MOORE INDUSTRIES

RDA

Resistance Bulb Alarm
DIN-style

USER'S MANUAL

July 1990

No. 193-709-00 B

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RDA

Introduction

Moore Industries' RDA is a RTD alarm packaged in a DIN-style housing. The RDA accepts input from any 2-, 3-, or 4-wire RTD and provides either a single or dual contact-closure output when an alarm condition exists.

This manual contains descriptive, calibration, installation, and maintenance information for the RDA. The Notes and Cautions contained in this manual are provided to avoid minor inconveniences and/or equipment damage while calibrating or installing the RDA.

Description

The RDA is a 4-wire alarm unit in a plastic, DIN-style housing. The unit features an LCD display in 0.25-inch black numerals over a reflective background. There are 3-1/2 active digits with a decimal point and minus sign to show ranges -5.0 percent to 105.0 percent. The display shows the trip point value or input value as a percent of span. These values are switch-selectable by a rotary switch on the front panel of the unit.

LEDs on the front panel indicate that the respective relay is either energized or de-energized.

Trip point controls allow the alarm to be set to trip at any point over the input range. Trip point potentiometers are provided to set the point at which each of the alarm relays changes state. With a fail-safe high alarm, the relay is de-energized when the input signal is above the trip point. The relay is de-energized when the input signal is below the trip point for a fail-safe low alarm. See figure 1.

The RDA can have relay outputs or opto-isolated outputs. The opto-isolated outputs are open-collector transistor switches. These switches may be used to control solid-state relays which in turn may control heaters, pumps, and other power equipment. The standard outputs for single alarm units are double-pole, double-throw relays; dual alarm units have single-pole, double-throw relays.

Jumpers on a printed circuit board (PCB) allow each channel to be set to a high or a low alarm and allow the input to be configured for 2-, 3-, or 4-wire RTDs. The RDA has an optional built-in intrinsic safety circuit, which allows inputs to be accepted directly from primary elements in hazardous locations without external barriers in the process loop.

Standard features include: complete isolation of the input, output, and power terminals, which prevents false signals due to ground loop currents; inherent RFI protection; and reduced power supply requirements over industry-standard alarm modules.

Complete equipment specifications for the RDA are listed in table 1.

