

MODEL IRMA - INTELLIGENT RTD MODULE WITH ANALOG OUTPUT



- **USER PROGRAMMABLE INPUT** (RTD $\alpha=0.00385$ (DIN 43760), $\alpha=0.00392$, or resistance)
- **12 to 42 VDC LOOP POWERED (4 to 20 mA Output)**
- **MICROPROCESSOR CONTROLLED**
- **SIMPLE ADJUSTABLE RANGE SETTING (Using Input Signal)**
- **RTD BREAK DETECTION**
- **MOUNTS ON "T" AND "G" STYLE DIN RAILS**
- **2-WAY ELECTRICAL ISOLATION (INPUT/OUTPUT & POWER)**
- **HIGH-DENSITY PACKAGING (22.5 mm wide)**
- **WIDE OPERATING TEMPERATURE RANGE**



DESCRIPTION

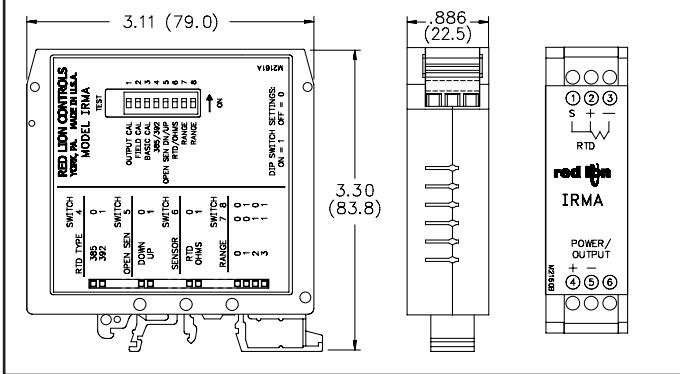
The IRMA accepts a 2, 3, or 4 wire RTD or resistance input and converts it into a 4 to 20 mA current output. The 4 to 20 mA output is linearly proportional to the temperature or the resistance input. This output is ideal for interfacing to indicators, chart recorders, controllers, or other instrumentation equipment.

The IRMA is loop-powered which means that the same two wires are carrying both the power and the output signal. The unit controls the output current draw from 4 to 20 mA in direct proportion to the input while consuming less than 4 mA for operation. The conversion to a current output signal makes the IRMA less susceptible to noise interference and allows accurate transmission over long distances. Two-Way isolation allows the use of grounded RTD's which can provide additional noise reduction benefits.

The IRMA uses an eight position DIP switch to accomplish the input sensor configuration, range selection, and unit calibration. A simple range setting technique (Field Calibration) is used so the actual input signal adjusts the output current for scaling. This technique eliminates the need for potentiometers which are vulnerable to changes due to vibration.

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including top hat rail (T) according to EN 50 022 - 35 X 7.5 and 35 X 15, and G profile according to EN 50 035 - G 32.

DIMENSIONS In inches (mm)



CAUTION: Risk of Danger.
Read complete instructions prior to installation and operation of the unit.



ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
IRMA	Intelligent RTD Module	IRMA2003

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

SPECIFICATIONS

- POWER:** 12 to 42 VDC *(Loop powered). The power supply must have a 30 mA min. capacity.
[* Min. voltage must be increased to include the drop across any current display indicator]
- INPUT:** RTD 2, 3, or 4 wire, 100 ohm platinum, $\alpha=0.00385$ (DIN 43760), $\alpha=0.00392$, or resistance [selectable via DIP switch]

Excitation: 0.170 mA nominal

Lead resistance: Less than 0.5°C with 15 ohms max. per lead

Note: There is no lead compensation for 2 wire input. Field calibration should be accomplished with equivalent series resistance.

- OUTPUT:** 4 to 20 mA Linear output with Temperature or resistance input.

Ripple: Less than 15 mV peak-to-peak max., across 250Ω load resistor (up to 120 Hz frequencies).

- RANGE & ACCURACY:** (12 Bit resolution)

Accuracy: $\pm (0.075\% \text{ Range} + 0.1^\circ\text{C})$ [Conformity] at 23°C after 20 min. warm-up, conforming to ITS-90.

Note: RTD conformity does not apply to resistance input.

Relative Humidity: Less than 85% RH (non-condensing)

Span: The input span can be set to a min. of 1/8 of the full scale range, anywhere within that range.

Range Accuracy:

INPUT	RANGE	DIP SWITCH TYPE RANGE 4 6 7 8	TEMPERATURE & OHMS RANGE	RANGE ACCURACY
RTD $\alpha = 0.00385$	0	0 0 0 0	-160 to 654°C	$\pm 0.61^\circ\text{C}$
	1	0 0 0 1	-108 to 207°C	$\pm 0.24^\circ\text{C}$
	2	0 0 1 0	-5 to 414°C	$\pm 0.31^\circ\text{C}$
	3	0 0 1 1	194 to 608°C	$\pm 0.31^\circ\text{C}$
RTD $\alpha = 0.00392$	0	1 0 0 0	-157 to 640°C	$\pm 0.60^\circ\text{C}$
	1	1 0 0 1	-106 to 203°C	$\pm 0.23^\circ\text{C}$
	2	1 0 1 0	-5 to 406°C	$\pm 0.31^\circ\text{C}$
	3	1 0 1 1	190 to 596°C	$\pm 0.30^\circ\text{C}$
OHMS	0	0 1 0 0	35.5 to 331.0 Ω	$\pm 0.222 \Omega$
	1	0 1 0 1	57.0 to 178.5 Ω	$\pm 0.091 \Omega$
	2	0 1 1 0	98.0 to 252.0 Ω	$\pm 0.116 \Omega$
	3	0 1 1 1	173.5 to 316.5 Ω	$\pm 0.107 \Omega$

Note: DIP switch settings

ON = 1 OFF = 0

SPECIFICATIONS (Cont'd)

5. **SENSOR BREAK DETECTION:** Upscale to 22.5 mA (nominal) or Downscale to 3.6 mA (nominal) [selectable via DIP switch]
6. **RESPONSE TIME:** 400 msec (to within 99% of final value w/step input; typically, response is limited to response time of probe.)
7. **DIELECTRIC WITHSTAND VOLTAGE:** 1500 VAC for 1 minute
- Working Voltage:** 50 VAC from input to output.
8. **CERTIFICATIONS AND COMPLIANCES:**

SAFETY

IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.

ELECTROMAGNETIC COMPATIBILITY

Immunity to EN 50082-2

Electrostatic discharge	EN 61000-4-2	Level 2; 4 Kv contact Level 3; 8 Kv air
Electromagnetic RF fields	EN 61000-4-3	Level 3; 10 V/m ² 80 MHz - 1 GHz
Fast transients (burst)	EN 61000-4-4	Level 4; 2 Kv I/O Level 3; 2 Kv power
RF conducted interference	EN 61000-4-6	Level 3; 10 V/rms 150 KHz - 80 MHz
Power frequency magnetic fields	EN 61000-4-8	Level 4; 30 A/m

Emissions to EN 50081-2

RF interference	EN 55011	Enclosure class A
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Notes:

1. This device was designed for installation in an enclosure. To avoid electrostatic discharge, precautions should be taken when the device is mounted outside an enclosure. When working in an enclosure, (ex. making adjustments, setting switches etc.) typical anti-static precautions should be observed before touching the device.

