MOORE INDUSTRIES

RIX

Isolated RTD Transmitter

USER'S MANUAL

June 1992

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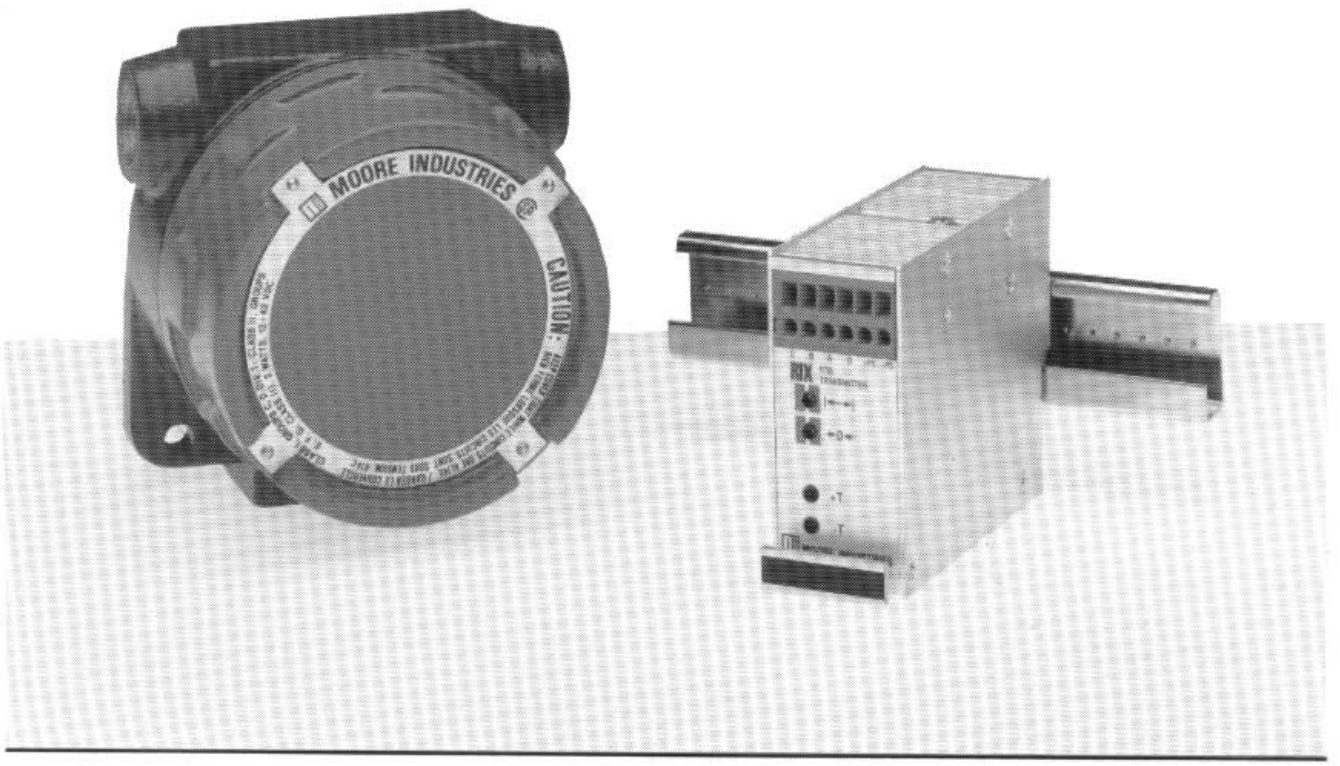

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Introduction

Moore Industries' Isolated RTD Transmitter (RIX) is a 2-wire transmitter that accepts an input from a 2-, 3-, or 4-wire RTD and produces a proportional, isolated process variable current output.

This manual contains descriptive, calibration, and installation information for the RIX. Field maintenance and troubleshooting information are also provided.

The NOTES presented in this manual are provided to help you avoid minor inconveniences while calibrating or installing the RIX.

Description

The RIX accepts an RTD input and produces an isolated 4-20 or 10-50 mA output. The output range is factory-set to one of these two user-selected ranges. But, the sensor type and input span range are jumper-selectable. The RIX can be field-configured to accept a 2-, 3-, or 4-wire RTD input, and for input ranges of 0-5 through 0-640 ohms.

The RIX provides galvanic isolation between its input and output terminals. This isolation eliminates the effects of troublesome ground loops and allows the RIX to produce a highly accurate output that is virtually immune to signal noise.

For 3- and 4-wire RTD's, the RIX provides constant current excitation and true lead-length compensation.

The current output settings are controlled by zero and span potentiometers (pots), located on the front panel of each unit. The Zero pot adjusts the zero-percent output setting and the Span pot adjusts the 100-percent output setting (refer to table 1 for specifications).

The RIX is available in two basic housing styles; the hockey-puck (HP) and the DIN-style. The standard HP Housing is equipped with spring clips that hold the RIX in the base of an explosionproof enclosure.