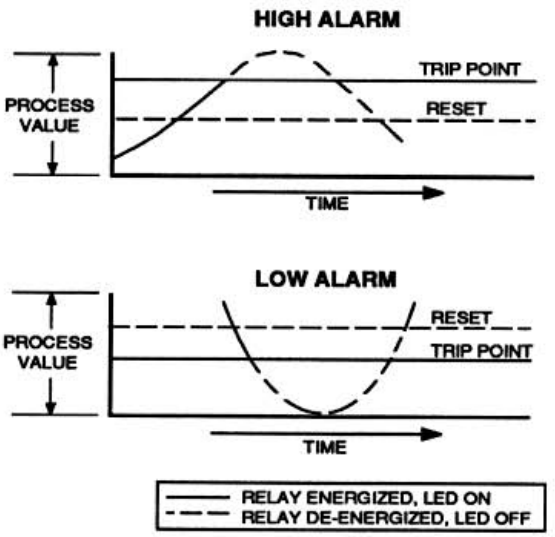


Figure 1. *Normal Fail-Safe High-Alarm and Low-Alarm Configuration*

Table 1. RDA Equipment Specifications

Characteristic	Specification
Input	Specify type of RTD and input span in ohms change with a value for elevated zero **RTD Type: 2W** 2-wire **3W** 3-wire **4W** 4-wire **Input Spans: 5** 5 ohms change **10** 10 ohms change **25** 25 ohms change **50** 50 ohms change **100** 100 ohms change **200** 200 ohms change **400** 400 ohms change **Elevated Zero:** 100 Ω (0°C) and 93.03 Ω (0°F) standard **RTD Excitation:** 1 mA (max.)
Output	The standard output is a DPDT relay for single alarm and two SPDT relays for dual alarms **Relay Contact Ratings:** Relay contacts are rated 5 A @117 Vac or 28 Vdc; or 2 A @ 240 Vac (all non-inductive loads, 50/60 Hz)
Power	**24DC:** Accepts 18-30 Vdc (1.0 -1.5 W, nominal)
Front Panel Adjustments	**Trip Points:** Multi-turn front panel potentiometers adjust over a range of -5% to 105% of span, typical **Input/Trip Point Viewing:** Rotary switch allows selection of viewing input, Trip A or Trip B on front panel LCD
Internal Adjustments	**Dead Band:** Adjustable dead band 1-20% of span, nominal (AD option). **Zero:** Adjustable to ±20% of span **Span:** With full-scale input, output is adjustable to 100%, ±20%
Indicators	**Display:** 3-1/2 digit LCD displays either input, Trip A, or Trip B as determined by rotary switch. Display indicates from -5.0% to 105% of input span and is linear with respect to the input signal **Trip Point:** LED on front panel indicates alarm status for each trip point ("ON" LED indicates energized relay) **Display Accuracy:** ±0.1% of input span ±1 count to include repeatability, hysteresis, and adjustment resolution **Relay Status:** LEDs light when relays are energized **Alarm Status:** Jumper-selectable for high/low status
Performance	**Repeatability:** Trip point repeats within ±0.1% of input span **Dead Band:** 1% of input span, standard **Alarm Response:** 50 ms, standard (Input signal must be beyond trip point continuously for 50 ms before an alarm state is output.) **Signal Response:** -3 dB @ 5 Hz, typical (low pass) **Line Voltage Effect:** ±0.005% / 1% line change
NOTE: Refer to Installation Section for physical dimensions.	

Table 1. RDA Equipment Specifications (Continued)

Characteristic	Specification
Environmental Conditions	**Ambient Operating Temperature:** - 18 to 65°C (0 to 150°F) **Effect on Amplifier:** 0.018% of span/°C
Isolation	500 Vac, input to output to power
RFI/EMI Effect	With field strengths of 10 V per meter, at frequencies of 20-500 MHz, unit will not go into alarm status unless process variable is within ±1.0% of trip point.
NOTE: Refer to Installation Section for physical dimensions.	

RDA Options

In addition to standard features, the RDA is available with the following options:

AD Option. Adjustable Dead Band -- 1-20 percent, nominal; available up to 100 percent.

AR Option. Alarm Response Time Delay -- specify 1-30 seconds (factory set).

BIS Option. Unit is BASEEFA-approved. Intrinsically safe for direct connections to inputs from hazardous locations; consult factory on availability.

DPSTNO Option. DPST normally open relays (dual alarms).

DPSTNC Option. DPST normally closed relays (dual alarms).

DPSTNONC Option. DPST with one normally open and one normally closed contact per relay (dual alarms).

EZ Option. Elevated zero (20 to 200 ohms).

GR Option. Adapter for mounting on a DIN (50035-G32) G-rail.

HS Option. Hermetically sealed relays (required for U.S. Division 2) rated at 3 A at 28 Vdc non-inductive or 1 A @ 120 Vac non-inductive, 50/60 Hz.

MR Option. Manual Reset -- terminals provided; pushbuttons must be supplied by the user.