2. *Self-recoverable loss of performance during EMI disturbance at 10 V/m: Analog output signal may deviate during EMI disturbance.*

For operation without loss of performance:

Unit is mounted in a metal enclosure (Buckeye SM7013-0 or equivalent). I/O and power cables are routed in metal conduit connected to earth ground.

9. ENVIRONMENTAL CONDITIONS:

Operating Temperature Range: -25°C to 75°C (-13°F to 167°F)

Storage Temperature Range: -40°C to 85°C (-40°F to 185°F)

Temperature Coefficient: $\pm 0.01\%$ of input range per °C

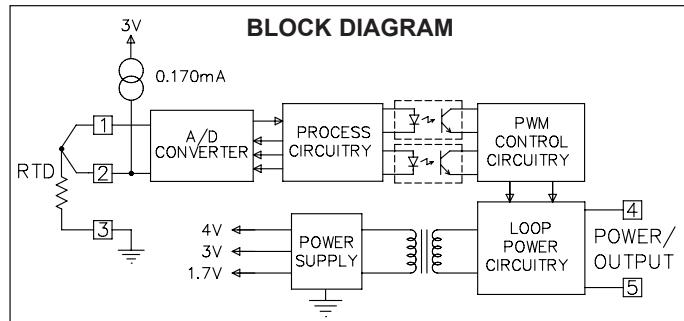
Altitude: Up to 2000 meters.

10. MOUNTING: Universal mounting foot for attachment to standard DIN style mounting rails, including top hat (T) profile rail according to EN50022 - 35 x 7.5 and 35 x 15, and G profile rail according to EN50035 - G32.

11. CONNECTION: Compression type terminal block

12. CONSTRUCTION: High impact green plastic case

13. WEIGHT: 2.7 oz (76.54 g)



2. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.

3. Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.

4. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:

Ferrite Suppression Cores for signal and control cables:

Fair-Rite # 0443167251 (RLC #FCOR0000)

TDK # ZCAT3035-1330A

Steward #28B2029-0A0

Line Filters for input power cables:

Schaffner # FN610-1/07 (RLC #LFIL0000)

Schaffner # FN670-1.8/07

Corcom #1VR3

Note: Reference manufacturer's instructions when installing a line filter.

5. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.

FUNCTION DESCRIPTIONS

Open Sensor Detection

The output can be set to go Upscale or Downscale for the detection of an open sensor. The Upscale setting makes the output go to 22.5 mA (nominal). The Downscale setting makes the output go to 3.5 mA (nominal). This setting is always active, so changes in the setting are effective immediately.

Calibration Malfunction

If the unit has scaling problems (current remains at 3.5 mA nominal), check the voltage between the RTD- Input (-) and TEST pad (+) [located next to the DIP switches on the side of the unit]. For normal operation the voltage is 0 V (nominal). If the voltage is +3 V(nominal), a problem occurred storing information in the E2PROM. When this happens, perform a Basic Calibration and then a Field Calibration. Turn off power for 5 seconds. Turn on power and check the voltage between the TEST pad (+) and RTD- Input (-). If the voltage is still +3 V(nominal), contact the factory.

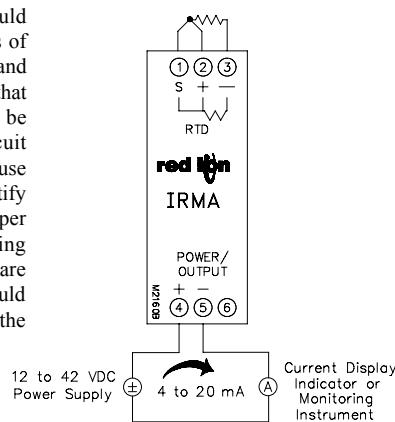
EMC INSTALLATION GUIDELINES

Although this unit is designed with a high degree of immunity to ElectroMagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of electrical noise, source or coupling method into the unit may be different for various installations. In extremely high EMI environments, additional measures may be needed. For the purpose of EMC testing, both input and output lines on the unit were connected with 25 feet (8 m) of cable. Cable length, routing and shield termination are very important and can mean the difference between a successful or a troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

1. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
 - a. Connect the shield only at the rail where the unit is mounted to earth ground (protective earth).
 - b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
 - c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.

WIRING CONNECTIONS

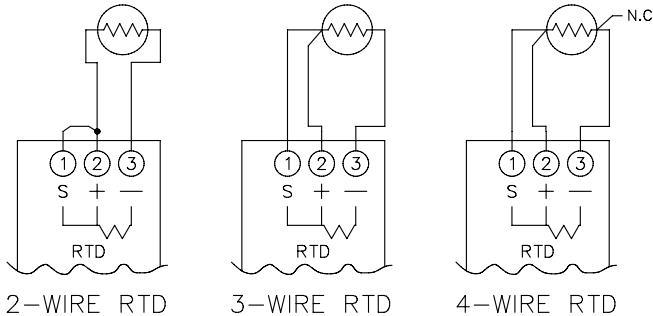
All conductors should meet voltage and current ratings for each terminal. Also, cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit be protected by a fuse or circuit breaker. When wiring the unit, use the numbers on the label to identify the position number with the proper function. Strip the wire, leaving approximately 1/4" (6 mm) of bare wire exposed (stranded wire should be tinned with solder). Insert the wire into the terminal, and tighten the screw until the wire is clamped tightly.



INPUT AND POWER/OUTPUT CONNECTIONS

INPUT

When connecting the RTD or resistance device, be certain that the connections are clean and tight. Attach the device to terminals #2 and #3. Install a copper sense lead of the same gauge as those used to connect the device. Attach one end of the wire at the probe where the lead connected to terminal #2 is attached and the other end to terminal #1. This configuration will provide complete lead wire compensation. If a sense wire is not utilized, then Terminal #1 should be shorted to terminal #2. To avoid errors due to lead wire resistance, field calibration should be performed with a series resistance equal to the total lead resistance in the system. Always refer to the probe manufacturer's recommendations for mounting, temperature range, shielding, etc.



POWER/OUTPUT

The unit has the power and current output sharing the same two wires (loop-powered). Connect DC power to terminals #4 and #5, observing the correct polarity, with a current meter/indicator connected in between so that the output current can be monitored. Be certain that the DC power is relatively "clean" and within the 12 to 42 VDC range at the terminals. The current meter voltage drop must be included in the power supply considerations.

