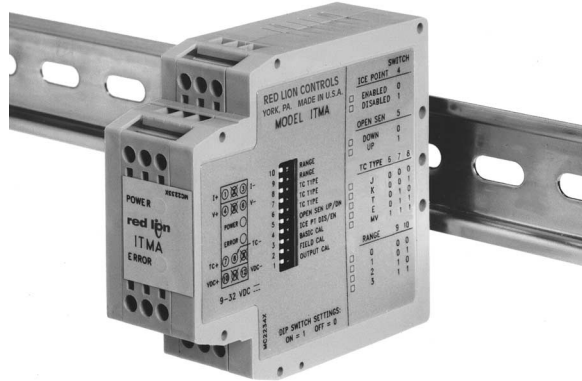


MODEL ITMA DC - INTELLIGENT THERMOCOUPLE MODULE WITH ANALOG OUTPUT



- USER PROGRAMMABLE INPUT
(Thermocouple types J, K, T, & E, or millivolt)
- MICROPROCESSOR CONTROLLED
- SIMPLE ADJUSTABLE RANGE SETTING (Using Input Signal)
- THERMOCOUPLE 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)
- POWER & MEMORY ERROR INDICATION
- 9 to 32 VDC POWERED



DESCRIPTION

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

The ITMA 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 thermocouple or millivolt 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 ITMA 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 thermocouples which can provide additional noise reduction benefits.

The ITMA uses a ten 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 x 7.5 and 35 x 15, and (G) profile according to EN 50 035 - G 32.

SAFETY SUMMARY

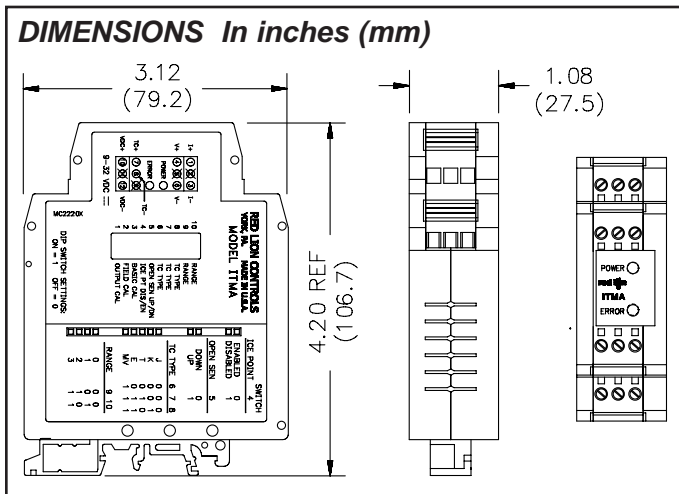
All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection 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 The power supply must have 300 mA for 200 msec. surge capacity.
2. **INPUT:** J, K, T, E, mV [selectable via DIP switch]
3. **OUTPUT:** All output signals scaled linearly using temperature or mV input. Unit is shipped set for 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 freq. up to 120 Hz)
4. **TC 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
 - Ice Point Compensation:** ± 0.75°C for a 50°C change in temperature
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.
8. **RANGE & ACCURACY:** (12 Bit resolution)
Accuracy: ± (0.075% Range + 0.25°C [Conformity] + 0.50°C [Ice Point]) at 23°C after 20 min. warm-up, conforming to ITS-90.
 Note: TC Conformity and Ice Point do not apply to mV 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.

