ACTION I/Q® Q488-0001

MODEL

RTD/Thermocouple Input, Field Configurable Isolator

Provides an Isolated DC Output in Proportion to the Temperature Signal Input

DESCRIPTION

The ActionI/Q model Q488 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 field configurable input of 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 (2, 3, 4) of RTD leads and voltage or current output are also set via DIP switches (see Tables 1, 2, 5 & 6).

An optional Microsoft Windows® based (PC) program on CD ROM and serial port adapter cable are available (model C681) for those who would prefer PC configuration capability. The Graphic User Interface (GUI) program takes the place of setting DIP switches and using the push button for ranging. The C681 GUI program can significantly speed configuration and an input signal calibrator is not required for ranging since the values only need to be entered and down loaded.

INSTANT ACCURACY™ TECHNOLOGY

Instant Accuracy™ Technology is incorporated to maximize accuracy and performance during warm up 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, we can determine the terminal junction temperature with extreme accuracy. Even during unstable thermal states such as "start-up" or changing load or power, the Q488 performs extremely accurate thermocouple temperature measurement.

Benefits

- Instant Accuracy™ Technology Ensures Maxmum Accuracy in Thermally Unstable Environments
- Easy Field Configurable Input Ranges for RTDs, Thermocouples, Ohms & mV
- PC or DIP Switch Configuration
- Eliminates Ground Loops with 1800V Input-to Output Isolation
- Advanced TouchCAL™ Technology for Simplified Ranging
- Field Configurable Output; Any Range within 0/20mA or 0/10V
- SnapLoc™, Plug-in Terminals for Low MTTR
- Lifetime Warranty

ACTION INSTRUMENTS

Protecting the Integrity of Industrial Process Signals

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The direct benefits of Instant Accuracy include improved system performance and productivity due to reduced warm- up time, fewer temperature measurement errors and tighter process control for higher quality. Finally and possibly most significantly, calibration can be checked quickly and accurately without the negative effects of rapid ambient temperature changes due to opening a control panel door. This 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 Q488 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 ActionI/Q 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 via the SnapLoc™ terminal block or 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 over- and under-range and input open circuit (yellow-flash) and switch setting error (red-on). If the input is out of range or open circuit the LEDs provide a clear indication of the error.

TOUCHCAL

The Q488 utilizes Action Instruments' TouchCAL technology which greatly simplifies set up. Once the unit is configured via DIP switches for input and output type, the push-button is used to precisely set up the minimum and maximum levels.

To set the input level, within the DIP switch configured range, the user simply applies the high input signal (t/c, millivolts or ohms) and pushes the CAL button. The low input signal is then applied and pushing the CAL button again stores the low input signal level.

The high and low input levels are stored in non-volatile memory and correspond to the high and low output levels. These output levels are precisely adjusted using the input signal reference.

CONFIGURATION

A major advantage of the Q488 is its wide ranging capabilities and ease of configuration. The Q488 can be configured via DIP switches for a wide variety of temperature input ranges for RTD, thermocouple, ohm and millivolt sensors.

Note: For PC configuration refer to the software manual and help files associated with the model C681 accessort kit.