DIP SWITCH SETTING DESCRIPTIONS

SWITCH	DESCRIPTION	
1	OUTPUT CAL	Output Calibration
2	FIELD CAL	Field Calibration
3	BASIC CAL	Basic Calibration
4	385/392	Select RTD alpha - 0.00392 (ON) / 0.00385 (OFF)
5	OPEN SEN DN/UP	Open Sensor Detection - Upscale (ON) / Downscale (OFF)
6	RTD/OHMS	Select Input Type - Ohms (ON) / RTD (OFF)
7	RANGE	Sensor Range - 2 switch combination setting
8		

Range switch settings (ON = 1 OFF = 0)

RANGE	DIP SWITCH	
	7	8
0	0	0
1	0	1
2	1	0
3	1	1

FACTORY SETTINGS

The unit is shipped from the factory calibrated for a 4 to 20 mA output using a type 385 RTD in range 0. The IRMA should be calibrated by the operator for the application environment it will be used in. If the unit is not recalibrated by the operator, the following table lists the temperature ranges for each RTD type.

TYPE	RANGE	TEMPERATURE RANGE
385	0	150°C to 606°C
392	0	150°C to 595°C

CALIBRATION PROCEDURES

1.0 Field Calibration

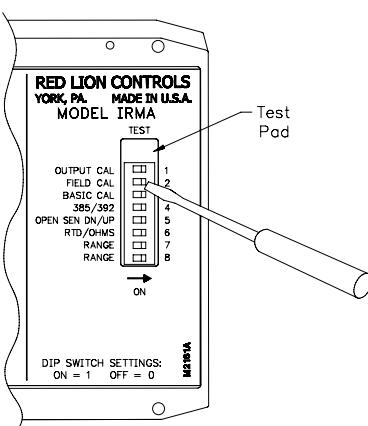
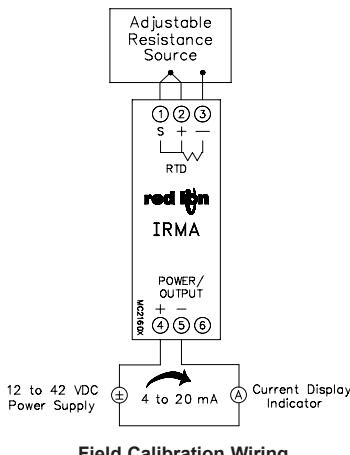
Allow a 30 minute warm-up period before starting Field Calibration. Field Calibration scales the 4 to 20 mA output to a temperature or resistance input. This procedure assigns an input value to 4 mA and an input value to 20 mA. The microprocessor handles configuring the output so it is linear to the temperature or resistance input. The Field Calibration procedure is described below.

Note: The unit needs to have the Field Calibration completed by the operator before normal operation. To abort this calibration and reset to the previous settings, set the FIELD CAL switch OFF prior to the final OFF setting of the OUTPUT CAL switch (Step 1.11) and turn off power. Wait 5 seconds and then turn on power and the previous settings will be loaded.

RTD temperature to resistance conversion table

Temperature °C	alpha 0.00385 ohms	alpha 0.00392 ohms
-160	35.53	34.38
-150	39.71	38.64
-100	60.25	59.55
-50	80.30	79.96
0	100.00	100.00
50	119.40	119.75
100	138.5	139.20
150	157.33	158.36
190	172.17	173.48
200	175.85	177.23
250	194.09	195.80

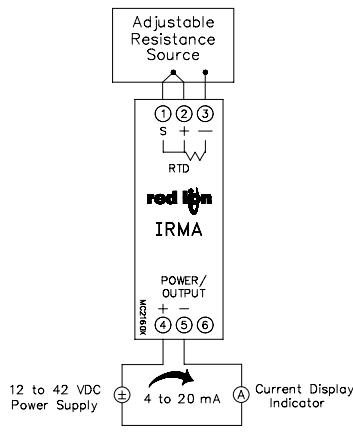
Temperature °C	alpha 0.00385 ohms	alpha 0.00392 ohms
300	212.03	214.08
350	229.69	232.07
400	247.05	249.77
410	250.49	253.28
450	264.13	267.18
500	280.92	284.30
550	297.42	301.13
590	310.41	314.38
600	313.63	317.66
640	326.38	330.68
650	329.54	333.90



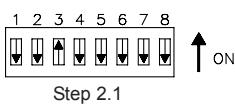
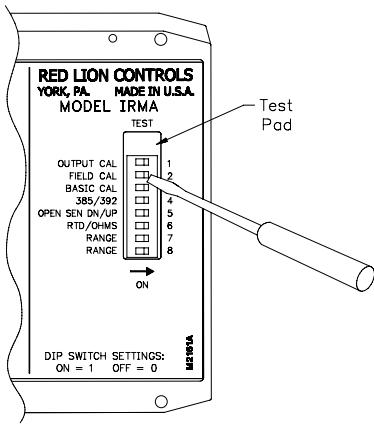
Field Calibration with an Accurate Adjustable Resistance Source

- 1.1 Connect an Adjustable Resistance Source with an accuracy of 0.03% to the RTD input terminals using a third sense wire. For 2 wire sensors short terminal #1 to terminal #2.
- 1.2 Set the Type and Range for the RTD or resistance used in your application (DIP switches #4, #6, #7 and #8). (RTD alpha=0.00385, Range 0 shown)
- 1.3 Set the FIELD CAL switch (#2) ON. [Current goes to 3.6 mA (nominal)]
- 1.4 Set the resistance source to the desired resistance for the 4 mA output. For 2 wire sensors add the system lead resistance to the desired value.
- 1.5 Set the OUTPUT CAL switch (#1) ON. [Current stays at 3.6 mA (nominal)]
- 1.6 Adjust the input resistance up until the output equals 4 mA.
- 1.7 Set the OUTPUT CAL switch (#1) OFF. [Current increases to 22.3 mA (nominal)]
- 1.8 Set the resistance source to the desired resistance for the 20 mA output. For 2 wire sensors add the system lead resistance to the desired value.
- 1.9 Set the OUTPUT CAL switch (#1) ON. [Current decreases to 20.5 mA (nominal)]
- 1.10 Adjust the input resistance down until the output equals 20 mA.
- 1.11 Set the OUTPUT CAL switch (#1) OFF.
- 1.12 Set the FIELD CAL switch (#2) OFF.
- 1.13 Disconnect the resistance source from the IRMA and connect the actual sensor to be used in the application.

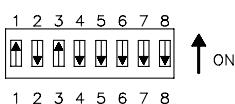
2.0 Basic Calibration (Factory Calibration)



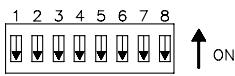
Basic Calibration Wiring



Step 2.1



Steps 2.3 to 2.15



Step 2.16

The Basic Calibration should only be performed with an ambient temperature between 21°C and 29°C. The Basic Calibration was performed on the unit at the factory and generally does not need to be done again. This procedure initializes the unit by calibrating the input circuitry. The Basic Calibration should be performed only if a condition exists as described in the "Calibration Malfunction" section. After completion of this calibration, the unit needs to be scaled in Field Calibration. The Basic Calibration procedure is described below.

