MOORE INDUSTRIES

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Programmable Isolated RTD Transmitter

RIY

RIY *Programmable Isolated RTD Transmitter*

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Introduction

Moore Industries' Programmable Isolated RTD Transmitter (RIY) is a 2-wire, microprocessor-based instrument that converts an RTD or ohms input into a 4-20 mA output. The output is field-configurable to be linear with temperature or linear with an ohms input.

The highly accurate RIY features easy-to-use push buttons, a rotary switch, and a SIP switch for field calibration and configuration.

This manual contains descriptive, calibration, installation, and operation information for the RIY. Also included in this manual is a quick reference page containing often referred to setup and hookup information (see appendix A).

Notes and cautions are provided throughout this manual to help you avoid minor inconveniences (NOTES) and equipment damage (CAUTIONS).

Description

The RIY is a loop-powered, RTD transmitter that accepts an input from 2-, 3-, or 4-wire RTD's, or a resistance source. The RIY processes the input signal using digital technology and produces a proportional 4-20 mA output.

Tactile push buttons, located on the front panel, are used to set the zero and span (full-scale). The values entered are stored in an EEPROM and remain, even when power is removed, until the values are changed by the user. The push buttons provide greater calibration accuracy and stability than do potentiometer adjustments of non-microprocessor-based instruments.

A 4-digit, liquid crystal display (LCD) is standard on the RIY. (The RIY is available without the LCD.) This display provides readouts of the applied input (either in temperature or ohms), and it displays problem codes. (The LCD is required for *quick ranging*.)

Switches are used to configure several functional characteristics of the RIY. Each of these switches is accessible without disassembling the unit. The switch-selectable features include:

- Readouts in degrees Celsius or Fahrenheit, or ohms (only on units with LCD's)
- Sensor type and number to be input to the RIY
- Upscale/downscale drive
- Quick/standard ranging
- Keyboard lockout/enable

The RIY is available in two housing styles; a hockey-puck (HP) housing and a DIN-style housing. Both housing styles have the same operational features and offer the same options. The intended application of the RIY must be clearly identified to determine which housing style is most suitable.

The standard HP-style housing is equipped with spring clips for mounting in explosionproof enclosures. An RIY packaged in an HP-style housing and equipped with flange plates (FL Housing option) is designed to mount on a flat surface or on relay tracks. The configuration switches for HP-style units are accessible through a removable panel at the rear of each unit.

The all-aluminum DIN-style housing snaps directly onto standard G-type or Top-hat DIN rails. The configuration switches for DIN-style units are accessible through a removable panel on the upper right-side panel of the unit. The physical layout of the configuration switches in DIN-style units is identical to that of HP-style units.

Table 1 contains the operational and performance specifications for the RIY.

Options

The RIY is available with several optional features. The following is a brief description of the most popular options:

DD Option — Downscale drive on loss of input (upscale drive is standard)

ND Option — No display (LCD)

For availability of other options, including intrinsic safety approvals, contact your local Sales Representative or Moore Industries' directly.

Table 1. *RIY Operational and Performance Specifications*

Characteristic	Specification
Input	**RTD's,** 2-, 3-, or 4-wire (single, dual, or triple sensors) **Ohms,** 0-4000Ω (refer to the Calibration Section for ranges)
Output	**4-20 mA** – linear with temperature or ohms input (switch-selectable)
Power	**12-42 Vdc loop-power, standard** 12-30 Vdc, I.S. version
Controls	**Four front panel push buttons:** used to set zero and span; SAVE function (2 'up' buttons); and CANCEL function (2 'down' buttons) **Switches**: Used to set the unit's operating configuration (see Calibration Section for application of switches)
Indicators	**Liquid Crystal Display:** 4-digit LCD; diaplays input values; zero and full-scale values; problem codes; and high and low table limit warnings (RIY available without LCD) **LCD Accuracy:** ±0.1% of maximum span, ±1 digit
Fault Response	**On Loss of Input:** Upscale drive to 21.4 mA; downscale drive to 3.6 mA (switch-selectable)
Performance	**Accuracy:** ±0.05% of span (refer to table 2 for accuracy by input type) **Isolation:** Galvanic isolation between input and output up to 1000 Vdc **Stability:** ±0.1% of calibrated span for 6 months **Ripple:** <10 mV P/P, maximum (up to frequencies of 120 Hz) measured across a 250Ω load resistor **RFI/EMI Susceptability:** 30 V/m – abc -0.1% of ohms reading as defined by SAMA 33.1 (HP and DIN units) **Ambient Temperature Effect:** All combined effect, ±0.006% of span/°C ±10 ppm of ohms reading/°C
Environmental Ratings	**Ambient Operating Temperature:** –40 to 82 °C (–40 to 180 °F) **Storage Temperature:** –40 to 100 °C (–40 to 212 °F)
NOTE: Refer to the Installation Section of this manual for housing dimensions.	

Unit Data Tracking – Model/Serial Numbers. Moore Industries keeps a record of configuration information on every unit it sells or services. This information is keyed to the unit model and serial numbers.

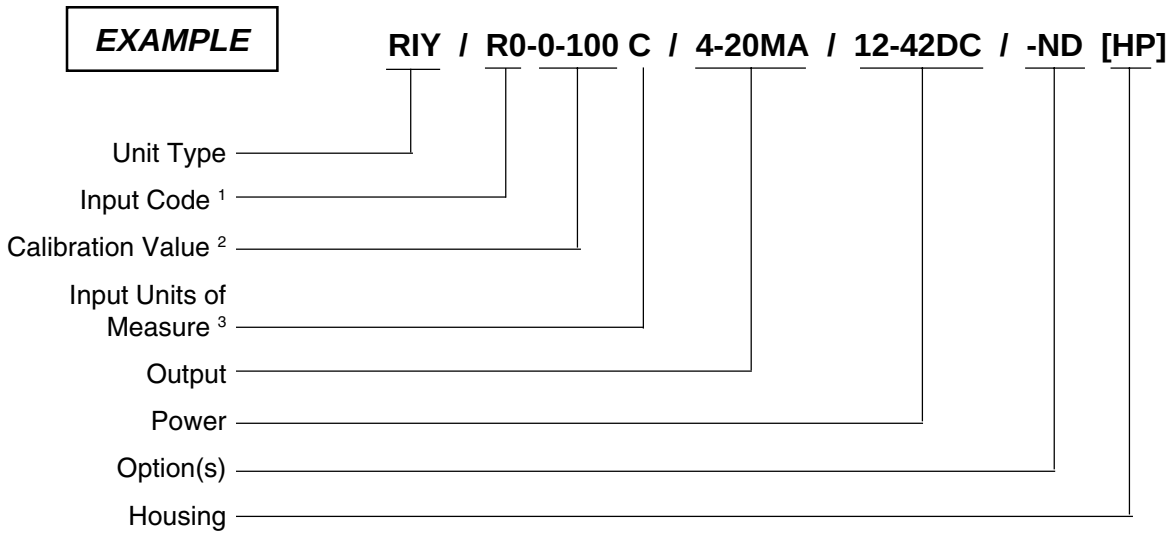
The serial and model number for the HP-style RIY is located on the back panel of the unit. The serial and model number for the DIN-style unit is located on the right-side panel of the unit.

If product information is ever required, make a note of the unit model number before contacting the factory. For fastest assistance, also note the unit serial number, and the job number and purchase

order number under which the unit was shipped. This information assists our factory representative in providing you with the answers you need as efficiently as possible.

The following example identifies the significance of each field of the RIY model number. Refer to this example in deciphering the model number of your RIY.

NOTE
Consult the factory for availability of specific configuration options.



[1] Table 2 lists the input range for each model number Input Code.
[2] Indicates the input range used for factory calibration.
[3] **F**, Fahrenheit; **C**, Celsius; **OHMS**, ohms

Calibration

Prior to shipment, every RIY is factory-checked using automated test equipment. Duplication of the factory check is not expected nor intended for the field. However, field calibration procedures involving use of the front panel push buttons and the configuration switches are described in this section for field applications.

Both the HP- and DIN-style housings are available with the same options, and they have the same push button and switch arrangements. The following descriptions of the push buttons and configuration switches pertain to both housing styles.

Using the Push Buttons

The RIY is equipped with a membrane panel that contains four tactile push buttons used to set zero and span (full-scale). Figure 1 shows the layout of the membrane panel for both the HP- and DIN-style units. Each push button is labeled with an Up or Down arrow inside a circular background that is contoured to the membrane-panel surface.

The functions of the push buttons are labeled “ZERO”, “SPAN”, “SAVE”, and “CANCEL”. When the arrows are pressed individually or in certain simultaneous combinations, one of these four functions is affected.

