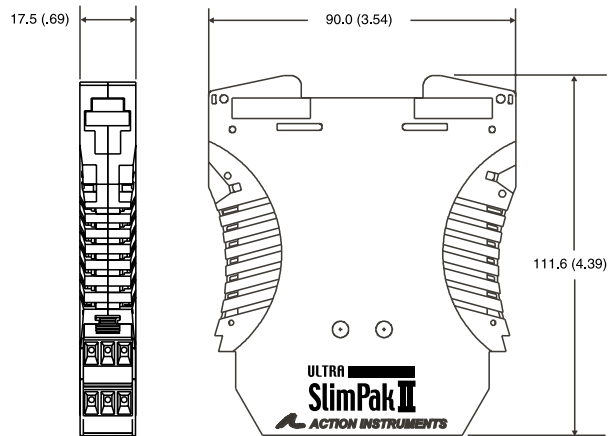
**Accessories**

All WV Series modules will mount on standard TS35 (model MD03) DIN rail. In addition, the following accessories are available:

- WVC16** Communications Interface
- MD03** TS35 x 7.5 DIN Rail (2 meters)
- WV905** 24VDC Power Supply (0.5 Amp)
- H910** 24VDC Power Supply (1 Amp)
- H915** 24VDC Power Supply (2.3 Amp)
- MB03** End Bracket for MD03
- C650** Utility software for WVC16

**Dimensions**

Dimensions are in millimeters (inches)





WV428-2000

# ULTRA SLIMPAK® II WV428

## DC Powered Thermocouple Input Isolating Signal Conditioner

High Accuracy Signal Conditioner with an Isolated,  
Linearized DC Voltage or Current Output



- Lower Power Requirements with SmartPower
- Improved Accuracy
- Bussed Power with Plug-in Power Clips
- Removable Terminals for Easy Service
- Approved for use in Class I Div 2 Group A, B, C, D areas

- RoHS Compliant
- Touch Cal for Best Stability and Accuracy
- DIP Switch Configuration
- Optional E-mail Notification of Alarms

Ultra Slimpak® II

### Description

The Ultra SlimPak II is an exciting new line of isolating signal conditioners from Action Instruments with greater accuracy and better stability than virtually any other signal conditioners on the market today. The Ultra SlimPak II features Smart Power, which eliminates wasted power for low loop resistance loads in the current output mode.

The WV428 supports B, C, E, J, K, N, R, S & T thermocouples that are DIP switch selectable. The WV428 also supports a millivolt range of -20 to +80mVDC. The input accuracy of the WV428 is  $\pm 0.05\%$  with a CJC error of  $\pm 1^\circ\text{C}$ . Both voltage and current have an input accuracy of 0.015% of full scale. Outputs include 0-10V, 0-20mA and 4-20mA. The WV428 is recognized for use in Class 1, Division 2, Groups A, B, C, D hazardous locations.

### Smart Power

The Ultra SlimPak II uses Smart Power to control its output supply. Smart Power automatically adjusts the the voltage to drive the output loop to the required current. A low impedance current loop will subsequently require less voltage than a loop with higher impedance. Previous designs provided only a single supply at the highest voltage required to drive the highest impedance load. Using Smart Power results in power savings and reduces the operating temperature of the signal conditioner.

### Approved for use in Class I Div 2 Group A, B, C, D areas

Users can now enjoy significant labor savings over traditional protection methods since there is no need for explosion proof enclosures and conduits.

A Class I hazardous location is one in which flammable gases or vapors may be present in the air to be ignitable or explosive (typical applications include petroleum refineries, spray finishing areas, utility gas plants and fuel servicing areas).

A Division 2 area is one in which the flammable gases or vapors are normally not present in an explosive concentration, but could accidentally exist.

Group A is acetylene; Group B includes hydrogen; Group C includes ether; and Group D includes hydrocarbons, fuels and solvents.

### Instant Accuracy™

Instant Accuracy maximizes accuracy and performance during warmup and during changes in ambient temperature. This patented cold-junction compensation technique utilizes two temperature sensors to measure the differential temperature near the terminal block. Using heat transfer calculations with the measured differential temperature and the known thermal conductivity of the PCB, the terminal junction temperature is determined with extreme accuracy. Even during unstable thermal states such as start-up, ambient temperature changes, or changing load or power, the WV408 performs extremely accurate thermocouple temperature measurement. Instant Accuracy improves system performance and productivity due to reduced warm-up time, fewer temperature measurement errors, and tighter process control for higher quality. Most significantly, it allows calibration to be checked quickly and accurately without the effects of rapid ambient temperature changes due to opening a control panel door, which often causes erroneous readings and miscalibrations - a common cause of measurement errors.

### Enhanced LED Diagnostics

Other than when executing the pushbutton calibration routine, the LEDs blink under the following conditions:

#### GREEN:

Flashes at 2Hz when the input is under range.  
Flashes at 8Hz when the input is over range.

#### RED:

Flashes at 2Hz when the output is under range.  
Flashes at 8Hz when the output is over range.

#### YELLOW:

Flashes at 2Hz for a TC burnout.

An Under Range condition exists when the signal is lower than the operational low value minus 6.25% of the operational span. An Over Range condition exists when the signal is higher than the operational high value plus 6.25% of the operational span.

A voltage output short circuit may cause an under range condition (RED blinking at 2Hz rate). A current output open circuit may cause an over range condition (RED blinking at an 8Hz rate).

There could be two or more LEDs blinking at the same time, which means the module has more than one error condition. Only when all error conditions have been removed, will the LEDs be back to normal (Green ON, Red and Yellow Off).

**Configuring Modules**

Unless otherwise specified, the factory presets the Model WV428 as follows:

- Input: Type J thermocouple
- Range: -210°C to 760°C  
(-346°F to 1400°F)
- Output: 4-20mADC
- Burnout: Upscale
- Remote Cal: Off

1. For other ranges, refer to the SWITCH SETTINGS table. Reconfigure switch S1 for the desired input type and range.
2. Set position 1 of S1 to ON if a WVC16 will be utilized and remote calibration capability is desired.
3. Set position 2 and 3 of S1 for the desired output type.
5. Set positions 4-7 of S1 for the desired input range.

It is also possible to remotely select the setpoints using an Ethernet connection and the optional WVC16 WebView Communications Interface module.

**Calibration**

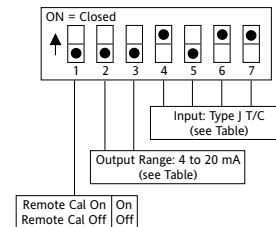
See the calibration flowchart in Figure 3. The complete calibration procedure is contained in the Installation & Calibration Instructions document, which is available on our website ([www.actionio.com](http://www.actionio.com)). You can also obtain it by telephoning Action technical support (703-669-1318).

Note that Custom Calibration (option C620) is available from the factory (settings **MUST** be within the units specifications). For a C620, specify the following:

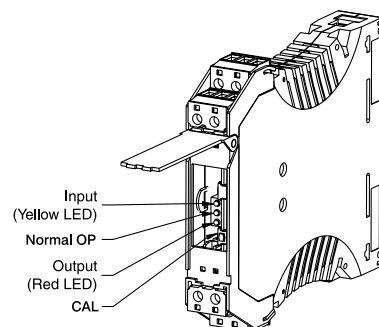
- a) Input Type, Range & Units (°C or °F).
- b) Output Type, Range & Units (mA, V).
- c) Burnout (Upscale or Downscale).

Function	S1						
	1	2	3	4	5	6	7
<b>Input</b>							
Type B Thermocouple	-	-	-	■	■	■	
Type C Thermocouple	-	-	-	■	■		■
Type E Thermocouple	-	-	-	■	■		
Type J Thermocouple	-	-	-	■		■	■
Type K Thermocouple	-	-	-	■		■	
Type N Thermocouple	-	-	-	■			■
Type R Thermocouple	-	-	-	■			
Type S Thermocouple	-	-	-		■	■	■
Type T Thermocouple	-	-	-		■	■	
-20mV to +80mV	-	-	-	■	■	■	■
Remote Cal Enable	■	-	-	-	-	-	-
<b>Output Range</b>							
0 to 10V	-	■	■	-	-	-	-
0 to 20mA	-		■	-	-	-	-
4 to 20mA	-			-	-	-	-

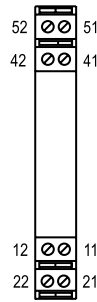
Key: ■ = 1 = ON or Closed; - = n/a



*Default Switch Settings*



*Figure 1: Switch Settings*



Pin	Description
11	DC Power (+)
12	DC Power (-)
21	DC Power (+)
22	DC Power (-)
41	Input (+)
42	Input (-)
51	Output (+)
52	Output (-)

Figure 2: Wiring Connections

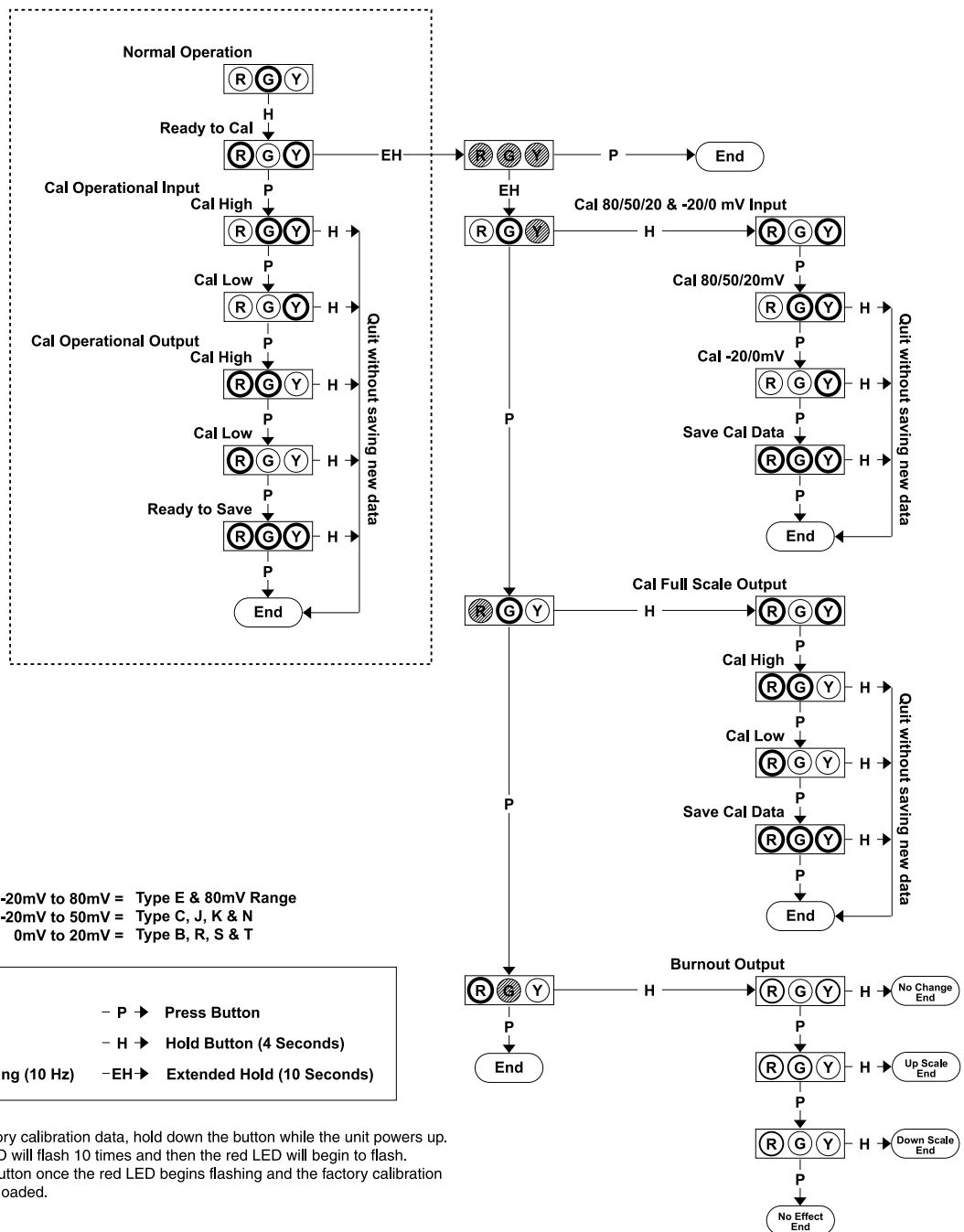


Figure 3: Calibration Flowchart

**Specifications****Inputs:****Thermocouples:**

Type °C °F

B	75 to 1800	167 to 3272
C	0 to 2315	32 to 4199
E	-200 to 1000	-328 to 1832
J	-210 to 760	-346 to 1400
K	-200 to 1370	-328 to 2498
N	-200 to 1300	-328 to 2372
R	0 to 1760	32 to 3200
S	0 to 1760	32 to 3200
T	-200 to 400	-328 to 752

**Millivolts:** -20 to +80mV**Accuracy:** ±0.05% of F.S. & CJC to ±1°C**Pushbutton Adjustment:**

Effective zero offset: +95% (Inputs &gt;10mV)

Effective span turn-down: = -95%

**Outputs:****Voltage:** 0 to 10VDC**Source Impedance:** <10 ohms**Drive:** 10mA**Current:** 0 to 20mA**Source Impedance:** >100k ohms**Compliance:** 20V @ 20mA (1k ohms max)**Output Accuracy:** ±0.05% of Full Scale**Local Range Selection:** By DIP switch**Burnout Detection:** Programmable for upscale, downscale or none**Response Time:** 100mSec (10 to 90%)**Stability:** ±100ppm of full scale/°C (±0.01%/°C)**Common Mode Rejection:** 120dB @ DC, >90dB @ 60Hz, or better**Isolation:** 1800VDC or peak AC between input, output & power**ESD Susceptibility:** Capable of meeting IEC 801-2 level 3 (8kV)**Power:** 9-30VDC; 1.0W typ., 2.0W max**Host Module Interface:** IR Link**Size:** DIN rail case – refer to Dimensions drawing**Operating Temperature:** 0°C to +60°C (32°F to 140°F)**Storage Temperature:** -25°C to +85°C (-13°F to 185°F)**Operating Humidity:** 15% to 95% RHNC @ 45°C**Storage Humidity:** 90% RHNC @ 60°C for 24 hours**Agency Approvals (EMC & Safety):**

CE: EN50081-1, EN50082-2, EN61010

CSA C22.2, No. 0-M91, 142-M1987

UL508

RoHS compliant

*Note that detailed installation instructions are available on our website.***Ordering Information**

Specify:

1. Model:  
**WV428-2000**
2. Optional Custom Factory Calibration (specify **C620**, see required settings under "Calibration, page 2).
3. Accessories.

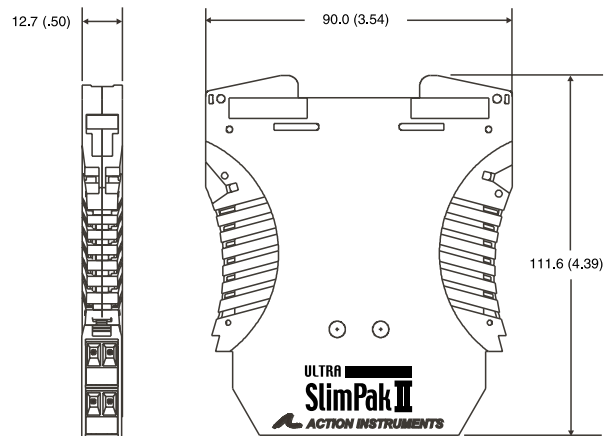
**Accessories**

All WV Series modules will mount on standard TS35 (model MD03) DIN rail. In addition, the following accessories are available:

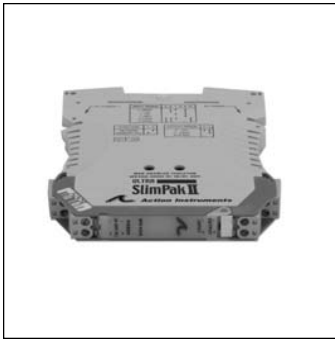
<b>WVC16</b>	Communications Interface
<b>MD03</b>	TS35 x 7.5 DIN Rail (2 meters)
<b>WV905</b>	24VDC Power Supply (0.5 Amp)
<b>H910</b>	24VDC Power Supply (1 Amp)
<b>H915</b>	24VDC Power Supply (2.3 Amp)
<b>MB03</b>	End Bracket for MD03
<b>C650</b>	Utility software for WVC16

**Dimensions**

Dimensions are in millimeters (inches)







WV438-2000

# ULTRA SLIMPAK® II WV438

## DC Powered Potentiometer Input Isolating Signal Conditioner

High Accuracy Signal Conditioner with an  
Isolated DC Voltage or Current Output



- Lower Power Requirements with SmartPower
- Improved Accuracy
- Bussed Power with Plug-in Power Clips
- Removable Terminals for Easy Service

- RoHS Compliant
- Touch Cal for Best Stability and Accuracy
- DIP Switch Configuration
- Optional E-mail Notification of Alarms

Ultra Slimpak® II

### Description

The Ultra SlimPak II is an exciting new line of isolating signal conditioners from Action Instruments with greater accuracy and better stability than virtually any other signal conditioners on the market today. The Ultra SlimPak II features Smart Power, which eliminates wasted power for low loop resistance loads in the current output mode.

The WV438 is a potentiometer input signal conditioner supporting 3-wire potentiometers and slidewire devices from 100 ohms to 100k ohms. The switch selectable output ranges are 0-10VDC, 0-20mA and 4-20mA. All of the output ranges are fully adjustable via pushbutton calibration. The input default range is 0 to 100% of the potentiometer range, but can be adjusted via pushbutton calibration to any 20% portion of the potentiometer. The default output range is 4-20mA.

### Smart Power

The Ultra SlimPak II uses Smart Power to control its output supply. Smart Power automatically adjusts the the voltage to drive the output loop to the required current. A low impedance current loop will subsequently require less voltage than a loop with higher impedance. Previous designs provided only a single supply at the highest voltage required to drive the highest impedance load. Using Smart Power results in power savings and reduces the operating temperature of the signal conditioner.

### Enhanced LED Diagnostics

Other than when executing the pushbutton calibration routine, the LEDs blink under the following conditions:

#### GREEN:

Flashes at 2Hz when the input is under range.  
Flashes at 8Hz when the input is over range.

#### RED:

Flashes at 2Hz when the output is under range.  
Flashes at 8Hz when the output is over range.

An Under Range condition exists when the signal is lower than the operational low value minus 6.25% of the operational span. An Over Range condition exists when the signal is higher than the operational high value plus 6.25% of the operational span.

A voltage output short circuit may cause an under range condition (RED blinking at 2Hz rate). A current output open circuit may cause an over range condition (RED blinking at an 8Hz rate).

There could be two or more LEDs blinking at the same time, which means the module has more than one error condition. Only when all error conditions have been removed, will the LEDs be back to normal (Green ON, Red and Yellow Off).

### Configuring Modules

Unless otherwise specified, the factory presets the Model WV438 as follows:

- Input: Potentiometer
- Range: 100 ohms to 100k ohms
- Output: Current
- Range: 4-20mA
- Reverse Out: Off
- Remote Cal: Off

1. Set position 1 of S1 to ON if a WVC16 will be utilized and remote calibration capability is desired.
2. Set position 2 and 3 of S1 for the desired output type.
3. Set position 4 of S1 to ON for reverse output operation.

It is also possible to remotely select the setpoints using an Ethernet connection and the optional WVC16 Communications Interface module.

### Calibration

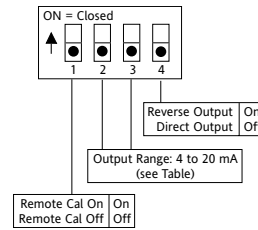
See the calibration flowchart in Figure 3. The complete calibration procedure is contained in the Installation & Calibration Instructions document, which is available on our website ([www.actionio.com](http://www.actionio.com)). You can also obtain it by telephoning Action technical support (703-669-1318).

Note that Custom Calibration (option C620) is available from the factory (settings **MUST** be within the units specifications). For a C620, specify the following:

- a) Potentiometer Input Range, in percent (for example: Input = 25 to 75% of pot rotation).
- b) Output Type & Range (for example: 4-20mA).
- c) Reverse Output Function (ON/OFF).

Function	S1			
	1	2	3	4
Remote Cal Enable	■	-	-	-
<b>Output Range</b>				
0 to 10V	-	■	■	-
0 to 20mA	-		■	-
4 to 20mA	-			-
Reverse Out	-	-	-	■

Key: ■ = 1 = ON or Closed; - = n/a



Default Switch Settings

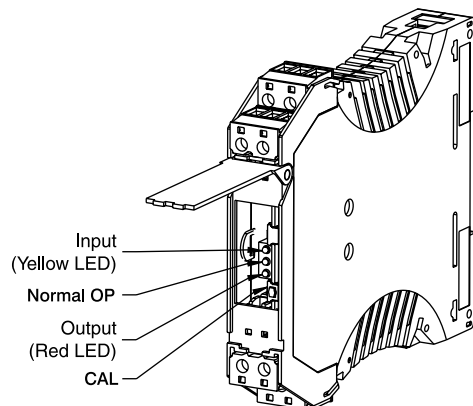
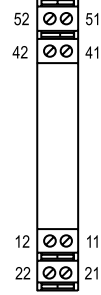


Figure 1: Switch Settings



Pin	Description
11	Potentiometer Input (full CW)
12	Potentiometer Input (full CCW)
21	DC Power (+)
22	DC Power (-)
41	Potentiometer Input (wiper)
42	Shield Ground
51	Output (+)
52	Output (-)

Figure 2: Wiring Connections

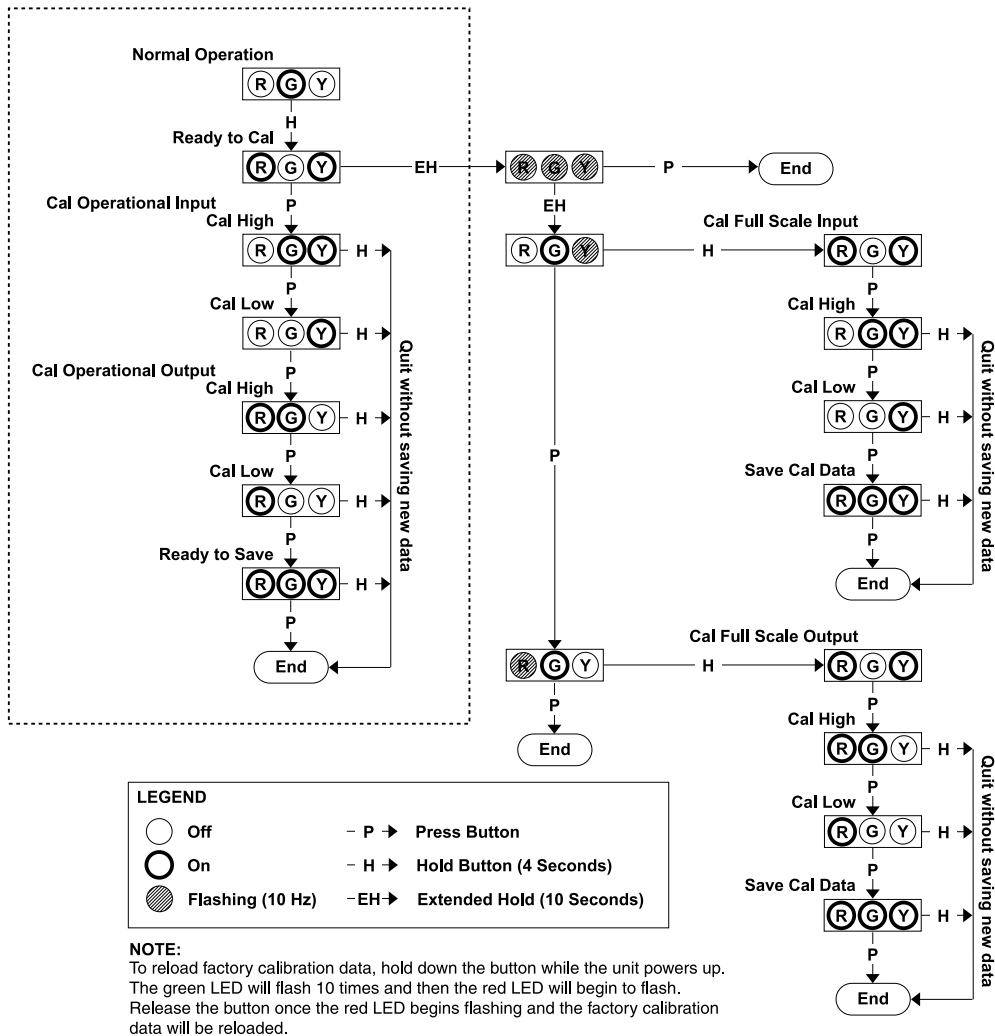


Figure 3: Calibration Flowchart

**Specifications****Potentiometer Resistance (end to end):**

100 ohms (min.) to 100k ohms (max.)

**Input Ranges:** Pushbutton adjustable**Linearity:**  $\pm 0.1\%$  of span, typical**Excitation:** 300mV, nominal**Turn-Up/Turn-Down:** 80% (90% to  $\pm 0.2\%$  linearity)**Common Mode Rejection:**

60Hz: &gt;100dB

DC: &gt;120dB

**Output Ranges:**

0 to 10VDC

0 to 20mA

4 to 20 mA

**Response Time:** 100mSec typical**Stability:**  $\pm 100$ ppm of full scale/ $^{\circ}$ C**Output Ripple:** 0.2% of span, or 5mVrms, whichever is greater**Output Impedance:**

Voltage Output: &lt;10 ohms

Current Output: &gt;100k ohms

**Output Drive:**

Voltage Output: 10 mA, max

Current Output: 20V compliance @ 20mA

**Power:** 9-30VDC; 1.0W typ., 2.0W max.**Isolation:** 1800VDC input to output to power**Host Module Interface:** IR Link**Size:** DIN rail case – refer to Dimensions drawing**Operating Temperature:** 0 to +60 $^{\circ}$ C (32 to 140 $^{\circ}$ F)**Storage Temperature:** -25 to +85 $^{\circ}$ C (-13 to 185 $^{\circ}$ F)**Operating Humidity:** 15% to 95% RH, non-condensing @ 45 $^{\circ}$ C**Storage Humidity:** 90% RH, non-condensing @ 60 $^{\circ}$ C for 24 hours**Agency Approvals (EMC & Safety):**

CE: EN50081-1, EN50082-2, EN61010

CSA C22.2, No. 0-M91, 142-M1987

UL508

RoHS compliant

*Note that detailed installation instructions are available on our website.***Ordering Information**

Specify:

1. Model:  
**WV438-2000**
2. Optional Custom Factory Calibration (specify **C620**, see required settings under "Calibration, page 2).
3. Accessories.

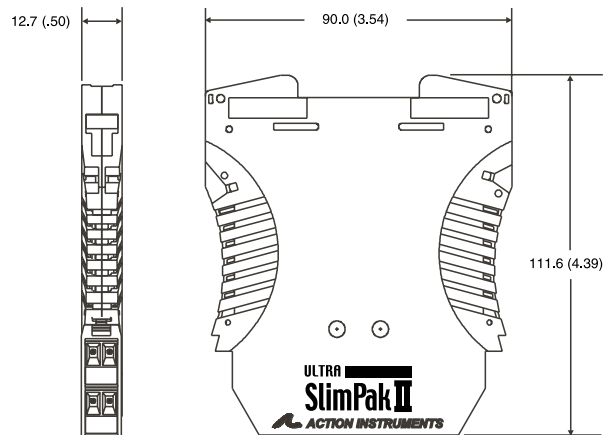
**Accessories**

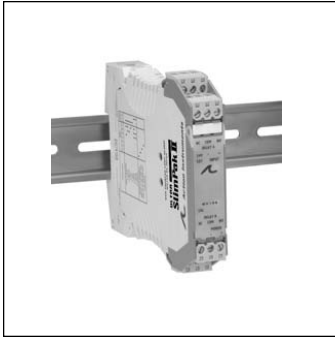
All WV Series modules will mount on standard TS35 (model MD03) DIN rail. In addition, the following accessories are available:

<b>WVC16</b>	Communications Interface
<b>MD03</b>	TS35 x 7.5 DIN Rail (2 meters)
<b>WV905</b>	24VDC Power Supply (0.5 Amp)
<b>H910</b>	24VDC Power Supply (1 Amp)
<b>H915</b>	24VDC Power Supply (2.3 Amp)
<b>MB03</b>	End Bracket for MD03
<b>C650</b>	Utility software for WVC16

**Dimensions**

Dimensions are in millimeters (inches)





WV448-2000

# ULTRA SLIMPAK® II WV448

## DC Powered Bridge Input Isolating Signal Conditioner

High Accuracy Signal Conditioner with an  
Isolated DC Voltage or Current Output



- Lower Power Requirements with SmartPower
- Improved Accuracy
- Bussed Power with Plug-in Power Clips
- Removable Terminals for Easy Service
- Optional E-mail Notification of Alarms

- RoHS Compliant
- Touch Cal for Best Stability and Accuracy
- DIP Switch Configuration
- 120mA Excitation to Drive up to Four 350 Ohm Load Cells

Ultra SlimPak® II

### Description

The Ultra SlimPak II is an exciting new line of isolating signal conditioners from Action Instruments with greater accuracy and better stability than virtually any other signal conditioners on the market today. The Ultra SlimPak II features Smart Power, which eliminates wasted power for low loop resistance loads in the current output mode.

The WV448 is a bridge input signal conditioner supporting bridge input full scale ranges of  $\pm 5\text{mV}$  to  $\pm 200\text{mV}$ , (default is  $\pm 50\text{mV}$ ). The switch selectable output ranges are 0-10VDC, 0-20mA and 4-20mA. All the input and output ranges are fully adjustable via pushbutton calibration. The default output range is 4-20mA.

### Smart Power

The Ultra SlimPak II uses Smart Power to control its output supply. Smart Power automatically adjusts the the voltage to drive the output loop to the required current. A low impedance current loop will subsequently require less voltage than a loop with higher impedance. Previous designs provided only a single supply at the highest voltage required to drive the highest impedance load. Using Smart Power results in power savings and reduces the operating temperature of the signal conditioner.

### Enhanced LED Diagnostics

Other than when executing the pushbutton calibration routine, the LEDs blink under the following conditions:

#### GREEN:

Flashes at 2Hz when the input is under range.  
Flashes at 8Hz when the input is over range.

#### RED:

Flashes at 2Hz when the output is under range.  
Flashes at 8Hz when the output is over range.

An Under Range condition exists when the signal is lower than the operational low value minus 6.25% of the operational span. An Over Range condition exists when the signal is higher than the operational high value plus 6.25% of the operational span.

A voltage output short circuit may cause an under range condition (RED blinking at 2Hz rate). A current output open circuit may cause an over range condition (RED blinking at an 8Hz rate).

There could be two or more LEDs blinking at the same time, which means the module has more than one error condition. Only when all error conditions have been removed, will the LEDs be back to normal (Green ON, Red and Yellow Off).

## Configuring Modules

Unless otherwise specified, the factory presets the Model WV448 as follows:

Input: 0-30mV  
(using  $\pm 50\text{mV}$  range)  
Excitation: 10V  
Output: Current  
Range: 4-20mA  
Remote Cal: Off

- For other ranges, refer to the SWITCH SETTINGS table. Reconfigure switch S1 for the desired input type and range.
- Set position 1 of S1 to ON if a WVC16 will be utilized and remote calibration capability is desired.
- Set position 2 and 3 of S1 for the desired output type.
- Set positions 4-6 of S1 for the desired input range.

It is also possible to remotely select the setpoints using an Ethernet connection and the optional WVC16 WebView Communications Interface module.

## Calibration

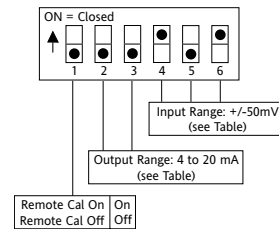
See the calibration flowchart in Figure 3. The complete calibration procedure is contained in the Installation & Calibration Instructions document, which is available on our website ([www.actionio.com](http://www.actionio.com)). You can also obtain it by telephoning Action technical support (703-669-1318).

Note that Custom Calibration (option C620) is available from the factory (settings **MUST** be within the units specifications). For a C620, specify the following:

- Input Range.
- Output Type, Range & Units (mA, V).
- Excitation Voltage.

Function	S1					
	1	2	3	4	5	6
<b>Input</b>						
+/- 5mV	-	-	-			■
+/- 10mV	-	-	-		■	
+/- 20mV	-	-	-		■	■
+/- 50mV	-	-	-	■		■
+/- 100mV	-	-	-	■	■	
+/- 200mV	-	-	-	■	■	■
Remote Cal Enable	■	-	-	-	-	-
<b>Output Range</b>						
0 to 10V	-	■	■	-	-	-
0 to 20mA	-		■	-	-	-
4 to 20mA	-			-	-	-

Key: ■ = 1 = ON or Closed; - = n/a



Default Switch Settings

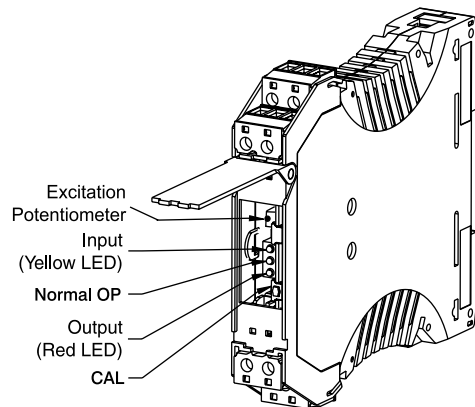
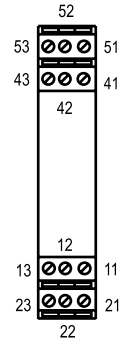


Figure 1: Switch Settings



Pin	Description
11	DC Power (+)
12	DC Power (-)
13	No Connection
21	DC Power (+)
22	DC Power (-)
23	No Connection
41	Bridge Input (+)
42	Bridge Input (-)
43	Excitation (+)
51	Output (+)
52	Output (-)
53	Excitation (-)

Figure 2: Wiring Connections

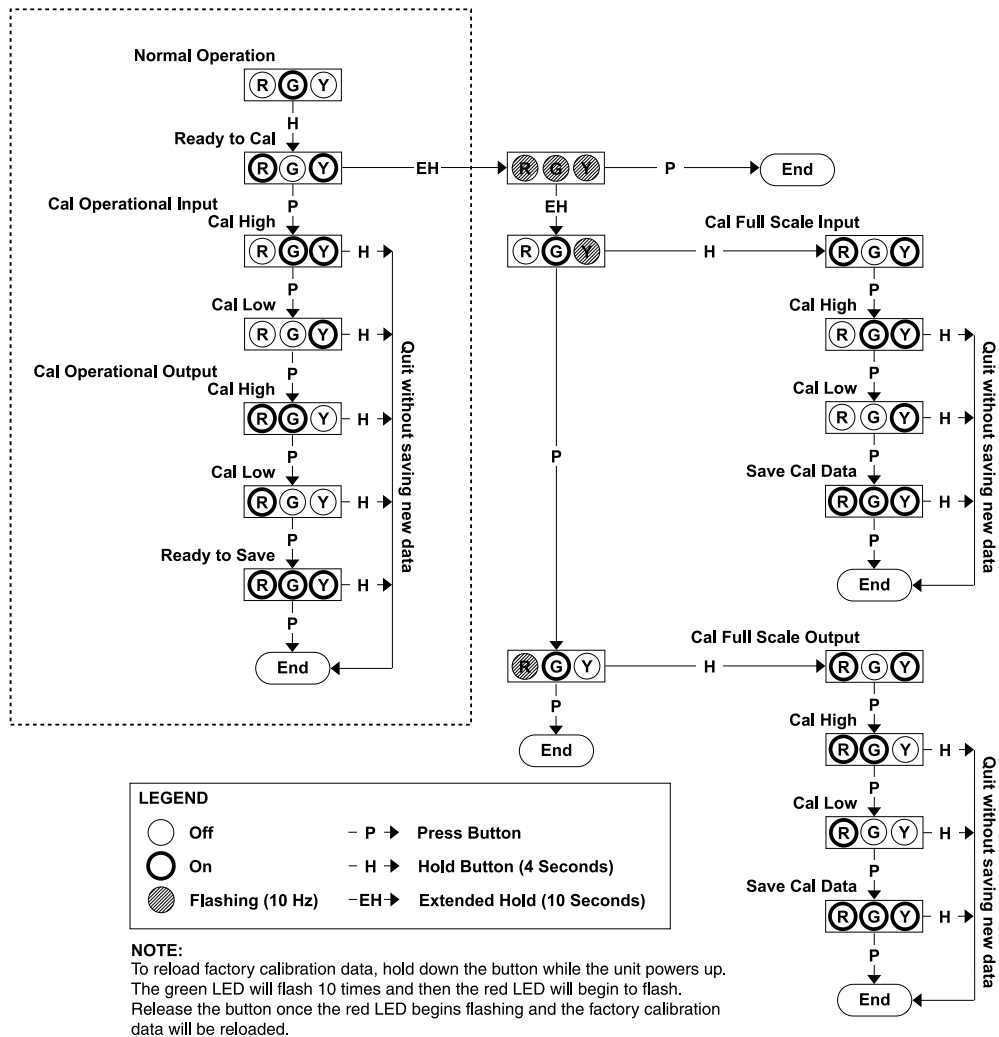


Figure 3: Switch Settings

**Specifications****Inputs:****Full Scale Range:**  $\pm 5\text{mV}$ ,  $\pm 10\text{mV}$ ,  $\pm 20\text{mV}$ ,  $\pm 50\text{mV}$ ,  $\pm 100\text{mV}$ ,  $\pm 200\text{mV}$ **Impedance:** 1M ohms**Over-voltage:** 400Vrms (intermittent); 264Vrms (continuous)**Operation:** Direct or reverse acting**Bridge Excitation:** 1 to 10VDC, 120mA**Input Accuracy:** 0.015% of span**Pushbutton Adjustment:****(Inputs <10mV):**Effective zero offset:  $\geq 95\%$ Effective span turn down:  $\geq 95\%$ **(Inputs <10mV):**Effective zero offset:  $\geq 50\%$ Effective span turn down:  $\geq 50\%$ **Local Range Selection:** By DIP switch**Output:****Voltage:**

0 to 10V (pushbutton adjust. to 75% of range)

Source Impedance:  $<10$  ohms**Drive:** 10mA**Current:**

0 to 20mA (pushbutton adjust. to 75% of range)

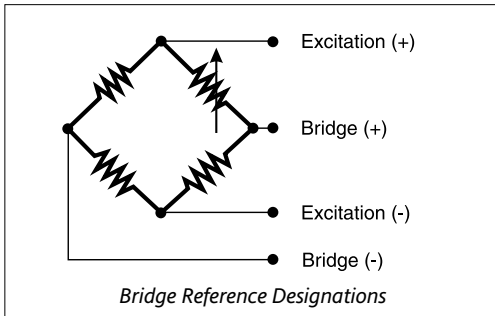
(4mA min position available on range switch)

Source Impedance:  $>100\text{k}$  ohms**Compliance:** 20V**Output Accuracy:** 0.05% of Full Scale**Overall Accuracy:** 0.065% of Full Scale**Output Ripple:** 0.03% rms**Response Time:** 150 mSec, 10 to 90%**Stability:**  $\pm 100\text{ppm}/^\circ\text{C}$ **Common Mode Rejection:** 120dB @ DC,  $>90\text{dB}$  @ 60Hz, or better**Isolation:** 1800VDC or peak AC between input, output & power.**Size:** DIN rail case – refer to Dimensions drawing**Operating Temperature:**  $0^\circ\text{C}$  to  $+60^\circ\text{C}$  ( $32^\circ\text{F}$  to  $140^\circ\text{F}$ )**Storage Temperature:**  $-25^\circ\text{C}$  to  $+85^\circ\text{C}$  ( $-13^\circ\text{F}$  to  $185^\circ\text{F}$ )**Operating Humidity:** 15% to 95% RH (non-condensing) at  $45^\circ\text{C}$ **Non-operating Humidity:** 90% RH (non-condensing) at  $60^\circ\text{C}$  for 24hrs**Power:** 9 to 30VDC, 1.5W typ. 3.5W max.**Agency Approvals (EMC & Safety):**

CE: EN61326, EN61010-1

CSA &amp; UL Combined mark

RoHS compliant

*Note that detailed installation instructions are available on our website.***Ordering Information**

Specify:

1. Model:  
**WV448-2000**
2. Optional Custom Factory Calibration (specify **C620**, see required settings under "Calibration, page 2).
3. Accessories.

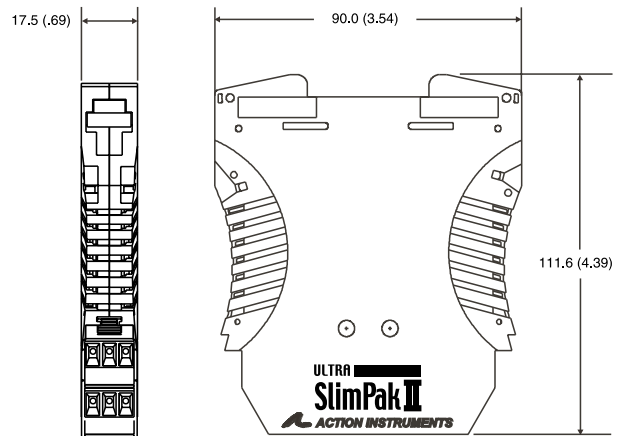
**Accessories**

All WV Series modules will mount on standard TS35 (model MD03) DIN rail. In addition, the following accessories are available:

<b>WVC16</b>	Communications Interface
<b>MD03</b>	TS35 x 7.5 DIN Rail (2 meters)
<b>WV905</b>	24VDC Power Supply (0.5 Amp)
<b>H910</b>	24VDC Power Supply (1 Amp)
<b>H915</b>	24VDC Power Supply (2.3 Amp)
<b>MB03</b>	End Bracket for MD03
<b>C650</b>	Utility software for WVC16

**Dimensions**

Dimensions are in millimeters (inches)







WV468-2000

# ULTRA SLIMPAK® II WV468

## DC Powered AC Voltage/Current Input Isolating Signal Conditioner

High Accuracy Signal Conditioner with an  
Isolated DC Voltage or Current Output



- True RMS Output
- Lower Power Requirements with SmartPower
- Improved Accuracy
- Bussed Power with Plug-in Power Clips
- Removable Terminals for Easy Service

- RoHS Compliant
- Touch Cal for Best Stability and Accuracy
- DIP Switch Configuration
- Optional E-mail Notification of Alarms

Ultra SlimPak® II

### Description

The Ultra SlimPak II is an exciting new line of isolating signal conditioners from Action Instruments with greater accuracy and better stability than virtually any other signal conditioners on the market today. The Ultra SlimPak II features Smart Power, which eliminates wasted power for low loop resistance loads in the current output mode.

The WV468 has both voltage and current input ranges. Eight AC voltage input ranges (50mV, 150mV, 500mV, 5V, 20V, 50V, 150V & 250V) are DIP switch selectable. Each of these ranges has at least 95% zero and span adjustment. Two AC current input ranges (20mA and 100mA) are also available. Outputs include 0-10V, 0-20mA and 4-20mA. The WV468 also supports reverse output mode.

### Smart Power

The Ultra SlimPak II uses Smart Power to control its output supply. Smart Power automatically adjusts the the voltage to drive the output loop to the required current. A low impedance current loop will subsequently require less voltage than a loop with higher impedance. Previous designs provided only a single supply at the highest voltage required to drive the highest impedance load. Using Smart Power results in power savings and reduces the operating temperature of the signal conditioner.

### Enhanced LED Diagnostics

Other than when executing the pushbutton calibration routine, the LEDs blink under the following conditions:

#### GREEN:

Flashes at 2Hz when the input is under range.  
Flashes at 8Hz when the input is over range.

#### RED:

Flashes at 2Hz when the output is under range.  
Flashes at 8Hz when the output is over range.

An Under Range condition exists when the signal is lower than the operational low value minus 6.25% of the operational span. An Over Range condition exists when the signal is higher than the operational high value plus 6.25% of the operational span.

A voltage output short circuit may cause an under range condition (RED blinking at 2Hz rate). A current output open circuit may cause an over range condition (RED blinking at an 8Hz rate).

There could be two or more LEDs blinking at the same time, which means the module has more than one error condition. Only when all error conditions have been removed, will the LEDs be back to normal (Green ON, Red and Yellow Off).

**Configuring Modules**

Unless otherwise specified, the factory presets the Model WV468 as follows:

- Input: mVAC
- Range: 0-500mV
- Output: DC Current
- Range: 4-20mA
- Reverse Out: Off
- Remote Cal: Off

1. For other ranges, refer to the SWITCH SETTINGS table. Reconfigure switches S1 and S2 for the desired input type and range.
2. Set position 1 of S1 to ON if a WVC16 will be utilized and remote calibration capability is desired.
3. Set position 2 and 3 of S1 for the desired output type.
4. Set position 4 of S1 to ON for reverse output operation.
5. Set positions 5-8 of S1 and positions 1 & 4 of S2 for the desired input range.

It is also possible to remotely select the setpoints using an Ethernet connection and the optional WVC16 WebView Communications Interface module.

**Calibration**

See the calibration flowchart in Figure 3. The complete calibration procedure is contained in the Installation & Calibration Instructions document, which is available on our website ([www.actionio.com](http://www.actionio.com)). You can also obtain it by telephoning Action technical support (703-669-1318).

Note that Custom Calibration (option C620) is available from the factory (settings **MUST** be within the units specifications). For a C620, specify the following:

- a) Input Type, Range and Units.
- b) Output Type, Range and Units.
- c) Reverse Output (ON/OFF).

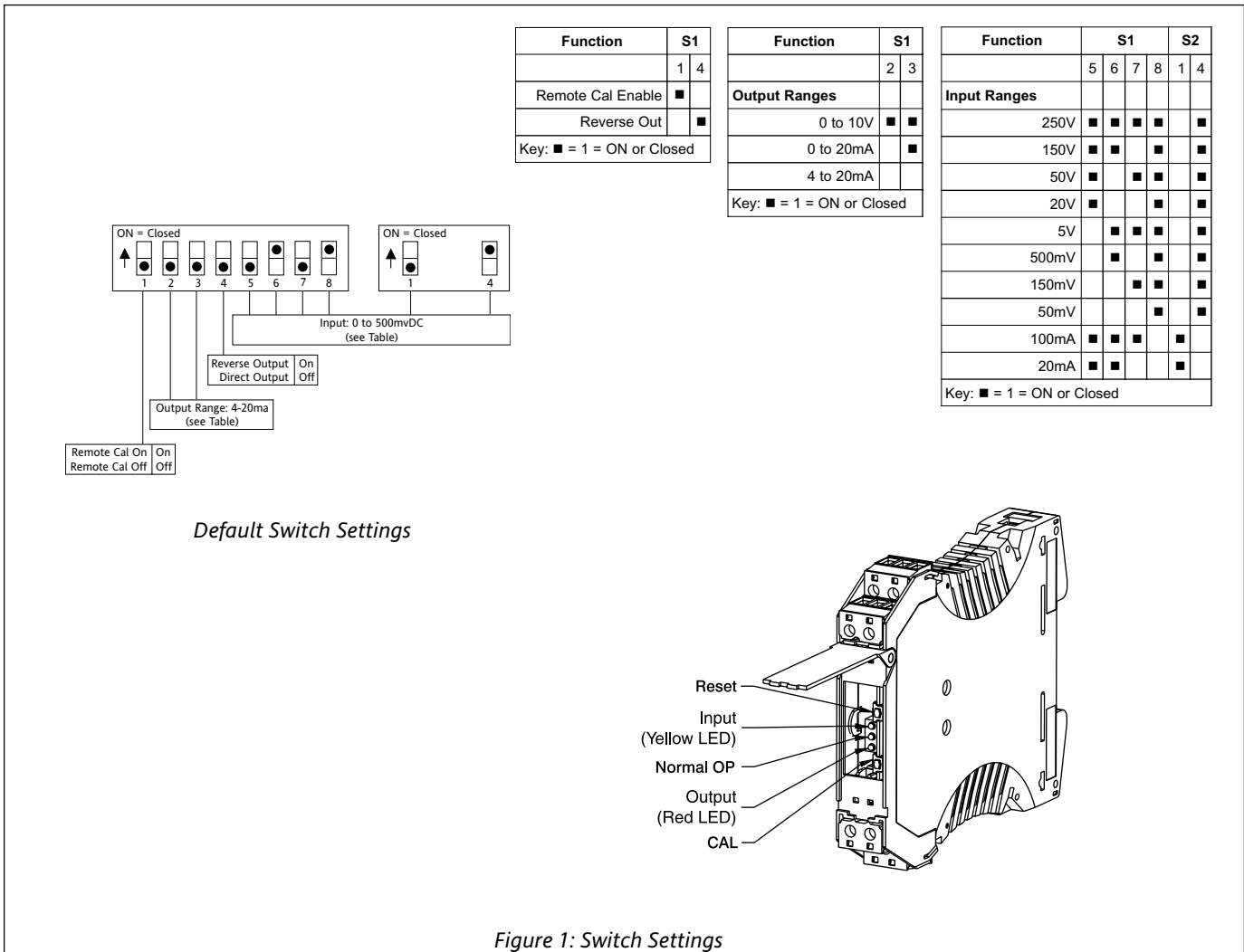
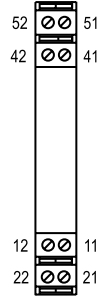


Figure 1: Switch Settings



Pin	Description
11	DC Power (+)
12	DC Power (-)
21	DC Power (+)
22	DC Power (-)
41	AC Input (hot)
42	AC Input (neutral)
51	Output (+)
52	Output Common

Figure 2: Wiring Connections

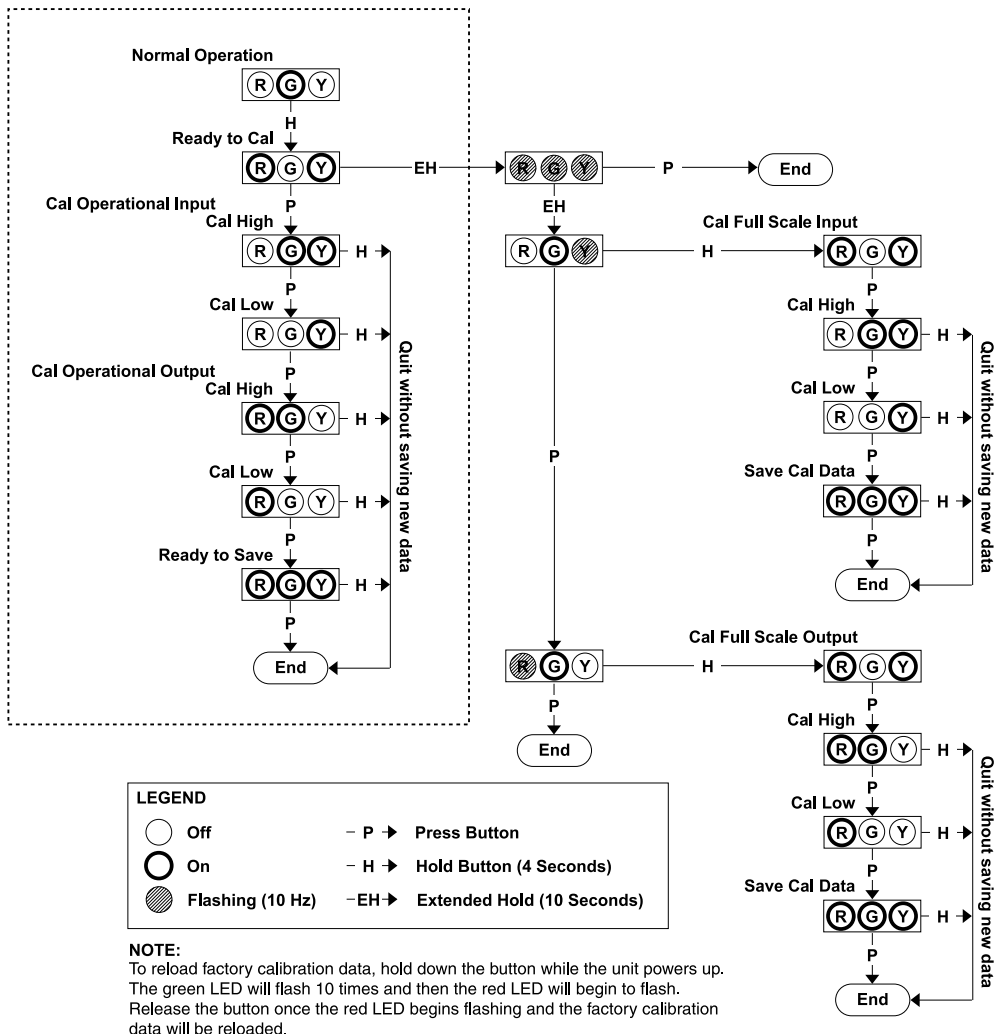


Figure 3: Calibration Flowchart

**Specifications**

**Inputs:**

**Voltage Ranges:**

50mV, 150mV, 500mV, 5V, 20V, 50V,  
150V, 250V @ ±0.15% of FS accuracy

**Impedance:** >100k ohms

**Over-voltage:** 275Vrms

**Current Ranges:**

20mA, 100mA @ ±0.15% of FS accuracy

**Impedance:** 10 ohms typical

**Over-current:** 200mA, protected by self-resetting fuse

**Over-voltage:** 60V

**Frequency Range:** 40 to 400Hz

**Linearity:** ±0.1% of span, typical

**Input Ranges:**

Pushbutton adjustable

Effective zero offset: ≥ 95%

Effective span turndown: ≥ 95%

**Turn-Up/Turn-Down:** 80% (90% to ±0.25%)

**Output Ranges:** 0-10VDC; 0-20mA, 4-20mA

**Output Accuracy:** ±0.05% of Full Scale

**Response Time:** 100mSec typical

**Stability:** ±100ppm of span/°C

**Output Ripple:** 0.2% of span, or 5mVrms, whichever is greater

**Output Impedance:**

Voltage Output: <10 ohms (source impedance)

Current Output: >100k ohms

**Common Mode Rejection:** 60Hz: >90dB; DC: >120dB

**Output Drive:**

Voltage Output: 10mA, max

Current Output: 20V compliance @ 20mA (1k ohms max)

**Temperature Range:**

Operating: 0° to 60°C (32 to 140°F)

Storage: -20° to 85°C (-4 to 185°F)

**Power:** 9 to 30VDC; 1W typical, 2W maximum

**Isolation, Input to Output to Power:** 1800VDC

**Host Module Interface:** IR Link

**Size:** DIN rail case – refer to Dimensions drawing

RoHS compliant

*Note that detailed installation instructions are available on our website.*

**Ordering Information**

Specify:

1. Model:  
**WV468-2000**
2. Optional Custom Factory Calibration(specify **C620**, see required settings under "Calibration, page 2).
3. Accessories.

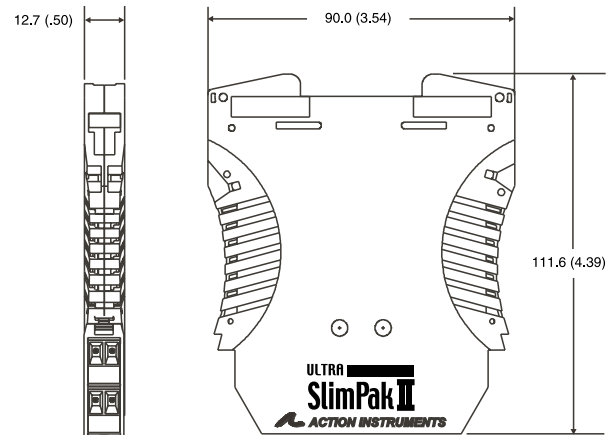
**Accessories**

All WV Series modules will mount on standard TS35 (model MD03) DIN rail. In addition, the following accessories are available:

- WVC16** Communications Interface
- MD03** TS35 x 7.5 DIN Rail (2 meters)
- WV905** 24VDC Power Supply (0.5 Amp)
- H910** 24VDC Power Supply (1 Amp)
- H915** 24VDC Power Supply (2.3 Amp)
- MB03** End Bracket for MD03
- C650** Utility software for WVC16

**Dimensions**

Dimensions are in millimeters (inches)





WV478-2000

# ULTRA SLIMPAK® II WV478

## DC Powered Frequency Input Isolating Signal Conditioner

High Accuracy Signal Conditioner with an  
Isolated DC Voltage or Current Output



- Lower Power Requirements with SmartPower
- Improved Accuracy
- Bussed Power with Plug-in Power Clips
- Removable Terminals for Easy Service

- RoHS Compliant
- Touch Cal for Best Stability and Accuracy
- DIP Switch Configuration

Ultra SlimPak® II

### Description

The Ultra SlimPak II is an exciting new line of isolating signal conditioners from Action Instruments with greater accuracy and better stability than virtually any other signal conditioners on the market today. The Ultra SlimPak II features Smart Power, which eliminates wasted power for low loop resistance loads in the current output mode.

The WV478 accepts a frequency of up to 10kHz, with a minimum input span of 2Hz. The input amplitude can range from 150mVp to 150Vrms.

### Smart Power

The Ultra SlimPak II uses Smart Power to control its output supply. Smart Power automatically adjusts the the voltage to drive the output loop to the required current. A low impedance current loop will subsequently require less voltage than a loop with higher impedance. Previous designs provided only a single supply at the highest voltage required to drive the highest impedance load. Using Smart Power results in power savings and reduces the operating temperature of the signal conditioner.

### Enhanced LED Diagnostics

Other than when executing the pushbutton calibration routine, the LEDs blink under the following conditions:

#### GREEN:

Flashes at 2Hz when the input is under range.  
Flashes at 8Hz when the input is over range.

#### RED:

Flashes at 2Hz when the output is under range.  
Flashes at 8Hz when the output is over range.

An Under Range condition exists when the signal is lower than the operational low value minus 6.25% of the operational span. An Over Range condition exists when the signal is higher than the operational high value plus 6.25% of the operational span.

A voltage output short circuit may cause an under range condition (RED blinking at 2Hz rate). A current output open circuit may cause an over range condition (RED blinking at an 8Hz rate).

There could be two or more LEDs blinking at the same time, which means the module has more than one error condition. Only when all error conditions have been removed, will the LEDs be back to normal (Green ON, Red and Yellow Off).

### Configuring Modules

Unless otherwise specified, the factory presets the Model WV478 as follows:

Input: Frequency  
 Range: 0-1000Hz  
 Sensitivity: Low (set at 1Vrms)  
 Output: DC Current  
 Range: 4-20mA  
 Remote Cal: Off

1. For other ranges, refer to the SWITCH SETTINGS table. Reconfigure switches S1 and S2 for the desired input type and range.
2. Set position 1 of S1 to ON if a WVC16 will be utilized and remote calibration capability is desired.
3. Set position 2 and 3 of S1 for the desired output type.
4. Set position 4 of S1 to ON for reverse output operation.
5. Set position 1 of S2 for the desired input sensitivity.

It is also possible to remotely select the setpoints using an Ethernet connection and the optional WVC16 WebView Communications Interface module.

### Calibration

See the calibration flowchart in Figure 3. The complete calibration procedure is contained in the Installation & Calibration Instructions document, which is available on our website ([www.actionio.com](http://www.actionio.com)). You can also obtain it by telephoning Action technical support (703-669-1318).

Note that Custom Calibration (option C620) is available from the factory (settings **MUST** be within the units specifications). For a C620, specify the following:

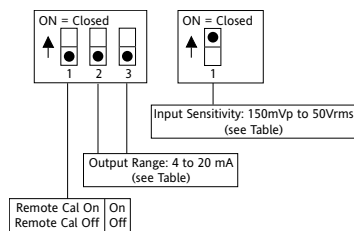
- a) Input Frequency Range (for example: 0 to 5000Hz).
- b) Input Amplitude (for example: 2.5 Volts, Peak).
- c) Output Type and Range (for example: 4 to 20mA).

Function	S1		
	1	2	3
Remote Cal	■	-	-
Output			
0 to 10V	-	■	■
0 to 20mA	-		■
4 to 20mA	-		

Key: ■ = 1 = ON or Closed; - = n/a

Function	S2
Input Sensitivity	1
High Range (500mVp to 150Vrms)	
Low Range (150mVp to 50Vrms)	■

Key: ■ = 1 = ON or Closed; - = n/a



Default Switch Settings

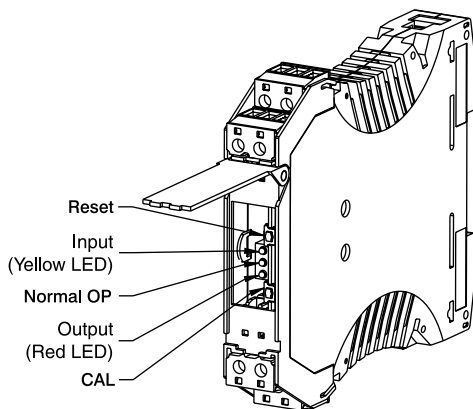


Figure 1: Switch Settings



**Specifications**

**Input:**

- Frequency Input Range:** 0 to 10kHz
- Minimum Input Span:** 2Hz
- Amplitude (switch selectable):**
  - Low Range: 150mVp to 50Vrms
  - High Range: 500mVp to 150Vrms

**Output:**

- Voltage:** 0 to 10VDC;
- Source Impedance:** 10 ohms
- Drive:** 10mA
- Current:** 0 to 20mA
- Source Impedance:** >100k ohms
- Compliance:** 20V@20mA (1k ohms max)

**Output Accuracy:**

±0.05% of full scale local range

**Response Time:**

100mSec + 3 input cycles (10-90%) typical

**Stability:**

±100ppm of full scale/°C (±0.01%/°C)

**Common Mode Rejection:**

- 60Hz: >90dB
- DC: >120dB

**Isolation:**

Input to Output to Power: 1800VDC

**ESD Susceptibility:**

Capable of meeting IEC801-2 level 3 (8kV)

**Power:**

- 9 to 30VDC
- 1W typical, 2W maximum

**Host Module Interface:**

IR Link

**Size:**

DIN rail case – refer to Dimensions drawing

**Temperature Range:**

- Operating: 0°C to 60°C (32°F to 140°F)
- Storage: -25°C to 85°C (-13°F to 185°F)

**Humidity Range:**

- Operating: 15% to 95% RHNC @ 45°C
- Storage: 90% RHNC @60°C for 24 hrs

**Agency Approvals (EMC & Safety):**

- CE: EN50081-1, EN50082-2, EN61010
- CSA C22.2, No. 0-M91, 142-M1987
- UL508
- RoHS compliant

*Note that detailed installation instructions are available on our website.*

**Ordering Information**

Specify:

1. Model:  
**WV478-2000**
2. Optional Custom Factory Calibration (specify **C620**, see required settings under "Calibration, page 2).
3. Accessories.

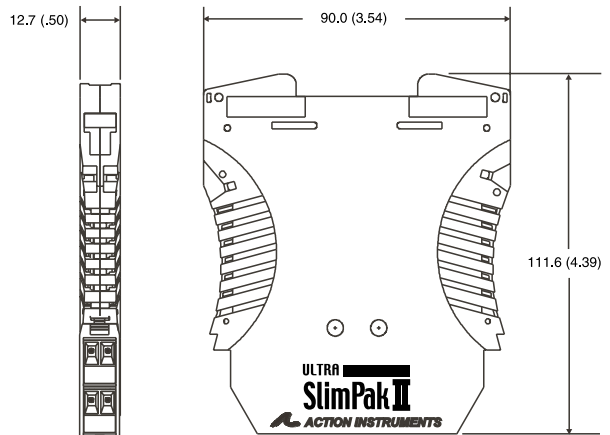
**Accessories**

All WV Series modules will mount on standard TS35 (model MD03) DIN rail. In addition, the following accessories are available:

- WVC16** Communications Interface
- MD03** TS35 x 7.5 DIN Rail (2 meters)
- WV905** 24VDC Power Supply (0.5 Amp)
- H910** 24VDC Power Supply (1 Amp)
- H915** 24VDC Power Supply (2.3 Amp)
- MB03** End Bracket for MD03
- C650** Utility software for WVC16

**Dimensions**

Dimensions are in millimeters (inches)







# ULTRA SLIMPAK® II

## WVC16

### Communications Interface

Provides Ethernet Connection for  
Ultra SlimPak II Modules



- Interface with up to 32 Signal Conditioning Modules
- Bussed Power with Plug-in Power Clips
- Removable Terminals for Easy Service
- RoHS Compliant
- Battery Backed Data
- No Programming Required

Ultra Slimpak® II

#### Description

The Ultra SlimPak II Communications Interface adds functionality never before found in a signal conditioning system. A single WVC16 interfaces with as many as 32 Ultra SlimPak II devices by means of an internal infrared communications link. Through an Ethernet link in the WVC16, the information can then be made available over the user's intranet. This powerful combination allows the user to view process data on a near real time basis, perform data logging functions on specified modules, view diagnostic information, and (under certain conditions) calibrate the modules remotely.

The WVC16 can send email messages to people who might need to be notified when an alarm condition exists. It can also send an email message letting maintenance personnel know when it's time to perform calibration checks. All of this functionality is made possible by a signed Java applet which is (transparently) downloaded to run on the client's computer. Using an applet rather than a traditional web page allows data to be updated in near real time. The applet provides access to the signal conditioner's data, which includes:

- Module configuration summary
- Module configuration editing
- Diagnostic/warning status
- Alarm setup & status
- E-mail setup, editing & address book
- Process variable viewing
- Data logging capabilities

All memory to support the signal conditioner's historical data is battery backed. The web pages and all e-mail messages are stored in non-volatile memory.

#### The Software

There are two software programs built into the WVC16. The first is a web server that provides the connection between the WVC16 and the client's computer. The second is the Ultra SlimPak II Data Viewer applet.

The web server (see Figure 1) is the "Home" page. Other functions can be selected from there. The Statistics frame contains information on the Ethernet connection, the frames sent and received, as well as information about the infrared bus between the modules. An Error Log will list any errors that have occurred. The Help file contains the entire user instruction manual for the WVC16.

The Data Viewer applet is launched from the Home page. Note that in order to install the Data Viewer, you must first have the Java Runtime Environment (JRE) 1.3.1 (or greater) plug-in installed on the client machine. If the plug-in has not been installed, the web browser will detect the fact and automatically connect to Sun Microsystems Java site in order to download and install the plug-in. Once the plug-in is installed, the Data Viewer will download and open.

The Data Viewer is used to view process data, define data logging parameters, and set up e-mail and address book information. The applet runs in a window of its own. The window shows all of the modules connected to the WVC16 (see Figure 2). The data logging function is defined in this window. Note that data logging is not simultaneous data from channel to channel - there is a time delay from sample to sample, as well as network delays that may need to be considered. The time-stamped data gathered here would then be downloaded to a program like MS Excel for further analysis.

Clicking on a module name brings up a window showing the signal connected to the selected module. From this window, the input and output ranges can be viewed, high and low alarm limits can be set, and module calibration can be performed. The About tab will list the firmware revision, the current temperature of the module, the high and low temperature to which the module has been subjected, and the number of hours it has been in operation.

**LED Indicators**

There are six LED indicators, in two groups of three, that can be viewed through the translucent front cover. They are located down the left side of the unit. There is also a power LED located on the right side of the unit. Their functions are described as follows:

**POWER (Green):**

On when 9 to 30VDC is applied to the unit.

**(Upper Group)****ERROR (Red):**

Flashes if a module error has been logged into the non-volatile SRAM or if the battery was disabled prior to applying power.

**CONNECT (Green):**

On to indicate Ethernet Client connection.

Flashes if no connection.

Off if network parameters need to be set.

**MODULE (Yellow):**

On when modules are detected on IR bus.

Flashes if no modules are detected on IR bus.

**(Lower Group)****OFFLINE (Red):**

On to indicate a network socket connection fault.

**TRAFFIC (Yellow):**

On to indicate 10Base-T transmit/receive and collision activity.

**LINK (Yellow):**

On to indicate 10Base-T link activity.

**ACTION INSTRUMENTS**

**WVC16 WebView I/O Communications Interface**

[Home](#)      **WVC16 Module Information**

[Statistics](#)      *Page Last Refreshed 2007-03-16 10:57:30*

[Error Log](#)

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[WebView I/O Data Viewer](#)

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Web Links

[Action Instruments](#)

[Eurotherm](#)

[Invensys](#)

Unit Name:                      WVC16 Boiler 1

Number of Clients Connected:   1 (Admin)

Number of Modules Connected: 4

Battery Status:                      Good

Firmware Revision:                2.0

**Network Configuration**

DHCP:                                      Disabled

IP Address:                                149.121.30.52

Gateway Address:                        0.0.0.0

Subnet Mask:                              255.0.0.0

**Contact Information**

Eurotherm Inc.  
741-F Miller Drive, Leesburg, VA 20175-8993 USA  
703-443-0000  
Fax 703-669-1300

**Technical Support**

[support@actionio.com](mailto:support@actionio.com)  
703-443-0000  
Fax 703-669-1301

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*Best viewed in Internet Explorer 6.0, Netscape 7.0 or later.*

Figure 1: The Webserver Home Page

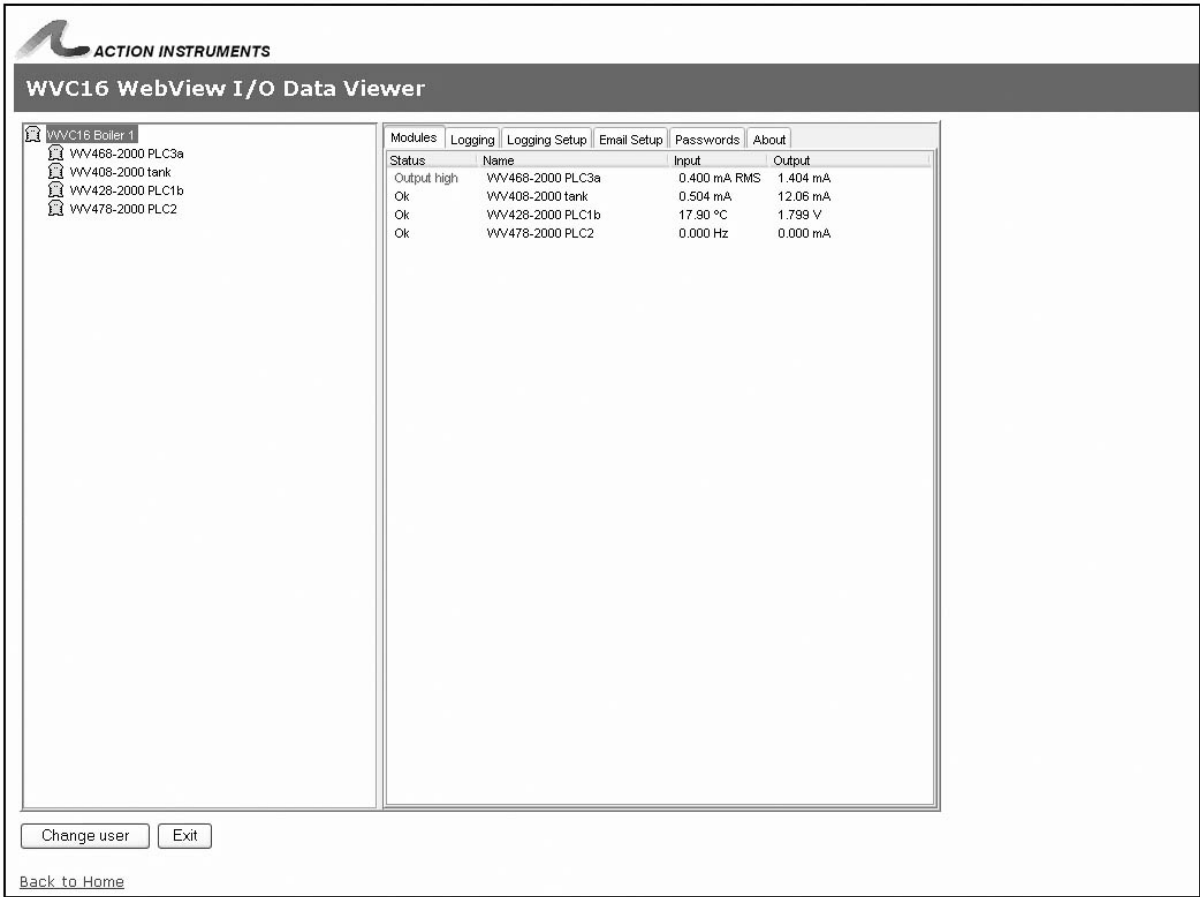


Figure 2: Data Viewer Home Page

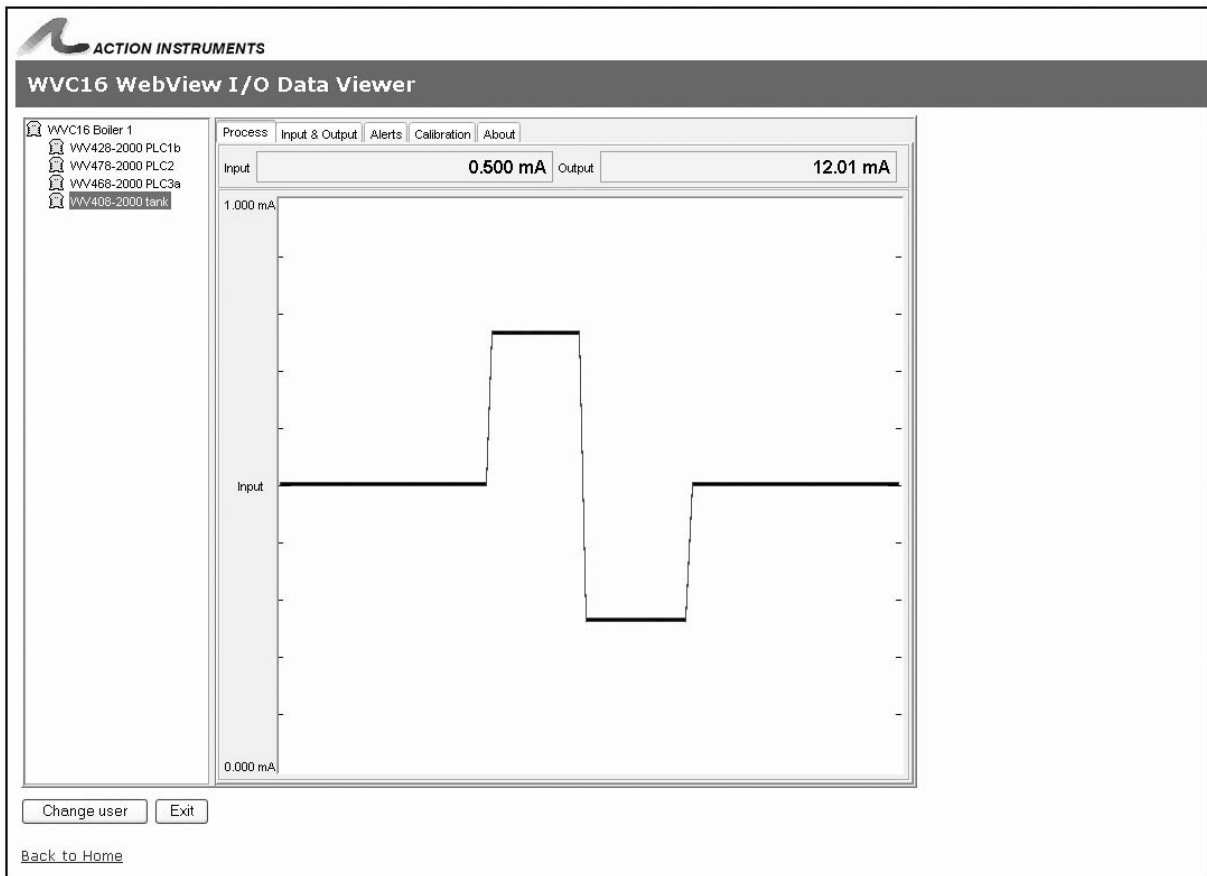


Figure 3: Module Page

**Specifications****Processor:**

AM186ESLV, 25MHz

**Data Logging Capacity:**

&gt;24k samples

**Host Interface:**

Type: Ethernet, 10Base-T

Connector: RJ45

Cable: Cat 5 recommended

**Utility Interface:**

Type: RS-232

Baud Rate: 9600

Data Bits: 8

Stop Bits: 1

Parity: None

Flow Control: None

**Module Interface:**

Type: Infrared

32 Modules max

**User Interface:**

Type: Web Browser, requires Java 2 Plug-in; Internet Explorer 5.01 (or later) or Netscape Navigator 4.7 (or later)

**Isolation:**

1500Vrms between 10Base-T port and all other external connections.

**Battery:**

Type: 3V Lithium, non-rechargeable cr2032 or BR2032. Life expectancy is 16 months typical in use (battery enable switch ON). Shelf life 10 yrs.

**Power:**

9-30VDC; 1.2W max

**Size:**

DIN rail case – refer to Dimensions drawing

**Operating Temperature:**

0°C to +60°C (32°F to 140°F)

**Storage Temperature:**

-25°C to +85°C (-13°F to 185°F)

**Operating Humidity:**

15% to 95% RHNC @ 45°C

**Storage Humidity:**

90% RHNC @ 60°C for 24 hours

**Agency Approvals (EMC & Safety):**

CE: EN50081-1, EN50082-2, EN61010

CSA C22.2, No. 0-M91, 142-M1987

UL508

RoHS compliant

*Note that detailed installation instructions are available on our website.***Ordering Information**

Specify:

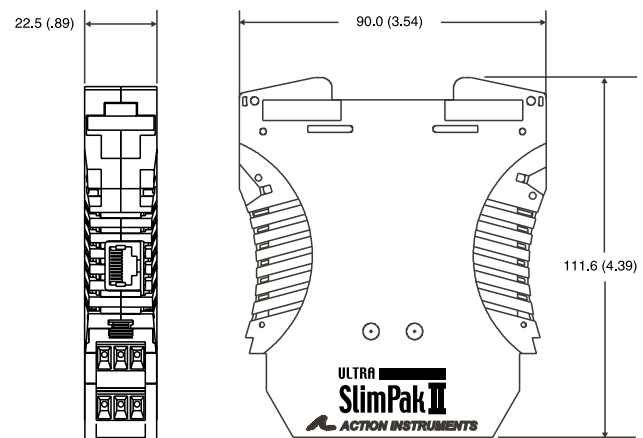
1. Model:  
WVC16

2. Accessories:

C650-0000 - Utility CD and Serial Interface Cable (one C650-0000 accessory kit is necessary per installation, in order to set the IP address on the WVC16's).

**Dimensions**

Dimensions are in millimeters (inches)



## Description

The ActionI/Q DIN rail mount package was developed to reduce the cost of signal conditioning. The two primary design considerations were to house as many channels of isolated I/O as possible and to reduce the number of power connections and I/O disconnects. Providing more I/O channels per module reduces per channel material cost and wiring savings reduces the long term cost of ownership.

The result is a 3/4" wide plug-in DIN rail mount package containing two full size printed circuit boards and fitted with up to 26 terminals for plug-in I/O. The ActionI/Q provides some of the most cost effective signal conditioning and isolation solutions in the world, including the the four channel RTD transmitter (model Q510) and the four channel, 4-20mA loop powered isolator (model Q500) from the original ActionI/Q series of multi-channel transmitters.

## Original ActionI/Q Series

The original ActionI/Q series consists of loop powered, two-wire and three-wire transmitters for sensor signal inputs including DC voltage, DC current, Platinum 100 Ohm RTDs and thermocouples. These DC powered, fixed range, multi-channel signal conditioners and isolators offer stable 0.1% accuracy over an operating ambient temperature range of 20° to 80°C. Their multi-channel design ensures high density and low material cost. Plug-in terminal sockets make wiring quick and easy.

To isolate a powered 4-20mA loop, the Q500 loop powered isolator is available for one, two or four channel applications. Voltage or current DC inputs can be specified by range for the Q501 two-wire transmitter, which is available with one or two 4-20mA output channels. The Q510 two-wire transmitter provides two or four RTD input channels and the Q520 two-wire transmitter provides two channels for the most popular thermocouple input types and ranges.

## AC ActionI/Q Series

The AC powered ActionI/Q series of four-wire transmitters offer many of the most advanced microprocessor and ASIC based signal conditioning solutions available. Field configurable and wide ranging, these modules are an off-the-shelf solution for most isolation, signal conditioning, and limit alarm applications. The benefits enjoyed by users include lower spares inventories and quick availability for DC, RTD, thermocouple, potentiometer, strain gauge, AC and frequency input signal applications.

Action's unique TouchCal™ pushbutton calibration provides increased stability, as well as higher repeatability and accuracy since it replaces adjustment potentiometers which can be thermally sensitive and mechanically less reliable. Additional cost of ownership benefits are realized in terms of reduced calibration time and the wiring savings provided by the use of an I/QRail. The I/QRail is used to power all AC ActionI/Q modules and provides an added level of safety.

For temperature measurement, the model Q486 with patented Instant Accuracy cold junction compensation technology, is twice as accurate and four times more stable than older temperature measurement instruments. The Q486 can be field configured using DIP switches, or it can be configured using a PC, which reduces setup time to seconds.

## DC ActionI/Q Series

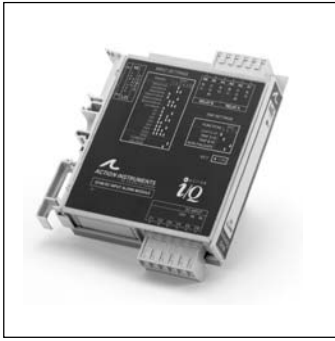
The DC ActionI/Q series is similar to the AC series except that it must be powered by a 9-30Vdc supply. The DC series can be wired using the power terminals or an optionally available DC powered I/QRail.

# AC ActionI/Q® Selection Guide

Input	Typical Application	Description	Model (No. of Channels)
DC Voltage or Current (V, mV, A, mA)	Process alarming, DC to DC isolation, Voltage/Current scalings and conversions for PLC and DCS I/O interface	DC limit alarm	Q106
		DC isolator (fast response time)	Q403 (1, 2)
		Field configurable DC isolator, optional excitation supply and dual outputs	Q406 (1, 2)
Potentiometer (0-100 Ohms, up to 0-100k Ohms)	Position feedback, setpoint transmitter, level transmitter	Field configurable potentiometer to DC signal conditioner	Q436
RTD (Pt100 Ohm, Ni110 Ohm, Cu10 Ohm)	Temperature alarming, motors, HVAC, process safety	RTD limit alarm	Q116 (2 setpoints)
		Instant Accuracy temperature to DC isolator, field configurable via DIP switch or PC	Q486
Thermocouple (Types B, C, E, J, K, N, R, S, T)	Temperature alarming, motors, HVAC, process safety	Field configurable T/C limit alarm	Q126 (2 setpoints)
		Instant Accuracy temperature to DC isolator, field configurable via DIP switch or PC	Q486
Frequency (0-2Hz to 0-10kHz)	Flow/velocity control or monitoring, motor speed control, scaling, pulse accumulation, integration, totalizing	Field configurable frequency to DC isolator	Q476
Strain Gauge (0.5, 1, 3, 5, 10, 20, 50mV/V) 1 to 10V Adjustable Excitation	Pressure control, pressure status monitoring, weight, load cell conditioning and data acquisition	Field configurable bridge input isolator	Q446
AC Voltage or Current (V, mV, A, mA)	Voltage/Current scaling, power monitoring, isolation, buffering	Field configurable AC input isolator	Q466

# DC ActionI/Q® Selection Guide

Input	Typical Application	Description	Model (No. of Channels)
DC Voltage or Current (V, mV, A, mA)	Process alarming, DC to DC isolation, Voltage/Current scalings and conversions for PLC and DCS I/O interface	DC limit alarm	Q108 (2 setpoints)
		DC isolator (fast response time)	Q404 (2)
		Field configurable DC isolator, optional excitation supply and dual outputs	Q408 (1, 2)
Potentiometer (0-100 Ohms, up to 0-100k Ohms)	Position feedback, setpoint transmitter, level transmitter	Field configurable potentiometer to DC signal conditioner	Q438 (1)
RTD (Pt100 Ohm, Ni110 Ohm, Cu10 Ohm)	Temperature alarming, motors, HVAC, process safety	Instant Accuracy temperature to DC isolator, field configurable via DIP switch or PC	Q488 (1)
		Temperature transmitting, monitoring, signal isolation	
Thermocouple (Types B, C, E, J, K, N, R, S, T)	Temperature alarming, motors, HVAC, process safety	Field configurable T/C limit alarm	Q126 (2 setpoints)
		Instant Accuracy temperature to DC isolator, field configurable via DIP switch or PC	Q486
Frequency (0-2Hz to 0-10kHz)	Flow/velocity control or monitoring, motor speed control, scaling, pulse accumulation, integration, totalizing	Field configurable frequency to DC isolator	Q478 (1)
Strain Gauge (0.5, 1, 3, 5, 10, 20, 50mV/V) 1 to 10V Adjustable Excitation	Pressure control, pressure status monitoring, weight, load cell conditioning and data acquisition	Field configurable bridge input isolator	Q448 (1)
AC Voltage or Current (V, mV, A, mA)	Voltage/Current scaling, power monitoring, isolation, buffering	Field configurable AC input isolator	Q468 (1)



Q106-0000

# ACTIONIQ® Q106

## AC Powered DC Input Limit Alarm

Provides Relay Contact Closures  
at a Preset DC Input Level



- Field Configurable Input Ranges
- TouchCAL™ Technology
- Setpoints Programmable HI or LO and Failsafe or Non-Failsafe
- DIN Rail Mounting with IQRL
- Universal AC Power 85 to 265 VAC
- 24VDC Transducer Excitation
- SnapLoc™ Plug-in Terminals
- ASIC Technology for Enhanced Reliability

### Description

The ActionIQ model Q106 is a DIN rail mount, DC voltage or current input limit alarm with dual setpoints and two contact closure outputs. The field configurable input and alarm functions offer flexible setpoint capability. Input voltage spans from 10mV to 200V and input current spans from 1mA to 100mA can be field configured. Bipolar inputs are also accepted.

The Q106 is configurable as a single or dual setpoint alarm, with HI or LO trips and failsafe or non-failsafe operation. Also included are adjustable deadbands (up to 100% of full scale input) for each setpoint, a 24VDC voltage source (isolated from line power) for transducer excitation, and a universal AC power supply which accepts any voltage between 85 and 265VAC.

### TouchCAL Technology

Action has simplified setpoint calibration. Using a pushbutton instead of potentiometers, improvements in calibration resolution and reliability are realized due to the elimination of the potentiometers' mechanical variability.

For calibration, simply input the signal level of the desired trip and press the pushbutton to store it in non-volatile memory. Deadband is entered the same way with another pushbutton press to store.

### Diagnostic LEDs

The Q106 is equipped with three front panel LEDs. The green LED is a dual function LED labeled IN, which indicates line power and input signal status. Active AC power is indicated by the illuminated LED. If this LED is off, check AC power and wiring connections. If the input signal is 7% above or below the configured input range the green LED will flash at 8Hz or 4Hz, respectively.

The two red LEDs indicate the relay state of each setpoint. An illuminated red LED indicates the tripped condition for the respective setpoint.

### Output

The Q106 is equipped with two SPDT (form C) relays, rated at 120VAC or 28VDC at 5 amperes. Each of these relays is independently controlled by the field configurable setpoint and deadband.

### Operation

The Q106 limit alarm setpoints can be configured for HI or LO, failsafe or non-failsafe operation. Each of the setpoints has a respective HI or LO deadband. In a tripped condition, the setpoint is exceeded and the appropriate red LED will illuminate. The trip will reset only after the process falls below the HI deadband or rises above the low deadband (see Figure 1). For proper deadband operation, the HI setpoint must be set above the LO setpoint. In failsafe operation, the relay is energized when the process is below the HI setpoint or above the LO setpoint (opposite for non-failsafe). In the failsafe mode, a power failure results in an alarm state output.

### Dynamic Deadband

Circuitry in the Q106 prevents false trips by repeatedly sampling the input. The input must be beyond the setpoint for 100 milliseconds, uninterrupted, to qualify as a valid trip condition. Likewise, the input must fall outside the deadband and remain there for 100 milliseconds to return the alarm to an untripped condition. This results in a "dynamic deadband" —based on time— in addition to the normal deadband.

### Configuration

Unless otherwise specified, the factory presets the Model Q106 as follows:

- Input: Current
- Range: 0-20mA
- Output: Dual, SPDT
- Trip: A: HI, B: LO
- Failsafe: No
- Deadband: A, B: 0.25%

The AC power input accepts any AC source between 85 and 265VAC.

Note: An I/QRail is required to power the modules. See ordering information.

For other I/O ranges, refer to Table 1 and Figure 5. Reconfigure switch SW1 for the desired input type, range and function.

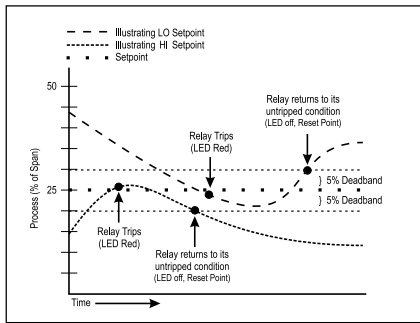


Figure 1: Limit alarm operation and effect of deadband.

**WARNING:** Do not change switch settings with power applied. Severe damage will result!

1. With the module removed from the rail and not powered, snap off the face plate by lifting the right edge away from the heat sink. Note the input switch (SW1) is located under the face plate. Set positions 9 & 10 for voltage or current input (see Table 1).
2. Set positions 1 through 4 of input range switch “SW1” for the desired input range (see Table 1).
3. Set position 5 of input range switch “SW1” to ON (closed) for unipolar (e.g., zero based, 0-20mA) range or OFF (open) for bipolar (e.g. -100% offset, -20 to 20mA) range.
4. Set positions 6 and 7 of input range switch “SW1” to ON for a HI trip setpoint or OFF for a LO trip setpoint.
5. Set position 8 of input range switch “SW1” to ON for non-failsafe operation or OFF for failsafe operation (e.g., alarm trips on power failure).

### Calibration

1. After configuring the DIP switches, connect the input to a calibrated DC source and apply power. Refer to the terminal wiring in the specifications section.

*Note: For best results, calibration should be performed in the operating environment, mounted on a DIN rail, allowing at least one hour for thermal equilibrium of the system.*

2. After applying power to the unit all three LEDs will flash for approximately 10 seconds. Adjust the input signal level for the Relay “A” setpoint. The green LED should be on. Press and hold the CAL button for four seconds (until the red LED starts flashing) to enter the calibration mode. The green LED will be on and the red Relay “A” LED will be flashing.

**NOTE:** If the green LED is flashing, the input is out of range (i.e. 7% above or below the configured range). Check to make sure the input signal is within the DIP switch configuration range. Double check the DIP switch settings.

3. Setpoint “A”: Input the desired trip level for Relay “A” and press the CAL button. The green LED and the red Relay “A” LED will be flashing. Note that the green LED will stop flashing when the input drops below a high setpoint or rises above a low setpoint.

4. Deadband “A”: For minimum deadband (approximately 0.25%), press and hold the CAL button for 4 seconds. For high setpoints, lower the input level to the desired deadband point and push the CAL button. For low setpoints increase the input level (green LED turns off) to the desired deadband level and push the CAL button. The green LED will be on and the red Relay “B” LED will be flashing.

5. Setpoint “B”: Input the desired trip level for Relay “B” and push the CAL button. The green and the red Relay “B” LED will be flashing. Note that the green LED will stop flashing when the input drops below a high setpoint or rises above a low setpoint.

6. Deadband “B”: For minimum deadband (approximately 0.25%), press and hold the CAL button for 4 seconds. For high setpoints lower the input level (green LED turns off) to the desired deadband point and push the CAL button. For low setpoints increase the input level to the desired deadband level and push the CAL button. The green LED will be on and both the red LEDs will be flashing.

7. Press the CAL button once again to exit the calibration mode. Check the setpoint and deadband to validate calibration.

### Relay Protection and EMI Suppression

When switching inductive loads, maximum relay life and transient EMI suppression is achieved by using external protection (see Figures 2 and 3). Place all protection devices directly across the load and minimize lead lengths. For AC inductive loads, place a properly rated MOV across the load in parallel with a series RC snubber. Use a 0.01 to 0.1mF pulse film capacitor (foil polypropylene recommended) of sufficient voltage, and a 47 ohm, 1/2W carbon resistor. For DC inductive loads, place a diode across the load (PRV > DC supply, 1N4006 recommended) with (+) to cathode and (-) to anode (the RC snubber is an optional enhancement).

Table 1: Q106 Input Range Switch

Voltage	Current	Input Range Selector SW1			
		1	2	3	4
10 mV	1 mA			■	
20 mV	2 mA			■	■
50 mV	5 mA		■		
100 mV	10 mA		■		■
200 mV	20 mA		■	■	
500 mV	50 mA		■	■	■
1V	100 mA	■			
2V		■			■
5V		■		■	
10V		■		■	■
20V		■	■		
50V		■	■		■
100V		■	■	■	
200V		■	■	■	■

Key: ■ = 1 = ON or Closed



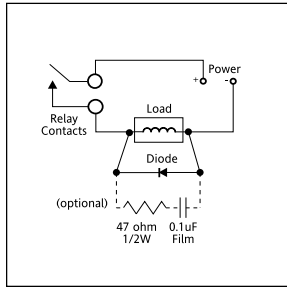


Figure 2: DC Inductive Loads

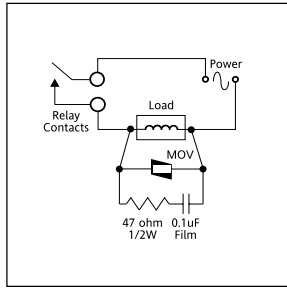


Figure 3: AC Inductive Loads

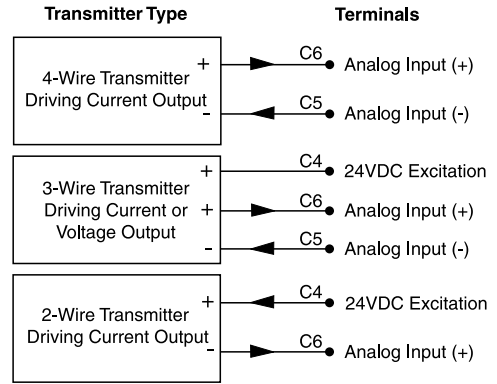
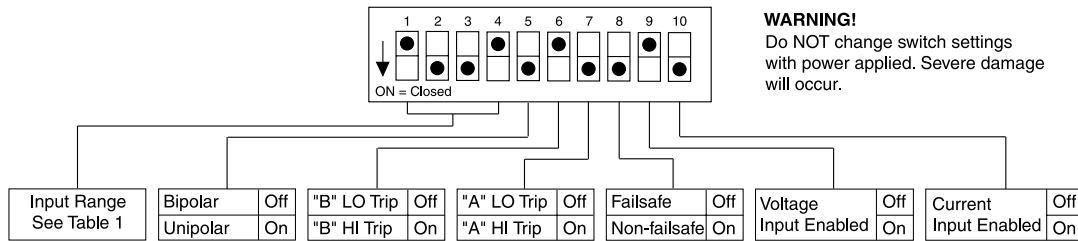


Figure 4: Typical Connections for Voltage or Current for Q106



**WARNING!**  
Do NOT change switch settings with power applied. Severe damage will occur.

Figure 5: Q106 Input Range/Function Selection (SW1) Factory Default Settings

Note: For voltage inputs Current Enable must be off. For current inputs Voltage Enable must be off.

Note:  
1. During normal operation, the green LED will be ON or flashing. The Red LEDs will be ON while the relative relay is tripped.  
2. In the calibration mode, if no button is pushed within 2 minutes, the unit will revert to normal operation.

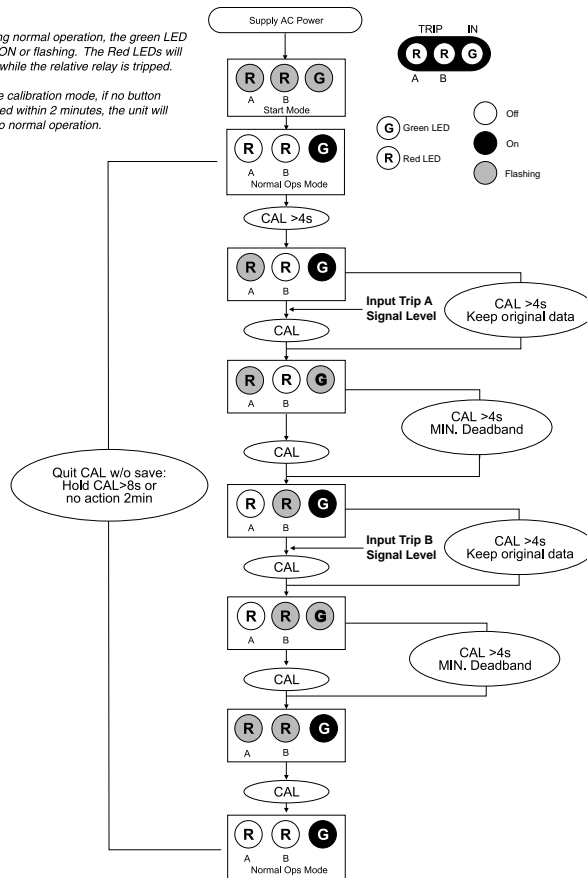


Figure 6: Q106 Calibration Flow Chart

**Specifications**

**Voltage Input:**

Range: 10mV to ±200V; Impedance: >100K ohms  
 Overvoltage: 200V rms, max.

**Current Input:**

Range: 1mA to ±100mA; Impedance: 20 ohms, typical  
 Overcurrent: 170mA rms, max.  
 Overvoltage: 60VDC (self-resetting fuse)  
 Common Mode (Input to Gnd): 1800VDC, max.

**LED Indicators:**

Input (Green):  
 >110% input: 8Hz flash  
 <10% input: 4Hz flash  
 Setpoint (Red):  
 Tripped: Solid red  
 Safe: Off

**Limit Differential (Deadband):**

>50mV/5mA: 0.25% to 100% of span  
 <50mV/5mA: 1% to 100% of span

**Response Time:**

Dynamic Deadband:  
 Relay status will change when proper setpoint/process condition exists for 100msec.  
 Normal Mode (analog filtering): <250mSec, (10-90%)

**Setpoints:**

Effectivity: Setpoints are adjustable over 100% of the selected input span.  
 Repeatability (constant temp.):  
 >50mV/5mA: 0.1% of full scale  
 <50mV/5mA: 0.2% of full scale

**Ordering Information**

**Models & Accessories**

**Specify (model number)**

- 1) **Q106-0000**
- 2) Specify I/QRail type and quantity (required)
- 3) Accessories: (see Accessories)
- 4) Optional Custom Factory Calibration: Specify **C620** with desired input, setpoint and deadband.

**Accessories**

Action/I/Q series modules mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition, the following accessories are available:

- MD02** TS32 DIN rail
- MD03** TS35 x 7.5 DIN rail
- IQRL-2002** 2 Position I/QRail & DIN rail
- IQRL-2004** 4 Position I/QRail & DIN rail
- IQRL-2008** 8 Position I/QRail & DIN rail

Terminal	Connection	Terminal	Connection
A1	Relay A, N.O.	C4	24 VDC Excitation
A2	Relay A, Common	C5	Input (-)
A3	Relay A, N.C.	C6	Input (+)
A4	Relay B, N.O.	P1	AC Power (Hot)
A5	Relay B, Common	P2	Not Used
A6	Relay B, N.C.	P3	Not Used
C1, C2, C3	Not Internally Connected	P4	AC Power (Neutral)

**Stability:**

Temperature: +0.05% of full scale/°C, max.

**Excitation Voltage:**

24VDC, 20mA, maximum

**Common Mode Rejection:**

DC to 60Hz: 120dB

**Isolation:**

1800VDC between contacts, input and power

**ESD & Transient Susceptibility:** Meets IEC 801-2, Level 3 (8KV)

**Humidity (Non-Condensing):**

Operating: 15 to 95% @ 45°C  
 Soak: 90% for 24hours @ 65°C

**Temperature Range:**

Operating: 0 to 55°C (32 to 131°F)  
 Storage: -25 to 70°C (-13 to 158°F)

**Power:** 2.5W max., 100 to 240VAC +10%, 50Hz -400Hz

**Relay Contacts:** 2 SPDT (2 form C) Relays; 1 Relay per setpoint

Current Rating (resistive) 120VAC:5A; 240VAC: 2A; 28VDC: 5A  
 Material: Gold flash over silver alloy

Electrical Life:10<sup>5</sup> operations at rated load

*Note: External relay contact protection is required for use with inductive loads.*

Mechanical Life: 10<sup>7</sup> operations

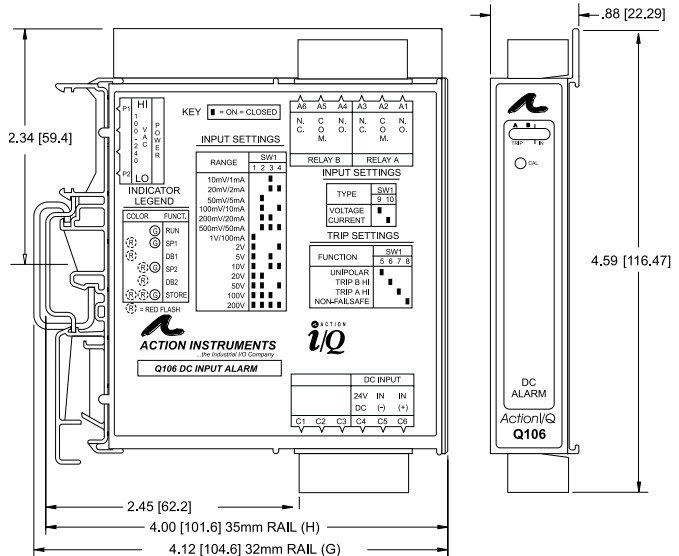
**Wire Terminations:** Screw terminations for 12-22 AWG

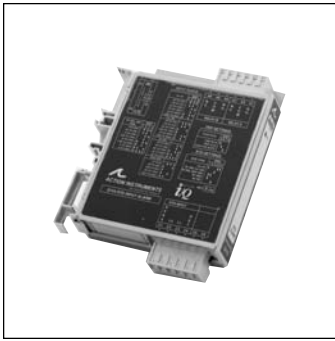
**Weight:** 0.56 lbs.

**Agency Approvals:**

CSA certified per standard C22.2 (File No LR42272)  
 UL recognized per standard UL508 (File No E99775)  
 CE EN61326, EN61010-1

**Dimensions**





Q116-0000



# ACTIONI/Q<sup>®</sup> Q116 AC Powered RTD Input Limit Alarm

Provides Relay Contact Closures  
at a Preset RTD Input Level



- Field Configurable Input Ranges
- TouchCAL™ Technology
- Setpoints Programmable HI or LO and Failsafe or Non-Failsafe
- DIN Rail Mounting with IQRL
- Universal AC Power 85 to 265 VAC
- SnapLoc™ Plug-in Terminals
- ASIC Technology

## Description

The ActionI/Q model Q116 is a DIN rail mount, RTD input limit alarm with dual setpoints and two contact closure outputs. The field configurable input and alarm functions offer flexible setpoint capability. There are up to eight temperature ranges available for each RTD type to ensure accuracy and maximize setpoint resolution.

The Q116 is configurable as a single or dual setpoint alarm, with HI or LO trips and failsafe or non-failsafe operation. Also included are adjustable deadbands (up to 100% of full scale input) for each setpoint and a universal AC power supply which accepts any voltage between 85 and 265VAC.

## TouchCAL Technology

Action has simplified setpoint calibration. Using a pushbutton instead of potentiometers, improvements in calibration resolution are realized due to the elimination of the potentiometer's mechanical variability.

For calibration, simply input the signal level of the desired trip and press the pushbutton to store it in non-volatile memory. Deadband is entered the same way with another pushbutton press to store.

## Diagnostic LEDs

The Q116 is equipped with three front panel LEDs. The green LED is a dual function LED labeled IN, which indicates line power and input signal status. Active AC power is indicated by the illuminated LED. If this LED is off, check AC power and wiring connections. If the input signal is 7% above or below the configured input range the green LED will flash at 8Hz or 4Hz, respectively.

The two red LEDs indicate the relay state of each setpoint. An illuminated red LED indicates the tripped condition for the respective setpoint.

## Output

The Q116 is equipped with two SPDT (form C) relays, rated at 120VAC or 28VDC at 5 amperes. Each of these relays is independently controlled by the field configurable setpoint and deadband.

## Operation

The Q116 limit alarm setpoints can be configured for HI or LO, failsafe or non-failsafe operation. Each of the setpoints has a respective HI or LO deadband. In a tripped condition, the setpoint is exceeded and the appropriate red LED will illuminate. The trip will reset only after the process falls below the HI deadband or rises above the low deadband (see Figure 1). For proper deadband operation, the HI setpoint must be set above the LO setpoint. In failsafe operation, the relay is energized when the process is below the HI setpoint or above the LO setpoint (opposite for non-failsafe). In the failsafe mode, a power failure results in an alarm state output.

## Dynamic Deadband

Circuitry in the Q116 prevents false trips by repeatedly sampling the input. The input must be beyond the setpoint for 100 milliseconds, uninterrupted, to qualify as a valid trip condition. Likewise, the input must fall outside the deadband and remain there for 100 milliseconds to return the alarm to an untripped condition. This results in a “dynamic deadband” —based on time— in addition to the normal deadband.

## Configuration

Unless otherwise specified, the factory presets the Model Q116 as follows:

- Input: Platinum (100 ohm)
- Range: 0 to 250°C
- Output: Dual, SPDT
- Trip: A: HI; B: LO
- Failsafe: No
- Deadband: A, B: 0.25%

The AC power input accepts any AC source between 85 and 265VAC.

*Note: An I/Q Rail is required to power the modules. See ordering information.*

For other I/O ranges, refer to Tables 1 through 4 and reconfigure switches SW1 and SW2 for the desired input type, range and function.

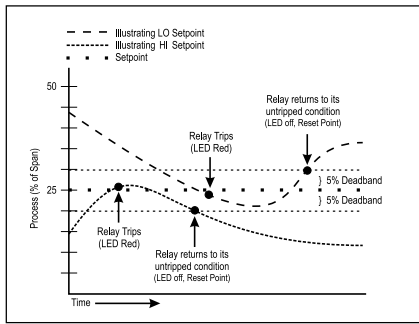


Figure 1: Limit alarm operation and effect of deadband.

**WARNING:** Do not change switch settings with power applied. Severe damage will result!

1. With the module removed from the rail and not powered, snap off the face plate by lifting the right edge away from the heatsink. Slide the heat sink off the module. Note the input switches (SW1 & SW2) are located under the heatsink. Set positions 1 through 8 on "SW2" and position 8 on SW1 for RTD type (see Tables 1 & 4).
2. Set position 1 through 4 of input range switch "SW1" for the desired RTD type and input temperature range (Table 3).
3. Set position 5 and 6 of input range switch "SW1" to ON (Closed) for a HI trip setpoint or OFF (Open) for a LO trip setpoint (Figure 6 & Table 2).
4. Set position 7 of input range switch "SW1" to ON (Closed) for non-failsafe operation or OFF (Open) for failsafe operation (e.g., alarm trips on power failure).

### Calibration

1. After configuring the DIP switches, connect the input to a calibrated RTD source or a resistance decade box and apply power.

*Note: For best results, calibration should be performed in the operating environment, mounted on a DIN rail, allowing at least one hour for thermal equilibrium of the system.*

2. After applying power to the unit all three LEDs will flash for approximately 10 seconds. Adjust the input signal level for the Relay "A" setpoint. The green LED should be on. Press and hold the CAL button for 4 seconds (until the red LED starts flashing) to enter the calibration mode. The green LED will be on and the red Relay "A" LED will be flashing.

Note: If the green LED is flashing, the input is out of range (i.e. 7 % above or below the configured range). Check to make sure the input signal is within the DIP switch configuration range. Double check the DIP switch settings.

3. Setpoint "A": Input the desired trip level for Relay "A" and push the CAL button. The green LED and the red Relay "A" LED will be flashing. Note that the green LED will stop flashing when the input drops below a high setpoint or rises above a low setpoint.

4. Deadband "A": For minimum deadband (approximately 0.25%), press and hold the CAL button for 4 seconds. For high setpoints, lower the input level to the desired deadband point and push the CAL button. For low setpoints, increase the input level (green LED

turns off) to the desired deadband level and push the CAL button. The green LED will be on and the red Relay "B" LED will be flashing.

5. Setpoint "B": Input the desired trip level for Relay "B" and push the CAL button. The green and the red Relay "B" LED will be flashing. Note that the green LED will stop flashing when the input drops below a high setpoint or rises above a low setpoint.

6. Deadband "B": For minimum deadband (approximately 0.25%), press and hold the CAL button for 4 seconds. For high setpoints, lower the input level (green LED turns off) to the desired deadband point and push the CAL button. For low setpoints, increase the input level to the desired deadband level and push the CAL button. The green LED will be on and both the red LEDs will be flashing.

7. Press the CAL button once again to exit the calibration mode. Check the setpoint and deadband to validate calibration.

### Relay Protection and EMI Suppression

When switching inductive loads, maximum relay life and transient EMI suppression is achieved using external protection (see Figures 2 and 3). Place all protection devices directly across the load and minimize all lead lengths. For AC inductive loads, place a properly rated MOV across the load in parallel with a series RC snubber. Use a 0.01 to 0.1mF pulse film capacitor (foil polypropylene recommended) of sufficient voltage, and a 47 ohm 1/2W carbon resistor. For DC inductive loads, place a diode across the load (PRV > DC supply, 1N4006 recommended) with (+) to cathode and (-) to anode (the RC snubber is an optional enhancement). For AC inductive loads, place a properly-rated MOV across the load in parallel with a series RC snubber. Use a 0.01 to 0.1mF pulse film capacitor (foil polypropylene recommended) with (+) to cathode and (-) to anode (the RC snubber is an optional enhancement).

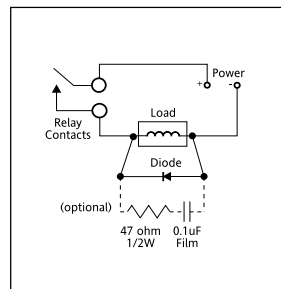


Figure 2: DC Inductive Loads

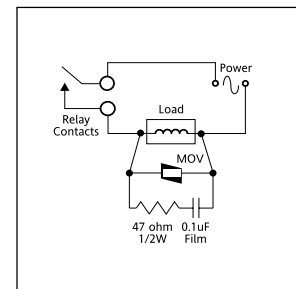


Figure 3: AC Inductive Loads

Table 1: RTD Input Type

RTD Input Type	Selector SW2					
	1	2	3	4	5	6
Cu10	■					■
Pt100, Cu100				■		
Pt500, NiFe604	■	■				
Pt1000		■				
Ni120				■		

Key: ■ = 1 = ON or Closed

**Table 2: Setpoint Function**

Setpoint Function	Selector SW1		
	5	6	7
Trip "B" HI	■		
Trip "A" HI		■	
Non-Failsafe			■

Key: ■ = 1 = ON or Closed

**Table 3: Input Range**

RTD Input Range	Selector SW1				Resistance (Ohms)
	1	2	3	4	
<b>Pt100, 500, 1000 (alpha = 0.00385)</b>					<b>*Pt100</b>
0 to 50° C (32 to 122° F)	■	■			100 to 119.4
-50 to 50° C (-58 to 122° F)	■	■			
0 to 100° C (32 to 212° F)			■	■	100 to 138.5
-100 to 100° C (-148 to 212° F)			■	■	60.2 to 138.5
0 to 250° C (32 to 482° F)	■	■			100 to 194.1
-200 to 250° C (-328 to 482° F)	■	■			18.5 to 194.1
0 to 550° C (32 to 1022° F)	■	■			100 to 297.4
0 to 850° C (32 to 1562° F)	■	■			100 to 390.3
<b>Cu10</b>	1	2	3	4	<b>Cu10</b>
25 to 70° C (77 to 158° F)	■	■			
-30 to 70° C (-22 to 158° F)	■	■			7.876 to 11.74
25 to 120° C (77 to 248° F)			■	■	10.0 to 13.67
-70 to 120° C (-94 to 248° F)			■	■	6.318 to 13.67
25 to 260° C (77 to 500° F)	■	■			10.0 to 19.116
-200 to 260° C (-328 to 500° F)	■	■			1.058 to 19.116
<b>Cu100</b>	1	2	3	4	<b>Cu100</b>
25 to 75° C (77 to 167° F)	■	■			100 to 115.5
-25 to 75° C (-13 to 167° F)	■	■			80.7 to 115.5
25 to 150° C (77 to 302° F)	■			■	100 to 148.3
-100 to 150° C (-148 to 302° F)	■			■	51.3 to 148.3
25 to 260° C (77 to 500° F)	■	■			100 to 191.2
-200 to 260° C (-328 to 500° F)	■	■			10.6 to 191.2
<b>Ni120</b>	1	2	3	4	<b>Ni120</b>
-30 to 30° C (-22 to 86° F)			■	■	99.4 to 142.1
-80 to 30° C (-112 to 86° F)			■	■	66.6 to 142.1
-30 to 100° C (-22 to 212° F)	■	■			
-30 to 200° C (-22 to 392° F)	■	■			99.4 to 303.5
-30 to 320° C (-22 to 608° F)	■	■			99.4 to 471.2
<b>NiFe604</b>	1	2	3	4	<b>NiFe604</b>
-40 to 0° C (-40 to 32° F)	■	■			499.1 to 604.0
-40 to 50° C (-40 to 122° F)	■	■			499.1 to 751.8
-200 to 50° C (-328 to 122° F)	■				245.3 to 751.8
-200 to 100° C (-328 to 212° F)	■				245.3 to 917.3
-200 to 240° C (-328 to 464° F)	■	■			245.3 to 1475.6

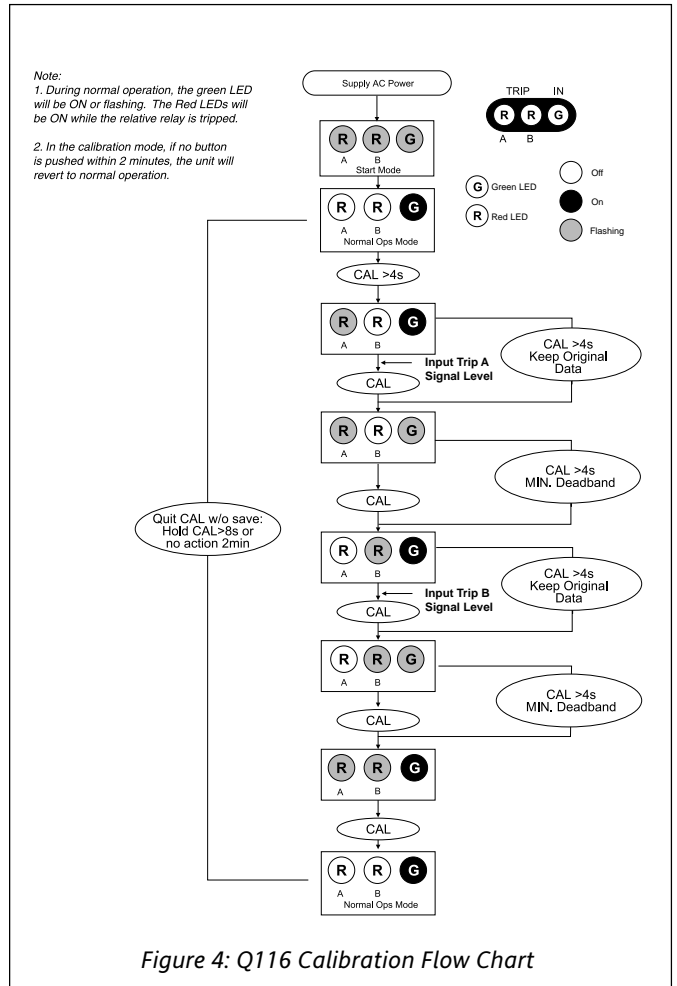
Key: n = 1 = ON or Closed

\*Resistance values for Pt500 and Pt1000 are 5 and 10 times the resistance of Pt100, respectively.

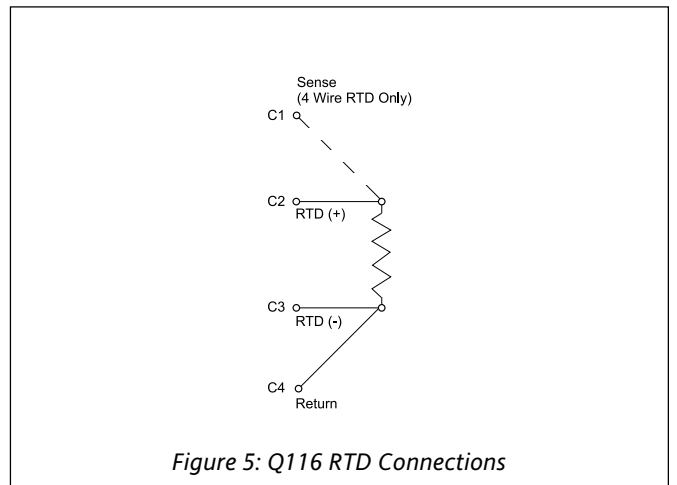
**Table 4: Excitation Type**

RTD Excitation	SW1	SW2
	8	7 8
3-wire RTD	■	■
4-wire RTD		■

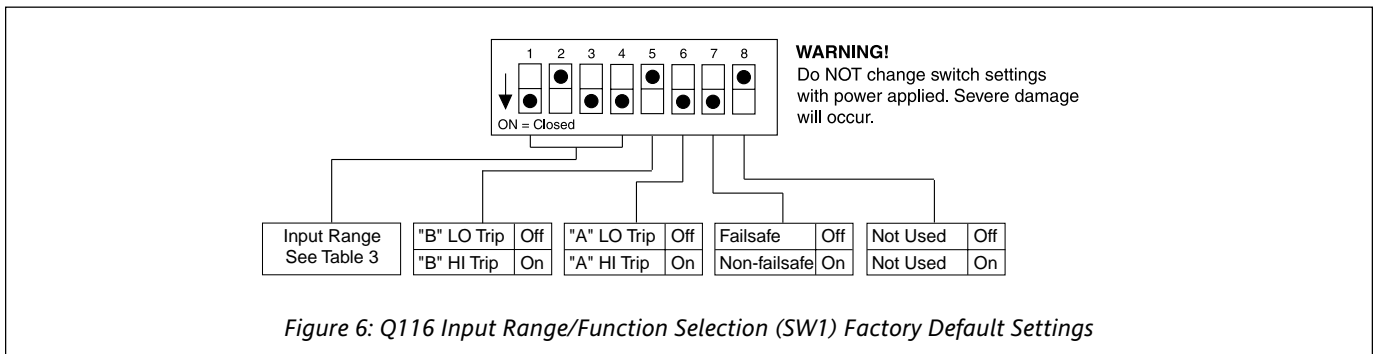
Key: ■ = 1 = ON or Closed



**Figure 4: Q116 Calibration Flow Chart**



**Figure 5: Q116 RTD Connections**



**Figure 6: Q116 Input Range/Function Selection (SW1) Factory Default Settings**

**Specifications**

**Sensor Types:**

Pt100, Pt500, Pt1000 (0.00385Ω/Ω/°C); Cu10, Cu100; Ni120, NiFe604

Sensor Connection: 3-wire.

Input Ranges: see Table 1.

**Excitation Current (Maximum):**

<2mA for Pt100, Pt500, Pt1000, Ni120, Cu100 or NiFe604

<10mA for Cu10

**Leadwire Resistance:**

40% of base sensor resistance or 100 ohms (whichever is less), maximum per lead.

**Leadwire Effect:**

Less than 1% of full scale over entire leadwire resistance range.

**Input Protection:**

Normal Mode: Withstands ±5VDC.

Common Mode (Input to Ground): 1800VDC, max.

**LED Indicators:**

Input Range (Green)

>110% input: 8Hz flash

<-10% input: 4Hz flash

Setpoint (Red)

Tripped: Solid red

Safe: Off

**Limit Differential (Deadband):** 0.25% to 100% of span

**Response Time:**

Dynamic Deadband: Relay status will change when proper setpoint/process condition exists for 100msec.

Normal Mode (analog filtering): <250mSec, (10-90%)

**Setpoints:**

Effectivity: Setpoints adjustable over 100% of the selected input span

Repeatability (constant temp.): ±0.2% of full scale

**Ordering Information**

**Models & Accessories**

**Specify (model number)**

- 1) **Q116-0000**
- 2) Specify I/QRail type and quantity (required)
- 3) Accessories: (see Accessories)
- 4) Optional Custom Factory Calibration: Specify **C620** with desired input, setpoint and deadband.

**Accessories**

ActionI/Q series modules mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition, the following accessories are available:

**MD02** TS32 DIN rail

**MD03** TS35 x 7.5 DIN rail

**IQRL-2002** 2 Position I/QRail & DIN rail

**IQRL-2004** 4 Position I/QRail & DIN rail

**IQRL-2008** 8 Position I/QRail & DIN rail

Terminal	Connection	Terminal	Connection
A1	Relay A, N.O.	C3	RTD Input (-)
A2	Relay A, Common	C4	RTD Input Return
A3	Relay A, N.C.	C5	Not Used
A4	Relay B, N.O.	C6	Not Used
A5	Relay B, Common	P1	AC Power (Hot)
A6	Relay B, N.C.	P2	Not Used
C1	RTD Input Sense	P3	Not Used
C2	RTD Input (+)	P4	AC Power (Neutral)

**Stability:**

Line Voltage: ±0.01%/%, max.

Temperature: ±0.05% of full scale/°C, max.

**Common Mode Rejection:**

DC to 60Hz: 120dB

>60Hz: 100dB

**Isolation:** 1800VDC between contacts, input and power

**ESD Susceptibility:** Capable of meeting IEC 801-2 level 3(8KV)

**Humidity (Non-Condensing):**

Operating: 15 to 95% @45°C

Soak: 90% for 24 hours @65°C

**Temperature Range:**

Operating: -15 to 55°C (5 to 131°F)

Storage: -25 to 75°C (-13 to 158°F)

**Power:** 2.5W max.; 100 to 240VAC ±10%; 50-400Hz

**Relay Contacts:**

2 SPDT (2 form C) Relays, 1 Relay per setpoint

Current Rating (resistive):

120VAC: 5A; 240VAC: 2A; 28VDC: 5A

Material: Gold flash over silver alloy

Electrical Life: 10<sup>5</sup> operations at rated load

*Note: External relay contact protection is required for use with inductive loads.*

Mechanical Life: 10<sup>7</sup> operations

**Weight:** 0.56lbs.

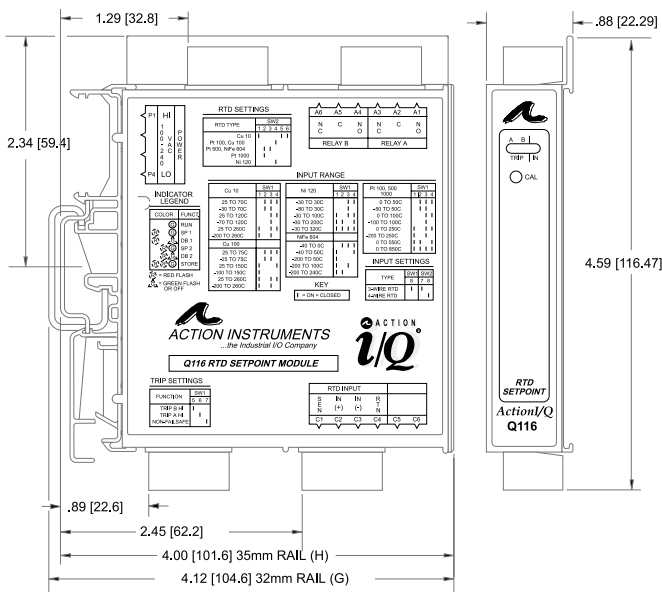
**Agency Approvals:**

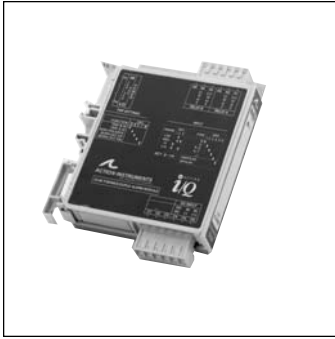
CSA certified per standard C22.2 (File No LR 42272).

UL recognized per standard UL 508 (File No E99775).

CE EN61326, EN61010-1

**Dimensions**





Q126-0000



# ACTIONI/Q® Q126 AC Powered T/C Input Limit Alarm

Provides Relay Contact Closures  
at a Preset Temperature Input Level



- Field Configurable Input Ranges
- TouchCAL™ Technology
- Setpoints Programmable HI or LO and Failsafe or Non-Failsafe
- DIN Rail Mounting with IQRL
- Universal AC Power 85 to 265 VAC
- SnapLoc™ Plug-in Terminals
- ASIC Technology

## Description

The ActionI/Q model Q126 is a DIN rail mount, thermocouple input limit alarm with input terminal cold junction compensation (cjc), dual setpoints and two contact closure outputs. The field configurable input and alarm functions offer flexible setpoint capability. There are up to six temperature ranges available for each thermocouple type to ensure accuracy and maximize setpoint resolution. A bipolar input switch is provided for temperature ranges below 0°C.

The Q126 is configurable as a single or dual setpoint alarm, with HI or LO trips, upscale or downscale thermocouple burnout detection and failsafe or non-failsafe operation. Also included are adjustable deadbands (up to 100% of full scale input) for each setpoint and a universal AC power supply which accepts any voltage between 85 and 265VAC.

## TouchCAL Technology

Action has simplified setpoint calibration. Using a pushbutton instead of potentiometers, improvements in calibration resolution and reliability are realized due to the elimination of the potentiometer's mechanical variability. For calibration, the user simply inputs the signal level of the desired trip, then presses the push-button to store it in non-volatile memory. The deadband, or hysteresis, level is input next and is stored with another press of the button.

## Diagnostic LEDs

The Q126 is equipped with three front panel LEDs. The green LED is a dual function LED labeled IN, which indicates line power and input signal status. Active AC power is indicated by the illuminated LED. If this LED is off, check AC power and wiring connections. If the input signal is 7% above or below the configured input range the green LED will flash at 8Hz or 4Hz, respectively. The two red LEDs indicate the relay state of each setpoint. An illuminated red LED indicates the tripped condition for the respective setpoint.

## Output

The Q126 is equipped with two SPDT (form C) relays, rated at 120VAC or 28VDC at 5 amperes. Each of these relays is independently controlled by the field configurable setpoint and deadband.

## Operation

The Q106 limit alarm setpoints can be configured for HI or LO, failsafe or non-failsafe operation. Each of the setpoints has a respective HI or LO deadband. In a tripped condition, the setpoint is exceeded and the appropriate red LED will illuminate. The trip will reset only after the process falls below the HI deadband or rises above the low deadband (see Figure 1). For proper deadband operation, the HI setpoint must be set above the LO setpoint. In failsafe operation, the relay is energized when the process is below the HI setpoint or above the LO setpoint (opposite for non-failsafe). In the failsafe mode, a power failure results in an alarm state output.

## Dynamic Deadband

Circuitry in the Q106 prevents false trips by repeatedly sampling the input. The input must be beyond the setpoint for 100 milliseconds, uninterrupted, to qualify as a valid trip condition. Likewise, the input must fall outside the deadband and remain there for 100 milliseconds to return the alarm to an untripped condition. This results in a “dynamic deadband” —based on time— in addition to the normal deadband.

## Configuration

Unless otherwise specified, the factory presets the Model Q126 as follows:

- Input: Type J
- Range: 0 to 350°C
- Output: Dual, SPDT
- Trip: A: HI, B: LO
- Failsafe: No
- Deadband: A, B: 0.25%

The AC power input accepts any AC source between 85 and 265VAC.

*Note: An I/QRail is required to power the modules. See ordering information.*

For other I/O ranges, refer to Table 1 and reconfigure switches SW1 and SW2 for the desired input type, range and function.

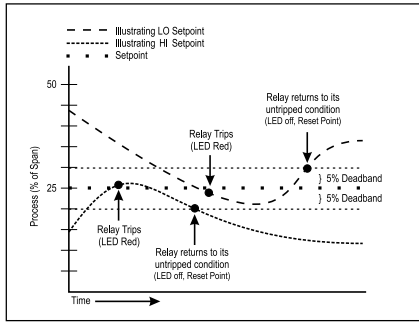


Figure 1: Limit alarm operation and effect of deadband.

**WARNING:** Do not change switch settings with power applied. Severe damage will result!

1. With the module removed from the rail and not powered, snap off the faceplate by lifting the right edge away from the heatsink. Note the input switches (SW1 & SW2) are located under the faceplate. Set positions 1 through 3 on "SW1" and positions 1 through 8 on "SW2" for the desired input and range (see Table 1).
2. Set positions 4 and 5 of "SW1" to ON (closed) for a HI trip setpoint or OFF (open) for a LO trip setpoint (Figure 5).
3. Set position 6 of "SW1" to ON for non-failsafe operation or OFF for failsafe operation (e.g., alarm trips upon power failure).
4. Set positions 7 and 8 of "SW1" to upscale or downscale burnout.

### Calibration

1. After configuring the DIP switches, connect the input to a calibrated t/c source and apply power.

Note: For best results, calibration should be performed in the operating environment, mounted on a DIN rail, allowing at least one hour for thermal equilibrium of the system.

2. After applying power to the unit all three LEDs will flash for approximately 10 seconds. Adjust the input signal level for the Relay "A" setpoint. The green LED will be on. Press and hold the CAL button for 4 seconds (until the red LED starts flashing) to enter the calibration mode. The green LED will be on and the red Relay "A" LED will be flashing.

**Note:** If the green LED is flashing, the input is out of range (i.e. 7% above or below the configured range). Check to make sure the input signal is within the DIP switch configuration range. Double check dip switch settings.

3. Setpoint "A": Input the desired trip level for Relay "A" and push the CAL button. The green and the red Relay "A" LED will be flashing. Note that the green LED will stop flashing when the input drops below a high setpoint or rises above a low setpoint.

4. Deadband "A": For minimum deadband (approximately 0.25%), press and hold the CAL button for 4 seconds. For high setpoints lower the input level to the desired deadband point and push the CAL button. For low setpoints increase the input level to the desired deadband level and push the CAL button. The green LED will be on and the red Relay "B" LED will be flashing.

5. Setpoint "B": Input the desired trip level for Relay "B", and push the CAL button. The green and the red Relay "B" LED will be flashing.

6. Deadband "B": For minimum deadband (approximately 0.25%), press and hold the CAL button for 4 seconds. For high setpoints lower the input level to the desired deadband point and push the CAL button. For low setpoints increase the input level to the desired deadband level and push the CAL button. The green LED will be on and both the red LEDs will be flashing.

7. Press the CAL button once again to exit the calibration mode. Check the setpoint and deadband to validate calibration.

**Note:** Pressing and holding the CAL button for >8s or no action for more the 2 min will quit the calibration process without saving changes anywhere within the calibration process.

### Relay Protection and EMI Suppression

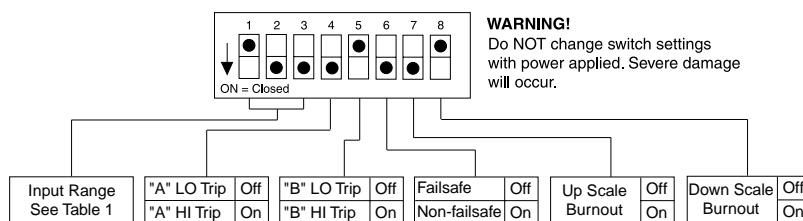
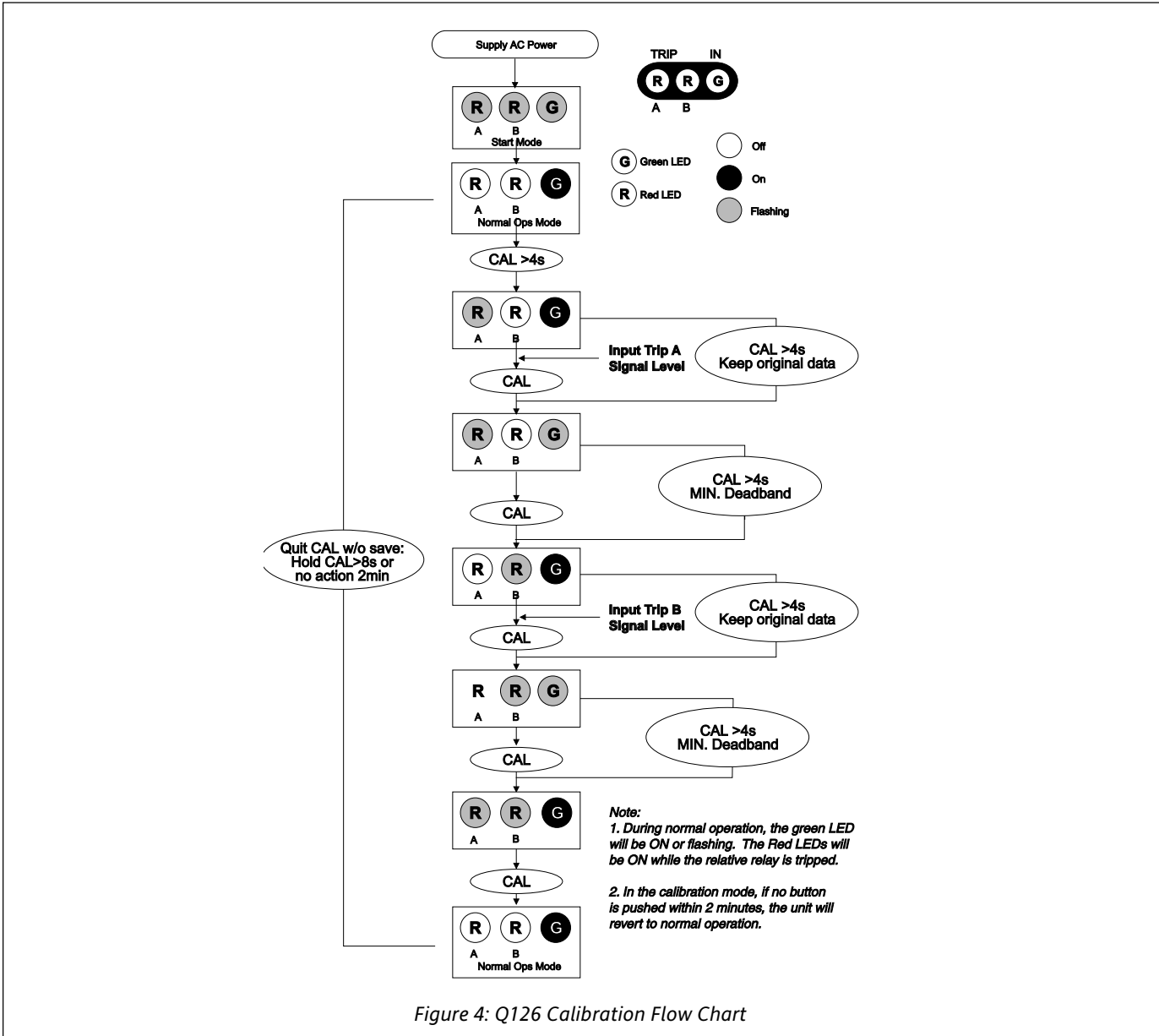
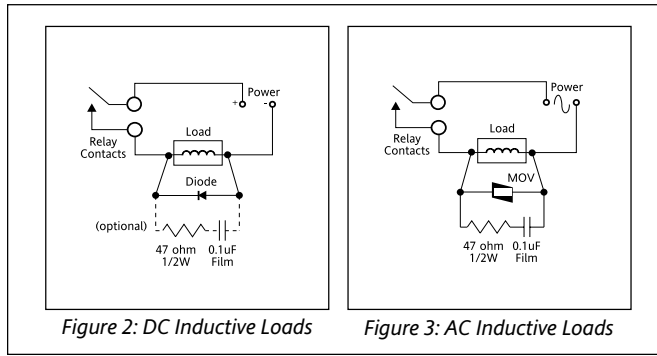
When switching inductive loads, maximum relay life and transient EMI suppression is achieved using external protection (see Figures 2 and 3). Place all protection devices directly across the load and minimize all lead lengths. For AC inductive loads, place a properly-rated MOV across the load in parallel with a series RC snubber. Use a 0.01 to 0.1mF pulse film capacitor (foil polypropylene recommended) of sufficient voltage, and a 47 ohm, 1/2W carbon resistor. For DC inductive loads, place a diode across the load (PRV > DC supply, 1N4006 recommended) with (+) to cathode and (-) to anode (the RC snubber is an optional enhancement).

Table 1: Input Range

TC	Input Range	Selector SW2								SW1		
		1	2	3	4	5	6	7	8	1	2	3
B	0 to 1490° C (32 to 2714° F)	■								■	■	
B	0 to 1820° C (32 to 3308° F)	■								■	■	■
C	0 to 550° C (32 to 1022° F)						■			■	■	■
C	0 to 1000° C (32 to 1832° F)						■			■	■	■
C	0 to 2320° C (32 to 4208° F)						■			■	■	
E	0 to 150° C (32 to 302° F)	■								■	■	
E	0 to 290° C (32 to 554° F)	■								■	■	■
E	0 to 660° C (32 to 1220° F)	■								■	■	
E	0 to 1000° C (32 to 1832° F)	■								■	■	■
E	-270 to 150° C (-454 to 302° F)	■								■		
E	-270 to 290° C (-454 to 554° F)	■								■	■	
J	0 to 190° C (32 to 374° F)				■					■	■	■
J	0 to 350° C (32 to 662° F)				■					■	■	■
J	0 to 760° C (32 to 1400° F)				■					■	■	
J	-210 to 190° C (-364 to 374° F)				■					■		■
J	-210 to 350° C (-364 to 662° F)				■					■	■	■
K	0 to 250° C (32 to 482° F)			■						■	■	■
K	0 to 480° C (32 to 896° F)			■						■	■	■
K	0 to 1280° C (32 to 2336° F)			■						■	■	
K	0 to 1372° C (32 to 2502° F)			■						■	■	■
K	-270 to 250° C (-454 to 482° F)			■						■		■
K	-270 to 480° C (-454 to 896° F)			■						■	■	■
N	-200 to 300° C (-328 to 572° F)							■			■	
N	0 to 300° C (32 to 572° F)							■		■	■	
N	0 to 550° C (32 to 1022° F)							■		■	■	■
N	0 to 1300° C (32 to 2372° F)							■		■	■	
R	0 to 970° C (32 to 1778° F)			■						■	■	
R	0 to 1690° C (32 to 3000° F)			■						■	■	■
R	0 to 1760° C (32 to 3200° F)			■						■	■	
S	0 to 1050° C (32 to 1922° F)			■						■	■	
S	0 to 1750° C (32 to 3182° F)			■						■	■	■
T	0 to 210° C (32 to 410° F)				■					■	■	
T	0 to 390° C (32 to 734° F)				■					■	■	■
T	-270 to 210° C (-454 to 410° F)				■					■		■
T	-270 to 390° C (-454 to 734° F)				■					■	■	■

Key: ■ = 1 = ON or Closed





**Figure 5: Input Range/Function Selection (SW1) Factory Default Settings**

**Specifications**

**Inputs:**

- Range: See Table 1
- Impedance: >1 Megohm
- Input Bias Current (burnout detect): <1.5 microamp
- Overvoltage: ±10V differential
- Common Mode (Input to Ground): 1800VDC, max.

**LED Indicators:**

- Input Range (Green)
  - >110% input: 8Hz flash
  - <-10% input: 4Hz flash
- Setpoint (Red):
  - Tripped: Solid red
  - Safe: off

**Limit Differential (Deadband):**

0.25% to 100% of span

**Response Time:**

- Dynamic Deadband:
  - Relay status will change when proper setpoint/process condition exists for 100msec
- Normal Mode (analog filtering):
  - <250msec, (10-90%)

**Setpoint:**

- Effectivity: Setpoints adjustable over 100% of the selected input span.
- Repeatability (constant temp.):
  - 0.2% for temp > 0°C
  - 0.3% for temp < 0°C

**Stability:**

Temperature: ±0.05% of full scale/°C, max.

**Common Mode Rejection:**

DC to 60Hz: 120dB

**Isolation:**

1800VDC between contacts, input and power

**ESD Susceptibility:**

Capable of meeting IEC 801-2 level 3 (8kV)

**Humidity (Non-Condensing):**

- Operating: 15 to 95% @45°C
- Soak: 90% for 24 hours @65°C

**Temperature Range:**

- Operating: 0 to 55°C (32 to 131°F)
- Storage: -15 to 70°C (5 to 158°F)

**Power:**

2.5W max. 100 to 240VAC ±10%, 50 to 400Hz

**Relay Contacts:**

- 2 SPDT (2 Form C) Relays, 1 Relay per setpoint
- Current Rating (resistive):
  - 120VAC: 5A; 240VAC: 2A; 28VDC: 5A
- Material: Gold flash over Silver alloy
- Electrical Life: 10<sup>5</sup> operations at rated load
- Note: External relay contact protection is required for use with inductive loads.*
- Mechanical Life: 10<sup>7</sup> operations

**Wire Termination:**

Screw terminations for 12-22 AWG

**Weight:**

0.56lbs.

**Agency Approvals:**

- CSA certified per standard C22.2 (File No LR 42272).
- UL recognized per standard UL 508 (File No E99775).
- CE EN61326, EN61010-1

**Ordering Information**

**Models & Accessories**

**Specify (model number)**

- 1) **Q126-0000**
- 2) Specify I/QRail type and quantity (required)
- 3) Accessories: (see Accessories)
- 4) Optional Custom Factory Calibration: Specify **C620** with desired input, setpoint and deadband.

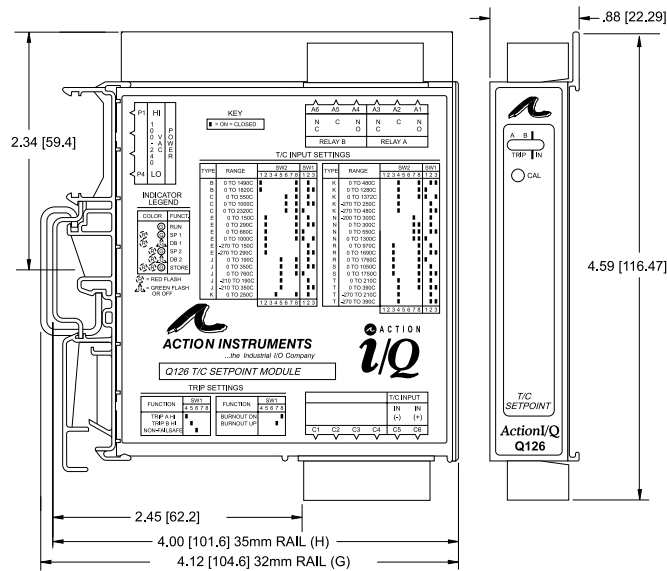
**Accessories**

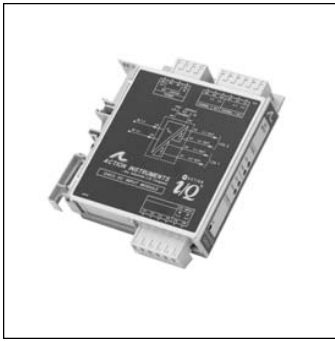
ActionI/Q series modules mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition, the following accessories are available:

- MD02** TS32 DIN rail
- MD03** TS35 x 7.5 DIN rail
- IQRL-2002** 2 Position I/QRail & DIN rail
- IQRL-2004** 4 Position I/QRail & DIN rail
- IQRL-2008** 8 Position I/QRail & DIN rail

Terminal	Connection	Terminal	Connection
A1	Relay A, N.O.	C3	Not Used
A2	Relay A, Common	C4	Not Used
A3	Relay A, N.C.	C5	Thermocouple Input (-)
A4	Relay B, N.O.	C6	Thermocouple Input (+)
A5	Relay B, Common	P1	AC Power (Hot)
A6	Relay B, N.C.	P2	Not Used
C1	Not Used	P3	Not Used
C2	Not Used	P4	AC Power (Neutral)

**Dimensions**





Q403-1 (1 input; 1 output)  
Q403-2 (2 inputs; 2 outputs)

# ACTIONI/Q® Q403

## AC Powered DC Input Multi-Channel Isolator

Provides 1 or 2 Fully Isolated DC Output Signals  
in Proportion to 1 or 2 DC Inputs



- Multi-Channel Design
- 2000VAC Isolation
- High Density DIN Rail Mounting

- Universal AC Power 85 to 265 VAC
- SnapLoc™ Plug-in Terminals
- Fast Response

### Description

The model Q403 is a fast response, DIN rail mount, DC input signal conditioner with 2000VAC isolation between input, output and power. It is available as a single channel signal conditioner (1 input/1 output) or multi-channel signal conditioner (2 inputs/2 outputs).

Factory configured input and output ranges support bipolar voltage signals ( $\pm 5$  Volts and  $\pm 10$  Volts) or unipolar ranges of 4-20mA, 0-5 Volts, 0-10 Volts and 1-5 Volts. Front accessed zero and span potentiometers allow adjustment of offset and gain to compensate for sensor errors or signal losses.

All ActionI/Q modules feature SnapLoc plug-in, screw terminals for easy installation. Two or more modules can slide together and interlock for solid, high density mounting (remove either the DIN rail foot or the adjacent unit's face plate, for right side or left side mounting, respectively). The module to be attached will easily slide on to the side of the mounted unit.

### Application

DC input four-wire transmitters are used to isolate and convert DC voltage or current signals into proportional, standard industrial control signals such as -5/5V or -10/10V. Typically an industrial control system such as a DCS or PLC requires standard industrial control signals and isolation to ensure reliable strong signals.

In most industrial process control or data acquisition applications several different input sources, including voltages and currents from various field instruments (e.g. level, flow, pressure and position sensors), are common. Four-wire transmitters accept these field inputs and provide the controller (DCS & PLC) with the standard industrial signals it requires. The four-wire transmitter will increase the signal drive to high impedance loads and may improve resolution of the process variable.

The 2000VAC isolation capability of the Q403 prevents ground loops from causing errors in DC signals. Filtering and common mode rejection are included to reduce susceptibility to EMI and RFI. Isolation also provides protection from high voltages and current spikes which can damage expensive Supervisory Control and Data Acquisition (SCADA) equipment.

### Operation

The Q403 operates as a four-wire transmitter; each channel derives its power from an independent, transformer isolated, AC to DC power source (85 to 265VAC).

The Q403 has fixed input/output ranges. The standard I/O ranges in Tables 1 are calibrated to rated accuracy. One range per module; two channels per module, maximum.

### Calibration

*Note: For best results, calibration should be performed with the intended output load, in the operating environment, mounted on a DIN rail, allowing at least one hour for thermal equilibrium of the system.*

1. To check calibration connect the input to a calibrated DC source. Connect the output to a DC voltage or current meter and the input power to an AC source (between 85 and 256 VAC) capable of providing up to 0.5 Amps.
2. Set the calibrator to the specified minimum DC input value and adjust the zero potentiometer for minimum (e.g. -10V) output.
3. Set the calibrator to the specified maximum DC input value and adjust the span potentiometer for maximum (e.g. +10V) output.
4. Repeat steps 2 and 3 to validate calibration to the output load.

Table 1: Standard Ranges

Available Models		
Model	Input	Output
Q403-1L08	0 to 10 Volts	4 to 20 mA
Q403-1L09	0 to 10 Volts 0 to 10 Volts 0 to 10 Volts	0 to 5 Volts 1 to 5 Volts 0 to 10 Volts
Q403-1L28	-10/10 Volts -10/10 Volts	-5/5 Volts -10/10 Volts
Q403-2L00	4 to 20mA (both Channels)	4 to 20mA (both Channels)

**Specifications**

**Inputs:**

- Range: see Table 1
- Impedance:  $\geq 1M$  ohms (voltage inputs)  
 $\leq 20$  ohms (current inputs)
- Protection:  
withstands up to 24VDC (current input), 120VAC (voltage input) without damage
- Common Mode: 2000VAC, input to ground

**Outputs:**

- Range: see Table 1
- Voltage Output Drive: 10mA (1k ohms, min.)
- Current Output Compliance: 15V (750 ohms, max.)

**Output Accuracy:**

- $\leq \pm 0.1\%$  of full-scale input typical,
- $\leq \pm 0.2\%$  maximum @ 23°C including linearity, repeatability and hysteresis

**LED Indication:**

Green LED indicates power on

**Adjustability:**

Front accessed 10 turn pot. for zero and span

**Stability:**

$\leq 0.025\%/^{\circ}C$  maximum for full-scale and zero

**ESD Susceptibility:**

Capable of meeting IEC 801-2 level 3 (8kV)

**Isolation:**

$\geq 2000VAC$  between input, output, power and channel to channel

**Response Time:**

- 100 microSec, -3dB @ 3500Hz (bipolar)
- 25mSec (10 to 90%)(unipolar)

**Power:**

85 to 256VAC, 2.5W per channel max.

**Temperature:**

- Operating: -5 to 60°C (23 to 140°F)
- Storage: -40 to 80°C (-40 to 176°F)

**Humidity (non-condensing):**

- Operating: 15 to 90% @45°C
- Soak: 90% for 24 hours @60°C

**Wire Terminal:**

Socketed screw terminals for 12-22 AWG

**Agency Approvals:**

- CSA certified per standard 22.2 (File No LR42272).
- UL recognized per standard UL508 (File No E99775).
- CE compliance per EMC directive 89/336/EEC and low voltage 73/23/EEC.

**Ordering Information**

Models & Accessories

**Specify:**

1. Model: **Q403-1:** One Input, one output  
**Q403-2:** Two inputs, two outputs
2. Input Range: (see Table 1)
3. Output Range: (see Table 1)
4. Accessories: (see Accessories)

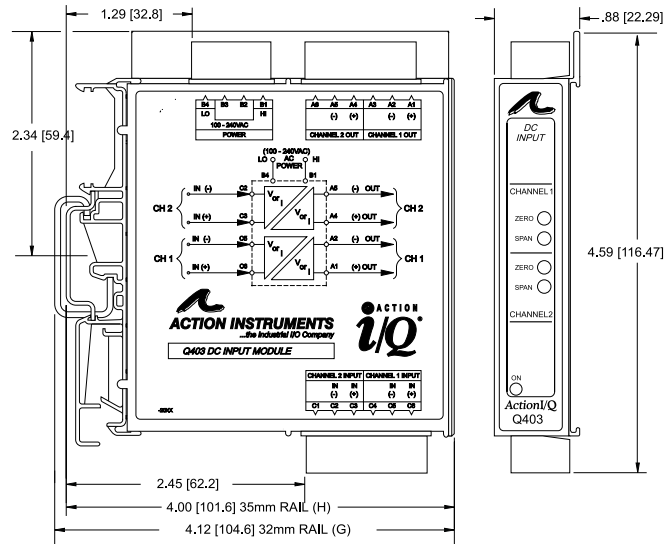
**Accessories**

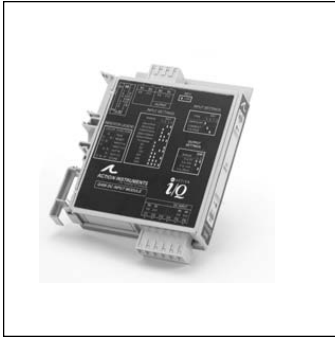
ActionIQ modules mount on standard TS3(model MD02) or TS35 (model MD03) DIN rail. In addition the following accessories are available:

- MD02** TS32 DIN rail
- MD03** TS35 x 7.5 DIN rail

Terminal	Connection	Terminal	Connection
A1	Channel 1, Output (+)	C3	Channel 2, DC Input (+)
A2	Channel 1, Output (-)	C4	Not Connected
A3	Not Connected	C5	Channel 1, DC Input (-)
A4	Channel 2, Output (+)	C6	Channel 1, DC Input (+)
A5	Channel 2, Output (-)	B1	AC Power (Hot)
A6	Not Connected	B2	Not Connected
C1	Not Connected	B3	Not Connected
C2	Channel 2, DC Input (-)	B4	AC Power (Neutral)

**Dimensions**





# ACTIONI/Q® Q406

## AC Powered DC Input Multi-Channel Isolator

- Q406-A000 (1 input; 1 output)
- Q406-A001 (1 input; 1 output with Excitation Source)
- Q406-A002 (signal splitter: 1 input; 2 output)
- Q406-A003 (1 input; 2 output with Excitation Source)
- Q406-A004 (2 input; 2 output)

Provides 1 or 2 Fully Isolated DC Output Signals  
in Proportion to 1 or 2 DC Inputs



- Field Configurable Input Ranges
- Field Configurable Output Ranges
- 1800VAC Isolation
- TouchCAL™ Technology
- High Density DIN Rail Mounting
- Universal AC Power 85 to 265 VAC
- SnapLoc™ Plug-in Terminals

### Description

The model Q406 is an AC powered, DIN rail mount, DC input signal conditioner, with 1800V isolation between input, output and power. The field configurable input and output feature offers flexible, wide ranging capability for DC current and voltage signals.

The Q406 is available as a single channel signal conditioner (1 input/1 output) or as a multi-channel signal conditioner (1 input/2 outputs, or 2 inputs/2 outputs). All models maintain the high 1800V isolation level from channel to channel, as well as input to output to power.

### TouchCAL Technology

Action has simplified setpoint calibration. Using a pushbutton instead of potentiometers, improvements in calibration resolution and reliability are realized due to the elimination of the potentiometers' mechanical variability. The thermal drift and mechanical variability of the potentiometers has been removed and replaced with a digitally stable circuit. Additionally, the inherent zero and span interactivity of analog amplifier circuitry is removed, providing 100% non-interactive adjustment.

The Q406 can be field configured for virtually any DC input to DC output within the limits specified. Calibration utilizes "TouchCAL" technology where the user simply configures the input for the current or voltage range via switches, then follows the Calibration Flow Chart. The output is set by adjusting the input until the desired output is present and then pressing the CAL button to store the output level.

Optionally available is a 24VDC excitation source (20mA max.) common to the input and isolated from AC power, which can be used to power a two- or three-wire transducer.

### Diagnostic LEDs

The Q406 has three diagnostic LEDs. The green (RUN) LED is used for diagnostics to indicate that power is on. It will flash quickly if the input signal is above the calibrated range or slowly if the input signal is below range. It is on continuously when the unit is functioning within the calibrated range.

The yellow (IN) LED is on while calibrating the input and the red (OUT) LED is on while calibrating the output.

### Configuration

The Q406 can be configured for input ranges from 10mV to 100V or 1mA to 100mA, with >90% input offset or will adjust down to <10% of full scale input span (except on 20mV/2mA range where maximum offset or gain adjustment is 50%). Unless a specific custom calibration is specified, the factory presets the Model Q406 as follows:

- Input Range: 20mA (Current on)
- Input Configuration: Unipolar
- Calibrated Input: 4-20mA
- Operation: Direct (Reverse off)
- Calibrated Output: 4-20mA

For other I/O ranges, refer to the tables below.

**WARNING:** Do not change switch settings with power applied. Severe damage will result!

1. With power off, snap off the faceplate by lifting the right edge away from the heatsink. Slide the heatsink forward and off the module.
2. The single channel module has two eight position switch blocks, one for input and one for output. The dual output modules have a second board behind the heatsink. Gently lift this board away from the main board, rocking it back while lifting. The one input, two output module has one ten position switch block for input and channel 1 output, along with a two position switch for the second output. The two input, two output module has two ten position switch blocks, one for each channel.
3. For single channel modules, choose the desired input, function and output range from Table 1, 2, and 3. For multi-channel modules, use Table 4. Set the dip switches for the desired I/O.

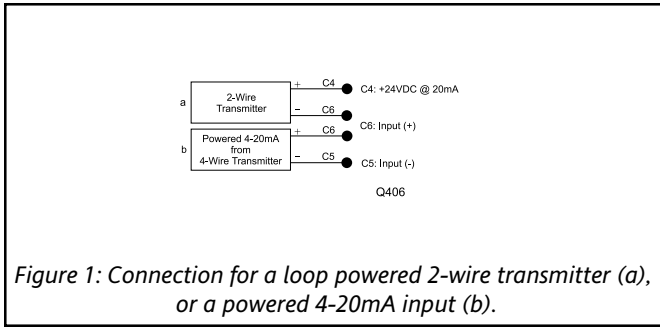


Figure 1: Connection for a loop powered 2-wire transmitter (a), or a powered 4-20mA input (b).

**Calibration**

Note: For best results, calibration should be performed with the intended output load, in the operating environment, mounted on a DIN rail, allowing at least one hour for thermal equilibrium of the system.

1. Install the module on to a piece of DIN rail and the I/Q Rail mounting combination. See the I/Q Rail Data sheet for details.

Note: An I/Q Rail is required to deliver power to the modules. See ordering information.

2. Connect the input to a calibrated DC source and the output to a voltage or current meter. Apply power and allow the system to reach thermal equilibrium (approx. 20 minutes).

3. Adjust the input signal to the desired maximum and observe that the green LED is on or flashing. Push the CAL button and hold it down for more than 5 seconds (until the yellow and Green LEDs are flashing).

Table 1: Input Range Settings for Single Channel Modules

Ranges		Selector SW1			
Voltage	Current	1	2	3	4
20mV	2mA			■	■
50mV	5mA		■		
100mV	10mA		■		■
200mV	20mA		■	■	
500mV	50mA		■	■	■
1V	100mA	■			
2V		■			■
5V		■		■	■
10V		■	■		
25V		■	■	■	■
50V		■	■	■	■
100V		■	■	■	■

Key: ■ = 1 = ON or Closed

Table 2: Input Function Settings for Single Channel Modules

Type	Selector SW1			
	5	6	7	8
Unipolar	■	-	-	-
Bipolar	-	-	-	-
Reverse	-	■	-	-
Direct	-	-	-	-
Current	-	-	-	■
Voltage	-	-	-	■

Key: ■ = 1 = ON or Closed; - = n/a

4. When the yellow and green LEDs stop flashing, the yellow and red LEDs will be on. Push the CAL button momentarily (the yellow and green LEDs will be on).

Note: To quit the calibration mode and reset the unit, push the CAL button and hold for more than 5 seconds. Or, wait for more than two minutes and the unit will timeout and reset itself to the previously stored calibration.

5. Apply the maximum input signal level desired, and push the CAL button to store (the yellow LED will be on).

6. Apply the minimum input signal level desired, and push the CAL button to store (the green and red LED will be on).

7. Adjust the input signal while monitoring the output signal until the output is at the desired maximum level (e.g. 20.00mA), then push the CAL button to store (the red LED will be on).

8. Adjust the input signal while monitoring the output signal until the output is at the desired minimum level (e.g. 4.00mA), then push the CAL button to store (the yellow, green and red LEDs will be on).

9. Push the CAL button one final time to store the calibration data. The green LED will be on if the input is within the calibrated range.

Table 3: Output Range Settings for Single Channel Modules

Ranges	Selector SW2							
Output	1	2	3	4	5	6	7	8
0 to 5V	■	■	■	■				
0 to 10V	■	■	■	■				
0 to 1mA			■	■				
4 to 20mA						■	■	■
0 to 20mA	■	■					■	■

Key: ■ = 1 = ON or Closed

Table 4: I/O Range & Function Settings for Dual Channel Modules

Ranges		Selector SW1 or SW2*										SW2**	
Voltage	Current	1	2	3	4	5	6	7	8	9	10	1	2
20mV	2mA			■	■								
50mV	5mA		■										
100mV	10mA		■	■									
200mV	20mA		■	■									
500mV	50mA		■	■	■								
1V	100mA	■											
2V		■			■								
5V		■			■	■							
10V		■	■										
25V		■	■		■								
50V		■	■	■									
100V		■	■	■	■								
Unipolar						■							
Voltage									■				
Current										■			
Output		1	2	3	4	5	6	7	8	9	10	1	2
0 to 5V												■	■
0 to 10V												■	■
0 to 1mA												■	■
4 to 20mA													

Key: ■ = 1 = ON or Closed  
 \*Applies to dual channel model  
 \*\*SW2, two position switch applies only to 1 input, 2 output module

Note that 0-20mA output is NOT available on multichannel units. Note also that Reverse Action is NOT available on multichannel units.

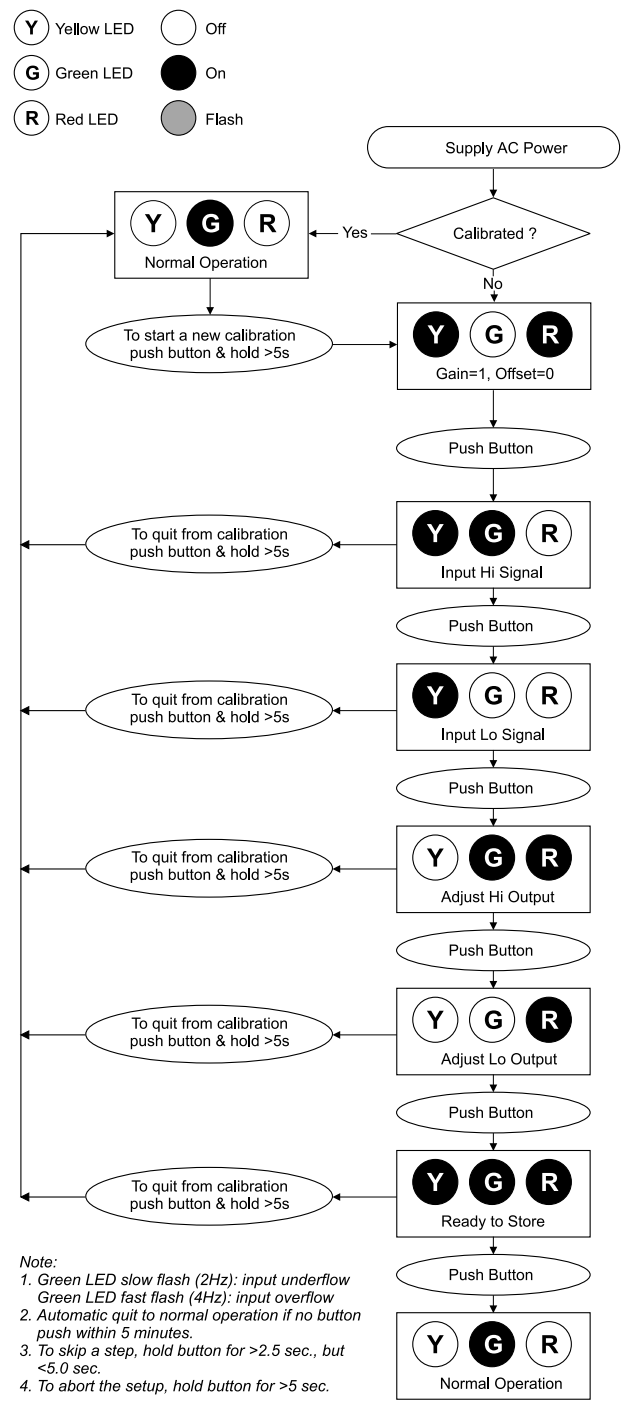


Figure 2: Q406 Calibration Flow Chart

**Specifications**

**Inputs:**

- Voltage:
  - Range Limits: 10mV to 100V (see Table 1)
  - Impedance:  $\geq 100k$  ohms
  - Overvoltage: 200V continuous
- Current Input:
  - Range Limits: 1mA to 100mA
  - Impedance: 20 ohms typical
  - Overcurrent: 170mA, protected by self resetting fuse
  - Overvoltage: 60V
- Pushbutton Adjustment (inputs $>10mV$ )
  - Effective zero offset:  $\geq 90\%$
  - Effective span turn down:  $\geq 90\%$  except 20mV/2mA range in which 50% is max. zero offset and span turndown

**Outputs:**

- Voltage:
  - Output: 0-5V, 0-10V
  - Source Impedance:  $<10$  ohms
  - Drive: 10mA max.
- Current:
  - Output: 4-20mA, 0-1mA (0-20mA on single channel versions only)
  - Source Impedance:  $>100k$  ohms
  - Compliance:
    - 0-1mA: 7.5V max. (7.5k ohms)
    - 4-20mA: 12V max. (600 ohms)\*
    - 0-20mA: 12V max. (600 ohms)
  - \*10V max. (500 ohms) on dual out versions

**Output Ripple:**

- $<50\%$  offset or span adjust: $<0.1\%$  off full scale span or 25mV RMS, whichever is greater
- $>50\%$  offset or span adjust: $<0.2\%$  of full scale span or 50mV RMS, whichever is greater.

**Ordering Information**

Models & Accessories

Specify:

1. Model:
  - Q406-A000:** one input, one output DC Isolator
  - Q406-A001:** one input, one output DC Isolator with 24VDC excitation source
  - Q406-A002:** one input, two output DC Isolator with 24VDC excitation source
  - Q406-A003:** one input, two output DC Isolator with 24VDC excitation source
  - Q406-A004:** two input, two output DC Isolator
2. Specify I/QRail type and quantity (required)
3. Custom Calibration: **C620** - calibrates units to a customer specified range.
4. Accessories: (see Accessories)

**Accessories**

Action/I/Q modules mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition the following accessories are available:

- MD02** TS32 DIN rail
- MD03** TS35 x 7.5 DIN rail
- IQRL-2002** 2 Position I/QRail & DIN rail
- IQRL-2004** 4 Position I/QRail & DIN rail
- IQRL-2008** 8 Position I/QRail & DIN rail

**Output Accuracy:**

- $>2mA / >20mV$  input spans:
  - $\pm 0.1\%$  of full-scale input typical,  $\pm 0.2\%$  maximum
- $<2mA / <20mV$  input spans:
  - $\pm 0.35\%$  of fullscale input typical,  $\pm 0.5\%$  maximum; including linearity, repeatability and hysteresis @23C.

**Response Time:** 200mSec, typical

**Stability:**  $\pm 0.025\%$  of full scale /C, maximum for fullscale and zero

**Excitation Voltage (optional):** 24VDC, 20mA maximum

**Common Mode Rejection:** 120dB at DC,  $>90dB$  at 60Hz

**Isolation:**  $\geq 1800VDC$  or peak AC between input, output, power and channel to channel

**ESD Susceptibility:** Capable of meeting IEC 801-2 level 3(8kV)

**Humidity (non-condensing):**

- Operating: 15 to 95% RH @45°C
- Soak: 90% RH for 24 hours @60°C

**Temperature:**

- Operating: 0 to 55°C (32 to 131°F)
- Storage: -25 to 70°C (-13 to 158°F)

**Power:** 2.5W max; 100 to 240VAC,  $\pm 10\%$ , 50 to 400Hz

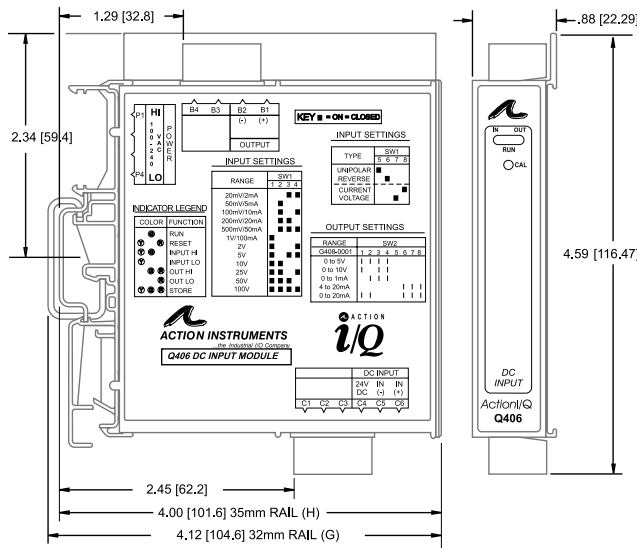
**Wire Terminals:** Socketed screw terminals for 12-22 AWG

**Agency Approvals:**

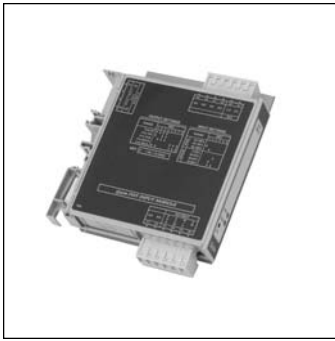
- CSA certified per standard C22,2 (File No LR 42272).
- UL recognized per standard UL508 (File No. E99775).
- CE compliance per EMC directive 89/336/EEC and low voltage 73/23/EEC.

Terminal	Connection	Terminal	Connection
B1	Channel 1 Out (+)	C4	Voltage Supply (+24VDC)
B2	Channel 1 Out (-)	C5	Channel 1 In (-)
B3	Channel 2 Out (+)	C6	Channel 1 In (+)
B4	Channel 2 Out (-)	P1	AC Power (Hot)
C1	Channel 2 In (-)	P2	Not Used
C2	Channel 2 In (+)	P3	Not Used
C3	Not Connected	P4	AC Power (Neutral)

**Dimensions**







Q436-0000



# ACTIONI/Q® Q436

## AC Powered Potentiometer Input Signal Conditioner

Provides a DC Output in Proportion  
to a Potentiometer Input



- Accepts Potentiometers from 100 Ohms to 100k Ohms
- Wide Ranging Zero and Span
- ASIC Technology

- DIN Rail Mounting with IQRL
- Universal AC Power 85 to 265 VAC
- SnapLoc™ Plug-in Terminals

### Description

The Q436 is a DIN rail mount, potentiometer input signal conditioner with 1800VDC isolation between AC power and the input/output circuitry. The input provides a constant voltage and is designed to accept any 3-wire potentiometer from 100 ohms to 100k ohms. The field configurable output is switch selectable providing a 0-5V, 0-10V, 0-1mA, 0-20mA or 4-20mA DC signal. Wide ranging, precision zero and span pots, used in conjunction with DIP switches, allow 80% adjustability of offset and gain to transmit a full scale output from any 20% portion of the potentiometer input.

### Application

The Q436 is useful in transmitting process control setpoints to remote PID controllers or interfacing position or level sensors to data acquisition and control systems. The high density DIN rail mounting offers an extremely compact solution for saving valuable panel space.

### Configuration

In a valve positioning application a potentiometer is sometimes used as a feedback signal. Quite often a wide open valve is only a 25% turn of the feedback potentiometer. The Q436 can easily be adjusted with the zero and span to provide a fullscale output signal (e.g. 4-20mA) representing 0-25% or even 50-75% of the potentiometer input.