Note: To abort this calibration and reset to the previous settings, set the BASIC CAL switch OFF prior to the final setting of the OUTPUT CAL switch (Step 2.15) and turn off power for 5 seconds. Then turn on power and the previous settings will be loaded.

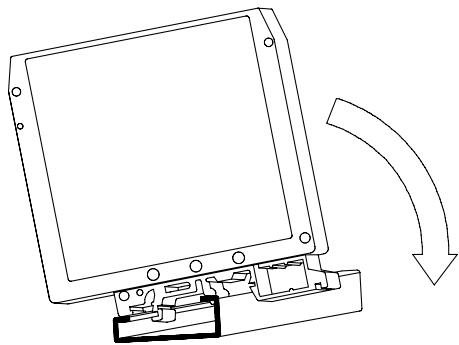
- 2.1 Connect an Adjustable Resistance Source with an accuracy of 0.03% to the RTD input terminals using a third sense wire. Set the RANGE (#7), TYPE (#4), OUTPUT CAL (#1), and FIELD CAL (#2) switches OFF. Set the BASIC CAL switch (#3) ON.
- 2.2 Apply power and allow a 30 minute warm-up period. [Current goes to 3.5 mA (nominal)]
- 2.3 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.4 Set the resistance source to 40 ohms and wait 5 seconds.
- 2.5 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.6 Set the resistance source to 60 ohms and wait 5 seconds.
- 2.7 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.8 Set the resistance source to 100 ohms wait 5 seconds.
- 2.9 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.10 Set the resistance source to 175 ohms and wait 5 seconds.
- 2.11 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.12 Set the resistance source to 250 ohms and wait 5 seconds.
- 2.13 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.14 Set the resistance source to 315 ohms and wait 5 seconds.
- 2.15 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.16 Set the BASIC CAL switch (#3) OFF. [Current increases to 3.6 mA (nominal) or more]
- 2.17 Perform a Field Calibration. (See Section 1.0)

INSTALLATION

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including G profile rail according to EN50035 - G32, and top hat (T) profile rail according to EN50022 - 35 x 7.5 and 35 x 15. The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

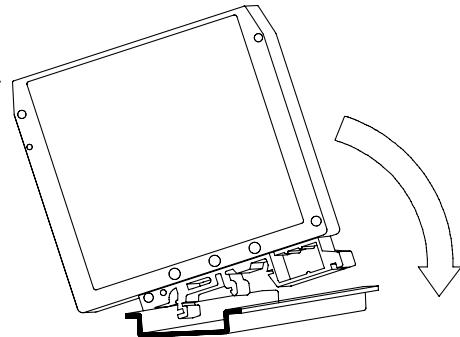
G Rail Installation

To install the IRMA on a "G" style DIN rail, angle the module so that the upper groove of the "foot" catches under the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, push up on the bottom of the module while pulling out away from the rail.



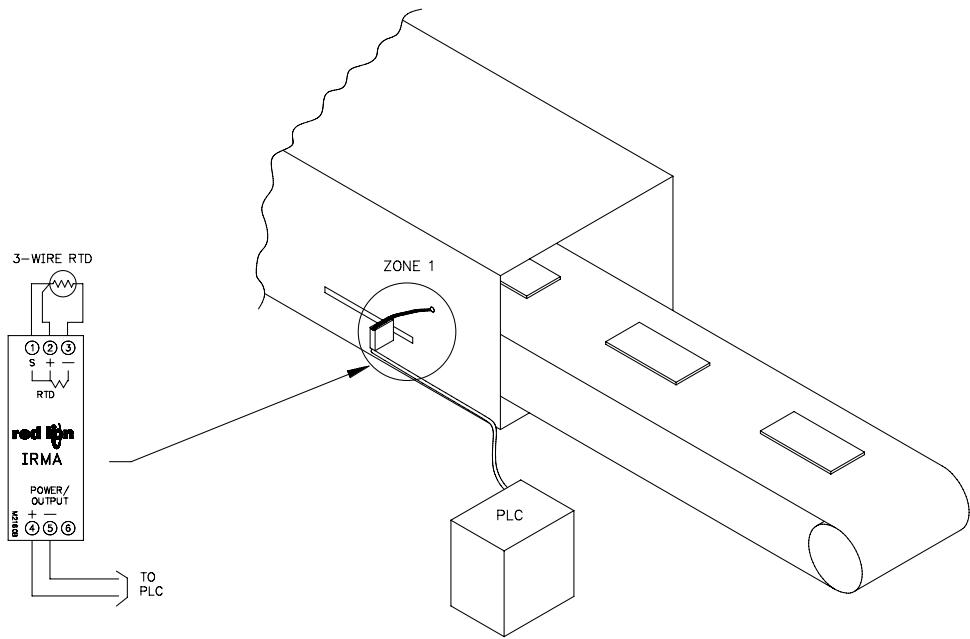
T Rail Installation

To install the IRMA on a "T" style rail, angle the module so that the top groove of the "foot" is located over the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, insert a screwdriver into the slot on the bottom of the "foot", and pry upwards on the module until it releases from the rail.



APPLICATION

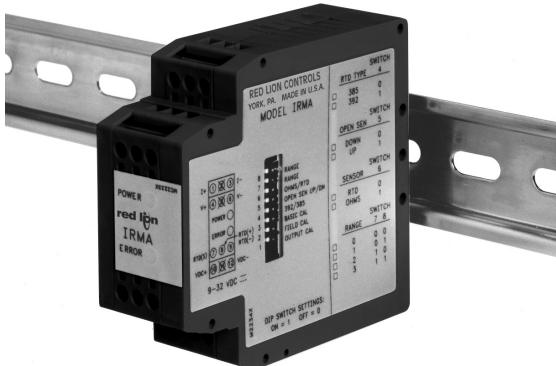
An aluminum manufacturer had the requirement to heat soak aluminum ingots before they were to advance into their hot roll mill. The system is being controlled by a PLC that allows the material to move to the next of twelve zones as soon as the aluminum ingot reaches the soak temperature. An IRMA, RTD Loop powered signal conditioner was used to transmit each zone temperature, measured by an RTD sensor, to the PLC. Because the heat soak procedure was accomplished in an eighty foot furnace tunnel, a relatively long wire run was required to connect each RTD with the PLC. The IRMA transmitter converts and linearizes the RTD signal into a 4 to 20 mA signal that can be run long distances to connect to the PLC.



TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.