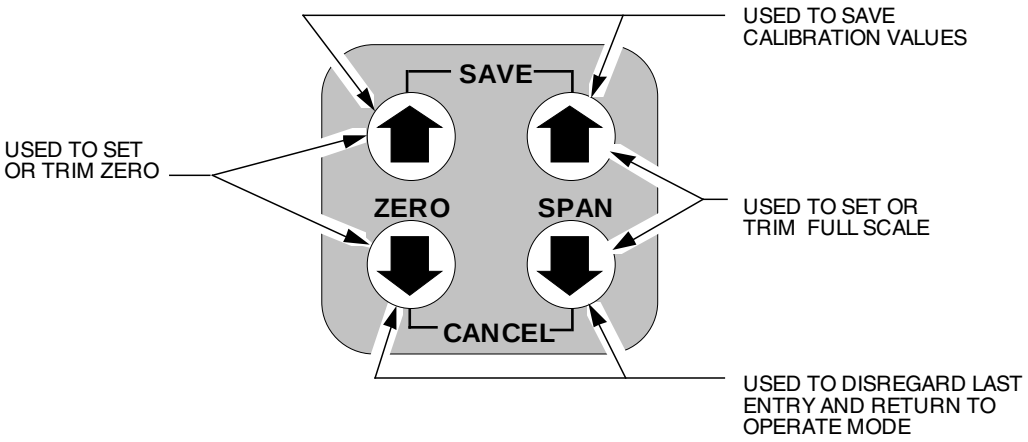


Figure 1. *RIY Front Panel Push Buttons*

*The **Up** arrows:*

- display the latest calibrated setting for zero or span, respectively, when pressed individually during normal operation (units with LCD's only); does not affect the output of the RIY
- increment zero or span values, respectively, when pressed individually while in *quick ranging* (units with LCD's only)
- increment the 'trim' value for the zero- and 100-percent output levels in *standard ranging*
- save the calibration setting for zero or span while in the calibrate mode, then returns the unit to normal operation, when both are pressed simultaneously

*The **Down** arrows:*

- display the latest calibrated setting for zero or span, respectively, when pressed individually during normal operation (units with LCD's only); does not affect the output of the RIY
- decrement zero or span values, respectively, when pressed individually while in *quick ranging* (units with LCD's only)
- decrement the 'trim' value for the zero- and 100-percent output levels in *standard ranging*
- cancel the calibration mode and returns the unit to normal operation when both are pressed simultaneously; retains previous values

Pressing the ZERO or SPAN Up and Down arrows simultaneously sets the unit to the calibrate mode (if enabled through switch settings) for that particular setting.

CAUTION

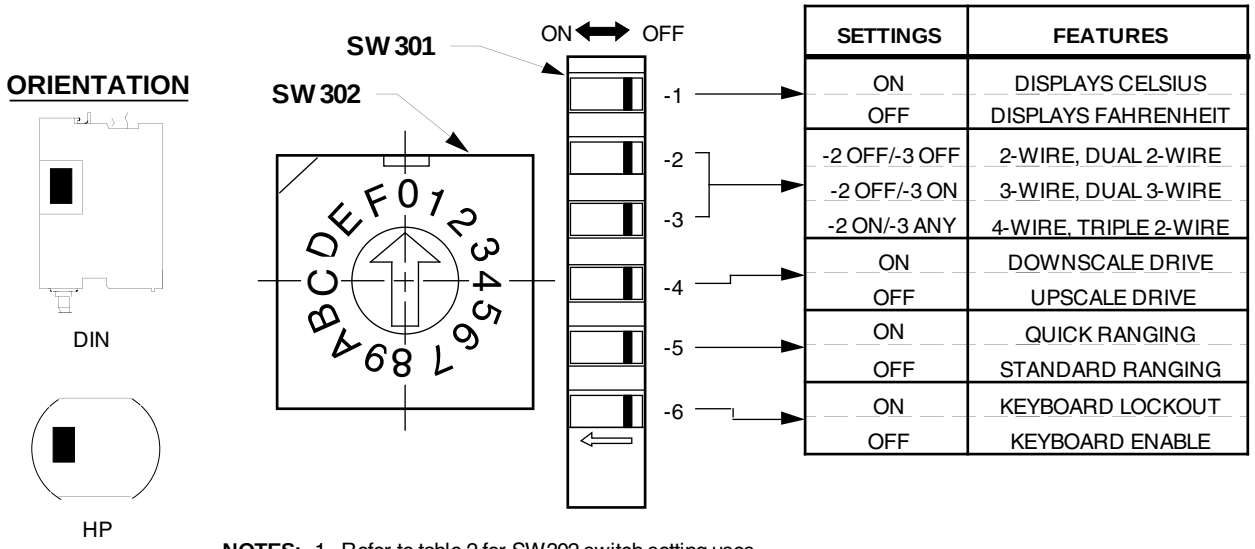
The push buttons are not designed to be actuated with sharp, pointed objects. Using a pen, screwdriver, or other sharp object will damage the push buttons.

Using the Configuration Switches

A rotary switch and a single in-line package (SIP) switch are used to configure the RIY for user-selectable operating and calibration parameters.

Figure 2 shows the layout of the configuration switches and the switch setting options for SW301. The switch settings for rotary switch SW302 are listed in table 2. The reference designators and physical layout of the switches in the HP- and DIN-style units are identical.

The switches for HP-style units are accessed through a cutout at the rear of the unit. The cutout is filled with a small, removable panel. A narrow, slotted-head screwdriver may be used to gently pry the panel off the unit to access the switches.



SETTINGS	FEATURES
ON	DISPLAYS CELSIUS
OFF	DISPLAYS FAHRENHEIT
-2 OFF/-3 OFF	2-WIRE, DUAL 2-WIRE
-2 OFF/-3 ON	3-WIRE, DUAL 3-WIRE
-2 ON/-3 ANY	4-WIRE, TRIPLE 2-WIRE
ON	DOWNSCALE DRIVE
OFF	UPSCALE DRIVE
ON	QUICK RANGING
OFF	STANDARD RANGING
ON	KEYBOARD LOCKOUT
OFF	KEYBOARD ENABLE

NOTES: 1. Refer to table 2 for SW302 switch setting uses.
2. The relative position of SW301 and SW302 is identical for HP- and DIN-style units.
3. SW301-6 may be inactive in earlier units. In these units, the switch setting can be disregarded.

Figure 2. *Internal Switches, Layout, Designations, and Settings*

Switches for DIN-style units are accessed by removing a small, L-shaped panel from the upper right-side of the unit. This panel is bent over the top, right-side edge of the unit and is secured with a single screw on top. A Phillips-head screwdriver is required to remove one screw securing the small L-shaped panel to the housing frame.

The configuration switches are used to set the following features:

SW301-1 — Displayed Temperature Type
ON – Sensor input displayed in Celsius
OFF – Sensor input displayed in Fahrenheit
This switch determines the type of temperature units that will be displayed on the LCD. If an ohms range is selected, the display will show OHMS and this switch is ignored.

SW301-2 & -3 — Number of Wires or Sensors
These two switches determine the number of wires for a single sensor input, or the number of sensors of a multi-sensor input configuration. Refer to table 2.

SW301-4 — Upscale/Downscale on Fault
ON – Downscale Output Drive on Fault
OFF – Upscale Output Drive on Fault
This switch determines the reaction of the RIY output when an error is detected (during power-on diagnostics) or when an input or sensor lead is physically open.

SW301-5 — Ranging Method
ON – Quick Ranging (for units with LCD's only)
OFF – Standard Ranging
Quick Ranging can only be performed on units with an LCD. To set the 4-20 mA output with this ranging method, dc power is the only input needed for the unit. The pushbuttons are used to set the zero and full-scale inputs.

Standard Ranging requires an input source, an output monitoring device, and dc power. The push buttons are used to capture the zero and full-scale input values and to trim the zero- and 100-percent output settings.

Table 2. *RTD and Ohms Input by Input Code (SW302 Settings)*

Input[1] Code	SW302 Setting	Input Type	Description	Range[2,3]	Accuracy Adjustments ±0.05% of Span, ±
R0	0	Pt 100Ω 385 RTD	100Ω at 0 °C, α = 0.003850	–200 to 850 °C (–328 to 1562 °F)	0.20 °C (0.36 °F)
R1	1	Pt 100Ω 3923 RTD	98.129Ω at 0 °C, α = 0.003923	–200 to 600 °C (–328 to 1112 °F)	0.20 °C (0.36 °F)
R2	2	Pt 100Ω 3916 RTD	100Ω at 0 °C, α = 0.003916	–200 to 510 °C (–328 to 950 °F)	0.20 °C (0.36 °F)
R3	3	Pt 100Ω 3902 RTD	100Ω at 0 °C, α = 0.003902	–200 to 650 °C (–328 to 1202 °F)	0.20 °C (0.36 °F)
R4	4	Pt 200Ω 385 RTD	200Ω at 0 °C, α = 0.003850	–200 to 630 °C (–328 to 1166 °F)	0.13 °C (0.23 °F)
R5	5	Pt 500Ω 385 RTD	500Ω at 0 °C, α = 0.003850	–200 to 630 °C (–328 to 1166 °F)	0.10 °C (0.18 °F)
R6	6	Pt 1000Ω 385 RTD	1000Ω at 0 °C, α = 0.003850	–200 to 630 °C (–328 to 1166 °F)	0.10 °C (0.18 °F)
R7	7	Pt 1000Ω 375 RTD	1000Ω at 0 °C, α = 0.003750	–185 to 540 °C (–301 to 1004 °F)	0.10 °C (0.18 °F)
R8	8	Two Pt 100Ω 385 RTD's, Ave.	2 or 3 of R0 Averaged	–200 to 850 °C (–328 to 1562 °F)	0.20 °C (0.36 °F)
R9	9	Two Pt 100Ω 3923 RTD's, Diff.	2 of R1 Differential	–550 to 800 °C (–990 to 1440 °F)	0.40 °C (0.72 °F)
R10	A	Two Pt 100Ω 385 RTD's, Diff.	2 of R0 Differential	–550 to 1050 °C (–990 to 1890 °F)	0.40 °C (0.72 °F)
R11	B	Two Pt 500Ω 385 RTD's, Diff.	2 of R5 Differential	–550 to 830 °C (–990 to 1494 °F)	0.20 °C (0.36 °F)
R12	C	NI 120Ω RTD	120Ω at 0 °C, α = 0.00672	–80 to 320 °C (–112 to 608 °F)	0.14 °C (0.25 °F)
R13	D	CU 10Ω RTD	9.035Ω at 0 °C, α = 0.00427	–50 to 250 °C (–58 to 482 °F)	1.6 °C (2.9 °F)
R14	E	Ohms	0-4000Ω	0-4000Ω	0.2Ω
R15	F	FLEX-SOR™	1000Ω at 0 °C, α = 0.00285	–90 to 175 °C (–130 to 347 °F)	0.08 °C (0.14 °F)
PRG	Programmable input, unspecified at time of order; factory default of R0, -300 to +267 °F (see model number).				