Unless otherwise specified, the factory presets the Model Q436 as follows:

Input Range: 0 to 100%  
Output: 4 to 20mA

For other output ranges, refer to Tables 1 and 2 to reconfigure switches SW1 and SW2 for the desired input and output ranges.

**WARNING:** Do not change switch settings with power applied. Severe damage will result!

### Calibration

Note: For best results, calibration should be performed with the intended output load, in the operating environment, mounted on a DIN rail, allowing at least one hour for thermal equilibrium of the system.

1. With power disconnected, set the output and input switch selectors (SW1 and SW2) to the desired ranges (see Tables 1 and 2).

*Note: An I/Q Rail is required to power the modules. See Ordering Information.*

2. Connect the input to a potentiometer. Connect the output to the actual device load (or a load approximately equivalent to the actual device load value) and apply power.

*Note: To maximize thermal stability, final calibration should be performed in the operating installation, allowing approximately 1 to 2 hours for warm up and thermal equilibrium of the system.*

3. Set the input to the desired minimum and adjust the zero potentiometer for the desired minimum output.

4. Set the input to the desired maximum and adjust the span potentiometer for the desired maximum output.

5. Repeat steps 3 and 4, if necessary.

Table 1: Input Range Settings

Span	Selector SW2					
	1	2	3	4	5	6
20 - 100%						
45 - 100%	■					
(default) 85 - 100%		■				
Offset	1	2	3	4	5	6
(default) 0 - 20%						
20 - 45%				■		
45 - 65%				■		
65 - 80%				■	■	

Key: ■ = 1 = ON or Closed

Table 2: Output Range Settings

Output	Selector SW1							
	1	2	3	4	5	6	7	8
0 to +5V	■	■	■	■				
0 to +10V	■		■	■				
0 to 1mA		■	■	■				
(default) 4 to 20mA						■	■	■
0 to 20mA	■	■				■	■	■

Key: ■ = 1 = ON or Closed

**Specifications**

**Potentiometer Input:**

- End-to-end Resistance: 100 ohms up to 100k ohms
- Input Impedance: >1M ohms
- Input Excitation: 500mV, 5mA maximum drive.
- Zero Turn-Up: 80% of full scale input
- Span Turn-Down: 80% of full scale input
- Common Mode Rejection: 1800VDC (input to power)

**Output:**

- Voltage
  - Output: 0-5V, 0-10V
  - Source Impedance: <10 ohms
  - Drive: 10mA, max. (1k ohms min. @10V)
- Current Output
  - Output: 0-1mA, 0-20mA, 4-20mA
  - Source Impedance: >100k ohms
  - Compliance:
    - 0-1mA: 7.5V, max. (7.5k ohms, max.)
    - 0-20mA: 12V, max. (600 ohms, max.)
    - 4-20mA: 12V, max. (600 ohms, max.)

**Accuracy (Including Linearity, Hysteresis):**

±0.1% maximum at 25°C.

**Stability:**

Temperature: <±0.05%/°C maximum of full scale range.

**Response Time (10 to 90%):**

<200mSec., typical.

**Common Mode Rejection:**

120dB @ DC, >100dB @ 60Hz

**Isolation:**

800VDC between line power and input, output

**EMC Compliance (CE Mark):**

- Emissions: EN50081-1
- Immunity: EN50082-2
- Safety: EN50178

**LED Indication (green):**

Active DC power

**Humidity (Non-Condensing):**

- Operating: 15 to 95% @ 45°C
- Soak: 90% for 24 hours @ 65°C

**Temperature Range:**

- Operating: 0 to 55°C (32 to 131°F)
- Storage: -25 to 70°C (-13 to 158°F)

**Power:**

- Consumption: 1.5W typical, 2.5W max
- Range: 100 to 240VAC, ±10%, 50 to 400Hz

**Weight:**

0.48 lbs

**Agency Approvals:**

- UL recognized per standard UL508 (File No. E99775).
- CSA certified per standard C22.2, No. 0-M91 and 142-M1987 (Cert. # 2500003630).
- CE Compliance per EMC directive 89/336/EEC and Low Voltage 73/23/EEC.

Terminal	Connection	Terminal	Connection
A1	DC Output (+)	C3	Shield Ground
A2	DC Output (-)	C4	Pot. Input (fully CCW)
A3	Not Used	C5	Pot. Input Wiper
A4	Not Used	C6	Pot. Input (fully CW)
A5	Not Used	P1	AC Power (Hot)
A6	Not Used	P2	Not Used
C1	Not Used	P3	Not Used
C2	Not Used	P4	AC Power (Neutral)

**Ordering Information**

**Models and Accessories**

**Specify:**

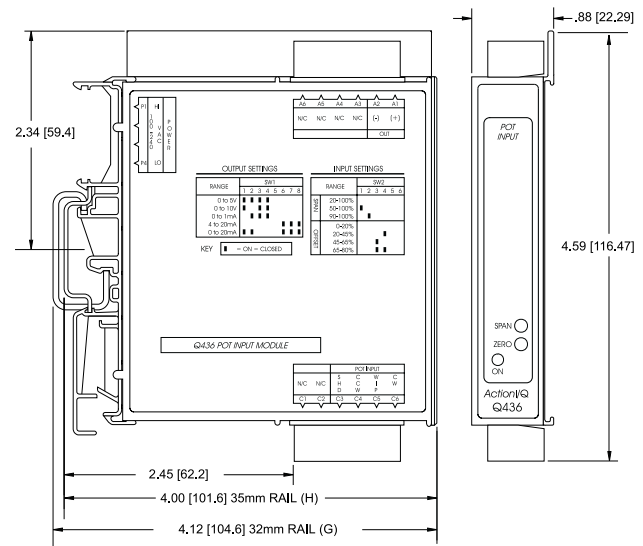
- Model: **Q436-0000**
- Specify I/QRail type and quantity (required)
- Optional Custom Factory Calibration; specify **C620** with desired input and output range
- Accessories: (see Accessories)

**Accessories**

ActionIQ modules will mount on standard TS32 (model MD02) or TS35 (model MD03) DIN Rail. In addition, the following accessories are available:

- MD02** TS32 DIN rail
- MD03** TS35 x 7.5 DIN rail
- IQRL-2002** 2 Position I/QRail & DIN rail
- IQRL-2004** 4 Position I/QRail & DIN rail
- IQRL-2008** 8 Position I/QRail & DIN rail
- C620** Factory Calibration

**Dimensions**





Q446-0000

# ACTIONI/Q® Q446

## AC Powered Bridge Input Signal Isolator

Provides an Isolated DC Output in Proportion  
to a Bridge/Strain Gauge Input



- Adjustable Bridge Excitation
- Field Configurable Input Ranges
- Field Configurable Output Ranges
- TouchCAL Technology

- DIN Rail Mounting with IQRL
- Universal AC Power 85 to 265 VAC
- SnapLoc™ Plug-in Terminals

### Description

The Q446 is a DIN rail mount, bridge or strain gauge input signal conditioner with 1800VDC isolation between input, output and power. Advanced digital technology combined with ASIC technology allows the Q446 to be field configured for virtually any Bridge input to DC output within the limits specified. The input can be set via DIP switches for any one of 11 voltage ranges from 10mV to ±200mV (see Table 1). The output is linear to the input and can be set for either 0-5V, 0-10V, 0-1mA or 4-20mA, direct or reverse acting.

### TouchCAL™ Technology

The Q446 utilizes TouchCAL technology which greatly simplifies calibration. Once the unit is configured via DIP switches, the pushbutton is used to precisely calibrate the minimum and maximum levels. The thermal drift and mechanical variability of the potentiometers has been removed and replaced with a digitally stable circuit. Additionally, the inherent zero and span interactivity of potentiometer based analog amplifier circuitry is removed, providing 100% non-interactive adjustment.

TouchCAL provides more than 90% offset of the zero value and adjustment down to 10% of the full scale input span for most of the 11 switch selectable input ranges. For example, the DIP switch configured 0-100mV input range could be calibrated via pushbutton for 0-40mV (i.e. 60% span reduction) or offset to a range of 60-100mV (i.e. 60% offset and 60% span reduction). If the output was configured for 0-10V, then 60-100mV input would correspond to the 0-10V full scale output. Thus, an input range such as 90-100mV is possible using the 0-100mV range. A TARE function is also provided to allow batch offsets.

To calibrate the input within the DIP switch configured range, simply apply the high input signal and push the CAL button. The low input signal is then applied and pushing the CAL button again stores the low input signal (these steps are reversed for reverse mode operation).

The high and low input levels are stored in nonvolatile memory and correspond to the high and low output levels. These output levels are precisely adjusted using the input signal.

### Diagnostic LEDs

The Q446 has three diagnostic LEDs. The green (RUN) LED is used for diagnostics to indicate that power is on. It will flash quickly if

the input signal is above the calibrated range or slowly if the input signal is below range. It is on continuously when the unit is functioning within the calibrated range.

The yellow (IN) LED is on while calibrating the input and the red (OUT) LED is on while calibrating the output.

### Application

The Q446 bridge input signal conditioner is useful in isolating ground loops and interfacing bridge sensors to data acquisition and control systems.

Three-way isolation completely eliminates ground loops from any source. Isolation protects expensive SCADA systems from ground faults and provides filtering for noise reduction which can be a significant problem with millivolt bridge signals.

Wide ranging flexibility allows the user to easily zero out dead-loads in weighing systems or configure bipolar input ranges for tension-compression or vacuum-pressure bridge applications.

High density DIN rail mounting offers an extremely compact solution for saving valuable panel space.

### Configuration

The Q446 can be configured for input ranges from 10mV to +/-200mV, with 90% input offset, or it will adjust down to 10% of fullscale input span (except on 10mV, +/-5mV range where maximum offset or gain adjustment is 50%).

Unless otherwise specified, the factory presets the Model Q446 as follows:

Input Setting:	0 to 50mV
Input Range:	0 to 30mV (3mV/V)
Excitation:	10V
Operation:	Direct
Output:	4 to 20mA

For other I/O ranges, refer to the tables.

**WARNING:** Do not change switch settings with power applied. Severe damage will result!

1. With power off, snap off the faceplate by lifting the right edge away from the heat sink. Slide off the metal heatsink.
2. Note that the module has two eight position switch blocks, one for input and one for output.
3. Choose the desired ranges from Tables 1-4. Return the heatsink to its original position and attach the faceplate before beginning calibration.

**Calibration**

For best results, calibration should be performed in the operating installation, allowing at least one hour for thermal stability of the system. If pre-calibration on a test bench is preferred, then an output load equal to the input impedance of the device connected to the Q446 output is recommended, along with a 1 hour warm up period.

1. For best results install the module on to a piece of DIN rail or the I/Q Rail mounting accessory. See the I/Q Rail data sheet for details.

*Note: An I/QRail is required to power the modules. See ordering information.*

2. Connect the input to a calibrated DC source and the output to a voltage or current meter. Apply power and allow the system to reach thermal equilibrium (approximately 20 minutes).

3. Adjust the input signal to the desired maximum and observe that the green LED is on or flashing. Push the CAL button and hold it down for six flashes of the yellow LED (until the yellow and green LEDs are flashing), then release the button.

*Note: To quit the calibration mode and reset the unit, push the CAL button again and hold for more than 5 seconds. Or wait for more than two minutes and the unit will time-out and automatically reset to the previously stored calibration.*

*Note: For the reverse operating mode (SW1-6 closed), input the minimum signal in step 4 of calibration.*

4. The yellow and red LEDs will be on. Push the CAL button. Apply the maximum input signal level desired and push the CAL button to store. The yellow LED will now be on.

*Note: For the reverse operating mode (SW1-6 closed), input the maximum signal in step 5 of calibration.*

5. Apply the minimum input signal level desired and push the CAL button to store. The green and red LED will now be on.

6. Adjust the input signal while monitoring the output signal until the output is at the desired maximum level (e.g. 20.00mA), then push the CAL button to store (the red LED will be on).

7. Adjust the input signal while monitoring the output signal until the output is at the desired minimum level (e.g. 4.00mA), then push the CAL button to store (the yellow, green and red LEDs will be on).

8. To finish calibration, push the CAL button once again. The green LED will be on if the input is within the calibrated range.

*Note: The TARE function is enabled by depressing the TARE/(CAL) until the yellow LED flashes at least once and less than six times. The input present at that time will be used as the TARE value and the output will be the minimum output when the module was calibrated.*

*Table 1: Input Range Settings*

Input Range	Selector SW1				
	1	2	3	4	5
0 to 10mV	■			■	■
0 to 20mV	■	■			■
0 to 50mV		■	■	■	■
0 to 100mV	■				■
0 to 200mV	■			■	■
-5 to 5mV		■			
-10 to 10mV		■		■	
-20 to 20mV		■	■		
-50 to 50mV			■	■	■
-100 to 100mV	■				
-200 to 200mV	■			■	

Key: ■ = 1 = ON or Closed

*Table 3: Bridge Excitation Settings*

Excitation Voltage	SW1	
	7	8
9.8 to 10.1V	■	
4.8 to 5.2V		
0 to 10V	■	■
0 to 2.5V		■

Key: ■ = 1 = ON or Closed

*Table 2: Direct or Reverse Setting*

Operation	SW1
	6
Direct	
Reverse	■

Key: ■ = 1 = ON or Closed

*Table 4: Output Range Settings*

Output Range	Selector SW2							
	1	2	3	4	5	6	7	8
0 to 5V	■	■	■	■				
0 to 10V	■		■	■				
0 to 1mA		■	■	■				
4 to 20mA						■	■	■
0 to 20mA	■	■			■		■	■

Key: ■ = 1 = ON or Closed

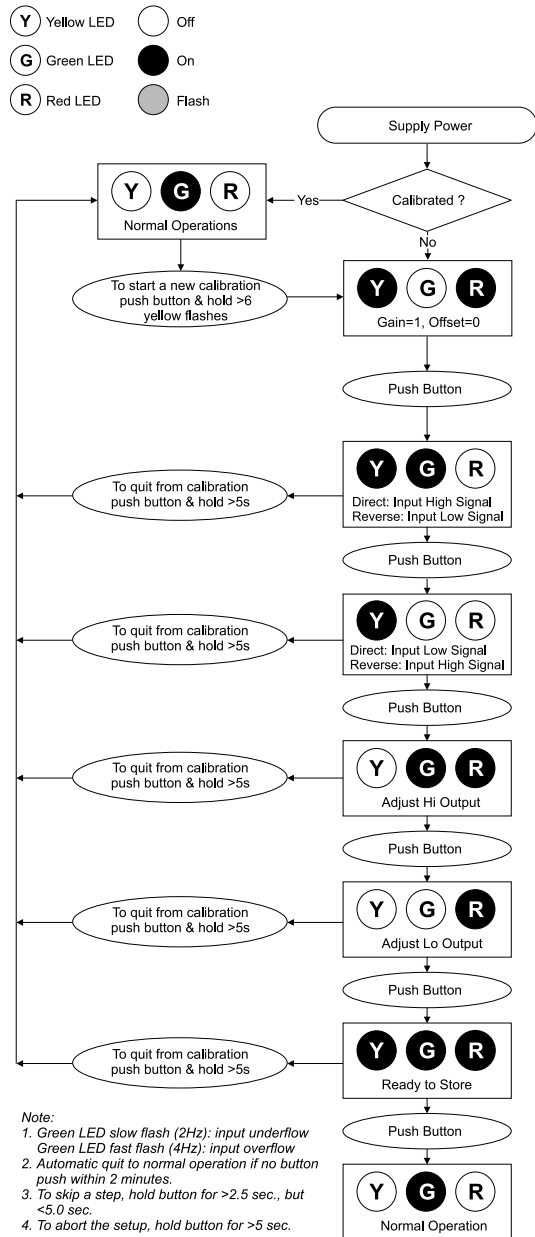


Figure 1: Q446 Calibration Flow Chart

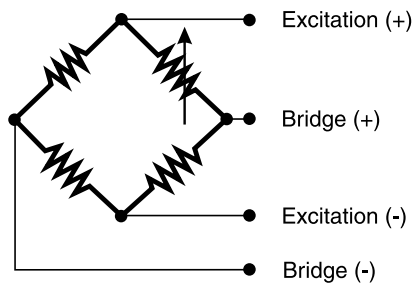


Figure 2: Bridge Reference Designations

**Specifications**

**Input:**

- Voltage:
  - Full Scale Range: 10mV to ±200mV (Table 1).
  - Impedance: >1M ohm
- Overvoltage:
  - Intermittent 400V, max.
  - Continuous 264V, max.
- Common Mode (Input to Ground):
  - 1800VDC, max.
- Pushbutton Adjustment:
  - Effective zero offset: >90%
  - Effective span turn down: >90% except for 10mV & +/-5mV range in which 50% is max. zero offset and span turndown
- Operation: direct or reverse acting

**Output:**

- Voltage:
  - Output: 0-5V, 0-10V
  - Impedance: <10 ohms
  - Drive: 10mA, max. (1K ohms, min. @ 10V)
- Current:
  - Output: 0-1mA, 0-20mA, 4-20mA
  - Impedance: >100K ohms
- Compliance:
  - 0-1mA; 7.5V, max. (7.5K ohms, max.)
  - 0-20mA; 12V, max. (600 ohms, max.)
  - 4-20mA; 12V, max. (600 ohms, max.)

**Bridge Excitation:**

1 to 10VDC, 120mA max. Current drive decreases at 10mA/V below 5V (e.g. 4V, 110mA max.)

**Accuracy (Including Linearity, Hysteresis):**

±0.1% typical, ±0.2% maximum of selected input range at 25°C.

**Stability:**

±0.025%/°C typical, 0.05%/°C maximum, of selected full scale input range.

**Ordering Information**

**Models & Accessories**

**Specify:**

1. Model: **Q446-0000**;
2. Specify optional I/QRail, type and quantity (required)
3. Accessories: (see Accessories)
4. Optional Factory Custom Calibration, specify **C620** - with desired input and output ranges.

**Accessories**

ActionIQ modules mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition the following accessories are available:

- MD02** TS32 DIN rail
- MD03** TS35 x 7.5 DIN rail
- IQRL-2002** 2 Position I/QRail & DIN rail
- IQRL-2004** 4 Position I/QRail & DIN rail
- IQRL-2008** 8 Position I/QRail & DIN rail

Terminal	Connection	Terminal	Connection
A1	DC Output (+)	C3	Bridge Input (-)
A2	DC Output (-)	C4	Bridge Excitation (-)
A3	Not Used	C5	Not Connected
A4	Not Used	C6	Not Connected
A5	Not Used	P1	AC Power (Hot)
A6	Not Used	P2	Not Used
C1	Bridge Excitation (+)	P3	Not Used
C2	Bridge Input (+)	P4	AC Power (Neutral)

**Output Noise (maximum):**

0.1% rms of span, or 10mV whichever is greater.

**Response Time (10 to 90%):**

<200mSec., typical.

**Common Mode Rejection:**

DC to 60Hz: 120dB, 100dB (0 -1mA, range)

**Isolation:**

1800VDC between input, output and power.

**EMC Compliance (CE Mark)**

Emissions: EN50081-1; Immunity: EN50082-2; Safety: EN50178

**LED Indication (Green):**

- Input Range (approx.)
  - >110% input: 8Hz flash
  - <0% input: 4Hz flash

**Humidity (Non-Condensing):**

- Operating: 15 to 95% @ 45°C
- Soak: 90% for 24 hours @ 65°C

**Temperature Range:**

- Operating: 0 to 55°C (32 to 131°F)
- Storage: -25 to 70°C (-13 to 158°F)

**Power:**

- Consumption:
  - 2.7W typical (one 350 ohm bridge),
  - 5W max. (four 350 ohm bridges).
- Range: 100-240VAC

**Shipping Weight:**

0.54 lbs.

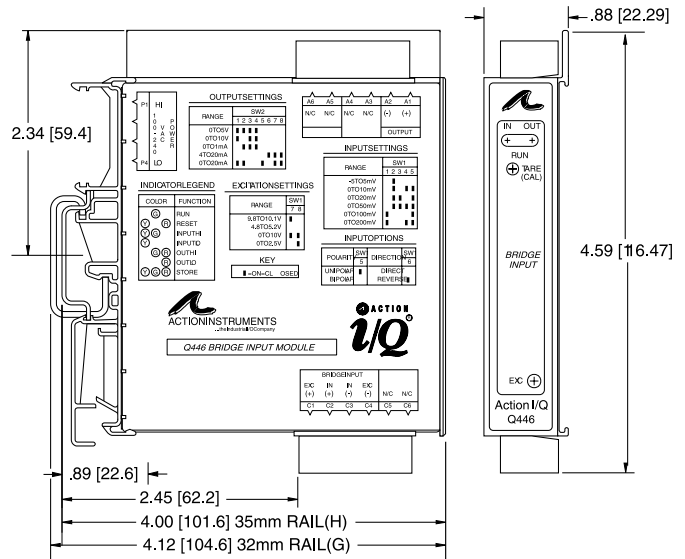
**Wire Terminations:**

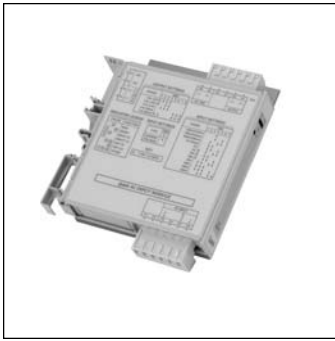
Screw terminals for 12-22 AWG

**Agency Approvals:**

- UL recognized per standard UL508.
- CSA certified per standard 22.2 No. 0-M91 and 142-M1987.
- CE Compliance per EMC directive 89/3/36 EEC and Low Voltage 73/23/EEC.

**Dimensions**





Q446-0000



# ACTIONI/Q® Q466

## AC Powered AC Input Field Configurable Isolator

Provides an Isolated DC Output  
in Proportion to an AC Input



- Eliminates Ground Loops
- Field Configurable Input Ranges
- Field Configurable Output Ranges
- TouchCAL Technology

- DIN Rail Mounting with IQRL
- Universal AC Power 85 to 265 VAC
- SnapLoc™ Plug-in Terminals

### Description

The Q466 is a DIN rail mount, AC input signal conditioner with 1800VDC isolation between input, output and power. The field configurable input and output offers flexible, wide ranging capability for scaling, converting or buffering AC inputs ranging from 5mA to 100mAAC or 50mV to 300VAC.

For current inputs above 100mA, it is recommended that an input shunt resistor be used and the Q466 be configured for the proper input range. For example, a 5A current transformer output can use the C006 shunt resistor (0.1 ohm, 5W) with the input of the Q466 set for 0-500mVAC.

The DC output of the Q466 is proportional to the average of the fully-rectified AC input signal, and is calibrated for sine waves between 40-400Hz.

### TouchCAL™ Technology

The Q466 utilizes TouchCAL technology which greatly simplifies calibration. The thermal drift and mechanical variability of the potentiometers has been removed and replaced with a digitally stable circuit. Once the unit is configured via DIP switches for voltage or current, the pushbutton is used to precisely calibrate the minimum and maximum levels.

To set the input level within the dip switch configured range, simply apply the high input signal (voltage or current) and push the CAL button. The low input signal is then applied and pushing the CAL button again stores the low input signal. The high and low input levels are stored in nonvolatile memory and correspond to the high and low output levels. These output levels are precisely adjusted using the input signal.

TouchCAL technology enables precise calibration and provides more than 90% offset of the zero value and adjustment down to 10% of the full scale input span for most of the 16 switch selectable input ranges. For example, the dipswitch configured 0-200V input range could be calibrated via pushbutton for 0-80V (i.e. 60% span reduction) or offset to a range of 120-200V (i.e. 60% offset and 60% span reduction). If the output was configured for 0-10V, then 120-200V input would correspond to the 0-10V full scale output. Input ranges such as 180-200V or 0-20V are possible using the 0-200V range.

Advanced digital technology combined with Action's exclusive ASIC technology allows the Q466 to be field configured for virtually any AC input to DC output within the limits specified.

### Application

The Q466 is useful in applications requiring an isolated, conditioned DC output from an AC signal. Typical applications include energy management, load shedding, motor current/load monitoring, locked rotor detection, isolation and data acquisition. The output of the Q466 can drive a digital meter for direct display or can interface with alarm or control devices including PLCs and computers.

### Diagnostic LEDs

The Q466 has three diagnostic LEDs. The green (RUN) LED is used for diagnostics to indicate that power is on. It will flash quickly if the input signal is above the calibrated range or slowly if the input signal is below range. It is on continuously when the unit is functioning within the calibrated range.

The yellow (INPUT) LED is on while calibrating the input level. The red (OUTPUT) LED is on while calibrating the output level.

### Configuration

The Q466 can be configured for input ranges from 50mV to 300V or 5mA to 100mA, with >90% input offset or it will adjust down to <10% of full scale input span (except on the 100mV/10mA range in which maximum offset or gain adjustment is 50%).

Unless a specific custom calibration is specified, the factory presets the Q466 as follows:

Input Range: 0 -500mV  
Calibrated Output: 4-20mA

For other I/O ranges, refer to the tables.

**WARNING:** Do not change switch settings with power applied. Severe damage will result!

1. With power off, snap off the faceplate by lifting the right edge away from the heatsink. Slide the heatsink forward and off the module.

2. Choose the desired range from Tables 1-3. Return the heatsink to its original position and attach the faceplate before beginning calibration.

**Calibration**

For best results, calibration should be performed in the operating installation, allowing at least one hour for thermal stability of the system. If pre-calibration on a test bench is preferred, then an output load equal to the input impedance of the device connected to the Q466 output is recommended, along with a 1 hour warm up period.

1. For best results install the module on to a piece of DIN rail or the I/Q Rail mounting accessories if desired. See the I/Q Rail Data sheet for details.

*Note: An I/Q Rail is required to power the modules. See ordering information.*

2. Connect the input to a calibrated AC source and the output to a voltage or current meter. Apply power and allow the system to reach thermal equilibrium (approx. 20 minutes ).

3. Adjust the input signal to the desired maximum and observe that the green LED is on or flashing. Push the CAL button and hold it down for more than 5 seconds (until the yellow and Green LEDs are flashing), then release the button.

*Note: To quit the calibration mode and reset the unit, push and hold the CAL button for more than 5 seconds. Or, wait for more than two minutes and the unit will timeout and automatically reset to the previously stored calibration.*

4. When the yellow and green LEDs stop flashing, the yellow and red LEDs will be on. Push the CAL button momentarily (the yellow and green LEDs will now be on).

5. Apply the maximum input signal level desired and push the CAL button to store. The yellow LED will now be on.

6. Apply the minimum input signal level desired and push the CAL button to store. The green and red LED will now be on.

7. Adjust the input signal while monitoring the output signal until the output is at the desired maximum level (e.g. 20.00mA), then push the CAL button to store (the red LED will be on).

8. Adjust the input signal while monitoring the output signal until the output is at the desired minimum level (e.g. 4.00mA), then push the CAL button to store (the yellow, green and red LEDs will be on).

9. To finish calibration, push the CAL button once again. The green LED will be on if the input is within the calibrated range.

Table 1: Input Range Settings

Ranges		Selector SW1						
AC Voltage	AC Current	1	2	3	4	5	6	7
100mV	10mA				■			
200mV	20mA				■			■
500mV	50mA			■		■	■	
1V	100mA			■	■			
2V				■	■			■
5V		■		■		■	■	
10V		■		■	■			
20V		■		■	■			■
50V			■	■		■	■	
100V			■	■	■			
200V			■	■	■			■
300V				■	■			■

Key: ■ = 1 = ON or Closed

Table 2: Output Range Settings

Ranges	Selector SW2							
Output	1	2	3	4	5	6	7	8
0 to 5V	■	■	■	■				
0 to 10V	■		■	■				
0 to 1mA		■	■	■				
4 to 20mA						■	■	■
0 to 20mA	■	■				■	■	■

Key: ■ = 1 = ON or Closed

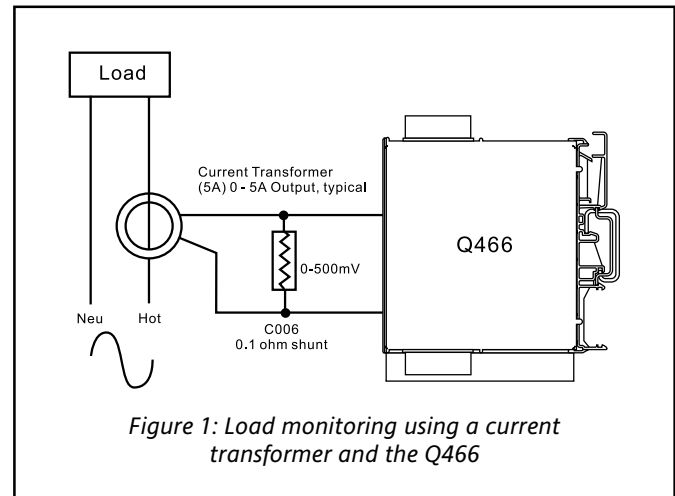


Figure 1: Load monitoring using a current transformer and the Q466

Table 3: Input Type Settings

Input Type	SW1
	8
Current	■
Voltage	

Key: ■ = 1 = On or Closed



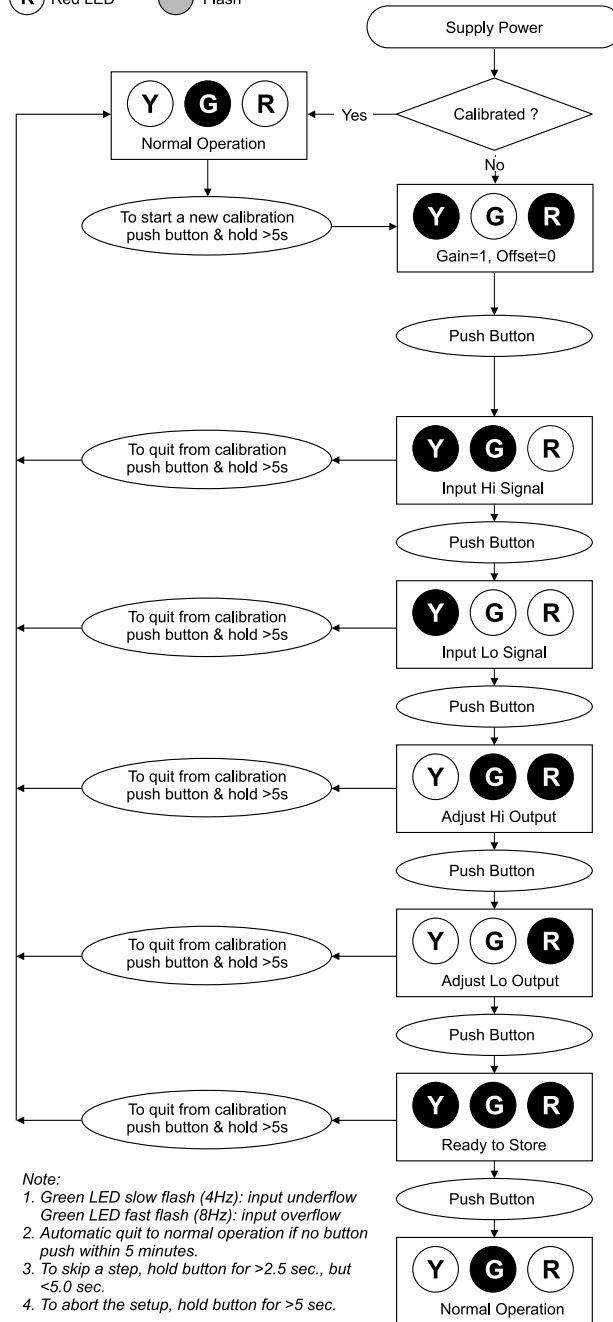
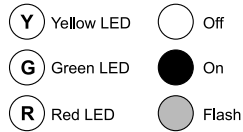


Figure 2: Q466 Calibration Flow Chart

**Specifications**

**Inputs:**

- Voltage:
  - Ranges: 100mVAC to 300VAC
  - Impedance: >100K ohms
  - Overvoltage: 330VAC
- Current:
  - Ranges: 10mAAC to 100mAAC
  - Impedance: 20 ohms, typical
  - Overcurrent: 170mAAC
  - Overvoltage: 60V peak
- Frequency Range:
  - 40Hz to 400Hz, factory calibrated at 60Hz
- Common Mode (Input to Ground):
  - 1800VDC, max.
- Pushbutton Adjustment:
  - Max. zero offset and span turn down is 50%

**Output:**

- Voltage:
  - Output: 0-5V, 0-10V
  - Source Impedance: <10 ohms
  - Drive: 10mA, max. (1K ohms, min. @ 10V)
- Current:
  - Output: 0-1mA, 0-20mA, 4-20mA
  - Source Impedance: >100K ohms
  - Compliance:
    - 0-1mA; 7.5V, max. (7.5K ohms, max.)
    - 0-20mA; 12V, max. (600 ohms, max.)
    - 4-20mA; 12V, max. (600 ohms, max.)

**LED Indication**

- RUN (green):
  - On when unit is powered
  - flashes at 8Hz when input is 7% above max.
- INPUT (yellow):
  - On while calibrating the input level
- OUTPUT (red):
  - On while calibrating the output level

**Ordering Information**

**Models And Accessories**

**Specify:**

1. Model: **Q466-0000**; one input, one output AC Isolator
2. Specify I/QRail type and quantity (required)
3. Accessories: (see Accessories)
4. Optional Custom Factory Calibration: specify **C620** with desired input and output range.

**Accessories**

Action/IQ modules mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition the following accessories are available:

- MD02** TS32 DIN rail
- MD03** TS35 x 7.5 DIN rail
- IQRL-2002** 2 Position I/QRail & DIN rail
- IQRL-2004** 4 Position I/QRail & DIN rail
- IQRL-2008** 8 Position I/QRail & DIN rail

**Accuracy (Including Linearity & Hysteresis):**

- +0.1% of span, typical, +0.2% max.
- +0.5% of span, maximum (100mV range)

**Stability:**

- +0.025%/°C of selected input span, typical.

**Response Time (10 to 90%):**

- 250mSec., typical.

**Common Mode Rejection:**

- DC to 60Hz: 90dB

**Isolation:**

- 1800VDC between input, output and power.

**EMC Compliance (CE Mark):**

- Emmissions: EN50081-1; Immunity: EN50082-2; Safety: EN50178

**Humidity (Non-Condensing):**

- Operating: 15 to 95% @ 45°C
- Soak: 90% for 24 hours @ 65°C

**Temperature Range:**

- Operating: 0 to 55°C (32 to 131°F)
- Storage: -25 to 70°C (-13 to 158°F)

**Power:**

- Consumption: 1.5W typical, 2.5W max.
- Range: 100 to 240 VAC ±10%, 50 to 400 Hz

**Wire Terminations:**

- Screw terminals for 12-22 AWG

**Shipping Weight:**

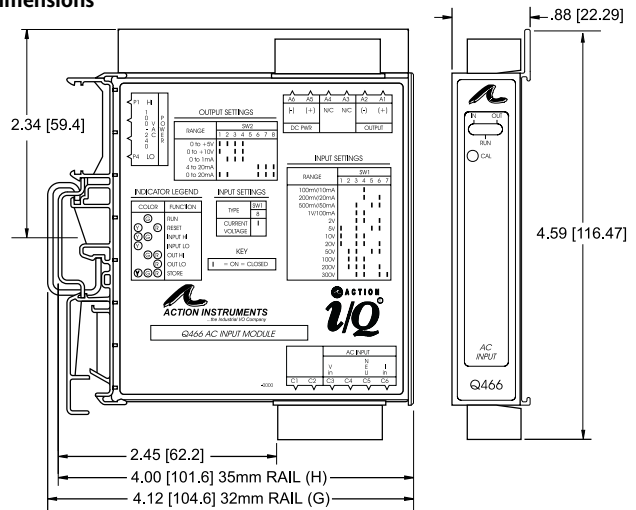
- 0.48 lbs.

**Agency Approvals:**

- UL recognized per standard UL508 (File No. E99775)
- CSA certified per standard C22.2 No. 0-M91 and 142-M1987 (File No. LR42272-84).
- CE Compliance per EMC directive 89/336 EEC and Low Voltage 73/23/EEC.

Terminal	Connection	Terminal	Connection
A1	Output (+)	C3	Input Voltage (Line)
A2	Output (-)	C4	Not Used
A3	Not Used	C5	Input (Neutral)
A4	Not Used	C6	Input Current (Line)
A5	Not Used	P1	AC Power (Hot)
A6	Not Used	P2	Not Used
C1	Not Used	P3	Not Used
C2	Not Used	P4	AC Power (Neutral)

**Dimensions**





Q476-0000



# ACTIONI/Q® Q476

## AC Powered Frequency Input Field Configurable Isolator

Provides an Isolated DC Output  
in Proportion to Input Frequency



- Eliminates Ground Loops
- Field Configurable Input Ranges 2Hz to 10,000Hz
- Field Configurable Output Ranges
- 150mV to 150V Input Amplitude
- TouchCAL Technology
- DIN Rail Mounting with IQRL
- Universal AC Power 85 to 265 VAC
- SnapLoc™ Plug-in Terminals

### Description

The Q476 is a DIN rail mount, frequency input signal conditioner with 1800VDC isolation between input, output and power. The field configurable input and output offers flexible, wide ranging capability for variable frequency drives, magnetic pickups, turbine flowmeters, and other pulse or frequency output transducers.

The input of the Q476 can be configured for any frequency span from 2Hz to 10,000Hz. The input amplitude threshold sensitivity can be adjusted from 150mVp to 10Vp to ensure accurate frequency measurement and minimize transient noise related errors. The maximum input amplitude is 150 Vrms. The output can be set for either 0-5V, 0-10V, 0-1mA, 0-20mA or 4-20mA.

The Q476 can be field configured for virtually any frequency input to DC signal output within the ranges specified. There is also an 8VDC excitation source common to the input. This can be used as a signal source for relay contacts or as an excitation source for open collector type proximity sensors. The Q476 is AC powered and will accept any power between 85 and 265VAC.

### TouchCAL Technology

The Q476 utilizes TouchCAL Technology to greatly simplify configuration. The high and low input ranges are stored in non-volatile memory and correspond to the high and low output range which is selected via DIP switches.

### Diagnostic LEDs

The Q476 utilizes three diagnostic LEDs. The green (RUN) LED indicates DC power and input signal status. Active line power is indicated by an illuminated LED. If the input signal is 7% or more high, the LED will flash at 8Hz. If the input signal is 7% or more low, the LED will flash at 4Hz.

The yellow (IN) LED is lit when calibrating the input. The red (OUT) LED is lit when calibrating the output.

### Application

The Q476 field configurable, frequency input signal conditioner is useful in eliminating ground loops and interfacing pulse output transducers, such as turbine flow meters and magnetic pickups, to data acquisition and control systems.

Advanced digital technology, combined with ASIC technology, provides a stable output at low frequencies for higher accuracy, and 3-way isolation which completely eliminates ground loops from any source.

### Configuration

Any 2Hz range from 0 to 10,000Hz can be converted to a full scale output signal (e.g. 0-2Hz/4-20mA or 9998-10,000Hz/4-20mA).

Unless otherwise specified, the factory presets the Model Q476 as follows:

- Input Range: 0 to 1000Hz
- Sensitivity: 1V RMS
- Output Range: 4 to 20mA

*Note that "Sensitivity" refers to the noise rejection level (the trigger threshold of the input).*

For other I/O ranges, refer to the tables below.

**WARNING:** Do not change switch settings with power applied. Severe damage will result!

1. With power off, snap off the faceplate by lifting the right edge away from the heatsink. Then slide the heatsink forward and off the module. The output switch block (SW2) is located under the heatsink. Choose the desired output voltage/current range from Table 1 and set positions 1-8 of SW2.
2. Set the input sensitivity switch (SW2, 9 & 10) to LO for input amplitudes between 150mVp and 50Vrms, with noise rejection to 1Vp; or to HI for input amplitudes between 500mVp and 150Vrms, with noise rejection up to 10Vp.
3. Return the heatsink to its original position and attach the faceplate before beginning calibration.

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### Calibration

For best results, calibration should be performed in the operating installation, allowing at least one hour for thermal stability of the system. If pre-calibration on a test bench is preferred, then an output load equal to the input impedance of the device connected to the Q476 output is recommended, along with a 1 hour warm up period.

*Note: An I/Q Rail is required to power the modules. See Ordering Information.*

1. Install the module on a piece of DIN rail and the I/Q Rail mounting combination. See the I/Q Rail data sheet for details.
2. Connect the input to a calibrated frequency source and the output to a voltage or current meter. Apply power and allow the system to reach thermal equilibrium (approx 20 minutes).
3. Adjust the input frequency to the desired maximum and observe that the output has increased and is sensing the input. If the output fails to increase, turn the sensitivity potentiometer in a counterclockwise direction until the output begins to change proportionally to the input.

*Note: The level LED may not appear to be on if the new range is less than 10% of the previously calibrated range.*

4. With the green LED on press the CAL button for 5 seconds to enter the calibration mode. The yellow and green LEDs will now be on.
5. Input the maximum desired frequency and press the CAL button to store. The yellow LED will now be the only LED on.
6. Input the minimum desired frequency and press the CAL button to store. The green and red LEDs will now be on.

*Note: The most reliable way to input 0Hz is to short circuit the input pins (C5 & C6).*

7. To precisely adjust the maximum output, adjust the input frequency until the output reads within  $\pm 0.1\%$  of the maximum selected output range. This typically occurs near 90% of the HI input frequency. Press the CAL button to store the value. The red LED will now be on.

8. To precisely adjust the minimum output, lower the input frequency until the output reads within  $\pm 0.1\%$  of the minimum selected output. This typically occurs near 10% of the HI input frequency. Press the CAL button to store the value. The yellow and Red LEDs will be on. The green LED should be dim.

9. Press the CAL button once again to exit the calibration mode. The green LED will now be on.

10. Check the minimum and maximum input-to-output calibration. Repeat steps 1 to 8 if calibration is not within desired specifications.

*Note 1: To reset the unit while in the calibration mode, push the CAL button and hold for 5 seconds.*

*Note 2: Removing power to the unit at anytime before Step 8 will restore previous settings and calibration.*

### Optimal Sensitivity

If the amplitudes of the input frequency are within the sensitivity parameters (i.e. 150mVp - 1Vp for LO and 0.5Vp - 10Vp for HI), then the sensitivity parameters can be set for optimum noise rejection.

1. Set the input near midrange (50% input) or to a frequency that exhibits the minimum pulse amplitude.
2. Turn the sensitivity pot (SENS) clockwise (CW) until the output drops to minimum.
3. Turn the sensitivity pot counter-clockwise (CCW) a turn or two until the output returns to the previous level.
4. Run the input through the entire frequency range to make sure that the pulses are sensed at both the low and high input frequencies. If the output drops out during this test, turn the sensitivity pot counterclockwise another turn or two until the output picks up. Repeat to validate sensitivity settings.

Table 1: Output Range Settings

Ranges	Selector SW2							
	1	2	3	4	5	6	7	8
0 to 5V	■	■	■	■				
0 to 10V	■		■	■				
0 to 1mA		■	■	■				
4 to 20mA						■	■	■
0 to 20 mA	■	■			■		■	■

Key: ■ = 1 = ON or Closed

Table 2: Input Sensitivity Settings

Sensitivity	SW2	
	9	10
High (0.5 to 10Vp; 150Vrms maximum)		
Low (150mVp to 1Vp; 50Vrms maximum)		■

Key: ■ = 1 = On or Closed

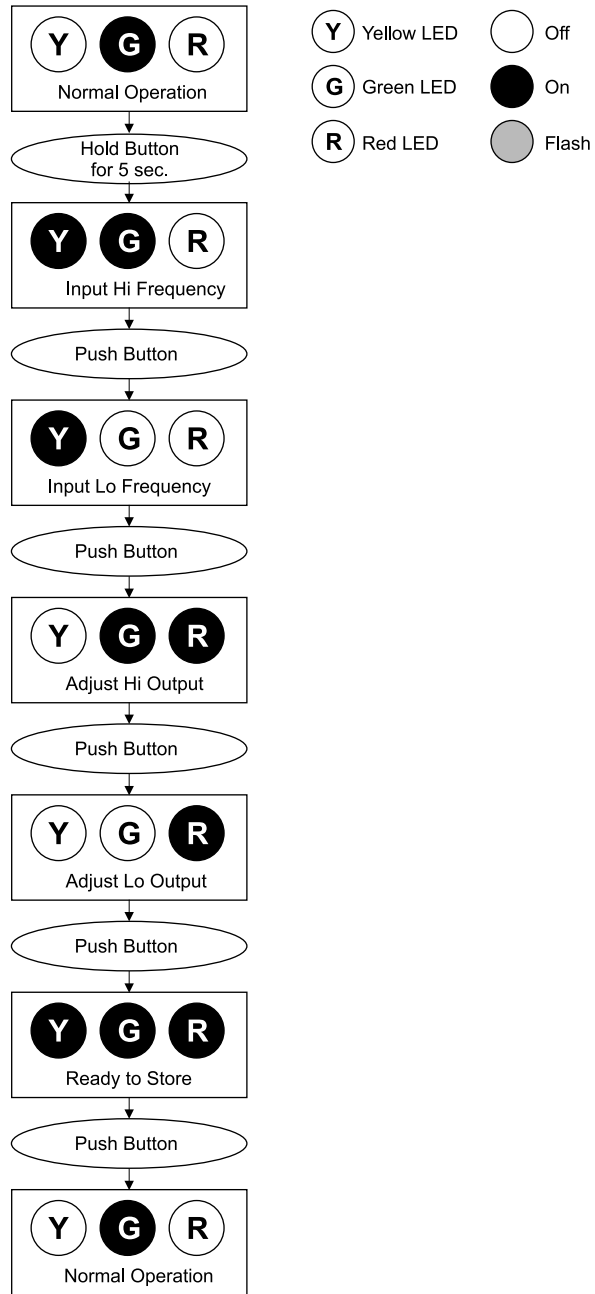


Figure 1: Q476 Calibration Flow Chart

**Specifications**

**Input:**

- Frequency
  - Full Scale Range: 2Hz to 10,000Hz.
  - Amplitude Range: 150mVp to 150Vrms
  - Impedance: >10K ohms
  - Overtoltage: 180Vrms, max.
  - Over-range: 20KHz, max.
  - Common Mode (Input to Gnd): 1800V, max.
  - Zero Turn-Up: 99% of full scale range (9998Hz)
  - Span Turn-Down: 99% of full scale range (2Hz)

**Output:**

- Voltage
  - Output: 0-5V, 0-10V
  - Source Impedance: <100 ohms
  - Drive: 10mA, max. (1K ohms, min. @ 10V)
- Current
  - Output: 0-1mA, 0-20mA, 4-20mA
  - Source Impedance: >100K ohms
  - Compliance:
    - 0-1mA; 7.5V, max. (7.5K ohms, max.)
    - 0-20mA; 12V, max. (600 ohms, max.)
    - 4-20mA; 12V, max. (600 ohms, max.)

**Accuracy (Including Linearity & Hysteresis):**

±0.1% of selected range at 25°C

**Stability:**

±0.025%/°C maximum of selected range.

**Excitation Voltage:**

8VDC, for open collector and contact closure inputs. 5mA short circuit current max.

**Response Time (10 to 90%):**

500mSec., or 100 times the period of the full scale frequency.

**Common Mode Rejection:**

- DC: 100dB
- >60Hz: 80dB

**Isolation:**

1800VDC between input, output and power.

**Ordering Information**

**Models & Accessories**

**Specify:**

1. Model: **Q476-0000**
2. Specify I/QRail type and quantity (required)
3. Accessories: (see Accessories)
4. Optional Custom Factory Calibration; specify **C620** with desired input and output range

**Accessories**

Action/I/Q modules will mount on standard TS32 (model MD02) or TS35 (model MD03) DIN Rail. In addition, the following accessories are available:

- MD02** TS32 DIN Rail
- MD03** TS35 x 7.5 DIN Rail
- IQRL-2002** 2 Position I/QRail & DIN rail
- IQRL-2004** 4 Position I/QRail & DIN rail
- IQRL-2008** 8 Position I/QRail & DIN rail

**ESD Susceptibility:**

Capable of meeting IEC 801-2 level 3(8KV)

**LED Indication (green):**

- LVL (green):
  - Lit when power is on
  - Input < 107% then 8Hz flash
  - Input > -7% then 4Hz flash

IN (yellow):

Input range programming status

OUT (red):

Output range programming status

**Humidity (Non-Condensing):**

- Operating: 15 to 95% @ 45°C
- Soak: 90% for 24 hours @ 65°C

**Temperature Range:**

- Operating: 0 to 55°C (5 to 131°F)
- Storage: -25 to 70°C (-13 to 158°F)

**Power:**

2.5W max., 100 to 240VAC ±10%, 50 to 400Hz

**Weight:**

0.50 lbs

**Wire Terminations:**

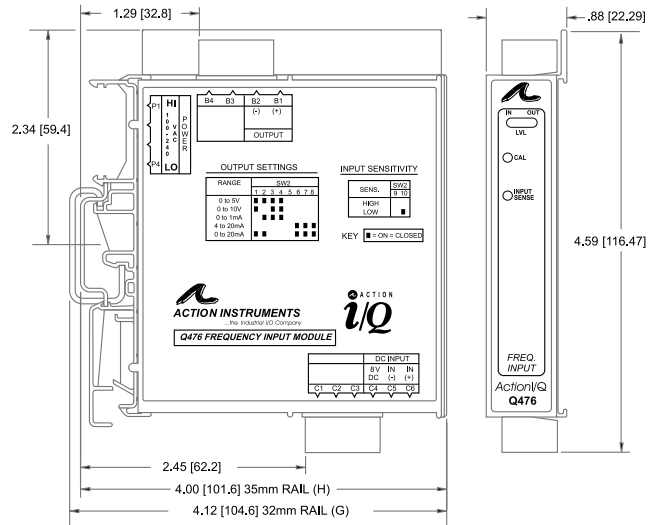
Screw terminals for 12-22 AWG

**Agency Approvals:**

- CSA certified per standard C22.2 (File No LR 42272).
- UL recognized per standard UL508 (File No E99775).

Terminal	Connection	Terminal	Connection
B1	DC Output (+)	C4	Excitation Source (8VDC)
B2	DC Output (-)	C5	Frequency Input (-)
B3	Not Used	C6	Frequency Input (+)
B4	Not Used	P1	AC Power (Hot)
C1	Not Used	P2	Not Used
C2	Not Used	P3	Not Used
C3	Not Used	P4	AC Power (Neutral)

**Dimensions**





Q486-0001



# ACTIONI/Q® Q486

## AC Powered RTD, T/C, Ohm & mV Input Field Configurable Isolator

Provides an Isolated DC Output  
in Proportion to the Temperature Signal Input



- Instant Accuracy™
- Field Configurable Input Ranges
- PC or DIP Switch Configuration
- Eliminates Ground Loops

- TouchCAL Technology
- DIN Rail Mounting with IQRL
- Universal AC Power 85 to 265 VAC
- SnapLoc™ Plug-in Terminals

### Description

The Q486 is a DIN rail mount, RTD, thermocouple, mV or Ohm input signal conditioner with 1800V isolation between input, output and power. The field configurable input and output offers flexible, wide ranging capability for most temperature signal conditioning applications. The Q486 is configured via DIP switch for the thermocouple type (B, C, E, J, K, N, R, S, T) or the RTD type (Pt, Ni & Cu). Additionally, functions such as signal linearization, up or down scale burnout, number of RTD leads (2, 3, 4) and voltage or current output are also set via dip switches (see Tables).

Configuration software, along with a serial port adapter cable is available for those who would prefer PC configuration capability. This Graphic User Interface (GUI) program takes the place of setting DIP switches and using the pushbutton for ranging. With this software, an input signal calibrator is not required for ranging since the values only need to be typed into the program and downloaded.

### Instant Accuracy™

Instant Accuracy™ maximizes accuracy and performance during warmup and during changes in ambient temperature. This patented cold-junction compensation technique utilizes two temperature sensors to measure the differential temperature near the terminal block. Using heat transfer calculations with the measured differential temperature and the known thermal conductivity of the PCB, the terminal junction temperature is determined with extreme accuracy. Even during unstable thermal states such as start-up, ambient temperature changes or changing load or power, the Q486 performs extremely accurate thermocouple temperature measurement.

Instant Accuracy improves system performance and productivity due to reduced warm up time, fewer temperature measurement errors and tighter process control for higher quality. Most significantly, it allows calibration to be checked quickly and accurately without the effects of rapid ambient temperature changes due to opening a control panel door, which often causes erroneous readings and miscalibrations; a common cause of measurement errors.

### TouchCAL™ Technology

TouchCAL™ technology allows easy field ranging for any of the thermocouple or RTD input types. For example, the dip switch

configured range for the J type thermocouple is -210 to 760°C. Using a thermocouple simulator as a reference, the model Q486 could be ranged for 0 to 50°C or 0 to 500°C by simply applying the desired minimum and maximum input levels and pushing the range button to store the levels in non-volatile memory. The output is ranged by applying an input signal to achieve an accurate output level and pushing the range button.

### Applications

The model Q486 field configurable thermocouple or RTD input isolator is useful in eliminating ground loops and interfacing temperature sensors to data acquisition and control systems.

Three-way isolation completely eliminates ground loops from any source. Isolation protects expensive SCADA systems from ground faults and allows the noise reduction benefits of grounded thermocouples or sensors to be realized.

The Q486 employs the latest analog to digital signal processing technology and advanced low-power microprocessors. Instant Accuracy cold-junction-compensation (CJC) of thermocouples, and lead length compensation for RTDs ensures an extremely accurate and stable signal for virtually any temperature sensor to DC signal conversion.

High density DIN rail mounting offers a very compact solution and saves valuable panel space. Power is delivered to the Q486 using the exclusive I/QRail which reduces wiring requirements and the need to daisy-chain power. SnapLoc terminals ensure easy installation and low Mean-Time-To-Repair (MTTR).

### Diagnostic LEDs

The Q486 is equipped with front panel LEDs for input power (green-on), input overrange and underrange; input open circuit (yellow-on); and switch setting error (red-on).

### Configuration

The Q486 can be configured via DIP switches for a wide variety of temperature input ranges for RTD, thermocouple, ohm and millivolt sensors. Inputs can be offset by >90% or adjusted down to <10% of the full scale span.

Unless a specific customer range is ordered, the factory presets the Q486 as follows:

Input Type: Thermocouple, J-Type  
 Input Range: 0 to 500°C  
 Burnout: Up Scale  
 Output Range: 4/20mA

Refer to the tables for other I/O ranges.

1. With power off, snap off the faceplate by lifting the right edge away from the heatsink.
2. For RTD or Resistance inputs, set position 1 and 2 of SW2 for 2, 3 or 4 wire resistance input (see Table 1). For thermocouple inputs these switches ignored and can be in any position.
3. Configure the output for voltage or current using position 3 of SW2 (see Table 2).
4. If the input range desired is the full scale range for the input type (e.g. Pt100 Ohm = -200°C to 850°C), then set position 4 of SW2 to ON (or closed) for this default range (see Table 3). If configuration of a sub-range is preferred (e.g. Pt100 Ohm, 0 to 500°C), then set position 4 of SW2 to OFF (or open) to enable use of the ranging pushbutton adjustment.
5. If the output range desired is the full scale range for the output type (e.g. 4-20mA or 2-10V), then set position 5 of SW2 to ON for either of the full scale default output ranges (see Table 4). If configuration of a sub-range is preferred (e.g. 12-20mA or 1-5V), then set position 5 of SW2 to OFF (or open) to enable use of the ranging pushbutton adjustment.

6. Set Burnout detection with position 6 of SW2 (see Table 5). The ON position (up scale) will force the output beyond full scale when the t/c input is open circuit. The OFF position (down scale) will force the output below 0% when the input is open circuit.

7. Set the t/c Linearization function with position 7 of SW2 (see Table 6). The ON position will provide an output linear to the temperature input signal. The OFF position will provide an output directly proportional to the thermoelectric (mV) input (i.e. not linearized to temperature).

Note: The unit must be configured with linearization turned ON. Once the configuration is saved, linearization can then be turned OFF.

8. Set the Configuration Mode with position 8 of SW2 (see Table 7). The ON position is for DIP switch configuration. The OFF position is for configuring via PC using a serial interface cable (consult factory regarding cable and software).

9. Set the Input Type with position 1 and 2 of SW3 (see Table 8).

10. Set the specific RTD, thermocouple, millivolt or resistance input with position 3 through 6 of SW3 (see Table 9).

Note: For PC configuration refer to the software manual and help files associated with the model C681 accessory kit.

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Table 1: RTD Type

RTD Type	SW2	
	1	2
3-Wire	■	■
4-Wire	■	
2-Wire		■

Key: ■ = 1 = On or Closed

Table 5: Input Type

Input Type	SW3	
	1	2
Thermocouple	■	■
RTD	■	
mV or Ohms		■

Key: ■ = 1 = On or Closed

Table 9: Input Select

T/C Type	SW3				Input Range	Accuracy Range	Input (A/D) Accuracy	
	3	4	5	6				
R	■	■	■	■	0 to +1760° C	+200 to +1760° C	+/-1.0° C	
J	■		■	■	-210 to +760° C	-100 to +760° C	+/-0.25° C	
S	■	■	■		0 to +1760° C	+400 to +1760° C	+/-1.0° C	
B	■	■		■	0 to +1800° C	+400 to +1800° C	+/-2.0° C	
T	■	■			-270 to +400° C	0 to +400° C	+/-0.25° C	
K	■		■		-270 to +1370° C	-100 to +1370° C	+/-0.3° C	
N	■			■	-270 to +1300° C	70 to +1300° C	+/-0.4° C	
C	■				0 to +2320° C	0 to +2320° C	+/-0.5° C	
E		■	■	■	-270 to +1000° C	-100 to +1000° C	+/-0.25° C	
RTD Type	SW3				Input Range	Input (A/D) Accuracy		
	3	4	5	6				
Cu-9.035	■	■	■	■	-40 to +260° C	+/-0.25° C		
Ni-120 067	■		■	■	-80 to +320° C	+/-0.15° C		
Pt-100 385	■	■	■		-200 to +850° C	+/-0.15° C		
Pt-100 3911	■	■		■	-200 to +630° C	+/-0.15° C		
Pt-100 392	■	■			-200 to +630° C	+/-0.15° C		
Pt-200 385	■		■		-200 to +850° C	+/-0.20° C		
Pt-200 392	■			■	-200 to +630° C	+/-0.20° C		
Pt-500 385	■				-200 to +850° C	+/-0.20° C		
Pt-500 3911		■	■	■	-200 to +630° C	+/-0.20° C		
Pt-500 392		■	■		-200 to +630° C	+/-0.20° C		
Pt-1000 385		■	■	■	-200 to +850° C	+/-0.20° C		
mV & Ohm Type	SW3				Input Range	Accuracy Range	Input (A/D) Accuracy	Minimum Span
	3	4	5	6				
+/- 90mV	■	■	■	■	-90 to +90mV	-90 to +90mV	+/-12uV	3mV
+/- 900mV	■	■	■		-100 to 900mV	-100 to 900mV	+/-25uV	3mV
0 to 4000 Ohms	■	■		■	10 to 4000 Ohms	10 to 4000 Ohms	+/-1.0 Ohms	10 Ohms

Key: ■ = 1 = ON or Closed

Table 2: Output Type

Output	SW2
	3
Current	■
Voltage	

Key: ■ = 1 = On or Closed

Table 6: Burnout Detection

Burnout Detection	SW2
	6
Upscale	■
Downscale	

Key: ■ = 1 = On or Closed

Table 3: Input Range Type\*

Input Range	SW2
	4
Default	■
User Defined	

Key: ■ = 1 = On or Closed

Table 7: Output Linearization

Output Linear to Temperature	SW2
	7
On	■
Off	

Key: ■ = 1 = On or Closed

Table 4: Output Range Type\*

Output Range	SW2
	5
Default	■
User Defined	

Key: ■ = 1 = On or Closed

Table 8: Config Mode

Configuration Mode	SW2
	8
By DIP Switch	■
By PC	

Key: ■ = 1 = On or Closed

\*Default for Outputs is either 2-10V or 4-20mA. Default for Inputs is the "Input Range" specified in Table 9. Note that if the input or output is set for default, then the input or output calibration will be skipped in the pushbutton programming sequence.

Input to Output error at 25°C is less than or equal to the Input Accuracy, plus the Linearization Accuracy, plus the Output Accuracy (plus the CJC Error for T/C Inputs).



## Calibration

The Q486 is a microprocessor based circuit with internal references that are factory calibrated to better than 0.000005V. For this reason the Q486 does not need field calibration, but it can be configured (ranged) in the field for virtually any temperature to DC I/O combination.

For best results ranging should be performed in the operating installation, allowing at least 30 minutes for thermal equilibrium of the system. If ranging on a test bench is preferred, then an output load equal to the input impedance of the device connected to the output is recommended, along with a 30 minute warm up period.

*Note: An I/Q Rail is required to deliver power to the module. See ordering information.*

1. After configuring the unit, install the module onto a piece of DIN rail and the I/Q Rail mounting combination. See the I/Q Rail data sheet for details.
2. Connect the input to a calibrated thermocouple simulator or resistance source and the output to a voltage or current meter. Apply power and allow the system to reach thermal equilibrium (approx. 20 minutes).
3. Adjust the input signal to the desired maximum and observe that the green LED is on. Push the CAL button and hold it down for more than 5 seconds (until the yellow and red LEDs are on).

*Note: To quit the calibration mode and reset the unit, push the CAL button and hold for more than 5 seconds. Or, wait for more than five minutes and the unit will time-out and automatically reset to the previously stored calibration.*

4. Push the CAL button momentarily (the yellow and green LEDs will now be on).
5. Apply the maximum input signal level, then push the CAL button to store. The yellow LED will now be on.
6. Apply the minimum input signal level, then push the CAL button to store. The green and red LEDs will now be on.
7. Adjust the input signal while monitoring the output signal until the output is at the desired maximum level (e.g. 20.00mA), then push the CAL button to store (the red LED will be on).
8. Adjust the input signal while monitoring the output signal until the output is at the desired minimum level (e.g. 4.00mA), then push the CAL button to store (the yellow, green and red LEDs will be on).
9. To finish calibration, push the CAL button once again. The green LED will be on if the input is within the calibrated range.

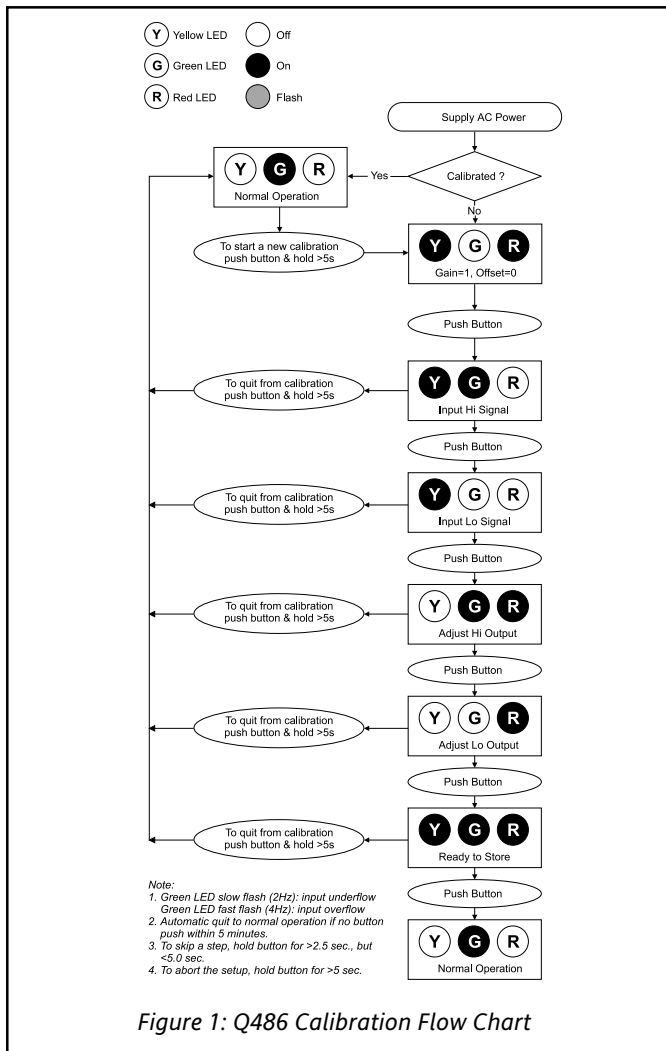


Figure 1: Q486 Calibration Flow Chart

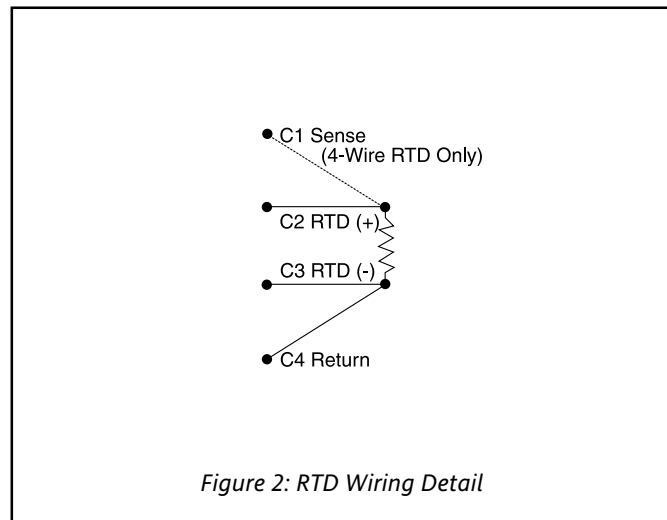


Figure 2: RTD Wiring Detail

Terminal	Connection	Terminal	Connection
A1	Current Output (+)	C3	RTD Input (-) or Resistance
A2	Voltage Output (+)	C4	RTD Return
A3	Output Common (-)	C5	T/C Input (-) or mV (-)
A4	PC Interface Return	C6	T/C Input (+) or mV (+)
A5	TX, Transmit	P1	AC Power (Hot)
A6	RX, Receive	P2	Not Used
C1	RTD Sense	P3	Not Used
C2	RTD Input (+) or Resistance	P4	AC Power (Neutral)

**Specifications**

**Inputs:**

- Sensor Types: 2, 3 or 4-wire; see Table 9
- Ranges: Any span within the Accuracy Range in Table 9
- Impedance:  $\geq 1.0M$  ohms typical for t/c and mV inputs
- RTD Excitation:  $\leq 0.3mA$
- Burnout Detection: upscale or downscale CJC Error:  $\leq +0.1^{\circ}C$  max. (Instant Accuracy ensures the output is within  $\pm 0.5^{\circ}C$  of rated accuracy 30 seconds after powering)

**Output:**

- Voltage:
  - Range: 0-10V
  - Drive: 10mA (1000 ohm load min.)
- Current:
  - Range: 0-20mA
  - Drive: 15V (750 ohms max.)

**Isolation:**

1800VDC or peak AC between input, output and power

**Configuration:**

- SW1: Pushbutton, input and output ranging
- SW2: Linearization, Burnout, Output (voltage or current), and initialization mode
- SW3: Input Type

**Accuracy:**

- Input (A/D): see Table 9
- Linearization:  $\leq \pm 0.05\%$  of accuracy range, max.
- Output:  $\leq \pm 10mA$  for current output  
 $\leq \pm 5mV$  for voltage output

**Thermal Stability:**

- CJC:  $\pm 0.01^{\circ}C/^{\circ}C$  change in ambient, max.
- Zero:  $\pm 0.0075\%$  of full scale/ $^{\circ}C$  change in ambient, max.
- Span:  $\pm 0.0075\%$  of full scale/ $^{\circ}C$  change in ambient, max.
- Long Term:  $\pm 0.1\%$  max. over a 9 month period

**Response Time:**

400mSec, typical.

**Turn On Time:**

$\leq 5$  seconds to establish output within 99% or  $2^{\circ}C$  of final value or  $0.5^{\circ}C$  within 30 seconds

**LED Indicator:**

- Power (green):
  - On when power is on,
  - Flashes for t/c burnout
- Input (yellow):
  - Flashes for out of range
- (red):
  - Flashes for switch setting error
- Calibration: 1 green, 1 yellow and 1 red LEDs indicate steps in ranging process

**Common Mode Rejection:**

120dB at DC,  
> 90dB at 60Hz

**ESD Susceptibility:**

Capable of meeting IEC 801-2 level 3 (8kV)

**Humidity (non-condensing):**

Operating: 15 to 95% @  $45^{\circ}C$   
Soak: 90% RH for 24 Hours @  $60^{\circ}C$

**Temperature:**

Operating:  $-25^{\circ}C$  to  $+65^{\circ}C$  (-13 to  $149^{\circ}F$ )  
Storage:  $-25^{\circ}C$  to  $+70^{\circ}C$  (-13 to  $158^{\circ}F$ )

**Power:**

2.5W max., 100 to 240VAC  $\pm 10\%$ , 50 to 400Hz

**Wire Terminal:**

Socketed screw terminals for 12-22AWG

**Agency Approvals**

CSA certified per standard C22.2 (File No. LR42272).  
UL recognized per standard UL508 (File No.E99755).  
CE Compliance per EMC directive 89/336/EEC and Low Voltage 73/23/EEC.

**Ordering Information Models & Accessories**

**Specify:**

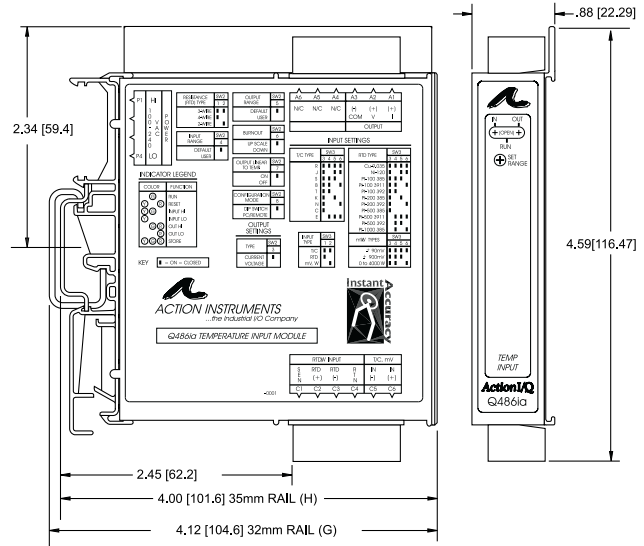
- Model: **Q486-0001**
- Specify I/QRail type and quantity (required)
- Accessories: (see Accessories)
- Optional Custom Factory Calibration; specify **C620** with desired input and output ranges.

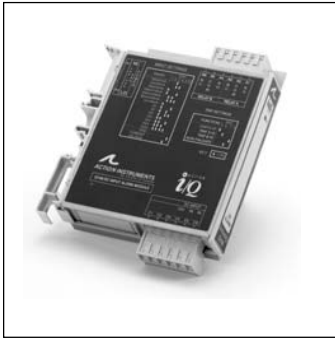
**Accessories**

Action/I/Q series modules will mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition, the following accessories are available:

- C681-0001** PC Adapter & Configuration Software
- MD02** TS32 DIN rail
- MD03** TS35 x 7.5 DIN rail
- IQRL-2002** 2 Position I/QRail & DIN rail
- IQRL-2004** 4 Position I/QRail & DIN rail
- IQRL-2008** 8 Position I/QRail & DIN rail
- C620** Factory Calibration

**Dimensions**





Q108-0000



# ACTIONIQ® Q108

## DC Powered DC Input Limit Alarm

Provides Relay Contact Closures  
at a Preset DC Input Level



- Field Configurable Input Ranges
- TouchCAL™ Technology
- Setpoints Programmable HI or LO and Failsafe or Non-Failsafe
- High Density DIN Rail Mounting
- Flexible 9 to 30VDC Power Supply
- 24VDC Transducer Excitation
- SnapLoc™ Plug-in Terminals
- ASIC Technology

### Description

The ActionIQ model Q108 is a DIN rail mount, DC voltage or current input limit alarm with dual setpoints and two contact closure outputs. The field configurable input and alarm functions offer flexible setpoint capability. Input voltage spans from 10mV to 200V and input current spans from 1mA to 100mA can be field configured. Bipolar inputs are also accepted.

The Q108 is configurable as a single or dual setpoint alarm, with HI or LO trips and failsafe or non-failsafe operation. Also included are adjustable deadbands (up to 100% of full scale input) for each setpoint, a 24VDC voltage source (isolated from line power) for transducer excitation, and a universal DC power supply which accepts any voltage between 9 and 30VDC.

### TouchCAL Technology

Action has simplified setpoint calibration. Using a pushbutton instead of potentiometers, improvements in calibration resolution and reliability are realized due to the elimination of the potentiometers' mechanical variability.

For calibration, simply input the signal level of the desired trip and press the pushbutton to store it in non-volatile memory. Deadband is entered the same way with another pushbutton press to store.

### Diagnostic LEDs

The Q108 is equipped with three front panel LEDs. The green LED is a dual function LED labeled IN, which indicates line power and input signal status. Active DC power is indicated by the illuminated LED. If this LED is off, check DC power and wiring connections. If the input signal is 10% above or below the configured input range the green LED will flash at 8Hz or 4Hz, respectively.

The two red LEDs indicate the relay state of each setpoint. An illuminated red LED indicates the tripped condition for the respective setpoint.

### Output

The Q108 is equipped with two SPDT (form C) relays, rated at 120VAC or 28VDC at 5 amperes. Each of these relays is independently controlled by the field configurable setpoint and deadband.

### Operation

The Q108 limit alarm setpoints can be configured for HI or LO, failsafe or non-failsafe operation. Each of the setpoints has a respective HI or LO deadband. In a tripped condition, the setpoint is exceeded and the appropriate red LED will illuminate. The trip will reset only after the process falls below the HI deadband or rises above the low deadband (see Figure 1). For proper deadband operation, the HI setpoint must be set above the LO setpoint. In failsafe operation, the relay is energized when the process is below the HI setpoint or above the LO setpoint (opposite for non-failsafe). In the failsafe mode, a power failure results in an alarm state output.

### Dynamic Deadband

Circuitry in the Q108 prevents false trips by repeatedly sampling the input. The input must be beyond the setpoint for 100 milliseconds, uninterrupted, to qualify as a valid trip condition. Likewise, the input must fall outside the deadband and remain there for 100 milliseconds to return the alarm to an untripped condition. This results in a "dynamic deadband" —based on time— in addition to the normal deadband.

### Configuration

Unless otherwise specified, the factory presets the Model Q108 as follows:

Input:	Current
Range:	0-20mA
Output:	Dual, SPDT
Trip:	A: HI; B: LO
Failsafe:	No
Deadband:	A, B: 0.25%

The DC power input accepts any DC source between 9 and 30VDC.

**Note:** An I/QRail is an optional accessory to power the modules. A 2, 4, or 8 position rail is available. See ordering information.

For other I/O ranges, refer to Table 1 and Figure 5. Reconfigure switch SW1 for the desired input type, range and function.

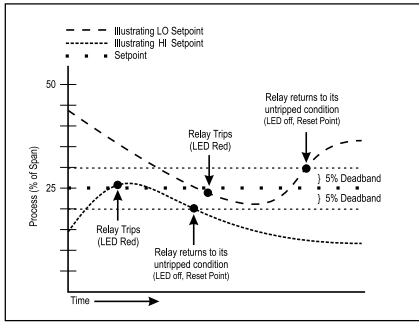


Figure 1: Limit alarm operation and effect of deadband.

**WARNING:** Do not change switch settings with power applied. Severe damage will result!

1. With the module removed from the rail and not powered, snap off the face plate by lifting the right edge away from the heat sink. Note the input switch (SW1) is located under the faceplate. Set positions 9 & 10 for voltage or current input (see Table 1).
2. Set positions 1 through 4 of "SW1" for the desired input range (see Table 1).
3. Set position 5 of "SW1" to ON (closed) for unipolar (e.g., zero based, 0-20mA) range or OFF (open) for bipolar (e.g., -100% offset, -20 to 20mA) range (see Figure 5).
4. Set positions 6 and 7 "SW1" to ON for a HI trip setpoint or OFF for a LO trip setpoint (see Figure 5).
5. Set position 8 of "SW1" to ON for non-failsafe operation or OFF for failsafe operation (e.g., alarm trips upon power failure).

### Calibration

1. After configuring the DIP switches, connect the input to a calibrated DC source and apply power. Refer to the terminal wiring in the specifications section.

Note: For best results, calibration should be performed in the operating environment, mounted on a DIN rail, allowing at least one hour for thermal equilibrium of the system.

2. After applying power to the unit all three LEDs will flash for approximately 10 seconds. Adjust the input signal level for the Relay "A" setpoint. The green LED should be on. Press and hold the CAL button for 4 seconds (until the red LED starts flashing) to enter the calibration mode. The green LED will be on and the red Relay "A" LED will be flashing.

Note: If the green LED is flashing, the input is out of range (i.e. 7 % above or below the configured range). Check to make sure the input signal is within the DIP switch configuration range. Double check the DIP switch settings.

3. Setpoint "A": Input the desired trip level for Relay "A" and push the CAL button. The green LED and the red Relay "A" LED will be flashing. Note that the green LED will stop flashing when the input drops below a high setpoint or rises above a low setpoint.

4. Deadband "A": For minimum deadband (approximately 0.25%), press and hold the CAL button for 4 seconds. For high setpoints, lower the input level to the desired deadband point and push the

CAL button. For low setpoints, increase the input level (green LED turns off) to the desired deadband level and push the CAL button. The green LED will be on and the red Relay "B" LED will be flashing.

5. Setpoint "B": Input the desired trip level for Relay "B" and push the CAL button. The green and the red Relay "B" LED will be flashing. Note that the green LED will stop flashing when the input drops below a high setpoint or rises above a low setpoint.

6. Deadband "B": For minimum deadband (approximately 0.25%), press and hold the CAL button for 4 seconds. For high setpoints, lower the input level (green LED turns off) to the desired deadband point and push the CAL button. For low setpoints, increase the input level to the desired deadband level and push the CAL button. The green LED will be on and both the red LEDs will be flashing.

7. Press the CAL button once again to exit the calibration mode. Check the setpoint and deadband to validate calibration.

### Relay Protection and EMI Suppression

When switching inductive loads, maximum relay life and transient EMI suppression is achieved by using external protection (see Figures 2 and 3). Place all protection devices directly across the load and minimize lead lengths. For AC inductive loads, place a properly rated MOV across the load in parallel with a series RC snubber. Use a 0.01 to 0.1mF pulse film capacitor (foil polypropylene recommended) of sufficient voltage, and a 47 ohm, 1/2W carbon resistor. For DC inductive loads, place a diode across the load (PRV > DC supply, 1N4006 recommended) with (+) to cathode and (-) to anode (the RC snubber is an optional enhancement).

Table 1: Q108 Input Range Switch

Voltage	Current	Input Range Selector SW1			
		1	2	3	4
10 mV	1 mA			■	
20 mV	2 mA			■	■
50 mV	5 mA		■		
100 mV	10 mA		■		■
200 mV	20 mA		■	■	
500 mV	50 mA		■	■	■
1V	100 mA	■			
2V		■			■
5V		■		■	
10V		■		■	■
20V		■	■		
50V		■	■		■
100V		■	■	■	
200V		■	■	■	■

Key: ■ = 1 = ON or Closed

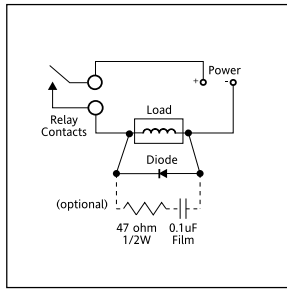


Figure 2: DC Inductive Loads

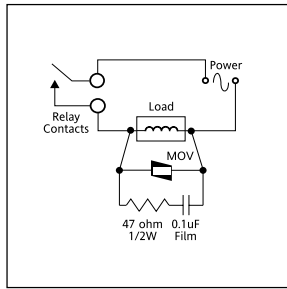


Figure 3: AC Inductive Loads

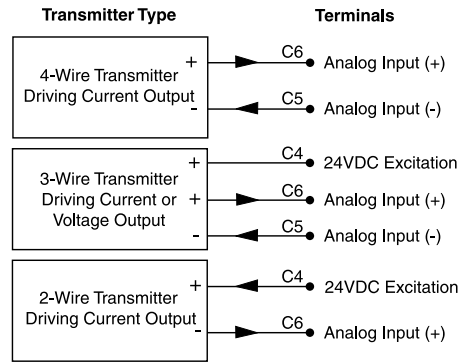
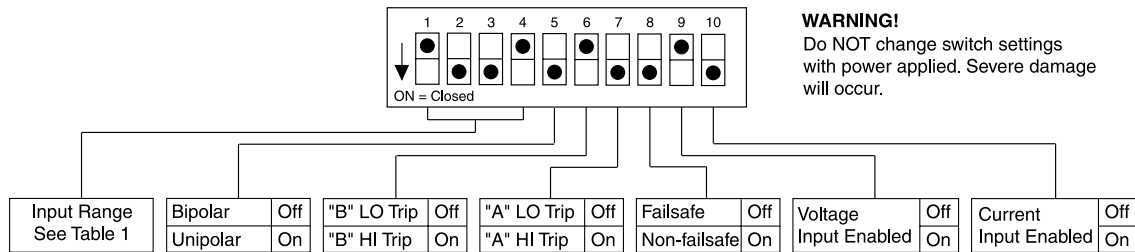


Figure 4: Typical Connections for Voltage or Current for Q108



**WARNING!**  
Do NOT change switch settings with power applied. Severe damage will occur.

Figure 5: Q108 Input Range/Function Selection (SW1) Factory Default Settings  
Note: For voltage inputs Current Enable must be off. For current inputs Voltage Enable must be off.

Note:  
1. During normal operation, the green LED will be ON or flashing. The Red LEDs will be ON while the relative relay is tripped.  
2. In the calibration mode, if no button is pushed within 2 minutes, the unit will revert to normal operation.

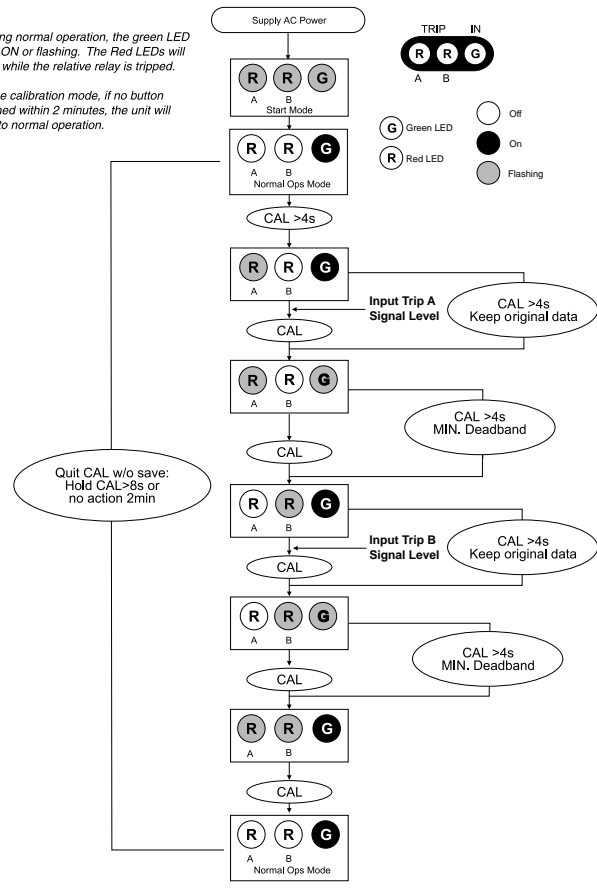


Figure 6: Q108 Calibration Flow Chart

## Specifications

### Inputs:

#### Voltage Input:

Range: 10mV to  $\pm 200V$ ; Impedance:  $>100k$  ohms  
 Overvoltage: 200V rms, max.

#### Current Input:

Range: 1mA to  $\pm 100mA$ ; Impedance: 20 ohms, typical  
 Overcurrent: 170mA rms, max.  
 Overvoltage: 60VDC (protected by self resetting fuse)

**Common Mode (Input to Ground):** 1800VDC, max.

### LED Indicators:

Input Range (Green)  
 $>110\%$  input: 8Hz flash  
 $<10\%$  input: 4Hz flash

Setpoint (Red)  
 Tripped: Solid red  
 Safe: Off

### Limit Differential (Deadband):

$>50mV/5mA$ : 0.25% to 100% of span  
 $<50mV/5mA$ : 1% to 100% of span

### Response Time:

Dynamic Deadband:  
 Relay status will change when proper setpoint/process condition exists for 100msec.

Normal Mode (analog filtering):  $<250mSec$  (10-90%)

### Setpoints:

Effectivity: Setpoints are adjustable over 100% of selected input span.  
 Repeatability (constant temp.):  
 $>50mV/5mA$ : 0.1% of full scale  
 $<50mV/5mA$ : 0.2% of full scale

**Temperature Stability:**  $\pm 0.05\%$  of full scale/ $^{\circ}C$ , max.

**Excitation Voltage:** 24VDC, 20mA, maximum

**Common Mode Rejection:** DC to 60Hz: 120dB

**Isolation:** 1800VDC between contacts, input and power

**ESD & Transient Susceptibility:** Meets IEC 801-2, Level 3 (8KV)

### Humidity (Non-Condensing):

Operating: 15 to 95% @ $45^{\circ}C$   
 Soak: 90% for 24 hours @ $65^{\circ}C$

### Temperature Range:

Operating: 0 to  $55^{\circ}C$  (32 to  $131^{\circ}F$ )  
 Storage:  $-25$  to  $70^{\circ}C$  ( $-13$  to  $158^{\circ}F$ )

**Power:** 2.5W max., 9 to 30VDC

### Relay Contacts

2 SPDT (2 form C) Relays; 1 Relay per setpoint  
 Current Rating (resistive)  
 120VAC: 5A; 240VAC: 2A; 28VDC: 5A

Material: Gold flash over silver alloy  
 Electrical Life:  $10^5$  operations at rated load

*Note: External relay contact protection is required for use with inductive loads.*

Mechanical Life:  $10^7$  operations

**Wire Terminations:** Screw terminations for 12-22 AWG

**Weight:** 0.56lbs.

### Agency Approvals

UL recognized per standard UL508 (File No. E99775).  
 CSA certified per C22.2 No. 0-M91 & 142-M1987 (File No. LR42272-84).  
 CE Compliance per EMC directive 89/3/36 EEC and Low Voltage 73/23/EEC.

Terminal	Connection	Terminal	Connection
A1	Relay A, N.O.	C3	Relay B, N.C.
A2	Relay A, Common	C4	Voltage Supply (+24VDC)
A3	Relay A, N.C.	C5	Input (-)
A4	Not Connected	C6	Input (+)
A5	DC Power (+)	P1	Not Used
A6	DC Power (-)	P2	Not Used
C1	Relay B, N.O.	P3	DC Power (+)
C2	Relay B, Common	P4	DC Power (-)

## Ordering Information

### Models & Accessories

#### Specify (model number)

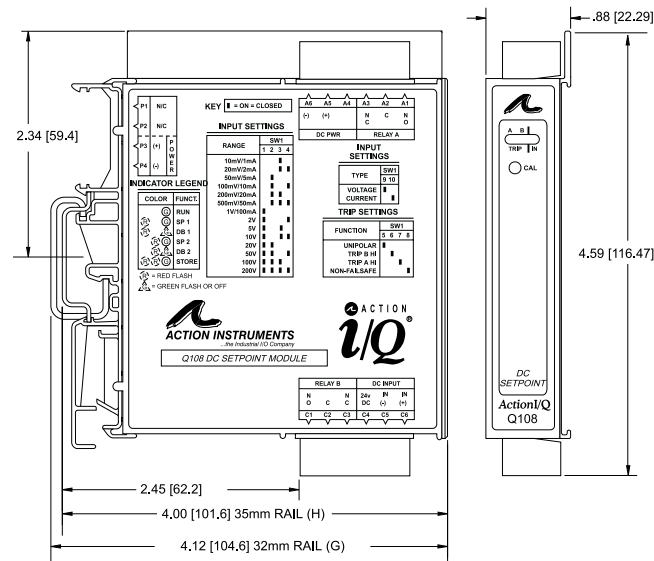
- 1) **Q108-0000**
- 2) Specify I/QRail type and quantity (optional)
- 3) Accessories: (see Accessories)
- 4) Optional Custom Factory Calibration: Specify **C620** with desired input, setpoint and deadband.

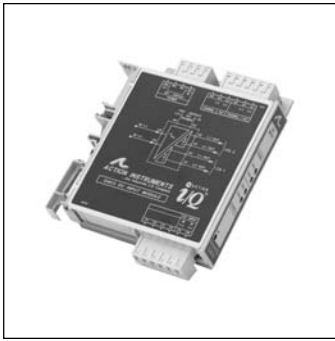
### Accessories

Action/I/Q series modules mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition, the following accessories are available:

- MD02** TS32 DIN rail
- MD03** TS35 x 7.5 DIN rail
- WV905** 24VDC Power Supply (500mA)
- H910** 24VDC Power Supply (1 Amp)
- H915** 24VDC Power Supply (2.3 Amp)
- IQRL-2002** 2 Position I/QRail & DIN rail
- IQRL-2004** 4 Position I/QRail & DIN rail
- IQRL-2008** 8 Position I/QRail & DIN rail

## Dimensions





Q404-2 (2 inputs; 2 outputs)  
 Q404-3 (1 input; 1 output; 24V Exc)  
 Q404-4 (signal splitter: 1 input; 2 outputs)

# ACTIONI/Q® Q404-2/3/4 DC Powered DC Input Multi-Channel Isolator

Provides 1 or 2 Fully Isolated DC Output Signals  
 in Proportion to 1 or 2 DC Inputs



- Multi-Channel Design
- 2000VAC Isolation
- High Density DIN Rail Mounting

- Universal DC Power 10.8 to 26.4VDC
- SnapLoc™ Plug-in Terminals
- Fast Response Time

## Description

The model Q404 is a DIN rail mount, DC input signal conditioner, with 2000VAC isolation between input output and power. It is available as a single channel signal conditioner (1 input/1 output) or as a multi-channel signal conditioner (1 input/2 outputs or 2 inputs/2 outputs).

Factory configured input and output ranges support standard industrial control signals such as 4-20mA and 0-10V. Front accessed zero and span potentiometers allow 50% adjustment of offset and gain to compensate for sensor errors or signal losses.

All ActionI/Q modules feature SnapLoc plug-in screw terminals for easy installation. Two or more modules can slide together and interlock for solid, high density mounting (remove either the DIN rail foot or the adjacent unit's faceplate, for right side or left side mounting, respectively). The module to be attached will easily slide onto the side of the mounted unit.

## Application

DC input four-wire transmitters are used to isolate and convert DC voltage or current signals into proportional, standard industrial control signals such as 4-20mA or 0-10V. Typically an industrial control system such as a DCS or PLC requires standard industrial control signals with full isolation to ensure reliable, strong signals.

In most industrial process control or data acquisition applications, several different input sources, including voltages and currents from various field instruments (e.g. level, flow, pressure and position sensors), are common. Four-wire transmitters accept these field inputs and provide the controller (DCS & PLC) with the standard industrial signal it requires. The four-wire transmitter will increase the signal drive to high impedance loads and may improve resolution of the process variable.

## Operation

The ActionI/Q model Q404 operates as a four-wire transmitter; each channel derives its power from an independent, transformer isolated DC power source (10.8 to 26.4VDC).

The Q404 has fixed input and output ranges. The standard input and output ranges shown in Table 1 are calibrated to rated accuracy. One range per module; two channels per module, maximum.

## Calibration

Note: For best results, calibration should be performed with the intended output load, in the operating environment, mounted on a DIN rail, allowing at least one hour for thermal equilibrium of the system.

- 1) To check calibration, connect the input to a calibrated DC source. Connect the output to a DC voltage or current meter and the input power to a DC source (10.8 to 26.4VDC) capable of providing up to 0.5 Amps.
- 2) Set the calibrator to the specified minimum DC input value and adjust the zero potentiometer for minimum (e.g. 4mA) output.
- 3) Set the calibrator to the specified maximum DC input value and adjust the span potentiometer for maximum (e.g. 20mA) output.
- 4) Repeat steps 2 and 3 to validate calibration to the output load.

Standard Ranges		
Model	Input	Output
Q404-2L08	0 to 10 Volts	4 to 20 mA
Q404-2L08	0 to 10 Volts 0 to 10 Volts 0 to 10 Volts	0 to 5 Volts 1 to 5 Volts 0 to 10 Volts
Q404-2L28	-10/10 Volts	-5/5 Volts -10/10 Volts
Q404-3L00	-10/10 Volts	4 to 20mA
Q404-3L01	4 to 20mA	0 to 5 Volts 1 to 5 Volts 0 to 10 Volts
Q404-4L00	4 to 20mA	4 to 20mA

## Specifications

### Input:

Range: see Table 1

Impedance:

≥1M ohms (voltage inputs)

≤ 20 ohms (current inputs)

Protection:

withstands up to 24VDC (current input)

120VAC (voltage input) without damage

Common Mode: 2000VAC, input to ground

### Output:

Range: see Table 1

Voltage Output Drive: 10mA (1k ohms, min.)

Current Output Compliance: 15V (750 ohms, max.)

### LED Indication:

Green LED indicates power on

### Output Accuracy:

≤ ±0.1% of full-scale input typical

≤ ±0.2% maximum @ 23°C including linearity, repeatability and hysteresis

### Adjustability:

Front accessed 10 turn pot., ± 50% of range for zero and span

### Stability:

≤ 0.025%/C of full-scale maximum for full-scale and zero

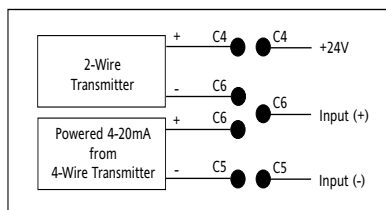


Figure 1. Connections for a Loop Powered 2-Wire Transmitter or a Powered 4-20mA Input

## EMC Compliance (CE Mark):

Emmissions: EN50081-1

Immunity: EN50082-2

Safety: EN50178

## Isolation:

≥ 2000VAC between input and output and channel to channel

## Response Time:

285microSec, -3db @ 3500 Hz (bipolar)

25mSec typical (10 to 90%) 9unipolar)

## Power:

10.8 to 26.4VDC, 2W per channel max.

## Temperature:

Operating: -5 to 60°C (23 to 140°F)

Storage: -40 to 80°C (-40 to 176°F)

## Humidity (non-condensing):

Operating: 15 to 90% @45°C

Soak: 90% for 24 hours @60°C

## Wire Terminal:

Socketed screw terminals for 12-22 AWG

## Agency Approvals:

CSA certified per standard 22.2 (File No LR42272).

UL recognized per standard UL508 (File No E99775).

CE compliance per EMC directive 89/336/EEC and low voltage 73/23/EEC.

Terminal	Connection	Terminal	Connection
A1	Channel 1, Output (+)	C3	Channel 2, DC Input (+)
A2	Channel 1, Output (-)	C4	Voltage Supply (+24VDC)
A3	Not Connected	C5	Channel 1, DC Input (-)
A4	Channel 2, Output (+)	C6	Channel 1, DC Input (+)
A5	Channel 2, Output (-)	B1	Not Connected
A6	Not Connected	B2	Not Connected
C1	Not Connected	B3	DC Power (+)
C2	Channel 2, DC Input (-)	B4	DC Power (-)

## Ordering Information

Models & Accessories

### Specify:

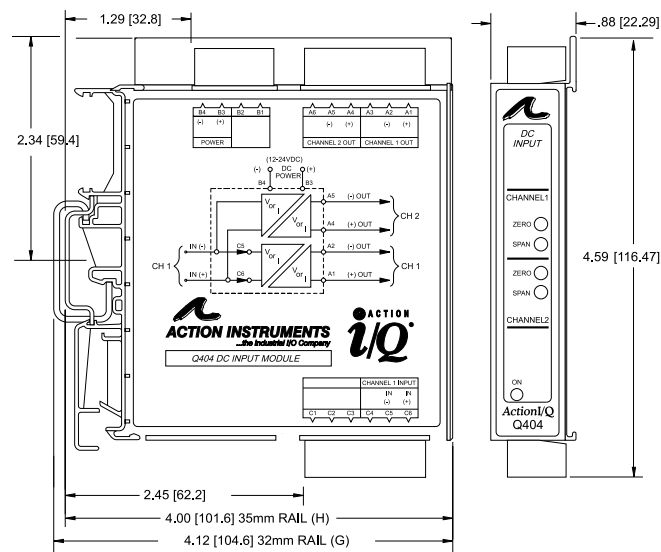
- Model: **Q404-2L08**: Two 0-10Vdc inputs, two 4-20mA outputs  
**Q404-2L09**: Two 0-10Vdc inputs, two 0-10Vdc outputs  
**Q404-2L28**: Two -10/+10Vdc inputs, two -10/+10Vdc outputs  
**Q404-3L00**: One 4-20mA input, one 4-20mA output, 24V Exc.  
**Q404-3L01**: One 4-20mA input, one 0-10Vdc output, 24V Exc.  
**Q404-4L00**: One 4-20mA input, two 4-20mA outputs
- Input Range: (see Table 1)
- Output Range: (see Table 1)
- Accessories: (see Accessories)

### Accessories

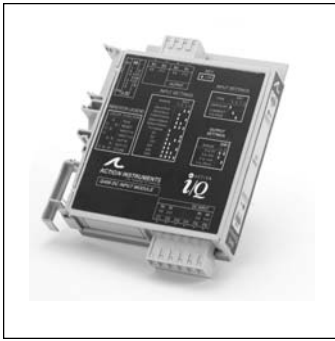
Action/Q modules mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition the following accessories are available:

- MD02** TS32 DIN rail
- MD03** TS35 x 7.5 DIN rail
- WV905** 24VDC Power Supply (500mA)
- H910** 24VDC Power Supply (1 Amp)
- H915** 24VDC Power Supply (2.3 Amp)

## Dimensions







Q408-A000 (1 input; 1 output)  
Q408-A004 (2 inputs; 2 outputs)

# ACTIONI/Q® Q408

## DC Powered DC Input Multi-Channel Isolator

Provides 1 or 2 Fully Isolated DC Output Signals  
in Proportion to 1 or 2 DC Inputs



- Field Configurable Input Ranges
- Field Configurable Output Ranges
- 1800VAC Isolation
- TouchCAL™ Technology

- High Density DIN Rail Mounting
- Universal DC Power 10.8 to 26.4VDC
- SnapLoc™ Plug-in Terminals

### Description

The model Q408 is a DC powered, DIN rail mount, DC input signal conditioner, with 1800V isolation between input, output and power. The field configurable inputs and outputs provide flexible, wide ranging capability for DC current and voltage signals.

The Q408 is available as a single channel signal conditioner (1 input/1 output) or a multi-channel signal conditioner (2 inputs/2 outputs). All models maintain the high 1800V isolation level from channel to channel, as well as input to output to power.

### TouchCAL Technology

Action has simplified setpoint calibration. Using a pushbutton instead of potentiometers, improvements in calibration resolution and reliability are realized due to the elimination of the potentiometers' mechanical variability. The thermal drift and mechanical variability of the potentiometers has been removed and replaced with a digitally stable circuit. Additionally, the inherent zero and span interactivity of analog amplifier circuitry is removed, providing 100% non-interactive adjustment.

The field configurable input of the Q408 can be set via DIP switches for any one of 12 voltage ranges from 10mV to 100V or 6 current ranges from 1mA to 100mA (see Table 1). The field configurable output is linear to the input and can be set for either 0-5V, 0-10V, 0-1mA or 4-20mA.

### Application

The ActionI/Q Q408 field configurable isolator is useful in eliminating ground loops, converting signal levels, and providing signal drive. The field configurable, wide ranging capabilities ensure maximum flexibility for most DC to DC applications, minimizing spare parts requirements.

### Diagnostic LEDs

The Q408 has three diagnostic LEDs. The green (RUN) LED is used for diagnostics to indicate that power is on. It will flash quickly if the input signal is above the calibrated range or slowly if the input signal is below range. It is on continuously when the unit is functioning within the calibrated range. The yellow (IN) LED is on while calibrating the input and the red (OUT) LED is on while calibrating the output.

### Configuration

The Q408 can be configured for input ranges from 10mV to 100V or 1mA to 100mA, with >90% input offset or it will adjust down to <10% of fullscale input span (except on 20mV/2mA range where maximum offset or gain adjustment is 50%).

Unless a specific custom calibration is specified, the factory presets the Q408 as follows:

- Input Range: 20mA (Current on)
- Input Configuration: Unipolar
- Calibrated Input: 4-20mA
- Operation: Direct (Reverse off)
- Calibrated Output: 4-20mA

For other I/O ranges, refer to the tables below.

**WARNING:** Do not change switch settings with power applied. Severe damage will result!

1. With power off, snap off the faceplate by lifting the right edge away from the heatsink. Slide the heatsink forward and off the module.
2. The single channel module has two eight position switch blocks, one for input and one for output. The dual output modules have a second board behind the heatsink. Gently lift this board away from the main board, rocking it back while lifting. The one input, two output module has one ten position switch block for input and channel 1 output, along with a two position switch for the second output. The two input, two output module has two ten position switch blocks, one for each channel.
3. For single channel modules, choose the desired input, function and output range from Table 1, 2, and 3. For multi-channel modules, use Table 4. Set the dip switches for the desired I/O.

## Calibration

Note: For best results, calibration should be performed with the intended output load, in the operating environment, mounted on a DIN rail, allowing at least one hour for thermal equilibrium of the system.

1. Install the module on to a piece of DIN rail and the I/Q Rail mounting combination. See the I/Q Rail Data sheet for details.

Note: An I/Q Rail is required to deliver power to the modules. See ordering information.

2. Connect the input to a calibrated DC source and the output to a voltage or current meter. Apply power and allow the system to reach thermal equilibrium (approx. 20 minutes).

3. Adjust the input signal to the desired maximum and observe that the green LED is on or flashing. Push the CAL button and hold it down for more than 5 seconds (until the yellow and Green LEDs are flashing).

4. When the yellow and green LEDs stop flashing, the yellow and red LEDs will be on. Push the CAL button momentarily (the yellow and green LEDs will be on).

Note: To quit the calibration mode and reset the unit, push the CAL button and hold for more than 5 seconds. Or, wait for more than two minutes and the unit will timeout and reset itself to the previously stored calibration.

5. Apply the maximum input signal level desired, and push the CAL button to store (the yellow LED will be on).

6. Apply the minimum input signal level desired, and push the CAL button to store (the green and red LED will be on).

7. Adjust the input signal while monitoring the output signal until the output is at the desired maximum level (e.g. 20.00mA), then push the CAL button to store (the red LED will be on).

8. Adjust the input signal while monitoring the output signal until the output is at the desired minimum level (e.g. 4.00mA), then push the CAL button to store (the yellow, green and red LEDs will be on).

9. Push the CAL button one final time to store the calibration data. The green LED will be on if the input is within the calibrated range.

Table 1: Input Range Settings for Single Channel Modules

Ranges		Selector SW1			
Voltage	Current	1	2	3	4
20mV	2mA			■	■
50mV	5mA	■			
100mV	10mA	■			■
200mV	20mA		■	■	
500mV	50mA	■	■	■	■
1V	100mA	■			
2V		■			■
5V		■		■	■
10V		■	■		
25V		■	■		■
50V		■	■	■	
100V		■	■	■	■

Key: ■ = 1 = ON or Closed

Table 2: Input Function Settings for Single Channel Modules

Type	Selector SW1			
	5	6	7	8
Unipolar	■	-	-	-
Bipolar	-	-	-	-
Reverse	-	■	-	-
Direct	-	-	-	-
Current	-	-	-	■
Voltage	-	-	-	■

Key: ■ = 1 = ON or Closed; - = n/a

Table 3: Output Range Settings for Single Channel Modules

Ranges	Selector SW2							
	1	2	3	4	5	6	7	8
0 to 5V	■	■	■	■				
0 to 10V	■		■	■				
0 to 1mA		■	■	■				
4 to 20mA						■	■	■
0 to 20mA	■	■				■	■	■

Key: ■ = 1 = ON or Closed

Table 4: I/O Range & Function Settings for Dual Channel Modules

Ranges		Selector SW1 or SW2*									
Voltage	Current	1	2	3	4	5	6	7	8	9	10
20mV	2mA			■	■						
50mV	5mA		■								
100mV	10mA		■		■						
200mV	20mA		■	■							
500mV	50mA		■	■	■						
1V	100mA	■									
2V		■			■						
5V		■		■	■						
10V		■	■								
25V		■	■		■						
50V		■	■	■							
100V		■	■	■	■						
Unipolar						■					
Voltage								■			
Current									■		
Output		1	2	3	4	5	6	7	8	9	10
0 to 5V										■	■
0 to 10V										■	
0 to 1mA											■
4 to 20mA											

Key: ■ = 1 = ON or Closed  
\*Applies to dual channel model

Note that 0-20mA output is NOT available on multichannel units. Note also that Reverse Action is NOT available on multichannel units.

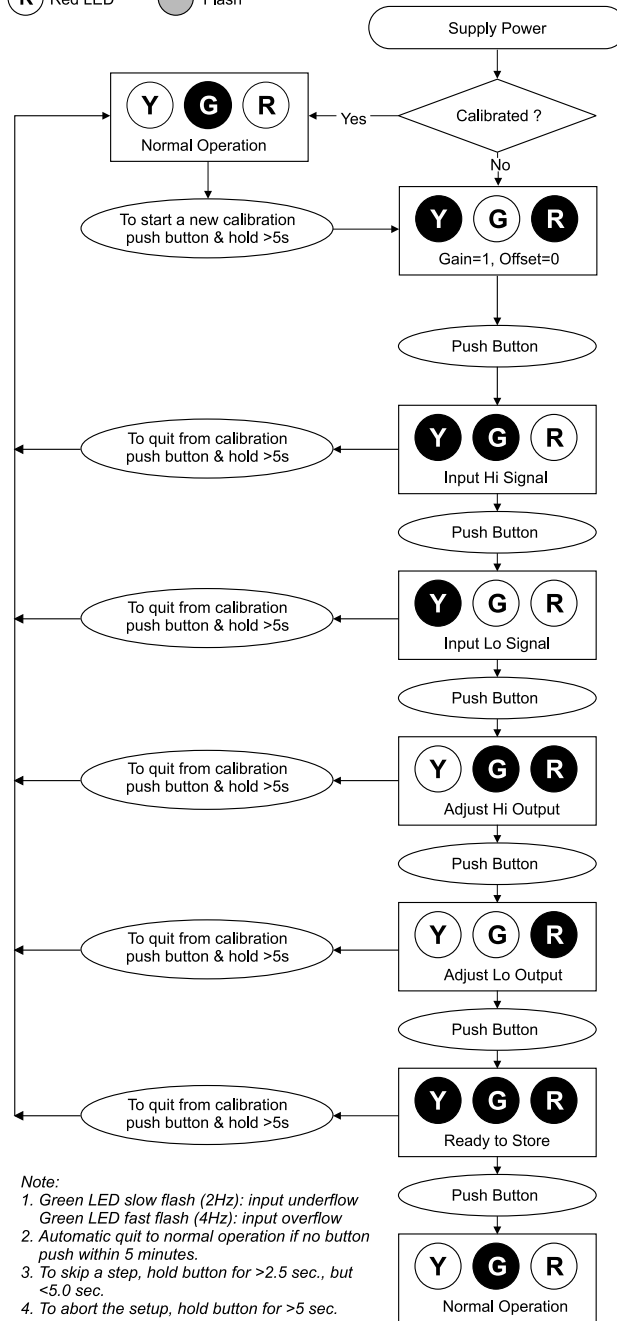
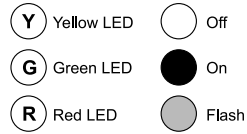


Figure 1: Q408 Calibration Flow Chart

**Specifications**

**Input:**

- Voltage:
  - Range Limits: 10mV to 100V (see Table 1)
  - Impedance:  $\geq 100k$  ohms
  - Overtoltage: 200V continuous
- Current:
  - Range Limits: 1mA to 100mA
  - Impedance: 20 ohms typical
  - Overcurrent: 170mA, protected by self resetting fuse
  - Overtoltage: 60V
- Pushbutton Adjustment (inputs > 10mV)
  - Effective zero offset:  $\geq 90\%$
  - Effective span turn down:  $\geq 90\%$  except for 20mV/2mA range where 50% is max. zero offset and span turndown

**Output:**

- Voltage:
  - Output: 0-5V, 0-10V
  - Source Impedance: < 10 ohms
  - Drive: 10mA max.
- Current:
  - Output: 4-20mA, 0-1mA
  - (and 0-20mA on single output channel versions only)
  - Source Impedance: > 100k ohms
- Compliance:
  - 0-1mA: 7.5V max. (7.5k ohms)
  - 4-20mA: 12V max. (600 ohms)\*
  - 0-20mA: 12V max. (600 ohms)
  - \*10V max. (500ohms) on dual output versions

**Output Accuracy:**

- >2mA / >20mV input spans:
  - $\pm 0.1\%$  of full-scale input typical,
  - $\pm 0.2\%$  maximum
- <2mA / <20mV input spans:
  - $\pm 0.35\%$  of fullscale input typical,
  - $\pm 0.5\%$  maximum; including linearity, repeatability and hysteresis @23°C

**Output Ripple:**

- <50% offset or span adjust:
  - <0.1% off full scale span or 25mV RMS, whichever is greater
- >50% offset or span adjust:
  - <0.2% of full scale span or 50mV RMS, whichever is greater.

**Response Time:** 200mSec, typical

**Stability:**  $\pm 0.025\%$  of fullscale/°C, max. (fullscale & zero)

**Common Mode Rejection:** 120dB at DC, >90dB at 60Hz

**Isolation:**

- $\geq 1800VDC$  or peak AC between input, output, power and channel to channel

**ESD Susceptibility:** Capable of meeting IEC 801-2 level 3 (8kV)

**Humidity (non-condensing):**

- Operating: 15 to 95% RH @45°C
- Soak: 90% RH for 24 hours @60°C

**Temperature:**

- Operating: 0 to 55°C (32 to 131°F)
- Storage: -25 to 70°C (-13 to 158°F)

**Power:** 2.5W max; 9-30VDC

**Wire Terminals:** Socketed screw terminals for 12-22 AWG

**Agency Approvals**

- CSA certified per standard C22,2 (File No LR 42272).
- UL recognized per standard UL508 (File No. E99775).

Terminal	Connection	Terminal	Connection
A1	Channel 1 Out (+)	C3	Not Connected
A2	Channel 1 Out (-)	C4	Not Connected
A3	Channel 2 Out (+)	C5	Channel 1 In (-)
A4	Channel 2 Out (-)	C6	Channel 1 In (+)
A5	DC Power (+)	P1	Not Used
A6	DC Power (-)	P2	Not Used
C1	Channel 2 In (-)	P3	DC Power (+)
C2	Channel 2 In (+)	P4	DC Power (-)

**Ordering Information Models & Accessories**

**Specify:**

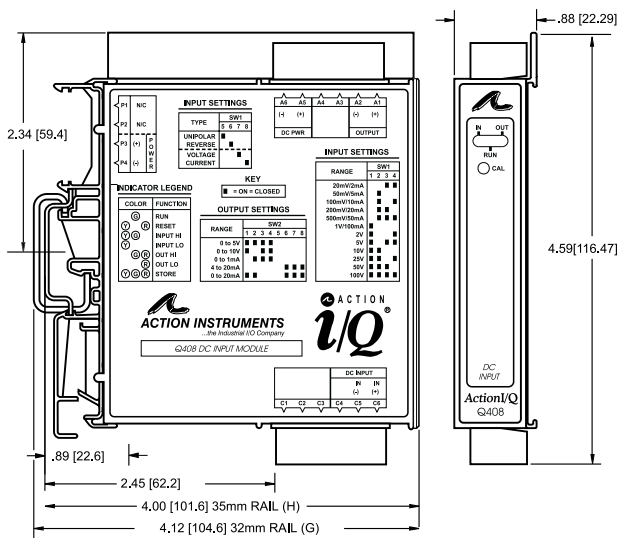
1. Model:
  - Q408-A000:** one input, one output DC Isolator
  - Q408-A004:** two input, two output DC Isolator
2. Specify optional I/QRail, type and quantity.
3. Optional Factory Custom Calibration, specify **C620** - with desired input and output ranges.
4. Accessories: (see Accessories)

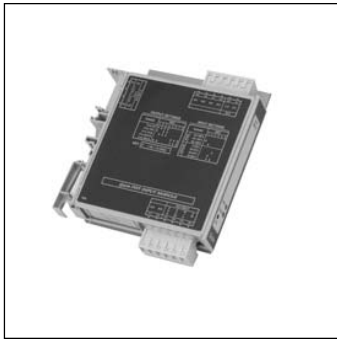
**Accessories**

Action/I/Q modules mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition the following accessories are available:

- MD02** TS32 DIN rail
- MD03** TS35 x 7.5 DIN rail
- IQRL-D002** 2 Position I/QRail & DIN rail
- IQRL-D004** 4 Position I/QRail & DIN rail
- IQRL-D008** 8 Position I/QRail & DIN rail
- WV905** 24VDC Power Supply (0.5Amp)
- H910** 24VDC Power Supply (1Amp)
- H915** 24VDC Power Supply (2.3Amp)

**Dimensions**





Q438-0000

# ACTIONI/Q® Q438

## DC Powered Potentiometer Input Signal Conditioner

Provides a DC Output in Proportion  
to a Potentiometer Input



- Accepts Potentiometers from 100 Ohms to 100k Ohms
- Wide Ranging Zero and Span
- ASIC Technology

- High Density DIN Rail Mounting
- Flexible DC Power Supply 9 to 30VDC
- SnapLoc™ Plug-in Terminals

### Description

The Q438 is a DIN rail mount, potentiometer input signal conditioner with 1800VDC isolation between DC power and the input/output circuitry. The input provides a constant voltage and is designed to accept any three-wire potentiometer from 100 ohms to 100k ohms. The field configurable output is switch selectable providing a 0-5V, 0-10V, 0-1mA, 0-20mA or 4-20mA DC signal. Wide ranging, precision zero and span pots, used in conjunction with DIP switches, allow 80% adjustability of offset and gain to transmit a full scale output from any 20% portion of the potentiometer input.

### Application

The Q438 is useful in transmitting process control setpoints to remote PID controllers or interfacing position or level sensors to data acquisition and control systems. The high density DIN rail mounting offers an extremely compact solution for saving valuable panel space.

### Configuration

In a valve positioning application a potentiometer is sometimes used as a feedback signal. Quite often a wide open valve is only a 25% turn of the feedback potentiometer. The Q438 can easily be adjusted with the zero and span to provide a fullscale output signal (e.g. 4-20mA) representing 0-25% or even 50-75% of the potentiometer input.

Unless otherwise specified, the factory presets the Model Q438 as follows:

Input Range: 0 to 100%  
Output: 4 to 20mA

For other output ranges, refer to Tables 1 and 2 to reconfigure switches SW1 and SW2 for the desired input and output ranges.

**WARNING: Do not change switch settings with power applied. Severe damage will result!**

### Calibration

Note: For best results, calibration should be performed with the intended output load, in the operating environment, mounted on a DIN rail, allowing at least one hour for thermal equilibrium of the system.

1. With power disconnected, set the output and input switch selectors (SW1 and SW2) to the desired ranges (see Tables 1 and 2).

2. Connect the input to a potentiometer. Connect the output to the actual device load (or a load approximately equivalent to the actual device load value) and apply power.

*Note: To maximize thermal stability, final calibration should be performed in the operating installation, allowing approximately 1 to 2 hours for warm up and thermal equilibrium of the system.*

3. Set the input to the desired minimum and adjust the zero potentiometer for the desired minimum output.

4. Set the input to the desired maximum and adjust the span potentiometer for the desired maximum output.

5. Repeat steps 3 and 4, if necessary.

Table 1: Input Range Settings

Span	Selector SW2					
	1	2	3	4	5	6
20 - 100%						
45 - 100%	■					
(default) 85 - 100%		■				
Offset	1	2	3	4	5	6
(default) 0 - 20%						
20 - 45%				■		
45 - 65%			■			
65 - 80%			■	■		

Key: ■ = 1 = ON or Closed

Table 2: Output Range Settings

Output	Selector SW1							
	1	2	3	4	5	6	7	8
0 to +5V	■	■	■	■				
0 to +10V	■	■	■	■				
0 to 1mA		■	■					
(default) 4 to 20mA						■	■	■
0 to 20mA						■	■	■

Key: ■ = 1 = ON or Closed

## Specifications

### Potentiometer Input:

- End-to-end Resistance: 100 ohms up to 100k ohms
- Input Impedance: >1M ohms
- Input Excitation: 500mV, 5mA maximum drive.
- Zero Turn-Up: 80% of full scale input
- Span Turn-Down: 80% of full scale input

### Output:

- Voltage:
  - Output: 0-5V, 0-10V
  - Source Impedance: <10 ohms
  - Drive: 10mA, max. (1k ohms min. @10V)
- Current Output:
  - Output: 0-1mA, 0-20mA, 4-20mA
  - Source Impedance: >100k ohms
- Compliance:
  - 0-1mA; 7.5V, max. (7.5k ohms, max.)
  - 0-20mA; 12V, max. (600 ohms, max.)
  - 4-20mA; 12V, max. (600 ohms, max.)

### Accuracy (Including Linearity, Hysteresis):

±0.1% maximum at 25°C

### Stability:

<±0.05%/°C maximum of full scale range

### Response Time (10 to 90%):

<200mSec., typical.

### Common Mode Rejection:

120dB @ DC, >100dB @ 60Hz

### Isolation:

1800VDC between line power and input, and power and output

### EMC Compliance (CE Mark):

- Emissions: EN50081-1
- Immunity: EN50082-2
- Safety: EN50178

### LED Indication (green):

Active DC power

### Humidity (Non-Condensing):

- Operating: 15 to 95% @ 45°C
- Soak: 90% for 24 hours @ 65°C

### Temperature Range:

- Operating: 0 to 55°C (32 to 131°F)
- Storage: -25 to 70°C (-13 to 158°F)

### Power:

- Consumption: 1.5W typical, 2.5W max
- Range: 9 to 30VDC

### Weight:

0.48 lbs

### Agency Approvals:

- UL recognized per standard UL508 (File No. E99775)
- CSA certified per standard C22.2 No. 0-M91 and 142-M1987 (File No. LR42272-84).
- CE Compliance per EMCdirective 89/3/36 EEC and Low Voltage 73/23/EEC.

Terminal	Connection	Terminal	Connection
A1	DC Output (+)	C1	Not Used
A2	DC Output (-)	C2	Not Used
A3	Not Used	C3	Pot. Case Ground
A4	Not Used	C4	Pot. Input (fully CCW)
A5	DC Power (+)	C5	Pot. Input Wiper
A6	DC Power (-)	C6	Pot. Input (fully CW)

## Ordering Information

### Models And Accessories

#### Specify:

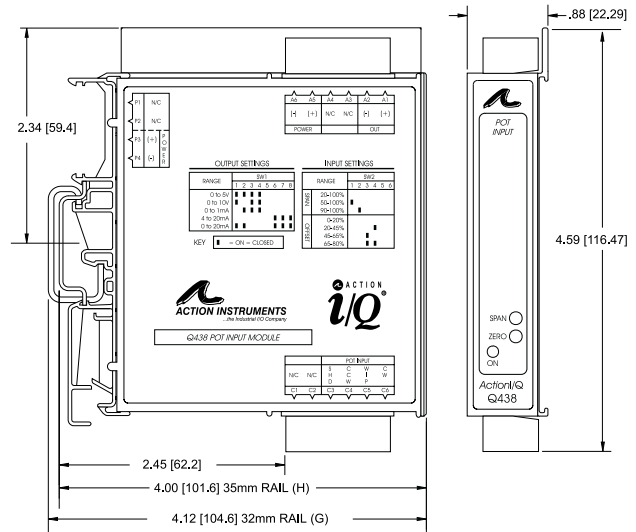
- Model: **Q438-0000**
- Specify optional I/QRail, type and quantity.
- Optional Custom Factory Calibration; specify **C620** with desired input and output range
- Accessories: (see Accessories)

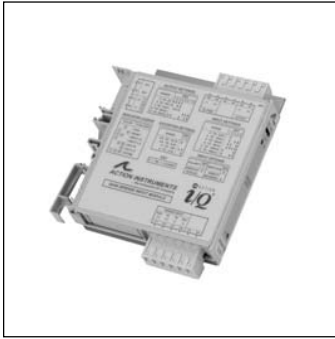
### Accessories

Action/I/Q modules will mount on standard TS32 (model MD02) or TS35 (model MD03) DIN Rail. In addition, the following accessories are available:

- MD02** TS32 DIN rail
- MD03** TS35 x 7.5 DIN rail
- IQRL-D002** 2 Position I/QRail & DIN rail
- IQRL-D004** 4 Position I/QRail & DIN rail
- IQRL-D008** 8 Position I/QRail & DIN rail
- WV905** 24VDC Power Supply (0.5Amp)
- H910** 24VDC Power Supply (1Amp)
- H915** 24VDC Power Supply (2.3Amp)

## Dimensions





Q448-0000



# ACTIONIQ® Q448

## DC Powered Bridge Input Signal Isolator

Provides an Isolated DC Output in Proportion to a Bridge/Strain Gauge Input



- Adjustable Bridge Excitation
- Field Configurable Input Ranges
- Field Configurable Output Ranges
- TouchCAL Technology

- High Density DIN Rail Mounting
- Flexible DC Power Supply Accepts 18 to 30VDC
- SnapLoc™ Plug-in Terminals

### Description

The Q448 is a DIN rail mount, DC powered bridge or strain gauge input signal conditioner with 1800VDC isolation between input, output and power. Advanced digital technology combined with ASIC technology allows the Q448 to be field configured for virtually any Bridge input to DC output within the limits specified. The input can be set via DIP switches for any one of 11 voltage ranges from 10mV to ±200mV (see Table 1). The output is linear to the input and can be set for either 0-5V, 0-10V, 0-1mA or 4-20mA, direct or reverse acting.

### TouchCAL™ Technology

The Q448 utilizes TouchCAL technology which greatly simplifies calibration. Once the unit is configured via DIP switches, the pushbutton is used to precisely calibrate the minimum and maximum levels. The thermal drift and mechanical variability of the potentiometers has been removed and replaced with a digitally stable circuit. Additionally, the inherent zero and span interactivity of potentiometer based analog amplifier circuitry is removed, providing 100% non-interactive adjustment.

TouchCAL provides more than 90% offset of the zero value and adjustment down to 10% of the full scale input span for most of the 11 switch selectable input ranges. For example, the DIP switch configured 0-100mV input range could be calibrated via pushbutton for 0-40mV (i.e. 60% span reduction) or offset to a range of 60-100mV (i.e. 60% offset and 60% span reduction). If the output was configured for 0-10V, then 60-100mV input would correspond to the 0-10V full scale output. Thus, an input range such as 90-100mV is possible using the 0-100mV range. A TARE function is also provided to allow batch offsets (0285 and later firmware).

To calibrate the input within the DIP switch configured range, simply apply the high input signal and push the CAL button. The low input signal is then applied and pushing the CAL button again stores the low input signal (these steps are reversed for reverse mode operation).

The high and low input levels are stored in nonvolatile memory and correspond to the high and low output levels. These output levels are precisely adjusted using the input signal.

### Diagnostic LEDs

The Q448 has three diagnostic LEDs. The green (RUN) LED is used for diagnostics to indicate that power is on. It will flash quickly if the input signal is above the calibrated range or slowly if the input signal is below range. It is on continuously when the unit is functioning within the calibrated range.

The yellow (IN) LED is on while calibrating the input and the red (OUT) LED is on while calibrating the output.

### Application

The Q448 bridge input signal conditioner is useful in isolating ground loops and interfacing bridge sensors to data acquisition and control systems. Three-way isolation completely eliminates ground loops from any source. Isolation protects expensive SCADA systems from ground faults and provides filtering for noise reduction which can be a significant problem with millivolt bridge signals.

Wide ranging flexibility allows the user to easily zero out dead-loads in weighing systems or configure bipolar input ranges for tension-compression or vacuum-pressure bridge applications.

High density DIN rail mounting offers an extremely compact solution for saving valuable panel space.

### Configuration

The Q448 can be configured for input ranges from 10mV to +/- 200mV, with 90% input offset, or it will adjust down to 10% of fullscale input span (except on 10mV, +/-5mV range where maximum offset or gain adjustment is 50%).

Unless otherwise specified, the factory presets the Model Q448 as follows:

- Input Setting: 0 to 50mV
- Input Range: 0 to 30mV (3mV/V)
- Excitation: 10V
- Operation: Direct
- Output: 4 to 20mA

For other I/O ranges, refer to the tables below.

**WARNING:** Do not change switch settings with power applied. Severe damage will result!

1. With power off, snap off the faceplate by lifting the right edge away from the heat sink. Slide off the metal heatsink.
2. Note that the module has two eight position switch blocks, one for input and one for output.
3. Choose the desired ranges from Tables 1-4. Return the heatsink to its original position and attach the faceplate before beginning calibration.

### Calibration

For best results, calibration should be performed in the operating installation, allowing at least one hour for thermal stability of the system. If pre-calibration on a test bench is preferred, then an output load equal to the input impedance of the device connected to the Q448 output is recommended, along with a 1 hour warm up period.

1. For best results install the module on to a piece of DIN rail or the I/Q Rail mounting accessory. See the I/Q Rail data sheet for details.

*Note: An I/Q Rail is required to power the modules. See ordering information.*

2. Connect the input to a calibrated DC source and the output to a voltage or current meter. Apply power and allow the system to reach thermal equilibrium (approximately 20 minutes).

3. Adjust the input signal to the desired maximum and observe that the green LED is on or flashing. Push the CAL button and hold it down for six flashes of the yellow LED (until the yellow and green LEDs are flashing), then release the button.

*Note: To quit the calibration mode and reset the unit, push the CAL button again and hold for more than 5 seconds. Or wait for more than two minutes and the unit will time-out and automatically reset to the previously stored calibration.*

*Note: For the reverse operating mode (SW1-6 closed), input the minimum signal in step 4 of calibration.*

4. The yellow and red LEDs will be on. Push the CAL button. Apply the maximum input signal level desired and push the CAL button to store. The yellow LED will now be on.

*Note: For the reverse operating mode (SW1-6 closed), input the maximum signal in step 5 of calibration.*

5. Apply the minimum input signal level desired and push the CAL button to store. The green and red LED will now be on.

6. Adjust the input signal while monitoring the output signal until the output is at the desired maximum level (e.g. 20.00mA), then push the CAL button to store (the red LED will be on).

7. Adjust the input signal while monitoring the output signal until the output is at the desired minimum level (e.g. 4.00mA), then push the CAL button to store (the yellow, green and red LEDs will be on).

8. To finish calibration, push the CAL button once again. The green LED will be on if the input is within the calibrated range.

*Note: The TARE function is enabled by depressing the TARE/(CAL) until the yellow LED flashes at least once and less than six times. The input present at that time will be used as the TARE value and the output will be the minimum output when the module was calibrated.*

Table 1: Input Range Settings

Input Range	Selector SW1				
	1	2	3	4	5
0 to 10mV	■			■	■
0 to 20mV		■	■		■
0 to 50mV		■	■	■	■
0 to 100mV	■				■
0 to 200mV	■			■	■
-5 to 5mV	■				
-10 to 10mV	■			■	
-20 to 20mV		■	■		
-50 to 50mV		■	■	■	
-100 to 100mV	■				
-200 to 200mV	■			■	

Key: ■ = 1 = ON or Closed

Table 2: Direct or Reverse Setting

Operation	SW1
Direct	6
Reverse	■

Key: ■ = 1 = ON or Closed

Table 3: Bridge Excitation Settings

Excitation Voltage	SW1	
	7	8
9.8 to 10.1V	■	
4.8 to 5.2V		
0 to 10V	■	■
0 to 2.5V		■

Key: ■ = 1 = ON or Closed

Table 4: Output Range Settings

Output Range	Selector SW2							
	1	2	3	4	5	6	7	8
0 to 5V	■	■	■	■				
0 to 10V	■		■	■				
0 to 1mA		■	■	■				
4 to 20mA						■	■	■
0 to 20mA	■	■			■		■	■

Key: ■ = 1 = ON or Closed



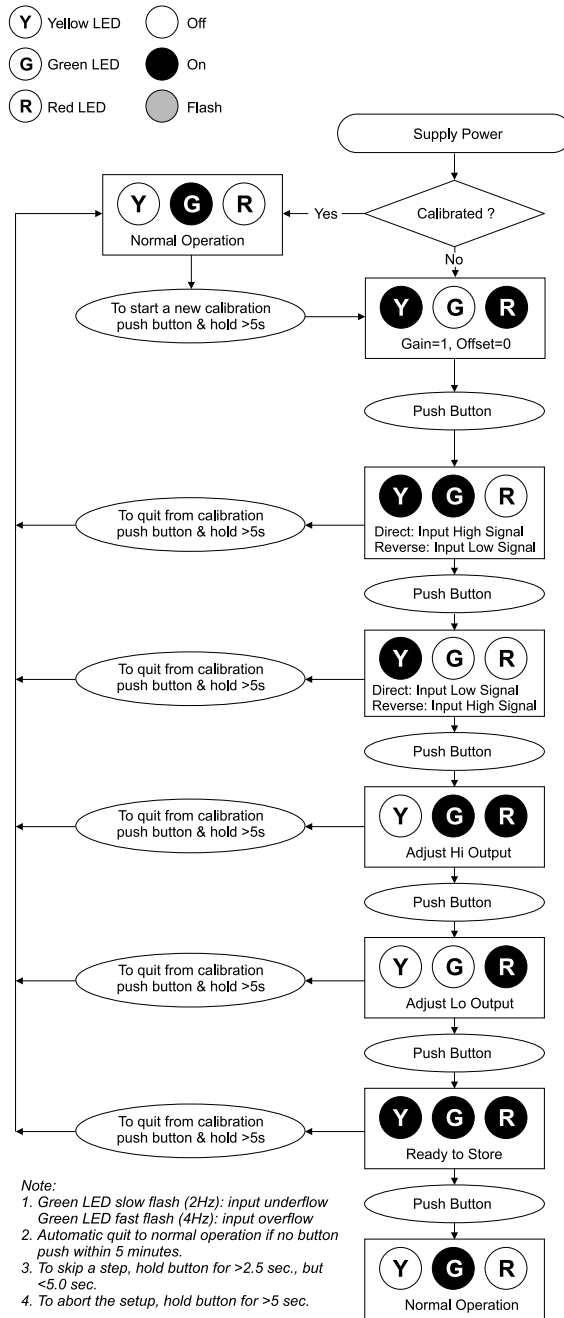


Figure 1: Q448 Calibration Flow Chart

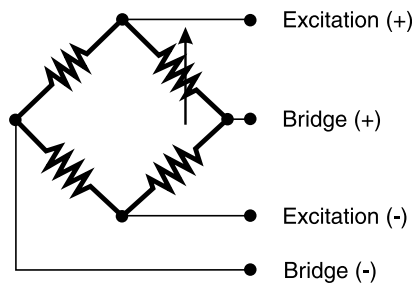


Figure 2: Bridge Reference Designations

## Specifications

### Input:

Voltage:

Full Scale Range: 10mV to ±200mV (Table 1).

Impedance: >1M ohm

Overvoltage:

Intermittent 400V, max.; Continuous 264V, max.

Common Mode (Input to Ground):

1800VDC, max.

Pushbutton Adjustment:

Effective zero offset: >90%

Effective span turn down: >90% except for 10mV & +/-5mV range in which 50% is max. zero offset and span turndown

Operation: direct or reverse acting

### Output:

Voltage:

Output: 0-5V, 0-10V

Impedance: <10 ohms

Drive: 10mA, max. (1K ohms, min. @ 10V)

Current:

Output: 0-1mA, 0-20mA, 4-20mA

Impedance: >100K ohms

Compliance:

0-1mA; 7.5V, max.(7.5K ohms, max.)

0-20mA; 12V, max. (600 ohms, max.)

4-20mA; 12V, max. (600 ohms, max.)

### Bridge Excitation

1 to 10VDC, 120mA max. Current drive decreases at 10mA/V below 5V (e.g. 4V, 110mA max.)

### Accuracy (Including Linearity, Hysteresis):

±0.1% typical, ±0.2% maximum of selected input range at 25°C.

### Stability:

±0.025%/°C typical, 0.05%/°C maximum, of selected full scale input range.

### Output Noise (maximum):

0.1% of span, rms, or 10mV, whichever is greater.

### Response Time (10 to 90%):

<200mSec., typical.

## Ordering Information

### Models & Accessories

#### Specify:

1. Model: **Q448-0000**;
2. Specify optional I/QRail, type and quantity.
3. Optional Factory Custom Calibration, specify **C620** - with desired input and output ranges.
4. Accessories: (see Accessories)

### Accessories

Action/I/Q modules mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition the following accessories are available:

<b>MD02</b>	TS32 DIN rail
<b>MD03</b>	TS35 x 7.5 DIN rail
<b>IQRL-D002</b>	2 Position I/QRail & DIN rail
<b>IQRL-D004</b>	4 Position I/QRail & DIN rail
<b>IQRL-D008</b>	8 Position I/QRail & DIN rail
<b>WV905</b>	24VDC Power Supply (0.5Amp)
<b>H910</b>	24VDC Power Supply (1Amp)
<b>H915</b>	24VDC Power Supply (2.3Amp)

### Common Mode Rejection:

DC to 60Hz: 120dB, 100dB (0 -1mA, range)

### Isolation:

800VDC between input, output and power.

### EMC Compliance (CE Mark):

Emissions: EN50081-1; Immunity: EN50082-2; Safety: EN50178

### LED Indication (green):

Input Range (approx.)

>110% input: 8Hz flash

<0% input: 4Hz flash

### Humidity (Non-Condensing):

Operating: 15 to 95% @ 45°C

Soak: 90% for 24 hours @ 65°C

### Temperature Range:

Operating: 0 to 55°C (32 to 131°F)

Storage: -25 to 70°C (-13 to 158°F)

### Power:

Consumption:

2.7W typical (one 350 ohm bridge)

4W max. (four 350 ohm bridges).

Range: 18 to 30VDC

### Shipping Weight:

0.54 lbs.

### Wire Terminations:

Screw terminals for 12-22 AWG

### Agency Approvals:

UL recognized per standard UL508 (File No. E99775).

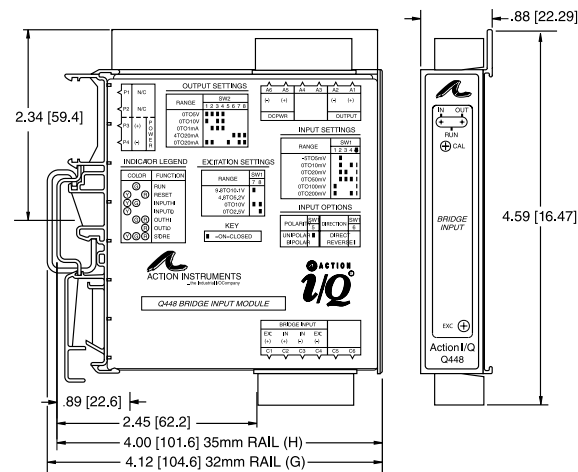
CSA certified per standard C22.2 No. 0-M91 and 142-M1987

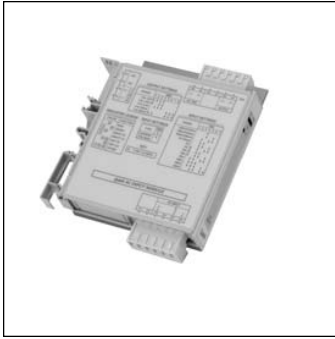
(File No. LR42272-84).

CE Compliance per EMC directive 89/336 EEC and Low Voltage 73/23/EEC.

Terminal	Connection	Terminal	Connection
A1	DC Output (+)	C3	Bridge Input (-)
A2	DC Output (-)	C4	Bridge Excitation (-)
A3	Not Used	C5	Not Connected
A4	Not Used	C6	Not Connected
A5	DC Power (+)	P1	Not Used
A6	DC Power (-)	P2	Not Used
C1	Bridge Excitation (+)	P3	DC Power (+)
C2	Bridge Input (+)	P4	DC Power (-)

## Dimensions





Q468-0000



# ACTIONI/Q® Q468 DC Powered AC Input Signal Isolator

Provides an Isolated DC Output  
in Proportion to an AC Input



- Eliminates Ground Loops
- Field Configurable Input Ranges
- Field Configurable Output Ranges
- TouchCAL Technology

- High Density DIN Rail Mounting
- Flexible DC Power Supply Accepts 9 to 30VDC
- SnapLoc™ Plug-in Terminals

## Description

The Q468 is a DIN rail mount, AC input signal conditioner with 1800VDC isolation between input, output and power. The field configurable input and output offers flexible, wide ranging capability for scaling, converting or buffering AC inputs ranging from 5mA to 100mAAC or 50mV to 300VAC.

For current inputs above 100mA, it is recommended that an input shunt resistor be used and the Q468 be configured for the proper input range. For example, a 5A current transformer output can use the C006 shunt resistor (0.1 ohm, 5W) with the input of the Q468 set for 0-500mVAC.

The DC output of the Q468 is proportional to the average of the fully-rectified AC input signal, and is calibrated for sine waves between 40-400Hz.

## TouchCAL™ Technology

The Q468 utilizes TouchCAL technology which greatly simplifies calibration. The thermal drift and mechanical variability of the potentiometers has been removed and replaced with a digitally stable circuit. Once the unit is configured via DIP switches for voltage or current, the pushbutton is used to precisely calibrate the minimum and maximum levels.

To set the input level within the dip switch configured range, simply apply the high input signal (voltage or current) and push the CAL button. The low input signal is then applied and pushing the CAL button again stores the low input signal. The high and low input levels are stored in nonvolatile memory and correspond to the high and low output levels. These output levels are precisely adjusted using the input signal.

TouchCAL technology enables precise calibration and provides more than 90% offset of the zero value and adjustment down to 10% of the full scale input span for most of the 16 switch selectable input ranges. For example, the dipswitch configured 0-200V input range could be calibrated via pushbutton for 0-80V (i.e. 60% span reduction) or offset to a range of 120-200V (i.e. 60% offset and 60% span reduction). If the output was configured for 0-10V, then 120-200V input would correspond to the 0-10V full scale output. Input ranges such as 180-200V or 0-20V are possible using the 0-200V range.

Advanced digital technology combined with Action's exclusive ASIC technology allows the Q468 to be field configured for virtually any AC input to DC output within the limits specified.

## Application

The Q468 is useful in applications requiring an isolated, conditioned DC output from an AC signal. Typical applications include energy management, load shedding, motor current/load monitoring, locked rotor detection, isolation and data acquisition. The output of the Q468 can drive a digital meter for direct display or can interface with alarm or control devices including PLCs and computers.

## Diagnostic LEDs

The Q468 has three diagnostic LEDs. The green (RUN) LED is used for diagnostics to indicate that power is on. It will flash quickly if the input signal is above the calibrated range or slowly if the input signal is below range. It is on continuously when the unit is functioning within the calibrated range.

The yellow (INPUT) LED is on while calibrating the input level. The red (OUTPUT) LED is on while calibrating the output level.

## Configuration

The Q468 can be configured for input ranges from 50mV to 300V or 5mA to 100mA, with >90% input offset or it will adjust down to <10% of full scale input span (except on the 100mV/10mA range in which maximum offset or gain adjustment is 50%).

Unless a specific custom calibration is specified, the factory presets the Q468 as follows:

Input Range: 0 -500mV  
Calibrated Output: 4-20mA

For other I/O ranges, refer to the tables.

**WARNING:** Do not change switch settings with power applied. Severe damage will result!

1. With power off, snap off the faceplate by lifting the right edge away from the heatsink. Slide the heatsink forward and off the module.

2. Choose the desired range from Tables 1-3. Return the heatsink to its original position and attach the faceplate before beginning calibration.

**Calibration**

For best results, calibration should be performed in the operating installation, allowing at least one hour for thermal stability of the system. If pre-calibration on a test bench is preferred, then an output load equal to the input impedance of the device connected to the Q468 output is recommended, along with a 1 hour warm up period.

1. For best results install the module on to a piece of DIN rail or the I/Q Rail mounting accessories if desired. See the I/Q Rail Data sheet for details.

*Note: An I/Q Rail is required to power the modules. See ordering information.*

2. Connect the input to a calibrated AC source and the output to a voltage or current meter. Apply power and allow the system to reach thermal equilibrium (approx. 20 minutes).

3. Adjust the input signal to the desired maximum and observe that the green LED is on or flashing. Push the CAL button and hold it down for more than 5 seconds (until the yellow and Green LEDs are flashing), then release the button.

*Table 1: Input Range Settings*

Ranges		Selector SW1						
AC Voltage	AC Current	1	2	3	4	5	6	7
100mV	10mA				■			
200mV	20mA				■		■	
500mV	50mA			■		■	■	
1V	100mA			■	■			
2V				■	■		■	
5V		■		■		■	■	
10V		■		■	■			
20V		■		■	■		■	
50V			■		■	■	■	
100V			■	■	■			
200V			■	■	■		■	
300V			■	■	■		■	■

Key: ■ = 1 = ON or Closed

*Table 2: Output Range Settings*

Ranges	Selector SW2							
Output	1	2	3	4	5	6	7	8
0 to 5V	■	■	■	■				
0 to 10V	■		■	■				
0 to 1mA		■	■	■				
4 to 20mA						■	■	■
0 to 20mA	■	■				■	■	■

Key: ■ = 1 = ON or Closed

*Note: To quit the calibration mode and reset the unit, push and hold the CAL button for more than 5 seconds. Or, wait for more than two minutes and the unit will timeout and automatically reset to the previously stored calibration.*

4. When the yellow and green LEDs stop flashing, the yellow and red LEDs will be on. Push the CAL button momentarily (the yellow and green LEDs will now be on).

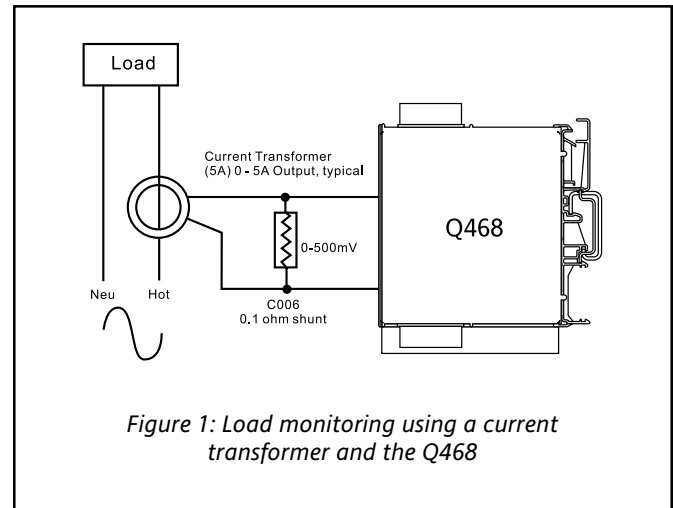
5. Apply the maximum input signal level desired and push the CAL button to store. The yellow LED will now be on.

6. Apply the minimum input signal level desired and push the CAL button to store. The green and red LED will now be on.

7. Adjust the input signal while monitoring the output signal until the output is at the desired maximum level (e.g. 20.00mA), then push the CAL button to store (the red LED will be on).

8. Adjust the input signal while monitoring the output signal until the output is at the desired minimum level (e.g. 4.00mA), then push the CAL button to store (the yellow, green and red LEDs will be on).

9. To finish calibration, push the CAL button once again. The green LED will be on if the input is within the calibrated range.



*Figure 1: Load monitoring using a current transformer and the Q468*

*Table 3: Input Type Settings*

Input Type	SW1
	8
Current	■
Voltage	

Key: ■ = 1 = On or Closed

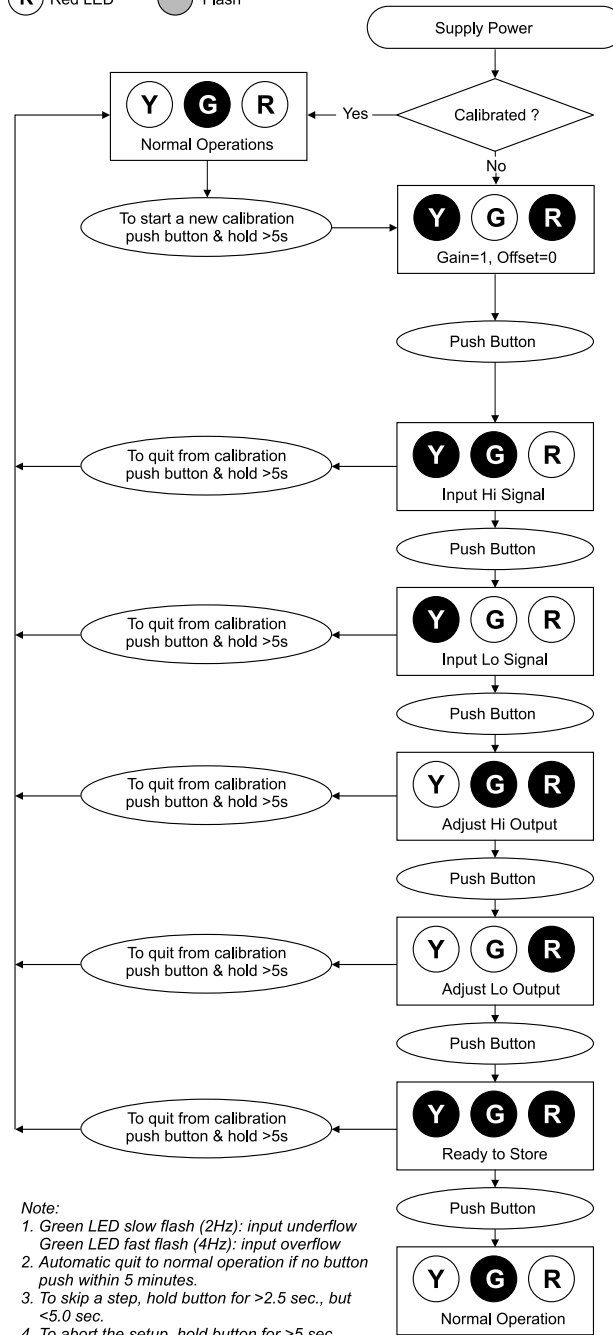
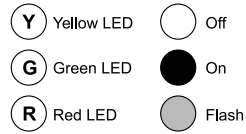


Figure 2: Q468 Calibration Flow Chart

## Specifications

### Inputs:

Voltage:

Ranges: 100mVAC to 300VAC

Impedance: >100K ohms

Overvoltage: 330VAC

Current:

Ranges: 10mA to 100mAAC

Impedance: 20 ohms, typical

Overcurrent: 170mAAC

Overvoltage: 60V peak

Frequency Range:

DC to 400Hz, factory calibrated at 60Hz

Common Mode (Input to Ground):

1800VDC, max.

Pushbutton Adjustment:

Effective zero offset: >90%

Effective span turn down: >90% except for 100mV/10mA

range in which 50% is max. zero offset and span turn down

### Output:

Voltage:

Output: 0-5V, 0-10V

Source Impedance: <10 ohms

Drive: 10mA, max. (1K ohms, min. @ 10V)

Current:

Output: 0-1mA, 0-20mA, 4-20mA

Source Impedance: >100K ohms

Compliance:

0-1mA; 7.5V, max. (7.5K ohms, max.)

0-20mA; 12V, max. (600 ohms, max.)

4-20mA; 12V, max. (600 ohms, max.)

### LED Indication:

RUN (green):

On when unit is powered

flashes at 8Hz when input is 7% above max.

INPUT (yellow):

On while calibrating the input level

OUTPUT (red):

On while calibrating the output level

### Ordering Information

#### Models and Accessories

#### Specify:

1. Model: **Q468-0000**
2. Specify optional I/QRail, type and quantity.
3. Optional Factory Custom Calibration, specify **C620** - with desired input and output ranges.
4. Accessories: (see Accessories)

### Accessories

Action/Q modules mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition the following accessories are available:

- MD02** TS32 DIN rail
- MD03** TS35 x 7.5 DIN rail
- IQRL-D002** 2 Position I/QRail & DIN rail
- IQRL-D004** 4 Position I/QRail & DIN rail
- IQRL-D008** 8 Position I/QRail & DIN rail
- WV905** 24VDC Power Supply (0.5Amp)
- H910** 24VDC Power Supply (1Amp)
- H915** 24VDC Power Supply (2.3Amp)

### Accuracy (Including Linearity & Hysteresis):

+0.1% of span, typical

+0.5% of span, maximum (100mV range)

### Stability:

+0.025%/°C of selected input span, typical.

### Response Time (10 to 90%):

250mSec., typical.

### Common Mode Rejection:

DC to 60Hz: 120dB

### Isolation:

1800VDC between input, output and power.

### EMC Compliance (CE Mark):

Emissions: EN50081-1; Immunity: EN50082-2; Safety: EN50178

### Humidity (Non-Condensing):

Operating: 15 to 95% @ 45°C

Soak: 90% for 24 hours @ 65°C

### Temperature Range:

Operating: 0 to 55°C (32 to 131°F)

Storage: -25 to 70°C (-13 to 158°F)

### Power:

Consumption: 1.5W typical, 2.5W max.

Range: 9 to 30VDC

### Wire Terminations:

Screw terminals for 12-22 AWG

### Shipping Weight:

0.48 lbs.

### Agency Approvals:

UL recognized per standard UL508 (File No. E99775).

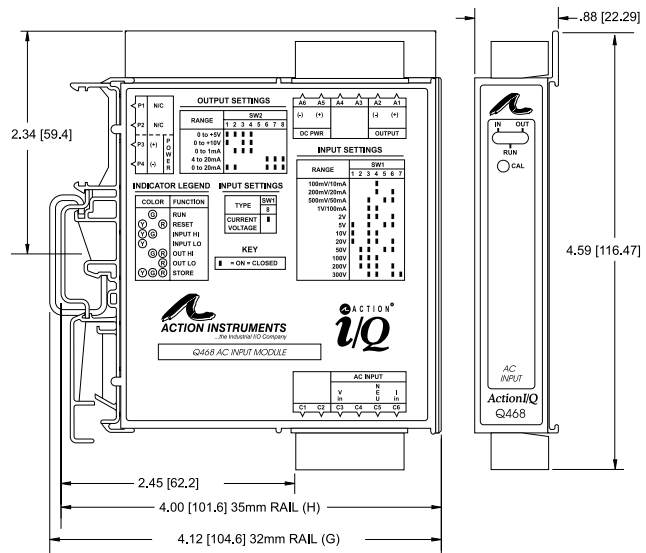
CSA certified per standard C22.2 No. 0-M91 and 142-M1987

(File No. LR42272-84).

CE Compliance per EMC directive 89/336/EEC and Low Voltage 73/23/EEC.

Terminal	Connection	Terminal	Connection
A1	Output (+)	C3	Input Voltage (Line)
A2	Output (-)	C4	Not Used
A3	Not Used	C5	Input (Neutral)
A4	Not Used	C6	Input Current (Line)
A5	DC Power (+)	P1	Not Used
A6	DC Power (-)	P2	Not Used
C1	Not Used	P3	DC Power (+)
C2	Not Used	P4	DC Power (-)

### Dimensions





Q478-0000



# ACTIONI/Q® Q478

## DC Powered Frequency Input Field Configurable Isolator

Provides an Isolated DC Output  
in Proportion to an Input Frequency



- Eliminates Ground Loops
- Field Configurable Input Ranges 2Hz to 10,000Hz
- Field Configurable Output Ranges
- 150mV to 150V Input Amplitude

- TouchCAL Technology
- High Density DIN Rail Mounting
- Flexible DC Power Supply Accepts 9 to 30VDC
- SnapLoc™ Plug-in Terminals

### Description

The Q478 is a DC powered DIN rail mount, frequency input signal conditioner with 1800VDC isolation between input, output and power. The field configurable input and output offers flexible, wide ranging capability for variable frequency drives, magnetic pickups, turbine flowmeters, and other pulse or frequency output transducers.

The input of the Q478 can be configured for any frequency span from 2Hz to 10,000Hz. The input amplitude threshold sensitivity can be adjusted from 150mVp to 10Vp to ensure accurate frequency measurement and minimize transient noise related errors. The maximum input amplitude is 150 Vrms. The output can be set for either 0-5V, 0-10V, 0-1mA, 0-20mA or 4-20mA.

The Q478 can be field configured for virtually any frequency input to DC signal output within the ranges specified. There is also an 8VDC excitation source common to the input. This can be used as a signal source for relay contacts or as an excitation source for open collector type proximity sensors. The Q478 is DC powered and will accept any power between 9 and 30VDC.

### TouchCAL Technology

The Q478 utilizes TouchCAL Technology to greatly simplify configuration. The high and low input ranges are stored in non-volatile memory and correspond to the high and low output range which is selected via DIP switches.

### Diagnostic LEDs

The Q478 utilizes three diagnostic LEDs. The green (RUN) LED indicates DC power and input signal status. Active line power is indicated by an illuminated LED. If the input signal is 7% or more high, the LED will flash at 8Hz. If the input signal is 7% or more low, the LED will flash at 4Hz.

The yellow (IN) LED is lit when calibrating the input. The red (OUT) LED is lit when calibrating the output.

### Application

The Q478 field configurable, frequency input signal conditioner is useful in eliminating ground loops and interfacing pulse output transducers, such as turbine flow meters and magnetic pickups, to data acquisition and control systems.

Advanced digital technology, combined with ASIC technology, provides a stable output at low frequencies for higher accuracy, and 3-way isolation which completely eliminates ground loops from any source.

### Configuration

Any 2Hz range from 0 to 10,000Hz can be converted to a full scale output signal (e.g. 0-2Hz/4-20mA or 9998-10,000Hz/4-20mA).

Unless otherwise specified, the factory presets the Model Q478 as follows:

- Input Range: 0 to 1000Hz
- Sensitivity: 1V RMS
- Output Range: 4 to 20mA

*Note that "Sensitivity" refers to the noise rejection level (the trigger threshold of the input).*

For other I/O ranges, refer to the tables.

**WARNING:** Do not change switch settings with power applied. Severe damage will result!

1. With power off, snap off the faceplate by lifting the right edge away from the heatsink. Then slide the heatsink forward and off the module. The output switch block (SW2) is located under the heatsink. Choose the desired output voltage/current range from Table 1 and set positions 1-8 of SW2.

2. Set the input sensitivity switch (SW2, 9 & 10) to LO for input amplitudes between 150mVp and 50Vrms, with noise rejection to 1Vp; or to HI for input amplitudes between 500mVp and 150Vrms, with noise rejection up to 10Vp.

3. Return the heatsink to its original position and attach the faceplate before beginning calibration.

## Calibration

For best results, calibration should be performed in the operating installation, allowing at least one hour for thermal stability of the system. If pre-calibration on a test bench is preferred, then an output load equal to the input impedance of the device connected to the Q478 output is recommended, along with a 1 hour warm up period.

*Note: An I/QRail is required to power the modules. See Ordering Information.*

1. Install the module on a piece of DIN rail and the I/Q Rail mounting combination. See the I/Q Rail data sheet for details.
2. Connect the input to a calibrated frequency source and the output to a voltage or current meter. Apply power and allow the system to reach thermal equilibrium (approx. 20 minutes).
3. Adjust the input frequency to the desired maximum and observe that the output has increased and is sensing the input. If the output fails to increase, turn the sensitivity potentiometer in a counterclockwise direction until the output begins to change proportionally to the input.

*Note: The level LED may not appear to be on if the new range is less than 10% of the previously calibrated range.*

4. With the green LED on press the CAL button for 5 seconds to enter the calibration mode. The yellow and green LEDs will now be on.
  5. Input the maximum desired frequency and press the CAL button to store. The yellow LED will now be the only LED on.
  6. Input the minimum desired frequency and press the CAL button to store. The green and red LEDs will now be on.
- Note: The most reliable way to input 0Hz is to short circuit the input pins (C5 & C6).*
7. To precisely adjust the maximum output, adjust the input frequency until the output reads within  $\pm 0.1\%$  of the maximum selected output range. This typically occurs near 90% of the HI input frequency. Press the CAL button to store the value. The red LED will now be on.

Table 1: Output Range Settings

Ranges	Selector SW2							
	1	2	3	4	5	6	7	8
0 to 5V	■	■	■	■				
0 to 10V	■		■	■				
0 to 1mA		■	■	■				
4 to 20mA						■	■	■
0 to 20 mA	■	■			■		■	■

Key: ■ = 1 = ON or Closed

8. To precisely adjust the minimum output, lower the input frequency until the output reads within  $\pm 0.1\%$  of the minimum selected output. This typically occurs near 10% of the HI input frequency. Press the CAL button to store the value. The yellow and Red LEDs will be on. The green LED should be dim.

9. Press the CAL button once again to exit the calibration mode. The green LED will now be on.

10. Check the minimum and maximum input-to-output calibration. Repeat steps 1 to 8 if calibration is not within desired specifications.

*Note 1: To reset the unit while in the calibration mode, push the CAL button and hold for 5 seconds.*

*Note 2: Removing power to the unit at anytime before Step 8 will restore previous settings and calibration.*

## Optimal Sensitivity

If the amplitudes of the input frequency are within the sensitivity parameters (i.e. 150mVp - 1Vp for LO and 0.5Vp - 10Vp for HI), then the sensitivity parameters can be set for optimum noise rejection.

1. Set the input near midrange (50% input) or to a frequency that exhibits the minimum pulse amplitude.
2. Turn the sensitivity pot (SENS) clockwise (CW) until the output drops to minimum.
3. Turn the sensitivity pot counter-clockwise (CCW) a turn or two until the output returns to the previous level.
4. Run the input through the entire frequency range to make sure that the pulses are sensed at both the low and high input frequencies. If the output drops out during this test, turn the sensitivity pot counterclockwise another turn or two until the output picks up. Repeat to validate sensitivity settings.

Table 2: Input Sensitivity Settings

Sensitivity	SW2	
	9	10
High (0.5 to 10Vp; 150Vrms maximum)		
Low (150mVp to 1Vp; 50Vrms maximum)		■

Key: ■ = 1 = On or Closed



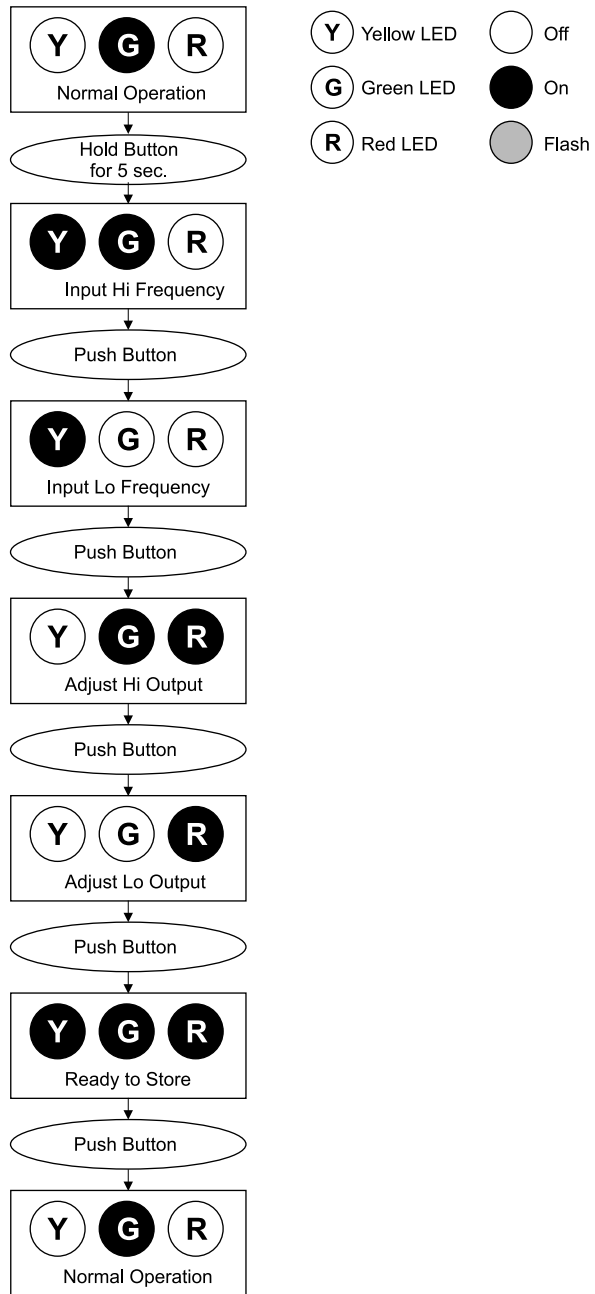


Figure 1: Q478 Calibration Flow Chart

**Specifications****Input:**

## Frequency

Full Scale Range: 2 Hz to 10,000Hz.  
 Amplitude Range: 150mVp to 150Vrms  
 Impedance: >10K ohms  
 Overvoltage: 180Vrms, max.  
 Over-range: 20KHz, max.  
 Common Mode (Input to Gnd): 1800V, max.  
 Zero Turn-Up: 99% of full scale range (9998Hz)  
 Span Turn-Down: 99% of full scale range (2Hz)

**Output:**

## Voltage:

Output: 0-5V, 0-10V  
 Source Impedance: <100 ohms  
 Drive: 10mA, max. (1K ohms, min. @ 10V)

## Current:

Output: 0-1mA, 0-20mA, 4-20mA  
 Source Impedance: >100K ohms  
 Compliance:  
 0-1mA; 7.5V, max. (7.5K ohms, max.)  
 0-20mA; 12V, max. (600 ohms, max.)  
 4-20mA; 12V, max. (600 ohms, max.)

**Accuracy (Including Hysteresis & Linearity):**

+0.1% of selected range at 25°C

**Stability:**

±0.025%/°C maximum of selected range.

**Excitation Voltage:**

8VDC, for open collector and contact closure inputs, 5mA short circuit current max.

**Response Time (10 to 90%)**

500mSec., or 100 times the period of the full scale frequency.

**Common Mode Rejection:**

DC: 100dB  
 >60Hz: 80dB

**Isolation:**

1800VDC between input, output and power.

**Ordering Information****Models & Accessories****Specify:**

1. Model: **Q478-0000**
2. Specify optional I/QRail, type and quantity.
3. Optional Custom Factory Calibration; specify **C620** with desired input and output range
4. Accessories: (see Accessories)

**Accessories**

Action/IQ modules will mount on standard TS32 (model MD02) or TS35 (model MD03) DIN Rail. In addition, the following accessories are available:

**MD02** TS32 DIN rail

**MD03** TS35 x 7.5 DIN rail

**IQRL-D002** 2 Position I/QRail & DIN rail

**IQRL-D004** 4 Position I/QRail & DIN rail

**IQRL-D008** 8 Position I/QRail & DIN rail

**WV905** 24VDC Power Supply (0.5Amp)

**H910** 24VDC Power Supply (1Amp)

**H915** 24VDC Power Supply (2.3Amp)

**ESD Susceptibility**

Capable of meeting IEC 801-2 level 3(8KV)

**LED Indication:**

## LVL (green):

Lit when power is on  
 Input < 107% then 8Hz flash  
 Input > -7% then 4Hz flash

## IN (yellow):

Input range programming status

## OUT (red):

Output range programming status

**Humidity (Non-Condensing):**

Operating: 15 to 95% @ 45°C

Soak: 90% for 24 hours @ 65°C

**Temperature Range:**

Operating: 0 to 55°C (5 to 131°F)

Storage: -25 to 70°C (-13 to 158°F)

**Power:**

2.5W max., 9 to 30VDC

**Weight:**

0.50 lbs

**Wire Terminations:**

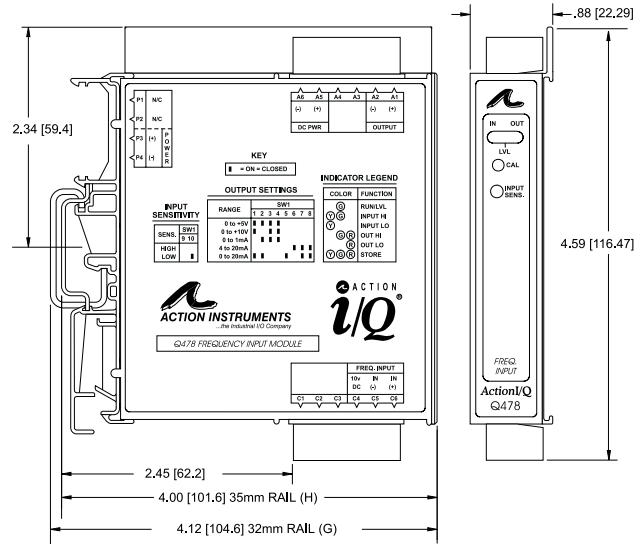
Screw terminals for 12-22 AWG

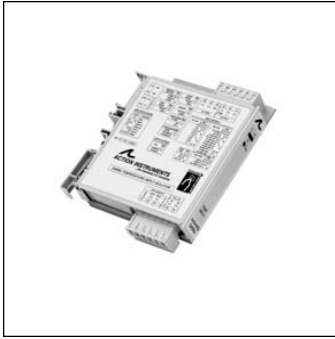
**Agency Approvals:**

UL recognized per standard UL508 (File No. E99775).

CSA Certified per standard C222 No.0-M91 and 142-M1987 (File No. LR42272-84.)

Terminal	Connection	Terminal	Connection
A1	DC Output (+)	C3	Not Used
A2	DC Output (-)	C4	Excitation Source (8VDC)
A3	Not Used	C5	Frequency Input (-)
A4	Not Used	C6	Frequency Input (+)
A5	DC Power (+)	P1	Not Used
A6	DC Power (-)	P2	Not Used
C1	Not Used	P3	DC Power (+)
C2	Not Used	P4	DC Power (-)

**Dimensions**



Q488-0001



# ACTIONIQ® Q488

## DC Powered RTD, T/C, Ohm & mV Input Field Configurable Isolator

Provides an Isolated DC Output  
in Proportion to the Temperature Signal Input



- Instant Accuracy™
- Field Configurable Input Ranges
- PC or DIP Switch Configuration
- Eliminates Ground Loops

- TouchCAL Technology
- High Density DIN Rail Mounting
- Flexible DC Power Supply 9 to 30VDC
- SnapLoc™ Plug-in Terminals

### Description

The Q488 is a DC powered, DIN rail mount, RTD, thermocouple, mV or Ohm input signal conditioner with 1800V isolation between input, output and power. The field configurable input and output offers flexible, wide ranging capability for most temperature signal conditioning applications.

The Q488 is configured via DIP switch for the thermocouple type (B, C, E, J, K, N, R, S, T) or the RTD type (Pt, Ni & Cu). Additionally, functions such as signal linearization, up or down scale burnout, number of RTD leads (2, 3, 4) and voltage or current output are also set via dip switches (see Tables).

Configuration software, along with a serial port adapter cable is available for those who would prefer PC configuration capability. This Graphic User Interface (GUI) program takes the place of setting DIP switches and using the pushbutton for ranging. With this software, an input signal calibrator is not required for ranging since the values only need to be typed into the program and downloaded.

### Instant Accuracy™

Instant Accuracy™ maximizes accuracy and performance during warmup and during changes in ambient temperature. This patented cold-junction compensation technique utilizes two temperature sensors to measure the differential temperature near the terminal block. Using heat transfer calculations with the measured differential temperature and the known thermal conductivity of the PCB, the terminal junction temperature is determined with extreme accuracy. Even during unstable thermal states such as start-up, ambient temperature changes or changing load or power, the Q488 performs extremely accurate thermocouple temperature measurement.

Instant Accuracy improves system performance and productivity due to reduced warm up time, fewer temperature measurement errors and tighter process control for higher quality. Most significantly, it allows calibration to be checked quickly and accurately without the effects of rapid ambient temperature changes due to opening a control panel door, which often causes erroneous readings and miscalibrations; a common cause of measurement errors.

### TouchCAL™ Technology

TouchCAL™ technology allows easy field ranging for any of the thermocouple or RTD input types. For example, the dip switch configured range for the J type thermocouple is -210 to 760°C. Using a thermocouple simulator as a reference, the model Q486 could be ranged for 0 to 50°C or 0 to 500°C by simply applying the desired minimum and maximum input levels and pushing the range button to store the levels in non-volatile memory. The output is ranged by applying an input signal to achieve an accurate output level and pushing the range button.

### Applications

The model Q488 field configurable thermocouple or RTD input isolator is useful in eliminating ground loops and interfacing temperature sensors to data acquisition and control systems.

Three-way isolation completely eliminates ground loops from any source. Isolation protects expensive SCADA systems from ground faults and allows the noise reduction benefits of grounded thermocouples or sensors to be realized.

The Q488 employs the latest analog to digital signal processing technology and advanced low-power microprocessors. Instant Accuracy cold-junction-compensation (CJC) of thermocouples, and lead length compensation for RTDs ensures an extremely accurate and stable signal for virtually any temperature sensor to DC signal conversion.

High density DIN rail mounting offers a very compact solution and saves valuable panel space. Power is delivered to the Q488 using the exclusive I/QRail which reduces wiring requirements and the need to daisy-chain power. SnapLoc terminals ensure easy installation and low Mean-Time-To-Repair (MTTR).

### Diagnostic LEDs

The Q488 is equipped with front panel LEDs for input power (green-on), input overrange and underrange; input open circuit (yellow-on); and switch setting error (red-on).

## Configuration

The Q488 can be configured via DIP switches for a wide variety of temperature input ranges for RTD, thermocouple, ohm and millivolt sensors. Inputs can be offset by >90% or adjusted down to <10% of the full scale span.

Unless a specific customer range is ordered, the factory presets the Q488 as follows:

Input Type: Thermocouple, J-Type  
 Input Range: 0 to 500°C  
 Burnout: Up Scale  
 Output Range: 4/20mA

Refer to the tables for other I/O ranges.

1. With power off, snap off the faceplate by lifting the right edge away from the heatsink.
2. For RTD or Resistance inputs, set position 1 and 2 of SW2 for 2, 3 or 4 wire resistance input (see Table 1). For thermocouple inputs these switches ignored and can be in any position.
3. Configure the output for voltage or current using position 3 of SW2 (see Table 2).
4. If the input range desired is the full scale range for the input type (e.g. Pt100 Ohm = -200°C to 850°C), then set position 4 of SW2 to ON (or closed) for this default range (see Table 3). If configuration of a sub-range is preferred (e.g. Pt100 Ohm, 0 to 500°C), then set position 4 of SW2 to OFF (or open) to enable use of the ranging pushbutton adjustment.