Thermocouple Accuracy for each type and the corresponding ranges:

| TC (INPUT) | RANGE | DIP SWITCH TYPE RANGE 6 7 8 9 10 | TEMPERATURE & mV RANGE | RANGE ACCURACY | WIRE COLOR | |
|------------|-------|-------------------------------------|------------------------|----------------|-----------------------|------------------------|
| | | | | | ANSI | BS1843 |
| J | 0 | 0 0 0 0 0 | -136 to 111°C | ± 0.19°C | White (+) Red (-) | Yellow (+) Blue (-) |
| | 1 | 0 0 0 0 1 | 69 to 575°C | ± 0.38°C | | |
| | 2 | 0 0 0 1 0 | 338 to 800°C | ± 0.35°C | | |
| | 3 | 0 0 0 1 1 | -149 to 862°C | ± 0.76°C | | |
| K | 0 | 0 0 1 0 0 | -200 to 541°C | ± 0.56°C | Yellow (+) Red (-) | Brown (+) Blue (-) |
| | 1 | 0 0 1 0 1 | 427 to 1132°C | ± 0.53°C | | |
| | 2 | 0 0 1 1 0 | 648 to 1372°C | ± 0.54°C | | |
| | 3 | 0 0 1 1 1 | -192 to 1372°C | ± 1.17°C | | |
| T | 0 | 0 1 0 0 0 | -225 to 149°C | ± 0.28°C | Blue (+) Red (-) | White (+) Blue (-) |
| | 1 | 0 1 0 0 1 | 74 to 326°C | ± 0.19°C | | |
| | 2 | 0 1 0 1 0 | 68 to 400°C | ± 0.25°C | | |
| | 3 | 0 1 0 1 1 | -200 to 400°C | ± 0.45°C | | |
| E | 0 | 0 1 1 0 0 | -111 to 311°C | ± 0.32°C | Violet (+) Red (-) | Brown (+) Blue (-) |
| | 1 | 0 1 1 0 1 | 276 to 609°C | ± 0.25°C | | |
| | 2 | 0 1 1 1 0 | 377 to 1000°C | ± 0.47°C | | |
| | 3 | 0 1 1 1 1 | -114 to 1000°C | ± 0.84°C | | |
| mV | 0 | 1 1 1 0 0 | -9 to 6 mV | ± 0.0113 mV | N/A | N/A |
| | 1 | 1 1 1 0 1 | -9 to 22 mV | ± 0.0233 mV | | |
| | 2 | 1 1 1 1 0 | -9 to 63 mV | ± 0.0540 mV | | |
| | 3 | 1 1 1 1 1 | -9 to 77 mV | ± 0.0645 mV | | |

Note: DIP switch settings ON = 1 OFF = 0

Accuracy Example:
Type "J" Range "0"
-136°C to 111°C

| Range | Conformity | Ice Point | Total Error |
|------------|------------|------------|-------------|
| (±0.19°C + | ±0.25°C | + ±0.50°C) | = ±0.94°C |

9. 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

- 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. 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 contact ¹ 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 |

Emission to EN 50081-2

| | | |
|-----------------|----------|-------------------|
| RF interference | EN 55011 | Enclosure class B |
|-----------------|----------|-------------------|

Notes:

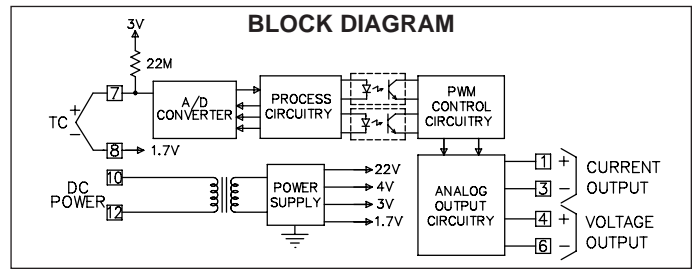
- This device was designed for installation in an enclosure. To avoid electrostatic discharge, precautions should be taken when the device is mounted outside an enclosure. When working in an enclosure (ex. making adjustments, setting switches etc.) typical anti-static precautions should be observed before touching the unit.
- Self-recoverable loss of performance during EMI disturbance at 10 V/m: Process 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.

- 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 TC Break Detection in the Specifications section. This setting is always active, so changes to the setting are effective immediately.

Ice Point Compensation

The Ice Point Compensation for the thermocouple sensors can be enabled (DIP Switch OFF) or disabled (DIP Switch ON). The mV sensor input is not affected by this setting. Generally, the Ice Point Compensation is always enabled.