NOTES: 1. This column contains the Input Code for the model number of each RIY.
2. The lower table limit extends 5%, or more, of maximum span below the listed value. When this limit is exceeded, the RIY will clamp at the limit value and the display will read "–LO–". For ohms ranges, 0Ω is the lower table limit.
3. The upper table limit extends 10%, or more, of maximum span above the listed value. When this limit is exceeded, the RIY will clamp at the limit value and the display will read "–HI–". For ohms range, 4095Ω is the upper table limit.

SW301-6 — Keyboard Lockout/Enable

ON – Lockout

OFF – Enable

In some units, this switch inhibits quick or standard ranging when it is set to the 'on' position. When set to the 'off' position, quick or standard ranging can be performed. Even with this switch in the 'on' position (lockout), the zero and span settings of the unit can be viewed on units with an LCD.

NOTE

If you are uncertain of the functionality of SW301-6 for a particular RIY, set it to 'on' and try to change the settings. If you can change the settings, this switch DOES NOT provide keyboard lockout.

SW302 — Range Select Switch

This is a 16-position rotary switch that is used to configure the unit for a particular input range. Refer to table 2 for switch settings.

Anytime a switch setting is changed while power is applied, one of the front panel push buttons must be pressed to ensure that the RIY accepts and acknowledges the configuration change.

Reading the LCD

The 4-digit, liquid crystal display (LCD) of the RIY displays:

- the currently applied input in degrees Celsius (°C), degrees Fahrenheit (°F), or ohms (Ω)
- the calibrated zero or span settings when called for during normal operation
- zero and span input values during calibration
- "–LO–" or "–HI–" when the input value exceeds the lower or upper range table limits for a particular input range, as determined by the setting of the Range Switch
- problem codes discovered by the self-diagnostics during power-up, calibration, or normal operation (refer to the Operation Section for code definitions)

The LCD is also used to perform *quick ranging*. This feature allows you to calibrate the RIY using predetermined representative zero and span (full-scale) input values. However, quick ranging can only be performed on units with an LCD.

The LCD operates independently from the highly accurate conversion circuits of the RIY. Field calibration of the LCD itself is typically not required, as the performance of the LCD does not affect the accuracy of the output. However, if the LCD readings drift beyond the accuracy ratings stated in table 1, you should consult the factory for LCD calibration requirements. To check the LCD's accuracy in the field, the RIY must be supplied a highly accurate and controllable input signal, and then the input device and the RIY's LCD readings compared.

The LCD on the RIY displays the input readings in degrees Celsius, degrees Fahrenheit, or Ohms. The values displayed in various functional modes are either rounded off to the nearest whole digit or they are exact values.

When the RIY is in any display mode other than quick ranging, such as the operate mode, standard ranging, or display zero or span values, the LCD displays input values that are electronically rounded to the nearest whole unit (e.g., 121, 1143, 237). Because the actual input to the RIY includes temperature or resistance values that are not exactly whole units (e.g., 120.6, 1142.91, 237.4), the RIY rounds off the input to the nearest whole unit for display purposes. However, the electronics process the exact input value.

When the RIY is in quick ranging, the values displayed are exact to the least significant whole unit (e.g., 121.0, 1143.0 237.0), because these values are computed internally.

Labels denoting the unit-of-measure that the display reading indicates are provided with the RIY. These adhesive-backed labels are marked "°F", "°C", and "Ω". These labels are sized to fit in the lower, angled portion of the LCD frame. Figure 3 shows all three labels at actual size.

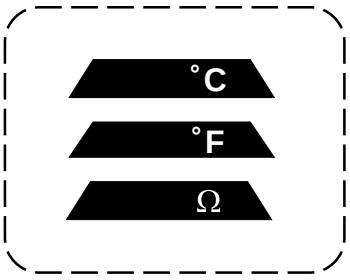


Figure 3. *Units-of-Measure Labels for the LCD*

'Ranging' the RIY

Ranging is a method of field calibration. The RIY features two methods of ranging; *standard* and *quick*. To use either method, configuration switch SW301-5 must be set to the desired setting and SW301-6 must be set to the 'off' position (see figure 2).

Before ranging (or calibrating) the RIY, you should verify all switch settings to ensure that the unit will operate in a predictable manner. Refer to the sub-section titled "Using the Configuration Switches" presented earlier in this section for switch setting options.

Standard Ranging Overview

Standard ranging is used to set the zero- and 100-percent output settings of the RIY based on user-selected input values. The input values are simulated by calibration equipment to represent actual RTD or resistance input values. Refer to a resistance-temperature table for ohm values representative of RTD temperature values.

Standard ranging is the only field calibration possible for units without an LCD. Whether your RIY has an LCD or not, you should rely on the readings from the calibration equipment while performing standard ranging.

By setting switch SW301-5 to the 'off' position, the unit is configured for standard ranging (see figure 2).

In standard ranging, input values for zero and span must first be *captured* by the RIY's microprocessor. Then, the output can be *trimmed* further for a zero-percent output of 4 mA and a 100-percent output of 20 mA. But to effect any range changes, switch SW301-6 must be set to the 'off' position (keyboard enable).

Reverse Output. The RIY can also be set up for *reverse output*, where the zero-percent output is 20 mA and the 100-percent output is 4 mA. To setup the RIY for reverse output operation, the zero and span settings must cross over one another. These settings are made by capturing the *greater,* or full-scale, input with the ZERO push buttons as described in step 7 of the upcoming standard ranging procedure. Then, the span is captured in step 10 with the SPAN push buttons when the input is zero percent for a 100-percent output. When the zero output setting is greater than the span output setting, the unit is configured for reverse output operation.

Trimming. 'Trimming' is a feature of standard ranging that allows the user to vary the zero- and 100-percent output values using the ZERO and SPAN push buttons, respectively.

Trimming the zero-percent setting varies the zero reference point and the 100-percent output value, proportionally. For this reason, when a new zero input value is captured, all previously set trim values are eliminated. The *span* of the output remains constant while trimming the zero-percent output.

Trimming the 100-percent output with the SPAN push buttons varies only the full-scale output value; the zero reference point remains at the level it was last set to. The zero-percent output should always be trimmed before trimming the 100-percent output.

Standard Ranging Setup

To perform standard ranging you need an input source, dc power source, and an output monitoring device. Table 3 lists the calibration equipment and the equipment accuracy required to perform this method of ranging.

Figure 4 illustrates the calibration setup required to perform standard ranging.

To monitor the output, a dc voltmeter and a precision load resistor are called for. Volmeter readings of 1-5 Vdc read across a 250 ohm resistor represent 4-20 mA, proportionally. An output reading of 3 Vdc is equal to a 12 mA output with a 250 Ohm resistor. Similar calculations can be made over the 1-5 Vdc range with the following conversion formula: V (voltage reading)/250Ω = mA.

Standard Ranging Procedure

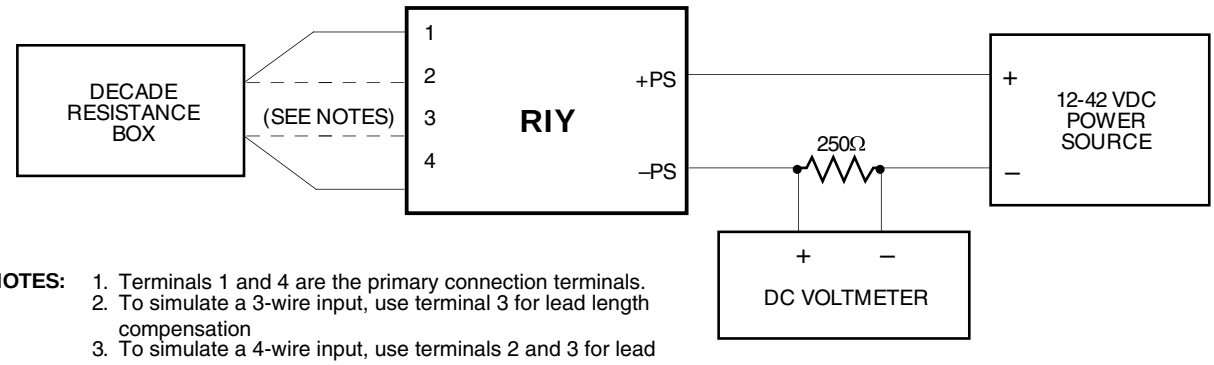
1. Set range and other configuration switches for the required RTD or ohms input, as necessary (refer to figure 2 and table 2).

NOTE

Switch SW301-5 must be set to the 'off' position to perform standard ranging, and set switch SW301-6 to the 'off' position for units with this switch functional for keyboard enable.

Table 3. *RIY Calibration Equipment (Standard Ranging)*

Equipment	Specifications
Decade Resistance Box	Accuracy of ±0.01%, or better
Voltmeter and Precision Resistor	Digital voltmeter, accuracy of ±0.005% or better; 250Ω precision resistor, tolerance of ±0.01%
DC Power Source	12-42 Vdc

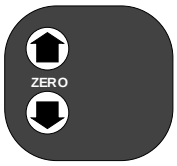


NOTES:
1. Terminals 1 and 4 are the primary connection terminals.
2. To simulate a 3-wire input, use terminal 3 for lead length compensation
3. To simulate a 4-wire input, use terminals 2 and 3 for lead length compensation.