Table 1: Select RTD Type

RESISTANCE (RTD) TYPE	SW2 1	SW2 2
3-WIRE	I	I
4-WIRE	I	
2-WIRE		I

Table 2: Select Output

TYPE	SW2 3
CURRENT	I
VOLTAGE	

Table 3: Select Input Full Scale (default) Range or Sub-range*

INPUT RANGE	SW2 4
DEFAULT	I
USER	

Table 4: Select Output Full Scale (default) Range or Sub-range*

OUTPUT RANGE	SW2 5
DEFAULT	I
USER	

KEY I = ON = CLOSED

Table 5: Select Burnout Detection

BURNOUT	SW2 6
UP SCALE	I
DOWN	

Table 6: Select Linearized Output

OUTPUT LINEAR TO TEMP.	SW2 7
ON	I
OFF	

Table 7: Select Configuration Mode

CONFIGURATION MODE	SW2 8
DIP SWITCH	I
PC/REMOTE	

Table 8: Select Input Type

INPUT TYPE	SW3 1	SW3 2
T/C	I	I
RTD	I	
mV, Ω		I

Table 9: Input Selection and Ranges

T/C TYPE	SW3 3	SW3 4	SW3 5	SW3 6	Input Range	Accuracy Range	Input (A/D) Accuracy
R	I	I	I	I	0 to +1760°C	+200 to +1760°C	±1.0°C
J	I		I	I	-210 to +760°C	-100 to +760°C	±0.25°C
S	I	I	I		0 to +1760°C	+400 to +1760°C	±1.0°C
B	I	I		I	0 to +1800°C	+400 to +1800°C	±2.0°C
T	I	I			-270 to +400°C	0 to +400°C	±0.25°C
K	I		I		-270 to +1370°C	-100 to +1370°C	±0.3°C
N	I			I	-270 to +1300°C	0 to +1300°C	±0.4°C
C	I				0 to +2320°C	0 to +2320°C	±0.5°C
E		I	I	I	-270 to +1000°C	-100 to +1000°C	±0.25°C

RTD TYPE	SW3 3	SW3 4	SW3 5	SW3 6	Input Range	Input (A/D) Accuracy
Cu-9.035	I	I	I	I	-40 to +260°C	±0.25°C
Ni-120 067	I		I	I	-80 to +320°C	±0.15°C
Pt-100 385	I	I	I		-200 to +850°C	±0.15°C
Pt-100 3911	I	I		I	-200 to +630°C	±0.15°C
Pt-100 392	I	I			-200 to +630°C	±0.15°C
Pt-200 385	I		I		-200 to +850°C	±0.20°C
Pt-200 392	I			I	-200 to +630°C	±0.20°C
Pt-500 385	I				-200 to +850°C	±0.20°C
Pt-500 3911		I	I	I	-200 to +630°C	±0.20°C
Pt-500 392		I	I		-200 to +630°C	±0.20°C
Pt-1000 385		I		I	-200 to +850°C	±0.20°C

mV, Ω TYPES	SW3 3	SW3 4	SW3 5	SW3 6	Input Range	Accuracy Range	Input (A/D) Accuracy	Minimum Span
± 90mV	I	I	I	I	-90 to +90mV	-90 to +90mV	±12µV	3mV
± 900mV	I	I	I		-100 to +900mV	-100 to +900mV	±25µV	3mV
0 to 4000 Ω	I	I		I	10 to 4000Ω	10 to 4000Ω	±1.0Ω	10Ω

Input to output error (@25C)≤ Input Acurracy plus, Linearization Accuracy, plus output accuracy, plus cjc error (for t/c inputs).

**Sub-range allows the "user" to define the input or output span. Default is either 2-10V or 4-20mA for outputs or the "Input Range" specified in Table 9.*
Note: If the input or output is set for default, then the input or output calibration will be skipped in the push button programming sequence.

SPECIFICATIONS

Inputs	Sensor Types: see Table 9
	Ranges: Any span within Range in Table 9
	Impedance: ≥ 1.0MΩ typical for t/c and mV inputs
	RTD Excitation: ≤ 0.3mA
	Burnout Detection: up or down scale
	CJC Error: ≤ ±0.1°C max. Instant Accuracy™ ensures the output is within ±0.5°C of rated accuracy 30 seconds after powering
Output	Voltage Output
	Ranges: 0-5V or 0-10V (default)
	Drive: 10mA (1000Ω load min.)
	Current Output
	Ranges: 0-20mA or 4-20mA (default)
	Drive: 15V (750Ω max.)
Isolation	1800VDC or peak AC between input output and power
Adjustments	
Configuration	SW1: Push Button, 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: ≤ ±0.05% of accuracy range, max.
	Output: ≤ ±10µA for current output ≤ ±5mV for voltage output
Thermal Stability	CJC: ± 0.01°C / °C change in ambient, max.
	Zero: ± 0.0075% of full scale /°C change in ambient, max.
	Span: ± 0.0075% of full scale /°C change in ambient, max.
	Long Term: ± 0.1% maximum over a 9 month period
Response Time	400mSec, typical.
Turn On Time	≤ 5 seconds to establish output within 99% or 0.5°C of final value
LED Indicator	Power: green on, t/c burnout flash
	Input: yellow flash, out of range
	Switch setting error: red flash
	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-condensiing)	Operating: 15 to 95% (@ 45°C)
	Soak: 90% RH for 24 Hours (@ 60°C)
Temperature	Operating: -25°C to +65°C (-13 to 149°F)
	Storage: -25°C to +70°C (-13 to 158°F)
Power	2.5W max., 9 to 30VDC ± 10%
Shipping Weight	0.5 lbs.
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.