MODEL IRMA DC - INTELLIGENT RTD MODULE WITH ANALOG OUTPUT



- **USER PROGRAMMABLE INPUT** (RTD alpha = 0.00385 (DIN 43760), alpha = 0.00392, or resistance)
- **MICROPROCESSOR CONTROLLED**
- **SIMPLE ADJUSTABLE RANGE SETTING (Using Input Signal)**
- **RTD BREAK DETECTION**
- **MOUNTS ON "T" AND "G" STYLE DIN RAILS**
- **3-WAY ELECTRICAL ISOLATION (POWER/INPUT/OUTPUT)**
- **MULTIPLE ANALOG OUTPUTS (0 to 20 mA, 4 to 20 mA, and 0 to 10 VDC)**
- **WIDE OPERATING TEMPERATURE RANGE (-25°C to 75°C)**
- **LED INDICATION (POWER & MEMORY ERROR)**
- **9 to 32 VDC POWERED**



DESCRIPTION

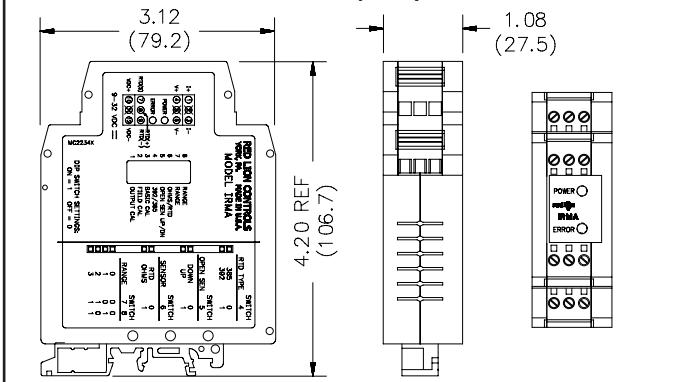
The IRMA accepts an RTD or resistance input and converts it into a voltage or current output. The output is linearly proportional to the temperature or resistance input. This output is ideal for interfacing to indicators, chart recorders, controllers, or other instrumentation equipment.

The IRMA is DC powered. The DC power input is isolated from the signal input and analog output. The unit scales the analog output proportionally to the RTD or resistance input signal. The analog output may be configured for one of the following: 0 to 20 mA, 4 to 20 mA, or 0 to 10 VDC. Making the signal conversion with the IRMA to a current output signal, makes the signal less susceptible to noise interference and allows accurate transmission over long distances. The 3-Way isolation allows the use of grounded RTD's which can provide additional noise reduction benefits.

The IRMA uses an eight position DIP switch to accomplish the input sensor configuration, range selection, and unit calibration. A simple range setting technique (Field Calibration) is used so the actual input signal adjusts the output for scaling. This technique eliminates the need for potentiometers which are vulnerable to changes due to vibration.

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including top hat rail (T) according to EN 50 022 - 35 × 7.5 and 35 × 15, and (G) profile according to EN 50 035 - G 32.

DIMENSIONS In inches (mm)



SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



CAUTION: Read complete instructions prior to installation and operation of the unit.

SPECIFICATIONS

1. **POWER:** 9 to 32 VDC; 1.75 W. 200 mA max. current. The power supply must have 400 mA for 200 msec. surge capacity.

2. **INPUT:** RTD 2, 3, or 4 wire, 100 ohm platinum, alpha = 0.00385 (DIN 43760), alpha = 0.00392, or resistance [selectable via DIP switches].

Excitation: 0.170 mA nominal

Lead resistance: Less than 0.5°C with 15 ohms max. per lead

Note: There is no lead compensation for 2 wire input. Field calibration should be performed with equivalent series resistance.

3. **OUTPUT:** All output signals scaled linearly using temperature or resistance input. Unit is shipped set for the 4 to 20 mA output. 4 to 20 mA or 0 to 20 mA selected via internal jumper.

Voltage Output Compliance:

0 to 10 VDC across min. 1 KΩ load (10 mA)

20 mV peak to peak max. ripple (for frequencies up to 120 Hz)

Current Output Compliance:

0 to 20 mA through max. 600Ω load (12 VDC)

4 to 20 mA through max. 600Ω load (12 VDC)

15 mV peak to peak max. ripple across 600Ω load (for frequencies up to 120 Hz)

4. **RTD BREAK DETECTION:** Nominal values shown in the following order: (0 to 20 mA, 4 to 20 mA, and 0 to 10 VDC).

Upscale: 22.9 mA, 22.5 mA, and 11.5 VDC

Downscale: -0.5 mA, 3.5 mA, and -0.4 VDC

5. **RESPONSE TIME:** 400 msec. (to within 99% of final value w/step input; typically, response is limited to response time of probe.)

6. **TEMPERATURE EFFECTS:**

Temperature Coefficient: ± 0.025% of input range per °C

7. **DIELECTRIC WITHSTAND VOLTAGE:** 1500 VAC for 1 minute

Working Voltage: 50 VAC

Power input to Signal input, Power input to Signal output, & Signal input to Signal output.

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
IRMA	Intelligent RTD Module	IRMA3035

8. RANGE & ACCURACY: (12 Bit resolution)

Accuracy: $\pm (0.075\% \text{ Range} + 0.1^\circ\text{C} [\text{Conformity}])$ at 23°C after 45 min. warm-up, conforming to ITS-90.

Note: RTD Conformity does not apply to resistance input. For best accuracy, calibration should be performed under operating conditions.

Relative Humidity: Less than 85% RH (non-condensing)

Span: The input span can be set to a min. of 1/8 of the full scale range, anywhere within that range.

Range Accuracy

INPUT	RANGE	DIP SWITCH TYPE RANGE 4 6 7 8	TEMPERATURE & OHMS RANGE	RANGE ACCURACY
RTD alpha = 0.00385	0	0 0 0 0	-160 to 654°C	$\pm 0.61^\circ\text{C}$
	1	0 0 0 1	-108 to 207°C	$\pm 0.24^\circ\text{C}$
	2	0 0 1 0	-5 to 414°C	$\pm 0.31^\circ\text{C}$
	3	0 0 1 1	194 to 608°C	$\pm 0.31^\circ\text{C}$
RTD alpha = 0.00392	0	1 0 0 0	-157 to 640°C	$\pm 0.60^\circ\text{C}$
	1	1 0 0 1	-106 to 203°C	$\pm 0.23^\circ\text{C}$
	2	1 0 1 0	-5 to 406°C	$\pm 0.31^\circ\text{C}$
	3	1 0 1 1	190 to 596°C	$\pm 0.30^\circ\text{C}$
OHMS	0	0 1 0 0	35.5 to 331.0Ω	$\pm 0.222 \Omega$
	1	0 1 0 1	57.0 to 178.5Ω	$\pm 0.091 \Omega$
	2	0 1 1 0	98.0 to 252.0Ω	$\pm 0.116 \Omega$
	3	0 1 1 1	173.5 to 316.5Ω	$\pm 0.107 \Omega$

Note: DIP switch settings ON = 1 OFF = 0

Accuracy Example:
RTD 385 Range "0"
-160°C to 654°C

Range	Conformity	Total Error
($\pm 0.61^\circ\text{C}$ + $\pm 0.1^\circ\text{C}$)	=	$\pm 0.71^\circ\text{C}$

9. CERTIFICATIONS AND COMPLIANCES:

SAFETY

IEC 1010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.