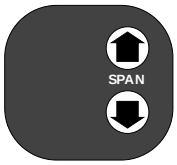
Figure 4. *Calibration Hookup Diagram (Standard Ranging)*

2. Connect RIY as shown in figure 4. Apply power.

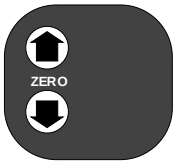
3. Press and hold either the Up **or** Down ZERO push button. Note zero value displayed.



4. Press and hold either the Up **or** Down SPAN push button. Note span (full-scale) value displayed.



5. To enter zero calibrate mode, press the Up **and** Down ZERO push buttons simultaneously.

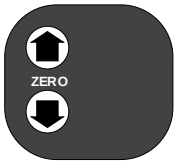


NOTE

In standard ranging, the LCD will continually flash while in the calibrate mode.

6. Set input device for zero-percent input to RIY.

7. To capture zero input value, press (slowly) the Up **and** Down ZERO push buttons simultaneously, twice.



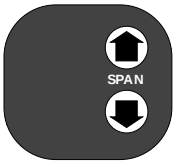
NOTE

If the input value being captured exceeds the upper or lower programmed table limits for a particular input (refer to table 2), the LCD will flash -HI- or -LO-, respectively. The input value must be within programmed table limits to be displayed or captured.

8. Verify that voltmeter reading is 5 Vdc (equivalent to 20 mA). This indicates that zero input value was captured successfully. If voltmeter reads 1 Vdc (4 mA), repeat steps 6 and 7 until 5 Vdc reading is obtained.

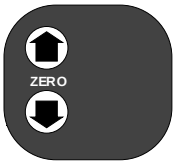
9. Set input device for full-scale input to RIY.

10. To capture full-scale input value, press (slowly) the Up **and** Down SPAN push buttons simultaneously, twice.

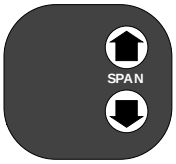


11. Verify that voltmeter reading is 1 Vdc (4 mA). This indicates that full-scale value was captured successfully. If voltmeter reads 5 Vdc, repeat steps 9 and 10 until 1 Vdc reading is obtained.

12. To trim zero-percent output, while monitoring output, press the Up **or** Down ZERO push button until desired output reading is obtained (e.g., 1.000 Vdc).

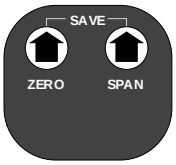


13. Press the Up **and** Down SPAN push buttons simultaneously.



14. To trim 100-percent output, while monitoring output, press the Up **or** Down SPAN push button until desired output reading is obtained (e.g., 5.000 Vdc).

15. When desired values are captured and outputs trimmed, press **both** Up arrows simultaneously to save latest settings.



16. Check zero and full-scale settings as described in steps 3 and 4. If settings are correct, standard ranging is complete. If not, repeat entire procedure.

17. When procedure is complete, set SW301-6 to the 'on' position for keyboard lockout (for units with SW301-6 functional).

The settings entered during calibration are stored in an EEPROM when the SAVE push buttons are pressed. These setting are retained until a subsequent calibration (quick or standard ranging) is performed. If the latest settings are not saved before removing power, or if the CANCEL push buttons (both Down arrows) are pressed simultaneously, the unit will revert to the previously saved values.

Quick Ranging Overview & Setup

Quick ranging is a unique feature that allows the user to calibrate an RIY equipped with an LCD, without the use of an input source or an output monitoring device.

With switch SW301-5 set to the 'on' position and SW301-6 is set to the 'off' position, a 12-42 Vdc power source applied to the +PS and –PS terminals of the RIY is all that is required to perform quick ranging. The front-panel push buttons are used to set zero and span (full-scale) values to user-selected input settings that yield the desired zero- and 100-percent outputs. The user selected values are displayed on the unit's LCD.

When quick ranging is selected, the RIY ignores any input applied to the input terminals. The zero-percent output will be 4 mA for whatever value zero is set to with the ZERO push buttons, and the 100-percent output will be 20 mA for whatever the full-scale value is set to with the SPAN push buttons.

The RIY can be set up for reverse output using quick ranging. To do this, simply increase the zero setting beyond the full-scale setting, and decrease the full-scale setting below the zero setting. When the zero and span output settings cross one another, reverse output is achieved. The reverse output setup is accomplished while selecting the zero and span settings in the upcoming procedure.

Figure 5 illustrates the dc power hookup required to perform quick ranging of the RIY.

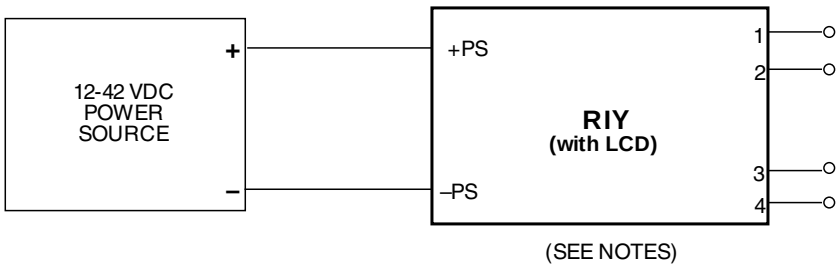
If the unit is configured for standard ranging, the display will continually flash the applied input value when the Up and Down arrows are pressed simultaneously to enter the calibrate mode. Pressing the Up or Down arrows will have no affect on the displayed value. This reaction indicates that the unit is NOT configured for quick ranging.

Quick Ranging Procedure

1. Set range and other configuration switches for the required RTD or ohms input, as necessary (refer to figure 2 and table 2).

NOTE

Switch SW301-5 must be set to the 'on' position to perform quick ranging, and set SW301-6 to the 'off' position for units with this switch functional for keyboard enable.

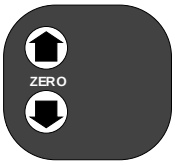


NOTES: 1. The RIY must be equipped with an LCD to perform quick ranging.
2. The input is ignored when the unit is configured for quick ranging.

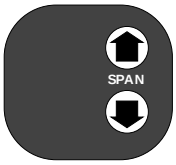
Figure 5. *Quick Ranging Hookup Diagram*

2. Apply dc power as shown in figure 5. (Ignore any problem codes that appear on the LCD, they will be cleared in the next step.)

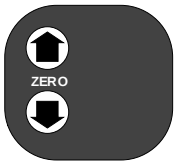
3. Press and hold either the Up **or** Down ZERO push button. Note zero value displayed.



4. Press and hold either the Up **or** Down SPAN push button. Note span (full-scale) value displayed.



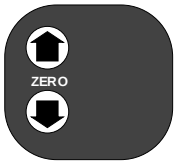
5. To change zero setting, press the Up **and** Down ZERO push buttons simultaneously. Value displayed on LCD will change.



NOTE

If the display begins to flash after pressing the Up and Down push buttons simultaneously, the RIY is configured for standard ranging. Check SW301-5. If there is no change in the LCD, the RIY is configured for keyboard lockout. Check SW301-6.

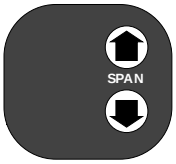
6. Set zero input value shown on LCD to desired setting using the Up **or** Down ZERO push button to increment or decrement displayed value.



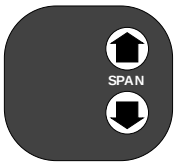
NOTE

When the value entered exceeds the upper or lower programmed table limits for a particular input (refer to table 2), the LCD will display -HI- or -LO-, respectively. The value entered must be within programmed table limits to be displayed.

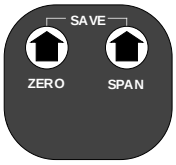
7. To change span (full-scale) setting, press the Up **and** Down SPAN push buttons simultaneously.



8. Set 100-percent (full-scale) input value shown on LCD to desired setting using the Up **or** Down SPAN push button to increment or decrement displayed value.



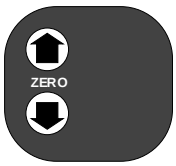
9. When 100-percent input value is obtained, press **both** Up arrows simultaneously to save the new zero and span (full-scale) settings.



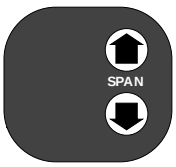
NOTE

The RIY will take a moment to store the new value and reset itself. It will return to the operate mode and display the currently applied input value.

10. Press and hold the Up **or** Down ZERO push button to verify zero setting.



11. Press and hold the Up **or** Down SPAN push button to verify full-scale setting.



12. Remove dc power, quick ranging is complete.

For units with SW301-6 functional, set it to the 'on' position to avoid inadvertent changes to the settings after calibratrion. This will allow for viewing of the zero and span settings, but will not allow for changes to any range settings.

Ranging the RIY for a Differential Input

Some applications require a differential input, which consists of two sensors connected to the RIY where the difference between them influences the 4-20 mA output of the RIY. For example, when resistance of one sensor (RTD) increases while the other remains constant the output of the RIY may also increase toward 20 mA. If both inputs are varying, increasing and decreasing in value, the output will vary proportionally with the difference of the two inputs.

Although the RIY *may be quick ranged for differential inputs*, the following procedure allows you to verify the response of the RIY as you vary the inputs.

To range an RIY for differential input operation, you must determine the minimum and maximum differential input values for the intended application. The lower differential value will be used to set the zero output level and the higher differential value will be used to set the span output level. The following examples show how to determine the zero-percent and full-scale differential values based on known (substitute your own values) minimum and maximum input temperature ranges.

Selecting a Zero-percent Differential Input. The following examples show how to determine a zero-percent differential input that produces a zero-percent output. The RIY responds to negative (–), zero-percent differential input values, as determined in example 2.