By removing the spring clips and adding flange plates (FL Housing) to the standard HP Housing, the hockey-puck unit can be mounted on relay tracks or on a flat surface. DIN-style units mount directly on G-type DIN rails.

All electrical connections are made to a 6-position, removable terminal block (optional on HP-style units). The block is keyed so that it mates with the connector on the unit in only one orientation. Each terminal is clearly marked on the unit's front panel.

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

Options

Several factory-installed optional features are available for the RIX. The following are brief descriptions of the most popular options:

DT Option — Differential input; the RIX accepts two, 2-wire RTD's and produces an output based on the difference between the two inputs. Not available with EZ, LNP, or RO Options.

EZ Option — Elevated zero; specifies the input value in ohms that yields a zero-percent output. All RIX's require this option. Not available with DT Option.

LNP Option — Linearization of 100-ohm, platinum RTD inputs. The temperature range and mid-point must be specified. Not available with the DT Option.

RF Option — RFI/EMI protection; 50 V/m – abc ≤ 0.1% of full-scale span as defined by SAMA Standard PMC 33.1.

RO Option — Reversed output; the input/output relationship is reversed. Zero-percent input is used to set the 100-percent output, and the 100-percent input is used to set the zero-percent output. Not available with the DT Option.

For availability of other RIX optional features contact your local Moore Industries Sales Representative.

Table 1. RIX Operational and Performance Specifications

Characteristic	Specification
Input	**RTD**; 2-, 3-, or 4-wire (jumper-selectable) (platinum, copper, or nickel) For jumper-selectable input span ranges, refer to table 2 With DT Option, two sensor inputs
Output	Factory-set **4-20 mA**; limited to 30 mA, max. **10-50 mA**; limited to 65 mA, max.
Power	**12-42 Vdc** (loop-powered)
Controls	Two front panel, multiturn potentiometers **Zero Adjustment:** Output is adjustable to ±10% of span around factory-set elevated zero setting **Span Adjustment:** Output is fully adjustable over user-selected input range **LNP Option:** Linearity adjustment, internal pot
Performance	**Accuracy:** ±0.1% of span **Isolation:** Input to output terminals isolated to 500 Vrms, continuous; With RF Option, 500 Vdc **Frequency Response:** DC to 2 Hz, minimum (–3dB) **Load Capability:** 600Ω @ 24 Vdc **Load Effect:** ±0.002% of span for 100Ω change in loop resistance **Ambient Temperature Effect:** ±0.01% of span/°F for 10Ω spans and above; ±0.02% of span/°F for spans below 10Ω
Environmental Ratings	**Ambient Operating Temperature:** –29 to 82 °C (–20 to 180 °F)
NOTE: Refer to the Installation Section for the RIX outline dimensions.	

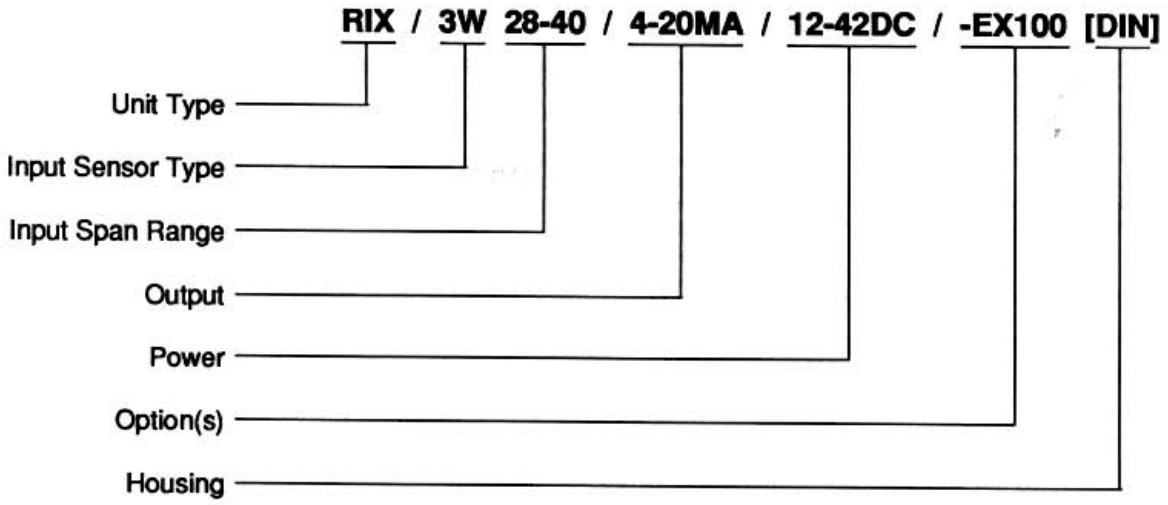
Serial/Model Number. A historical record is kept at the factory on every product Moore Industries sells and services. This information is keyed to the unit's serial number. If you wish to obtain historical information about a particular unit, you must provide the factory with the serial number of that unit.