ELECTROMAGNETIC COMPATIBILITY

Immunity to EN 50082-2

Electrostatic discharge EN 61000-4-2 Level 2; 4 kV contact¹
Level 3; 8 kV air

Electromagnetic RF fields EN 61000-4-3 Level 3; 10 V/m²
80 MHz - 1 GHz

Fast transients (burst) EN 61000-4-4 Level 4; 2 kV I/O
Level 3; 2 kV power

RF conducted interference EN 61000-4-6 Level 3; 10 Vrms
150 KHz - 80 MHz

Power frequency magnetic fields EN 61000-4-8 Level 4; 30 A/m

Emission to EN 50081-2

RF interference EN 55011 Enclosure class B

Notes:

1. This device was designed for installation in an enclosure. To avoid electrostatic discharge, precautions should be taken when the device is mounted outside an enclosure. When working in an enclosure (ex. making adjustments, setting switches etc.) typical anti-static precautions should be observed before touching the unit.

2. Self-recoverable loss of performance during EMI disturbance at 10 V/m:
Analog output signal may deviate during EMI disturbance.

For operation without loss of performance:

Unit is mounted in a metal enclosure (Buckeye SM7013-0 or equivalent)
I/O and power cables are routed in metal conduit connected to earth ground.
Refer to the EMC Installation Guidelines section of this bulletin for additional information.

10. ENVIRONMENTAL CONDITIONS:

Operating Temperature Range: -25°C to 75°C (-13°F to 167°F)

Storage Temperature Range: -40 to 85°C (-40°F to 185°F)

Operating and Storage Humidity: 85% max. relative humidity (non-condensing) from -25°C to 75°C.

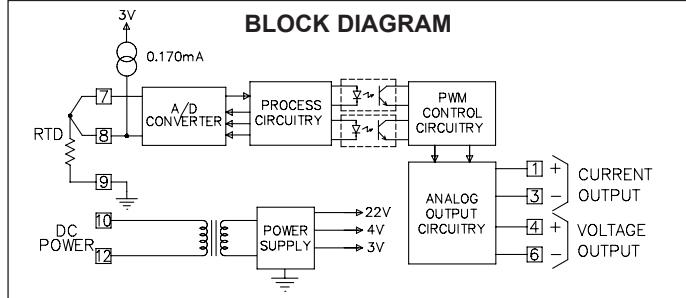
Altitude: Up to 2000 meters

11. MOUNTING: Universal mounting foot for attachment to standard DIN style mounting rails, including top hat (T) profile rail according to EN50022 - 35 × 7.5 and 35 × 15, and G profile rail according to EN50035 - G32.

12. CONNECTION: Compression type terminal block

13. CONSTRUCTION: High impact black plastic case, Installation Category I, Pollution Degree 2.

14. WEIGHT: 4.02 oz. (114.0 g)



FUNCTION DESCRIPTIONS

Open Sensor Detection

The output can be set to go Upscale or Downscale for the detection of an open sensor. The nominal values for each output range are listed under RTD Break Detection in the Specifications section. This setting is always active, so changes to the setting are effective immediately.

Unit Malfunction

If the unit has scaling problems (output remains at -0.5 mA, 3.5 mA, or -0.5 VDC nominal), check the ERROR LED on the front of the unit. An E²PROM problem is indicated when the ERROR LED is on. If the ERROR LED is on, perform a Basic Calibration followed by a Field Calibration. Turn the power off for 5 seconds. Turn power on and check if the ERROR LED is on. If the LED is on, contact the factory.

EMC INSTALLATION GUIDELINES

Although this unit is designed with a high degree of immunity to ElectroMagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the unit may be different for various installations. Cable length, routing and shield termination are very important and can mean the difference between a successful or a troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

1. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
 - a. Connect the shield only at the rail where the unit is mounted to earth ground (protective earth).
 - b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
 - c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.
2. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
3. Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
4. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:

Ferrite Suppression Cores for signal and control cables:

Fair-Rite # 0443167251 (RLC #FCOR0000)

TDK # ZCAT3035-1330A

Steward #28B2029-0A0

Line Filters for input power cables:

Schaffner # FN610-1/07 (RLC #LFIL0000)

Schaffner # FN670-1.8/07

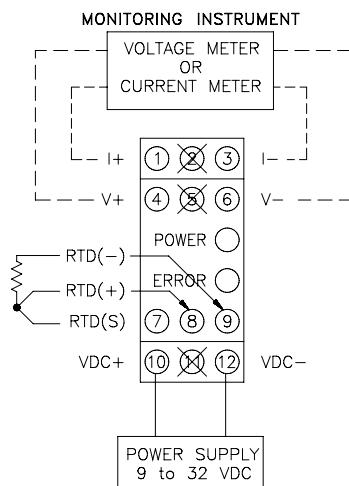
Corcom #1VR3

Note: Reference manufacturer's instructions when installing a line filter.

5. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.

WIRING CONNECTIONS

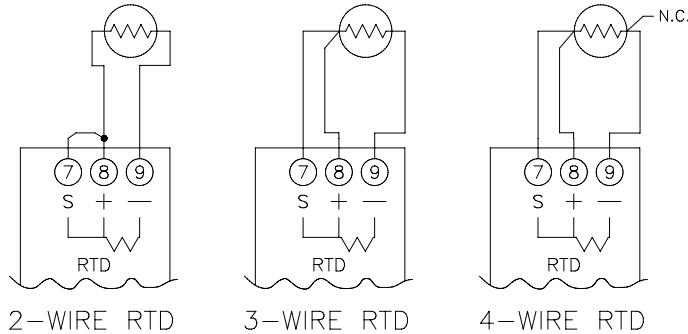
All conductors should meet voltage and current ratings for each terminal. Also, cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit be protected by a fuse or circuit breaker. When wiring the unit, use the numbers on the label to identify the position number with the proper function. Strip the wire, leaving approximately 1/4" (6 mm) of bare wire exposed (stranded wire should be tinned with solder). Insert the wire into the terminal, and tighten the screw until the wire is clamped tightly.