Example 1:

- *For zero-percent differential input*
- *R10 Range (Input Code)*
- *Pt 100Ω 385 RTD*
- *0 °C differential*

Input #1 (box #1): *0 °C (100.00Ω)*
Input #2 (box #2): *0 °C (100.00Ω)*
Differential: ***0 °C***

Example 2:

- *For zero-percent differential input*
- *R10 Range (Input Code)*
- *Pt 100Ω 385 RTD*
- *–50 °C differential*

Input #1 (box #1): *-50 °C (80.30Ω)*
Input #2 (box #2): *0 °C (100.00Ω)*
Differential: ***-50 °C***

Selecting a 100-percent Differential Input. The following examples show how to determine a 100-percent differential input setting that produces a 100-percent (full-scale) output.

Example 1:

- *For 100-percent differential input*
- *R10 Range (Input Code)*
- *Pt 100Ω 385 RTD's*
- *100 °C differential*

Input #1 (box #1): *100 °C (138.50Ω)*
Input #2 (box #2): *0 °C (100.00Ω)*
Differential: ***100 °C***

Example 2:

- *For 100-percent differential input*
- *R10 Range (Input Code)*
- *Pt 100Ω 385 RTD's*
- *50 °C differential*

Input #1 (box #1): *50 °C (119.39Ω)*
Input #2 (box #2): *0 °C (100.00Ω)*
Differential: ***50 °C***

Figure 6 illustrates the hookup required to range a unit for a differential input. Notice that an additional decade resistance box is required over the standard ranging procedure. Refer to the Standard Ranging Subsection earlier in this section for information regarding zero and span settings and trimming.

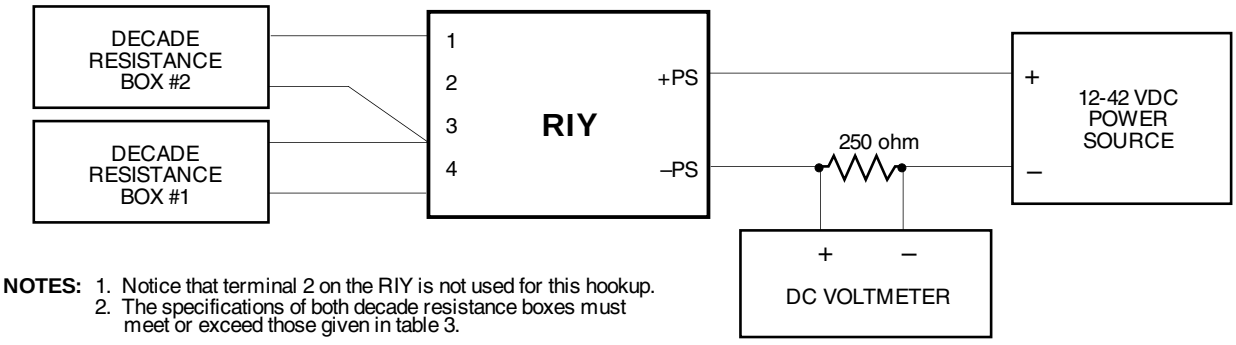


Figure 6. *Differential Input Ranging Setup*

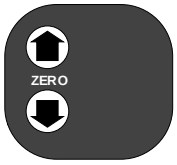
Differential Input Ranging Procedure

1. Set range and other configuration switches for the required RTD or ohms input range as determined by the combined minimum and maximum values of the intended application (refer to figure 2 and table 2; choose from ranges R9, R10, or R11).

NOTE
Switch SW301-5 to the 'off' position to perform the following procedure, and set SW301-6 to the 'off' position for units with this switch functional for keyboard enable.

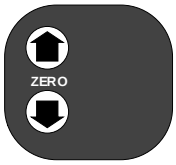
2. Connect RIY as shown in figure 6. Apply power.

3. To enter zero calibrate mode, press the Up **and** Down ZERO push buttons simultaneously.



4. Set both decade resistance boxes (#1 and #2) to required zero-percent differential input to RIY. (Refer to examples prior to this procedure.)

5. To capture zero input value, press (slowly) the Up **and** Down ZERO push buttons simultaneously, twice.

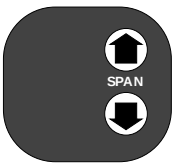


NOTE
If the input value being captured exceeds the upper or lower programmed table limits for a particular input (refer to table 2), the LCD will flash -HI- or -LO-, respectively. The input value must be within programmed table limits to be displayed or captured.

6. Verify that voltmeter reading is 5 Vdc (equivalent to 20 mA). This indicates that zero input value was captured successfully. If voltmeter reads 1 Vdc (4 mA), repeat steps 4 and 5 until 5 Vdc reading is obtained.

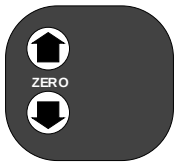
7. Set decade resistance box #1 to full-scale differential value as determined earlier. Do not change resistance box #1 setting. (Refer to examples prior to this procedure.)

8. To capture full-scale input value, press (slowly) the Up **and** Down SPAN push buttons simultaneously, twice.

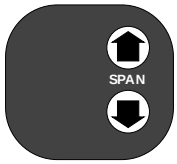


9. Verify that voltmeter reading is 1 Vdc (4 mA). This indicates that full-scale value was captured successfully. If voltmeter reads 5 Vdc, repeat steps 7 and 8 until 1 Vdc reading is obtained.

10. To trim zero-percent output, while monitoring output, press the Up **or** Down ZERO push button until desired output reading is obtained (e.g., 1.000 Vdc).

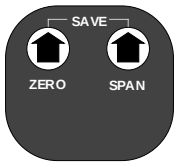


11. Press the Up **and** Down SPAN push buttons simultaneously.



12. To trim 100-percent output, while monitoring output, press the Up **or** Down SPAN push button until desired output reading is obtained (e.g., 5.000 Vdc).

13. When desired values are captured and outputs trimmed, press **both** Up arrows simultaneously to save latest settings.



14. When procedure is complete, set SW301-6 to the 'on ' position for keyboard lockout.

Installation

Installing the RIY consists of physically mounting the unit and completing the electrical connections.

Before installing the RIY, you should perform a bench check and calibration, if needed, to confirm that the configuration of the unit is appropriate for the intended application.

Mounting the RIY

The RIY is available in an HP- or DIN-style housing. Mounting considerations differ for each of these housing style.

The HP Housing. Figure 7 is an outline dimension drawing of the HP-style unit with the FL housing option. The spring clips on standard HP-style units have no dimensional significance, so they are not shown here.

The standard HP-style housing is equipped with spring clips, which hold the unit in place when mounted in an explosionproof enclosure. The spring clips are squeezed inward to allow for positioning of the unit in the base of the enclosure. When released, they recoil to an extended position slightly over the outer edge of the unit, providing adequate outward force to hold the unit in place.

For other applications, an HP-style unit equipped with flange plates (the FL Housing option) can be mounted on relay tracks or a sturdy flat surface. While for other applications, the DIN-style housing that mounts on standard DIN rails is more suitable.

The DIN-style Housing. Figure 8 is an outline dimension drawing of the DIN-style RIY. The all aluminum DIN-style units mount directly onto standard G-type (DIN EN50035) or Top-hat (DIN EN50022), DIN rails. This packaging is ideal for high-density mounting of DIN-style packages on a common DIN rail.

Making the Electrical Connections

The RIY is a loop-powered instrument. The terminals for the loop-power connections are marked "+PS" and "–PS". The loop-power connections and the input connections marked "1", "2", "3", and "4" are the only electrical connections to be made to the RIY. These terminals are clearly marked on the front panel of each unit.

Electrical connections for HP-style units are made at the front panel to individual compression screw terminals; one for each connection. Each terminal has a slotted-head screw that is used to terminate electrical wires.

On DIN-style units, the sensor input and loop-power connections are made to removable terminal blocks. Wires are connected to these blocks through openings in the top, and secured by compression screws on the front of each block.