5. If the output range desired is the full scale range for the output type (e.g. 4-20mA or 2-10V), then set position 5 of SW2 to ON for either of the full scale default output ranges (see Table 4). If configuration of a sub-range is preferred (e.g. 12-20mA or 1-5V), then set position 5 of SW2 to OFF (or open) to enable use of the ranging pushbutton adjustment.

6. Set Burnout detection with position 6 of SW2 (see Table 5). The ON position (up scale) will force the output beyond full scale when the t/c input is open circuit. The OFF position (down scale) will force the output below 0% when the input is open circuit.

7. Set the t/c Linearization function with position 7 of SW2 (see Table 6). The ON position will provide an output linear to the temperature input signal. The OFF position will provide an output directly proportional to the thermoelectric (mV) input (i.e. not linearized to temperature).

Note: The unit must be configured with linearization turned ON. Once the configuration is saved, linearization can then be turned OFF.

8. Set the Configuration Mode with position 8 of SW2 (see Table 7). The ON position is for DIP switch configuration. The OFF position is for configuring via PC using a serial interface cable (consult factory regarding cable and software).

9. Set the Input Type with position 1 and 2 of SW3 (see Table 8).

10. Set the specific RTD, thermocouple, millivolt or resistance input with position 3 through 6 of SW3 (see Table 9).

Note: For PC configuration refer to the software manual and help files associated with the model C681 accessort kit.

Table 1: RTD Type

RTD Type	SW2	
	1	2
3-Wire	■	■
4-Wire	■	
2-Wire		■

Key: ■ = 1 = On or Closed

Table 5: Input Type

Input Type	SW3	
	1	2
Thermocouple	■	■
RTD	■	
mV or Ohms		■

Key: ■ = 1 = On or Closed

Table 2: Output Type

Output	SW2
	3
Current	■
Voltage	

Key: ■ = 1 = On or Closed

Table 6: Burnout Detection

Burnout Detection	SW2
	6
Upscale	■
Downscale	

Key: ■ = 1 = On or Closed

Table 3: Input Range Type\*

Input Range	SW2
	4
Default	■
User Defined	

Key: ■ = 1 = On or Closed

Table 7: Output Linearization

Output Linear to Temperature	SW2
	7
On	■
Off	

Key: ■ = 1 = On or Closed

Table 4: Output Range Type\*

Output Range	SW2
	5
Default	■
User Defined	

Key: ■ = 1 = On or Closed

Table 8: Config Mode

Configuration Mode	SW2
	8
By DIP Switch	■
By PC	

Key: ■ = 1 = On or Closed

Table 9: Input Select

T/C Type	SW3				Input Range	Accuracy Range	Input (A/D) Accuracy	
	3	4	5	6				
R	■	■	■	■	0 to +1760° C	+200 to +1760° C	+/-1.0° C	
J	■		■	■	-210 to +760° C	-100 to +760° C	+/-0.25° C	
S	■	■	■		0 to +1760° C	+400 to +1760° C	+/-1.0° C	
B	■	■		■	0 to +1800° C	+400 to +1800° C	+/-2.0° C	
T	■	■			-270 to +400° C	0 to +400° C	+/-0.25° C	
K	■		■		-270 to +1370° C	-100 to +1370° C	+/-0.3° C	
N	■			■	-270 to +1300° C	70 to +1300° C	+/-0.4° C	
C	■				0 to +2320° C	0 to +2320° C	+/-0.5° C	
E		■	■	■	-270 to +1000° C	-100 to +1000° C	+/-0.25° C	
RTD Type	SW3				Input Range	Accuracy Range	Input (A/D) Accuracy	
	3	4	5	6				
Cu-9.035	■	■	■	■	-40 to +260° C		+/-0.25° C	
Ni-120 067	■	■	■	■	-80 to +320° C		+/-0.15° C	
Pt-100 385	■	■	■		-200 to +850° C		+/-0.15° C	
Pt-100 3911	■	■		■	-200 to +630° C		+/-0.15° C	
Pt-100 392	■	■			-200 to +630° C		+/-0.15° C	
Pt-200 385	■		■		-200 to +850° C		+/-0.20° C	
Pt-200 392	■			■	-200 to +630° C		+/-0.20° C	
Pt-500 385	■				-200 to +850° C		+/-0.20° C	
Pt-500 3911		■	■	■	-200 to +630° C		+/-0.20° C	
Pt-500 392		■	■		-200 to +630° C		+/-0.20° C	
Pt-1000 385		■		■	-200 to +850° C		+/-0.20° C	
mV & Ohm Type	SW3				Input Range	Accuracy Range	Input (A/D) Accuracy	Minimum Span
	3	4	5	6				
+/- 90mV	■	■	■	■	-90 to +90mV	-90 to +90mV	+/-12uV	3mV
+/- 900mV	■	■	■		-100 to 900mV	-100 to 900mV	+/-25uV	3mV
0 to 4000 Ohms	■	■		■	10 to 4000 Ohms	10 to 4000 Ohms	+/-1.0 Ohms	10 Ohms

Key: ■ = 1 = ON or Closed

\*Default for Outputs is either 2-10V or 4-20mA. Default for Inputs is the "Input Range" specified in Table 9. Note that if the input or output is set for default, then the input or output calibration will be skipped in the pushbutton programming sequence.

Input to Output error at 25°C is less than or equal to the Input Accuracy, plus the Linearization Accuracy, plus the Output Accuracy (plus the CJC Error for T/C Inputs).

## Calibration

The Q488 is a microprocessor based circuit with internal references that are factory calibrated to better than 0.000005V. For this reason the Q488 does not need field calibration, but it can be configured (ranged) in the field for virtually any temperature to DC I/O combination.

For best results ranging should be performed in the operating installation, allowing at least 30 minutes for thermal equilibrium of the system. If ranging on a test bench is preferred, then an output load equal to the input impedance of the device connected to the output is recommended, along with a 30 minute warm up period.

1. After configuring the unit, install the module onto a piece of DIN rail and the I/Q Rail mounting combination. See the I/Q Rail data sheet for details.

2. Connect the input to a calibrated thermocouple simulator or resistance source and the output to a voltage or current meter. Apply power and allow the system to reach thermal equilibrium (approx. 20 minutes).

3. Adjust the input signal to the desired maximum and observe that the green LED is on. Push the CAL button and hold it down for more than 5 seconds (until the yellow and red LEDs are on).

*Note: To quit the calibration mode and reset the unit, push the CAL button and hold for more than 5 seconds. Or, wait for more than five minutes and the unit will time-out and automatically reset to the previously stored calibration.*

4. Push the CAL button momentarily (the yellow and green LEDs will now be on).

5. Apply the maximum input signal level, then push the CAL button to store. The yellow LED will now be on.

6. Apply the minimum input signal level, then push the CAL button to store. The green and red LEDs will now be on.

7. Adjust the input signal while monitoring the output signal until the output is at the desired maximum level (e.g. 20.00mA), then push the CAL button to store (the red LED will be on).

8. Adjust the input signal while monitoring the output signal until the output is at the desired minimum level (e.g. 4.00mA), then push the CAL button to store (the yellow, green and red LEDs will be on).

9. To finish calibration, push the CAL button once again. The green LED will be on if the input is within the calibrated range.

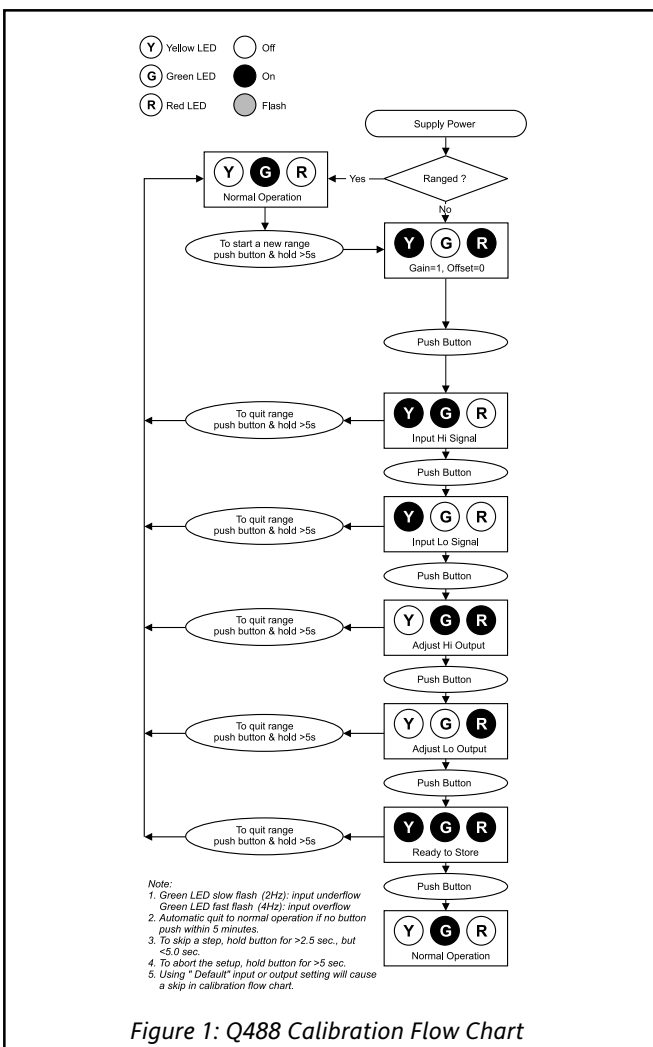


Figure 1: Q488 Calibration Flow Chart

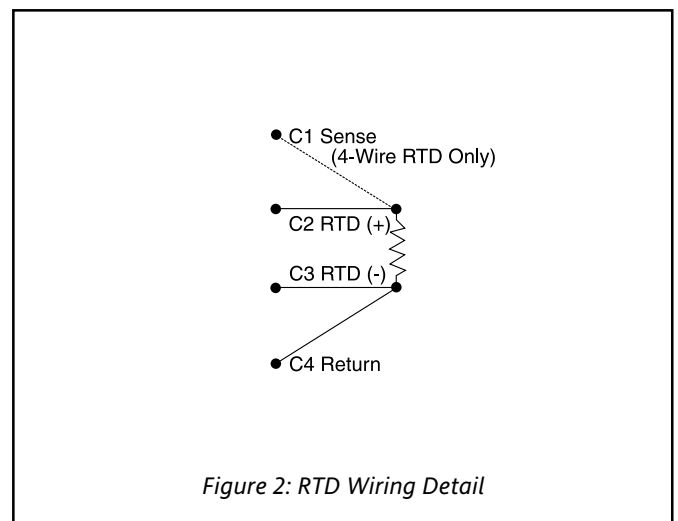
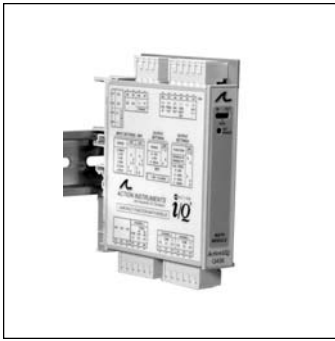


Figure 2: RTD Wiring Detail

Terminal	Connection	Terminal	Connection
A1	Current Output (+)	C3	RTD Input (-) or Resistance
A2	Voltage Output (+)	C4	RTD Return
A3	Output Common (-)	C5	T/C Input (-) or mV (-)
A4	Not Used	C6	T/C Input (+) or mV (+)
A5	DC Power (+)	P1	Not Used
A6	DC Power (-)	P2	Not Used
C1	RTD Sense	P3	DC Power (+)
C2	RTD Input (+) or Resistance	P4	DC Power (-)





Q498-0000

# ACTIONI/Q® Q498

## DC Powered DC Input Field Configurable Isolator with Math Functions

Provides 2 Isolated Analog Inputs, 1 Analog Output & 1 Frequency Output, as well as a Discrete Input & Output



- Multi-Function, Multi-Channel Input
- TouchCAL™ Technology
- DC-Frequency or Frequency-DC Converter
- Optional PC Based Programming Software

- High Density DIN Rail Mounting
- Math Function Capability
- SnapLoc™ Plug-in Terminals

### Description

The Q498 is a DC powered, DIN rail mount, DC input signal conditioner. The unit is fully isolated to 1800V between input, output and power. It has two isolated analog inputs that each accept either a DC voltage or current input signal. The one analog output delivers either DC bi-polar voltage or uni-polar current. The Q498 also has a separate frequency input channel and a frequency output, as well as a discrete input and output channel. The field configurable input and output feature provides flexible, wide ranging capability for DC current and voltage signals. The Q498 can also be configured via a PC with the optional C698 Windows based GUI software. The Q498 is also capable of performing math calculations on the input values. This provides the ability to perform single or double input math functions. The frequency input can also have the math functions applied (with the exception of Sq and Sqroot). The available operators are: +, -, \*, /, Sq, Sqroot & Average. Process control functions include Hi/Lo Select (utilizing the Digital Output for channel identification), Rate of Change Limiter and Track & Hold (utilizing the Digital Input for the hold control). A 25-point linearization function is available for the Channel 1 Analog input only. Note that all output math and process control functions require the C698 software.

The field configurable input of the Q498 can be set via DIP switches. Voltage input ranges are:  $\pm 150\text{mV}$ ,  $\pm 1.5\text{V}$ ,  $\pm 15\text{V}$  and  $\pm 150\text{V}$ . The current input ranges are:  $\pm 2.5\text{mA}$  and  $\pm 25\text{mA}$ . All ranges are fully adjustable over a  $\approx 90\%$  range from zero or span. Simply choose the range closest to your needs and perform the calibration based on zero and span values.

There are three analog output ranges, 0 to 20mA, 0 to 10VDC and -10 to +10VDC, which are also fully adjustable. If the application requires a 4-20mA output, simply choose the 0-20mA range and calibrate with the zero point at 4mA (the Math Functions can be used to scale the output).

The frequency section has two separate inputs, depending on voltage levels, only one of which can be active at a time. The LoV input supports signals with amplitudes from 150mVp to 5Vp (50Vrms max) and the HiV input supports signals between 500mVp and 20Vp (150Vrms max). The frequency range is from 2Hz to 10kHz in software selectable ranges.

### Applications

The Q498 can be used in many types of operations. This section describes a few process control applications and how to configure the unit in order to perform the various operations.

### Track & Hold

The Digital Input is used as the control element for Track & Hold. Short the Digital Input (Pin A6) to Digital Common (Pin A3) using an external relay or switch. The Analog Output will be held at the current output level until the connection is opened. Because the system is under microprocessor control, when the digital input is grounded, the current output level that is being processed cannot be stopped. As an extreme example, if the output has been told to make a step change from 0V to 10V, the output could still be in the process of slewing to that value (which could take as long as 700mSec). When the Hold input is applied during that 700mSec window, the output will continue to rise to the 10V level and then hold at that point. The Hold function only stops any future input changes from having an effect on the output.

If a step response is not desired when the Hold line is released, ensure that the Output Changing Limit is set to the desired amount (in the Configuration Window section of the C698 Configuration Software).

## Hi/Lo Select

This function is accomplished by selecting either the Max or Min function for F1(x). (Refer to the Output Math section of the Specifications.) After F1(x) has been assigned the Max or Min function, the higher input (or lower if Min is selected) will drive the output. If a step response is not desired when the input channels switch control, then ensure the Output Changing Limit (accessed in the Configuration window of the configuration software) is set to the desired amount. Take note that the coefficients A and B and the exponents of each channel also effect the comparison.

The digital output can be programmed to go high when CH1>CH2, or when CH1<CH2. The Yellow LED indicates the status of the digital output.

## 25-Point Linearization

The Q498 provides the ability to input unique linearization tables. This feature is only available through the C698 software package, and can only be used on analog input 1 (Ch 1).

## Digital & Frequency Output Loads

The digital and frequency outputs are designed to be powered with a 24VDC external supply. These outputs will each safely sink a maximum of 20mA. If an external supply is not used, the digital and frequency outputs are limited to 1mA.

## Math Functions

All of the basic math functions perform percentage math, not true math. The formulas are as follows:

**Addition:**            %Output = (%Ch1 + %Ch2)/2

**Subtraction:**        %Output = (%Ch1 - %Ch2),  
Ch1 must be ≥Ch2

**Multiplication:**    %Output= (%Ch1)(%Ch2)

**Division:**            %Output = %Ch1/%Ch2

**Sq. Root:**            %Output = %Chx<sup>0.5</sup>

## PC Programmable

The Model Q498 is calibrated either by using a serial port from a PC or by using the onboard DIP switch and pushbutton. Math and Process Control Functions are only configurable using the optional PC Configuration Software Model C698.

The software comes with a serial cable to connect the Q498 to a serial port of a PC. The software is also available on our Website. The software is compatible with Windows 95, 98, 2000 and NT operating systems. Instructions are included in the program as Help screens.

## TouchCAL™ Technology

Touch-CAL™ technology allows for the replacement of zero and span adjustment potentiometers with a pushbutton. The thermal drift and mechanical variability of the potentiometers is removed and replaced with a digitally stable circuit. Additionally, the inherent zero and span interactivity of potentiometer based analog amplifier circuitry is removed, providing 100% non-interactive adjustment.

TouchCAL enables precise calibration and provides more than 90% offset of the zero value and adjustment down to 10% of the full scale input span for most of the six switch selectable input ranges. For example, the DIP switch set for ±25mA input range could be configured via the pushbutton for an offset range of 4 to 20mA (58% offset and 68% span reduction) or -25 to 0mA (a 50% span reduction). If the output was configured for 0-10V, then -25 to 0mA input would correspond to the 0-10V full scale output. Thus, input ranges such as 4-20mA or 0-5mA are possible using the ±25mA range.

## Diagnostic LEDs

The Q498 has three diagnostic LED's. The green (RUN) LED is used to indicate that power is on, and for diagnostics. It flashes quickly if the input signal is above the configured range or slowly if the input signal is below range. It is continuously on when the unit is functioning within the configured range. The red LED flashes when the output is over/under range. The yellow LED indicates the status of the Discrete Output. The LED's also provide indication of which steps are being performed during pushbutton calibration.

## Wiring Connections

### Power

Power can be applied either by means of an IQ Rail adapter (see the Accessories section), in which case pins P3 and P4 will apply the power through the adapter; or if the IQ Rail adapter is not utilized, power is applied via connector "B" on the top rear of the unit (the connector nearest the DIN rail mounting foot). Pin B1 is for the positive (+) 9-30VDC and pin B2 is for the common (-).

### Analog Inputs

The DC voltage or current inputs are applied using connector "C" on the bottom front of the unit. Each channel has its own separate voltage or current input. Channel 1 (CH1) positive voltage input is pin C6. Channel 1 positive current input is pin C4. The common connection for CH1 is pin C5. The Channel 2 inputs are pin C3 for positive voltage, pin C1 for positive current and pin C2 for the common. [Note: In order to utilize CH2, the C698 software is required.] Either channel can be set independently for voltage or current.

### Frequency Inputs

The Frequency Input is applied using connector "D" on the bottom rear of the unit (the connector next to the DIN rail mounting foot). There are two inputs shown: IN LOV for voltages of 150mV to 50Vrms max.; IN HIV for voltages of 0.5V to 150Vrms max. Note that there are NOT two separate frequency inputs - only one set of terminals can be used at a time. The Frequency Input Common is pin D4. The positive terminal for the low voltage range is pin D5, and the positive terminal for the high voltage range is pin D6. [Note: In order to utilize the frequency input, the C698 software is required.]

### Outputs

The outputs and the discrete function are applied to connector "A" on the top front of the Q498. Pin A1 is the positive terminal (+) of the Voltage or Current output. Pin A3 is the Voltage Return and Pin A2 is the Current Return. Pin A3 is also the Common Return (-) for the Discrete (digital) Input and Output, as well as the Frequency Output Common. Several wires can be twisted together for the various commons as long as the combined wire size does not exceed the 12 AWG limit of the terminal. The Discrete Output (+) is pin A4 while the Discrete Input (+) is pin A6. The Frequency Output (+) is pin A5.



## Default Settings

The default settings are 4-20mA input on Analog Channel 1 (pins C4/C5) and 4-20mA output from the Analog Output (pins A1/A2). The frequency and digital inputs and outputs are not active, and require the C698 Configuration Software to utilize. The Output Math equation for the Analog Output is set as follows: A=1, F1(x)="+", B=0, F2(x)="+", C=0, D=1. Any change to the output math requires the C698 software.

## Isolation

The Analog Inputs (CH1 & CH2) are isolated from each other, as well as from the Analog Output and Power. The Frequency Input circuitry is in the same isolation section as Analog Input CH2, so it is isolated from CH1, but not CH2. The Frequency Output is referenced to the same common as the Analog Output, therefore, the Frequency Output is not isolated from the Analog Output, but is isolated from the Frequency Input, Analog Inputs CH1 & CH2 and Power. The Digital Input and Digital Output are not isolated from each other and are referenced to the same common as the Analog Output and Frequency Output. The Serial Port is also referenced to the output section, so it is not isolated from the Output circuitry, but is isolated from the Analog and Frequency Input Sections. The Isolation level between all isolated sections is 1800VDC.

## Serial Port

The serial port connection for using the C698 software is located below the DIP switch. The cable is provided with the C698 software option. Please refer to the software Help File for further explanation.

## Calibration

For best results, calibration should be performed in the operating environment, allowing at least one hour for thermal stability of the system. If pre-calibration on a test bench is preferred then an output load equal to the input impedance of the devices connected to the Q498 output is recommended.

1. For the optimum results, install the module on to a piece of DIN rail or an I/Q Rail.

Note: An I/Q Rail is an optional accessory to deliver power to the modules. A two, four or eight position rail is available. See the ordering information.

2. Connect the analog input to be calibrated (usually starting with Ch. 1) to a calibrated DC source and the analog output to a voltage or current meter. A frequency source should be connected to the frequency input and a frequency counter to the frequency output. Apply power and allow the system to reach thermal equilibrium (approx. 20 minutes).

The Q498 can be calibrated by either of two methods, manually, as described in this procedure, or by means of the C698 configuration software utility. For software calibration, first set DIP switch position SW1-10 to ON to enable PC Calibration. Refer to the information in the Help files of the software for the correct procedure.

While performing a manual calibration, refer to the flow charts in Figures 1a & 1b.

3. While it is not mandatory, less button-pushing is involved if all inputs are calibrated before calibrating the output. To start the process, the Green LED should be on.

4. Press and hold the calibration button for 4 seconds. The Green LED will be lit and the Yellow LED will be flashing. From this point, to calibrate channel 1, press and hold the button down again for 4 seconds. The Red and Yellow LED's will be lit indicating the input is ready to calibrate.

5. Press the button once. The Yellow and Green LED's will be lit.

6. Apply the maximum input signal and press the button once. The Yellow LED will be lit.

Note: After any calibration step, you can abort by pressing the button and holding for 4 seconds. This will take you back to normal operation without saving the new data. You then step back through the flowchart to return to where you were in your calibration.

7. Apply the minimum input signal and press the button once. All three LED's will be lit.

8. Press the button once again. The Channel 1 input data is saved and you are back at the beginning with the Green LED lit.

9. Press and hold the button for 4 seconds. The Green LED will be lit and the Yellow LED will be flashing. Press the button one more time and the Red LED will be lit and the Yellow LED will be flashing. From this point, to calibrate channel 2, press and hold the button down for 4 seconds. The Red and Yellow LED's will be lit.

10. Repeat steps 5 through 8.

11. After completing the analog input calibration, the Green LED is lit. Press and hold the button for 4 seconds. The Green LED will be lit and the Yellow LED will be flashing. Press the button twice. The Green LED will be lit and the Red LED will be flashing, indicating that the frequency input is ready for calibration.

12. Press and hold the button for 4 seconds. The Red LED and Yellow LED's will be flashing.

13. Repeat steps 5 through 8.

14. After completing the frequency input calibration, the Green LED is lit. Press and hold the button for 4 seconds. The Green LED will be lit and the Yellow led will be flashing. Press the button three times. The Yellow LED will be lit and the Red LED will be flashing. The analog output is now ready for calibration.

15. Press and hold the button for 4 seconds. The Red and Yellow LED's will be lit.

16. Press the button once. The Red and Green LED's will be lit.

17. While monitoring the output, increase the input (from either Ch1 or Ch2) until the desired maximum output signal level is reached. Press the button once. The Red LED will be lit.

18. Monitor the output and decrease the input until the desired minimum output signal level is reached. Press the button once. All three LED's will be lit. Press the button once again to save the data and you will be back to the Green LED lit.

19. Press and hold the button for 4 seconds. The Green LED will be lit and the Yellow LED will be flashing. Press the button 4 times (until the Green LED is flashing). The frequency output is now ready for calibration.

20. Press and hold the button down for 4 seconds. The Red and Yellow LED's will be lit. Manually calibrating the output frequency requires first selecting the desired frequency output range with DIP Switch SW1, positions 9 & 10, as described in Figure 1B. These switch settings are not required if calibrating via the software utility. After the output frequency is calibrated, the switches can be reset to their previous settings for calibration method. Press the button one more time and the Red and Green LED's will be lit.

21. Set the input frequency to maximum. While monitoring the output of the frequency output channel with a frequency counter, decrease the input until the desired maximum output is reached. Press the button once and the Red LED will be lit.

22. Set the input to minimum. While monitoring the output, increase the input until the desired minimum output value is reached. Press the button once and all three LED's will be lit.

23. Press the button once again and you are back to the Green LED lit (normal operating condition).

Table 1: Input Settings

Input Settings - SW1						
Range	Channel 1			Channel 2		
	1	2	3	4	5	6
+/-150mV						
+/-1.5V		■			■	
+/-15V			■			■
+/-150V		■	■		■	■
+/-2.5mA	■			■		
+/-25mA	■	■		■	■	

Key: ■ = 1 = ON or Closed

Table 5: Output Settings

Output Settings - SW1		
Range	7	8
0 - 10V		
+/-10V		■
0 - 20mA		

Key: ■ = 1 = ON or Closed

Table 2: Enable 25-Point Calibration Setting

Enable 25-Point Cal - SW1	
	9
Enable 25-Point Calibration	■

Key: ■ = 1 = ON or Closed

Table 5: Manual Calibration Frequency Settings

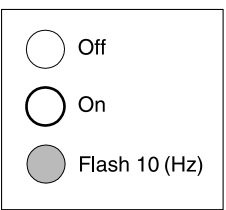
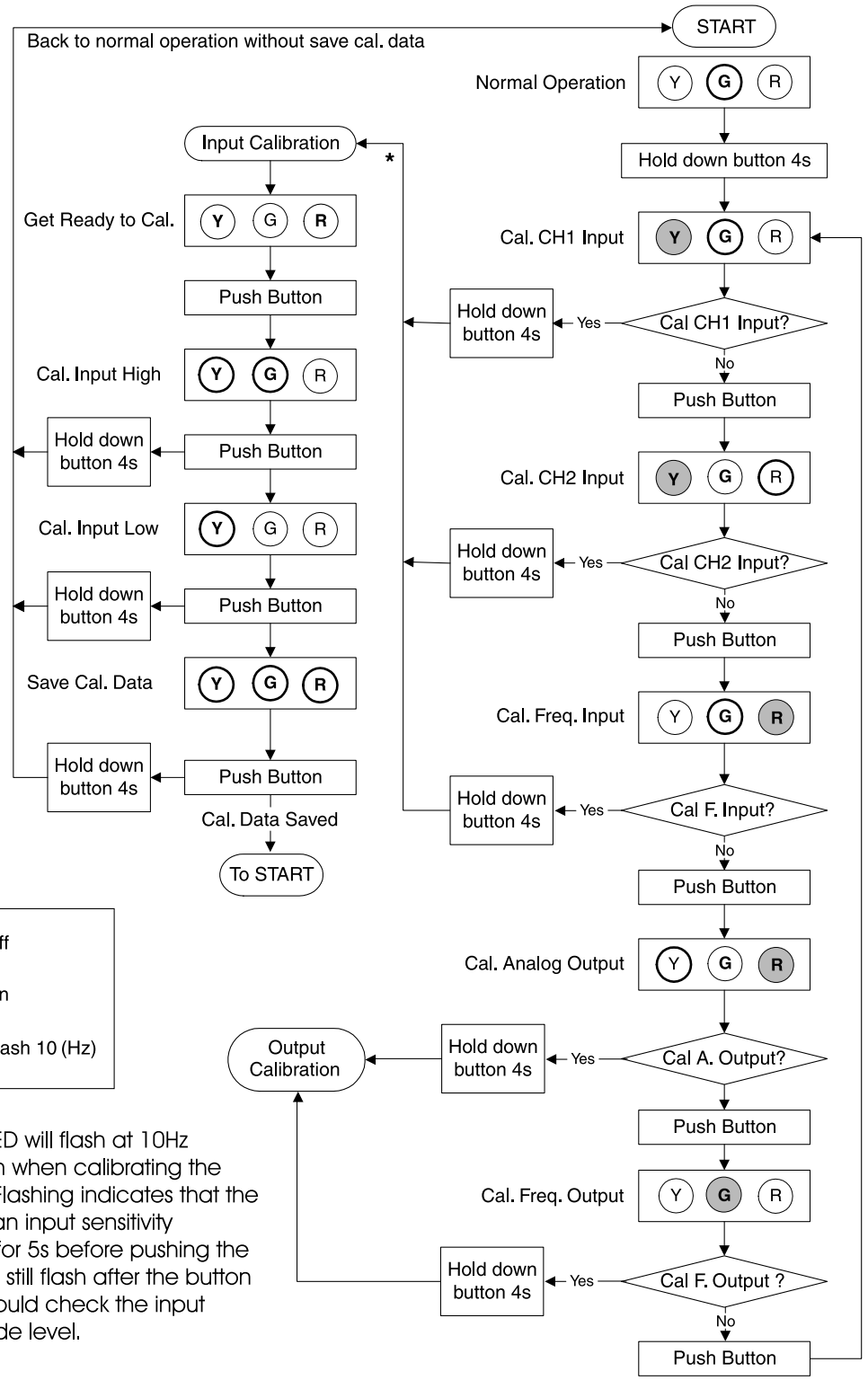
Frequency Output Range Manual Calibration Only - SW1		
Range	9	10
0 - 5 Hz	■	■
0 - 50 Hz		■
0 - 1,000 Hz	■	
0 - 10,000 Hz		

Key: ■ = 1 = ON or Closed

Table 2: Enable PC Calibration Setting

Enable PC Cal - SW1	
	10
Enable PC Calibration	■

Key: ■ = 1 = ON or Closed



Red and Yellow LED will flash at 10Hz instead of solid on when calibrating the frequency input. Flashing indicates that the module is doing an input sensitivity adjustment. Wait for 5s before pushing the button. If the LEDs still flash after the button is pushed, you should check the input signal for amplitude level.

Figure 1a: Q498 Input Calibration Flow Chart

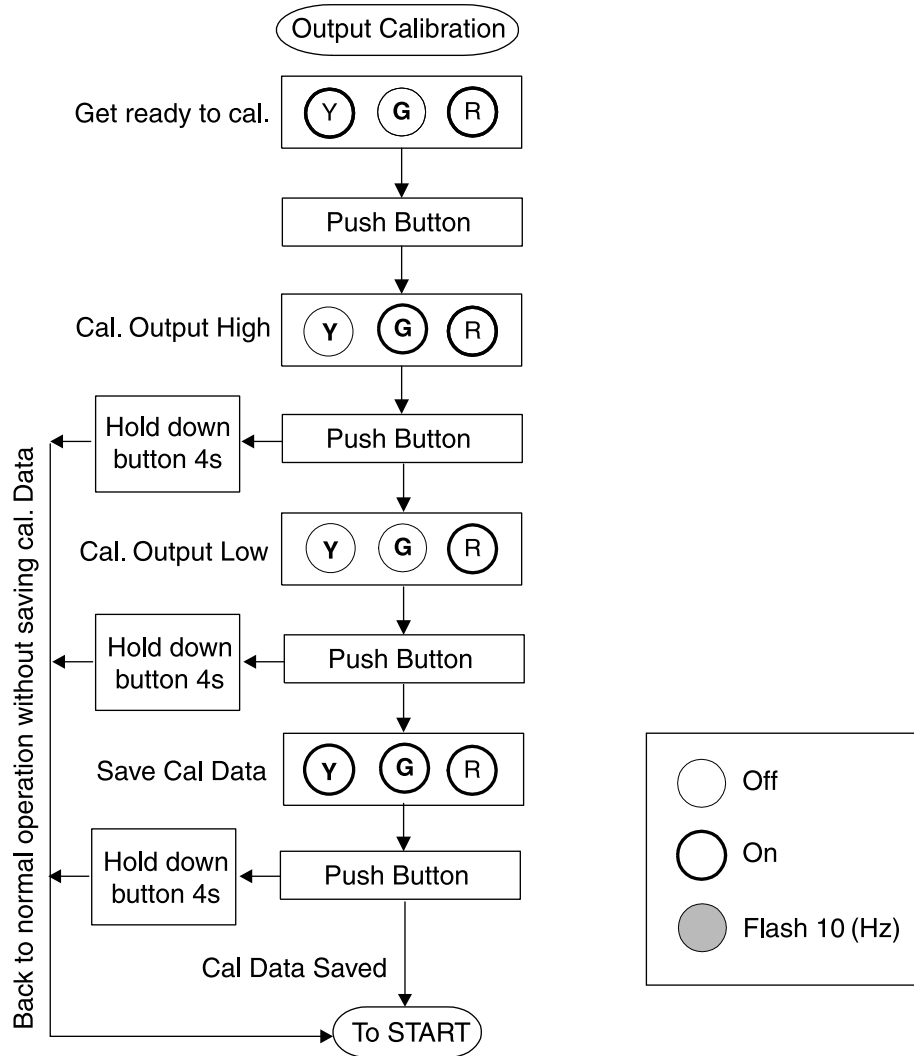


Figure 1b: Q498 Output Calibration Flow Chart

## Specifications

### Analog Input Ranges (2 Isolated Channels):

+/-150mV, +/-1.5V, +/-15V, +/-150V  
+/-2.5mA, +/-25mA

### Pushbutton Adjustment:

Effective zero offset:  $\geq 90\%$   
Effective span turn-down:  $\geq 90\%$

### Analog Maximum Overload (continuous):

200V DC for voltage inputs;  
170mA DC or 60V DC maximum for current inputs (protected by self-resetting fuse)

### Analog Output Ranges:

0-20mA, 0-10V, -10 to +10V

### Analog Output Drive:

0-20mA: 12VDC compliance. (600 ohms max.)  
Voltage ranges: 10mA drive (1000 ohm load min.)

### Analog Output Accuracy:

$\pm 0.005\%$  of the FS Input Range ( $\pm 0.05\%$  on 150 volts range), plus  $\pm 0.05\%$  of the FS Output Range ( $\pm 0.1\%$  for output loads  $< 200$  ohms)

### Analog Stability:

$\pm 0.005\%$  of Full Scale/ $^{\circ}\text{C}$  typical ( $\pm 0.01\%$  maximum) for zero and span

### Analog Response Time:

750mSec max. (10-90%)

### Analog Input Impedance:

$\geq 100\text{k}$  ohms on voltage ranges  $> 1.5\text{V}$   
 $\geq 10\text{M}$  ohms on voltage ranges  $\leq 1.5\text{V}$   
70 ohm typ. (non-overload) on all current ranges

### Analog Output Impedance:

Less than 3 ohms on voltage output ranges  
 $\geq 500\text{k}$  ohms on current output ranges

### Frequency Input:

One frequency channel with two different voltage range inputs, LOV for 150mV to 50Vrms with 5Vp noise suppression, or HIV for 0.5V to 150Vrms with 20Vp noise suppression, 2Hz to 10kHz in software selectable ranges.

### Frequency Output:

2Hz to 10kHz in software selectable ranges.  
Open collector pulled up through 20k to 18V, with 1mA drive.  
Sinks up to 20mA through a load from a 24V external supply.

### Frequency Output Accuracy:

$\pm 0.1\%$

### Discrete Output:

Open collector pulled up through 20k to 18V, with 1mA drive.  
Sinks up to 20mA through a load from a 24V external supply.  
Operation under software control.

### Discrete Input:

Input active to Common, with soft pull-up (1mA) to +18V.  
Operation under software control.

### Output Math:

$V_{out} = (A \cdot CH1^y F1(x) B \cdot CH2^z F2(x) C \cdot CH3)/D$   
 $F_{out} = (A \cdot CH1^y F1(x) B \cdot CH2^z F2(x) C \cdot CH3)/D$

CH1: Output value contributed by channel 1 input only

CH2: Output value contributed by channel 2 input only

CH3: Output value contributed by frequency input only

Where:

$F_x(x)$  can be: +, -, \*, /, Min, Max, Average, and y & z can be: 0, 1, 2, or 1/2

The constants A-D can be any number from 0 to 255 (except D cannot be equal to 0).

When using the square or square root functions, the relative input channel should be calibrated in the positive direction only.

## Process Control Functions:

Hi/Lo Select (Max/Min), Rate of Change Limiter, Track & Hold and 25-Point Linearization (25-point linearization only on Analog Input Ch 1 and only effects the Analog Output channel. Also, in this mode the square and square root functions are not available.)

## Default Settings:

Analog Input 1 (Ch1):  
 $\pm 25\text{mA}$  range, calibrated for 4-20mA

Analog Output:  
0-20mA range, calibrated for 4-20mA

Math:  
 $(1 \cdot CH1 + 0 \cdot CH2 + 0 \cdot CH3)/1$

Analog Input 2 (Ch2):  
Not active (nulled by the math)

Frequency:  
Not active (nulled by the math)

(The unit can be reconfigured manually for different ranges on input and output, using only Analog Input 1 (CH1) and the Analog Output. In order to utilize scaling factors, math functions, other inputs/outputs and process control functions, the C698 software is required.)

## Common Mode Rejection:

$\geq 90\text{dB}$  for 60 Hz  
120 dB @ DC

## Diagnostics:

Green LED Indicator flashes for over or under range

Red LED flashes for output malfunction  
(Voltage short circuit or current open)

Yellow LED indicates status of Discrete Output

## Power Requirements:

9-30VDC, 2.5 watts max

## Power Supply Current:

280mA max. @ 9VDC; limited to prevent in-rush currents from exceeding steady-state value. (At turn on, the unit appears as a capacitive load up to 100mF.)

## Wire Terminals:

Socketed screw terminals for 12-22 AWG

## Isolation:

Input to Input to Output to Power, 1800VDC (Analog Input 2 and the Frequency input are both considered Channel 2. The Frequency Input is isolated from Analog Input 1 but not from Analog Input 2. The Discrete Input is not isolated from the Discrete Output, but is isolated from the Analog and Frequency Inputs. All of the outputs are isolated from the Analog and Frequency Inputs.)

## Size:

DIN rail case (0.88" x 4.0" x 4.59")

## Operating Temperature:

0°C to +55°C (32 to 131°F)

## Storage Temperature:

-25°C to +70°C (-13 to 158°F)

## Operating Humidity:

15% to 95%RHNC at 45°C

## Non-operating Humidity:

90%RH at 65°C for 24 hours

## Agency Approvals (EMC & Safety):

UL recognized per standard UL508 (File No. E99775).

CSA certified per standard C22.2, No. 0-M91 and 142-M1987  
(Cert. # 2500003630).

CE Compliance per EMC directive 89/336/EEC and Low Voltage 73/23/EEC.

## Minimum PC for the C698 Calibration Software:

100MHz CPU, 16MB RAM, 20MB hard disk space

Terminal	Connection	Terminal	Connection
A1	Output (+) Voltage & Current	C4	Input 1 Current
A2	Current Output (-)	C5	Input 1 Common
A3	Vout, Digital I/O, Frequency Out Common (-)	C6	Input 1 Voltage
A4	Discrete Output (+)	D1	Not Used
A5	Frequency Output (+)	D2	Not Used
A6	Discrete Input (+)	D3	Not Used
B1	DC Power (+)	D4	Frequency Input Common
B2	DC Power (-)	D5	Frequency Input (Lo Voltage)
B3	Not Used	D6	Frequency Input (Hi Voltage)
B4	Not Used	P1	Not Used
C1	Input 2 Current	P2	Not Used
C2	Input 2 Common	P3	DC Power (+)
C3	Input 2 Voltage	P4	DC Power (-)

## Ordering Information Models & Accessories

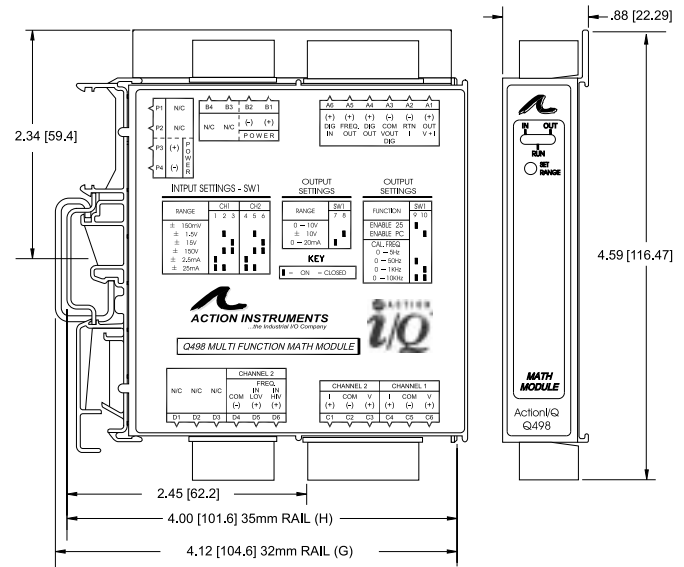
### Specify:

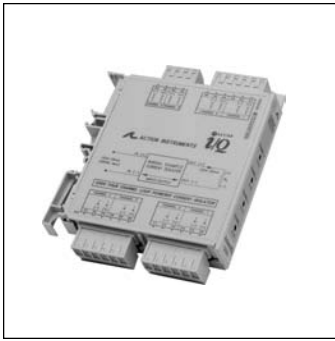
1. Model: **Q498-0000**
2. Optional Factory Custom Calibration, **C620** – with desired input and output ranges for 25-point linearization.
3. Optional I/QRail, and other accessories (see Accessories list).

### Accessories

<b>C698-0000</b>	Configuration Software & PC Serial Cable (recommended)
<b>MD02</b>	TS32 DIN rail (2 meters)
<b>MD03</b>	TS35 x 7.5 DIN rail (2 meters)
<b>IQRL-D002</b>	2-Position I/QRail & DIN rail
<b>IQRL-D004</b>	4-Position I/QRail & DIN rail
<b>IQRL-D008</b>	8-Position I/QRail & DIN rail
<b>WV905</b>	0.5Amp, 24VDC Power Supply
<b>H910</b>	1Amp, 24VDC Power Supply
<b>H915</b>	2.3Amp, 24VDC Power Supply

## Dimensions





Q500-1B00 (1 channel)  
Q500-2B00 (2 channel)  
Q500-4B00 (4 channel)

# ACTIONI/Q® Q500

## Loop Powered Multi-Channel Isolator

Provides up to 4 Isolated DC Current Outputs in Proportion to the Input Currents



- Up to 4 Loop Isolators in a Single Package
- Prevents Ground Loops
- High Density DIN Rail Mounting
- SnapLoc™ Plug-in Terminals
- ASIC Technology

### Description

The Q500 is a DIN rail mount, loop-powered isolator with single, dual or quad (4) channel capability. Each channel accepts a 0-20mA or 4-20mA input and outputs a proportional 0-20mA or 4-20mA signal. The Q500 provides 1800VDC signal isolation from input to output and channel to channel.

All ActionI/Q modules feature SnapLoc plug-in screw terminals for easy installation and low Mean-Time-To-Repair (MTTR). Two or more modules can slide together and interlock for solid, high density mounting. This is accomplished by removing either the foot or the adjacent unit's faceplate (for right-hand side or left-hand side mounting, respectively). The module to be attached will easily slide on to the side of the mounted unit.

### Application

Loop-powered isolators are used to isolate process signals transmitted between field instrumentation, Programmable Logic Controllers (PLC), Distributed Control Systems (DCS) and Data Acquisition Systems (DAS). Outputs from these systems can also drive one or more isolator channels of the Q500. Field devices such as flow, level or temperature transmitters can also drive a Q500 isolator channel. The 1800VDC isolation capability prevents ground loops from causing errors in 4-20mA current signals and can reduce susceptibility to Radio Frequency Interference (RFI). Isolation also provides protection from high voltages and current spikes which can damage expensive Supervisory Control And Data Acquisition (SCADA) equipment, such as a PLC or DCS.

### Operation

The Q500 operates as a loop-powered isolator, with each channel deriving its power from the input loop current, 0(4)-20mA. The effective load of a Q500 isolator channel on a loop is 300 ohms plus the output load resistance. For example, if the load on an output of the Q500 is 500 ohms, then the current loop connected to the input would need to drive 300 ohms plus 500 ohms (i.e. 800 ohms) at a maximum current of 20mA, or 800 ohms x 20mA which equals 16.0V.

The Q500 is protected from reverse input polarity and output short circuit. A span pot is provided for each channel in order to calibrate the output to the load.

### Calibration

1. Connect the input to a calibrated milliamp source. Connect the output to the actual device or to a load (between 100 and 500 ohms) equivalent to the actual device. Monitor the output current with a milliamp meter in series with the load or monitor the voltage across the load.
2. Set the calibrator to 20mA and adjust the span potentiometer for 20mA output.
3. Set the calibrator to 4mA and confirm that the output is 4mA.

**Specifications**

**Input Range:**

0(4) to 20mA, 30VDC max, each channel  
Voltage Drop: 6V (300 ohms), plus output load

**Output Range:**

0(4) to 20mA,  
Drive: 10V or 500 ohms maximum @ 20mA, 100 ohms minimum

**Output Accuracy:**

Better than ±0.2% of full-scale, including linearity, hysteresis and repeatability, maximum

**Linearity:**

0.1% of span typical, from 4 to 20mA at 250ohm load

**Stability:**

±0.02%/°C of span max. for full-scale and zero

**Load Regulation:**

±0.1% of span, typical per 10 ohm change

**Common Mode Rejection Ratio:**

≥ 100dB (DC to 60Hz)

**Isolation:**

1800VDC, input to output and channel to channel.

**ESD Susceptibility:**

Capable of meeting IEC 801-2 level 3 (8kV)

**Response Time:**

50mSec typical, 100mSec max 10 to 90% (each channel)

**Temperature:**

Operating: -40 to 80°C (-40 to 176°F)  
Storage: -40 to 80°C (-40 to 176°F)

**Humidity (non-condensing):**

25 to 95% (@40°C)

**Wire Terminals:**

Socketed screw terminals for 12-22 AWG

**Weight:**

0.34lbs

**Agency Approvals:**

CSA certified per standard C22.2 (File No. LR42272).  
UL recognized per standard UL508 (File No.E99775).  
CE conformance per EMC directive 89/336/EEC and Low voltage 73/23/EEC.

**Q500-1B Terminals**

Terminal	Connection	Terminal	Connection
A1	Channel 1 Output (+)	C1	Not Connected
A2	Channel 1 Output (-)	C2	Not Connected
A3	Not Connected	C3	Not Connected
A4	Not Connected	C4	Not Connected
A5	Not Connected	C5	Channel 1 Input (-)
A6	Not Connected	C6	Channel 1 Input (+)

**Q500-2B Terminals**

Terminal	Connection	Terminal	Connection
A1	Channel 1 Output (+)	C1	Not Connected
A2	Channel 1 Output (-)	C2	Channel 2 Input (-)
A3	Not Connected	C3	Channel 2 Input (+)
A4	Channel 2 Output (+)	C4	Not Connected
A5	Channel 2 Output (-)	C5	Channel 1 Input (-)
A6	Not Connected	C6	Channel 1 Input (+)

**Q500-4B Terminals**

Terminal	Connection	Terminal	Connection
A1	Channel 1 Output (+)	C1	Not Connected
A2	Channel 1 Output (-)	C2	Channel 2 Input (-)
A3	Not Connected	C3	Channel 2 Input (+)
A4	Channel 2 Output (+)	C4	Not Connected
A5	Channel 2 Output (-)	C5	Channel 1 Input (-)
A6	Not Connected	C6	Channel 1 Input (+)
B1	Channel 3 Output (+)	D1	Not Connected
B2	Channel 3 Output (-)	D2	Channel 4 Input (-)
B3	Channel 4 Output (+)	D3	Channel 4 Input (+)
B4	Channel 4 Output (-)	D4	Not Connected
		D5	Channel 3 Input (-)
		D6	Channel 3 Input (+)

**Ordering Information Models & Accessories**

**Specify:**

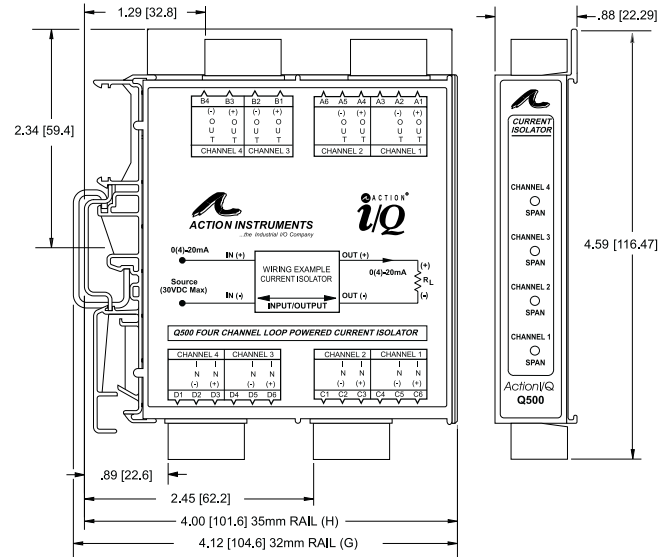
- Model:  
**Q500-1B00**, Single (1) Channel,  
**Q500-2B00**, Dual (2) Channel, or  
**Q500-4B00**, Quad (4) Channel  
Loop-Powered Isolator
- Accessories: (see Accessories)

**Accessories**

Action/Q modules mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition the following accessories are available:

- MD02** TS32 DIN rail
- MD03** TS35 x 7.5 DIN rail

**Dimensions**



ActionIQ®

Loop Powered





Q501-1xxx (1 channel out)  
Q501-2xxx (2 channel out)

# ACTIONI/Q® Q501

## Loop Powered Multi-Channel DC Input Isolating, 2-Wire Transmitter

Provides One or Two Isolated 4-20mA Output Current Loops in Proportion to One or Two DC Inputs



- Multi-Channel Design
- Prevents Ground Loops
- Standard Input Ranges

- High Density DIN Rail Mounting
- SnapLoc™ Plug-in Terminals
- Output Loop Powered from 12 to 35VDC

### Description

The Q501 is a DIN rail mount, DC input, single or dual channel, two-wire transmitter. Each channel accepts a DC voltage or current input and provides an isolated 4-20mA output. Each channel is fully isolated (1800VDC) from input to output and channel to channel.

All I/Q modules feature SnapLoc plug-in screw terminals for easy installation and low Mean-Time-To-Repair (MTTR). Two or more modules can slide together and interlock for solid, high density mounting. This is accomplished by removing either the foot, or the adjacent unit's faceplate (for right-hand side or left-hand side mounting, respectively). The module to be attached will easily slide on to the side of the mounted unit.

### Application

DC input, two-wire transmitters are used to isolate and convert a DC voltage or current into a proportional 4-20mA signal. Two-wire transmitters are primarily used in remote locations near the sensor since they reduce the probability of signal errors and save wiring costs by utilizing the two power wires to send the 4-20mA signal. The current signal is usually monitored by a control system or displayed for an operator.

Typically, DC voltages or currents from various field instruments (e.g. level, flow, pressure and position sensors) are used to monitor and control a manufacturing process. Voltage signals can only run a short distance to a panel without errors caused by noise or lead resistance in the wires. These sensor (voltage) signal wires are usually terminated at the two-wire transmitter and converted into a 4-20mA signal which is highly immune to noise and not affected by lead resistance, both of which can cause significant errors in voltage signals transmitted over long distances.

The 1800VDC isolation capability of the Q501 prevents ground loops from causing errors in DC voltage or current signals and can reduce susceptibility to Radio Frequency Interference (RFI). Isolation also provides protection from high voltages and current spikes which can damage expensive Supervisory Control And Data Acquisition (SCADA) equipment, such as a PLC or DCS.

### Operation

The Q501 operates as a two-wire transmitter; each channel derives its power from a 12-35VDC source connected in series with the 4-20mA output loop. Typically a 24VDC source is used for power, allowing 12VDC (600 ohms @ 20mA) for other devices connected in series in the current loop. The outputs of the Q501 are isolated from the inputs and protected from reverse polarity. Zero and span pots are provided for each channel to calibrate the output to the input source (+/-5%).

Standard input ranges (see Table) are calibrated to rated accuracy. One range per module; one or two channels per module.

### Calibration

1. Connect the input to a calibrated DC source. Connect the output in series to a voltage source capable of supplying at least 20mA and a milliamp current meter.

Note: The voltage source ( $V_s$ ) must be sufficient to accommodate all other device loads ( $R_L$ ) in the current loop:

$$V_s \geq 12 + (0.02R_L)$$

2. Set the calibrator to the specified minimum DC input value and adjust the zero potentiometer for 4mA output.

3. Set the calibrator to the specified maximum DC input value and adjust the span potentiometer for 20mA output.

4. Repeat steps 2 and 3, as necessary.

Q501 Input Ranges			
0 to 1 mA	0 to 50mV	0 to 1V	+/-10V
0 to 20mA	0 to 100mV	0 to 5V	
4 to 20mA	0 to 500mV	1 to 5V	
		0 to 10V	
		0 to 100V	

\*Consult factory for non-standard ranges

## Specifications

### Input:

Ranges: see Table

Impedance:

≥100K ohms (voltage inputs)

≤ 20 ohms (20mA Inputs),

≤ 400 ohms (1mA Inputs)

Protection: withstands up to 24VDC (current input), 120VAC (voltage input) without damage

### Output Range:

4-20mA

### Supply Voltage Range:

12 to 35VDC, each channel

### Output Accuracy:

≤ 0.1% of full-scale input typical, ≤ 0.2% max. @23°C including linearity, repeatability and hysteresis

### Adjustability:

Front accessed 10 turn, ± 5% of span for zero and span, typical

### Stability:

≤ 0.025%/°C of full-scale maximum

Meets IEC 801-2 level 2 (4kV)

### ESD Susceptibility:

Meets IEC 801-2 level 2 (4kV)

### Isolation:

1800VDC or peak AC between input and output and channel to channel

### Response Time:

100mSec typical (10 to 90%)

### Temperature:

Operating: -40 to 80°C (-40 to 176°F)

Storage: -40 to 80°C (-40 to 176°F)

### Humidity (non-condensing):

Operating: 15 to 90% (@45°C)

### Wire Terminals:

Socketed screw terminals for 12-22 AWG

### Weight:

0.34lbs

### Agency Approvals:

CSA certified per standard C22.2 (File No. LR42272).

UL recognized per standard UL508 (File No. E99775).

CE conformance per EMC directive 89/336/EEC and low voltage 73/23/ EEC (Input <75VDC)

Q501-1B00: 1 Channel; 4-20mA input; 4-20mA outputs  
 Q501-1B01: 1 Channel; 0-20mA input; 4-20mA output  
 Q501-1B02: 1 Channel; 0-1mA input; 4-20mA output  
 Q501-1B03: 1 Channel; 0-10Vdc input; 4-20mA output  
 Q501-1B04: 1 Channel; 0-5Vdc input; 4-20mA output  
 Q501-1B05: 1 Channel; 1-5Vdc input; 4-20mA output  
 Q501-1B07: 1 Channel; 0-500mVdc input; 4-20mA output  
 Q501-1B08: 1 Channel; 0-1Vdc input; 4-20mA output  
 Q501-1B09: 1 Channel; 0-100mVdc input; 4-20mA output  
 Q501-1B11: 1 Channel; -10/10Vdc input; 4-20mA output  
 Q501-1B13: 1 Channel; 0-100Vdc input; 4-20mA output

Q501-2B00: 2 Channel; 4-20mA inputs; 4-20mA outputs  
 Q501-2B01: 2 Channel; 0-20mA inputs; 4-20mA outputs  
 Q501-2B02: 2 Channel; 0-1mA inputs; 4-20mA outputs  
 Q501-2B03: 2 Channel; 0-10Vdc inputs; 4-20mA outputs  
 Q501-2B04: 2 Channel; 0-5Vdc inputs; 4-20mA outputs  
 Q501-2B05: 2 Channel; 1-5Vdc inputs; 4-20mA outputs  
 Q501-2B07: 2 Channel; 0-500mVdc inputs; 4-20mA outputs  
 Q501-2B08: 2 Channel; 0-1Vdc inputs; 4-20mA outputs  
 Q501-2B09: 2 Channel; 0-100mVdc inputs; 4-20mA outputs  
 Q501-2B11: 2 Channel; -10/10Vdc inputs; 4-20mA outputs  
 Q501-2B13: 2 Channel; 0-100Vdc inputs; 4-20mA outputs

## Ordering Information

### Models & Accessories

#### Specify:

1. Model: **Q501** (see above)
2. Channels: 1 or 2
3. Input Range: (see Table)
4. Accessories: (see Accessories)

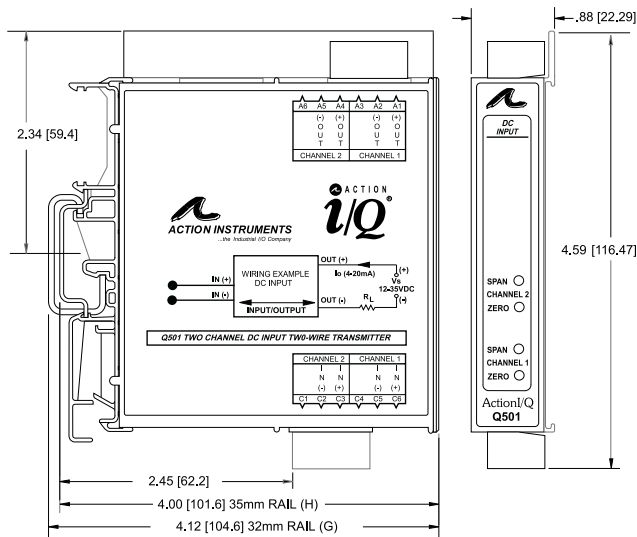
### Accessories

Action/Q modules mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition the following accessories are available:

- MD02** TS32 DIN rail
- MD03** TS35 x 7.5 DIN rail
- WV905** 24VDC Power Supply (500mA)
- H910** 24VDC Power Supply (1 Amp)
- H915** 24VDC Power Supply (2.3 A)

Terminal	Connection	Terminal	Connection
A1	Channel 1 Power & Output (+)	C1	Not Connected
A2	Channel 1 Power & Output (-)	C2	Channel 2 DC Input (-)
A3	Not Connected	C3	Channel 2 DC Input (+)
A4	Channel 2 Power & Output (+)	C4	Not Connected
A5	Channel 2 Power & Output (-)	C5	Channel 1 DC Input (-)
A6	Not Connected	C6	Channel 1 DC Input (+)

## Dimensions



Action/Q®

Loop Powered



Q510-0xxx (2 Channel)  
Q510-4xxx (4 Channel)

# ACTIONI/Q® Q510

## Loop Powered Multi-Channel RTD Input Isolating, 2-Wire Transmitter

Provides 2 or 4 Current Loop Outputs in Proportion to the PT100 Ohm RTD Inputs



- Up to 4 Two-Wire Transmitters in a Single Package
- Output Linear to Input Temperature
- Standard Input Ranges

- High Density DIN Rail Mounting
- SnapLoc™ Plug-in Terminals
- Output Loop Powered from 10 to 35VDC

### Description

The Q510 is a DIN rail mount, RTD Input, dual or quad channel two-wire transmitter. Each channel accepts an RTD input and provides an output loop powered 4-20mA signal, linear to the temperature input. Each channel is an independent transmitter with 600VDC channel to channel isolation.

All ActionI/Q modules feature SnapLoc plug-in screw terminals for easy installation and low Mean-Time-To-Repair (MTTR). Two or more modules can slide together and interlock for solid, high density mounting (remove either the foot, or the adjacent unit's faceplate for right-hand side or left-hand hand side mounting, respectively). The module to be attached will easily slide on to the side of the mounted unit.

### Application

RTD input, two-wire transmitters are used to convert a specific temperature range into a regulated 4-20mA signal. Two-wire transmitters are primarily used in remote locations near the sensor since they reduce the probability of signal errors and save wiring costs by utilizing the two power wires to send the 4-20mA signal. The current signal is usually sensed by a control system or displayed for an operator.

Typically, several RTDs are used to measure temperatures in a vessel or cell. The lead wires can run a short distance to a panel, or farther with the use of shielded wire, without errors caused by noise or lead resistance in the wires. These sensor wires are then terminated at the two-wire transmitter and converted into a 4-20mA signal which is highly immune to noise and not affected by lead resistance, both of which can cause significant errors in voltage signals transmitted over long distances.

### Operation

The Q510 operates as a two-wire transmitter; each channel derives its power from a (10-35VDC) source connected in series with the 4-20mA output loop. Typically a 24VDC source is used, allowing 14VDC (700 ohms @ 20mA) for other devices connected in series in the current loop. The outputs of the Q510 are protected from reverse polarity. Zero and span pots are provided for each channel to calibrate the output to the input RTD. Standard input temperature ranges (see Table) are calibrated to the rated accuracy. One range per module; two or four channels per module.

### Calibration

1. Connect the input to a calibrated three-wire resistance source (not a resistance simulator). Connect the output in series to a voltage source capable of supplying at least 20mA and a milliamp current meter.

2. Set the calibrator to the specified minimum temperature resistance value and adjust the zero potentiometer for 4mA output.

Note: The voltage source ( $V_s$ ) connected to the output must be sufficient to accommodate all other device loads ( $R_L$ ) in the current loop:

$$V_s \geq 10V + 0.02xR_L$$

3. Set the calibrator to the specified maximum temperature resistance value and adjust the span potentiometer for 20mA output.

4. Repeat steps 2 and 3, as necessary.

Q510 Ranges			
2 Channel Models	4 Channel Models	Inputs	Outputs
Q510-0B01	Q510-4B01	0 to 100° C	4-20mA
Q510-0B02	Q510-4B02	0 to 150° C	4-20mA
Q510-0B03	Q510-4B03	0 to 200° C	4-20mA
Q510-0B04	Q510-4B04	0 to 250° C	4-20mA
Q510-0B05	Q510-4B05	0 to 500° C	4-20mA
Q510-0B06	Q510-4B06	0 to 200° F	4-20mA
Q510-0B07	Q510-4B07	0 to 300° F	4-20mA
Q510-0B08	Q510-4B08	0 to 400° F	4-20mA
Q510-0B09	Q510-4B09	0 to 500° F	4-20mA
Q510-0B10	Q510-4B10	0 to 1000° F	4-20mA

## Specifications

### Input:

Accepts two or four, 3-wire Pt100 RTDs ( $\alpha = 0.00385\text{Ohms}/\text{Ohm}/^\circ\text{C}$ )

Ranges: see Table

### Input Excitation:

0.8mA, typical, each channel

### Input Leadwire Effect:

<1% of full scale output, max. @40Ohms max./ lead

### Output Range:

4-20mA

### Supply Voltage Range:

10 to 35VDC, each channel

### Output Accuracy:

≤ 0.1% of full-scale input typical, ≤0.4% max., including linearity, repeatability and hysteresis

### Adjustability:

Front accessed 10 turn pot., ±2% of span for zero and span, typical.

### Stability:

≤ 0.025%/°C of full-scale maximum for full-scale and zero

### ESD Susceptibility:

Meets IEC 801-2 level 2 (4kV)

### Response Time:

50mSec typical (10 to 90%)

## Temperature:

Operating: -40 to 80°C (-40 to 176°F)

Storage: -40 to 80°C (-40 to 176°F)

## Humidity (non-condensing):

Operating: 15 to 90% @45°C

## Wire Terminals:

Socketed screw terminals for 12-22 AWG

## Weight:

0.34lbs

## Agency Approvals:

CSA certified per standard C22.2 (File No. LR42272).

UL recognized per standard UL508 (File No. E99775).

CE conformance per EMC directive 89/336/EEC and low voltage 73/23/EEC (Input <75VDC).

### Q510 (2 Channel) Terminals

Terminal	Connection	Terminal	Connection
A1	Channel 1 Power & Output (+)	C1	Channel 2 RTD Input Return
A2	Channel 1 Power & Output (-)	C2	Channel 2 RTD Input (-)
A3	Not Connected	C3	Channel 2 RTD Input (+)
A4	Channel 2 Power & Output (+)	C4	Channel 1 RTD Input Return
A5	Channel 2 Power & Output (-)	C5	Channel 1 RTD Input (-)
A6	Not Connected	C6	Channel 1 RTD Input (+)

### Q510 (4 Channel) Terminals

Terminal	Connection	Terminal	Connection
A1	Channel 1 Power & Output (+)	C1	Channel 2 RTD Input Return
A2	Channel 1 Power & Output (-)	C2	Channel 2 RTD Input (-)
A3	Not Connected	C3	Channel 2 RTD Input (+)
A4	Channel 2 Power & Output (+)	C4	Channel 1 RTD Input Return
A5	Channel 2 Power & Output (-)	C5	Channel 1 RTD Input (-)
A6	Not Connected	C6	Channel 1 RTD Input (+)
B1	Channel 3 Power & Output (+)	D1	Channel 4 RTD Input Return
B2	Channel 3 Power & Output (-)	D2	Channel 4 RTD Input (-)
B3	Channel 4 Power & Output (+)	D3	Channel 4 RTD Input (+)
B4	Channel 4 Power & Output (-)	D4	Channel 3 RTD Input Return
		D5	Channel 3 RTD Input (-)
		D6	Channel 3 RTD Input (+)

## Ordering Information

### Models & Accessories

#### Specify:

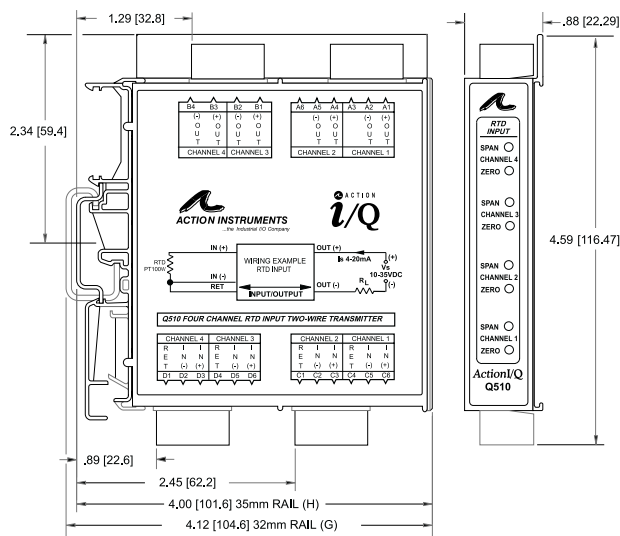
1. Model: **Q510** (see Table)
2. Channels: 2 or 4
3. Input Range: (see Table)
4. Accessories: (see Accessories)

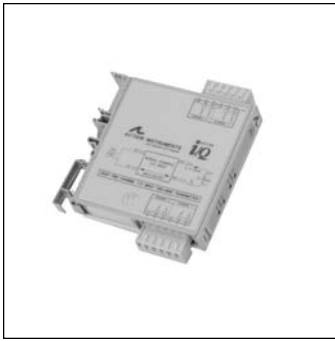
## Accessories

ActionIQ modules mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition the following accessories are available:

- MD02** TS32 DIN rail
- MD03** TS35 x 7.5 DIN rail
- WV905** 24VDC Power Supply (500mA)
- H910** 24VDC Power Supply (1 Amp)
- H915** 24VDC Power Supply (2.3 A)

## Dimensions





Q520-2xxx (2 channel)

# ACTIONI/Q® Q520

## Loop Powered Multi-Channel T/C Input Isolating, 2-Wire Transmitter

Provides 2 Isolated Current Loops in Proportion to 2 Thermocouple Millivolt Inputs



- Two 2-Wire Transmitters in a Single Package
- Output Linear to T/C Millivolt Input
- Standard Input Ranges

- High Density DIN Rail Mounting
- SnapLoc™ Plug-in Terminals
- Output Loop Powered from 12 to 35VDC

### Description

The Q520 is a DIN rail mount, thermocouple input, dual channel, two-wire transmitter. Each channel accepts a thermocouple input and provides an isolated, 4-20mA output signal, linear to the millivolt input. Cold junction compensation is provided and each channel is fully isolated (1800VDC) from input to output and channel to channel.

All ActionI/Q modules feature SnapLoc plug-in screw terminals for easy installation and low Mean-Time-To-Repair (MTTR). Two or more modules can slide together and interlock for solid, high density mounting (by removing either the foot, or the adjacent unit's faceplate, for right-hand side or left-hand side mounting, respectively). The module to be attached will easily slide on to the side of the mounted unit.

### Application

Thermocouple input, two-wire transmitters are used to convert a specific temperature range into a regulated 4-20mA signal. Two-wire transmitters are primarily used in remote locations near the sensor since they reduce the probability of signal errors and save wiring costs by utilizing the two power wires to send the 4-20mA signal. The current signal is usually monitored by a control system or data recorder.

Typically, thermocouples are used to measure high temperatures such as in an oven or furnace. Thermocouple wires can be run a short distance to a panel, or farther with the use of shielded wire, without errors caused by noise or lead resistance in the wires. These sensor wires are usually terminated at the two-wire transmitter and converted into a 4-20mA signal which is highly immune to noise and not affected by lead resistance, both of which can cause significant errors in voltage signals transmitted over long distances.

### Operation

Each channel derives its power from a (12-35VDC) source connected in series with the 4-20mA output loop. Typically a 24VDC source is used for power, allowing 12VDC (600 ohms @ 20mA) for other devices connected in series in the current loop. The outputs of the Q520 are isolated from the inputs and protected from reverse polarity. Zero and span pots are provided for each channel. Standard input temperature ranges (see Table) are calibrated to the rated accuracy. One range per module; two channels per module.

### Calibration

1. Connect the input to a calibrated thermocouple simulator or millivolt source (thermocouple wire corresponding to the input range may be required; check your calibrator's capabilities). Connect the output in series to a voltage source capable of supplying at least 20mA and a milliamp current meter.

Note: The voltage source ( $V_s$ ) connected to the output must be sufficient to accommodate all other device loads ( $R_L$ ) in the current loop:

$$V_s \geq 12V + 0.02 \times R_L$$

2. Set the calibrator to the specified minimum temperature or equivalent millivolt value and adjust the zero potentiometer for 4mA output.
3. Set the calibrator to the specified maximum temperature or equivalent millivolt value and adjust the span potentiometer for 20mA output.
4. Repeat steps 2 and 3, as necessary. Note that the output is linear to mV (not temperature).

Q520 Ranges		
2 Channels	Inputs	Outputs
Q520-0B01	Type J; 0 to 500 ° F	4-20mA
Q520-0B02	Type J; 0 to 1000 ° F	4-20mA
Q520-0B03	Type J; 0 to 500 ° C	4-20mA
Q520-0B04	Type K; 0 to 500 ° F	4-20mA
Q520-0B05	Type K; 0 to 2000 ° F	4-20mA
Q520-0B06	Type K; 0 to 1000 ° C	4-20mA
Q520-0B07	Type T; 0 to 500 ° F	4-20mA
Q520-0B08	Type T; 0 to 250 ° C	4-20mA
Q520-0B09	Type K; 0 to 400 ° C	4-20mA
Q520-0B10	Type K; 0 to 500 ° C	4-20mA

Consult factory for non-standard ranges

## Specifications

### Input:

Accepts two J, K or T Type thermocouples

Ranges: see Table

### Burnout Detection:

Upscale standard; Downscale, option B

### Cold-Junction Compensation Error

1°C typical, 0 to 80°C ambient;

3°C typical, -40 to 0°C ambient

### Output Range:

4-20mA

### Supply Voltage Range:

12 to 35VDC, each channel

### Output Accuracy:

≤ 0.1% of full-scale input (mV) typical, ≤ 0.2% max. @23°C including linearity, repeatability and hysteresis (not including CJC error)

### Adjustability:

Front accessed 10 turn pot., ± 5% of span for zero and span

### Stability:

≤ 0.025%/°C of full-scale max. for full-scale and zero

### ESD Susceptibility:

Meets IEC 801-2 level 2 (4kV)

### Isolation:

1800VDC or peak AC between input and output and channel to channel

### Response Time:

100mSec typical (10 to 90%)

### Temperature:

Operating: -40 to 80°C (-40 to 176°F)

Storage: -40 to 80°C (-40 to 176°F)

### Humidity (non-condensing):

Operating: 15 to 90% (@45°C)

### Wire Terminals:

Socketed screw terminals for 12-22 AWG

### Weight:

0.34 lbs

### Agency Approvals:

CSA certified per standard C22.2 (File No. LR42272).

UL recognized per standard UL508 (File No. E99775).

CE conformance per EMC directive 89/336/EEC and low voltage 73/23/EEC (Input <75VDC).

Terminal	Connection	Terminal	Connection
A1	Channel 1 Power & Output (+)	C1	Not Connected
A2	Channel 1 Power & Output (-)	C2	Channel 2 T/C Input (-)
A3	Not Connected	C3	Channel 2 T/C Input (+)
A4	Channel 2 Power & Output (+)	C4	Not Connected
A5	Channel 2 Power & Output (-)	C5	Channel 1 T/C Input (-)
A6	Not Connected	C6	Channel 1 T/C Input (+)

## Ordering Information

### Models & Accessories

#### Specify:

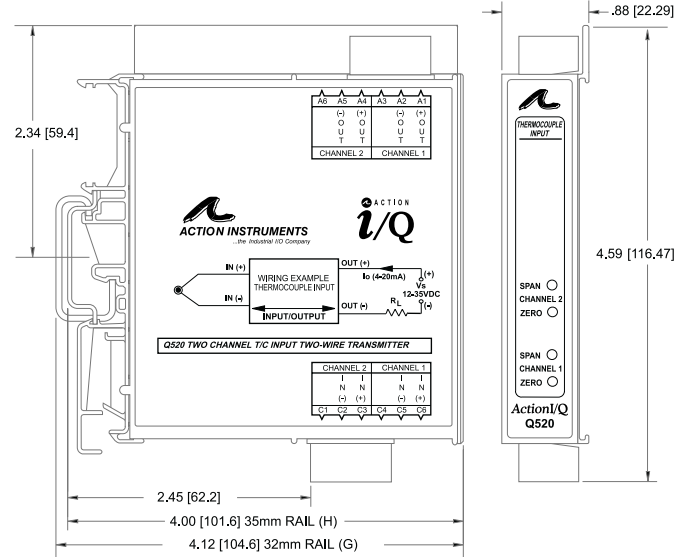
1. Model: **Q520** (see Table)
2. Option: B (downscale burnout detection), upscale standard
3. Input Range: (see Table)
4. Accessories: (see Accessories)

### Accessories

ActionIQ modules mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition the following accessories are available:

- MD02** TS32 DIN rail
- MD03** TS35 x 7.5 DIN rail
- WV905** 24VDC Power Supply (500mA)
- H910** 24VDC Power Supply (1A)
- H915** 24VDC Power Supply (2.3A)

## Dimensions





IQRL-D002 (powers 2 DC modules)  
 IQRL-D004 (powers 4 DC modules)  
 IQRL-D008 (powers 8 DC modules)  
 IQRL-2002 (powers 2 AC modules)  
 IQRL-2004 (powers 4 AC modules)  
 IQRL-2008 (powers 8 AC modules)

# ACTIONI/Q® IQRL

## Power Distribution Bus

Provides Power to ActionI/Q  
Signal Conditioning Modules



- Reduces Wiring Time
- Improves Reliability with Fewer Wire to Terminal Connections

- Attaches Directly to the ActionI/Q Module
- SnapLoc™ Plug-In Terminals

### Description

The I/QRail is a power distribution bus for the ActionI/Q Series of multi-channel signal conditioners. It can be used optionally on DC powered units, but is required for AC powered units. The I/QRail provides a means of effectively distributing 24VDC or 120/240VAC power to ActionI/Q modules.

#### DC Powered Rails

IQRL-D002 (up to 2 modules)  
 IQRL-D004 (up to 4 modules)  
 IQRL-D008 (up to 8 modules)

#### AC Powered Rail Assemblies

IQRL-2002 (up to 2 modules)  
 IQRL-2004 (up to 4 modules)  
 IQRL-2008 (up to 8 modules)

The I/QRail is a two-layer printed circuit board with power and ground planes protected to withstand an 1800VDC differential. There are 2, 4 or 8 female plug-in connectors to mount as many as 2, 4 or 8 modules. All assemblies include DIN rail and Action I/Q mounting feet.

### Application

The I/QRail is designed to reduce the time and cost associated with power wiring. It eliminates the need to daisy chain or make power connections to individual modules. The I/QRail is held in place by the ActionI/Q mounting feet, which are already attached to the I/Q Rail. The mounting foot is simply attached to a DIN rail. The I/Q Rail allows the user to easily remove or replace any module, with or without power applied.

### Operation

The DC powered versions are designed to power 3-wire or 4-wire transmitters in the ActionI/Q product family, specifically models Q1x8, Q4x4, Q4x5 and Q4x8. The AC powered versions are designed to power 4-wire transmitters in the ActionI/Q family, specifically models Q1x6, and Q4x6.

Individual modules can be removed or replaced with power applied to the I/QRail without damage to the rail or the modules.

*Note: When installing modules while power is on, it is highly recommended that the input and output connections be made after mounting the module to the I/Q Rail, making certain that the output circuit will not cause a hazardous condition in the event of minimum or full-scale output from the module.*

The ActionI/Q modules are designed to hold the I/QRail firmly in place and parallel to the DIN mounting rail. No additional mounting holes or cutouts are required for I/QRail installation. ActionI/Q modules mount on standard TS32 (32mm) or TS35 (35mm) DIN rails which then support the complete installation.

## Installation

1. Separate the DIN rail from the I/Q Rail assembly by either sliding it off or releasing each mounting foot tab. Mount the DIN rail in the panel or rack at the desired location.

*Note: The module which is to mount on the I/Q Rail and DIN rail has a base (foot) which is removable from the body. This foot has one bracket to mount on a DIN rail (32mm or 35mm) and another bracket to hold the I/Q Rail (see Figure 1).*

2. Once the DIN rail is firmly in place, snap the foot and I/Q Rail assembly to the DIN mounting rail, starting from the center unit on the rail and working outward. When all the feet are mounted to the DIN rail the I/Q Rail should be held firmly in place parallel with the DIN mounting rail (see Figure 2).

3. To mount the first module on its foot, start with the farthest left hand foot (P1 or P2 on I/Q Rail). Snap the module to this foot making sure that the rail connector matches the opening receptacle on the base of the module. Check that both tabs on the foot have snapped in place.

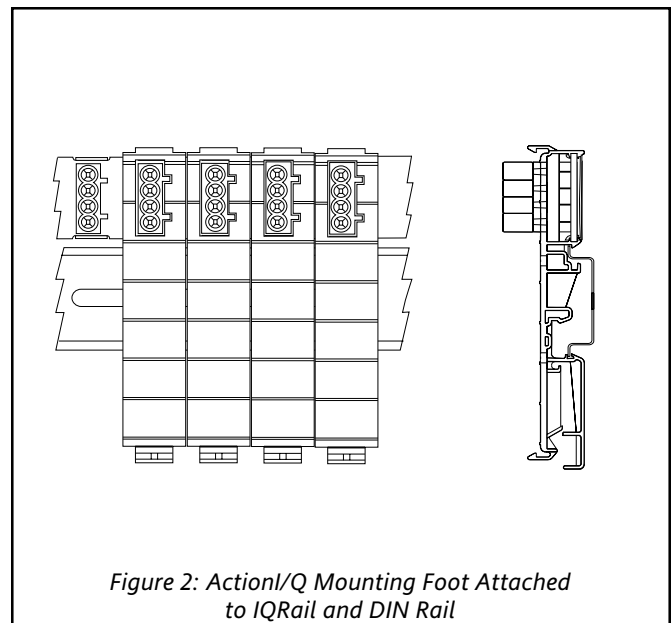
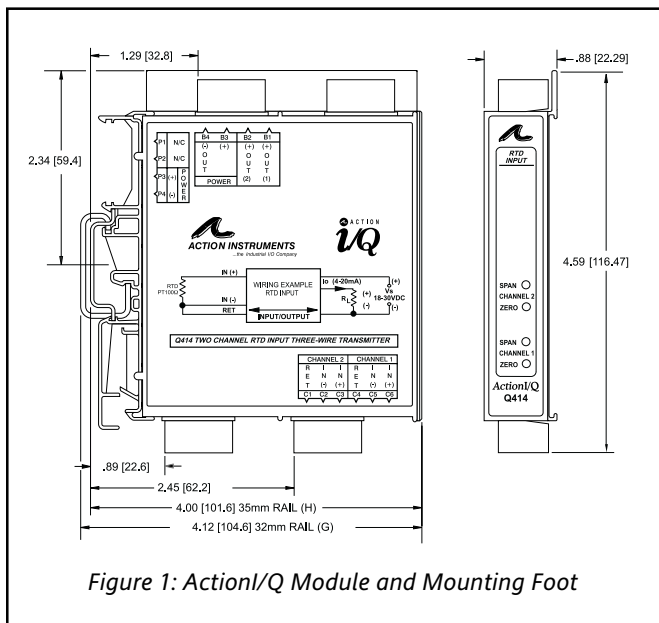
4. The second module can now slide on to the first module's metal heatsink. Align the plastic ridges, which start at the base of the second unit, into the grooves on the metal heatsink. Slide the second unit down until the foot tabs snap in place. Repeat this procedure for the remaining modules to be attached.

5. To remove a module from a row, first detach the faceplate of the unit to the right of the unit to be removed (see figure 3). Then remove the terminal connectors by gently pulling them away from the module. Once the terminals are clear, use a blade screw driver to release the foot tabs from the base of the module while pulling the unit gently free (see Figure 4). Replace the faceplate of the adjacent unit.

6. Installation can be accomplished by reversing step 5, making sure the right hand unit's faceplate is removed before installation.

7. Individual modules can be removed or replaced with power applied to the I/Q Rail, without damage to the rail or the modules.

8. Calibration should be performed as specified on the specific module's data sheet.





**Specifications**

**Isolation:**

1800V DC, between power conductors

**Power Rating:**

DC Versions: 30VDC max., powering up to 8 two channel modules  
AC Versions: 265VAC max., powering up to 8 two channel modules

**ESD Susceptibility:**

Meets IEC 801-2 Level 2 (4kV)

**Temperature:**

Operating: 0 to 65°C (32 to 131°F)  
Storage: -40 to 80°C (-40 to 176°F)

**Humidity (non-condensing):**

Operating: 25 to 95% @40°C  
Soak: 90% for 24 hours @60°C

**Wire Terminals:**

Socketed screw terminals for 14-22 AWG

**Agency Approvals**

The IQRL is designed to operate with and support the UL, CE and CSA approvals for the specific signal conditioners listed. Refer to the signal conditioner data sheets for specific approvals.

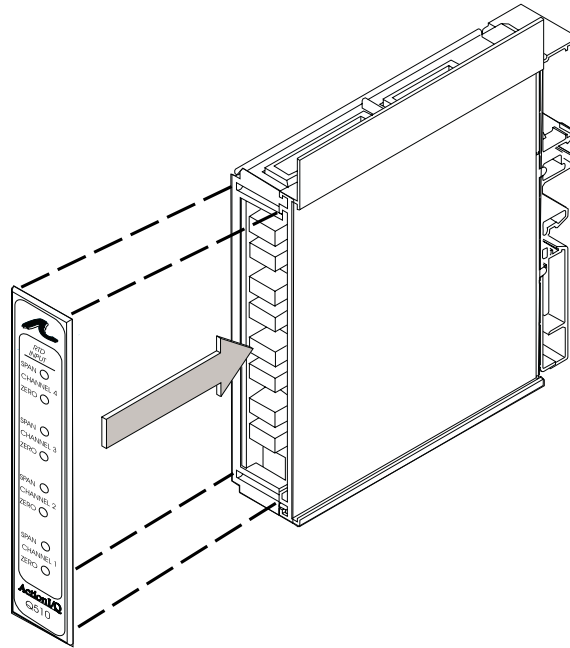


Figure 3: ActionIQ Module and Removable Faceplate

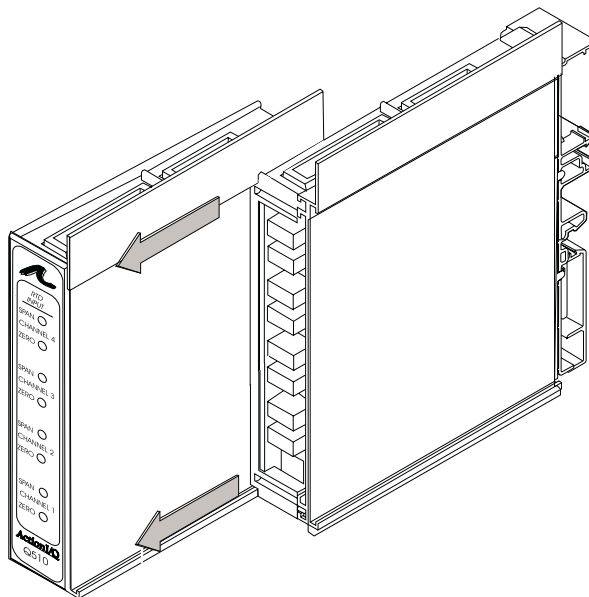
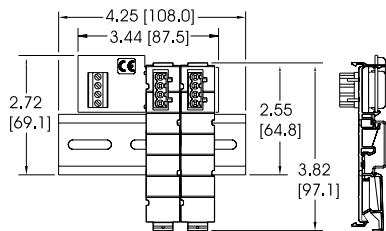


Figure 4: ActionIQ Modules and Interlocking Slides

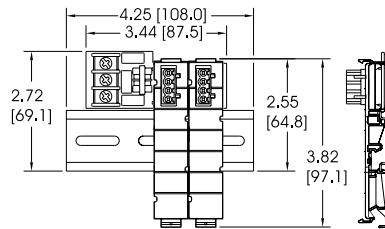
## Dimensions

Dimensions are in inches (millimeters)

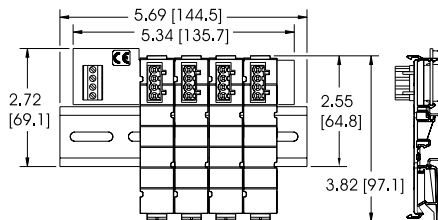
*IQRL-D002 (DC Power Only)*



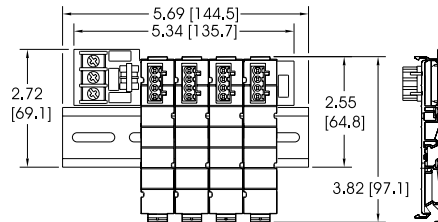
*IQRL-2002 (AC Power Only)*



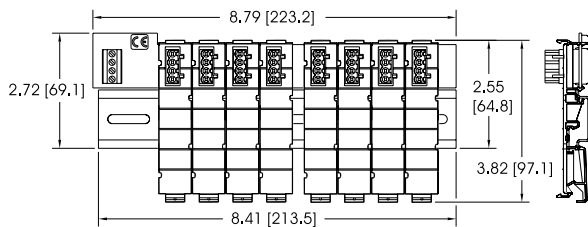
*IQRL-D004 (DC Power Only)*



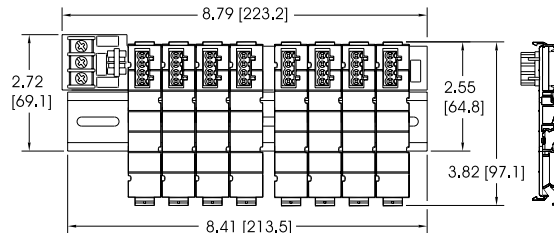
*IQRL-2004 (AC Power Only)*



*IQRL-D008 (DC Power Only)*



*IQRL-2008 (AC Power Only)*



## Ordering Information

### Models & Accessories

#### Specify:

##### 1. Model:

- IQRL-D002** (powers 2 DC modules), or
- IQRL-D004** (powers 4 DC modules), or
- IQRL-D008** (powers 8 DC modules), or
- IQRL-2002** Assembly (powers 2 AC modules) includes DIN rail, or
- IQRL-2004** Assembly (powers 4 AC modules) includes DIN rail, or
- IQRL-2008** Assembly (powers 8 AC modules) includes DIN rail

##### 2. Accessories: (see Accessories):

## Accessories

Action/Q modules mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rails. The I/QRail mounts to the Action/Q.

The following accessories are available:

- MD02** TS32 DIN rail
- MD03** TS35 x 7.5 DIN rail
- WV905** 24VDC Power Supply (500mA)
- H910** 24VDC Power Supply (1A)
- H915** 24VDC Power Supply (2.3A)



C681-0001

# ACTIONIQ® C681

## Q486 & Q488 Graphic User Interface

Provides a Graphic User Interface and Communication Cable to Speed Transmitter Configuration

- Quickly Configures Q486 & Q488 Transmitters
- CD ROM Contains Program & User Guide
- Configure Multiple Modules Quickly & Easily
- Displays Measured Temperature to Check Accuracy
- Displays Diagnostics Information to Check Switch Settings

### Description

The C681 is a Graphic User Interface (GUI) program and interface cable used to configure Q486 and Q488 Temperature Transmitters. The C681 speeds configuration and can also be used as a diagnostic tool to confirm switch positions or read the measured temperature to check accuracy.

*Note that this software is designed to be used as a configuration tool for normal setup and operation. In some cases under abnormal circumstances it may not always report sensor data values correctly. For example, during burnout or open circuit sensor conditions, the software may report high or low default values and not necessarily the actual sensor input and output data.*

### Instruction Manual

A complete instruction manual is contained on the CD ROM. The file ("Q486HELP.doc.") can be read directly using Microsoft Word or WordPad or it can be read using the online help command while running the application. For detailed information relating to system requirements, program installation and operation, read Section 3 of the instruction manual.

### Program Installation

1. Insert the CD into the CD ROM drive.
2. If the program does not start automatically, click on the "Setup.exe" file.
3. Follow the instructions on the screen to install the program onto your hard drive.
4. To run the application, click the AIQ486GUI.exe icon.

### Connecting the Q488 or Q486-0001 to a Personal Computer

1. Connect the communication cable to an unused RS-232 serial port of the PC (e.g., com1, com2).
2. Remove the front panel of the Q488 (or Q486-0001) to access the communication jack connector and plug the cable into the jack connector.

### Connecting the Q486-0000 to a Personal Computer

1. Connect the communication cable to an unused RS-232 serial port of the PC.
2. Install the cable adaptor provided to the output connector, A4 to A6, and plug the cable into the jack connector.



C698-0000

# ACTIONIQ® C698

## Q498 Graphic User Interface

Provides a Graphic User Interface and Communication Cable to Speed Transmitter Configuration

- Quickly Configures Q498 Math Modules
- CD ROM Contains Program & User Guide
- Configure Multiple Modules Quickly & Easily
- Displays Diagnostics Information to Check Switch Settings

### Description

The C698 is a Graphic User Interface (GUI) program and interface cable used to configure the Model Q498 Math Function Module. The C698 speeds configuration and can be used as a diagnostic tool to confirm switch positions. This software is required in order to take advantage of the math functions.

### Instruction Manual

A complete instruction manual is contained on the CD ROM. The file ("Q498HELP.doc.") can be read directly using Microsoft Word or WordPad or it can be read using the online help command while running the application.

### Program Installation

1. Insert the CD into the CD ROM drive.
2. If the program does not start automatically, click on the "Setup.exe" file.
3. Follow the instructions on the screen to install the program onto your hard drive.
4. To run the application, click the AIQ498GUI.exe icon.

### Connecting the Q498 to a Personal Computer

1. Connect the communication cable to an unused RS-232 serial port of the PC (e.g., com1, com2).
2. Remove the front panel of the Q498 to access the communication jack connector and plug the cable into the jack connector.

## Description

The Ultra SlimPak is the result of over 10 years of experience in wide-ranging, field configurable instrument design. The Ultra SlimPak utilizes ASIC and microprocessor technology to provide 1800VDC isolation and wide ranging adjustments for easy, accurate, discrete signal conditioning. The power supply of the Ultra SlimPak will accept any AC or DC source between 9 and 30 volts, typically a 12 or 24VDC supply is used.

The value of a field configurable instrument is that it allows the user to easily set the instrument for their specific (or custom) I/O range. This flexibility reduces spare parts inventory and increases the efficiency of the process by maximizing resolution in critical process measurements.

## Ultra High Density

The Ultra SlimPak was developed for high density applications in which panel space cannot be wasted. From 17 to 24 Ultra SlimPaks can mount on one linear foot of DIN rail. DIN rail mounting also provides easy "snap in place" installation.

## Limit Alarms

Limit alarms are setpoint controllers that regulate industrial processes – discrete, batch or continuous. Two-position (On/Off) controllers simplify processes through automation, and by removing personnel from tedious and possibly harmful environments.

Alarms are indicators of problems – whether it is a production line fault, a process upset, an equipment failure or a control system abnormality. Limit alarms safeguard industrial facilities and workers by alerting and informing process personnel of abnormal conditions.

## Ultra SlimPak G1X8 Series of Limit Alarms

The Ultra SlimPak G1X8 series of limit alarms accept the most popular process signals: DC voltage and current (G108); RTD (G118); thermocouples (G128); and AC voltage and current (G168). Their output is a dual contact closure (2 SPDT relays) that can be used to light hazard beacons, sound audible alarms or alert control systems of abnormalities.

## Setpoint Flexibility

Wide ranging, field configurable Ultra SlimPaks allow the user to configure the input type, input range, setpoint, deadband, HI/LO operation and failsafe or non-failsafe relay state.

These features provide the flexibility required to solve many diverse process control applications, with the additional benefits of reduced spare parts inventory and the convenience of an off-the-shelf solution.

## Signal Conditioners

Signal conditioners amplify and condition weak signals generated by process sensors. They send signals long distances without degradation by electrical noise. They are also used to drive devices such as indicators, alarms, controllers, computer interfaces and other process instrumentation.

## Ultra SlimPAK G4X8 Series of Conditioners

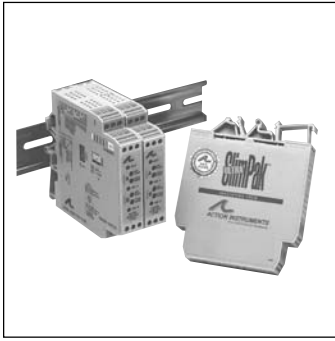
The Ultra SlimPak G4X8 series of signal conditioners accepts a variety of process signals: DC voltage and current (G428); RTD (G418); thermocouple (G428); potentiometer (G438); strain gauge (G448); AC voltage and current (G468); and frequency/pulse (G478). Three port isolation – input to output to power – ensures that common ground faults are eliminated from any source.

## ASIC Reliability

Action's exclusive analog ASIC increases reliability by reducing components and interconnections by up to 70%.

# Ultra SlimPak™ Selection Guide

Input	Typical Application	Description	Model
DC Voltage or Current (V, mV, A, mA)	Voltage/Current scaling, isolation, noise reduction and signal drive	Field configurable DC input isolator	G408
	DC motor/current limit, level/position control, HI/LO pressure alarm, power demand warning, totalization alarm, 2-channel comparator	Field configurable DC input limit alarm	G108
Potentiometer (0-100 Ohms, up to 0-100k Ohms)	Tank level control, monitoring, data acquisition, resistance position sensor conditioning	Field configurable potentiometer input signal conditioner	G438
RTD (Types Pt, Ni, Cu)	Temperature control, monitoring, data acquisition	Field configurable RTD input isolator	G418
	Heater/cooler control, HI/LO temperature alarm, motor temperature monitor	Field configurable RTD input limit alarm	G118
Thermocouple (Types B, E, J, K, R, S, T)	Temperature control, monitoring, data acquisition	Field configurable thermocouple input isolator	G428
	Heater/cooler control, HI/LO temperature alarm, motor temperature monitor	Field configurable thermocouple input limit alarm	G128
Frequency (0-2Hz to 0-10kHz)	Flow/velocity control or monitoring, motor speed control, scaling, pulse accumulation, integration, totalizing	Field configurable frequency input isolator	G478
Strain Gauge (0.5, 1, 3, 5, 10, 20, 50mV/V) 1 to 10V Adjustable Excitation	Pressure control, pressure status monitoring, weight, load cell conditioning and data acquisition	Field configurable bridge input isolator	G448
AC Voltage or Current (V, mV, A, mA)	Voltage/Current scaling, power monitoring, isolation, buffering	Field configurable AC input isolator	G468
	AC motor/current limit, AC power status monitor	Field configurable AC input limit alarm	G168
24 Volt DC Power Supplies	Supply 24VDC power to 2, 3 and 4 wire transmitters	24VDC, 500mA	WV905
		24VDC, 1.0A	H910
		24VDC, 2.3A	H915



G108-0001

# ULTRA SLIMPAK® G108-0001

## DC Powered DC Input Limit Alarm

Provides Relay Contact Closures  
at a Preset DC Input Level



- Programmable HI or LO, Failsafe or Non-failsafe
- Field Configurable Input Ranges
- 24VDC Transducer Excitation
- LED Trip and Input Indicators

- Flexible Power Supply Accepts 9 to 30 VDC
- ASIC Technology for Enhanced Reliability
- RoHS Compliant

### Description

The Ultra SlimPak G108 is a DIN rail mount, DC voltage or current input limit alarm with dual setpoints and two contact closure outputs. The field configurable input and alarm functions offer flexible setpoint capability. Input voltage spans from 10mV to 200V and input current spans from 1mA to 100mA can be field configured. Bipolar inputs are also accepted.

The G108 is configurable as a single or dual setpoint alarm, with HI or LO trips and failsafe or non-failsafe operation. Also included are adjustable deadbands (0.25 to 5% of full scale input) for each setpoint, a 24VDC voltage source (isolated from line power) for transducer excitation, and a flexible DC power supply which accepts any voltage between 9 and 30VDC.

### Diagnostic LEDs

The G108 is equipped with three front panel LEDs. The dual function green LED is labeled INPUT and indicates line power and input signal status. Active DC power is indicated by an illuminated LED. If this LED is off, check DC power and the wiring connection. If the input signal is more than 110% of the full scale range, the LED will flash at 8 Hz. Below 0%, it flashes at 4 Hz. Two red LEDs indicate the relay state for each setpoint. An illuminated red LED indicates the tripped condition.

### Output

The G108 is equipped with two SPDT (form C) relays, rated at 120VAC or 28VDC at 5 Amperes. Each of these relays is independently controlled by the field configurable setpoint and deadband.

### Operation

The field configurable G108 limit alarm setpoints can be configured for HI or LO, failsafe or non-failsafe operation. Each of the setpoints has a respective HI or LO deadband. In a tripped condition, the setpoint is exceeded and the appropriate red LED will illuminate. The trip will reset only when the process falls below the HI deadband or rises above the low deadband (see Figure 1). For proper deadband operation, the HI setpoint must always be set above the LO setpoint. In failsafe operation, the relay is energized when the process is below the HI setpoint or above the LO setpoint (opposite for non-failsafe). In the failsafe mode, a power failure results in an alarm state output.

### Dynamic Deadband

Circuitry in the G108 prevents false trips by repeatedly sampling the input. The input must remain beyond the setpoint for 100 milliseconds, uninterrupted, to qualify as a valid trip condition. Likewise, the input must fall outside the deadband and remain there for 100 milliseconds to return the alarm to an untripped condition. This results in a “dynamic deadband” (based on time) in addition to the normal deadband.

### Configuration

Unless otherwise specified, the factory presets the Model G108 as follows:

- Input: Current
- Range: 0-20mA
- Output: Dual, SPDT
- Trip: A:HI, B:LO
- Failsafe: No
- Deadband: A, B: 0.25%

The DC power input accepts any DC source between 9 and 30V. Typically a 12V or 24VDC source is used (see Accessories).

For other I/O ranges, refer to Table 1. Reconfigure switch SW1 for the desired input type, range and function.

1. With DC power off, set position 9 and 10 of SW1 for current or voltage (see Figure 4).
2. Set position 1 through position 4 of input range switch “SW1” for the desired input range (see Table 1).
3. Set position 5 of input range switch “SW1” to ON for unipolar (e.g. zero based, 0-20mA) range or OFF for bipolar (e.g. -100% offset, -20 to 20mA) range.
4. Set position 6 and 7 of input range switch “SW1” to ON for a HI trip setpoint or OFF for a LO trip setpoint.
5. Set position 8 of input range switch “SW1” to ON for non-failsafe operation or OFF for failsafe operation (e.g. alarm trips upon power failure).

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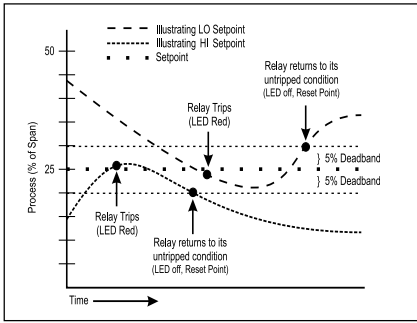


Figure 1: Limit alarm operation and effect of deadband.

**Calibration**

1. After configuring the DIP switches, connect the input to a calibrated DC source and apply power. Refer to the terminal wiring (Figure 7).

*Note: To maximize thermal stability, final calibration should be performed in the operating installation, allowing approximately 1 to 2 hours for warm up and thermal equilibrium of the system.*

2. Setpoint: Set deadband to its minimum (fully counterclockwise) before adjusting the setpoint. With the desired trip voltage or current input applied, adjust the setpoint until the relay trips. For HI trip calibration, start with the setpoint above the desired trip (full clockwise). For LO trip calibration, start below the desired trip (full counterclockwise).

3. Deadband: Set deadband to its minimum (fully counterclockwise). Set the setpoint to desired trip. Adjust the input until the relay trips. Readjust deadband to 5% (fully clockwise). Set the input signal to desired deadband position. Slowly adjust deadband until relay untrips.

Table 2: G108 Trip Settings

Function	Selector SW1			
	5	6	7	8
Unipolar			■	
Trip B HI			■	■
Trip A HI		■		
Non-Failsafe		■		■

Key: ■ = 1 = ON or Closed

**Relay Protection & EMI Suppression**

When switching inductive loads, maximum relay life and transient EMI suppression is achieved using external protection (see Figures 2 and 3). Place all protection devices directly across the load and minimize all lead lengths. For AC inductive loads, place a properly rated MOV across the load in parallel with a series RC snubber. Use a 0.01 to 0.1uF pulse film capacitor (foil polypropylene recommended) of sufficient voltage, and a 47 ohm, 1/2W carbon resistor. For DC inductive loads, place a diode across the load (PRV > DC supply, 1N4006 recommended) with (+) to cathode and (-) to anode (the RC snubber is an optional enhancement).

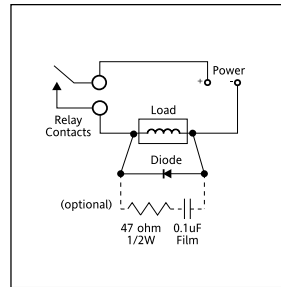


Figure 2: DC Inductive Loads

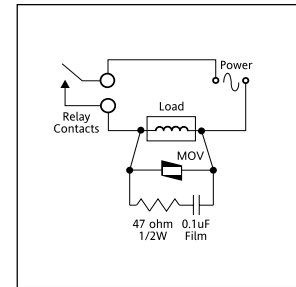


Figure 3: AC Inductive Loads

Table 1: G108 Input Range Settings

Ranges		Selector SW1					
Voltage	Current	1	2	3	4		
10mV	1mA			■			
20mV	2mA			■	■		
50mV	5mA		■				
100mV	10mA		■		■		
200mV	20mA		■	■			
500mV	50mA		■	■	■		
1V	100mA	■					
2V		■			■		
5V		■		■			
10V		■		■	■		
20V		■	■				
50V		■	■		■		
100V		■	■	■			
200V		■	■	■	■		
<b>Input Type</b>						9	10
Current							■
Voltage						■	

Key: ■ = 1 = ON or Closed

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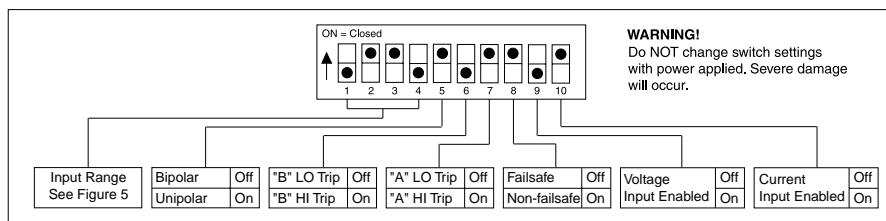


Figure 4: G108 Input Range/Function Selection (SW1) Factory Default Settings



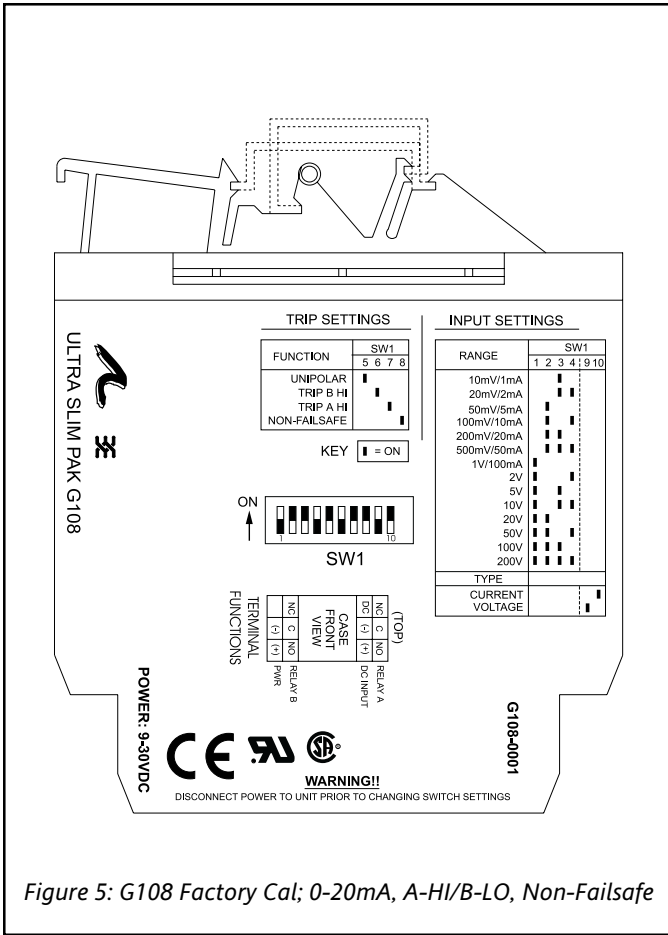


Figure 5: G108 Factory Cal; 0-20mA, A-HI/B-LO, Non-Failsafe

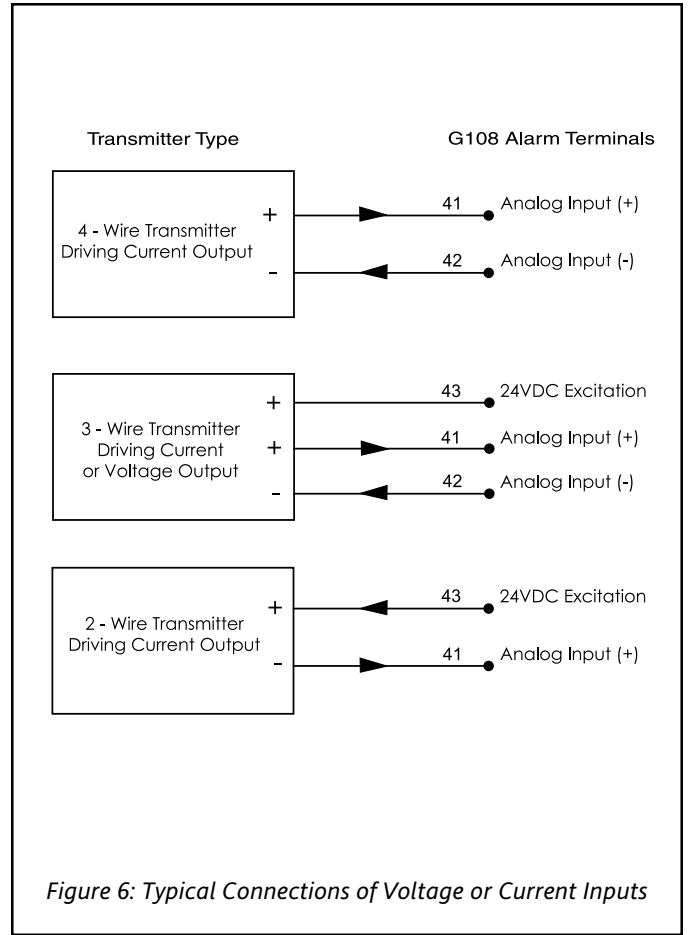


Figure 6: Typical Connections of Voltage or Current Inputs

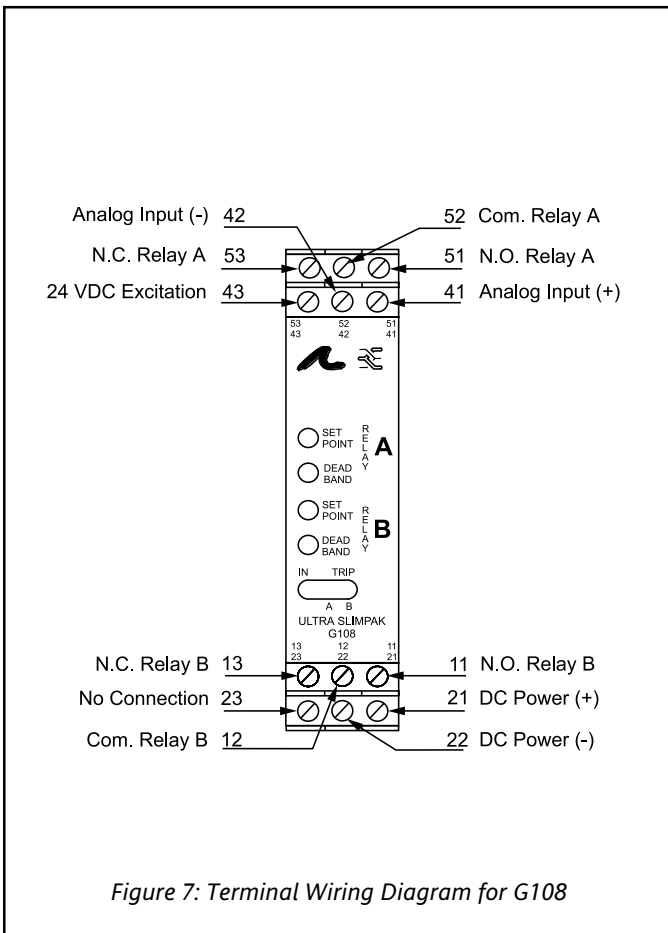


Figure 7: Terminal Wiring Diagram for G108

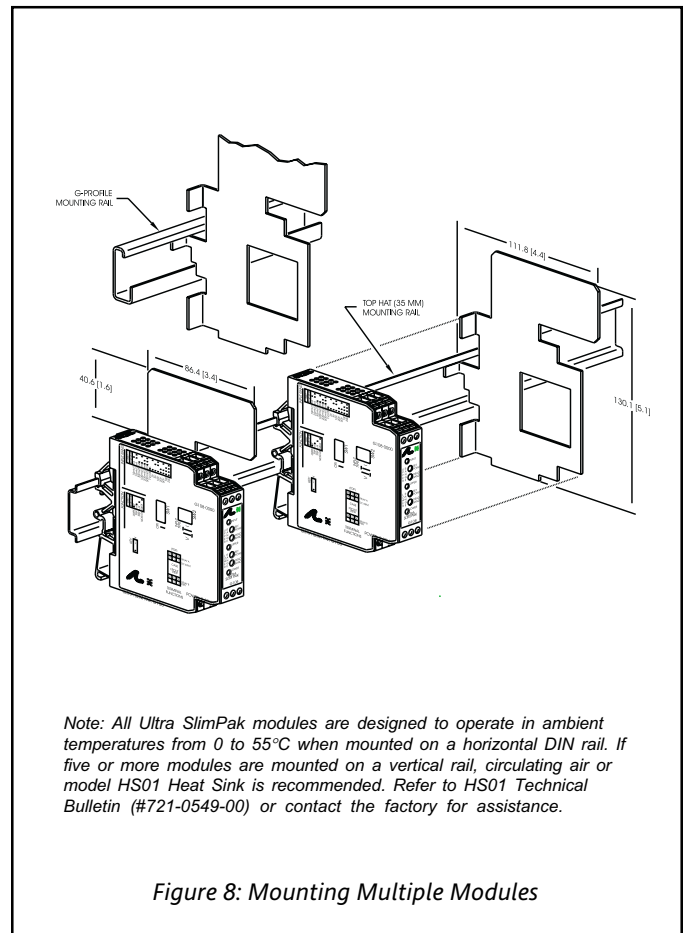


Figure 8: Mounting Multiple Modules

Note: All Ultra SlimPak modules are designed to operate in ambient temperatures from 0 to 55°C when mounted on a horizontal DIN rail. If five or more modules are mounted on a vertical rail, circulating air or model HS01 Heat Sink is recommended. Refer to HS01 Technical Bulletin (#721-0549-00) or contact the factory for assistance.

## Specifications

### Inputs

#### Voltage

Range: 10mV to  $\pm 200V$   
 Impedance: >100K ohms  
 Overvoltage: 200V rms, max.

#### Current

Range: 1mA to  $\pm 100mA$   
 Impedance: 20 ohms, typical  
 Overcurrent: 170mA rms, max.  
 Overvoltage: 60VDC (protected by self resetting fuse)

Common Mode (Input to Ground):  
 1800VDC, max.

### LED Indicators

#### Input Range (Green)

>110% input: 8Hz flash  
 <0% input: 4Hz flash

#### Setpoint (Red)

Tripped: Solid red  
 Safe: Off

### Limit Differentials (Deadbands)

>50mV/5mA: 0.25% to 5% of span  
 <50mV/5mA: 1% to 5% of span

### Response Time

#### Dynamic Deadband:

Relay status will change when proper setpoint/process condition exists for 100msec.

#### Normal Mode (analog filtering):

<250mSec, (10-90%)

## Setpoints

### Effectivity:

Setpoints are adjustable over 100% of the selected input span.

### Repeatability (constant temp.):

>50mV/5mA: 0.1% of full scale  
 <50mV/5mA: 0.2% of full scale

## Stability

Temperature:  $\pm 0.05\%$  of full scale/ $^{\circ}C$ , max.

## Excitation Voltage

24VDC, 20mA, maximum

## Common Mode Rejection

DC to 60Hz: 120dB

## Isolation

1800VDC between contacts, input & power

## EMC Compliance (CE Mark)

Emmissions: EN50081-1  
 Immunity: EN50082-2  
 Safety: EN50178

## Humidity (Non-Condensing)

Operating: 15 to 95% @45 $^{\circ}C$   
 Soak: 90% for 24hours @65 $^{\circ}C$

## Temperature Range

Operating: 0 to 55 $^{\circ}C$  (32 to 131 $^{\circ}F$ )  
 Storage: -25 to 70 $^{\circ}C$  (-13 to 158 $^{\circ}F$ )

## Power

Consumption: 1.5W typical, 2.5W max.  
 Supply Range: 9 to 30VDC, inverter isolated

## Relay Contacts

2 SPDT (2 form C) Relays

1 Relay per setpoint

Current Rating (resistive):

120VAC: 5A; 240VAC: 2A; 28VDC: 5A

Material: Gold flash over silver alloy

Electrical Life:  $10^5$  operations at rated load

*Note: External relay contact protection is required for use with inductive loads (see Figures 2 & 3).*

Mechanical Life:  $10^7$  operations

## Wire Terminations

Screw terminations for 12-22 AWG

## Weight

0.56lbs.

## Agency Approvals

CSA certified per standard C22.2, No. 0-M91 and 142-M1987 (File No. LR42272)

UL recognized per standard UL508 (File No.E99775)

CE Conformance per EMC directive 89/336/EEC and Low Voltage 73/23/EEC (Input < 75VDC, only).

RoHS Compliant

Ultra SlimPak®

## Ordering Information

### Models & Accessories

#### Specify:

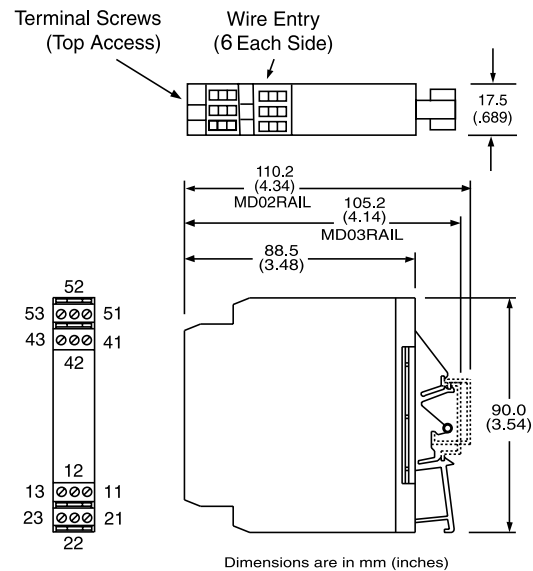
1. Model: **G108-0001**
2. Accessories: (see Accessories)
3. Optional Custom Factory Calibration; specify **C620** with desired input and output range.

### Accessories

SlimPak "G" series modules will mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition, the following accessories are available:

- HS01** Heatsink (vertical rail applications)
- MD03** TS35 x 7.5 DIN rail
- WV905** 24VDC Power Supply (0.5A)
- H910** 24VDC Power Supply (1A)
- H915** 24VDC Power Supply (2.3A)
- MB03** End Bracket for MD03
- C664** I/O Descriptive Tags
- C006** Shunt Resistor (0.1 ohm, 5A max.)

## Dimensions



*Note that detailed installation instructions are available on our web site.*



G118-0002

# ULTRA SLIMPAK® G118-0002

## DC Powered RTD Input Limit Alarm

Provides Relay Contact Closures  
at a Preset RTD/Resistance Input Level



- Programmable HI or LO, Failsafe or Non-failsafe
- Field Configurable Ranges for Platinum, Nickel and Copper RTDs
- Ultra Slim Housing for High Density Installations

- LED Trip and Input Indicators
- Flexible Power Supply Accepts 9 to 30 VDC
- ASIC Technology for Enhanced Reliability
- RoHS Compliant

### Description

The Ultra SlimPak G118 is a DIN rail mount, RTD input limit alarm with dual setpoints and two contact closure outputs. The field configurable input and alarm functions offer flexible setpoint capability. There are up to eight temperature ranges available for each RTD type to ensure accuracy and maximize setpoint resolution.

The G118 is configurable as a single or dual setpoint alarm, with HI or LO trips and failsafe or non-failsafe operation. Also included are adjustable deadbands (0.25 to 5% of full scale input) for each setpoint and a flexible DC power supply which accepts any voltage between 9 and 30VDC.

### Diagnostic LEDs

The G118 is equipped with three front panel LEDs. The dual function green LED is labeled INPUT and indicates line power and input signal status. Active DC power is indicated by an illuminated LED. If this LED is off, check DC power and the wiring connection. If the input signal is more than 110% of the full scale range, the LED will flash at 8 Hz. Below 0%, it flashes at 4 Hz. Two red LEDs indicate the relay state for each setpoint. An illuminated red LED indicates the tripped condition.

### Output

The G118 is equipped with two SPDT (form C) relays, rated at 120VAC or 28VDC at 5 Amperes. Each of these relays is independently controlled by the field configurable setpoint and deadband.

### Operation

The field configurable G118 limit alarm setpoints can be configured for HI or LO, failsafe or non-failsafe operation. Each of the setpoints has a respective HI or LO deadband. In a tripped condition, the setpoint is exceeded and the appropriate red LED will illuminate. The trip will reset only when the process falls below the HI deadband or rises above the LO deadband (see Figure 1). For proper deadband operation the HI setpoint must always be set above the LO setpoint. In failsafe operation, the relay is energized when the process is below the HI setpoint or above the LO setpoint (opposite for non-failsafe). In the failsafe mode, a power failure results in an alarm state output.

### Dynamic Deadband

Circuitry in the G118 prevents false trips by repeatedly sampling the input. The input must remain beyond the setpoint for 100 milliseconds, uninterrupted, to qualify as a valid trip condition. Likewise, the input must fall outside the deadband and remain there for 100 milliseconds to return the alarm to an untripped condition. This results in a “dynamic deadband” (based on time) in addition to the normal deadband.

### Configuration

Unless otherwise specified, the factory presets the Model G118 as follows:

- Input: Platinum (100 Ohm)
- Range: 0 to 250°C
- Output: Dual, SPDT
- Trip: A:HI, B:LO
- Failsafe: No
- Deadband: A, B: 1.0%

The DC power input accepts any DC source between 9 and 30V; typically a 12V or 24VDC source is used (see Accessories).

For other I/O ranges, refer to Tables 1 through 3 and reconfigure switches SW1 and SW2 for the desired input type, range and function.

**WARNING:** Do not change switch settings with power applied. Severe damage will result!

1. With DC power off, position input switches 1 through 6 on “SW2” for RTD type (Table 1).
2. Set position 1 through 4 of input range switch “SW1” for the desired RTD type and input temperature range (Table 3).
3. Set position 5 and 6 of input range switch “SW1” to ON for a HI trip setpoint or OFF for a LO trip setpoint (Figure 4).
4. Set position 7 of input range switch “SW1” to ON for non-failsafe operation or OFF for failsafe operation (e.g. alarm trips upon power failure).

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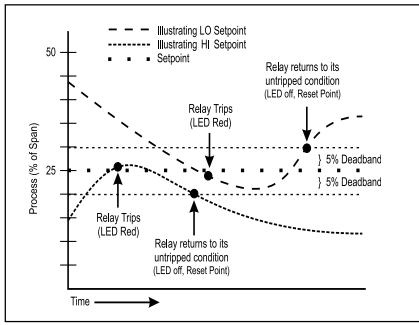


Figure 1: Limit alarm operation and effect of deadband.

**Calibration**

1. After configuring the DIP switches, connect the input to a calibrated RTD source or a resistance decade box and apply power.

*Note: To maximize thermal stability, final calibration should be performed in the operating installation, allowing approximately 1 to 2 hours for warm up and thermal equilibrium of the system.*

2. Setpoint Calibration: Before adjusting the setpoint, adjust the deadband pot to its minimum (fully counterclockwise). With the desired trip RTD resistance input applied, adjust the setpoint pot until the relay trips. For HI trip calibration, start with the setpoint pot above the desired trip (fully clockwise). For LO trip calibration, start with the setpoint pot below the desired trip (fully counterclockwise).

3. Deadband Calibration: Set the deadband pot to its minimum (fully counterclockwise). Adjust the setpoint pot to the desired trip. Adjust the RTD resistance input until the relay trips. Readjust the deadband pots to 5% (fully clockwise). Set th RTD resistance input to the desired deadband position. Slowly adjust deadband (counterclockwise) until the relay untrips.

Table 1: G118 RTD Type Settings

RTD Type	Selector SW2					
	1	2	3	4	5	6
Cu 10	■				■	■
Pt 100, Cu 100				■		
Pt 500, NiFe 604	■	■				
Pt 1000		■				
Ni 120				■		

Key: ■ = 1 = ON or Closed

Table 2: G118 Trip Settings

Function	Selector SW1		
	5	6	7
Trip B HI	■		
Trip A HI		■	
Non-Failsafe			■

Key: ■ = 1 = ON or Closed

**Relay Protection & EMI Suppression**

When switching inductive loads, maximum relay life and transient EMI suppression is achieved using external protection (see Figures 2 and 3). Place all protection devices directly across the load and minimize all lead lengths. For AC inductive loads, place a properly rated MOV across the load in parallel with a series RC snubber. Use a 0.01 to 0.1uF pulse film capacitor (foil polypropylene recommended) of sufficient voltage, and a 47 ohm, 1/2W carbon resistor. For DC inductive loads, place a diode across the load (PRV > DC supply, 1N4006 recommended) with (+) to cathode and (-) to anode (the RC snubber is an optional enhancement).

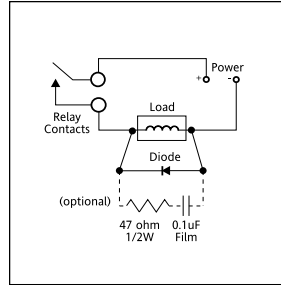


Figure 2: DC Inductive Loads

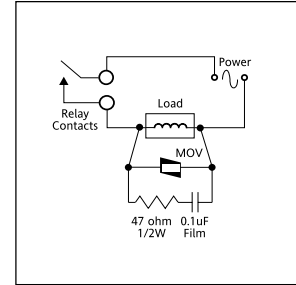


Figure 3: AC Inductive Loads

Table 3: G118 Range Settings

TC	Input Range	SW1		Selector SW2							
		1	2	3	1	2	3	4	5	6	
B	0 to 1490° C (32 to 2714° F)	■			■						■
B	0 to 1820° C (32 to 3308° F)	■	■	■							■
E	0 to 150° C (32 to 302° F)	■				■					■
E	0 to 290° C (32 to 554° F)	■	■			■					■
E	0 to 660° C (32 to 1220° F)	■				■					■
E	0 to 1000° C (32 to 1832° F)	■	■			■					■
E	-270 to 150° C (-454 to 302° F)	■				■					
E	-270 to 290° C (-454 to 554° F)	■	■			■					
J	0 to 190° C (32 to 374° F)	■								■	■
J	0 to 350° C (32 to 662° F)	■	■							■	■
J	0 to 760° C (32 to 1400° F)	■								■	■
J	-210 to 190° C (-364 to 374° F)	■				■					
J	-210 to 350° C (-364 to 662° F)	■	■			■					■
K	0 to 250° C (32 to 482° F)	■				■				■	■
K	0 to 480° C (32 to 896° F)	■	■			■				■	■
K	0 to 1280° C (32 to 2336° F)	■				■				■	■
K	0 to 1372° C (32 to 2502° F)	■	■			■				■	■
K	-270 to 250° C (-454 to 482° F)	■				■					
K	-270 to 480° C (-454 to 896° F)	■	■			■					
R	0 to 970° C (32 to 1778° F)	■				■				■	■
R	0 to 1690° C (32 to 3000° F)	■	■			■				■	■
R	0 to 1760° C (32 to 3200° F)	■				■				■	■
S	0 to 1050° C (32 to 1922° F)	■				■				■	■
S	0 to 1750° C (32 to 3182° F)	■	■			■				■	■
T	0 to 210° C (32 to 410° F)	■				■				■	■
T	0 to 390° C (32 to 734° F)	■	■			■				■	■
T	-270 to 210° C (-454 to 410° F)	■				■					
T	-270 to 390° C (-454 to 734° F)	■	■			■					

Key: ■ = 1 = ON or Closed

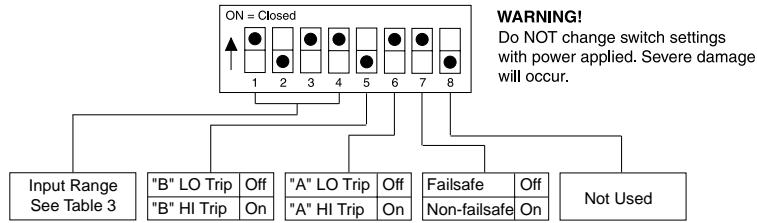


Figure 4: G118 Input Range/Function Selection (SW1) Factory Default Settings

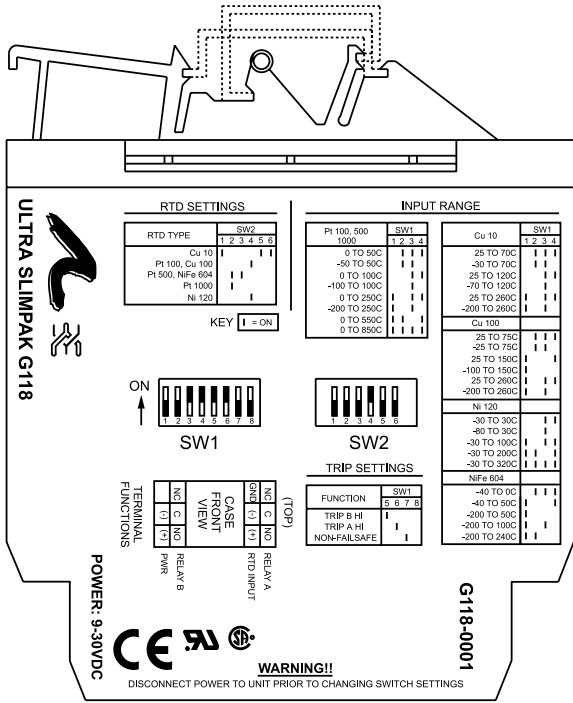


Figure 5: G118 Factory Cal; 0-250°C (Pt 100), A-HI/B-LO, Non-Failsafe

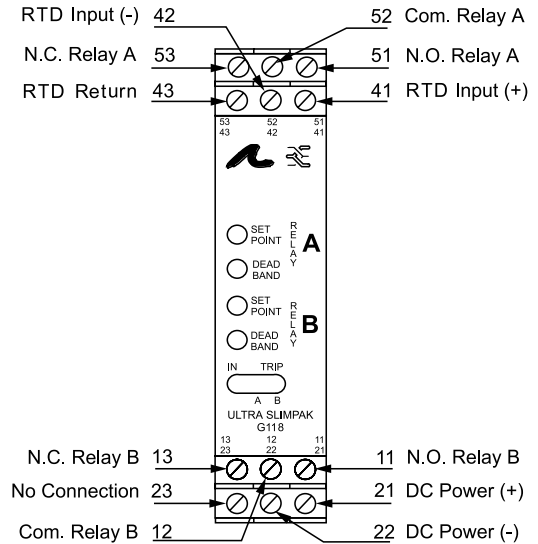


Figure 6: Terminal Wiring Diagram for G118

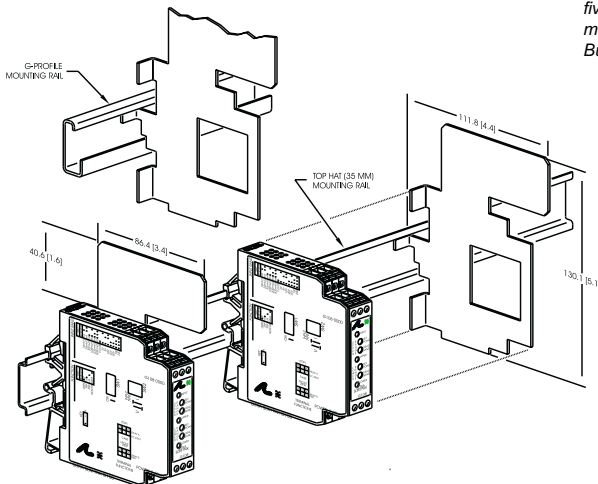


Figure 7: Mounting Multiple Modules

Note: All Ultra SlimPak modules are designed to operate in ambient temperatures from 0 to 55°C when mounted on a horizontal DIN rail. If five or more modules are mounted on a vertical rail, circulating air or model HS01 Heat Sink is recommended. Refer to HS01 Technical Bulletin (#721-0549-00) or contact the factory for assistance.

## Specifications

### Inputs

Sensors:  
Pt100, Pt500, Pt1000 (0.00385Ohms/Ohm/°C);  
Cu10, Cu100; Ni120, NiFe604  
Sensor Connection: 3-wire.  
Input Ranges: See table 1.

### Excitation Current (Max)

<2mA for Pt100, Pt500, Pt1000, Ni120,  
Cu100 or NiFe604  
<10mA for Cu10

### Leadwire Resistance

40% of base sensor resistance or 100 Ohms  
(whichever is less), maximum per lead.

### Leadwire Effect

Less than 1% of selected span over entire  
leadwire resistance range.

### Input Protection

Normal Mode: Withstands ±5VDC.  
Common Mode (Input to Gnd): 1800VDC, max.

### LED Indicators

Input Range (Green):  
>110% input: 8Hz flash;  
>-10% input: 4Hz flash  
Setpoint (Red):

Tripped: Solid red;  
Safe: Off

### Limit Differentials (Deadbands)

0.25% to 5% of span

## Response Time

Dynamic Deadband:  
Relay status will change when proper  
setpoint/ process condition exists for  
100msec.  
Normal Mode (analog filtering):  
<250mSec, (10-90%)

## Setpoints

Effectivity:  
Setpoints are adjustable over 100% of  
the selected input span  
Repeatability (constant temp.):  
±0.2% of full scale

## Stability

Line Voltage: ±0.01%/%, max.  
Temperature: ±0.05% of full scale/°C, max.

## Common Mode Rejection

DC to 60Hz: 120dB  
>60Hz: 100dB

## Isolation

1800VDC between contacts, input & power

## EMC Compliance (CE Mark)

Emissions: EN50081-1  
Immunity: EN50082-2  
Safety: EN50178

## Humidity (Non-Condensing)

Operating: 15 to 95% @45°C  
Soak: 90% for 24 hours @65°C

## Temperature Range

Operating: -15 to 55°C (5 to 131°F)  
Storage: -25 to 75°C (-13 to 158°F)

## Power

Consumption: 1.5W typical, 2.5W max.  
Supply Range: 9 to 30VDC, inverter isolated

## Relay Contacts

2 SPDT (2 form C) Relays, 1 Relay per  
setpoint  
Current Rating (resistive)  
120VAC: 5A; 240VAC: 2A; 28VDC: 5A  
Material: Gold flash over silver alloy  
Electrical Life: 10<sup>5</sup> operations at rated load  
*Note: External relay protection is required  
for use with inductive loads (see Figures 2 & 3).*  
Mechanical Life: 10<sup>7</sup> operations

## Weight

0.56lbs.

## Agency Approvals

CSA certified per standard C22.2, No. 0-M91  
and 142-M1987 (File No. LR42272)  
UL recognized per standard UL508  
(File No. E99775)  
CE Compliance per EMC directive 89/336/EEC

## Ordering Information

### Models & Accessories

#### Specify:

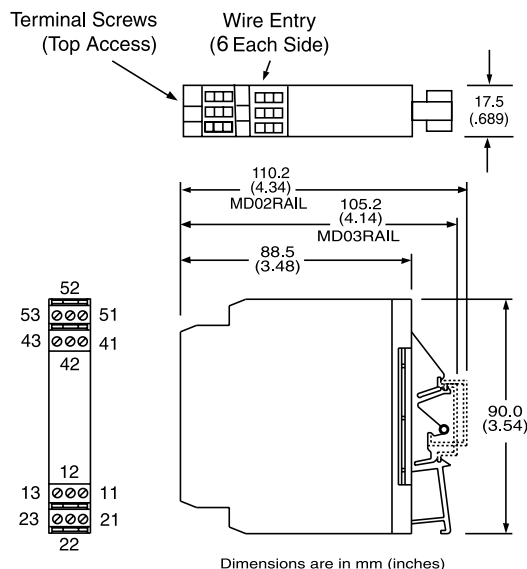
1. Model: **G118-0002**
2. Accessories: (see Accessories)
3. Optional Custom Factory Calibration; specify **C620** with desired input and output range.

### Accessories

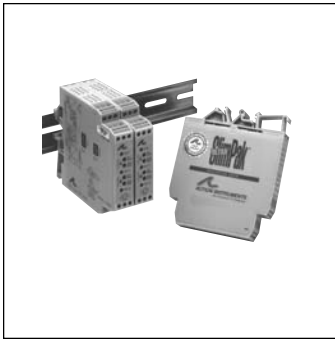
SlimPak "G" series modules will mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition, the following accessories are available:

- HS01** Heat Sink
- MD03** TS35 x 7.5 DIN Rail
- WV905** 24VDC Power Supply (0.5 Amp)
- H910** 24VDC Power Supply (1Amp)
- H915** 24VDC Power Supply (2.3 Amp)
- MB03** End Bracket for MD03
- C664** I/O Descriptive Tags

## Dimensions



Note that detailed installation instructions are available on our web site.



G128-0001



# ULTRA SLIMPAK® G128-0001 DC Powered T/C Input Limit Alarm

Provides Relay Contact Closures  
at a Preset Temperature Input Level



- Programmable HI or LO, Failsafe or Non-failsafe
- Field Configurable Input Ranges
- LED Trip and Input Indicators

- Flexible Power Supply Accepts 9 to 30 VDC
- ASiC Technology for Enhanced Reliability
- RoHS Compliant

## Description

The Ultra Slim Pak G128 is a DIN rail mount, thermocouple input limit alarm with input terminal cold junction compensation (cjc), dual setpoints and two contact closure outputs. The field configurable input and alarm functions offer flexible setpoint capability. There are up to six temperature ranges available for each thermocouple type to ensure accuracy and maximize setpoint resolution.

The G128 is configurable as a single or dual setpoint alarm, with HI or LO trips, upscale or downscale thermocouple burnout detection and failsafe or non-failsafe operation. Also included are adjustable deadbands (0.25 to 5% of full scale input) for each setpoint and a flexible DC power supply which accepts any voltage between 9 and 30VDC.

## Diagnostic LEDs

The G128 is equipped with three front panel LEDs. The dual function green LED is labeled INPUT and indicates line power and input signal status. Active DC power is indicated by an illuminated LED. If this LED is off, check DC power and the wiring connection. If the input signal is more than 110% of the full scale range, the LED will flash at 8 Hz. Below -10%, it flashes at 4 Hz. Two red LEDs indicate the relay state for each setpoint. An illuminated red LED indicates the tripped condition.

## Output

The G128 is equipped with two SPDT (form C) relays, rated at 120VAC or 28VDC at 5 Amperes. Each of these relays is independently controlled by the field configurable setpoint and deadband.

## Operation

The field configurable G128 limit alarm setpoints can be configured for HI or LO, failsafe or non-failsafe operation. Each of the setpoints has a respective HI or LO deadband. In a tripped condition, the setpoint is exceeded and the appropriate red LED will illuminate. The trip will reset only when the process falls below the HI deadband or rises above the LO deadband (see Figure 1). For proper deadband operation, the HI setpoint must always be set above the LO setpoint. In failsafe operation, the relay is energized when the process is below the HI setpoint or above the LO setpoint (opposite for non-failsafe). In the failsafe mode, a power failure results in an alarm state output.

## Dynamic Deadband

Circuitry in the G128 prevents false trips by repeatedly sampling the input. The input must remain beyond the setpoint for 100 milliseconds, uninterrupted, to qualify as a valid trip condition. Likewise, the input must fall outside the deadband and remain there for 100 milliseconds to return the alarm to an untripped condition. This results in a “dynamic deadband” (based on time) in addition to the normal deadband.

## Configuration

Unless otherwise specified, the factory presets the Model G128 as follows:

- Input: J Type
- Range: 0 to 350°C
- Output: Dual, SPDT
- Trip: A: HI, B: LO
- Failsafe: No
- Deadband: A, B: 0.25%

The DC power input accepts any DC source between 9 and 30V; typically a 12V or 24VDC source is used (see Accessories).

For other I/O ranges, refer to Table 1 and reconfigure switches SW1 and SW2 for the desired input type, range and function.

**WARNING:** Do not change switch settings with power applied. Severe damage will result!

1. With DC power off, set SW1-1, 2, 3 and SW2-1 through 6 for the desired input range (Table 1).
2. Set positions 4 and 5 of “SW1” to ON for a HI trip setpoint or OFF for a LO trip setpoint (Figure 4).
3. Set position 6 of “SW1” to ON for non-failsafe operation or OFF for failsafe operation (e.g., alarm trips upon power failure).
4. Set positions 7 and 8 of “SW1” to upscale or downscale burnout.

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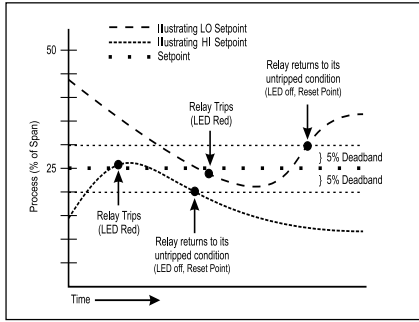


Figure 1: Limit alarm operation and effect of deadband.

**Calibration**

1. After configuring the DIP switches, connect the input to a calibrated TC source and apply power. Refer to the terminal wiring (Figure 5).

Note: To maximize thermal stability, final calibration should be performed in the operating installation, allowing approximately 1 to 2 hours for warm up and thermal equilibrium of the system.

2. Setpoint: set deadband at its minimum (fully counterclockwise) before adjusting the setpoint. With the desired trip thermocouple millivolt input applied, adjust the setpoint until the relay trips. For HI trip calibration, start with the setpoint above the desired trip (fully clockwise). For LO trip calibration, start below the desired trip (fully counterclockwise).

3. Deadband: Set deadband to its minimum (fully counterclockwise). Set the setpoint to the desired trip. Adjust the thermocouple millivolt input until the relay trips. Readjust deadband to 5% (fully clockwise). Set the input to the desired deadband position. Slowly adjust deadband until the relay untrips

**Relay Protection & EMI Suppression**

When switching inductive loads, maximum relay life and transient EMI suppression is achieved using external protection (see Figures 2 and 3). Place all protection devices directly across the load and minimize all lead lengths. For AC inductive loads, place a properly rated MOV across the load in parallel with a series RC snubber. Use a 0.01 to 0.1uF pulse film capacitor (foil polypropylene recommended) of sufficient voltage, and a 47 ohm, 1/2W carbon resistor. For DC inductive loads, place a diode across the load (PRV > DC supply, 1N4006 recommended) with (+) to cathode and (-) to anode (the RC snubber is an optional enhancement).

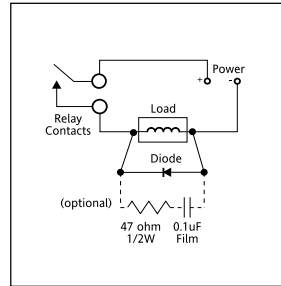


Figure 2: DC Inductive Loads

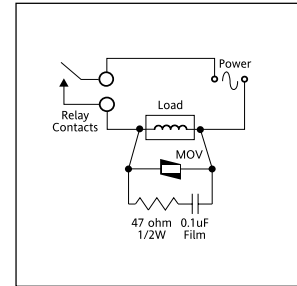


Figure 3: AC Inductive Loads

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Table 1: G128 Input Range Settings

TC	Input Range	SW1		Selector SW2						
		1	2	3	1	2	3	4	5	6
B	0 to 1490° C (32 to 2714° F)	■	■							■
B	0 to 1820° C (32 to 3308° F)	■	■	■						■
E	0 to 150° C (32 to 302° F)	■								■
E	0 to 290° C (32 to 554° F)	■				■				■
E	0 to 660° C (32 to 1220° F)	■				■				■
E	0 to 1000° C (32 to 1832° F)	■				■				■
E	-270 to 150° C (-454 to 302° F)	■				■				
E	-270 to 290° C (-454 to 554° F)	■	■			■				
J	0 to 190° C (32 to 374° F)	■							■	■
J	0 to 350° C (32 to 662° F)	■				■			■	■
J	0 to 760° C (32 to 1400° F)	■							■	■
J	-210 to 190° C (-364 to 374° F)	■							■	
J	-210 to 350° C (-364 to 662° F)	■	■						■	
K	0 to 250° C (32 to 482° F)	■						■		■
K	0 to 480° C (32 to 896° F)	■	■					■		■
K	0 to 1280° C (32 to 2336° F)	■						■		■
K	0 to 1372° C (32 to 2502° F)	■				■				■
K	-270 to 250° C (-454 to 482° F)	■				■				
K	-270 to 480° C (-454 to 896° F)	■	■			■				
R	0 to 970° C (32 to 1778° F)	■					■			■
R	0 to 1690° C (32 to 3000° F)	■	■				■			■
R	0 to 1760° C (32 to 3200° F)	■					■			■
S	0 to 1050° C (32 to 1922° F)	■					■			■
S	0 to 1750° C (32 to 3182° F)	■	■				■			■
T	0 to 210° C (32 to 410° F)	■						■		■
T	0 to 390° C (32 to 734° F)	■	■					■		■
T	-270 to 210° C (-454 to 410° F)	■						■		
T	-270 to 390° C (-454 to 734° F)	■	■					■		

Key: ■ = 1 = ON or Closed

Table 2: G128 Trip Settings

Function	Selector SW1				
	4	5	6	7	8
Trip B HI	■				
Trip A HI		■			
Non-Failsafe			■		
Burnout Up				■	
Burnout Down					■

Key: ■ = 1 = ON or Closed





## Specifications

### Inputs

- Range: See Table 1
- Impedance: >1M Ohm
- Input Bias Current (burnout detect): <1.5 uAmp
- Overvoltage: ±10V differential
- Common Mode (Input to Gnd): 1800VDC, max.

### LED Indicators

- Input Range (Green)
  - >110% input: 8Hz flash
  - <-10% input: 4Hz flash
- Setpoint (Red):
  - Tripped: Solid red
  - Safe: off

### Limit Differentials (Deadbands)

- 0.25% to 5% of span

### Response Time

- Dynamic Deadband:
  - Relay status will change when proper setpoint/process condition exists for 100msec
- Normal Mode (analog filtering):
  - <250msec, (10-90%)

### Setpoint

- Effectivity:
  - Setpoints are adjustable over 100% of the selected input span
- Repeatability (constant temp.):
  - 0.2% for temp > 0°C
  - 0.3% for temp < 0°C

## Stability

- Temperature: ±0.05% of full scale/°C, max.

## Common Mode Rejection

- DC to 60Hz: 120dB

## Isolation

- 1800VDC between contacts, input & power

## EMC Compliance (CE Mark)

- Emissions: EN50081-1
- Immunity: EN50082-2
- Safety: EN50178

## Humidity (Non-Condensing)

- Operating: 15 to 95% @45°C
- Soak: 90% for 24 hours @65°C

## Temperature Range

- Operating: 0 to 55°C (32 to 131°F)
- Storage: -15 to 70°C (5 to 158°F)

## Power

- Consumption: 1.5W typical, 2.5W max.
- Supply Range: 9 to 30 VDC, inverter isolated

## Relay Contacts

- 2 SPDT (2 Form C) Relays, 1 Relay per setpoint
- Current Rating (resistive)
  - 120VAC: 5A; 240VAC: 2A; 28VDC: 5A
- Material: Gold flash over silver alloy
- Electrical Life: 10<sup>5</sup> operations at rated load
  - Note: External relay contact protection is required for use with inductive loads (see relay protection Figures 2 & 3).*
- Mechanical Life: 10<sup>7</sup> operations

## Wire Terminations

- Screw terminations for 12-22 AWG

## Weight

- 0.56lbs.

## Agency Approvals

- CSA certified per standard C22.2, No. 0-M91 and 142-M1987 (File No. LR42272)
- UL recognized per standard UL508 (File No.E99775)
- CE Compliance per EMC directive 89/336/EEC and low voltage 73/23/EEC.
- RoHS Compliant

## Ordering Information

### Models & Accessories

#### Specify:

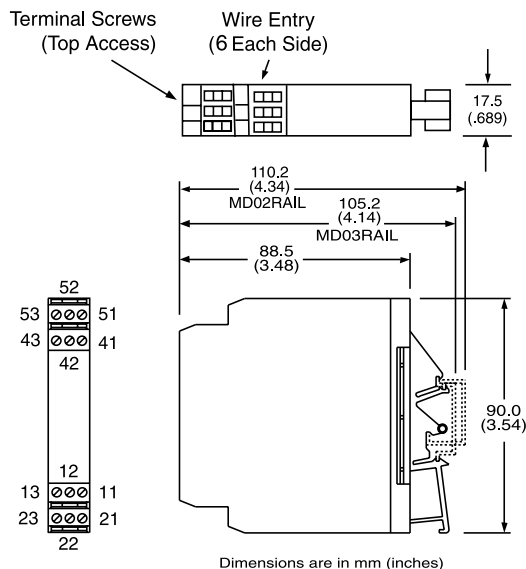
- Model: **G128-0001**
- Accessories: (see Accessories)
- Optional Custom Factory Calibration; specify **C620** with desired input and output range.

### Accessories

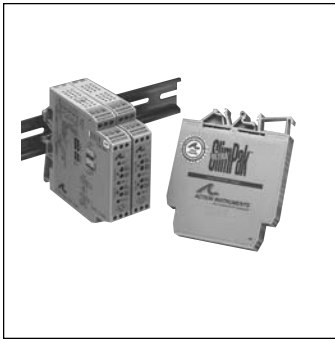
SlimPak "G" series modules will mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition, the following accessories are available:

- HS01** Heat Sink
- MD03** TS35 x 7.5 DIN Rail
- WV905** 24VDC Power Supply (0.5A)
- H910** 24VDC Power Supply (1A)
- H915** 24VDC Power Supply (2.3A)
- MB03** End Bracket for MD03
- C664** I/O Descriptive Tags

## Dimensions



*Note that detailed installation instructions are available on our web site.*



G168-0001

# ULTRA SLIMPAK® G168-0001

## DC Powered AC Input Limit Alarm

Provides Relay Contact Closures  
at a Preset AC Input Level



- Programmable HI or LO, Failsafe or Non-failsafe
- Field Configurable Input Ranges
- LED Trip and Input Indicators

- Flexible Power Supply Accepts 9 to 30 VDC
- ASiC Technology for Enhanced Reliability
- RoHS Compliant

### Description

The Ultra Slim Pak G168 is a DIN rail mount, DC powered, AC voltage or current input limit alarm with dual setpoints and two contact closure outputs. The field configurable input and alarm functions offer flexible setpoint capability. Input voltage spans from 100mV to 250VAC and input current spans from 10mA to 100mA AC can be field configured. For current input spans of 1 to 5 Amps a 0.1 Ohm (5W) shunt resistor (Model# C006) is available.

The G168 is configurable as a single or dual setpoint alarm, with HI or LO trips and failsafe or non-failsafe operation. Also included are adjustable deadbands (0.25 to 5% of full scale input) for each setpoint. The G168 will accept any DC voltage between 9 and 30VDC.

### Diagnostic LEDs

The G168 is equipped with three front panel LEDs. The dual function green LED is labeled INPUT and indicates line power and input signal status. Active DC power is indicated by an illuminated LED. If this LED is off, check DC power and the wiring connection. If the input signal is more than 110% of the full scale range, the LED will flash at 8 Hz. Below 0%, it flashes at 4 Hz. Two red LEDs indicate the relay state for each setpoint. An illuminated red LED indicates the tripped condition.

### Output

The G168 is equipped with two SPDT (form C) relays, rated at 120VAC or 28VDC at 5 Amperes. Each of these relays is independently controlled by the field configurable setpoint and deadband.

### Operation

The field configurable G168 limit alarm setpoints can be configured for HI or LO, failsafe or non-failsafe operation. Each of the setpoints have a respective HI or LO deadband. In a tripped condition, the setpoint is exceeded and the appropriate red LED will illuminate. The trip will reset only when the process falls below the HI deadband or rises above the LO deadband (see Figure 1). For proper deadband operation, the HI setpoint must always be set above the LO setpoint. In failsafe operation, the relay is energized when the process is below the HI setpoint or above the LO setpoint (opposite for non-failsafe). In the failsafe mode, a power failure results in an alarm state output.

### Dynamic Deadband

Circuitry in the G168 prevents false trips by repeatedly sampling the input. The input must remain beyond the setpoint for 100 milliseconds, uninterrupted, to qualify as a valid trip condition. Likewise, the input must fall outside the deadband and remain there for 100 milliseconds to return the alarm to an untripped condition. This results in a “dynamic deadband” (based on time) in addition to the normal deadband.

### Configuration

Unless otherwise specified, the factory presets the Model G168 as follows:

- Input: Voltage
- Range: 0-500mVAC
- Output: Dual, SPDT
- Trip: A:HI, B:LO
- Failsafe: No
- Deadband: A, B: 0.25%

The DC power input accepts any DC source between 9 and 30V; typically a 12V or 24VDC source is used (see Accessories).

For other I/O ranges, refer to Table 1 and Figure 4 to reconfigure switches SW1 and SW2 for the desired input type, range and function.

1. With DC power off, position input switch "SW1-9, 10" for voltage or current.
2. Set position 1 through 8 of "SW1" for the desired input range (see Table 1).
3. Set position 1 and 2 of "SW2" to ON for a HI trip setpoint or OFF for a LO trip (see Figure 4).
4. Set position 4 of "SW2" to ON for non-failsafe operation or OFF for failsafe operation (e.g., alarm trips when power fails).

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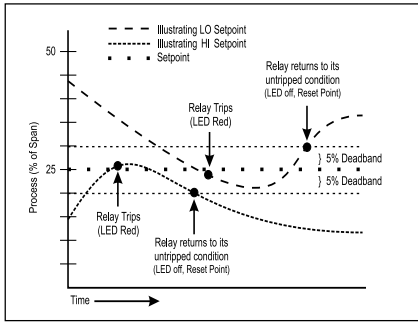


Figure 1: Limit alarm operation and effect of deadband.

**Calibration**

Note: To maximize thermal stability, final calibration should be performed in the operation installation, allowing approximately 1 to 2 hours for warm up and thermal equilibrium of the system.

1. After configuring the dip switches, connect the input to a calibrated AC source and apply power. Refer to the terminal wiring (Figure 6).
2. Setpoint: set deadband at its minimum (fully counterclockwise) before adjusting the setpoint. With the desired trip input applied, adjust the setpoint until the relay trips. For HI trip calibration, start with the setpoint above the desired trip (fully clockwise). For LO trip calibration, start below the desired trip (fully counterclockwise).
3. Deadband: Set deadband to its minimum (fully counterclockwise). Set the setpoint to the desired trip. Adjust the input until the relay trips. Readjust deadband to 5% (fully clockwise). Set the input signal to the desired deadband position. Slowly adjust deadband until the relay untrips

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**Relay Protection & EMI Suppression**

When switching inductive loads, maximum relay life and transient EMI suppression is achieved using external protection (see Figures 2 and 3). Place all protection devices directly across the load and minimize all lead lengths. For AC inductive loads, place a properly rated MOV across the load in parallel with a series RC snubber. Use a 0.01 to 0.1uF pulse film capacitor (foil polypropylene recommended) of sufficient voltage, and a 47 ohm, 1/2W carbon resistor. For DC inductive loads, place a diode across the load (PRV > DC supply, 1N4006 recommended) with (+) to cathode and (-) to anode (the RC snubber is an optional enhancement).

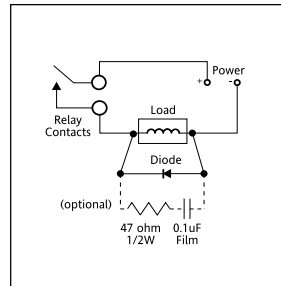


Figure 2: DC Inductive Loads

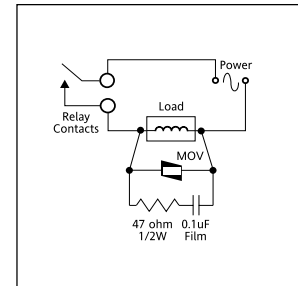


Figure 3: AC Inductive Loads

Table 1: G168 Input Range Settings

Ranges		Selector SW1									
Voltage	Current	1	2	3	4	5	6	7	8	9	10
100mV	10mA				■					■	
200mV	20mA				■		■		■		
500mV	50mA			■			■		■		
1V	100mA			■	■					■	
2V				■	■			■	■		
5V		■		■	■		■	■			
10V		■		■	■		■	■			
20V		■		■	■		■	■			
50V			■	■	■		■	■			
100V			■	■	■		■	■			
200V			■	■	■		■	■			
250V			■	■	■		■	■			
<b>Input Type</b>											
	Current										■
	Voltage									■	

Key: ■ = 1 = ON or Closed

Table 2: G168 Trip Settings

Function	Selector SW2			
	1	2	3	4
Trip B HI	■			
Trip A HI		■		
Non-Failsafe				■

Key: ■ = 1 = ON or Closed

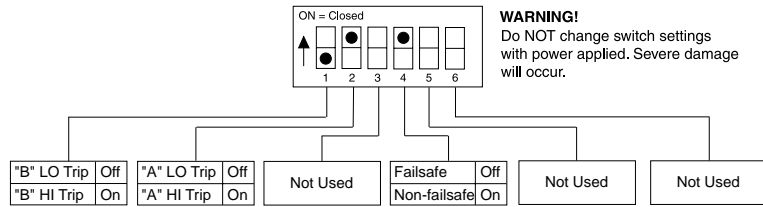


Figure 4: G168 Function Selection Switch-Settings (SW4) Factory Default Settings

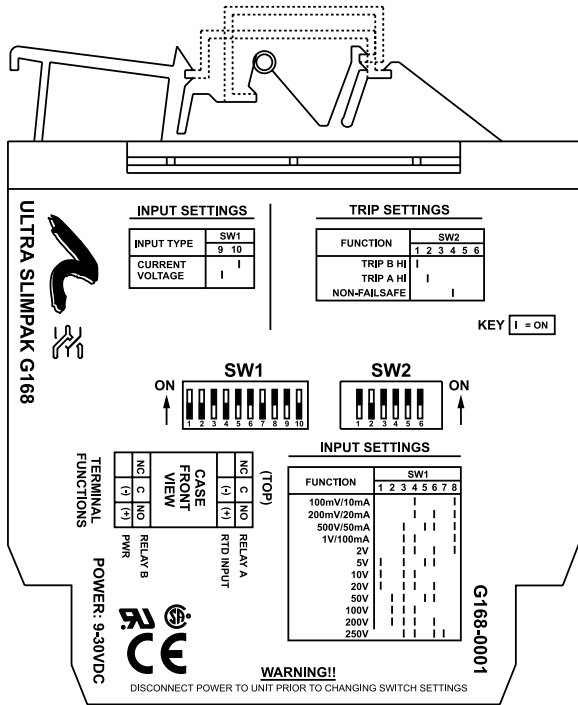


Figure 5: G168 Factory Calibration; 0-500mV, A-HI/B-LO, Non-Failsafe

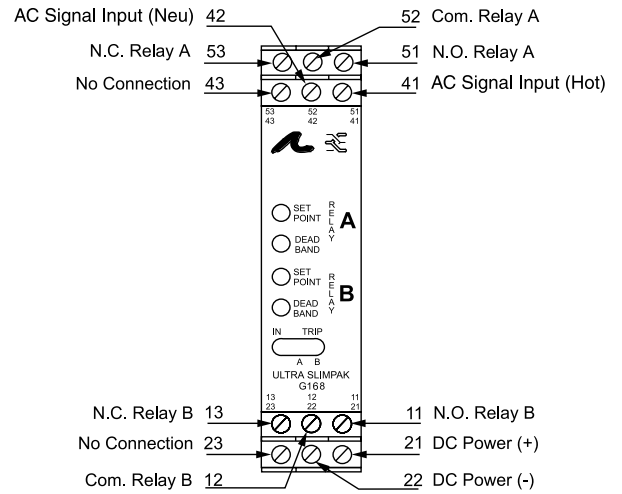


Figure 6: G168 Wiring Diagram

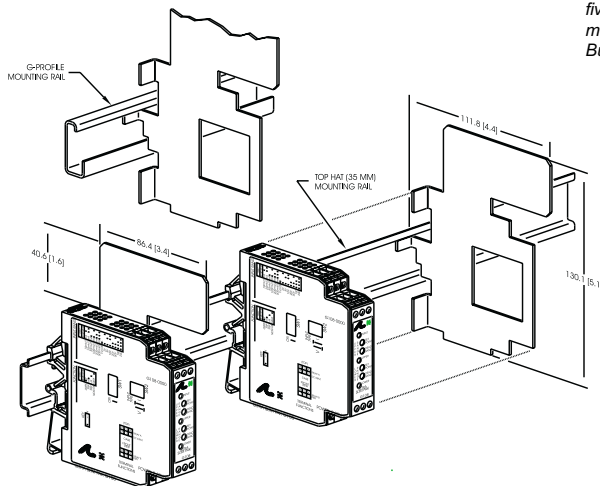


Figure 7: Mounting Multiple Modules

Note: All Ultra SlimPak modules are designed to operate in ambient temperatures from 0 to 55°C when mounted on a horizontal DIN rail. If five or more modules are mounted on a vertical rail, circulating air or model HS01 Heat Sink is recommended. Refer to HS01 Technical Bulletin (#721-0549-00) or contact the factory for assistance.

Ultra SlimPak®

## Specifications

### Inputs

#### Voltage Input

Range: 100mV to 250VAC  
 Impedance: >100K Ohms  
 Overvoltage: 300VAC, max.

#### Current Input

Range: 10mA to 100mA AC  
 Impedance: 20 Ohms, typical  
 Overcurrent: 200mA AC, max.  
 Overvoltage: 60V peak (protected by self resetting fuse)  
 Frequency Range: 40 to 400Hz  
 Common Mode (Input to Gnd): 1800VDC, max.

### LED Indicators

Input Range (Green)  
 >110% input: 8Hz flash  
 Setpoint (Red)  
 Tripped: Solid red  
 Safe: Off

### Limit Differentials (Deadbands)

>50mV/5mA: 0.25% to 5% of span  
 <50mV/5mA: 1% to 5% of span

### Response Time

Dynamic Deadband:  
 Relay status will change when proper setpoint/process condition exists for 100msec.  
 Normal Mode (analog filtering):  
 <250mSec, (10-90%)

## Setpoints

Effectivity:  
 Setpoints are adjustable over 100% of the selected input span  
 Repeatability (constant temp.):  
 0.2% of full scale

### Stability

Temperature:  $\pm 0.025\%$  of full scale/ $^{\circ}\text{C}$ , max.

### Common Mode Rejection

DC to 60Hz: 120dB

### Isolation

1800VDC between contacts, input & power

### EMC Compliance (CE Mark)

Emmissions: EN50081-1  
 Immunity: EN50082-1  
 Safety: EN50178

### Humidity (Non-Condensing)

Operating: 15 to 95% @45 $^{\circ}\text{C}$   
 Soak: 90% for 24hours @65 $^{\circ}\text{C}$

### Temperature Range

Operating: 0 to 55 $^{\circ}\text{C}$  (32 to 131 $^{\circ}\text{F}$ )  
 Storage: -25 to 70 $^{\circ}\text{C}$  (-13 to 158 $^{\circ}\text{F}$ )

### Power

Consumption: 1.5W typical, 2.5W max.  
 Supply Range: 9 to 30VDC, inverter isolated

## Relay Contacts

2 SPDT (2 form C) Relays, 1 Relay per setpoint

Current Rating (resistive):  
 120VAC: 5A; 240VAC: 2A; 28VDC: 5A

Material: Gold flash over silver alloy  
 Electrical Life: 10<sup>5</sup> operations at rated load  
*Note: External relay contact protection is required for use with inductive loads (see Figures 2 & 3).*

Mechanical Life: 10<sup>7</sup> operations

### Wire Terminations

Screw terminals for 12-22 AWG

### Agency Approvals

CSA certified per standard C22.2, No. 0-M91 and 142-M1987 (File No. LR42272)

UL recognized per standard UL508 (File No. E99775)

CE Conformance per EMC directive 89/336/EEC & Low Voltage 73/23/EEC (Input <50VAC, only).  
 RoHS Compliant

## Ordering Information Models & Accessories

### Specify:

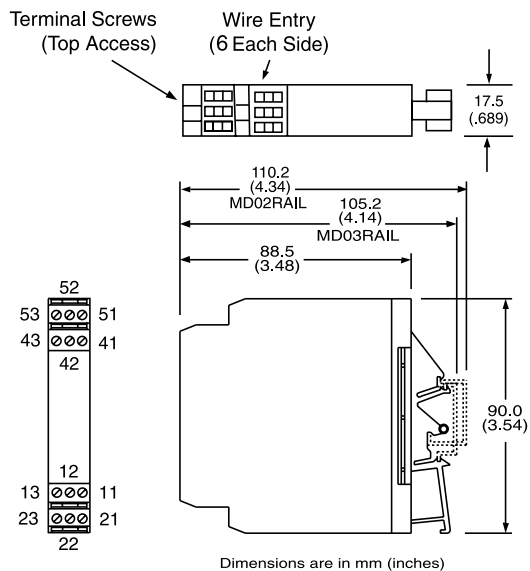
1. Model: **G168-0001**
2. Accessories: (see Accessories)
3. Optional Custom Factory Calibration; specify **C620** with desired input and output range.

### Accessories

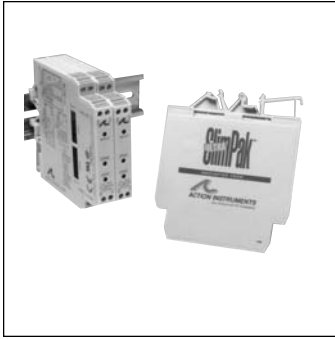
SlimPak "G" series modules will mount on standard TS32 (model MD02) or TS35 (model MD03) DIN. In addition, the following accessories are available:

- HS01** Heat Sink
- MD03** TS35 x 7.5 DIN Rail
- WV905** 24VDC Power Supply (0.5Amp)
- H910** 24VDC Power Supply (1Amp)
- H915** 24VDC Power Supply (2.3 Amp)
- MB03** End Bracket for MD03
- C664** I/O Descriptive Tags
- C006** Shunt Resistor (0.1W, 5A max.)

## Dimensions



Note that detailed installation instructions are available on our web site.



G408-0001 (standard outputs)  
G408-1001 (bipolar outputs)

# ULTRA SLIMPAK® G408-0001 & G408-1001

## DC Powered DC Input Field Configurable Isolator

Provides a Fully Isolated DC Output  
in Proportion to a DC Input



- Eliminates Ground Loops
- Field Configurable Input Ranges: 10mV to 100V, 1mA to 100mA
- Field Configurable Output Ranges: 0-5V, 0-10V, 0-1mA, 0-20mA, 4-20mA,  $\pm 5V$ ,  $\pm 10V$

- Ultra Slim Housing for High Density Installations
- Flexible Power Supply Accepts 9 to 30 VDC
- ASiC Technology
- RoHS Compliant

### Description

The Ultra SlimPak G408 is a DIN rail mount, DC input signal conditioner with 1800VDC isolation between input, output and power. The field configurable input and output offers flexible, wide ranging capability for DC current and voltage signals.

The input can be configured for any one of 12 voltage ranges from 10mV to 100V or 6 current ranges from 1mA to 100mA (see Table 1). The output is linear to the input and can be set for either 0-5V, 0-10V, 0-1mA, 0-20mA or 4-20mA (for models G408-0001) and -5 to +5V or -10 to +10V (for model G408-1001).

Wide ranging, precision zero and span pots allow 50% adjustability of offset and span turn-down within each of the 18 switch selectable ranges. For example, the 0-2mA input range could be turned down to 0-1mA and provide a full scale output signal (e.g. 4-20mA), or turned down and offset to achieve a 1-2mA/4-20mA I/O combination.

The G408 also accepts bipolar inputs (e.g. 10V range set to bipolar = -10 to +10V) and offers selectable normal or reverse operation (e.g. 4-20mA/20-4mA). The ASiC based I/O channel is optically isolated to 1800VDC and is transformer isolated from the power supply.

### Application

The G408 is useful in eliminating ground loops, converting signal levels, and providing signal drive. The field configurable, wide ranging capability ensures maximum flexibility for most DC to DC applications, minimizing spare part requirements.

### Diagnostic LED

The G408 is equipped with a dual function LED signal monitor. The green, front mounted LED indicates both DC power and input signal status. Active DC power is indicated by an illuminated LED. If the input signal is more than 110% of the full scale range, the LED will flash at 8Hz. Below -10%, the flash rate is 4Hz.

### Configuration

The G408 has 18 input range settings. Trim potentiometers allow 50% input zero and span adjustability within each of the 18 full scale input ranges.

Unless otherwise specified, the factory presets the Model G408-0001 and G408-1001 as follows:

#### G408-0001

Input Range: 4-20mA  
Output Range: 4-20mA

#### G408-1001

Input Range: 4-20mA  
Output Range: -10 to +10V

The DC power input accepts any source between 9 and 30V; typically a 12V or 24VDC source is used (see Accessories).

To minimize interference from electrical and magnetic fields, the use of shielded, twisted pair wires on the input and output is recommended.

**WARNING!** Do not change switch settings with power applied. Severe damage will result!

Refer to Tables 1 through 4 for the proper switch settings. Use the switches on SW1 to select the input type (voltage or current) and also to select the desired input range and function setting. Use SW2 to select the desired output type.

Ultra SlimPak®

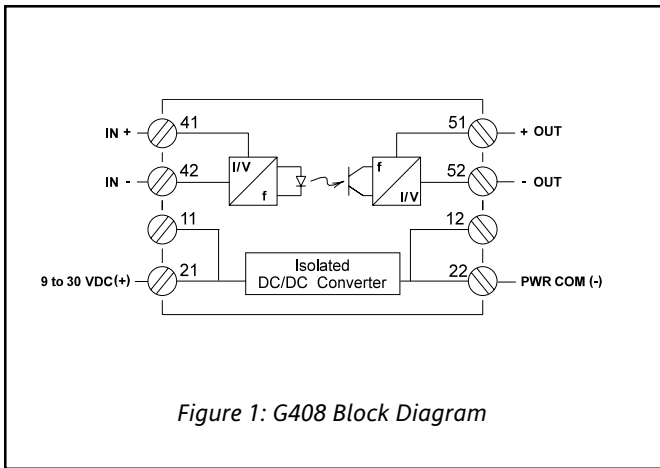


Figure 1: G408 Block Diagram

**Calibration**

1. After configuring the DIP switches, connect the input to a calibrated DC source. Connect the output to the actual device load (or a load approximately equivalent to the device load) and apply power.