INPUT AND POWER/OUTPUT CONNECTIONS

INPUT

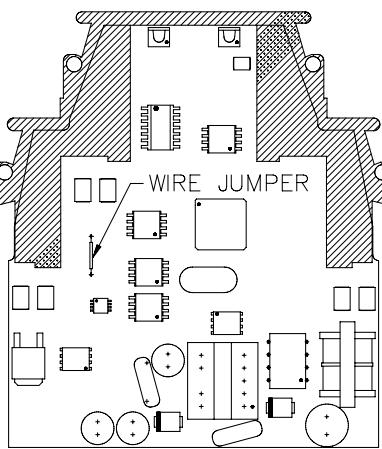
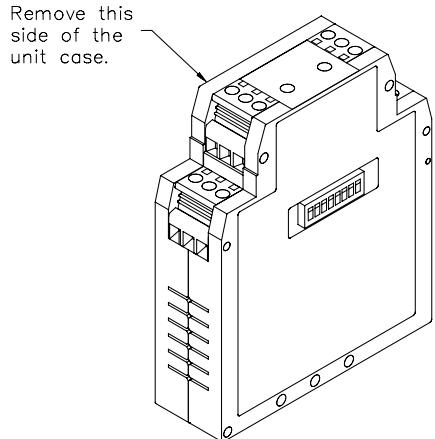
When connecting the RTD or resistance device, be certain that the connections are clean and tight. Attach the device to terminals #8 and #9. Install a copper sense lead of the same gauge as those used to connect the device. Attach one end of the wire at the probe where the lead connected to terminal #8 is attached and the other end to terminal #7. This configuration will provide complete lead wire compensation. If a sense wire is not utilized, then Terminal #7 should be shorted to terminal #8. To avoid errors due to lead wire resistance, field calibration should be performed with a series resistance equal to the total lead resistance in the system. Always refer to the probe manufacturer's recommendations for mounting, temperature range, shielding, etc.



OUTPUT

Connect the output signal wires to the desired output terminals. For voltage output, use terminals #4 and #6; for current output, use terminals #1 and #3 observing proper polarity. Only one output may be used at a time. The unit is factory set for a 4 to 20 mA output. The voltage output will track the current output linearly within $\pm 2.5\%$ deviation of range endpoints.

To select 0 to 20 mA, output you must open the case and cut the wire jumper. The jumper is located to the left side of the board as shown in the drawing.



POWER

Connect DC power to terminals #10 and #12 observing proper polarity. Be certain DC power is within the 9 to 32 VDC specifications.

POWER LED

The IRMA has a green LED located on the front to indicate that power is applied to the unit.

DIP SWITCH SETTING DESCRIPTIONS

SWITCH	LABEL	DESCRIPTION
1	OUTPUT CAL	Output Calibration
2	FIELD CAL	Field Calibration
3	BASIC CAL	Basic Calibration
4	385/392	RTD Type
5	OPEN SEN UP/DN	Open Sensor Detection - Upscale (ON) / Downscale (OFF)
6	RTD/OHMS	Select Input Type - Ohms (ON) / RTD (OFF)
7	RANGE	Sensor Range - 2 switch combination setting
8		

Range switch settings (ON = 1 OFF = 0)

RANGE	DIP SWITCH	
	7	8
0	0	0
1	0	1
2	1	0
3	1	1

FACTORY SETTINGS

The unit is shipped from the factory calibrated for a 4 to 20 mA output using a type 385 RTD in range 0. The IRMA should be Field calibrated by the operator for the application environment it will be used in. If the unit is not recalibrated by the operator, the following table lists the temperature ranges for each RTD type.

NOMINAL FACTORY FIELD CALIBRATION		
TYPE	RANGE	TEMPERATURE RANGE
385	0	150°C to 606°C
392	0	150°C to 595°C

TROUBLESHOOTING

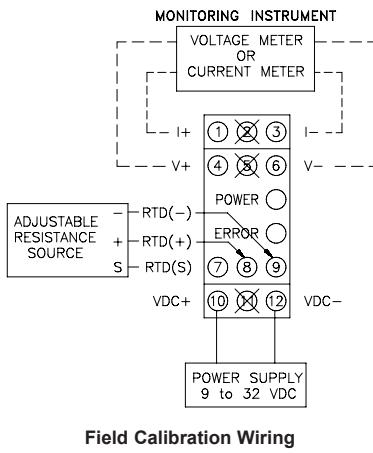
For further technical assistance, contact technical support at the appropriate company numbers listed.

CALIBRATION PROCEDURES

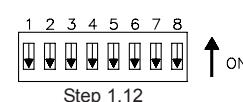
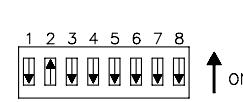
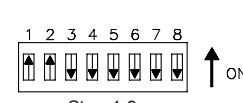
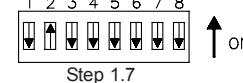
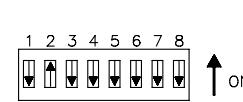
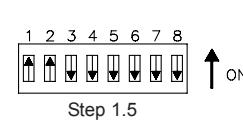
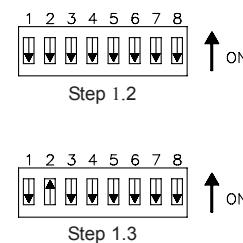
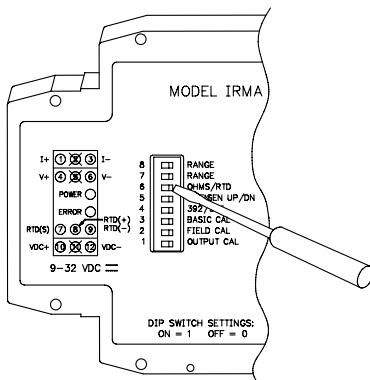
1.0 Field Calibration

Field Calibration scales the selected output to a temperature or resistance input. This procedure assigns an input value to the low end and an input value to the high end. The microprocessor handles configuring the output so it is linear to the temperature or resistance input. The Field Calibration procedure is described below.

Note: The unit needs to have the Field Calibration completed by the operator before normal operation. To abort this calibration and reset to the previous settings, set the FIELD CAL switch OFF prior to the final OFF setting of the OUTPUT CAL switch (Step 1.11) and turn off power. Wait 5 seconds and then turn on power and the previous settings will be loaded.



Field Calibration Wiring



RTD temperature to resistance conversion table

Temperature °C	alpha 0.00385	alpha 0.00392
-160	35.53	34.38
-150	39.71	38.64
-100	60.25	59.55
-50	80.30	79.96
0	100.00	100.00
50	119.40	119.75
100	138.5	139.20
150	157.33	158.36
190	172.17	173.48
200	175.85	177.23
250	194.09	195.80

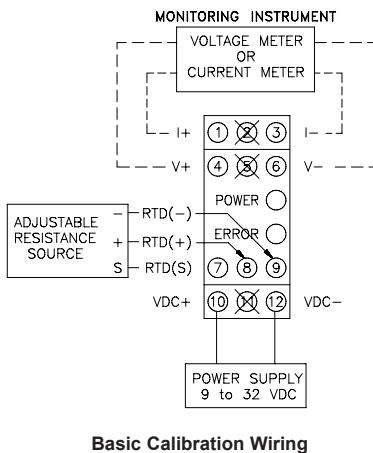
Temperature °C	alpha 0.00385	alpha 0.00392
300	212.03	214.08
350	229.69	232.07
400	247.05	249.77
410	250.49	253.28
450	264.13	267.18
500	280.92	284.30
550	297.42	301.13
590	310.41	314.38
600	313.63	317.66
640	326.38	330.68
650	329.54	333.90

Field Calibration with an Accurate Adjustable Resistance Source

Note: The nominal output value for the various output ranges are designated in the following order: (0 to 20 mA, 4 to 20 mA, 0 to 10 VDC)