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

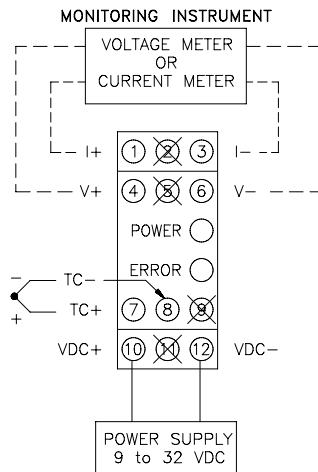
Although this unit is designed with a high degree of immunity to ElectroMagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the unit may be different for various 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.

- 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.
 - Connect the shield only at the rail where the unit is mounted to earth ground (protective earth).
 - Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
 - Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.
- 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.
- Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
- 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.
- 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.

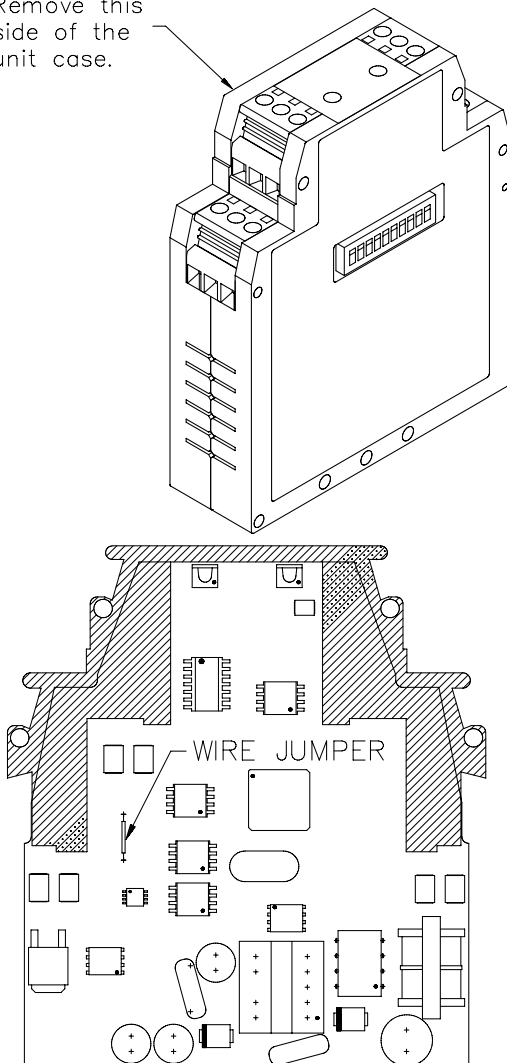


INPUT, OUTPUT, AND POWER CONNECTIONS

INPUT

Ensure thermocouple wire ends are stripped and clean. Connect positive thermocouple lead to terminal #7 (TC+). Connect negative thermocouple lead to terminal #8 (TC-). If the thermocouple probe cannot be connected directly to the module, thermocouple wire or thermocouple extension-grade wire must be used to extend the connection (copper wire does not work). Always refer to the thermocouple manufacturer's recommendations for: mounting, temperature range, shielding, etc.

Remove this side of the unit case.



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 nominally within a $\pm 2.5\%$ deviation range.

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 ITMA 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 | ICE PT DIS/EN | Ice Point Compensation - Disabled (ON) / Enabled (OFF) |
| 5 | OPEN SEN UP/DN | Open Sensor Detection - Upscale (ON) / Downscale (OFF) |
| 6 | TC TYPE | Thermocouple Type - 3 switch combination setting |
| 7 | | |
| 8 | | |
| 9 | RANGE | Sensor Range - 2 switch combination setting |
| 10 | | |

TC Type and Range switch settings (ON = 1 OFF = 0)

| TC TYPE | DIP SWITCH | | |
|---------|------------|---|---|
| | 6 | 7 | 8 |
| J | 0 | 0 | 0 |
| K | 0 | 0 | 1 |
| T | 0 | 1 | 0 |
| E | 0 | 1 | 1 |
| mV | 1 | 1 | 1 |

| RANGE | DIP SWITCH | |
|-------|------------|----|
| | 9 | 10 |
| 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 J thermocouple in range 3. The ITMA 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 the given thermocouple types.