*Note: To maximize thermal stability, final calibration should be performed in the operating installation, allowing approximately 1 to 2 hours for warm up and thermal equilibrium of the system.*

2. Set the calibrator to the desired minimum input and adjust the zero potentiometer for the desired minimum output.

3. Set the calibrator to the desired maximum input and adjust the span potentiometer for the desired maximum output.

4. Repeat steps 2 and 3, as necessary, for best accuracy.

Table 1: G408 Input Range Settings

Ranges		Selector SW1			
Voltage	Current	1	2	3	4
20mV	2mA			■	■
50mV	5mA		■		
100mV	10mA		■		■
200mV	20mA		■	■	
500mV	50mA		■	■	■
1V	100mA	■			
2V		■			■
5V		■		■	■
10V		■	■		
25V		■	■		■
50V		■	■	■	
100V		■	■	■	■

Key: ■ = 1 = ON or Closed

Table 3: G408-0001 Output Settings

G408-0001 Ranges	Selector SW2							
	1	2	3	4	5	6	7	8
0 to 5V	■	■	■	■				
0 to 10V	■		■	■				
0 to 1mA		■	■	■				
4 to 20m						■	■	■
0 to 20mA	■	■				■	■	■

Key: ■ = 1 = ON or Closed

Table 2: G408 Function Settings

Function	Selector SW1			
	5	6	7	8
Unipolar Input	■			
Reverse Output		■		
Current Input				■
Voltage Input			■	

Key: ■ = 1 = ON or Closed

Table 4: G408-1001 Output Settings

G408-1001 Ranges	Selector SW1	
	9	10
-5V to +5V		■
-10V to +10V		

Key: ■ = 1 = ON or Closed



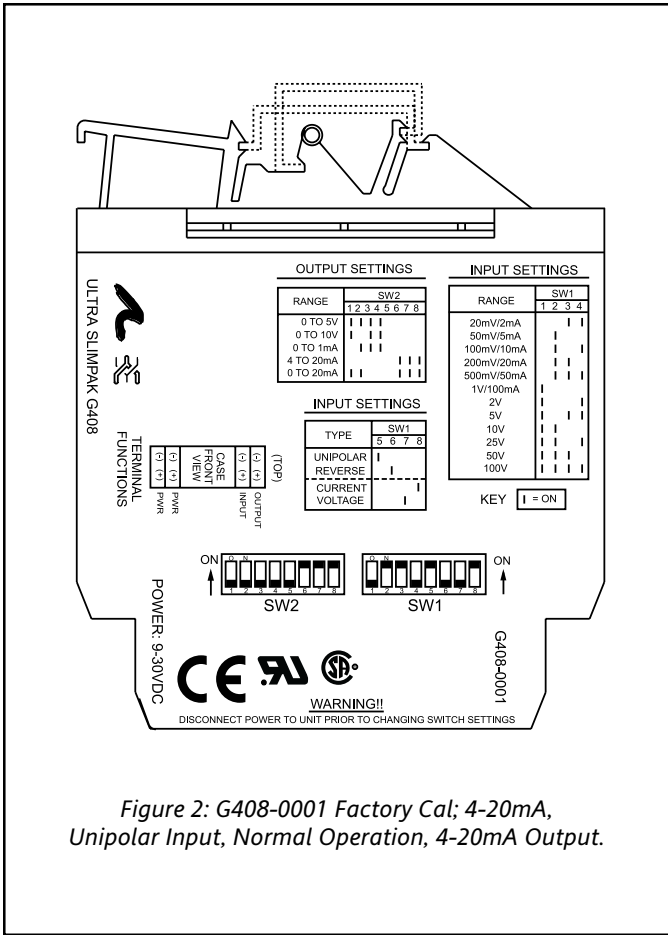


Figure 2: G408-0001 Factory Cal; 4-20mA, Unipolar Input, Normal Operation, 4-20mA Output.

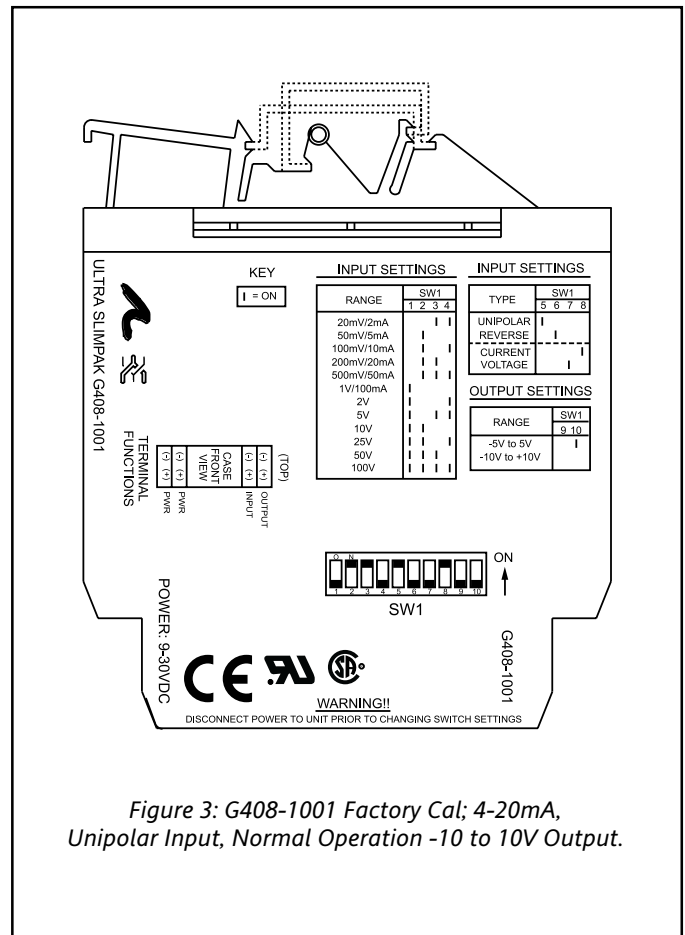


Figure 3: G408-1001 Factory Cal; 4-20mA, Unipolar Input, Normal Operation -10 to 10V Output.

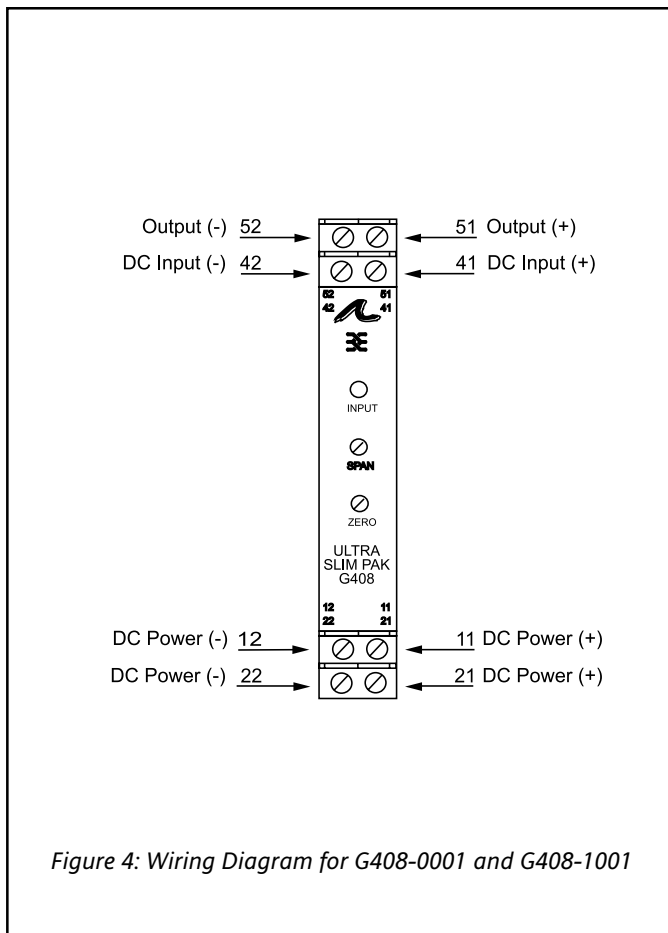
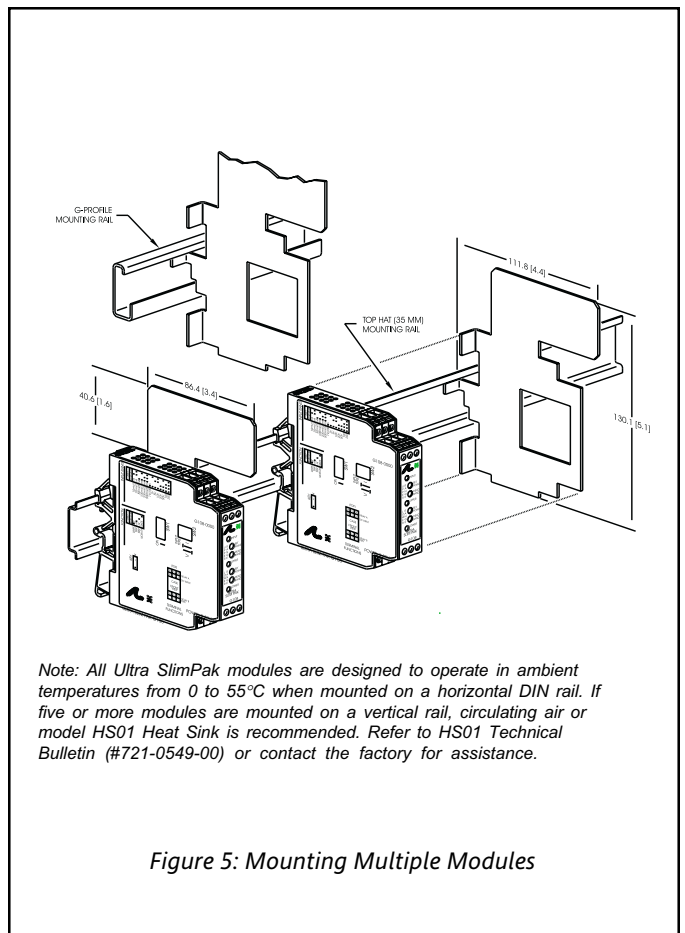


Figure 4: Wiring Diagram for G408-0001 and G408-1001



Note: All Ultra SlimPak modules are designed to operate in ambient temperatures from 0 to 55°C when mounted on a horizontal DIN rail. If five or more modules are mounted on a vertical rail, circulating air or model HS01 Heat Sink is recommended. Refer to HS01 Technical Bulletin (#721-0549-00) or contact the factory for assistance.

Figure 5: Mounting Multiple Modules

**Specifications**

**Input:**

- Voltage:
  - Range Limits: 10mV to 100V
  - Impedance: >100K Ohms
  - Overvoltage:
    - 400 Vrms, max.(Intermittent);
    - 264 Vrms,max. (Continuous)
- Current:
  - Range Limits: 1mA to 100mA
  - Impedance: 20 Ohms, typical
  - Overcurrent: 170mA RMS, max.
  - Overvoltage: 60VDC
  - Zero Turn-Up: 50% of full scale input
  - Span Turn-Down: 50% of full scale input
  - Common Mode (Input to Gnd): 1800 VDC, max.

**Output (G408-0001):**

- Voltage:
  - Output: 0-5V, 0-10V
  - Source Impedance: <10 Ohms
  - Drive: 10mA, max.
- Current:
  - Output: 0-1mA,4-20mA,0-20mA
  - Source Impedance: >100K Ohms
  - Compliance:
    - 0-1mA: 7.5V, max (7.5K Ohms)
    - 4-20mA: 12V, max (600 Ohms)
    - 0-20mA: 12V, max (600 Ohms)

**Output (G408-1001):**

- Voltage:
  - Output: -5V to +5V, -10 to +10V
  - Source Impedance: <10 Ohms
  - Drive: 10mA, max.

**LED Indication (green):**

- Input Range
  - >110%(approx) input:8Hz flash
  - < -10%(approx) input: 4Hz flash

**Accuracy (Including Linearity, Hysteresis):**

- <2mA/<20mV:± 0.35% of full scale, typical; 0.5%,max.
- >2mA/>20mV:± 0.1% of full scale, typical; 0.2%, max.

**Response Time (10-90%):**

200mSec., typical

**Stability (Temperature):**

±0.025% of full scale/°C,typical; ±0.05%/°C, max.

**Common Mode Rejection:**

DC to 60Hz: 100dB

**Isolation (Input to Output):**

1800VDC between input, output & power

**EMC Compliance (CE Mark):**

- Emissions: EN50081-1
- Immunity: EN50082-2
- Safety: EN50178

**Mean Time Between Failures:**

60K Hours

**Humidity (Non-Condensing):**

- Operating: 15 to 95% @ 45°C
- Soak: 90% for 24 hours @ 65°C

**Temperature Range:**

- Operating: 0 to 55°C (32 to 131°F)
- Storage: -25 to 70°C (-13 to 158°F)

**Wire Terminals:**

Screw terminals for 12-22AWG

**Power:**

- Consumption: 1.5W typical, 2.5W max.
- Range: 9 to 30VDC

**Weight:**

0.5 lbs.

**Agency Approvals:**

- CSA certified per standard C22.2, No. 0-M91 and 142-M1987 (File No. LR42272).
- UL recognized per standard UL508 (File No.E99775).
- CE Conformance per EMC directive 89/336/EEC and Low Voltage 73/23/EEC (Input < 75VDC, only).
- RoHS Compliant

**Ordering Information**

**Models & Accessories**

**Specify:**

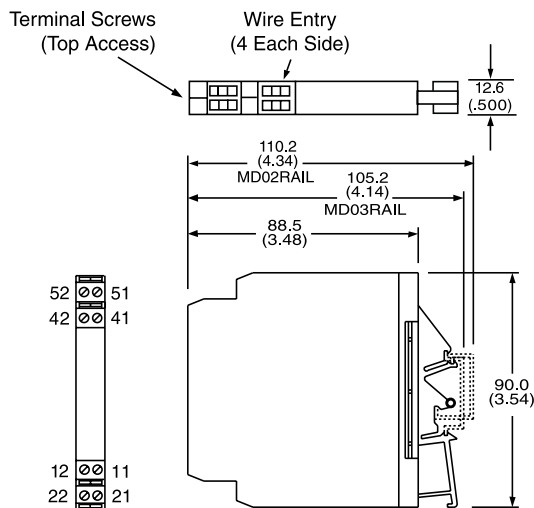
1. Model: **G408-0001** (standard outputs) or **G408-1001** (bipolar outputs)
2. Accessories: (see Accessories)
3. Optional Custom Factory Calibration; specify **C620** with desired input and output range.

**Accessories**

SlimPak "G" series modules will mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail and include model HS01 heat sink. In addition, the following accessories are available:

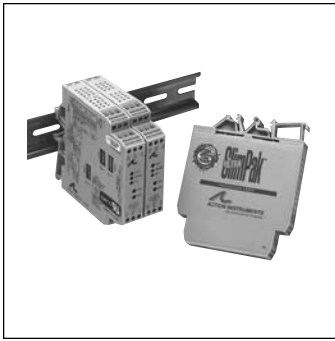
- MD03** TS35x7.5 DIN rail
- WV905** 24VDC Power Supply (0.5 Amp)
- H910** 24VDC Power Supply (1 Amp)
- H915** 24VDC Power Supply (2.3 Amp)
- MB03** End Bracket for MD03
- C664** I/O Descriptive Tags
- C006** 0.1 Ohm, 5W, 1% shunt resistor

**Dimensions**



Dimensions are in mm (inches)

*Note that detailed installation instructions are available on our web site.*



G418-0001

# ULTRA SLIMPAK® G418-0001 RTD Input Field Configurable Isolator

Provides an Isolated, Linearized DC Output  
in Proportion to an RTD Input



- Field Configurable Input Ranges for Platinum and Copper RTDs
- Eliminates Ground Loops
- Field Configurable Output Ranges: 0-5V, 0-10V, 0-1mA, 0-20mA and 4-20mA
- Ultra Slim Housing for High Density Installations
- Flexible Power Supply Accepts 9 to 30 VDC
- ASiC Technology for Enhanced Reliability
- RoHS Compliant

### Description

The Ultra SlimPak G418 is a DIN rail mount, RTD input signal conditioner with 1800VDC isolation between input, output and power. The field configurable input and output offers flexible, wide ranging capability for Platinum and Copper RTDs.

The G418 can be configured for any one of up to 16 temperature ranges (see Tables 1 & 2). The output is linear to the RTD temperature input and can be set for either 0-5V, 0-10V, 0-1mA, 0-20mA or 4-20mA.

Wide ranging, precision zero and span pots allow 50% adjustability of offset and span turn-down within each of the switch selectable ranges. For example, the 0-500°F range could be offset and turned down to provide a 4-20mA signal representing 0-250°F (or 250-500°F).

### Application

Three way isolation in the G418 completely eliminates ground loops from any source. Isolation protects expensive SCADA systems from ground faults and significantly reduces the effect of high common mode voltages which are prevalent in many RTD applications.

The constant current RTD excitation circuitry uses the third lead of the RTD to sense and compensate for the RTD lead resistance, resulting in an accurate RTD temperature measurement.

High density DIN rail mounting offers an extremely compact solution for saving valuable panel space.

### Diagnostic LED

The G418 is equipped with a dual function LED signal monitor. The green, front mounted LED indicates both DC power and input signal status. Active DC power is indicated by an illuminated LED. If the input signal is more than 110% of the full scale range, the LED will flash at 1Hz. Below -10%, the flash rate is 0.5Hz. If the LED flashes very fast, then the RTD input wires are open circuit. An 8Hz flash indicates that RTD (+) input (terminal 41) is open circuit, or a 4Hz flash indicates that either RTD (-) or RTD Return (terminal 42 or 43) are open. The CAL LED is on under normal operating conditions. If the CAL LED is off when the unit is powered, consult the factory for assistance.

### Configuration

The G418 has 16 input temperature range settings, six RTD type settings and five output range settings. Trim potentiometers allow 50% input zero and span adjustability within each of the 16 full scale input ranges.

Unless otherwise specified, the factory presets the Model G418 as follows:

Input: Pt100 Ohm  
 Range: -200 to 600°C  
 Output: 4-20mA

The DC power input accepts any DC source between 9 and 30V; typically a 12V or 24VDC source is used (see Accessories).

### Calibration

1. After configuring the dip switches, connect the input to a calibrated RTD source or decade resistance box. Connect the output to the device load (or a load approximately equivalent to the device load) and apply power.

*Note: To maximize thermal stability, final calibration should be performed in the operating installation, allowing approximately 1 to 2 hours for warm-up and thermal equilibrium of the system.*

2. Set the calibrator to the desired minimum temperature and adjust the zero potentiometer for the desired minimum output.

3. Set the calibrator to the desired maximum temperature and adjust the span potentiometer for the desired maximum output.

4. Repeat steps 2 and 3, as necessary for best accuracy.

Ultra Slimpak®

Table 1: G418 Platinum RTD Ranges

Pt100, Pt500 & Pt1000		Range
Celsius	Fahrenheit	
-200 to 600° C	-328 to 1112° F	1
-200 to 400° C	-328 to 752° F	2
-100 to 400° C	-148 to 752° F	3
-200 to 260° C	-328 to 500° F	4
-200 to 0° C	-328 to 32° F	5
-200 to -100° C	-328 to -148° F	6
-100 to 260° C	-148 to 500° F	7
-100 to 100° C	-148 to 212° F	8
-50 to 50° C	-58 to 122° F	9
-18 to 50° C	0 to 122° F	10
-18 to 100° C	0 to 212° F	11
-18 to 260° C	0 to 500° F	12
-18 to 300° C	0 to 572° F	13
-18 to 400° C	0 to 752° F	14
-18 to 500° C	0 to 932° F	15
-18 to 600° C	0 to 1112° F	16

Table 3: RTD Range Settings

Range	SW2				
	1	2	3	4	5
1		■	■	■	■
2		■	■	■	
3		■	■		■
4		■	■		
5		■		■	■
6		■		■	
7		■			■
8		■			
9			■	■	■
10			■	■	
11			■		■
12			■		
13				■	■
14				■	
15					■
16					

Key: ■ = 1 = ON or Closed

(SW2-1 is undefined)

Table 5: G418 Excitation Type

Excitation Type	SW3							
	1	2	3	4	5	6	7	8
Pt100, Cu100	■							
Pt500		■						
Pt1000			■					
Cu10				■		■		
Cu25					■		■	

Key: ■ = 1 = ON or Closed

(SW3-8 is undefined)

Table 2: G418 Copper RTD Ranges

Cu10, Cu25 & Cu100		Range
Celsius	Fahrenheit	
-200 to 260° C	-328 to 500° F	4
-200 to 0° C	-328 to 32° F	5
-200 to -100° C	-328 to -148° F	6
-100 to 260° C	-148 to 500° F	7
-100 to 100° C	-148 to 212° F	8
-50 to 50° C	-58 to 122° F	9
-18 to 50° C	0 to 122° F	10
-18 to 100° C	0 to 212° F	11
-18 to 260° C	0 to 500° F	12

Table 4: G418 RTD Input Type

RTD Type	SW2		
	6	7	8
Pt100	■	■	■
Pt500	■	■	
Pt1000	■		■
Cu10	■		
Cu25		■	■
Cu100		■	

Key: ■ = 1 = ON or Closed

Table 6: G418 Output Settings

Output	SW1							
	1	2	3	4	5	6	7	8
0 to 5V	■	■	■	■				
0 to 10V	■		■	■				
0 to 1mA		■	■	■				
4 to 20mA						■	■	■
0 to 20mA	■	■			■		■	■

Key: ■ = 1 = ON or Closed

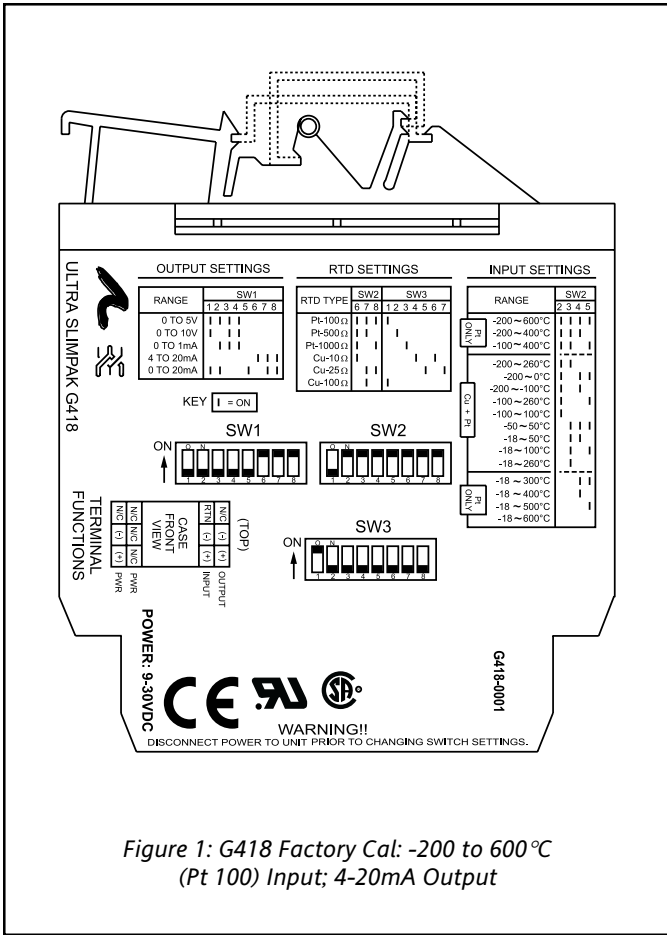


Figure 1: G418 Factory Cal: -200 to 600°C (Pt 100) Input; 4-20mA Output

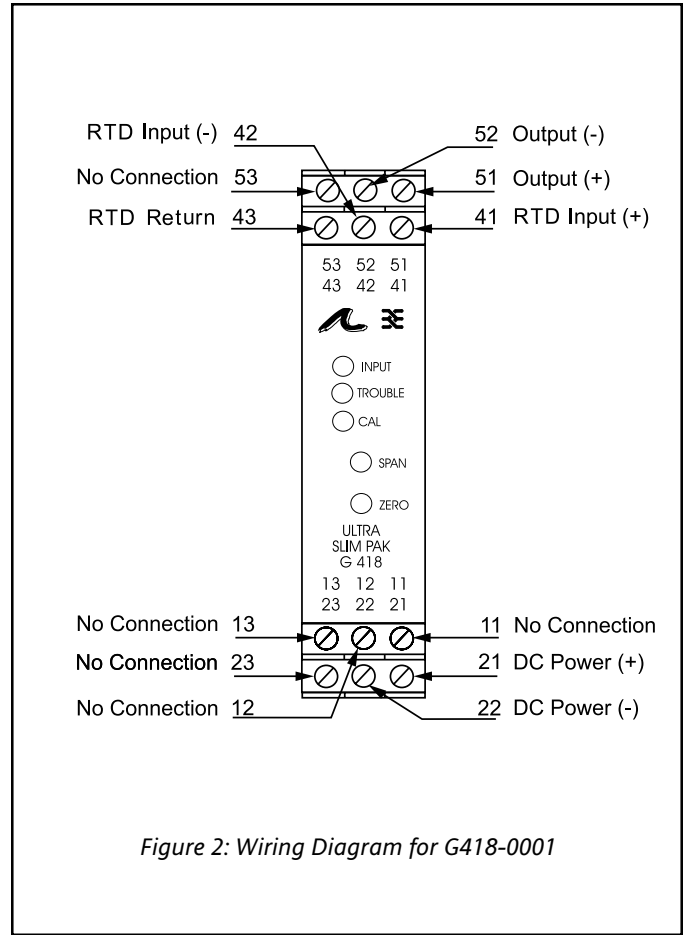


Figure 2: Wiring Diagram for G418-0001

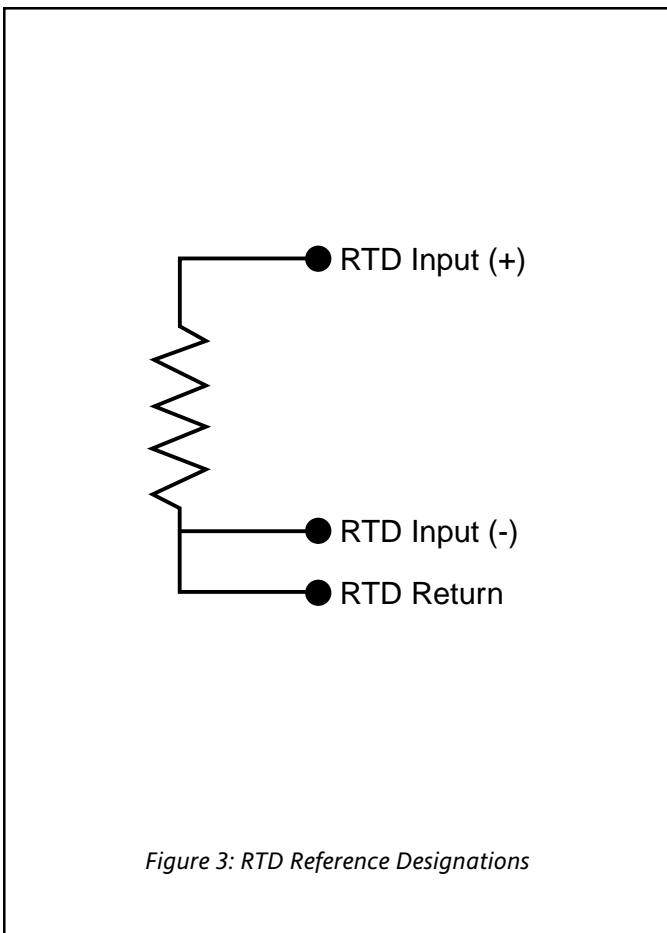
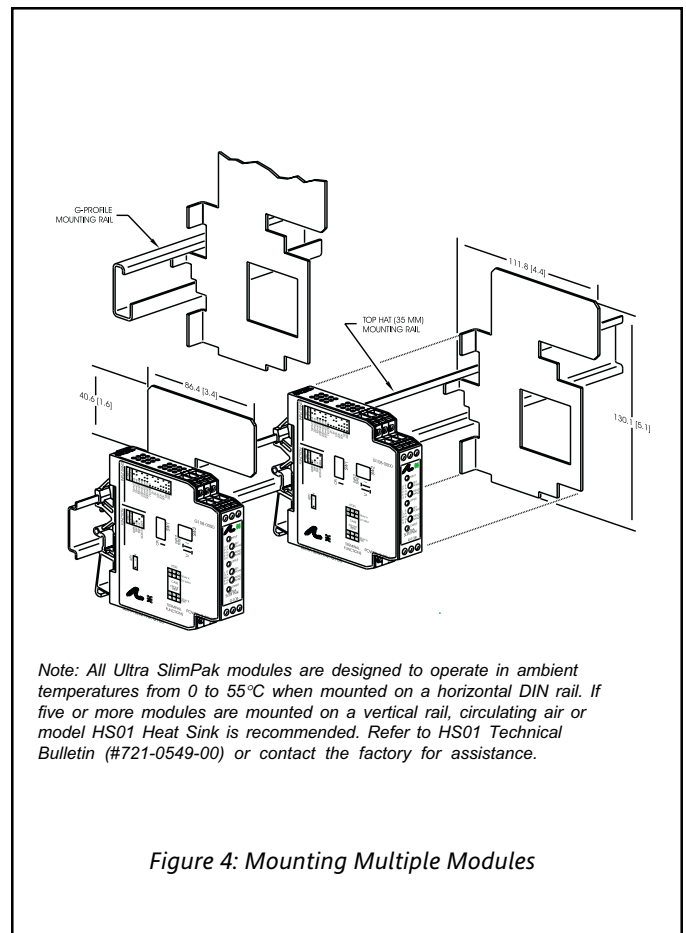


Figure 3: RTD Reference Designations



Note: All Ultra SlimPak modules are designed to operate in ambient temperatures from 0 to 55°C when mounted on a horizontal DIN rail. If five or more modules are mounted on a vertical rail, circulating air or model HS01 Heat Sink is recommended. Refer to HS01 Technical Bulletin (#721-0549-00) or contact the factory for assistance.

Figure 4: Mounting Multiple Modules

## Specifications

### Input:

Sensor Types:

Pt100, Pt500, Pt1000  
(alpha: 0.00385Ohms/Ohm/°C or  
0.00392Ohms/Ohm/°C); Cu10, Cu25, Cu100.

Sensor Connection:

3-wire

Input Ranges: see table 1.

Common Mode (Input to Gnd): 1800VDC, max.

Zero Turn-Up:

50% of full scale range

Span Turn-Down:

50% of full scale range

### Excitation Current:

<2mA for Pt100, Pt500, Pt1000;  
<5mA for Cu100;<10mA for Cu10, Cu25.

### Leadwire Resistance:

40% of base sensor resistance or 100 Ohms  
(whichever is less), max per lead.

### Leadwire Effect:

Less than 1% of the max. input  
temperature span

### Output:

Voltage:

Output: 0-5V, 0-10V

Source Impedance: <10 Ohms

Drive: 10mA, max. (1K Ohms, min @10V)

Current:

Output: 0-1mA, 0-20mA, 4-20mA

Source Impedance: >100K Ohms

Compliance:

0-1mA; 7.5V, max.(7.5K Ohms)

0-20mA; 12V, max.(600 Ohms)

4-20mA; 12V, max.(600 Ohms)

### LED Diagnostics:

Solid Green:

power on

Flashing Green:

0.5Hz input under range (<-10%)

1.0Hz input over range (110%)

4Hz input open circuit (terminal 41)

8Hz input open circuit (terminal 42 or 43)

Yellow ON = CAL OK

### Accuracy (Including Linearity, Hysteresis):

±0.1% typical, ±0.2% max. of the  
maximum input temperature range  
configurable for the RTD type; @ 25°C  
ambient and 0 Ohms lead resistance.

### Stability:

±0.015% of the max. input temperature  
range for the RTD type per °C change  
in ambient temperature, max.

### Response Time (10 to 90%):

200mSec., typical.

### Common Mode Rejection:

DC to 60Hz: 120dB

### Isolation:

1800VDC between input, output & power.

### ESD Susceptibility:

Meets IEC801-2, Level 2 (4kV)

### Humidity (Non-Condensing):

Operating: 15 to 95% @ 45°C

Soak: 90% for 24 hours @ 65°C

### Temperature Range:

Operating: 0 to 55°C (32 to 131°F)

Storage: -25 to 70°C (-13 to 158°F)

### Wire Terminations:

Screw terminals for 12-22 AWG

### Power:

Consumption: 1.5W typical, 2.5 W Max.

Range: 9-30VDC

### Weight:

0.54 lbs

### Agency Approvals:

CSA certified per standard C22.2, No. 0-M91  
and 142-M1987 (File No. LR42272)

UL recognized per standard UL508

(File No.E99775)

CE Conformance per EMC directive 89/336/EEC  
and low voltage 73/23/EEC.

RoHS Compliant

## Ordering Information

### Models & Accessories

#### Specify:

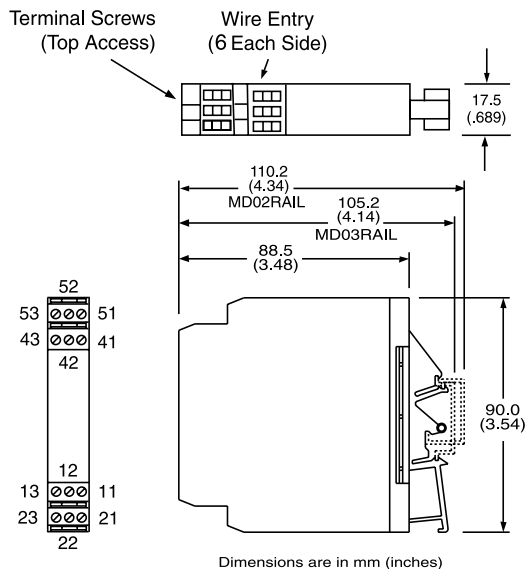
1. Model: **G418-0001**
2. Accessories: (see Accessories)
3. Optional Custom Factory Calibration; specify **C620** with desired input and output range.

### Accessories

SlimPak "G" series modules will mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition, the following accessories are available:

<b>HS01</b>	Heat Sink
<b>MD03</b>	TS35 x 7.5 DIN rail
<b>WV905</b>	24VDC Power Supply (0.5A)
<b>H910</b>	24VDC Power Supply (1A)
<b>H915</b>	24VDC Power Supply (2.3A)
<b>MB03</b>	End Bracket for MD03
<b>C664</b>	I/O Descriptive Tags

## Dimensions



Note that detailed installation instructions are available on our web site.



G428-0001



# ULTRA SLIMPAK® G428-0001

## T/C Input Field Configurable Isolator

Provides an Isolated, Linearized DC Output  
in Proportion to a Thermocouple Input



- Field Configurable Input Ranges for J, K, T, R, S, E, and B Type Thermocouples
- Eliminates Ground Loops
- Field Configurable Output Ranges: 0-5V, 0-10V, 0-1mA, 0-20mA and 4-20mA
- Ultra Slim Housing for High Density Installations
- Flexible Power Supply Accepts 9 to 30 VDC
- ASIC Technology for Enhanced Reliability
- RoHS Compliant

### Description

The G428 is a DIN rail mount, thermocouple input signal conditioner with 1800VDC isolation between input, output and power. The field configurable input and output offer flexible, wide ranging capability for J, K, T, R, S, E and B type thermocouples.

The G428 input can be configured for over 60 thermocouple temperature ranges (see Table 6). The output is linear to temperature and can be set for either 0-5V, 0-10V, 0-1mA, 0-20mA or 4-20mA.

Wide ranging, precision zero and span pots allow 50% adjustability of offset and span turn-down within each of the ranges. For example, the 0-1000°C range could be offset and turned down to provide a 4-20mA signal representing 500-1000°C. Similarly, adjustment can be referenced to the output range. The example above could be used to provide a 12-20mA signal from a 750 to 1000°C temperature input.

### Application

Three way isolation in the G428 completely eliminates ground loops from any source. Isolation protects expensive SCADA systems from ground faults and allows the noise reduction benefits of grounded thermocouples to be realized.

The G428 is equipped with cold junction compensation (CJC) circuitry to provide ice-point reference. Upscale or downscale thermocouple burnout detection is switch selectable.

High density DIN rail mounting offers an extremely compact solution to save valuable panel space.

### Diagnostic LEDs

The G428 is equipped with front panel LEDs for INPUT (green), TROUBLE (yellow) and CAL OK (yellow). At start-up, both the INPUT and the CAL OK LEDs flash alternately for 10 seconds.

### INPUT

This green LED is lit continuously when the input is within the specified range. In the full temperature range setting, for the overrange condition the LED flashes at 8Hz; for the under range condition it flashes at 4Hz. In a sub-range temperature setting, for the overrange condition the LED flashes at 1Hz; for the under range condition it flashes at 0.5Hz.

### CAL OK

This yellow LED is continuously on when the device is calibrated.

### TROUBLE

This yellow LED is off during the normal operation. Consult factory if this LED is on, indicating a microprocessor malfunction.

### Configuration

The G428 offers 50% input zero and span adjustability within each of the fullscale input ranges. Unless otherwise specified, the factory presets the Model G428 as follows:

Input: J-type  
Range: 0 to 500°C  
Output: 4 to 20mA  
Burn Out: Upscale

The DC power input accepts any DC source between 9 and 30V; typically a 12V or 24VDC source is used (see Accessories).

For other I/O ranges, refer to Tables 1 through 6 and reconfigure switches SW1 and SW2 for the desired input type range and output.

**WARNING:** Do not change switch settings with power applied. Severe damage will result!

1. Choose the desired temperature range from Table 6, then use Table 1 and 2 to configure the switches (as described in the following steps) for thermocouple type and range.
2. With DC power off, position input switches 1 and 2 of SW2 for the desired burnout detection mode.
3. Set positions 4 through 10 of SW2 for the desired thermocouple range and type.
4. Set positions 1 through 8 of SW1 for the desired output signal. (Table 4)

Calibration

1. After configuring the dip switches, connect the input to a calibrated thermocouple source. Connect the output to the device (or a load approximately equivalent to the device) and apply power.

**Note:** To maximize thermal stability, final calibration should be performed in the operation installation, allowing approximately 1 to 2 hours for warm up and thermal equilibrium of the system.

2. Set the calibrator to the desired minimum input and adjust the zero potentiometer for the desired minimum output.

3. Set the calibrator to the desired maximum input and adjust the span potentiometer for the desired maximum output.

4. Repeat steps 2 and 3, if necessary for best accuracy.

Table 5:  
G428 Thermocouple Accuracy

TC Type	Temperature Range	Accuracy
J	-200 to 750° C (-328 to 1382° F)	+/-2.0° C (+/-3.6° F)
K	-200 to 140° C (-328 to -220° F)	+/-5.0° C (+/-9.0° F)
K	-140 to 1250° C (-220 to 2282° F)	+/-2.0° C (+/-3.6° F)
K	1250 to 1370° C (2282 to 2498° F)	+/-4.0° C (+/-7.2° F)
E	-150 to 1000° C (-238 to 1832° F)	+/-2.5° C (+/-4.5° F)
T	-150 to 400° C (-238 to 752° F)	+/-3.0° C (+/-5.4° F)
R	50 to 1760° C (122 to 3200° F)	+/-6.0° C (+/-10.8° F)
S	50 to 1760° C (122 to 3200° F)	+/-6.0° C (+/-10.8° F)
B	500 to 1820° C (932 to 3308° F)	+/-5.0° C (+/-9.0° F)

Table 1:  
G428 T/C Types

Type	SW2		
	8	9	10
B	■	■	■
E	■	■	
J	■		■
K	■		
R		■	■
S		■	
T			■

Key: ■ = 1 = ON or Closed

Table 2:  
G428 Range Settings

Range	SW2			
	4	5	6	7
1	■		■	
2	■	■	■	
3			■	■
4	■	■		
5	■		■	■
6	■	■	■	■
7	■			
8	■			
9		■	■	■
10			■	■
11				■
12		■		
13			■	■
14	■	■	■	
15				■
16				

Key: ■ = 1 = ON or Closed

Table 6: G428 Thermocouple Range Settings

TC Type	Range	Temperature Range	
B	6	500 to 1820° C (932 to 3308° F)	
	7	1000 to 1820° C (1832 to 3308° F)	
	8	500 to 1000° C (932 to 1832° F)	
	11	500 to 1820° C (932 to 3308° F)	
	12	750 to 1000° C (1382 to 1832° F)	
E	2	-18 to 1000° C (0 to 1832° F)	
	3	-18 to 500° C (0 to 932° F)	
	4	-18 to 250° C (0 to 482° F)	
	5	-18 to 125° C (0 to 257° F)	
	8	500 to 1000° C (932 to 1832° F)	
	9	250 to 500° C (482 to 932° F)	
	10	125 to 250° C (257 to 482° F)	
	12	750 to 1000° C (1382 to 1832° F)	
	13	375 to 500° C (707 to 932° F)	
	14	-150 to 750° C (-238 to 1382° F)	
	15	-150 to 250° C (-238 to 482° F)	
	16	-150 to 0° C (-238 to 32° F)	
	J	2	-18 to 750° C (0 to 1382° F)
		3	-18 to 500° C (0 to 932° F)
		4	-18 to 250° C (0 to 482° F)
		5	-18 to 125° C (0 to 257° F)
8		500 to 750° C (932 to 1382° F)	
9		250 to 500° C (482 to 932° F)	
10		125 to 250° C (257 to 482° F)	
13		375 to 500° C (707 to 932° F)	
14		-200 to 750° C (-328 to 1382° F)	
15		-200 to 250° C (-328 to 482° F)	
16		-200 to 0° C (-328 to 32° F)	

TC Type	Range	Temperature Range	
K	1	-18 to 1370° C (0 to 2498° F)	
	2	-18 to 1000° C (0 to 1832° F)	
	3	-18 to 500° C (0 to 932° F)	
	4	-18 to 250° C (0 to 482° F)	
	5	-18 to 125° C (0 to 257° F)	
	7	1000 to 1370° C (1832 to 2498° F)	
	8	500 to 1000° C (932 to 1832° F)	
	9	250 to 500° C (482 to 932° F)	
	10	125 to 250° C (257 to 482° F)	
	12	750 to 1000° C (1382 to 1832° F)	
	13	375 to 500° C (707 to 932° F)	
	14	-200 to 750° C (-328 to 1382° F)	
	15	-200 to 250° C (-328 to 482° F)	
	16	-200 to 0° C (-328 to 32° F)	
	R, S	1	50 to 1760° C (122 to 3200° F)
		2	50 to 1000° C (122 to 1832° F)
3		50 to 500° C (122 to 932° F)	
4		50 to 250° C (122 to 482° F)	
7		1000 to 1760° C (1832 to 3200° F)	
8		500 to 1000° C (932 to 1832° F)	
9		250 to 500° C (482 to 932° F)	
10		125 to 250° C (257 to 482° F)	
12		750 to 1000° C (1382 to 1832° F)	
13		375 to 500° C (707 to 932° F)	
T		3	-18 to 400° C (0 to 752° F)
		4	-18 to 250° C (0 to 482° F)
		5	-18 to 125° C (0 to 257° F)
	9	250 to 40° C (482 to 752° F)	
	10	125 to 250° C (257 to 482° F)	
	13	375 to 400° C (707 to 752° F)	
	14	-150 to 400° C (-238 to 752° F)	
	15	-150 to 250° C (-238 to 482° F)	
16	-150 to 0° C (-238 to 32° F)		

Table 3:  
G428 Burnout Settings

Burnout	SW2	
	1	2
Not Allowed	■	■
Upscale	■	
Downscale		■
None		

Key: ■ = 1 = ON or Closed

Table 4:  
G428 Output Settings

Output	SW1							
	1	2	3	4	5	6	7	8
0 to 5V	■	■	■	■				
0 to 10V	■		■	■				
0 to 1mA		■	■	■				
4 to 20mA						■	■	■
0 to 20mA	■	■					■	■

Key: ■ = 1 = ON or Closed



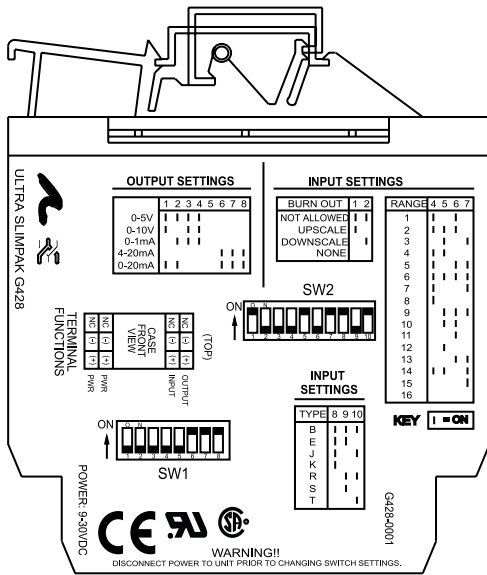


Figure 1: G428 Factory Cal: J-Type, 0-500°C, 4-20mA, Upscale

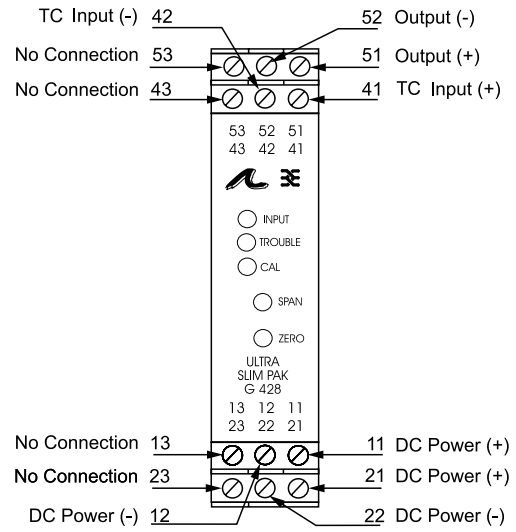


Figure 2: Wiring Diagram for G428

Note: All Ultra SlimPak modules are designed to operate in ambient temperatures from 0 to 55°C when mounted on a horizontal DIN rail. If five or more modules are mounted on a vertical rail, circulating air or model HS01 Heat Sink is recommended. Refer to HS01 Technical Bulletin (#721-0549-00) or contact the factory for assistance.

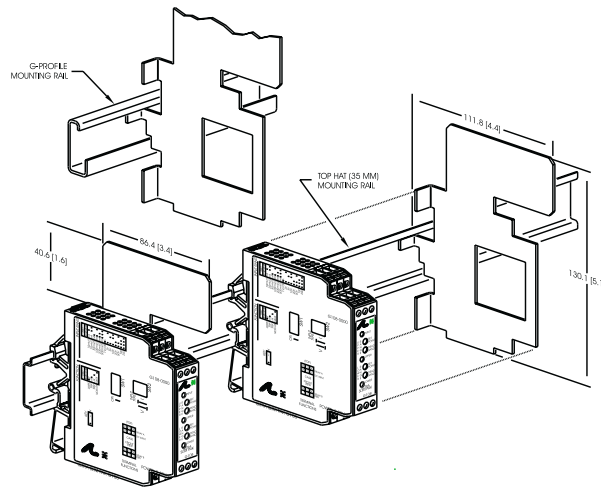


Figure 3: Mounting Multiple Modules

**Specifications**

**Inputs:**

Sensor Types: J, K, T, R, S, E, B  
 Input Ranges: See Table 6.  
 Impedance: >1M Ohms  
 Bias Current (burnout detection): <1.5microamp  
 Overvoltage: ±10V differential  
 Common Mode (Input to Gnd): 1800VDC, max.

**Zero and Span Adjustability:**

50% of any selected range

**Output:**

**Voltage**  
 Output: 0-5V, 0-10V  
 Source Impedance: <10 Ohms  
 Drive: 10mA, max.

**Current**  
 Output: 0-1mA, 0-20mA, 4-20mA  
 Source Impedance: >100K Ohms  
 Compliance:  
 0-1mA; 7.5V, max.(7.5K Ohms)  
 0-20mA; 12V, max.(600 Ohms)  
 4-20mA; 12V, max.(600 Ohms)

**Accuracy (Including Linearity, Hysteresis):**  
 see Table 5

**Stability:**

±0.04% of the maximum full scale range per °C change in ambient temperature, maximum.

**Response Time (10 to 90%):**

500mSec., typical.

**Common Mode Rejection:**

DC to 60Hz: 120dB

**Isolation:**

1800VDC between input, output & power.

**EMC Compliance (CE Mark):**

Emissions: EN50081-1  
 Immunity: EN50082-2  
 Safety: EN50178

**LED Indication:**

INPUT (Green):  
 continuously on if input is within selected range, flashes otherwise

TROUBLE (Yellow):  
 off during normal device operation.

CAL OK (Yellow):  
 continuously on in normal device operation

**Thermocouple Burnout Detect:**

Field configurable upscale, downscale, or disabled

**Humidity (Non-Condensing):**

Operating: 15 to 95% @ 45°C  
 Soak: 90% for 24 hours @ 65°C

**Temperature Range:**

Operating: 0 to 55°C (32 to 131°F)  
 Storage: -25 to 70°C (-13 to 158°F)

**Power:**

Consumption: 1.5W typical, 2.5W max.  
 Range: 9 to 30VDC

**Terminations and Wire:**

Screw terminals for 12-22 AWG. Use twisted pair for output and power connections.

**Weight:**

0.54 lbs

**Agency Approvals:**

CSA certified per standard C22.2, No. 0-M91 and 142-M1987 (File No. LR42272)  
 UL recognized per standard UL508 (File No.E99775)  
 CE Conformance per EMC directive 89/336/EEC and Low Voltage 73/23/EEC  
 RoHS Compliant

Ultra Slimpak®

**Ordering Information Models & Accessories**

**Specify:**

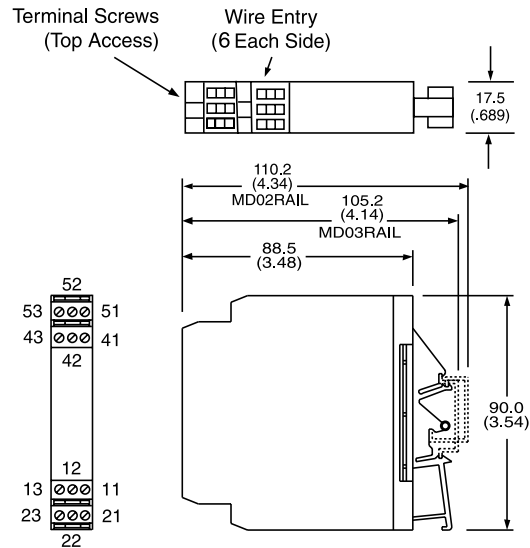
1. Model: **G428-0001**
2. Accessories: (see Accessories)
3. Optional Custom Factory Calibration; specify **C620** with desired input and output range.

**Accessories**

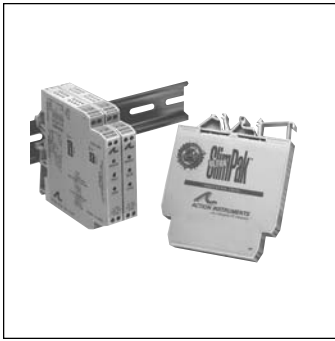
All SlimPak "G" series modules will mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition, the following accessories are available:

- HS01** Heat Sink
- MD03** TS35 x 7.5 DIN rail
- WV905** 24VDC Power Supply (0.5A)
- H910** 24VDC Power Supply (1A)
- H915** 24VDC Power Supply (2.3A)
- MB03** End Bracket for MD03
- C664** I/O Descriptive Tag

**Dimensions**



*Note that detailed installation instructions are available on our web site.*



G438-0001

# ULTRA SLIMPAK® G438-0001

## Potentiometer Input Field Configurable Isolator

Provides an Isolated, Linearized DC Output  
in Proportion to a Potentiometer Input



- Potentiometers from 100 Ohms to 100K Ohms
- Wide Ranging Zero & Span Adjustability
- Field Configurable Output Ranges: 0-5V, 0-10V, 0-1mA, 0-20mA and 4-20mA
- Ultra Slim Housing for High Density Installations
- Flexible Power Supply Accepts 9 to 30 VDC
- ASiC Technology for Enhanced Reliability
- RoHS Compliant

### Description

The G438 is a DIN rail mount, potentiometer input signal conditioner with 1800VDC isolation between input, output and power. The input provides a constant voltage and is designed to accept any three-wire potentiometer from 100 Ohms to 100K Ohms. The field configurable output is switch selectable providing either a 0-5V, 0-10V, 0-1mA, 0-20mA or 4-20mA DC signal.

Wide ranging precision zero and span pots used in conjunction with DIP switches allow 80% adjustability of offset and gain to transmit a fullscale output from any 20% portion of the potentiometer input.

### Application

The G438 is useful in transmitting process control setpoints to remote PID controllers or interfacing position sensors to data acquisition and control systems. The high density DIN rail mounting offers an extremely compact solution for saving valuable panel space.

In a valve positioning application a potentiometer is sometimes used as a feedback signal. Quite often a wide open valve is only a 25% turn of the feedback potentiometer. In a case such as this, the G438 can easily be adjusted with the zero and span to provide a fullscale output signal (e.g. 4-20mA) representing 0-25% or even 50-75% of the potentiometer input.

### Configuration

Unless otherwise specified, the factory presets the Model G438 as follows:

Input Range: 0 to 100%  
Output: 4 to 20mA.

The DC power input accepts any DC source between 9 and 30V; typically a 12V or 24VDC source is used (see Accessories). For other output ranges, refer to Tables 1 and 2 to reconfigure switches SW1 and SW2 for the desired input and output ranges.

**WARNING:** Do not change switch settings with power applied. Severe damage will result!

Ultra Slimpak®

## Calibration

**Note:** To maximize thermal stability, final calibration should be performed in the operating installation, allowing approximately 1 to 2 hours for warm up and thermal equilibrium of the system.

1. With power disconnected, set the output and input switch selectors (SW1 and SW2) to the desired ranges (Tables 1 and 2).
2. Connect the input and output as shown in Figure 1. Connect the output to the device (or a load approximately equivalent to the device) and apply power.
3. Set the input potentiometer to the desired minimum and adjust the zero potentiometer for the desired minimum output.
4. Set the input potentiometer to the desired maximum and adjust the span potentiometer for the desired maximum output.
5. Repeat steps 3 and 4, if necessary, for best accuracy.

Table 1: G438 Input Ranges

Span	Selector SW2					
	1	2	3	4	5	6
20 - 100%						
45 - 100%	■					
85 - 100%		■				
Offset						
	1	2	3	4	5	6
0 - 20%						
20 - 45%				■		
45 - 65%			■			
65 - 80%			■	■		
Key: ■ = 1 = ON or Closed						

Table 2: G438 Output Ranges

Output	SW1							
	1	2	3	4	5	6	7	8
0 to +5V	■	■	■	■				
0 to +10V	■		■	■				
0 to 1mA		■	■	■				
4 to 20mA						■	■	■
0 to 20mA	■	■				■	■	■
Key: ■ = 1 = ON or Closed								

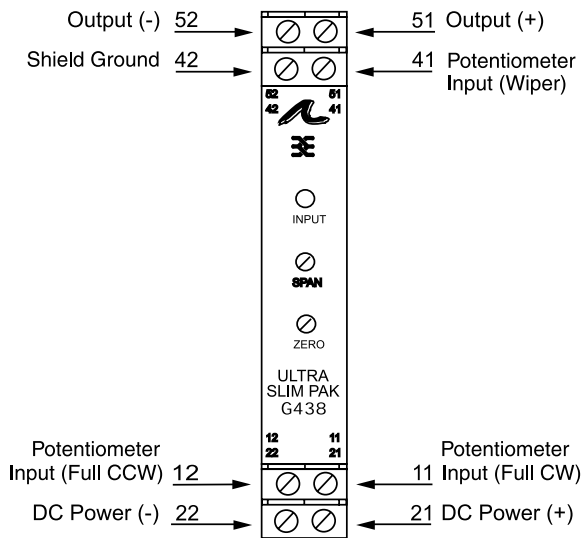


Figure 1: Wiring Diagram for G438

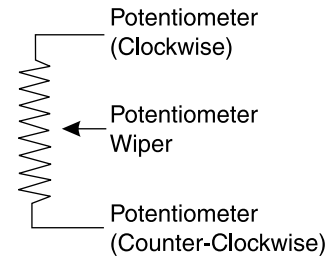


Figure 2: Potentiometer Wiring for G438

Note: All Ultra SlimPak modules are designed to operate in ambient temperatures from 0 to 55°C when mounted on a horizontal DIN rail. If five or more modules are mounted on a vertical rail, circulating air or model HS01 Heat Sink is recommended. Refer to HS01 Technical Bulletin (#721-0549-00) or contact the factory for assistance.

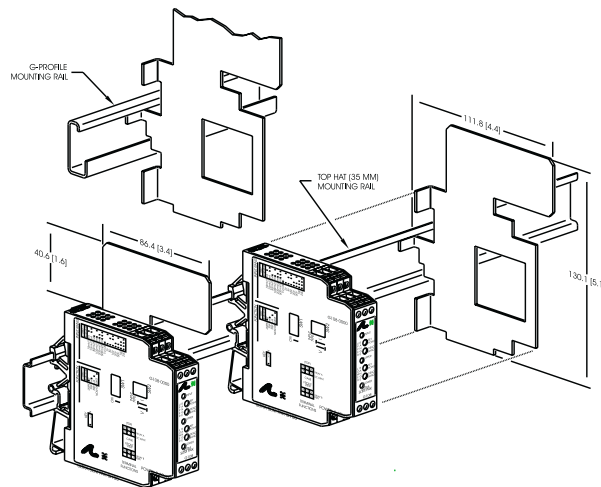


Figure 3: Mounting Multiple Modules

## Specifications

### Potentiometer Input:

- Resistance (End to End):
  - 100 Ohms up to 100K Ohms
- Input Impedance: >1M Ohms
- Input Excitation: 500mV, 5mA max. drive.
- Zero Turn-Up: 80% of full scale input
- Span Turn-Down: 80% of full scale input (Table 1)
- Common Mode Rejection:
  - 1800VDC (input to ground)

### Output:

- Voltage:
  - Output: 0-5V, 0-10V
  - Source Impedance: <10 Ohms
  - Drive: 10mA, max. (1K Ohms min. @ 10V)
- Current:
  - Output: 0-1mA, 0-20mA, 4-20mA
  - Source Impedance: >100K Ohms
  - Compliance:
    - 0-1mA; 7.5V, max. (7.5K Ohms, max.)
    - 0-20mA; 12V, max. (600 Ohms, max.)
    - 4-20mA; 12V, max. (600 Ohms, max.)

### Accuracy (Including Linearity, Hysteresis):

±0.1% maximum at 25°C.

### Stability:

Temperature: <±0.05%/°C max. of full scale range.

### Response Time (10 to 90%):

<200mSec., typical.

### Common Mode Rejection:

DC to 60Hz: 120dB

### Isolation:

1800VDC between line pwr & input, output

### EMC Compliance (CE Mark):

Emissions: EN50081-1  
Immunity: EN50082-2  
Safety: EN50178

### LED Indication (green):

Active DC power

### Humidity (Non-Condensing):

Operating: 15 to 95% @ 45°C  
Soak: 90% for 24 hours @ 65°C

### Temperature Range:

Operating: 0 to 55°C (32 to 131°F)  
Storage: -25 to 70°C (-13 to 158°F)

### Mounting:

Horizontal DIN rail mounting is recommended.  
Vertical DIN rail mounting requires heatsink (model HS01, included) and circulating air is recommended.

### Power:

Consumption: 1.5W typical, 2.5W max  
Range: 9 to 30VDC

### Weight:

0.48 lbs

### Agency Approvals:

CSA certified per standard C22.2, No. 0-M91 and 142-M1987 (File No. LR42272)  
UL recognized per standard UL508 (File No.E99775)  
CE Conformance per EMC directive 89/336/EEC and low voltage 73/23/EEC  
RoHS Compliant

## Ordering Information Models & Accessories

### Specify:

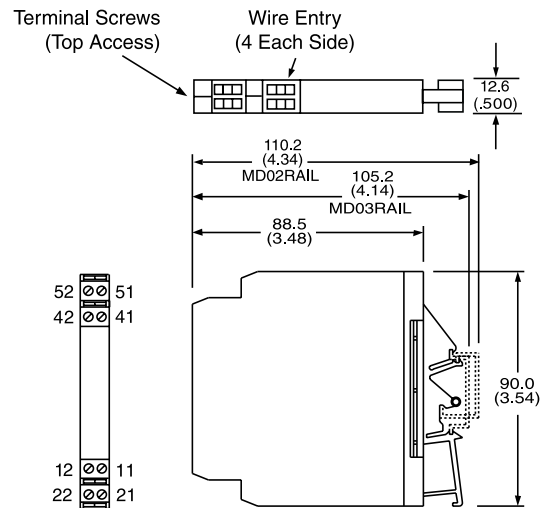
- Model: **G438-0001**
- Accessories: (see Accessories)
- Optional Custom Factory Calibration: specify **C620** with desired input and output range.

### Accessories

SlimPak "G" series modules will mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition, the following accessories are available:

- HS01** Heat Sink
- MD03** TS35 x 7.5 DIN rail
- WV905** 24VDC Power Supply (0.5 Amp)
- H910** 24VDC Power Supply (1 Amp)
- H915** 24VDC Power Supply (2.3 Amp)
- MB03** End Bracket for MD03
- C664** I/O Descriptive Tag

## Dimensions



Dimensions are in mm (inches)

Note that detailed installation instructions are available on our web site.



G448-0002

# ULTRA SLIMPAK® G448-0002

## Bridge Input Field Configurable Isolator

Provides an Isolated DC Output  
in Proportion to a Bridge/Strain Gauge Input



- Adjustable Excitation 1 to 10V with up to 120mA drive
- Field Configurable Inputs from 10mV to  $\pm 200\text{mV}$  (0.5mV/V to  $>50\text{mV/V}$ )
- Field Configurable Outputs: 0-5V, 0-10V, 0-1mA, 0-20mA and 4-20mA
- Ultra Slim Housing for High Density Installations
- Flexible Power Supply Accepts 9 to 30 VDC
- ASiC Technology for Enhanced Reliability
- RoHS Compliant

### Description

The G448 is a DIN rail mount, bridge or strain gauge input signal conditioner with 1800VDC isolation between input, output and power. The field configurable input and output offer flexible, wide ranging capability for bridge or strain gauge input applications from 0.5mV/V to over 50mV/V.

Wide ranging, precision zero and span pots allow 50% adjustability of offset and gain within each of the 11 switch selectable input ranges. The output can be set for either 0-5V, 0-10V, 0-1mA, 0-20mA or 4-20mA.

### Application

Three way isolation in the G448 completely eliminates ground loops from any source. Isolation protects expensive SCADA systems from ground faults and provides filtering for noise reduction which can be a significant problem with small, millivolt, bridge signals. Wide ranging flexibility allows the user to easily zero out dead-loads in weighing systems or configure bipolar input ranges for expansion-compression or vacuum-pressure bridge applications.

### Diagnostic LED

The G448 is equipped with a dual function LED signal monitor. The green, front mounted LED indicates both DC power and input signal status. Active DC power is indicated by an illuminated LED. If the input signal is more than 110% of the full scale range, the LED will flash at 8Hz. Below -10%, the flash rate is 4Hz.

### Configuration

The G448 has 11 input range switch settings. Trim potentiometers allow 50% input zero and span adjustability within each of the 11 full-scale, input ranges.

For example, the 200mV switch setting in Table 1 configures the input for a 0 to 200mV range. Since the span can be contracted by 50%, this enables an input span as narrow as 100mV of the range, or 50%. This span can be positioned anywhere within the 0-200mV range with a zero off-set as large as 50% of the full scale range (e.g. 100 to 200mV input).

Unless otherwise specified, the factory presets the Model G448 as follows:

- Input Setting: 0 to 50mV
- Input Range: 0 to 30mV (3mV/V)
- Excitation: 10V
- Operation: Direct
- Output: 4 to 20mA

The DC power input accepts any DC source between 18 and 30V, typically a 24VDC source is used (see Accessories).

For other I/O ranges refer to Tables 1 through 4 and reconfigure switches SW1 and SW2 for the desired input range, function, excitation and output range.

**WARNING:** Do not change switch settings with power applied. Severe damage will result!

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## Calibration

1. After configuring the DIP switches, connect the input to a calibrated millivolt source. Connect the output to the device (or a load equivalent to the device) and apply power. (see Wiring Diagram, Figure 2 or 3).

**Note:** To maximize thermal stability, final calibration should be performed in the operating installation, allowing approximately 1 to 2 hours for warm up and thermal equilibrium of the system.

2. Set the calibrator to the desired minimum and adjust the zero potentiometer for the desired minimum output.

3. Set the calibrator to the desired maximum and adjust the span potentiometer for the desired maximum output.

4. Repeat steps 2 and 3, if necessary for best accuracy.

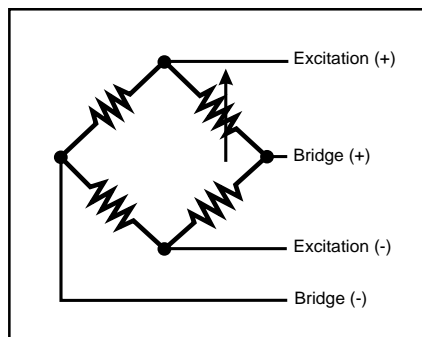


Table 1: G448 Input Ranges

Input Range	Selector SW1				
	1	2	3	4	5
0 to 10mV		■		■	■
0 to 20mV		■	■		■
0 to 50mV		■	■	■	■
0 to 100mV	■				■
0 to 200mV	■			■	■
-5 to 5mV		■			
-10 to 10mV		■		■	
-20 to 20mV		■	■		
-50 to 50mV		■	■	■	
-100 to 100mV	■				
-200 to 200mV	■			■	

Key: ■ = 1 = ON or Closed

Table 2: G448 Direct or Reverse Operation

Operation	SW1
Direct	
Reverse	■

Key: ■ = 1 = ON or Closed

Table 3: G448 Bridge Excitation Settings

Bridge Excitation	SW1	
	7	8
9.8 to 10.1V	■	
4.8 to 5.2V		
0 to 10V	■	■
0 to 2.5V		■

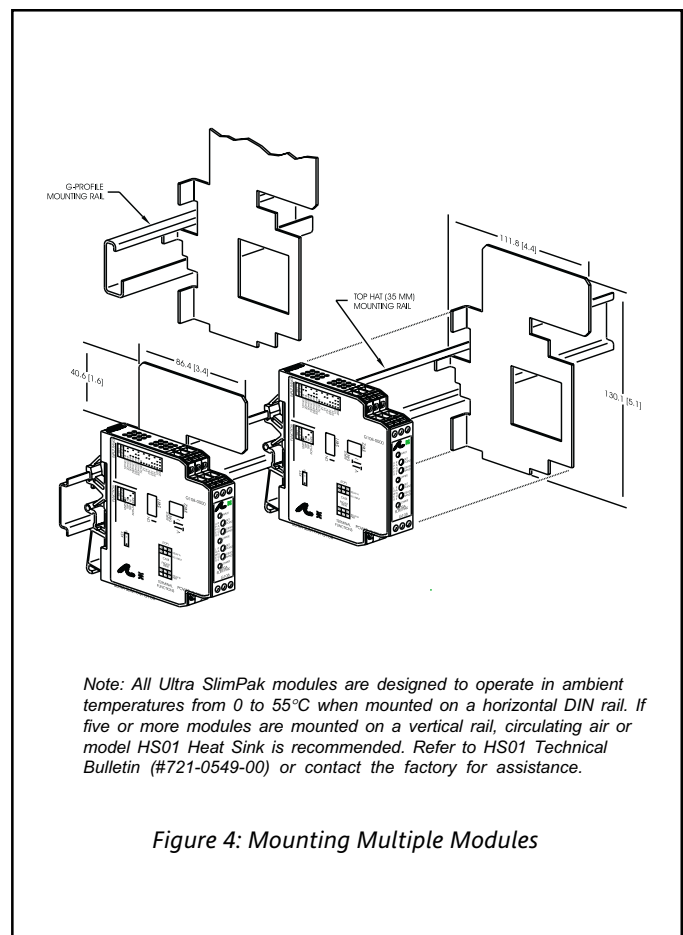
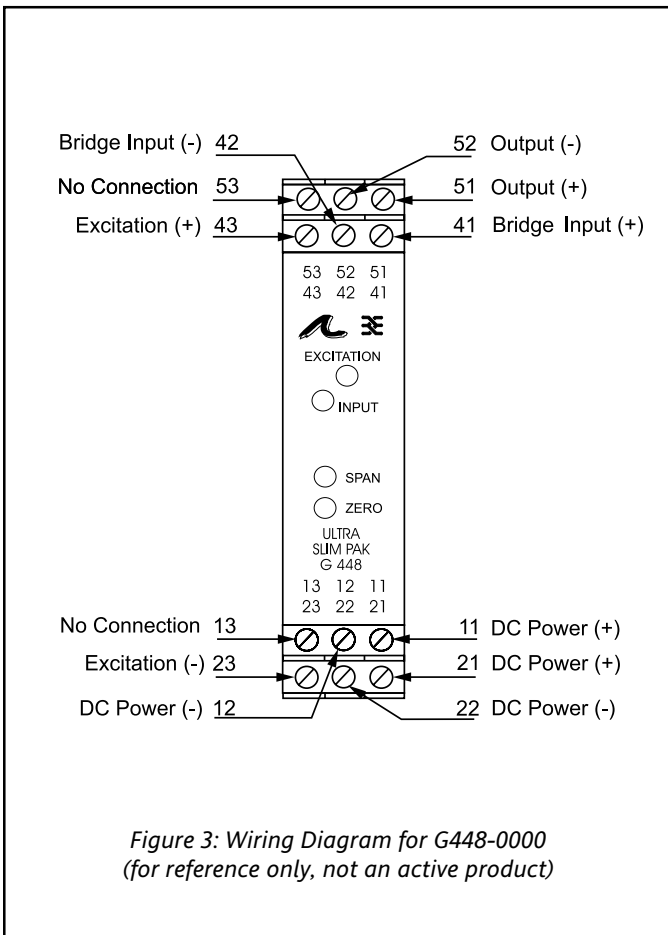
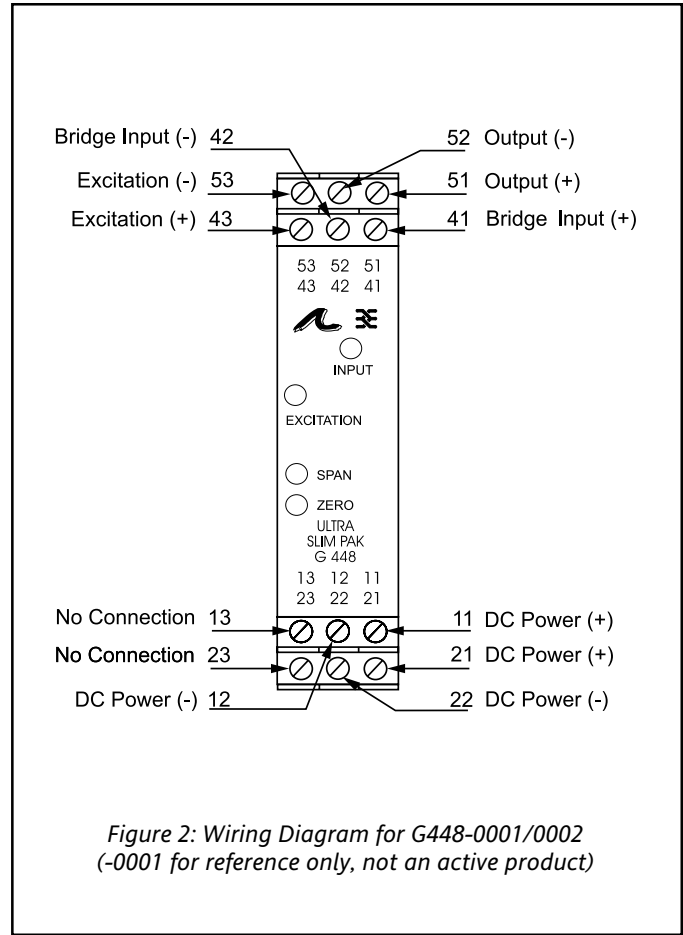
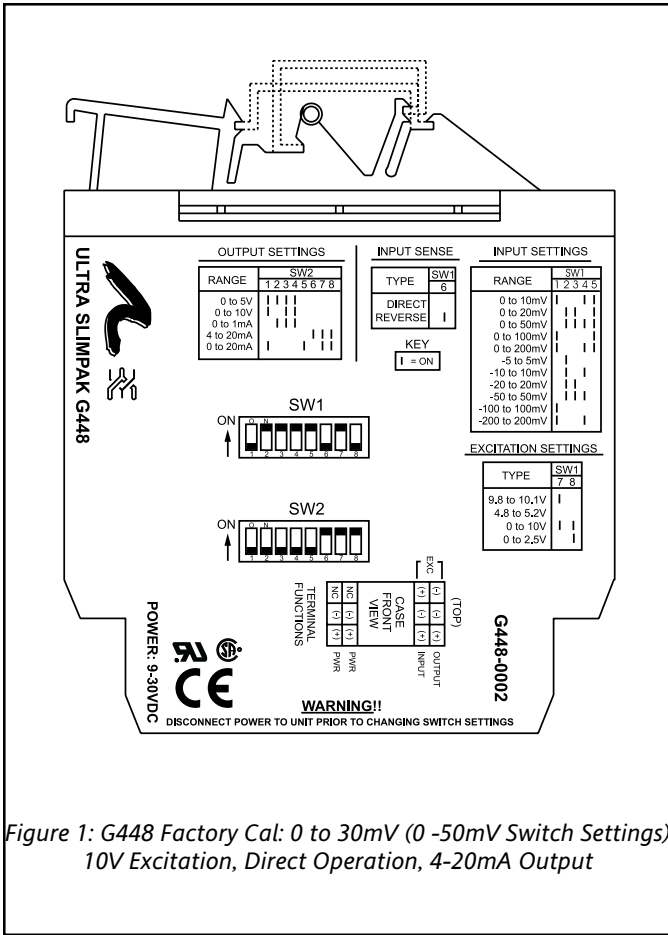
Key: ■ = 1 = ON or Closed

Table 4: G448 Output Settings

Output	SW2							
	1	2	3	4	5	6	7	8
0 to +5V	■	■	■	■				
0 to +10V	■		■	■				
0 to 1mA		■	■	■				
4 to 20mA						■	■	■
0 to 20mA	■	■			■		■	■

Key: ■ = 1 = ON or Closed





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**Specifications**

**Input:**

**Voltage:**

Full Scale Range: 10mV to ±200mV (Table 1).

Impedance: >1M Ohms

**Overvoltage:**

intermittent 400V, max.;  
continuous 264V, max.

**Common Mode (Input to Ground):**

1800VDC, max.

**Zero Turn-Up:**

50% of full scale range

**Span Turn-Down:**

50% of full scale range

**Operation:**

direct or reverse acting

**Output:**

**Voltage:**

Output: 0-5V, 0-10V

Impedance: <10 Ohms

Drive: 10mA, max. (1K Ohms, min. @ 10V)

**Current:**

Output: 0-1mA, 0-20mA, 4-20mA

Impedance: >100K Ohms

**Compliance:**

0-1mA; 7.5V, max.(7.5K Ohms, max.)

0-20mA; 12V, max. (600 Ohms, max.)

4-20mA; 12V, max. (600 Ohms, max.)

**Bridge Excitation:**

1 to 10VDC, 120mA max.

**Accuracy (Including Linearity, Hysteresis):**

±0.1% typical, ±0.2% maximum of selected input range at 25°C.

**Stability:**

±0.025%/°C typical, 0.05%/°C maximum, of selected full scale input range.

**Output Noise (maximum):**

0.1% of span, rms, or 10mV whichever is greater.

**Response Time (10 to 90%):**

<200mSec., typical.

**Common Mode Rejection:**

DC to 60Hz: ≈120dB, ≈100dB for 0-1mA range

**Isolation:**

1800VDC between input, output & power.

**EMC Compliance (CE Mark):**

Emissions: EN50081-1

Immunity: EN50082-2

Safety: EN50178

**LED Indication (green):**

Input Range (approx.)

>110% input: 8Hz flash

<0% input: 4Hz flash

**Humidity (Non-Condensing):**

Operating: 15 to 95% @ 45°C

Soak: 90% for 24 hours @ 65°C

**Temperature Range:**

Operating: 0 to 55°C (32 to 131°F)

Storage: -25 to 70°C (-13 to 158°F)

**Power:**

**Consumption:**

2.5W typical (one 350 Ohm bridge),  
4W max. (four 350 Ohm bridges).

Range: 18 to 30VDC

**Weight:**

0.54 lbs.

**Wire Terminations:**

Screw terminals for 12-22 AWG

**Agency Approvals:**

CSA certified per standard C22.2, No. 0-M91 and 142-M1987 (File No. LR42272).

UL recognized per standard UL508 (File No.E99775).

CE Conformance per EMC directive 89/336/EEC and low voltage 73/23/EEC.

RoHS Compliant

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**Ordering Information Models & Accessories**

**Specify:**

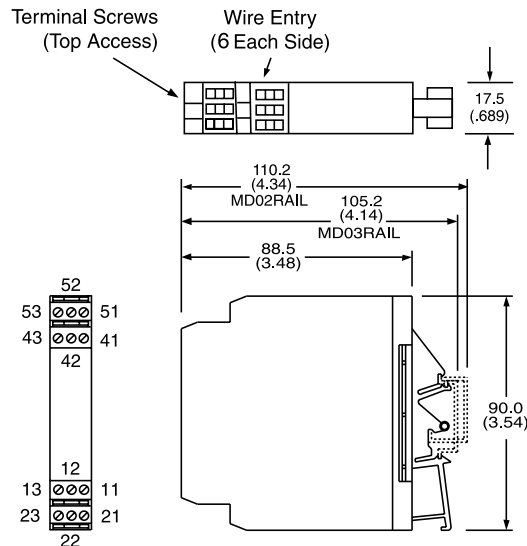
1. Model: **G448-0002**
2. Accessories: (see Accessories)
3. Optional Custom Factory Calibration; specify **C620** with desired input and output ranges.

**Accessories**

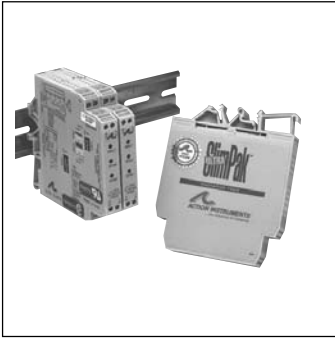
Slim Pak "G" series modules will mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition, the following accessories are available:

- HS01** Heat Sink
- MD03** TS35 x 7.5 DIN rail
- WV905** 24VDC Power Supply (0.5 Amp)
- H910** 24VDC Power Supply (1 Amp)
- H915** 24VDC Power Supply (2.3 Amp)
- MB03** End Bracket for MD03
- C664** I/O Descriptive Tags

**Dimensions**



*Note that detailed installation instructions are available on our web site.*



G468-0001



# ULTRA SLIMPAK® G468-0001

## AC Input Field Configurable Isolator

Provides an Isolated DC Output  
in Proportion to an AC Input



- Field Configurable Input Ranges: 50mV to 250VAC, 5mA to 5A AC
- Eliminates Ground Loops
- Field Configurable Outputs: 0-5V, 0-10V, 0-1mA, 0-20-mA and 4-20mA
- Ultra Slim Housing for High Density Installations
- Flexible Power Supply Accepts 9 to 30 VDC
- ASIC Technology for Enhanced Reliability
- RoHS Compliant

### Description

The G468 is a DIN rail mount, AC input signal conditioner with 1800VDC isolation between input, output and power. The field configurable input and output offers flexible, wide ranging capability for scaling, converting or buffering AC inputs ranging from 5mA to 100mA or 50mV to 250V.

For AC current measurements above 100mA, use the model C006 shunt resistor (0.1 Ohm, 5Watt). This resistor must be wired in series with the current source, with the G468 configured to measure the voltage generated across the resistor (see Figure 3 for an example).

The DC output of the G468 is proportional to the average of the fully-rectified AC input signal, and is calibrated for sine waves between 40-400Hz.

### Application

The G468 is useful in applications requiring an isolated, conditioned DC output from an AC signal. Typical applications include energy management, load shedding, motor current/load monitoring, locked rotor detection, isolation and data acquisition. The output of the G468 can drive a digital meter for direct display or it can interface with alarm or control devices, including PLCs and computers.

### Diagnostic LED

The G468 is equipped with a dual function LED signal monitor. The green, front mounted LED indicates both DC power and input signal status. Active DC power is indicated by an illuminated LED. If the input signal is more than 110% of the full scale range, the LED will flash at 8Hz. Below -10%, the flash rate is 4Hz.

### Configuration

The G468 has 15 input range switch settings. Trim potentiometers allow 50% input zero and span adjustability within each of the 15 fullscale, input ranges.

Since the unit has 50% adjustability, it can be ranged so that any 100 volt input span can create the full output (e.g., 25 to 125Vac = full output).

Unless otherwise specified, the factory presets the Model G468 as follows:

Input Range: 0-500mVAC  
Output: 4-20mA

The DC power input accepts any DC source between 9 and 30V; typically a 12V or 24VDC source is used (see Accessories).

Refer to Tables 1 through 3 for the proper switch settings. With power disconnected, use the switches (9 & 10) on SW1 to select the input type (voltage or current), on SW2 to select the desired output ranges, and (1-8) on SW1 to select the desired input range.

**WARNING:** Do not change switch settings with power applied. Severe damage will result!

## Calibration

1. After configuring the DIP switches, connect the input to a calibrated AC source. Connect the output to the device (or a load approximately equivalent to the device) and apply power. Refer to the Terminal Wiring Diagram (Figure 2).

*Note: To maximize thermal stability, final calibration should be performed in the operating installation, allowing approximately 1 to 2 hours for warm up and thermal equilibrium of the system.*

2. Set the calibrator to the desired minimum and adjust the zero potentiometer for the desired minimum output.

3. Set the calibrator to the desired maximum and adjust the span potentiometer for the desired maximum output.

4. Repeat steps 2 and 3, if necessary for best accuracy.

Table 1: G468 Input Ranges

Ranges		Selector SW1									
Voltage	Current	1	2	3	4	5	6	7	8	9	10
100mV	10mA				■				■		
200mV	20mA				■		■		■		
500mV	50mA			■		■		■			
1V	100mA			■	■				■		
2V				■	■		■		■		
5V		■		■		■	■				
10V		■		■	■						
20V		■		■	■	■					
50V			■	■		■	■				
100V			■	■	■						
200V			■	■	■	■					
250V				■	■		■	■			
<b>Input Type</b>											
	Current										■
	Voltage									■	

Key: ■ = 1 = ON or Closed

Table 2: G468 Output Ranges

Output	SW2							
	1	2	3	4	5	6	7	8
0 to +5V	■	■	■	■				
0 to +10V	■		■	■				
0 to 1mA		■	■	■				
4 to 20mA						■	■	■
0 to 20mA	■	■				■	■	■

Key: ■ = 1 = ON or Closed

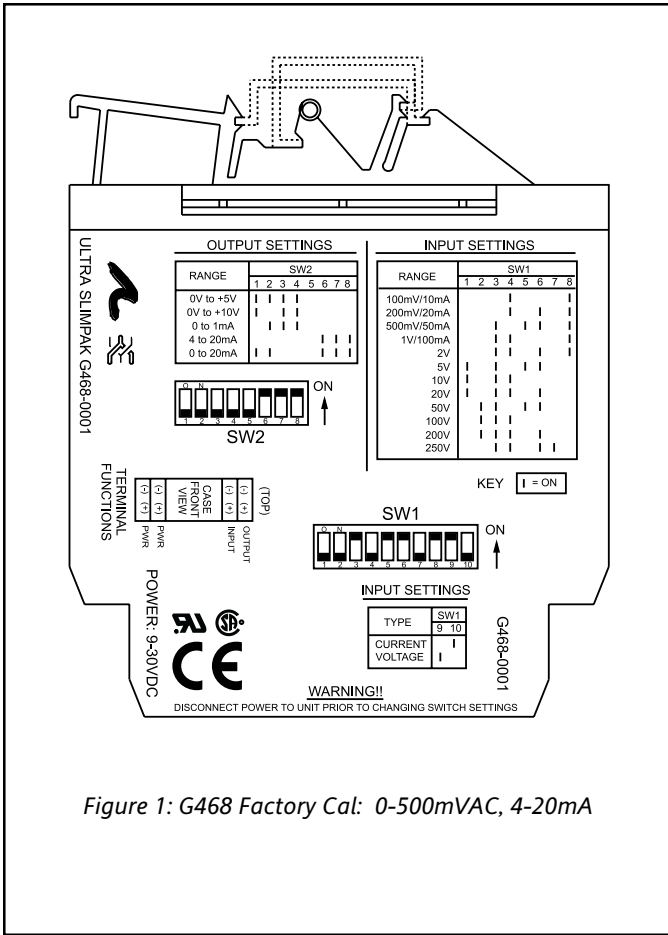


Figure 1: G468 Factory Cal: 0-500mVAC, 4-20mA

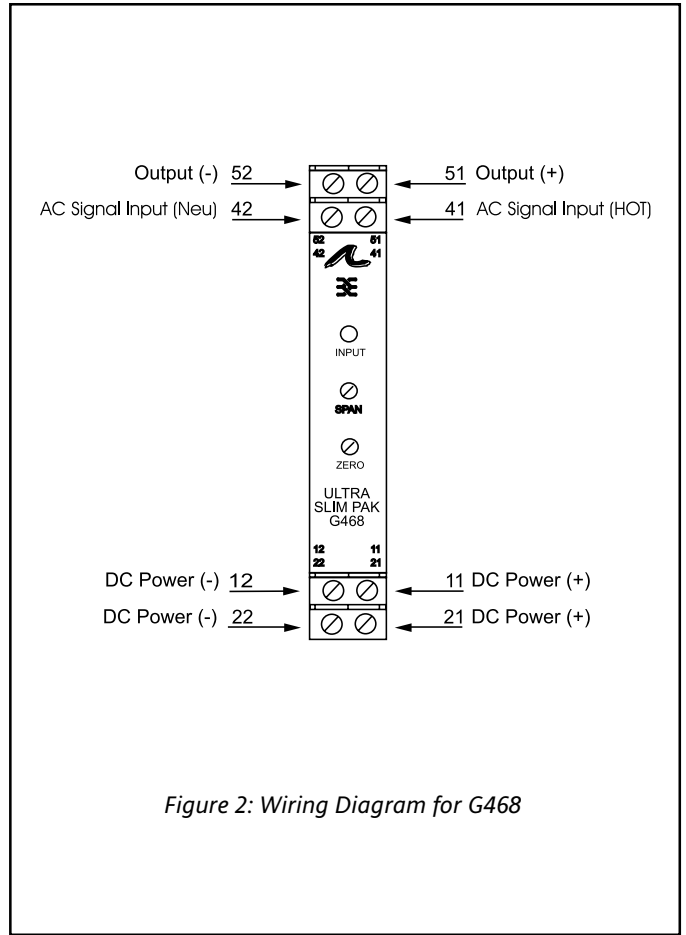


Figure 2: Wiring Diagram for G468

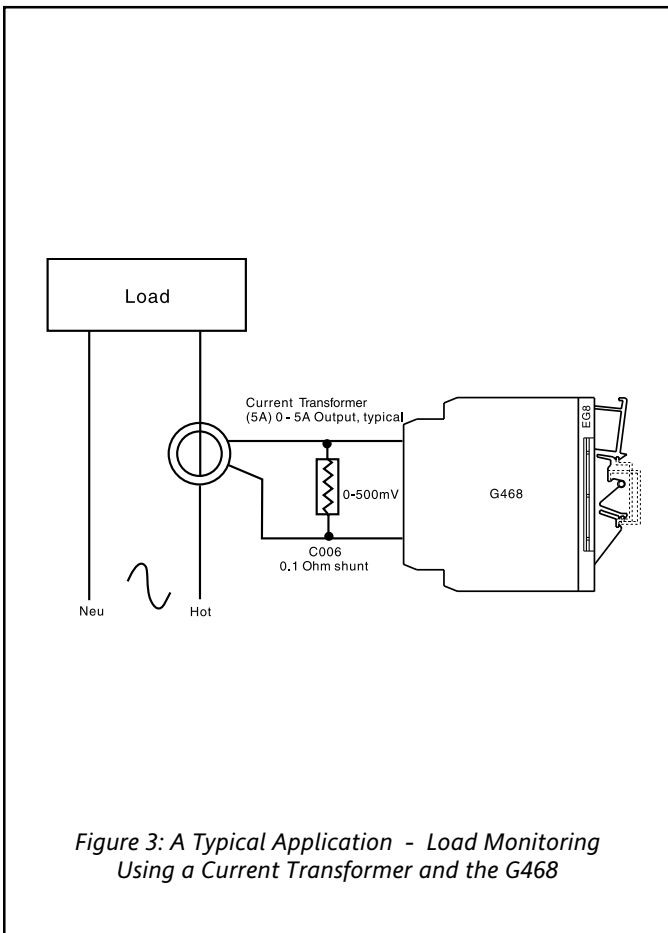
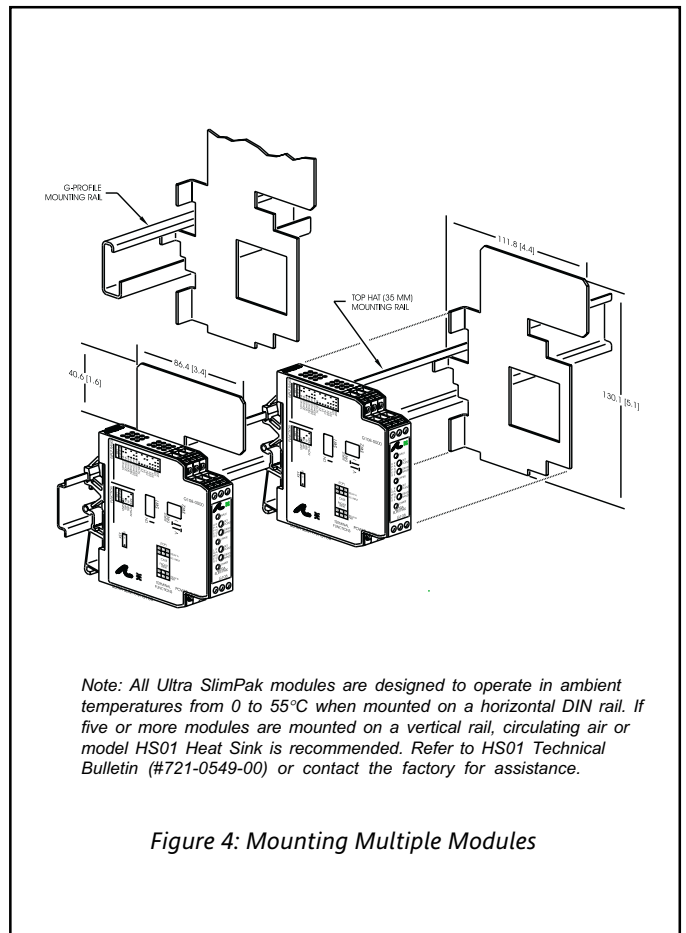


Figure 3: A Typical Application - Load Monitoring Using a Current Transformer and the G468



Note: All Ultra SlimPak modules are designed to operate in ambient temperatures from 0 to 55°C when mounted on a horizontal DIN rail. If five or more modules are mounted on a vertical rail, circulating air or model HS01 Heat Sink is recommended. Refer to HS01 Technical Bulletin (#721-0549-00) or contact the factory for assistance.

Figure 4: Mounting Multiple Modules

## Specifications

### Inputs:

Voltage:  
 Ranges: 100mV to 250VAC  
 Impedance: >100K Ohms  
 Overvoltage: 300VAC

### Current:

Ranges: 10mA to 100mA AC  
 Impedance: 20 Ohms, typical  
 Overcurrent: 200mAAC  
 Overvoltage: 60V peak

### Frequency Range:

DC or 40 to 400Hz AC, factory calibrated at 60Hz

### Common Mode (Input to Ground):

1800VDC, max.

### Zero and Span Range:

Zero Turn-Up: 50% of full scale range  
 Span Turn-Down: 50% of full scale range

### Output:

#### Voltage:

Output: 0-5V, 0-10V  
 Source Impedance: <10 Ohms  
 Drive: 10mA, max. (1K Ohms, min. @ 10V)

#### Current:

Output: 0-1mA, 0-20mA, 4-20mA  
 Source Impedance: >100K Ohms  
 Compliance:  
 0-1mA; 7.5V, max. (7.5K Ohms, max.)  
 0-20mA; 12V, max. (600 Ohms, max.)  
 4-20mA; 12V, max. (600 Ohms, max.)

### LED Indicator (green):

8Hz flash when input is 110% of full scale range  
 4Hz flash when input is 10% below full scale range

### Accuracy (Including Linearity, Hysteresis):

±0.1% of span, typical  
 ±0.5% of span, maximum

### Stability:

±0.025%/°C of selected input span, typical

### Response Time (10 to 90%):

250mSec., typical.

### Common Mode Rejection:

DC to 60Hz: 120dB

### Isolation:

1800VDC between input, output & power.

### EMC Compliance (CE Mark):

Emmissions: EN50081-1  
 Immunity: EN50082-2  
 Safety: EN50178

### Humidity (Non-Condensing):

Operating: 15 to 95% @ 45°C  
 Soak: 90% for 24 hours @ 65°C

### Temperature Range:

Operating: 0 to 55°C (32 to 131°F)  
 Storage: -25 to 70°C (-13 to 158°F)

### Power:

Consumption: 1.5W typical, 2.5W max.  
 Range: 9 to 30VDC

### Wire Terminations:

Screw terminals for 12-22 AWG

### Weight:

0.48 lbs.

### Agency Approvals:

CSA certified per standard C22.2, No. 0-M91 and 142-M1987 (File No. LR42272).

UL recognized per standard UL508 (File No.E99775).

CE Compliance per EMC directive 89/336/EEC and Low Voltage 73/23/EEC.

RoHS Compliant

## Ordering Information

### Models & Accessories

#### Specify:

1. Model: **G468-0001**
2. Accessories: (see Accessories)
3. Optional Custom Factory Calibration; specify **C620** with desired input and output ranges.

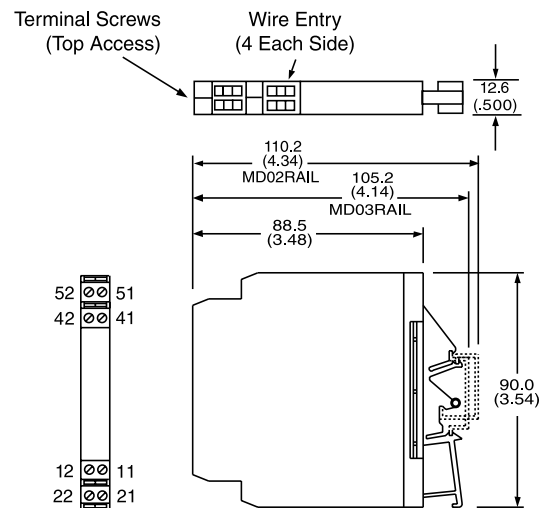
### Accessories

SlimPak "G" series modules mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition, the following accessories are available:

<b>HS01</b>	Heat Sink
<b>MD03</b>	TS35 x 7.5 DIN rail
<b>WV905</b>	24VDC Power Supply (0.5 Amp)
<b>H910</b>	24VDC Power Supply (1 Amp)
<b>H915</b>	24VDC Power Supply (2.3 Amp)
<b>MB03</b>	End Bracket for MD03
<b>C664</b>	I/O Descriptive Tags

Note that detailed installation instructions are available on our web site.

## Dimensions





G478-0001



# ULTRA SLIMPAK® G478-0001

## Frequency Input, Field Configurable Isolator

Provides an Isolated DC Output  
in Proportion to a Frequency Input



- Field Configurable Input Ranges from 2Hz to 10,000Hz
- Eliminates Ground Loops
- Field Configurable Output Ranges: 0-5V, 0-10V, 0-1mA, 0-20mA, 4-20mA
- Ultra Slim Housing for High Density Installations

- 150mV to 150V Input Amplitude Level
- Touch-Cal™ for Simplified Ranging
- Flexible Power Supply Accepts 9 to 30 VDC
- ASIC Technology for Enhanced Reliability
- RoHS Compliant

### Description

The G478 is a DIN rail mount, frequency input signal conditioner with 1800VDC isolation between input, output and power. The field configurable input and output offer flexible, wide ranging capability for variable frequency drives, magnetic pick-ups, turbine flow meters, and other pulse or frequency output transducers.

The input of the G478 can be configured for any frequency span from 2Hz to 10,000Hz. The input amplitude threshold sensitivity can be adjusted from 150mVp to 10Vp to ensure accurate frequency measurement and minimize transient noise related errors. The maximum input amplitude is 150 Vrms. The output can be set for 0-5V, 0-10V, 0-1mA, 0-20mA or 4-20mA.

The G478 to be field configured for virtually any frequency input to DC signal output within the ranges specified. Calibration utilizes 'Touch-Cal' technology in which the user simply applies the minimum and maximum input frequencies, and touches a recessed button to configure the corresponding minimum and maximum output range.

The Ultra SlimPak housing allows installation of up to 24 units per linear foot. The wide ranging power supply is inverter isolated and accepts any voltage between 9 and 30VDC.

### Application

The G478 is useful in eliminating ground loops and interfacing pulse output transducers, such as turbine flow meters and magnetic pick-ups, to data acquisition and control systems.

Advanced digital technology, combined with Action's ASIC technology, provide a stable output at low frequencies for higher accuracy.

### 'Touch-CAL'™ Technology

The G478 utilizes 'Touch-Cal' technology to greatly simplify configuration. To set the input frequency range, simply apply the high input frequency and push the CAL button while the INPUT LED is lit. The low input frequency is then applied and pushing the CAL button once again stores the low frequency input. The high and low ranges are stored in non-volatile memory and correspond to the high and low output range which is selected via DIP switches.

To precisely adjust the output, the user adjusts the input frequency while the OUTPUT LED is lit until the desired output level is achieved. The output levels are locked-in by pushing the CAL button. Status LEDs show the operation mode of the device.

### Status LEDs

The G478 utilizes three status LEDs.

The green LED varies intensity as the frequency changes from 0 to 100% of full scale range (e.g., for a configuration of 0-1000Hz, the LED will be off with an input of 0Hz and fully illuminated at 1000Hz. With an input of 500Hz, the LED will be dim). If the input signal is 10% more than full scale range (over-ranged), the LED will flash at 8Hz.

The yellow INPUT LED denotes input programming modes.

The red OUTPUT LED denotes output programming modes (see Configuration, Calibration and Figure 2 for details).

### Configuration

Any 2Hz range from 0 to 10,000Hz can be converted to a full scale output signal (e.g. 0-2Hz/4-20mA or 9998-10,000Hz/4-20mA). Unless otherwise specified, the factory presets the Model G478 as follows:

- Input Range: 0 to 1000Hz
- Sensitivity: 1V RMS
- Output Range: 4 to 20mA

**Note:** "Sensitivity" refers to the noise rejection level (the trigger threshold) of the input.

For other I/O ranges, refer to Table 1 and 2. For calibration mode reference, see the step-by-step flow chart in Figure 4.

1. With DC power off, choose the desired output voltage/current range from Table 1 and set position 1 through 8 of SW1.
2. Set the Input sensitivity switch (SW1, 9 & 10) to LO for input amplitudes between 150mVp and 50Vrms, with noise rejection to 1Vp. Set the switch to HI for input amplitudes between 500mVp and 150Vrms, with noise rejection up to 10Vp (see Table 2).

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## Calibration

1. Connect the input to a calibrated frequency source and apply power. Wait 1 hour for thermal stability before monitoring the voltage or current output.
2. Adjust the input frequency to the desired maximum and observe that the output has increased and is sensing the input. If the output does not increase, turn the sensitivity potentiometer in a counter-clockwise direction until the output begins to change proportionally to the input, plus another full turn.
3. Press the CAL button once to enter the calibration mode. The yellow and green LEDs will be on.
4. Input the maximum desired frequency and press the CAL button to store. The yellow LED will now be the only LED on.
5. Input the minimum desired frequency and press the CAL button to store. The green and red LEDs will now be on.

**Note:** The most reliable way to input 0Hz is to short circuit the input (Pins 41 & 42). It is usually easier to choose a value greater than 0Hz (e.g., 10% of full scale) when calibrating the minimum input and output (also 10%). When using this method signals below 10% are still converted linearly.

6. To precisely adjust the maximum output, adjust the input frequency until the output reads within  $\pm 0.1\%$  of the maximum selected output range. This typically occurs near 90% of the HI input frequency. Press the CAL button to store the value. The red LED will now be on.
7. To precisely adjust the minimum output, lower the input frequency until the output reads within  $\pm 0.1\%$  of the minimum selected output. This typically occurs near 10% of the HI input frequency. Press the CAL button to store the value. All three LEDs will be on.
8. Press the CAL button one final time to exit the calibration mode. The green LED will now be on.
9. Check the minimum and maximum input-to-output calibration. Repeat steps 1 through 8 if calibration is not within desired specifications.

**Note 1:** To skip Steps 6 and 7 (output adjustment), press CAL button two times after Step 5.

**Note 2:** Removing power to the unit at any time before Step 8 will restore previous settings and calibration.

## Optimal Sensitivity

If the amplitude of the input frequency is within the sensitivity parameters (i.e. 150mVp - 1Vp for LO and 0.5Vp - 10Vp for HI), then the sensitivity parameters can be set for optimum noise rejection:

1. Set the input near midrange (50% input) or to a frequency that exhibits the minimum pulse amplitude.
2. Turn the sensitivity pot (SENS) clockwise (CW) until the output drops to minimum.
3. Turn the sensitivity pot counter-clockwise (CCW) a turn or two until the output returns to the previous level.
4. Run the input through the full frequency range to make sure that the pulses are sensed at both the low and high input frequencies. If the output drops out during this test (and the input freq. >0%) then turn the sensitivity pot counter-clockwise another turn or two until the output picks up. Repeat to validate sensitivity settings.

Table 1: G478 Output Ranges

Output	SW1							
	1	2	3	4	5	6	7	8
0 to 5V	■	■	■	■				
0 to 10V	■		■	■				
0 to 1mA		■	■	■				
4 to 20mA						■	■	■
0 to 20mA	■	■			■		■	■

Key: ■ = 1 = ON or Closed

Table 2: G478 Input Sensitivity Settings

Sensitivity	SW1	
	9	10
High: 0.5 to 10Vp (150Vrms maximum)		
Low: 150mVp to 1Vp (50Vrms maximum)		■

Key: ■ = 1 = ON or Closed



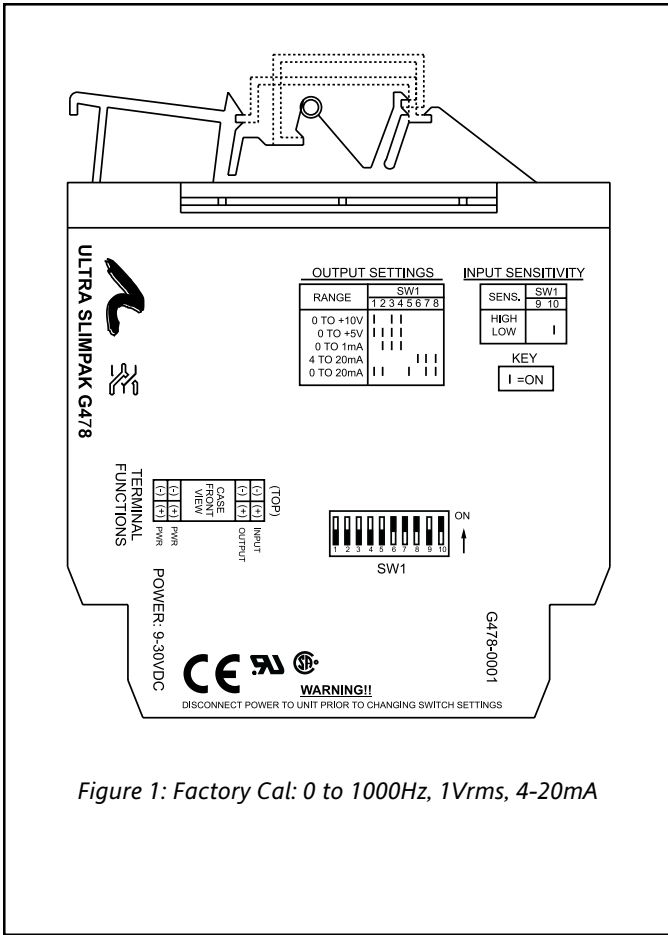


Figure 1: Factory Cal: 0 to 1000Hz, 1Vrms, 4-20mA

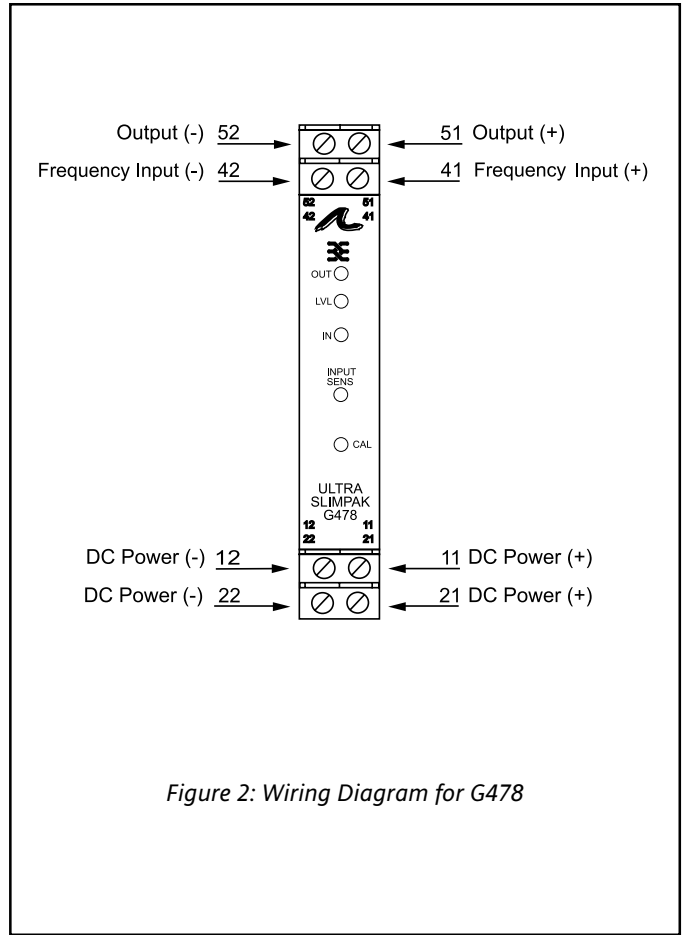
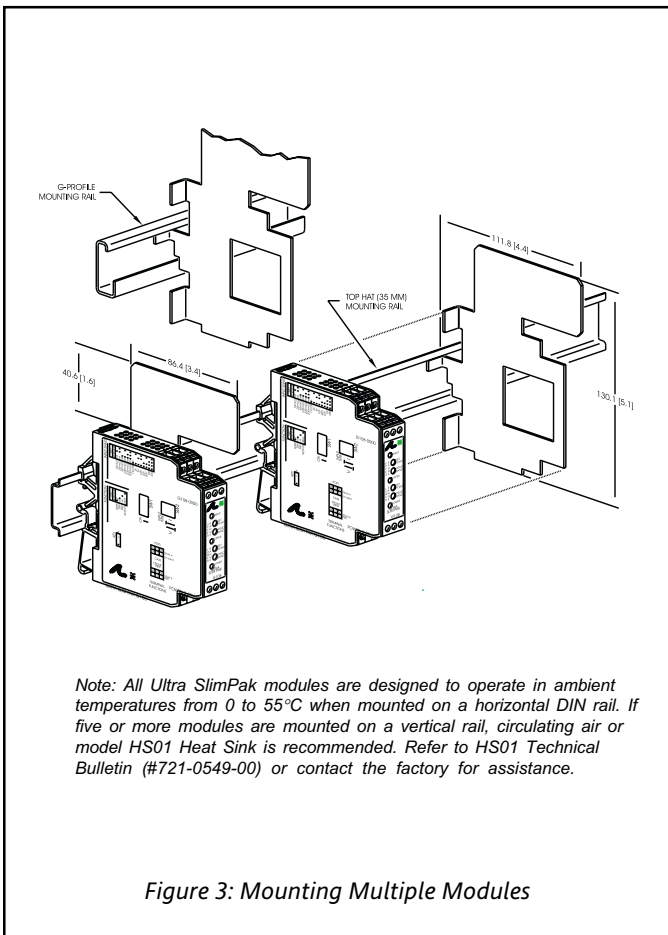


Figure 2: Wiring Diagram for G478

Ultra Slimpak®



Note: All Ultra SlimPak modules are designed to operate in ambient temperatures from 0 to 55°C when mounted on a horizontal DIN rail. If five or more modules are mounted on a vertical rail, circulating air or model HS01 Heat Sink is recommended. Refer to HS01 Technical Bulletin (#721-0549-00) or contact the factory for assistance.

Figure 3: Mounting Multiple Modules

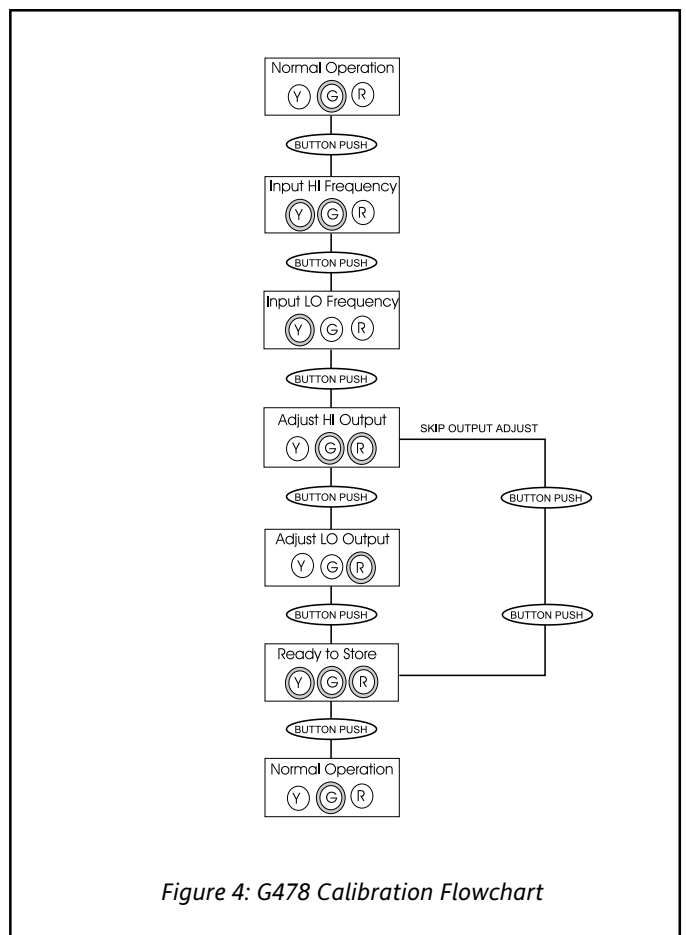


Figure 4: G478 Calibration Flowchart

## Specifications

### Input:

- Frequency Input
  - Full Scale Range: 2 Hz minimum from 2Hz to 10,000Hz.
  - Amplitude Range: 150mVp to 150Vrms
  - Impedance: >10K Ohms
  - Over-voltage: 180Vrms, max.
  - Over-range: 20KHz, max.
  - Common Mode (Input to Gnd): 1800VDC, max.
- Zero Turn-Up:
  - 99% of full scale range (9998Hz)
- Span Turn-Down:
  - 99% of full scale range (2Hz)

### Output:

- Voltage:
  - Output: 0-5V, 0-10V
  - Source Impedance: <100 Ohms
  - Drive: 10mA, max. (1K Ohms, min. @ 10V)
- Current:
  - Output: 0-1mA, 0-20mA, 4-20mA
  - Source Impedance: >100K Ohms
  - Compliance:
    - 0-1mA; 7.5V, max. (7.5K Ohms, max.)
    - 0-20mA; 12V, max. (600 Ohms, max.)
    - 4-20mA; 12V, max. (600 Ohms, max.)

### Accuracy (Including Linearity, Hysteresis):

±0.1% of selected range at 25°C.

### Stability:

±0.025%/°C maximum of selected range.

### Response Time (10 to 90%):

3 input cycles + 250ms

### Common Mode Rejection:

DC: 100dB  
>60Hz: 80dB

### Isolation:

1800VDC between input, output & power.

### EMC Compliance (CE Mark):

Emissions: EN50081-1  
Immunity: EN50082-2  
Safety: EN50178

### LED Indication:

LEVEL (green):  
lit when power is on  
Input > 110% then 8Hz. flash  
Input < -10% then 4Hz flash  
INPUT (yellow):  
input range programming status  
OUTPUT (red):  
output range programming status

### Humidity (Non-Condensing):

Operating: 15 to 95% @ 45°C  
Soak: 90% for 24 hours @ 65°C

### Temperature Range:

Operating: 0 to 55°C (5 to 131°F)  
Storage: -25 to 70°C (-13 to 158°F)

### Power:

Consumption: 1.5W typical, 2.5W max.  
Range: 9 to 30VDC

### Weight:

0.50 lbs

### Wire Terminations:

Screw terminals for 12-22 AWG

### Agency Approvals:

CSA certified per standard C22.2, No. 0-M91 and 142-M1987 (File No. LR42272).  
UL recognized per standard UL508 (File No.E99775).  
CE Conformance per EMC directive 89/336/EEC and Low Voltage 73/23/EEC (Input < 75Vp or < 50Vrms, only).  
RoHS Compliant

## Ordering Information

### Models & Accessories

#### Specify:

- Model: **G478-0001**
- Accessories: (see accessories)
- Optional Custom Factory Calibration: specify **C620** with desired input and output range

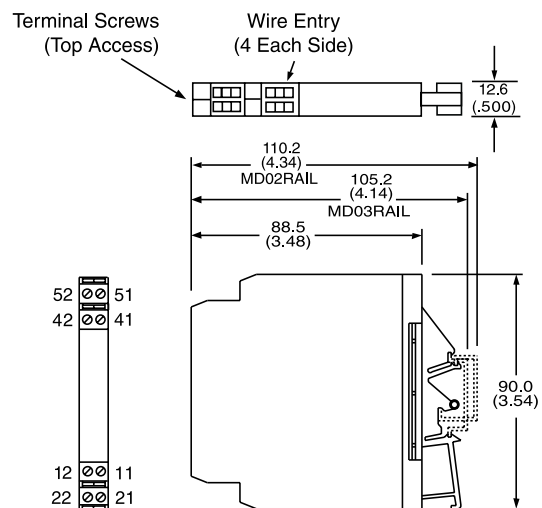
### Accessories

SlimPak "G" Series modules will mount on standard TS32 (model MD02) or TS35 (model MD03) DIN Rail. In addition, the following accessories are available:

- HS01** Heat Sink
- MD03** TS35 x 7.5 DIN rail
- WV905** 24VDC Power Supply (0.5 Amp)
- H910** 24VDC Power Supply (1 Amp)
- H915** 24VDC Power Supply (2.3 Amp)
- MB03** End Bracket for MD03
- C664** I/O Descriptive Tags

Note that detailed installation instructions are available on our web site.

## Dimensions



Dimensions are in mm (inches)

# TECHNICAL BULLETIN

## Ultra SlimPak Series

### Model HS01 Heat Sink

All Ultra SlimPak (USP) modules are designed and tested to operate in ambient temperatures from 0 to 55°C when mounted on a horizontal rail (see figure A) or with approximately 1/2" between modules on a vertical or horizontal rail (see figure B) to allow adequate air circulation.

When more than five modules are mounted in close proximity, our model HS01 Heat Sink is recommended (see figures C & D).

Figure A

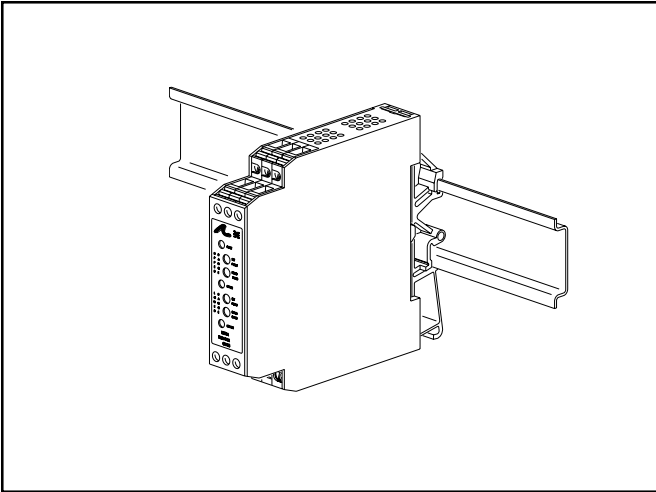


Figure B

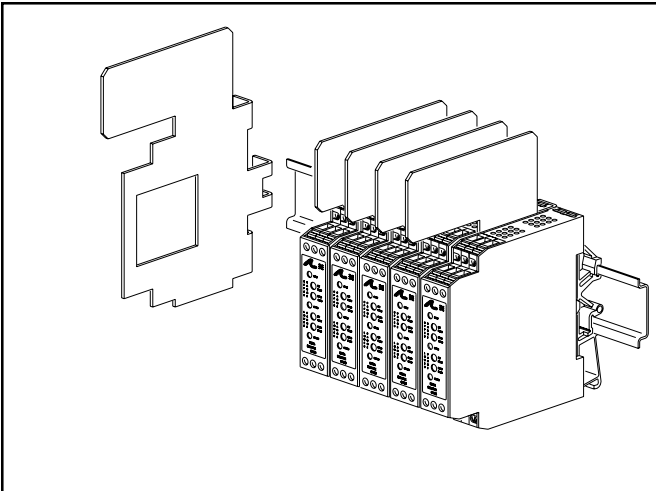
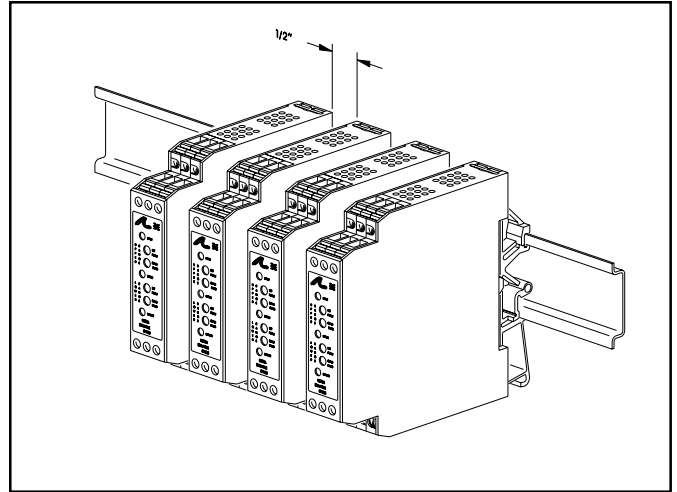


Figure C

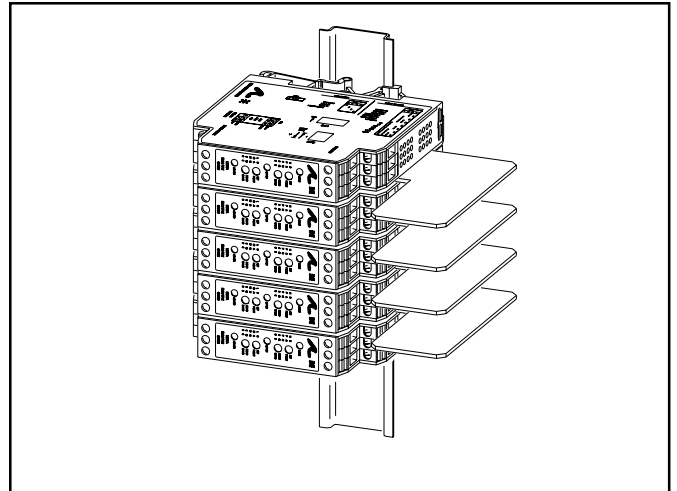
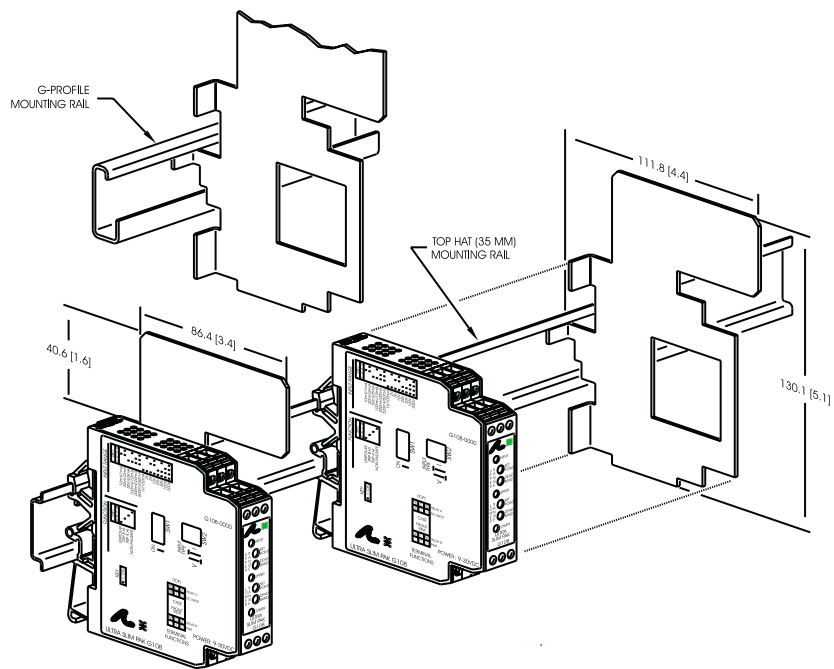


Figure D



### Installation

The HS01 heat sink mounts tightly between Ultra SlimPaks and the DIN mounting rail. Simply fit the HS01 heat sink to the Ultra SlimPak as shown above and snap both onto the rail.

To remove the Ultra SlimPak without removing the heat sink or combi-foot from the rail, slide the Ultra SlimPak up approximately 0.75", (off the combi-foot) and remove the module.

*Note that detailed installation instructions are available on our web site.*

### Specifications

Material: Aluminum Alloy 5052H32, 0.063" thick  
Anodized: Black, MIL-A-8625

### Ordering Information

Specify: Model: **HS01**

## Description

Transmitters are used to amplify and condition the very small electrical signals which are generated by sensors as they measure the physical variables of a process. Once conditioned to usable levels, these signals are used to drive other instrumentation such as industrial computers, dataloggers, chart recorders, alarms, panel meters and controllers.

## The TransPak Series

TransPak series two-wire transmitters are compact, rugged units that receive signals and direct sensor inputs, and operate from power derived from the output signal loop. The TransPak series provides a complete line of direct interface and conditioning modules for use with temperature, pressure, flow, strain, and other parameters. TransPak transmitters also accept a wide range of other electrical DC and AC voltage and current inputs.

## Two-wire Transmitters

Two-wire transmitters (also called "field transmitters" because they can be placed anywhere along the signal in a process) offer several major advantages over conventional four-wire types, which require two wires for the output signal and two more for the power supply, typically 120VAC. In applications where the process sensor might be located up to several thousand feet from the instrument, two-wire transmitters are more advantageous because their current output signals do not attenuate or degrade over distance as do the voltage signals of typical four-wire conditioners. There can also be significant savings in wiring costs since only two wires are needed for the power and signal when compared to the four-wire type.

## Intrinsic Safety

Because two-wire transmitters are powered by low-level 4-20mA or 10-50mA output current signals, no additional power has to be supplied to the remote transmitting location. This eliminates the associated problem of having to provide and maintain long runs of expensive wiring, and adds the benefit of being able to comply with safety requirements restricting the use of high voltage (120VAC) in hazardous locations.

Due to their low energy consumption and storage, two-wire transmitters are the only types of transmitters considered for intrinsically safe applications. Many of Action's TransPaks are Factory Mutual (FM), Canadian Standards Association (CSA) and CENELEC approved for intrinsically safe operation in hazardous - even explosive - environments when installed in accordance with the manufacturer's drawings.

## Input Selection

Six types of inputs are available to suit your process needs:

- DC Voltage or Current
- Potentiometer
- Thermocouple
- AC Voltage or Current
- RTD
- Frequency

# TransPak™ Selection Guide

Input	Typical Application	Description	Model
<b>DC Voltage or Current (V, mV, A, mA)</b>	Remote data acquisition, intrinsic safety, current to pressure, and isolation that provides equipment and personal protection.	Includes filtering and conditioning to reduce susceptibility to transients and signal noise.	T700 (Loop Isolator) T703 (Wide Ranging) T280, T287 (mV only)
<b>Potentiometer (50 Ohms, up to 200k Ohms)</b>	Remote tank level data acquisition, setpoint transmission, resistance position sensor conditioning and intrinsic safety and isolation that provides equipment and personal protection.	Includes excitation supply for 3-wire potentiometer or slidewires, to minimize circuitry at the sensor.	T752 (Wide Ranging) T287 (0-20k ohms)
<b>RTD (Type Pt, Ni110, Cu10)</b>	Remote temperature data acquisition, BTU transfer rate, intrinsic safety and isolation that provides equipment and personal protection.	Includes DC excitation supply for 3-wire RTD resistance sensors and sensor burnout detection.	T713 (Wide Ranging) T797/8 (Programmable/Hart) T280, T287 (Pt 100 only)
<b>Thermocouple (Types B, C, E, J, K, N, R, S, T)</b>	Remote temperature data acquisition, intrinsic safety and isolation that provides equipment and personal protection.	Includes encapsulated cold junction compensation (CJC) and sensor burnout detection.	T723 (Wide Ranging) T797/8 (Programmable/Hart) T280, T287
<b>Frequency (0-50Hz to 0-10kHz)</b>	Motor/pump speed, remote flow data acquisition, intrinsic safety and isolation that provides equipment and personal protection.	Includes 50% or greater span "turndown" adjustability. Accepts input amplitudes from 100Mvpp to 20Vrms.	T773 (Wide Ranging)
<b>AC Voltage or Current (V, mV, A, mA)</b>	Remote AC data acquisition, AC motor status control and isolation that provides equipment and personal protection.	Includes filtering and conditioning to reduce susceptibility to transients and signal noise.	T761 (Wide Ranging)



see next page

# TRANSPAK™

## T280

Isolated Universal 2-Wire Transmitter for  
Pt-100 RTD, Thermocouple, & mV

Miniature Thermal-Head Mounted,  
1000VDC Input to Output Isolation



- Universal Input Reduces Inventory Levels
- Eliminates Ground Loops
- Low Profile Design

- Hinged Cover Protects Potentiometers from the Environment
- Embedded Terminals

### Description

The T280 is an isolated, 2-wire temperature and mV input transmitter designed to fit in a standard industrial thermal-head. The T280 supports Pt-100 RTD and thermocouple inputs as well as voltages up to 100mV. Thermocouples supported include B, E, J, K, L, N, R, S and T. If thermal-head mounting is not required, the T280 can either be mounted directly on a bulkhead or to a DIN rail using the included DIN rail clip.

Three different series make up the T280 family. The -1xxx units are for Pt-100 RTD inputs. The default configuration from the factory is 3-wire, but the units can be easily reconfigured for 2-wire, as explained in the installation instructions. The -2xxx units are for thermocouple inputs and the -3xxx units are for millivolt inputs.

The list of model numbers shows our most popular ranges. Contact the Technical Services Group for information about other ranges.

*Head Mount Enclosure*



## Specifications

### Input

Thermocouple: B, E, J, K, L, N, R, S, T  
 RTD: Pt-100, 2-wire or 3-wire  
 mV: 100mV max.

### Input Span

Thermocouple: 5mV min. span  
 RTD: 20°C min. 500°C max.  
 mV: 5mV min span  
 Adjustability:  
 ±15% for both zero & span

### Output Span

4-20mA, limiting @ <28mA

## Burnout Detection

Upscale

## Linearity

Thermocouple/mV:  
 Better than ±0.1% of span, linear to mV input  
 RTD:  
 Better than ±0.1% of span, linear to temperature

## Stability

Thermocouple/mV:  
 0.02% of span/°C (25mV input)  
 RTD:  
 0.02% of span/°C (100°C span)

## T/C CJC

<0.05°C/°C of ambient temperature

## Isolation

1000VDC

## Supply Voltage

10 to 40VDC polarity protected

## Maximum Load

$R_{max} = (V_{supply} - 10V)/20mA$

## Operating Temperature

-20°C to +70°C

## Humidity

0 to 95% RH, non-condensing

## Agency Approvals

CE Compliance per EMC directive 89/3/36 EEC

## Models

### Thermocouple Models

T280-2000-JC	0 to 500°C
T280-2001-JC	0 to 760°C
T280-2002-JC	-200 to 600°C
T280-2003-JF	0 to 1000°F
T280-2004-JF	0 to 1400°F
T280-2005-JF	-350 to 1100°F
T280-2006-KC	0 to 500°C
T280-2007-KC	0 to 1000°C
T280-2008-KC	0 to 1200°C
T280-2009-KC	-270 to 500°C
T280-2010-KF	0 to 1000°F
T280-2011-KF	0 to 2000°F
T280-2012-KF	0 to 2500°F
T280-2013-KF	-450 to 1000°F
T280-2014-TC	0 to 250°C
T280-2015-TC	0 to 400°C
T280-2016-TC	-270 to 400°C

### Thermocouple Models (cont'd)

T280-2017-TF	0 to 500°F
T280-2018-TF	0 to 750°F
T280-2019-TF	-450 to 750°F
T280-2020-JC	0 to 400°C
T280-2021-JF	0 to 500°F
T280-2023-JF	200 to 600°F
T280-2024-KF	0 to 1500°F
T280-2025-SC	0 to 1500°C
T280-2026-EC	0 to 600°C
T280-2027-EC	0 to 500°C
T280-2028-JC	-100 to 300°C
T280-2029-TF	0 to 300°F

### mV Models

T280-3000	0 to 20mV
T280-3001	0 to 50mV
T280-3002	0 to 100mV

### RTD Models

T280-1000-C	0 to 100°C
T280-1001-C	0 to 150°C
T280-1002-C	0 to 200°C
T280-1003-C	0 to 300°C
T280-1004-C	0 to 500°C
T280-1005-F	0 to 200°F
T280-1006-F	0 to 300°F
T280-1007-F	0 to 400°F
T280-1008-F	0 to 500°F
T280-1009-F	0 to 900°F
T280-1010-F	0 to 100°F
T280-1011-F	0 to 250°F
T280-1012-C	0 to 50°C
T280-1013-F	-328 to 100°F
T280-1014-F	-200 to 100°F
T280-1015-F	32 to 390°F

Transpak™

## Ordering Information

### Models & Accessories

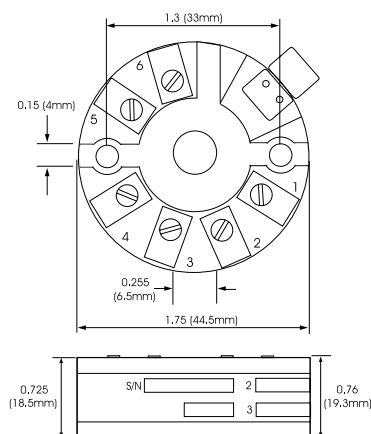
#### Specify:

**T280-1xxx-C** (F) for RTD Input, or  
**T280-2xxx-[tc type] C** (F) for thermocouple, or  
**T280-3xxx** for mV input

### Accessories

**AP9046** Action Pak 24/40VDC, 65mA Loop Power Supply  
**V560/565** 3-1/2 digit remote loop powered indicator with wide ranging display.  
**T25H-0000** Head Mount Enclosure - 1/2 NPT for Thermowell and Conduit.

## Dimensions



*Note that detailed installation instructions are available on our website.*





# TRANSPAK™

## T287

### Programmable Isolating Universal Input 2-Wire Transmitter

Provides an Isolated, Linearized Current Loop in Proportion to a Thermocouple, RTD, Millivolt, Potentiometer or Resistance Input



- Universal Input Reduces Inventory Levels
- Eliminates Ground Loops
- Supports Single or Dual Inputs
- User-Friendly Configuration
- Custom Linearization for Special T/C Types
- DIN Rail Mounting Adapter Included

#### Description

The T287 is a programmable two-wire transmitter that is configured to provide an isolated 4-20mA signal in proportion to the input signal. The T287 accepts thermocouple, 2-wire, 3-wire, or 4-wire RTD, potentiometer, resistance and millivolt inputs. The T287 supports either single or dual inputs. In the dual input mode, either input can be selected to control the output, or math functions can be applied in which both inputs have an effect on the output. The functions available are Sum, Difference, Average, Higher of the two or Lower of the two inputs. Typical applications include providing accurate, stable signals to distributed control systems (DCS), supervisory control and data acquisition systems (SCADA), environmental monitoring and control systems (EMCS), data acquisition and control systems (DACS) and custody transfer/pipeline systems.

Configuration is performed by connecting the transmitter to a standard (9-pin RS-232) PC serial port using an isolated interface adapter, and running a user-friendly Windows-based program. All of the configuration information can be defined and modified using only a PC, the interface adapter, and the transmitter. No loop supply, input simulation or meter on the output is required. The fully isolated adapter reduces the risk of damage to the PC which can be caused by spikes and surges on field wiring entering the computer via its unprotected serial port.

The T287 yields higher accuracy and long-term stability with lower power consumption than prior generation transmitters. The T287 automatically performs self-tests and auto-calibration while in service, resulting in a stability of better than  $\pm 0.1\%$  of span over 12 months.

#### Operation

Every T287 is factory calibrated and can be configured to perform the desired function using the Device Configuration screen and the Sensor Selection Screen. Just fasten the DB-9 connector to the computer's serial port and the keyed 6-pin connector to the port under the access cover on the top of the transmitter. There is no need to provide an external power supply and load to the T287's output to configure the transmitter.

Units already in service can have their configuration "up-loaded" to the PC. Their operating parameters can be reviewed, and if necessary, revised and downloaded again. All configuration parameters can be stored in a configuration file on the PC for future use. The Configuration & Calibration Software, Isolated RS-232/T287 Communications Adapter and User's Guide are included in the model C680-0001. A zero and span trimmer (model C680-0002) is also available which allows users to adjust the zero and span without connecting a PC. Just plug the trimmer into the programming port and press the up or down button.

**Specifications**

**Input Types:**

Thermocouples:

Most standard types & all special types using customer defined tables & polynomials.

RTD:

2-, 3- & 4-wire, Pt-100, Ni-110, Ni-120 & other RTDs. Includes Callandar-Van-Dusen adaptation and custom sensors linearization with user defined tables and polynomials.

DC mV: -10 to 100mV

Potentiometers: 0 to 20k Ohms

Resistance: 0 to 400 Ohms

**General Specifications:**

Minimum Range: 2mV

Output: 4-20mA

Supply Voltage: 9-40VDC @ no load, reverse polarity protected

Maximum Load:

$$R_{max} = (V_{supply} - 9V) / 20mA$$

Operating Temperature:

-40 to 85°C

Storage Temperature:

-55 to +125°C

Humidity:

0 to 95% RHNC

Response Time:

0.3 seconds, to 90% of input (>3 updates/sec)

Damping Factors:

Programmable 0 to 64 seconds, to 0 to 120% of input range, using config software

Stability:

Better than ±0.1% of span for 12 months

Isolation:

2000VDC, input to output

RFI Protection:

<1% effect of span at 20-1000MHz and at field strength of 20V/m

**Performance Specifications:**

Output Resolution:

0.015% of span (2.5uA)

Output Linearity (D/A):

Better then 0.02% of output span

Sensor Linearization:

Better than 0.1°C for RTDs

Better than 0.2°C for Thermocouple

Cold Junction Compensation:

Automatic to within ±0.7°C for all thermocouples

Temperature Stability:

0.015%/°C combined zero and span.

Supply Voltage Effect:

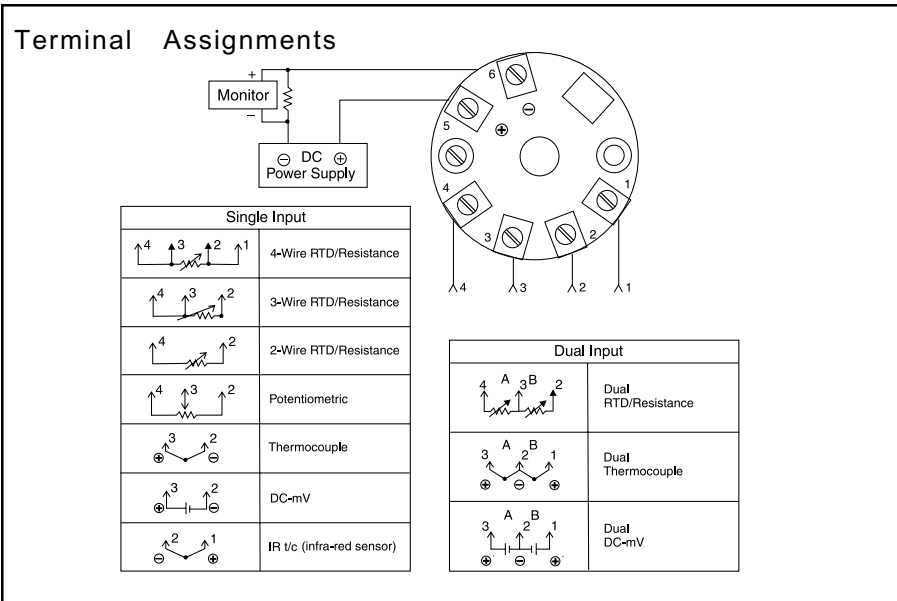
< ±0.003% per volt.

Calibration:

Automatic, unit includes all calibration parameters. The unit performs periodic zero and span self-test, and auto calibration.

Input Linearity:

Better than 0.01% of span (mV input)



**Ordering Information**

**Models & Accessories**

**Specify:**

1. Model: **T287-0000**
2. Model: **C680-0001** Isolated Communications Adapter, Configuration and Calibration Software, and User's Guide.
3. Model: **C680-0002** Zero/Span Trimmer

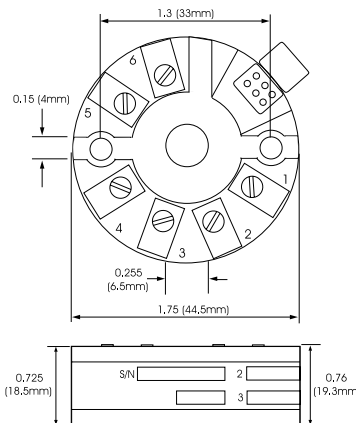
**Accessories**

**AP9046** Action Pak 24/40VDC, 65mA Loop Power Supply

**V560/565** 3-1/2 digit remote loop powered indicator with wide ranging display.

**T25H-0000** Head Mount Enclosure - 1/2 NPT for Thermowell and Conduit.

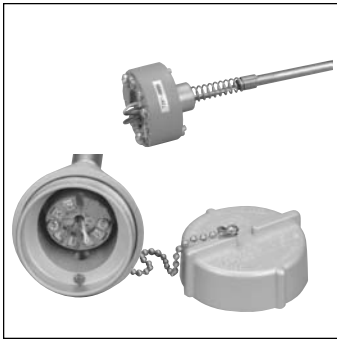
**Dimensions**



*Note that detailed installation instructions are available on our website.*

**Head Mount Enclosure**





# TRANSPAK™ T287 Transmitter Sensor Assemblies

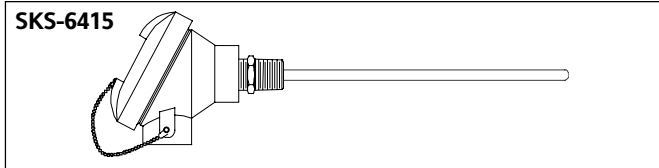
Thermocouple and RTD Assemblies with  
the T287 2-Wire Transmitter Installed

Preassembled, Preconfigured  
Temperature Sensor Solutions

- T287 Configured to Desired Range
- Type J, K, T or Pt-100 Sensors
- Four Head Styles
- Spring Loaded Available
- Three Types of Thermowells
- Mounting Bushings Included

## Description

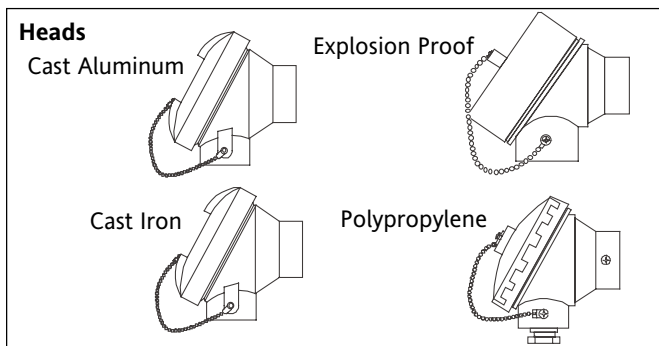
Eurotherm/Barber-Colman manufactures thermocouples and RTDs with the Action T287 transmitter already installed. The sensor assembly ships with the transmitter already configured to the customer specified temperature range. Some of the more common styles are listed here.



The SKS-6415 series are general purpose probes with 1/2" NPT mounting bushing. Thermocouples have ungrounded MgO insulated elements. Type J and T elements have a 304 stainless steel sheath. Type K elements have an Inconel sheath.

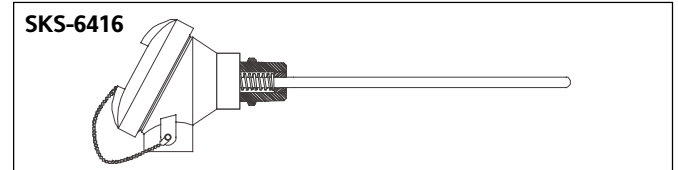
Pt-100 RTDs are available with either Teflon® or fiberglass insulated leads. The Teflon insulated units are rated for operation to 260°C. The fiberglass insulated RTDs are rated for operation to 500°C.

Four styles of NEMA 4 connecting heads are offered. The aluminum or cast iron screw cover heads provide excellent protection in most conditions. The aluminum explosion proof head is FM/CSA approved for Class I, Div. I, Groups B, C & D, and

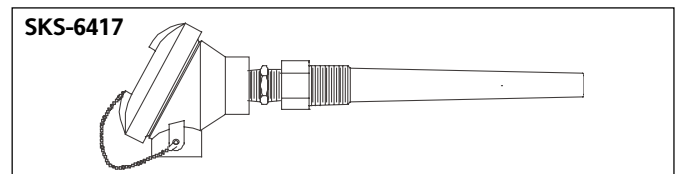


Class II, Div. II, Groups E, F & G. The white polypropylene head is suitable for wash down environments or applications in which corrosion resistance is an issue.

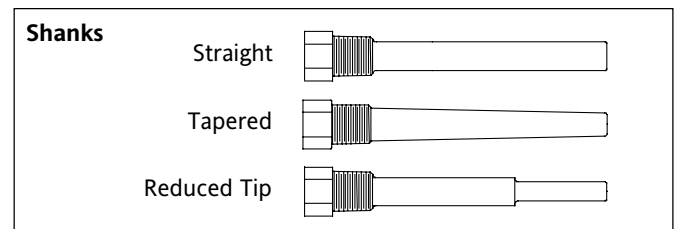
The SKS-6416 series and SKS-6415 series are identical except that the SK-6416 is equipped with a spring loaded bushing, making it suitable for applications in thermowells. The stainless steel spring loaded bushing provides greater than 1/2" travel.



The SKS-6417 series are complete assemblies that include a thermowell and a spring loaded bushing. Three styles of thermowells are available; straight shank, heavy duty tapered and reduced tip. All have 3/4" NPT threads and are manufactured from 304 stainless steel.

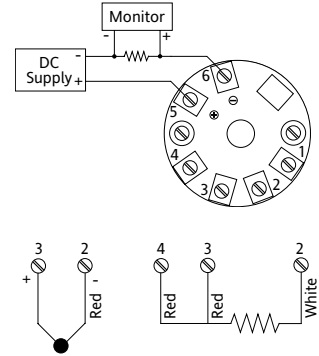
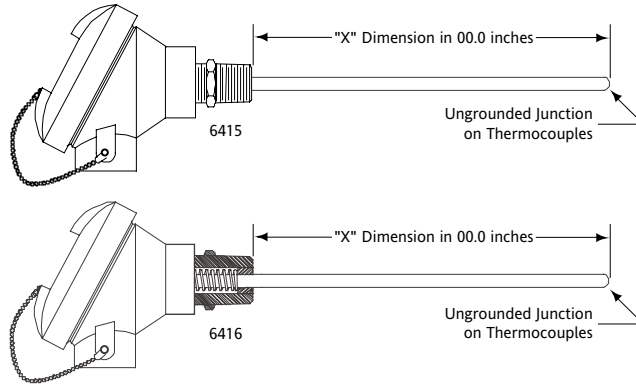


Eurotherm/Barber-Colman manufactures a complete line of thermocouples and RTDs. Contact us with your requirements.



Contact us at  
s e n s o r s @ e u r o t h e r m . c o m

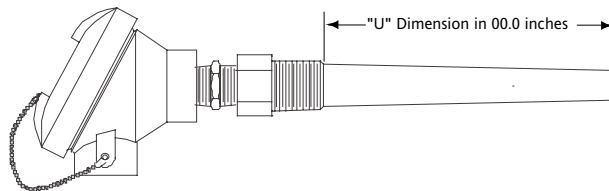
**SKS-6415 and SKS-6416**



**SKS-641X-XXX-0-XX**

- MgO Sensor Assembly**  
 5 = with Action T287 Transmitter and Double-Ended Bushing  
 6 = with Action T287 Transmitter and Double-Ended, Spring Loaded Bushing
- "X" Dimension in 00.0 inches  
 for example: 075 = 7-1/2 inches
- Head Type**  
 0 = Aluminum  
 1 = Cast Iron  
 2 = Explosion Proof  
 3 = Polypropylene
- Sensor Type and Sheath Material**  
 0 = Type J T/C, 1/4" dia. 304 Stainless Steel Sheath  
 1 = Type K T/C, 1/4" dia. Inconel Sheath  
 2 = Type T T/C, 1/4" dia. 304 Stainless Steel Sheath  
 3 = RTD, 1/4" dia. 304 Stainless Steel Tube, Teflon Insulated Wire  
 4 = RTD, 1/4" dia. 304 Stainless Steel Tube, Fiberglass Insulated Wire

**SKS-6417**



**SKS-6417-UUU-X-XX**

- MgO Sensor Assembly**  
 7 = with Action T287 Transmitter, Double-Ended, Spring Loaded Bushing and Thermowell
- "U" Dimension in 00.0 inches  
 for example: 075 = 7-1/2 inches
- Thermowell Style**  
 M = Straight Shank  
 N = Tapered Shank  
 P = Reduced Tip
- Head Type**  
 0 = Aluminum  
 1 = Cast Iron  
 2 = Explosion Proof  
 3 = Polypropylene
- Sensor Type and Sheath Material**  
 0 = Type J T/C, 1/4" dia. 304 Stainless Steel Sheath  
 1 = Type K T/C, 1/4" dia. Inconel Sheath  
 2 = Type T T/C, 1/4" dia. 304 Stainless Steel Sheath  
 3 = RTD, 1/4" dia. 304 Stainless Steel Tube, Teflon Insulated Wire  
 4 = RTD, 1/4" dia. 304 Stainless Steel Tube, Fiberglass Insulated Wire

Transpak™



# TRANSPAK™

## T700-0001

### Loop Powered Isolator

Provides an Isolated  
DC Current Output



- 1800V Input-to-Output Isolation
- 1:1 Current Transfer Ratio from 1 to 20mA
- Input Loop-Powered Design Eliminates Output Power Supply
- 500 Ohm Output Drive, up to 10V Compliance

#### Description

The T700-0001 is a loop-powered isolator that accepts a current input (typically 4-20mA). It takes its power source voltage and the output current loop drive (500 Ohm, 10V compliance, max.) from the input current loop. The 1-20mA output current follows the input current signal. Span adjustment is provided to adjust for load variations. There are two (+) output terminals. Terminal #3 is for loads less than 100 Ohms (e.g., current meter inputs) and terminal #4 is for loads greater than 100 Ohms.

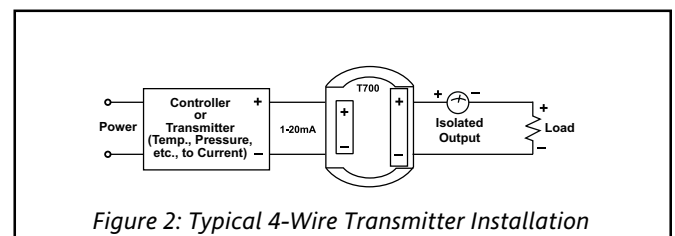
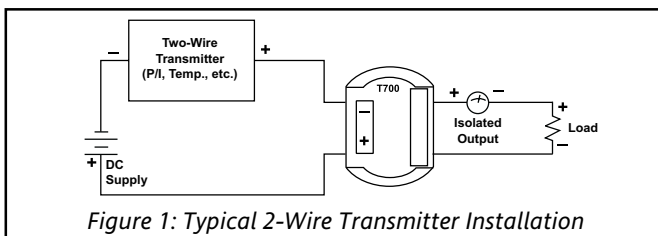
The T700 is designed for installation in industrial field environments. Circuitry is enclosed in the TransPak's rugged, diecast aluminum housing which is sealed for protection against corrosion, moisture, dust and electrical noise, such as radio frequency interference (RFI) and electromagnetic (EMI) interference. Top-mounted barrier terminal strip connections are provided. Optional mounting solutions and enclosures are also available (see Accessories).

#### Application

The T700 is useful in eliminating ground loop problems in existing systems, and as a preventative measure in the design of new systems. The DC current isolation allows a difference in potential of up to 1800V between the input, output signal and case ground. This isolation provides the benefits of grounded inputs without creating signal errors or ground loops.

#### Calibration

1. Connect the input to a calibrated milliamp source. Connect the output to the actual device or to a load equivalent to the actual device (use terminal #3 for loads <100 Ohms, terminal #4 for load >100 Ohms). Monitor the output current with a milliamp meter in series with the load or monitor the voltage across the load.
2. Set the calibrator to 20mA and adjust the span potentiometer for 20mA output.
3. Set the calibrator for 4mA and confirm that the output is 4 mA.



Transpak™

**Specifications**

**Input:**

Ranges: 1-20mA and 4-20mA, 30Vdc max.  
Voltage Drop: <3V, plus output load

**Common Mode Rejection:**

>100dB (DC to 60Hz)

**Output:**

Range: 1-20mA and 4-20mA  
Terminal #4 Drive: 100 to 500 Ohm loads,  
10V Max. at 20mA  
Terminal #3 Drive: 0 to 100 Ohm loads,  
2V Max. at 20mA

*Note that only one (+) output terminal (either #3 or #4) can be used at a time.*

**Output Accuracy:**

+0.1% of full-scale typical (250 Ohm load),  
+0.2% maximum including linearity,  
hysteresis and repeatability.

**Stability:**

< 0.02%/°C of span max. for full-scale and zero

**Load Regulation:**

< 0.1% of span, typical per 10 Ohm  
change, from 100 to 500 Ohms

**Isolation:**

1800Vdc, input to output to case ground

**ESD Susceptibility:**

Meets IEC 801-2 level 3 (8kV)

**Response Time:**

50mSec maximum, 10 to 90%

**Temperature:**

Operating/Storage: -20 to 80°C (-4 to 176°F)

**Humidity:**

25 to 95% @ 40°C, non-condensing

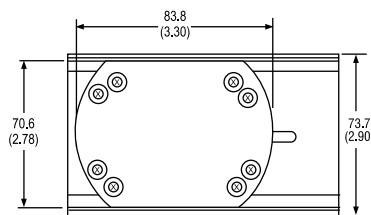
**Weight:**

0.56 lb.

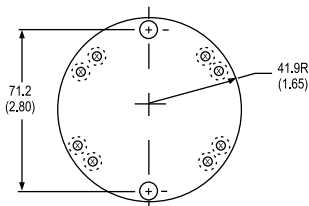
**Agency Approvals:**

UL recognized per standard UL508,  
(File No. E99775).  
CSA certified per standard C22.2, No. 0-M91,  
and 142-M1987, (Certificate No. 2500001267).

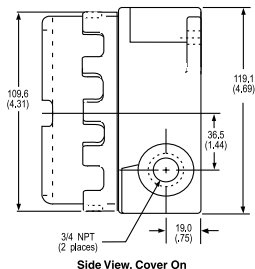
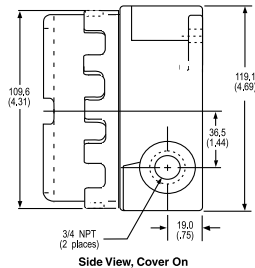
**Optional Mounting Hardware**



**T902 MOUNTING PLATE**  
(For snap-track mounting;  
includes snap track)  
Aluminum Alloy #6061 (0.06in, thick)



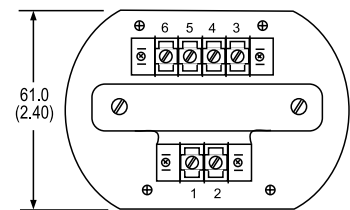
**T910 MOUNTING PLATE**  
(For bulkhead mounting)  
Aluminum Alloy #6061 (0.06in, thick)



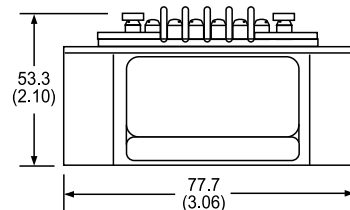
**T805 Field Mountable Housing**  
(EP, NEMA 4 rated) 3/4" Hub  
(Includes T903 Retainer Ring & NEMA 4 Gasket)

**Dimensions**

*Dimensions are in millimeters (inches)*



Top View



Front View

**Ordering Information**

**Models & Accessories**

**Specify:**

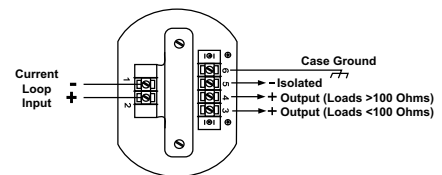
- Model **T700-0001**

**Accessories**

- M004** Snap-in Channel Track, 4 feet.
- T805** Explosion-Proof Housing.
- T902** Mounting Plate for M004, includes 4" track.
- T903** Extra Retaining Ring for T805 (included in T805).
- T906** Extra Mounting Plate w/slotted thumbscrews for Visipak V565C (included in V565C).
- T910** Bulkhead Mounting Plate.
- AP9046** Action Pak 24/40VDC, 65mA Power Supply.
- V565C** 3-1/2 Digit LCD Indicator, wide-ranging display, NEMA 4X Housing, Option C to house Transpak.

*Note that detailed installation instructions are available on our website.*

**Terminal Wiring**

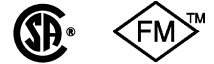




# TRANSPAK™ T703

## DC Input Isolating, Field Configurable Two-Wire Transmitter

Provides an Isolated Current Loop in Proportion to a DC Current or Voltage Input



- Field Configurable Input Ranges: 20mV to 200V, 1mA to 50mA
- Eliminates Ground Loops
- Wide Ranging Zero and Span
- Super Bright LED Provides Go/No-Go Loop Status
- FM and CSA Safety Approval for Hazardous Installations

### Description

The T703 has 16 overlapping input ranges which are field selectable via top-accessed DIP switches (see Table 1). The T703 can accept input voltage spans from 20mV to 200 volts and input current spans from 1mA to 50mA. Bipolar selection modifies the unipolar range to include a negative offset (e.g. 200V becomes ±100V). The T703 provides 1000Vrms of transformer-coupled isolation and 120VAC continuous input overload protection. The top-mounted super bright LED illuminates when the loop current is above 3.3mA. Standard surface mount RFI filters reject walkie-talkie interference and noise. Current output is in proportion to the selected voltage or current input.

The T703 has 80% zero “turn-up” and 80% span “turn-down” adjustments within any user-selected input range. For example, Range 11 of Table 1 specifies 0 to 100V with a minimum span of 20V (100V - 20V = 80V, or 80%). This 80% adjustability allows the user to field-calibrate the unit from the maximum (0 to 100V) down to any minimum (20V) span (e.g. 25V to 45V) within the selected 0 to 100V range. The same is true in any user-selectable range: all spans are field adjustable from 20% (minimum span) to 100% of the specified range.

### Application

The T703 is useful in any application requiring an isolated two-wire loop current from a DC source. Typical applications include long distance signal transmission and the elimination of ground loops. The output of the T703 can be used to drive a digital meter for direct display, or to interface with a computer for monitoring and control applications.

The model T703 is FM approved for intrinsically safe operation, entity, Classes I, II, III, Division 1, Groups A-G and Nonincendive, Class I, Division 2, Groups A-D hazardous when installed per manufacturer’s drawing 790-0028-00.

The model T703 is CSA approved for intrinsically safe operation for Class 1, Division 1, temperature code T3C, Groups A, B, C and D hazardous locations when installed per manufacturer’s drawing 790-0025-00. Refer to model F703 for NEMA 4, FM/CSA/CENELEC approved explosion-proof housing.

### Options

**U** Urethane coating of circuitry for protection from corrosive atmospheres.

### Calibration

**Note:** Factory settings are:

Input Range: 0 - 10V  
Output: 4-20mA

1. Open the access lid on the top of the unit (see Top View Diagrams).
2. Select the input range from Table 1 and configure switches S1 through S6. Bipolar span selection will divide the unipolar span in half (e.g., 20mA span = ±10mA bipolar span).
3. Determine the Span turn-down % (see Table 2).

$$\% = \frac{\text{Desired Min. Input}^*}{\text{Limit Span}} \times 100\%$$

Example, Input: 0-10V

$$\% = \frac{11.2V - 10V}{11.2V} \times 100\% = 10.7\%$$

4. Set the coarse Span rotary switch to the nearest span turn-down % setting (e.g., 10.7% = 20% position 1).

5. Determine the Zero turn-up % (see Table 3).

$$\% = \frac{(\text{Limit Span}) - (\text{Desired Span})}{\text{Limit Span}} \times 100\%$$

*\*Note: On range 14, subtract 4mA from Desired Min. Input.*

Example, Input: 0-10V

$$\% = \frac{0V}{11.2V} \times 100\% = 0\%$$

6. Set the coarse step Zero turn-up switch to the nearest % setting (e.g., 0% = position 0).

Table 1: T703-2000 Input Ranges

Input Range	Input Limits	Minimum Span	Selector Switch						
			S1	S2	S3	S4	S5	S6	
1	0 to 100mV	20mV			■	■	Unipolar OPEN		
2	0 to 200mV	40mV			■				
3	0 to 316mV	65mV				■			
4	0 to 632mV	130mV							
5	0 to 1.78V	360mV	■		■	■			
6	0 to 3.56V	710mV	■		■				
7	0 to 5.62V	1.2V	■			■			
8	0 to 11.2V	2.3V	■						
9	0 to 31.6V	6.4V	■	■	■	■		Bipolar CLOSED (■)	
10	0 to 63V	12.6V	■	■	■				
11	0 to 100V	20V	■	■		■			
12	0 to 200V	40V	■	■					
13	0 to 20mA	4mA							■
14	4 to 20mA	3.2mA							■
15	0 to 50mA	10mA	■		■	■			■
16	0 to 5mA	1mA			■	■			■

Key: ■ = 1 = ON or Closed

Table 2: Span Turn-Down Percent

Span Turn-Down	Position
0%	0
20%	1
40%	2, 3
60%	4, 5, 6, 7
80%	8, 9, A - F

Table 3: Zero Turn-Up Percent

Zero Turn-Up	Position
0%	0
10%	1
20%	2
30%	3
40%	4
50%	5
60%	6
70%	7
80%	8

**NOTES:**

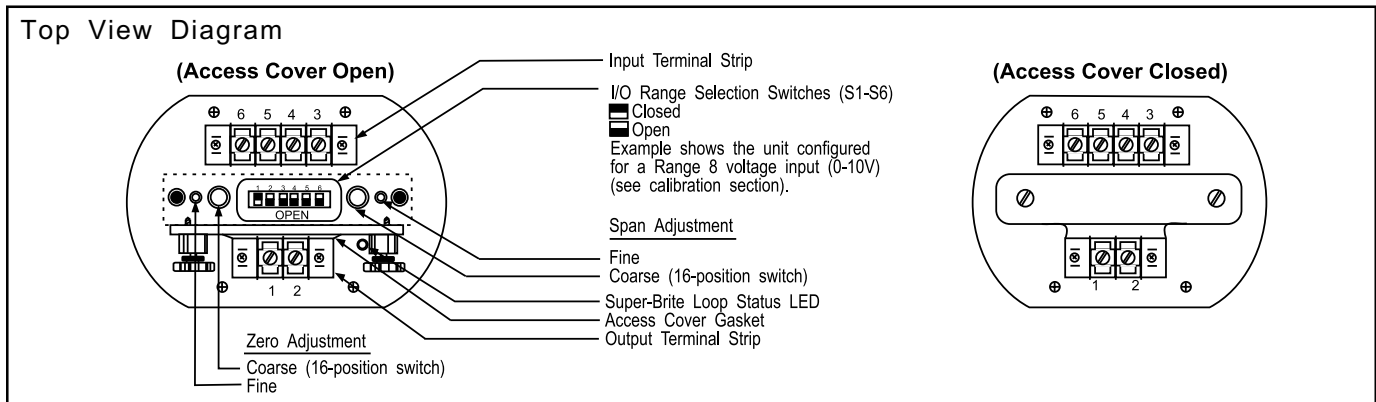
- To calibrate, use steps 1, 2, 7, 8 and 9. Adjust the coarse rotary switch before the fine potentiometer.
- Bipolar span selection will move the unipolar range to reflect a negative offset (e.g., 20mA = ±10mA).
- Connect the input to a calibrated DC voltage or current source. Connect the output loop to a voltage supply and monitor the output current (refer to terminal wiring).
- Set the calibrator to the desired minimum and adjust the fine zero to obtain an output of 4mA.
- Set the calibrator to the desired maximum and adjust the fine span to obtain an output of 20mA. Repeat steps 8 and 9, if necessary, for maximum accuracy.

**Field-Mounting**

The T703 is designed for installation in industrial field environments. A sealed, diecast aluminum housing protects against corrosion, moisture, dust and electrical noise such as radio-frequency (RFI) and electromagnetic (EMI) interference.

For protection against extreme moisture, hose-directed water (NEMA 4) or hazardous environments, use Action's FieldPak model F703. The F703 2-wire transmitter offers the same wide-ranging features of the TransPak T703, but includes a rugged EP/NEMA 4 enclosure with standard, 1/2" and 3/4" FPT ports for easy hook-up and operation in harsh process environments.

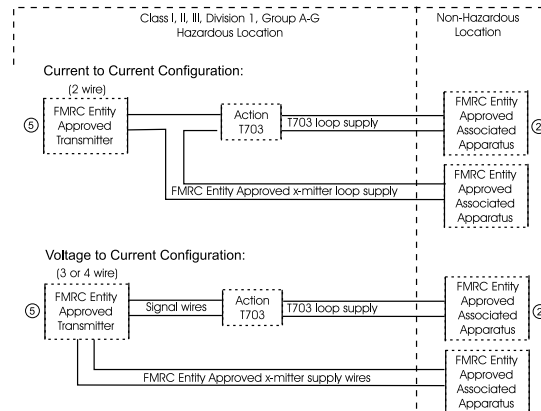
Transpak™





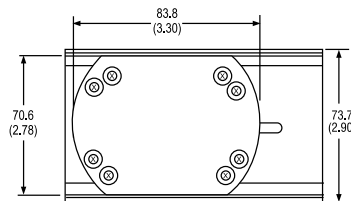
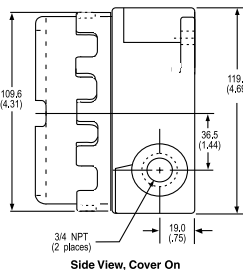
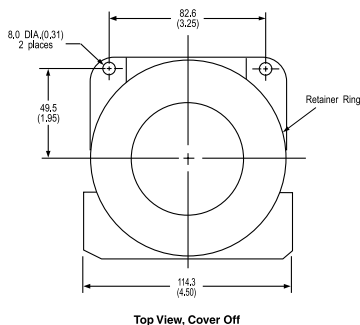
### Installation (Drawing No. 790-0028-00)

- The T703 loop supply Entity parameters:  $V_{max} - 33V$ ,  $I_{max} - 178.5mA$ ,  $C_i - 12, nF$ ,  $L_i - 0uH$ .
- FMRC Entity Approved associated apparatus used in an Approved configuration with  $V_{oc}$  or  $V_t$  less than  $V_{max}$  (33V) and  $I_{sc}$  or  $I_t$  less than  $I_{max}$  (178.5mA).
- $C_i$  of T703 (12 nF) plus total cable capacitance may not exceed  $C_a$  of associated apparatus.
- $L_i$  of T703 (0uH) plus total cable inductance may not exceed  $L_a$  of associated apparatus.
- Observe all requirements specified by the manufacturer's installation drawing for the Entity Approved x-mitter as well as the following requirements:
  - $V_{oc}$  or  $V_t$  of associated apparatus supplying FMRC Entity Approved x-mitter may not exceed 30V or the  $V_{max}$  of the x-mitter, whichever is lower.
  - $I_{sc}$  or  $I_t$  of associated apparatus supplying FMRC Entity Approved x-mitter may not exceed 60mA of the  $I_{max}$  of the x-mitter, whichever is lower.
  - $C_i$  of FMRC Entity Approved x-mitter plus total cable capacitance may not exceed  $C_a$  of associated apparatus. T703 input terminals contribute 0uF.
  - $L_i$  of FMRC Entity Approved x-mitter plus total cable inductance may not exceed  $L_a$  of associated apparatus. T703 terminals contribute 0uH.
- Control room equipment may not use or generate over 250 VRMS.
- Install in accordance with the NEC and local codes.
- Run all wiring within separate cables or separate shields.

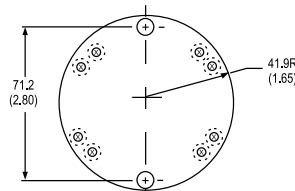


### Mounting Hardware

Dimensions in millimeters (inches)



T902 MOUNTING PLATE  
(For snap-track mounting;  
includes snap track)  
Aluminum Alloy #6061 (0.06in, thick)

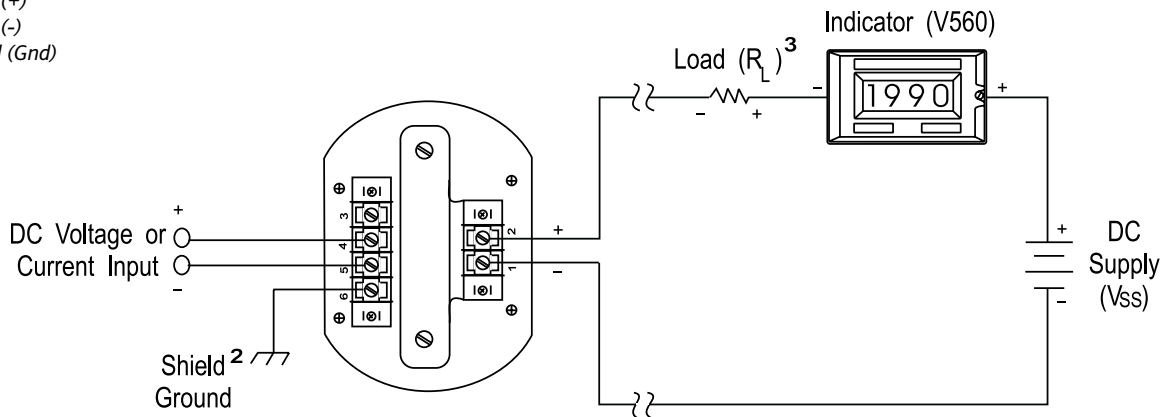


T910 MOUNTING PLATE  
(For bulkhead mounting)  
Aluminum Alloy #6061 (0.06in, thick)

T805 Field Mountable Housing (EP, NEMA 4 rated) 3/4" Hub  
(Includes T903 Retainer Ring & NEMA 4 Gasket)

### T703 Terminal Wiring

- Loop Output (-)
- Loop Output (+)
- No Connection
- Input (+)
- Input (-)
- Shield (Gnd)



**Note 2:** For best RF & common mode rejection, ground the case (pin 6).  
**Note 3:**  $R_L$  represents any other device loads in the current loop.

## Specifications

### Input Span Range (Min/Max)

See Table 1. Note: Bipolar span selection will move unipolar range to reflect negative offset (e.g., 20mA = ±10mA)

### Input Impedance:

Ranges 1-4: 5M Ohms, typical  
Ranges 5-12: >200k Ohms, typical  
Ranges 13-16: 20 Ohms, typical

### Output Span (fixed):

4-20mA

### Minimum Output Current:

3.3mA, typical

### Maximum Output Current:

24mA, typical

### Supply Voltage Range:

13 to 80VDC

### Maximum Change In Supply Voltage Effect:

0.05% of Span

### Maximum Changes In Load Effect:

0.05% of Span

### Loop Voltage Drop:

13VDC @ 20mA

### Output Current Limiting:

Active: 27mA

Fused (fixed): 0.25A

## Entity Parameters:

$V_{OC} = 33VDC$ ,  $I_{SC} = 178.5mA$ ,

$C_1 = 12nF$ ,  $L_1 = 0uH$

## Stability:

Zero: ±0.02% of span/°C, max. (±0.05%, bipolar)

Span: ±0.03% of span/°C, max.

## Accuracy:

Overall (Includes best straight line Linearity, Hysteresis & Repeatability @ 25°C):

±0.2% of any adjusted span, max.

Linearity: ±0.1% of range

Hysteresis & Repeatability: ±0.05% of range

Settability: ±0.05% of range

## Zero Adjustability:

80% "turn-up" of span (max)

## Span Adjustability:

80% "turn-down" of full-scale range (max)

## Response Time (63% response):

100ms, max.

## Output Ripple:

0.1% of span, rms, typical 0.5%, max.

## Normal Mode Rejection:

16dB @ 60Hz

## Common Mode Rejection:

60Hz: 80dB, DC: 120dB

## Common Mode Range:

60Hz: 1000Vrms

DC: 1000VDC

## RFI Effect (1.5W, 470MHz at 1.7 ft):

<1% of span error

## Isolation:

1000Vrms maximum, input to output, input to case, output to case.

## Temperature Range:

Operating : -40 to 80°C

Storage: (-40 to 176°F)

## Weight:

0.58lbs

## Agency Approval:

FM approved intrinsically safe for hazardous locations, certificate No. J.I. 1V4A5.AX.

CSA approved intrinsically safe for hazardous locations, Class I, Division I, Groups A-D, when connected in accordance with manufacturer's drawing 790-0025 (File No. LR42272-40).

## Ordering Information

### Models & Accessories

#### Specify:

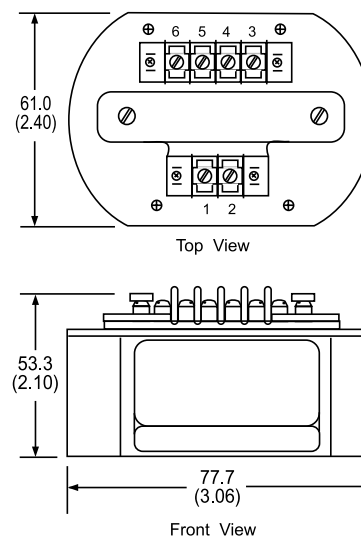
1. Model **T703-2000**
2. Option: U (see text)
3. Optional Custom Factory Calibration: Specify **C620** with desired input and output range.