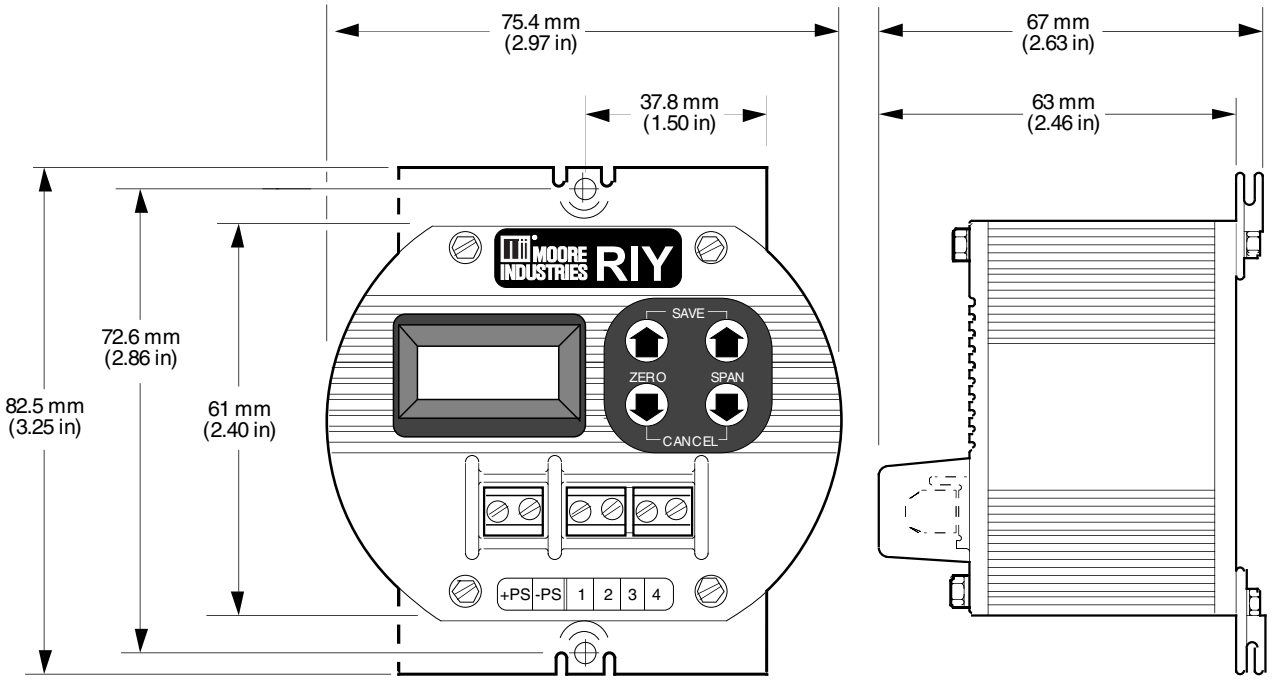


Figure 7. *RIY, HP-style Outline Dimension (FL Housing shown)*

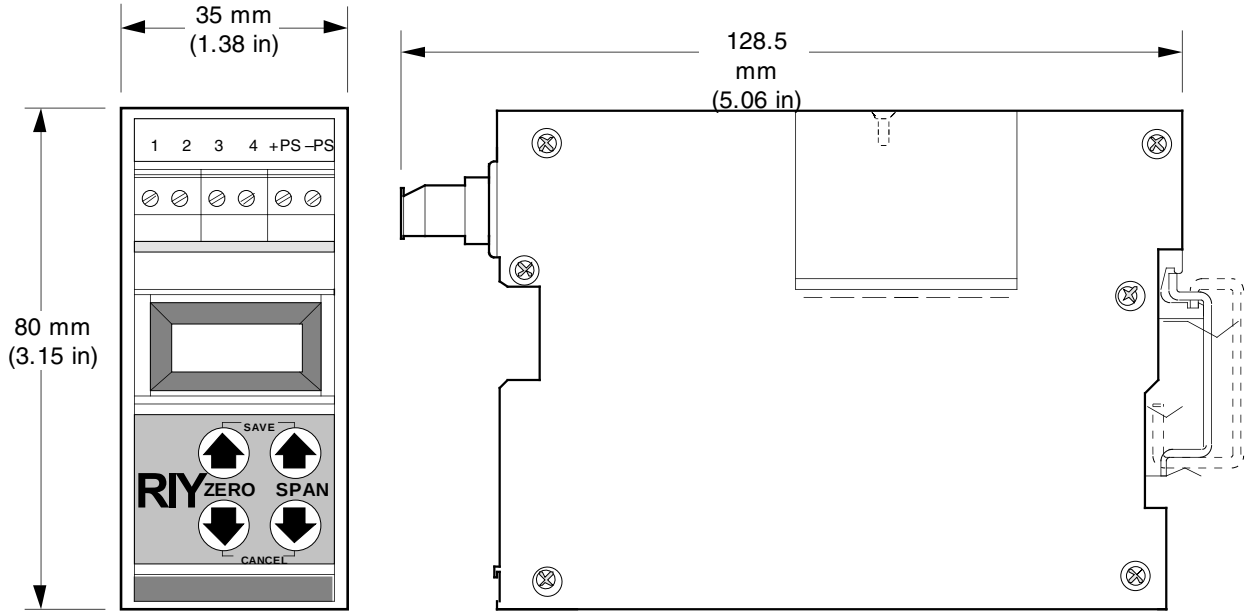


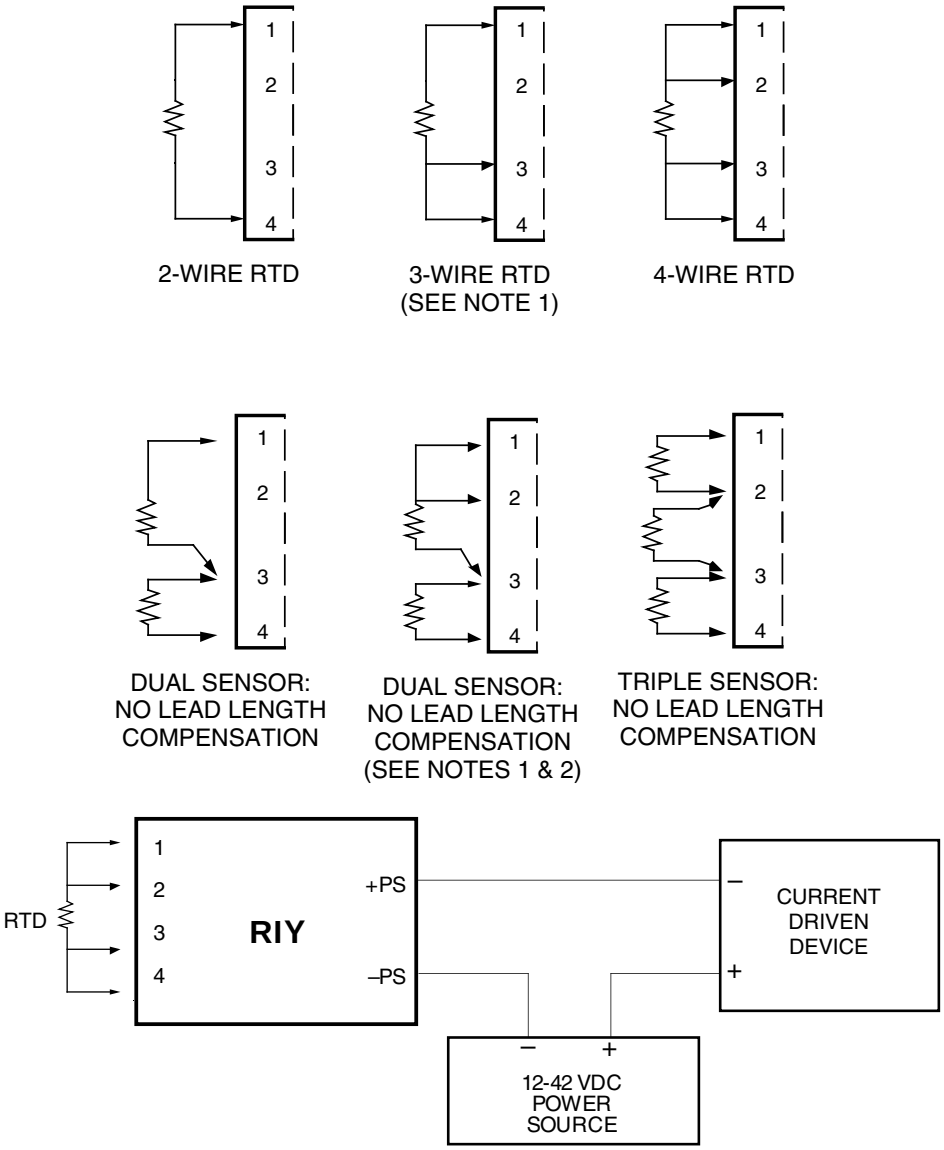
Figure 8. *RIY, DIN-style Outline Dimensions*

Shielded, twisted wire should be used for input signal connections. The shield of the wire set should be grounded to an earth ground potential as close to the RIY as possible. The HP-style unit has a grounding lug on its top that may be used for this purpose.

Figure 9 is an installation hookup diagram showing the connections necessary to operate the RIY.

NOTE

It is strongly recommend that you use shielded, twisted wire for low-level signals.



NOTES:
1. For 3-wire RTD's and dual sensors with lead length compensation, all leads should be of the same gauge and length, and kept at the same temperature.
2. The single lead length compensation wire used for dual sensor hookups is effective for both sensors.

Figure 9. *RIY Installation Hookup Diagram*

Operation

Operating the RIY is limited to viewing the LCD for input values, zero or span reading, or problem codes; and performing quick ranging using the push buttons. Units that are not equipped with an LCD have no definitive operating procedures.

The LCD is the only visual indicator on the RIY; without it, the user has no on-the-spot, visual indication as to the settings or operational status of the RIY.

When a non-LCD unit is calibrated with standard ranging methods, it can be reliably installed in a process loop, but it can not be quick ranged and must be removed from the loop for subsequent calibrations.

The LCD

The LCD also displays problem codes resulting from the RIY's self-diagnostics. Codes indicate malfunctions or discrepancies detected by the RIY's microprocessor at power-up, during calibration, or in the operate mode. Table 4 contains these codes, the problem indicated, and the remedy for each.

During normal operation, the LCD typically displays the applied input value. As the input changes, the read-out of the LCD changes accordingly.

The LCD can also display the zero and span settings during normal operation when the appropriate front panel push button is pressed.

Table 4. *Self-diagnostic Problem Codes*

Code	Problem	Remedy
P1	Failed RAM test on power up	Cycle dc power; if problem persists, return unit per instructions on the back cover of this manual
P2	Failed ROM checksum on power up	
P3	Failed EEPROM checksum on power up	If power is lost during calibration, repeat calibration; otherwise, cycle dc power; if problem persists, return unit per instructions on the back cover of this manual
P4	EEPROM did not write properly	Cycle dc power; if problem persists, return unit per instructions on the back cover of this manual
P5	EEPROM RTD table is bad	
P6 (or **EL1**)	Lead # 1 or 4 is open (2-wire sensor)	Repair sensor or wiring
P7 or **L4**	Lead #4 is open	
P8 or **L3**	Lead #3 is open	
P9 or **L2**	Lead #2 is open	
P10 or **L1**	Lead #1 is open	
P11 or **EL1**	RTD/Element #1 is open	
P12 or **EL2**	RTD/Element #2 is open	
P13 or **EL3**	RTD/Element #3 is open	

If zero or span settings need to be changed, the unit can be quick ranged using loop-power and the LCD. (SW301-5 must be set to ‘on’ and SW301-6 set to 'off' to perform quick ranging.) The front panel push buttons and the LCD are used to set these values to the desired settings.