- 1.1 Connect resistance source to the RTD input terminals using a third sense wire. (For 2 wire sensors, short terminal #7 to terminal #8.)
- 1.2 Set the type and Range for the RTD or resistance used in your application. (DIP switches #4, #6, #7 & #8). (RTD alpha = 0.00385, Range 0 shown). APPLY OPERATING VOLTAGE and allow 45 minute warm-up period.
- 1.3 Set the FIELD CAL switch (#2) ON. [Output goes to -0.8 mA, 3.5 mA, or -0.4 V nominal]
- 1.4 Set the input resistance to the value intended to generate the analog low endpoint (For 2 wire sensors, add the system lead resistance to the desired value.)
- 1.5 Set the OUTPUT CAL switch (#1) ON. [Output stays at -0.8 mA, 3.5 mA, or -0.4 V nominal]
- 1.6 Adjust the input signal up until the analog output equals desired low value.[0 mA, 4 mA, or 0 V]
- 1.7 Set the OUTPUT CAL switch (#1) OFF. [Output increases to 22.9 mA, 22.5 mA, or 11.5 V nominal]
- 1.8 Set the input resistance to the value intended to generate the analog high endpoint. (For 2 wire sensors, add the system lead resistance to the desired value.)
- 1.9 Set the OUTPUT CAL switch (#1) ON. [Output decreases to 21.1 mA, 20.7 mA, or 10.6 V nominal]
- 1.10 Adjust the input signal down until the output equals desired high value. [20 mA, 20 mA, or 10 V]
- 1.11 Set the OUTPUT CAL switch (#1) OFF.
- 1.12 Set the FIELD CAL switch (#2) OFF.
- 1.13 Disconnect the resistance source from the IRMA and connect the actual sensor to be used in the application.

2.0 Basic Calibration

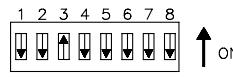


Basic Calibration Wiring

The Basic Calibration should only be performed with an ambient temperature between 21°C and 29°C. The Basic Calibration was performed on the unit at the factory and generally does not need to be done again. This procedure initializes the unit by calibrating the input. The Basic Calibration should be performed only if a condition exists as described in the “Unit Malfunction” section. After completion of this calibration, the unit needs to be scaled in Field Calibration. The Basic Calibration procedure is described below.

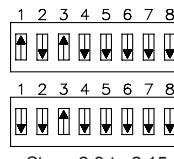
*Note: To abort this calibration and reset to the previous settings, set the **BASIC CAL** switch (#3) OFF prior to the final setting of the **OUTPUT CAL** switch (#1) (Step 4.17) and turn off power for 5 seconds. Then turn on power and the previous settings will be loaded.*

Note: The nominal output value for the various output ranges are designated in the following order: (0 to 20 mA, 4 to 20 mA, 0 to 10 VDC)



Step 2.1

- 2.1 Connect an adjustable resistance source with an accuracy of 0.03% to the RTD input terminals using a third sense wire. Set the RANGE (#7 & #8), TYPE (#4), OUTPUT CAL (#1), and FIELD CAL (#2) switches OFF. Set the BASIC CAL switch (#3) ON.
- 2.2 Apply operating power and allow a 45 minute warm-up period. [Current goes to -0.9 mA, 3.4 mA, or -0.5 V(nominal)]

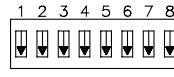


Steps 2.3 to 2.15

- 2.3 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.4 Set the resistance source to 40 ohms and wait 5 seconds.
- 2.5 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.6 Set the resistance source to 60 ohms and wait 5 seconds.
- 2.7 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.8 Set the resistance source to 100 ohms wait 5 seconds.
- 2.9 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.10 Set the resistance source to 175 ohms and wait 5 seconds.
- 2.11 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.12 Set the resistance source to 250 ohms and wait 5 seconds.
- 2.13 Set the OUTPUT CAL switch (#1) ON and then OFF.
- 2.14 Set the resistance source to 315 ohms and wait 5 seconds.
- 2.15 Set the OUTPUT CAL switch (#1) ON and then OFF.

- 2.16 Set the BASIC CAL switch (#3) OFF. [Current increases to 3.6 mA (nominal) or more]

- 2.17 Perform a Field Calibration. (See Section 1.0)



Step 2.16

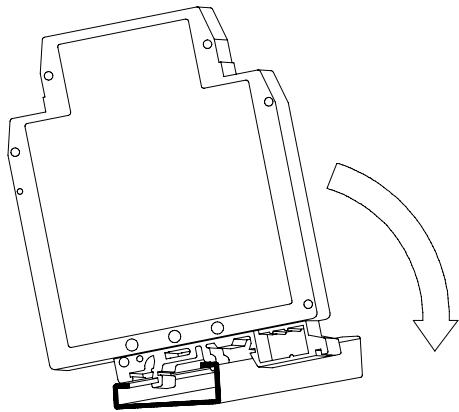
2.17 Perform a Field Calibration. (See Section 1.0)

INSTALLATION

The unit is equipped with a universal mounting foot for attachment to standard DIN style mounting rails, including G profile rail according to EN50035 - G32, and top hat (T) profile rail according to EN50022 - 35 x 7.5 and 35 x 15. The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

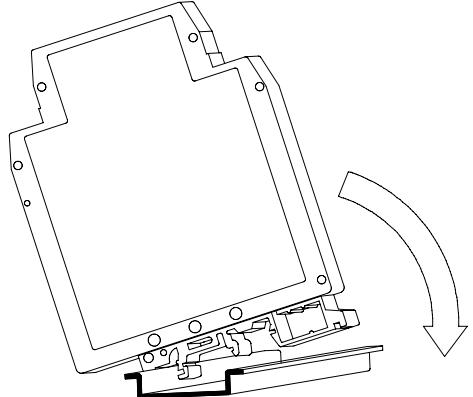
G Rail Installation

To install the IRMA on a "G" style DIN rail, angle the module so that the upper groove of the "foot" catches under the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, push up on the bottom of the module while pulling out away from the rail.



T Rail Installation

To install the IRMA on a "T" style rail, angle the module so that the top groove of the "foot" is located over the lip of the top rail. Push the module toward the rail until it snaps into place. To remove a module from the rail, insert a screwdriver into the slot on the bottom of the "foot", and pry upwards on the module until it releases from the rail.



APPLICATION

The temperature of certain industrial plastics is critical for melt flow of an injection molding process. Different plastic grades and the complexity of the mold determine required temperatures for efficient material flow. The master control room monitors the temperature of the melt flow of each injection mold machine. They will determine whether the operator may start the process on his machine or override the injection molding process. The injection molding machines are located throughout the plant, posing an RTD signal loss problem from long cable runs. The IRMA DC powered unit is mounted at the machine and uses the local 24 VDC for power. The signal loss problem is solved using the 4 to 20 mA analog output for the long cable run to the master control room.