## Accessories

- M004** Snap-in channel track, 4 ft. (non-conducting).
- T902** Mounting plate for M004, includes 4" track.
- T910** Bulkhead (flat surface) mounting plate.
- T805** NEMA 4, explosion proof enclosure
- AP9046** Action Pak 24/40VDC, 65mA power supply.
- V565** 3-1/2 digit remote loop-powered indicator, wide-ranging display, NEMA 4X enclosure. CSA & FM approval standard, specify Option C to house Transpak.

## Dimensions

Dimensions in millimeters (inches)





T713-0000  
T713-0013 (-200°C offset)

# TRANSPAK™ T713

## RTD Input Isolating, Field Configurable Two-Wire Transmitter

Provides an Isolated, Linearized Current Loop in  
Proportion to a 3-Wire Pt100 RTD Input



- Field Configurable, Switch Selectable Input Ranges
- Eliminates Ground Loops
- Wide Ranging Zero & Span
- Integral RTD Linearization/Output Linear to Temperature
- FM Safety Approval for Hazardous Installations

### Description

The T713 series has 6 widely adjustable input ranges and 2 output ranges, all of which are field selectable via top accessed DIP switches. The T713 provides 600VDC of isolation with outputs of either 4-20mA or 10-50mA. Current outputs are linear to temperature. Urethane coating of internal circuitry for protection from corrosive atmospheres is included as standard.

The T713 has an 80% zero and span adjustability within any user selected input range. For example, Range 1 of Table 1 specifies 0 to 1000° F with a minimum span of 200° F ( $1000^{\circ} - 200^{\circ} = 800^{\circ}$ , or 80%). This 80% adjustability allows the user to field calibrate the unit for the maximum (0 to 1000°) down to any minimum (200°) span (e.g. 740° to 940°) - as long as that adjusted span remains within the selected 0 to 1000°F range. The same is true for any user selectable range: all spans are field adjustable from 20% (minimum span) to 100% of the specified range.

### Application

The T713 is useful in any application requiring isolation of a 2-wire loop current from a 3-wire RTD. Typical applications include SCADA and remote data acquisition such as monitoring boiler or custody transfer/pipeline temperatures. The output of the T713 can be used to drive a digital meter for direct display or interface with a computer for monitoring and control applications.

The T713 is FM approved for intrinsically safe operation in Class I, Division 1, Groups A, B, C, and D; Nonincendive Class I Division 2, Groups A, B, C and D, and Classes II & III, Division 2, Group G hazardous locations when installed per manufacturer's drawing 790-0024-00. Refer to model T805 for NEMA 4, FM/CSA/CENELEC approved explosion proof housing.

## Calibration

**Note:** Factory settings are:

Input: Range 1  
Output: 4-20mA

1. Open the access lid on the top of the unit (see Top View Diagrams).
2. Select the output range using switch S4. The CLOSED position selects a 10-50mA output. The OPEN position selects a 4-20mA output.
3. Select the input range from Table 1 or 2 and configure switches S1 through S4.
4. Connect the input to a calibrated 3-wire resistance source and monitor the output current (refer to terminal wiring).
5. Set the calibrator to the desired minimum temperature.
6. Adjust the coarse zero rotary switch to obtain an output of approximately 4mA or 10mA. Adjust the fine zero for exact calibration. Note that it may be necessary to switch coarse zero up or down one position.
7. Set the calibrator to the desired maximum temperature and perform similar adjustments using the coarse span switch and fine span potentiometer.

Table 1: T713-0000 Input Ranges

Input Range (100 Ohm Pt RTD) 0.00385 alpha	° C		° F		Switch Position		
	Input Limits	Minimum Span	Input Limits	Minimum Span	1	2	3
1	0 to 600	120	0 to 1000	200			■
2	0 to 300	60	0 to 500	100		■	
3	0 to 50	10	30 to 130	20	■		

Key: ■ = 1 = ON or Closed

Table 2: T713-0013 Input Ranges

Input Range (100 Ohm Pt RTD) 0.00385 alpha	° C		° F		Switch Position		
	Input Limits	Minimum Span	Input Limits	Minimum Span	1	2	3
1	-200 to 360	120	-300 to 700	200			■
2	-200 to 85	60	-300 to 200	100		■	
3	-200 to -155	20	-300 to -250	40	■		

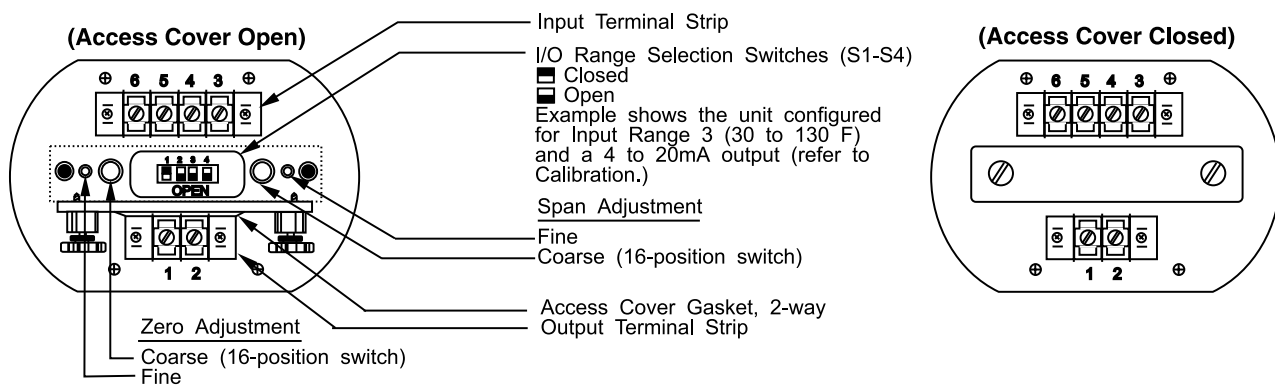
Key: ■ = 1 = ON or Closed

## Field Mounting

The T713 is designed for installation in industrial field environments. A sealed, diecast aluminum housing protects against corrosion, moisture, dust and electrical noise such as radio-frequency (RFI) and electromagnetic (EMI) interference. All circuit boards are urethane coated for environmental protection and FM approval.

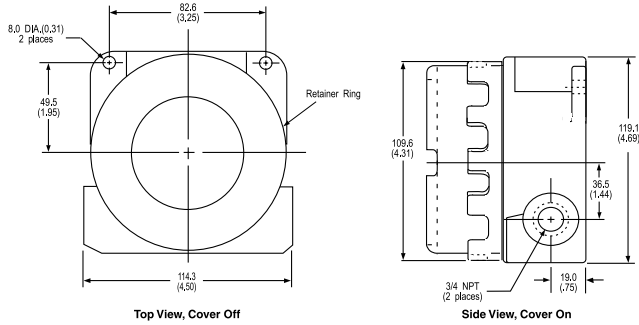
For protection against extreme moisture, hose directed water (NEMA 4) or hazardous environments, use the T805, a rugged EP/NEMA 4 enclosure with standard, 1/2" and 3/4" FPT ports for easy hookup and operation in harsh process environments.

### Top View Diagram

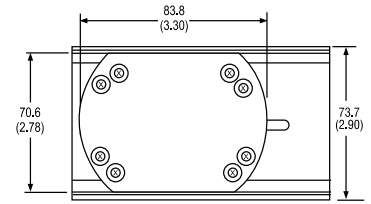


## Mounting Hardware

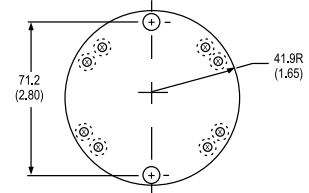
Dimensions in millimeters (inches)



T805 Field Mountable Housing (EP, NEMA 4 rated) 3/4" Hub  
(Includes T903 Retainer Ring & NEMA 4 Gasket)



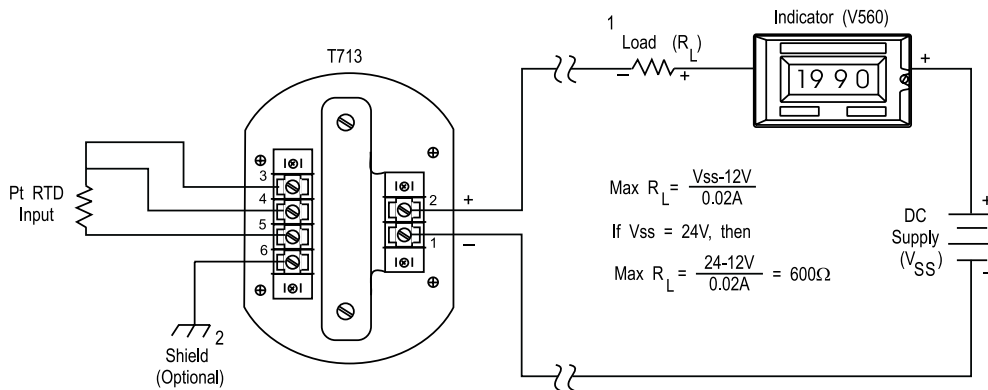
T902 MOUNTING PLATE  
(For snap-track mounting;  
includes snap track)  
Aluminum Alloy #6061 (0.06in, thick)



T910 MOUNTING PLATE  
(For bulkhead mounting)  
Aluminum Alloy #6061 (0.06in, thick)

## T713 Terminal Connections

1. Loop Output (-)
2. Loop Output (+)
3. RTD Exc (+)
4. RTD (-)
5. RTD (-)
6. Shield (Gnd)



**NOTE 1:**  $R_L$  represents any other device loads in the current loop.

**NOTE 2:** For best RF and common mode rejection, ground the case (pin #6).

## Specifications

### Input Span Range (Min/Max):

See Tables 1, 2

### Excitation Current:

1mA, typical

### Leadwire Resistance Effect:

1% of span error with up to 40 Ohms/lead

### Output Span:

4-20mA/10-50mA, switch selectable

### Minimum Output Current:

3.3mA, typical

### Maximum Output Current:

4-20mA: 24mA, typical

10-50mA: 58mA, typical

### Supply Voltage Range:

4-20mA: 12 to 80VDC

10-50mA: 12 to 60VDC

### Maximum Change in Supply - Voltage Effect:

0.05% of span

### Maximum Change in Load Effect:

0.05% of span

### Loop Voltage Drop:

12VDC @ 20mA

### Linearizing Accuracy:

T713-0000:  $\pm 0.1\%$  of standard R/T tables, typical; 0.2% max.

T713-0013:  $\pm 0.21\%$  of standard R/T tables, typical; 0.3% max.

### Stability:

Zero:  $\pm 0.02\%$  of span/ $^{\circ}\text{C}$ , typical, or 2mV, whichever is greater

Span:  $\pm 0.01\%$  of span/ $^{\circ}\text{C}$ , typical

### Overall Accuracy (Includes Linearity, Hysteresis, Stability):

$\pm 0.5\%$  of any adjusted span, max.

### Zero and Span Adjustability:

80% of any selected range

### Repeatability:

$\pm 0.05\%$  of span, typical

### Response Time:

150ms, typical, 400ms max.

### Output Ripple:

0.1% of span, rms, typical

### RFI Effect (5W, 470MHz at 3 Ft.):

<1% of span error

### Isolation:

600V DC maximum, input to output to case

### Temperature Range:

Operating:  $-40$  to  $80^{\circ}\text{C}$  ( $-40$  to  $176^{\circ}\text{F}$ )

### Weight:

0.64lbs

### Agency Approval:

FM approved intrinsically safe for hazardous locations, certificate No. J.I. 2M2A5.AX (3611).

## Ordering Information Models & Accessories

### Specify:

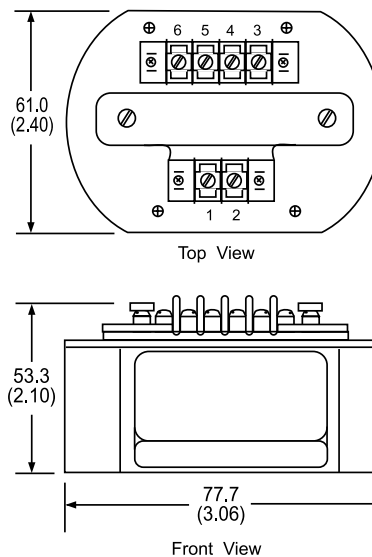
- Model:
  - T713-0000**
  - T713-0013** ( $-200^{\circ}\text{C}$  offset)
- Optional Custom Factory Calibration: Specify **C620** with desired input and output range.

### Accessories

- M004** Snap-in Channel Track, 4 ft. (nonconducting).
- T902** Mounting plate for M004, includes 4" track.
- T910** Bulkhead (flat surface) mounting plate.
- AP9046** Action Pak 24/40VDC, 65mA Power Supply.
- T805** NEMA 4, explosion proof enclosure.
- V565** 3-1/2 digit remote loop-powered indicator, wide ranging display, NEMA 4X enclosure, CSA & FM approval standard. Specify Option C to house Transpak.
- C620** Factory calibration (user specified).

## Dimensions

Dimensions in millimeters (inches)





T723-0000 (Type J/K/T input)  
T723-0001 (Type E/R/S input)

# TRANSPAK™ T723

## Thermocouple Input Isolating, Field Configurable Two-Wire Transmitter

Provides an Isolated Current Loop in Proportion to a Thermocouple Input



- Field Configurable Switch Selectable Input Ranges
- Eliminates Ground Loops
- Integral Cold-Junction Compensation
- 600V Input to Output Isolation
- Wide Ranging Zero and Span Adjustability (80%)
- FM Safety Approval for Hazardous Installations

### Description

The T723 offers a choice of J/K/T or E/R/S input ranges and 2 output ranges, which are field selectable via top-accessed DIP switches (see Tables 1-2). The T723 provides 600 VDC input to output isolation with outputs of either 4-20mA or 10-50mA. The current output is linear to the equivalent mV thermocouple signal and non-linear to temperature, which is useful in data acquisition systems that utilize linearizing software. Upscale burnout (maximum output with an open thermocouple) is standard.

The T723 has 80% zero and span adjustability within any user selected input ranges shown in Table 1 and 2. For example, Range K1 of Table 1 specifies 0° to 500°C with a minimum span of 100°C (500°-100° = 400°, or 80%). This 80% adjustability allows the user to field calibrate the unit from the maximum (0 to 500°) down to any minimum (100°C) span (e.g. 14°C to 114°C) as long as that adjusted span remains within the selected 0 to 500°C range. The same is true for any user selectable range: all spans are field adjustable from 20% (minimum span) to 100% of the specified range.

### Application

The T723 is useful in any application requiring isolation of a 2-wire loop current from a thermocouple input. Typical applications include energy management and data acquisition such as monitoring remote boiler temperatures. The output of the T723 can interface with a digital meter for direct display or interface with a computer for monitoring and control applications.

The T723 is FM approved for intrinsically safe operation in Class I, Division 1, Groups A, B, C, and D; Nonincendive Class I Division 2, Groups A, B, C and D, and Classes II & III, Division 2, Group G hazardous locations when installed per manufacturer's drawing 790-0024-00. Refer to model T805 for NEMA 4, FM/CSA/CENELEC approved explosion proof, field mount housing.

### Options

- B** Downscale Burnout (minimum output with an open TC)

Urethane coating of internal circuitry for protection from corrosive atmospheres is included as standard.

## Calibration

Factory settings are:

Input Range: J1

Output Range: 4-20mA

1. Open the access lid on the top of the unit (see Top View Diagrams).

2. Select the output range using switch S6. The CLOSED position selects a 10-50mA output. The OPEN position selects a 4-20mA output.

3. Select the input range from Table 1 or 2 and configure switches S1 through S5.

4. Connect the input to a calibrated thermocouple source. Connect the output loop to a voltage supply and monitor the output current. Refer to Terminal Wiring.

5. Set the calibrator to the desired minimum.

6. Adjust the coarse zero rotary switch to obtain an output of approximately 4mA or 10mA. Adjust the fine zero for exact calibration.

**Note:** It may be necessary to switch coarse zero up or down one position.

7. Set the calibrator to the desired maximum and perform similar adjustments using the coarse span switch and fine span potentiometer.

8. Repeat fine zero and span adjustment for maximum accuracy

## Field Mounting

The T723 is designed for installation in industrial field environments. A sealed, diecast aluminum housing protects against

Table 1: T723-0000 Input Ranges

TC Type/Range	° C		° F		Switch Position				
	Input Limits	Minimum Span	Input Limits	Minimum Span	1	2	3	4	5
J1	0 to 500	100	0 to 900	200	■	■	■	■	■
J2	0 to 760	150	0 to 1400	300	■	■	■	■	■
J3	-200 to 600	200	-350 to 1100	350	■	■	■	■	■
K1	0 to 500	100	0 to 900	200	■	■	■	■	■
K2	0 to 1000	200	0 to 1900	400	■	■	■	■	■
K3	0 to 1370	300	0 to 2500	500	■	■	■	■	■
K4	-270 to 500	200	-450 to 900	400	■	■	■	■	■
T1	0 to 400	100	0 to 750	150	■	■	■	■	■
T2	-270 to 400	200	-450 to 750	350	■	■	■	■	■

Key: ■ = 1 = ON or Closed

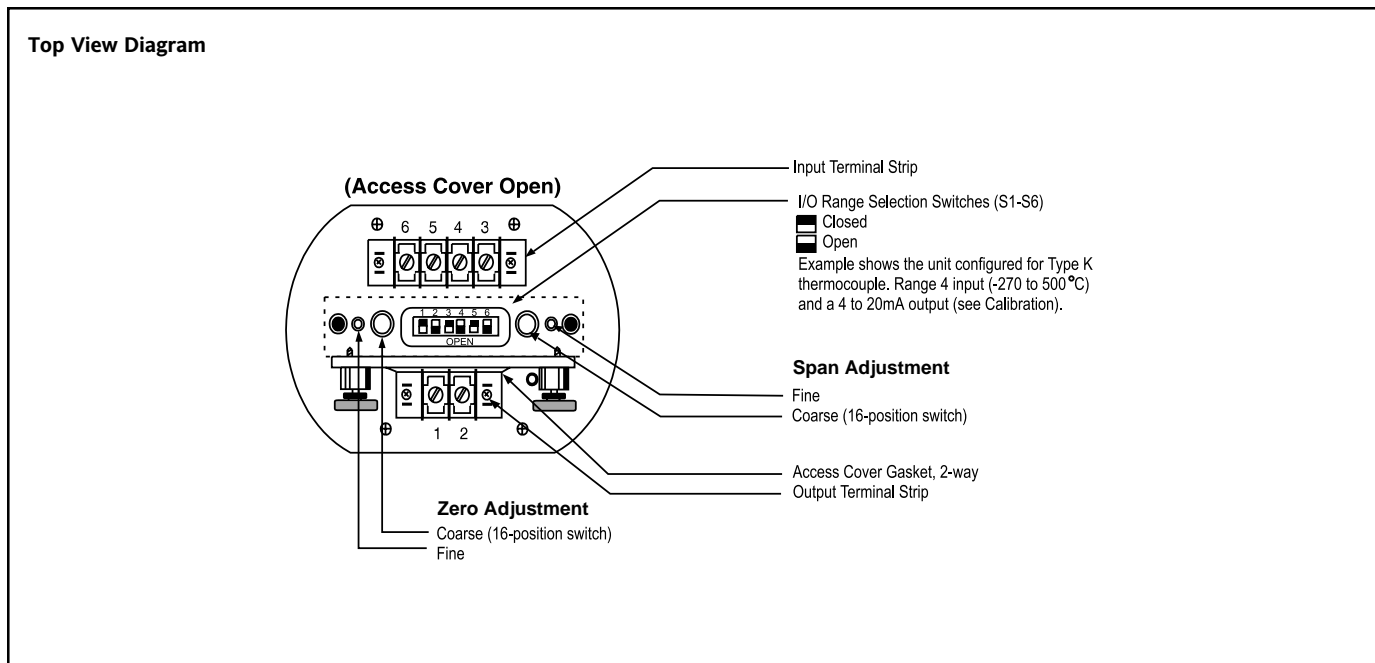
Table 2: T723-0001 Input Ranges

TC Type/Range	° C		° F		Switch Position				
	Input Limits	Minimum Span	Input Limits	Minimum Span	1	2	3	4	5
E1	0 to 150	30	0 to 300	60	■	■	■	■	■
E2	0 to 300	60	0 to 600	120	■	■	■	■	■
E3	0 to 500	100	0 to 950	200	■	■	■	■	■
E4	0 to 1000	200	0 to 1800	400	■	■	■	■	■
E5	-270 to 0	100	-450 to 0	160	■	■	■	■	■
E6	-270 to 150	150	-450 to 300	200	■	■	■	■	■
E7	-270 to 350	200	-450 to 650	350	■	■	■	■	■
E8	-270 to 850	300	-450 to 1550	550	■	■	■	■	■
R/S1	0 to 950	220	0 to 1700	400	■	■	■	■	■
R/S2	0 to 1760	450	0 to 3200	750	■	■	■	■	■

Key: ■ = 1 = ON or Closed

corrosion, moisture, dust and electrical noise such as radio frequency (RFI) and electromagnetic (EMI) interference. All circuit boards are urethane coated for environmental protection and FM approval.

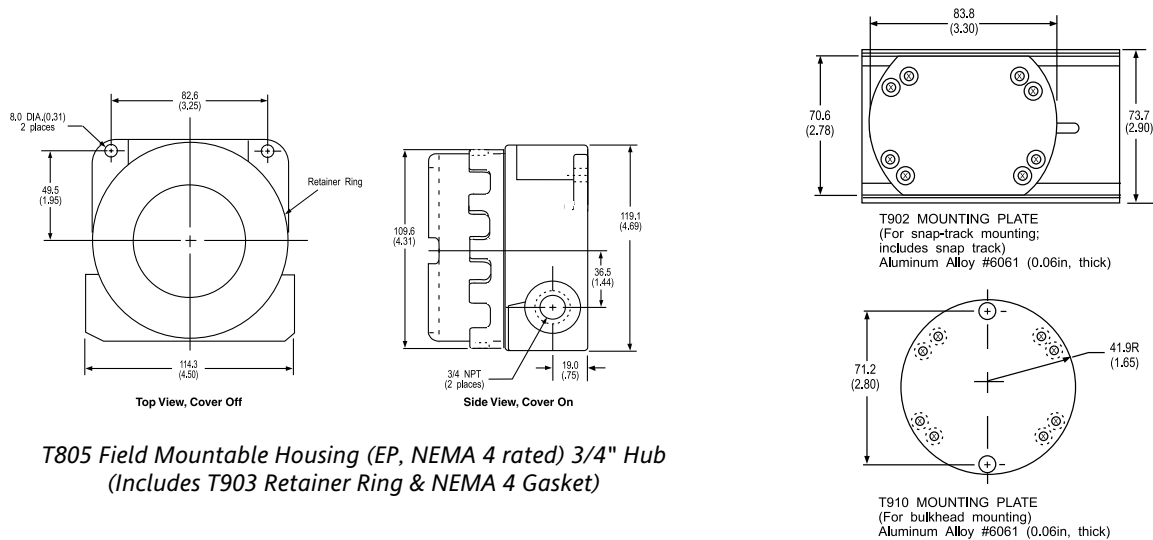
For protection against extreme moisture, hose-directed water (NEMA 4) or hazardous environments, use the T805, a rugged Explosion Proof (EP) NEMA 4 enclosure with standard, 1/2" and 3/4" FPT ports for operation in harsh process environments.





## Mounting Hardware

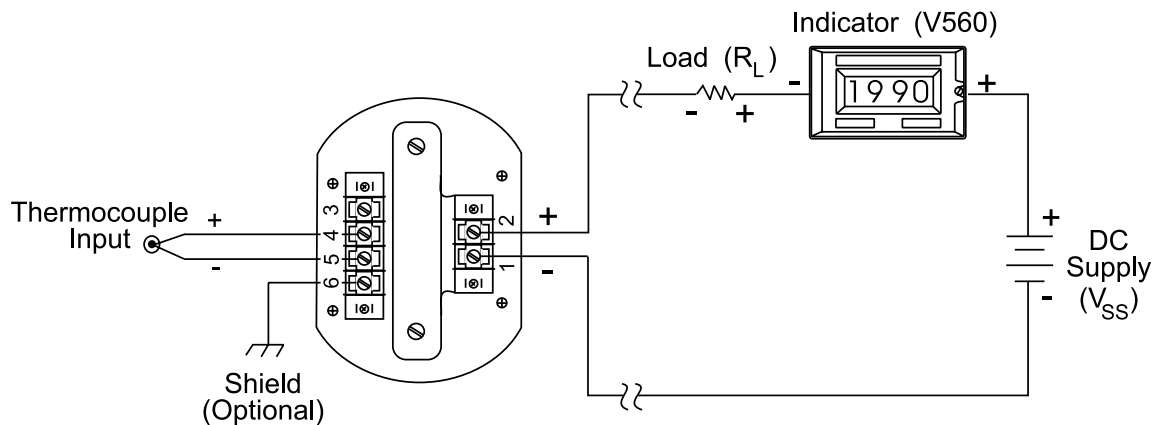
Dimensions in millimeters (inches)



**T805 Field Mountable Housing (EP, NEMA 4 rated) 3/4" Hub**  
(Includes T903 Retainer Ring & NEMA 4 Gasket)

## T723 Terminal Connections

1. Loop Output (-)
2. Loop Output (+)
3. No Connection
4. Input (+)
5. Input (-)
6. Shield (Gnd)



**Note 1:** For best RF & common mode rejection, ground the case (pin 6).

**Note 2:**  $R_L$  represents any other device loads in the current loop.

## Specifications

### Input Span Range (Max/Min):

See Tables 1 and 2

### Leadwire Resistance Effect:

<0.25  $\mu$ V/Ohm

### Burnout Detection Current:

250nA, max.

### Output Span:

4-20mA/10-50mA, switch selectable

### Minimum Output Current:

3.3mA, typical

### Maximum Output Current:

4-20mA: 24mA, typical  
10-50mA: 58mA, typical

### Supply Voltage Range:

4-20mA: 12 to 80VDC  
10-50mA: 12 to 60VDC

### Maximum Change in Supply:

0.05% of span

### Maximum Change in Load Effect:

0.05% of span

### Loop Voltage Drop:

12VDC @ 20mA

### Stability:

Zero:  $\pm 0.02\%$  of span/ $^{\circ}$ C, max.  
Span:  $\pm 0.01\%$  of span/ $^{\circ}$ C, max.

### Overall Accuracy (Includes Linearity, Hysteresis, Stability):

$\pm 0.5\%$  of any adjusted span, max.

### Zero and Span Adjustability:

80% of any selected range

### Repeatability:

$\pm 0.05\%$  of span, typical

### Cold-Junction Error (Ambient):

J/K/T/E Inputs  
0 to 80 $^{\circ}$ C: 1 $^{\circ}$ C, typical  
-40 to 0 $^{\circ}$ C: 3 $^{\circ}$ C, typical

### R/S Inputs

0 to 80 $^{\circ}$ C: 2 $^{\circ}$ C, typical  
-40 to 0 $^{\circ}$ C: 5 $^{\circ}$ C, typical

### Response Time:

100ms, typical; 200ms, max.

### Output Ripple:

0.1% of span, rms, typical

### RFI Effect (5W, 470MHz at 3 Ft.):

<1% of span error, typical

### Isolation:

600V DC or peak AC max., input to output to case

### Temperature Range:

Operating: -40 to 80 $^{\circ}$ C (-40 to 176 $^{\circ}$ F)

### Weight:

0.56lbs

### Agency Approvals:

FM approved intrinsically safe for hazardous locations, certificate No. 2M2A5AX.

## Ordering Information Models & Accessories

### Specify:

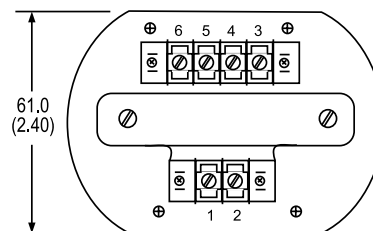
1. Model: **T723-0000**: J/K/T Inputs  
Model: **T723-0001**: E/R/S Inputs
2. Option: B (Downscale Burnout)
3. Optional Custom Factory Calibration: Specify **C620** with desired input and output range.

### Accessories

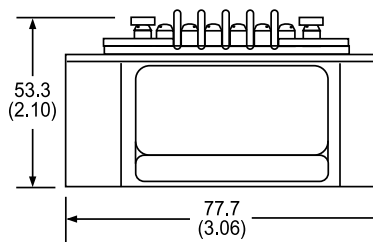
- M004** Snap-in Channel Track, 4 feet.
- T902** Mounting plate for M004, includes 4" track.
- T910** Bulkhead (flat surface) Mounting plate.
- T805** Explosion Proof/NEMA4 enclosure
- AP9046** Action Pak 24/40VDC, 65mA Power Supply.
- V565** 3-1/2 digit remote loop powered indicator. Wide ranging display, NEMA 4X enclosure. CSA & FM approval standard. Specify Option C to house Transpak.

## Dimensions

Dimensions in millimeters (inches)



Top View



Front View



T752-0000

# TRANSPAK™ T752

## Potentiometer Input Isolating, Field Configurable Two-Wire Transmitter

Provides an Isolated Current Loop in Proportion to a 3-Wire Potentiometer Input



- Accepts 0-50 Ohm to 0-200k Ohm Potentiometers
- Protects Equipment with 600V Input-to-Output Isolation

- Eliminates Ground Loops
- Wide Ranging Zero and Span Adjustability
- FM Safety Approval for Hazardous Installations

### Description

The T752 accepts potentiometer inputs from 0 to 50 Ohms to 0 to 200k Ohms (end to end). The T752 provides 600 VDC of isolation with outputs of either 4-20mA or 10-50mA which are field selectable via top accessed DIP switch. The current outputs are in proportion to the potentiometer input. Urethane coating of internal circuitry for protection from corrosive atmospheres is included as standard.

The T752 has 80% zero and span adjustability within the input range of the potentiometer. This allows the user to field calibrate the unit for a wide variety of input spans from the maximum (100%) down to any minimum (20%) span (e.g., 4% to 24%) as long as the adjusted span remains within the input range of the potentiometer.

### Application

The T752 is useful in any application requiring isolation of a 2-wire loop current from a 3-wire potentiometer. Typical applications include tank level data acquisition and position sensor conditioning. The output of the T752 can be used to drive a digital meter for direct display or interface with a computer for monitoring or control.

The T752 is FM approved for intrinsically safe operation in Class I, Division 1, Groups A, B, C, and D; Nonincendive Class I Division 2, Groups A, B, C and D, and Classes II & III, Division 2, Group G hazardous locations when installed per manufacturer's drawing 790-0024-00.

### Calibration

Factory settings are:

Input Range: 0-100%  
Output Range: 4-20mA

1. Open the access lid on the top of the unit (see Top View Diagram).
2. Select the output range using switch 1. The CLOSED position selects a 10-50mA output. The OPEN position selects a 4-20mA output. (Switches 2-6 are not used.)
3. Connect the input to a potentiometer. Connect the output loop to a voltage supply and monitor the output current (refer to the terminal wiring).
4. Set the potentiometer to the desired minimum.
5. Adjust the coarse zero rotary switch to obtain an output of either 4mA or 10mA. Adjust the fine zero for exact calibration. Note that it may be necessary to switch the coarse zero up or down one position.
6. Set the potentiometer to the desired maximum and perform similar adjustments using the coarse and fine span potentiometer.

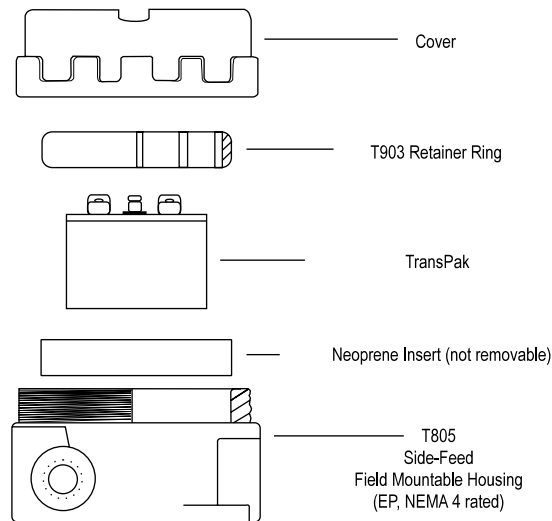
It may be necessary to repeat steps 4, 5, and 6 for best accuracy.

## Field Mounting

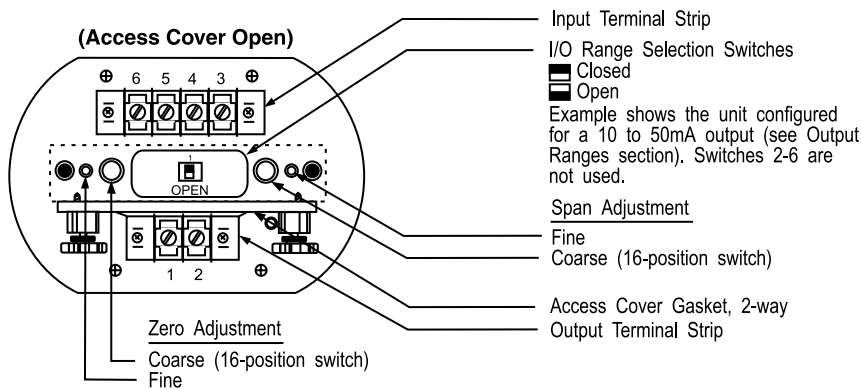
The T752 is designed for installation in industrial field environments. A sealed, diecast aluminum housing protects against corrosion, moisture, dust and electrical noise such as radio-frequency (RFI) and electromagnetic (EMI) interference. All circuit boards are urethane coated for environmental protection and FM approval.

For protection against extreme moisture, hose-directed water (NEMA 4) or hazardous environments, use Action's T805 explosion-proof housing. The T805 provides a 1/2" and 3/4" FPT port for easy hook-up and operation in harsh process environments. Model T805 is FM and CSA certified for use in Class I, Groups B, C & D and Class II, Groups E, F & G hazardous locations.

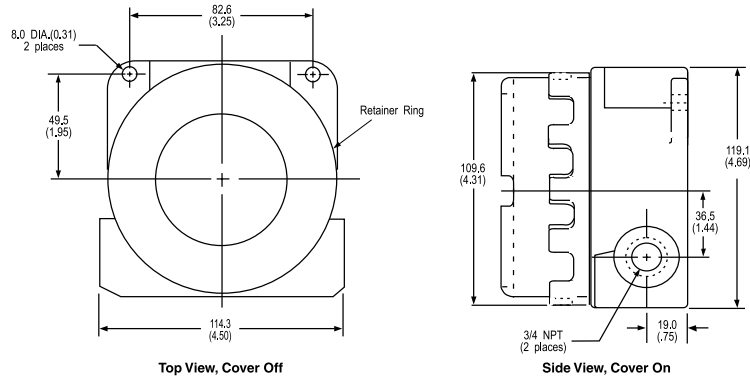
### T805 Explosion Proof Housing (Optional)



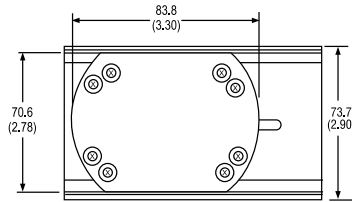
### Top View Diagram



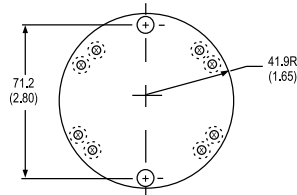
## Mounting Hardware



**T805 Field Mountable Housing (EP, NEMA 4 rated) 3/4" Hub**  
(Includes T903 Retainer Ring & NEMA 4 Gasket)



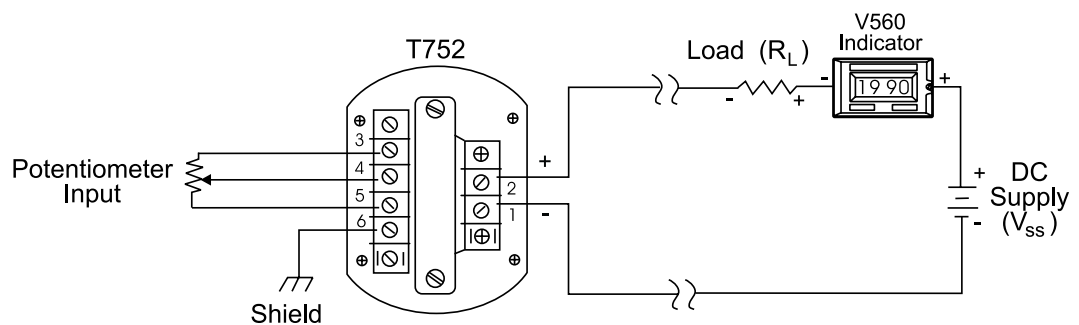
**T902 MOUNTING PLATE**  
(For snap-track mounting;  
includes snap track)  
Aluminum Alloy #6061 (0.06in, thick)



**T910 MOUNTING PLATE**  
(For bulkhead mounting)  
Aluminum Alloy #6061 (0.06in, thick)

## T752 Terminal Connections

1. Loop Output (-)
2. Loop Output (+)
3. Pot (CW)
4. Pot wiper
5. Pot (CCW)
6. Shield (Gnd)



- Note 1:** For best RF & common mode rejection, ground the case (pin 6).  
**Note 2:**  $R_L$  represents any other device loads in the current loop.

## Specifications

### Input Span Range:

Max: 0 to 100% of potentiometer

Min: 0 to 20% of potentiometer

### Excitation Voltage:

50mV typical

### Potentiometer Resistance (End to End):

50 Ohms to 200k Ohms

### Leadwire Resistance Effect:

<0.25  $\mu$ V/Ohm

### Input Impedance:

5M Ohms, typical

### Output Span:

4-20mA or 10-50mA, switch selectable

### Minimum Output Current:

3.3mA typical

### Maximum Output Current:

4-20mA: 24mA typical

10-50mA: 58mA typical

### Supply-Voltage Range:

4-20mA: 12 to 80VDC

10-50mA: 12 to 60VDC

### Maximum Change in Supply Voltage Effect:

0.05% of span

### Maximum Change in Load Effect:

0.05% of span

### Loop Voltage Drop:

12VDC @ 20mA

### Stability:

Zero:  $\pm$ 0.02% of span/ $^{\circ}$ C typical,

or 2 $\mu$ V, whichever is greater

Span:  $\pm$ 0.01% of span/ $^{\circ}$ C typical

### Overall Accuracy (Includes Linearity, Hysteresis, Repeatability):

$\pm$ 0.05% of any adjusted span maximum

### Zero and Span Adjustability:

80% of input

### Repeatability:

$\pm$ 0.05% of span

### Response Time:

50ms, max.

### Output Ripple:

0.1% of span rms, typical

### RFI Effect (5W, 470MHz at 3 Ft.):

<1% of span error

### Isolation:

600V DC maximum, input to output to case

### Temperature Range:

Operating: -40 to 80 $^{\circ}$ C (-40 to 176F)

### Weight:

0.62lbs

### Agency Approval:

FM approved intrinsically safe for hazardous location, certificate No. J.I. 2M2A5.AX.

## Ordering Information

### Models & Accessories

#### Specify:

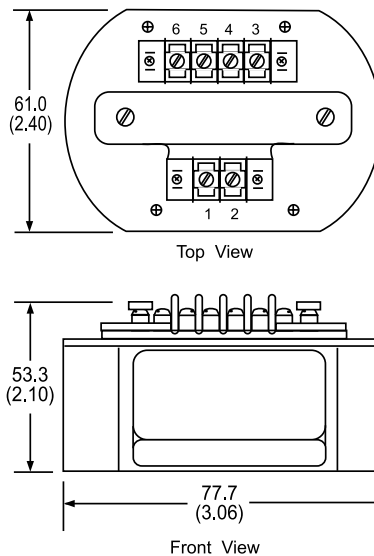
1. Model: **T752-0000**
2. Optional Custom Factory Calibration: Specify **C620** with desired input and output range.

### Accessories

- M004** Snap-in Channel Track, 4 feet.
- T902** Mounting plate for M004, includes 4" track.
- T910** Bulkhead (flat surface) Mounting plate.
- T805** Side feed explosion-proof housing (NEMA 4 rated), uncoated (specify Option P for white polyester coating).
- AP9046** Action Pak 24/40VDC, 65mA Power Supply.
- V565** 3-1/2 digit remote loop-powered indicator, wide-ranging display, NEMA 4X enclosure, CSA & FM approval standard, specify Option C to house TransPak.

## Dimensions

Dimensions in millimeters (inches)





T761-0000

# TRANSPAK™ T761

## AC Input Isolating Field Configurable Two-Wire Transmitter

Provides an Isolated Current Loop  
in Proportion to an AC Input

- Field Configurable Input Ranges
- Eliminates Ground Loops
- Wide Ranging Zero and Span Adjustability
- 600V Input-to-Output Isolation

### Description

The T761 has 12 widely adjustable input ranges and 2 output ranges, all of which are field selectable via top-accessed DIP switches. The T761 provides 600 VDC of isolation with outputs of either 4-20mA or 10-50mA. The current outputs are in proportion to selected AC voltage or current input.

The T761 measures the average value of the AC input signal and is calibrated for sine wave signals over a frequency range of 20Hz to 3KHz. For other wave forms, the calibration may be different, but the T761 will remain linear for the same wave form. For example, if the unit is calibrated using a square wave, the calibration will be valid for all square wave inputs in that range. The maximum DC component of the input signal is 50% of the range (e.g., 75VDC is half of a 0-150VAC range).

The T761 has 80% zero and span adjustability within most user-selected input ranges. For example, Range 3 of Table 1 specifies 0 to 25V with a minimum span of 5V (25V-5V = 20V, or 80%). This 80% adjustability allows the user to field calibrate the unit from the maximum (0 to 25V) down to any minimum (5V) span (e.g. 10V to 15V) as long as that adjusted span remains within the selected 0 to 25V range.

### Application

The T761 is useful in any application requiring the isolation of a 2-wire loop current from an AC signal source. Typical applications include AC motor status and energy management. The output of the T761 can be used to drive a digital meter for direct display or interface with a computer for monitoring and control.

### Options

**U** Urethane coating of internal circuitry for protection from corrosive atmospheres.

**C620** Factory calibration to customer's specifications.

### Calibration

1. Open the access lid on the top of the unit (see Top View Diagram).
2. Select the output range using switch S1. The CLOSED position selects a 10-50mA output. The OPEN position selects a 4-20mA output.
3. Select the input range from Table 1 and configure switches S2 through S6.
4. Connect the input to a calibrated AC voltage or current source. Connect the output loop to a voltage supply and monitor the output current (refer to terminal wiring).
5. Set the calibrator to the desired minimum.
6. Adjust the coarse zero rotary switch to either 4mA or 10mA. Adjust the fine zero for exact calibration. Note that it may be necessary to switch coarse zero up or down one position.
7. Set the calibrator to the desired maximum and adjust the fine span to obtain an output of either 20mA or 50mA. Repeat steps 5-7, if necessary for best accuracy.

## Field Mounting

The T761 is designed for installation in industrial field environments. A sealed, diecast aluminum housing protects against corrosion, moisture, dust and electrical noise such as radio-frequency (RFI) and electromagnetic (EMI) interference.

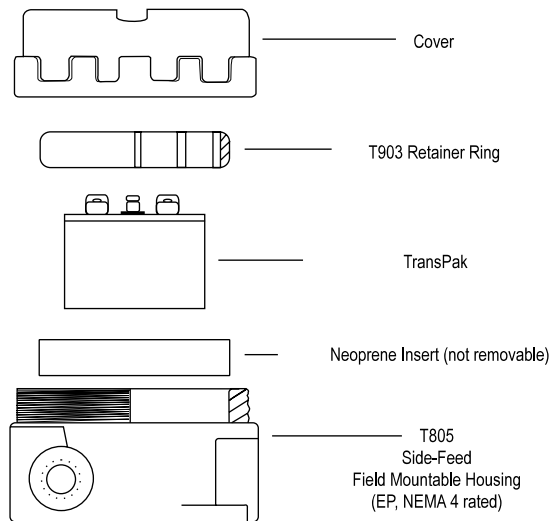
For protection against extreme moisture, hose-directed water (NEMA 4) or hazardous environments, use the T805 explosion-proof housing. The T805 provides a 1/2" and 3/4" FPT port for operation in harsh process environments. The T805 is FM and CSA certified for use in Class I, Groups B, C & D and Class II, Groups E, F & G hazardous locations.

Table 1: T761 Input Ranges

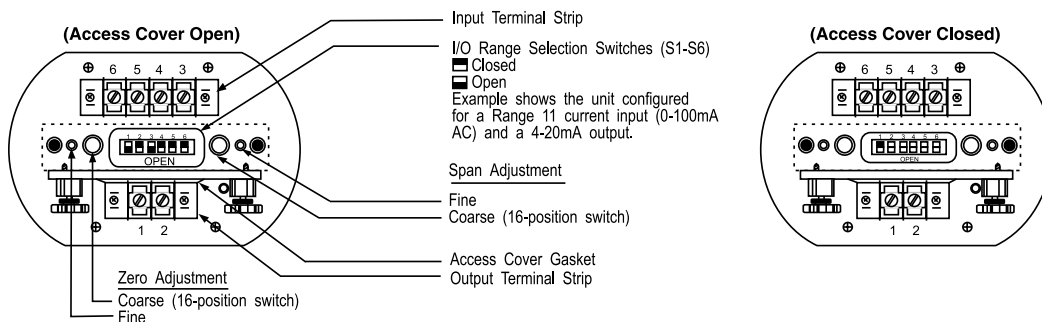
Range			Switch Position				
	Input Limits	Minimum Span	2	3	4	5	6
1	0 to 250VAC	100VAC		■			■
2	0 to 100VAC	20VAC		■			
3	0 to 25VAC	5VAC		■		■	■
4	0 to 5VAC	1VAC		■		■	
5	0 to 1VAC	200mVAC			■		■
6	0 to 200mVAC	40mVAC			■		
7	0 to 50mVAC	10mVAC			■	■	■
8	0 to 10mVAC	2mVAC			■	■	
9	0 to 2A AC	400mA AC	■		■		■
10	0 to 4mA AC	80uA AC	■		■		
11	0 to 100mA AC	20mA AC	■		■	■	■
12	0 to 20mA AC	4mA AC	■		■	■	

Key: ■ = 1 = ON or Closed

## T805 Explosion Proof Housing (Optional)

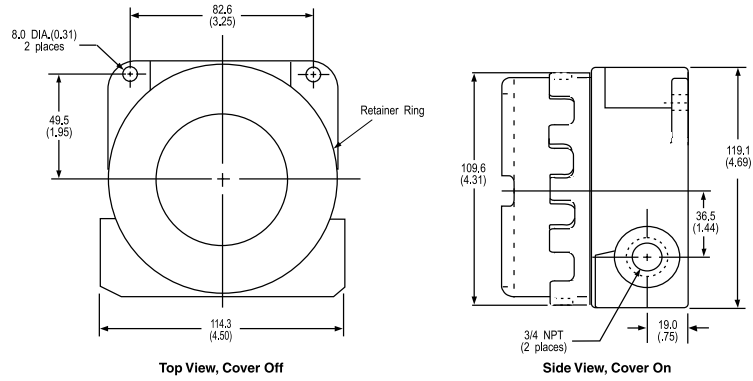


## Top View Diagram

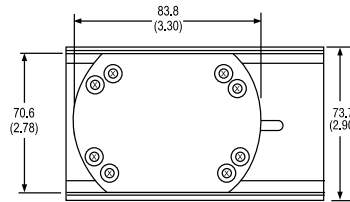




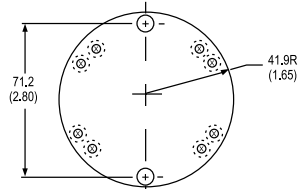
## Mounting Hardware



**T805 Field Mountable Housing (EP, NEMA 4 rated) 3/4" Hub**  
(Includes T903 Retainer Ring & NEMA 4 Gasket)



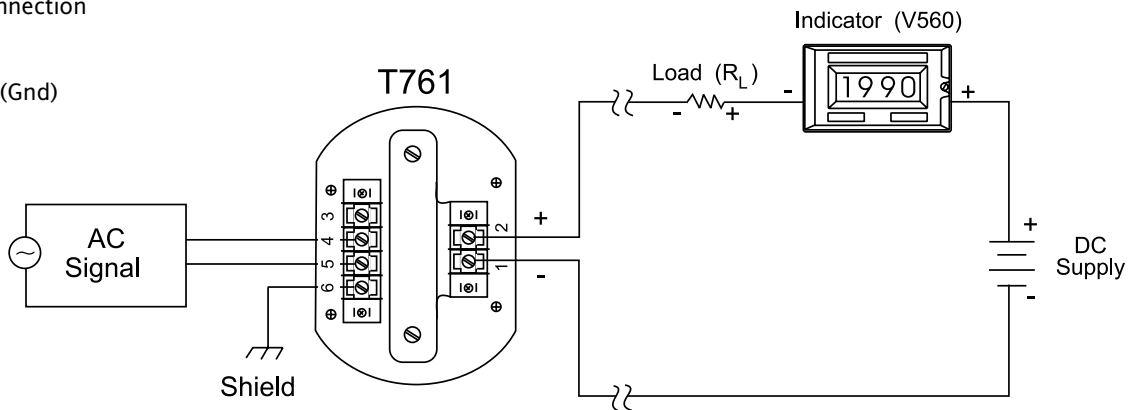
**T902 MOUNTING PLATE**  
(For snap-track mounting;  
includes snap track)  
Aluminum Alloy #6061 (0.06in, thick)



**T910 MOUNTING PLATE**  
(For bulkhead mounting)  
Aluminum Alloy #6061 (0.06in, thick)

## T761 Terminal Connections

1. Loop Output (-)
2. Loop Output (+)
3. No Connection
4. Input
5. Input
6. Shield (Gnd)



**Note 1:** For best RF & common mode rejection, ground the case (pin 6).

**Note 2:**  $R_L$  represents any other device loads in the current loop.

## Specifications

### Input Span Range (Max/Min):

See table 1

### Leadwire Resistance Effect:

<0.25 uV/Ohm

### Input Impedance:

Ranges 1-8: >1M Ohm

Ranges 9-12: 0.5 Ohm shunt

### Output Span:

4-20mA/10-50mA, switch selectable

### Minimum Output Current:

3.3mA, typical

### Maximum Output Current:

4-20mA: 24mA, typical

10-50mA: 58mA, typical

### Supply-Voltage Range:

4-20mA: 12 to 80VDC

10-50mA: 12 to 60VDC

### Maximum Change in supply Voltage Effect:

0.05% of span

### Maximum Change in Load Effect:

0.05% of span

### Loop Voltage Drop:

12VDC @ 20mA

### Stability:

Zero:  $\pm 0.02\%$  of span/ $^{\circ}\text{C}$ , typical, or 10uV/ $^{\circ}\text{C}$ , whichever is greater

Span:  $\pm 0.02\%$  of span/ $^{\circ}\text{C}$ , typical

### Overall Accuracy (Includes Linearity, Hysteresis and Stability):

$\pm 0.5\%$  of any adjusted span (50-400Hz sine wave input), max.

### Frequency Response ( $\pm 0.5\text{dB}$ ):

20Hz to 3KHz; average reading calibrated to sine wave input

### Maximum DC Input Component:

50% of range

### Zero and Span Adjustability:

80% of any selected range

### Repeatability:

$\pm 0.05\%$  of span, typical

### Response Time:

500ms, typical

### Output Ripple:

0.5% of span, rms, typical

### RFI Effect (5W, 470MHz at 3 Ft.):

<1% of span error

### Isolation:

600V DC maximum, input to output

### Temperature Range:

Operating: -40 to 80 $^{\circ}\text{C}$  (-40 to 176 $^{\circ}\text{F}$ )

### Weight:

0.64lbs

## Ordering Information Models & Accessories

### Specify:

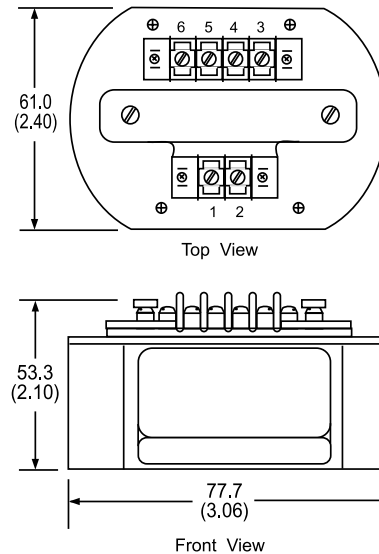
1. Model: **T761-0000**
2. Options: U (Urethane coating)
3. Optional Custom Factory Calibration: Specify **C620** with desired input and output range.

### Accessories

- M004** Snap-in Channel Track, 4 feet.
- T902** Mounting plate for M004, includes 4" track.
- T910** Bulkhead (flat surface) Mounting plate.
- T805** Side feed field-mountable housing (EP & NEMA 4 rated), uncoated (specify Option P for white polyester powder coat).
- C006** 0.1W, 5W, 1% shunt resistor
- AP9046** Action Pak 24/40VDC 65mA Power Supply.
- V565** 3-1/2 digit remote loop-powered indicator, wide-ranging display, NEMA 4X enclosure, CSA & FM approval standard, specify Option C to house TransPak

## Dimensions

Dimensions in millimeters (inches)





T773-0000

# TRANSPAK™ T773

## Frequency Input, Isolating Field Configurable Two-Wire Transmitter

Provides an Isolated Current Loop in Proportion to a Frequency Input



- Digitally-Synthesized, Field Configurable Ranges (105Hz to 18kHz)
- Eliminates Ground Loops
- Wide Ranging Zero and Span Adjustability
- Direct Magnetic Pickup Input
- Protects Equipment with 1000VRMS Isolation

### Description

The T773 isolating two-wire transmitter has 5 input ranges and 2 output ranges, all of which are field selectable via top-accessed DIP switches. The T773 can accept square, triangle or pulse waveforms up to 18KHz with amplitudes from 10mVrms to 35V peak-to-peak. The T773 provides 1000Vrms of transformer-coupled isolation with outputs of either 4-20mA or 10-50mA. Current outputs are in proportion to a selected frequency input.

The T773 has 30% zero “turn-up” and 80% span “turn-down” adjustments within any user-selected input range. For example, Range 3 of Table 1 specifies 0 to 2100Hz with a minimum span of 420Hz (2100Hz - 420Hz = 1680Hz, or 80%). This 80% adjustability allows the user to field calibrate the unit for the maximum range of 0 to 2100Hz down to the minimum range of 0 to 420Hz. The maximum obtainable offset is 30% of the calibrated span: a calibrated range of 0 of 1000 Hz can be offset by 300Hz (e.g., 300Hz to 1000Hz).

### Application

The T773 is useful in any application requiring isolation of a 2-wire loop current from a pulse output transducer, such as a magnetic pickup or a turbine flowmeter. The output of the T773 can be used to drive a digital meter for direct display of flow or velocity, or to interface with a computer or PLC for monitoring and control applications.

The T773 is CSA approved for intrinsically safe operation in Class I, Division 1, Groups A, B, C and D hazardous locations when installed per manufacturing drawing number.

### Options

**U** Urethane Coating of internal circuitry for protection from corrosive atmospheres.

### Calibration

Factory settings are:

Input Range: 1

Output Range: 4-20mA

1. Open the access lid on the top of the unit (see Top View Diagram).
2. Select the output range using switch S6. The CLOSED position selects a 10-50mA output. The OPEN position selects a 4-20mA output.
3. Select the input range from Table 1 and configure switches S1 through S5.
4. Determine the percent of span by the ratio of the desired maximum input to the input limit in Table 1 (e.g., 1000Hz/2100Hz = 48%).
5. Set the step Span rotary switch to the desired percent of span (e.g., 48% = position 4).

Percent of Span	Position
100%	A
≥90%	9
≥80%	8
≥70%	7
≥60%	6
≥50%	5
≥40%	4
≥30%	3
≥20%	2

6. Determine Zero turn-up % by the ratio of desired minimum input to the desired maximum input (e.g., 0/1000Hz = 0%).

7. Set step Zero turn-up switch to offset %. (e.g., 0% = position 0).

Zero Turn-Up % Position	
0%	0
≤10%	1
≤20%	2
≤30%	3

8. Connect the input to a calibrated frequency source. Connect the output loop to a voltage supply and monitor the output current (refer to the terminal wiring).

9. Set the calibrator to the desired minimum and adjust the fine zero to obtain an output of either 4mA or 10mA.

10. Set the calibrator to the desired maximum and adjust the fine span to obtain an output of either 20mA or 50mA. Repeat steps 9 and 10, if necessary, for maximum accuracy.

**Note:** If loop current "swings" on input ranges 1-2, close S-5 for extra filtering.

### Field Mounting

The T773 is designed for installation in industrial field environments. A sealed, diecast aluminum housing protects against corrosion, moisture, dust and electrical noise such as radio-frequency (RFI) and electromagnetic (EMI) interference.

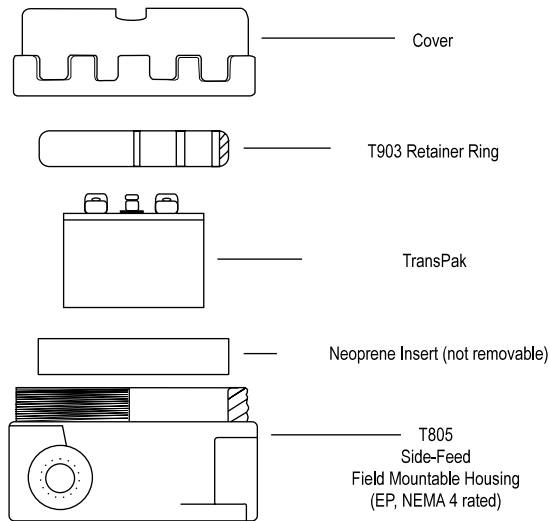
For protection against extreme moisture, hose-directed water (NEMA 4) or hazardous environments, use the T805 explosion-proof housing. The T805 provides a 1/2" and 3/4" FPT port for operation in harsh process environments. The T805 is FM and CSA certified for use in Class I, Groups B, C & D and Class II, Groups E, F & G hazardous locations.

Table 1: T773 Input Ranges

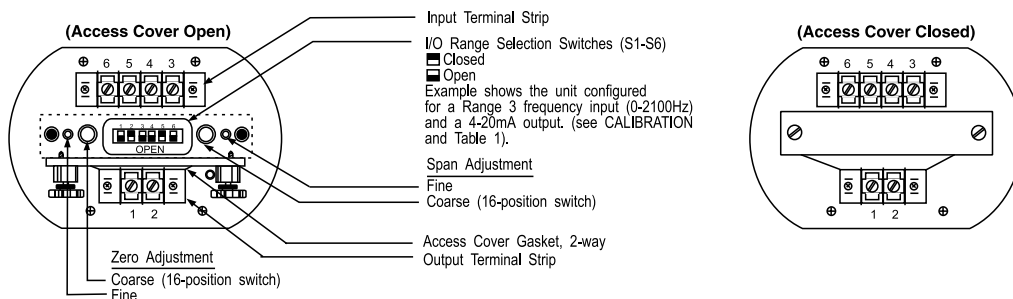
Range			Switch Position				
	Input Limits	Minimum Span	1	2	3	4	5
1	0 to 18KHz	3600Hz				■	
2	0 to 9KHz	1800Hz			■		
3	0 to 2100Hz	420Hz		■			■
4	0 to 525Hz	105Hz	■				■

Key: ■ = 1 = ON or Closed

### T805 Explosion Proof Housing (Optional)

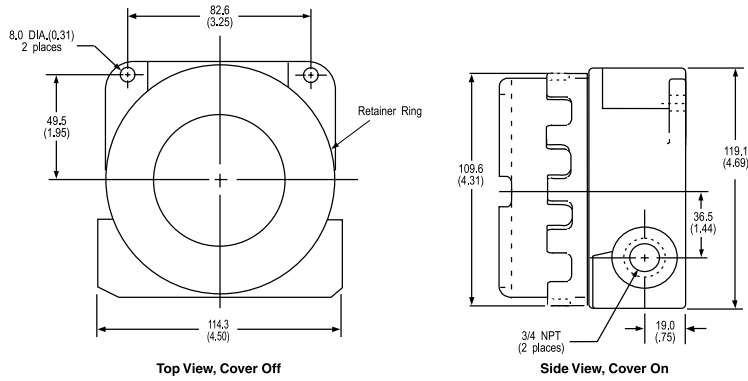


### Top View Diagram

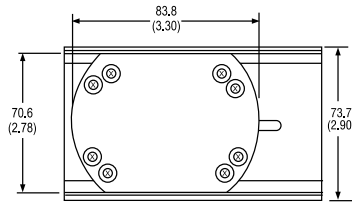


Transpak™

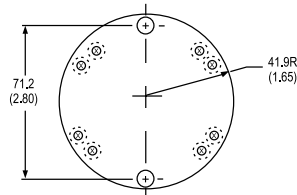
## Mounting Hardware



**T805 Field Mountable Housing (EP, NEMA 4 rated) 3/4" Hub**  
(Includes T903 Retainer Ring & NEMA 4 Gasket)



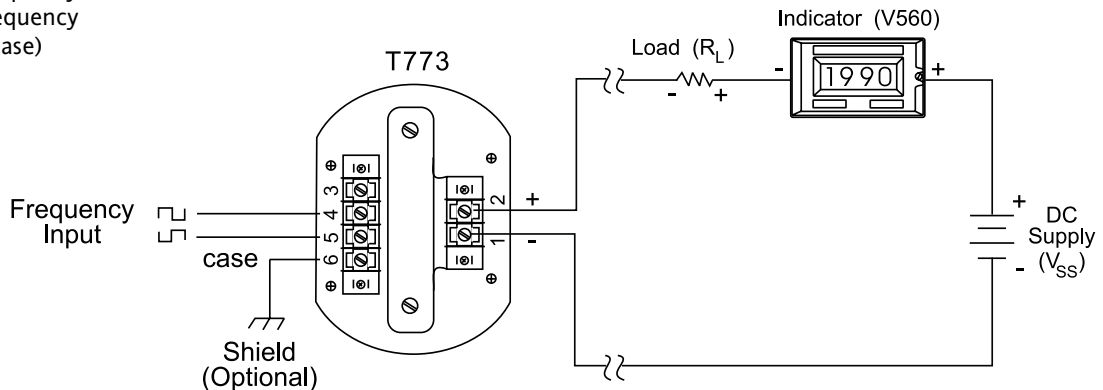
**T902 MOUNTING PLATE**  
(For snap-track mounting;  
includes snap track)  
Aluminum Alloy #6061 (0.06in, thick)



**T910 MOUNTING PLATE**  
(For bulkhead mounting)  
Aluminum Alloy #6061 (0.06in, thick)

## T773 Terminal Connections

1. Loop Output (-)
2. Loop Output (+)
3. No Connection
4. Input Frequency
5. Input Frequency
6. Shield (Case)



**Note 1:** For best RF & common mode rejection, ground the case (pin 6).

**Note 2:**  $R_L$  represents any other device loads in the current loop.

## Specifications

### Input:

Span Range (Max/Min): See Table 1  
Type: Capacitive coupled  
Minimum Amplitude:  
105-2150Hz: 10mVrms  
>2150Hz: 15mVrms  
Maximum Amplitude:  
35Vp-p  
Impedance:  
100-1KHz: >6k Ohms  
>1KHz: >40k Ohms

### Output Span:

4-20mA/10-50mA, switch selectable

### Minimum Output Current:

3.3mA, typical

### Maximum Output Current:

4-20mA: 24mA, typical  
10-50mA: 58mA, typical

### Supply Voltage Range:

4-20mA: 13 to 75VDC  
10-50mA: 13 to 50VDC

### Line Regulation:

0.07% of span (13-75V)

### Load Regulation:

0.05% of span (0-3k Ohms)

### Voltage Drop:

13VDC @ 20mA

### Stability:

Zero:  $\pm 0.015\%$  of span/ $^{\circ}\text{C}$ , typical,  
 $\pm 0.028\%$ / $^{\circ}\text{C}$ , max.  
Span:  $\pm 0.022\%$  of span/ $^{\circ}\text{C}$ , typical,  
 $\pm 0.043\%$ / $^{\circ}\text{C}$ , max.

### Overall Accuracy (Includes Linearity, Hysteresis, Stability):

$\pm 0.2\%$  of adjusted span, max.

### Zero Adjustability:

30% "turn-up" of span

### Span Adjustability:

80% "turn-down" of full-scale limit (Table 1)

### Repeatability:

$\pm 0.05\%$  of span

### Response Time (63% response):

<9KHz: 500mSec.  
>9KHz: 40mSec.

### Output Ripple, P-P (% at max. input range frequency; 0% turn-down):

Range 1: 0.5% (18KHz)  
Range 2: 0.5% (9KHz)  
Range 3: 0.7% (2100Hz)  
Range 4: 1.2% (525Hz)

### Common Mode Rejection:

60Hz: 97dB, DC: 120dB

### Common Mode Range:

60Hz: 75Vrms, max.  
DC: 1KV, max.

### RFI Effect (1.5W, 470MHz at 1.5 ft.):

<1% of span error

### Isolation:

1000Vrms maximum input to output,  
input to case, output to case

### Operating Temperature Range:

4-20mA: -40 to 80 $^{\circ}\text{C}$  (-40 to 176 $^{\circ}\text{F}$ )  
10-50mA: -40 to 60 $^{\circ}\text{C}$  (-40 to 140 $^{\circ}\text{F}$ )

### Weight:

0.58lbs

### Agency Approval:

CSA approved intrinsically safe for hazardous  
locations (File No. LR42272-70).

## Ordering Information Models & Accessories

### Specify:

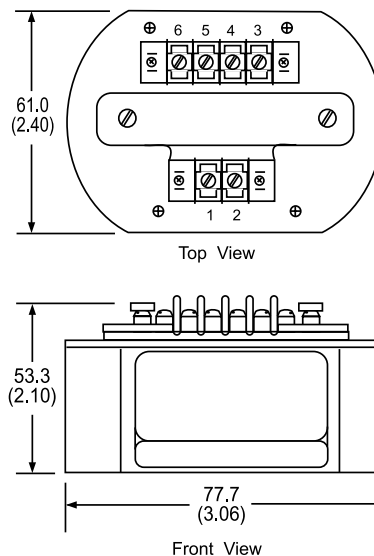
1. Model: **T773-0000**
2. Options: U (Urethane coating)
3. Optional Custom Factory Calibration: Specify **C620** with desired input and output range.

### Accessories

- M004** Snap-in Channel Track, 4 feet.
- T902** Mounting plate for M004, includes 4" track.
- T910** Bulkhead (flat surface) Mounting plate.
- T805** Side feed field-mountable housing (EP & NEMA 4 rated), uncoated (specify Option P for white polyester powder coat).
- AP9046** Action Pak 24/40VDC 65mA Power Supply.
- V565** 3-1/2 digit remote loop-powered indicator, wide-ranging display, NEMA 4X enclosure, CSA & FM approval standard, specify Option C to house TransPak

## Dimensions

Dimensions in millimeters (inches)





see back page

# TRANSPAK™ T797 & T798

## Temperature Input Smart, Isolating Two-wire Transmitter

Provides an Isolated, Linearized Current Loop in Proportion to an RTD or Thermocouple Input



- HART Compatible Protocol (T798) or Field Configurable with Optional Alphanumeric Display (T797 & T798)
- Intrinsically Safe Operation or Display & EP Enclosure
- Eliminates Ground Loops
- Programmable for 11 T/C Types, 6 RTD Types, mV or Ohm Inputs
- Minimal Calibration with Long Term Stability 0.025%/Year

### Description

The T798 is a Highway Addressable Remote Transducer (HART) based temperature transmitter that can be factory or field configured using an optional 1 or 2 line alpha-numeric display, optional PC based software and cable. Alternatively an HC275 Hand Held Communicator loaded with the T798 Device Description from the Hart Foundation Library can be used.

The T797 is a programmable temperature transmitter that can be factory or field configured using the same optional 1 or 2 line alphanumeric display as the T798.

Both the T798 and T797 accept a wide variety of thermocouples (B, C, E, J, K, L, N, R, S, T, U & special) and 2-wire, 3-wire, or 4-wire Platinum RTDs (DIN alpha = 0.00385, SAMA alpha = 0.003923 and special) as well as millivolt (mV) and resistance inputs. They provide an isolated 4-20mA output loop that is proportional and linear to the desired temperature input range. The factory can configure custom curves and accommodate other input types including 10 Ohm Copper and 120 Ohm Nickel RTDs.

### Programming via HART

Utilizing the HART protocol, the T798 can be accessed and programmed for dual two-wire RTD or dual thermocouple measurement; transmitting or displaying differential or average temperatures. For RTDs secure or independent dual RTD measurements can be made. Other functions can be set using Hart, such as input dampening, burnout detection, fail-safe report (sensor or transmitter failure produces over or under output range condition), loop test (manual control of output current), line frequency filtering, smart smoothing (filters small changes but reacts quickly to large changes), internal temperature, cold junction temperature and display or transmitter identification (e.g. display label, tag ID, descriptor, message, sensor serial number, configuration date, etc.).

### Configuring via Display

For quick and easy configuration the optional one line and two line alphanumeric displays (model T79D-1 and T79D-2) are useful for setting up and trimming the 4-20mA output or display reading to correct for sensor errors. These displays provide a 4 digit reading of the temperature (e.g. 2345, 234.5, 23.45) and will alert the user in the case of sensor failure or burnout for both RTDs and thermocouples by flashing 'fail' and 'safe' sequentially.

The display will also indicate the measured temperature even if the signal is in an out of range condition for the output. For example the factory default setting is a J-type thermocouple 40 to 200°F input to 4-20mA output. If the input measures 300°F, which is out of the configured 40 to 200°F range, then the output will be forced to its maximum level 23mA, however the display will accurately read 300.0°F.

The displays can be set for degrees F, C, R and K. The two-line display indicates the units and clearly displays the sensor types during configuration. The one line display does not show the units (i.e. F, C, R or K) unless it is physically labeled and the input types during configuration are coded (see user manual for the 4 digit codes).

### Safe Installations

Both the T797 and T798 are available in intrinsically safe and non-intrinsically safe configurations. The non-intrinsically safe versions are typically used with the alphanumeric displays and the windowed explosion proof (EP) enclosure for hazardous environments, or with the DIN rail mounting option instead of the EP enclosure for benign panel mount applications.

The intrinsically safe versions are designed to meet the Entity Parameters necessary for FM, CSA and CENELEC approval (pending) for Class I Division I, Groups A, B, C and D; and Class II, Division I, Groups E, F, & G and Class III Division I, when installed in accordance with Drawing #732-0220-00 for T797 and #732-0221-00 for T798. See the specifications for Nonincendive approval ratings and for the approval ratings of the EP enclosures.

The T79X series of smart programmable transmitters offers the features, functions and options required for easy operation in the most demanding applications. Accuracy, repeatability and long term stability performance are essentially the best that technology has to offer. See the Specification section of this data sheet for more details.

## Application

The T797 and T798 are ideal for any application requiring a 4-20mA two-wire transmitter loop output in proportion to a temperature, mV or resistance input. In applications where the advantages of communications with a HART based host computer or hand held terminal unit are utilized, the T798 proves to be a valuable solution. It offers the on line diagnostic functions and calibration certification features employed by a growing number of advanced users. Additionally, the efficiency advantages of PC based range programming can also be realized.

The T797 with the easy field programming display option provides a flexible 'off the shelf' solution to the majority of process temperature measurement applications, minimizing inventory requirements for spares.

Either mounted in an explosion proof enclosure or wired through intrinsic safety barriers, the T79X series can meet the stringent safety requirements of most hazardous environments.

## Calibration

Trimming of the display and output, as well as calibration utilizing an external source is described in the user manual, which is included with each transmitter shipped.

## Cables



Model T79A-M000 (for T797)



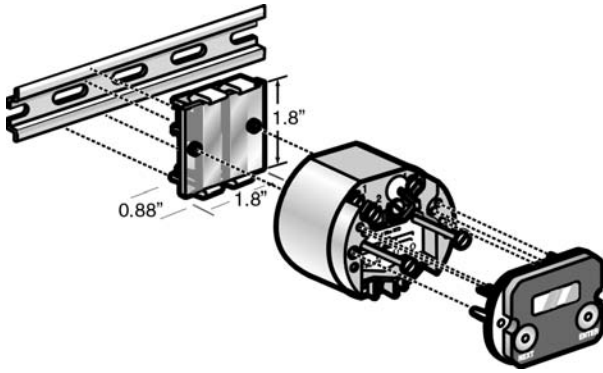
Model T79A-MH00 (for T798)

Table 1: T797 & T798 Input Ranges

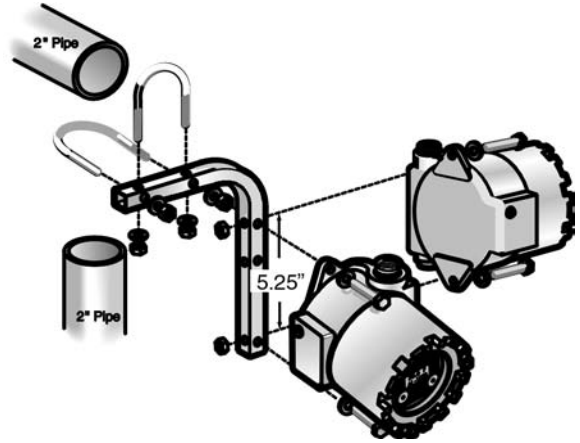
Sensor Type	Range	Accuracy	Range	Accuracy
Type B Thermocouple	+212 to +3272° F	+/-1.08° F	+100 to +1800° C	+/-0.6° C
Type C Thermocouple	+32 to +4208° F	+/-0.9° F	0 to +2320° C	+/-0.5° C
Type E Thermocouple	-58 to +1832° F	+/-0.36° F	+50 to +1000° C	+/-0.2° C
Type J Thermocouple	-292 to +1382° F	+/-0.36° F	-180 to +750° C	+/-0.2° C
Type K Thermocouple	-292 to +2282° F	+/-0.36° F	-180 to +1250° C	+/-0.2° C
Type L Thermocouple	-328 to +1652° F	+/-0.72° F	-200 to +900° C	+/-0.4° C
Type N Thermocouple	+32 to +2192° F	+/-0.36° F	0 to +1200° C	+/-0.2° C
Type R Thermocouple	+32 to +2822° F	+/-0.9° F	0 to +1600° C	+/-0.5° C
Type S Thermocouple	+32 to +2822° F	+/-0.9° F	0 to +1550° C	+/-0.5° C
Type T Thermocouple	-238 to +752° F	+/-0.54° F	-150 to +400° C	+/-0.3° C
Type U Thermocouple	-148 to +1112° F	+/-0.72° F	-100 to +600° C	+/-0.4° C
100 Ohm Platinum RTD DIN (alpha = 0.00385)	-328 to +1562° F	+/-0.14° F	-200 to +850° C	+/-0.08° C
100 Ohm Platinum RTD SAMA (alpha = 0.003923)	-328 to +1193° F	+/-0.14° F	-200 to +645° C	+/-0.08° C
Millivolt	-15 to 115mV	+/-0.006mV		
Ohm	0 to 500 Ohms	+/-0.002 Ohms		



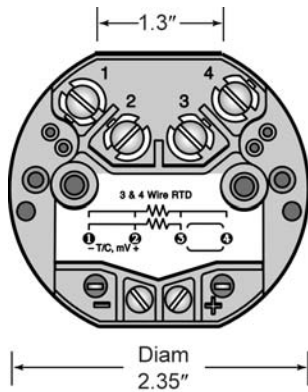
T79A-D DIN Mounting Kit



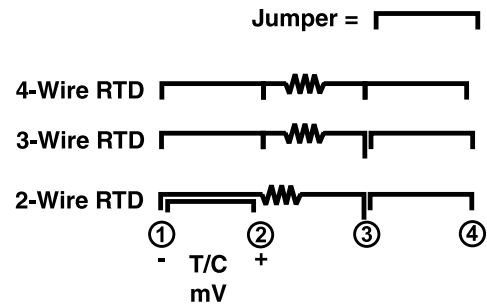
T79A-P Pipe Mount Bracket



Dimensions



Input Wiring



Installations

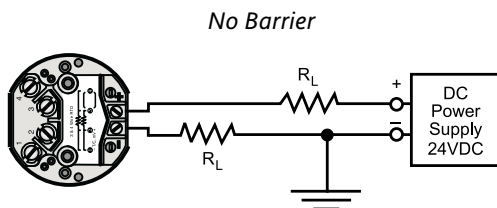


Figure 1: Normal Installation

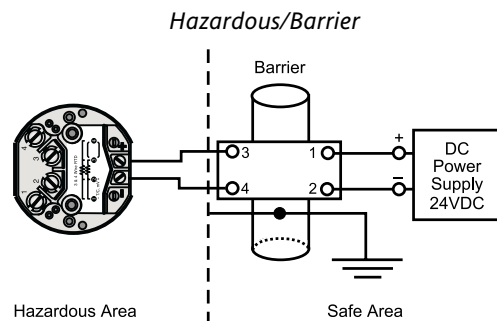
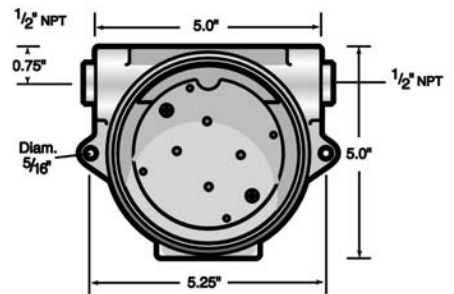
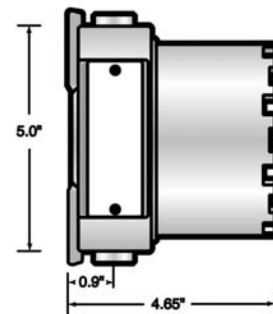


Figure 2: Intrinsically Safe Installation

T79E Explosion Proof Housing



Housing 3/4" NPT opening  
bushed to 1/2" NPT



## Specifications

### Linearization:

Thermocouple and RTD linearization to  $\pm 0.05^\circ\text{C}$ . Custom linearization with 22 pt curve (consult factory).

### Input Impedance:

Greater than 1M Ohm

### Output:

Analog, Two-wire 4 to 20mA

### Transmitter Accuracy:

$\pm 0.05\%$  of the millivolt or ohm equivalent input reading, or the value from the Accuracy Table, whichever is greater; plus  $\pm 0.05\%$  of the span. For thermocouples, add  $\pm 0.5^\circ\text{C}$  ( $0.9^\circ\text{F}$ ) for cold junction effect. Accuracy includes transmitter repeatability, hysteresis and linearity as well as ambient temperature effect. A/D conversion error, analog output error, line voltage effects, humidity effect under non-condensing conditions and vibration effect to 2g's & 500 Hz.

### Transmitter Repeatability:

One-half the transmitter accuracy

### Cold-Junction Compensation:

Digital self-correcting over the ambient temperature range to within  $\pm 0.5^\circ\text{C}$

### Output Ranging Adjustments:

Analog Zero: 100% of Sensor range (Non-interacting)

Analog Full-scale: Normal or Reverse Acting

### Ambient Temperature Stability:

Self-correcting over operating temperature range

### Long Term Stability:

Deviation per year is less than: 0.025% of the output span  $\pm 0.05\%$  of the reading)

### Damping:

Factory selectable constant (63%) from 0 to 32 sec.

### Failsafe:

User settable to 3.6 or 23mA

### Operating Temperature Range:

Electronics:

$-40^\circ\text{C}$  to  $+85^\circ\text{C}$ ,  $-40^\circ\text{F}$  to  $+185^\circ\text{F}$

Display (full visibility):

$-20^\circ\text{C}$  to  $+70^\circ\text{C}$ ,  $-4^\circ\text{F}$  to  $+158^\circ\text{F}$

Display (with reduced visibility):

$-40^\circ\text{C}$  to  $+85^\circ\text{C}$ ,  $-40^\circ\text{F}$  to  $+185^\circ\text{F}$

### Storage Temperature Range:

$-50^\circ\text{C}$  to  $+85^\circ\text{C}$ ,  $-58^\circ\text{F}$  to  $+185^\circ\text{F}$

### Mounting Position:

No effect on measurement value

### Weight:

T787: 6 oz.

T79E-O/D: 2 1/2 lbs.

T79E-1: 12 oz.

### Isolation:

500VAC Input to Output

### Power Supply:

The transmitter operates on 12 to 42VDC (30VDC for I/S installations) with no load.

Transmitter is protected against reverse polarity connection.

### Load Limitation:

Loop resistance including optional indicator:

$R(k\ \text{Ohms}) =$

$(\text{Supply Voltage} - 12\ \text{VDC}) / (23\ \text{mA})$

### Electromagnetic Compatibility

#### (CE Compliance):

Transmitter operates within specification in fields from 20 to 1,000MHz with field strengths to 30V/m. Meets EN 50082-1 Generic Immunity Standard and EN 55011 Compatibility Emissions Standard.

### Dynamic Response:

Update Rate:

150 milliseconds (7 times per second), typical

Response to Step Change:

250 milliseconds minimum; 1 second, typical

Start-up Time:

7 sec. Operation to spec in less than 30 sec.

### Ambient Temperature Change:

Selfcorrecting for ambient temperature changes up to  $20^\circ\text{C/hr}$ .

### Interchangeability:

Fully interchangeable without field calibration

### Hazardous Location Certifications:

Explosion Proof:

Explosion Proof Housings available with and without windows; CSA and FM approved for Class I, Div I & II, Groups B, C & D; Class II, Div I & II, Groups E, F, & G, Class III and are rated for NEMA 4X & NEMA 7 environments.

Nonincendive:

Transmitter is CSA & FM rated nonincendive in Class I, Div II, Groups A, B, C & D and Class II, Div I, Groups F & G, and Class III, Div II, CENELEC Ex N IIC T4-T6 certification pending.

Intrinsic Safety:

The Intrinsically Safe Rated Models T797-1 & T798-1 Transmitters are CSA and FM rated Intrinsically Safe for Class I, Div I, Groups A, B, C & D and Class II, Div I, Groups E, F & G, and Class III, Div I. Installed in accordance with Drawing #732-0220-00 for T797 and #732-0221-00 for T798. CENELEC EEx ia IIC T4-T6 Intrinsically Safe certification pending.

### Standard Configuration:

Sensor Input: J Type Thermocouple

LRV (4mA):  $40^\circ\text{F}$  Lower Range Value

URV (20mA):  $200^\circ\text{F}$  Upper Range Value

Damping: 0 seconds

Output Linear with Temperature

Failsafe: Upscale (23mA)

## Ordering Information

Specify: (model number)

- 1) Transmitter Model: **T79X-XXXX**
- 2) Optional Display, Configuration Cable, Software:
- 3) Optional Enclosure:
- 4) Optional Enclosure Mounting:
- 5) Optional Factory Configuration: Specify model **C620** and desired configuration

### Transmitters

<b>T797-0000</b>	Temperature Transmitter, Non IS
<b>T797-1000</b>	Temperature Transmitter, IS-FM/CSA
<b>T797-2000</b>	Temperature Transmitter, IS CENELEC
<b>T798-0000</b>	Temperature Transmitter, Hart, Non IS
<b>T798-1000</b>	Temperature Transmitter, Hart, IS-FM/CSA
<b>T798-2000</b>	Temperature Transmitter, Hart, IS-CENELEC

### Displays & Options

<b>T79D-2000</b>	Two Line Alphanumeric Display
<b>T79D-1000</b>	One line alpha-numeric Display
<b>T79E-D000</b>	Explosion Proof Housing w/ Window
<b>T79E-0000</b>	Explosion Proof Housing w/out Window
<b>T79E-1000</b>	Weather Proof Head-Mount Enclosure
<b>T79E-H000</b>	Explosion Proof Head-Mount Enclosure
<b>T79A-P000</b>	Pipe Mount Bracket for T79E-O/D only
<b>T79A-B000</b>	Bulkhead (flat surface) Mounting Plate
<b>T79A-D000</b>	DIN Rail Mounting Kit
<b>T79A-M000</b>	T797 PC Serial Configuration Cable (6')
<b>T79A-MH00</b>	T798 Hart Configuration Cable (6')
<b>T79A-C000</b>	Configuration Software for T797 & T798
<b>T79A-E000</b>	Mounting Kit for EP Enclosure

## Action Pak Alarms

Limit alarms are setpoint controllers that regulate industrial processes - discrete, batch or continuous. Two-position controllers simplify processes through automation, and by removing personnel from tedious and possibly harmful environments.

Alarms are used to indicate problems - production line faults, process upsets, equipment failures or control system abnormalities. Limit alarms safeguard industrial facilities and workers by alerting and informing process personnel of abnormal conditions.

### The AP1000 Series

The AP1000 series limit alarms are compact, electronic plug-in modules that receive direct sensor inputs and operate from 120VAC power (or optionally on 24VDC on some models). They provide the broad range of limit alarm and control capabilities required in today's industrial processes. The AP1000 series accepts a variety of direct sensor or transducer inputs, and provides either single trip, latching or dual trip relay outputs.

### Hard Control/Analog Back

Factory automation systems run the risk of central failures. A failure in a central system can prevent proper actions for critical conditions, resulting in costly downtimes and possible injury to personnel. Redundancy and reliability are important concerns that are best met with Hard Control/Analog Back (HC/AB) alarm systems.

The AP1000 series dedicated single-channel limit alarm provides excellent single-point control with a proven record of reliability.

### Setpoint Control

Setpoint adjustment is available to suit many needs:

- Single-turn or 10-turn screwdriver adjust.
- 10-turn clockface dial (for precise settings).

Setpoints are adjustable over the entire span to assure full-range alarm capabilities.

### Field Configurable Alarms

The DC input AP1080/90, the thermocouple input AP1280/90 and the AC input AP1690 can all be configured in the field by setting DIP switches for input range or type, alarm function (HI/LO) and alarm state (failsafe/non-failsafe). This minimizes spare parts inventory and provides an off-the-shelf solution for virtually any alarm function.

## Action Pak Signal Conditioners

Signal conditioners amplify and condition weak signals generated by process sensors. They send signals long distances without being degraded by electrical noise. They are also used to drive devices such as indicators, alarms, controllers, computer interfaces and other process instrumentation.

### The AP4000 - AP9000 Series

The AP4000 to AP9000 series signal conditioners are compact, electronic, plug-in modules that take direct sensor inputs and signals and convert them into useful high level signals. They operate from 120VAC power (or optionally on 24VDC on some models).

### Four-wire Transmitters

The AP4000 series four-wire transmitters typically operate from external AC line power and require two wires for that operating power and two wires for the output signal. Outputs are conventional DC process signals, such as 4-20mA or 0-10V, and are fully compatible with all important process instrumentation equipment, including other Action Pak modules. When AC power is impractical or not available, most 4000 series modules are available with a DC option so that they can be operated from a 24VDC source.

### Isolation

Grounding remote sensors is generally advised in order to reduce noise pickup and protect equipment from being damaged by lightning or other high voltages. However, if both the sensor and the signal conditioner are grounded, it is possible to get an unwanted current (a "ground loop") due to ground-to-ground potential differences. Ground loops degrade signal quality to the point of uselessness and can harm personnel and receiving equipment.

Isolation eliminates ground loops and common mode voltage, and checks power surges. Isolation also simplifies the connection of loop elements by eliminating the need for special grounding systems.

### Input Selection

Seven standard type of inputs are available to suit your process needs. Other input types are available on request.

- DC Voltage or Current
- Thermocouple
- RTD
- Strain Gauge
- Potentiometer
- AC Voltage or Current
- Frequency

# Action Pak™ Limit Alarm Selection Guide

Input	Typical Application	Description	Model
<b>DC Voltage or Current (V, mV, A, mA)</b>	DC motor/current limit, level/position control, HI/LO pressure alarm, power demand warning, totalization alarm, 2-channel comparator.	Includes LSI false trip circuitry, filtering and conditioning to reduce susceptibility to transients and noise.	AP1080 Single Trip DPDT Relay Outputs  AP1090 Dual Trip SPDT Relay Outputs
<b>Thermocouple (Types E, J, K, R, S, T)</b>	Heater/Cooler control, HI/LO temperature alarm, BTU monitor.	Includes encapsulated cold-junction compensation (CJC) and burnout detection.	AP1280 Single Trip DPDT Relay Outputs  AP1290 Dual Trip SPDT Relay Outputs
<b>AC Voltage or Current (V, mV, A, mA)</b>	AC motor/current limit, AC power status monitor.	Includes optional 0.1 Ohm, 5 Watt shunt resistor for high current input applications.	AP1690 Dual Trip SPDT Relay Outputs

# Action Pak™ Signal Conditioner Selection Guide

Input	Typical Application	Description	Model (No. of Channels)
<b>DC Voltage or Current (V, mV, A, mA)</b>	Voltage/Current scaling, isolation, buffering, noise reduction, drive.	Field configurable isolator	AP4380/AP4382 (single)  AP4390/AP4391/AP4392 (dual)
<b>Potentiometer (0-100 Ohms, up to 0-100k Ohms)</b>	Tank level control, monitoring, data acquisition, Resistance position sensor and setpoint conditioning.	General purpose	AP4003
<b>RTD (Types Pt, Ni, Cu)</b>	Temperature control, monitoring, data acquisition.	Linearizing	AP4151
<b>Thermocouple (Types E, J, K, R, S, T, B)</b>	Temperature control, isolation, monitoring, data acquisition.	Field configurable, linearizing isolator	AP4351
<b>Frequency (0-2Hz to 0-10kHz)</b>	Flow/velocity control or monitoring, motor speed control, scaling, pulse accumulation, integration, totalizing.	Field configurable isolator  DC to frequency  Frequency scaler	AP7380  AP7500/AP7501  AP7510
<b>Strain Gauge (1, 2, 3, 5, 10, 20mV/V) 5V-10V Excitation</b>	Pressure control, pressure status monitoring, weight, load cell conditioning and data acquisition.	Field configurable isolator	AP4081
<b>AC Voltage or Current (V, mV, A, mA)</b>	Voltage/Current scaling, power monitoring, isolation, buffering.	Field configurable isolator	AP6380
<b>Power Supplies</b>	Current loop supply, excitation.	24VDC supply  24VDC supply (heavy duty)	AP9046  T609



AP1080 (Single Trip, DPDT, 5A)  
AP1090 (Single/Dual Trip, 2 SPDT, 5A)

# Action PAK® AP1080 & AP1090

## DC Input, Field Configurable Limit Alarms

Provides Relay Contact Closures  
at a Preset DC Input Level



- Field Configurable Input Ranges for DC Voltage and Current
- Exclusive “Dynamic Deadband” Prevents False Trips
- Setpoints Programmable HI or LO
- Selectable Failsafe/Latching Operation
- Selectable 120/240VAC Input Power (9 to 30 VDC Available)

### Description

Action Pak models AP1080 single setpoint and AP1090 dual setpoint limit alarms offer flexible, wide-ranging DC input capability. Voltage spans from 10mV to 200 volts and current spans from 1mA to 100mA can be field configured. Bipolar inputs are also accepted. Both models offer configurable latching, failsafe and HI/LO operation. The AP1080 and AP1090 also include 0.25%-50% adjustable deadbands and selectable 120/240VAC input power.

### Diagnostic LED

Models AP1080-2000 and AP1090-2000 are equipped with a dual function diagnostic LED. The green center LED indicates line power and input signal status. Active line power is indicated by an illuminated LED. If the center LED is off, check line power and the wiring connection. If the input signal is above 100% full scale, the LED will flash at approximately 8Hz. Below 0%, the flash rate is approximately 4Hz.

### Output Selection

The single setpoint AP1080 and the dual setpoint AP1090 provide the following relay outputs:

- AP1080** Single Trip (DPDT, 5A)
- AP1090** Single/Dual Trip (2 SPDT, 5A)

Setpoints are top accessed multi-turn potentiometers or option "P" provides top mounted ten-turn dials.

### Operation

The field configurable AP1080 and AP1090 limit alarm setpoints can be configured for HI, LO, latching or failsafe trip operation. Non-latching HI and LO setpoints have respective HI and LO deadbands. In a tripped condition, the setpoint is exceeded and the appropriate red LED will illuminate. The trip will reset only when the process falls below the HI deadband or rises above the LO deadband (see figure 1). To reset a latched setpoint the signal must be in the safe region and the line power turned off for at least 5 seconds. For proper deadband operation, a HI setpoint must always be set above a LO setpoint.

In failsafe operation, the relay is energized when the process is below the HI setpoint or above the LO setpoint (opposite for non-failsafe). In the failsafe mode, the relays go to the tripped condition when the power fails.

### Dynamic Deadband

The input must remain beyond the setpoint for 100 milliseconds, uninterrupted, to qualify as a valid trip condition. Likewise, the input must fall outside the deadband and remain there for 100 milliseconds to return the alarm to an untripped condition. This effectively results in a “dynamic deadband” - based on time - in addition to the normal deadband.

### Options

- U** Urethane coating of internal circuitry for protection from corrosive atmospheres.
- P** Top Mounted, Ten-Turn Dial(s) for setpoint adjustment.
- C620** Factory calibration to input range, setpoints and output relays. Not available with option P.

### Configuration

The factory presets models AP1080 and AP1090 as follows:

	AP1080	AP1090
Input	0-20mA	0-20mA
Output	Single, DPDT	Dual, SPDT
Trip	HI	A: HI, B: LO
Latching	No	No
Failsafe	Yes	No
Deadband	0.25%	A/B: 0.25%
Power	120VAC	120VAC

For other I/O ranges, remove the four base screws and case to access the configuration switches.

Replace the cover before applying power.

Refer to Figure 5 for switch locations.

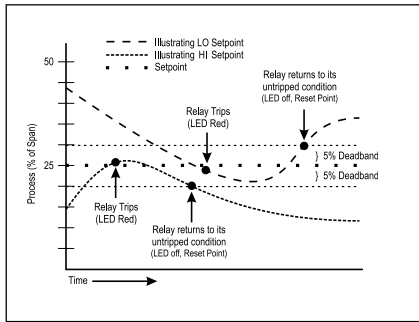
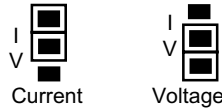


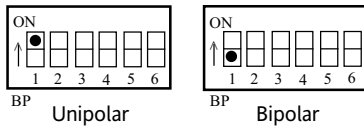
Figure 1: Limit alarm operation and effect of deadband.

**Input**

1. Position input jumper “W2” for Current or Voltage inputs.



2. Set position 1 of the Mode Selector for Unipolar or Bipolar operation. Unipolar is the default.



Note: A bipolar span selection will double any span from Table 1 (e.g., 10V unipolar span = ±10V bipolar span)

3. Using Table 1, configure positions 1 through 4 of the Input Range Selector for the desired maximum setpoint input. Round desired maximum input values to the next highest range (e.g., 0-120V = 200V range).

**Output**

Configure the Mode Selector for the required function. See Figure 6.

**Power**

Configure the AC jumpers for either 120 or 240 VAC operation. See Figure 4.

**Calibration**

Note: To maximize thermal stability, final calibration should be performed in the operating installation, allowing approximately 1-2 hours for warmup and thermal equilibrium of the system.

**Setpoint:** Set deadband at its minimum (factory default - 20 turns Counter Clockwise) before adjusting the setpoint. With the specified trip voltage or current input applied, adjust setpoint until the relay trips. For HI trip calibration, start with the setpoint above the desired trip. For LO trip calibration, start below the desired trip.

**Deadband:** Set deadband to its minimum (factory default - fully CCW). Set setpoint to desired trip. Adjust voltage/current input until relay trips. Readjust deadband to 50% (20 turns CW). Set voltage/current input to desired deadband position. Slowly adjust deadband until relay untrips.

Note that Custom Calibration (option C620) is available from the factory (settings **MUST** be within specifications):

a) Setpoint A: Type (HI/LO); Units (mA, mV, V); Deadband (%)

b) Setpoint B (1090 only): Type (HI/LO); Units (mA, mV, V); Deadband (%)

c) Latching (ON/OFF)

d) Failsafe (ON/OFF)

Note that if a deadband entry is not specified, the default entry will be used.

**Relay Protection and EMI Suppression**

When switching inductive loads, maximum relay life and transient EMI suppression is achieved using external protection (see Figures 2 & 3). Place all protection devices directly across the load and minimize all lead lengths. For AC inductive loads, place a properly-rated MOV across the load in parallel with a series RC snubber. Use a 0.01 to 0.1mF pulse film capacitor (foil polypropylene recommended) of sufficient voltage, and a 47ohm, 1/2W carbon resistor. For DC inductive loads, place a diode across the load (PRV > DC supply, 1N4006 recommended) with (+) to cathode and (-) to anode (the RC snubber is an optional enhancement).

Table 1: AP1080-2000 and 1090-2000 Input Ranges

*Voltage	*Current	Input Range Selector
10mV	1mA	
20mV	2mA	
50mV	5mA	
100mV	10mA	
200mV	20mA	
500mV	50mA	
1V	100mA	
2V		
5V		
10V		
20V		
50V		
100V		
200V		

\*Note: Use Jumper (W2) to configure either voltage or current input. All unipolar input ranges are zero based.

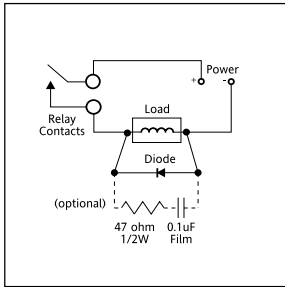


Figure 2: DC Inductive Loads

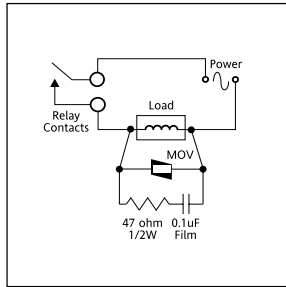
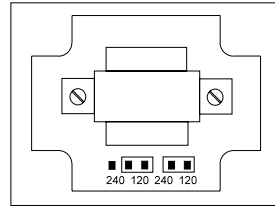
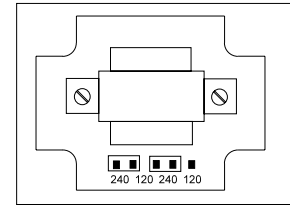


Figure 3: AC Inductive Loads



120 VAC Operation



240 VAC Operation

Figure 4: 120/240 VAC Selection

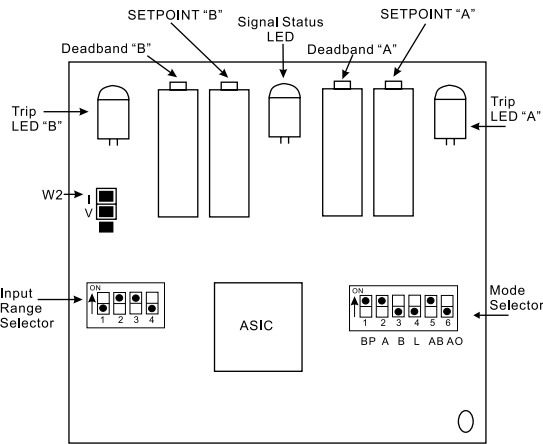


Figure 5: AP1090-2000 Factory Calibration 0-20mA, Dual HI/LO, Non-Latching, Non-Failsafe.

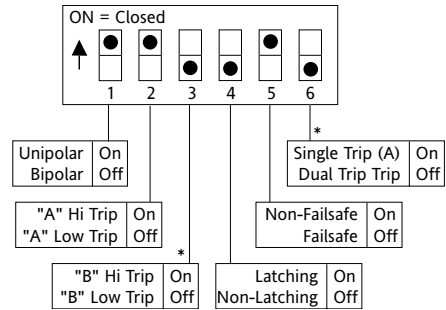


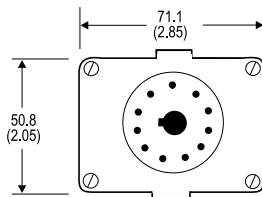
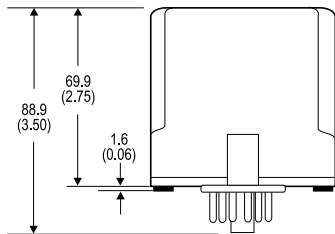
Figure 6: Mode Selection Dual Trip/A: HI, B: LO, Non-Latching, Non-Failsafe \*AP1090-2000 only.

**Mounting**

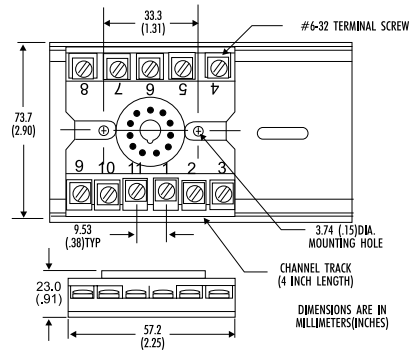
All Action Paks feature plug-in installation. Models AP1080 and AP1090 use an 11-pin base, either molded socket (M011) or DIN rail socket (MD11).

**Dimensions**

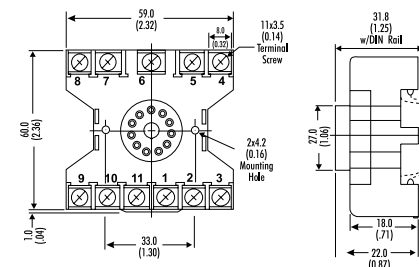
Dimensions are in millimeters (inches)



Mark III



M011 (Track/Surface)



MD11 (DIN Rail)

Action Pak®

## Specifications

### Inputs:

Voltage Input:  
Range: 10mV to 200V  
Impedance: >100Kohms  
Overvoltage: 400V, max  
Current Input:  
Range: 1mA to 100mA  
Impedance: 20ohms, typical  
Overcurrent: 200mA, max  
Overvoltage: 60VDC  
Common Mode (Input to Ground):  
1000VDC, max

### LED Indications:

Input Range (Green)  
>100% input: 8Hz flash  
<0% input: 4Hz flash  
Setpoint (Red)  
Tripped: Solid red  
Safe: Off

### Limit Differential (Deadband):

>50mV/5mA: 0.25% to 50% of span  
<50mV/5mA: 1% to 50% of span

### Response Time:

Dynamic Deadband:  
Relay status will change when proper setpoint/process condition exists uninterrupted for 100msec.  
Normal Mode (analog filtering):  
<250msec, (10-90%)

### Setpoint:

Effectivity:  
Setpoints are adjustable over 100% of the selected input span.  
Repeatability (constant temp):  
>50mV/5mA: 0.1% of full scale  
<50mV/5mA: 0.2% of full scale

### Stability:

Line Voltage:  $\pm 0.01\%$ , max.  
Temperature:  $\pm 0.05\%$  of full scale/ $^{\circ}\text{C}$ , max.

### Common Mode Rejection:

DC to 60Hz: 120dB

### Isolation:

1000VDC between contacts, input & power

### ESD Susceptibility:

Meets IEC 801-2, Level 2 (4KV)

### Humidity:

Operating: 15 to 95% (@ $45^{\circ}\text{C}$ )  
Soak: 90% for 24 hours (@ $65^{\circ}\text{C}$ )

### Temperature Range:

Operating: 0 to  $60^{\circ}\text{C}$  (32 to  $140^{\circ}\text{F}$ )  
Storage:  $-15$  to  $70^{\circ}\text{C}$  (5 to  $158^{\circ}\text{F}$ )

### Power:

Consumption: 2W typical, 5W max.  
Standard:  
Selectable 120/ 240VAC ( $\pm 10\%$ , 50-60Hz)  
Optional:  
9 to 30VDC, Inverter-Isolated

### Relay Contacts:

AP1080: DPDT (2 Form C)  
AP1090: 1 SPDT (1 Form C) per setpoint  
Current Rating (resistive)  
120VAC: 5A; 240VAC: 2A; 28VDC: 5A  
Material: Silver-Cadmium Oxide  
Electrical Life:  $10^5$  operations at rated load  
*Note: External relay contact protection is required for use with inductive loads. See relay protection section (Fig 2 & 3).*  
Mechanical Life:  $10^7$  operations

### Latch Reset Time:

5 seconds

### Weight:

AP1080: 0.46lbs; AP1090: 0.62lbs

### Agency Approvals:

CSA certified per standard C22.2, No. M1982, File No. LR42272-8, 9)  
UL recognized per standard UL508, (File No. E99775)

## Ordering Information

### Specify:

1. Model: **AP1080-2000, AP1090-2000**
2. Options: U, P (see text)
3. Line Power (see specs.)(All power supplies are transformer-isolated from the internal circuitry.)
4. C620 Custom Calibration? (see Options)

### Accessories:

M801-0000 Retaining Spring  
M011-A 11 pin Track Mount Socket  
M004-0000 4 ft Long Channel Track  
MD11-0000 11 pin DIN Mount Socket

## Pin Connections

- 1 AC Power (Hot)
- 2 No Connection
- 3 AC Power (Neu)
- 4 Input (+)
- 5 Input (-)
- 6 (A) N.O.
- 7 (A) C
- 8 (A) N.C.
- 9 (B) N.O.
- 10 (B) C
- 11 (B) N.C.

### Key:

N.O. = Normally Open  
C = Common  
N.C. = Normally Closed  
DC Power: Pin 1 = (+)  
Pin 3 = (-)

\*Contacts are in the "normal" state when the relay is de-energized.





AP1280 (Single Trip, DPDT, 5A)  
AP1290 (Single/Dual Trip, 2 SPDT, 5A)

# Action PAK®

## AP1280 & AP1290

### Thermocouple Input, Field Configurable Limit Alarms

Provides Relay Contact Closures  
at a Preset Temperature Input Level



- Field Configurable Input Ranges for E, J, K, R, S and T Type Thermocouples
- Exclusive “Dynamic Deadband” Prevents False Trips
- Burnout Detection
- Setpoints Programmable HI or LO
- Selectable Failsafe/Latching Operation
- Selectable 120/240VAC Input Power (9 to 30 VDC Available)

#### Description

Action Pak models AP1280 and AP1290 limit alarms offer wide ranging inputs and flexible setpoint capability. They accept six popular thermocouple types with inputs ranging from -270°C (-454°F) to 1760°C (3200°F). The AP1280 provides a single-setpoint alarm while the AP1290 provides two independent setpoint alarms. The AP1280 and AP1290 also include 0.25%-50% adjustable deadbands and selectable 120/240VAC power.

#### Diagnostic LED

Models AP1280 and AP1290 are equipped with a dual function diagnostic LED. The green center LED indicates line power and input signal status. Active line power is indicated by an illuminated LED. If the center LED is off, check line power and the wiring connection. If the input signal is above 100% full scale, the LED will flash at approximately 8Hz. Below 0%, the flash rate is approximately 4Hz.

#### Output Selection

The two models of thermocouple limit alarms reflect two styles of output and setpoint selection:

- AP1280** Single Trip (DPDT, 5A)
- AP1290** Single/Dual Trip (2 SPDT, 5A)

Setpoints are top accessed multi-turn potentiometers (or option "P" provides top mounted ten-turn dials).

#### Operation

The field configurable AP1280 and AP1290 limit alarm setpoints can be configured for HI, LO, latching or fail-safe trip operation. Non-latching HI and LO setpoints have respective HI and LO deadbands. In a tripped condition, the setpoint is exceeded and the appropriate red LED is lit. The trip will reset only when the process falls below the HI deadband or rises above the LO deadband (see figure 1). To reset a latched setpoint the signal must be in the safe region and the line power must be turned off for at least 5 seconds. For proper deadband operation, the HI setpoint must always be set above the LO setpoint.

In failsafe operation, the relay is energized when the process is below a HI setpoint or above a LO setpoint (opposite for non-failsafe). In the failsafe mode, a power failure results in an alarm condition.

#### Dynamic Deadband

The input must remain beyond the setpoint for 100 milliseconds, uninterrupted, to qualify as a valid trip condition. Likewise, the input must fall outside the deadband and remain there for 100 milliseconds to return the alarm to an untripped condition. This effectively results in a “dynamic deadband” - based on time - in addition to the normal deadband.

#### Options

- U** Urethane coating of internal circuitry for protection from corrosive atmospheres.
- P** Top mounted, ten-turn dial(s) for setpoint adjustment.
- C620** Factory calibration of input range, set points and output relays. Not available with option P.

#### Configuration

The factory presets for AP1280 and AP1290 are as follows:

	<b>AP1280</b>	<b>AP1290</b>
Input	J-type 0-360°C	J-type 0-360°C
Burn Out	Positive	Positive
Output	Single, DPDT	Dual, SPDT
Trip	HI	A: HI, B: LO
Latching	No	No
Failsafe	Yes	No
Deadband	0.25%	A/B: 0.25%
Power	120VAC	120VAC

Refer to Figure 5 for switch locations.

For other I/O ranges, remove the four base screws and case to access the configuration switches.

Replace the cover before applying power.

Action Pak®

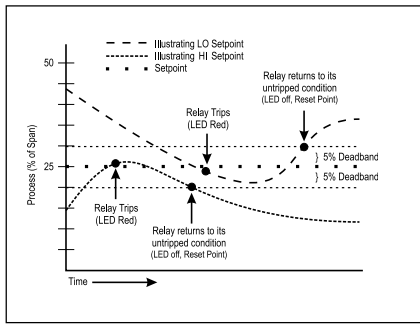


Figure 1: Limit alarm operation and effect of deadband.

**Input**

1. Using Table 1, configure positions 1 through 3 of SW1 and 1 through 5 of SW2 for the desired input range. Round desired maximum/minimum input values to the next highest range (e.g., 0-300°C = 0-350°C).

2. Choose the desired upscale/downscale thermocouple burnout detection by setting position 6 of SW2. See Figure 5.

**Output**

1. Configure positions 4 through 8 of SW1 for the desired alarm functions. See Figure 6.

**Power**

1. Configure the AC jumpers for either 120 or 240 VAC operation. See Figure 4.

**Calibration**

Note: To maximize thermal stability, final calibration should be performed in the operating installation, allowing approximately 1-2 hours for warmup and thermal equilibrium of the system.

**Setpoint:** Set deadband at its minimum (factory default - fully CCW) before adjusting the setpoint. With the appropriate input applied, adjust setpoint until the relay trips. For HI trip calibration, start with the setpoint above the desired trip. For LO trip calibration, start below the desired trip.

**Deadband:** Set deadband to its minimum (factory default - fully CCW). Set setpoint to desired trip. Adjust input until relay trips. Readjust deadband to 50% (fully CW). Set input to desired deadband position. Slowly adjust deadband until relay untrips.

Note that Custom Calibration (option C620) is available from the factory (settings **MUST** be within specifications):

- a) Input Type (see table)
- b) Setpoint A trip point and reset point
- c) Setpoint B trip point and reset point
- d) Latching (ON/OFF)
- e) Failsafe (ON/OFF)

Note that if a deadband entry is not specified, the default entry will be used.

Table 1: AP1280-1290 Input Ranges

TC Type	Temperature Range	SW1	SW2
E	0 to 150°C (32 to 302°F)		
E	0 to 290°C (32 to 554°F)		
E	0 to 660°C (32 to 1220°F)		
E	0 to 1000°C (32 to 1832°F)		
E	-270 to 150°C (-454 to 302°F)		
E	-270 to 290°C (-454 to 554°F)		
J	0 to 190°C (32 to 374°F)		
J	0 to 360°C (32 to 680°F)		
J	0 to 760°C (32 to 1400°F)		
J	-210 to 190°C (-346 to 374°F)		
J	-210 to 360°C (-346 to 680°F)		
K	0 to 250°C (32 to 482°F)		
K	0 to 480°C (32 to 896°F)		
K	0 to 1230°C (32 to 2246°F)		
K	0 to 1372°C (32 to 2501°F)		
K	-270 to 250°C (-454 to 482°F)		
K	-270 to 480°C (-454 to 896°F)		
R	0 to 970°C (32 to 1778°F)		
R	0 to 1690°C (32 to 3074°F)		
R	0 to 1760°C (32 to 3200°F)		
S	0 to 1050°C (32 to 1922°F)		
S	0 to 1760°C (32 to 3200°F)		
T	0 to 210°C (32 to 410°F)		
T	0 to 390°C (32 to 734°F)		
T	-270 to 210°C (-454 to 410°F)		
T	-270 to 390°C (-454 to 734°F)		

**Relay Protection and EMI Suppression**

When switching inductive loads, maximum relay life and transient EMI suppression is achieved using external protection (see Figures 2 & 3). Place all protection devices directly across the load and minimize lead lengths. For AC inductive loads, place a properly-rated MOV across the load in parallel with a series RC snubber. Use a 0.01 to 0.1mF pulse film capacitor (foil polypropylene recommended) of sufficient voltage, and a 47ohm, 1/2W carbon resistor. For DC inductive loads, place a diode across the load (PRV > DC supply, 1N4006 recommended) with (+) to cathode and (-) to anode (the RC snubber is an optional enhancement).

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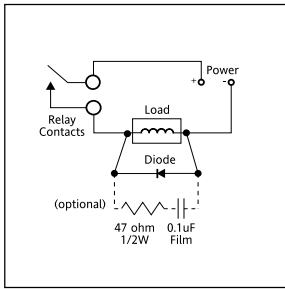


Figure 2: DC Inductive Loads

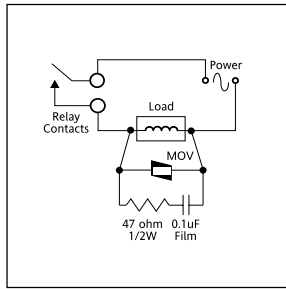
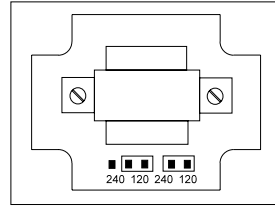
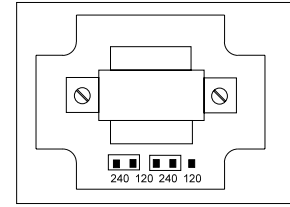


Figure 3: AC Inductive Loads



120 VAC Operation



240 VAC Operation

Figure 4: 120/240 VAC Selection

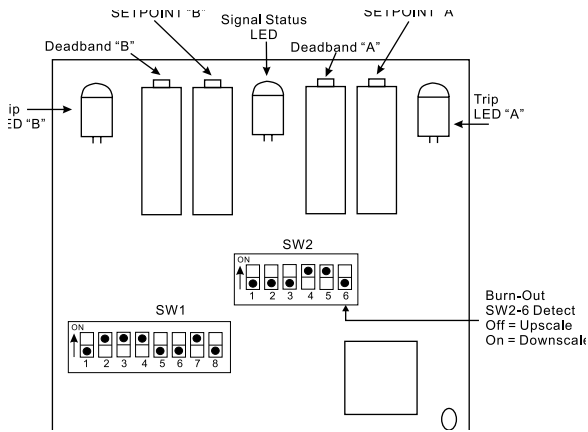


Figure 5: AP1290 Factory Calibration Type "J" 0-360°C Dual HI/LO, Non-Latching, Non-Failsafe

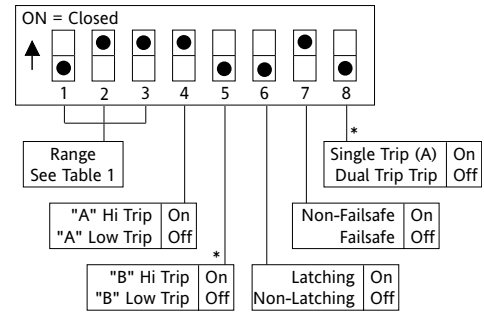


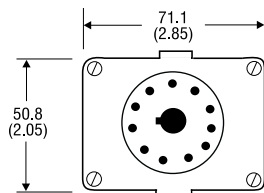
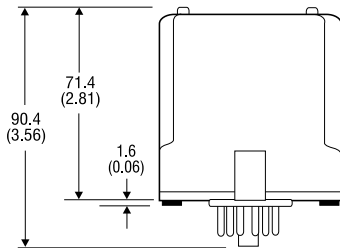
Figure 6: Mode Selection; Dual Trip/A: HI, B: LO, Non-Latching, Non-Failsafe \*AP1290-2000 only

### Mounting

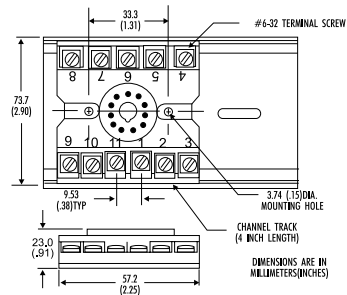
All Action Paks feature plug-in installation. Models AP1280 and AP1290 use an 11-pin base, either molded socket (M011) or DIN rail socket (MD11).

### Dimensions

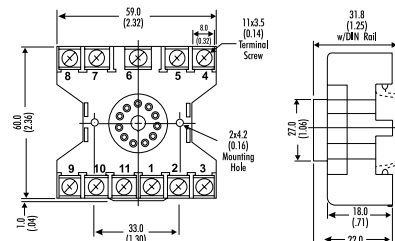
Dimensions are in millimeters (inches)



Mark II



M011 (Track/Surface)



MD11 (DIN Rail)

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## Specifications

### Inputs:

- Ranges: See Table 1
- Impedance: >1 M Ohms
- Input Bias Current (burnout detect): <1.5 microamp
- Overvoltage: ±10V differential
- Common Mode (Input to Ground): 600VAC or 1000VDC, max

### LED Indications:

- Input Range (Green)
  - >100% input: 8Hz flash
  - <0% input: 4Hz flash
- Setpoint (Red):
- Tripped: Solid red
- One LED for each setpoint

### Limit Differential (Deadband):

- 0.25% to 50% of span

### Response Time:

- Dynamic Deadband:
  - Relay status will change when proper setpoint/process condition exists uninterrupted for 100msec
- Normal Mode (analog filtering): <250msec, (10-90%)

### Setpoint:

- Effectivity: Setpoints are adjustable over 100% of input span
- Repeatability (Constant Temp):
  - ±0.2% for inputs > 0°C
  - ±0.3% for inputs < 0°C

### Stability:

- Line Voltage: ±0.01%/%, max
- Temperature: ±0.05% of full scale/°C, max.

### Common Mode Rejection:

- DC to 60Hz: 120dB

### Isolation:

- 1000V DC between contacts, input and power

### ESD Susceptibility:

- Meets IEC 801-2, Level 2 (4KV)

### Humidity:

- Operating: 15 to 95% (@45°C)
- Soak: 90% for 24 hours (@65°C)

### Temperature Range:

- Operating: 0 to 60°C (32 to 140°F)
- Storage: -15 to 70°C (5 to 158°F)

### Power:

- Consumption: 2W typical, 5W max
- Standard: Selectable 120/240VAC (±10%, 50-60Hz)
- Optional: 9 to 30VDC Inverter-Isolated

### Relay Contacts:

- AP1280: DPDT (2 Form C)
- AP1290: 1 SPDT (1 Form C) per setpoint
- Current Rating (resistive)
  - 120VAC: 5A; 240VAC: 2A; 28VDC: 5A
- Material: Silver-Cadmium Oxide
- Electrical Life: 10<sup>5</sup> operations at rated load
- Note: External relay contact protection is required for use with inductive loads. See relay protection.
- Mechanical Life: 10<sup>7</sup> operations

### Latch Reset Time:

- 5 seconds (with power removed)

### Weight:

- AP1280 0.72lbs
- AP1290 0.64lbs

### Agency Approvals:

- CSA certified per standard C22.2, No. 0-M1982, (File No. LR42272-8,9)
- UL recognized per standard UL 508, (File No. E99775)

## Ordering Information

### Specify:

- Model: **AP1280, AP1290**
- Options: U, P (see text)
- Line Power (see specs.)(All power supplies are transformer-isolated from the internal circuitry.)
- C620 Custom Calibration? (see Options)

### Accessories:

- M801-0000 Retaining Spring
- M011-A 11 pin Track Mount Socket
- M004-0000 4 ft Long Channel Track
- MD11-0000 11 pin DIN Mount Socket

## Pin Connections

- 1 AC Power (Hot)
- 2 No Connection
- 3 AC Power (Neu)
- 4 Input (+)
- 5 Input (-)
- 6 (A) N.O.
- 7 (A) C
- 8 (A) N.C.
- 9 (B) N.O.
- 10 (B) C
- 11 (B) N.C.

### Key:

- N.O. = Normally Open
- C = Common
- N.C. = Normally Closed
- DC Power: Pin 1 = (+)  
Pin 3 = (-)

\*Contacts are in the "normal" state when the relay is de-energized.



AP1690 (Single/Dual Trip, 2 SPDT, 5A)

# Action PAK® AP1690

## AC Input, Field Configurable Limit Alarms

Provides Relay Contact Closures  
at a Preset AC Input Level



- Field Configurable Input Ranges for AC Voltage or Current
- Exclusive “Dynamic Deadband” Prevents False Trips
- Setpoints Programmable HI or LO
- Selectable Failsafe/Latching Operation
- Selectable 120/240VAC Input Power

### Description

The Action Pak model AP1690 dual setpoint limit alarm offers flexible, wide ranging AC input and relay output capability. Voltage spans from 100mV to 200VAC and current spans from 10mA to 100mA AC can be field configured. For current input spans of 1 to 5 Amps a 0.1W (0.1%) shunt resistor (Model #C006) is available. The AP1690 offers configurable latching, failsafe, and HI/LO operation. The unit also includes 0.25% to 50% adjustable deadband and selectable 120/240VAC power.

### Diagnostic LED

The Model AP1690 is equipped with a dual function diagnostic LED. The green center LED indicates line power and input signal status. Active line power is indicated by an illuminated LED. If the center LED is off, check line power and the wiring connection. If the input signal is above 100% full scale, the LED will flash at approximately 8Hz.

### Output Selection

The dual setpoint AP1690 provides the following relay outputs:

**AP1690**                      Single/Dual Trip (2 SPDT, 5A)

Setpoints are top accessed multi-turn potentiometers or option "P" provides top mounted ten-turn clock face dials.

### Operation

The field configurable AP1690 limit alarm setpoints can be configured for HI, LO, latching or failsafe trip operation. Non-latching HI and LO setpoints have respective HI and LO deadbands. In a tripped condition, the setpoint is exceeded and the appropriate red LED will illuminate. The non-latching trip will reset only when the process falls below the HI deadband or rises above the low deadband (see figure 1). To reset a latched setpoint the signal must be in the safe region and the line power turned off for at least 5 seconds. For proper deadband operation, the HI setpoint must always be set above the LO setpoint.

In failsafe operation, the relay is energized when the process is below the HI setpoint or above the LO setpoint (opposite for non-failsafe). In the failsafe mode, the relays go to the trip condition when power fails.

### Dynamic Deadband

The input must remain beyond the setpoint for 100 milliseconds, uninterrupted, to qualify as a valid trip condition. Likewise, the input must fall outside the deadband and remain there for 100 milliseconds to return the alarm to an untripped condition. This effectively results in a “dynamic deadband” – based on time – in addition to the normal deadband.

### Options

**U** Urethane coating of internal circuitry for protection from corrosive atmospheres.

**P** Top Mounted, 10-Turn Clockface Dials for setpoint adjustment.

**C620** Factory calibration of input range, setpoints and output relays. Not available with option P.

### Configuration

The factory presets are as follows:

Input	0-500mV
Output	Dual, SPDT
Trip	A: HI, B: LO
Latching	No
Failsafe	No
Deadband	A/B: 0.25%
Power	120VAC

For other input ranges, remove the 4 base screws and case to access the configuration switches.

Replace the cover before applying power.

Refer to Figure 4 for switch locations.

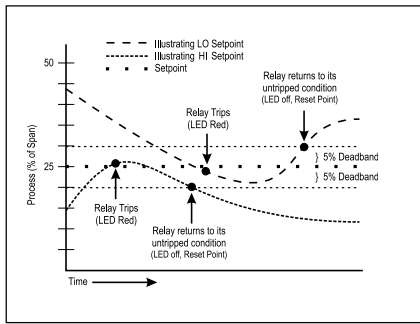
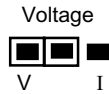


Figure 1: Limit alarm operation and effect of deadband.

### Input

1. Position input jumper "W1" for voltage or current inputs.



2. Using Table 1, set DIP switches "S1-S6" and jumper "W2" for the desired maximum setpoint input. Round desired maximum input values to the next highest range (e.g., 0-120V = 200V range).

### Output

1. Configure the Mode Selector for the required function. See Figure 5.

### Power

1. Configure the AC jumpers for either 120 or 240VAC operation. See Figure 6.

### Calibration

Note: To maximize thermal stability, final calibration should be performed in the operating installation, allowing approximately 1-2 hours for warmup and thermal equilibrium of the system.

**Setpoint:** Set deadband at its minimum (factory default - fully CCW) before adjusting the setpoint. With the specified trip voltage or current input applied, adjust setpoint until the relay trips. For HI trip calibration, start below the desired trip.

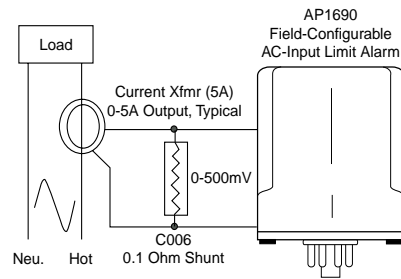
**Deadband:** Set deadband to its minimum (factory default - fully CCW). Set setpoint to desired trip. Adjust voltage or current input until relay trips. Readjust deadband to 50% (fully CW). Set voltage or current input to desired deadband position. Slowly adjust deadband until relay untrips.

Note that Custom Calibration (option C620) is available from the factory (settings **MUST** be within specifications):

- a) Setpoint A: Type (HI/LO); Units (mA, mV, V); Deadband (%)
- b) Setpoint B : Type (HI/LO); Units (mA, mV, V); Deadband (%)
- c) Latching (ON/OFF)
- d) Failsafe (ON/OFF)

Note that if a deadband entry is not specified, the default entry will be used.

### Typical Application



Load monitoring using a current transformer and the AP1690

### Relay Protection and EMI Suppression

When switching inductive loads, maximum relay life and transient EMI suppression is achieved using external protection (see Figure 2 & 3). Place all protection devices directly across the load and minimize lead lengths. For AC inductive loads, place a properly-rated MOV across the load in parallel with a series RC snubber. Use a 0.01 to 0.1mF pulse film capacitor (foil polypropylene recommended) of sufficient voltage, and a 47ohm, 1/2W carbon resistor. For DC inductive loads, place a diode across the load (PRV > DC supply, 1N4006 recommended) with (+) to cathode and (-) to anode (the RC snubber is an optional enhancement).

Table 1: AP1690 Input Ranges

Voltage	Current	Input Range Selector
100mV	10mA	SW1  W2
200mV	20mA	
500mV	50mA	
1V	100mA	
2V		
5V		
10V		
20V		
50V		
100V		
200V		

Table 3: AP1690 Input Jumper Settings

Input	Input Jumper Selector (W1)
Voltage	
Current	

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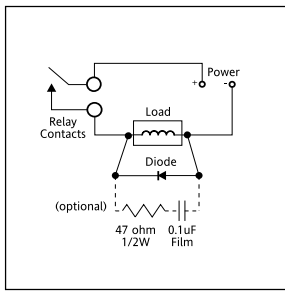


Figure 2: DC Inductive Loads

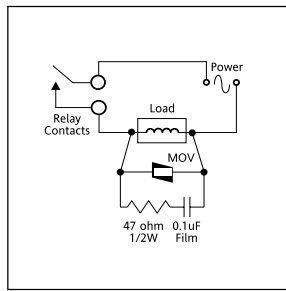
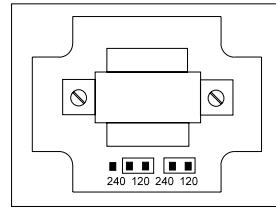
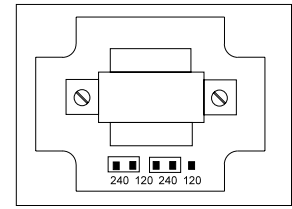


Figure 3: AC Inductive Loads



120 VAC Operation



240 VAC Operation

Figure 4: 120/240 VAC Selection

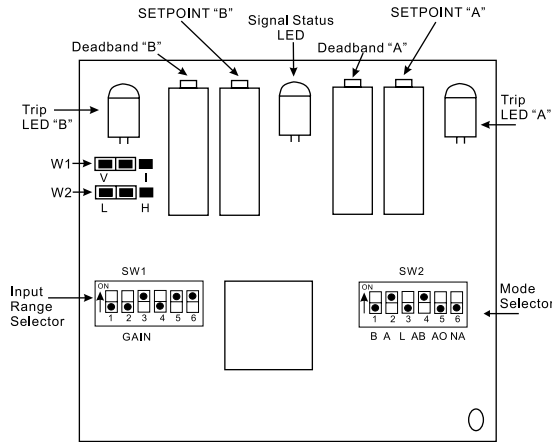


Figure 5: AP1690-2000 Factory Calibration 0-500mV, Dual HI/LO, Non-Latching, Non-Failsafe.

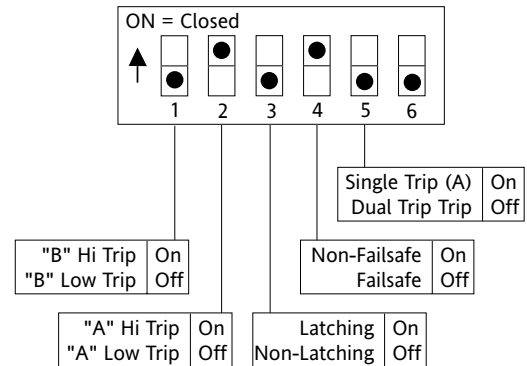


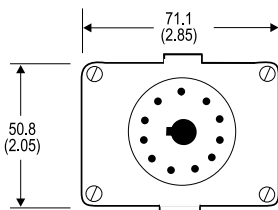
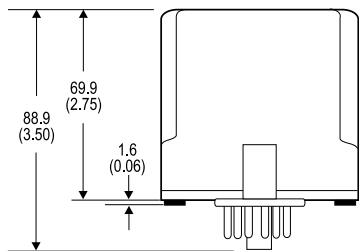
Figure 6: Mode Selection Dual Trip/A: HI, B: LO, Non-Latching, Non-Failsafe

**Mounting**

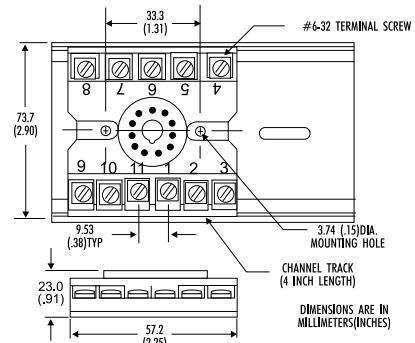
All Action Paks feature plug-in installation. Model AP1690 uses an 11-pin base and either molded socket M011 or DIN rail socket MD11.

**Dimensions**

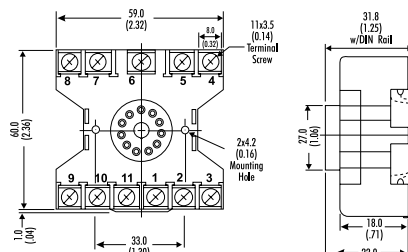
Dimensions are in millimeters (inches)



Mark III



M011 (Track/Surface)



MD11 (DIN Rail)

Action Pak®

## Specifications

### Inputs:

#### Voltage Input

Range: 100mV to 200VAC  
Impedance: >100K Ohms  
Overvoltage: 300VAC, max.

#### Current Input

Range: 10mA to 100mAAC  
Impedance: 20 Ohms, typical  
Overcurrent: 200mA AC, 60V peak, max  
Frequency Range: DC 40-400Hz,  
factory calibrated at 60Hz  
Common Mode (Input to Ground):  
1000V, max

### LED Indications:

Input Range (Green)  
>100% input: 8Hz flash (approx)  
Setpoint (Red):  
Tripped: Solid red  
Safe: Off

### Limit Differentials (Deadbands):

0.25% to 50% of selected span

### Response Time:

Dynamic Deadband:  
Relay status will change when proper  
setpoint/process condition exists  
uninterrupted for 100msec.  
Normal Mode (analog filtering):  
<250msec, (10-90%)

### Setpoint:

Effectivity:  
Setpoints are adjustable over 100% of the  
selected input span.  
Repeatability (constant temp):  
0.1% of selected input span

### Stability:

Line Voltage:  $\pm 0.01\%/%$ , max.  
Temperature:  $\pm 0.025\%$  of full scale/ $^{\circ}\text{C}$ , max.

### Common Mode Rejection:

DC to 60Hz: 120dB

### Isolation:

1000VDC between contacts, input & power

### ESD Susceptibility:

Meets IEC 801-2, Level 2 (4KV)

### Humidity:

Operating: 15 to 95% (@45 $^{\circ}\text{C}$ )  
Soak: 90% for 24 hours (@65 $^{\circ}\text{C}$ )

### Temperature Range:

Operating: 0 to 60 $^{\circ}\text{C}$  (32 to 140 $^{\circ}\text{F}$ )  
Storage: -15 to 70 $^{\circ}\text{C}$  (5 to 158 $^{\circ}\text{F}$ )

### Power:

Consumption: 2W typical, 5W max  
Standard:  
Selectable 120/240VAC ( $\pm 10\%$ , 50-60Hz)

### Relay Contacts:

1 SPDT (1 Form C) per setpoint  
Current Rating (resistive):  
120VAC: 5A; 240VAC: 2A; 28VDC: 5A  
Material: Gold flash over silver alloy  
Electrical Life: 10<sup>5</sup> operations at rated load  
*Note: External relay contact protection is  
required for use with inductive loads.  
See Relay Protection section.*  
Mechanical Life: 10<sup>7</sup> operations

### Latch Reset Time:

5 seconds

### Weight:

0.64lbs

### Agency Approvals:

CSA certified per standard C22.2  
(File No. LR42272-54).  
UL recognized per standard UL 805  
(File No. E99775)

## Ordering Information

### Specify:

1. Model: **AP1690-2000**
2. Options: U, P (see text)
3. Line Power (see specs.) (All power supplies are transformer isolated from the internal circuitry)
4. **C006** (0.1ohm shunt for 1 to 5Amp current inputs).
5. C620 Custom Calibration? (see Options)

### Accessories:

M801-0000 Retaining Spring  
M011-A 11 pin Track Mount Socket  
M004-0000 4 ft Long Channel Track  
MD11-0000 11 pin DIN Mount Socket

## Pin Connections

- 1 AC Power (Hot)
- 2 No Connection
- 3 AC Power (Neu)
- 4 Input (+)
- 5 Input (-)
- 6 (A) N.O.
- 7 (A) C
- 8 (A) N.C.
- 9 (B) N.O.
- 10 (B) C
- 11 (B) N.C.

### Key:

N.O. = Normally Open  
C = Common  
N.C. = Normally Closed  
DC Power: Pin 1 = (+)  
Pin 3 = (-)

Contacts are in the "normal" state when the relay is de-energized.





AP4003-0001

# Action PAK® AP4003

## Potentiometer Input Signal Conditioner

Provides a DC Output in Proportion to a Potentiometer Position Input



- Constant Voltage Excitation
- 100 to 100k Ohm Potentiometers
- Tank Level and Position Applications
- Selectable Failsafe/Latching Operation
- Plug-in Installation
- Selectable Failsafe/Latching Operation
- AC Line Powered

### Description

Model AP4003-0001 is the new version of the previous AP4003-xxxx series. Wide-ranging technology from the Ultra Slimpak II series has been utilized in this new version. This single model contains all of the input capability of previous dash numbers without the need for custom ranging from the factory. The resistance range is still 100 to 100k ohms. The default range is 0 to 100% but any portion of the span from 10% to 100% can be selected by pushbutton ranging. Four output ranges (0-5VDC, 0-10VDC, 0-20mA and 4-20mA) are available. A 15VDC output can also be used, but at a reduced drive level of 3mA. The default output is 4-20mA.

### Applications

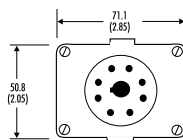
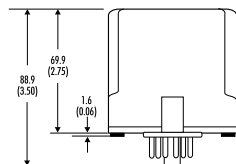
The AP4003-0001 is useful for converting potentiometer settings to voltage or current. It can be used anywhere a potentiometer or slidewire is used to determine position, displacement or rotation. The constant-voltage excitation allows use with potentiometers/slidewires with total resistances from 100 ohms to 100k ohms without affecting accuracy. For additional information on calibration, operation and installation, contact our Technical Support Group.

### Mounting

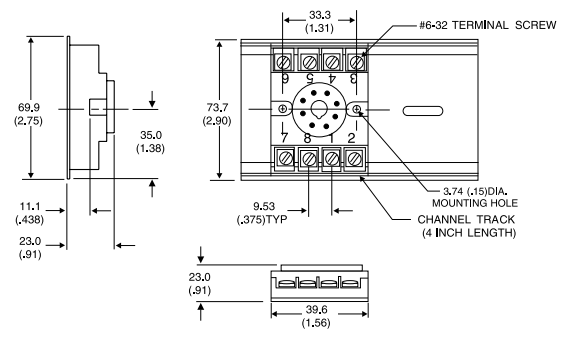
All Action Paks feature plug-in installation. Model AP4003 uses an 8-pin base, either molded socket (M008) or DIN rail socket (MD08).

### Dimensions

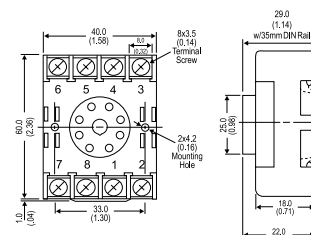
Dimensions are in millimeters (inches)



Mark III



M008 (Track/Surface)



MD08 (DIN Rail)

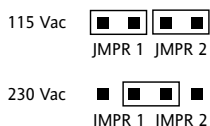
Action Pak®

## Mounting

All Action Paks feature plug-in installation. The AP4003-0001 uses an 8-pin base, either the molded socket (M008) or the DIN rail socket (MD08). An optional retaining spring (M801) is available if required for the application.

## Power Connections

See the pin connections at the back of this document. The unit supports either 115VAC input (the default) or 230VAC input. For 230VAC input, the jumpers next to the input transformer (on the base board) need to be changed according to the diagram below.



## Diagnostic LEDs

Other than when executing the pushbutton calibration routine, the LEDs blink under the following conditions:

**GREEN:** 2Hz when the input is under range 8Hz when the input is over range

**RED:** 2Hz when the output is under range 8 Hz when the output is over range

An Under Range condition exists when the signal is lower than the operational low value minus 6.25% of the operational span. An Over Range condition exists when the signal is higher than the operational high value plus 6.25% of the operational span.

A voltage output short circuit may cause an under range condition (RED blinking at a 2Hz rate). A current output open circuit may cause an over range condition (RED blinking at an 8Hz rate). There could be two or more LEDs blinking at the same time. That means the module has more than one error condition present. Only when all error conditions have been cleared will the LEDs be back to their normal condition (Green ON, Red and Yellow OFF).

## Calibration

For best results, calibration should be performed in the operating environment, allowing at least one hour warm-up for thermal stability of the system. If pre-calibration on a test bench is desired, then an output load equal to the input impedance of the devices connected to the AP4003-0001 output is recommended, along with the warm-up period.

Note: Many applications do not require calibrating the output levels and simply utilize the default operational ranges of the unit (0-5VDC, 0-10VDC, 0-20mA or 4-20mA). If the factory default calibration has been changed, the last saved operational output values are utilized. In those applications, the only calibration required is the operational input values. Once the maximum and minimum input values have been set, the Green and Red LEDs will be on. At this point, simply press the CAL button rapidly 3 times and you will exit the calibration routine without effecting the last saved calibration for the operational output values.

1. Connect a precision, multi-turn potentiometer of the required value to the input, with the CW lead connected to Pin 6, the Wiper lead to Pin 5 and the CCW lead to Pin 4. Connect the output to a voltage or current meter, depending on your application. Apply power and allow the system to reach thermal equilibrium.

2. Rotate the pot fully CW or to the desired maximum point and observe that the Green LED is on or flashing. Push the CAL button and hold for more than 4 seconds. The Yellow and Red LEDs should be on. Push the CAL button momentarily and the Yellow and Green LEDs will be on. (From this point on, you can exit the calibration procedure at any step without saving new data by holding the CAL button for at least 4 seconds.)

3. With the pot at the maximum input signal level desired, push the CAL button. The Yellow LED should now be on.

4. Rotate the pot to the full CCW position, or the exact minimum input signal level desired, then push the CAL button. The Green and Red LEDs should now be on. If you do not wish to change the output calibration, press the CAL button rapidly three times to exit the calibration routine.

5. If you do wish to do a custom operational range for the output, rotate the pot CW until the output is precisely at the desired maximum level (e.g. 20.00mA), then push the CAL button. The Red LED should be on.

6. Rotate the pot CCW until the output is precisely at the desired minimum level (e.g. 4.00mA), then push the CAL button. All three LEDs should now be on.

7. To finish calibration, push the button one final time. The calibration data is now saved. The Green LED should be on if the input is within the calibrated range.

## Default Settings

Input Range: 0 to 100%

Output Range: 4 to 20mA

Table 1. Output Range

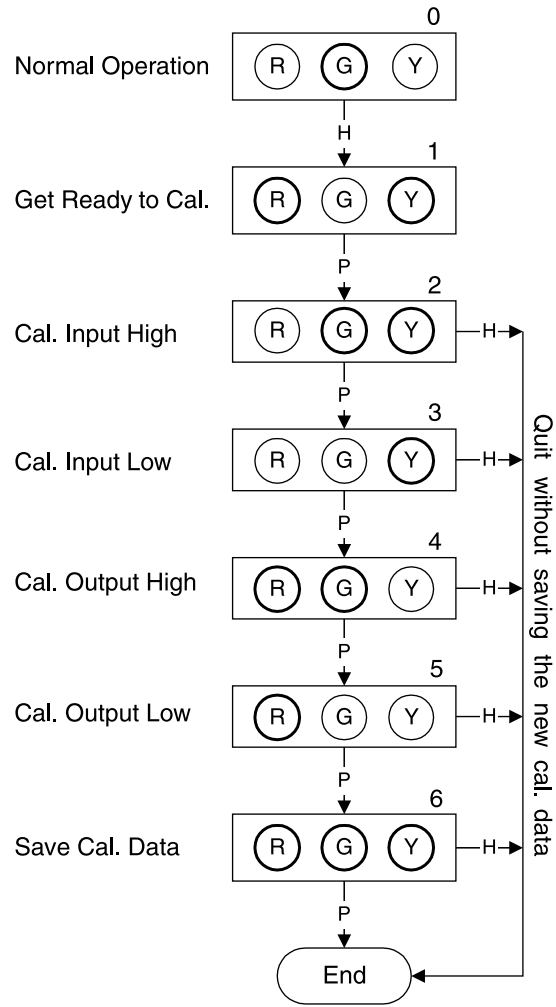
Function	S1		
	1	2	3
<b>Output Range</b>			
4 to 20 mA			
0 to 20 mA			■
0 to 5 Vdc		■	
0 to 10 Vdc		■	■

Key: ■ = 1 = ON or Closed

Table 2. Output Form

Function	S1
	4
<b>Output Form</b>	
Direct Out	
Reverse Out	■

Key: ■ = 1 = ON or Closed



- Off
- On
- ◐ Flash 10 Hz
- H→ Hold button 4 sec.
- P→ Press button

NOTE: If there is no data change from step 4 to 6, the output calibration data will remain unchanged

Figure 1. Calibration Flow Chart

## Specifications

### Input:

Impedance: >100M ohms  
Linearity:  $\pm 0.1\%$  of span, typical  
Excitation: 300mV, nominal  
Potentiometer Resistance:  
100 ohms (min) to 100k ohms (max)  
(end to end)  
Input Range:  
Any portion of the potentiometer from  
10% to 100% using pushbutton  
calibration  
Turn-Up/Turn-Down: 75%  
(90% of span @ 0.5% linearity; 80% of  
span @ 0.15% linearity)

### Common Mode Rejection:

60Hz: >100dB  
DC: >120dB

### Output Ranges:

0-5VDC, 0-10VDC  
(higher voltage to 15V @ 3mA drive)  
0-20mA  
4-20mA

### Response Time:

100mSec, typical

### Stability:

$\pm 100$ ppm ( $\pm 0.01\%$ ) of span/ $^{\circ}$ C, typical

### Output Ripple:

0.2% of span, or 5mVrms, whichever is greater

### Output Impedance:

Voltage Output: <10 ohms  
Current Output: >100k ohms

### Output Drive:

Voltage Output: 10mA, max  
Current Output: 20V compliance @20mA

### LED Indication:

RUN (Green): On when unit is powered.  
Flashes at 2Hz when input is below  
operational low minus 6.25% of  
operational span.  
Flashes at 8Hz when input is above  
operational span plus 6.25% of  
operational span. INPUT (Yellow): On  
while calibrating the input level.  
OUTPUT (Red): On while calibrating the  
output level. Flashes at 2Hz when output  
is below operational low minus 6.25% of  
operational span. Flashes at 8Hz when  
output is above operational span plus  
6.25% of operational span.

### Temperature Range:

Operating: 0 to 60 $^{\circ}$ C (32 to 140 $^{\circ}$ F)  
Storage: -20 to 85 $^{\circ}$ C (-4 to 185 $^{\circ}$ F)

### Humidity:

Operating: 15 to 95% RH non-condensing  
Non-operating: 90% RH @ 65 $^{\circ}$ C for 24 hrs

### Power Consumption:

3W typical, 5W max  
Standard: 115/230VAC  $\pm 10\%$

### Isolation:

Input to Output Power: 1500VDC

### Agency Approvals:

CSA C22.2, No. 0-M91, 142-M1987  
UL508

## Ordering Information

### Specify:

1. Model: **AP4003-0001**

### Accessories:

M801-0000 Retaining Spring  
M008-A 8 pin Track Mount Socket  
M004-0000 4 ft Long Channel Track  
MD08-0000 8 pin DIN Mount Socket

## Pin Connections

- 1 AC Power (Hot)
- 2 Shield (GND)
- 3 AC Power (Neu)
- 4 Pot CCW/Shield
- 5 Pot W
- 6 Pot CW
- 7 Output (+)
- 8 Output (-)



AP4081-0000

# Action PAK® AP4081

## Bridge Input, Field Configurable Isolator

Provides an Isolated, DC Output in Proportion to a Bridge/Strain-Gauge Input



- Adjustable Bridge Excitation 1 to 10V with up to 120mA drive
- 11 Field Configurable Input Ranges: 10mV to  $\pm 200\text{mV}$  ( $0.5\text{mV/V}$  to  $> 50\text{mV/V}$ )
- 4 Field Configurable Output Ranges: 0-5V, 0-10V, 0-1mA, and 4-20mA
- Plug-in Installation
- Selectable 120/240VAC Input Power

### Description

The Action Pak AP4081 is a bridge or strain-gauge input signal conditioner with 1500VDC isolation between input, output and power. The field configurable input and output offer flexible, wide ranging capability for bridge or strain-gauge input applications from  $0.5\text{mV/V}$  to over  $50\text{mV/V}$ .

Wide-ranging, precision zero and span pots allow 50% adjustability of offset and gain within each of the 11 switch selectable input ranges. The output can be set for either 0-5V, 0-10V, 0-1mA or 4-20mA. This flexibility, combined with an adjustable (1 to 10VDC) bridge excitation source, provides the user a reliable, accurate instrument to isolate and condition virtually any bridge or strain-gauge input.

### Application

The Action Pak AP4081 field configurable, bridge input signal conditioner is useful in isolating ground loops and interfacing bridge sensors to data acquisition and control systems.

Three way isolation completely eliminates ground loops from any source. Isolation protects expensive SCADA systems from ground faults and provides filtering for noise reduction, which can be a significant problem with small millivolt bridge signals.

Wide ranging flexibility allows the user to easily zero out dead-loads in weighing systems or configure bipolar input ranges for expansion-compression or vacuum-pressure bridge applications.

The convenient Action Pak is easy to install, using sockets suitable for surface mount, DIN rail mount or snap track mount. Troubleshooting is easy since no wires need to be removed when swapping units. The wide ranging power supply accepts either 120 or 240VAC power.

### Diagnostic LED

The AP4081 is equipped with a dual function LED signal monitor. The green, top mounted LED indicates both line power and input signal status. Active line power is indicated by an illuminated LED. If the input signal is more than 110% of the full-scale range, the LED will flash at 8Hz (or 4Hz when input  $< 0\%$ ).

### Configuration

A major advantage of the AP4081 is its wide ranging capabilities and ease of configuration. The AP4081 has 11 input range switch settings. Trim potentiometers allow 50% input zero and span adjustability within each of the 11 full-scale, input ranges.

For example, the 200mV switch setting in Table 1 configures the input for a 0 to 200mV range. The span can be contracted by 50% which enables an input span of 100mV. This 100mV span can be positioned anywhere within the 0-200mV range. The zero offset can be as large as 50% of the full scale range (e.g. 100 to 200mV range), which can be useful to tare out a dead load in weighing applications.

Unless otherwise specified, the factory presets the Model AP4081 as follows:

Input Setting:	0 to 50mV
Adjusted Range:	0 to 30mV ( $3\text{mV/V}$ )
Excitation:	10V
Operation:	Direct
Output:	4 to 20mA
Power:	120VAC

For other I/O ranges refer to Tables 1 through 4 and reconfigure switches SW1 and SW2 for the desired input range, function, excitation and output range.

*Warning: Do not attempt to change any switch settings with power applied. Severe damage will result!*

**Calibration**

1. Connect the input to a calibrated millivolt source, load the excitation supply with the bridge or an equivalent load and apply power. Wait at least 15 minutes for thermal stability before monitoring the voltage/current.
2. Adjust excitation to the desired level.
3. Set the calibrator to the desired minimum input and adjust the zero potentiometer for minimum output.
4. Set the calibrator to the desired maximum input and adjust the span potentiometer for maximum output.
5. Repeat steps 3 and 4, as necessary for best accuracy.

*Table 1: Input Range Selector-Switch settings*

	SW1				
	1	2	3	4	5
0 to 10mV	■	■	■	■	■
0 to 20mV	■	■	■	■	■
0 to 50mV	■	■	■	■	■
0 to 100mV	■				■
0 to 200mV	■			■	■
-5 to 5mV	■				
-10 to 10mV	■	■			
-20 to 20mV	■	■	■		
-50 to 50mV	■	■	■	■	
-100 to 100mV	■				
-200 to 200mV	■				■

KEY ■ = ON

*Table 2: Direct or Reverse Operation Setting*

	SW1
DIRECT	6
REVERSE	■

KEY ■ = ON

*Table 3: Bridge Excitation Selector-Switch Settings*

	SW1
9.8 to 10.1V	7 8
4.8 to 5.2V	■
0 to 10V	■
0 to 2.5V	■

KEY ■ = ON

*Table 4: Output Range Selector-Switch Settings*

	SW 2					
	1	2	3	4	5	6
0 to 5V	■	■	■	■	■	■
0 to 10V	■	■	■	■	■	■
0 to 1mA	■	■	■	■	■	■
4 to 20mA					■	■

KEY ■ = ON

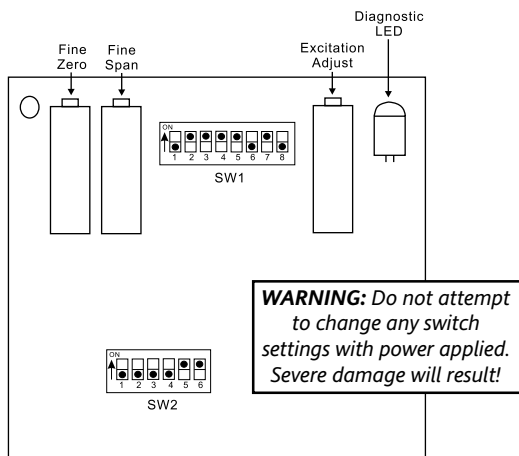


Figure 1: Factory Calibration; 0 to 50mV (calibrated to 0-30mV), 10V excitation, Direct, 4-20mA.

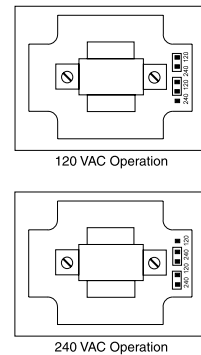


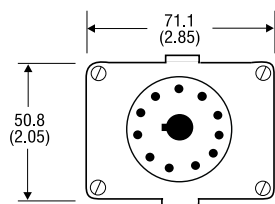
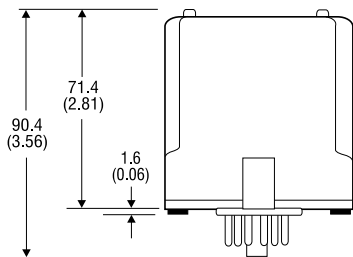
Figure 2: 120/240 VAC Selection

**Mounting**

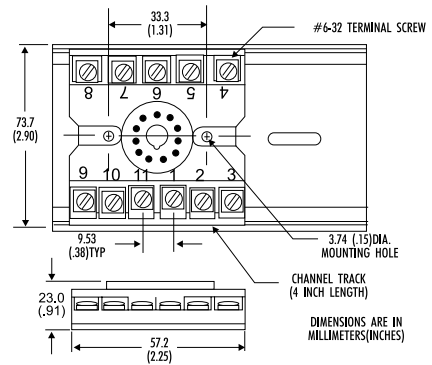
All Action Paks feature plug-in installation. Model AP4081 uses an 11-pin base, either molded socket (M011) or DIN rail socket (MD11).

**Dimensions**

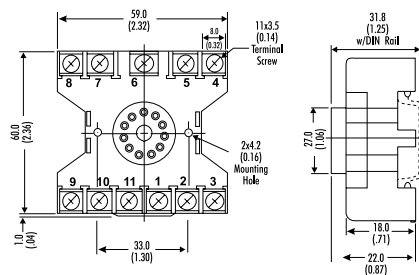
Dimensions are in millimeters (inches)



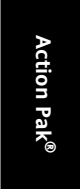
Mark II



M011 (Track/Surface)



MD11 (DIN Rail)



## Specifications

### Input:

- Voltage Input:
  - Full Scale Range: 10mV to  $\pm 200$ mV (see Table 1)
- Impedance: >1M ohms
- Overvoltage:
  - 400Vrms, max (Intermittent);
  - 264 Vrms, max (Continuous)
- Common Mode (Input to Ground):
  - 1500VDC, max
- Zero Turn-Up:
  - 50% of full scale range
- Span Turn-Down:
  - 50% of full scale range
- Operation:
  - direct or reverse acting

### Output:

- Voltage Output:
  - Output: 0-5V, 0-10V
  - Impedance: <10 ohms
  - Drive: 10mA, max (1K ohms min. @ 10V)
- Current Output:
  - Output: 0-1mA, 4-20mA
  - Impedance: >100K ohms
- Compliance:
  - 0-1mA; 10V, max (10K ohms max)
  - 4-20mA; 15V, max (750 ohms max)

### Bridge Excitation:

1 to 10VDC, 120mA max (84 ohms min)

### Accuracy (Including Linearity, Hysteresis):

$\pm 0.1\%$  typical,  $\pm 0.2\%$  maximum of selected range at 25°C.

### Stability:

$\pm 0.025\%/^{\circ}\text{C}$  typical,  $0.05\%/^{\circ}\text{C}$  maximum, of selected range.

### Output Noise (maximum):

0.1% of span, rms, or 10mV whichever is greater.

### Response Time (10 to 90%):

<200mSec., typical.

### Common Mode Rejection:

DC to 60Hz: >120dB,  
>100dB on 0-1mA output range

### Isolation:

1500VDC between input, output and power.

### ESD & Transient Susceptibility:

Meets IEC 801-2, Level 2 (4KV)  
and IEC 801-4, Level 3

### LED Indication (green):

Input Range  
>110% input: 8Hz flash  
<-10% input: 4Hz flash

### Humidity:

Operating: 15 to 95%  
non-condensing @ 45°C  
Soak: non-condensing 90%  
for 24 hrs @ 65°C

### Temperature Range:

Operating: 0 to 60°C (32 to 140°F)  
Storage: -25 to 70°C (-13 to 158°F)

### Power:

Consumption: 3W typical, 6.5W max.  
Standard: selectable 120/240VAC,  $\pm 10\%$ ,  
50-60Hz

### Weight:

0.80lbs

### Agency Approvals:

CSA certified per standard C22.2  
(File No. LR42272-64)  
UL recognized per standard UL508  
(File No. E99775)

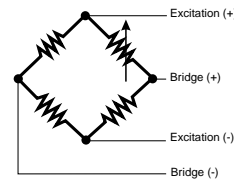


Figure 3: Bridge Reference Designations

## Ordering Information

### Specify:

- Model: **AP4081**
- Options: U, (see text)
- Line Power (see specs.)(All power supplies are transformer-isolated from the internal circuitry.)
- C620 Custom Calibration? (see Options)

### Accessories:

- M801-0000 Retaining Spring
- M011-A 11 pin Track Mount Socket
- M004-0000 4 ft Long Channel Track
- MD11-0000 11 pin DIN Mount Socket

### Pin Connections

- AC Power (Hot)
- No Connection\*
- AC Power (Neu)
- Bridge (+)
- Bridge (-)
- No Connection\*
- Excitation (+)
- Excitation (-)
- Output (+)
- Output (-)
- No Connection\*

\*Pins 2, 6 and 11 should NOT be used as terminations for other wires. Connections at these terminals will decrease isolation levels.





AP4151-2000

# Action PAK® AP4151

## RTD Input, Signal Conditioners

Provides a DC Output in Proportion to an RTD Input



- Direct RTD Input
- Integral Lead-Length Compensation
- Wide-ranging input and output
- Plug-in Installation
- Selectable 120/240VAC Input Power

### Description

The AP4151-2000 is a wide-ranging, isolating signal conditioner for RTD inputs. The input is configurable for either 2- or 3-wire RTDs (2-wire requires a jumper wire across terminals 4 and 5 of the mounting base). The RTD types supported are Platinum, Nickel and Copper. Pushbutton ranging is used for adjusting the input and output ranges. The output can be set to be either linear to resistance or linear to temperature.

In most applications, the model AP4151-2000 can be used to replace previous models of AP4001 and AP4151.

### Applications

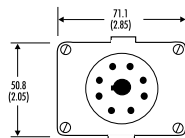
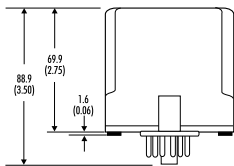
The Action Pak model AP4151-2000 is useful in any application requiring a DC output from an RTD input. Typical applications include energy management and data acquisition of process temperatures. The output of the AP4151-2000 can drive a digital meter for direct display, or interface with a computer for monitoring and control.

### Mounting

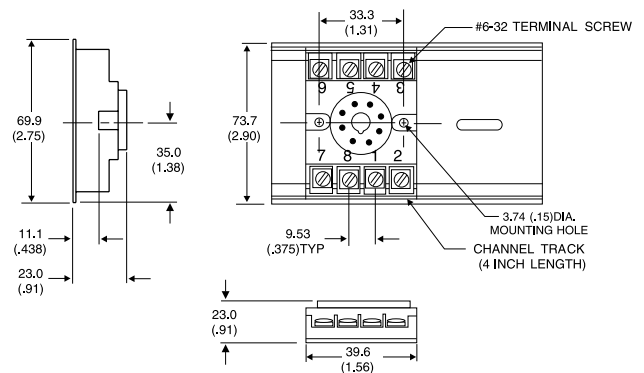
All Action Paks feature plug-in installation. The model AP4151-2000 uses an 8-pin base and either molded socket M008 or DIN socket MD08.

### Dimensions

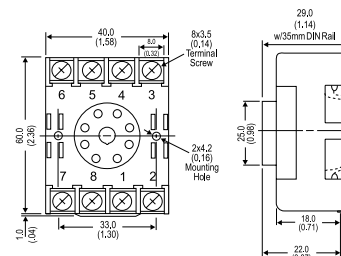
Dimensions are in millimeters (inches)



Mark III



M008 (Track/Surface)



MD08 (DIN Rail)

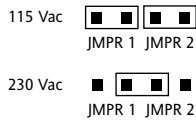
Action Pak®

## Mounting

All Action Paks feature plug-in installation. The AP4151-2000 uses an 8-pin base, either the molded socket (M008) or the DIN rail socket (MD08). An optional retaining spring (M801) is available if required for the application.

## Power Connections

Power is connected according to the table above. The unit supports either 115VAC input (the default) or 230VAC input. If you need 230VAC input, jumpers, located next to the input transformer on the base board, need to be changed according to the diagram below.



## Diagnostic LEDs

Other than when executing the pushbutton calibration routine, the LEDs blink under the following conditions:

- GREEN:** 2 Hz when the input is under range 8 Hz when the input is over range
- RED:** 2 Hz when the output is under range 8 Hz when the output is over range

An Under Range condition exists when the signal is lower than the operational low value minus 6.25% of the operational span. An Over Range condition exists when the signal is higher than the operational high value plus 6.25% of the operational span.

A voltage output short circuit can cause an under range condition (RED blinking at a 2 Hz rate). A current output open circuit can cause an over range condition (RED blinking at an 8 Hz rate). There could be two or more LEDs blinking at the same time, which means the module has more than one error condition present. Only when all error conditions have been cleared will the LEDs return to their normal condition (Green ON, Red and Yellow OFF).

## Calibration

For best results, calibration should be performed in the operating environment, allowing at least one hour warm-up for thermal stability of the system. If pre-calibration on a test bench is desired, an output load equal to the input impedance of the devices connected to the AP4151-2000 output is recommended, along with the warm-up period.

Note: Many applications do not require calibrating the output levels and simply utilize the default operational ranges of the unit (0-5VDC, 0-10VDC, 0-20mA or 4-20mA). If the factory default calibration has been changed, the last saved operational output values are utilized. In those applications, the only calibration required is the operational input values. Once the maximum and minimum input values have been set, the Green and Red LEDs will be on. At this point, simply press the CAL button rapidly 3 times and you will exit the calibration routine without effecting the last saved calibration for the operational output values.

1. Connect a resistance decade box (with 0.01 precision) to the input (Pins 5 and 6). Jumper pin 4 to pin 5. Connect the output to a voltage or current meter, depending on your application. Apply power and allow the system to reach thermal equilibrium.

2. Hold down the pushbutton switch for 4 seconds. The Yellow and Red LEDs should be on. Push the CAL button momentarily and the Yellow and Green LEDs will be on. (From this point on, you can exit the calibration procedure at any step without saving new data by holding the CAL button for at least 4 seconds.)

3. Set the resistance to the value that matches your desired maximum operational input temperature and push the CAL button. The Yellow LED should now be on.

4. Set the resistance to the value that matches your desired minimum operational input temperature and push the CAL button. The Green and Red LEDs should now be on. If you do not wish to change the output calibration, press the CAL button rapidly three times to exit the calibration routine.

5. If you do wish to do a custom operational range for the output, increase the resistance until the output is precisely at the desired maximum level (e.g. 20.00mA) and push the CAL button. The Red LED should be on.

6. Decrease the resistance until the output is precisely at the desired minimum level (e.g. 4.00mA) and push the CAL button. All three LEDs should now be on.

7. To finish calibration, push the button one final time. The calibration data is now saved. The Green LED should be on if the input is within the calibrated range.

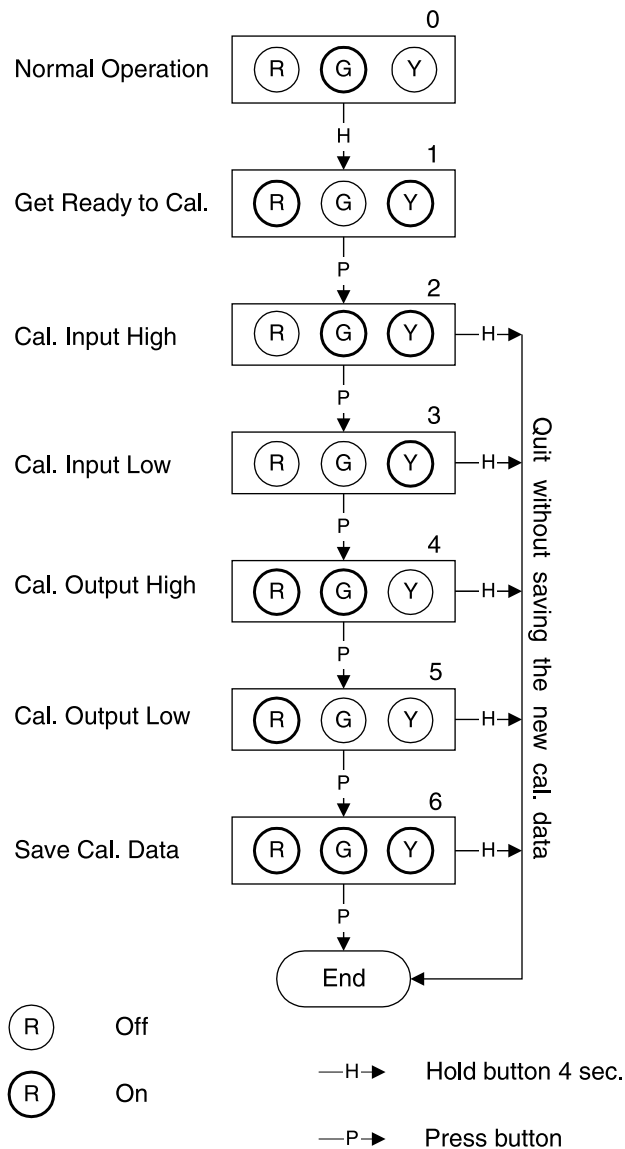
## Default Settings

- Input: Pt-100, 0-500°C  
Output: 4-20mA

Table 1. Switch Settings

Function	SW1								SW2				
	1	2	3	4	5	6	7	8	1	2	3	4	5
RTD Type													
Pt100-385					■	■	■	■	■				
Pt200-385						■	■	■					■
Pt500-385					■		■	■		■			
Pt1000-385							■	■			■		
Pt100-3911					■	■			■				
Pt200-3911						■							■
Pt500-3911					■			■		■			
Pt1000-3911								■			■		
Pt100-392					■	■	■		■				
Pt200-392						■	■						■
Pt500-392					■		■			■			
Pt1000-392							■				■		
Ni100-618					■	■			■				
Ni120-672						■			■				
Cu9.035-427					■								■
No Linearization	■												
Output													
4-20mA													
0-20mA			■										
0-5V		■											
0-10V		■	■										
Reverse Out				■									

Key: ■ = ON or Closed



NOTE: If there is no data change from step 4 to 6, the output calibration data will remain unchanged

Figure 1. Calibration Flow Chart

**Specifications**

Leadwire effect:  
 <+/- 0.1% of max input temperature span, max.  
**Leadwire Resistance (Max Ohms/lead):**  
 40% of RTD resistance  
**RTD Excitation Current:**  
 < 25uA to 2.5mA depending upon RTD type

**Operating Modes:**

Direct:: increasing input produces increasing output  
 Reverse: increasing input produces decreasing output

**Output Ranges:**

0-20mA, 4-20mA, 0-5VDC, 0-10VDC  
 (higher voltage to 15V @ 3mA drive)  
 Selectable between linear to temp or ohms

**Turn-Up/Turn-Down:**

75% (90% of span @ 0.5% linearity,  
 80% @ 0.15%)

**Output Drive:**

0-20mA, 4-20mA ranges: 15V compliance  
 (750 ohm load maximum)  
 0-5V and 0-10V ranges: 10mA drive  
 (1000 ohm load minimum)

**Output Accuracy:**

Current Outputs: ± 0.1% of full scale, max.  
 Voltage Outputs: ± 0.1% of full scale, max.

**Stability:**

±100ppm (±0.01%) of full scale / °C, typical

**Adjustments:**

Configuration: switch selectable input type, output range and linearization type  
 Pushbutton: Pushbutton zero and span from maximum to minimum specified in input range table.

**Response Time:**

250mSec typical, 300mSec maximum.

**LED Indicator:**

GREEN: RUN, on when unit is powered.  
 Flashes at a 2Hz rate when the input is under range by 6.25%  
 Flashes at an 8Hz rate when the input is over range by 6.25%  
 RED: OUTPUT, on while calibrating output.  
 Flashes at a 2Hz rate when the output is under range by 6.25%  
 Flashes at an 8Hz rate when the output is over range by 6.25%  
 YELLOW: INPUT, on while calibrating input

**Power Requirements:**

120/240VAC 50-400Hz, jumper selectable, 3W typical, 5W max.

**Isolation:**

1500VDC, Input to Output to Power

**Environmental:**

Operating Temperature:  
 0°C to +60°C (32 to 149°F)  
 Storage Temperature:  
 -20°C to 85°C (-4 to 185°F)  
 Operating Relative Humidity:  
 15% to 95% RHNC @ 45°C  
 Non-operating Relative Humidity:  
 90% RHNC @ 65°C for 24 Hrs.

**Agency Approvals:**

CSA C22.2, NO. 0-M91, 142-M1987  
 UL508, combined mark (pending)

**Ordering Information**

**Specify:**

- 1. Model: **AP4151-2000**

**Accessories:**

- M801-0000 Retaining Spring
- M008-A 8 pin Track Mount Socket
- M004-0000 4 ft Long Channel Track
- MD08-0000 8 pin DIN Mount Socket

**Pin Connections**

- 1 AC Power (Hot)
- 2 Shield (Gnd.)
- 3 AC Power (Neu.)
- 4 RTD Return
- 5 RTD Input (-)
- 6 RTD Input (+)
- 7 Output (+)
- 8 Output (-)

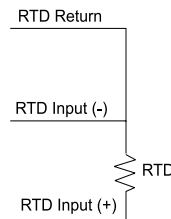


Table 1: AP4151 Input Limits

Input Type	Input Range	Minimum Recommended Span
Pt100 ohm, (0.00385, 0.003911, 0.00392)	-200 to +870° C	100° C
Pt200 ohm, (0.00385, 0.003911, 0.00392)	-200 to +870° C	100° C
Pt500 ohm, (0.00385, 0.003911, 0.00392)	-200 to +870° C	100° C
Pt1000 ohm, (0.00385, 0.003911, 0.00392)	-200 to +870° C	100° C
Ni100 ohm, (0.00618)	-100 to +320° C	50° C
Ni120 ohm, (0.00672)	-100 to +320° C	50° C
Cu9.035 ohm, (0.00472)	-200 to +260° C	50° C

Action Pak®



AP4351-2000

# Action PAK® AP4351

## Thermocouple-Input, Field Configurable Isolator

Provides Isolated, Linearized DC Output  
in Proportion to Thermocouple Input



- Field Configurable Thermocouple Types
- Linearized Outputs
- Wide-Ranging Zero and Span Adjustability (50%
- Eliminates Ground Loops
- Thermocouple Burnout Detection
- ASIC Technology for Enhanced Reliability

### Description

The AP4351 isolating thermocouple conditioner offers wide ranging input and output capability. The AP4351 can be field configured by the user to accept input from thermocouple types J, K, T, R, S, E, and B and to provide current or voltage output. The output is linearized to temperature according to the particular thermocouple type.