The Push Buttons

During normal operation, the push buttons are used to call-up and display the zero and full-scale settings. Pressing either of the ZERO push buttons during normal operation displays the most recent zero setting. When either of the SPAN push buttons are pressed during normal operation, the most recent full-scale setting is displayed.

If a switch, or combination of switches, is changed during normal operation, one of the front panel push buttons must be pressed to acknowledge the new settings. After making the desired switch setting changes, pressing any one of the four push buttons (or by cycling the power) causes the unit to reset and the microprocessor will register the switch change(s).

The push buttons are also used in conjunction with the LCD to perform quick ranging. (Refer to the Calibration Section for the quick ranging procedure.)

Maintenance

The RIY is designed to operate reliably with a minimum of field maintenance.

Field maintenance is limited to keeping the unit clean and the wire terminals free of oxidation. Periodic visual inspections should be performed to ensure the unit is clean and the electrical connections are in good condition. The frequency of these inspections is based on the environment in which the unit is operated. But, it is recommended that inspections be conducted at least once every six months.

If the RIY is mounted in an explosion-proof enclosure, the unit will remain much cleaner for a longer period of time than if it is openly exposed to changing environmental conditions.

To perform a thorough calibration of the RIY, the unit must be removed from the process loop and checked out using the standard ranging method described in the Calibration Section.

Should performance problems arise, or for technical assistance, you should contact your local Moore Industries’ Customer Service Department. In the U.S.A. call toll-free 1-800-999-2900.

RIY

Appendix A

RIY Quick Reference Sheet

Table A1. *SW301 Switch Settings*

SW301	Settings	Features
-1	ON	Displays Celsius
	OFF	Displays Fahrenheit
-2 & -3	-2 OFF/-3 OFF	2-wire, Dual 2-wire
	-2 OFF/-3 ON	3-wire, Dual 3-wire
	-2 ON/-3 ANY	4-wire, Triple 2-wire
-4	ON	Downscale Drive
	OFF	Upscale Drive
-5	ON	Quick Ranging
	OFF	Standard Ranging
-6	ON	Keyboard Lockout
	OFF	Keyboard Enable
NOTE: SW301-6 is not active on all units.		

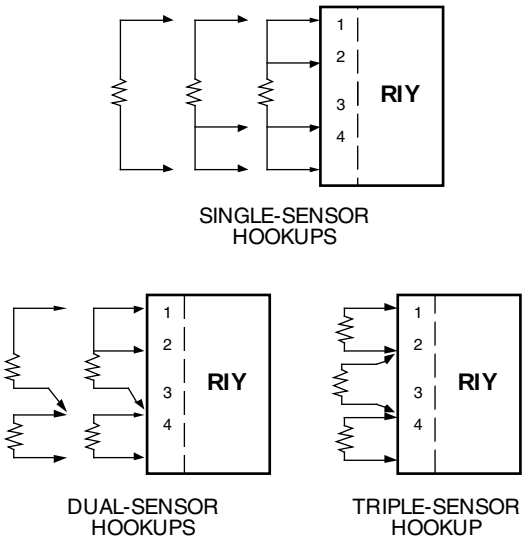


Figure A1. *Sensor Hookups*

Table A2. *SW302 Switch Settings*

SW302	Input Code	Input Type
0	R0	Pt 100Ω, 385 RTD
1	R1	Pt 100Ω, 3923 RTD
2	R2	Pt 100Ω, 3916 RTD
3	R3	Pt 100Ω, 3902 RTD
4	R4	Pt 200Ω, 385 RTD
5	R5	Pt 500Ω, 385 RTD
6	R6	Pt 1000Ω, 385 RTD
7	R7	Pt 1000Ω, 375 RTD
8	R8	2 or 3 Pt 100Ω, 385 RTD's (Ave.)
9	R9	2 Pt 100Ω, 3923 RTD's (Diff.)
A	R10	2 Pt 100Ω, 385 RTD's (Diff.)
B	R11	2 Pt 500Ω, 385 RTD's (Diff.)
C	R12	NI 120Ω RTD
D	R13	CU 10Ω RTD
E	R14	Ohms
F	R15	FLEX-SOR™

Table A3. *LCD Displayed Problem Codes*

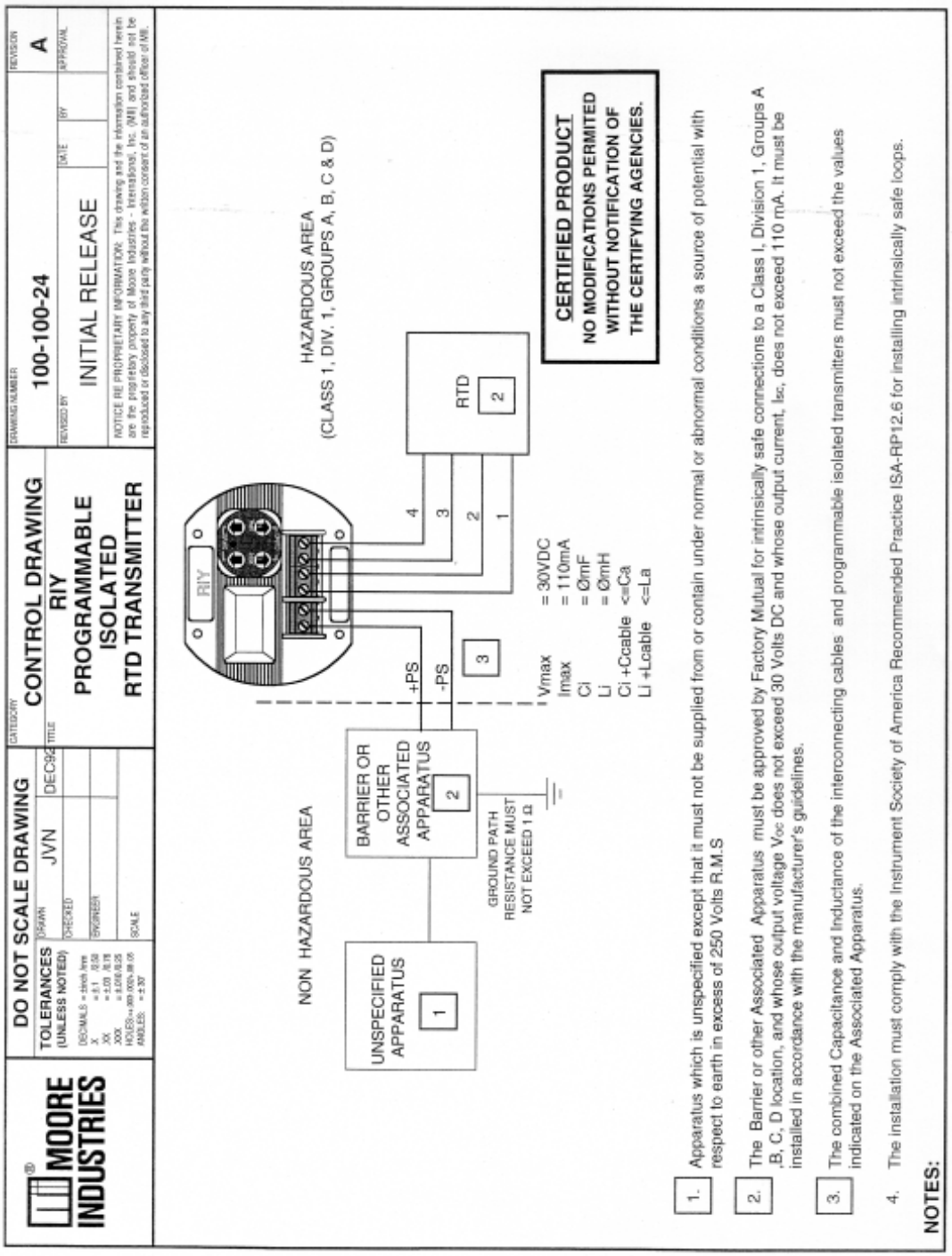
Code	Problem
P1	Failed RAM test on power up
P2	Failed ROM checksum on power up
P3	Failed EEPROM checksum on power up
P4	EEPROM did not write properly
P5	EEPROM RTD table is bad
EL1 (or **P6**)	Lead # 1 or 4 is open (2-wire sensor)
L4 or **P7**	Lead #4 is open
L3 or **P8**	Lead #3 is open
L2 or **P9**	Lead #2 is open
L1 or **P10**	Lead #1 is open
EL1 or **P11**	RTD/Element #1 is open
EL2 or **P12**	RTD/Element #2 is open
EL3 or **P13**	RTD/Element #3 is open

NOTE: For expanded switch setting information refer to the Calibration Section of the RIY User's Manual. For expanded hookup information refer to the Installation Section. For expanded problem code information refer to the Operation Section.

Intrinsic Safety

This page contains the installation diagram for the RIY carrying the intrinsically safe option. It also includes guidelines for setting up zener barriers necessary in these types of applications.

These diagrams must be used to augment the installation instructions earlier in this manual for units that are to operate in areas requiring intrinsically safe instrumentation.