Moore Industries' model numbers identify the unit type, functional characteristics, input and output types, any options, and the unit's housing type. You should always verify the model number of a unit before placing it into service to ensure it is properly configured for the intended application.

The serial and model numbers are printed on a label and affixed to the rear of HP-style units and to the left-side panel of DIN-style units.

The following example identifies the significance of each field of the RIX model number.

EXAMPLE



NOTE: All RIX's must have an EZ value entered in the Option(s) field, except for those with the DT Option. The EZ value represents the input resistance for a zero-percent output.

Calibration

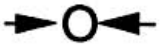
Every RIX is tested at the factory prior to shipment. After receiving your RIX, you should set it up for a bench check and verify that it responds to known inputs in a predictable manner. To do this properly, you must use test equipment to control the input and monitor the output.

A bench check will indicate if the RIX is ready to be placed into service, or if it needs to be re-calibrated for your particular application. We recommend you perform a bench check on each unit before placing it into service.

Controls

Adjustments. The RIX has two front panel adjustments; zero and span. The Zero pot adjusts the output for the zero-percent rating of the unit (e.g., 4 or 10 mA). The Span pot adjusts the output for the 100-percent rating of the unit (e.g., 20 or 50 mA). For units configured with the RO Option, the Zero pot adjusts the output for the 100-percent rating of the unit with a zero-percent input, and the Span pot adjusts the output for the zero-percent rating of the unit with a 100-percent input.

On DIN-style units, these pots are identified with the words "ZERO" and "SPAN" printed adjacent to them. HP-style units use the following symbols to identify the Zero and Span pots:

 represents Zero

 represents Span

RIX

LNP Option Adjustment. The LNP Option is intended for 100-ohm, platinum RTD inputs. Units configured with the LNP Option have an internal adjustment located on PC2. R230 on PC2 is the Linearity Pot. This pot is used to adjust the mid-point of the output signal to a value that is exactly 50 percent of the output span. To access R230, the HP unit must be disassembled and the DIN-style unit must have its right-side panel removed.

Figure 1 shows the disassembly required to access PC2 in HP-style units. There is no need to detach the printed circuit (PC) boards from the front panel. Once the four external screws are removed, you simply pull the front panel, with PCB's attached, out of the case. You must rotate the front panel and PCB's to reveal the component-side of PC2.

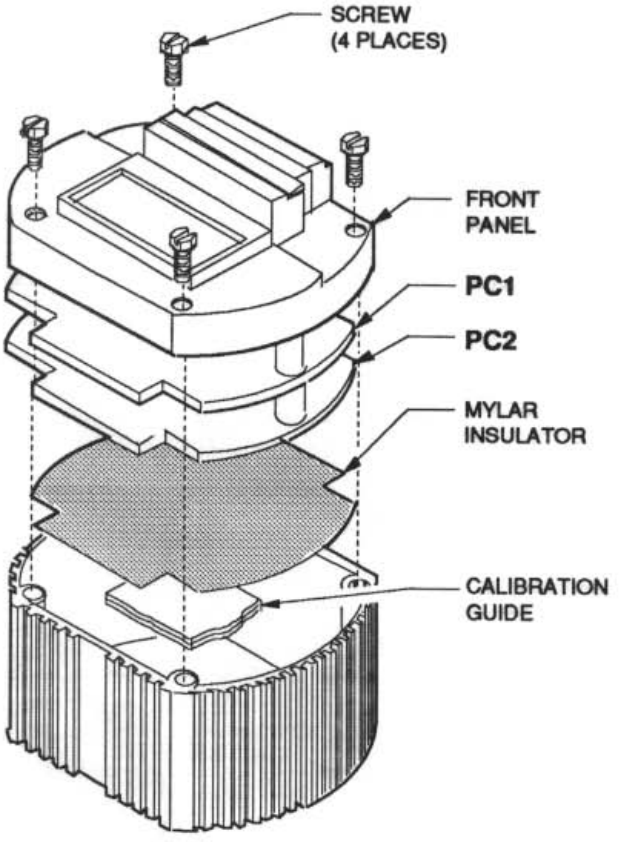


Figure 1. *HP Housing Disassembly, Accessing PC2*

Figure 2 shows the exposed view of PC2 in the DIN-style Housing. The right-side panel is secured to the case with six Phillips-head screws. Simply remove the six screws and slide the panel away to reveal the component-side of PC2.

Figure 3 shows the location of the Linearity Pot, R230, on PC2. PC2 has the same outline and board layout for both the HP- and DIN-style units. The actual LNP adjustment is described later in this section.

The zero, span, and LNP adjustments are made with multiturn pots. Each pot is equipped with a slip clutch at both ends of their travel to protect the pot from damage due to over turning. You will feel a slight slipping of the turn shaft of the pot, and may hear a faint clicking sound, when it reaches either limit of the wiper travel.