The AP4351 is a three-port industrial isolator — the output is optically isolated from the input up to 1500V, and both input and output are transformer isolated from the line power. Isolation allows the noise reduction benefits of grounded thermocouples to be realized without creating ground loop problems and it provides faster response. The AP4351 utilizes the latest in advanced analog/digital signal processing technology. In addition to its multiple microprocessors, it employs special ASIC circuitry for high accuracy and reliability.

The AP4351 is equipped with cold-junction compensation (CJC) circuitry to provide ice-point reference. Upscale, downscale or disabled thermocouple burnout detection is switch selectable.

### Application

The Action Pak Model AP4351 is useful in any application requiring an isolated DC output from a thermocouple input. Typical applications include energy management and data acquisition of process temperatures. The output of the AP4351 can drive a digital meter for direct display or interface with a computer for monitoring and control applications.

### Status LEDs

Model AP4351 is equipped with top-mounted LEDs for INPUT (green), TROUBLE (yellow) and CAL OK (yellow). At start-up, both the INPUT and the CAL OK LEDs light up momentarily for 1 second. Afterwards, these LEDs flash alternately for 10 seconds while start-up takes place.

### Input LED

This input LED is a diagnostic tool. It remains continuously lit if the measured temperature is within the selected range of the thermocouple. However, if the measured temperature is outside the full range of the thermocouple (for example, for a type J - below minus 200°C or above 750°C), the LED will flash at a rate of 4 or

8Hz for under/over range, respectively. If the thermocouple is within the full temperature range, but outside the selected sub-range (for example, if a type J thermocouple is set for range 13 and the temperature is either below 375°C or above 500°C) the LED will flash at 0.5 or 1Hz respectively.

### Cal OK LED

This LED is continuously on when the device is properly storing the factory calibration reference voltage.

### Trouble LED

This LED is off during normal operation of the device. If this LED is on contact Action's Technical Services Group.

### Options

- U** Urethane coating of internal circuitry for protection from corrosive atmospheres.
- C620** Factory calibration (specify input thermocouple type, temperature range and output).

### Configuration

A major advantage of the AP4351 is its wide ranging capabilities and ease of configuration. The AP4351 enables 50% input zero and span adjustability within the selected sub-range.

For example, range #5 for an E-Type thermocouple in Table 6 specifies -18°C to 125°C. Since the span can be contracted by 50%, this enables an input span as narrow as 50% of 143°C, or 72°C. This span can then be positioned anywhere within the temperature range and can have a zero step-up as large as 50% of the full scale range (e.g. span can start as high as 53°C).

Unless otherwise specified, the factory pre-sets the Model AP4351 as follows:

Input:	J-type
Range:	0-500°C
Output:	4-20mA
Burn Out:	Upscale

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For other settings, remove the four base screws and polycarbonate case to access the configuration switches.

Refer to Tables 1 through 6 and Figures 1 through 3 for the proper switch locations and settings. Using the switch on the input board select thermocouple type, temperature range, and thermocouple burnout detection. Using the switch on the output board, select desired type of output. Replace the case prior to applying power to the unit.

### Calibration

1. Connect the input to a calibrated thermocouple source and apply power. Wait 1-2 hours for thermal stability before monitoring the voltage/current output. Refer to PIN CONNECTIONS.

2. Set the calibrator to the desired minimum input and adjust the zero potentiometer for the desired minimum output.

3. Set the calibrator to the desired maximum input and adjust the span potentiometer for the desired maximum output.

4. Repeat steps 2 and 3, as necessary, for best accuracy.

### Installation

Model AP4351 is pin-compatible with Action's AP4100, AP4130, AP4150, and AP4350, allowing for easy field upgrade.

Table 1: Thermocouple type switch settings (SW 1 on Input Board)

TC Type	8	9	10
B	ON	ON	ON
E	ON	ON	OFF
J	ON	OFF	ON
K	ON	OFF	OFF
R	OFF	ON	ON
S	OFF	ON	OFF
T	OFF	OFF	ON
Not Used	OFF	OFF	OFF

Table 3: Range switch settings used in conjunction with Table 6 (SW 1 on Input Board, SW1-3 is not used)

Input Sub-Range	SW1-7	SW1-6	SW1-5	SW1-4
1	OFF	ON	OFF	ON
2	OFF	ON	ON	ON
3	ON	OFF	ON	OFF
4	OFF	OFF	ON	ON
5	ON	ON	OFF	ON
6	ON	ON	ON	ON
7	ON	OFF	OFF	ON
8	OFF	OFF	OFF	ON
9	ON	ON	ON	OFF
10	OFF	ON	ON	OFF
11	OFF	ON	OFF	OFF
12	OFF	OFF	ON	OFF
13	ON	ON	OFF	OFF
14	ON	OFF	ON	ON
15	ON	OFF	OFF	OFF
16	OFF	OFF	OFF	OFF

Table 4: Output switch settings (SW 1 on Output Board)

Output	SW1-2	SW1-1
0 - 5V	ON	ON
0 - 10V	OFF	ON
0 - 1mA	ON	OFF
4 - 20mA	OFF	OFF

Table 5: AP 4351 Accuracy

TC Type	Temp. Range °C (°F)	Accuracy
J	-200 to 750°C (-328 to 1382°F)	±2.0 °C (±3.6°F)
K	-200 to -140°C (-328 to -220°F)	±5.0 °C (±9.0°F)
	-140 to 1250°C (-220 to 2282°F)	±2.0 °C (±3.6°F)
	1250 to 1370°C (2282 to 2498°F)	±4.0 °C (±7.2°F)
E	-150 to 1000°C (-238 to 1832°F)	±2.5 °C (±4.5°F)
T	-150 to 400°C (-238 to 752°F)	±3.0 °C (±5.4°F)
R	50 to 1760°C (122 to 3200°F)	±6.0 °C (±10.8°F)
S	50 to 1760°C (122 to 3200°F)	±6.0 °C (±10.8°F)
B	500 to 1820°C (932 to 3308°F)	±5.0 °C (±9.0°F)

Table 2: Thermocouple burnout detection switch settings (SW 1 on Input Board)

TC Burnout Detect	SW1-2	SW1-1
Upscale	OFF	ON
Downscale	ON	OFF
Disable	OFF	OFF
Not Allowed	ON	ON

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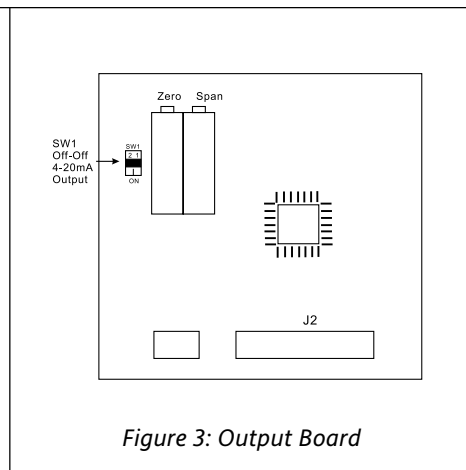
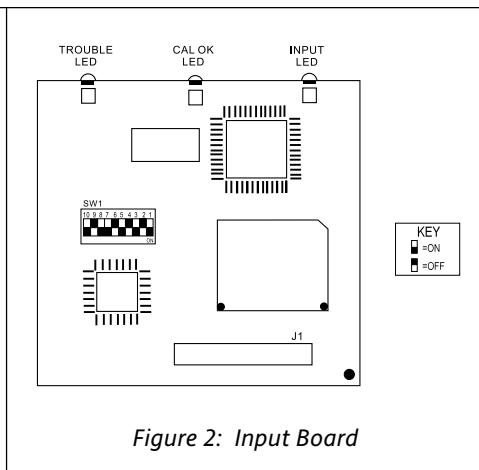
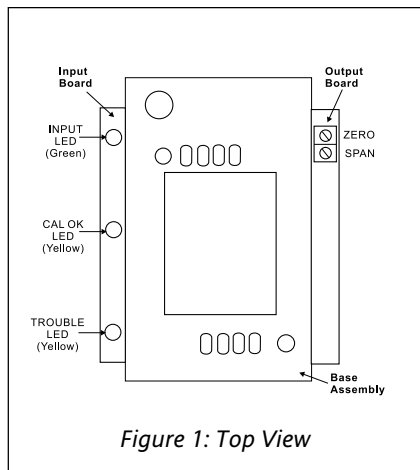


Table 6: Thermocouple Range Settings

TC Type	Range Number	Temperature Range	
B	6	500 to 1820° C	(932 to 3308° F)
	7	1000 to 1820° C	(1832 to 3308° F)
	8	500 to 1000° C	(932 to 1832° F)
	11	1500 to 1820° C	(2732 to 3308° F)
	12	750 to 1000° C	(1382 to 1832° F)
E	2	-18 to 1000° C	(0 to 1832° F)
	3	-18 to 500° C	(0 to 932° F)
	4	-18 to 250° C	(0 to 482° F)
	5	-18 to 125° C	(0 to 257° F)
	8	500 to 1000° C	(932 to 1832° F)
	9	250 to 500° C	(482 to 932° F)
	10	125 to 250° C	(257 to 482° F)
	12	750 to 1000° C	(1382 to 1832° F)
	13	375 to 500° C	(707 to 932° F)
	14	-150 to 750° C	(-238 to 1382° F)
	15	-150 to 250° C	(-238 to 482° F)
J	2	-18 to 750° C	(0 to 1382° F)
	3	-18 to 500° C	(0 to 932° F)
	4	-18 to 250° C	(0 to 482° F)
	5	-18 to 125° C	(0 to 257° F)
	8	500 to 750° C	(932 to 1382° F)
	9	250 to 500° C	(482 to 932° F)
	10	125 to 250° C	(257 to 482° F)
	13	375 to 500° C	(707 to 932° F)
	14	-200 to 750° C	(-328 to 1382° F)
	15	-200 to 250° C	(-328 to 482° F)
	16	-200 to 0° C	(-328 to 32° F)

TC Type	Range Number	Temperature Range	
K	1	-18 to 1370° C	(0 to 2498° F)
	2	-18 to 1000° C	(0 to 1832° F)
	3	-18 to 500° C	(0 to 932° F)
	4	-18 to 250° C	(0 to 482° F)
	5	-18 to 125° C	(0 to 257° F)
	7	1000 to 1370° C	(1832 to 2498° F)
	8	500 to 1000° C	(932 to 1832° F)
	9	250 to 500° C	(482 to 932° F)
	10	125 to 250° C	(257 to 482° F)
	12	750 to 1000° C	(1382 to 1832° F)
	13	375 to 500° C	(707 to 932° F)
	14	-200 to 750° C	(-328 to 1382° F)
	15	-200 to 250° C	(-328 to 482° F)
	16	-200 to 0° C	(-328 to 32° F)

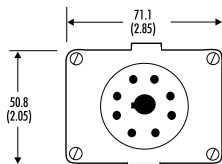
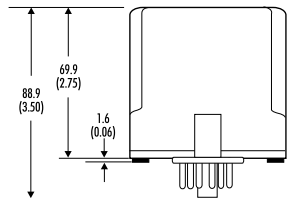
TC Type	Range Number	Temperature Range		
R, S	1	50 to 1760° C	(122 to 3200° F)	
	2	50 to 1000° C	(122 to 1832° F)	
	3	50 to 500° C	(122 to 932° F)	
	4	50 to 250° C	(122 to 482° F)	
	7	1000 to 1760° C	(1832 to 3200° F)	
	8	500 to 1000° C	(932 to 1832° F)	
	9	250 to 500° C	(482 to 932° F)	
	10	125 to 250° C	(257 to 482° F)	
	11	1500 to 1760° C	(2732 to 3200° F)	
	12	750 to 1000° C	(1382 to 1832° F)	
	13	375 to 500° C	(707 to 932° F)	
	T	3	-18 to 400° C	(0 to 752° F)
		4	-18 to 250° C	(0 to 482° F)
5		-18 to 125° C	(0 to 257° F)	
9		250 to 400° C	(482 to 752° F)	
10		125 to 250° C	(257 to 482° F)	
13		375 to 400° C	(707 to 752° F)	
14		-150 to 400° C	(-238 to 752° F)	
15		-150 to 250° C	(-238 to 482° F)	
16	-150 to 0° C	(-238 to 32° F)		

**Mounting**

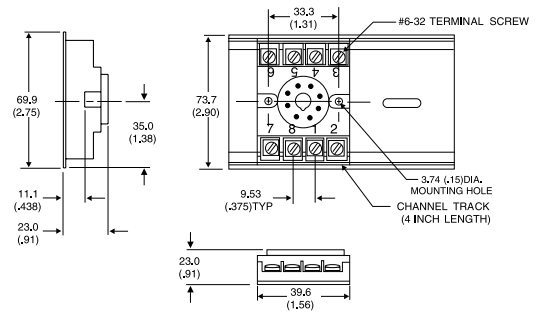
All Action Paks feature plug-in installation. Model AP4351-2000 uses an 8-pin base and molded-sockets M008, or DIN-socket MD08.

**Dimensions**

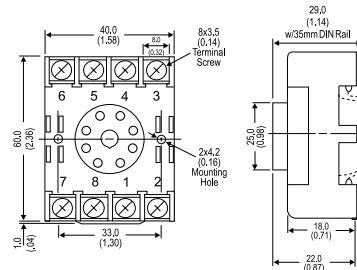
Dimensions are in millimeters (inches)



**Mark III**



**M008 (Track/Surface)**



**MD08 (DIN Rail)**

## Specifications

### Inputs:

Ranges: field configurable, see Table 6  
Impedance: >1M Ohms  
Input Bias Current (burnout detection):  
<1.5 microamp  
Overvoltage: ±10V differential  
Common Mode (Input to Ground):  
1500VDC or peak AC, max  
Zero and Span Range:  
Zero Turn-Up:  
0 to 50% of full scale range  
Span Turn-Down:  
100 to 50% of full scale range

### Outputs:

Voltage Output: field-configurable  
Ranges: 0-5V, 0-10V  
Impedance: <10 Ohms  
Drive: 10mA, max. (1K Ohms, min.)  
Current Output: field-configurable  
Ranges: 0-1mA, 4-20mA  
Impedance: >100K Ohms  
Compliance: 10V, max. (500 Ohms, max. @ 20mA)

### Accuracy (Including Linearity, Hysteresis):

see Table 5

### Response Time(10-90%):

500 mSec, typical

### Stability:

±0.04%/°C of full scale range

### Isolation:

1500VDC or peak AC between input,  
output and power

### ESD Susceptibility:

Meets IEC 801- 2, Level 2 (4KV)

### Common Mode Rejection:

DC - 60Hz: 120dB

### LED Indicators:

TROUBLE LED: Yellow - off during normal  
device operation

INPUT LED: Green - continuously on if  
input is within selected range, flashes  
otherwise

CAL OK LED: Yellow - continuously on in  
normal device operation

### Thermocouple Burnout Detect:

Field-configurable Up or Downscale, or  
disabled

### Humidity (Non-Condensing):

Operating: 25 to 95% (@ 45°C)

Soak: 90% for 24 Hrs. (@65°C)

### Temperature Range:

Operating: 0 to 60°C (32 to 140°F)

Storage: -15 to 75°C (5 to 167°F)

### Power:

Consumption: 3W typical, 5W max

Standard: 120VAC ±10%, 50 - 60Hz

Optional: 240VAC

### Weight:

0.62lbs

### Approvals:

UL recognized per standard UL508.  
(FileNo. E99775).

CSA certified per standards C22.2 No.  
M1982 (File No. LR42272-41).

## Ordering Information

Specify:

1. Model: **AP4351-2000**
2. Option: C620 factory calibration (specify input thermocouple type, temperature range and output).
3. Option: U, see text
4. Line Power, see specifications (All power supplies are transformer-isolated from the internal circuitry)

## Accessories:

M801-0000 Retaining Spring  
M008-A 8 pin Track Mount Socket  
M004-0000 4 ft Long Channel Track  
MD08-0000 8 pin DIN Mount Socket

## Pin Connections

- 1 Power (Hot)
- 2 No Connection
- 3 Power (Neu)
- 4 Do not use
- 5 Input (+)
- 6 Input (-)
- 7 Output (+)
- 8 Output (-)





AP4380-2000 (100Vdc max)  
AP4380-2001 (200Vdc max)

# Action PAK® AP4380

DC Input,  
Field Configurable Isolator

Provides Isolated DC Output  
in Proportion to a DC Input



- Eliminates Ground Loops
- 50% Adjustable Field Configurable Input Ranges:  
10mV to 100V (200V on -2001), 1mA to 100mA
- Four Field Configurable Output Ranges: 0-5V, 0-10V,  
0-1mA, 4-20mA
- Plug-in Installation
- Selectable 120/240VAC Power  
(9 to 30VDC Available)
- ASIC Technology for Enhanced Reliability

## Description

The field configurable AP4380 isolator offers wide ranging input and output capability for scaling and transmitting analog DC signals. The AP4380-2000 will accept input voltage spans from 10mV up to 100 volts, as well as input current spans from 1mA to 100mA. The AP4380-2001 will accept input voltages up to 200V, as well as the same input current ranges. The input zero and span potentiometers enable 50% input zero and span adjustability. For example, the 0-10V input range can be elevated to 5-10V, compressed to 0-5V or set to 2.5 - 7.5V. The AP4380 offers four (4) popular output ranges: 0-5V, 0-10V, 0-1mA and 4-20mA. The 4-20mA compliance is a powerful 20VDC. Model AP4380 can be configured to accept bipolar input ranges and offers selectable normal or reverse acting operation.

The AP4380 is a 3-port industrial isolator -- the output is optically isolated from its input up to 1500 VDC. The ASIC\*-based I/O channel is independently transformer isolated from the selectable 120/240VAC power supply.

## Application

The Action Pak AP4380 field configurable isolator is useful in eliminating ground loops, converting signal levels and providing signal drive and redundancy. The wide ranging capability of the AP4380 provides quick universal spare part coverage.

## Diagnostic LED

The AP4380 is equipped with a dual function LED signal monitor. The green, top-mounted LED indicates line power and input signal status. Active line power is indicated by an illuminated LED. If the input signal is 10% more than full scale range, the LED will flash at 8Hz. Below 0%, the flash rate is 4Hz.

## Options

- U** Urethane coating of internal circuitry for protection from corrosive atmospheres.

## Configuration

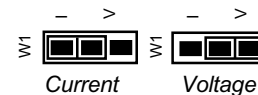
The factory presets the 4380-2000 input and output to 4-20mA, as shown in Figure 1. The 4380-2001 is preset to 0/200V input and 4/20mA output. The supply power is configured for 120 VAC operation. For other I/O ranges, remove the four base screws and case to access the I/O card.

Refer to Figure 1 for configuration and program the I/O channel as desired. Replace the cover before applying power.

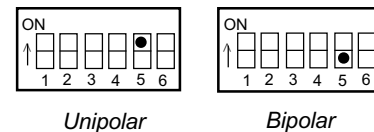
**Warning:** Do not attempt to change any switch settings with power applied. Severe damage will result!

## Input

1. Position input jumper "W1" for Current (I) or Voltage (V) input.

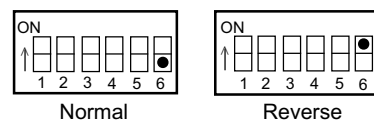


2. Set position 5 of the Input Range Selector for Unipolar (e.g. 0 to 5V) or Bipolar (e.g. -5 to 5V) operation.



*Note: A bipolar range selection will double any input range from Table 1 (e.g. 10V span becomes a -10 to 10V bipolar span)*

3. Set position 6 of the Input Range Selector for Normal or Reverse operation. Reverse acting produces a decreasing output with an increasing input.



4. Using Table 1, configure positions 1 through 4 of the Input Range Selector for the desired maximum input. Round the desired maximum input value to the next highest range (e.g., 0-70V = 100V range).

## Output

**Warning:** Do not configure the output ranges with the power on. Damage to unit may result.

1. Using Table 2, configure Output Selector for one of the four (4) standard outputs.

## Power

1. Configure the AC jumpers for either 120 or 240 VAC operation. See Figure 2.

## Calibration

1. Connect the input to a calibrated DC voltage or current source and apply power. Wait 1 hour for thermal stability before monitoring the voltage/current output. Refer to PIN CONNECTIONS.

2. Set the calibrator to the desired minimum input and adjust the Zero, 20-turn, potentiometer for desired minimum output.

3. Set the calibrator to the desired maximum input and adjust the Span, 20-turn, potentiometer for desired maximum output.

4. Repeat steps 2 and 3 for best accuracy.

Table 1: AP4380-2000/2001 Input Ranges

Voltage*	Current*	Input Range Selector (SW1)
20mV	2mA	
50mV	5mA	
100mV	10mA	
200mV	20mA	
500mV	50mA	
1V	100mA	
2V		
5V (-2000) 10V (-2001)		
10V (-2000) 20V (-2001)		
25V (-2000) 50V (-2001)		
50V (-2000) 100V (-2001)		
100V (-2000) 200V (-2001)		

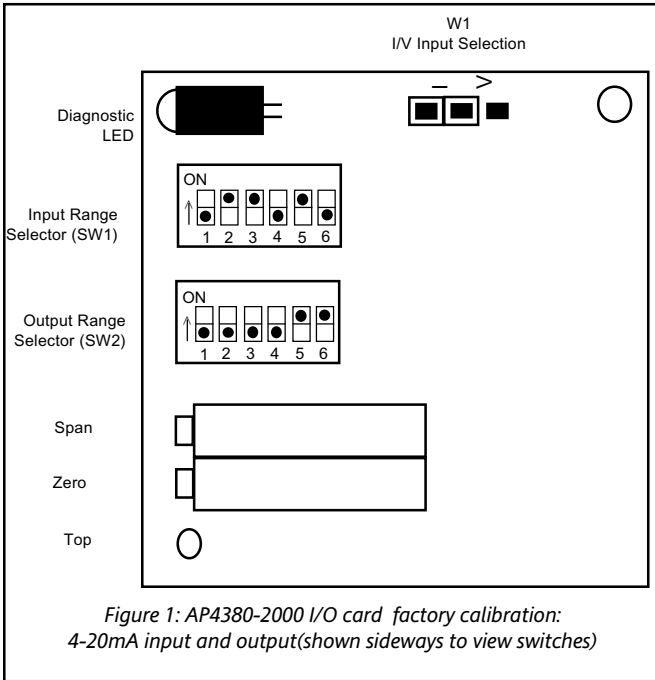
\* Use jumper (W1) to configure voltage or current input. All unipolar ranges are zero based.

Table 2: AP4380-2000 Output Ranges

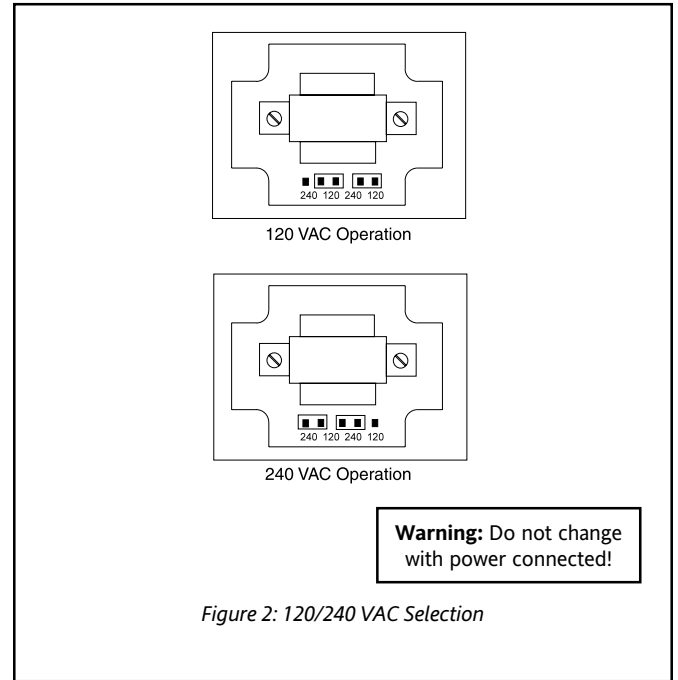
Range*	Output Range Selector (SW2)
0 to 10V	
0 to 5V	
0 to 1mA	
4 to 20mA	

\* For bipolar voltage outputs (e.g. -10 to +10V) see model AP4382.

## I/O Card Configuration



## Top View Diagram



**Warning:** Do not configure I/O switch ranges with power on. Damage will result!

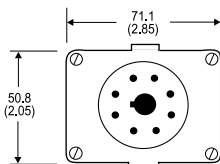
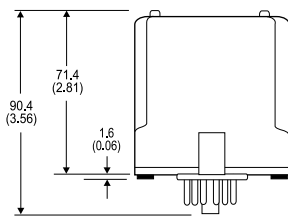
**Warning:** Applying voltage to the input with W1 in current (I) position will result in damage to the unit.

## Mounting

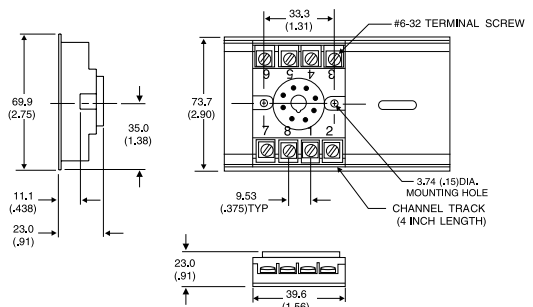
All Action Paks feature plug-in installation. Model AP4380 uses an 8-pin base, either molded socket M008 or DIN socket MD08.

## Dimensions

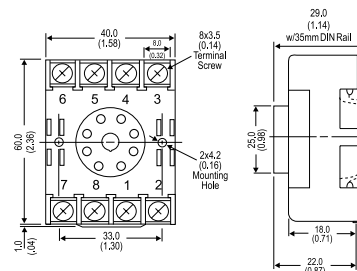
Dimensions are in millimeters (inches)



Mark II



M008 (Track/Surface)



MD08 (DIN Rail)

## Specifications

### Input:

- Voltage Input (field configurable)
  - Full Scale Range:
    - 2000: 10mV to 100V
    - 2001: 10mV to 200V
  - Impedance: >100K Ohms
  - Overvoltage:
    - Intermittent, 400Vrms
    - Continuous, 264 Vrms
- Current Input (field configurable)
  - Full Scale Range: 1mA to 100mA
  - Impedance: 20 Ohms, typical
  - Overcurrent: 170mA RMS, max
  - Overvoltage: 60VDC
- Common Mode (Input to Ground):
  - 1500VDC, max
- Zero Turn-Up:
  - 50% of full scale range
- Span Turn-Down:
  - 50% of full scale range

### Output:

- Voltage Output
  - Output: 0-5V, 0-10V
  - Drive: 10mA, max (1K Ohms min. @ 10V)
- Current Output
  - Output: 0-1mA, 4-20mA
  - Compliance:
    - 0-1mA: 10V, max. (10K Ohms, max)
    - 4-20mA: 20V, max. (1K Ohms, max)

### LED Indication (green):

- Input Range
  - >110% input: 8Hz flash
  - <0% input: 4Hz flash

### Accuracy (Including Linearity Hysteresis):

- <20mV/2mA:  $\pm 0.35\%$  of full scale, typical, 0.5%, max
- >20mV/2mA:  $\pm 0.1\%$  of full scale, typical, 0.2%, max

### Response Time (10-90%):

- 200 mSec., typical

### Stability (Temp):

- $\pm 0.025\%$  of full scale/ $^{\circ}\text{C}$ , typical,
- $\pm 0.05\%$ / $^{\circ}\text{C}$ , max.

### Common Mode Rejection:

- DC to 60Hz: 120dB

### Isolation:

- 1500 VDC between input, output & power

### ESD Susceptibility:

- Meets IEC 801-2, Level 2 (4KV)

### Humidity (Non-Condensing):

- Operating: 15 to 95% (@ 45 $^{\circ}\text{C}$ )
- Soak: 90% for 24 hours (@ 45 $^{\circ}\text{C}$ )

### Temperature Range:

- Operating: -15 to 60 $^{\circ}\text{C}$  (5 to 140 $^{\circ}\text{F}$ )
- Storage: -25 to 70 $^{\circ}\text{C}$  (-13 to 158 $^{\circ}\text{F}$ )

### Power:

- Consumption: 3W typical, 5W max
- Standard: selectable 120/240VAC,  $\pm 10\%$ , 50-60Hz
- Optional: 9 to 30VDC, inverter isolated

### Weight:

- 0.60lbs

### Agency Approvals:

- CSA certified per standard C22.2, No. M1982.
- UL recognized per standard UL508.

## Ordering Information

### Specify:

1. Model: **AP4380-2000** or **AP4380-2001**
2. Option: U, see text
3. Line Power, see specifications
4. Factory calibration (C620): Specify input range, output range and power.  
(All power supplies are transformer-isolated from internal circuitry.)

### Accessories:

- M801-0000 Retaining Spring
- M008-A 8 pin Track Mount Socket
- M004-0000 4 ft Long Channel Track
- MD08-0000 8 pin DIN Mount Socket

## Pin Connections

- 1 Power (Hot)
- 2 Not Internally Connected
- 3 Power (Neu)
- 4 Spare Termination
- 5 Input (+)
- 6 Input (-)
- 7 Output (+)
- 8 Output (-)

DC Power: PIN 1 = (+); PIN 3 = (-)



AP4382-2000

# Action PAK® AP4382

## DC Input, Bipolar Output, Field Configurable Isolator

Provides a Fully Isolated DC Output  
in Proportion to DC Input



- Eliminates Ground Loops
- Field Configurable Input Ranges: 10mV to 100V, 1mA to 100mA
- Two Field Configurable Output Ranges: -5 to 5V and -10 to 10V
- Plug-in Installation
- Selectable 120/240VAC Input Power (9 to 30 VDC Available)
- ASIC Technology for Enhanced Reliability

### Description

The field configurable AP4382 isolator offers wide ranging input and output capability for scaling and transmitting analog DC signals. The AP4382 will accept input voltage spans from 10mV up to 100 volts, as well as input current spans from 1mA to 100mA. The input zero and span potentiometers enable 50% input zero and span adjustability. For example, the 0-10V input range can be elevated to 5-10V, or compressed to 0-5V. The AP4382 offers two (2) bipolar output ranges: -5 to 5V and -10 to 10V.

Model AP4382 also accepts bipolar inputs and offers selectable normal or reverse acting operation

The AP4382 is an industrial isolator - the output is optically isolated from its input up to 1500 VDC. The ASIC-based I/O channel is independently transformer isolated from the selectable 120/240VAC power supply.

### Application

The Action Pak AP4382 field configurable isolator is useful in eliminating ground loops, converting signal levels and providing signal drive. The wide ranging capability of the AP4382 provides quick universal spare part coverage.

### Diagnostic LED

The AP4382 is equipped with a dual function LED signal monitor. The green, top-mounted LED indicates line power and input signal status. Active line power is indicated by an illuminated LED. If the input signal is 10% above the full scale range, the LED will flash at 8Hz. Below 0%, the flash rate is 4Hz.

### Options

- U** Urethane coating of internal circuitry for protection from corrosive atmospheres.

### Configuration

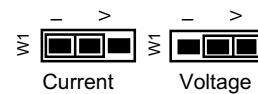
The factory preset input is 4-20mA and the output is -10 to 10V, as shown in Figure 1. The supply power is configured for 120 VAC operation. For other I/O ranges, remove the four base screws and case to access the I/O card.

Refer to Figure 1 for configuration and program the I/O channel as desired. Replace the cover before applying power.

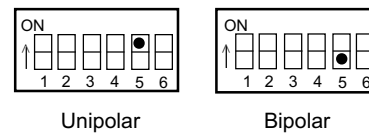
**Warning:** Do not change switch settings with power applied. Severe damage will result!

### Input

1. Position input jumper "W1" for Current (I) or Voltage (V) input.

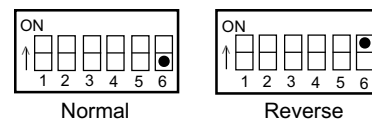


2. Set position 5 of the Input Range Selector for Unipolar (e.g. 0 to 5V) or Bipolar (e.g. -5 to 5V) operation.



**Note:** A bipolar range selection will double any input range from Table 1 (e.g. 10V span = -10 to 10V bipolar span)

3. Set position 6 of the Input Range Selector for Normal or Reverse operation. Reverse acting produces a decreasing output with an increasing input.

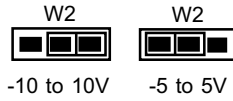


4. Using Table 1, configure positions 1 through 4 of the Input Range Selector for the desired maximum input. Round the desired maximum input value to the next highest range (e.g., 0-70V = 100V range).

**Warning:** Do not configure the output ranges with the power on. Damage to unit will result.

**Output**

1. Position output jumper "W2" for -5 to 5V or -10 to 10 V



**Power**

1. Configure the AC jumpers for either 120 or 240 VAC operation. See Figure 2.

**Calibration**

1. Connect the input to a calibrated DC voltage or current source and apply power. Wait 1 hour for thermal stability before monitoring the voltage/current output. Refer to PIN CONNECTIONS.

2. Set the calibrator to the desired minimum input and adjust the Zero, 20-turn, potentiometer for desired minimum output.

3. Set the calibrator to the desired maximum input and adjust the Span, 20-turn, potentiometer for desired maximum output.

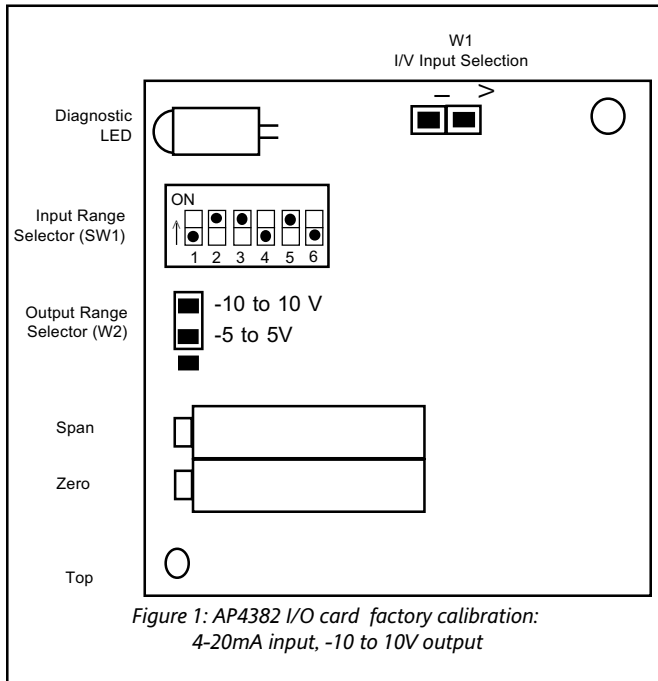
4. Repeat steps 2 and 3 for best accuracy.

Table 1: AP4382 Input Ranges

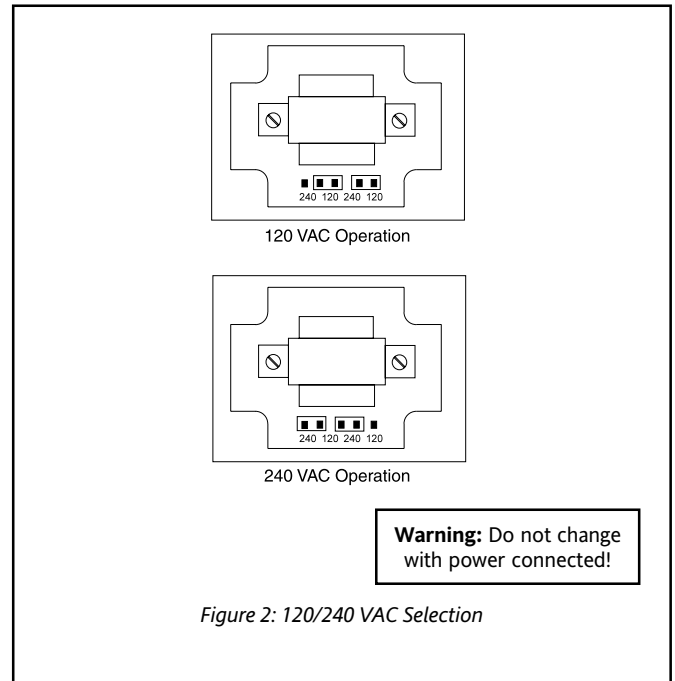
Voltage*	Current*	Input Range Selector (SW1)
20mV	2mA	
50mV	5mA	
100mV	10mA	
200mV	20mA	
500mV	50mA	
1V	100mA	
2V		
5V		
10V		
25V		
50V		
100V		

\*Note: Use jumper (W1) to configure either voltage or current input. For high voltage inputs >100V consult factory.

## I/O Card Configuration



## Top View Diagram



**Warning:** Do not configure I/O switch ranges with power on. Damage will result!

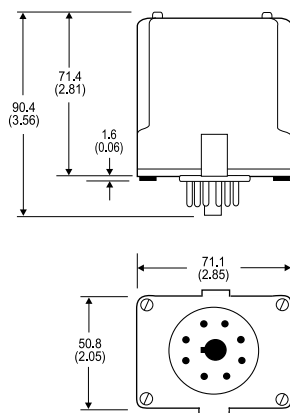
**Warning:** Applying voltage to the input with W1 in current (I) position will result in damage to the unit.

## Mounting

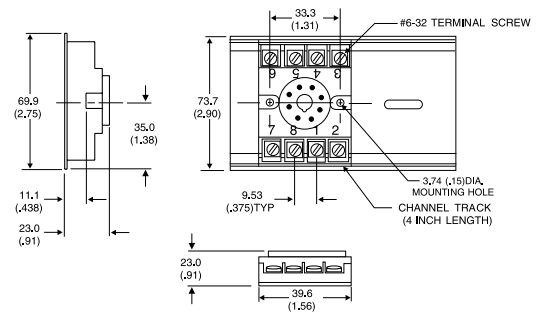
All Action Paks feature plug-in installation. Model AP4382 uses an 8-pin base and either molded socket M008 or DIN socket MD08.

## Dimensions

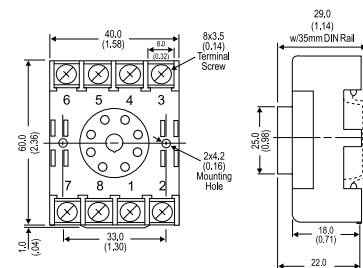
Dimensions are in millimeters (inches)



Mark II



M008 (Track/Surface)



MD08 (DIN Rail)

Action Pak®

## Specifications

### Input:

- Voltage Input (field configurable):
  - Full Scale Range: 10mV to 100V
  - Impedance: >100K Ohms
  - Overvoltage:
    - 400 Vrms, max (Intermittent)
    - 264 Vrms, max (Continuous)
- Current Input (field configurable):
  - Full Scale Range: 1mA to 100mA
  - Impedance: 20 Ohms, typical
  - Overcurrent: 170mA rms, max
  - Overvoltage: 60VDC

### Common Mode (Input to Ground):

1500VDC, max

### Zero and Span Range:

- Zero Turn-Up:
  - 0 to 50% of full scale range
- Span Turn-Down:
  - 100 to 50% of full scale range

### Output:

- Voltage Output
  - Output: -10 to 10V, -5 to 5V
  - Impedance: <10 Ohms
  - Drive: 10mA, max (1K Ohms min. @ 10V)

### LED Indication (green):

- Input Range >110% input: 8Hz flash
- <0% input: 4Hz flash

### Accuracy (Including Linearity, Hysteresis):

- <20mV/2mA:  $\pm 0.35\%$  of full scale, typical, 0.5%, max
- >20mV/2mA:  $\pm 0.1\%$  of full scale, typical, 0.2%, max

### Response Time (10-90%):

200 mSec., typical

### Stability (Temperature):

- $\pm 0.025\%$  of full scale/ $^{\circ}\text{C}$ , typical,
- $\pm 0.05\%$ / $^{\circ}\text{C}$ , max

### Common Mode Rejection:

DC to 60Hz: 120dB

### Isolation (Input to Output):

1500 VDC between input, output and power

### ESD Susceptibility:

Meets IEC 801-2, Level 2 (4KV)

### Humidity (Non-Condensing):

- Operating: 15 to 95% (@ 45 $^{\circ}\text{C}$ )
- Soak: 90% for 24 hours (@ 65 $^{\circ}\text{C}$ )

### Temperature Range:

- Operating: -15 to 60 $^{\circ}\text{C}$  (5 to 140 $^{\circ}\text{F}$ )
- Storage: -25 to 70 $^{\circ}\text{C}$  (-13 to 158 $^{\circ}\text{F}$ )

### Power:

- Consumption:
  - 3W typical, 5W max
- Standard:
  - selectable 120/240VAC,  $\pm 10\%$ , 50-60Hz
- Optional:
  - 9 to 30VDC, inverter isolated

### Weight:

0.60lbs

### Agency Approvals:

- CSA certified per standard C22.2, No. M1982 (File No.LR42272-54).
- UL recognized per standard UL508 (File No. E150323).

## Ordering Information

### Specify:

- Model: **AP4382-2000**
- Option: U, see text
- Line Power: 120/240 VAC or 9 to 30 VDC
- Factory calibration (C620): Specify input range, output range and power.  
(All power supplies are transformer-isolated from the internal circuitry.)

### Accessories:

- M801-0000 Retaining Spring
- M008-A 8 pin Track Mount Socket
- M004-0000 4 ft Long Channel Track
- MD08-0000 8 pin DIN Mount Socke

## Pin Connections

- Power (Hot)
- Shield (Gnd)
- Power (Neu)
- Spare Termination
- Input (+)
- Input (-)
- Output (+)
- Output (-)

DC Power: PIN 1 = (+); PIN 3 = (-)





AP4390-0000 (ChA = I or V out; ChB = I or V out)  
 AP4391-2000 (ChA = I or V out; ChB = ±V out)  
 AP4392-2000 (ChA = ±V out; ChB = ±V out)

# Action PAK®

## AP4390/AP4391/AP4392

### DC Input, Dual Channel Isolators

Provides Two Independent, Fully Isolated DC Outputs in Proportion to Two DC Inputs



- High Density 2-Channel Package
- Eliminates Ground Loops with 1500V Isolation
- Six Configurable Output Ranges: 0-5V, 0-10V, 0-1mA, 4-20mA, -5 to 5V and -10 to 10V
- Plug-in Installation
- Selectable 120/240VAC Input Power

#### Description

The field configurable AP4390 series dual channel isolators offer wide ranging input and output capability for scaling and transmitting analog DC signals. The AP4390 series will accept input voltage spans from 10mV up to 100 volts, as well as input current spans from 1mA to 100mA. For a full scale output range, the input zero and span potentiometers enable 50% input zero and span adjustability. For example, the 0-10V input range can be elevated to 5-10V or compressed to 0-5V.

The AP4390 series offers 6 popular output ranges which are either positive voltages and currents (e.g. 0-5V, 0-10V, 0-1mA and 4-20mA) or bipolar voltages (-5 to 5V and -10 to 10V). The model number defines the output channel ranges as shown in Table 1.

The 4-20mA compliance is a powerful 20VDC per channel. All models in the AP4390 series accept bipolar inputs and each I/O channel offers selectable normal or reverse acting operation (e.g. 4-20mA or 20-4mA).

Each Action Pak in the AP4390 series is a dual, three-port, industrial isolator -- both output channels are optically isolated from their respective input channels up to 1500 VDC. The two ASIC-based I/O channels are independently transformer isolated from the selectable 120/240VAC power supply.

Table 1: AP4390 Series Output Ranges  
 (**Bold** indicates factory preset ranges)

Model	Channel	Output Selections
AP4390	A	0-5V, 0-10V, 0-1mA, <b>4-20mA</b>
	B	0-5V, 0-10V, 0-1mA, <b>4-20mA</b>
AP4391	A	0-5V, 0-10V, 0-1mA, <b>4-20mA</b>
	B	-5 to 5V, <b>-10 to 10V</b>
AP4392	A	-5 to 5V, <b>-10 to 10V</b>
	B	-5 to 5V, <b>-10 to 10V</b>

#### Application

The Action Pak AP4390 series of field configurable isolators is useful in eliminating ground loops, converting signal levels and providing signal drive. The AP4390 series' dual channel design conserves installation space in high density applications and offers superior cost-benefit value over single channel isolators. The wide ranging capability of the AP4390s provides universal spare part coverage.

#### Diagnostic LED

The AP4390 series is equipped with dual function LED signal monitors. The green, top-mounted LED indicates line power and input signal status. Active line power is indicated by an illuminated LED. If the input signal is 10% above the full scale range, the LED will flash at 8Hz. Below 0%, the flash rate is 4Hz.

#### Option

- U** Urethane coating of internal circuitry for protection from corrosive atmospheres.

#### Configuration

Each channel of the AP4390 series can be independently set for a wide variety of input and output ranges.

#### Factory Presets

The factory presets all inputs for 4-20mA. The preset for positive based output channels is 4-20mA and -10 to 10VDC for bipolar voltage output channels (as shown in Table 1 and Figures 1 and 2). The supply power is configured for 120 VAC operation. For other I/O ranges, remove the four base screws and case to access the I/O cards.

Refer to figures 1 & 2 for configuration and program the I/O channels as desired.

Replace the cover before applying power.

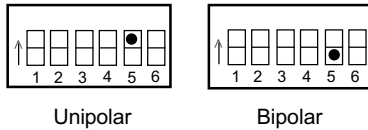
#### Input

1. Position input jumper "W1" for Current (I) or Voltage (V) input.



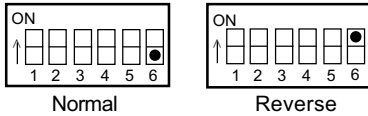
Action Pak®

2. Set position 5 of the Input Range Selector for Unipolar or Bipolar input operation.



Note: A bipolar range selection will double any range from Table 2 (e.g. 10V span = ±10V bipolar span)

3. Set position 6 of the Input Range Selector for Normal or Reverse operation. Reverse acting produces a decreasing output with an increasing input.



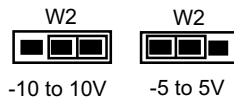
4. Using Table 2, configure positions 1 through 4 of the Input Range Selector for the desired maximum input. Round the desired maximum input value to the next highest range (e.g., 0-70V = 100V range).

**WARNING:** Do not change switch settings with power applied. Severe damage will result.

### Output

1. For the AP4390 channels A and B, and the AP4391 channel B, use Table 3 to configure the output selector switches for one of the four(4) standard output ranges.

2. For the AP4392 channels A and B, and the AP4391 channel B, position output jumper "W2" for -5 to 5V or -10 to 10V.



### Power

1. Configure the AC jumpers for either 120 or 240 VAC operation. See Figure 3.

### Calibration

1. Connect the input to a calibrated DC voltage or current source and apply power. Refer to PIN CONNECTIONS. Wait 1 hour for thermal stability before monitoring the voltage/current output.

2. Set the calibrator to the desired minimum input and adjust the Zero potentiometer for the desired minimum output.

3. Set the calibrator to the desired maximum input and adjust the Span potentiometer for the desired maximum output.

4. Repeat steps 2 and 3 for best accuracy.

Table 2: AP4390 Series Input Ranges

Voltage*	Current*	Input Range Selector (SW1)
20mV	2mA	
50mV	5mA	
100mV	10mA	
200mV	20mA	
500mV	50mA	
1V	100mA	
2V		
5V		
10V		
25V		
50V		
100V		

\*Use jumper (W1) to configure either voltage or current input. All unipolar ranges are zero based.

Table 3: AP4390 and AP4391 Output Ranges

Range	Output Range Selector (SW2)
0 to 10V	
0 to 5V	
0 to 1mA	
4 to 20mA	

## I/O Card Configuration

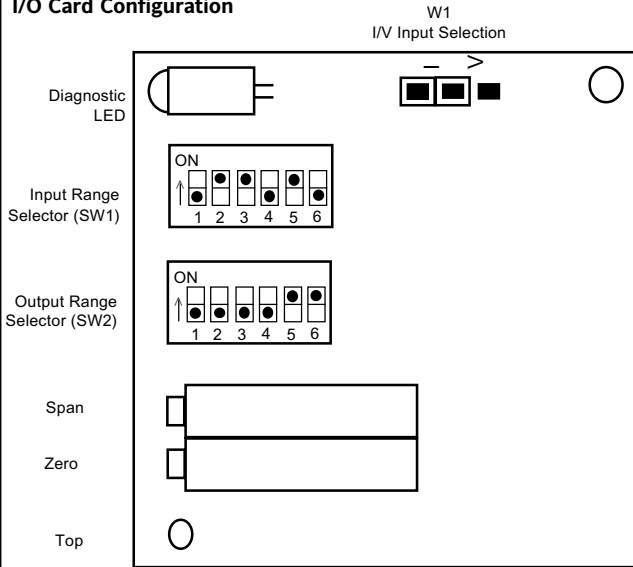


Figure 1: AP4390 and AP4391(A) I/O card factory calibration:  
4-20mA input and 4-20mA output

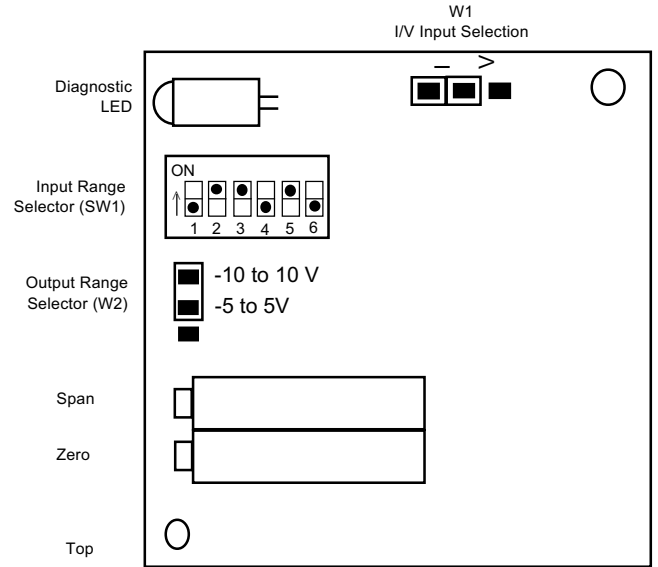
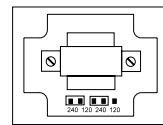
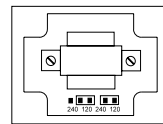
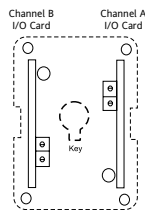


Figure 2: AP4391(B) and AP4392 I/O card factory calibration:  
4-20mA input, -10 to 10V output

**Warning:** Do not change switch settings with power applied. Severe damage will result!  
**Warning:** Applying voltage to the input with W2 in current (I) position will result in damage to the unit.

## Top View Diagrams



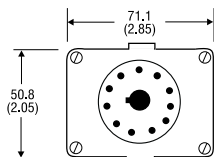
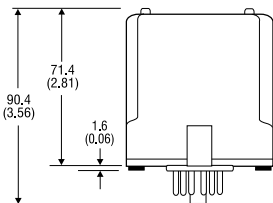
**Warning:**  
Do not change with power connected!

## Mounting

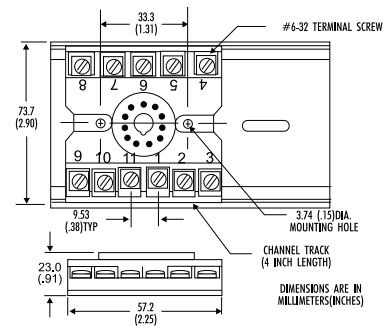
All Action Paks feature plug-in installation. Models AP4390, AP4391 and AP4392 use an 11-pin base and either molded socket M011 or DIN socket MD11 for mounting.

## Dimensions

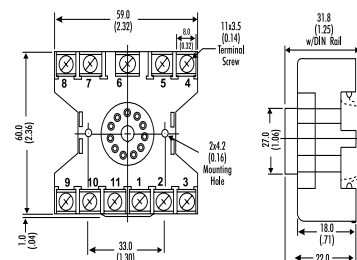
Dimensions are in millimeters (inches)



Mark II



M011 (Track/Surface)



MD11 (DIN Rail)

## Specifications

### Input:

Voltage Input (field configurable):  
Full Scale Range: 10mV to 100V  
Impedance: >100K Ohms  
Overvoltage:  
400 Vrms, max (Intermittent);  
264 Vrms, max (Continuous)  
Current Input (field configurable):  
Full Scale Range: 1mA to 100mA  
Impedance: 20 Ohms, typical  
Overcurrent: 170mA rms, max  
Overvoltage: 60VDC  
Common Mode (Input to Ground):  
1500VDC, max

### Zero Turn-Up:

50% of full scale range

### Span Turn-Down:

50% of full scale range

### Output:

Voltage Output:  
Output: 0-5V, 0-10V, -5 to 5V, -10 to 10V  
Drive: 10mA, max. (1K Ohms min. load @10V)  
Current Output:  
Output: 0-1mA, 4-20mA  
Compliance:  
0-1mA: 10V, max (10K Ohms max load)  
4-20mA: 20V, max (1K Ohms max load)

### LED Indication (green):

Input Range:  
>110% input: 8Hz flash  
<-10% input: 4Hz flash

### Accuracy (Including Linearity, Hysteresis):

<20mV, <2mA:  $\pm 0.35\%$  of full scale, typical, 0.5%, max  
>20mV, >2mA:  $\pm 0.1\%$  of full scale, typical, 0.2%, max

### Response Time:

(10-90%) 200 mSec., typical

### Stability (Temperature):

$\pm 0.025\%$  of full scale/ $^{\circ}\text{C}$ , typical,  
 $\pm 0.05\%$ / $^{\circ}\text{C}$ , max.

### Common Mode Rejection:

DC to 60Hz: 120dB

### Isolation (Input to Output):

1500 VDC between channels, input, output and power

### ESD Susceptibility:

Level 2 (4KV)

### Humidity (Non-Condensing):

Operating: 15 to 95% (@ 45 $^{\circ}\text{C}$ )  
Soak: 90% for 24 hours (@ 65 $^{\circ}\text{C}$ )

### Temperature Range:

Operating: -15 to 60 $^{\circ}\text{C}$  (5 to 140 $^{\circ}\text{F}$ )  
Storage: -25 to 70 $^{\circ}\text{C}$  (-13 to 158 $^{\circ}\text{F}$ )

### Power:

Consumption:  
4W typical, 6W max  
Standard:  
selectable 120/240VAC,  $\pm 10\%$ , 50-60Hz

### Weight:

AP4390: 0.66lbs  
AP4391: 0.68lbs  
AP4392: 0.68lbs

### Approvals:

CSA certified per standard C22.2 No. M1982  
(File No. LR42272).  
UL recognized per standard UL508  
(File No. E150323/E99775).

## Ordering Information

### Specify:

- Model: **AP4390-0000** (ChA = I or V out; ChB = I or V out)  
**AP4391-2000** (ChA = I or V out; ChB =  $\pm V$  out)  
**AP4392-2000** (ChA =  $\pm V$  out; ChB =  $\pm V$  out)
- Option: U, see text
- Line Power: 120/240VAC
- Optional Factory Calibration (C620): specify input range, output range and power. (All power supplies are transformer-isolated from the internal circuitry.)

### Accessories:

M801-0000 Retaining Spring  
M011-A 11 pin Track Mount Socket  
M004-0000 4 ft Long Channel Track  
MD11-0000 11 pin DIN Mount Socket

## Pin Connections

- Power (Hot)
- Spare Termination
- Power (Neu)
- Output B (+)
- Input A (+)
- Input A (-)
- Output A (+)
- Output A (-)
- Output B (-)
- Input B (+)
- Input B (-)



AP6380-0000

# Action PAK® AP6380

## Input Isolated, Field Configurable Isolator

Provides a Fully Isolated DC Output  
in Proportion to an AC Input



- Field Configurable Input Ranges: 50mV to 200V AC, 5mA to 100mA AC
- Four Field Configurable Output Ranges: 0-5V, 0-10V, 0-1mA, 4-20mA
- Eliminates Ground Loops
- Plug-In Installation
- Selectable 120/240VAC Input Power

### Description

The field configurable AP6380 signal conditioner offers wide ranging input capability for scaling, converting or isolating AC inputs ranging from 5mA AC to 100mA AC or 50mV AC to 200V AC. The DC output of the AP6380 is proportional to the average of the fully-rectified AC input signal, and is calibrated for sine waves from DC to 1KHz.

For current inputs above 100mA AC, it is recommended that an input shunt resistor be used and the AP6380 be configured for the proper input voltage range. For example, for a 5A AC current transformer output, use the Action model C006 resistor (0.1W, 5W, 1%) and set the input for 0-500mV AC.

### Application

The Action Pak AP6380 is useful in applications requiring a conditioned DC output from an AC source. Typical applications include energy management, load shedding, motor current/load monitoring, locked rotor detection, isolation and data acquisition. The output of the AP6380 can drive a digital meter for direct display or can interface with alarming or control devices including PLCs and computers.

### Diagnostic LED

Input power and signal status are indicated with a dual-function LED on the AP6380. The green LED will illuminate when line power is applied, and will pulse quickly (8 Hz) if the input rises 10% above the set input full scale range. If this continues to occur, you may wish to change your full scale input range setting.

### Configuration

The AP6380 can be set for a wide variety of full scale input ranges. The factory pre-sets the AP6380 with an input range of 0-500mV AC (SW1 & W2) and an output range of 4-20mA DC (SW2) as shown in Figure 1. For other I/O ranges, remove the four base screws to access the I/O range configuration selectors.

The line power is preset at the factory for 120V AC. This may be reconfigured by referring to figure 2.

**Warning:** Do not change switch settings with power applied. Severe damage may occur!

### Calibration

1. Before applying power to the Action Pak, set the DIP switches inside the Action Pak for your full scale input and full scale output ranges. Refer to Tables 1, 2 & 3 showing switch configuration settings.
2. Connect the AC input terminals (5 & 6) to a calibrated AC voltage or AC current source. Connect a meter to measure the output (terminals 7 & 8).
3. Connect power to terminals (1 & 3) on the Action Pak and turn on the power.
4. Wait approximately 1 hour to ensure thermal stability before calibrating.
5. Set the calibrator to the desired minimum AC input on the Action Pak. Adjust the "Zero" potentiometer until the DC output coincides with the desired minimum output.
6. Set the calibrator input to the desired full scale AC input. Adjust the "Span" potentiometer until the DC output coincides with the desired full scale output.
7. Repeat steps 5 and 6, as necessary, for best accuracy.

Table 1: Input Range Selector Switch Settings

Voltage Span*	Current Span*	Input Range Selector (SW1 & W2)
100mV	10mA	SW1: [ON] 1 2 3 4 5 6; W2: [ ] [ ] [ ]
200mV	20mA	SW1: [ON] 1 2 3 4 5 6; W2: [ ] [ ] [ ]
500mV	50mA	SW1: [ON] 1 2 3 4 5 6; W2: [ ] [ ] [ ]
1V	100mA	SW1: [ON] 1 2 3 4 5 6; W2: [ ] [ ] [ ]
2V		SW1: [ON] 1 2 3 4 5 6; W2: [ ] [ ] [ ]
5V		SW1: [ON] 1 2 3 4 5 6; W2: [ ] [ ] [ ]
10V		SW1: [ON] 1 2 3 4 5 6; W2: [ ] [ ] [ ]
20V		SW1: [ON] 1 2 3 4 5 6; W2: [ ] [ ] [ ]
50V		SW1: [ON] 1 2 3 4 5 6; W2: [ ] [ ] [ ]
100V		SW1: [ON] 1 2 3 4 5 6; W2: [ ] [ ] [ ]
200V		SW1: [ON] 1 2 3 4 5 6; W2: [ ] [ ] [ ]

Table 2: Output Range Selector Switch Settings

Range	Output Range Selector (SW2)
0 to 10V	[ON] 1 2 3 4 5 6
0 to 5V	[ON] 1 2 3 4 5 6
0 to 1mA	[ON] 1 2 3 4 5 6
4 to 20mA	[ON] 1 2 3 4 5 6

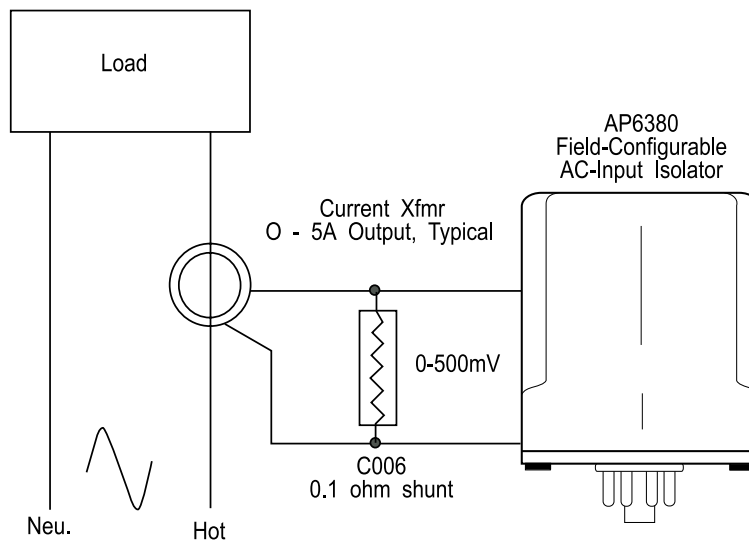
Table 3: AP6380 Input Jumper Settings

Input	Input Jumper Selector (W1)
Voltage	[ ] [ ] [ ]
Current	[ ] [ ] [ ]

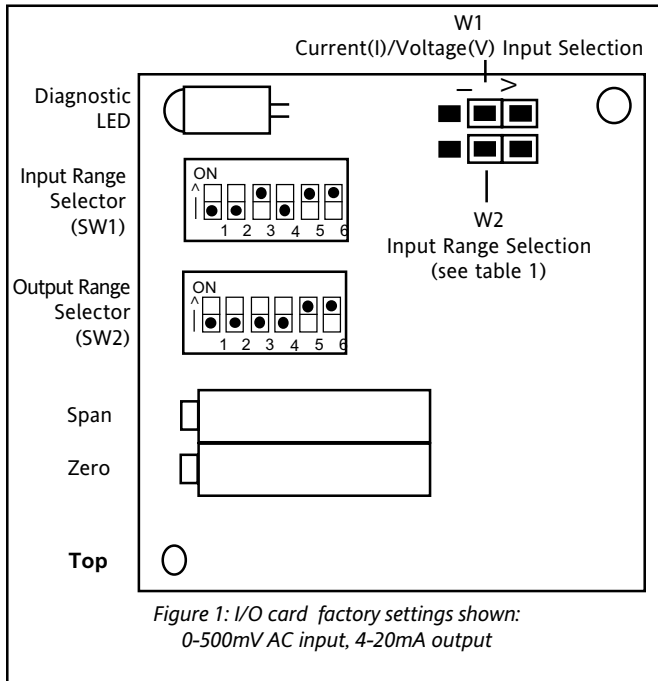
\*Use jumper (W1) to configure either voltage or current input. All unipolar ranges are zero based.

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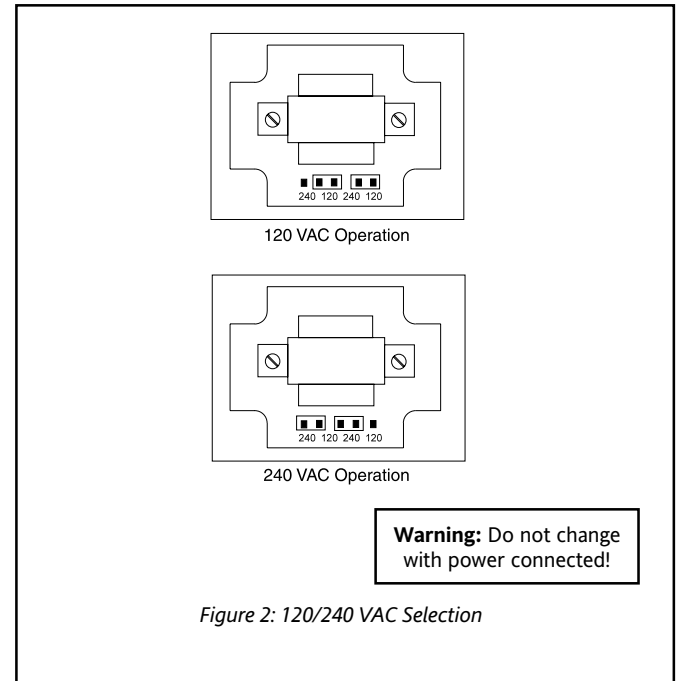
Typical Application



### I/O Card Configuration



### Top View Diagram



**Warning:** Do not configure I/O switch ranges with power on. Damage will result!

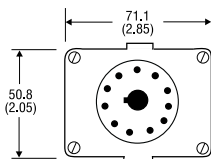
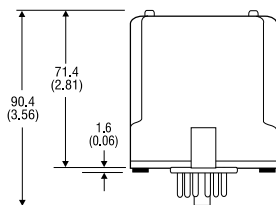
**Warning:** Applying voltage to the input with W1 in current (I) position will result in damage to the unit.

### Mounting

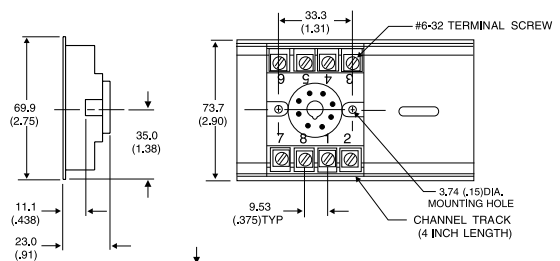
All Action Paks feature plug-in installation. Model AP6380 uses an 8-pin base, either molded socket (M008) or DIN rail socket (MD08).

### Dimensions

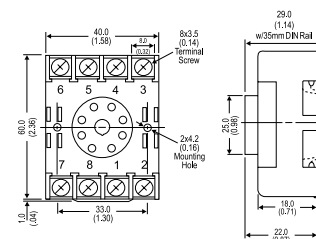
Dimensions are in millimeters (inches)



Mark II



M008 (Track/Surface)



MD08 (DIN Rail)

## Specifications

### Input Ranges (selectable):

Voltage: 50mV AC to 200V AC  
Current: 5mA AC to 100mA AC

### Input Frequency:

DC-1KHz, factory calibrated at 60Hz

### Input Impedance:

Voltage: >100K Ohms  
Current: 20 Ohms typical

### Input Overload (without damage):

Voltage: 300V AC  
Current: 200mA AC, 60V peak

### Common Mode Voltage:

1500V DC, input to ground

### Output Ranges (selectable):

Voltage: 0-5V DC, 0-10V DC  
Current: 4-20mA DC, 0-1mA DC

### Output Source Impedance:

Voltage: <10 Ohms  
Current: >100K Ohms

### Output Drive:

Voltage: 10mA, max (1K Ohms min. @ 10V)  
Current: 20VDC compliance  
(1K Ohms max @ 20mA)

### Span Turn Down:

50% of full scale range

### Zero Turn Up:

50% of full scale range

### LED Indication:

8Hz flash when input is 10% above full scale configuration

### Accuracy (including hysteresis and linearity):

±0.1% of span, typical  
±0.5% of span, maximum

### Response Time:

250mSec, typical

### Stability:

±0.025% of full scale per °C, typical

### Common Mode Rejection:

120dB, DC to 60Hz

### Isolation (input to output to power):

1500V DC or peak AC

### Temperature Range:

Operating: 0 to 60°C (32 to 140°F)  
Storage: -15 to 70°C (5 to 158°F)

### Humidity (Non-Condensing):

10 to 95% RH, at 45°C

### Power:

Consumption: 3W typical, 5W max  
Standard: Selectable 120/240V AC  
(±10%, 50-60Hz)

### Weight:

0.60lbs

### Agency Approvals:

CSA certified per standard C22.2, No. M1982  
(File No. LR42272-38).

UL recognized per standard UL508

(File No. E150323).

## Ordering Information

### Specify:

1. Model: AP6380-0000.
2. Option U (see text).
3. Line Power (see specs).
4. Optional Factory Calibration (C620):  
Specify input range, output range and power.
5. C006 (0.1 Ohm shunt for 1 to 5 Amp current inputs).

### Accessories:

M801-0000 Retaining Spring  
M008-A 8 pin Track Mount Socket  
M004-0000 4 ft Long Channel Track  
MD08-0000 8 pin DIN Mount Socket

## Pin Connections

- 1 AC Power (Hot)
- 2 Shield (GND)
- 3 AC Power (Neu)
- 4 Spare Termination
- 5 Input
- 6 Input
- 7 Output (+)
- 8 Output (-)





AP7380-0000

# Action PAK® AP7380

## Frequency Input, Field Configurable Signal Conditioner

Provides an Isolated DC Output  
in Proportion to Frequency Input



- Field Configurable Input Ranges from 2Hz to 10,000Hz
- Four Field Configurable Output Ranges 0-5V, 0-10V, 0-1mA, 4-20mA
- Eliminates Ground Loops
- Plug-in Installation
- Selectable 120/240VAC Input Power
- ASIC Technology for Enhanced Reliability

### Description

The Action Pak Model AP7380 is a frequency input signal conditioner with 1500VDC isolation between input, output and power. The field configurability of the input and output offers flexible, wide ranging capability for magnetic pick-ups, turbine flow meters, and other pulse or frequency output transducers.

The input of the AP7380 can be configured for any frequency span from 2Hz (e.g., 59-61Hz) to 10,000Hz. The input amplitude threshold (SENS POT) can be adjusted from 150mVp to 10Vp to ensure accurate frequency measurement and minimize transient noise related errors. The maximum input amplitude is 150 Vrms. The output can be set for either 0-5V, 0-10V, 0-1mA or 4-20mA.

Advanced digital technology allows the AP7380 to be field configured to convert virtually any frequency input to a DC signal output within the ranges specified. Calibration utilizes 'Touch-Sample' technology by which the user simply applies the desired input frequency, and touches a recessed button to configure the corresponding input range.

The convenient Action Pak is very easy to install using surface mount, DIN rail mount or snap track mounting sockets. Trouble shooting is very easy since no wires need to be removed when swapping units. The wide ranging power supply can be configured for either 120 or 240VAC power.

### Application

The AP7380 field configurable, frequency input signal conditioner is useful in eliminating ground loops and interfacing pulse output transducers, such as turbine flow meters and magnetic pick-ups, to data acquisition and control systems.

Advanced digital technology, combined with Action's ASIC technology, provides a stable output at low frequencies for higher accuracy, and three-way isolation completely eliminates ground loops from any source.

### Option

- U** Urethane coating of internal circuitry for protection from corrosive atmospheres

### 'Touch Sample' Technology

The AP7380 utilizes Action Instruments' 'Touch-Sample' technology which greatly simplifies configuration. To set the input frequency range, the user simply applies the high input frequency and pushes the CAL button while the INPUT LED is on. The low input frequency is then applied and pushing the CAL button again stores the low frequency input.

The high and low ranges are stored in non-volatile memory and correspond to the high and low output ranges which have been selected via DIP switches.

To precisely adjust the output, the user adjusts the input frequency while the OUTPUT LED is on until the desired output level is achieved. The output levels are locked in by pushing the CAL button. Status LEDs show the operational mode of the device.

### Status LEDs

The AP7380 utilizes three status LEDs. The green LEVEL LED changes in intensity with input level. Its intensity varies with the frequency of the input signal during normal operation. If the input signal is 10% more than full scale range, the LED will flash at 8Hz. Below 0%, the flash rate is 4Hz.

The yellow INPUT LED, when on, denotes input programming modes.

The red OUTPUT LED, when on, denotes output programming modes (see Configuration, Calibration and Figure 1 for details).

### Configuration

A major advantage of the AP7380 is its wide ranging capabilities and ease of configuration. The AP7380 enables virtually 99% zero and span adjustability. Any 2Hz range from 0 to 10,000Hz can be converted to a full scale output signal (e.g. 0-2Hz/4-20mA or 9998-10,000Hz/4-20mA).

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Unless otherwise specified, the factory presets are as follows:

Input Range: 0 to 1000Hz  
 Sensitivity: 1V peak (LO)  
 Output Range: 4 to 20mA  
 Power: 120VAC

Note: "Sensitivity" refers to the noise rejection level or the trigger threshold of the input.

For other I/O ranges, refer to Table 1 for output range (SW1) switch settings and to Figure 4 for sensitivity jumper setting (P3). For quick and easy calibration mode reference, see the step-by-step flow chart in Figure 1.

1. With DC power off, choose the desired output voltage/current range from Table 1 and set position 1 through 6 of the output switch selector (SW1).
2. Set the Input sensitivity jumper (P3) to LO for input amplitudes between 150mVp and 50Vrms, with noise rejection to 1Vp. Set P3 to HI for input amplitudes between 500mVp and 150Vrms, with noise rejection up to 10Vp.

**Calibration**

1. Connect the input to a calibrated frequency source and apply power. Wait 1 hour for thermal stability before monitoring the voltage or current output.
2. Adjust the input frequency to the desired maximum and observe that the output has increased and is sensing the input. If this is not observed, turn the sensitivity potentiometer in a counter-clockwise direction until the output changes proportionally to the input.
3. With the green LED on press the CAL button once to enter the calibration mode. The yellow and green LEDs should now be on.
4. Input the maximum desired frequency (if not done already) and press the CAL button to store. The yellow LED should now be the only LED on.
5. Input the minimum desired frequency and press the CAL button to store. The green and red LEDs should now be on.

Note: The most reliable way to input 0Hz is to short circuit the input pins (5&6).

6. To precisely adjust the maximum output, adjust the input frequency until the output reads within  $\pm 0.1\%$  of the maximum selected output range. This typically occurs near 90% of the HI input frequency. Press the CAL button to store the value. The red LED should now be on.
7. To precisely adjust the minimum output, lower the input frequency until the output reads within  $\pm 0.1\%$  of the minimum selected output. This typically occurs less than 10% of the HI input frequency. Press the CAL button to store the value. The Yellow, Red and Green LEDs should be on (see Figure 1).

8. Press the CAL button one final time to exit the calibration mode. The green LED should now be on. (With only 5-10% of input, the green LED is off.)

9. Check the minimum and maximum input-to-output calibration. Repeat steps 1 through 8 if calibration is not within desired specifications.

Note 1: To skip Steps 6 and 7 (output adjustment), press CAL button two times after Step 5.

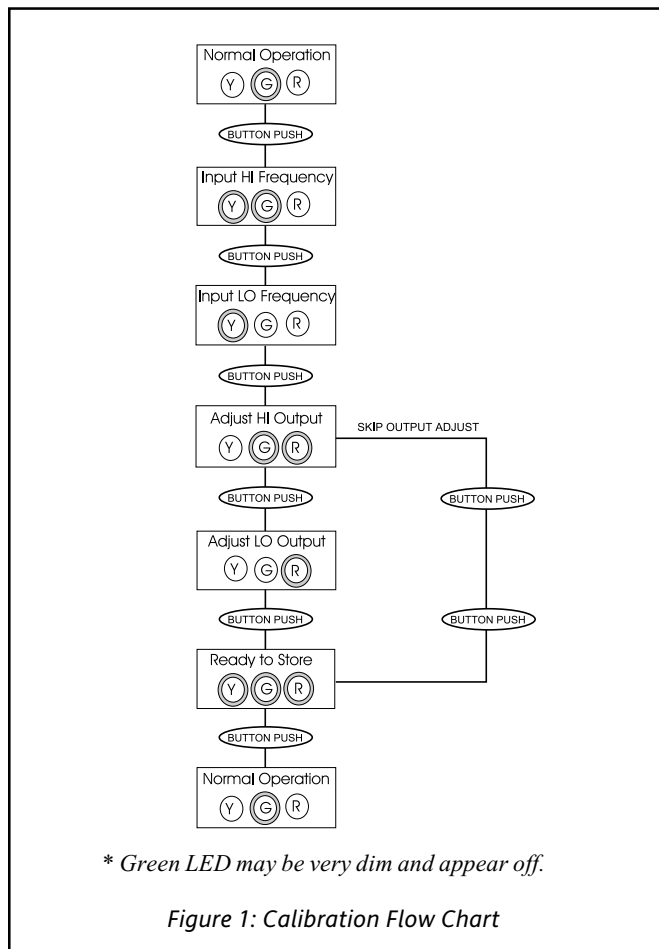
Note 2: Removing power to the unit at any time before Step 8 will restore previous settings

**Optimal Sensitivity**

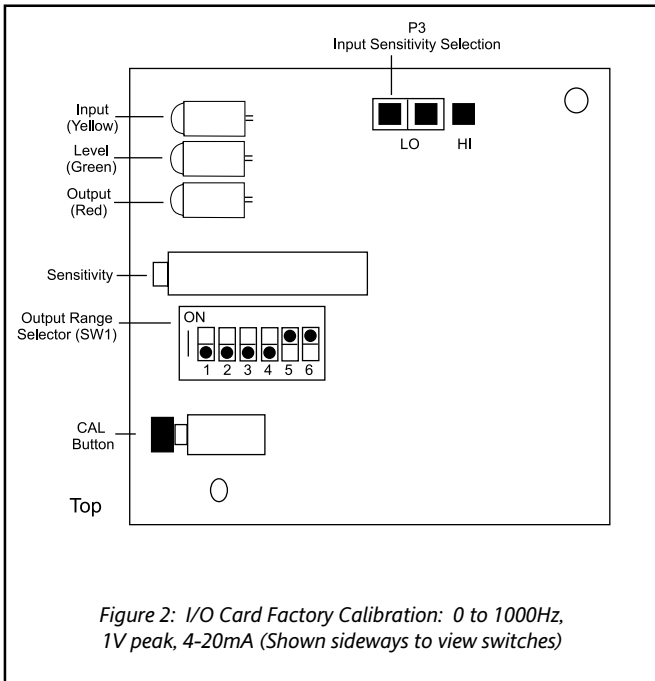
If the amplitudes of the input frequency is within the sensitivity parameters (i.e. 150mVp - 1Vp for LO and 0.5Vp - 10Vp for HI), then the sensitivity parameters can be set for optimum noise rejection.

1. Set the input near midrange (50% input) or to a frequency that exhibits the minimum pulse amplitude.
2. Turn the sensitivity pot (SENS) clockwise (CW) until the output drops to minimum.
3. Turn the sensitivity pot counter-clockwise (CCW) until the output returns to the previous level. A couple more CCW turns will provide optimal noise rejection.
4. Run the input through the full frequency range to make sure that the pulses are sensed at both the low and high input frequencies. If the output drops out during this test, when the input freq. >0% then turn the sensitivity pot counter-clockwise another turn or two until the output picks up. Repeat to validate sensitivity settings.

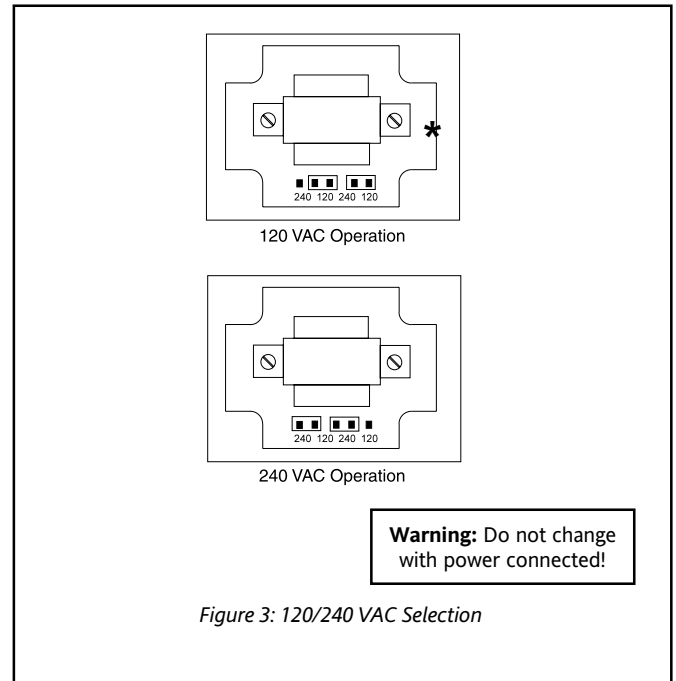
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## I/O Card Configuration



## Top View Diagram



**Warning:** Do not configure I/O switch ranges with power on. Damage will result!

**Warning:** Applying voltage to the input with W1 in current (I) position will result in damage to the unit.

	SW2					
	1	2	3	4	5	6
0 - 5V	■	■	■	■	■	■
0 - 10V	■	■	■	■	■	■
0 - 1mA	■	■	■	■	■	■
4 - 20mA	■	■	■	■	■	■

KEY ■=ON

Table 1: Output Switch Settings (SW1, 1 through 6)

**Warning:** Do not change with power connected!

LO ■ 150mVp -1Vp,  
 HI ■ 0.5Vp-10Vp,  
**P3**

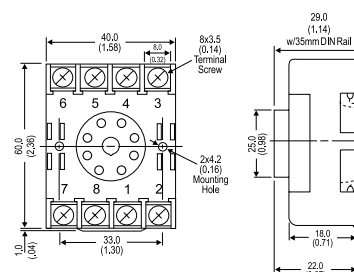
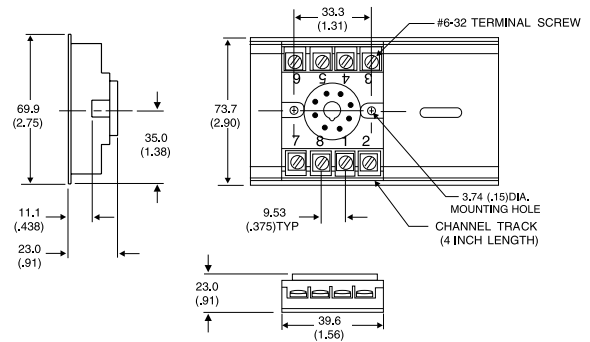
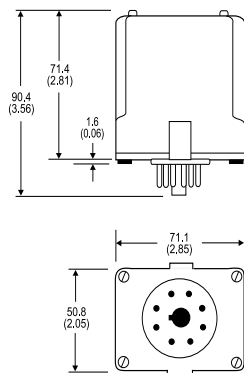
Figure 4: Input Sensitivity Settings (P3) (can reject voltage up to those shown)

## Accessories

All Action Paks feature plug-in installation. Model AP7380 uses an 8-pin base and either molded socket M008 or DIN socket MD08.

## Dimensions

Dimensions are in millimeters (inches)



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## Specifications

### Input Ranges (selectable):

#### Frequency Input:

Full Scale Range: 2 Hz to 10,000Hz

#### Amplitude Range:

150mVp to 10Vp, 150Vrms max

Impedance: >10K Ohms

Over-voltage: 180Vrms, max

Over-range: 20KHz, max.

Common Mode (Input to Ground):

1500VDC, max

Zero Turn-Up:

99% of full scale range (9998Hz)

Span Turn-Down:

99% of full scale range (2Hz)

### Output:

#### Voltage Output:

Output: 0-5V, 0-10V

Impedance: <10 Ohms

Drive: 10mA, max. (1K Ohms, min @10V)

#### Current Output:

Output: 0-1mA, 4-20mA

Impedance: >100K Ohms

Compliance:

0-1mA; 10V, max.(10K Ohms, max)

4-20mA; 20V, max.(1K Ohms, max)

### Accuracy (including Linearity & Hysteresis):

+0.1% of selected range at 25°C.

### Stability:

+0.025%/°C maximum of selected range.

### Response Time (10-90%):

3 input cycles plus 250mSec

### Common Mode Rejection:

DC: 100dB

>60Hz: 80dB

### Isolation:

1500VDC between input, output and power.

### ESD & Transient Susceptibility:

Meets IEC 801-2, Level 2 (4KV)

### LED Indication:

LEVEL (green): lit when power is on  
(Intensity varies with input signal);

input > 107% then 8Hz flash

input < -7% then 4Hz flash

INPUT (yellow): input range programming  
status

OUTPUT (red): output range programming  
status

### Humidity (Non-Condensing):

Operating: 15 to 95% (@ 45°C)

Soak: 90% for 24 hours (@ 65°C)

### Temperature Range:

Operating: -15 to 60°C (5 to 140°F)

Storage: -25 to 70°C (-13 to 158°F)

### Power:

Consumption:

2W typical, 3W max

Standard:

selectable 120/240VAC, ±10%, 50-60Hz

### Weight:

.60lbs

### Agency Approvals:

CSA certified per standard C22.2 No. 0-M91  
and 142-M1987 (File No. LR42272 - 64).

UL recognized per standard UL508

(File No. E99775)

## Ordering Information

### Specify:

1. Model: **AP7380-0000**
2. Option: U, see text
3. Line Power: 120/240VAC
4. C620: Factory Calibration of input range, setpoints and output relays.

(All power supplies are transformer-isolated from the internal circuitry.)

*Note: For UL applications above 100V (unrestricted), the signal must be transient limited (e.g. 150V MOV). For CSA applications above 100V (unrestricted), the signal must be isolated from the primary by a 150VA transformer and no fire result from a short circuit at the input.*

### Accessories:

M801-0000 Retaining Spring

M008-A 8 pin Track Mount Socket

M004-0000 4 ft Long Channel Track

MD08-0000 8 pin DIN Mount Socket

## Pin Connections

- 1 Power (Hot)
- 2 Shield (Gnd)
- 3 Power (Neu)
- 4 Spare Termination
- 5 Frequency Input (+)
- 6 Frequency Input (-)
- 7 Output (+)
- 8 Output (-)



AP7500-5012 (0-20mA in; square wave output)  
AP7500-5016 (4-20mA in; square wave output)  
AP7500-5065 (0-1Vdc in; square wave output)  
AP7500-5068 (0-5Vdc in; square wave output)  
AP7500-5070 (0-10Vdc in; square wave output)  
AP7500-5085 (1-5Vdc in; square wave output)  
AP7501-6007 (0-1mA in; relay contact output)  
AP7501-6012 (0-20mA in; relay contact output)  
AP7501-6016 (4-20mA in; relay contact output)  
AP7501-6065 (0-1Vdc in; relay contact output)  
AP7501-6068 (0-5Vdc in; relay contact output)  
AP7501-6070 (0-10Vdc in; relay contact output)  
AP7501-6085 (1-5Vdc in; relay contact output)

# Action PAK®

## AP7500 & AP7501

### DC to Frequency Converters

Provides a Field Selectable Frequency Output  
in Proportion to a DC Input



- Switch Selectable Output Range
- Adjustable Low End Cutout (0-10%)
- Totalization/Integration Applications
- Plug-In Installation
- Square Wave (AP7500) or Relay Contact (AP7501) Output
- Selectable 120/240VAC Input Power

#### Application

The AP7500 and AP7501 are useful in totalizing applications, where the total number of pulses counted in a given time period represents the time integral of the DC input. If, for example, the input represents a flow in gallons per hour, then the time integral of this flow signal (total count) will represent total gallons. The AP7500's 6V square wave output can be used to drive electronic counters (DTL, TTL, CMOS). The AP7501 can be used to drive electromechanical counters when connected to an external AC or DC power source. In the AP7501, the DPDT relay contacts are pulsed (closed) for only a short duration (100 milliseconds) for compatibility with standard electromechanical counters. The AP7500 can also be used in telemetry systems, where the dc signal is converted to a frequency, transmitted over long lines, and then decoded at the receiving end by means of a frequency to DC converter, such as the AP7380.

#### Options

- CS** Canadian Standards Association Certification.
- U** Urethane coating of internal circuitry for protection from corrosive atmospheres.
- C** Open collector output instead of the standard 6V output, sinks up to 50mA, up to 30V (AP7500 only).

#### Output Ranges

The output frequency range is selectable via the 16-position rotary switch accessible through the top cover. See tables 1 and 2 for output selection. Since ranging is accomplished through digital circuitry, the accuracy of the unit is unaffected by the switch position; each successive position exactly halves (clockwise) or doubles (counterclockwise) the previous output frequency (see "Calibration").

#### Input Ranges

Standard input ranges and limits are included in Tables 3 and 4.

#### Cutout

The top accessed Cutout adjustment determines the input (level) at which the AP7500 or AP7501 no longer responds (i.e., the unit is effectively "off") and is adjustable from 0-10% of the input span. This feature is especially useful with low frequency spans, where the time between output pulses is excessively long at low input levels. A light-emitting diode (LED) visible through the top-cover aids in adjusting cutout. This LED lights when the unit is no longer responding to the input. With the input at the desired cutout level, adjust Cutout slowly clockwise until the LED lights. Then turn the adjustment counterclockwise until the LED just goes out. Cutout is now set for the input level present.

#### Calibration

Zero, Span and Low-End Cutout adjustments are screwdriver adjustable, accessible through the top cover.

*Zero and Span:* Monitor the unit's output using an accurate frequency counter. Apply an input equal to 5% of the specified input span. If the cutout LED (visible through the top cover) is lit, adjust Cutout counterclockwise until it turns off. Adjust Zero for 5% of the desired full scale output frequency. Apply full scale input and adjust Span for the desired maximum output frequency. Repeat these adjustments for best accuracy.

Note: For faster calibration of low frequency spans, use the range selector switch to multiply the output frequency. Each position counterclockwise exactly doubles the output frequency. After calibration, return the selector switch to the proper range position.

Table 1: AP7500 Output Ranges

Switch Position	Minimum Range	Maximum Range
0	0-5kHz	0-10kHz
1	0-2.5kHz	0-5kHz
2	0-1.25kHz	0-2.5kHz
3	0-625Hz	0-1.25kHz
4	0-312Hz	0-625Hz
5	0-156Hz	0-312Hz
6	0-78Hz	0-156Hz
7	0-39Hz	0-78Hz
8	0-20Hz	0-39Hz
9	0-10Hz	0-20Hz
A	0-5Hz	0-10Hz
B	0-2.5Hz	0-5Hz
C	0-1.25Hz	0-2.5Hz
D	0-36ppm	0-1.25Hz
E	0-18ppm	0-36ppm
F	0-9ppm	0-18ppm

Table 2: AP7501 Output Ranges

Switch Position	Minimum Range	Maximum Range
0	0-65ppm	0-130ppm
1	0-32ppm	0-65ppm
2	0-16ppm	0-32ppm
3	0-8ppm	0-16ppm
4	0-4ppm	0-8ppm
5	0-2ppm	0-4ppm
6	0-1ppm	0-2ppm
7	0-0.5ppm	0-1ppm
8	0-0.25ppm	0-0.5ppm
9	0-8pph	0-16pph
A	0-4pph	0-8pph
B	0-2pph	0-4pph
C	0-1pph	0-2pph
D	0-0.5pph	0-1pph
E	0-0.24pph	0-0.5pph
F	0-0.12pph	0-0.24pph

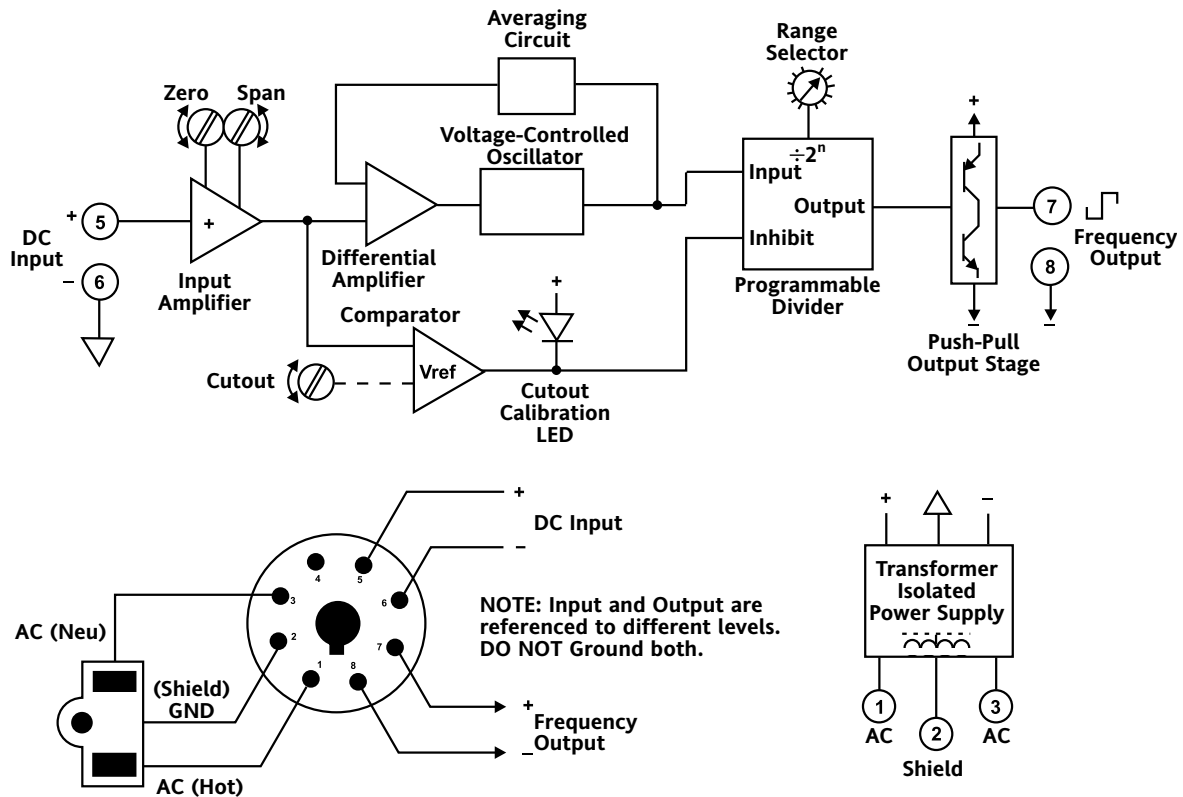
Table 3: AP7500/AP7501 Standard Inputs

0 to 1V	1 to 5V	4 to 20mA
0 to 5V	0 to 10V	10 to 50 mA

Table 4: AP7500/AP7501 Input Limits

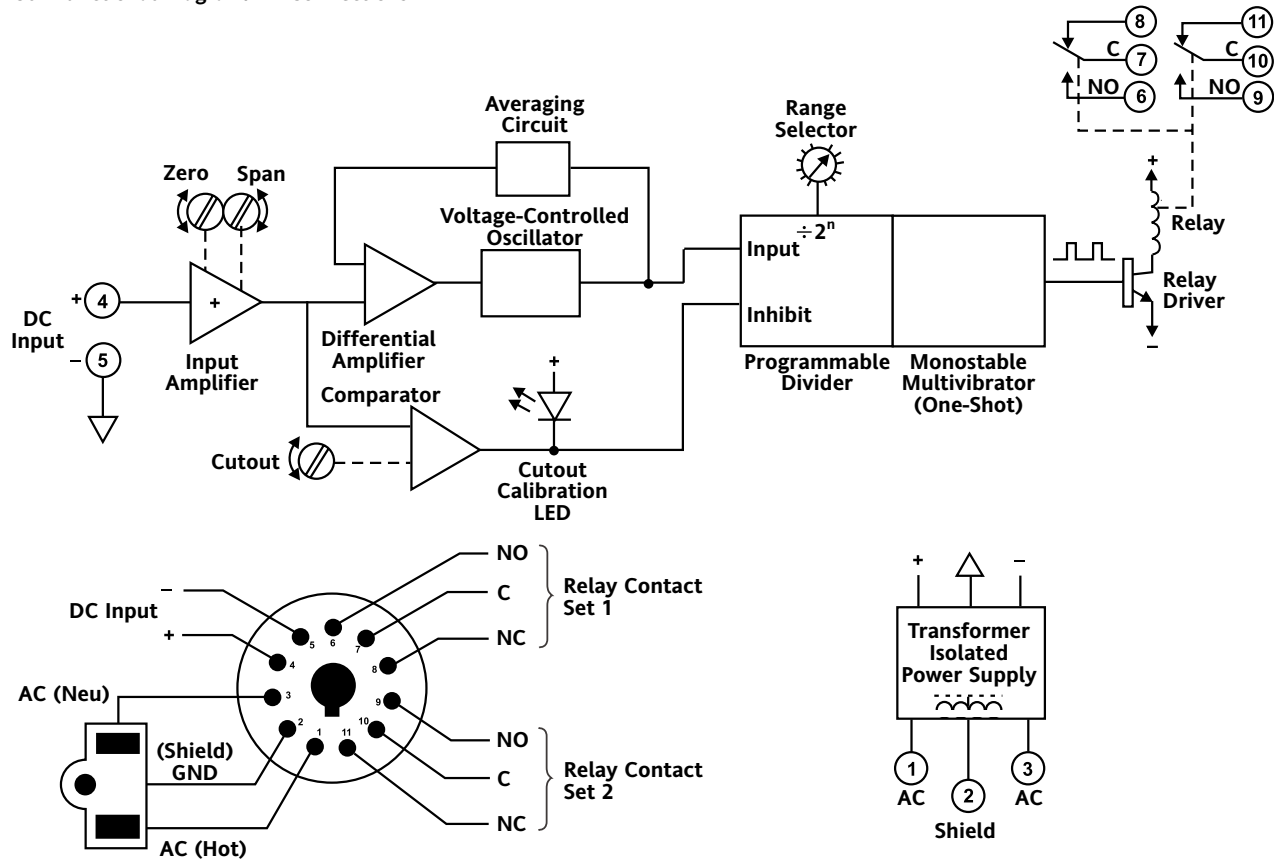
Minimum Span (Voltage)	Minimum Span (Current)	Maximum Input (Voltage)	Maximum Input (Current)
200mV	1mA	200V	100mA

AP7500 Functional Diagram/Pin Connections



Action Pak®

**AP7501 Functional Diagram/Pin Connections**

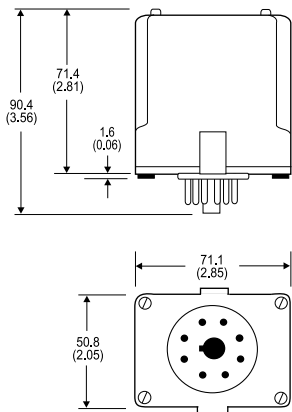


**Mounting**

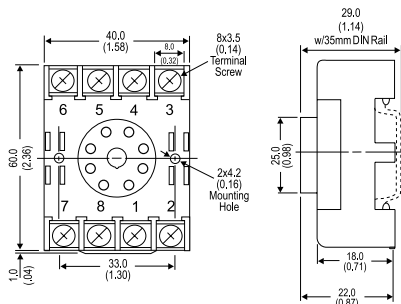
All Action Paks feature plug-in installation. The Action Pak AP7500 uses an 8-pin base and AP7501 uses an 11-pin base and either molded socket M008/M011, or DIN-Rail MD08/MD11 mounting sockets.

**Dimensions**

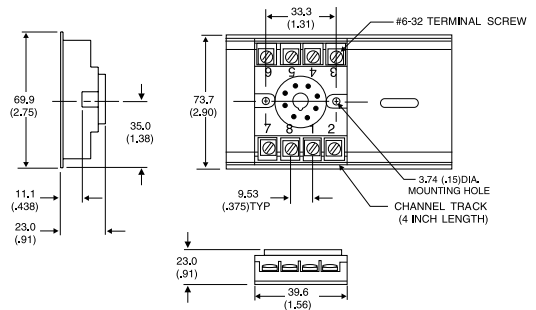
Dimensions are in millimeters (inches)



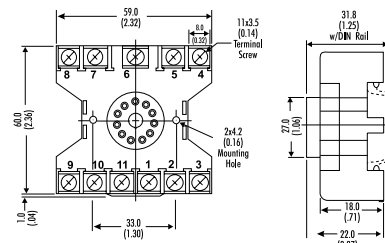
**Mark II**



**MD08 (DIN/Surface)**



**M008 (8 pin) shown, and M011 (11 pin) (Track/Surface)**



**MD11 (DIN-Rail)**

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## Specifications

### Input Impedance:

- Voltage Input: Greater than 100KW
- Current Input: Less than 500mV shunt @ full scale (e.g. 20W for 20mA)
- Input Protection: Withstands 200% of span

### Linearity (Best Straight Line & Linear Input):

0.25% of span, typical

### Low Input Cutout:

Adjustable, 0-10% of span (factory set at 1%), LED cutout indication

### Output:

AP7500: Square-wave, 0/6V, 1:1 mark/ space ratio, source 10mA, sink 50mA. Option C 50mA sink, 30V.

AP7501: Isolated DPDT relay contacts, rated 120VAC @5A or 28VDC @ 5A (100mSec min. on time).

Contact Material: Silver Cadmium Oxide

Life: 10<sup>5</sup> operations at rated load

### Response Time:

100 milliseconds typical, 200 milliseconds max

### Overrange Capability:

Output is linear to 120% of input

### Stability:

Better than 0.05% of span per degree C

### Common Mode Rejection:

DC: > 100dB  
60 Hz: > 80dB

### Maximum Common Mode Voltage:

50V

### Temperature Range:

Operating: 0 to 60°C (32 to 140°F)  
Storage: -20 to 85°C (-4 to 185°F)

### Power:

Consumption: 3W typical, 5W max  
Standard: 120 VAC (±10%, 50-400Hz)  
Available: 240VAC (±10%, 50-400Hz)

### Weight:

0.62lbs

### Agency Approvals:

CSA certified per standard C22.2, No. 0-M1982  
(File No. LR42272-8, 9)

- AP7500-5012 (0-20mA in; square wave output)
- AP7500-5016 (4-20mA in; square wave output)
- AP7500-5065 (0-1Vdc in; square wave output)
- AP7500-5068 (0-5Vdc in; square wave output)
- AP7500-5070 (0-10Vdc in; square wave output)
- AP7500-5085 (1-5Vdc in; square wave output)
- AP7501-6007 (0-1mA in; relay contact output)
- AP7501-6012 (0-20mA in; relay contact output)
- AP7501-6016 (4-20mA in; relay contact output)
- AP7501-6065 (0-1Vdc in; relay contact output)
- AP7501-6068 (0-5Vdc in; relay contact output)
- AP7501-6070 (0-10Vdc in; relay contact output)
- AP7501-6085 (1-5Vdc in; relay contact output)

## Ordering Information

### Specify:

1. Model: **AP7500** or **AP7501** (see above)
2. Options: CS, U, C (see text)
3. Input Range (see Tables 3, 4)
4. Line Power (see specs)
5. C620 Factory Calibration of input, setpoints and output relays.

### Accessories:

- M801-0000 Retaining Spring
- M008-A 8 pin Track Mount Socket
- M011-A 11 pin Track Mount Socket
- M004-0000 4 ft Long Channel Track
- MD08-0000 8 pin DIN Mount Socket
- MD11-0000 11 pin DIN Mount Socket

## Pin Connections

### AP7500

- 1 AC Power (Hot)
- 2 Shield (Gnd)
- 3 AC Power (Neu)
- 4 No Connection
- 5 Input (+)
- 6 Input (-)
- 7 Output (+)
- 8 Output (-)

### AP7501

- 1 AC Power (Hot)
- 2 Shield (Gnd)
- 3 AC Power (Neu)
- 4 Input (+)
- 5 Input (-)
- 6 N.O. } Set 1
- 7 C } Set 1
- 8 N.C. }
- 9 N.O. } Set 2
- 10 C } Set 2
- 11 N.C. }





AP7510-6001

# Action PAK® AP7510 Frequency Divider/Scaler

Provides Adjustable Frequency Attenuation



- Adjustable Scaling Factors
- High Accuracy Digital Conversion
- Over-Current Protection
- Plug-in Installation
- 120 or 240VAC Input Power
- 600V Input to Output Isolation

### Application

The AP7510 Frequency Scaler can be used to directly interface between totalizers and turbine flowmeters, magnetic tachometer sensors and other frequency transducers. A continuously adjustable scaling factor (input-to-output ratio) of 0.00001 to 0.99999 is provided to precisely match the frequency transducer and totalizer. The AP7510 provides a square wave output which can be used to drive electronic counters with TTL, CMOS, or 24V inputs.

### Operation

The AP7510 utilizes an unique combination of digital and analog conversion techniques, which features adjustable scaling and approaches the nearly absolute accuracy of purely digital frequency division. The Frequency Scaler accepts a variety of signal inputs, such as sine wave, square wave and pulses. It can also accept a contact closure input by attaching a jumper across pins 4 and 6. A top-mounted, single-turn sensitivity potentiometer permits an adjustable input sensitivity from 50mV to 5V. The conditioned and amplified frequency input is fed into an opto coupler, which consists of an LED and a phototransistor encapsulated in the same housing.

The opto-coupler provides full DC to DC isolation and feeds the input into the digital frequency divider circuitry. The input is then divided down and channeled through an over-current-protected output driver. The result is a proportionally reduced square wave frequency output. If a 5V TTL-compatible output is desired, use pins 9 and 10 for output. If a 24V square wave output is desired, connect the load between pins 7 and 9.

### Option

- U** Urethane coating of internal circuitry for protection from corrosive atmospheres.

### Input/Output Ranges

Any frequency range or scaling factor is available for the AP7510 within the limits specified in table 1.

### Sensitivity Adjustment

With a frequency input at the expected minimum amplitude, and with the sensitivity adjustment (SENS) fully clockwise, observe the steady oscillations of the frequency output. Adjust SENS counter-clockwise until the frequency output disappears, then return clockwise (slowly) until output reappears.

Table 1: Input and Output Frequency Ranges

Maximum Input Frequency	Minimum Output Frequency	Maximum Output Frequency
80 kHz	0.1Hz	0.99999 x Max. Input

Table 2: Amplitude/Frequency Limits

Input Amplitude (Minimum)	Absolute Maximum Input Frequency
50mVpp	to 20kHz
1Vpp	to 40kHz
5Vpp	to 80kHz

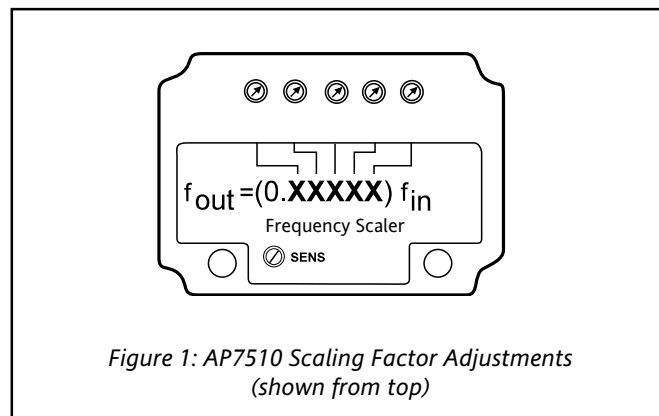


Figure 1: AP7510 Scaling Factor Adjustments (shown from top)

Action Pak®

**Specifications**

**Calibration Capability (includes Accuracy):**

± 1 Input pulse

**Input (see table 2):**

Sine wave, square wave, or pulse;  
50mVpp to 5Vpp to a max of 80kHz, or  
contact closures (15V pullup @ 1mA)

**Sensitivity:**

Adjustable input of 50mVpp to 5Vpp,  
user accessible

**Input Impedance:**

10k Ohms, nominal

**Isolation:**

Input to output, or either input/output  
to line power: 600VDC

**Output:**

5VDC pulse @10mA max, TTL compatible,  
or 24VDC pulse, 1KW load min.; frequency  
to 0.99999 of maximum input.

**Scaling Range:**

Multiplies input frequency by an adjustable  
factor of 0.00001 through 0.99999

**Temperature Range:**

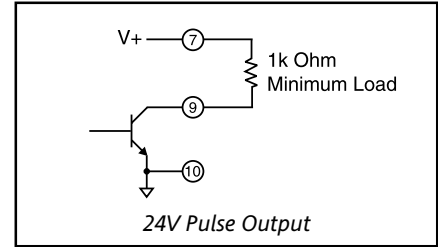
Operating: 0° C to 60° C (32 to140° F)  
Storage: -20 to 85°C (-4 to 185°F)

**Power:**

Consumption: 3W typical, 5W max.  
Standard: 120VAC (± 10%, 50 - 400 Hz)  
Available: 240VAC (±10%, 50-400Hz)

**Weight:**

0.60lbs



**Ordering Information**

**Specify:**

1. Model: **AP7510-6001**
2. Option U (see text)
3. Line Power (see specs)
4. C620 Factory Calibration. Specify input range, output range and power.

**Accessories:**

- M801-0000 Retaining Spring
- M011-A 11 pin Track Mount Socket
- M004-0000 4 ft Long Channel Track
- MD11-0000 11 pin DIN Mount Socket

**Pin Connections**

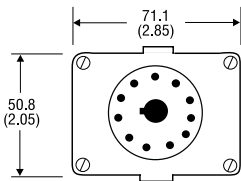
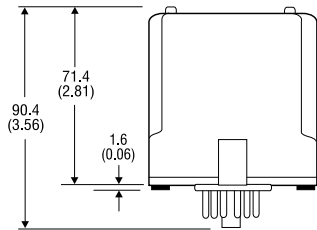
- 1 AC Power (Hot)
- 2 Shield (Gnd)
- 3 AC Power (Neu)
- 4 Input (+)
- 5 Input (-)
- 6 For Contact Closure Input, connect to Pin 4.
- 7 For 24V Pulse Output, connect load with Pins 7 and 9 (see figure above).
- 8 No Connection
- 9 Output (+)
- 10 Output (-)
- 11 No Connection

**Mounting**

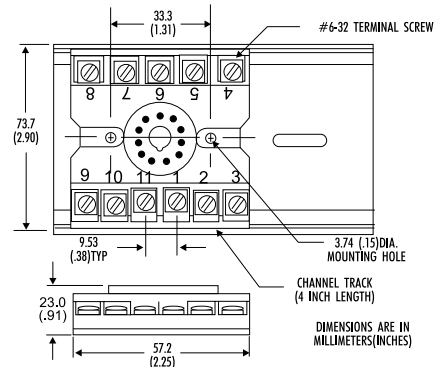
All Action Paks feature plug-in installation. The Action Pak AP7510 uses an 11-pin base and either molded socket M011 or DIN-Rail MD11 mounting sockets.

**Dimensions**

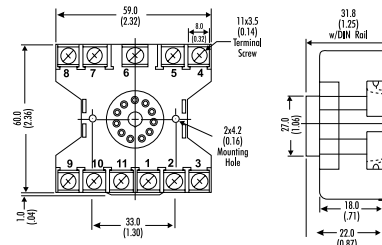
Dimensions are in millimeters (inches)



**Mark II**



**M011 (Track/Surface)**



**MD11 (DIN Rail)**

Action Pak®

## VisiPak Digital Indicators

Action's VisiPak indicators are a reliable, cost effective solution for displaying virtually any sensor or process variable. All VisiPak indicators have NEMA 4 or higher front panel ratings and a variety of agency approvals.

## V408 Modular, Universal Process Indicator

The V408 is Action's most advanced indicator. It accepts temperature (RTD and thermocouple), pressure or weight (strain gauge), and DC process signals. With better than 2 micro-volt input resolution and a bright red or green 5 digit display, the V408 accurately measures and displays the majority of signal types found in industrial process control or factory automation applications. The V408's modular design provides three I/O expansion slots and one communications slot to hold any of the 14 option modules. This allows the user to configure the best solution for an application by using modules to add functions, such as a second input, for signal comparison. Or add a retransmission module to transmit process variables or setpoint levels. Add digital inputs or outputs for remote pushbutton acknowledgment, function programming, alarm status signaling or annunciation. Add a voltage excitation module to power a strain gauge or current loop. Finally, the Modbus serial communication module can make the V408 an excellent window to the process, providing measurement data to a local PLC or back to an office PC.

## Miniature (1/32 DIN) to Standard (1/8 DIN) Indicators for Temperature and DC Signals

The V108, V116 and V132 are 1/8, 1/16 and 1/32 DIN indicators that are field configurable for temperature (RTD and thermocouple) or DC process signals. They are an economical solution that fits most panels and budgets. The V108 has three alarms, two relay outputs and a 5 digit display. The smaller V116 and V132 have three alarms, one relay output and a 4 digit display. Programmable as failsafe or non-failsafe, latching or non-latching, the relays and alarms can be acknowledged remotely with a pushbutton signal or locally using the configuration buttons on the front panel.

## Flow, Temperature, Weight, Pressure, AC Power, Frequency/Rate, Totalization and DC Process

The V43x series has an indicator for every application. The V430 accepts 4-20mA DC flow signals and can display the flow rate, calculate the accumulated flow, and control the On/Off filling of containers with programmable alarm setpoint offsets. The V432 measures temperature (RTD or thermocouple) and, like all V43x indicators, has options for dual relay contact outputs and 4-20mA signal outputs. The V434 accepts bridge or strain gauge inputs and is designed for pressure or weight applications with tare, peak-hold and alarm setpoint offset options for easy application solutions. The V436 True RMS AC input indicator measures AC voltage or AC current to monitor motor loads and help with preventive maintenance. The V437 accepts frequency or pulse inputs for rate and totalization applications, similar to the V430 for flow. The V438 is a DC process indicator with curve linearization capability, as well as full field programmability like the other V43x indicators.

## Loop Powered Field Mount Indicators

The V56x series provides a reliable solution regardless of environmental conditions. The V560 and V565 are intrinsically safe, and are approved by CSA and FM for use in hazardous locations, either with safety barriers and the standard NEMA 4X housing, or with the optional explosion proof housing. The small V561 explosion proof, loop powered indicator is handy for easy viewing in pipe mount applications. The optional backlighting feature sheds light on measurements in those dark, hazardous locations. The V56x series is a rugged, reliable solution with 15 years of field proven quality.

# VisiPak™ Selection Guide

Input	Typical Application	Description	Model
<b>DC Voltage or Current (V, mV, A, mA)</b>	DC process signal monitoring and alarming, including ON/OFF control, scaling and retransmission of process signal, two-wire transmitter excitation, 4-20mA loop powered indication, flow control and batch processing.	Includes field configurable input ranges, curve fitting linearization and square root extraction, wide ranging display with filtering and conditioning to reduce susceptibility to transients and noise.	V108 Indicating Alarm V116 Indicating Alarm V132 Indicating Alarm V408 Universal/Modbus V430 Flow, Rate, Totalizer V438 Alarms, Retran V560 Loop pwr'd IS V561 Loop pwr'd EP Housing V565, Loop pwr'd High Perf IS
<b>Potentiometer (0-300 Ohms, up to 0-10k Ohms)</b>	Tank level, position and setpoint indication, monitoring, alarming and ON/OFF control.	Includes 5 or 10V excitation supply for 3-wire potentiometers or slidewires, to minimize circuitry at the sensor and provide accurate, stable measurement.	V408 Universal/Modbus V438 Alarms, Retran
<b>RTD (Type Pt, Ni, Cu)</b>	Temperature indication, monitoring, alarming and retransmission of temperature.	Includes DC mA excitation supply for accurate, stable measurement of 2-wire or 3-wire RTD resistance sensors.	V108 Indicating Alarm V116 Indicating Alarm V132 Indicating Alarm V408 Universal/Modbus V432 Alarms, Retran
<b>Thermocouple (Types E, J, K, R, S, T)</b>	Temperature indication, monitoring, alarming and retransmission of temperature.	Includes encapsulated cold junction compensation (CJC) and configurable burnout detection.	V108 Indicating Alarm V116 Indicating Alarm V132 Indicating Alarm V408 Universal/Modbus V432 Alarms, Retran
<b>Frequency/Totalizer (0-1Hz to 0-30kHz)</b>	Flow, rate, speed indication, totalization, peak detect and alarming, including preset tracking for container fill applications.	Pulse or square wave, TTL, open collector or contact closure, 125mVpp to 120V amplitudes.	V437 Alarms, Retran
<b>Strain Gauge (+/-15mV to 200mV)</b>	Pressure and load cell indication, monitoring, alarming, ON/OFF control, peak hold, plus TARE.	Includes 5 or 10V excitation, for bridges from 300 Ohms to 10k Ohms.	V408 Universal/Modbus V434 Alarms, Retran
<b>AC Voltage or Current (0-5A, 0-50mV, up to 250V)</b>	AC power and load monitoring, alarming and isolated retransmission of conditioned signal.	True RMS, high voltage input or high current input with optional shunt resistor.	V436 Alarms, Retran

## Indicator and Alarm Units

Easy to Use, Versatile Units Provide  
"Out of the Box" Performance



V3204 (1/4 DIN)  
V32h8 (1/8 DIN Horizontal)  
V3216 (1/16 DIN)

- Universal Input
- PV Retransmission
- Scrolling Text Messages
- Recipes
- Modbus Communications
- Optional PC Based Configuration

### Description

Action's range of V3200i indicators offer accurate indication of temperature and process measurements. Process interlocks, including overtemperature furnace limits, are implemented using relay output channels.

The emphasis is on ease of use. A simple 'Quick Start' code is used to configure all the functions essential for indication and protection of your process, including input sensor type, measurement range and alarms, making 'Out the Box' operation truly achievable. In operation every parameter has a scrolling text message describing its function and is available in English, German, French, Spanish or Italian. More advanced features, including scrolling text messages, are configured using iTools, a PC based configuration wizard, which is an easy to use and instructive guide to all the functions available.

### Universal Input

A wide range of temperature and process inputs can be selected using the front panel pushbuttons without the need for any hardware change. This provides easy on-site set up.

### Strain Gauge Input

Melt pressure and weigh scale inputs can be energised from an internal 10Vdc transducer supply. An automatic shunt calibration routine is provided to remove zero and span offsets. The display on the V32h8i can show a full 5 digit value.

### Process Alarms

Four internal alarm setpoints are provided. They can be used to energise up to three relay outputs, which can be latched if required. A special 'Alarm Blocking' mode is available which ensures that when the unit is powered up an alarm must first enter a good state before the alarm becomes active. This is particularly useful for low alarms which can be blocked while the process is warming up.

### Custom Text Messaging

Custom messages can be created with iTools and downloaded to the V3200i to display when an event, alarm or process condition occurs. This provides the operator with good visibility of what is happening in the process and provides messages that they can understand and act upon.

### Recipes

iTools recipes can be created that can be used to change the operating parameters of the V3200i simply by selecting a recipe using the V3200i pushbuttons. This is very useful where multiple products are processed but require different parameters to be set. It can also be used to change the set-up of a indicator therefore allowing one unit to be used as a spare for multiple applications.

### Analogue Retransmission

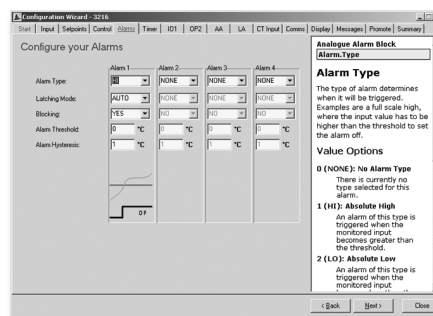
The measured process value can be retransmitted as either a mA or voltage signal with a selection of outputs including 4-20mA and 0-10Vdc. In the V32h8i this signal is isolated from all other electronics within the unit.

### Digital Communications

All units support both EIA232 and EIA485 communication using the Modbus protocol as a slave device. It is also possible to digitally retransmit one parameter using a Modbus broadcast to all other Modbus devices on the network.

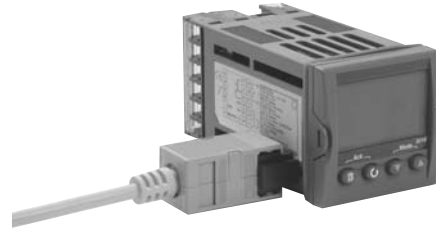
### iTools Wizard

Used to simplify the set up of V3200i series indicators, the wizard guides the user through the configuration process with interactive help and graphical demonstrations of features.



## Configuration Adaptor

PC configuration to all V3200i indicators can be achieved by using a configuration adaptor. It provides iTools with the ability to communicate with and configure devices without any power being connected.



### SPECIFICATIONS

#### General

#### Environmental performance

Temperature limits	Operation: 0 to 55°C Storage: -10 to 70°C
Humidity limits	Operation: 5 to 90% RH non condensing Storage: 5 to 90% RH non condensing
Panel sealing:	IP65, Nema 4X
Shock:	BS EN61010
Vibration:	2g peak, 10 to 150Hz
Altitude:	<2000 metres
Atmospheres:	Not suitable for use in explosive or corrosive atmosphere

#### Electromagnetic compatibility (EMC)

Emissions and immunity:	BS EN61326
Electrical safety (BS EN61010):	Installation cat. II; Pollution degree 2

#### INSTALLATION CATEGORY II

The rate impulse voltage for equipment on nominal 230V mains is 2500V.

#### POLLUTION DEGREE 2

Normally, only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation shall be expected

#### Physical

Panel mounting	3216i: 1/16 DIN 3204i: 1/4 DIN 32h8i: 1/8 DIN, horizontal
Dimensions and weight	3216i: 48W x 48H x 90D mm, 250g 3204i: 96W x 96H x 90D mm, 420g 32h8i: 96W x 48H x 90D mm, 350g
Panel cut-out:	3216i: 45W x 45H mm 3204i: 92W x 92H mm 32h8i: 92W x 45H mm

#### Operator interface

Type:	LCD TN with backlight
Main PV display:	3216i, 3204i: 4 digits, green 32h8i: 5 digits, green or red
Lower display:	3216i, 3204i: 5 character starburst, green 32h8i: 9 character starburst, green
Status beacons:	Units, outputs, alarms
Power requirements	3216i: 85 to 264Vac, -15%, +10%, 48 to 62 Hz, max 6W 24Vac, -15%, +10%, 24Vdc, -15% +20% ±5% ripple voltage max 6W 32h8i, 3204i: 85 to 264Vac, -15%, +10%, 48 to 62 Hz, max 8W 24Vac, -15%, +10%, 24Vdc -15% +20% ±5% ripple voltage max 8W

#### Approvals

CE, cUL listed (file E57766), Gost, FM, DIN 3440

#### Transmitter PSU (not 3216i)

Rating:	24Vdc, 20mA
Isolation:	264Vac double insulated

#### Communications

Serial Communications Protocol:	Modbus RTU slave Modbus RTU Master broadcast (1 parameter)
Isolation:	264Vac, double insulated
Transmission standard:	EIA232 or EIA485 (2 wire)

#### Process variable input

Calibration accuracy:	<±0.25% of reading ±1LSD (1)
Sample rate:	9Hz(110ms)
Isolation:	264Vac double insulation from the PSU and communication

Resolution (µV):	<0.5µV with 1.6s filter (mV range) <0.25mV with 1.6s filter (Volts range)
Resolution (effective bits):	>17 bits
Linearisation accuracy:	< 0.1% of reading
Drift with temperature:	<50ppm (typical) <100ppm (worst case)
Common mode rejection:	48-62Hz, >-120db
Series mode rejection:	48-62Hz, >-93dB
Input impedance:	100MΩ (200KΩ on volts range C)
Cold junction compensation:	>30/1 rejection of ambient change
External cold junction:	Reference of 0°C
Cold junction accuracy:	<±1°C at 25°C ambient
Linear(process) input range:	-10 to 80mV, 0 to 10V requires 100KΩ/ 806Ω external divider module (not 32h8i)
Thermocouple types:	K, J, N, R, S, B, L, T, C, custom download (2)
Resistance thermometer types:	3-wire Pt100 DIN 43760
Bulb current:	0.2mA
Lead compensation:	No error for 22 ohms in all leads
Input filter:	Off to 100s
Zero offset:	User adjustable over full range
User calibration:	2-point gain & offset

#### Notes

- (1) Calibration accuracy quoted over full ambient operating range and for all input linearisation types
- (2) Contact Eurotherm for details of availability of custom downloads for alternative sensors

#### Strain gauge input (32h8i)

Input type:	350Ω Bridge
Connection:	4 or 6 wire (6 uses internal shunt)
Calibration accuracy:	+0.1% of full scale
Sample time:	9Hz (110ms)
Isolation:	264Vac double isolation from the PSU and communications
Excitation:	10Vdc +7%
Sensitivity:	1.4 to 4mV/V
Input span:	-27% to +127% of full scale (approx. -10mV to +5mV): +25% of full scale +25% of full scale
Zero balance:	+25% of full scale
Tare:	+25% of full scale
Resolution (mV):	0.3mV/V (typical) with 1.6s filter
Resolution (effective bits):	14.3 bits
Drift with temperature:	<100ppm/°C of full scale
Common mode rejection:	48-62Hz, >-120db
Series mode rejection:	48-62Hz, >-60db
Input filter:	Off to 100s

#### AA relay

Type:	Form C (changeover)
Rating:	Min 100mA@12Vdc, max 2A@264Vac resistive
Function:	Alarms, events

#### Digital input A/B (B not on 3216i, A not on 32h8i with SG or SD)

Contact closure:	Open >600Ω, closed <300Ω
Input current:	<13mA
Isolation:	None from PV or system; 264Vac double insulated from PSU and communications
Function:	Includes alarm acknowledge, keylock, alarm inhibit, freeze display, tare, auto zero, peak reset

### Logic I/O module (3216i only)

#### Output

Rating: ON: 12Vdc@<44mA,  
OFF: <300mV@100µA

Isolation: None from PV or system.  
264Vac double insulated from PSU and comms

Function: Alarms, events

#### Input

Contact closure: Open >500Ω, closed <150Ω

Isolation: None from PV or system  
264Vac double insulated from PSU and comms

Function: Includes alarm acknowledge, keylock, alarm inhibit, freeze display, tare, auto zero, peak reset

#### Relay output channels

Type 3216i: Form A (normally open)  
32h8i, 3204i: Form C (changeover)

Rating: Min 100mA@12vdc, max 2A@264Vac resistive

Function: Alarms, events

#### Analogue output

##### OP1, OP2 (3216i only)

Rating: 0-20mA into <500Ω

Accuracy: ± (<0.5% of Reading + <100µA)

Resolution: 11.5 bits

Isolation: None from PV or system  
264Vac double insulated from PSU and comms

Function: Retransmission

##### OP3 (not on 3216i)

Isolation: 264Vac double insulated

Function: Retransmission

Current Output Rating: 0-20mA into <500Ω

Accuracy: ±(<0.25% of Reading + <50µA)

Resolution: 13.6 bits

Voltage Output Rating (not on 3204i): 0-10V into >500Ω

Accuracy: ±(<0.25% of Reading + <25mV)

Resolution: 13.6 bits

### Software features

#### Alarms

Number: 4  
Absolute high & low, Rate of change (rising or falling)

Latching: Auto or manual latching, non-latching, event only

Output assignment: Up to 4 conditions can be assigned to one output

#### Other status outputs

Function: Sensor break, power fail, new alarm, pre-alarm

Output assignment: Up to 4 conditions can be assigned to one output

#### Custom messages

Number: 15 scrolling text messages

No of characters: 127 characters per message max

Languages: English, German, French, Spanish, Italian

Selection: Active on any parameter status using conditional command

#### Recipes

Number: 5 recipes with 19 parameters

Selection: HMI interface, communications or digital IO

#### Transducer calibration

Calibration types: Shunt, load cell, comparison

Other features: Auto-zero, tare

#### Other features

Display colour (32h8i): Upper display selectable green or red or change on alarm

Scrolling text: Parameter help, custom messages

Display filter: Off to zero last 2 digits

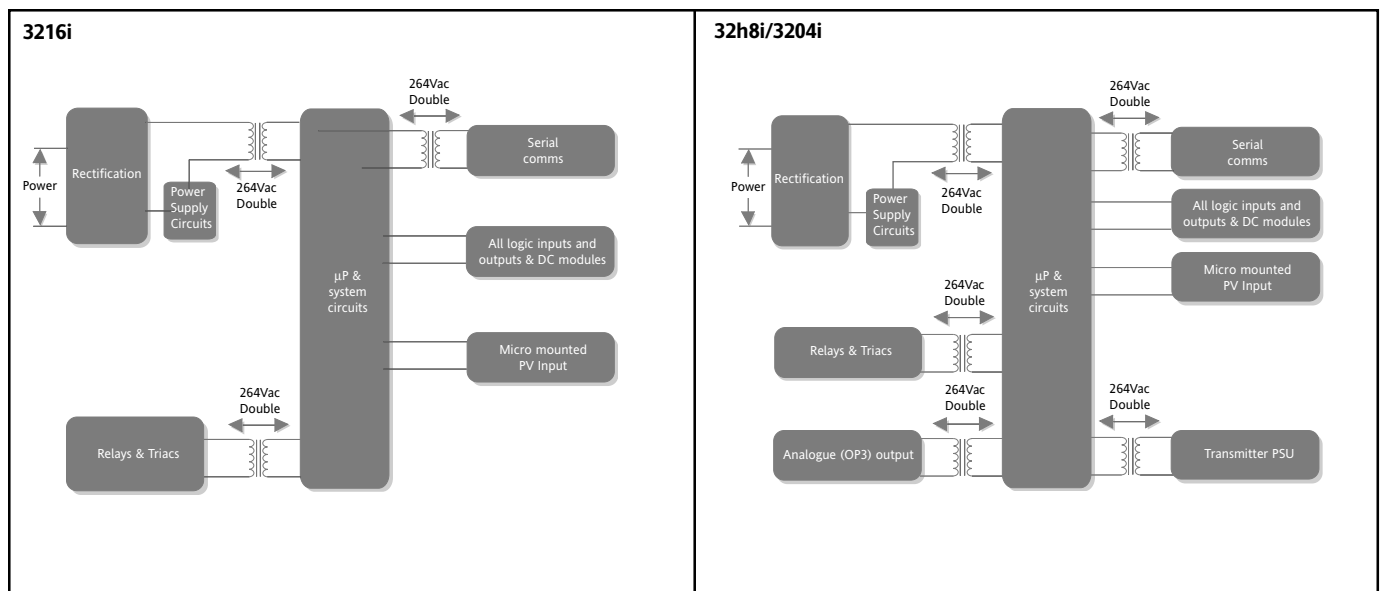
Peak monitor: Stores high and low values

#### FM/DIN 3440

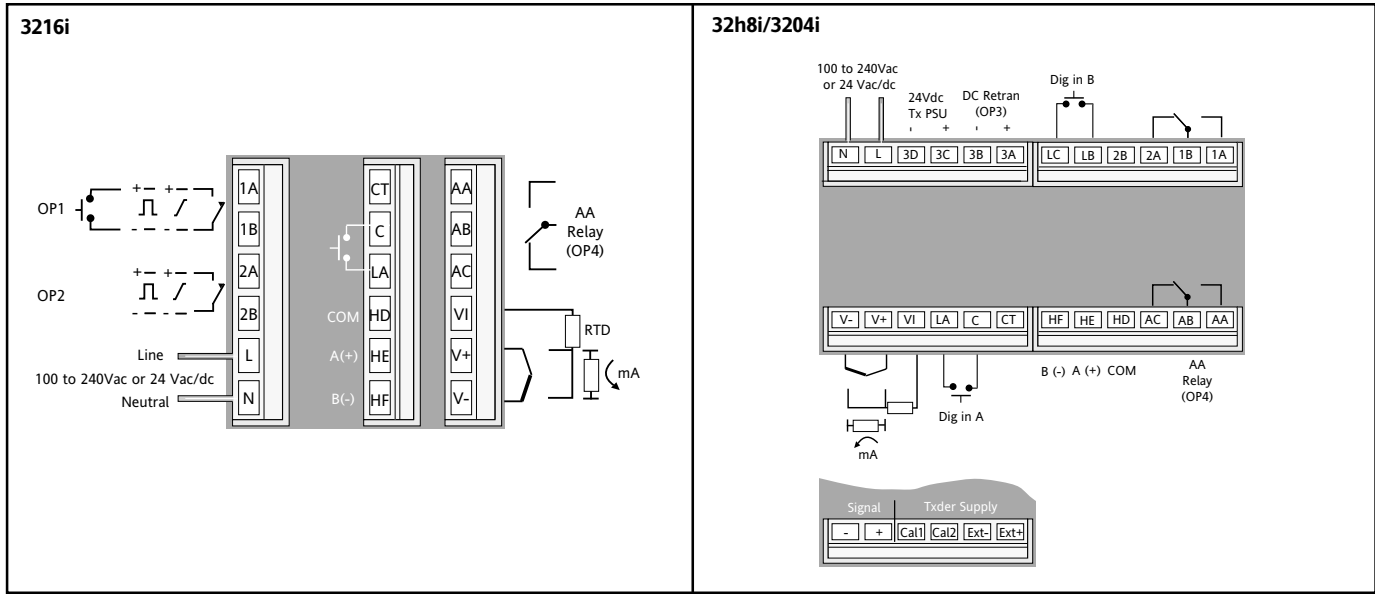
Alarm 1 configuration: Absolute hi or lo, de-energised in alarm  
Latching output on Form C (AA) Relay  
All alarms active on sensor break and power fail  
Adjustment protection via password

Alarm setpoint: FM/DIN 3440 option prevents reconfiguration of alarm config

## Isolation Diagrams



# isolation Diagrams



## Ordering Code

Model	Function	Power Supply	Outputs	AA Relay	Options	Fascia Color	Product Language	Manual Language	Input Adaptor	Warranty	Calibration Certificate	Custom Label	Specials & Access
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Model	
V3216i	1/16 DIN Unit
V32h8i	1/8 DIN Horizontal Unit
V3204i	1/4 DIN Unit

Function	
AL	Standard Unit
FM	FM Alarm Unit
DN	DIN 3440 Alarm Unit
SG	Strain Gauge Input (32h8i only)

Power Supply	
VH	85-264 Vac
VL	20-29 Vac/Vdc

Outputs		
<b>3216i</b>		
OP1	OP2	
LRXX	Logic	Relay
RRXX	Relay	Relay
LDXX	Logic	Analog
DRXX	Analog	Relay
<b>32h8i/3204i</b>		
OP1	OP3	
RXXX	Relay	None
RXDX	Relay	Analog

AA Relay	
X	Disabled
R	Form C (changeover)

Options	
XXX	Not Fitted
XXL	Digital Input A
2XL	RS232 + Digital Input A
4XL	RS485 + Digital Input A

Fascia Color	
G	Green
S	Silver

Product Language	
ENG	English
FRA	French
GER	German
SPA	Spanish
ITA	Italian

Manual Language	
ENG	English
FRA	French
GER	German
SPA	Spanish
ITA	Italian

Input Adaptor	
XX	None
V1	0-10 Vdc*
A1	mA Burden Resistor (2.49 $\Omega$ , 0.1%)

\*Not required for 32h8i

Warranty	
XXXXX	Standard
WL005	Extended

Calibration Certificate	
XXXXX	None
CERT1	Certificate of Conformity
CERT2	5 Point Factory Calibration

Custom Label	
F0734	Action Instruments

Specials and Accessories	
XXXXXX	None
RES250	250 $\Omega$ Resistor for 0-5Vdc OP
RES500	500 $\Omega$ Resistor for 0-10Vdc OP

VisiPak™

### Accessories

- User Guide ..... HA029005
- Engineering Manual ..... HA029006
- 2.49 $\Omega$  Precision Resistor ..... SUB35/ACCESS/2.49R.1
- Configuration Clip ..... iTools/None/3000CK
- 0-10V Input Adaptor ..... SUB21/1V10



# Optional Quick Start Code

Input Type	Display Limits	Decimal Point	PV Color	Home Display	Range Low	Range High	OP1	OP2 OP3	OP4 AA Relay	Digital Input A	Digital Input B
			32h8i Only							Not 32h8i/SG	

Input Type	
	Thermocouple
B	Type B
J	Type J
K	Type K
L	Type L
N	Type N
R	Type R
S	Type S
T	Type T
C	Type C
	<b>RTD</b>
P	Pt100
	<b>Linear</b>
M	0-80mV
2	0-20mA
4	4-20mA
	<b>32h8i Only</b>
0	0-10Vdc
1	1-5Vdc
3	2-10Vdc
6	0-5Vdc
G	Strain Gauge

Display Limits	
X	None
C	Deg C Full Range
F	Deg F Full Range
K	Kelvin
P	Percentage
	<b>32h8i Only</b>
	<b>Pressure</b>
0	Pa
1	mPa
2	Kpa
3	Bar
4	mBar
5	PSI
6	Kgcm <sup>2</sup>
7	mmWG
8	inWG
9	mmHG
A	Torr
	<b>Flow Rate</b>
B	L-H
D	L-m
	General
E	%RH
G	%O2
H	%CO2
J	%CP
L	V
M	Amps
R	mA
T	mV
U	Ohms
W	ppm
Y	RPM
Z	m-s

Decimal Point	
0	nnnnn
1	nnnn.n
2	nnn.nn
3	nn.nnn (32h8i only)
4	n.nnnn (32h8i only)

PV Color (32h8i Only)	
X	Not Applicable
G	Green
R	Red
C	Change on any alarm (Green to Red)

Home Display	
N	PV Only
A	First Alarm SP Only
1	PV + Alarm SP
2	PV + Alarm SP (read only)

Range Low	
Enter Value	

Range High	
Enter Value	

OP1	
X	Unconfigured
H	High Alarm
L	Low Alarm
R	Rising Rate of Change
N	New Alarm
O	Sensor Break
P	Power Fail
	<b>Combined with Sensor Break</b>
7	High Alarm
8	Low Alarm
9	Rising Rate of Change
	<b>Combined with Power Fail</b>
A	High Alarm
B	Low Alarm
C	Rising Rate of Change
	<b>Combined with Sensor Break and Power Fail</b>
E	High Alarm
F	Low Alarm
G	Rising Rate of Change
	<b>3216i Only</b>
	<b>Analog Output PV Retran</b>
1	4-20mA
2	0-20mA
	<b>Digital Input Logic Input</b>
W	Alarm Acknowledge
K	Keylock
U	Remote UP Button
D	Remote DOWN Button
J	Alarm Inhibit
M	Peak Reset
Y	Freeze Displayed PV
V	Recipe 1/2 Select

OP2 (3216i), OP3 (32h8i & 3204)	
X	Unconfigured
	<b>Analog Out PV Retran</b>
1	4-20mA
2	0-20mA
	<b>32h8i/3204i Only</b>
3	0-5Vdc
4	1-5Vdc
5	0-10Vdc
6	2-10Vdc
	<b>3216i Only</b>
	<b>Relay or Logic Out (Alarm 2)</b>
	<b>Alarm 2</b>
H	High Alarm
L	Low Alarm
R	Rising Rate of Change
N	New Alarm
O	Sensor Break
P	Power Fail
	<b>Combined with Sensor Break</b>
7	High Alarm
8	Low Alarm
9	Rising Rate of Change
	<b>Combined with Power Fail</b>
A	High Alarm
B	Low Alarm
C	Rising Rate of Change
	<b>Combined with Sensor Break and Power Fail</b>
E	High Alarm
F	Low Alarm
G	Rising Rate of Change

OP4 (AA Relay)	
X	Unconfigured
H	High Alarm
L	Low Alarm
R	Rising Rate of Change
N	New Alarm
O	Sensor Break
P	Power Fail
	<b>Combined with Sensor Break</b>
7	High Alarm
8	Low Alarm
9	Rising Rate of Change
	<b>Combined with Power Fail</b>
A	High Alarm
B	Low Alarm
C	Rising Rate of Change
	<b>Combined with Sensor Break and Power Fail</b>
E	High Alarm
F	Low Alarm
G	Rising Rate of Change

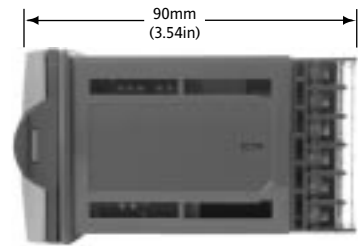
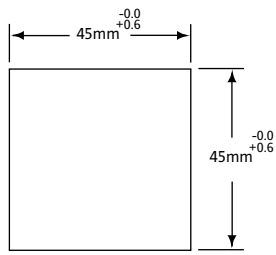
Digital Input A (n/a 32h81/SG)	
X	Unconfigured
W	Alarm Acknowledge
K	Keylock
U	Remote UP Button
D	Remote DOWN Button
J	Alarm Inhibit
M	Peak Reset
Y	Freeze Displayed PV
V	Recipe 1/2 Select

Digital Input B	
X	Unconfigured
W	Alarm Acknowledge
K	Keylock
U	Remote UP Button
D	Remote DOWN Button
J	Alarm Inhibit
M	Peak Reset
Y	Freeze Displayed PV
V	Recipe 1/2 Select
	<b>32h8i Strain Gauge</b>
T	Tare Correction
Z	Auto Shunt (Melt Pressure) Calibration

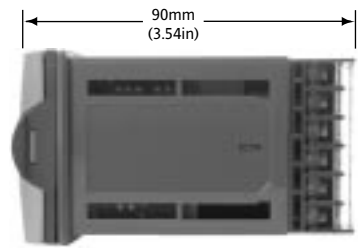
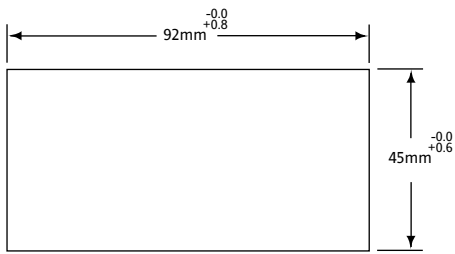


Dimensions

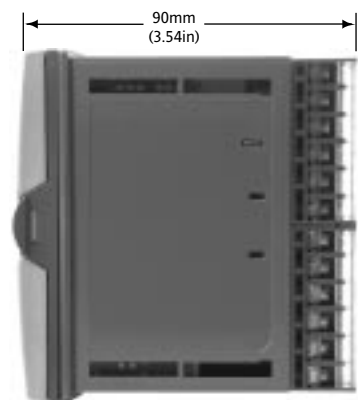
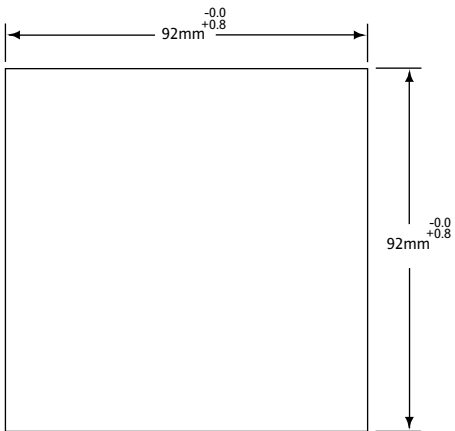
3216i



32h8i



3204i





V108-ALGNVH (green LEDs)  
V108-ALRDVH (red LEDs)

# VISIPAK™ V108

## Temperature/Process Indicator

Provides a 4 Digit Display and Alarm Output from RTD, Thermocouple or DC Inputs



- Field Configurable Input for Thermocouple, RTD, mV, and 4-20mA Signals
- Three Field Configurable Alarm Setpoints with Two Alarm Outputs
- Red or Green 4-Digit Display
- Combination Alarm Functions, Alarm Blocking and Programmable Latching/Non-latching
- NEMA 4 Front Panel
- 85 to 264VAC Power Supply

### Description

The V108 is a compact, 4 digit indicator (with alarms) that fits 1/8 DIN cutouts. It accepts temperature inputs from J, K, T, L, N, R, S, B, C and Platinel II type thermocouples and three-wire Platinum 100 Ohm (Pt100) RTDs. Process variables such as 4-20mA or ranges within -9.99 to 80mV can also be measured. Other thermocouple types such as D and E and custom curves can be configured at the factory. Voltage ranges from 0 to 10V can be measured with the optional (model SUB2-1V1) adapter.

Three programmable setpoint alarms can be field configured as rate of change, high or low; non-latching, latching or new. The new alarm indicates when a latched alarm has not been acknowledged and the measured value crosses the setpoint trip level a second time. Alarm hysteresis (deadband) can be configured from 1 to 9999 process variable units. Each alarm has a programmable delay up to 999.9 seconds. The alarms can be linked to either of two relay outputs. Alarms can be configured in combination (e.g. one or all three alarms linked to one or both relays) and will operate in fail-safe (e.g., normally energized) or non fail-safe modes. Additionally, the unit can be configured for password protection, limiting operator access to any or all functions. An alarm blocking function is also configurable to prevent alarm tripping during process or start-up. The unit also accepts wiring for remote alarm acknowledgment

Thermocouples, three-wire RTDs and mV inputs can be accepted directly into the indicator. Current signals such as 4-20mA are input using a 2.49 Ohm shunt resistor, included with the indicator and mounting hardware. Other shunt resistor values can be used to measure higher current levels, provided the produced signal is within the -9.99mV to 80mV input range. Similarly, voltage inputs such as 0-10V can be measured using the optional attenuator (model SUB2-1V1). The input can be scaled as desired for display. Offset and two point slope adjustments are fully programmable.

### Application

The V108 is excellent for temperature and process variable measurement. The NEMA 4, front plug-in, panel mount indicator fits standard 1/8 DIN cutouts.

The field configurable V108 makes an ideal standardized solution for a variety of temperature measurement and on-off control applications. For example, it can be used to control the heating and cooling elements in an oven or environmental control system using two setpoints for high and low temperature limits. Similarly, a 4-20mA pressure signal can be monitored and the setpoints used to control or alarm the gas pressure or liquid level in a tank or vessel. Weight, flow, pressure, temperature, speed, position and rate are just some of the process variables that can be accurately displayed and monitored with this flexible and effective unit.

Table 1: Input & Display Ranges

Input	Display Range and Setpoint Min & Max Limits	
Pt100	-200 to 850° C	-325 to 1562° F
Type J	-210 to 1200° C	-340 to 2192° F
Type K	-200 to 1372° C	-325 to 2500° F
Type T	-210 to 400° C	-325 to 750° F
Type L	-200 to 900° C	-325 to 1650° F
Type N	-200 to 1300° C	-325 to 2370° F
Type R	-50 to 1768° C	-58 to 3200° F
Type S	-50 to 1768° C	-58 to 3200° F
Type B	0 to 1820° C	32 to 3308° F
Type P (Platinel II)	0 to 1369° C	32 to 2469° F
-9.99 to 80mV	-999 to 9999	
0 to 20mA	-999 to 9999	
4 to 20mA	-999 to 9999	
0 to 10V*	-999 to 9999	

\*Requires input adaptor



**Specifications**

**Display:**

4 digit (-999 to 9999) with programmable decimal, green or red, 15.9mm (0.6 in.) high characters

**Inputs:**

See Table 1

**Output:**

Relay (isolated): 2A, 264VAC resistive.  
Minimum 12Vdc, 100mA.

**Accuracy:**

+/-1°C or +/-0.25% of reading, whichever is greater

**Cold Junction Compensation:**

>30:1 rejection of ambient temperature change. Uses Instant Accuracy cold junction sensing technology to eliminate warm-up drift and respond rapidly to ambient temperature changes.

**Input Filtering:**

Off to 999.9 seconds

**Panel Sealing:**

NEMA 4, or IP54 (EN60529)

**EMC Compliance (CE Mark):**

Emissions: EN50081-2  
Immunity: EN50082-2

**Temperature:**

Operating: 0 to 55°C (32 to 131°F)  
Storage: -30 to 75°C (-22 to 167°F)

**Humidity**

5 to 95%RH, non-condensing

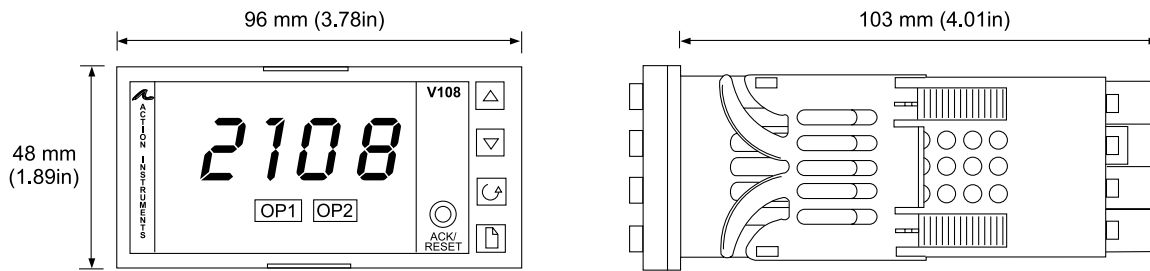
**Power:**

Standard 100 to 240VAC, -15%, +10%,  
48 to 62Hz, 5Wmax.

**Agency Approvals:**

cUL listed per standard UL508.  
CE conformance per EMC directive  
89/336/EEC, amended by 93/68/EEC  
and Low Voltage Directive 73/23/EEC,  
amended by 93/68/EEC.

**Dimensions**



**Ordering Information**

**Specify:**

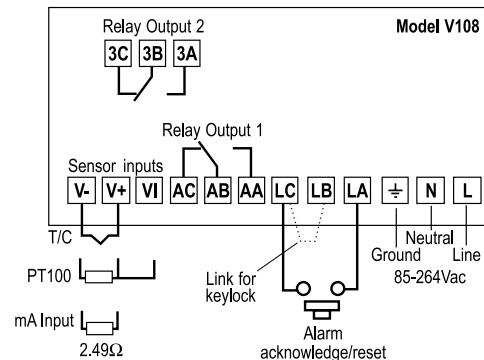
1. Model Number:  
**V108 - ALGNVH** (Green LEDs) or  
**V108-ALRDVH** (Red LEDs)
2. Accessories: (see Accessories)
3. Optional Factory Configuration, specify **C620** with the desired configuration information.

**Accessories**

The VisiPak model V108 is shipped with mounting brackets, a 2.49 Ohm shunt resistor and user manual. In addition, the following accessories are available:

**SUB2-1V1** 0-10V Input Adapter

**Wiring**



VisiPak™



V116-ALVH (65-264 VAC)  
 V116-ALVL (20-29 VAC/VDC)  
 V116-ALVH (65-264 VAC)  
 V116-ALVL (20-29 VAC/VDC)

# VISIPAK™ V116 & V132

## Miniature Temperature/Process Indicators

Provides a 4 Digit Display and Alarm Output from RTD, Thermocouple or DC Inputs



- Field Configurable Input for Thermocouple, RTD, mV and 4-20mA Signals
- Three Field Configurable Alarm Setpoints with One or Two Alarm Outputs
- Green 4 Digit (9999) Display
- NEMA 4 Front Panel
- Combination Alarm Functions, Alarm Blocking and Programmable Latching/Non-latching
- Power Supply: 85 to 264VAC or 20 to 29V DC or AC

### Description

The V116 and V132 are compact, 4 digit indicators (with alarms) that fit 1/16 and 1/32 DIN cutouts, respectively. They accept temperature inputs from J, K, T, L, N, R, S, C, B, and Platinel II type thermocouples and two-wire Platinum 100 Ohm (Pt100) RTDs. Process variables such as 4-20mA or ranges within -12 to 80mV can also be measured. Other thermocouple types such as D and E and custom curves can be configured at the factory. Voltage ranges up to 0-10V can be measured with the optional (model SUB2-1V1) adaptor.

Three programmable setpoint alarms can be field configured as high or low, non-latching and high or low or new, latching. The new alarm indicates when a latched alarm has not been acknowledged and the measured value crosses the setpoint trip level a second time. Alarm hysteresis (deadband) can be configured from 1 to 9999 process variable units.

The alarms can be linked to either the relay output or the digital I/O terminals. The digital I/O terminals can be configured for remote alarm acknowledgment. When configured as an output, those terminals will provide a TTL signal or drive an optional (model SUB2-1R7) relay. These alarm outputs can be configured in combination (e.g., one or all three alarms linked to the relay) and will operate in fail-safe (i.e., normally energized) or non-fail-safe modes. Additionally, the display can be configured for password protection, limiting operator access to any or all functions. An alarm blocking function is also configurable to prevent alarm tripping during process or start-up.

Thermocouples, two-wire RTDs and mV inputs can be accepted into the indicator. Current signals such as 4-20mA are input using the 2.49 Ohm shunt resistor, included with the indicator and mounting hardware. Other shunt resistor values can be used to measure higher current levels provided the produced signal is within the -12mV to 80mV input range. Similarly, voltage inputs such as 0-10V can be measured using the optional attenuator (model SUB2-1V1). The input can be scaled as desired for display. Offsets and two point slope adjustments are fully programmable to compensate for sensor variances.

### Application

The V116 and V132 are excellent for temperature and process variable measurement especially when panel space is limited. Extremely compact and efficient, the NEMA 4X, plug-in from front, panel mount indicators can fit in the smallest enclosures or OEM panels.

The field configurable VisiPak indicators make an ideal standardized solution for a variety of temperature measurement and on-off control applications. For example, either the V116 or the V132 can be used to control the heating and cooling elements in an oven or environmental control system using two setpoints for high and low temperature limits. Similarly, a 4-20mA pressure signal can be monitored and the setpoints can be used to control or alarm the gas pressure or liquid level in a tank or vessel. Weight, flow, pressure, temperature, speed, position and rate are just some of the process variables that can be accurately displayed and monitored with these highly compact and effective units.

Table 1: Input & Display Ranges

Input	Display Range and Setpoint Min & Max Limits	
Pt100	-200 to 850° C	-325 to 1562° F
Type J	-210 to 1200° C	-340 to 2192° F
Type K	-200 to 1372° C	-325 to 2500° F
Type T	-210 to 400° C	-325 to 750° F
Type L	-200 to 900° C	-325 to 1650° F
Type N	-200 to 1300° C	-325 to 2370° F
Type R	-50 to 1768° C	-58 to 3200° F
Type S	-50 to 1768° C	-58 to 3200° F
Type B	0 to 1820° C	32 to 3308° F
Type P (Platinel II)	0 to 1369° C	32 to 2469° F
-12 to 80mV	-999 to 9999	
0 to 20mA	-999 to 9999	
4 to 20mA	-999 to 9999	
0 to 10V*	-999 to 9999	

\*Requires input adaptor



**Specifications**

**Display:**

4 digit (-999 to 9999) with programmable decimal, green, 10mm (0.4 In.) high characters

**Inputs:**

See Table 1

**Output:**

Relay (isolated): 2A, 264VAC resistive.  
Minimum 12V DC, 100mA.

Logic (non-isolated): 9VDC, 12mA. Can be used as alarm output or alarm acknowledge input.

**Accuracy:**

+/-1°C or +/-0.25% of reading, whichever is greater

**Cold Junction Compensation:**

>30 to 1 rejection of ambient temperature change. Uses Instant Accuracy cold junction sensing technology to eliminate warm-up drift and respond rapidly to ambient temperature changes.

**Input Filtering:**

Off to 999.9 seconds

**Panel Sealing:**

NEMA 4X, or IP65 (EN60529)

**EMC Compliance (CE Mark):**

Emissions: EN50081-2  
Immunity: EN50082-2

**Temperature:**

Operating: 0 to 55°C (32 to 131°F)  
Storage: -30 to 75°C (-22 to 167°F)

**Humidity:**

5 to 95%RH, non-condensing

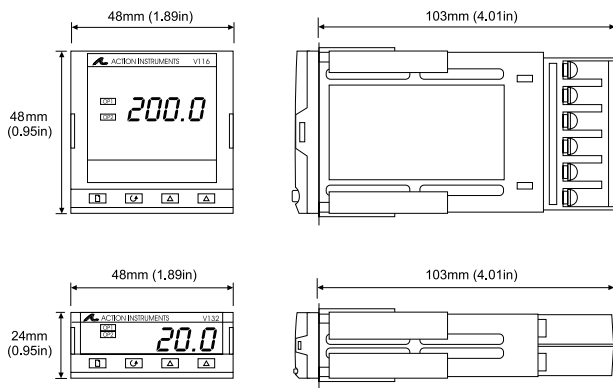
**Power:**

Standard 85 to 264VAC, 48 to 62Hz, optional 20 to 29V DC or AC, 5 W max.

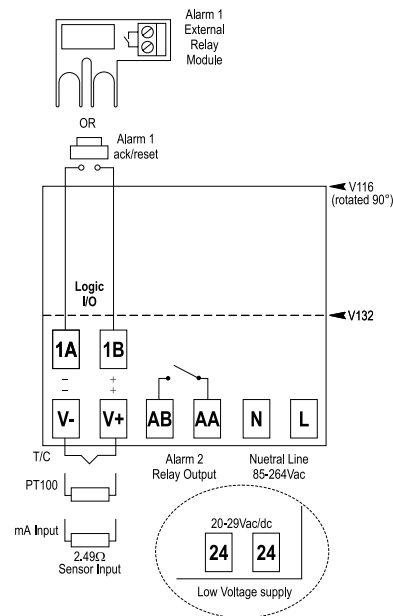
**Agency Approvals:**

cUL listed per standard UL508.  
CE conformance per EMC directive 89/336/EEC, amended by 93/68/EEC and Low Voltage Directive 73/23/EEC, amended by 93/68/EEC.

**Dimensions**



**Wiring**



**Ordering Information**

**Specify:**

1. Model Number:  
**V116-ALVH** (65-264VAC powered) or  
**V116-ALVL** (20-29VDC/AC powered) or  
**V132-ALVH** (65-264VAC powered) or  
**V132-ALVL** (20-29VDC/AC powered)
2. Accessories: (see Accessories)
3. Optional Factory Configuration, specify C620 with the desired configuration information.

**Accessories**

The VisiPak model V116 and V132 are shipped with mounting brackets, 2.49 Ohm shunt resistor and user manual. In addition, the following accessories are available:

- SUB2-1R7** External Relay
- SUB2-1V1** 0-10V Input Adapter



# VISIPAK™ V408

## Universal Temperature/Pressure/Process Indicator

V408-ALGNVH (green LEDs, 100-240VAC)  
V408-ALRDVH (red LEDs, 100-240VAC)  
V408-ALGNVL (green LEDs, 20-29VAC/VDC)  
V408-ALRDVL (red LEDs, 20-29VAC/VDC)

Provides a 5 Digit Display and Alarm Outputs from Thermocouple, RTD, Strain Gauge or DC Inputs



- Universal Field Configurable Input for TC, RTD, mV, bridge, 0-10V and 4-20mA Signals
- Modular Design Provides 3 Option Slots plus an Optional Modbus Communication Slot
- Option modules for 2<sup>nd</sup> Input, DC Retran, Sensor Excitation, 3 Digital Inputs & Outputs, and Relays
- Four Field Configurable Setpoints Support Combination Alarm Functions, Rate of Change, Deviation Alarms, Alarm Blocking and Latching/Non-latching
- NEMA 4 Front Panel with Plug-in From Front Design
- Power Supply: 85 to 264VAC or optional 20 to 29V DC or AC

### Description

The V408 is an 1/8 DIN, universal, 5 digit indicator with four alarms, two digital inputs and one SPDT relay output. Available with a green or red display, it accepts temperature inputs from J, K, T, L, N, R, S, B, C and Platinel II type thermocouples and three-wire Platinum 100 Ohm (Pt100) RTDs. Process variables such as 4-20mA, 1-5V and 0-10V as well as strain gauge bridge inputs can also be measured. Other thermocouple types or high accuracy 20 to 80 point custom linearization curves can be configured at the factory. Square root extraction or eight-point curve linearization can be user defined in the field. A second process input is available to accept remote setpoints and compare signals such as the average or difference, or selecting minimum or maximum readings.

Four programmable setpoint alarms can be field configured as rate of change, deviation high or low, non-latching and high or low or new, latching. The new alarm indicates the situation when a latched alarm has not been acknowledged and the measured value crosses the setpoint trip level a second time. The deviation alarm enables the user to reference alarm setpoints relative to a remote (main) setpoint from a controller. This remote setpoint would be a DC signal input to the optional 2<sup>nd</sup> process input module. Alarm hysteresis (deadband) can be configured from 1 to 9999 process variable units. Each alarm has a programmable delay up to 999.9 seconds.

The alarms can be linked to either the one standard relay output or up to three optional relay or digital output modules. These alarms can be configured in combination (e.g., one or all four alarms linked to one or all relays) and they will operate in fail-safe (i.e., normally energized) or non-fail-safe modes. Additionally, the display can be configured for password protection, limiting access to any or all functions. An alarm blocking function is also configurable to prevent alarm tripping during process start-up. Two digital input channels are provided to accept alarm acknowledgment (e.g., remote pushbutton). These two digital inputs or the optional triple-digital input modules can also be used for remote setpoint select, alarm acknowledge, process input select, bridge zero and span calibration and tare. Other functions include indicator control such as selecting full menu access, disabling the keypad lockout or simulating keypad functions.

The V408 indicator housing maintains a NEMA 4 (IP54) front panel seal and can be removed or unplugged from the front, without disconnecting any wiring. By disengaging the front panel clips the entire indicator and electronics can be quickly pulled from the panel.

Thermocouples, three-wire RTDs, bridge, voltage and mV signals can be accepted directly into the indicator. Current signals such as 4-20mA are input using the 2.49 Ohm shunt resistor included with the indicator and mounting hardware. The five-digit display (99999) is available in green or red and can be field configured to match the input signal range to the preferred engineering units. Offsets and two point slope adjustments are fully programmable to compensate for sensor variances.

### Application

The V408 is an excellent solution for temperature, pressure, level, flow and other process variable measurements. The modular design was developed to allow it to be optimally configured for most indication, alarm and data acquisition applications.

The wide variety of option modules and programming functions make the V408 a valuable plant-wide indication solution. For example, the secondary input enables functions such as differential measurement and summing with the use of K values for signal scaling. This function is useful in monitoring the mixing of products or raw materials. The deviation alarm can be used to ensure that a product is not diluted or spoiled by significant process excursions beyond the setpoint.

The field configurable V408 is an ideal standardized solution for a variety of temperature measurement and on-off control applications. For example, it can be used to control the heating and cooling elements in an oven or environmental control system using two setpoints for the high and low temperature limits. Similarly, a 4-20mA or bridge pressure signal can be monitored and the setpoints can be used to control or alarm the gas pressure or liquid levels in a tank. Weight, flow, pressure, temperature, speed, position and rate are just some of the process variables that can be accurately displayed and monitored with this flexible and effective indicator.

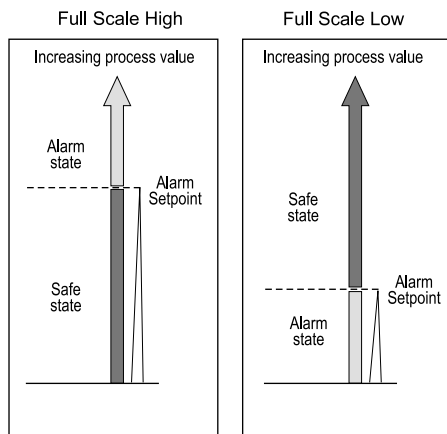
Table 1: Input & Display Ranges

Input	Display Range and Setpoint Min & Max Limits	
Pt100	-200 to 850° C	-325 to 1562° F
Type J	-210 to 1200° C	-340 to 2192° F
Type K	-200 to 1372° C	-325 to 2500° F
Type T	-210 to 400° C	-325 to 750° F
Type L	-200 to 900° C	-325 to 1650° F
Type N	-200 to 1300° C	-325 to 2370° F
Type R	-50 to 1768° C	-58 to 3200° F
Type S	-50 to 1768° C	-58 to 3200° F
Type B	0 to 1820° C	32 to 3308° F
Type P (Platinel II)	0 to 1369° C	32 to 2469° F
-9.99 to 80mV	-999 to 9999	
0 to 20mA	-999 to 9999	
4 to 20mA	-999 to 9999	
0 to 10V	-999 to 9999	

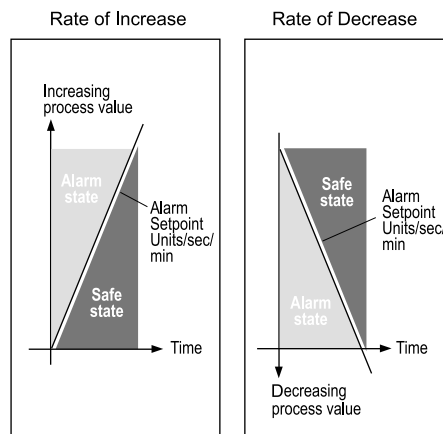
**Full Scale Alarms**

Alarm messages are flashed on the main display. Beacons flash for a new alarm and go steady when acknowledged. Four alarms are configured to operate as one of seven types.

**Full Scale Alarms**



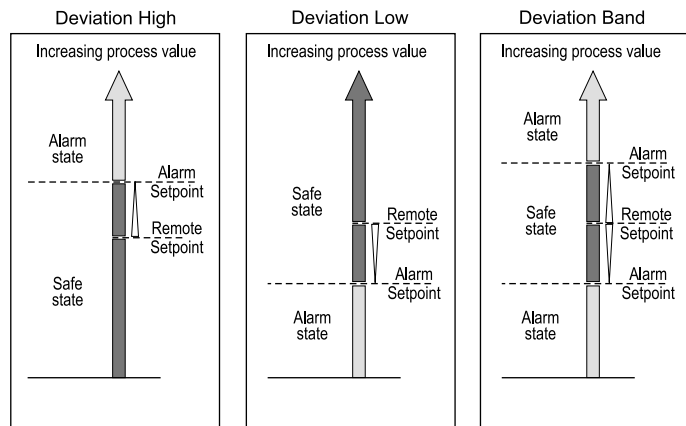
**Rate-of-Change Alarms**



**Deviation Alarms**

Deviation alarms operate on the difference between the process value and a remote setpoint input. The input is normally the retransmitted setpoint of the temperature controller. An alarm will be generated if the process value deviates from the setpoint by more than a preset amount. This is particularly useful for protecting a valuable product from excess temperature.

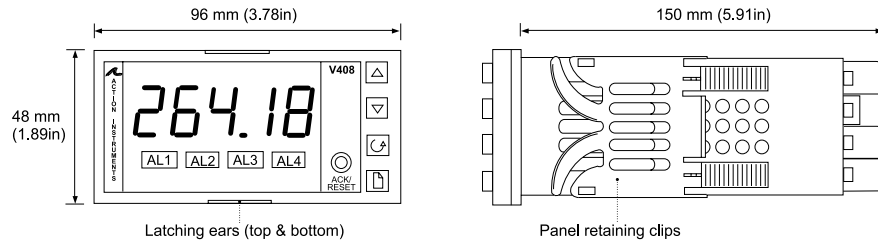
**Deviation from Setpoint Alarms**



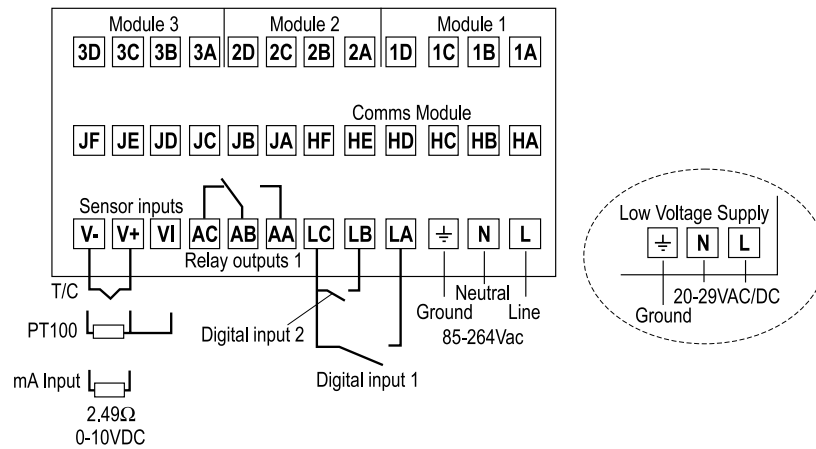
VisiPak™



## Dimensions

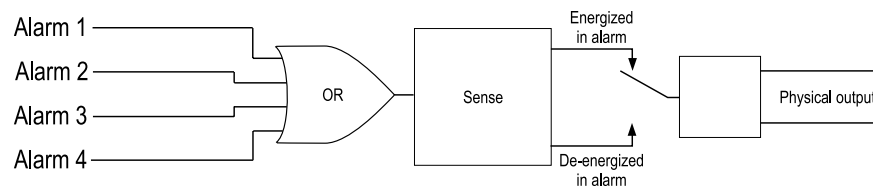


## Wiring



## Alarm Modes

Latching or non-latching operation can be selected and alarm delays can be applied. A special 'alarm blocking' mode is also available. With alarm blocking, after power ON, the alarm must first enter a safe state before the alarms will become active. This is particularly useful for low alarms which can be blocked while the process is warming up. Up to four alarms can be combined to activate one output.



Combining four alarms to activate one output

## Specifications

### Display:

5 digit (-9999 to 99999), 3 programmable decimal positions, red or green, 15.9mm (0.6 in.) high characters

### Inputs/Outputs:

Analog Process Value (including second input)  
Low Level Range: -100 to 100mV  
High Level Range: 0-20mA, 0-10V  
Sample Rate: 9Hz  
Resolution:  
<2mV for low levels, <2mV for high levels

### Linearity:

Better than 0.2°C

### Calibration Accuracy:

±0.2% of reading, or ± 1°C or ± 1LSD, whichever is greater

### User Calibration:

Low and high offsets can be applied

### Input Filtering:

Off to 999.9 seconds

### Thermocouples:

Types J, K, T, L, N, R, S, B and Platinel II

### Cold Junction:

In automatic mode, >30 to 1 rejection of ambient temperature change or external 0°C, 45°C, 50°C external references

3-wire Pt100: 0.3mA excitation current

### Functions, 2<sup>nd</sup> analog input:

2<sup>nd</sup> process value, remote setpoint, select min, select max., derived value

### Digital Inputs:

(contact closure or open collector)

### Digital Inputs 1 and 2:

switching voltage/current (non-isolated from the PV) 24VDC/20mA nominal  
Off state Resistance: <100 Ohms  
On State Resistance: >28K Ohms

### Triple Contact Inputs:

Specification is as per digital inputs 1 & 2, except inputs are functionally isolated

### Externally powered (triple logic inputs):

Off State: <5V DC

On State: 10.8 to 30V DC @ 2.5mA

### Functions:

Triple logic or contact inputs can be configured for disable, alarm acknowledge, keylock, remote setpoint select, PV input 2 select, and strain gauge 1&2 tare correction.

### DC Retransmission:

Range: Scaleable between 0-20mA and 0- 10VDC

Resolution: 1 part in 10,000

### Retransmission values:

Process value, setpoint or setpoint error

### Transmitter supply:

Rating: 20mA, 24V DC

### Strain gauge bridge supply:

Bridge voltage:

Software selectable, 5V or 10V DC

Bridge resistance: 300 Ohms to 10K Ohms

### Alarms:

Number: Four alarms

### Alarm types:

High, low, deviation high, deviation low, deviation band, rate of change (seconds or minutes), new alarm status, and sensor break.

### Alarm modes:

Latching or non-latching.