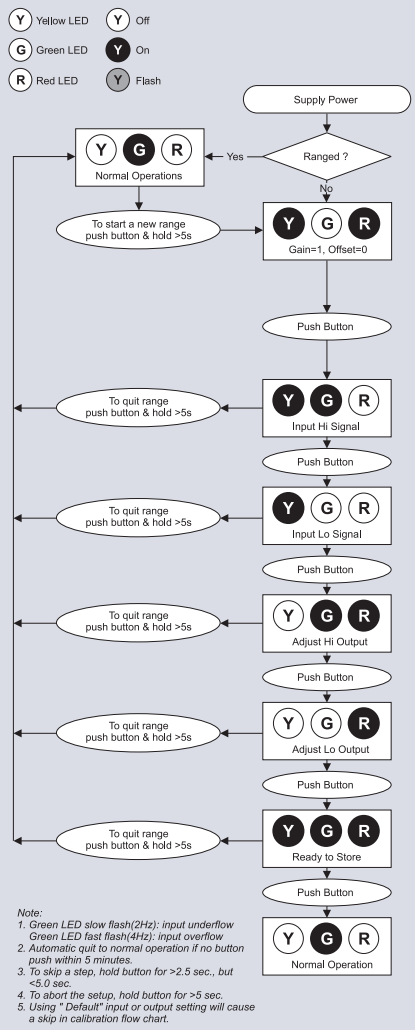


Figure 1: Q488 Ranging Flow Chart.

Each type of input and its respective temperature span can be offset by >90% or adjusted down to <10% of the full scale span.

Unless a specific customer range is specified, the factory presets the Model Q488 as follows:

Input Type:	Thermocouple, J-Type
Input Range:	0 to 500°C
Burn Out:	Up Scale
Output Range:	4/20mA

Regarding other I/O ranges, refer to DIP switch settings (SW2 & SW3) in Table 1 through 9. For quick and easy push button ranging, see the step by step flow chart in Figure 1.

1. With power off, snap off the face plate by lifting the right edge, away from the heat sink. Slide off the heat sink. The two switch banks (SW2 & SW3) should now be accessible.

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 switch positions are not used and can be in any state.

3. Next, the output should be configured 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. Pt100Ω = -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. Pt100Ω, 0 to 500°C), then set position 4 of SW2 to OFF (or open) to enable use of the ranging push button 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 push button 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 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 the thermoelectric voltage 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 Configuration Mode with position 8 of SW2 to ON for DIP switch configuration (see Table 7). The OFF position is for use when configuring via PC with serial interface cable model C681.

9. Set Input Type with position 1 and 2 of SW3 for the specific input type (see Table 8).

10. Set position 3 through 6 of SW3 for the specific RTD, thermocouple, millivolt or resistance input (see Table 9).

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 prefered, then an output load equal to the input impedance of the intended system device(s) connected to the output is recommended, along with a 30 minute warm up period.

1. If the input and the output range needs to be set, then after configuring the unit for the desired I/O, install the module onto a piece of DIN rail or the I/Q Rail mounting combination (see I/Q Rail data sheet for details).

2. According to the selected input type connect the input to a calibrated thermocouple simulator, voltage standard or resistance source and the output to a voltage or current meter. Apply

Note: An I/QRail is required to deliver power to the modules. A two position rail is included. See ordering information.

power and allow the system to reach thermal equilibrium (approx. 30 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, again. Or, wait for more than five minutes and the unit will timeout and automatically reset to the previously stored calibration.