| NOMINAL FACTORY FIELD CALIBRATION | | |
|-----------------------------------|-------|-------------------|
| TYPE | RANGE | TEMPERATURE RANGE |
| J | 3 | -50°C to 500°C |
| K | 3 | -85°C to 790°C |
| T | 3 | -195°C to 162°C |
| E | 3 | 3°C to 602°C |

TROUBLESHOOTING

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

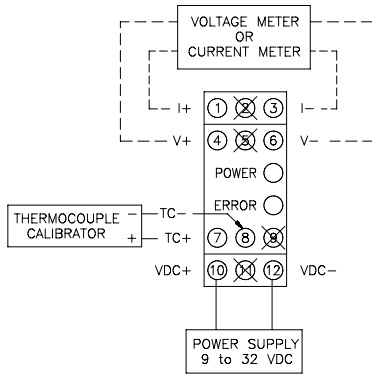
CALIBRATION PROCEDURES

1.0 Field Calibration

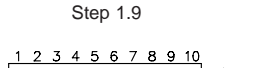
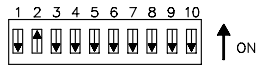
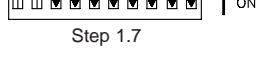
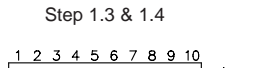
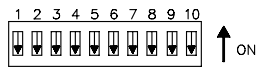
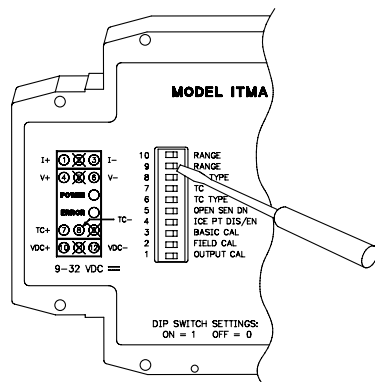
Note: The nominal output value for the various output ranges are designated in the following order: (0 to 20 mA, 4 to 20 mA, 0 to 10 VDC)

Allow a 30 minute warm-up period before starting Field Calibration. Field Calibration scales the voltage or current output to a temperature or mV input. This procedure assigns an input value to analog output low and an input value to analog output high. The microprocessor handles configuring the output so it is linear to the temperature or mV 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(#2) OFF prior to the final OFF setting of the OUTPUT CAL switch (Step 1.13) and turn off power. Wait 5 seconds and then turn on power and the previous settings will be loaded.



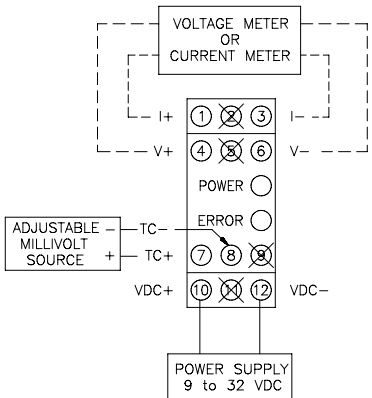
Field Calibration Wiring



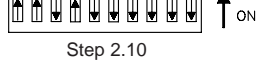
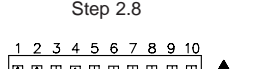
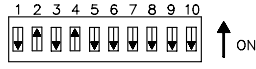
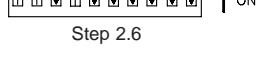
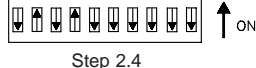
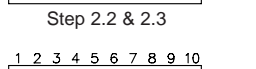
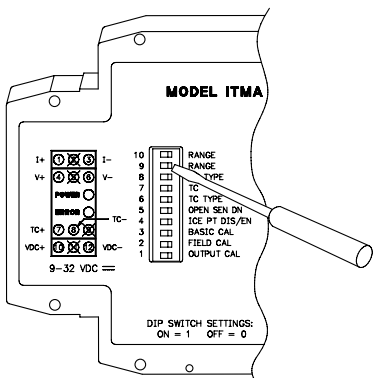
Field Calibration with a Thermocouple Calibrator