Jumper Settings

The RIX allows for field-configuration of the input span range and sensor type using removable jumpers. All jumpers are located inside each unit on PC2. Figure 3 shows the location and identification of each jumper. To access the jumpers, the HP-style RIX must be partially disassembled, and the right-side panel of the DIN-style unit will have to be removed. See figures 1 and 2.

If a particular jumper setting is required, a removable jumper is slid on to two adjacent pins. If a jumper setting for a particular location is not required, the jumper is stored by placing it on only one pin, as shown in figure 3.

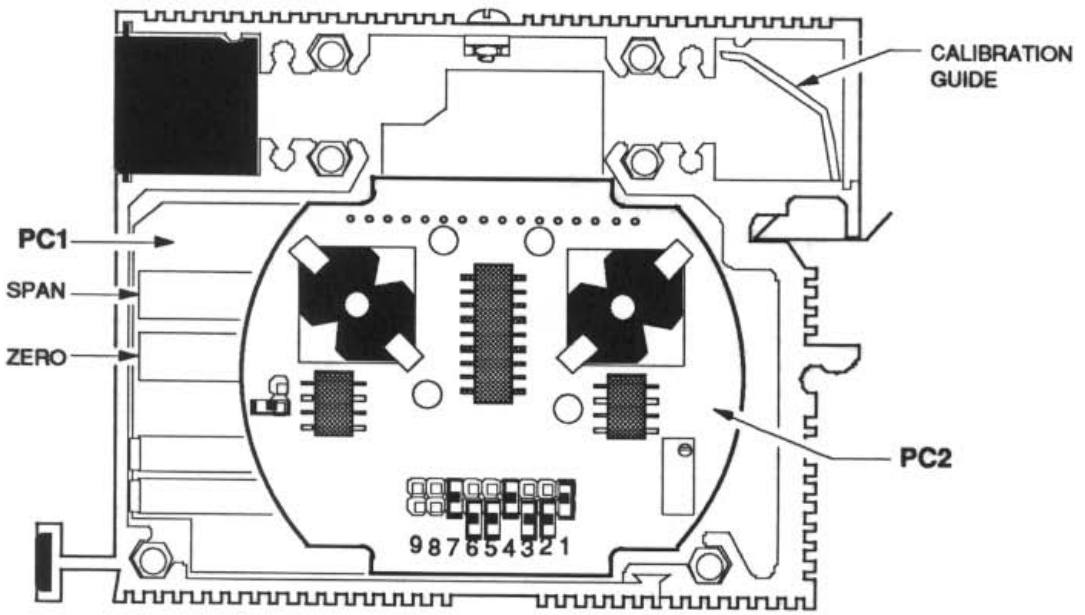


Figure 2. *DIN Housing View of PC2*

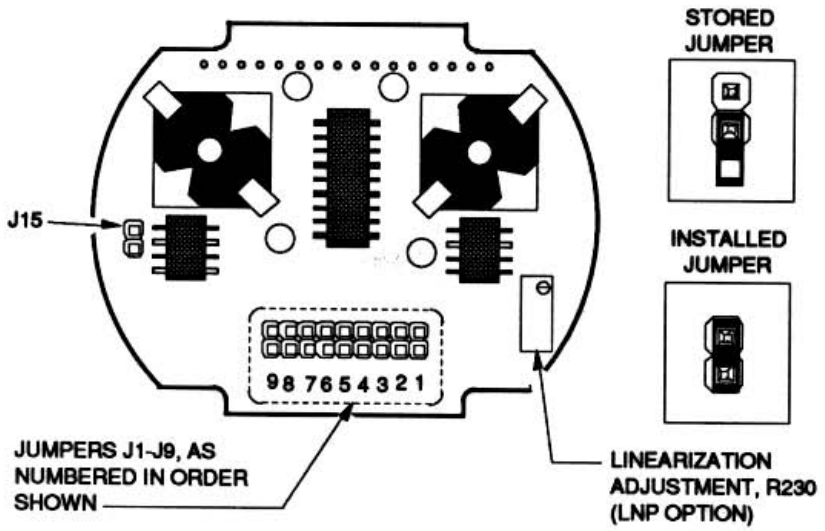


***Figure 3.** PC2 Component Locations*

Jumper settings are made at the factory prior to shipment based on user-specified configuration requirements. Before placing an RIX into service, you should verify that the jumper settings are appropriate for the intended application.

Table 2 lists the jumper settings required for the input span range desired. Table 3 lists the jumper settings required to set the input sensor configuration of the unit. Note that jumpers J1-5 and J15 are used for setting the input span range and jumpers J6-9 are used to set the input sensor type.

Calibration Setup

Table 4 lists the calibration equipment required to perform an authorized field calibration on the RIX. After the equipment is hooked up, the RIX is actually bench checked to verify that it meets the required settings or to determine if re-calibration is needed.

Figure 4 is the calibration hookup for an RIX configured for a 2-, 3-, or 4-wire RTD input. Figure 5 is the calibration hookup for an RIX configured for a differential input (DT Option).