### Blocking:

Energized or de-energized (failsafe) in alarm

### Alarm delay:

Off to 999.9 seconds

### Communications:

#### Module types:

RS-232, 2-wire RS-485, and 4-wire RS-485

Protocols: Modbus

### Panel Sealing:

NEMA 4, or IP54 (EN60529)

### Dimensions:

96mm (3.78In.)W x 48mm (1.89In.)H  
x150mm (4.01In.)D

### EMC Compliance (CE Mark):

Emissions: EN50081-2

Immunity: EN50082-2

Safety: EN61010

### Temperature:

Operating: 0 to 55°C (32 to 131°F)

Storage: -30 to 75°C (-22 to 167°F)

### Humidity:

5 to 95%RH, non-condensing

### Power:

Standard 100 to 240VAC, -15%,+10%, optional 24V dc, -15%, +20%; 15 W max.

### Agency Approvals:

cUL approved per standard UL508.

CE conformance per EMC directive 89/336/EEC, amended by 93/68/EEC and Low Voltage Directive 73/23/EEC, amended by 93/68/EEC.

### Accessories

The VisiPak model V408 is shipped with mounting brackets, 2.49 Ohm shunt resistor and user manual. In addition, the following accessories are available:

<b>SUB2K-D5</b>	2nd Input
<b>SUB2K-R4</b>	Form C Relay
<b>SUB2K-D6</b>	DC Re-trans
<b>SUB2K-TK</b>	Triple Contact Input
<b>SUB2K-TL</b>	Triple Logic Input
<b>SUB2K-TP</b>	Triple Logic Output
<b>SUB2K-RR</b>	Dual Relay
<b>SUB2K-LR</b>	Logic Relay
<b>SUB2K-Y2</b>	485 Comms
<b>SUB2K-A2</b>	232 Comms
<b>SUB2K-F2</b>	422 Comms
<b>SUB2K-MS</b>	24V, 20mA Exc.
<b>SUB2K-G3</b>	5V, Transducer Exc.
<b>SUB2K-G5</b>	10V Transducer Exc.

## Ordering Information

### Specify:

1. Model Number:  
**V408 - ALGNVH** (Green LED, 100-240VAC)  
**V408 - ALRDVH** (Red LED, 100-240VAC),  
**V408 - ALGNVL** (Green LED, 20-29VAC)  
**V408 - ALRDVL** (Red LED, 20-29VAC),
2. Accessories: (see Accessories)
3. Optional Factory Configuration, specify C620 with the desired configuration information.



V430-0000 (no options)  
V430-1000 (2 relays, rate or count)  
V430-2000 (4-20mA output)  
V430-3000 (4-20mA and 2 relays, rate or count)

# VISIPAK™ V430

## Analog Input, Rate Indicator/ Totalizer/Batch Controller

Provides a Digital Display of Rate or Totalized  
Count from a DC Current or Voltage Input



- Field Configurable Input: 4-20mA, 1-5V, 0-5V, or 0-10V
- 6 Digit Display for Counts to  $\pm 999999$
- Independent Scaling for Rate & Total
- Programmable Square Root, 11 Pt Linearization & Peak Hold Functions
- NEMA 4 Front Panel
- Optional 2 Relay Output & 4-20mA Transmitter Output
- Isolated 24V Excitation Source

### Description

The V430 is a programmable, analog input LED indicator which displays either rate or the totalized count of the rate. The VisiPak housing provides a NEMA 4X water tight front panel that fits 1/8 DIN cutouts. The time base of the rate can be set for seconds, minutes, or hours (e.g., pulses per second, gallons per minute, or barrels per day) and the totalization factor can be set for conversion of rate units to totalization units (e.g., gallons per minute rate converted to totalized barrels). Additionally, square root, peak hold, low flow cut-off, square root and 11 point linearization functions are also included.

The four visual setpoint alarms are annunciated via individual front panel LEDs and come as standard on the unit. Two can be programmed to alarm on rate limits and two can be programmed to alarm on a specific count or total, complete with delays and offsets.

Two form C relays are available as optional outputs for the first two setpoints; either two for rate or two for totalized count. The rate alarms can be configured as high or low, failsafe or non-failsafe. Each rate setpoint has a 100% adjustable deadband (or reset point) which can be effectively used in on/off control applications or as a latching alarm. An isolated 4-20mA transmitter output that follows the rate input is also available.

The totalized count alarms can be configured to trip at an absolute or offset count (e.g., setpoint #1 trips 10 counts before setpoint #2), for applications where batch size varies. Additionally the Priority Batch Programming feature allows quick access to the setpoints by holding the ENTER button down for three seconds.

The V430 accepts 4-20mA, 0-20mA, 0-5V, 1-5V, 0-10V analog inputs and displays the rate or the totalized count, and can alternate between the rate and count display on a ten second cycle. The unit has an isolated 24V excitation source to power a two-wire transmitter or the optional 4-20mA output.

Field configuration of the input range, alarm function, and analog transmitter output scaling is quick and easy. The indicator is factory calibrated to rated accuracy and can be field adjusted as necessary.

Terminals are provided for both remote alarm acknowledgment and remote count reset.

A lockout jumper is used to limit access to the configuration buttons. The lockout function can be used to display only those variables needed for operator use.

### Application

The V430 is ideal for indication, control and alarming of any analog rate signal. The input range can be scaled for display as required.

The peak hold and setpoint alarms can be used for flow and container filling applications. Alarms are useful as annunciators for critical process variables such as excessive motor speed or low coolant flow.

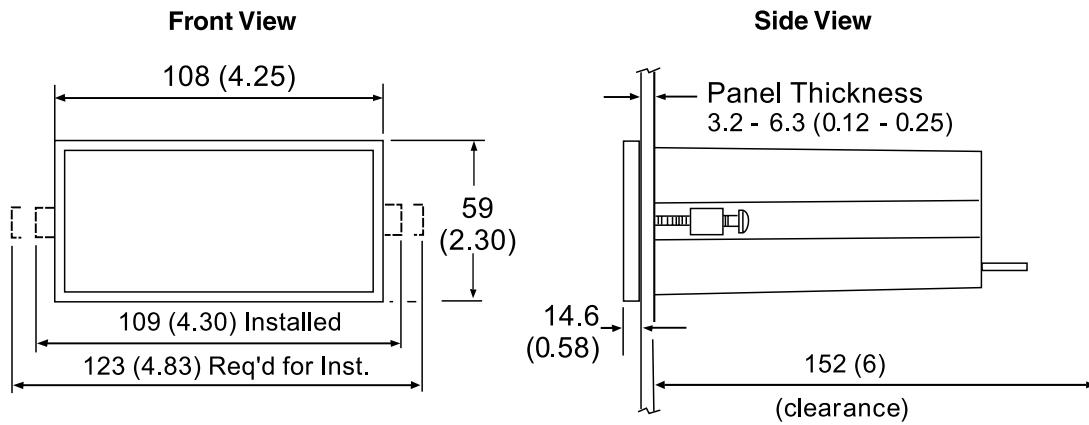
The unit accepts 11 user entered point-pairs for sensors with non-linear inputs. The square root function resolves flow from a differential pressure transducer across an orifice plate.

In all applications the highly visible 0.56 inch, eight-segment LEDs provide a clear reading of the measured variable. The NEMA 4X rating allows the V430 to be used in most industrial control panels under harsh environmental conditions.

The wide selection of scaling and control functions make the V430 an excellent choice as a standard totalizer, batch controller, rate indicator and alarm. Its versatility makes it a cost effective solution.

**Dimensions**

Dimensions in millimeters (inches)



**Notes:**

- 1. Panel cutout required: 45mm x 92mm (1.77" X 3.62") 1/8 DIN
- 2. Panel thickness: 3.2mm - 6.3mm (0.12" - 0.25")
- 3. Allow 152mm (6 inches) behind the panel
- 4. Weight 16oz. (454g)

# V430 Wiring Diagrams

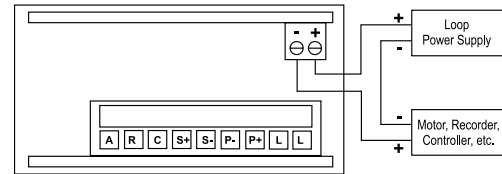
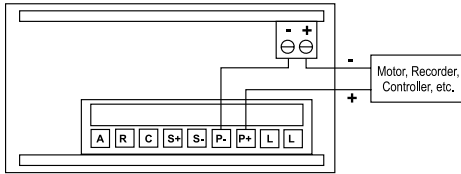
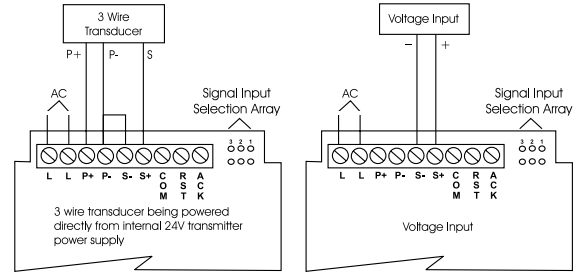
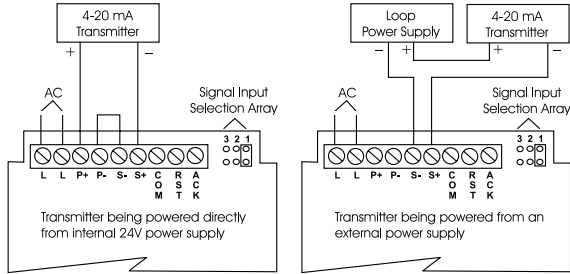
## Analog Input, Rate Indicator/Totalizer/Batch Controller

### Wiring Instructions

- All field connections to be made with insulated copper wire, either solid or stranded. Tighten all screw terminals to 7 in/lb. (0.8Nm). Strip length = 1/4 in (7mm). **DO NOT** pre-treat wire with solder.
- Terminals L & L:** Use AWG #12-18 wire, 600 volt, 60°C. Only one wire to each terminal.
- Terminals P+, P-, S-, S+, COM, RST & ACK:** Use AWG #12-22 wire, 150 volt, 60°C. If using AWG #20 or smaller wire, up to 2 wires can be connected to each terminal. If using AWG #18 or larger wire, only 1 wire can be connected to each terminal.

The jumper array is located at the rear of the instrument, next to the screw terminal block. Remove jumper J3 (if installed) to disable the Lockout feature.

Input Signal	Jumper 1:	Jumper 2:
1-5, 0-5 V	OFF	OFF
0-10V	OFF	ON
0-20, 4-20mA	ON	OFF

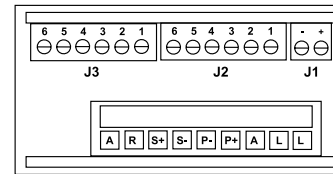


4-20mA output signal powered by the V430's internal 24V power supply.

4-20mA output signal powered by an external 24V power supply.

### Terminal Assignments

PIN	Function	Screw Terminal Block
1	Transmitter	J1
2	Transmitter	J1
1	Relay #1 Common	J2
2	Relay #1 NC	J2
3	Relay #1 NO	J2
4	Relay #2 Common	J2
5	Relay #2 NC	J2
6	Relay #2 NO	J2



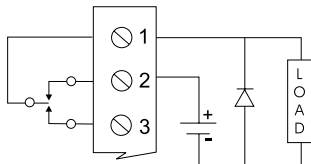
#### Notes:

- Alarm acknowledgment terminals (ACK and COM) are located on the meter main board.
- In the alarm condition, the NC contact is connected to common in the failsafe mode.
- J2 Terminals are for Total relays and J3 Terminals are for Rate relays.

### Switching Inductive Loads

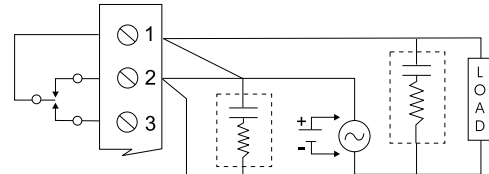
To minimize the effect of electrical noise and also prolong the life of the relay contacts, the use of a suppression network is recommended. RC networks can be purchased as an assembly. Refer to the following circuits for RC network assembly and installation:

#### Low Voltage DC Loads



Use a diode with a reverse breakdown voltage two to three times the circuit voltage and forward current at least as large as the load current.

#### AC & DC Loads



#### Choose R and C as follows

- R: 0.5 to 1 Ohm for each volt across the contacts
- C: 0.5 to 1 microfarad for each 1A through closed contacts

#### Notes:

- Use connectors rated for 240 VAC.
- Snubbers may affect load release time of solenoid loads, check to confirm proper operational mode.
- Install the RC network at the V430's relay screw terminals. An RC network can also be installed across the load. Experiment for best results.

## Specifications

### BASIC METER

#### Inputs:

Field selectable 4-20mA, 0-20mA, 0-5V, 1-5V, 0-10V

#### Calibration Range:

4mA (1V) input can be set anywhere in range of the meter; 20mA (5V) can be set anywhere above or below 4mA (1V) input.

#### Loop Power:

Isolated, up to 20 mA at 24VDC regulated  $\pm 5\%$ , noise less than 10mVpp. Max. loop resistance of 1200 Ohms. Use to power either external transmitter or 4-20mA output signal.

#### Linear Input Accuracy:

0.05% of calibrated span,  $\pm 1$  count

#### Square Root Extraction Accuracy:

$\pm 0.1\%$  F.S.  $\pm 1$  count from 10-100% of flow,  $\pm 1\%$  F.S. (0-10% flow)

#### Minimum Input Span:

1.6 mA between points

#### Input Impedance:

Voltage ranges; greater than 300k Ohms  
Current ranges; 100 Ohms

#### Display:

6 digit, 0.56" (14.2mm) high efficiency red LED.  
Rate: 0 to 29,999(0) with selectable extra zero.  
Total: 0 to 999,999. Automatic lead zero blanking.

#### Alternating Display:

Display can be programmed to alternate between rate and total every 10 sec.

#### Power:

115VAC  $\pm 10\%$ , 50/60 Hz, 10VA

#### Totalize:

Calculates total based on rate and field prog. multiplier to display total in engineering units.

#### Total Reset:

Via front panel ENTER button, external contact closure at terminals RST and COM, or automatic via user selectable preset value #2.

#### Peak Hold:

Captures the peak rate and displays it via the front panel ENTER button.

#### Peak Hold Indication:

Front panel flashing "R" LED

#### Low Flow Cutoff:

1 count to 100% F.S., user selectable. To disable low flow cutoff, program cutoff value to zero.

#### Rollover:

Totalizer "rolls over" when display exceeds 999,999. Relay status reflects display.

#### Lockout:

Jumper at rear of instrument restricts modification of calibration values.

#### Temperature/Humidity:

Operating range: 0 to +65°C

Storage range: -40 to +85°C

RH: 0 to 90%, non-condensing

#### Front Panel/Enclosure:

NEMA 4X, panel gasket provided/1/8 DIN, high impact plastic, UL 94V-0

#### Connections:

Removable screw terminal block

#### RELAYS (OPTIONAL)

##### Rating:

2 SPDT (form C); rated 2Amp @ 30VDC

or 2Amp @ 250VAC resistive load;

1/14 HP @ 125/250VAC for inductive loads

#### Totalizer Presets:

Relays #1 and #2 are assigned to total and can be programmed anywhere in the range of the meter; relays trip when total exceeds preset value and reset when total is reset to zero. #2 preset is user programmable to reset total to zero when preset value is reached. A delay between 1 and 999 seconds can be programmed before relays #1 and #2 reset.

#### Preset Value Tracking:

Relay #1 can be programmed to trip at any point below relay #2 preset value. If relay offset mode is selected, relay #1 will always trip at programmed offset value before relay #2 trips, eg., if the relay offset is set at 10 then relay #1 will trip at 10 counts before relay #2.

#### Rate Relays:

#3 & #4 assigned to rate, any combination of high or low alarms.

#### Rate Alarm Deadband:

0-100% of full scale, user selectable

#### TRANSMITTER (OPTIONAL)

##### Calibration Range:

The transmitter output (4-20mA) can be calibrated so that a 4mA output is produced for any rate displayed on the meter. The 20mA output must correspond to any rate that is at least 501 counts greater than or 501 counts less than the rate corresponding to 4mA (for example, 4mA = 0, 20mA = 501). If the span from 4 to 20mA is less than 501 counts, an error message will appear.

##### Output Loop Resistance:

24VDC: 10 Ohms min; 600 Ohms max

35VDC max (ext): 600 Ohms min; 1k Ohms max

##### Accuracy:

$\pm 0.1\%$  F.S.,  $\pm 0.004$ mA

##### Isolation:

500VDC or peak AC, input-to-output or input/output-to-power line

##### External Loop Power Supply:

35Vmax

## Ordering Information

### Specify:

#### 1. Model Number:

**V430-0000** (no options),

**V430-1000** (2 relays, rate or count)

**V430-2000** (4-20mA output)

**V430-3000** (4-20mA and 2 relays, rate or count)

#### 2. Power: 115VAC (standard)

#### 3. Optional Factory Configuration. Specify **C620** with the desired configuration information.



- V432-0000 (no options)
- V432-1000 (2 relay outputs)
- V432-2000 (4-20mA outputs)
- V432-3000 (4-20mA and 2 relay outputs)

# VISIPAK™ V432

## Temperature Input, Digital Indicator

Provides a Digital Display of Temperature from RTD and Thermocouple Inputs



- Field Configurable Input Accepts Pt100 Ohm RTDs and J, K, T, E, R & S Type Thermocouples
- RTD Display to 1° or 0.1°
- 4 Visual Alarm Points with Front Panel LED Status
- NEMA 4 Front Panel
- Optional 2 Relay Output & 4-20mA Transmitter Output
- 115VAC Power Supply std; 24VDC optional

### Description

The V432 is a versatile, field configurable, 1/8 DIN, RTD and thermocouple input LED indicator. Four visual setpoint alarms are annunciated via individual front panel LEDs and are a standard feature of the V432. The unit has a front panel NEMA 4X rating.

Two form C relays are available as optional outputs for the first two setpoints. They can be configured as high or low, failsafe or non-failsafe. Each setpoint has a 100% adjustable deadband (or reset point) which can be effectively used in on/off control applications or as a latching alarm. An isolated 4-20mA transmitter output is also available as an option.

The V432 accepts types J, K, T, E, R, and S thermocouples and 100 Ohm Pt RTD (0.00385 and 0.00392 alpha curves) and displays temperature with 1 degree resolution (°F or °C). In addition, type T thermocouple and the 100 Ohm Pt RTD can be displayed at 0.1 degree resolution.

Field configuration of the input type, alarm function, and analog transmitter output scaling is simple. The indicator is factory calibrated to rated accuracy and can be field adjusted as necessary.

A front panel button is used for acknowledgment of alarms. Wiring terminals are also provided for remote alarm acknowledgment.

A lockout jumper is used to limit access to configuration functions. When in the lockout mode, only alarm setpoints and output scaling functions are displayed and cannot be altered.

### Application

The V432 is ideal for indication, control and alarming of process temperature variables. The unit can be used on heating and cooling systems to maintain the required temperature range, providing on/off control for refrigeration, oven or kiln applications. It can be used as a high or low temperature alarm and the current transmitter output can feed a multi-loop controller for zone furnace applications.

In all applications, the highly visible 0.56 inch, eight-segment LEDs provide a clear reading of the measured temperature. Constructed to withstand corrosion and moisture, the NEMA 4X rated V432 can be used in most industrial control panels under harsh environmental conditions.

The field configurable design and wide selection of input and output types makes the V432 an excellent choice as a standard temperature display and alarm.

Table 1: V432 Input Ranges

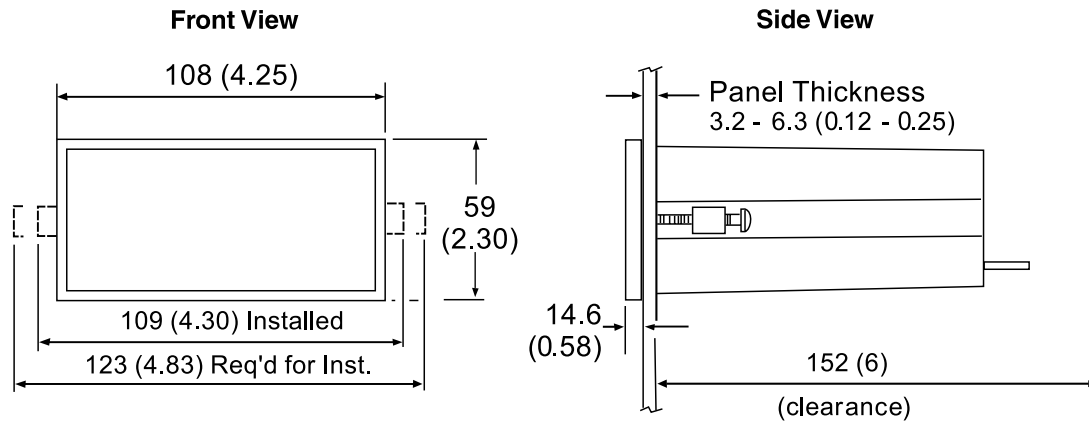
Sensor Type	Range	Accuracy
Type J Thermocouple	-328 to 1382° F -200 to 750° C	+/-1.4° F +/-0.8° C
Type K Thermocouple	-328 to 2498° F -200 to 1330° C	+/-1.7° F +/-0.9° C
Type T Thermocouple	-330 to 760° F -200 to 404° C	+/-1.5° F* +/-0.8° C**
Type E Thermocouple	-328 to 1832° F -200 to 1000° C	+/-1.4° F +/-0.8° C
Type R Thermocouple	32 to 3213° F 0 to 1767° C	+/-4.8° F +/-2.7° C
Type S Thermocouple	40 to 3214° F 4 to 1768° C	+/-5.7° F +/-2.9° C
100 Ohm RTD	-328 to 1382° F -200 to 750° C	+/-0.6° F +/-0.3° C

\*The accuracy from -450° F to -331° F is +/-4.6° F

\*\*The accuracy from -263° C to -201° C is +/-2.6° C

## Dimensions

Dimensions in millimeters (inches)



### Notes:

1. Panel cutout required: 45mm x 92mm (1.77" X 3.62") 1/8 DIN
2. Panel thickness: 3.2mm - 6.3mm (0.12" - 0.25")
3. Allow 152mm (6 inches) behind the panel
4. Weight 16oz. (454g)

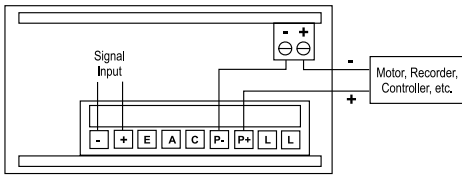
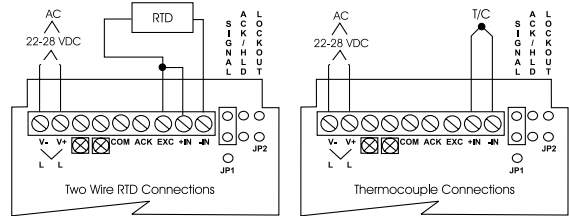
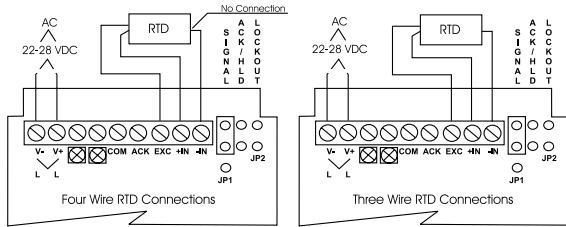


# Model V432 Wiring Diagrams

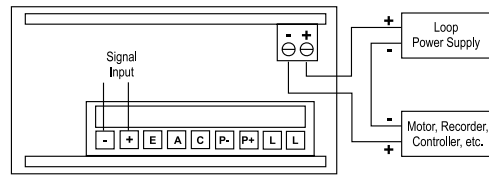
## Temperature Input Digital Indicator

### Wiring Instructions

- All field connections to be made with insulated copper wire, either solid or stranded. Tighten all screw terminals to 7 in/lb. (0.8Nm). Strip length = 1/4 in (7mm). **DO NOT** pre-treat wire with solder.
- Terminals L & L:** Use AWG #12-18 wire, 600 volt, 60°C. Only one wire to each terminal.
- Terminals +, -, EXC, ACK/HLD & COM:** Use AWG #12-22 wire, 150 volt, 60°C. If using AWG #20 or smaller wire, up to 2 wires can be connected to each terminal. If using AWG #18 or larger wire, only 1 wire can be connected to each terminal.



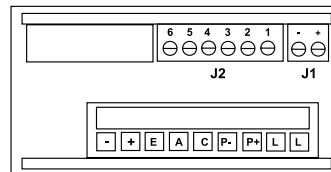
4-20mA output signal powered by the V432's internal 24V power supply.



4-20mA output signal powered by an external 24V power supply.

### Terminal Assignments

PIN	Function	Screw Terminal Block
1	Transmitter	J1
2	Transmitter	J1
1	Relay #1 Common	J2
2	Relay #1 NC	J2
3	Relay #1 NO	J2
4	Relay #2 Common	J2
5	Relay #2 NC	J2
6	Relay #2 NO	J2



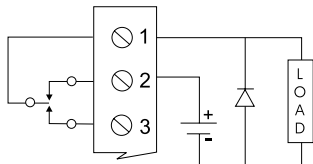
#### Notes:

- Alarm acknowledgment terminals (ACK and COM) are located on the meter main board.
- In the alarm condition, the NC contact is connected to common in the failsafe mode.

### Switching Inductive Loads

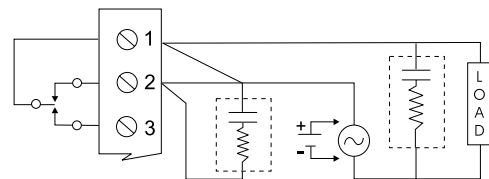
To minimize the effect of electrical noise and also prolong the life of the relay contacts, the use of a suppression network is recommended. RC networks can be purchased as an assembly. Refer to the following circuits for RC network assembly and installation:

#### Low Voltage DC Loads



Use a diode with a reverse breakdown voltage two to three times the circuit voltage and forward current at least as large as the load current.

#### AC & DC Loads



#### Choose R and C as follows

- R: 0.5 to 1 Ohm for each volt across the contacts
- C: 0.5 to 1 microfarad for each 1A through closed contacts

#### Notes:

- Use connectors rated for 240 VAC.
- Snubbers may affect load release time of solenoid loads, check to confirm proper operational mode.
- Install the RC network at the V430's relay screw terminals. An RC network can also be installed across the load. Experiment for best results.

## Specifications

### BASIC METER

#### Inputs:

Field selectable, type J, K, T, E, R, or S thermocouples with 1° resolution; type T to 0.1°; 100 Ohm platinum RTD (0.00385 or 0.00392 curve) to 1° or 0.1° resolution.

#### Display:

14.2mm (0.56") high efficiency red LEDs, 4-1/2 digits. "F" or "C" can be switched on to indicate Fahrenheit or Celsius.

#### Cold Junction Reference:

Automatic, fixed, no user calibration needed.

#### T/C Open Indication:

Open thermocouple circuit indicated by display flashing 'OPEN'. Relays will remain in same state prior to open T/C condition.

#### Hold Reading:

Connect switch to ACK/HLD and COM terminals, also connect JP1 HLD pins.

#### Accuracy:

See Input Ranges table.

#### Lockout:

Jumper JP2 at rear of instrument restricts modification of calibration values.

#### Input Impedance:

>100k Ohms

#### Power:

115 VAC  $\pm$ 10%, 50/60Hz, 10VA (std)  
18-36VDC (optional)

#### Common/Normal Mode Rejection:

110dB/64dB at 50-60Hz

#### Temperature/Humidity:

Operating range: 0 to 65°C  
Storage range: -40 to 85°C  
RH: 0 to 90%, non-condensing

#### Front Panel/Enclosure:

NEMA 4X, panel gasket provided/1/8 DIN, high impact plastic, UL 94V-0

#### Connections:

Removable screw terminal block (provided), accepts 24 to 12 AWG.

#### Alarm Points:

4, any combination of high or low alarms, front panel LED indicated.

#### Alarm Deadband:

0-100% of full scale, user selectable.

### RELAYS (OPTIONAL)

#### Rating:

2 SPDT (form C); rated 2Amp @ 30VDC or 2Amp @ 250 VAC resistive load; 1/14 Hp @ 125/250 VAC for inductive loads.

### TRANSMITTER (OPTIONAL)

#### Calibration Range:

The transmitter output (4-20mA) can be calibrated so that a 4mA output is produced for any number displayed on the meter. The 20mA output can correspond to any other (larger or smaller) number displayed on the meter. However, best results are obtained with a 501 (minimum) count difference between the 4 & 20mA output displays.

#### Loop Power:

Isolated, up to 20mA at 24VDC regulated  $\pm$  5%, noise less than 10mV p-p max. To power the 4-20mA output signal.

#### Output Loop Resistance:

Between 10 and 600 Ohms when using the built in 24 Volt power supply.  
Between 600 and 1000 Ohms when using an external 35 Volt power supply.

#### External Loop Power Supply:

35V max.

#### Accuracy:

$\pm$  0.1% F.S.,  $\pm$  .004mA

#### Isolation:

500VDC or peak AC, input-to-output or input/output-to-power line.

## Ordering Information

### Specify:

1. Model number:  
**V432-0000** (no options)  
**V432-1000** (2 relays)  
**V432-2000** (4-20mA output)  
**V432-3000** (4-20mA and 2 relays)
2. Power: 115VAC (standard),  
18-36VDC (optional)
3. Optional Factory Configuration, specify **C620** with the desired configuration information.



- V434-0000 (no options)
- V434-1000 (2 relay outputs)
- V434-2000 (4-20mA output)
- V434-3000 (4-20mA and 2 relay outputs)

# VISIPAK™ V434

## Bridge/Strain Gauge Input, Digital Indicator

Provides a Digital Display from Bridge & Strain Gauge mV Inputs



- Field Configurable Input Accepts 0-30mV, 0-200mV,  $\pm 15\text{mV}$  and  $\pm 100\text{mV}$
- Field Configurable Excitation Source 5V, 10V & 24VDC
- 4-1/2 Digit Display for up to  $\pm 199990$  Count Spans
- 4 Visual Alarm Points with Front Panel LED Status
- NEMA 4 Front Panel
- Optional 2 Relay Output & 4-20mA Transmitter Output
- Programmable Tare and Peak Hold Functions

### Description

The V434 is a 1/8 DIN, field configurable, bridge and strain gauge input LED indicator. Four visual setpoint alarms are annunciated via individual front panel LEDs and are a standard feature of the V434. Programmable tare and peak hold functions are incorporated for weight and pressure measurement applications. The unit has a front panel NEMA 4X rating.

Two form C relays are available as optional outputs for the first two setpoints. They can be configured as high or low, failsafe or non-failsafe. Each setpoint has a 100% adjustable deadband (or reset point) which can be effectively used in on/off control applications or as a latching alarm. An isolated 4-20mA transmitter output is also available as an option.

The V434 accepts 0-30mV, 0-200mV,  $\pm 15\text{mV}$ , and  $\pm 100\text{mV}$  inputs, which can be scaled as desired between  $\pm 199990$  with a programmable decimal point (minimum span is 501 counts). The unit includes an isolated, field configurable 5V, 10V or 24V excitation source to power a bridge or strain gauge, or the optional two-wire transmitter output.

Field configuration of the input range, alarm function, and analog transmitter output scaling is simple. The indicator is factory calibrated to rated accuracy and can be field adjusted as necessary.

The programmable tare function can accept a measured value by using the TARE button or a tare value can be input via the display, using the ENTER button. Terminals are provided for remote alarm acknowledgment.

A lockout jumper is used to limit access to configuration functions. When the lockout mode is enabled, only tare, peak, alarm setpoints and output scaling functions are displayed and, except for the tare, cannot be altered without moving the jumper.

### Application

The V434 is ideal for indication, control and alarming of any bridge or strain gauge signals. It can be used to display whatever process measurement is required for weight, pressure, tension and compression applications.

The tare function and setpoint alarms can be used for weight control on a scale; tare function can zero the container weight and the setpoints can be used for fast and slow fill rates. Alarms are useful as annunciators for a critical process variable such as excessive pressure in a vessel or weight on a conveyor.

An 11 point-pair custom curve can be user entered for non-linear sensors.

In all applications, the highly visible 0.56 inch, eight-segment LEDs provide a clear reading of the measured variable. Constructed to withstand corrosion and moisture, the NEMA 4X rated V434 can be used in most industrial control panels under harsh environmental conditions.

The field configurable design and wide selection of input and output types makes the V434 an excellent choice as a standard pressure display, weight display and alarm. The versatility of the V434 makes it a cost effective solution.

Table 1: V434 Input Ranges

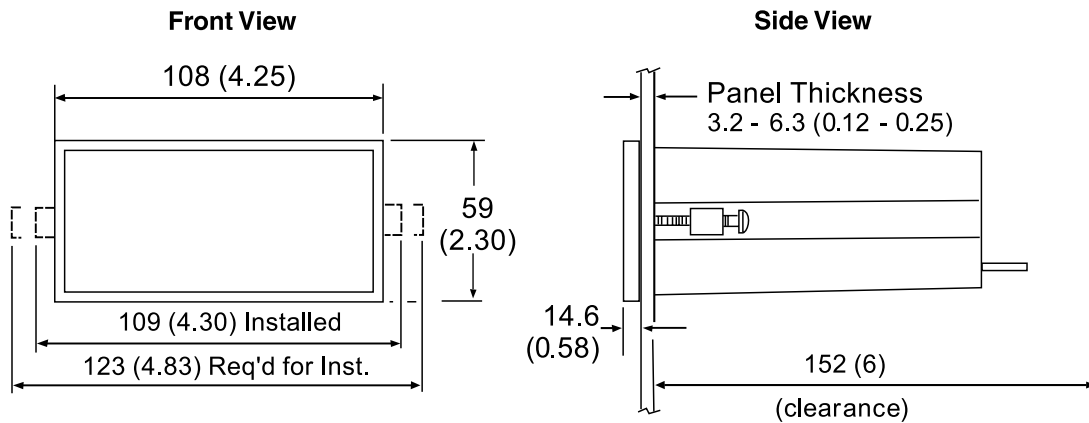
Input	Minimum Span
0 to 30mV	1.0mV
0 to 200mV	5.0mV
-15 to 15mV	1.0mV
-100 to 100mV	5.0mV

Set the configuration Switch (SW1) for the desired Input and Excitation per the chart below. The Configuration Switch is located at the rear of the instrument next to the screw terminal block. Set switch 8 to the OFF position to disable the Lockout feature.

Function	Configuration Switch SW1							
	8	7	6	5	4	3	2	1
Ratiometric with Internal Excitation		ON	ON					
Ratiometric with External Excitation		OFF	OFF					
0 to 30mV Input				ON	OFF			
0 to 100mV Input				OFF	OFF			
+/-15mV Input				ON	ON			
+/-100mV Input				OFF	ON			
24VDC Excitation						OFF	OFF	ON
10VDC Excitation						ON	OFF	OFF
5VDC Excitation						OFF	ON	OFF
Lockout Features	ON							

### Dimensions

Dimensions in millimeters (inches)



### Notes:

1. Panel cutout required: 45mm x 92mm (1.77" X 3.62") 1/8 DIN
2. Panel thickness: 3.2mm - 6.3mm (0.12" - 0.25")
3. Allow 152mm (6 inches) behind the panel
4. Weight 16oz. (454g)

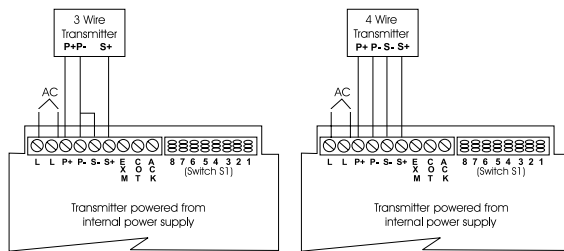
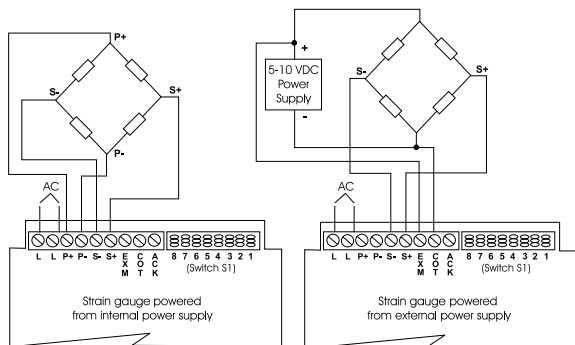
VisiPak™

# Model V434 Wiring Diagrams

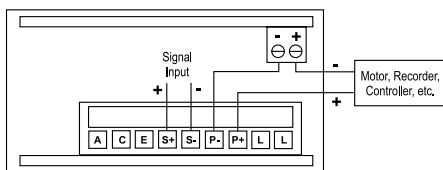
## Bridge/Strain Gauge Input, Digital Indicator

### Wiring Instructions

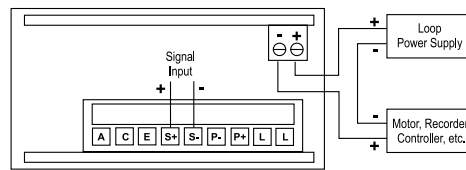
- All field connections to be made with insulated copper wire, either solid or stranded. Tighten all screw terminals to 7 in./lb. (0.8Nm). Strip length = 1/4 in (7mm). **DO NOT** pre-treat wire with solder.
- Terminals L & L:** Use AWG #12-18 wire, 600 volt, 60°C. Only one wire to each terminal.
- Terminals P+, P-, S-, S+, EXC, COM & ACK:** Use AWG #12-22 wire, 150 volt, 60°C. If using AWG #20 or smaller wire, up to 2 wires can be connected to each terminal. If using AWG #18 or larger wire, only 1 wire can be connected to each terminal.



For 2 wire mV signals connect the positive lead to S+ and negative to S-.



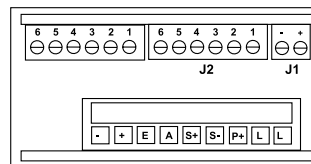
4-20 mA output signal powered by the V434's internal 24V power supply



4-20 mA output signal powered by an external 24V power supply

### Terminal Assignments

PIN	Function	Screw Terminal Block
1	Transmitter	J1
2	Transmitter	J1
1	Relay #1 Common	J2
2	Relay #1 NC	J2
3	Relay #1 NO	J2
4	Relay #2 Common	J2
5	Relay #2 NC	J2
6	Relay #2 NO	J2



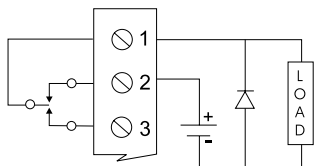
#### Notes:

- Alarm acknowledgment terminals (ACK and COM) are located on the meter main board.
- In the alarm condition, the NC contact is connected to common in the failsafe mode.

### Switching Inductive Loads

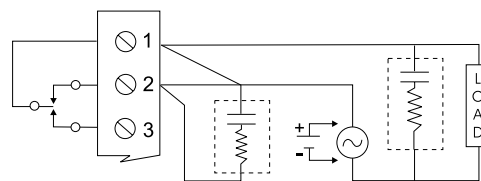
To minimize the effect of electrical noise and also prolong the life of the relay contacts, the use of a suppression network is recommended. RC networks can be purchased as an assembly. Refer to the following circuits for RC network assembly and installation:

#### Low Voltage DC Loads



Use a diode with a reverse breakdown voltage two to three times the circuit voltage and forward current at least as large as the load current.

#### AC & DC Loads



#### Choose R and C as follows

- R: 0.5 to 1 Ohm for each volt across the contacts
- C: 0.5 to 1 microfarad for each 1A through closed contacts

#### Notes:

- Use connectors rated for 240 VAC.
- Snubbers may affect load release time of solenoid loads, check to confirm proper operational mode.
- Install the RC network at the V430's relay screw terminals. An RC network can also be installed across the load. Experiment for best results.



## Specifications

### BASIC METER

#### Inputs:

Field selectable: 0-30mV, 0-200mV,  $\pm 15$ mV, and  $\pm 100$ mV

#### Ratiometric Compensation:

Deviation less than 0.1% of full scale,  $\pm 1$  count, with  $\pm 10\%$  variation in excitation voltage.

#### Display:

0.56" (14.2mm) high efficiency red LEDs, 4 1/2 digits + extra zero can be switched on to display  $\pm 19999(0)$ . Leading zeros blanked.

#### Calibration Range:

Minimum (0mV) input can be set anywhere in range of the meter. Maximum (200mV) can be set anywhere above or below the minimum (0mV) input.

#### Isolated Power Supply:

Selectable 5VDC or 10VDC,  $\pm 5\%$  @ 50mA, 24VDC,  $\pm 5\%$  @ 20mA. Noise less than 10mVpp. Available for either signal input or 4-20mA output option (not both). Max. loop resistance of 1200 Ohms.

#### Peak Hold:

Captures the peak reading and displays it via front panel ENTER button.

#### Tare:

Capture - Sets current display to zero via front panel TARE button. Programmable - Automatically sets TARE to a preset value.

#### Accuracy:

0.05% of calibrated span,  $\pm 1$  count.

#### Zero Stability:

0.5mV/ $^{\circ}$ C

#### Span Stability:

0.005% of full scale / $^{\circ}$ C

#### Sensitivity:

Max 0.6mV

#### Lockout:

Switch 8 at rear of instrument restricts modification of calibrated values.

#### Input Impedance:

20k Ohms

#### Power:

115 VAC  $\pm 10\%$ , 50/60Hz, 10VA

#### Isolation:

500VDC or peak AC, input to output or input/output to power line.

#### Common/Normal Mode Rejection:

120dB/60dB at 60Hz

#### Overload Protection:

30VDC or VAC across inputs or input to gnd

#### Temperature/Humidity:

Operating range: 0 to 65 $^{\circ}$ C

Storage range: -40 to 85 $^{\circ}$ C

RH: 0 to 90%, non-condensing

#### Front Panel/Enclosure:

NEMA 4X, panel gasket provided/1/8 DIN, high impact plastic, UL 94V-0.

#### Connections:

Removable screw terminal block (provided), accepts 24 to 12 AWG.

#### Alarm Points:

4, any combination of high or low alarms, front panel LED, Indication

#### Alarm Deadband:

0-100% of full scale, user selectable.

#### 11 Point Linearization:

See Input Spans table. Example, min. span for a 11 point 30mV calibration is 1mV between inputs.

#### RELAYS (OPTIONAL)

##### Rating:

2 SPDT (form C); rated 2Amp @ 30VDC or 2 Amp @ 250VAC resistive load; 1/14 HP @ 125/250VAC for inductive loads.

#### TRANSMITTER (OPTIONAL)

##### Calibration Range:

The transmitter output (4-20mA) can be calibrated so that a 4mA output is produced for any number displayed on the meter. The 20mA output must correspond to any rate that is at least 501 counts greater than or 501 counts less than the rate corresponding to 4mA (for example, 4mA = 0, 20mA = 501). If the span from 4 to 20mA is less than 501 counts, an error message will appear.

##### Loop Power:

Isolated, up to 20mA at 24VDC regulated  $\pm 5\%$ , noise less than 10 mV p-p. Use to power the 4-20mA output signal.

##### Output Loop Resistance:

1500 Ohms max. using external loop power supply. 500 Ohms max. using built-in loop-power supply.

##### External Loop Power Supply:

35V max.

##### Accuracy:

$\pm 0.1\%$  F.S.,  $\pm .004$ mA

## Ordering Information

### Specify:

- Model Number:  
**V434-0000** (no options)  
**V434-1000** (2 relays)  
**V434-2000** (4-20mA output)  
**V434-3000** (4-20mA and 2 relays)
- Power:  
115VAC (standard),
- Optional Factory Configuration, specify **C620** with the desired configuration information.



V437-0000 (no options)  
V437-1000 (2 relays, rate or count)  
V437-2000 (4-20mA output)  
V437-3000 (4-20mA and 2 relays, rate or count)

# VISIPAK™ V437

## Frequency/Pulse Input, Rate Indicator/ Totalizer/Batch Controller

Provides a Digital Display of Rate or Totalized Count  
from a Frequency or Pulse Input



- Field Configurable Input Accepts Pulse, Open Collector, Switch Closure, TTL or Square Wave
- 6 Digit Display for Counts up to +999999
- 4 Visual Alarm Points with Front Panel LED Status
- Programmable 11 Point Linearization and Peak Hold Functions
- NEMA 4 Front Panel
- Isolated 12V and 24V Excitation Source
- Optional 2 Relay Output & 4-20mA Transmitter Output

### Description

The V437 is a 1/8 DIN programmable, frequency or pulse input LED indicator which displays either a totalized count or the pulse rate, complete with scaling k-factor function.

The programmable k-factor for pulse scaling ensures that the display can be configured to show the preferred engineering units (e.g Gallons, GPM, Barrels, BPD, ppm, Hz, etc.) as they relate to the number of pulses. Additionally, peak-hold, low flow cut-off, and 11 point linearization functions are also included.

Four visual setpoint alarms are annunciated via individual front panel LEDs and are included as standard on the unit. Two can be programmed to alarm on rate limits and two can be programmed to alarm on a specific count or total, complete with delays and offsets.

Two form C relays are available as optional outputs for the setpoints; either two for rate or two for totalized count. The rate alarms can be configured as high or low, failsafe or non-failsafe. Each rate setpoint has a 100% adjustable deadband (or reset point) which can be effectively used in on/off control applications or as a latching alarm.

The totalized count alarms can be configured to trip at an absolute count or one can be programmed to trip at an offset count (e.g., setpoint #1 trips 10 counts before setpoint #2) for applications where batch size varies. Additionally, the Priority Batch Programming feature allows quick access to the setpoints by holding the ENTER button down for three seconds.

An isolated 4-20mA transmitter output that follows the rate input is also available as an option, with or without the two relays.

The V437 accepts pulse, open collector, switch closure, TTL or square wave frequency inputs and displays the rate or the totalized count. The display can alternate between rate and count every ten seconds. There is an isolated, field configurable 12V or 24V excitation source to power open collector and contact closure transducer inputs.

Field configuration of the input range, alarm function, and analog transmitter output scaling is simple. The indicator is factory calibrated to rated accuracy and can be field adjusted as necessary.

Terminals are provided for remote alarm acknowledgment and remote count reset.

A lockout jumper is used to limit access to the configuration functions. The unit can be programmed to display only those variables needed for operator use.

### Application

The V437 is ideal for indication, control and alarming of any pulse or frequency signals. It can be scaled to display whatever process flow, rate, speed or counted quantity is desired.

The peak hold and setpoint alarms can be used for flow and container filling applications. Alarms are useful as annunciators for critical process variables such as excessive motor speed or low coolant flow.

The highly visible 0.56 inch, eight-segment LEDs provide a clear reading of the measured variable. Constructed to withstand corrosion and moisture, the NEMA 4X rated V437 can be used in most industrial control panels under harsh environmental conditions.

The field configurable design and wide selection of scaling and control functions makes the V437 an excellent choice as a standard totalizer, batch controller, rate indicator and alarm. The versatility of the V437 makes it a cost effective solution since it incorporates many indicator and controller functions in a single display.

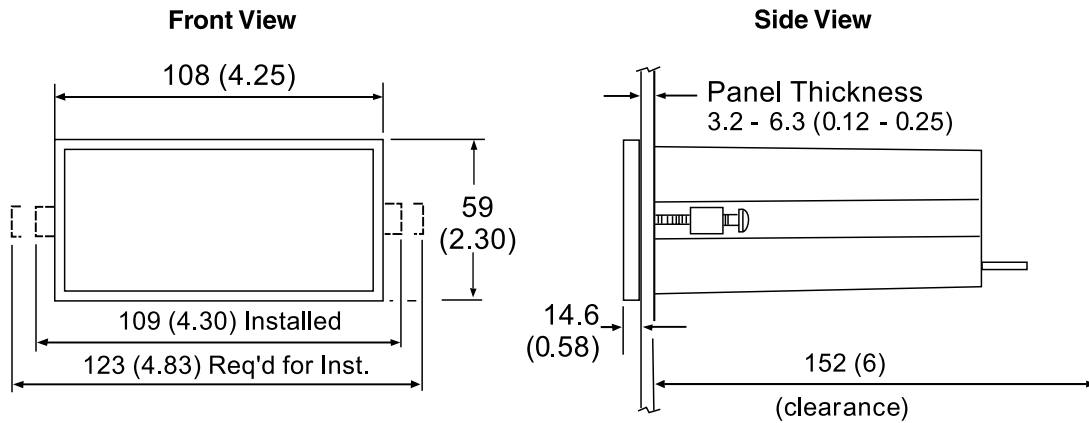
Program the jumper selection array and switch S1 for desired input and excitation per Table 1 below. The jumper array is located at the rear of the instrument, next to the screw terminal block. Remove jumper JP2 to disable lockout feature.

Table 1: Jumper Settings

Function	Jumper				
	JP1	JP2	JP5 (1-2)	JP5 (2-3)	S1
mV Pulse Input			OFF	ON	mV
5V Pulse Input			ON	OFF	V
12V Pulse Input			OFF	ON	V
12VDC Excitation	ON				
24VDC Excitation	OFF				
Lockout Features		ON			

**Dimensions**

Dimensions in millimeters (inches)



**Notes:**

1. Panel cutout required: 45mm x 92mm (1.77" X 3.62") 1/8 DIN
2. Panel thickness: 3.2mm - 6.3mm (0.12" - 0.25")
3. Allow 152mm (6 inches) behind the panel
4. Weight 16oz. (454g)

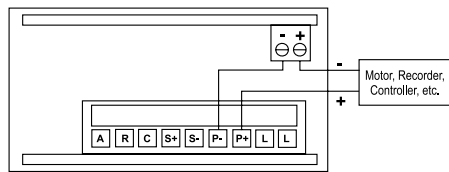
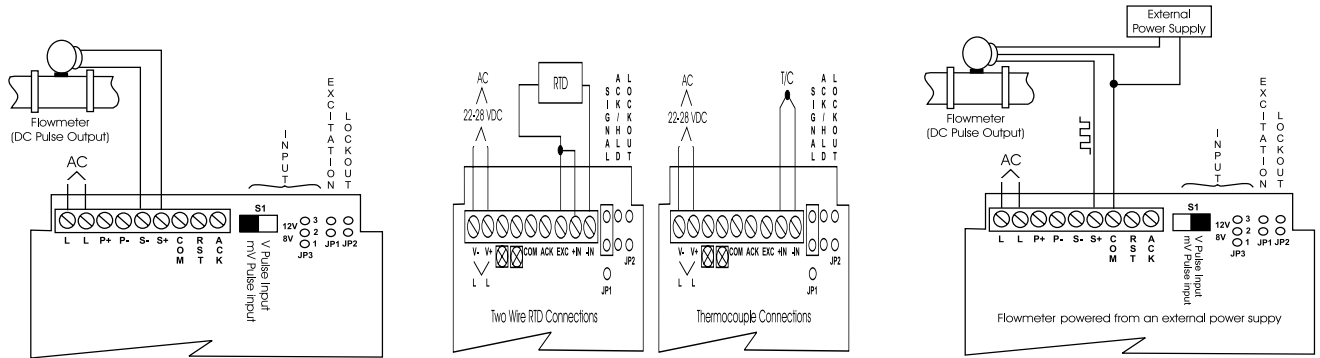


# Model V437 Wiring Diagrams

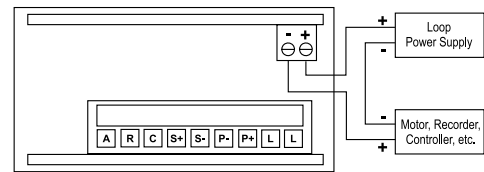
## Frequency/Pulse Input, Rate Indicator/Totalizer/Batch Controller

### Wiring Instructions

- All field connections to be made with insulated copper wire, either solid or stranded. Tighten all screw terminals to 7 in/lb. (0.8Nm). Strip length = 1/4 in (7mm). **DO NOT** pre-treat wire with solder.
- Terminals L & L:** Use AWG #12-18 wire, 600 volt, 60°C. Only one wire to each terminal.
- Terminals P+, P-, S-, S+, COM, RST & ACK:** Use AWG #12-22 wire, 150 volt, 60°C. If using AWG #20 or smaller wire, up to 2 wires can be connected to each terminal. If using AWG #18 or larger wire, only 1 wire can be connected to each terminal.



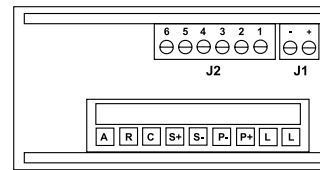
4-20mA output signal powered by internal 24V power supply.



4-20mA output signal powered from an external 24V power supply.

### Terminal Assignments

PIN	Function	Screw Terminal Block
1	Transmitter	J1
2	Transmitter	J1
1	Relay #1 Common	J2
2	Relay #1 NC	J2
3	Relay #1 NO	J2
4	Relay #2 Common	J2
5	Relay #2 NC	J2
6	Relay #2 NO	J2



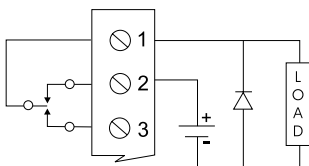
#### Notes:

- External alarm acknowledgment terminals (ACK and COM) are located on the meter main board.
- In the alarm condition, the NC contact is connected to common in the failsafe mode

### Switching Inductive Loads

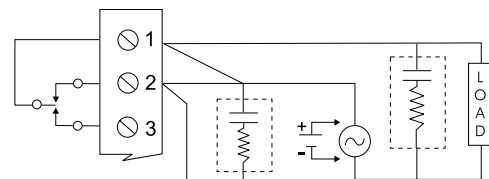
To minimize the effect of electrical noise and also prolong the life of the relay contacts, the use of a suppression network is recommended. RC networks can be purchased as an assembly. Refer to the following circuits for RC network assembly and installation:

#### Low Voltage DC Loads



Use a diode with a reverse breakdown voltage two to three times the circuit voltage and forward current at least as large as the load current.

#### AC & DC Loads



#### Choose R and C as follows

- R: 0.5 to 1 Ohm for each volt across the contacts
- C: 0.5 to 1 microfarad for each 1A through closed contacts

#### Notes:

- Use connectors rated for 240 VAC.
- Snubbers may affect load release time of solenoid loads, check to confirm proper operational mode.
- Install the RC network at the V437's relay screw terminals. An RC network can also be installed across the load. Experiment for best results.

## Specifications

### BASIC METER

#### Frequency Inputs:

Field selectable: Pulse or Square Wave 0-5V or 0-12V @ 30kHz; TTL; Open Collector 4.7k Ohms pull up to 12V 30kHz; Switch Contact 4.7k Ohms pull up to 12V @40 Hz. 1Hz minimum input

#### Low Voltage/Mag Pickup (Isolated):

Sensitivity: 125mV p-p  
Hysteresis: 30mV

#### Calibration:

Can be calibrated using K-factor scaling, internal calibration or by external calibration signal

#### Output Power:

Field selectable, isolated, 12VDC @ 50mA for sensor supply, or 24VDC @ 20mA regulated  $\pm 5\%$ , noise less than 10mVpp. Max. loop resistance of 1200 Ohms

#### Accuracy:

$\pm 0.1\%$  of full scale

#### Minimum input Span:

2.0Hz between points

#### Display:

6 digit, 0.56" (14.2mm) high efficiency red LED. Rate: 0 to 29,999(0) with selectable extra zero. Total: 0 to 999,999. Automatic lead zero blanking

#### Alternating Display:

Display can be programmed to alternate between rate and total every 10 seconds.

#### Power:

115VAC  $\pm 10\%$ , 50/60Hz, 10VA

#### Totalizer:

Calculates total based on rate and field prog. multiplier to display total in any engineering units

#### Total Reset:

Via front panel ENTER button, external contact closure at terminals RST and COM, automatically via user selectable preset value #2.

#### Peak Hold:

Captures the peak rate and displays it via the front panel ENTER button

#### Peak Hold Indication:

Front panel flashing "R" LED.

#### Low Flow Cutoff:

1 count to 100% F.S., user selectable. To disable low flow cutoff, program cutoff value to zero

#### Roll Over:

Totalizer "rolls over" when display exceeds 999,999 or preset value. Relay status reflects display.

#### Lockout:

Jumper at rear of instrument restricts modification of calibration values

#### Temperature/Humidity:

Operating range: 0 to +65°C  
Storage range: -40 to +85°C  
RH: 0 to 90%, non-condensing

#### Front Panel/Enclosure:

NEMA 4X, panel gasket provided 1/8 DIN, high impact plastic, UL 94V-0

#### Connections:

Removable screw terminal block (provided)

#### Input Impedance:

Pulse Input: Greater than 300k ohms @ 1kHz Open Collector/ Switch Input: 4.7k Ohms pull-up resistor to 12V

### RELAYS (OPTIONAL)

#### Rating:

2 SPDT (form C); rated 2Amp @ 30VDC or 2 Amp @ 250VAC resistive load; 1/14 HP @ 125/250VAC for inductive loads

#### Totalizer Presets:

Relays #1 and #2 are assigned to total or rate and can be programmed anywhere in the range of the meter; relays trip when total exceeds preset value and reset when total is reset to zero. #2 preset is user programmable to reset total to zero when preset value is reached. A delay of between 1 and 999 seconds can be programmed before relays #1 and #2 reset.

#### Preset Value Tracking:

Relay #1 can be programmed to trip at any point below relay #2 preset value. If relay offset mode is selected relay #1 will always trip at a programmed offset value before relay #2 trips, e.g., if the relay offset is set at 10 then relay #1 will trip at 10 counts before relay #2.

### TRANSMITTER (OPTIONAL)

#### Calibration Range:

The transmitter output (4-20mA) can be calibrated so that a 4mA output is produced for any rate displayed on the meter. The 20mA output can correspond to any other (larger or smaller) number displayed on the meter. However, best results are obtained with a 501 minimum count difference between the 4 & 20mA output displays.

#### Output Loop Resistance:

24VDC, 10 Ohms min. 500 Ohms max.; 35VDC max (ext), 600 Ohms min. 1k Ohms max.

#### Accuracy:

$\pm 0.1\%$  F.S.,  $\pm 0.004$ mA

#### Isolation:

500VDC or peak AC, input-to-output or input/output-to-powerline

#### External Loop Power Supply:

35V max

## Ordering Information

### Specify:

1. Model number:
  - V437-0000** (no options)
  - V437-1000** (2 relays, rate or count)
  - V437-2000** (4-20mA output)
  - V437-3000** (4-20mA and 2 relays, rate or count)
2. Power: 115VAC (standard)
3. Optional Factory Configuration, specify **C620** with the desired configuration information.



V438-0000-1 (Indicator)  
V438-1000-1 (2 relay outs)  
V438-2000-1 (4-20mA out)  
V438-3000-1 (4-20mA & 2 relay outs)

# VISIPAK™ V438

## DC Input Digital Indicator

Provides a Digital Display of Process Variables from DC Voltage and Current Inputs



- Field Configurable Input 4-20mA, 1-5V, 0-5V & 0-10V
- 4-1/2 Digit Display for +199990 Count Spans
- 4 Visual Alarm Points with Front Panel LED Status
- Optional 2 Relay Output & 4-20mA Transmitter Output
- NEMA 4 Front Panel
- Isolated 24VDC Excitation for 2-Wire Transmitter Inputs or Optional 4-20mA Output
- 11 Point Linearization & Square Root - Curve Fitting

### Description

The V438 is a versatile, field configurable, DC current and voltage input LED indicator. The unit provides a NEMA 4X water tight front panel that fits 1/8 DIN cutouts. Four visual setpoint alarms are annunciated via individual front panel LEDs and are a standard feature of the indicator.

Two form C relays are available as optional outputs for the first two setpoints. They can be configured as high or low, failsafe or non-failsafe. Each setpoint has a 100% adjustable deadband (or reset point) which can be effectively used in on/off control applications, or as latching alarms. An isolated 4-20mA transmitter output is also available as an option.

The V438 accepts 4-20mA, 1-5V, 0-5V and 0-10V inputs which can be scaled as required between  $\pm 199990$  (with a minimum span of 501 counts). An isolated 24V excitation source is included to power a two-wire transmitter or transducer.

Field configuration of the input range, alarm function, and analog transmitter output scaling is simple. The indicator is factory calibrated to rated accuracy but can be field adjusted as necessary.

Latched alarms can be acknowledged via a front panel button or by wiring to the terminals provided for remote alarm acknowledgment.

A lockout jumper is used to limit access to configuration functions. With the lockout mode enabled, only alarm setpoints and output scaling functions are displayed and cannot be altered without moving the jumper. When in the lockout mode, the unit can be programmed to display only those variables required for operator use.

### Application

The V438 is ideal for indication, control and alarming of process variables. It can be used to display whatever process variable is represented by the dc input signal: level, flow, temperature, pressure, speed, weight, etc.

Built-in linearization functions allow users to program the unit to solve non-linear equations, such as the volume of material in a horizontal cylindrical tank from the level signal, or linear flow from the square root of the differential pressure across an orifice plate.

The setpoint alarms can be used for level control on a tank in which the low setpoint starts the filling process and the high setpoint stops it. Alarms are also useful as annunciators, warning of a critical process variable.

In all applications, the highly visible 0.56 inch, eight-segment LEDs provide a clear reading of the measured variable. Constructed to withstand corrosion and moisture, the NEMA 4X rated V438 can be used in most industrial control panels, under harsh environmental conditions.

The field configurable design and wide selection of input and output types makes the V438 an excellent choice as a standard process meter and alarm.

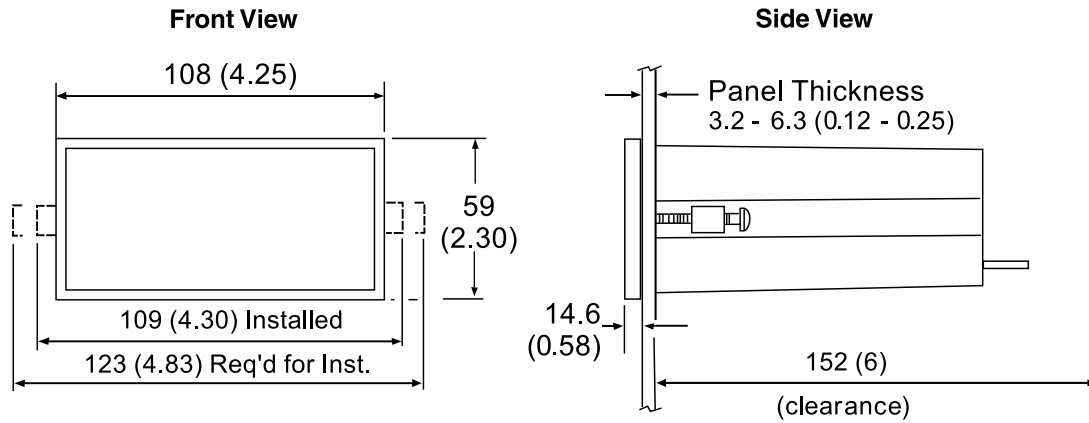
Table 1: V438 Input Spans

Input	Minimum Span
0 to 5V	0.16V
0 to 10V	0.32V
4 to 20mA	1.6mA

11 Point Linearization	Minimum Span
0 to 5V	0.16/(No. of pts -1V)
0 to 10V	0.32/(No. of pts -1V)
4 to 20mA	1.6/(No. of pts -1mA)

**Dimensions**

Dimensions in millimeters (inches)



**Notes:**

1. Panel cutout required: 45mm x 92mm (1.77" X 3.62") 1/8 DIN
2. Panel thickness: 3.2mm - 6.3mm (0.12" - 0.25")
3. Allow 152mm (6 inches) behind the panel
4. Weight 16oz. (454g)

# Model V438 Wiring Diagrams

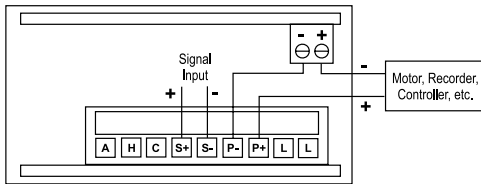
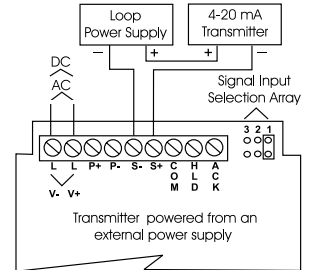
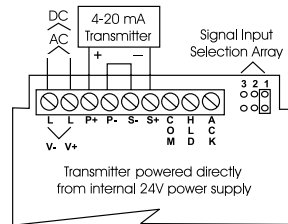
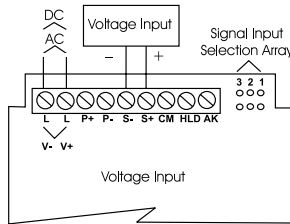
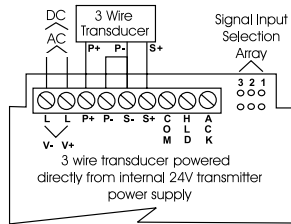
## DC Input Digital Indicator

### Wiring Instructions

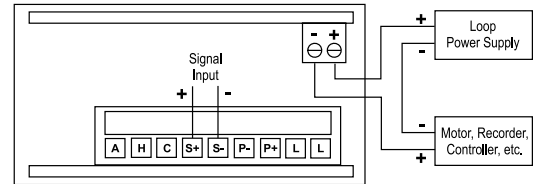
- All field connections to be made with insulated copper wire, either solid or stranded. Tighten all screw terminals to 7 in/lb. (0.8Nm). Strip length = 1/4 in (7mm). **DO NOT** pre-treat wire with solder.
- Terminals L & L:** Use AWG #12-18 wire, 600 volt, 60°C. Only one wire to each terminal.
- Terminals P+, P-, S-, S+, COM, HLD & ACK:** Use AWG #12-22 wire, 150 volt, 60°C. If using AWG #20 or smaller wire, up to 2 wires can be connected to each terminal. If using AWG #18 or larger wire, only 1 wire can be connected to each terminal.

Program the Signal Input Selection Array according to chart below. This jumper array is located at the rear of the instrument, next to the screw terminal block. Remove J3 to disable lockout feature.

Input Signal	Jumper 1:	Jumper 2:
1-5, 0-5 V	OFF	OFF
0-10V	OFF	ON
0-20, 4-20mA	ON	OFF



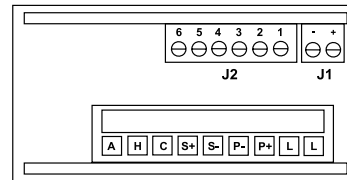
4-20mA output signal powered by internal 24V power supply (AC powered units only).



4-20mA output signal being powered by external 24V power supply.

### Terminal Assignments

PIN	Function	Screw Terminal Block
1	Transmitter	J1
2	Transmitter	J1
1	Relay #1 Common	J2
2	Relay #1 NC	J2
3	Relay #1 NO	J2
4	Relay #2 Common	J2
5	Relay #2 NC	J2
6	Relay #2 NO	J2



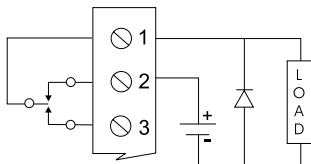
#### Notes:

- External alarm acknowledgment terminals (ACK and COM) are located on the meter main board.
- In the alarm condition, the NC contact is connected to common in the failsafe mode.

### Switching Inductive Loads

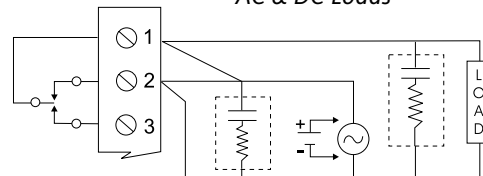
To minimize the effect of electrical noise and also prolong the life of the relay contacts, the use of a suppression network is recommended. RC networks can be purchased as an assembly. Refer to the following circuits for RC network assembly and installation:

#### Low Voltage DC Loads



Use a diode with a reverse breakdown voltage two to three times the circuit voltage and forward current at least as large as the load current.

#### AC & DC Loads



#### Choose R and C as follows

- R: 0.5 to 1 Ohm for each volt across the contacts
- C: 0.5 to 1 microfarad for each 1A through closed contacts

#### Notes:

- Use connectors rated for 240 VAC.
- Snubbers may affect load release time of solenoid loads, check to confirm proper operational mode.
- Install the RC network at the V438's relay screw terminals. An RC network can also be installed across the load. Experiment for best results.

## Specifications

### BASIC METER

#### Inputs:

Field selectable:

4 to 20mA, 1 to 5V, 0 to 5V and 0 to 10V

#### Display:

0.56" (14.2mm) high efficiency red LED, 4-1/2 digits + extra zero can be switched on to display  $\pm 19999(0)$ . Programmable decimal 501 count min.

#### Calibration:

Can be calibrated using internal calibration (I-CAL) or by external calibration signal (E-CAL).

#### Calibration Range:

4mA (1V) input can be set anywhere in range of the meter. 20mA (5V) can be set above or below the 4mA (1V) input. An error message will appear if input 1 signal and input 2 signal are too close together (see Input Spans table). Corresponds to any range (larger or smaller)

#### Loop Power (AC powered units only):

Isolated 24VDC @ 20mA regulated  $\pm 5\%$ . Noise less than 10mV p-p. Max. loop resistance of 1200 Ohms. Available for either signal input or 4-20mA output option, but not both.

#### Hold Reading:

Connect terminals HLD and COM.

#### Accuracy:

0.05% of calibrated span,  $\pm 1$  count.

#### Lockout:

Jumper JP3 restricts modification of cal values.

#### Input Impedance:

Voltage ranges: greater than 300k Ohms.  
Current ranges: 100 Ohms.

#### Power:

115 VAC  $\pm 10\%$ , 50/60Hz, 10VA.

#### Isolation:

500VDC or peak AC, input-to-output or input/output-to-power line.

#### Common/Normal Mode Rejection:

110dB/64dB at 50-60Hz

#### Temperature/Humidity:

Operating range: 0 to 65°C

Storage range: -40 to 85°C

RH: 0 to 90% RH non-condensing

#### Front Panel/Enclosure:

NEMA 4X, panel gasket provided/1/8 DIN, high impact plastic, UL 94V-0.

#### Connections:

Removable screw terminal block (provided), accepts 22 to 12 AWG.

#### Alarm Points:

4, any combination of high or low alarms, front panel LED indicated

#### Alarm Deadband:

0-100% of full scale, user selectable.

#### 11 Point Linearization:

See minimum Input Spans table. Example, min. span for a 11 point 4-20mA calibration is 0.16mA between inputs.

#### SQUARE ROOT EXTRACTION

#### Accuracy:

$\pm 0.1\%$  F.S.  $\pm 1$  count from 10 to 100% of flow. Low flow cut-off, 0 to 100% of full scale, user selectable.

## RELAYS (OPTIONAL)

#### Rating:

2 SPDT (form C); rated 2Amp @ 30VDC or 2 Amp @ 250VAC resistive load; 1/14 HP @ 125/250VAC for inductive loads.

#### Deadband:

0-100%, User selectable.

## TRANSMITTER (OPTIONAL)

#### Calibration Range:

The transmitter output (4-20mA) can be calibrated so that a 4mA output is produced for any rate displayed on the meter. The 20mA output must correspond to any rate that is at least 501 counts greater than or 501 counts less than the rate corresponding to 4mA (for example, 4mA = 0, 20mA = 501). If the span from 4 to 20mA is less than 501 counts, an error message will appear.

#### Output Loop Resistance:

Power Supply

24VDC: min 10 Ohms, max 600 Ohms

35VDC (external): min 600 Ohms, max 1k Ohms

#### External Loop Power Supply:

35V max.

#### Accuracy:

$\pm 0.1\%$  F.S.,  $\pm .004$ mA

## Ordering Information

### Specify:

1. Model number:
  - V438-0000-1 (indicator only)
  - V438-1000-1 (2 relays)
  - V438-2000-1 (4-20mA output)
  - V438-3000-1 (4-20mA and 2 relays)
2. Power: 115VAC (standard)
3. Optional Factory Configuration, specify **C620** with the desired configuration information.



V560

# VISIPAK™ V560

## Loop Powered LCD Indicator

Provides a 3-1/2 Digit Liquid Crystal Display (LCD)  
in Proportion to a 4-20mA Current Input



- Eliminates Extra Power Supply
- LCD Readable from 30ft.
- Switch Selectable mA Inputs and Decimal Points
- Field Configurable Wide Ranging Display
- NEMA 4 Front Panel
- Readings to  $\pm 19990$
- FM & CSA Safety Approval for Hazardous Installations

### Description

The V560 is a loop powered digital process indicator which derives its power entirely from the 4-20mA or 10-50mA signal being measured. No local power is required at the point of measurement. A large, 3° digit, 0.8" high LCD provides clear visibility and can be quickly and easily calibrated to the required range. Zero can be adjusted to  $\pm 1999$  counts with a span of 100 counts or greater. The trailing "dummy" zero allows display readings to  $\pm 19990$ . The decimal point position is switch selectable and can be independently set to any of 4 positions (1. 9. 9. 9. 0).

### Application

The V560 is useful in any application requiring a wide ranging 3° digit display from a 4-20mA or 10-50mA current source. The standard NEMA 4X housing enables indoor or outdoor installation with protection from sleet, corrosion, moisture, chemicals, and even hose directed water or severe condensation. The V560 is ideal for displaying process variables such as temperature, pressure or flow, in local and remote areas where line power is either impractical or not available. *Refer to the V565 High-Performance LCD indicator for 1.00 Volt loop-drop and square root selection.*

The V560 is FM/CSA approved for intrinsically safe operation in Class I, Division 1, Groups A, B, C, & D hazardous locations when connected in accordance with manufacturer's drawing 790-0024(FM) or 790-0025(CSA).

### Options/Accessories

- C** Conduit housing for internal mounting of T600/T700 series transmitters; includes external mounting bracket, conformal coating, T906 mounting plate, screws (pictured above).
- EP** Explosion-proof housing (Class I, Gr. C&D, Class II, Gr. E,F,G;NEMA 4), LCD board conformal coated, includes T901 and screws.
- U** Urethane coating of internal circuitry for additional protection from corrosive atmospheres.
- C620** Factory Calibration, specify desired range.
- T901** TransPak mounting plate for option EP.
- T906** TransPak mounting plate for option C enclosure.
- V860** Conduit mounting kit (option C without LCD main board), includes T906 mounting plate & screws.
- V960** Explosion-proof mounting kit, (option EP without LCD main board), includes T901 & screws.

## Calibration

The V560 indicator is easily configured using the switches and potentiometers mounted on the circuit board located directly behind the hinged front cover (or screw cover for the EP option). To configure and calibrate, refer to the function switches diagram. Position the switches accordingly to obtain the desired zero and span count values. Next, fine tune the display using the zero and span trimpots. Displays calibrated for either 4-20mA or 10-50mA will maintain calibration within 1% if switched to the other range.

*Note: Span refers to counts from "minimum" and not a full-scale input.*

### Installation (V560 EP)

1. Conduit for field wiring is attached to the 3/4" NPT threaded hole provided, which can be configured as either the top or the bottom of the instrument.

2. Unscrew cover. Remove the phillips screws from the black mounting plate and then remove the indicator assembly (four outermost screws).

3. A TransPak T600/T700 series two-wire can be installed using T901 mounting plate.

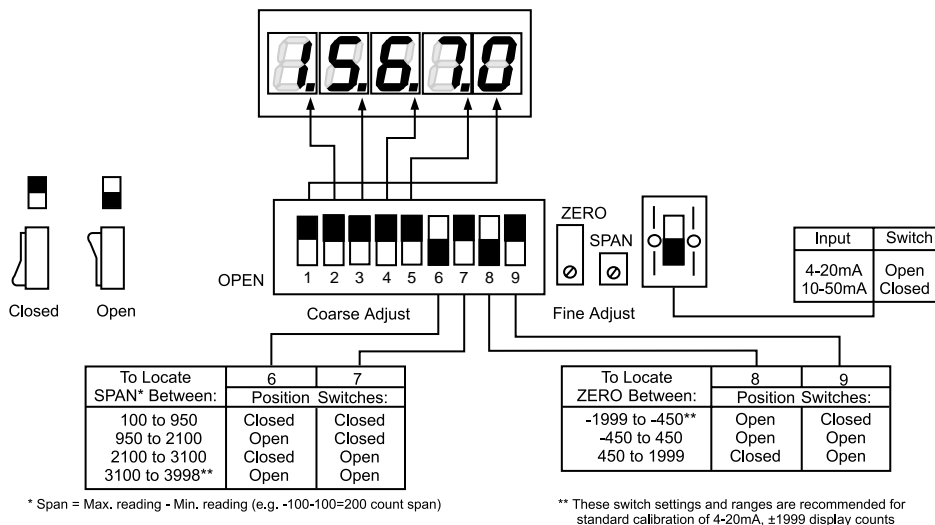
4. Connect the field wiring to the back of the indicator assembly terminals (and TransPak if installed). Connect the ground wire to the EP case. Route the wiring through the bracket grommet and conduit port.

5. Replace the indicator assembly.

6. Reinstall the cover until snug (do NOT use sealant on the cover).

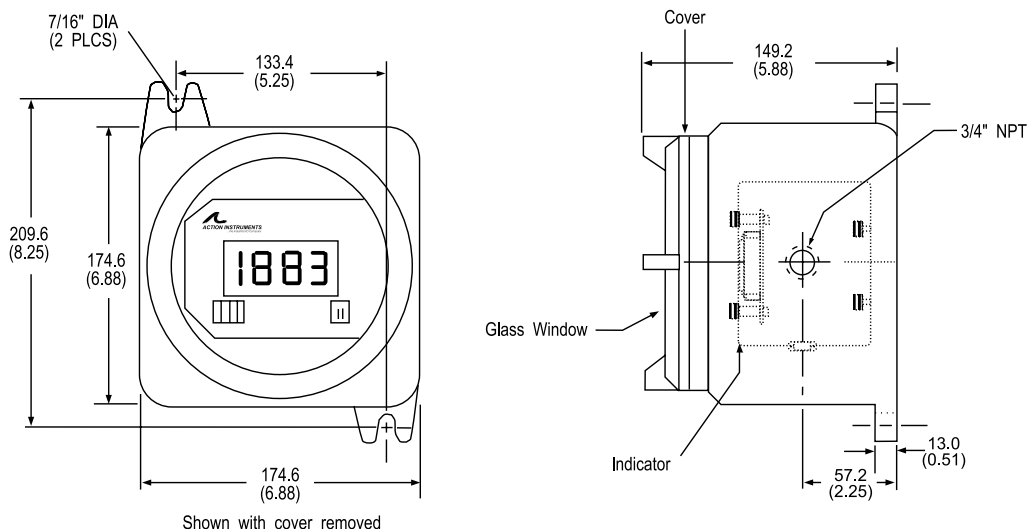
### Function Switches

Example shows the V560 configured for a 4/20mA input range (Switch S2), a span between 950 and 2100 counts (Switches 6 and 7), and zero between -1999 and -450 counts (Switches 8 and 9).



### V560 EP Mounting

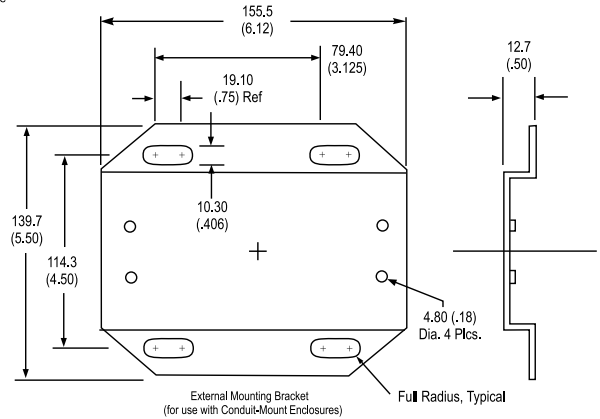
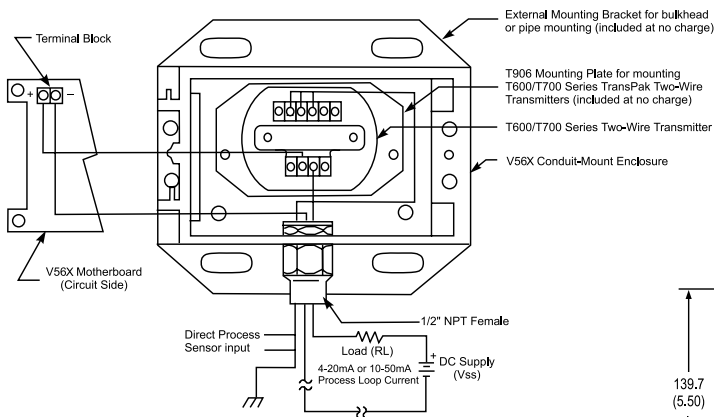
(Class I, Gr. C&D, Class II, Gr. E,F,G, NEMA 4)



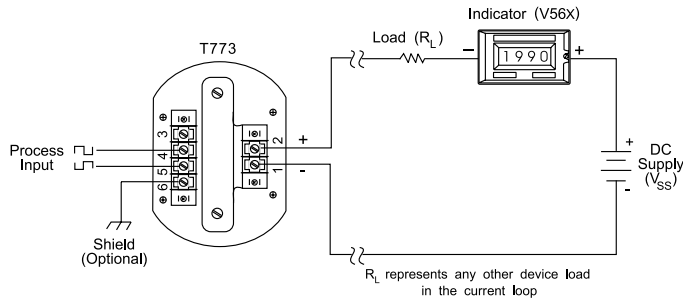


### Connection Diagram, Option C

V560 Conduit-Mount Enclosure (front door removed) showing internally mounted TransPak two-wire transmitter.



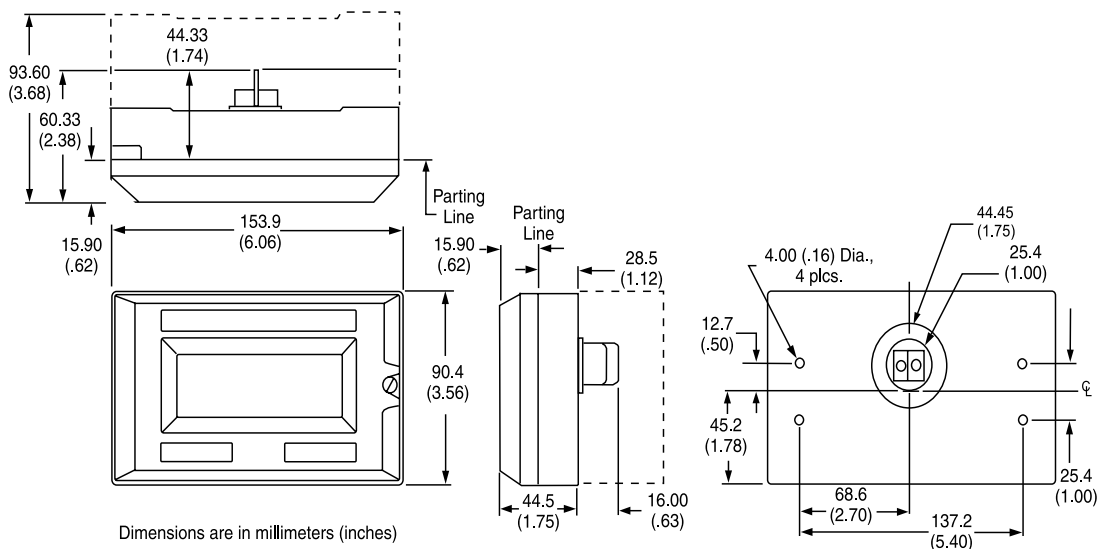
The V560 Conduit-Mount enclosure conveniently mounts any TransPak two-wire transmitter within a NEMA 4X-rated housing for on-site process loop indication.



### Mounting Enclosures

The following dimension drawing shows both the panel mount (thin case) and the conduit-mount enclosures. The conduit mount is represented by a dotted line in the top and side views only. The front and back view dimensions are the same for both enclosures.

Note: panel mount includes an attached gasket surrounding the terminals, providing a NEMA 4 seal to the panel and the 1" diameter cutout. Four screws should be used to ensure a tight, flush fit between the panel and the V560.



Dimensions are in millimeters (inches)

## Specifications

### Input Current Ranges:

4-20mA and 10-50mA, switch selectable

### Input Current Limits:

Minimum: 3mA

Maximum: 100mA

### Input Voltage Drop:

3.9V maximum at fullscale input  
(20mA or 50mA)

### Power Consumption:

12mW maximum @ 3mA input

### Display Reading Update:

2.5 conversions per second

### Readout Display:

Type: 0.8" High Liquid Crystal, 3° digit (1999)

Decimal Point Indication: Switch-selectable, four positions: 1.9.9.9.

Dummy Zero: Switch-selectable trailing zero, e.g., 19990

Underrange (belowm - 1999): displays -1

Overrange (above +1999): displays 1

### Wide Range Display Calibration:

Zero (4mA/10mA):

Adjustable from -1999 to 1999

Span (20mA/50mA):

Adjustable from 100 to 3998 counts

### Accuracy:

±0.1% of span counts, ±1 count

### Screws (V560/V560C):

Front Panel: 10-32 brass with corrosion resistant stainless steel plating:

MIL-W-52263C (MR)

Rear Electrical: 6-32 nickel plated brass

### Temperature Coefficient:

#### (Standard Calibration: -10 to 70°C)

Zero: ±50ppm/°C, typical, ±100ppm/°C, max.

Span: ±50ppm/°C, typical, ±150ppm/°C, max.

### Temperature Range:

Standard: -10 to 70°C (14 to 158°F)

Storage: -55 to 85°C (-67 to 185°F)

### Weight:

V560: 14 oz

V560C: 2.2 lbs

V560 EP: 11 lbs

### Agency Approval:

FM and CSA approved intrinsically safe for hazardous locations, certificate No. 2M2A5.AX. Contact factory for installation drawings.

## Ordering Information

### Specify:

1. Model **V560, V860, V960**
2. Options C, EP, U (see text)



# VISIPAK™ V561

## Loop Powered LCD Indicator

Provides a 3-1/2 Digit Liquid Crystal Display (LCD)  
in Proportion to a 4-20mA Current Input

V561-0000 Loop Powered, Explosion Proof LCD Indicator

V561-1000 Loop Powered, Explosion Proof LCD Indicator with Backlight

- 4-20mA Input
- 3-1/2 Digit Display
- Easy Calibration and Installation
- Loop-Powered Backlight Option
- -40 to 85°C Operation
- FM and CSA Approved Explosion Proof Enclosure

### Description

The V561 3 1/2 digit loop-powered meter is perfect for applications in which a simple inexpensive display is required but no ac power is available. The V561 is supplied in an explosion-proof enclosure. The loop-powered backlight eliminates the need for additional wiring or batteries and provides a good view under any lighting conditions.

### Setup

All that is required for calibration of the unit is a calibrated current source and a screwdriver.

### Disassembly

The removable screw terminal connector is located on the lower circuit board. To access these input terminals it is necessary to remove the display board from the input signal board. First remove the enclosure cover. Next, loosen the 2 screws that hold the display board to the standoffs. Rotate the display board so that the right side comes off the standoff first, and then proceed to remove the display board from both standoffs. Avoid contact of the display with rough surfaces. The display board can be disconnected from the ribbon cable simply by pulling up on the ribbon cable connector located above the display.

Connect a 4-20 mA input signal to terminal J5 located on the input signal board.

When re-assembling be careful NOT to over-tighten the screws.

### Installation

Installation is accomplished using the two 1/2" NPT conduit holes provided with 1/2" NPT fittings. There are no provisions for wall mounting.

### Decimal Point Selection

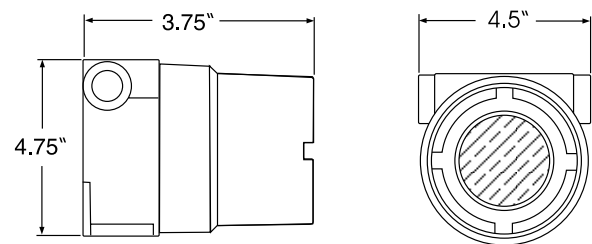
The decimal point jumper array (JP1) is located at the upper right corner of the display board. Place a jumper across the bottom pins for a display of XXX.X; across the middle pins for a display of XX.XX; and across the top pins for a display of X.XXX.

### Calibration

The LO calibration control (R11) is located below the display and the HI calibration control (R9) is located to the right of the display.

Apply a 4 mA input signal and adjust the LO control to display the desired reading. Apply a signal between 16 and 20 mA and adjust the HI control to display the desired reading. Complete the procedure by making any minor adjustments to the LO and HI controls.

### Dimensions



VISIPAK™

## Specifications

### Input:

4-20 mA

### Display:

0.5" high LCD, 3° digits; 1999, User selectable decimal point.

### Calibration:

2 Step; Non-interacting zero and span.

### Calibration Range:

4 mA input: -500 to +500;

20 mA input: between 20 to 2000 above

4 mA display.

### Maximum Current:

30 mA

### Maximum Voltage Drop:

1.5 VDC @ 20 mA; 3.5 VDC @ 20 mA with backlighting option.

### Accuracy:

±0.1% of span, ±1 count.

### Connections:

Removable screw terminal block (provided).

### Operating Temperature Range:

-40 to 85°C

### Weight:

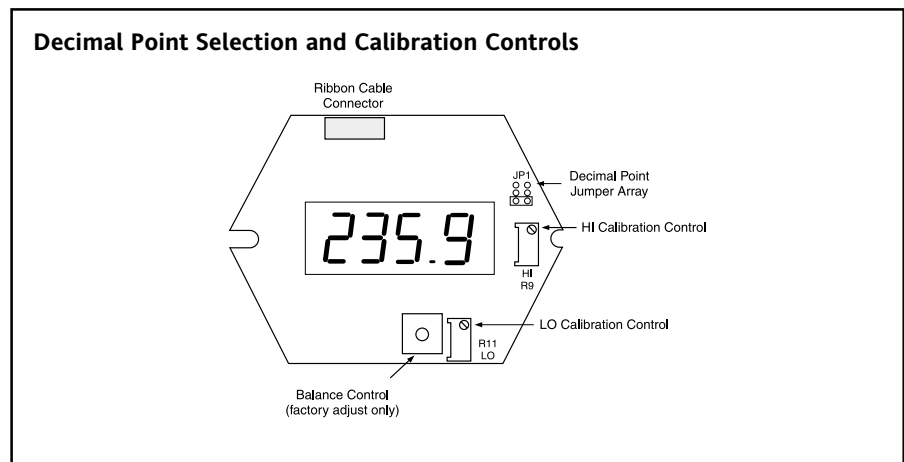
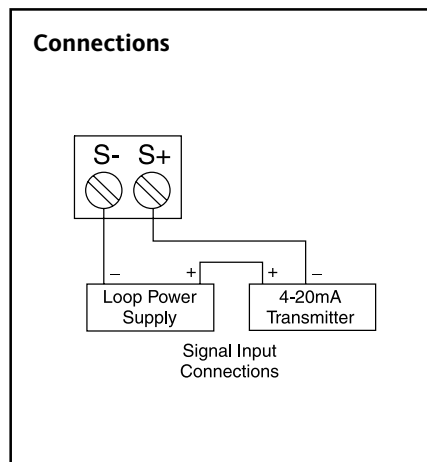
4 lbs.

### V561 Enclosure:

Cast aluminum, approved by FM and CSA; NEMA 4, 7 & 9; Class I, Groups B, C & D and Class II, Groups E, F, & G. Two 1/2" NPT holes provided.

### Loop-Powered Backlighting Option:

Factory installed only. Powered directly off the 4-20 mA loop, no batteries required. The display brightness will increase as the input signal current increases.



## Ordering Information

### Specify:

1. Model number:

**V561-0000** Loop Powered, Explosion Proof LCD Indicator

**V561-1000** Loop Powered, Explosion Proof LCD Indicator with Backlight



V565-0000

# VISIPAK™ V565

## High Performance Loop-Powered LCD Indicator

Provides a 3-1/2 Digit LCD Indication with a 1 Volt Loop Drop



- Loop Drop of Only 1 Volt Provides Extra Compliance
- Selectable Square Root Mode for Flow Applications
- LCD Readable from 30ft.
- Switch Selectable 4-20mA, 10-50mA, Decimal Point and Direct/Reverse "Display Gain"
- NEMA 4 Front Panel
- FM and CSA Safety Approval for Hazardous Installations
- Wide-Ranging 3-1/2 Digit Display

### Description

The V565 is a loop-powered digital process indicator which derives its power entirely from the 4-20mA or 10-50mA signal being measured. No local power is required at the point of measurement.

The 3-1/2 digit, 0.8" high Liquid Crystal Display (LCD) provides clear visibility up to a distance of 30 feet, and can be easily calibrated to the required range. Zero and fullscale can be set anywhere between -1999 and 1999. Span can be from 0 to 3998 counts (100 count minimum span).

The V565 provides linear and square root operation, permitting direct flow readings from differential pressure origins (e.g., orifice plates). The V565 is also equipped with selectable direct/reverse display gain. Reverse operation provides a decreasing count with an increasing input. A trailing, dummy, zero allows display readings to  $\pm 19990$ . The decimal point position is switch selectable and can be independently set to any of four positions (1.9.9.9.).

### Application

The V565 is useful in any application requiring a wide-ranging 3° digit display from a 4-20mA or 10-50mA current source. The V565's standard NEMA 4X housing enables indoor or outdoor installation with protection from sleet, corrosion, moisture, chemicals, and even hose directed water or severe condensation. The V565 is ideal for displaying process variables in local and remote areas where line power is not available or impractical.

The V565 is entity approved by FM for intrinsically safe operation in Class I, II, and III, Division 1 & 2 hazardous locations when installed per manufacturer's drawing 790-0029-00.

The V565 is also intrinsically safe per CSA for operation with the following housings when installed per manufacturers drawing 790-0025-00: panel housing: Class I, Groups A, B, C and D; conduit housing: (Opt C) Class I, Groups A, B, C and D. Class II, Groups E, F and G. Class III; EP housing: Class I, Groups C and D. Class II, Groups E, F and G.t.

### Loop Drop of 1 Volt

The supply requirement of model V565 is only 1.0 volt on a 4-20mA current loop. This is beneficial in applications where intrinsic safety barriers are used and voltage compliance is at a

premium. The V565 can provide an extra 3-5 volts of loop drive above standard loop-powered indicators.

### Options

**C** NEMA 4X conduit housing, allows internal mounting of Transpak T700 series 2-wire transmitter, includes external mounting bracket.

**C620** Factory calibration; specify range

**EP** Explosion-Proof housing (Class I, Gr. C&D, Class II, Gr. E, F, G; NEMA 4), LCD board conformal coated, includes T901 and screws.

**U** Urethane coating of internal circuitry for additional protection from corrosive atmospheres

### Display Configuration

The V565 is easily configured using the switches and potentiometers on the display board. To configure the unit, refer to the function switches diagram below.

1. Set jumpers W1 & W2 to "Normal" or "Reverse" for direct or reverse count, respectively.

2. Set switch S2 for the correct current input: "Linear" for linear operation and "Square Root" for square root operation.

3. Set switch S1 accordingly to obtain the desired zero and span count values.

4. Fine tune the display using the "Display Zero" and "Display Span" trim pots. Use table 1 for square root display configuration. Display readings calibrated for either 4-20mA or 10-50mA linear scaling will maintain calibration within 1% if switched to the other range. If readings are inaccurate, the input amplifiers may require adjustment. See Factory Calibration.

*Note: Span refers to counts from minimum to full-scale input.*

## Calibration

The V565's input and square root zero amplifiers are pre-calibrated at the factory (4-20mA). For best accuracy, the input amplifiers should be recalibrated when the square root function is selected or the current input is changed (10-50mA). Perform recalibration at an ambient temperature of 20-30°C (68-86°F).

1. Connect DVM (-) to "TP0" (gnd) of plug P1 and (+) to "ZERO" and "SQRT" for zero and square root calibration, respectively.
2. Apply 4.000mA or 10.000mA to the input. Set S2-1 accordingly.
3. Adjust the "Input Zero" and "Square Root Zero" potentiometers until the DVM reads 0.000 volts (Zero:  $\pm 0.0005V$ ; Sqrt:  $\pm 0.001V$ ). Note that Input zero must be calibrated first.

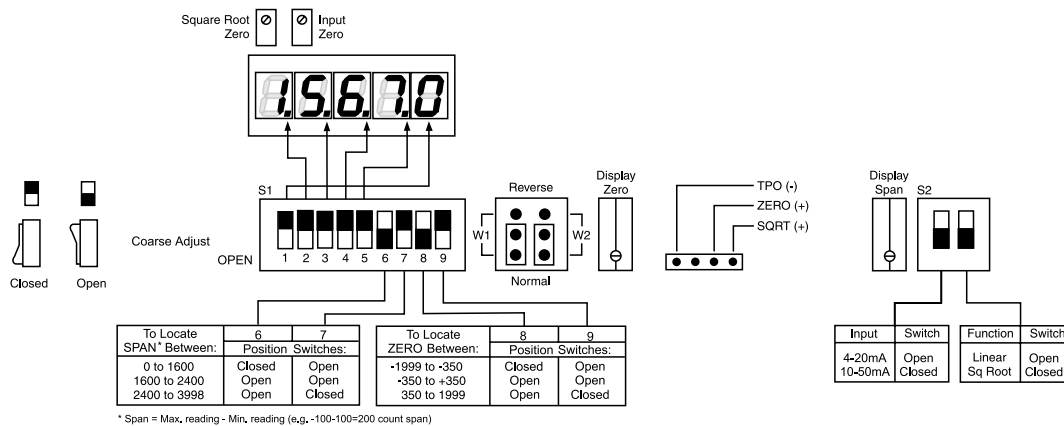
Remove the DVM leads from P1 before configuring the display or errors may occur.

## V565 EP Installation

1. Conduit for field wiring should be attached to the 3/4" NPT threaded hole provided. The display board can be rotated to permit either top or bottom service.
2. Unscrew the cover. Remove the four (4) outermost phillips screws from the black display plate and remove the indicator assembly.
3. Install the T600/T700 series transmitter if required. Mounting hardware is included.
4. Connect the field wiring to the indicator assembly terminals (and Transpak if installed). Connect the ground wire to the EP case. Route the wiring through the bracket grommet and conduit port.
5. Replace the indicator assembly.
6. Reinstall the cover with at least 5 clockwise revolutions. Do NOT use sealant on the threads.

## Function Switches

Example shows the V565 configured for a 4/20mA input range and linear display (switch S2), normal count direction (W1/W2), a span between 2400 and 3998 counts (switches 6&7), and zero between 350 and 1999 counts (switches 8&9).



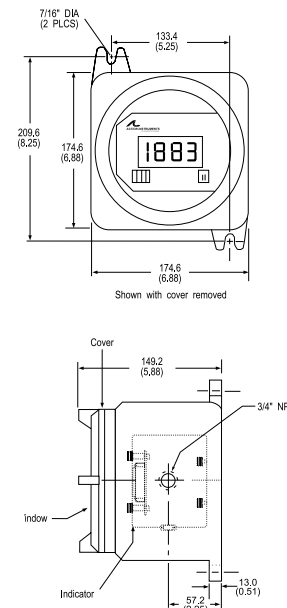
## Square Root Display Configuration

%	Input		Display	
	4-20mA	10-50mA	%	0-1000
0%	4.000mA	10.000mA	0%	0
1%	4.160mA	10.400mA	10%	100
25%	8.000mA	20.000mA	50%	500
100%	20.000mA	50.000mA	100%	1000

1. Calibrate the input amplifiers (see Calibration).
2. Set the input to 4.000mA or 10.000mA and trim the Display Zero for the desired minimum display value.
3. Set the input to 20.000mA or 50.000mA and trim the Display Span for the desired maximum display value.
4. Set the input to 25% of span. Verify the display count using the table above. Correct by adjusting the Display Zero and repeating steps 3 & 4 as necessary.
5. Set the input to 1% of span. Verify the display count using the table above.
6. Correct by adjusting the Square Root Zero and repeating steps 3-5 as necessary.

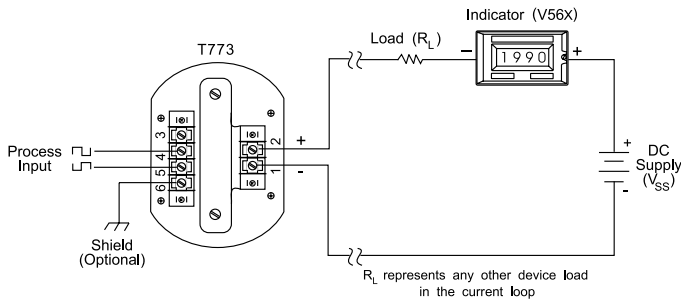
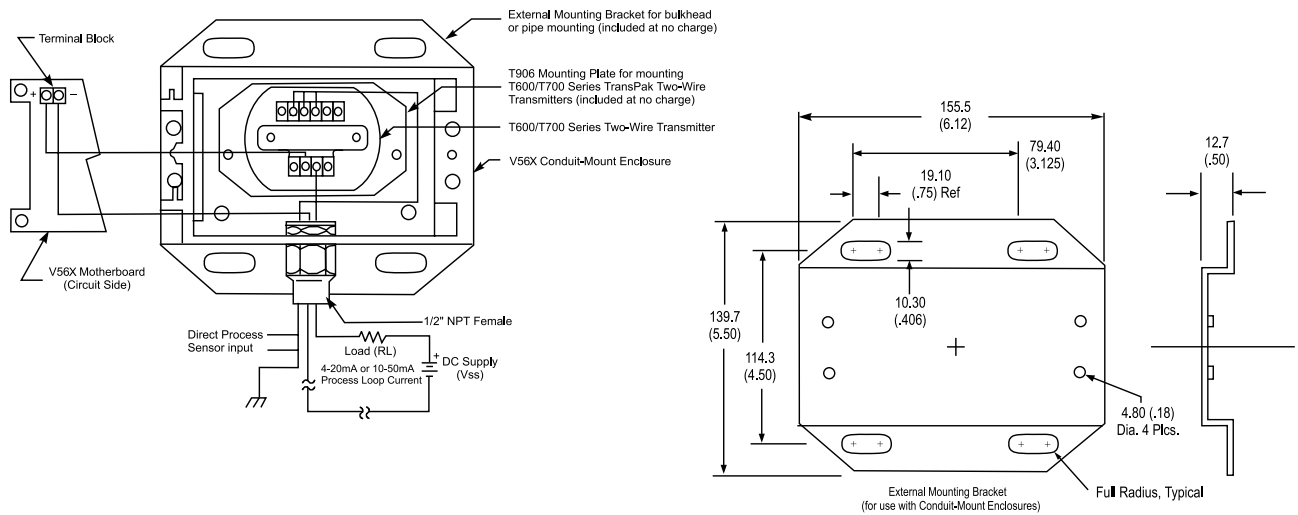
## EP Mounting

(Class I, Gr. C&D, Class II, Gr. E,F,G, NEMA 4)



### Connection Diagram, Option C

Conduit-Mount Enclosure (front door removed) showing internally mounted TransPak two-wire transmitter.

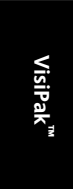
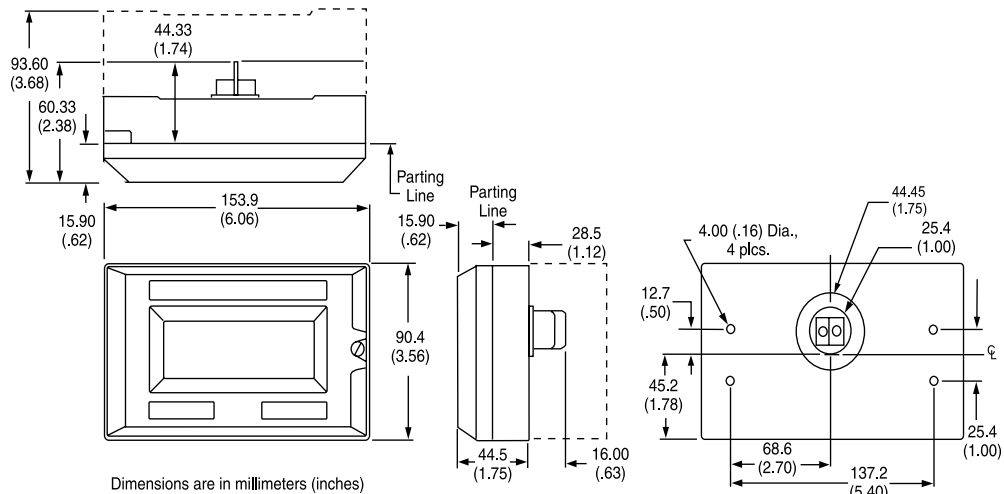


The Conduit-Mount enclosure conveniently mounts any TransPak two-wire transmitter within a NEMA 4X-rated housing for on-site process loop indication.

### Mounting Enclosures

The following dimension drawing shows both the panel mount (thin case) and the conduit-mount enclosures. The conduit mount is represented by a dotted line in the top and side views only. The front and back view dimensions are the same for both enclosures.

Note: panel mount includes an attached gasket surrounding the terminals, providing a NEMA 4 seal to the panel and the 1" diameter cutout. Four screws should be used to ensure a tight, flush fit between the panel and the V565.



## Specifications

### Input Current Ranges:

4-20mA and 10-50mA, switch selectable

### Input Current Limits:

Minimum: 3mA

Maximum: 220mA (Fuse)

### Input Voltage Drop:

4-20mA: 1 volt max. @ 20mA

10-50mA: 1.4 volt max @ 50mA

### Power Consumption:

2.5mW maximum @ 3.5mA input

### Display Reading Update

2 readings per second

### Readout Display:

Type: 0.8" High Liquid Crystal, 3-1/2 digit (1999)

Decimal Point Indication: Switch-selectable, four positions 1.9.9.9.

Dummy Zero: Switch-selectable trailing zero, e.g., 19990

Direction: Jumper-selectable,

Underrange (below -1999): displays -1

Overrange (above +1999): displays 1

### Display Calibration:

Zero (4mA/10mA):

Adjustable from -1999 to 1999

Span (20mA/50mA):

Adjustable from 0 to 3998

### Accuracy (@ 25 ±5°C):

Linear: <math>\pm 0.1\%</math> of span counts,  $\pm 1$  count.

Square-Root: <math>\pm 0.1\%</math> of span counts,  $\pm 1$  count (from 1% to 100% of span)

### Ripple Rejection:

1 count error with 1mA p-p ripple @ 50Hz

### Screws (V565/V565C):

Front Panel: 10-32, brass with corrosion resistant stainless steel plating:

MIL-W-52263C (MR)

Rear Electrical: 6-32, nickel plated brass

### Terminals:

Standard: 6-32 screw (accepts 0.2" ring lug)

Conduit mount (Opt C): Screw clamp,

12 AWG wire gauge, max.

### Temperature Coefficient:

#### (Std Calibration: -10 to 70°C; Linear mode):

Zero:  $\pm 0.1$  counts/°C,  $\pm 1$  count, typical.  
 $\pm 0.2$  counts/°C,  $\pm 1$  count, max.

Span (1000 to 3998):  $\pm 150$ ppm/°C,

$\pm 1$  count, max.

Span (100 to 999):

$150$ ppm/°C +  $.95(1000 - \text{Span})$ ,  $\pm 1$  count, max.

### Temperature Coefficient (Square-root):

Equivalent to  $1 \mu\text{A}/^\circ\text{C}$  max. input drift

### Temperature Range:

Standard: -10 to 70°C (14 to 158°F)

Storage: -55 to 80°C (-67 to 176°F)

### Humidity (with conformal coat @25°C):

5 to 95% RH, non-condensing

### Weight:

V565: 15 oz.

V565C: 2.2 lbs.

V565 EP: 11 lbs.

### Agency Approval:

FM approved intrinsically safe for hazardous locations, certificate No.3V1A5.AX.  
Contact factory for installation drawings.  
CSA approved intrinsically safe for hazardous locations, (File No.LR422272-45).

### FM Entity Parameters:

Vmax=33V

I<sub>max</sub>=178.5mA

Ci=0mF

Li=0mH

## Ordering Information

### Specify:

1. Model: **V565-0000**
2. Options C, EP, U (EP includes conformal coat)



# Barber-Colman 7SC 1/16 DIN Temperature/Process Controller

## 4-digit Dual Display



7SC937113000  
 7SC937115000  
 7SC937133000  
 7SC937113R00  
 7SC937115R00  
 7SC937133R00

With Analog Output



- Universal Input (7 T/C, RTD, mV, V, mA)
- PID and Smart AT Autotuning
- NEMA 4X, IP65
- 100 to 240 Vac or 24 Vac/Vdc Power Supply
- Auxiliary Setpoint Selection
- Heat or Heat/Cool Control
- Up to 2 Independent Alarms
- Optional RS-485 Communications

### Description

The compact Model 7SC is a dual display general purpose 1/16 DIN PID controller with autotuning and 3 configurable outputs. OP1 is a programmable analog output for heating, cooling or analog retransmission. OP2 (time proportioning relay) is used for heating/cooling (air, oil or water) or alarm. OP3 can be an alarm or a heat/cool output if OP2 is configured as an alarm. Alarms can be process, band or deviation type, direct or reverse, with masking and automatic or manual reset. A logic input is fitted as standard, allowing remote selection of an auxiliary setpoint. Bumpless Auto/Manual control can be selected from the front panel. Detection of an out of range or sensor break forces the output to a safe value (Auto Comp™ sensor break). The 7SC is available with optically isolated RS-485 communications in three protocols for use with supervisory systems. This easy to use instrument comes

with factory calibrated inputs and can be configured from the front panel or via the communications port. NEMA 4X sealing allows use in washdown or dust conditions.

### Optically Isolated Analog Output

The 7SC has an optically isolated linear analog output, programmable as a control output for heating or cooling, or as a filtered retransmission of process variable or setpoint.

### Other Features

The externally selected (logic input) transfer between SP1 and SP2 can be a step or a ramp with two configurable rates of change (ramp up/ramp down). The 7SC also has an "output off" function, allowing the instrument to disable control and act as an indicator.

Model	Input	Control	Output 1	Output 2	Output 3	Power Supply	MountinBag	Reserved
7SC	9	3	7	1		3		00

Input	Control	Output 1	Output 2
9 T/C Type J, K, L, N, R, S & T (°C, °F) Pt100 3W RTD (°C, °F) 0 to 20 mAdc & 4 to 20 mAdc 0 to 60 mVdc & 12 to 60 mVdc 0 to 5 Vdc & 1 to 5 Vdc 0 to 10 Vdc & 1 to 10 Vdc	3 PID & Smart AT	7 0 to 20 mAdc or 4 to 20 mAdc, programmable as heating, cooling or analog retransmission	1 Relay (Heating/Cooling/Alarm)

Output 3	Power Supply	Mounting
1 Relay (Heating/Cooling/Alarm) 3 Alarm plus RS-485*	3 100 to 240 Vac 5 24 Vac/Vdc	0 Panel Mount R DIN Rail/Wall Mount

\*Not available with 24V supply.

### Available Configurations

#### Panel Mount:

- 7SC937113000: PID with auto-tune, linear output, alarm, 100 to 240 Vac
- 7SC937115000: PID with auto-tune, linear output, alarm, 24 Vac/Vdc
- 7SC937133000: PID with auto-tune, linear output, 2 alarms, RS-485, 100 to 240 Vac

#### DIN Rail Mount:

- 7SC937113R00: PID with auto-tune, linear output, alarm, 100 to 240 Vac
- 7SC937115R00: PID with auto-tune, linear output, alarm, 24 Vac/Vdc
- 7SC937133R00: PID with auto-tune, linear output, 2 alarms, RS-485, 100 to 240 Vac

**Specifications**

**Control Modes:**

PID with Smart AT Autotuning,  
Manual Mode

**Supply Voltage:**

100-240 Vac (+10%, -15%), 50/60 Hz  
or 24 Vac/Vdc (±10%)

**Operating Ambient:**

0-50°C, 20-85% RH non-condensing

**Inputs:**

T/C Types J, K, L, N, R, S & T (°C, °F);  
Pt 100 3W RTD (°C, °F) ; mAdc, mVdc, Vdc

**Logic Input:**

for setpoint select (SP1 or SP2), requires  
contact rated at 0.5 mA, 5 Vdc minimum

**Output Ratings:**

Output 1:  
0 to 20 mA or 4 to 20 mA, isolated  
(500Ω max.) (Control) Heat, Cool or  
Retransmission of PV or SP

Output 2:  
Time Proportioning Relay (Heat/Cool)  
or Alarm 1 Relay, (NO/NC Jumper  
Selectable), 2A/250V, SPST, Resistive

Output 3:  
Time Proportioning Relay (Heat/Cool  
or Alm 2 Relay, 2A/250V, SPST, Resistive

**Serial Communications:**

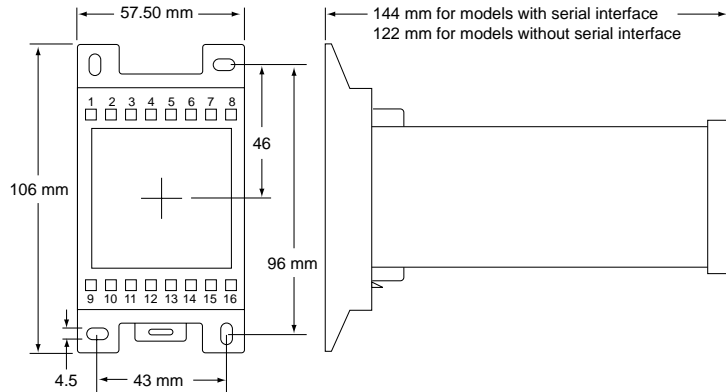
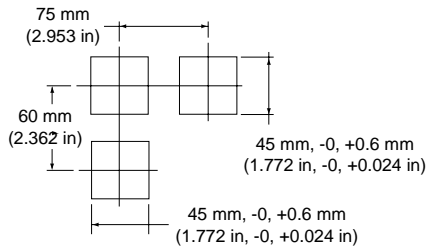
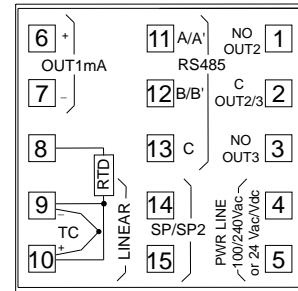
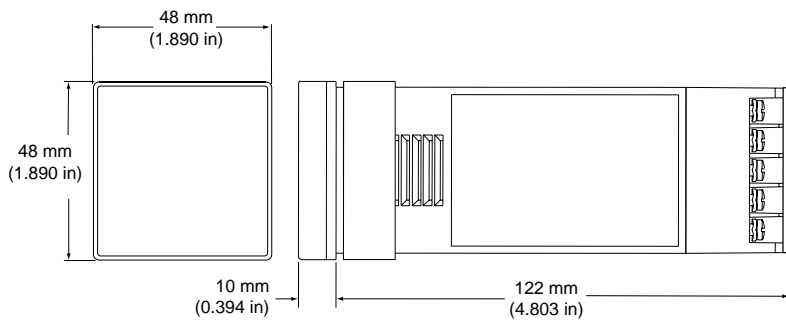
EIA RS-485 Modbus®, JBUS

**Mounting:**

Panel Mount or DIN Rail/Wall Mount

**Dimensions**

Dimensions are in millimeters





# Barber-Colman 7EC 1/8 DIN Temperature/Process Controller

## 4-digit Dual Display

With Analog Output



7EC937123000  
7EC937133000

- Universal Input (7 T/C, RTD, mV, V, mA)
- PID and Smart AT Autotuning
- NEMA 4X, IP65
- Algorithms for Heat or Heat/Cool Control
- Remote Selection of up to 4 Setpoints
- Up to 4 Outputs, 3 Independent Alarms
- Control Output Disable Function
- Optional RS-485 Communications

### Description

Designed for equipment manufacturers requiring analog process control functions and a full suite of advanced features, the 7EC offers outstanding performance as a 4-digit 1/8 DIN controller. The 7EC is configurable for heat or heat/cool PID control with Smart AT auto or adaptive tuning, universal inputs, up to 4 outputs (including one analog output) and up to 3 independent alarms. It is ideal for demanding applications in plastics, rubber fibers, annealing, small ovens, and other processes requiring 4 digit accuracy. The 7EC has a bright dual display for process temperature and setpoint, and 10 LED beacons for operating status. The analog and two relay outputs can be programmed as heating +2 alarms or heating/cooling + alarm. Alternately, OP2 can be an SSR logic output. The isolated analog output can alternatively be programmed as a retransmission of the PV or operating SP. OP4 can be configured as Alarm 3. Alarms can be process, deviation or band type, direct or reverse, with masking and programmable

automatic or manual reset. An alarm standby feature allows masking of alarm conditions until the PV reaches the low alarm threshold. A non-isolated 24 Vdc transducer power supply is a standard feature. Optional RS-485 communications are available for connection to supervisory computers. A NEMA 4X front panel allow the 7EC to work in washdown or dusty environments.

Among the 7EC's standard features are bumpless auto/manual transfer, password security and Auto Comp® sensor break. The 7EC also has an "output off" function which disables the control output, allowing the instrument to operate as an indicator but return smoothly to control when the output is again enabled. The 7EC is equipped with 2 logic inputs used to select between up to 4 setpoints. Transfer can be step or ramp, with different configurable rates for ramp up and ramp down.

Model	Input	Control	Output 1	Outputs 2 & 3	Options	Power Supply	Reserved
7EC	9	3	7	1		3	000

Input	Control	Output 1	Outputs 2 & 3
9 T/C Type J, K, L, N, R, S & T (°C, °F) Pt100 3W RTD (°C, °F)* 0 to 20 mAdc & 4 to 20 mAdc 0 to 60 mVdc & 12 to 60 mVdc 0 to 5 Vdc & 1 to 5 Vdc 0 to 10 Vdc & 1 to 10 Vdc	3 PID & Smart AT	7 0 to 20 mAdc or 4 to 20 mAdc, programmable as heating, cooling or analog retransmission	1 OP2 Jumper Selectable SPST Relay or SSR (Control/Alarm) and OP3 SPST Relay (Control/Alarm)

\* Ranges - See Table G, page 1-21

Options	Power Supply
2 OP4 Relay (Alarm) 3 OP4 Relay (Alarm) plus RS-485	3 100 to 240 Vac

**Available Configurations**

7EC937123000: One linear output, 2 relay outputs, output 4, 100 to 240 Vac

7EC937133000: One linear output, 2 relay outputs, output 4, RS-485, 100 to 240 Vac

Miscellaneous Products

### Specifications

#### Control Modes:

PID with Smart AT Autotuning

#### Supply Voltage:

100-240 Vac (+10%, -15%), 50/60 Hz

#### Operating Ambient:

0-50°C, 20-85% RH non-condensing

#### Inputs:

T/C Types J, K, L, N, R, S & T (°C, °F);  
Pt 100 3W RTD (°C, °F); mA, mVdc, Vdc

#### Logic Inputs (2):

for setpoint select (SP, SP2, SP3, SP4),  
requires contacts rated at 0.5 mA, 5 Vdc min.

#### Aux Transducer Power Supply:

Non-isolated 24 Vdc (±10%) rated at  
25 mA, short circuit protected

### Mounting:

Panel Mount or DIN Rail

### Output Ratings:

#### Output 1:

0 to 20 mA or 4 to 20 mA, isolated  
(500Ω max.) Control Out (Heat or  
Cool) or Retran of PV or SP

#### Output 2:

Relay, 3A/250V, SPST, NO/NC Selectable,  
Resistive Time Proportioning Heat or  
Cool, Alarm 1.

Jumper Selectable Logic SSR (unisolated)

Logic Level 1: 14 Vdc ±20% @ 20 mA max.  
(700 Ω min.) 24 Vdc max. ±20% @ 1mA

Logic Level 0: Less than 0.5 Vdc

Time Proportioning Heat or Cool

#### Output 3:

Relay, 2A/250V, SPST, Resistive  
Time Prop. Heat or Cool, Alarm 2

#### Output 4:

Relay, 2A/250V, SPST, Resistive  
Optional Alarm 3

### Serial Communications:

EIA RS-485 Modbus®, JBUS

### Mounting Dimensions:

48W x 96H x 116D mm

### Cutout:

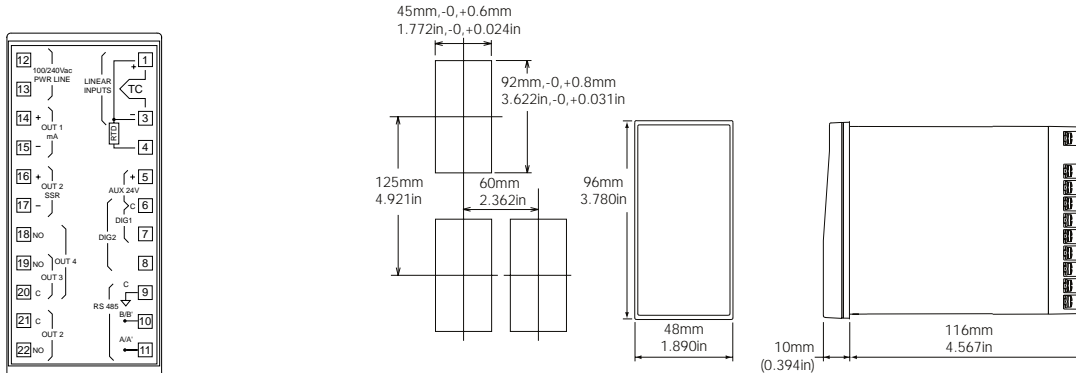
45W (-0, +0.6) x 92H (-0, +0.8) mm  
125 mm min. center-to-center vertical  
spacing; 60 mm min. center-to-center  
horizontal spacing

### Weight:

400 gm max.

### Dimensions

Dimensions are in millimeters





# Barber-Colman RFS Temperature/Process Controller

## Compact DIN Rail Mount Controller

Equipped with RS-485 Modbus  
Communications as Standard

- Universal T/C, 3-Wire RTD, and Linear mA, mV and V Input
- Smart Tune PID Control
- Soft Start power Limiter
- 3 Relay/SSR Outputs
- OPC Based Configuration Software

### Description

The RFS provides outstanding control performance and a comprehensive solution for a wide variety of applications; such as food processing, plastic manufacturing, and process applications requiring heat/cool control and process protection alarms in a compact DIN rail mounted package.

Universal thermocouple or RTD input coupled with a responsive SMART auto-tuning PID control algorithm that is equipped with special functions, including soft start and non-linear cooling. A complete set of process protection alarm functions; high and low limit, band and deviation are included.

Modular interconnection allows simultaneous connection of all common instrument elements: power supply, serial interface, logic input and open collector output for common alarms. The RFS-AL alarm-logic input expansion unit makes use of the modular interconnection function to provide additional I/O capacity.

### Dual Setpoint Selection

Two user configurable operation setpoints are selectable through logic input or the communication interface. For ON/OFF control action, this provides a method for fast and convenient run-hold switching, either by an external switch or by a host supervisory system.

The setpoint ramp rates of all heating zones within a group are synchronized by “holding back” the ramping setpoint. In order to achieve this, the individual loop band alarms are controlled by the common alarm output and isolated logic input functions.

### PC Interface Port + OPC Based Configuration Software

The integrated configuration port uses special software and an adaptor allowing:

1. Easy configuration of the instrument, with descriptions of the parameters and the relative limits.
2. Computer storage of the complete configuration allowing it to be copied to other RFS units.
3. Copying and cloning of the configuration to a new instrument.
4. The configuration interface port can be used for configuration and for monitoring the process during setup.

### Synchronized Pre-heating

Eliminates differential heating during startup due to different heat rates of individual heaters in applications such as extruders and injection hot runner control.

### Process Protection Alarms

Process (high or low limit), Band and Deviation alarm outputs are available with the additional flexibility of latching and masking functions until the process variable reaches the alarm threshold. Band and Deviation alarms are also masked after a setpoint change until the process variable reaches the alarm threshold. The alarm latching function holds the alarm on until it is acknowledged.

### Smart Tuning

Automatically adjusts the PID parameters according to the process dynamics. An important characteristic of the Eurotherm Controls continuous self tuning algorithm is its ability to optimize control parameters without injecting any artificial disturbances into the system.

### I/O Communications

All RFS I/O can be read directly over the Modbus communication interface by the host supervisory system. Additionally, the communication host can write to RFS outputs that are not assigned as alarm or status functions. This expands available PLC and host supervisory system I/O, simplifies machine troubleshooting and provides the ability to perform remote diagnostics.

### Sequential Modbus Addresses

To maximize the data transfer rates between the RFS and the host supervisory system, important operating parameters are grouped. Digital status information is transferred as data words to increase efficiency. The RFS is able to communicate relevant parameter information with a single data request, instead of a series of separate address operations.

### Startup Energy Management

At machine startup, the sequence of the RFS control outputs is scheduled according to the selected instrument Modbus address. This significantly reduces maximum startup current requirements and offers potential savings in electrical installation capacity and cabling specification requirements.

## OFD - Output Failure Detection (optional)

Using the CT input, the output failure detection function monitors the current in the load driven by output 1. Load and actuator protection is provided in the following manner:

During the ON period of the output, the instrument measures the current through the load and generates an alarm condition if the

current is lower than a pre-programmed threshold. A low current indicates a partial or total breakdown of the load or actuator SSR. During the OFF period of the output, the instrument measures the leakage current through the load and generates an alarm condition if the current is higher than a pre-programmed threshold value. A high leakage current indicates a short circuit of the actuator.

## INPUTS

All inputs are configurable and calibrated at the factory.

### RTD Input:

Type: 3-wire Pt100  
Calibration: according to DIN 43760  
Measuring current: 130 $\mu$ A  
Line resistance: auto-compensation up to 20 ohms per wire with no measurable error  
Engineering units: programmable °C or °F  
Sensor break: indicates break of sensor or one or more wires; indicates short circuit when sensor resistance <12 ohms

### Thermocouple Input:

Sensor break: open circuit sensor break detection  
Cold junction compensation: automatic compensation of temperature between 0 and 50°C  
Cold junction compensation error: 0.1°C/°C  
Input impedance: 1M ohms  
Calibration: according to IEC 584-1: 1995; DIN 43710-1977 for TC type L

### Linear Inputs:

Scaling: programmable from keyboard -2000 to 4000  
Decimal point: programmable to any position

### Logic Input:

Selection of the operating setpoint (SP or SP2) or of the temporary block of setpoint ramp  
Type: dry contact excitation 8V, 8mA  
Insulation: functional insulation  
Insulation voltage: 50Vrms

### Current Transformer Input:

Input current: 50mA, 50/60Hz  
Full scale range: 0-10A, 0-100A (configurable)  
Resolution: 0-20A: 0.1A; 21-100A: 1A  
Programmable output: NO or NC relay control output; Logic level 1 or 0; SSR control output  
Minimum period: On and Off: 400mSec

## OUTPUTS

### Output 1 and 2 - SSR:

Function: control output  
Type: non-isolated  
Logic level 1: 27VDC max. @ 1mA; 14VDC min. @ 20mA  
Logic level 0: < 0.5V

### Output 1 and 2 - Relay:

#### Output 1:

Function: control output  
Type: SPST  
Contact load: 3A @ 250VAC max. on resistive load

#### Output 2:

Function: control output or alarm  
Type: relay with SPST contact  
Contact load: 3A @ 250VAC max. on resistive load

### Output 3 and 4 - Relay:

#### Output 3:

Function: alarm output  
Type: relay with SPDT contact  
Contact load: 3A @ 250VAC max. on resistive load

#### Output 4:

Function: group alarm (common output)  
Type: open collector  
Contact load: 20mA max. @ 48V

## Control:

Type: one (heating) or two (heating/cooling) control outputs  
Output action: time proportioning  
Control Action: ON/OFF; PI or PID + SMART  
Proportional band: 1.0% to 100.0% of the input range for one control element; 1.5% to 100.0% of the input range for two control elements; Setting PB = 0 causes ON/OFF control  
Hysteresis: programmable from 0.1% to 10.0% of the input span  
Integral time: programmable from 1 second to 20 minutes (or none)  
Derivative time: programmable from 1 second to 10 minutes (or none)  
Integral offset: for one control element (heating), the offset is programmable from 0 to 100% of the output range; for two control elements (heating/cooling) the offset is programmable from -100% to +100% of the output range.  
Output 1 cycle time: 1 second to 200 seconds  
Manual to Auto: bumpless  
Output 2 relative gain: Programmable from 0.20 to 1.00 of the proportional band  
Output 2 cycle time: 1 second to 200 seconds  
Overlap/deadband: programmable from -20% (deadband) to +50% (overlap) of the proportional band

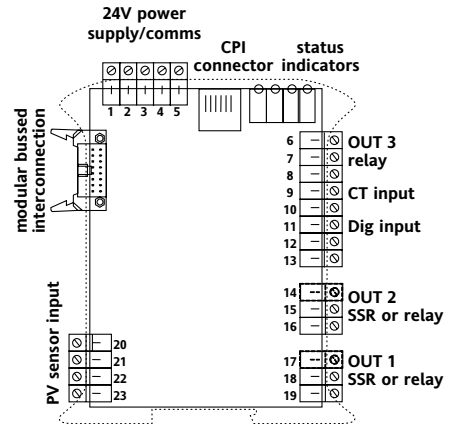
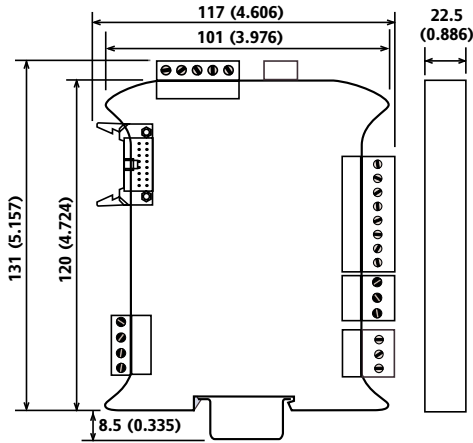
## Alarms:

Alarm action: direct or inverse  
Alarm functions: configurable as process, band or deviation alarms  
Alarm reset: programmable as automatic or manual  
Alarm masking: configurable as masked or unmasked alarms  
Hysteresis: 0.1 to 10.0% of input

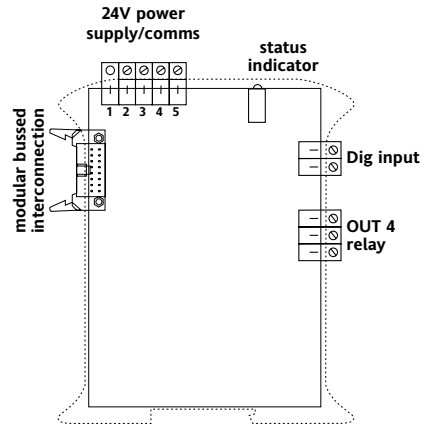
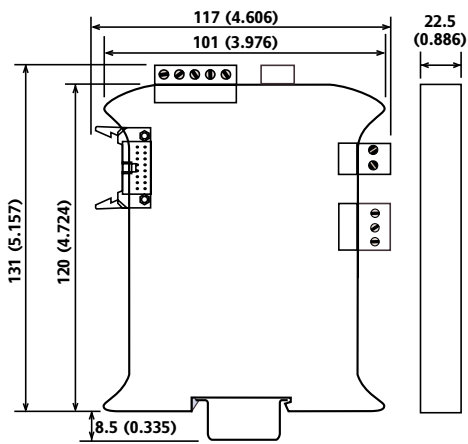
## Serial Interface:

Type: isolated RS-485  
Protocol: Modbus (2-wire)  
Baud rate: 600 to 19200 BAUD  
Byte format: 8 bit  
Parity: even, odd or none  
Stop bit: one  
Address: 1 to 254  
Voltage levels: according to EIA comm standard  
Line loading: 1/4 unit load

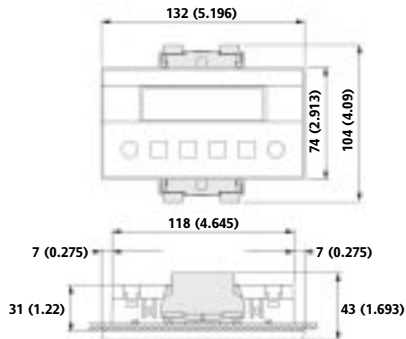
### RFS Controller



### RFS Alarm Unit



### RFS Text Display Unit



- 9. Modbus
- 10. 24 Vdc
- 11. Not used

**Specifications**

**Case:** PC/ABS grey  
**Self-extinguishing degree:** V0 according to UL 746C  
**Front protection:** IP20  
**Weight:** 250g max.  
**Power supply:** switching 24VAC/VDC (±10% of nominal value)  
**Power consumption:** 6VA  
**Insulation:** reinforced insulation is guaranteed between supply input, instrument inputs and outputs  
**Common mode rejection:** 120dB @ 50/60Hz  
**Normal mode rejection:** 60dB @ 50/60Hz  
**Installation:** DIN rail mounting

**Installation category:** II

**EMC/Safety:** CE certified; compliant with regs 89/336/EEC (harmonized reference standard EN-50081-2 and EN-50082-2) and 73/23/EEC e 93/68/EEC (harmonized reference standard EN 61010-1)  
**Sampling time:** 250mSec for linear inputs  
 500mSec for TC or RTD inputs  
**Accuracy:** ±0.2% f.s.v. @ 25°C with nominal supply voltage  
**Operating temperature:** 0 to +50°C  
**Storage temperature:** -20 to +70°C  
**Humidity:** 20% to 85% RH, non-condensing

**Text Display**

- High Visibility Display
- Up to 4 Lines of 20 Characters
- Three Color Backlighting
- Extended Graphics
- Multiple Languages including Cyrillic and Katakana
- 128 Customizable Characters



**Specifications**

**Operating Temperature:** 0 to 55°C  
**Humidity:** 20 to 85% RH, non-condensing  
**Comm Port:** DB25 Female; RS-232, RS-485 Modbus Master, RTU up to 19.2k baud  
**Supply Voltage:** 24 Vdc (18-30 Vdc, 5W max.)  
**Protection:** IP65 (front)  
**Certification:** CE,uL, CSA

**Order Information**

Model	Input	Control Action	Output 1	Output 2	Options	Power Supply	Customer Config
RFS	5	3				5	0ER

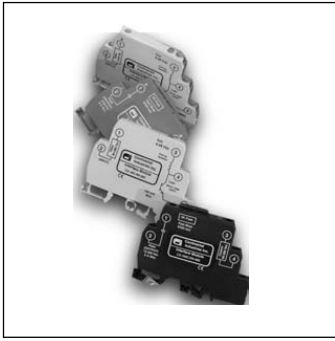
<b>Model</b> RFS DIN Rail Temperature Controller <i>(order connectors separately)</i>	<b>Output 1</b> 1 Relay 6 SSR	<b>Options</b> 0 None 4 OFD + Logic IN 5 ALM2 + OFD + Logic IN
<b>Input</b> 5 TC Type L, J, K, N, R, S, T and 3-Wire PT100 RTD	<b>Output 2</b> 0 None 1 Relay 6 SSR	<b>Power Supply</b> 5 24 Vac/Vdc
<b>Customer Configuration</b> 0ER Standard Labels		

**Accessories**

Connector Kit .....	ARFSKITCON000
Interconnecting Bus Cable .....	ARFSFLAT13000
Current Transformers	
10A .....	7ERR10000000
25A .....	7ERR20000000
50A .....	7ERR40000000
100A .....	7ERR50000000
RFS Configuration Port Interface Cable (without power supply) .....	CPI1202000ER
RFS Configuration Port Interface Cable (with power supply) .....	CPI1222000ER
RFS Alarm Unit .....	ARFSAL00000ER
RFS User Manual CD .....	HA136732
RFS Text Display .....	71-1165
Text Display Configuration Software & Cable .....	71-1166
RFS to Text Display Cable .....	A-60222

Miscellaneous Products





# Continental Industries

## Mini DIN I/O Modules

### DIN Rail Mount I/O Modules

Optically Isolated High Density Design  
Input/Output

- Compact Size
- Wide Logic Voltage Range
- Color Coded Cases
- TTL Compatible
- 4000 Volt Isolation

#### Description

The Mini DIN I/O Series input/output modules provide a high density, DIN rail mountable device for low power heating loads or conversion of AC or DC control logic levels to a low level DC signal.

Table 1. Mini I/O Input Module Specifications

Part Number	Case Color	Input Voltage	Logic Type	Output Voltage	Max Load Current	Turn On Time Max	Turn Off Time Max	Output Voltage Drop @ 100mA
I.O.-IAC-R0-280	Yellow	90-280 Vac	Negative	4-28 Vdc	100 mA	20 ms	20 ms	0.5 Vdc
I.O.-IAC+R0-280	Yellow	90-280 Vac	Positive	4-28 Vdc	100 mA	20 ms	20 ms	0.5 Vdc
I.O.-IDC-R0-028	White	4-28 Vdc	Negative	4-28 Vdc	100 mA	30 μs	60 μs	0.5 Vdc
I.O.-IDC+R0-028	White	4-28 Vdc	Positive	4-28 Vdc	100 mA	30 μs	60 μs	0.5 Vdc

Table 1. Mini I/O Output Module Specifications

Part Number	Case Color	Input Voltage	Logic (Input) Impedance	Output Voltage	Output Current @45° C	Leakage Current @ Max Field Voltage	Voltage Drop @ Max I <sub>out</sub>
I.O.-OAC-R0-280	Black	4-28 Vdc	1.5K Ohms	12-280 Vac	0.10-3A <sub>rms</sub> *	5 mA	1.65 Vac
I.O.-OAC-RA-280	Black	90-280 Vac	40K Ohms	12-280 Vac	0.10-3A <sub>rms</sub> *	5 mA	1.65 Vac
I.O.-ODC-R0-060**	Red	4-28 Vdc	1.5K Ohms	5-60 Vdc	0-3A*	1 mA	1 Vdc
I.O.-ODC-RL-060***	Red	4-28 Vdc	1.5K Ohms	5-60 Vdc	0-3A*	100 μA	1 Vdc

Notes: 4000 V<sub>RMS</sub> isolation on all model numbers (input and output modules)  
Operating temperature 0-70°C (input and output modules)

\*The 3 Amp output is obtained when there is <45°C ambient air surrounding all sides of the module. Derate the output if the ambient temperature is higher or if the modules are tightly stacked together.

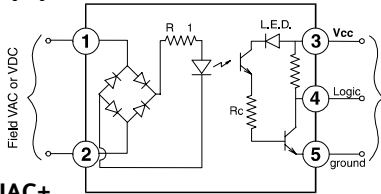
\*\* Turn On time: 40us; Turn Off time: 40us

\*\*\*Turn On time: 50us; Turn Off time: 100us

## Input Modules

### IAC-

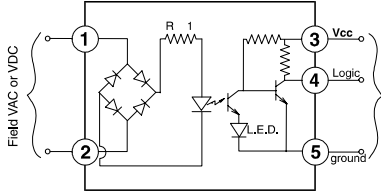
Neg Logic



A voltage on the field side will cause the voltage on terminal 4 to change from Vcc to ground.

### IAC+

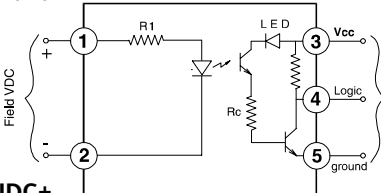
Pos Logic



A voltage on the field side will cause the voltage on terminal 4 to change from ground to Vcc.

### IDC-

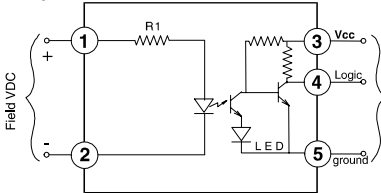
Neg Logic



A voltage on the field side will cause the voltage on terminal 4 to change from Vcc to ground.

### IDC+

Pos Logic

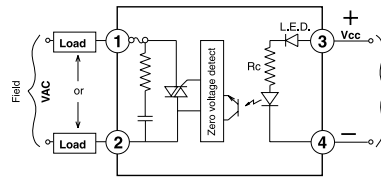


A voltage on the field side will cause the the voltage on terminal 4 to change from ground to Vcc.

Module Logic	Field Voltage?	Logic Voltage Signal (Terminal 4)
Negative	Yes	No
Negative	No	Yes
Positive	Yes	Yes
Positive	No	No

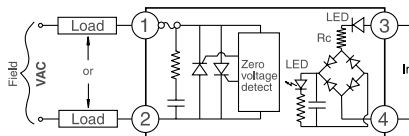
## Output Modules

### OAC-R0



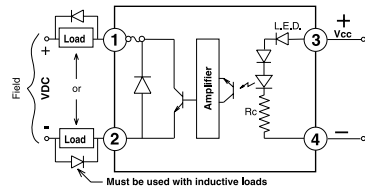
Application of a voltage here will cause the load to turn on.

### OAC-RA



Application of a voltage here will cause the load to turn on.

### ODC

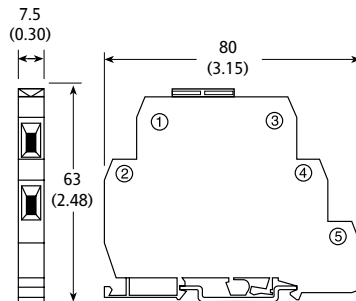


Application of a voltage here will cause the load to turn on.

Must be used with inductive loads

## Dimensions

Dimensions are in millimeters (inches)



# IP51/IP61

## Current to Pressure Transducers

Produces a Pneumatic Output  
in Response to a Current Input



IP51-2000	(NEMA 4X, 3-27 psig output)
IP51-3000	(NEMA 4X, 3-15 psig output)
IP51-4000	(NEMA 4X, 6-30 psig output)
IP61-2000	(Explosion Proof, 3-27 psig output)
IP61-3000	(Explosion Proof, 3-15 psig output)
IP61-4000	(Explosion Proof, 6-30 psig output)

- Compact Size
- NEMA 4X or Explosion Proof
- Intrinsically Safe
- Field Configurable Direct, Split and Inverse Ranges
- Accuracy Greater Than 0.15%
- Calibrate without Removing Tubes or Wires

### Description

IP51 and IP61 current to pressure converters produce a pneumatic output in response to a current input. They are useful for applications involving the control of actuators and valves, or for interfacing electrical equipment to pneumatic instrumentation.

Their unique solid state current to pressure converter uses minimal electrical energy and air consumption to produce accurate output pressure signals. Because there are no moving parts, the unit will operate reliably for many years when installed properly.

These transducers are available in a NEMA 4X housing (IP51) or in an Explosion Proof housing (IP61). They are rated Intrinsically Safe and are available with FM approval (standard) and CSA approval (optional).

### Operation

See Figure 1. The electric to pneumatic conversion takes place in the E-Pi valve. A conditioned 4-20 mA input signal provides a current to the coil of the E-Pi. This creates a magnetic field which magnetizes the valve. The magnetization is proportional to the input current signal and positions the membrane relative to the valve seat. The pneumatic output (back pressure) is thereby modulated relative to the input current. Further conditioning of the pneumatic output is achieved with a volume booster.

Final conditioning of the boosted pneumatic output signal is achieved by measuring the output with a pressure sensor. This signal is then compared with the current to the "E-Pi" to achieve the exact pneumatic output relative to the 4-20 mA current input.

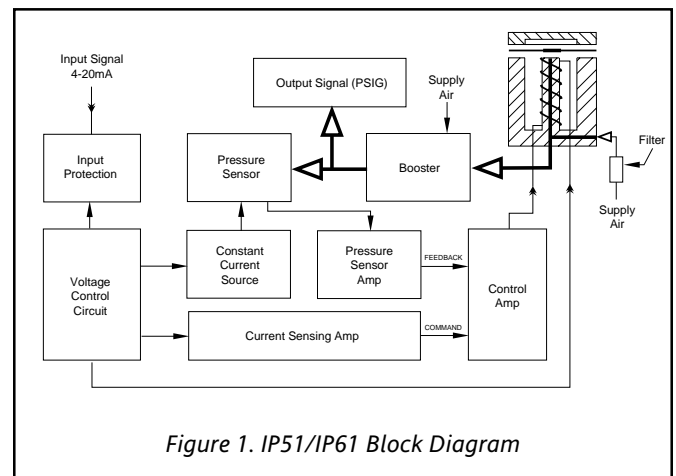


Figure 1. IP51/IP61 Block Diagram

**Specifications**

**Input:** 4-20mA

**Output:** 3-27, 3-15, 6-30 PSIG

**Accuracy:**

3-15 PSIG: ±0.15% of Span

3-27, 6-30 PSIG: ±0.25% of Span

**Repeatability:** 0.05% of Span

**Deadband:** 0.02% of Span

**Stability Reproducibility:** 0.5% of Span/6 mo.

**Position Effect:** Not Measurable

**Vibration Effect:** <0.25% from 1-200Hz/1g

**Frequency Response:** -3db at 5Hz  
(per ISA-S26.4.3.1 Configuration A)

**Loop Load:** 3.8VDC + 5 ohms  
(195 ohm load at 20mA)

**Operating Current:** 3.7mA min., 200mA max,  
continuous at 120°F  
Half Cycle 70 amp 1/20sec. at 68°F

**Failure Mode:** Transducer always fails in the direct mode, i.e., if input current drops below 3.7mA DC the output will drop to 1 to 2 psig regardless of direct or reverse mode selection.

**Enclosure:** Internally purged NEMA 4X Cast/Machined Aluminum with powder coat epoxy.

**Connections:**

1/4" NPTF supply port (1)

1/4" NPTF output Port (2)

1/2" NPTF electrical conduit connection

**Weight:** 2.5 lbs

**Supply Pressure:** Minimum of 3 psig and maximum of 10 psig above the maximum calibrated output.

**Supply Pressure Effect:** Not measurable within recommended supply pressure range.

**Output Capacity:** 4.0 SCFM (Supply and Exhaust Characteristics are balanced to within ±10%)

**Air Consumption:** 0.04 SCFM Steady State Average (0.06 SCFM Maximum)

**Operating Temperature:**

-20 to 150°F (-29 to 66°C)

**Temperature Effect:** <1% per 100°F (38°C) change

**RFI-EMI Effect:** Per SAMA PMC 33.1 standard (b), (c) 20 to 100MHz, Class 3 effect on zero & span less than 1%

**Operational Modes:** Direct, reverse and/or split-range (field-selectable)

**Agency Approvals:** CSA & FM approved for hazardous environments

**Ordering Information**

Specify:

1. Model:

IP51-2000 (NEMA 4X, 3-27 psig output)

IP51-3000 (NEMA 4X, 3-15 psig output)

IP51-4000 (NEMA 4X, 6-30 psig output)

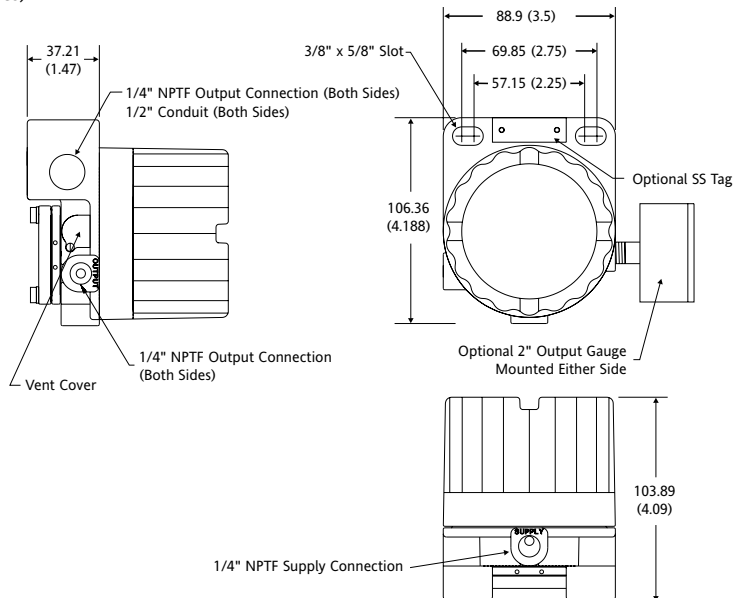
IP61-2000 (Explosion Proof, 3-27 psig output)

IP61-3000 (Explosion Proof, 3-15 psig output)

IP61-4000 (Explosion Proof, 6-30 psig output)

**Dimensions**

Dimensions are in millimeters (inches)



Miscellaneous Products



# Barber-Colman MEMOCAL 2000/2000S Hand Held Calibrator

A Versatile Portable Calibrator ideal for  
both Field and Laboratory

- Two-line 16 Character Backlit LCD Display
- Calibration for T/C, RTD, mA<sub>dc</sub>, mV<sub>dc</sub>, V<sub>dc</sub> & Ohms
- Reference Accuracy to 0.015% of Range
- Temperature Drift of 0.1 $\mu$ V/ $^{\circ}$ C
- Battery or AC Adapter Operated
- Built-in Auxiliary Power Supply
- High & Low Peak Reading Memory
- 50 Step Ramp, Soak & Step Function

## Description

The MEMOCAL 2000 is a lightweight, versatile, hand-held calibrator for use both in the field and laboratory. The small size, simple programming, friendly interface, high noise immunity and long battery life make the MEMOCAL ideal for field maintenance calibration. The optional leather carrying case features an over the shoulder strap and allows for viewing of both the display and the keypad. The high accuracy, large range of I/O capabilities and digital interface make the MEMOCAL ideal for laboratory use. A standard 120/240 Vac adapter saves battery capacity when working at the bench.

The MEMOCAL 2000 simulates and measures 15 different thermocouple, 2 RTD, mA<sub>dc</sub>, mV<sub>dc</sub>, V<sub>dc</sub> and Ohms signals. A built-in auxiliary power supply allows excitation and measurement of 2-wire and 4-wire transmitters. Standard features also include configurable internal or external cold junction compensation, square root extraction and quadratic signal generation.

The Memocal 2000S is engineered specifically for the hospital and healthcare industry. It has the same specifications as the standard model except that it provides Type T thermocouple and process inputs only.

Up to 50 program steps can be created in one or more programs, providing pre-configured ramp, soak and step functions for calibration zero, span and midpoints. Two dry contact inputs allow program advance and hold.

**Thermocouple Input Ranges (°F)**

TC Type	Range in °F	Resolution	Reference Accuracy (±)
J	-328° F to 2192° F	0.1° F	0.021%
K	-328° F to 3° F	<0.2° F	0.018%
	33° F to 1772° F	0.1° F	0.014%
	1773° F to 2264° F	0.1° F	0.023%
	2265° F to 2498° F	<0.3° F	0.032%
T*	-328° F to 32° F	<0.2° F	0.045%
	33° F to 752° F	0.1° F	0.023%
E	-328° F to 1832° F	0.1° F	0.019%
R	-58° F to 32° F	<0.5° F	0.08%
	33° F to 350° F	<0.4° F	0.048%
	351° F to 500° F	<0.3° F	0.036%
	501° F to 3062° F	<0.2° F	0.025%
	3063° F to 3214° F	<0.3° F	0.037%
S	-58° F to 32° F	<0.5° F	0.06%
	33° F to 140° F	<0.4° F	0.048%
	141° F to 470° F	<0.3° F	0.036%
	471° F to 3214° F	<0.2° F	0.024%
B	122° F to 212° F	<4° F	0.75%
	213° F to 320° F	<2° F	0.25%
	321° F to 600° F	<1° F	0.12%
	601° F to 1250° F	<0.5° F	0.063%
	1251° F to 1770° F	<0.3° F	0.041%
U	1771° F to 3276° F	<0.2° F	0.025%
	-328° F to 1112° F	0.1° F	0.027%
L	-328° F to 1299° F	0.1° F	0.016%
	1300° F to 1652° F	<0.2° F	0.026%
N	32° F to 1083° F	<0.2° F	0.014%
	1084° F to 2006° F	0.1° F	0.028%
	2007° F to 2570° F	<0.2° F	0.031%
Ni/Ni	32° F to 1529° F	0.1° F	0.016%
	1530° F to 2372° F	<0.2° F	0.024%
PLII	-148° F to 924° F	0.1° F	0.013%
	925° F to 1761° F	<0.2° F	0.015%
	1762° F to 2552° F	<0.3° F	0.039%
W (G)	32° F to 392° F	<1.2° F	0.16%
	393° F to 1292° F	<0.2° F	0.045%
	1293° F to 2309° F	0.1° F	0.023%
	2310° F to 2786° F	0.2° F	0.025%
W3 (D)	2787° F to 3276° F	<0.3° F	0.038%
	32° F to 572° F	<0.2° F	0.024%
	573° F to 1832° F	0.1° F	0.017%
	1833° F to 1994° F	<0.2° F	0.019%
W5	1995° F to 3276° F	<0.3° F	0.053%
	32° F to 572° F	<0.2° F	0.018%
	573° F to 1958° F	<0.3° F	0.048%
W5	1959° F to 3276° F	<0.4° F	0.054%

**Thermocouple Input Ranges (°C)**

TC Type	Range in °C	Resolution	Reference Accuracy (±)
J	-200° C to 1200° C	0.1° C	0.021%
K	-200° C to 967° C	0.1° C	0.018%
	968° C to 1370° C	<0.2° C	0.032%
T*	-200° C to 0° C	0.1° C	0.045%
	1° C to 400° C	0.1° C	0.023%
E	-200° C to 1000° C	0.1° C	0.019%
R	-50° C to 0° C	<0.3° C	0.08%
	1° C to 350° C	<0.2° C	0.048%
	351° C to 1684° C	0.1° C	0.024%
S	1685° C to 1760° C	<0.2° C	0.037%
	-50° C to 0° C	<0.3° C	0.06%
B	1° C to 600° C	0.2° C	0.048%
	601° C to 1760° C	0.1° C	0.024%
U	50° C to 100° C	<3° C	0.7%
	101° C to 200° C	<1° C	0.23%
	201° C to 600° C	<0.5° C	0.11%
	601° C to 1150° C	0.2° C	0.039%
L	1151° C to 1820° C	0.1° C	0.023%
	-200° C to 600° C	0.1° C	0.027%
N	-200° C to 900° C	0.1° C	0.026%
Ni/Ni	0° C to 1410° C	<0.2° C	0.034%
	0° C to 1300° C	0.1° C	0.024%
PLII	-100° C to 961° C	0.1° C	0.014%
	962° C to 1400° C	<0.2° C	0.039%
W (G)	0° C to 50° C	<1° C	0.126%
	51° C to 100° C	<0.3° C	0.048%
	101° C to 250° C	<0.2° C	0.035%
	251° C to 1530° C	0.1° C	0.019%
W3 (D)	1531° C to 2300° C	<0.2° C	0.03%
	0° C to 100° C	0.1° C	0.019%
	101° C to 1090° C	0.1° C	0.014%
W5	1091° C to 2310° C	<0.3° C	0.042%
	0° C to 1096° C	0.1° C	0.014%
W5	1097° C to 2250° C	0.2° C	0.037%
	2251° C to 2315° C	<0.3° C	0.042%

**mV, Volt and mA Input Ranges\***

Range	Resolution	Reference Accuracy (±)
-20mV to 20mV	1µV	0.015%
-200mV to 200mV	10µV	0.015%
-2V to 2V	100µV	0.015%
-20V to 20V	1mV	0.020%
-20mA to 20mA	1µA	0.015%
-130mA to 130mA	10µA	0.020%

**Pt100 RTD Input Ranges\***

Range	Resolution	Reference Accuracy (±)
-200° C to 850° C	0.1° C	0.028%
-328° F to 512° F	0.1° F	0.012%
513° F to 1562° F	<0.2° F	0.029%

**Ni100 RTD Input Ranges**

Range	Resolution	Reference Accuracy (±)
-60° C to 350° C	0.1° C	0.029%
-76° F to 662° F	0.1° F	0.029%

**Ohms Input Range**

Range	Resolution	Reference Accuracy (±)
0 to 800	0.1	0.025%

\* Only ranges marked with an asterisk are available with the Healthcare version (2000S).

Shaded ranges available only when the IPTS standard is selected.

Miscellaneous Products

### *mV, Volt and mA Output Ranges*

Range	Resolution	Reference Accuracy (±)
-4mV to 20mV	1µV	0.015%
-40mV to 200mV	10µV	0.015%
-400mV to 2000mV	100µV	0.015%
-4V to 20V	1mV	0.020%
0mA to 21mA	1µA	0.015%

### *Ohms Output Range*

Range	Resolution	Reference Accuracy (±)
15 to 500	0.1	0.031%

### *Pt100 RTD Output Ranges*

Range	Resolution	Reference Accuracy (±)
-200° C to 850° C	0.1° C	0.029%
-328° F to 512° F	0.1° F	0.022%
513° F to 1562° F	<0.2° F	0.025%

### *Ni100 RTD Output Ranges*

Range	Resolution	Reference Accuracy (±)
-60° C to 350° C	0.1° C	0.036%
-76° F to 680° F	0.1° F	0.036%

#### Specifications

- Case:** ABS, color similar to RAL 6038.
- Self-extinguishing degree:** V-0 according to UL.
- Input Protection:** All ranges are protected against a fault connection up to 30 Vac/Vdc.
- Terminals:** 3 external screw female plugs, 4 mm diameter.
- Weight:** 600 grams (1.4lb) maximum.
- Power Supply:** - 4 AA batteries (Alkaline 1.5V; Ni-Cd 1.2V; or Ni-MH 1.2V).  
- Switching Type AC adapter (100 to 240 Vac).
- Battery Life:** 24 hours average (with Ni-MH batteries).
- Recharging Time:** 12 Hours
- Insulation Res:** Greater than 100MΩ.
- Isolation Voltage:** 1500 Vac rms
- Common Mode Rejection Ratio:** 120 dB @ 50/60 Hz.
- Normal Mode Rejection Ratio:** 60 dB @ 50/60 Hz.
- Safety Standard:** Meets EN60950/A2
- EMC Standard:** Meets generic emissions standard EN50081-2 and immunity standard EN50082-2 for industrial environments.
- A/D Conversion:** Dual slope integration.
- Sampling Time:** 500 ms.
- Display Update:** 500 ms.
- Temperature Drift:** 0.0028%/°C or 28ppm/°C
- Operating Temp:** 0 to 40 °C.
- Storage Temp:** -10 to 60 °C.
- Humidity:** 20% to 85% RH, non-condensing.

#### Measuring Inputs

- Thermocouple Inputs:**
- Type:** (J, K, T, E, R, S, B, U, L, N, W, W3, W5, Ni/Ni-Mo and Platinel II), keyboard configurable (and programmable choice of IPTS-68 or ITS 90).
- Engineering Units:** °C and °F keyboard configurable.
- Burn Out:** Detection of the open input circuit (wires or sensor) with "OPEN" indication
- Cold Junction:** Automatic compensation
- Cold Junction Compensation Error:** ±0.3 °C, ±0.05 °C/°C.
- External Cold Junction Compensation:** Programmable from -20 to 80 °C.
- Input Impedance:** Greater than 10MΩ.

#### RTD Inputs:

- Type:** Pt100 Ω and Ni100 Ω, 3-wire connection.
- Calibration:** Programmable according to IPTS-68 or ITS-90
- Line Resistance:** Up to 20 Ω/wire with no measurable error.
- Engineering Units:** °C and °F keyboard configurable.
- Measuring Current:** 100 µAmps.
- Burn Out:** Detection of sensor open circuit and one or more wire open circuit
- mA, mV & Volts Inputs:**
- Type:** Linear Inputs (mAdc, mVdc, Vdc), keyboard programmable.
- Input Impedance:** 10 Ω for mAdc inputs.  
Greater than 500KΩ for 20 Volt input.
- Range Selection:** Automatic or manual.
- Square Root Extraction:** Programmable.
- Readout:** -20,000 to 20,000 keyboard programmable.
- Decimal Point:** Programmable to any position.

#### Ohms Input:

- Range:** 0 to 800.
- Resolution:** 0.1 Ω.

#### Outputs:

- Thermocouple Outputs:**
- Type:** (J, K, T, E, R, S, B, U, L, N, W, W3, W5, Ni/Ni-Mo and Platinel II), keyboard configurable (and programmable choice of IPTS-68 or ITS 90).
- Engineering Units:** °C and °F keyboard configurable.
- Output Impedance:** 50 Ω.

#### RTD Outputs:

- Type:** Pt100 Ω and Ni100 Ω, 3-wire connection.
- Engineering Units:** °C and °F keyboard configurable.
- Calibration:** According to DIN 43760.

#### mA, mV & Volts Outputs:

- Type:** Linear (mAdc, mVdc, Vdc), keyboard programmable.
- Output Impedance:** 50 Ω for mVdc outputs.  
0.5 Ω for Vdc outputs.

#### Current Output

- Maximum Load:** 500 Ω.
- Range Selection:** Automatic or manual.
- Quadratic Signal Generation:** Programmable.
- Readout:** -20,000 to 20,000 keyboard programmable.
- Decimal Point:** Programmable to any position.

**Ohms Output:**

**Type:** Ohms.  
**Range:** 15 to 80; 80 to 500.  
**Resolution:** 0.1 Ω.

**Special Functions**

**Peak High/Peak Low Detection:**

The instrument memorizes (and displays) the high and lowest detected reading.

**Backlight:** The backlight on the LED display automatically turns off after 30 seconds.

**Program Routine:** Up to 50 steps which can be programmed to one or more separate routines.

**Battery Check:** The instrument operates at 3 different battery levels:  
Level 1 The instrument is fully operational.  
Level 2 The instrument is still fully operational, but "BATTERY LOW" appears on the upper display.  
Level 3 The instrument turns OFF automatically and utilizes the remaining power for memory back-up only.

**Logic Inputs:**

(Not available with digital communications)  
Logic Input 1 sequences to the next program step.  
Logic Input 2 starts/stops program operation.

**Digital Communications (optional):**

**Type:** Built-in RS-232C. External RS-232 to RS-485 converter available in desk-top stand.  
**Protocol:** MODBUS, JBUS.  
**Baud Rate:** 600, 1200, 2400, 4800, 9600 and 19,200 baud.  
**Byte Format:** 8 bits.  
**Parity:** Even, odd, or none.  
**Stop Bit:** One.  
**Address:** From 1 to 255.

**Ordering Information**

**Specify:**

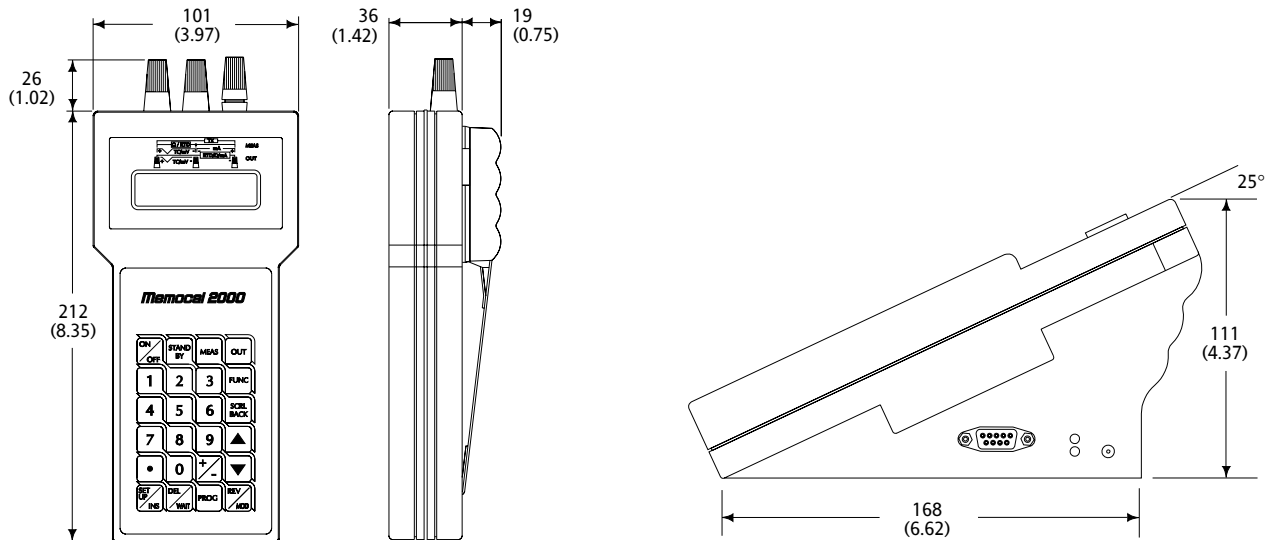
- 1. Model: MEM2090 (standard product)  
MEM2095 (healthcare version)
- 2. Options: RS-232 Communications (n/a with MEM2095)  
Desk top Adaptor (n/a with MEM2095)  
Case
- 3. Accessories.

**Accessories**

- MEM2000BATTO Rechargeable battery pack
- MEM2000CALER Factory calibration and certificate

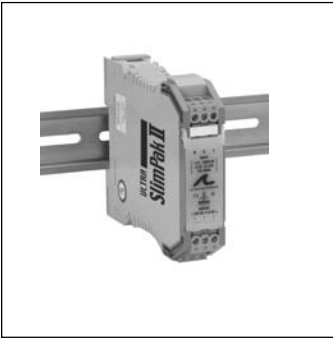
**Dimensions**

Dimensions are in millimeters (inches)



Miscellaneous Products





# ULTRA SLIMPAK® II

## WV905

### DIN Rail Mount Power Supply

### 24VDC @ 0.5A

The perfect power source for Ultra SlimPak II  
Signal Conditioners and Alarms



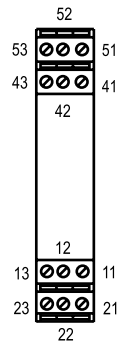
- Compact Size
- Auto-ranging Input
- Thermal Shutdown
- Bussed Power with Plug-in Power Clips

- RoHS Compliant
- Removable Terminals for Easy Service
- Overcurrent Shutdown with Automatic Restart
- UL, CSA & CE

#### Description

The WV905 power supply can be used to operate most 24VDC instruments, including Action's Ultra SlimPak II, Ultra SlimPak, and ActionI/Q models. The WV905 will operate on input voltages ranging from 85 to 265VAC or 120 to 300VDC. The 24VDC, 0.5A output has overcurrent shutdown with automatic restart and thermal shutdown. The input is protected by fuse, a thermistor for inrush current protection, and a varistor for over voltage.

The WV905 is the perfect power source for Ultra SlimPak II signal conditioners and alarm units. The integrated power jumping system makes short work of connecting power, eliminating the need to "daisy-chain" power wires.



Pin	Description
11	DC Power (+)
12	DC Power (+)
13	DC Power (+)
21	DC Power (-)
22	DC Power (-)
23	DC Power (-)
41	Line In (115-230VAC)
42	Earth Ground
43	Neutral
51	No Connection
52	No Connection
53	No Connection

**Specifications**

**Input Voltage:**

Typical: 115 to 239VAC, ±10%, 50/60Hz  
Minimum: 85VAC, 120VDC  
Maximum: 265VAC, 300VDC

**Input Current:**

(average values for reference only)  
@115VAC: 250mA<sub>rms</sub>, ±20%  
@230VAC: 150mA<sub>rms</sub>, ±20%  
@125VDC: 125mA, ±20%  
@250VDC: 65mA, ±20%

**Output Voltage:**

24VDC

**Maximum Output Current:**

0.5A

**Input Protection:**

Fuse: 2A slowblow (internal)  
Inrush Current: Thermistor  
Over Voltage: Varistor

**Switching Frequency:**

100kHz

**Efficiency @ Maximum Load:**

79%

**Maximum Ripple:**

0.1%

**Load Regulation:**

0.2% (10% to 100% Load)

**Line Regulation:**

0.2% (85VAC to 265VAC In)

**Overload Protection:**

Over current shutdown with automatic restart  
plus thermal shutdown

**Maximum Load Capacitance on Output:**

5.000uF

**Hold Time:**

(full output current after loss of input)  
@115VAC: 14ms  
@230VAC: 70ms

**Isolation:**

Input to Output: 3kV  
Input/Output to Rail: 4kV  
Input to Ground: 1.5kV  
Output to Ground: 500V

**Wire Size:**

26-12AWG (0.1 to 4.0mm<sup>2</sup>)

**Operating Temperature:**

-20°C to +50°C (-4°F to 122°F)

**Storage Temperature:**

-40°C to +85°C (-40°F to 185°F)

**Operating Humidity:**

20% to 85% RHNC @ 45°C

**Storage Humidity:**

20% to 90% RHNC @ 60°C for 24 hours

**Size:**

DIN rail case – refer to Dimensions drawing

**Agency Approvals:**

UL, CSA, CE mark  
RoHS compliant

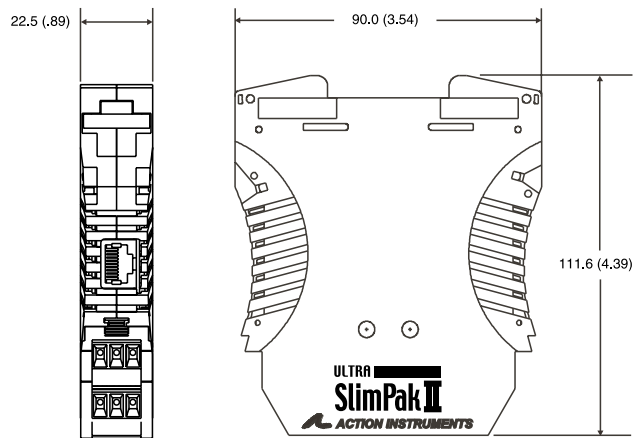
*Note that detailed installation instructions are available on our website.*

**Ordering Information**

- Specify:  
1. Model:  
WV905-0000

**Dimensions**

Dimensions are in millimeters (inches)





# H910/H915

## DIN-Rail Mount Power Supplies

Provides 24VDC Power for DC-Powered Equipment



- For use with Ultra SlimPak™, ActionI/Q™ and other 24VDC Powered Products
- DIN-Rail Mount Housing for High-Density Installations
- Overload and Short Circuit Protection
- Two Different Models and Power Ratings
- 110VAC or 85 to 265VAC
- RoHS Compliant

### Description

Model H910 and H915 power supplies can be used to operate most 24VDC instruments, including Action's Ultra SlimPak® and the ActionI/Q™. All models convert 110VAC to 24VDC.

Model H910 supplies up to 1000mA at 24VDC and the H915 supplies up to 2300mA at 24VDC. Both models feature an LED power indicator. The H915 has multiple wire terminal connections. They both have input fuse protection and their outputs have DC short circuit protection.

### Ordering Information

#### Models & Accessories

##### Specify:

1. Model: **H910 or H915**

#### Accessories

DIN-rail mount power supplies will mount on standard TS32 (model MD02) or TS35 (model MD03) DIN rail. In addition, the following accessories are available:

**MD03** TS35 X 7.5 DIN rail, 2 meters, slotted

**C664** I/O Descriptive Tags

#### Terminal Connections

##### H910 and H915

- L Line Power Hot (Black)
- N Line Power Neutral (White)
- + DC Power Output (+)
- DC Power Output (-)

**Specifications**

**Input:**

H910: 115-230VAC, 50 to 60Hz  
H915: 85 to 265VAC, 50 to 60Hz

**Isolation:**

Input to Output: 3KVrms  
Input/Output to rail: 4KVrms  
Input to Ground: 1.5Vrms  
Output to Ground: 500Vrms

**Input Power:**

H910: 60VA  
H915: 50VA

**Output:**

H910: 24VDC @ 1000mA max.  
H915: 24VDC @ 2300mA max.