- 1.1 Enable the Ice Point Compensation on the Thermocouple Calibrator and set it to the Thermocouple type being used in your application.
- 1.2 Connect the thermocouple wire as selected in step 1 to the TC input terminals of the ITMA and the thermocouple calibrator.
- 1.3 Set the ICE PT EN/DIS switch (#4) OFF to enable Ice Point Compensation.
- 1.4 Set the Type and Range for the thermocouple or mV used in your application (DIP switches #6 through #10). (TC type "J", Range 0 shown)
- 1.5 Set the FIELD CAL switch (#2) ON. [Output goes to -0.8 mA, 3.5 mA, or -0.4 V nominal]
- 1.6 Apply the input signal for the analog output low value.
- 1.7 Set the OUTPUT CAL switch (#1) ON. [Output stays at -0.8 mA, 3.5 mA, or -0.4 V nominal]
- 1.8 Adjust the input signal up until the output equals desired low value.
- 1.9 Set the OUTPUT CAL switch (#1) OFF. [Output increases to 22.9 mA, 22.5 mA, or 11.5 V nominal]
- 1.10 Apply the input signal for the analog output high value.
- 1.11 Set the OUTPUT CAL switch (#1) ON. [Output decreases to 21.1 mA, 20.7 mA, or 10.6 V nominal]
- 1.12 Adjust the input signal down until the output equals desired high value.
- 1.13 Set the OUTPUT CAL switch (#1) OFF.
- 1.14 Set the FIELD CAL switch (#2) OFF.
- 1.15 Disconnect the thermocouple calibrator from the ITMA and connect the actual sensor to be used in the application.

2.0 Field Calibration With an Accurate Adjustable Millivolt Source: (Alternate Method)



Field Calibration Wiring



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)

This calibration procedure can be used to assign the high and low input values if a thermocouple calibrator is not available.

Note: To abort this calibration and reset to the previous settings, set the FIELD CAL switch(#2) OFF prior to the final OFF setting of the OUTPUT CAL switch (Step 2.12) and turn off power. Wait 5 seconds and then turn on power and the previous settings will be loaded.

- 2.1 Connect the accurate Adjustable Millivolt Source to the TC input terminals.
- 2.2 Set the ICE PT EN/DIS switch (#4) ON to disable Ice Point Compensation.
- 2.3 Set the Type and Range for the thermocouple or mV used in your application (DIP switches #6 through #10). (TC type "J", Range 0 shown)
- 2.4 Set the FIELD CAL switch (#2) ON. [Output goes to -0.8 mA, 3.5 mA, or -0.4 V nominal]
- 2.5 Apply the input signal (mV equivalent for the thermocouple temperature) for the analog output low value.
- 2.6 Set the OUTPUT CAL switch (#1) ON. [Output stays at -0.8 mA, 3.5 mA, or -0.4 V nominal]
- 2.7 Adjust the input signal up until the output equals desired low value.
- 2.8 Set the OUTPUT CAL switch (#1) OFF. [Output increases to 22.9 mA, 22.5 mA, or 11.5 V nominal]
- 2.9 Apply the input signal (millivolt equivalent for the thermocouple temperature) for the analog output high value.
- 2.10 Set the OUTPUT CAL switch (#1) ON. [Output decreases to 21.1 mA, 20.7 mA, or 10.6 V nominal]
- 2.11 Adjust the input signal down until the output equals desired high value.
- 2.12 Set the OUTPUT CAL switch (#1) OFF.
- 2.13 Set the FIELD CAL switch (#2) OFF.
- 2.14 Set the ICE PT EN/DIS switch (#4) OFF to enable Ice Point Compensation.
- 2.15 Disconnect millivolt source from the ITMA and connect the actual sensor to be used in the application.