To determine the proper resistance values to be applied to the RIX being calibrated, you must use standard resistance-temperature tables (RTD tables) for the RTD material type to be used in the actual application. You will have to convert the intended input temperature range to an appropriate resistance range to perform the calibration described here.

The output rating of the unit will determine what value load resistor to use. For 4-20 mA output, use a 250Ω resistor. For 10-50 mA output, use a 100Ω resistor. The voltmeter reading in either case will be 1-5 volts and will be proportional to the input. For example, with a 4-20 mA input unit, a 12 mA input would produce a 3 volt output. This is true because 3 volts is the midpoint of the output range as 12 mA is the midpoint of the input range.

Table 2. *Input Span Range Jumper Settings*

Input Span Range (Ω)	Jumper(s)
5 to 7	J1, J4, J15
7 to 10	J1, J4
10 to 14	J1, J5, J15
14 to 20	J1, J5
20 to 28	J2, J5, J15
28 to 40	J2, J5
40 to 57	J2, J15
57 to 80	J2
80 to 113	J3, J15
113 to 160	J3
160 to 226	J5, J15
226 to 320	J5
320 to 452	J5, J15
452 to 640	None

NOTE: If a unit with the LNP Option will not produce the required output with a particular span, use the jumpers for the next higher or lower span. If span adjustability is insufficient, remove or insert J15.

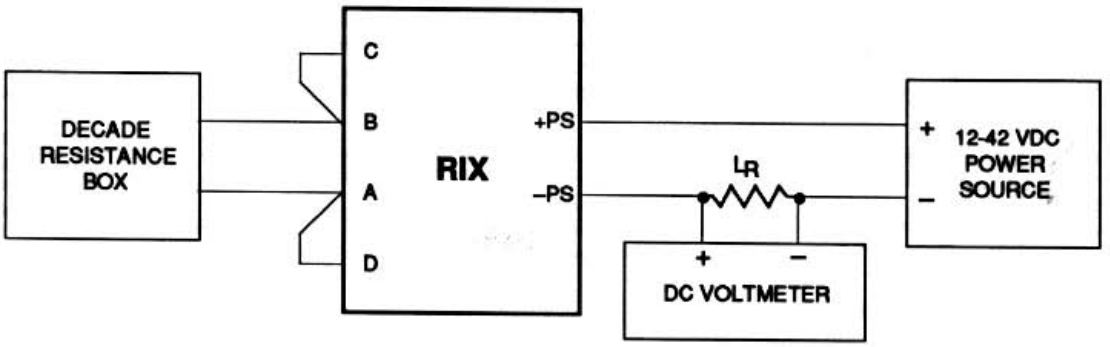
Table 3. *Sensor (RTD) Type Jumper Settings*

Sensor Type	Jumper(s)
2-wire RTD	J6, J8, J9
3-wire RTD	J6, J7
4-wire RTD	J9
Differential (DT Option)	J7

NOTE: An internal jumper (J7) is factory-set for units configured with the DT Option.

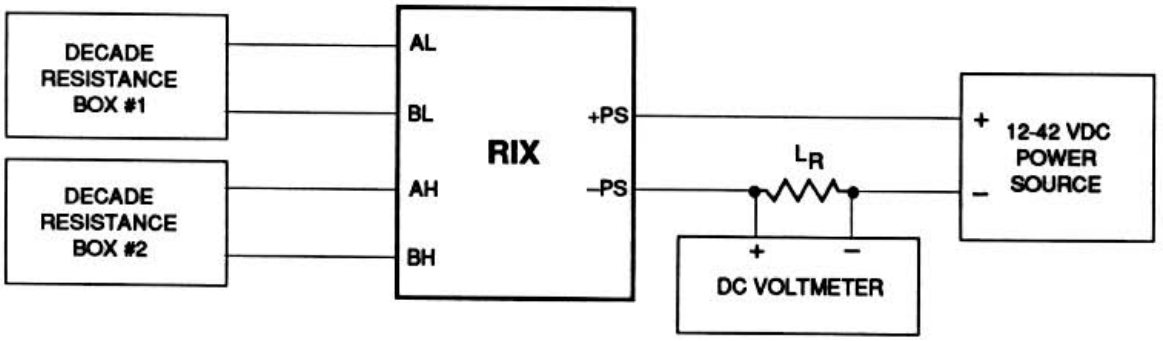
Table 4. *RIX Calibration Equipment*

Equipment	Specifications
Decade Resistance Box	Accuracy of ±0.005%, or better; capable of producing the resistance inputs required
DC Voltmeter w/Load Resistor	Voltmeter: accuracy of ±0.005%, or better; Resistor: tolerance of ±0.01%, 250Ω for 4-20 mA; 100Ω for 10-50 mA output
Power Source	12-42 Vdc
Screwdriver	Slotted-tip, head width no greater than 2.54 mm (0.1 inch)
NOTE: Units with the DT Option require two decade resistance boxes for calibration.	