**Load Regulation:**

H910: <1%

**Fuse:**

H910, H915: 250V, 2A, 5 X 20mm

**Ambient Temperature:**

H910  
Operating: 0 to 50°C  
Storage: -40 to 85°C  
H915  
Operating: 0 to 40°C  
Storage: -40 to 85°C

**Humidity:**

Operating: 0 to 80% @ 45°C non-condensing

**Wire Terminations:**

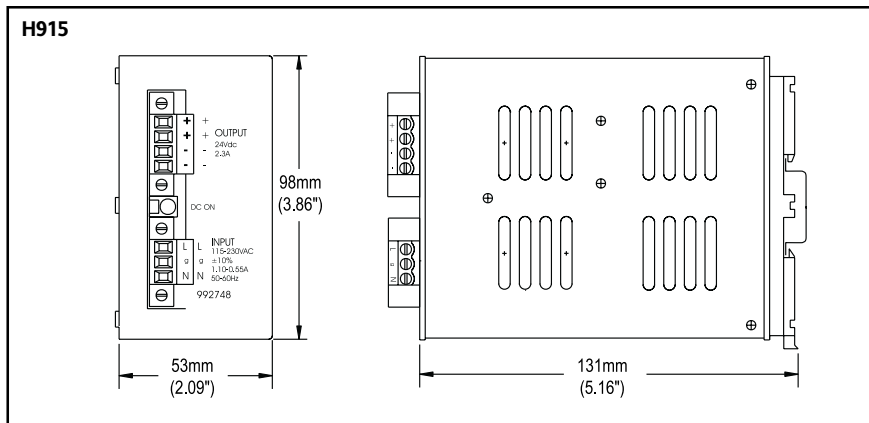
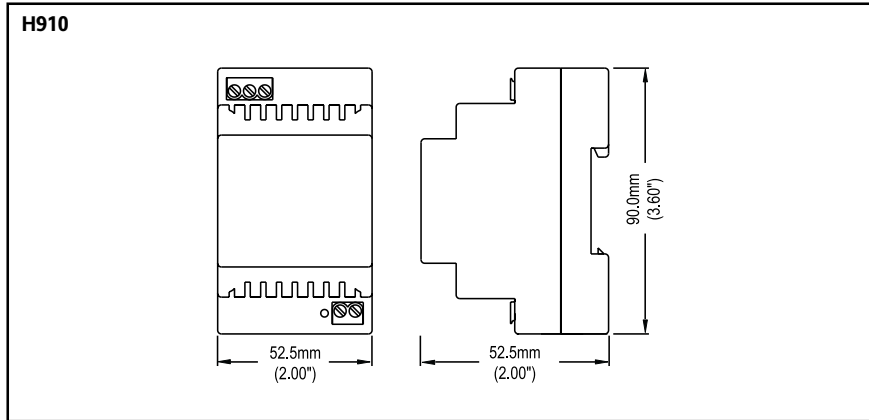
Screw terminals for 12-22AWG

**Agency Approval:**

H910: CSA, UL508A, CE Mark  
RoHS Compliant

**Dimensions**

*Note that detailed installation instructions are available on our web site.*



Miscellaneous Products



AP9046-101

# Action PAK® AP9046

## DC Output Power Supply

Provides a Regulated 24VDC Output at up to 65mA



- Ideal for Two-Wire Transmitters
- Plug-in Installation
- Regulated & Unregulated Outputs
- AC Line Powered

### Application

The AP9046 is useful in any two-wire transmission application to power the current loop. The 24VDC regulated output provides maximum loop drive capability without exceeding intrinsically safe voltage requirements. For installations where intrinsic safety is not a factor, the 40V unregulated output provides increased loop drive. The current rating of the AP9046 allows it to power up to three standard 4-20mA current loops simultaneously.

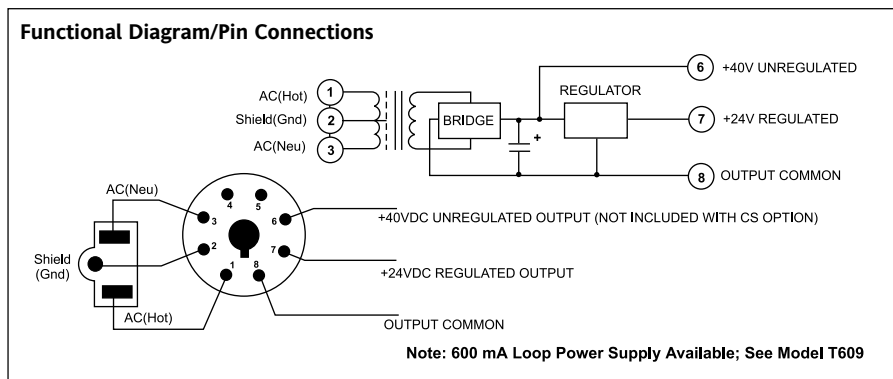
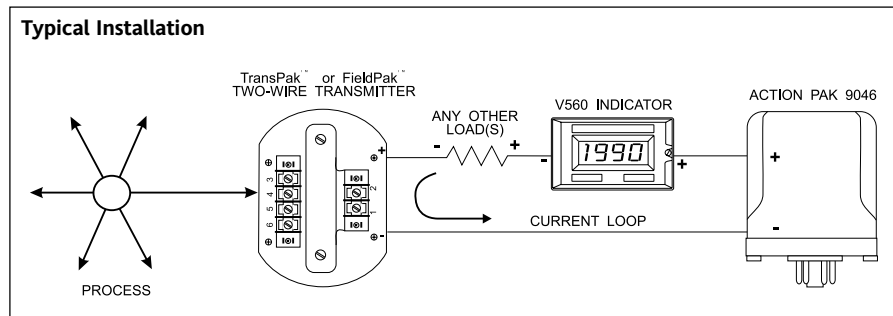
The AP9046 can also be used as a general purpose DC power supply for alarms and indicators, or any application requiring 24/40VDC at up to 65mA. *(Note: 24 VDC only with CS option)*

### Options

- CS** Canadian Standards Association Certification.
- U** Urethane coating of internal circuitry for protection from corrosive atmospheres.

### Mounting

All Action Paks feature plug-in design for ease of service or system modification, and low MTTR (mean-time-to-repair). Mounting hardware options for the AP9046 Power Supply include a surface/track socket (M008), a surface/DIN rail socket (MD08), and a retaining spring (M801) for high vibration applications.



**Specifications**

**Output Voltage:**

24VDC ±5% and 40VDC unregulated

**Regulation (24VDC Output Only):**

Line: within 1% (@ 120VAC10%)  
 Load: within 1% to rated current  
 Ripple: less than 15mV peak-to-peak

**Output Current:**

65mA @ 24VDC, max (short-circuit protected)

**Operating Temperature Range (Ambient):**

0 to 60°C (32 to 140°F)

**Power:**

120VAC ±10%, 50 to 400Hz, standard:  
 3 Watts, typical; 5 Watts, maximum

**Weight:**

0.52lbs

**Agency Approvals:**

CSA certified per standard C222, No. 0-M1982  
 (File No. LR42272-8,9)

**Ordering Information**

**Specify:**

1. Model: **AP9046-101**
2. Options: CS or U (see text)
3. Line Power (if not 120VAC): 240VAC

**Accessories:**

- M801-0000 Retaining Ring
- M008-A 8 pin Track Mount Socket
- M004-0000 4 ft Long Channel Track
- MD08-0000 8 pin DIN Mount Socket

**Pin Connections**

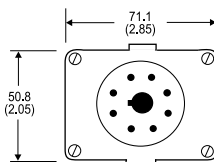
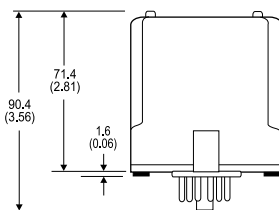
- 1 AC Power (Hot)
- 2 Shield (Gnd)
- 3 AC Power (Neu)
- 4 No Connection
- 5 No Connection
- 6 +40V unregulated
- 7 +24V regulated
- 8 Output Common

**Mounting**

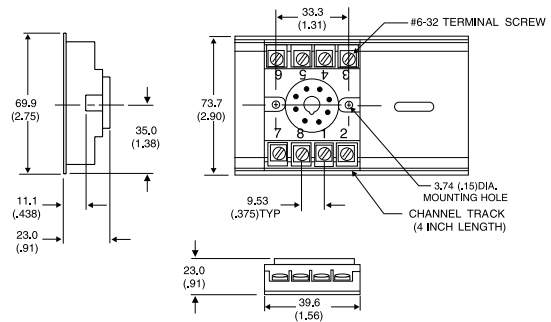
All Action Paks feature plug-in installation. The Action Pak AP9046 uses an 8-pin base either molded socket M008 or DIN-Rail MD08 mounting sockets.

**Dimensions**

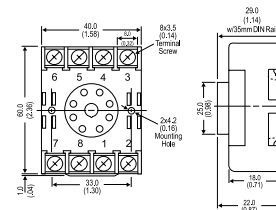
Dimensions are in millimeters (inches)



**Mark II**



**M008 (Track/Surface)**



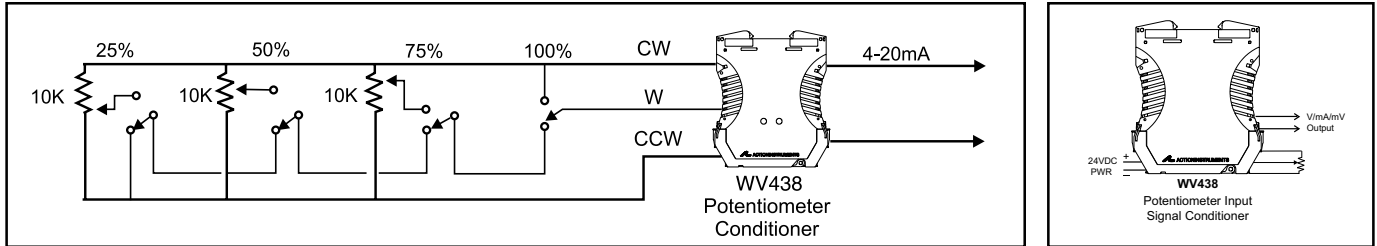
**MD08 (DIN Rail)**

# Application Notes

## Pump Control

### Problem

Part of a beer brewing process involves gravity flow pipes carrying liquid to downstream pumps that need to be controlled in relation to the level of liquid in the pipe. If the level is not controlled properly, the quality of the process is affected. Unfortunately, the pipes used are often too shallow for conventional pressure-based measurement. In one case, operators installed four level switches that are set to trip at 25%, 50%, 75% and 100% of the capacity of the pipes. Since the pumps are controlled by a 4-20mA signal, the problem becomes how to convert the discrete inputs into 4, 8, 12, 16 and 20mA.



### Solution

We solved this problem using a single off-the-shelf Potentiometer Input Transmitter. Three pots were chained to the Potentiometer Transmitter and the level switches were used to select the wiper of the appropriate pot, with the pots set at 25%, 50%, and 75% of their rotation. (For enhanced reliability, each pot could have been replaced by a pair of fixed resistors selected for the desired ratio.) A Potentiometer Transmitter provides constant voltage excitation for loads as low as 100 ohms. Because of this, we selected 10k pots so that the equivalent parallel resistance would stay above 100 ohms. The 4mA and 20mA outputs were obtained by merely tying the wiper connection to the CCW and CW terminals respectively - no pots are needed for 0% or 100%. The Potentiometer Transmitter is useful for converting manual potentiometer settings to a voltage or current for input to instrumentation, and in any application where a potentiometer or slidewire is used to determine position, displacement or rotation.

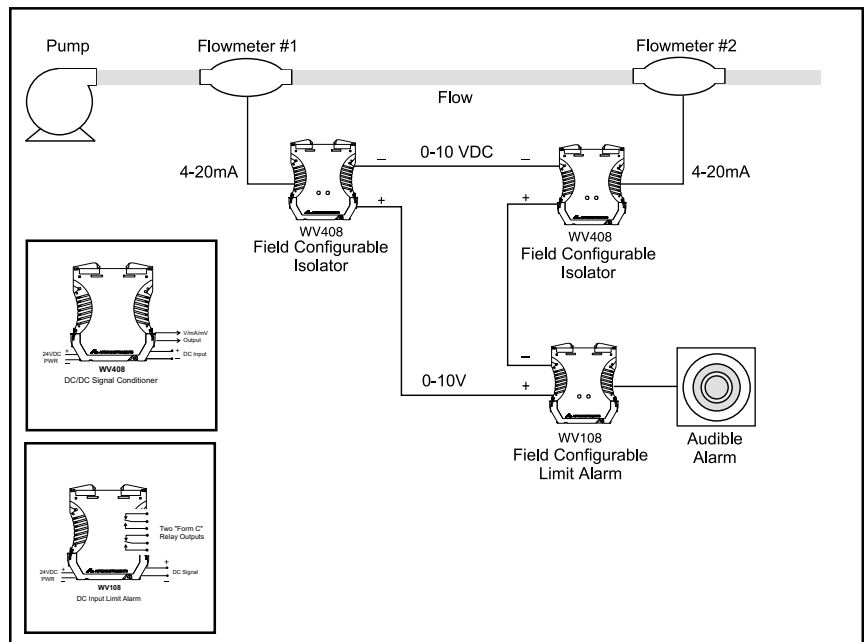
## Pipeline Leak Detection

### Problem

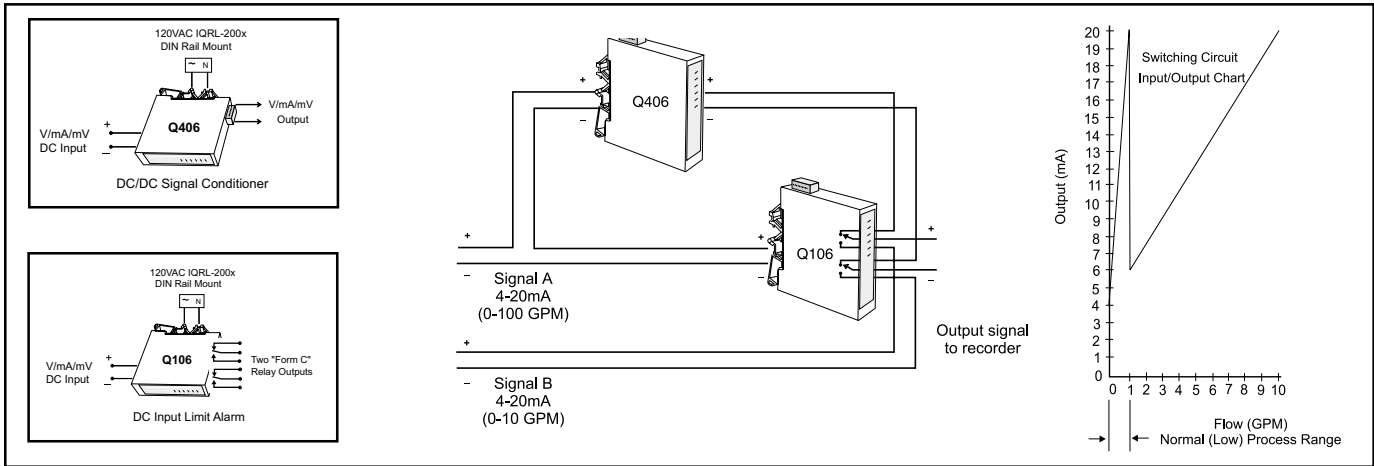
An oil pipeline company transfers crude oil from a well to a refinery through a large pipeline. A portion of the pipeline crosses under a bay, and hence is difficult to inspect and maintain. Always present is the chance of pipeline breakage due to a colliding ship, moving earth, or simple corrosion. Leakage of crude oil into the bay must be detected to avoid loss of product, and especially to minimize environmental impact and resulting fines. On each side of the bay are flowmeters that provide 4-20mA signals.

### Solution

Two Ultra SlimPak II WV408 DC Input, Field Configurable Isolators scale the 4-20mA signals from the flowmeters into 0-10VDC signals. Isolation avoids possible ground loops between the flowmeters. The outputs of the isolators are wired to "buck" each other, or subtract, and are sent to an Ultra SlimPak II WV108 DC Input, Field Configurable Limit Alarm. A no-leak condition yields a null signal (zero volts are sent to the limit alarm). If a leak occurs, the flow rates will be different and the voltage at the WV108's input will rise. The limit alarm detects the voltage difference and trips the alarm. Both the WV408 and the WV108 are field configurable for most standard input and output signals.



# Sensitive Flow Measurement



## Problem:

A manufacturer of petroleum fuels records the flow of additives to the process. Most of the time the flow rate is in the bottom 10% of total flow capacity, and it is difficult to discern signal differences when observing graphical displays. The operator needs amplified resolution when the signal is less than 10% but still wants valid recording when 10% is exceeded.

## Solution

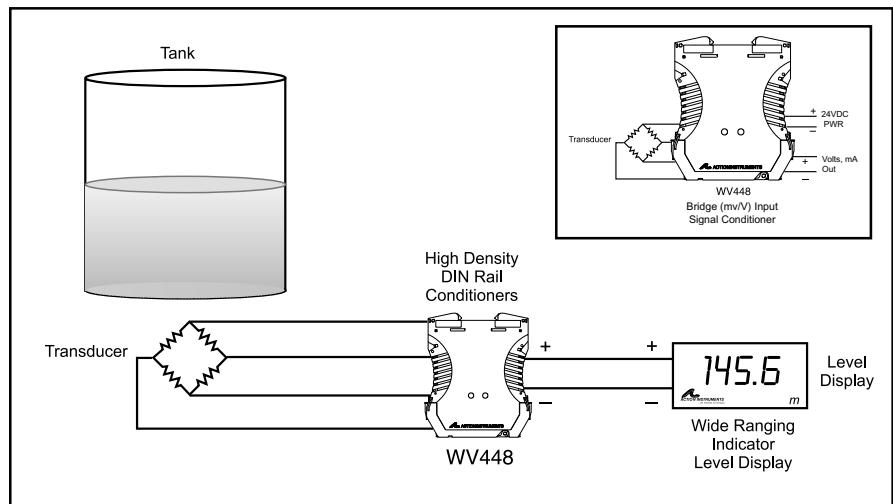
A more sensitive flow transmitter calibrated to 0-10% of the flow was added. To select the appropriate signal, two modules were used: a DC Trip Alarm and an Analog Isolator. The input range of the DC Trip Alarm is 4-20mA and the setpoint is set to 10% of the signal, or 5.6mA. When the signal is below 10%, signal "B" is sent to the recording apparatus, which records with the amplified resolution range. When the signal exceeds 10%, signal "A" is sent so that the full range of flow can be recorded.

Note that when a signal is selected its loop is closed by the recording apparatus, but the unselected signal loop becomes open. This creates a problem for signal loop "A" since the DC Trip Alarm must always monitor that signal. The Analog Isolator is needed to keep signal loop "A" from being broken when signal "B" is selected.

# Tank Level (Unpressurized)

## Problem

A process operator needs to measure the liquid level within a tank. It is important for the operator to visually inspect the measurement frequently. The process is not automated in this case, as human intervention is constantly required for the batch process to function successfully. A common method of measuring liquid level employs a pressure sensor at the bottom of the tank. This requires the density of the liquid to be constant, and the tank must be open or vented. The pressure of the liquid at the bottom of the tank is proportional to the level of the liquid in the tank.

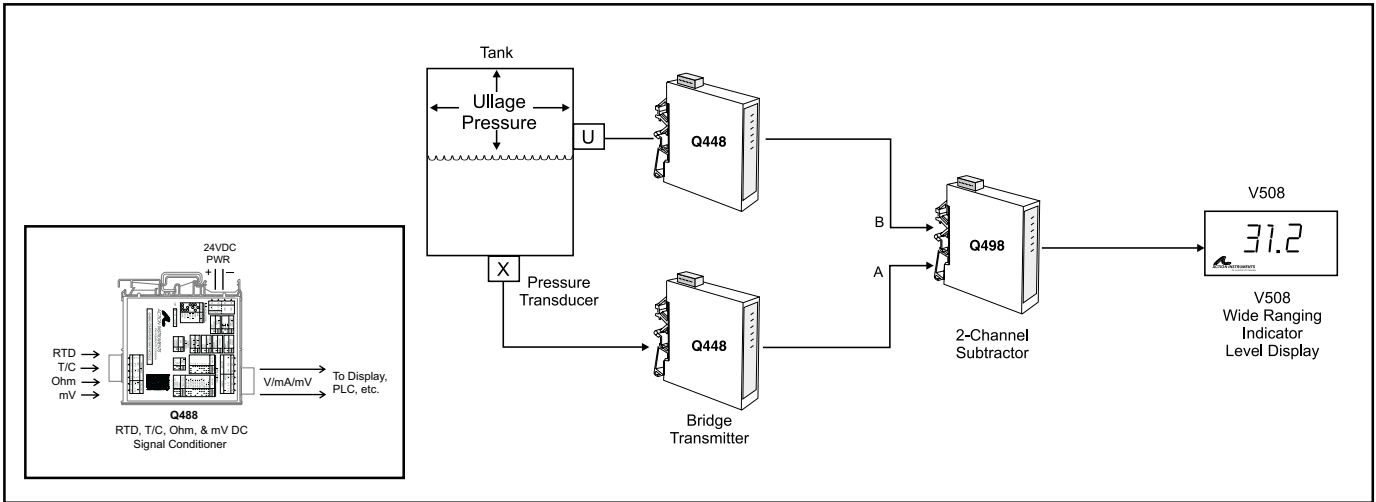


## Solution

A strain gauge pressure sensor is mounted on the bottom of the tank to measure the pressure of the liquid. We solved this problem using a Bridge/Strain Gauge Transmitter which provides excitation and signal conditioning for the pressure sensor. The output of the Bridge/Strain Gauge is fed to a Digital Indicator, which is configured to display the engineering units appropriate to properly display the level of liquid in the tank. The Bridge/Strain Gauge is field configurable for both input and output and offers flexible, wide ranging capability for inputs from 0.5mV/V to over 50mV/V.



# Tank Level (Pressurized)



## Problem

The liquid level of a pressurized tank needs to be measured. Since the tank is sealed, the pressure above the liquid will not be constant and the simple method of measuring the pressure at the bottom of the tank is not accurate.

## Solution

Under these conditions, pressure in the tank that is not caused by the weight of the liquid must be subtracted from the bottom pressure. The pressure measured at X is equal to the pressure caused by the weight of the liquid plus the pressure at U, known as the ullage pressure. The two Bridge/Strain Gauge Transmitters provide excitation to the pressure sensors at X and U, and scale the signals from them into 0-10VDC. The outputs of the two Bridge Strain Gauge Isolators are connected to the Q498, which performs the subtraction, the result of which is displayed on a Digital Indicator. An empty tank yields a null condition (Zero volts are sent to the indicator). As the tank fills, there is a pressure differential, and the voltage sent to the Digital Indicator increases proportionally to the level in the tank.

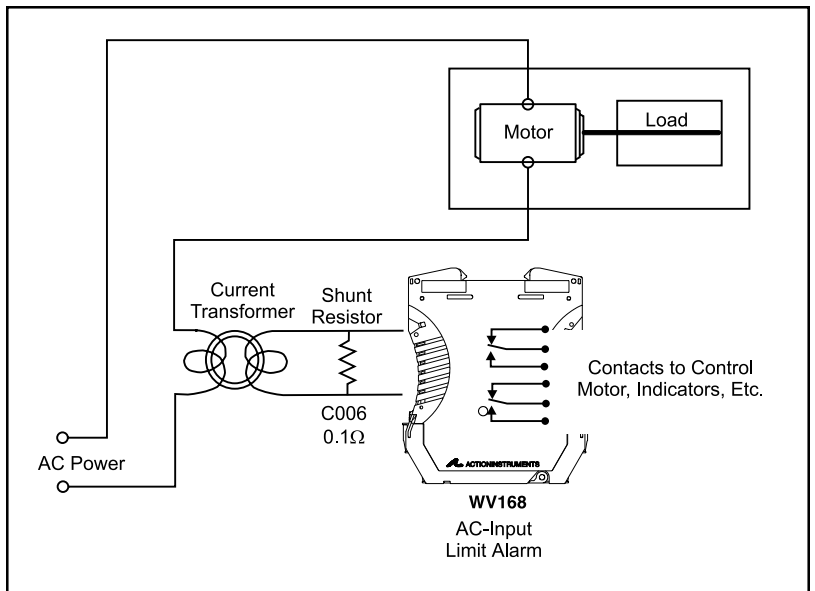
# Motor Load

## Problem

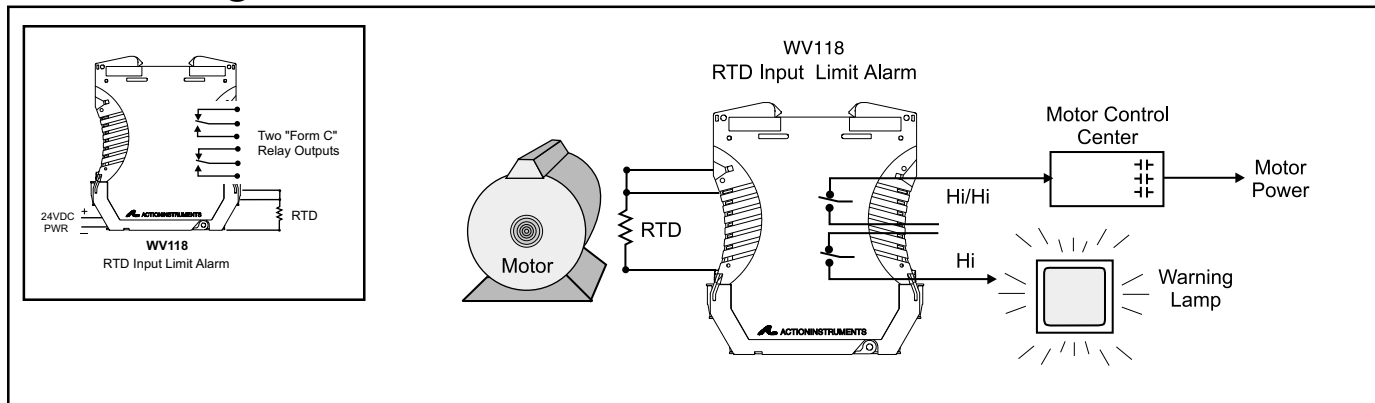
A mining operation has several pieces of machinery, such as conveyor belts and crushers, that are driven by electric motors. Because of the nature of ore, it is quite possible for the motors to become overloaded, resulting in damage to bearings, brushes, and rotor bars. The operator wants to measure the load on a motor and shut it off when the load becomes too great.

## Solution

The current drawn by a motor is proportional to the load applied to the motor. A current transformer is placed in the power line to the motor. Installing a 0.1 ohm shunt resistor converts the secondary current into a low level voltage for the AC Input Trip Alarm. As the load on the motor increases, the current increases. The trip alarm is set to trip at the current level corresponding to the maximum safe load. The dynamic deadband circuitry of the repeatedly samples the current, which must remain beyond the setpoint for 100 milliseconds uninterrupted before the limit alarm relay activates, shutting down the power to the motor. This eliminates tripping on nuisance spikes. The unit can also be configured as a latching alarm, so that the motor is not automatically restarted once the overload is removed.



# Overheating Control



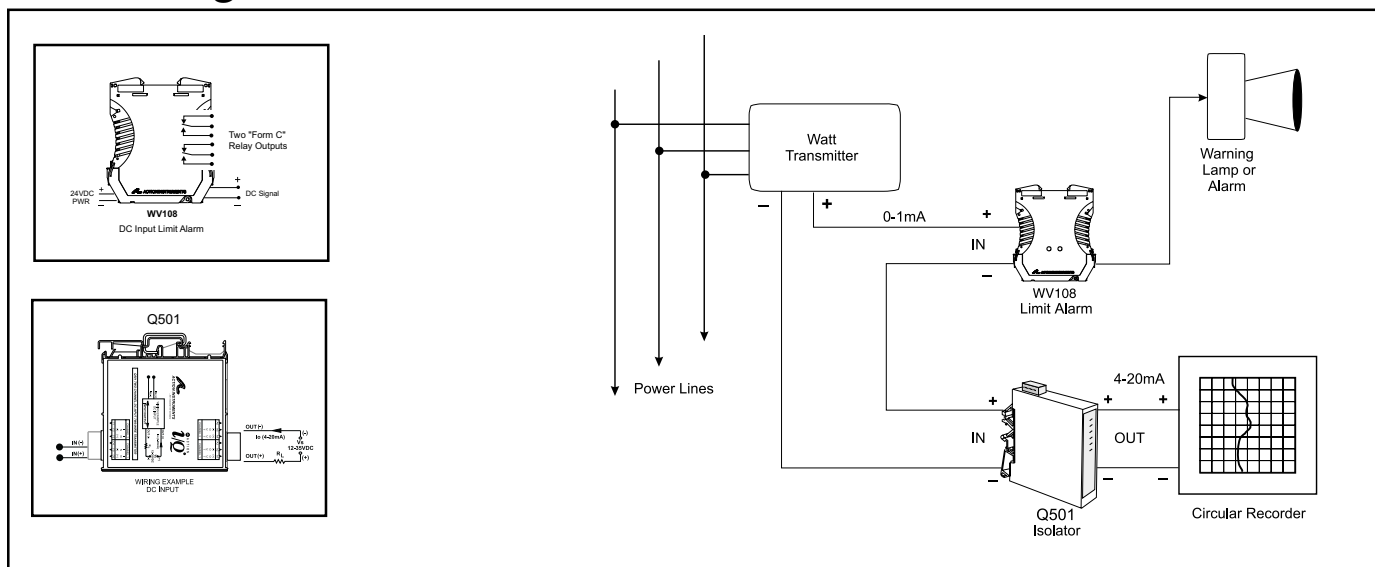
## Problem

Manufacturers of all types use electric motors to power various pieces of machinery. To avoid overheating the motors, it is advisable to monitor their temperature, providing warning or shutdown when damage to the bearings and brushes is imminent.

## Solution

An RTD is mounted on a motor bearing according to the recommendation of the motor supplier. The RTD Input Dual Trip Alarm provides all the necessary warning and shutdown functions. In this case, the trip alarm is set up as a HI/HI and HI limit alarm. The HI limit is set at a cautionary temperature and activates an indicator alarm. The HI/HI limit is set at the maximum allowable temperature. If this temperature is exceeded, main power to the motor is shut off.

# Power Usage Measurement



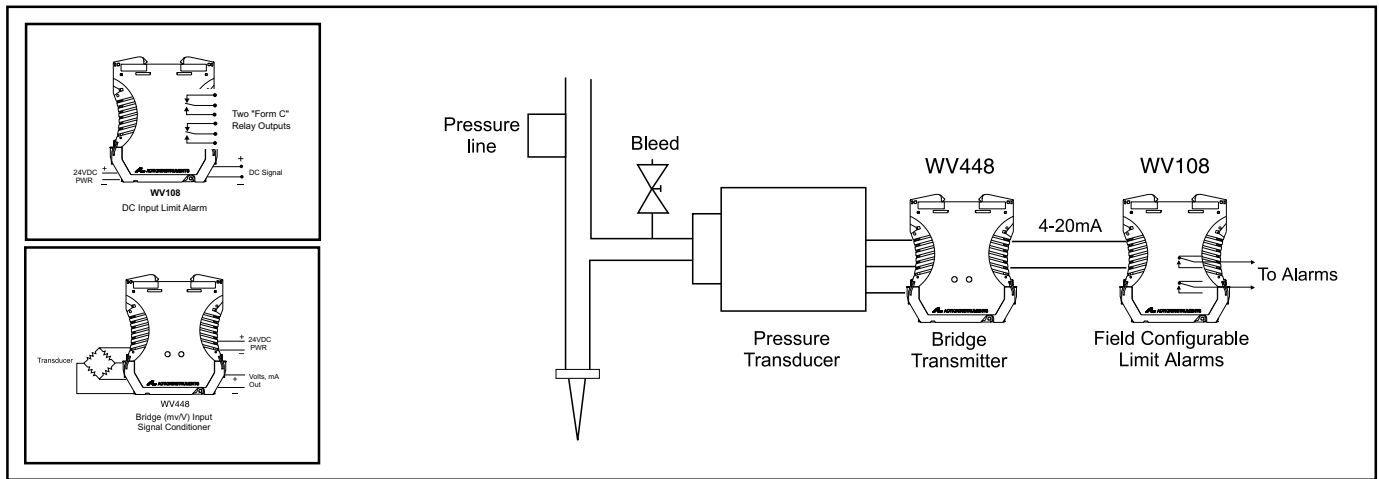
## Problem

A steel plant uses large amounts of air to support combustion in the furnaces. Huge blowers draw air from outside the building as part of the air supply system. These blowers consume tremendous amounts of electrical power. Plant operators want to record power used by the blowers, and also want to sound an alarm if power exceeds certain limits. The blower system has a Watt transducer that measures the power consumed.

## Solution

The Watt Transducer provides a 0-1mA output that is proportional to the AC power level. A DC Input Trip Alarm is set to trip at the appropriate power level. Its DPDT relay contacts can control a visual or sound alert. A DC Input Isolator can be used for isolation and to convert the 0-1mA signal to the required 4-20mA input for recording equipment. The DC Input Isolator provides isolation up to 1800VDC

# Low Air Pressure Detection



## Problem

Some automated assembly lines use pneumatic nailers in various stages of the operation, as in this case with furniture manufacturing. If the supply of air pressure to a nailer should drop below a certain level, incorrect nailing can occur which would result in waste material. The operator needs to detect inadequate pressure so that they can shut down the appropriate phase of assembly.

## Solution

The Bridge/Strain Gauge Transmitter is used to provide excitation to the pressure sensor and transmit a signal to a DC Input Trip Alarm. The alarm is set to trip when the pressure level drops too low, and with the adjustable deadband, reset when the pressure returns to normal.

Optionally, if the pressure sensor is a two-wire device, one DC Input Trip Alarm is all that is required. The internal loop supply allows the DC Trip Alarm to power the loop and monitor the current, all in one module. The DC Trip Alarm provides a relay contact closure at a preset DC input level.

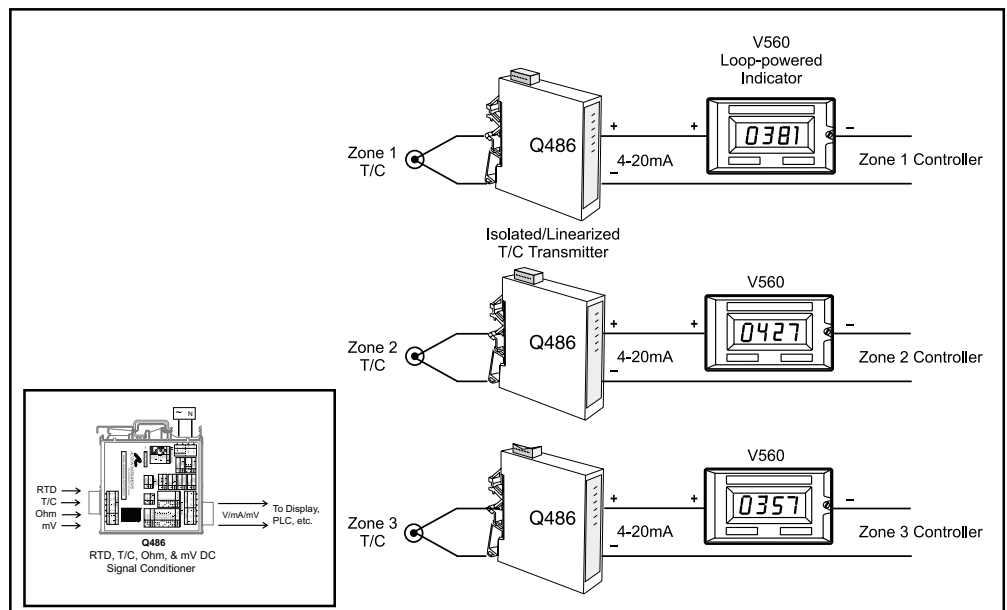
# Multiple Temperature Zones

## Problem

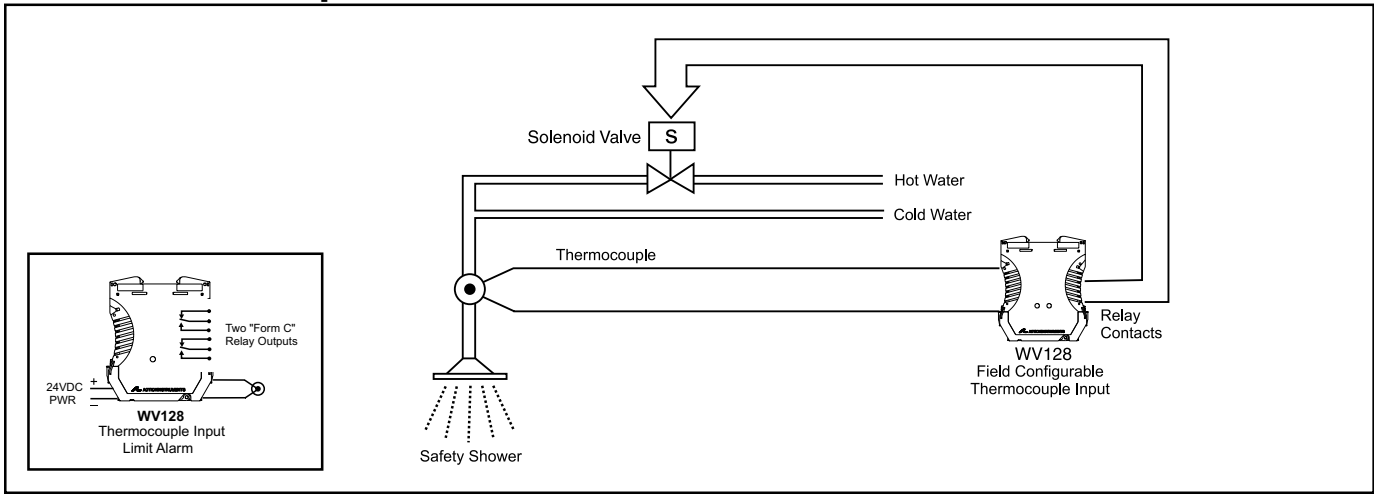
A maker of ceramic insulators is expanding operations and installing a new 3-zone furnace. The curing process of the ceramic parts involves passing them through the zones of the furnace slowly on a conveyor belt. Each zone is maintained at a different temperature. The operator needs to condition the signals from three thermocouples, display the temperature, and provide a 4-20mA signal for the temperature controllers.

## Solution

The Thermocouple Transmitter isolates and linearizes thermocouple signals, and provides a 4-20mA signal proportional to temperature for indication and control. The Loop-Powered Indicator displays individual zone temperatures. Note that each zone has a separate thermocouple, conditioner, indicator and controller. The Thermocouple Transmitter features wide ranging zero and span adjustability and offers thermocouple burnout detection for all the popular thermocouple types.



# Safe Water Temperature



## Problem

Chemical processing plants frequently have outside safety showers available for use by workers in case of accidental spillage. Both hot and cold water pipes feed the shower head. Since the water is heated from process heat exchangers, at times the water temperature may become dangerously high, affecting worker safety, so water temperature needs to be kept at a safe level.

## Solution

The Thermocouple Trip Alarm provides a simple solution. A thermocouple mounted at the shower head is connected to the input of the Thermocouple Trip Alarm. The relay contacts of the trip alarm switch power to a solenoid valve inserted in the hot water line. The setpoint of the trip alarm is adjusted so that when a safe temperature is exceeded, the alarm trips and the solenoid shuts off the hot water to the shower. The valve is a fail-closed type so that the hot water is also shut off in case of power failure.

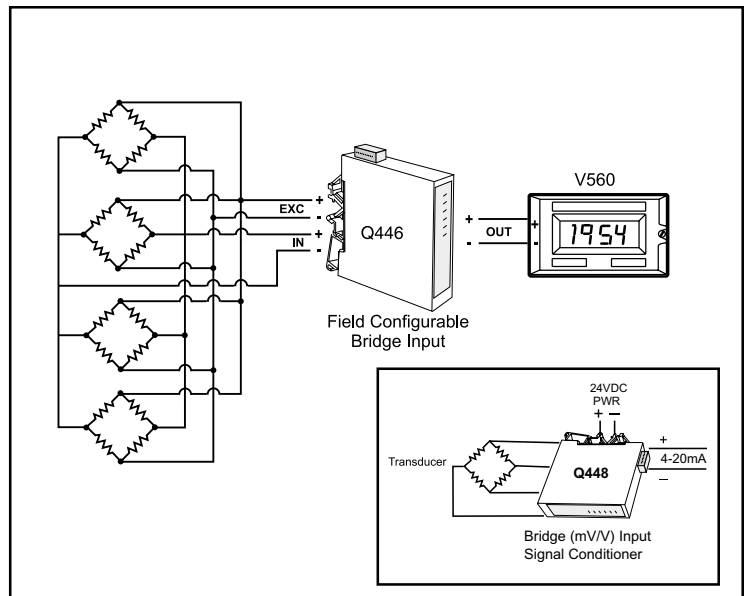
# Combining Load Cells

## Problem

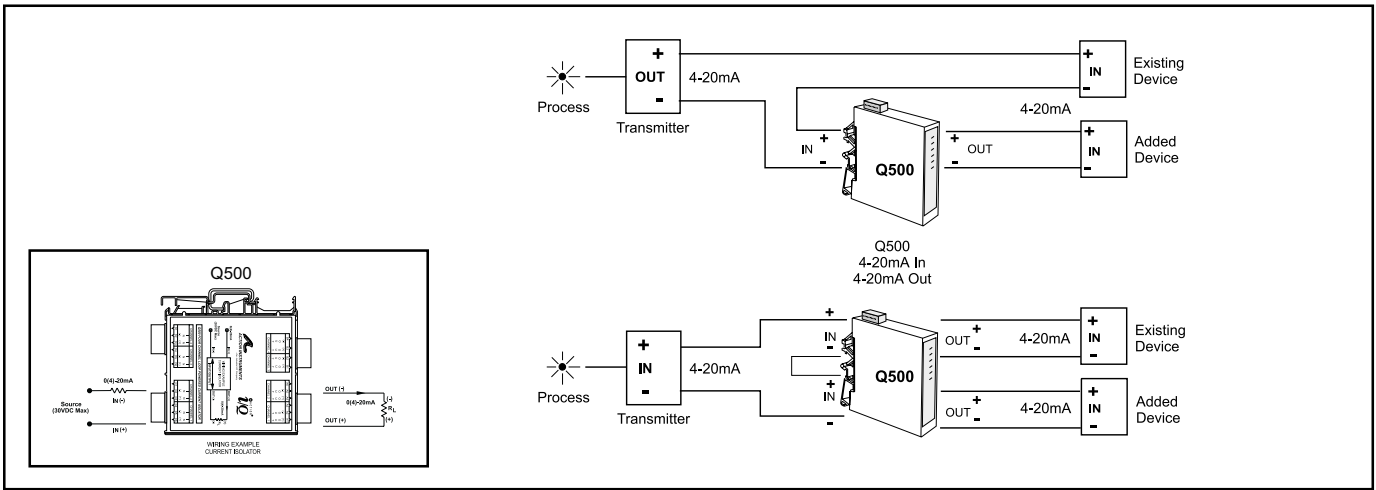
In weighing applications, an operator often needs to convert the output from four load cells, one at each corner of the container, into one 4-20mA signal proportional to the weight of the product in his container.

## Solution

Connecting the four load cells in parallel using an Bridge/Strain Gauge Transmitter solves this problem. The Bridge/Strain Gauge Transmitter provides excitation to the four load cells. The four 350 ohm cells require excitation of 114mA at 10 volts. The Bridge/Strain Transmitter Gauge provides up to 120mA drive at up to 10 volts. The outputs from all four load cells can be fed into the Bridge/Strain Transmitter Gauge. If the load cells are paralleled, the resulting signal will be the average of the four, for example, if the load is evenly distributed and each cell puts out 3mV/V, the resulting signal will be 3mV/V. The 50% zero adjustment capability of the Bridge/Strain Transmitter Gauge allows the operator to zero out or "tare" the weight of the container, so that only product is weighed. The resulting isolated 4-20mA signal can then be sent to a Loop-Powered Indicator for local indication, as well as to data acquisition or process control.



# Loop Isolation



## Problem

Action Instruments is recognized around the world as the leading supplier of loop isolators. We get a lot of phone calls from people looking for a "Current Splitter." What they usually mean is that they have an existing 4-20mA current loop and need to also route this signal to some other piece of equipment, typically a data acquisition system. They also know (usually from painful experience) that they must isolate this new loop from the existing loop. Many industrial I/O devices are non-isolated, with the negative sides of the inputs commoned to ground. This unfortunate arrangement is incompatible with most existing loops that already have a ground point somewhere else in their wiring, hence the need for isolation.

## Solution

Although not specifically called a "current splitter," Action's isolating signal conditioners perform the function admirably. In most cases, a single DC Input loop isolator can do the job of creating a new, isolated and powered 4-20mA loop from an existing loop. Since the input is isolated from power and output, the isolator will not interfere with the operation of the existing loop.

# Tank Level Differential

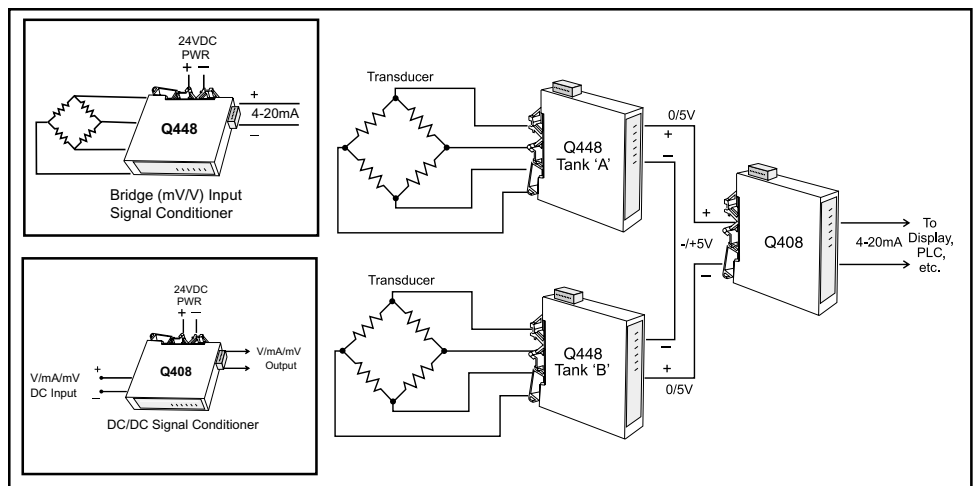
## Problem

An operator needs to know the liquid level differential between two tanks. Each tank is open, so the pressure at the bottom of the tank is linear and proportional to the actual level in each tank.

Strain gauge pressure transducers are installed to the bottom of each tank which becomes the millivolt input signal to the Q448 Bridge Input Field Configurable Isolator. The Q448 provides 1 to 10 volts of excitation to the transducer and accepts a wide range of input spans. The output is set to the 5 volt range. The negative output terminals of the Q448's are then connected together, resulting in a 'differential' from the two positive output signals.

## Solution

A Q408 DC Input Field Configurable Isolator is set to accept a bipolar  $\pm 5$  volt input and provide a 4-20 milliamp output. When the tanks are at equal levels, the output signal from the Q408 will be a constant 12mA. If Tank 'A' increases in level with respect to Tank 'B', the current signal will rise above 12mA. Conversely, if the level in Tank 'A' decreases with respect to Tank 'B', the current signal will be below 12mA.



# Controlling Thermocouple Calibration Errors Caused by Thermal Shock

*“Cold Junction Temperature sensing is the Achilles Heel of temperature measurement.”*

When thermocouples are wired directly to control instrumentation, it is often the instruments' thermal behavior which limits performance. Excessive warm-up times and poor repeatability are common problems. When the effective cold junction is at the input terminals of an instrument, measuring its temperature accurately requires the CJT sensor be located very close (in a thermal sense) to those terminals. The successful measurement of temperature by an instrument using a thermocouple is dependent upon three things:

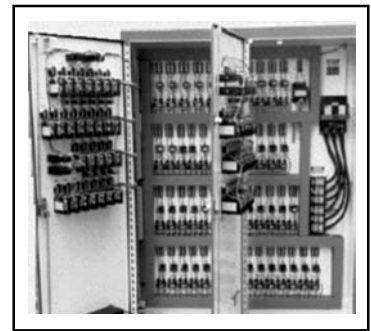
- the location of the thermocouple 'Hot Junction' relative to the load or work being processed
- the accuracy, drift and calibration of the measurement electronics
- the ability of the cold junction sensor to properly measure the CJT, Cold Junction Temperature

Locating the hot junction of the thermocouple at the work is a simple or easily understood task. Accuracy, drift and calibration of the measuring electronics is clearly specified in instrument data sheets and can be maintained. Successful CJT measurement is another story. CJT measurement is based on many factors, some of which are based on the mechanics of the rear of the instrument. The location of the CJT sensor, the thermal mass of the entire instrument and changes in the local ambient temperature all affect the cold junction temperature measurement. These uncontrollable characteristics of the CJT circuit account for why 'CJT sensing is the Achilles Heel of temperature measurement'.

## Problem

During routine maintenance of control cabinets, it is an accepted practice to open a cabinet to check the state of a relay coil or replace a blown fuse or even retrieve a misplaced tool or blueprint. It is also common to air-condition a control cabinet to prolong the life of the electronics. Air-conditioning is even more common in hot climates, which includes most of the United States.

Consider what happens when an air-conditioned control cabinet is opened on a hot summer day. When closed, the cabinet ambient is controlled to around 65 degrees F. The outside room ambient on a hot August afternoon can easily exceed 110 degrees F. Conventional temperature transmitters are mounted in the control cabinet. When the door is opened, the temperature transmitters are exposed to the 110 degree room air; they are subjected to a 45 degree F thermal shock. This thermal shock alters the Cold Junction Temperature and, more importantly, the ability of the CJT sensor to accurately measure the CJT. In short, the transmitter is out of calibration until it returns to equilibrium. The amount of calibration error and the settling time varies with the instrument. Some transmitters are quick to respond while others with high thermal mass are quite sluggish. Some transmitters deviate by only a small amount while others with loosely coupled CJT sensors may have 5 or even 10 degree excursions before returning to an accurate reading.



What makes this situation worse is that the calibration error is not apparent to the operator. Quite often, the instrument's signal will be used to control the process to this new offset value which is in fact in error. Simply put, the instrument is out of cal and nobody knows.

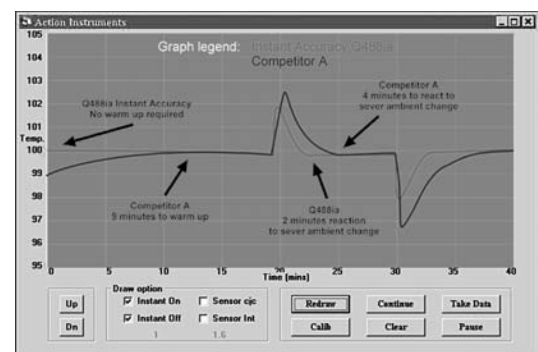
*Anyone in charge of a process which must be controlled to within 2 degrees F must be keenly aware of this phenomenon.*

## Solution

The Q486, Q488 and WV428 temperature transmitters use a patented dual sensor method of measuring CJT. We call this technique 'Instant Accuracy.' One sensor is used to measure the CJT near the rear terminals of the instrument, and the second is used to extrapolate out to the rear terminals. In this way, the CJC network can compensate for any heat flow temperature error and respond quickly to internal warming affects as well as external influences. This extrapolation makes these transmitters highly responsive to ambient temperature changes and also provides rapid recovery to stability.

Note that there is some calibration shift as a result of a change in ambient conditions - this is caused by the imperfect nature of the Cold Junction Compensation and is specified in the data bulletins for the products. Recovery time from thermal shock is often not specified, however. The graph details the recovery of a Q488 to a 25°C thermal plunge. The peak excursion was 1.15°C but settled within 15 minutes at the final offset value of 0.6°C. Even the best competitive instrument tested was found to be still settling in after one hour and the maximum excursion was almost 2°C. The worst instrument tested exhibited an excursion of over 5°C as a result of a 25 degree thermal plunge.

The thermal plunge associated with opening a control cabinet door can have a major effect on product quality for critical processes. The most devastating aspect of this is that the transmitter appears to be functioning properly with no ill effects whereas, in fact, it is out of calibration and producing substandard product.



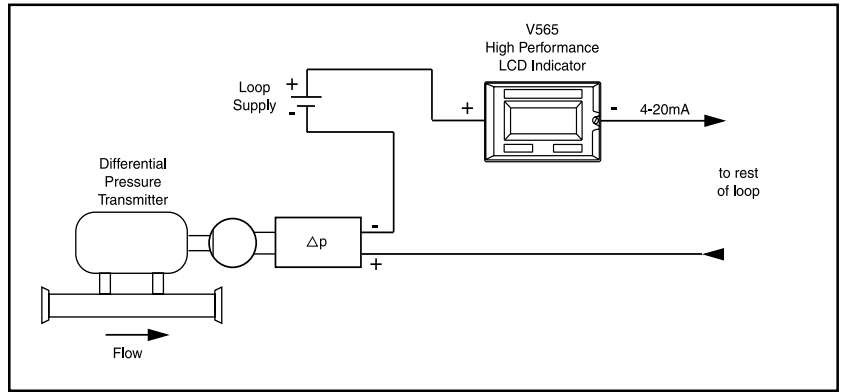
# Displaying Flow

## Problem:

In many processes, the flow of a liquid or gas may need to be indicated or visually monitored, often for safety or quality reasons. Examples are chemicals that are mixed into a product, steam used to provide heat, or fuel used by engines to power equipment. Differential pressure transmitters are often used to provide the flow signal. A differential pressure transmitter yields a flow signal that is proportional to the square root of the pressure difference between the two points separated by a restriction in the flow line. To linearize the display, a square root function must be applied.

## Solution:

Action's high performance VisiPak V565 Loop-Powered Digital Indicator is perfect for this type of application. The indicator is powered from the same current loop as the pressure transmitter and performs the square root function to correctly display the flow. The wide adjustability of the V565 assures that it can be set to display in the desired engineering units. No additional wiring is required.



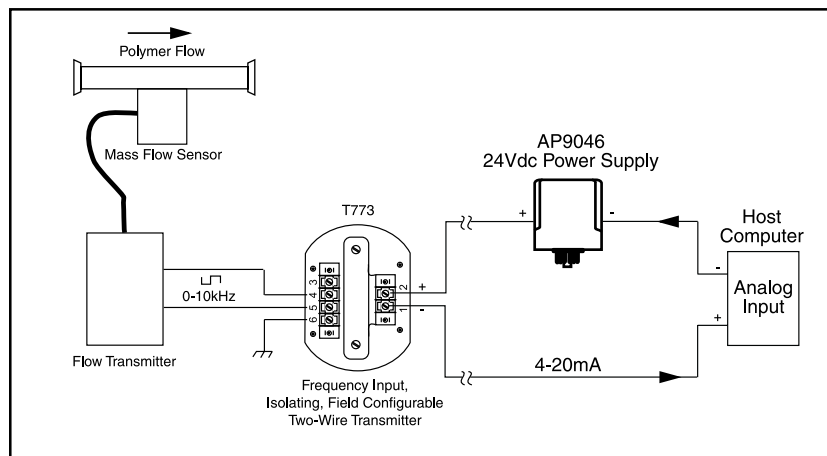
# Mass Flow

## Problem:

To determine the mass flow and density of a polymer, a chemical company has chosen to use an in-line mass flow transmitter. The flow transmitter outputs a 0-10kHz signal proportional to mass flow, but the operator uses a host computer that requires a 4-20mA input signal.

## Solution:

Since line power is not easily available in the area of the plant where the flow sensor is located, Action's TransPak T773 Two-Wire Frequency Transmitter can be used to eliminate the cost and danger of routing power lines in a processing plant. The T773 is located near the flow sensor and receives loop power from the Action Pak AP9046 Power Supply, which is located where 120Vac is easily available. The resulting 4-20mA proportional signal is sent to the host computer for monitoring. In some cases, the host computer can supply loop voltage, further simplifying the solution.



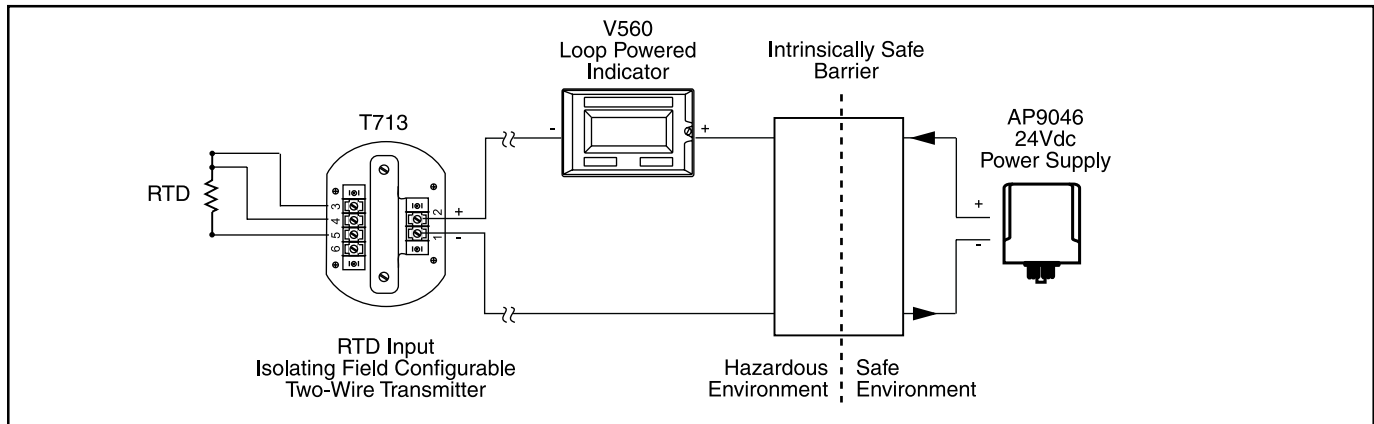
# Hazardous Environments

## Problem:

Hazardous conditions often occur in natural gas plants where explosive products such as butane or propane gas are produced. In a gas plant for example, the temperature within distillation columns must be measured and controlled to yield a quality product. Likewise, in oil refineries, monitoring the temperature of a vessel can be dangerous in areas where explosive fumes from the oil may exist.

## Solution:

Action's TransPak T713 Two-Wire RTD Transmitter and VisiPak V560 Loop-Powered Indicator have been approved by Factory Mutual Research as non-incendive in Class I, Divisions 1 and 2, Groups A, B, C and D. Both the TransPak T700 series and the VisiPak V560 series are wide ranging. To meet FM approval, in a Division 1 environment an intrinsic safety barrier must be installed in the current loop (consult the factory for approved barrier manufacturers). A Division 2 environment does not require barriers. The V560 with the "C" option can house the T713 for installation convenience. Note that if there is not enough loop voltage available (due to drops across the safety barrier and other equipment), a V565 (which has only a 1 volt drop) can be used instead.



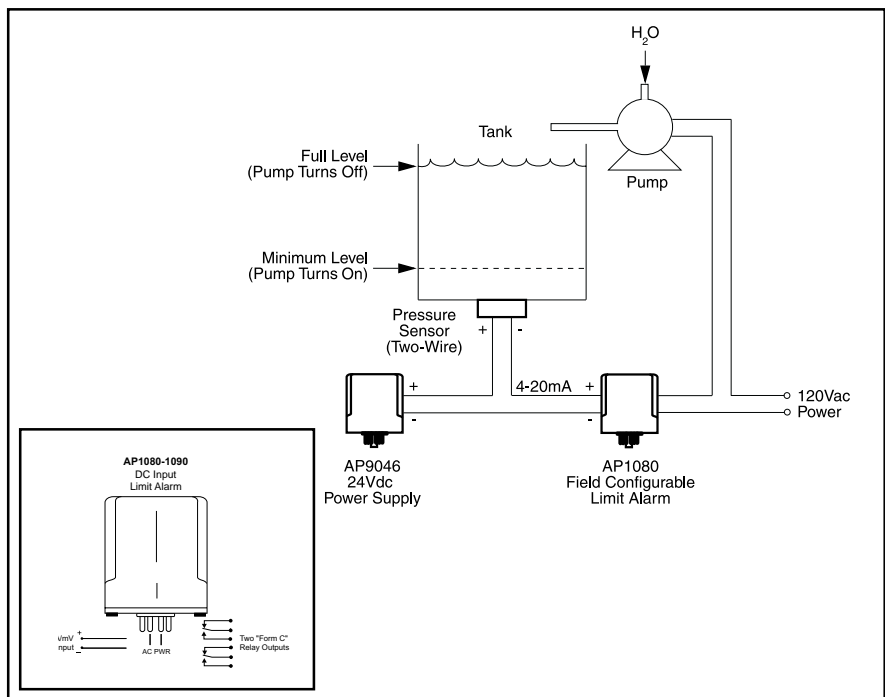
# Water Level

## Problem:

The level of a tank of cleaning water at a beverage plant needs to remain at a certain level. The tank is open, so the pressure at the bottom is proportional and linear to the actual water level.

## Solution:

The solution makes use of the adjustable deadband in the Action Pak AP1080 DC Input, Field Configurable Limit Alarm. The AP1080 single setpoint limit alarm, configured as a LO alarm provides a simple means of filling the tank to capacity each time the contents fall below a minimum level. The setpoint is adjusted to the milliamp setting that corresponds to the desired minimum water level. The deadband is adjusted to the value that corresponds to the desired maximum level. When the water falls below the low level, the AP1080 trips and turns on the pump until the signal from the rising water reaches deadband, which resets the AP1080 and turns the pump off, ready for the next cycle. Note that if two-wire pressure sensors are used, they can be excited with an Action Pak AP9046 Current Loop Power Supply.





# “Long Distance” 4-20mA

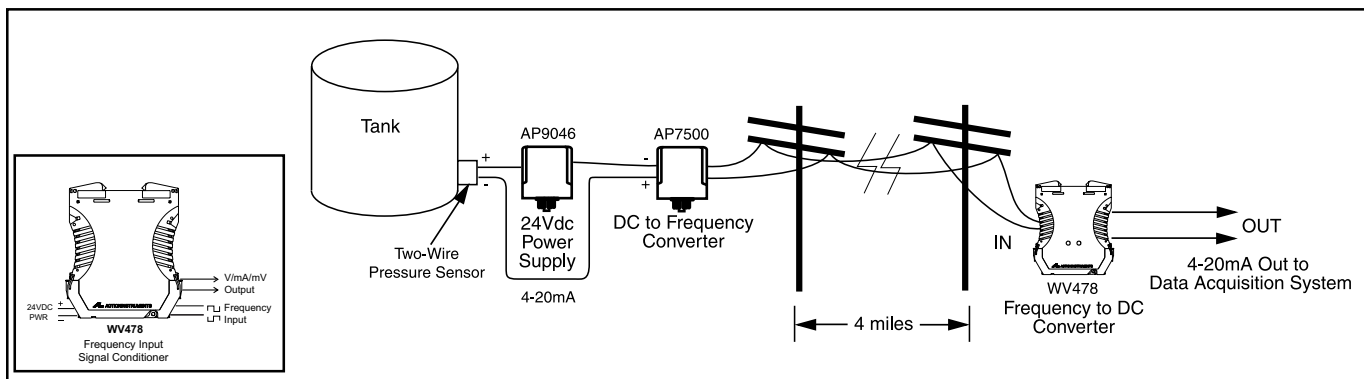
## Problem:

The city of Hillsborough, North Carolina needed to monitor the level of a remote tank in their wastewater treatment system. The tank is over 4 miles away from the monitoring station. The telephone company could provide a permanent, dedicated “dry pair” of wires for only \$15 a month. The catch is that they use relatively small gauge wire, and the amount of resistance in an 8 mile circuit (4 miles out and 4 miles back) was too high for a conventional 4-20mA current loop.

## Solution:

Action solved the problem with a unique low-cost combination of units. At the tank, a two-wire pressure sensor produces a 4-20mA signal that represents the level in the tank. Power is supplied by an AP9046 24Vdc supply. The 4-20mA signal is fed to an action AP7500 DC to Frequency Converter which converts the 4-20mA signal into a 0-500Hz signal. This signal is then connected to the dry pair of wires. At the receiving end, a WV478 Frequency Input, Field Configurable Isolator accepts the 0-500Hz signal and converts it back to 4-20mA for their monitoring purposes. There is some amplitude loss along the lines (about 5% in this case) but that still leaves adequate signal to trigger the WV478, which is able to correctly read the frequency and provide an accurate output.

This solution represents a major cost savings for the city of Hillsborough, compared to the least expensive single-point telemetry units, which start at around \$1200.



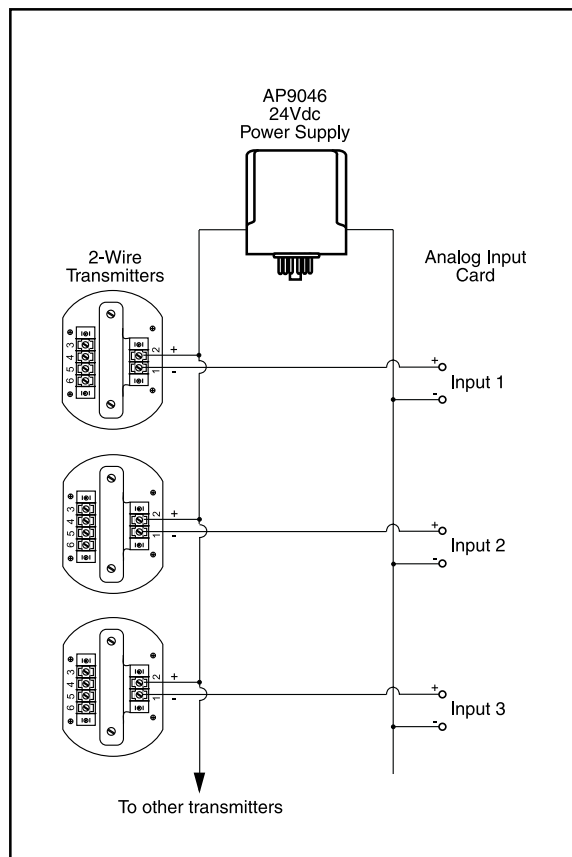
# Powering Multiple Transmitters

## Problem:

We are frequently asked how to wire a circuit that uses a single power supply to power multiple two-wire transmitters. These loops typically feed computer analog input cards, I/O Pak Plus input modules, or any number of other receiving devices.

## Solution:

The correct wiring is shown here. The power supply can be an AP9046 (65mA) for up to 3 loops, or a T609 (600mA) for up to 30 loops. Although all of the loops shown here share the one common power supply, each receiving device is in a section of the loop unique to each transmitter. As always, we highly recommend using isolated, two-wire transmitters (i.e., the T700 Series) to avoid ground loops from sensors that are grounded. In most cases, the negative input terminals on analog input cards are tied together to the computer’s ground as a common. This makes the use of isolating transmitters mandatory.



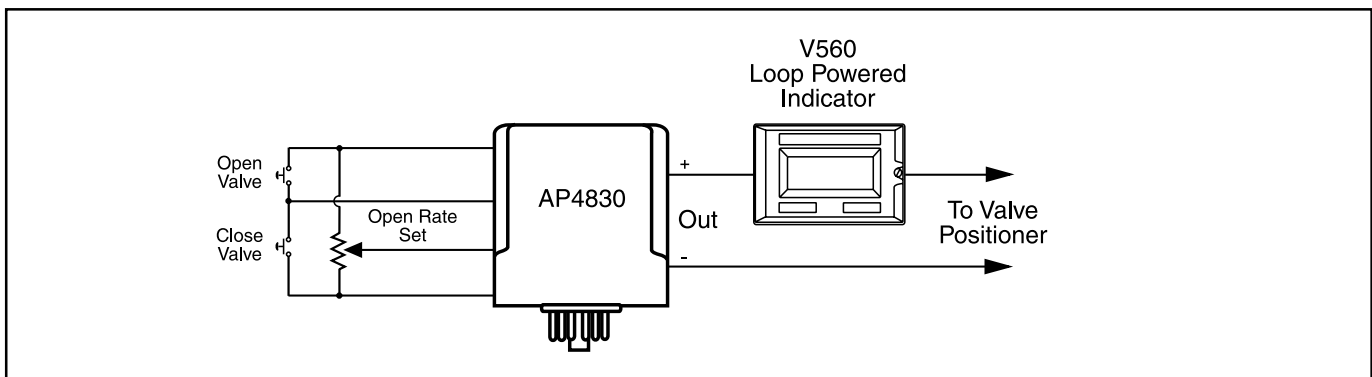
# Ramping a 4-20mA Output

## Problem:

Most industrial facilities use motorized valves somewhere in their system. Operators often manually adjust the position of these valves by generating a 4-20mA control signal to drive the valve's positioner. To minimize wear and tear on these valves, it is desirable to limit the rate at which the valves open and close. We are often asked to provide a device that will create a 4-20mA signal that can be ramped up or down using a pushbutton.

## Solution:

The Action Pak AP4830 Up/Down Ramp Generator can be configured to do exactly this with a minimum of external parts. The AP4830 is quite flexible and can support complex ramping requirements. In this application, all that is required is the up and down pushbuttons and one 10k Ohm potentiometer to set the ramp rate. Typically, the operators would have access to the pushbuttons, but not the potentiometer. As long as they hold one of the pushbuttons closed, the valve will move at the preset rate. If neither button is closed, the valve will maintain its position. It is common practice to include an indicator such as the V560 loop powered indicator in the output loop to display valve position. This arrangement has also been used to control the speed of large fans, and the position of overhead cranes or other equipment that requires gentle adjustment.



# Remote Signal Conditioning for Industrial Sensors

Two-wire transmitters amplify and condition low voltage signals generated by industrial process sensors such as those used for temperature (thermocouples and RTDs), frequency (magnetic and photocell pickups), force and strain (load cells and strain gauges), and position (potentiometers and LVDTs).

Once conditioned, the signals can be transmitted over long distances (often up to several thousand feet) to panel meters, controllers, data loggers, chart recorders, industrial computers, and other process instrumentation. The most common requirement of today's receivers is a 4 to 20 mA current proportional to the sensor output.

Two-wire transmitters are so named because they require only two wires to carry both the output signal and the power supply. The transmitter draws a small current from a DC power supply, in direct proportion to the level of the input signal. In a 4-20mA loop, for example, a transmitter for thermocouples draws 4mA at the lowest reported temperature. As temperature increases, the transmitter draws more current until reaching 20mA at the highest reported temperature.

Internal conditioning circuitry, powered by a portion of the loop current, determines the temperature range represented by the output signal. The power supply's voltage level determines the line drive capability of the transmitter.

## Advantages of Two-Wire Transmitters

Two-wire transmitters offer major advantages over other types of transmitters. To assure more accurate measurements, their current output does not attenuate over distance as do DC voltage signals from four-wire transmitters or sensors which connect directly to a receiver. Furthermore, their current output is highly immune to noise pickup, especially when compared to the signal from the sensor itself. Any residual noise voltage is usually eliminated by the common mode rejection of the receiver.

The natural noise immunity of two-wire transmitters also eliminates costs associated with installing expensive extension cables, and providing and maintaining adequate shielding against large electric motors and other electromagnetic or inductive fields commonly found in industrial environments.

Two-wire transmitters also save the cost of running a separate set of power cables, which are often 120Vac in four-wire systems. This enables two-wire transmitters to comply with safety requirements that restrict the use of AC power in hazardous locations such as chemical environments and dusty atmospheres.

Since they employ only low level current, TransPak transmitters are intrinsically safe. And many are Factory Mutual and Canadian Standards Association approved for intrinsically safe operation, even in explosive environments.

### Electrical Isolation

Remote sensors and their receivers are usually electrically grounded to suppress noise pickup and to protect them from lightning. Since there is typically a difference in voltage potential between two grounding points on the earth's surface, current can flow between the grounding points and induce an error signal on the transmission line.

To prevent these "ground loops" from occurring, users can select an isolating two-wire transmitter. This type of transmitter electronically isolates the sensor signal from the output current loop, enabling the system to be safely grounded at both the sensor and the receiver. Besides reducing measurement errors, isolation provides protection for personnel and equipment.

### Loop Drive

The capability of two-wire transmitters to provide accurate transmission over long distances can be calculated using the following formula:

$$R_{Lmax} = \frac{V_{supply} - V_{min reqd}}{I_{max}}$$

where:

- $V_{supply}$  = Supply voltage of power source (volts)
- $V_{min reqd}$  = Transmitter's minimum operating voltage (volts)
- $I_{max}$  = Transmitter's maximum output current (amps)
- $R_{Lmax}$  = Loop's maximum resistance (ohms)

If, for example, the selected output current is 4 to 20mA, the supply voltage is 90 volts, and the drop required by the transmitter is 12 volts, the equation is expressed as:

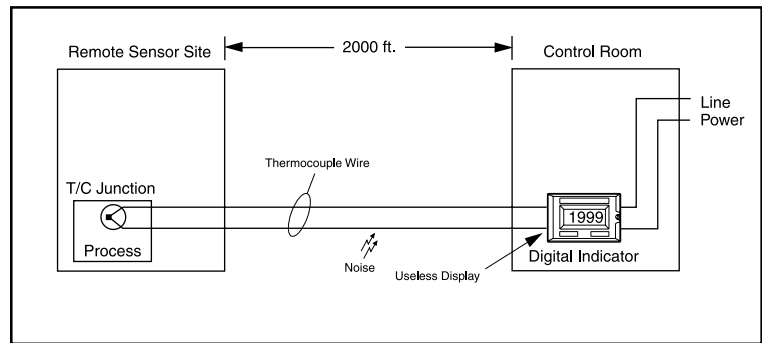
$$R_{Lmax} = \frac{90 - 12}{0.020} = 3900 \text{ Ohms}$$

The transmitter can therefore deliver accurate signals over any connecting line in which the resistance does not exceed 3900 Ohms.

## Evolution of the Two-Wire Transmitter

### Alternative 1:

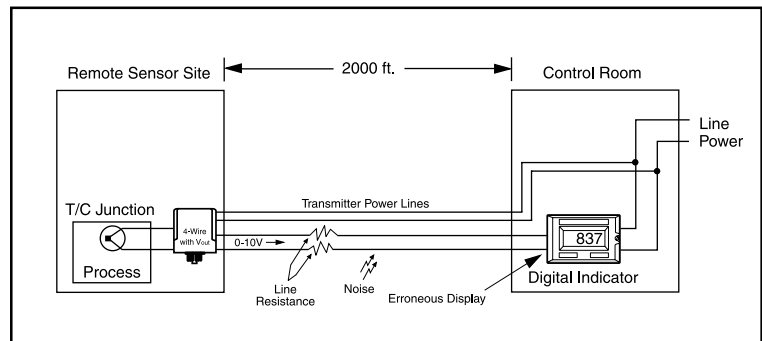
The most elementary way to transmit thermocouple signals is to run special extension wire from the cold junction to the control room. This practice is not acceptable because thermocouple wire is expensive and, unless well shielded, will lead to noise pickup from electric motors, generators, radio transmitters, power lines, etc. Since thermocouple signals are only a few millivolts, any noise is a problem, and it doesn't take much to completely mask the temperature data.



### Alternative 2:

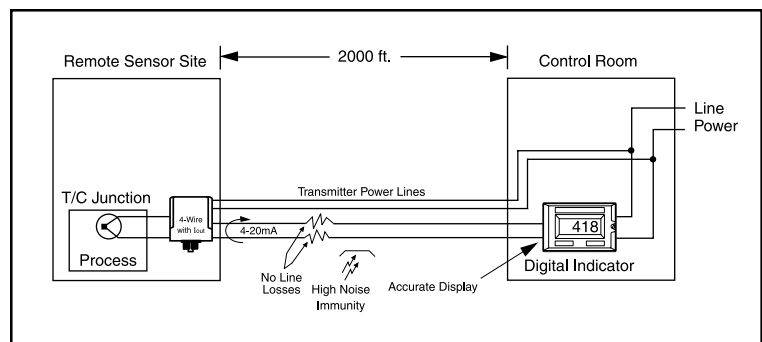
The risks of noise pickup can be reduced by using a four-wire transmitter with voltage output to amplify the signal at the cold junction. Whereas 20 mV of induced noise can completely mask a 0 to 10mV signal in Alternative 1, its effect is greatly reduced if the signal is amplified to 0 to 10 volts. In actual practice, however, several volts of noise can be encountered, resulting in degradation of even a 0 to 10 volt signal.

Another weakness in four-wire transmitters is voltage loss due to the resistance of the extension wires, resulting in system calibration being dependent on line length and temperature. Line losses can be overcome by a high input impedance receiving device, but this makes the system even more susceptible to noise pickup.



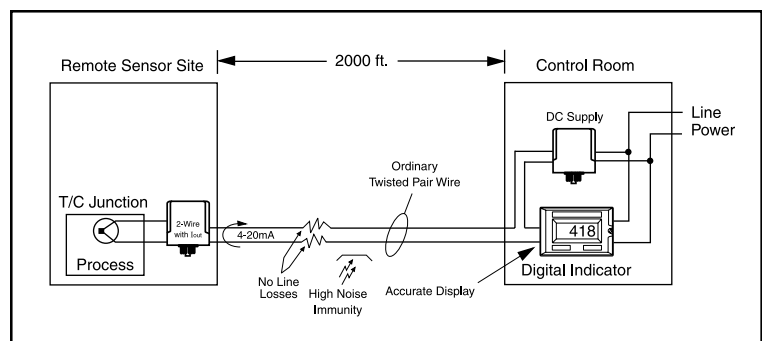
### Alternative 3:

Significant advantages are realized if the transmitter has a current output instead of a voltage output. The threat of resistance losses is eliminated because the current remains constant. Also, noise pickup is virtually eliminated by the inherent noise immunity of the current line. This allows use of low cost, twisted-pair connection wire, representing considerable savings over the shielded cable required in Alternative 2. The wires are twisted so that any noise will appear on both lines and will therefore be filtered out by the common mode rejection of the receiving device. The only remaining challenge is to eliminate the two extra wires used to power the transmitters in Alternative 2 and 3.



### Alternative 4:

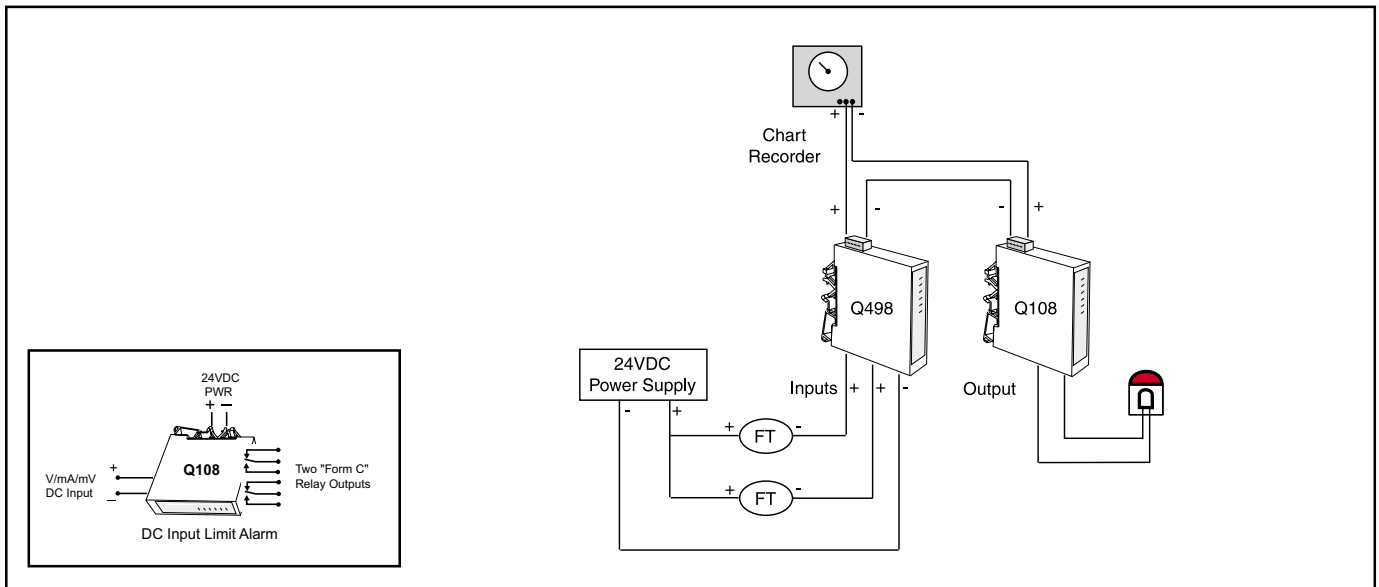
The best alternative is a two-wire transmitter which employs a single pair of wires to carry both the current signal and the power supply. This system has all of the advantages of current output systems (high noise immunity, no line losses, and inexpensive connecting wires). It has the added advantage of not requiring a separate set of power wires. Moreover, since the supply is DC, the transmission can be intrinsically safe all the way back to the sensor.



# Summing Two Flows

## Problem

A customer needs to find the sum of two flow transmitters, provide a visual warning of an overflow condition and record total flow from the transmitters.



## Solution

We suggested a system utilizing the Q498 Math Module, the Q108 Field Configurable Limit Alarm, two flow transmitters and a chart recorder. Each flow transmitter (FT) draws 4 to 20mA (based on product flow) from the 24VDC power supply. The two 4-20mA signals are fed into the Q498 Math Module. The Q498 is a highly configurable multi-input module capable of providing various math functions such as addition, subtraction, multiplication, etc. In this application, the signals are summed.

The Q108's input terminals are connected in series with the chart recorder. Both the Q108 and the chart recorder are configured for a current input. When flow exceeds a predetermined setpoint, the Q108 limit alarm trips.

# PLC/DCS Loop Isolation

## Problem

One of the more common requests we receive is based on the need to “isolate” a 4-wire field transmitter from a PLC or DCS that supplies loop power. This is not “isolation” in the traditional sense of eliminating ground loops. In this case, the problem is that there are too many devices powering the 4-20mA loop.

## Solution

By definition, a 4-wire transmitter supplies the required loop voltage (“sources” the current - sometimes referred to as an “active output”). This is handy when the field device is a 2-wire transmitter (“current sinking” or “passive”). The problem arises when the receiving device also tries to put voltage on the loop.

The benefits of 2-wire transmitters are well documented, and frequently analog input cards have loop power built in as a “feature”. But when the field device is a 4-wire transmitter, sending a current signal out towards the PLC, and the PLC is trying to push current into that output, there is literally a collision of currents. In many instances, the customer has a combination of 2- and 4-wire transmitters, and frequently experiences a mismatched loop or two.

Action is better prepared than ever to “isolate” (buffer?) these two competing power supplies. The Q501, in single and dual channel formats, is ideally suited to the task. This unit is a 2-wire transmitter, satisfying the demands of the input device supplying loop power. Traditionally, 2-wire transmitters were packaged for rugged field locations (like Action's T700 series), but more and more 2-wires are finding their way into cabinets, and the DIN rail mount format and dual channel design of the Q501 is perfect for such installations.

# Loop Drive Capability

## Problem

When designing a two-wire loop-powered system, the voltage supply selected is an important consideration. The supply must be of sufficient voltage to drive all components in the current loop. Two-wire transmitters typically require from 10 to 13 volts to operate and each device in the system will produce a voltage across its shunt resistance.

## Solution

To determine the minimum supply voltage needed, you must know the total resistance in the current loop. Multiply the total resistance by 0.02 and add the two-wire transmitter's requirement. The 0.02 represents the maximum current of 20 mA, hence the maximum voltage requirement. The general formula is:

$$V_{s\min} = (R_L \times 0.02) + V_t$$

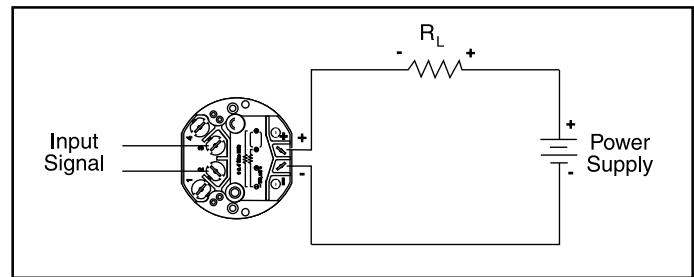
where:

$V_{s\min}$  is the minimum voltage supply required

$R_L$  is the total resistance in the current loop

$V_t$  is the transmitter voltage requirement

For example, a system using a Transpak T797-0000 is connected in series to the input of a PLC and a chart recorder. Since the T797 requires 12 volts to operate and the input impedance of the PLC and recorder are 250 Ohms each, we have a minimum voltage requirement of 22 volts:  $(500 \times .02) + 12 = 22$ . A 24 volt supply is sufficient to drive the 4-20 mA current signal through all devices in the system. When existing loop-powered systems are being expanded, determining voltage supply requirement is equally important. If the above system was being expanded to accommodate a remote loop-powered display, would you choose the Visipak V560 or the V565? Only the V565 would work without changing the power supply. The V565 requires only 1 volt from the supply to operate, resulting in a total voltage requirement of 23 volts. Selecting the V560 (which requires 4 volts to operate) would mean that you would need a minimum supply voltage of 26 volts to ensure proper operation.



# Differential Temperature - Measurement & Display

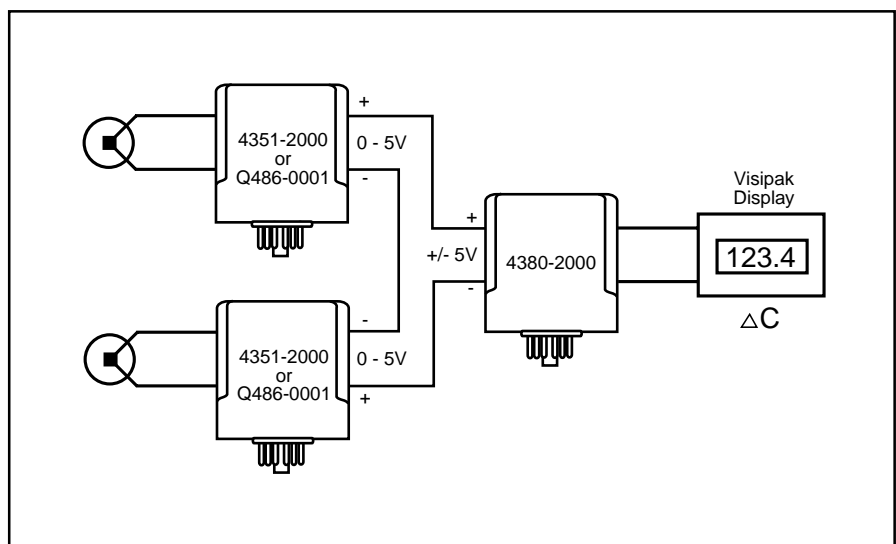
## Problem

How to measure and display differential temperature.

## Soution

This is an example of an easy and accurate way of displaying differential temperature measurements using thermocouples. The Action Pak 4351-2001 or, if a DIN rail mounting is preferred, the ActionI/Q Q486-0001's are used to linearize the thermocouple signal. By tying the negative outputs of the devices together and running the positive outputs into the Action Pak 4380-2000, the 4380 becomes a differential amplifier and the output will represent the temperature difference between the two thermocouples.

To alarm on the difference, an Action Pak 1080-2000 (single trip) or an Action Pak 1090-2000 (dual trip) can be used in place of the 4380. A Visipak display is used to show the actual difference of the thermocouple signals.



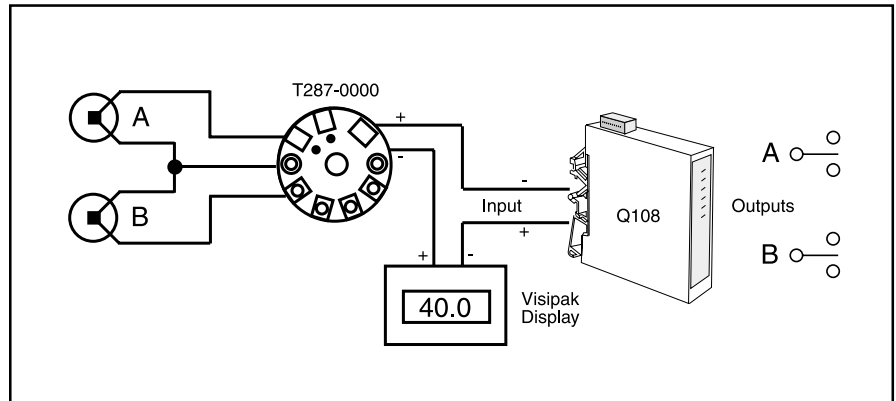
# Differential Temperature Control

## Problem

An engineer called and told us she was heating both sides of her product and it was critical to keep the temperatures within a couple of degrees of each other. She wanted a system to monitor both sides and modulate the burners to keep the temperatures tracking each other. She had a burner controller that accepted a single input. She also needed an indication if the temperatures exceeded a specified differential.

## Solution

For this application, we chose a T287-0000 temperature transmitter. The T287-0000 is a head mount, PC configurable, temperature transmitter that can be configured for a differential thermocouple input. The 4/20 mA dc output represents the differential temperature. When both temperatures are equal the output will be at 12 mA. The controller will respond to heat the A side of the product if the 4/20 mA signal is less than 12 mA, and the B side if the 4/20 mA signal is greater than 12 mA.



The indication of excessive variance is accomplished using a Q108-0000 (or G108). The Q108-0000's configurable input is set for the 20 mA input range. One setpoint is configured as a 'Hi' trip, the other as a 'Lo' trip. The setpoints are adjusted for the specified temperature differential. When A exceeds B by the specified temperature differential the 'Hi' relay will trip. Similarly, when B exceeds A by the specified differential the 'Lo' relay will trip.

The Q108-0000 has an isolated 24 Vdc, 20 mA source to power the T287-0000. The T287-0000 causes a mere 9 V drop, allowing for 15 V drive remaining in the current loop, more than enough to accommodate the input of the controller. If the T287-0000 is not mounted in a thermocouple head junction assembly it can be DIN rail mounted next to the Q108-0000.

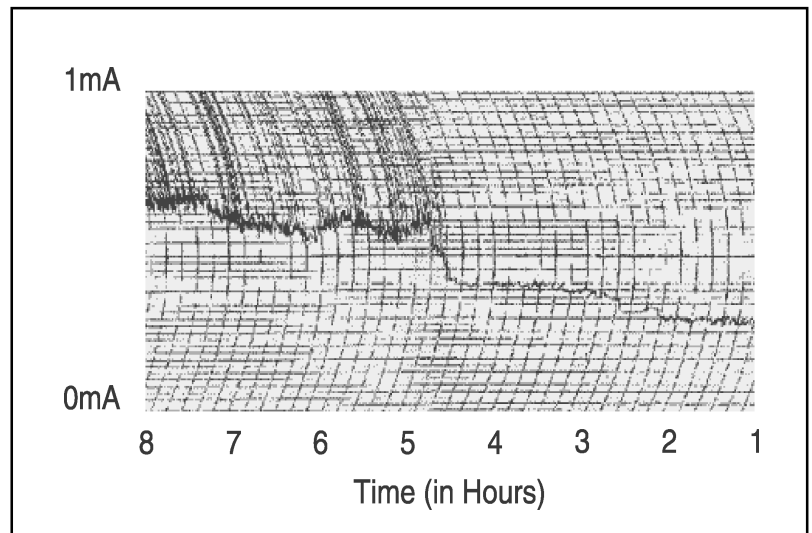
# Debounce Circuit

## Problem

One of our customers is using the Q476, AC powered, frequency to DC isolator. The (standard) 10V excitation source is used to drive a relay. The relay provides an input frequency from 0-2.32Hz and the Q476 is set to provide a 0-1mA output to a chart recorder. The graph of their chart recorder, scaled for 0-1mA, is shown below. The horizontal axis shows a time frame of about eight hours. As can be seen, whenever the output rises to about 500uA, it begins to intermittently slam high.

## Solution

The module was returned to us to determine why there was a spike on the output. A relay was connected to the input terminals and sure enough, the spike was observed when input frequencies were above 1Hz. The cause was traced to the relay which was occasionally sending a false trip (an additional closure) to the Q476. Adding a debounce circuit to the input of the Q476 was an effective solution. A 47 Ohm resistor in series with a 0.1mF film capacitor across the Q476's input terminals completely suppressed the unwanted signal. Action not only provides unparalleled assistance in helping customers select and use our products, we also provide excellent after sales support.



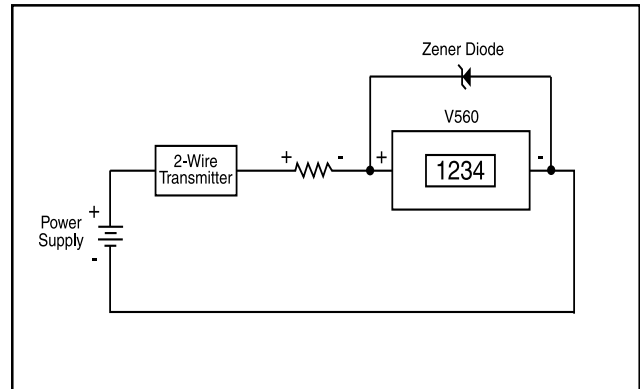
# Breaking a Current-Loop, without breaking it...

## Problem

A customer has a 4-20mA current loop and wants to install a loop powered indicator. The Visipak V560 is a perfect fit to provide an LCD display in proportion to a 4-20mA signal. However, they also need the capability of removing the indicator without breaking or affecting the current signal.

## Solution

By placing a zener diode in parallel with the V560, the indicator can be removed without disrupting the current signal. The V560 has an input voltage drop of 3.9 volts maximum at 20mA, so the zener diode selected must have a threshold greater than 3.9 volts. Since Zener diodes operate in reverse breakdown and the zener threshold is greater than 3.9 volts, the V560 tracks the 4-20mA signal when installed in the loop. When the V560 is removed from the loop, the zener threshold is exceeded and allows current to flow uninterrupted. For the typical application below using a Two-Wire Transmitter, the power supply must be of sufficient voltage to drive all components in the current loop. The general formula is expressed as:



$$V_{smin} = (RL \times 0.02) + V_t + V_z$$

where:

$V_{smin}$  is the minimum power supply required

$RL$  is the total resistance (load) in the current loop

$V_t$  is the transmitter voltage requirement

$V_z$  is the zener threshold

Recommended Zener Diodes:

1. 1N750A:  $V_{Zmin} = 4.23V$ ;  $V_{Zmax} = 5.12V$
2. 1N751A:  $V_{Zmin} = 4.59V$ ;  $V_{Zmax} = 5.61V$

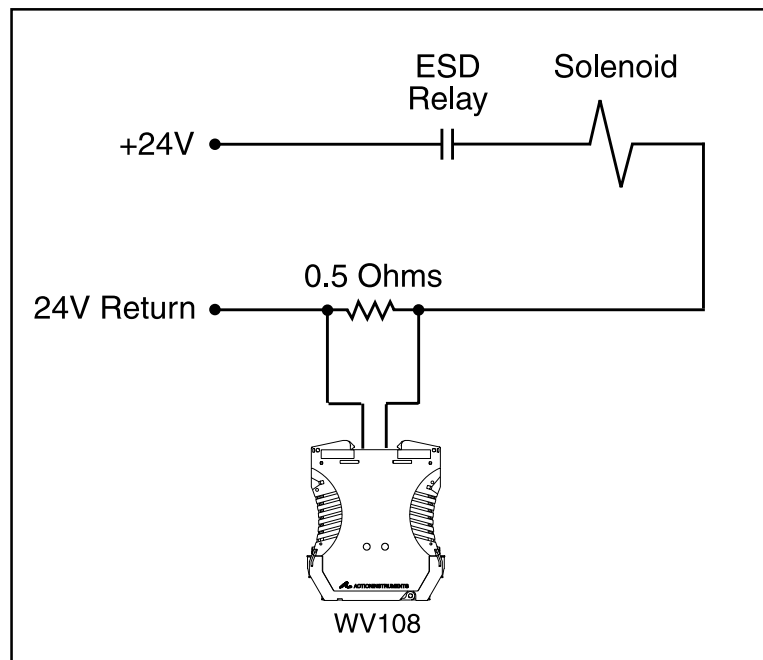
## High Current Sensing

### Problem

An engineering company is constructing a system to test solenoids. Their circuit typically generates a current flow of 1 Amp. They need to trip an alarm with a high current input signal.

### Solution

This application has a wide range of similar uses. A 0.5 Ohm, 1 Watt precision resistor connected in series with the current loop produces a 500 millivolt signal. This 500mV signal becomes the input to an Ultra Slimpak II WV108 Limit Alarm. A Hi alarm is indicated if the solenoid is drawing too much current and a Lo alarm if the solenoid is drawing insufficient current. If an AC powered module is preferred, either the Action Pak 1090-2000 or an ActionI/Q Q106-0000 can be used.





## Who is Arthur Holland?

Arthur Holland operates Holland Technical Skills in Oakville Ontario, a consulting engineering firm specializing in process instrumentation, temperature and power control technology and technical writing. He also writes a monthly column on control technology in Process Heating magazine out of Bensenville, Illinois. Mr. Holland has worked as an instrument and control engineer with Honeywell, the UK Atomic Energy Authority, Eurotherm, and Holland Instrument Company. He has for several years practiced his profession serving Canada's manufacturing and research sectors.

## A Look at 4-20mA Signals

Arthur Holland, Holland Technical Skills

Wherever a process is monitored or controlled you find 4 – 20mA dc as the standard analog signal of choice. Of course, there are others such as 0 – 5V dc and the many digital signal standards.

### As Process Variables

Emerging from transmitters (signal converters and transducers), 4-20mA signals represent variables such as temperature, pressure and power. They are routed to controllers, indicators, PLCs, DCS systems etc., to be used in display, control and alarm monitoring of the process.

Transducers handling non-linear inputs, for example, thermocouples and differential pressure flowmeters, often hand the job of linearizing the signal over to the receiving device. Some so-called "smart" modules have digital processing circuitry that can linearize the process signal. Even smarter models are configurable, meaning that you can select and range any one of several types of process signals as the input. It is a short step from here to incorporate a digitally coded output, typically for entry into a DCS system.

Compared with the low millivolt signals from thermocouples or RTDs, the 4-20mA signal is robust enough to ignore electrical interference in plant-wide wiring. The signal wire can be copper, not the more expensive, dedicated thermocouple extension wire.

### Why is this Signal Known as a Current Source?

It means that the receiving circuit and wiring can have any resistance (typically between 0 and 600 ohms) without affecting the accuracy of the mA signal. Similarly, a voltage source remains stable for the entire range of load resistances within its specification.

### Loop-Powered Transmitters

A loop-powered transmitter is one in which the transmitter output, an external dc power supply and the receiving devices are strung in a series loop. Some 12 volt's of the dc supply is dropped across the transmitter as power for the internal electronic circuit. If the receiving device resistance is too high for the power supply, a higher voltage dc supply (up to about 90V) can be used.

### Self Powered Transmitters

These have a second pair of terminals that take the normal 115V ac supply from which the now internal dc supply is derived. You can now achieve electrical isolation between all transmitters on the same ac power supply as well as between inputs, outputs and ground. This avoids the gross, unpredictable measurement errors that connection to grounded receiving devices can cause. Input/output isolation is also important. For example, when a thermocouple tip is exposed and vulnerable to touching high heater or process voltages (in furnaces or duct heaters). Isolation keeps hazardous voltages off the plant signal wiring and avoids common-mode measurement errors.

As a control signal, the 4-20mA would come from (for example) the output of a temperature controller and feed into a final control device such as an electro-pneumatic control valve or silicon controlled rectifier. Usually a high control signal calls for high output of the final control device (direct acting mode). Reverse acting is the other option, for example, high milliamps to close a valve. So decide which action you want - if your controller or wiring should break with loss of milliamps, choose the mode that is fail-safe.

### Force-balance principle

The 4 -20mA signal is about the right size for use in the force balance system found in pressure transmitters. Here the magnetic force of the milliamps in a coil performs a null-balance against the diaphragm pressure, resulting in an accurate transduction of pressure to milliamps.

The same principle is used in I/P (current to pressure) converters, often incorporated into electro-pneumatic control valves or valve positioners where, by servo action, the valve is forced to a position proportional to the mA signal.

### Signal Converters

A simple example is the signal isolator with 4-20mA in and 4-20mA out. It is used to isolate an incoming signal that is grounded from a receiving device that cannot tolerate a second ground reference. The input/output/ground isolation will usually withstand about 1500V. There are many combinations of available signal ranges for both inputs and outputs, including multiple channels, mathematical functions, and user defined linearizations. Packaging can be a DIN rail mounted box or a plant mounted pillbox shaped enclosure with two pairs of terminals (for input and output - a third pair is added on models having external ac power).

# Signal Conditioners

## The Little Hidden Boxes that Manipulate your Process Signals

Arthur Holland, Holland Technical Skills

When you are planning or modifying your process control and monitoring system, the odds are you will be reaching for your inventor's hat. This is because there are always some functions that cannot be performed by the normal control system; or there may be unforeseen requirements that need an extra device of some kind.

Look around your process and you might see small hockey-puck shaped components on the heads or inside the covers of temperature sensors. You might find others in a different package around the plant and inside control enclosures, mounted on a bulkhead or on a DIN rail. There is a good chance that these are **signal conditioners**, doing jobs that complement that of your main control system. These are essential items in the inventor's tool kit.

They are stand-alone components whose internal circuitry is usually powered by the 115V ac line or by a 24V dc supply. They can alternatively be **loop-powered**, which means that the power for the device comes from an incoming or an outgoing 4-20mA circuit driven by its own dc power supply.

Signal conditioners have at least one pair of input terminals and one pair of output terminals. The power supply pair can be omitted if you take loop power from a 4-20 mA input or output signal.

### Input/Output Options and How they Apply to Signal Isolators

The signal isolator may come as a millivolt in/voltage out model, with isolation, adjustable gain and offset, high input impedance and a robust low-impedance output signal.

A current in/current out isolator would also offer adjustable gain and offset. It would have near zero input impedance (current sink) and very high output impedance (current source). Voltage/current and current/voltage isolators are also available. De facto standard process signals are 0-10V dc and 4-20mA dc. Five-way isolation applies between input, output, power supply, relay contacts and ground. The isolation is commonly designed to withstand 700V rms ac and 1000V peak. Some models can withstand up to 4000V peak.

Signal isolators are also available with an inversion option in which the output increases from 0 to 100% as the input decreases from 100 to 0% of working range. This could, for example, be used to convert a reverse acting control loop into a direct acting control loop. Gain and offset adjustments are usually provided. This would allow you, for example, to adjust the working range of a control valve. Major benefits of isolation are reliable operation in electrically noisy plants and the elimination of common-mode and ground-loop problems.

### Signal Conversion - Thermocouple to DC mA with Isolation

This provides a robust interference-free signal and enables use of copper extension cable in place of the more expensive and higher resistance thermocouple extension cable. There are two things to bear in mind. Most low-cost models come with only one choice out of a selection of the most popular thermocouples and would be factory configured (not field configurable). The output signal would conform to the same non-linear law as the thermocouple, which means that you would have to take into account the inaccuracy if you use a linear receiving indicator or recorder.

### Volt, mV and mA Signal Scaling

The gain function can be selected to be linear, or to follow a mathematical function or to follow a custom curve. A square root function requirement is common when handling flow signals. A custom curve can be used either to linearize a grossly non-linear final control element which otherwise would harm control stability, or to linearize an uncommon non-linear sensor.

### Math Functions

Some models have multiple inputs that can be manipulated mathematically to form the output.

### Voltage-to-Frequency (V/f) and Frequency-to-Voltage Converters.

The output of V/f converters can be monitored over great distances using a telephone line and then easily reconverted to represent a process measurement at the receiving end using an f/V converter. Models are available with multiple and mixed inputs and outputs.

In one case a BTU/h measurement was required, calculated from **mass flow rate x (T2 – T1)**. Inlet and outlet temperatures T1 and T2 were taken from two RTDs into a three-input conditioner. The third input was a frequency signal representing flow from a mass flowmeter. The temperature difference (T2 – T1) was obtained and then multiplied by the frequency signal. The resulting dc output was scaled to show BTU/h. A second conditioner took in the dc BTU/h signal and converted it to a frequency in which each cycle represented a fixed number of BTUs. The frequency was suitably scaled and totalized as BTUs on an electric counter. Later versions of conditioners can derive the same two results using only one conditioner with multiple inputs and outputs.

### 3-Terminal Potentiometer to High-Level DC

Two applications here: retransmission to the control room of gate position on a hydro-electric station, and manual adjustment of a remote electro-pneumatic damper positioner.

### Potentiometer to Pulse-Width Modulation

One application example is manual adjustment of percentage input of a heat process. The heat source could be gas, electricity or a heat transfer medium.

### Strain Gauge Output to High Level DC

Weight measurement and batch loading applications.

### Alternating Voltage and Current Inputs

AC inputs can be converted to signals representing voltage, current, power, reactive power, kVA, power factor and, with a frequency output, pulses representing watt hours per count. Monitoring and alarm annunciation functions can minimize the demand component of energy costs.

### Signal Input/Output Configuration

An increasing number of models now are field configurable in respect to magnitude and type of input and output signal. This can be done by manual adjustments and DIP switches, or alternatively by a PC. The upmarket models linearize thermocouple and RTD signals. An LCD display is available on some models to show the process signal or as an aid to field configuration.

### Rate of Change of Signal Limiter

Let's say your process cannot tolerate more than a certain rate of change of power input, pressure, flow, etc. Some converters offer an adjustable output ramp rate limit in the face of a wildly varying signal input.

### Alarm Choices

Multiple alarm relays or open collector outputs can be specified and configured as high, low, deviation or rate of change of signal.

### Communications

Models are available with RS-232 or RS-485 communication capability, providing internet access to process signals and alarm conditions. Remote ranging and some configuration items are also possible.

### Intrinsic Safety

In this context, intrinsic safety refers to instruments and low voltage circuits designed to prevent release of sufficient energy to ignite volatile gases. Signal conditioners are available that comply with the rules of intrinsic safety in specified hazardous atmospheres.

## Smart Field-Mounted Control Components

### They Obey Your Commands and Tell You How They're Doing

Arthur Holland, Holland Technical Skills

You are already accustomed to the smart and versatile nature of communicating process controllers. The dumb and obedient field devices have for some time been evolving in the same way.

Access to process information and the ability to act on it is becoming faster and easier year after year. Watch-keeping and actions that once involved a walk and poke around the plant are now being done from the control room. Archived records become readily available for environmental conformity and process fault and incident analysis.

There are impressive case histories of time and cost savings on commissioning, maintenance, asset management, process up-time and record keeping. Control components that make this possible have **digital electronics and sensing devices built in** and are often called **smart** or **intelligent**. These are also marketing words so judge each case carefully.

A communications cable leaving the control room calls at each component enabling you to watch and manipulate its parameters. This has bestowed great benefits onto process diagnostics, preventive maintenance and plant up time; and don't forget wiring complexity. These components include control valves, power control devices, temperature sensors, signal converters, transducers and motor drives. Controllers, indicators and PLCs have long had smart features. They too are often remote but can still keep in touch with a control center.

## Control Valves

A control valve is not often located where you can see it working. You may see its 4-20mA command signal and an analog position signal in the control room. What more could you want to do without leaving your seat?

Control the valve position with a digital signal (modbus, profibus, etc.)

Set the stroke (the span and zero positions of the valve)

Make its travel linear

Measure the applied thrust or torque

Observe the deadband

Measure the speed

Count the number operations

Measure and control the flow; usually a more relevant and linear manipulated variable than position

Measure upstream and downstream pressures

All these functions can be built into a microprocessor incorporated into a control valve and exploited from the control room while the process is running.

## Power Control.

Many heat processes are controlled using low-cost solid-state contactors (SSRs) operating in the time-proportioning mode. At this basic level, more features may not give you a payback and you may not even justify a load ammeter. A small but handy step up market is a bit of circuitry that compares the coincidence of a control pulse with the resulting load current and gives an alarm upon finding an inconsistency. For example; pulse present but no load current (= load open circuit); also no pulse but load current present (= short circuit SSR). These say "you'll soon be making scrap, get out here."

There are many rich control features that let you grow the SSR into a sophisticated SCR unit. Though they use traditional logic and analog techniques I rate them smart even before we turn to microprocessor use.

## Some Smart Features of SCRs

Soft start

Control by voltage", current" and true power

Transfer between these modes

Voltage, current and power limiting and monitoring

Line-voltage monitoring

Receive measurements over the analog control line

Heatsink temperature alarm

Partial load failure alarm

Phase unbalance monitoring and control

With communicating SSRs and SCRs, access to these features over your Ethernet link enables remote adjustment, fast fault diagnosis, automatic or operator intervention and recording of load and process behavior.

## Signal Conditioners

A typical conditioner may come with millivolt input and voltage output, with 3-way (in/out/ground) isolation, adjustable gain and offset, high input impedance and a robust low-impedance at the output. A current in/current out isolator would also offer adjustable gain and offset. It would have near zero input impedance (current sink) and very high output impedance (current source). You find appropriately ranged models buried in flow transmitters or thermocouple heads.

Other functions include: **Inversion, thermocouple/mA with isolation, mV, Volt and mA signal scaling, custom linearizing, voltage-to-frequency (V/f) and f/V conversion, math functions, relay or logic alarm outputs.** Many models now are field configurable in respect to magnitude and type of input and output signal. This can typically be done by manual adjustments and DIP switches; or alternatively by a PC. LCD displays are available showing the process signal and other parameters to aid field configuration.

Using an extra module you can, with a standard web browser, calibrate and configure some models and view all the sensor's data directly. You can automatically trigger e-mail messages when process variables or maintenance-based performance parameters exceed preset limits.

## Traps and Color Confusion in Thermocouple Wiring

Arthur Holland, Holland Technical Skills

**This article addresses inaccuracies and instabilities caused by misuse of thermocouple extension cable on temperature control systems. The jungle of different cable color codes is a major source of such problems.**

A newly wired furnace suffered burnout of all six of its silicon carbide elements at a cost of some \$9000. The controllers were in good order and showed normal working temperature though the furnace was clearly much hotter. The Type R thermocouples were good and located properly but somehow the controllers were being deceived.

### Cause

The extension cables were Type J and should have been Type R. Red was connected as + and white as – (i.e., the wires were crossed at both ends).

Red as positive sounds logical being a common worldwide convention but not on North American thermocouple wires. This is an understandable but costly error. Treacherous too, because for a while after the furnace came up to temperature there was no problem. But as the thermocouple head heated up in relation to the controller terminals, the Type J extension cable injected a large negative signal into the controller. This made it read low by as much as 5 times the thermocouple head-to-controller temperature difference, causing it to severely overheat the furnace. Knowledge of extension cables and their color codes could have prevented this damage.

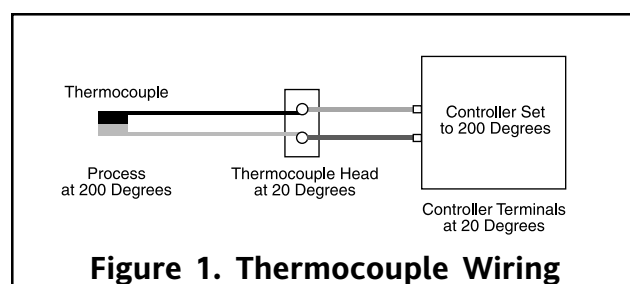
### Typical Symptom

You suspect that your processing temperature is high even though the correct temperature shows on the controller. The process appears to overheat gradually over the first few hours after start up. This usually occurs on an imported or newly installed process or one where the thermocouple has been rewired or worked on.

You have verified that you are using the right thermocouple for the temperature and atmosphere; it is located where it sees the work temperature and it is calibrated correctly. Your controller is accurate, calibrated for the thermocouple in use and is tuned for good control stability.

### How the Controller receives Signals from the Process

The circuit below shows the signal route from the hot tip of the thermocouple to the temperature controller. Degrees C are used in this example.



There are three contributions to the millivolt signal that the controller receives and acts upon, totalling 200 degrees worth in this case:

Those generated between the hot junction and head of the thermocouple  
(180 degrees worth in this case, being proportional to the temperature difference).

Those generated by the extension cable between the thermocouple head and the controller  
(0 degrees worth at this point, because there is no temperature difference).

Those generated by the controller, representing its own (ambient) temperature (20 degrees in this example).  
It needs to contribute this so as not to be short by an amount equal to its own ambient temperature.  
This is called cold junction compensation.

After start up, the outside of the process begins to warm up and let's say the temperature of the thermocouple head rises to 40 degrees. The thermocouple now delivers 160 degrees of signal and the correct extension cable will generate the 20 degrees representing the 20 degree end to end difference. The controller will still see 200 degrees.

### **Trap 1. Use copper instead of extension cable**

The copper fails to generate the 20 degrees of signal in the above example and the controller faces the prospect of seeing 180 degrees instead of the true 200 degrees. However it will get to work as soon as any shortfall appears and will already be turning the process up towards 220 degrees in order to be satisfied. This will raise no suspicion because the controller will be indicating the desired 200 degree temperature all the time the temperature is slowly climbing. Ignoring thermocouple non-linearities the temperature will settle out too high by an amount about equal to the head-to-controller temperature difference.

### **Trap 2. Use the correct extension cable but cross the pair of wires at both ends**

This is even worse than using copper. The temperature will settle out higher than indicated by about twice the head-to-controller temperature difference. This error can vary during the day from not noticeable to some 100 degrees too hot, depending on how near the thermocouple head is to the hot process and how long the process has been running.

This double reversal wiring error is common and understandable since the negative wire is color coded red on all North American extension cables and can be mistaken for positive. Red positive is indeed used by Japan and Germany (see the table on the inside back cover).

### **Trap 3. Use the wrong extension cable**

Remember that extension cable makes its contribution to the millivolt signal, which is interpreted as temperature by the controller. The proper cable will match the thermocouple in respect to its microvolts per degree. Wrong cable can make the controller indicate too high or too low, depending on how much its microvolts per degree differs from that of the thermocouple. In the burnout case noted above, the Type J extension cable delivered some 5 times the output of the correct Type R cable, and injected errors of some hundreds of degrees. There are even worse combinations than this.

### **Extension Cable Color Codes**

The table on the inside back cover includes the six most commonly used thermocouple types. It shows five varieties of cable color codes used in various countries, plus the IEC codes. The IEC codes represent a single world standard and are beginning to show up on European equipment. They will eventually replace the currently used codes.

### **Tips for cable identification**

Look at the colors of the cable all the way from the thermocouple head to the controller.

Check for wires crossed at both ends.

If you don't trust or cannot see the colors, perform a heat test for polarity:

Disconnect the extension cable from the thermocouple head and twist or clamp the extension cable bare wire ends together. The controller should now show room temperature at that location and the indication should increase when you heat this junction.

A magnet test is useful with Types J and K wire:

On Type J, the positive conductor is iron and therefore magnetic.

On Type K, the negative conductor is Ni/Al and slightly magnetic.

Note too that thermocouple connectors are color coded to agree with the corresponding cable jacket.

# Thermocouples Part 1:

## Eight Established Types to Choose From. What Type do I Need?

Arthur Holland, Holland Technical Skills

Of all the temperature sensors used in industry and research, the thermocouple is the sensor of choice on grounds of temperature range, speed of response, ruggedness and cost. Though there are other important sensors, this article is limited to the eight most commonly used thermocouples, Types **J, K, T, E, N, S, R and B**. These letter designations, now used world wide, follow the recommendations of the **IEC** (International Electrotechnical Commission), the **ISA** (Instrumentation, Systems and Automation Society), the **ASTM** (American Society for Testing and Materials) and the **ANSI** (American National Standards Institute).

**Type J** is useable up to 720°C. It is not very susceptible to aging up to about 540°C. It is cost effective and is the thermocouple of choice in the plastics processing industry where temperatures rarely exceed 400 °C. The iron conductor is subject to oxidation at higher temperatures and when unprotected.

**Type K** is useable up to 1150°C in an oxidizing atmosphere. Metallurgical changes can cause a calibration drift of 1 to 2°C in a few hours, increasing to 5°C over time. A special grade of Type K is available that can maintain special limit accuracy up to ten times longer than the regular grade.

**Type E – Chromel/Constantan** is useable up to 820°C. It has the highest mV output of all the thermocouples and has similar calibration drift to that of Type.

**Type N – Nicrosil/Nisil** is useable up to 1260°C. It was developed to overcome several problems inherent in Type K thermocouples. Aging in the 300 to 600°C range is considerably less. Also Type N has been found to be more stable than Type K in nuclear environments, where Type K has been the sensor of choice.

**Type T – Copper/Constantan** Oxidization of the copper limits the useable temperature to about 370°C. It has been the thermocouple of choice for applications down to – 200°C.

**Type R – (Platinum-13% Rhodium/Platinum) and Type S (Platinum-10% Rhodium/Platinum)** are useable up to 1480°C. They are extremely stable but reducing atmospheres are particularly damaging. These types should be protected by a gas-tight ceramic tube and a secondary tube of porcelain, silicon carbide or metal, as conditions require. Type R delivers some 15% more mV than Type S.

**Type B – (Platinum-13% Rhodium/Platinum-6% Rhodium)** is useable up to 1700°C. Also easily contaminated and damaged by reducing atmospheres. The same protective measures for R and S apply to Type B thermocouples.

### Wire Size and Atmosphere

The upper temperature limits and life expectancy of all thermocouples are dependent on atmosphere and wire size. Don't count on reaching those limits in most applications. For longer life and higher temperature use, choose larger size wires. For speed of response, choose the smaller sizes; but note that a protection tube will dominate response time. With the platinum alloys the high cost and the long life of the materials usually dictate small wire sizes, typically 0.35mm.

### Construction

Basic: Take two wires, join them at the hot end, measure the mV at the other end; who needs more? Often nothing wrong with that. Poke it in a duct or a non-aggressive liquid, or clamp it to the process under a screw and washer or a hose clip. For protection from damage, abrasion and corrosion, I'll give a few choices here, but for the hundreds of real workable answers **look in the many excellent supplier catalogs and web sites**. Here are just a few design examples:

1. Twin or quad bore alumina with the wires inside. The junction can be exposed, given a non-aggressive environment. Otherwise it can be fitted in a metal or ceramic outer tube to protect from atmosphere or damage.
2. Fiberglass or ceramic-fiber insulated wire inside a stainless steel tube; hot junction welded to the closed end. This is common on plastics machinery and good for fast heat transfer.
3. The metal clad MgO (magnesium oxide) compacted design is rugged, easily bent and good for protection from aggressive media. There is a wide choice of sizes and metal sheath grades for different media.
4. The thermowell is a tough, handy fitting for giving access to the contents of a vessel or pipe. You can slip your thermocouple inside it and still get to it for service or replacement without draining the contents. The hot junction stops short of the closed end of the well. To aid heat transfer you might use a blob of electrically insulating, thermally conducting material at the tip. Thermowell assemblies can be big, strong and slow, and so can mess up your control system response. Keep them small as possible.

### Response Times of thermocouples

A "time constant" is the time taken to reach 63% of the final value. Time constants go from 0.15 (e.g., exposed tip in a fast stream) to some 155 (e.g., a thermowell in a tank). Watch that you don't hurt the control response by putting a slow thermocouple on a lively process.

## Thermocouples Part 2: Traps and Hazards and Why We Don't Need Types J, K, T, E and S

Arthur Holland, Holland Technical Skills

### How do you pick up all of the temperature?

Keep in mind that you are processing material, so try to get to it rather than a pipe or vessel surface. If it's a liquid or a gas stream, you need an immersion depth at least four times the probe diameter. Heavy metal-sheathed probes can conduct heat outwards, cooling the tip and giving a lower than true reading. Thin wall or non-metallic probes mitigate this effect. Plastic processing machinery calls for deep holes drilled in barrels, molds and dies, ending just short of the polymer. You then insert a spring-loaded bayonet-mounted thermocouple that has a grounded hot junction in contact with the blind end of the hole. On a work-piece in an oven or furnace, an attached thermocouple is advisable in addition to one in the space. In a vacuum furnace you have to wonder what a thermocouple in the space is representing.

### Surface Measurements

These may be acceptable but you need a low mass thermocouple in intimate contact with the surface and under a thermally insulating pad. Otherwise the reading will be a compromise between the true surface temperature and the surrounding air temperature.

For a clean or reasonably conducting metal surface you can use a **foundry probe**. This is a spring-loaded pair of sharp spikes of different thermocouple materials (e.g., one of chromel, the other of alumel). These are connected by the appropriate thermocouple extension cable out to your instrument. The metal that you are prodding completes the hot junction but makes no thermoelectric interference with the measurement. This probe is usually used for spot measurements of billets and castings rather than for control.

### Don't Ground Thermocouple Wiring

Many thermocouples are grounded already at the hot end during manufacture for reasons of fast response. Any more grounds, at the protection tube or anywhere at all along the wiring route will more often than not reduce the temperature signal, tell lies to the controller and overheat the process.

### Millivolts Vs Degrees Curves

These curves are different for every type of thermocouple. The top end of the useable range is around 12mV for Type B and some 60mV for Type E. Modern dc amplifiers are so stable that the magnitude of the signal is not a big issue when choosing a thermocouple. The curves and tables are widely available from suppliers and on the internet so are not shown here.

### The Hazards of Variety - The Wider the Choice, The Greater The Risk

Mismatching controllers and thermocouples during installation and maintenance has long been a threat, not just to product yield and quality but also to people and plant. You cannot depend on round the clock vigilance of operators, installers and maintenance technicians. Do all you can to reduce the variety of thermocouples in your plant. Decide whether you want a °F or a °C shop and stick to it. Label your indicators, controllers, thermocouples and zones with the thermocouple type.

The continued use of six different territorial extension cable color codes multiplied by eight different thermocouple types in an importing and exporting industrial market cannot be justified. The color codes have **since 1989** been harmonized and standards agreed world wide by representatives of the major industrial countries through the IEC committees. Their adoption in North America has not yet begun at year **2002**.

Standards Committee work is needed, aimed at minimizing the variety of thermocouple types in process plants. Four of the eight most common (J, K, T and E) can be replaced by Type N, which has been around and proven for 30 or more years. This would eliminate the short and long-term instability problems associated with these four. Type T is well established for low temperatures in the food industry and has the advantage of about 40% bigger signal than Type N. The useable range of Type N (-250 to 1230 °C) brackets all four. Also, there is no need to keep both Type R and Type S. Either one could go and not be missed. For many years controllers, indicators and recording systems, being microprocessor based, have been field configurable to match any of the eight standard thermocouples, so changing a thermocouple type does not present a problem. A bigger challenge would be replacement of the thermocouple extension cables in the plant.

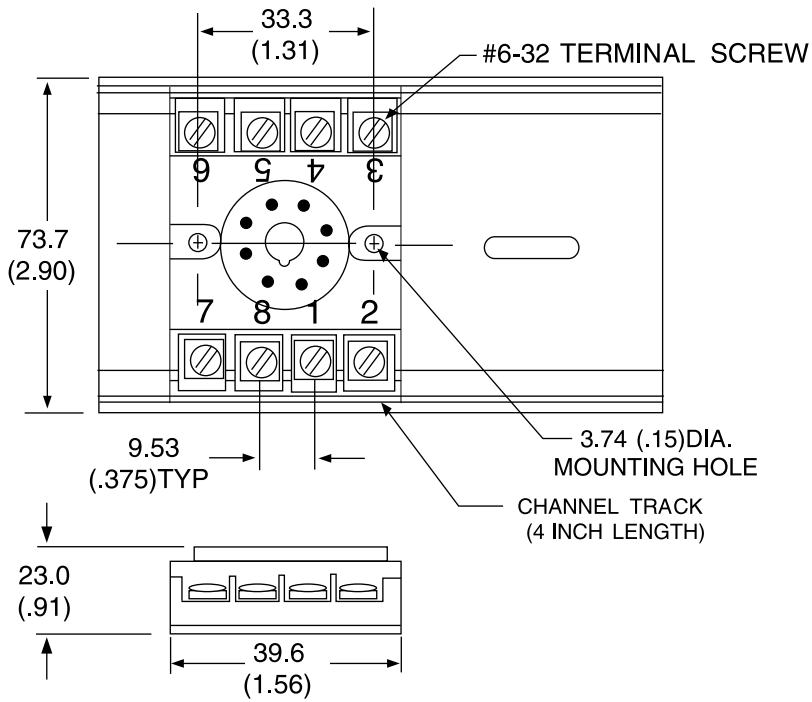
### Name Confusion

Some common thermocouple alloys are given registered trade names that differ from the commonly used names or defined alloy composition names. Some have caught on and are almost generic and are even used here to avoid being pedantic. Other trade names may not be recognizable and could add to identification problems.

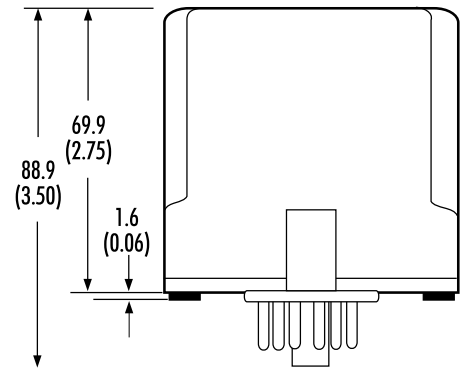


# Action Pak® Dimensions

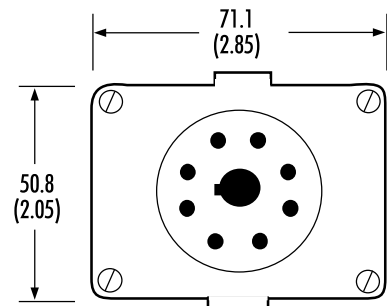
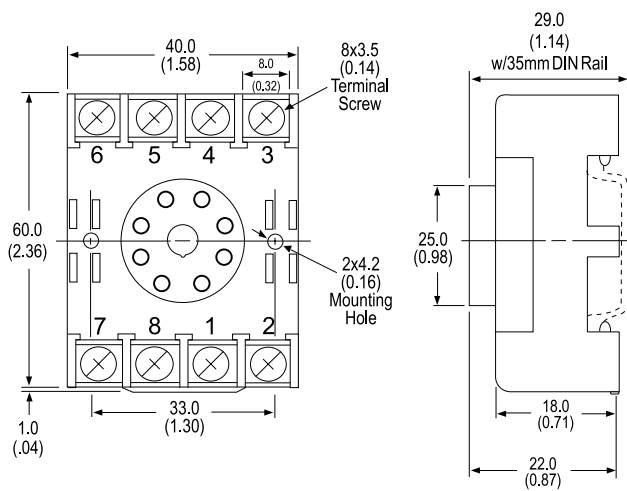
## M008 (Track/Surface) Mounting



## Mark III

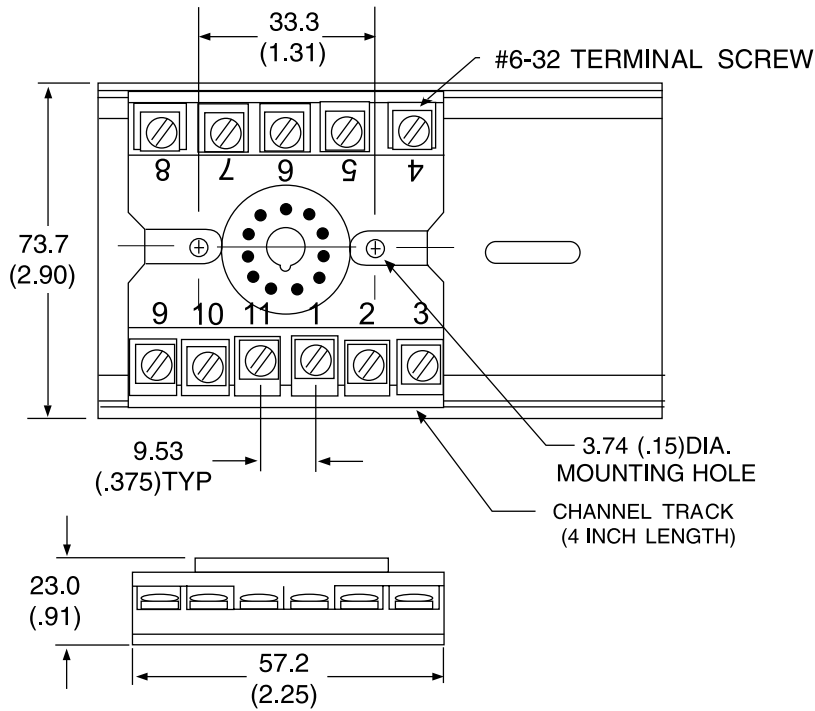


## MD08 (DIN Rail) Mounting

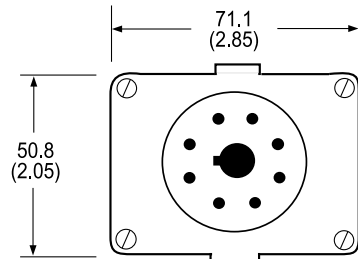
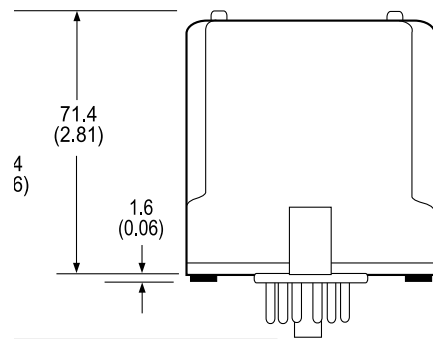


# Action Pak® Dimensions

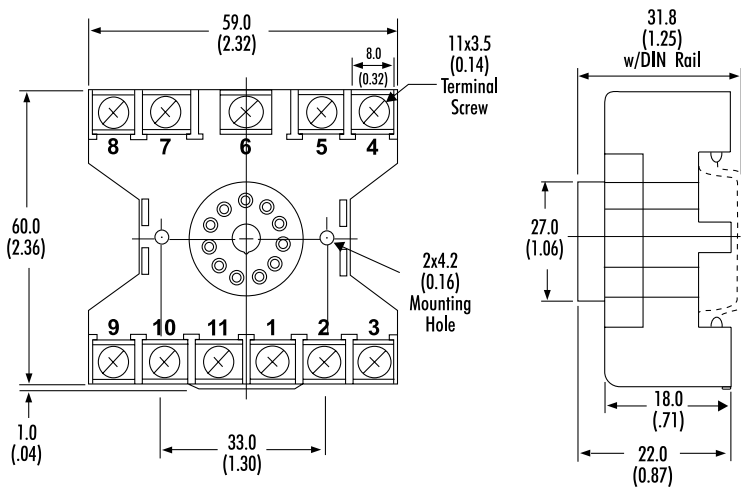
## M011 (Track/Surface) Mounting



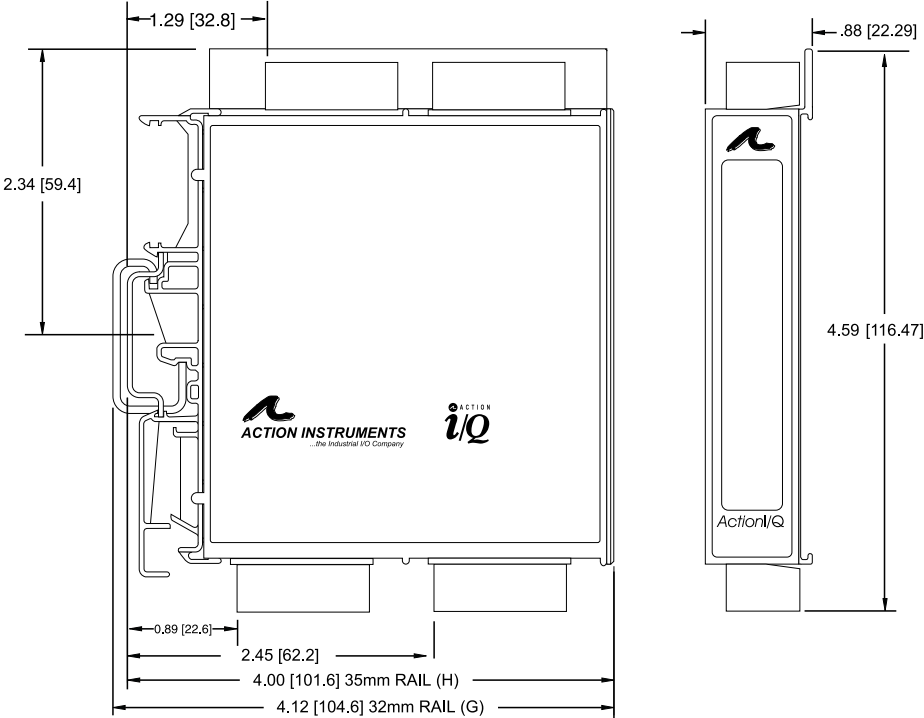
## Mark II



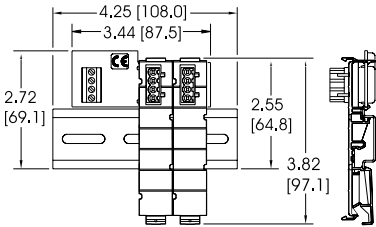
## MD11 (DIN Rail) Mounting



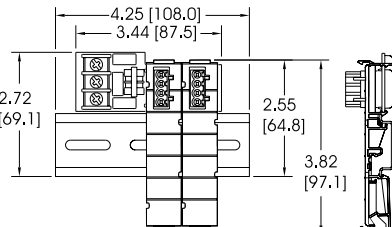
# ActionI/Q<sup>®</sup> Dimensions



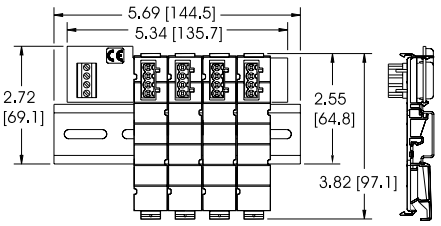
**IQRL-D002 (DC Power Only)**



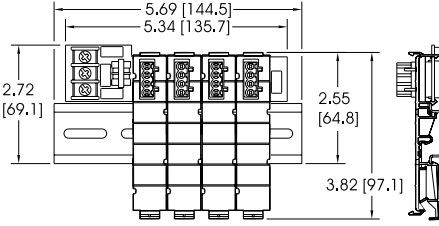
**IQRL-2002 (AC Power Only)**



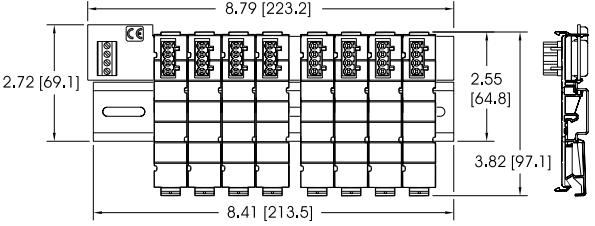
**IQRL-D004 (DC Power Only)**



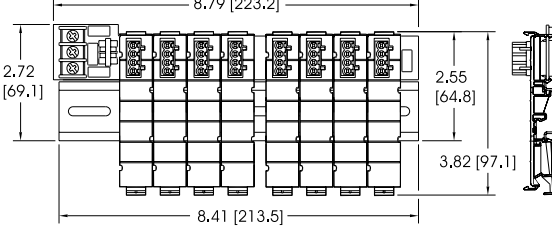
**IQRL-2004 (AC Power Only)**



**IQRL-D008 (DC Power Only)**

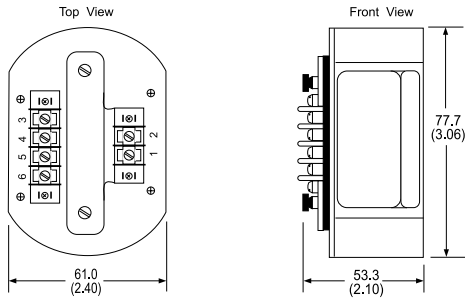


**IQRL-2008 (AC Power Only)**

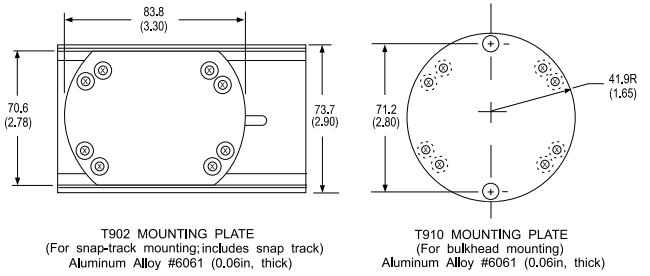


# TransPak® Dimensions

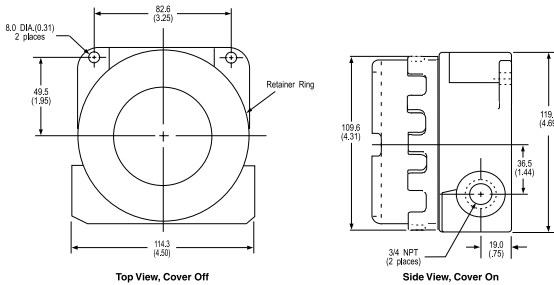
## T700 Series



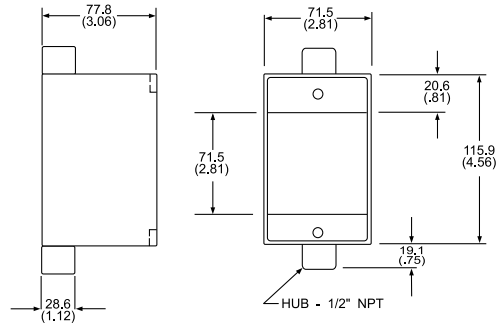
## T700 Series Mounting Hardware



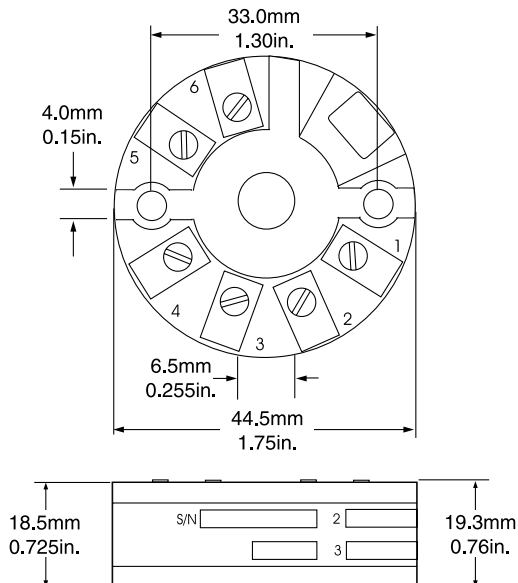
## T805 Explosion Proof Enclosure



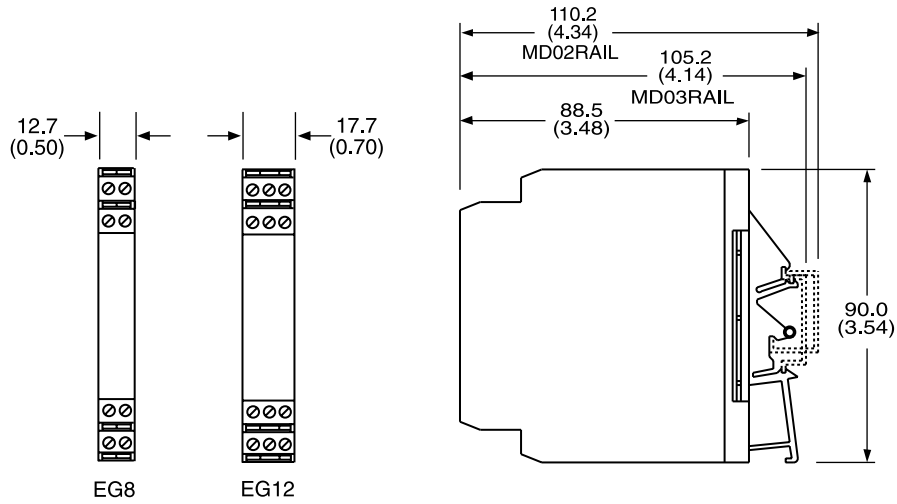
## T804 Conduit Device Housing



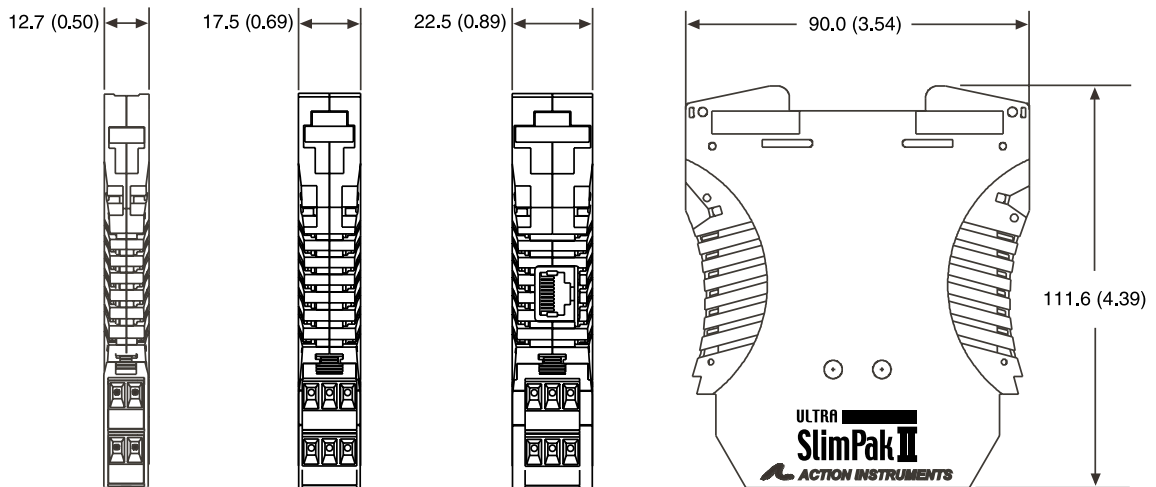
## T280 & T287



# Ultra Slimpak® Dimensions

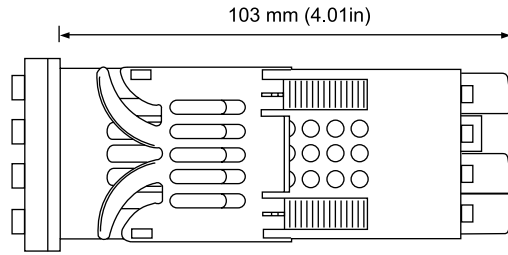
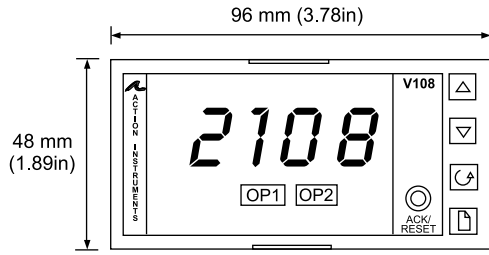


# Ultra Slimpak® II Dimensions

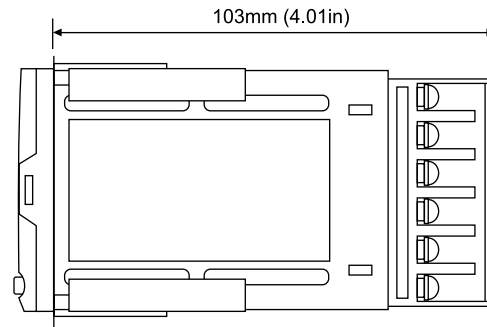
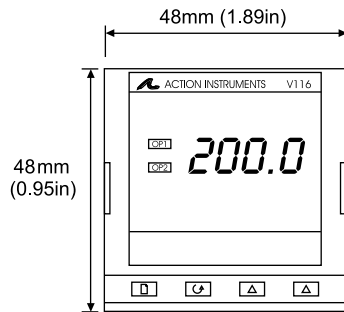


# VisiPak® Dimensions

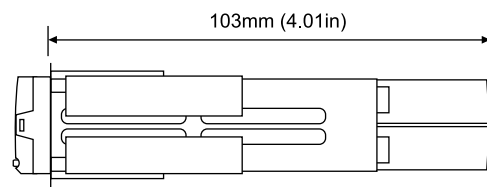
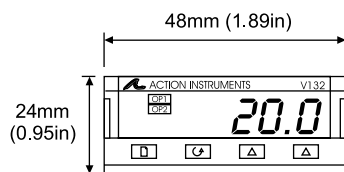
## V108



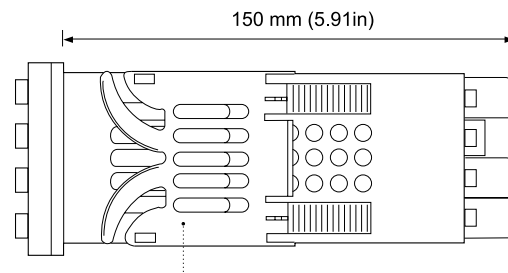
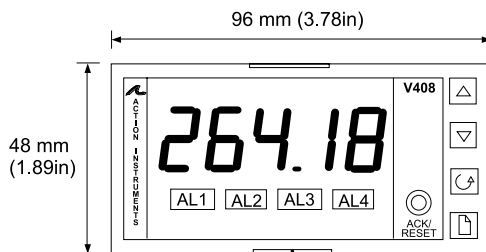
## V116



## V132

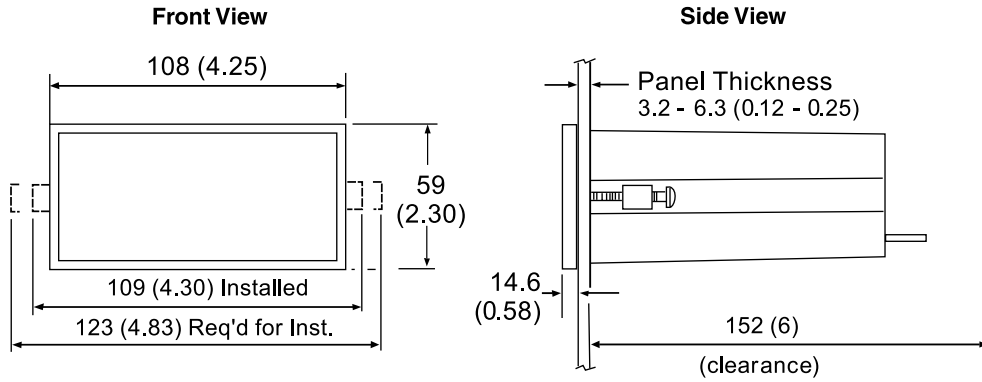


## V408

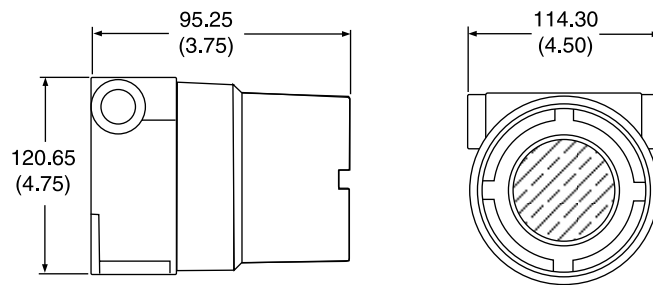


# VisiPak<sup>®</sup> Dimensions

## V43X Series

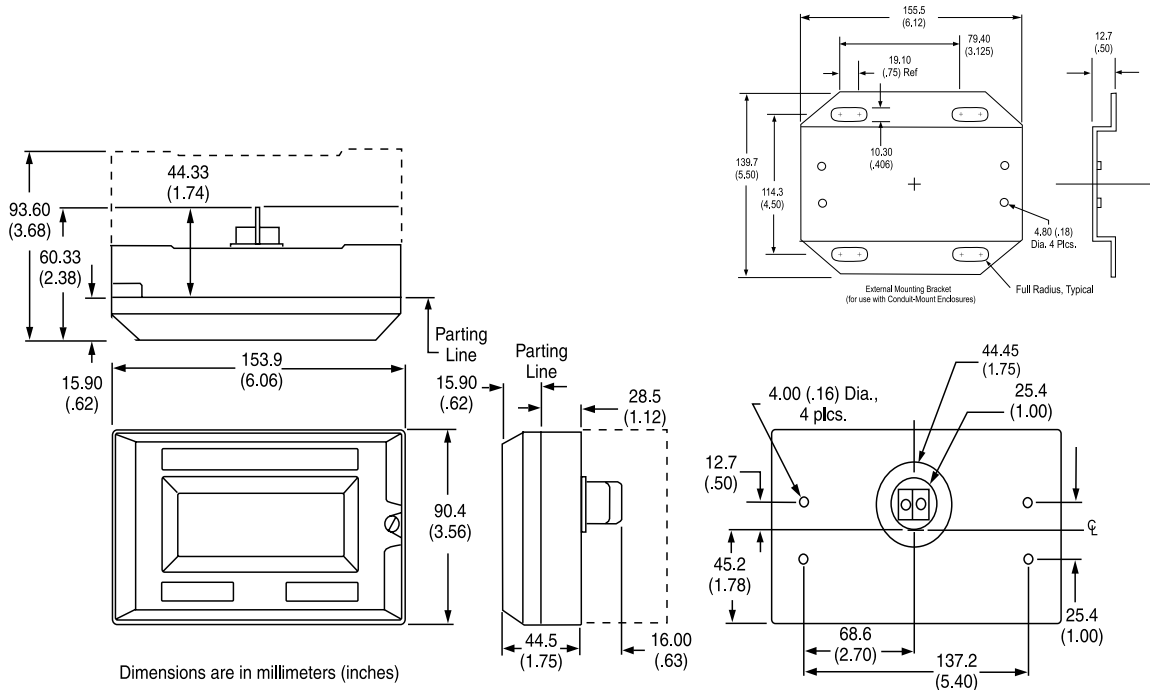


## V561

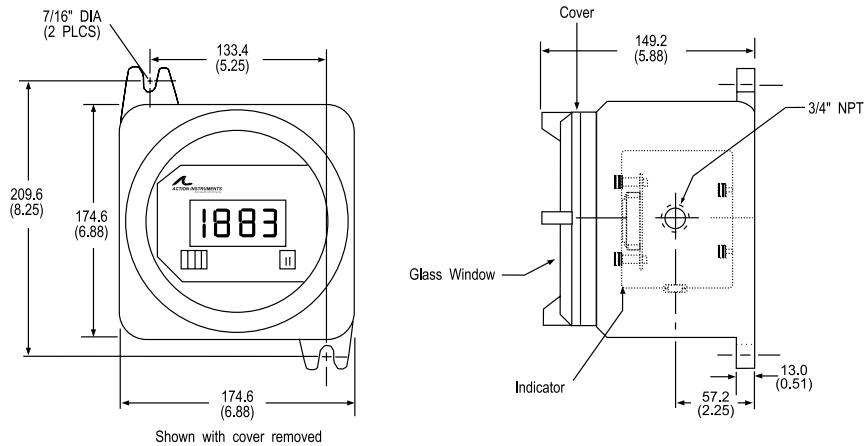


# VisiPak® Dimensions

## V560 & V565



## V560 & V565 Explosion Proof Housing





# Action Product Agency Approvals

## Approval Agencies

CE	Conformite Europeenne, European Union
CSA	Canadian Standards Association, Canada
CUL	Canadian Safety Approval from UL
FM	Factory Mutual Research Corporation, USA
NEC	National Electronics Council, USA
NEMA	National Electrical Manufacturer's Association, USA
UL	Underwriters Laboratories, USA

## CE Mark (CE)

CE mark approval for the Ultra SlimPak, the Ultra SlimPak II, VisiPak and ActionI/Q are defined by European Norms (EN#50081-1 and EN# 50082-2). Consult Action Technical Support for more details.

## CSA Certification

The CSA certification of the Action Pak series, Ultra SlimPak, Ultra SlimPak II and ActionI/Q complies with CSA standard C22.2 No. 0-M1982: General Requirements/Canadian Electrical Code, Part II, and No. 0-M1983: Process Control Equipment/Industrial Products, Certificate No. LR 42272. The only Action Paks to qualify are those with an 8 or 11-pin base.

### Action Pak®

AP1000 Series: All models except those with 20 pin base.  
AP4000 Series: All models.  
AP4400 Series: AP4440 only.  
AP4500 Series: AP4570 and AP4580 only.  
AP6000 Series: AP6380 only.  
AP7000 Series: AP7380 only.  
AP7500 Series: AP7500 and AP7501 only.  
AP9000 Series: AP9046 only.

### Ultra SlimPak®

G100 Series: All models.  
G400 Series: All models.

### Ultra SlimPak® II

WV100 Series: All models.  
WV400 Series: All models.

### ActionI/Q™

Q400 Series: All models.  
Q500 Series: All models.

### TransPak™

The CSA certification of the T700 series allows intrinsically safe installations in Class I, Division 1, Groups A-D hazardous locations. All installations require approved intrinsic barriers per manufacturer's drawing 790-0025-00. Certificate No. LR 42272.

The CSA certification of the T797-1 and T798-1 allows intrinsically safe installations in Class I, Division 1, Groups A-D; Class II, Division 1, Groups E, F and G; and Class III, Division 1, when installed in accordance with drawing 732-0220-00 or 732-0221-00.

T700 Series: T703-2000, T761, and T773.  
T797 & T798: All models.

### VisiPak™

The CSA certification of the V508/V509 complies with CSA Standard C22.2 No. 0-M1982: General Requirements/Canadian Electrical Code, Part II, and No. 0-M1983: Process Control Equipment/Industrial Products. Certificate No. LR 42272. V508 and V509 only.

The CSA certification of the V560 series allows intrinsically safe installations in Class I, Division 1, Groups A-D hazardous locations. All installations require approved intrinsic barriers per manufacturer's drawing 790-0027-00. Certificate No. LR 42272-10. V560, V560C and V565. See enclosure ratings for V560EP and V561.

## Factory Mutual (FM)

### TransPak™

The FM approval of the T600/T700 series allows intrinsically safe installations in Class I, Division 1, Groups A-D hazardous locations. All installations require approved intrinsic barriers per manufacturer's drawing 790-0024-00.

The T700 series (except the T700-0001 and T703-2000) is also permitted in non-incendive Class I, Division 2, Groups A-D; and Class II and III, Division 2, Group G areas. Division 2 locations do not require barriers. Certificate No. J.I.2M2A5.AX(3611).

The T703-2000 is approved Intrinsically Safe, Entity, Class I, II, III, Division 1, Groups A-G hazardous locations per drawing 790-0028-00; and non-incendive Class 1, Division 2, Groups A-D hazardous indoor locations per manufacturer's drawing 790-0028-00. Certificate No. J.I.1V4A5.AX.

T700 Series: All models except T700, T761, and T773.  
T797 & T798: All models.

### VisiPak™

The FM approval of the V560/V565 series permits intrinsically safe installations in Class I, Division 1, Groups A-D hazardous locations and non-incendive Class I, II, III, Division 2, Groups A-D and G areas. All Division 1 installations require approved intrinsic barriers per manufacturer's drawing 790-0024-00. Division 2 installations do not require a barrier. Certificate No. J.I.2M2A5.AX (3611). V565 is Entity Approved, drawing 790-0029-00, Certificate No. J.I.3V1A5.AX. V560, V560C, V565 and V565C only.

## Underwriters Laboratories (UL and CUL)

UL recognition for Action Pak, Ultra SlimPak, Ultra SlimPak II, ActionI/Q and VisiPak complies with UL standard 508 for Industrial Equipment. Canadian safety requirements C22.2 are met with CUL (as indicated).

### Action Pak®

AP1080/1090-2000  
 AP1280/1290-2000  
 AP1680/1690-2000  
 AP4351  
 AP4380-2000  
 AP4382, AP4390, AP4391, AP4392, AP6380, AP7380

### Ultra SlimPak®

G100 Series: All models.  
 G400 Series: All models.

### Ultra SlimPak® II

WV100 Series: All models.  
 WV400 Series: All models.

### ActionI/Q™

Q400 Series: All models.  
 Q500 Series: All models.

### VisiPak™

V108, V116, V132, V408: UL and CUL listed.  
 V430 Series: All UL and CUL listed except V436.  
 V508-5000 Series only.  
 V509-5000 Series only.

M Series Sockets: All except M020.

## Explosion Proof Ratings for Enclosures

### Action Pak®

C008: NEC, NEMA 4, CSA.  
 C011: NEC, NEMA 4, CSA.

### TransPak®

T690/691EP: NEC, NEMA 4.  
 T79E (except T79E-1): NEMA 4X and 7, CSA, FM  
 T800: NEC, NEMA 4, CSA  
 T805: NEC, NEMA 4, CSA, FM

### VisiPak™

V560EP: NEC, NEMA 4, CSA, FM  
 V561: NEC, NEMA 4, CSA, FM  
 V960: NEC, NEMA 4, CSA, FM

### FieldPak™

Housing and transmitter are approved separately. Refer to the T805 housing and the T700 TransPak series.

## NOTES:

The NEC and CSA approvals for the C008, C011, T690EP, T691EP and T800 enclosures permit installations in Class I, Group D (also Group C with approved 3/4" or smaller reducer); Class I, Groups E and G; Class III hazardous locations per Articles 500 through 517 (1987 edition). The above enclosures are equipped with 3/4" NEC approved reducers for Group C rating and a gasket for NEMA 4 protection against liquids. The use of the supplied gasket does not void the hazardous rating.

The NEC, CSA and FM approvals for the T805 and F700 enclosures permit installations in Class I, Groups B, C, D; and Class II, Groups E, F, G hazardous locations. All enclosures are equipped with a gasket for NEMA 4 protection against washdowns. The use of the supplied gasket does not void the hazardous rating.

The CSA and FM approvals for the T79E explosion proof housings, available with and without windows, permit installations in Class I, Divisions 1 and 2, Groups B, C and D; Class II, Divisions 1 and 2, Groups E, F and G; and Class III, and are rated for NEMA 4X and NEMA 7 environments.

The NEC, CSA and FM approvals for the V560EP and V960 enclosures permit installations in Class I, Groups C and D; and Class II, Groups E, F and G hazardous locations. Both enclosures are NEMA 4 rated.

The NEC, CSA and FM approvals for the V561 enclosure permits installations in Class I, Groups B, C and D; and Class II, Groups E, F and G hazardous locations. The V561 enclosure is NEMA 4 rated.

# Success Services<sup>SM</sup> from Eurotherm

Training

Help Desk

Repair Depot

Field Service

Commissioning

Project Engineering

Application Engineering

Service and Support Agreements

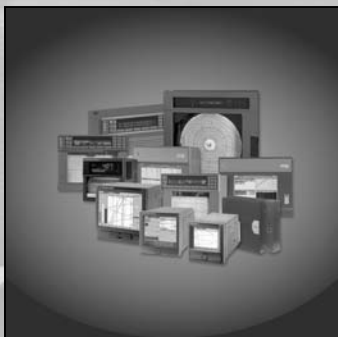
Product Services...  
System Services...  
Annuity Services...

*Let us support, maintain and enhance your process*

[www.eurotherm.com](http://www.eurotherm.com)

# Eurotherm - what we make:

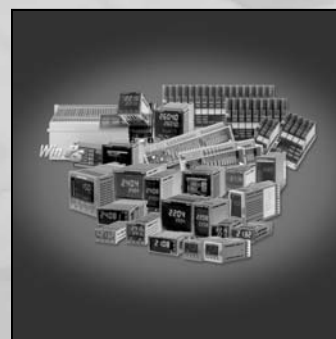
## Recorders and Data Management Equipment



- Graphic Recorders (100, 180, 250mm)
- Circular Chart Recorders
- Strip Chart Recorders (100, 180, 250mm)
- Data Acquisition/Management
- Configuration Software
- Ethernet Connection
- Modbus® and Profibus® EIA Communications
- Validation Support (GAMP)

## Temperature and Process Controllers, Indicators and Alarm Units

- 1/32, 1/16, 1/8 and 1/4 DIN
- Single and Multi-loop with Remote I/O
- Temperature, Flow, Level, Pressure, Atmosphere, Ratio and Cascade
- Setpoint Controllers, Ramp/Dwell Programmers
- Common Operation and Hardware
- PC Configuration and Software
- Modbus®, Profibus®, DeviceNet®, Ethernet
- FM Alarm Units



## Power Controllers and Solid State Relays



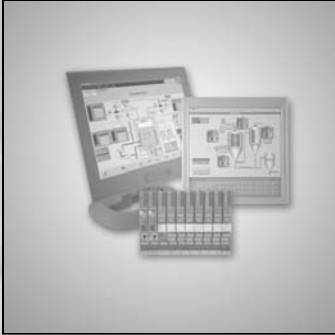
- Single Phase (120-690V/16-1650A)
- Two Phase (120-690V/16-1650A)
- Three Phase (240-690V/16-1800A)
- Modbus®, Profibus®, EI Bisync and Jbus Communications
- Field Configurable
- Custom Units
- Filters and Fuses
- CE Mark

## MACO®/EM-3 Control Systems

- Extrusion Control Systems
- Injection Control Systems
- Blow Molding Control Systems
- Operator Stations and Touchscreen Monitors
- Industrial PCs
- Application Specific Blocks and Rack Systems
- Terminal I/O Blocks
- Pushbutton Stations



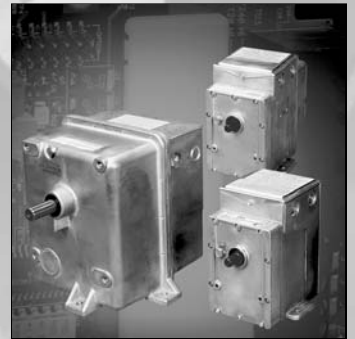
## Process Control Systems



- T Series Controllers/Processors
- PC300/PC3000 Programmable Controllers
- Network Support and I/O Drivers
- Visualization Packages
- Data Reporting and Manipulation
- Configuration Tools
- Control and Application Modules

## Actuators

- EA Series Rotary Actuators with Integrated Electronics ■
- Spring Return and Non-spring Return Actuators ■
- Current to Position Converters ■
- Resistance to Position Converters ■
- Accessories ■



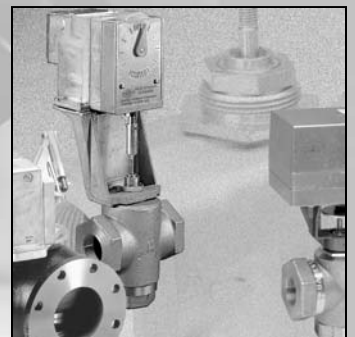
## Signal Conditioners, Thermocouples and RTDs



- Thermocouples and RTDs
- Atmosphere Probes
- Special Builds
- Handheld Calibration Devices
- DIN Rail Conditioning Modules/Transmitters

## Valve Bodies, Components and Assemblies

- Two-way and Three-way Globe Valve Bodies ■
- Linkage Kits ■
- Valve Assembly Tables ■
- Annuity Service ■
- Valve Usage Guidelines ■
- Replacement Parts and Accessories ■



# Eurotherm - where you find us:

## Food and Beverages

- Distillation Columns
- Fermentation Vessels
- Pasteurization
- CIP
- Baking & Conveyor Ovens
- Gas Burners
- Freezer & Cold Stores
- Mixers & Blenders



## Water

- Dosing Control
- Penstock Control
- Weir Level Control
- Effluent, pH and Turbidity Monitoring
- Level, Temperature and Pressure Monitoring



## Hospitals & Healthcare

- Boiler Control
- Sterilizer Control
- Sterilizer Monitoring
- Washer/Disinfector Monitoring
- Periodic Scheduled Testing
- Blood Storage Monitoring



## Heat Treatment

- Vacuum Control
- Casting
- Hardening
- Brazing
- Creep Testing
- Atmosphere Control
- Annealing Furnaces
- Quench Furnaces



## Glass

- Melting & Electrode Heating
- Forehearth Control
- Glass Lehrs
- Batch Monitoring & Reporting
- Float Line Controls
- Glass Level Ratio Controls
- Power/Energy Control



## Plastics

- Extrusion
- Injection Molding
- Blow Molding
- Thermoforming
- Blown Film
- Cast Film





## Power Generation

- Boiler Leak Detection
- Remote Data Recording
- Turbine Monitoring
- Drum Level
- Steam Monitoring
- Wind Speed & Direction
- Waste Water Plants



## Environmental Testing & Monitoring

- Control of Temperature, Humidity, Altitude, Pressure and Light
- Plant and Biological Growth
- Compressor Control
- Altitude Monitoring
- Gene Developments



## Pharmaceuticals

- Pressure/pH/Temperature/Flow Control
- Fermentation
- Reaction Vessels
- Freeze Drying
- Environment Monitoring Systems
- Autoclave Control
- Spray Drier Control
- Clean Steam
- Purified Water
- Equipment Sterilization
- Mixers and Blenders



## Boiler Control

- TDS Control
- Integrated Boiler Control
- Gas Burner Management
- Level & Pressure Control
- Flow Computer
- Continuous Blowdown
- Timed Bottom Blowdown
- Pressure Control
- Steam Main Warm-up
- Pump Sequence Control

## Semiconductor Fabrication

- Diffusion Furnaces
- MBE Machines
- Crystal Growth
- CVD
- Environment Monitoring



## Metals

- Furnaces & Soaking Pits
- Galvanizing & Aluminizing
- Sinter Strands
- Blast Furnaces & Stoves
- Coking Plants
- Continuous Casting Lines
- Coating Lines



# 21 CFR Part 11

Eurotherm has a range of product solutions that are used in pharmaceutical applications. Additional functionality has recently been added in order to meet the requirements of 21 CFR Part 11. This capability for electronic signatures and electronic records is provided in our 5000 Series data acquisition and management products, Visual Supervisor, multifunction controllers and EurothermSuite Operations Server and Viewer plant management systems.

To match 21 CFR Part 11 requirements, the following key features are now available:

## Electronic Records

- Tamperproof data viewable in human readable form
- Audit trails including process values, alarms, events and electronic signatures
- Date and time stamps
- Time synchronization
- Data export conversion to standard packages (e.g., Excel)

## Electronic Signatures

- User actions with signing and authorization
- Unique signatures
- Automatic log-off
- Minimum length password
- Access control according to authority level
- Automatic password expiration

**ENHANCED FOR**  
**21 CFR PART 11**









North America



UK



Germany



France



Japan



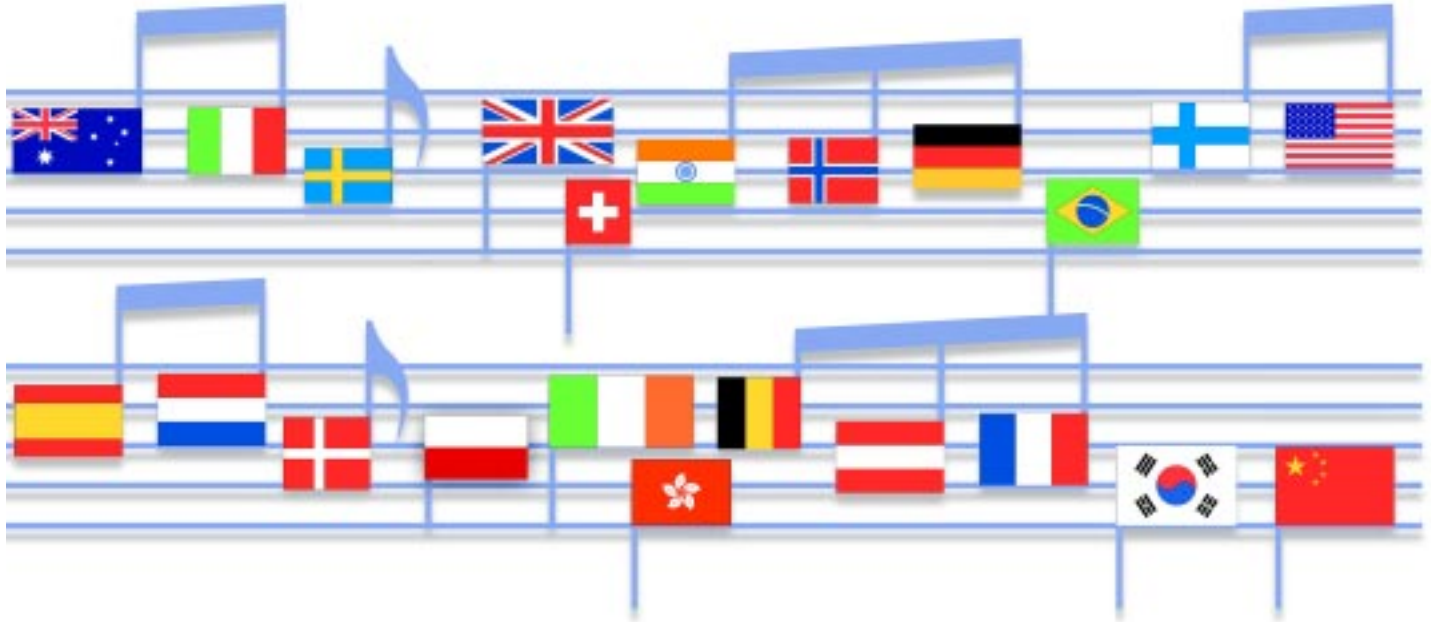
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**HONG KONG & CHINA**  
Eurotherm Limited North Point  
T (+85 2) 28733826  
F (+85 2) 28700148  
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Guangzhou Office  
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Eurotherm India Limited  
T (+91 44) 24961129  
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Eurotherm S.r.l.  
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Invensys Eurotherm Sp z o.o.  
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E [info.pl@eurotherm.com](mailto:info.pl@eurotherm.com)

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Eurotherm España SA  
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F (+34 91) 6619093  
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**SWEDEN** Malmo  
Eurotherm AB  
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F (+46 40) 384545  
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**SWITZERLAND** Wollerau  
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T (+41 44) 7871040  
F (+41 44) 7871044  
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**UNITED KINGDOM** Worthing  
Eurotherm Limited  
T (+44 1903) 268500  
F (+44 1903) 265982  
E [info.uk@eurotherm.com](mailto:info.uk@eurotherm.com)  
[www.eurotherm.co.uk](http://www.eurotherm.co.uk)

**USA** Leesburg VA  
Eurotherm Inc.  
T (+1 703) 443 0000  
F (+1 703) 669 1300  
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