MOORE INDUSTRIES

DO NOT SCALE DRAWING

TOLERANCES (UNLESS NOTED)
DECIMALS = (inch /mm
.X = ±.1 /2.50
.XX = ±.03 /0.76
.XXX = ±.010/0.25
HOLES = .093-.008+.08-.05
ANGLES: = ±.30'

DRAWN	JAD	7/94
CHECKED		
ENGINEER		
SCALE		

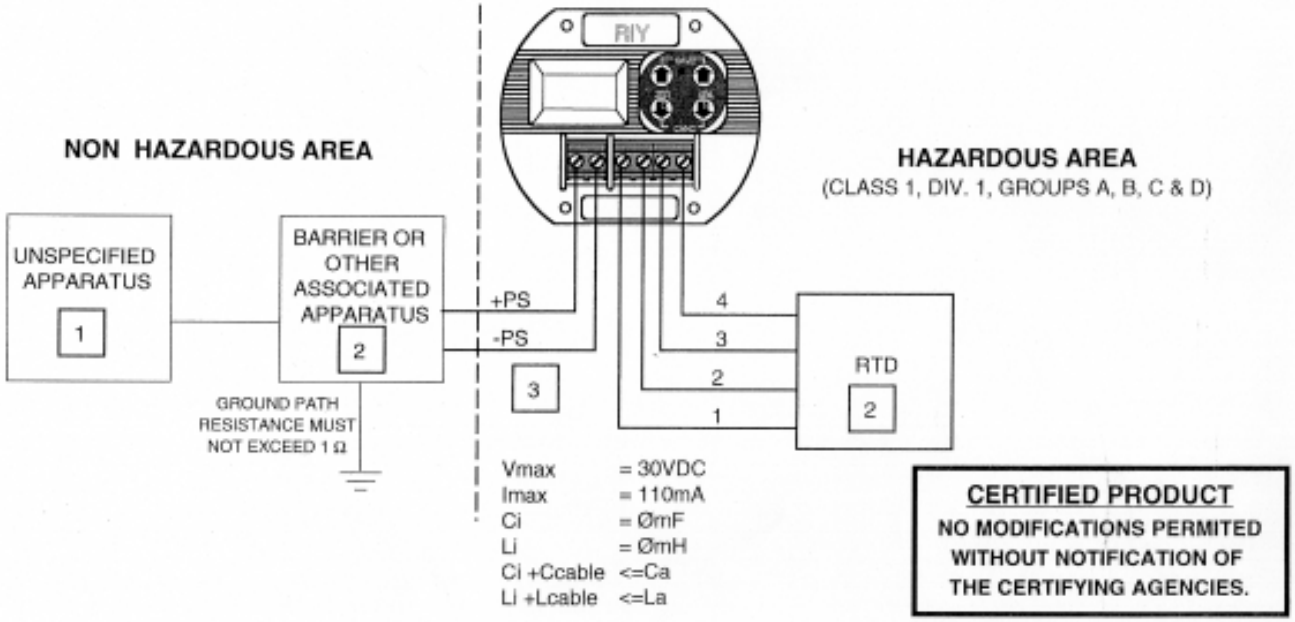
CATEGORY: CONTROL DRAWING

TITLE: RIY-ISC [HP] PROGRAMMABLE ISOLATED RTD TRANSMITTER

DRAWING NUMBER: 100-100-33

REVISION: A

REVISED BY	DATE	BY	APPROVAL
INITIAL RELEASE			



NOTES:

1. Apparatus which is unspecified except that it must not be supplied from or contain under normal or abnormal conditions a source of potential with respect to earth in excess of 250 Volts R.M.S

2. The Barrier or other Associated Apparatus must be approved by CSA for intrinsically safe connections to a Class I, Division 1, Groups A ,B, C, D location, and whose output voltage V_{oc} does not exceed 30 Volts DC and whose output current, I_{sc}, does not exceed 110 mA. It must be installed in accordance with the manufacturer's guidelines.

3. The combined Capacitance and Inductance of the interconnecting cables and programmable isolated transmitters must not exceed the values indicated on the Associated Apparatus.

4. The installation must comply with the Instrument Society of America Recommended Practice ISA-RP12.6 for installing intrinsically safe loops.

MOORE INDUSTRIES

DO NOT SCALE DRAWING

TOLERANCES (UNLESS NOTED)

DECIMALS = ±inch /mm
X = ±.1 /2.50
XX = ±.03 /0.76
XXX = ±.010 /0.25
HOLES=+.003/-.005 /+.08/-.13
ANGLES: = ±30'

DRAWN	JAD	8/94
CHECKED		
ENGINEER		
SCALE		

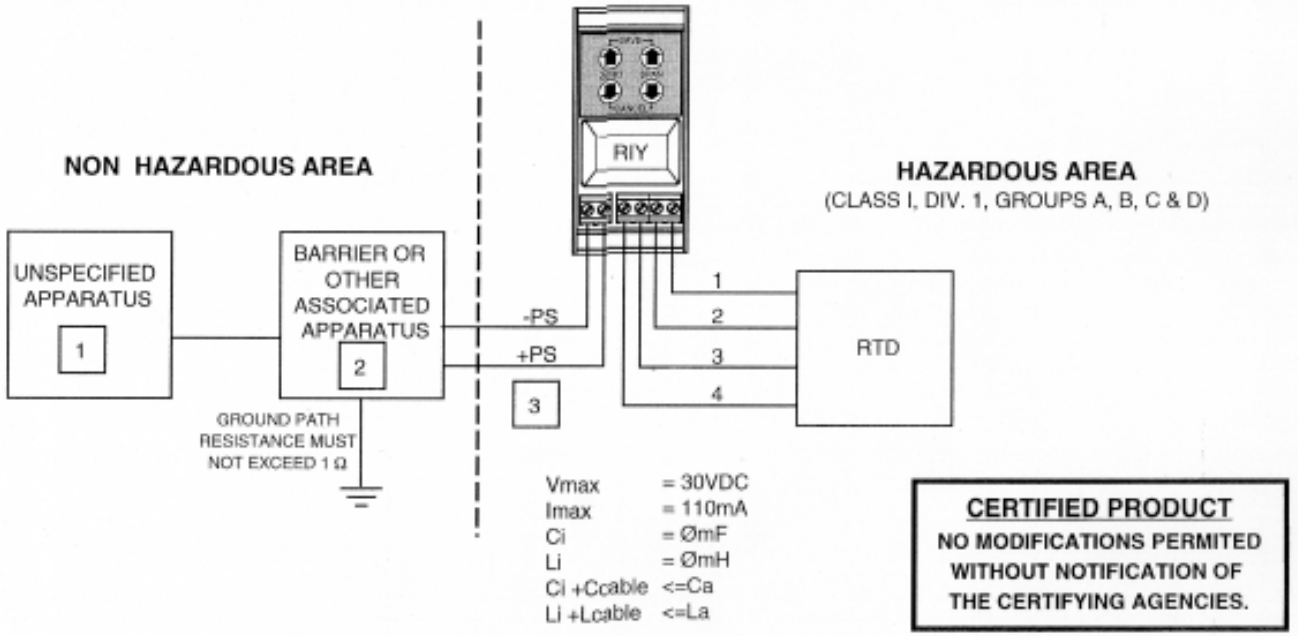
CATEGORY: CONTROL DRAWING

TITLE: RIY-ISF [DIN] PROGRAMMABLE ISOLATED RTD TRANSMITTER

DRAWING NUMBER: 100-100-35

REVISION: A

REVISED BY	DATE	BY	APPROVAL
INITIAL RELEASE	10/94		



CERTIFIED PRODUCT
NO MODIFICATIONS PERMITED WITHOUT NOTIFICATION OF THE CERTIFYING AGENCIES.

1. Apparatus which is unspecified except that it must not be supplied from or contain under normal or abnormal conditions a source of potential with respect to earth in excess of 250 Volts R.M.S

2. The Barrier or other Associated Apparatus must be approved by Factory Mutual for intrinsically safe connections to a Class I, Division 1, Groups A ,B, C, D location, and whose output voltage V_{oc} does not exceed 30 Volts DC and whose output current, I_{sc}, does not exceed 110 mA. It must be installed in accordance with the manufacturer's guidelines.

3. The combined Capacitance and Inductance of the interconnecting cables and programmable isolated transmitters must not exceed the values indicated on the Associated Apparatus.

4. The installation must comply with the Instrument Society of America Recommanded Practice ISA-RP12.6 for installing intrinsically safe loops.

NOTES:

RETURN PROCEDURES

To return equipment to Moore Industries for repair, follow these four steps:

1. Call Moore Industries and request a Returned Material Authorization (RMA) number.

   Warranty Repair –
   If you are unsure if your unit is still under warranty, we can use the unit's serial number to verify the warranty status for you over the phone. Be sure to include the RMA number on all documentation.

   Non-Warranty Repair –
   If your unit is out of warranty, be prepared to give us a Purchase Order number when you call. In most cases, we will be able to quote you the repair costs at that time. The repair price you are quoted will be a "Not To Exceed" price, which means that the actual repair costs may be less than the quote. Be sure to include the RMA number on all documentation.

2. Provide us with the following documentation:
   a) A note listing the symptoms that indicate the unit needs repair
   b) Complete shipping information for return of the equipment after repair
   c) The name and phone number of the person to contact if questions arise at the factory

3. Use sufficient packing material and carefully pack the equipment in a sturdy shipping container.

4. Ship the equipment to the Moore Industries location nearest you.

The returned equipment will be inspected and tested at the factory. A Moore Industries representative will contact the person designated on your documentation if more information is needed. The repaired equipment, or its replacement, will be returned to you in accordance with the shipping instructions furnished in your documentation.

MOORE INDUSTRIES

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