NOTE: L_R = 250Ω for 4-20 mA output; 100Ω for 10-50 mA output.

Figure 4. *Basic RIX Calibration Hookup*



NOTE: L_R = 250Ω for 4-20 mA output; 100Ω for 10-50 mA output.

Figure 5. *DT Option Calibration Hookup*

Basic Calibration Procedure

The following calibration procedure is for units configured for a 2-, 3-, or 4-wire RTD input. Procedures to calibrate units with the DT and LNP Options are presented separately after this procedure.

Before beginning any calibration procedure, check the model number and jumper settings of the unit and note the input, output, and other features of the unit to ensure that you hookup and bench check the unit properly.

1. Connect RIX and calibration equipment as shown in figure 4.
2. Apply power and allow unit to warm-up for 5 minutes.
3. Using resistance-temperature tables, find minimum and maximum resistance values equivalent to desired temperature range.

NOTE
The minimum resistance value is the elevated zero (EZ) shown in the unit's model number.

4. Set decade resistance box to required minimum input setting.
5. Monitor output on voltmeter and adjust Zero pot for 1 V output reading (zero-percent output). Units with RO Option, skip to step 8.
6. Set decade resistance box to required maximum input setting.
7. Monitor output on voltmeter and adjust Span pot for 5 V output reading (100-percent output). Units with RO Option, skip to step 8.
8. For units with RO Option, adjust Zero pot for a 5 V output and with maximum input adjust Span pot for a 1 V output.
9. Repeat steps 4 through 7 until no further adjustment of Zero or Span pots is required.

NOTE
If unit is configured with the LNP Option, proceed to the LNP Calibration Procedure later in this section.

10. Basic calibration procedure is complete. Remove dc power and disconnect equipment.

DT Option Calibration Procedure

The DT Option accepts two sensor inputs and produces an output that is proportional to the difference between them. To calibrate units with this option, two input sources are required. In this procedure, two decade resistance boxes are called for.

1. Connect RIX and calibration equipment as shown in figure 5.
2. Apply power and allow to warm-up for 5 minutes.
3. Using resistance-temperature tables, find minimum and maximum resistance values equivalent for both input temperature ranges.
4. Set BOTH decade resistance boxes to unit's specified minimum input setting.
5. Monitor output with voltmeter and adjust Zero pot to set zero-percent output to 1 V.
6. Set decade resistance box #2 for maximum input resistance appropriate for your application. (Leave #1 at minimum resistance setting.)
7. Monitor output with voltmeter and adjust Span pot to set 100-percent output to 5 V.
8. Repeat steps 4 through 7 until no further adjustment of either Zero or Span pot is required. Calibration procedure is complete. Remove DC power and disconnect equipment.

LNP Option Calibration Procedure

The LNP Option allows you to improve the linearity of a 100-ohm, platinum RTD input, which products a more linear output than would otherwise be achieved.

The LNP Option provides an additional internal adjustment located on PC2. To access the linearity pot (R230), the HP-style unit must be disassembled and the right-side panel of the DIN-style unit must be removed. See figures 1 and 2 for disassembly. See figure 3 for the location of R230.

1. Perform the Basic Calibration Procedure described earlier in this section.
2. Using resistance-temperature tables, determine resistance for 25, 50, and 75 percent of required input span for your application.

   NOTE

   The input values found for the above percentages must be within the unit's input span range.

3. Calculate 25, 50, and 75 percent of unit's output rating.
4. Set decade resistance box for 50-percent input and adjust R230 for 50-percent output reading on voltmeter.
5. Apply zero- and 100-percent inputs and readjust Zero and Span pots for Zero- and 100-percent outputs, as needed.
6. Repeat steps 4 and 5 until no further adjustment is needed for any of the pots.
7. Set decade resistance box for 25- and 75-percent inputs and verify output is at 25- and 75-percent, respectively.
8. If outputs respond properly to corresponding inputs, remove power and disconnect calibration equipment. LNP Option calibration procedure is complete.
9. If outputs do not respond properly, check input and output percentage calculations and perform entire procedure again, starting with the Basic Calibration Procedure.

   NOTE

   If difficulties persist, contact your nearest Moore Industries' Customer Service Department for assistance.

Installation

Installation of the RIX is divided into two phases; physically mounting the unit and completing the electrical connections. Both phases are described separately in the following paragraphs.

We recommend that you mount the RIX in its intended operating location before completing the electrical connections.

Mounting the RIX

The RIX is available in two basic housing styles; HP- and DIN-style. Each has been designed for different mounting applications. Regardless of the housing style selected, the RIX should always be mounted in an area that is free of excessive dust, moisture, or corrosive elements. Also, you should mount the RIX in an orientation and area that aids in the dissipation of heat (refer to table 1 for operating temperature specifications).