4. To proceed, push the CAL button momentarily, the yellow and green LEDs should now be on.

5. Apply the maximum input signal level, if not already applied, then push the CAL button to store. The yellow LED should now be on.

6. Apply the minimum input signal level, then push the CAL button to store. The green and red LEDs should now be on.

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

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

9. To finish calibration, push the CAL button one final time. The green LED should be on if the input is within the calibrated range.

FACTORY ASSISTANCE

For additional information on calibration, operation and installation please contact Action's Technical Service Group. Call toll-free:

800-767-5726

MODELS & ACCESSORIES

Accessories

All ActionI/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-D002	2 Position I/QRail & DIN rail
IQRL-D004	4 Position I/QRail & DIN rail
IQRL-D008	8 Position I/QRail & DIN rail
C620-*	Factory Calibration

ORDERING INFORMATION

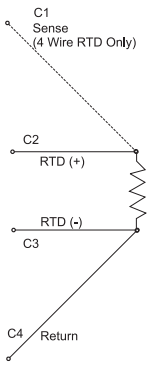
Accessories

Specify:

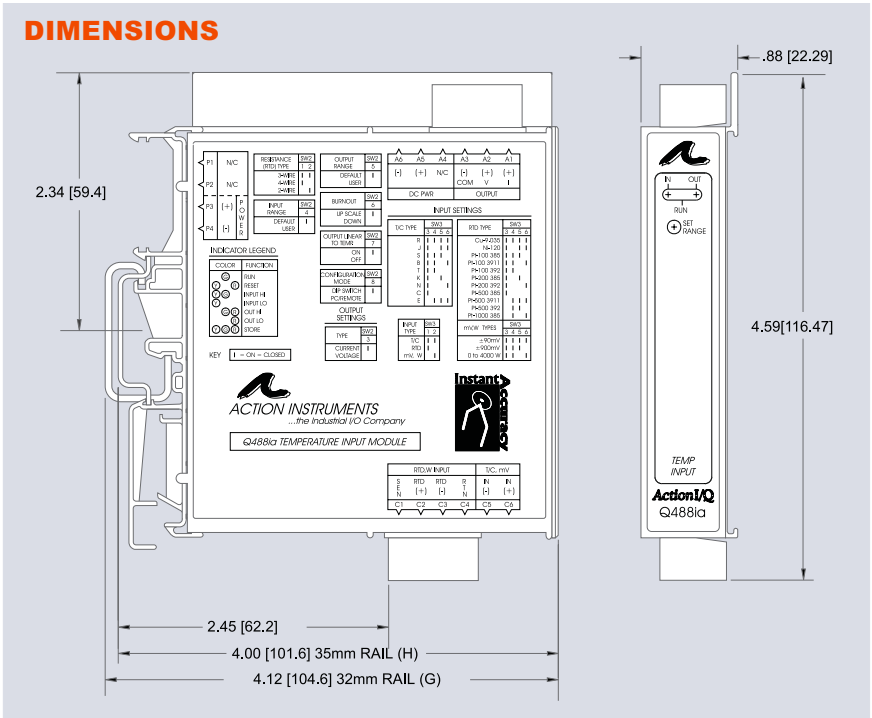
1. Model: **Q488-0001**
2. Accessories: (see Accessories)
3. Optional Custom Factory Calibration; specify **C620** with desired input and output ranges.

Terminal Connections

Pin: A1 Current Output (+)
Pin: A2 Voltage Output (+)
Pin: A3 Output Common (-)
Pin: A4 Not used
Pin: A5 DC Power (+)
Pin: A6 DC Power (-)



DIMENSIONS



Pin: C1 RTD Sense
Pin: C2 RTD Input (+), or resistance
Pin: C3 RTD Input (-), or resistance
Pin: C4 RTD Return
Pin: C5 t/c Input (-), or mV(-)
Pin: C6 t/c Input (+), or mV(+)
Pin: P1 Not Used
Pin: P2 Not Used
Pin: P3 DC Power (+)
Pin: P4 DC Power (-)

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