HP Housing. The basic HP-style unit is designed to mount inside Moore Industries' explosionproof enclosures. The spring clips on the front of the unit are used to hold it in place inside the enclosure. By squeezing the spring clips inward, toward the center of the unit, the HP-style unit can be positioned in the base of the enclosure. When the spring clips are released, the RIX will be held in place by the force of the springs applied against the inside walls of the enclosure base.

The basic HP-style unit can also be factory-fitted with flange plates for mounting on relay tracks or flat surfaces. The FL Housing is a hockey-puck unit with the spring clips removed and flange plates added.

Figure 6 shows the outline dimensions for the HP-style unit with and without flange plates. The spring clips have no dimensional significance and are not shown here.

DIN-style Housing. The DIN-style unit is designed to mount directly on to G-type DIN rails (DIN EN50035). The rear of the DIN-style RIX has lips and grooves for clipping the unit on to the rail. Mounting is accomplished by placing the grooved portion of the upper lip under the upper edge of the G-rail and pivoting it downward with light to moderate pressure until it snaps into place on the bottom portion of the rail. Removal is performed by lifting upward and outward on the bottom of the unit until it snaps free from the rail.

Figure 7 shows the outline dimensions for the DIN-style RIX.

Making the Electrical Connections

All electrical connections for the RIX are made at the unit's front panel (of both housing styles). Six terminals are provided for connecting the sensor input and loop-power. Each terminal of the terminal block is clearly marked on the front panel. For 2-wire RTD's, use terminals A and B. For 3-wire RTD's, use terminals A, B, and C; terminal C is used for lead length compensation. For 4-wire RTD's, use terminals A, B, C, and D; terminals C and D are used for lead length compensation.

Units configured with the DT Option use terminals AL, BL, AH, and BH for two sensor inputs. Terminals AL and BL are for the LOW RTD input, and terminals AH and BH are for the HIGH RTD input.

The loop-power connections are made to the +PS and –PS terminals. Observe the polarity of these connections as marked.

NOTE
We recommend you use shielded pair wire for all low level signals.

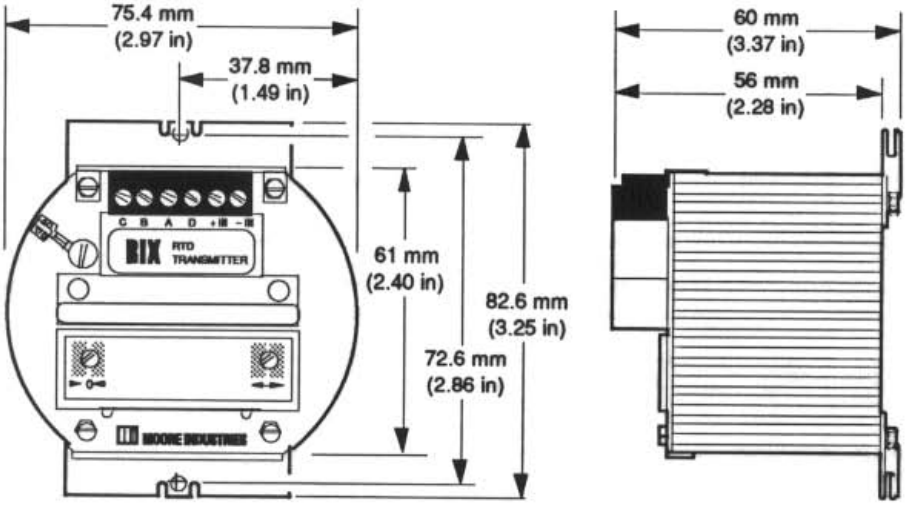


Figure 6. *HP-style Housing Outline Dimensions*

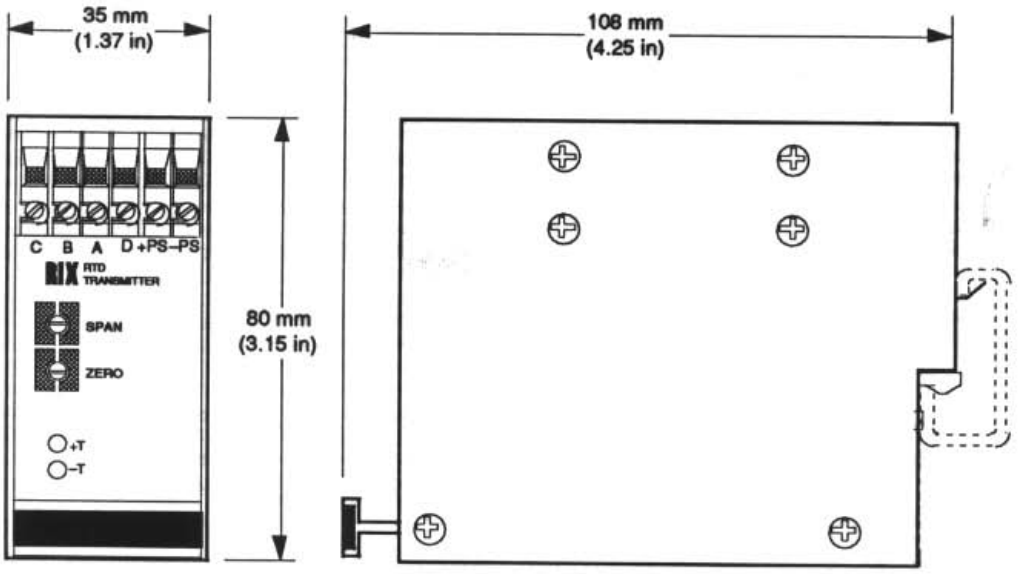


Figure 7. *DIN-style Housing Outline Dimensions*

The HP-style unit is available with a fixed or a removable terminal block. DIN-style units have a removable terminal block only. A removable terminal block allows you to disconnect the electrical wiring from the unit without unscrewing individual wires. This feature makes swapping or replacement of units much more convenient.

Electrical connections are made to individual terminals using compression screws. Both fixed and removable terminal blocks have compression screws for connecting electrical wires.

Figure 8 is the installation hookup diagram for the RIX. Included in this illustration are the various hookups for the different sensor types the RIX is designed to accept.

Operation. Once calibrated and installed, the RIX will operate unattended. Since there are no visual indicators on the unit, there is no need for extra attention to be given to the RIX once it is placed into service.

The DIN-style RIX has a unique feature on its front panel. Two telephone test jacks are provided so that the process loop the RIX is connected to can be monitored without interrupting its operation. Using a milliammeter, and observing polarities as marked, an output reading of 4-20 or 10-50 mA will be detected while the RIX is in operation.

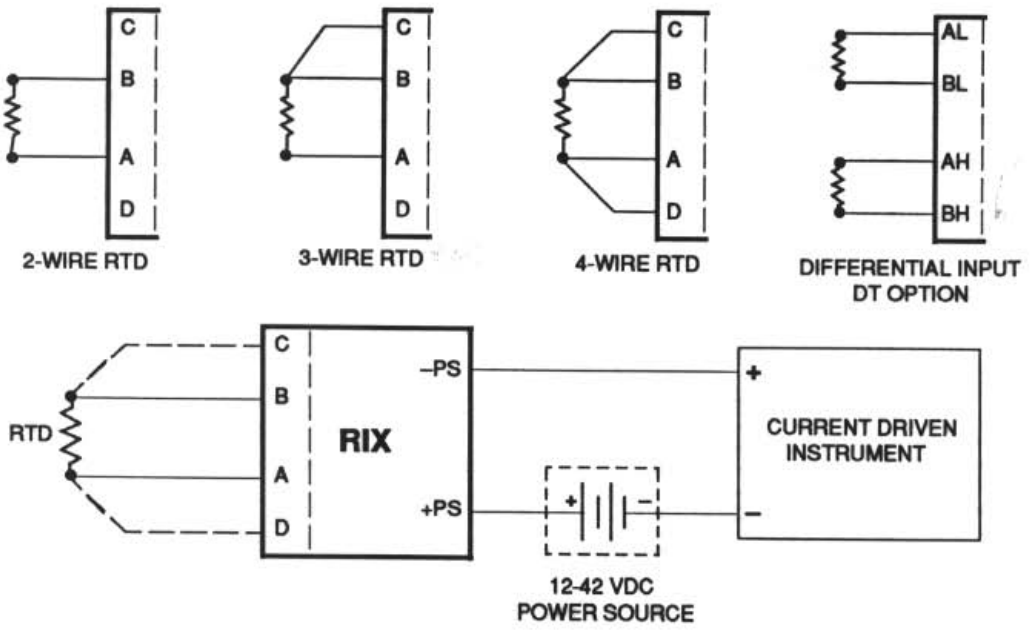


Figure 8. *RIX Installation Hookup*

Maintenance

Field maintenance for the RIX is limited to ensuring that the electrical connections are secure and free of oxidation. Periodic inspections should be made of the unit to ensure its physical condition is acceptable for contiuned use.

Once the RIX is operating, visual inspections of the unit and its immediate environment should be conducted at least once every six months.

Troubleshooting

If the RIX's operating performance becomes suspect, the unit should be removed from operation and bench checked as described in the Calibration Section of this manual.

To verify the DIN-style RIX's performance while in operation, you may monitor the output of the unit by connecting a milliammeter across the +T and –T test jacks accessible at the front panel of the unit. Using these test jacks while the unit is in operation will not interrupt the output loop current path. The reading you receive should be within the output range that the unit is configured for; as stated in the unit's model number.

CAUTION

The maximum resistance the milliammeter can introduce into the test jack circuit and still provide reliable readings is 10 Ohms.

There are no established field troubleshooting procedures for the RIX. But, should the performance of the RIX be questioned, and you've performed a bench check and re-calibration, you may call the nearest Moore Industries' Customer Service Department for further assistance.

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.

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