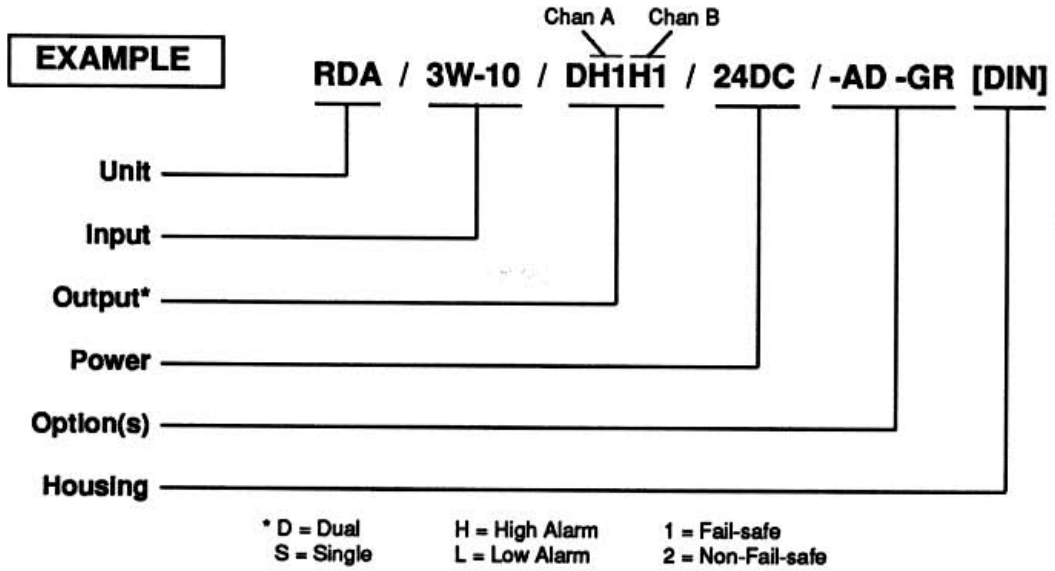
TSO Option. Transistor switch (opto-isolated) to drive external circuits. (Ratings: 60 Vdc maximum, and 60 mA dc maximum -- used in lieu of relay outputs.)

For information regarding other available options, contact Moore Industries at 1-800-999-2900.

Serial Number. A complete history is kept on every Moore Industries unit. This information is keyed to the serial number. Whenever service data is required on a unit, it is necessary to provide the factory with the serial number. The serial number is located on a label affixed to the rear of the unit.

Model Number. Moore Industries' model numbers identify the type of instrument, functional characteristics, operating parameters, any options ordered, and housing type of the unit. If all accompanying documentation of a unit is missing, the model number can be used to obtain technical information. The model number for the RDA is located on the same label as the serial number, which is affixed to the rear of the unit.

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



Calibration

This section contains information necessary to adjust and calibrate the unit. Each unit is adjusted and checked at the factory for proper performance before shipment.

After the RDA is unpacked, general operation level checks of the individual unit are recommended. Generally, these checks, which are specified in the Calibration Procedures paragraph, require little or no adjustment.

Adjustments

The following adjustments consist of a multi-turn potentiometer that is adjustable with a slotted screwdriver. The type of potentiometer used with these adjustments requires 15 turns of the shaft to move the wiper from one end of its range to the other.

All potentiometers are equipped with a slip clutch at each end to prevent damage if the adjustment is turned beyond the wiper stop. Usually a slight change can be sensed when the clutch is at the end of a range (i.e., slipping). However, if this change is not sensed, either end can be reached by turning the shaft 15 turns in the desired direction.

Trip Point. The RDA has trip point potentiometers located on the front panel of the unit. For single alarm units, the potentiometer is labeled TRIP A; for dual alarm units, the potentiometers are labeled TRIP A and TRIP B. A trip point value is displayed in percent of span when the selector switch is in the trip position.

Selector Switch. A rotary switch on the front panel selects input or trip point values shown on the LCD.

Zero and Span. The Zero (R540) and Span (R507) potentiometers adjust the input range to zero percent and 100 percent. They are located inside the unit. To adjust these potentiometers, partial disassembly of the unit is required. To access the potentiometers, use a screwdriver to release the tabs on both sides of the unit and pull the front panel straight out. Attached to the inside of the front panel are five PCBs. The Zero and Span potentiometers are located on PC5, one of the side PCBs. See figure 2.

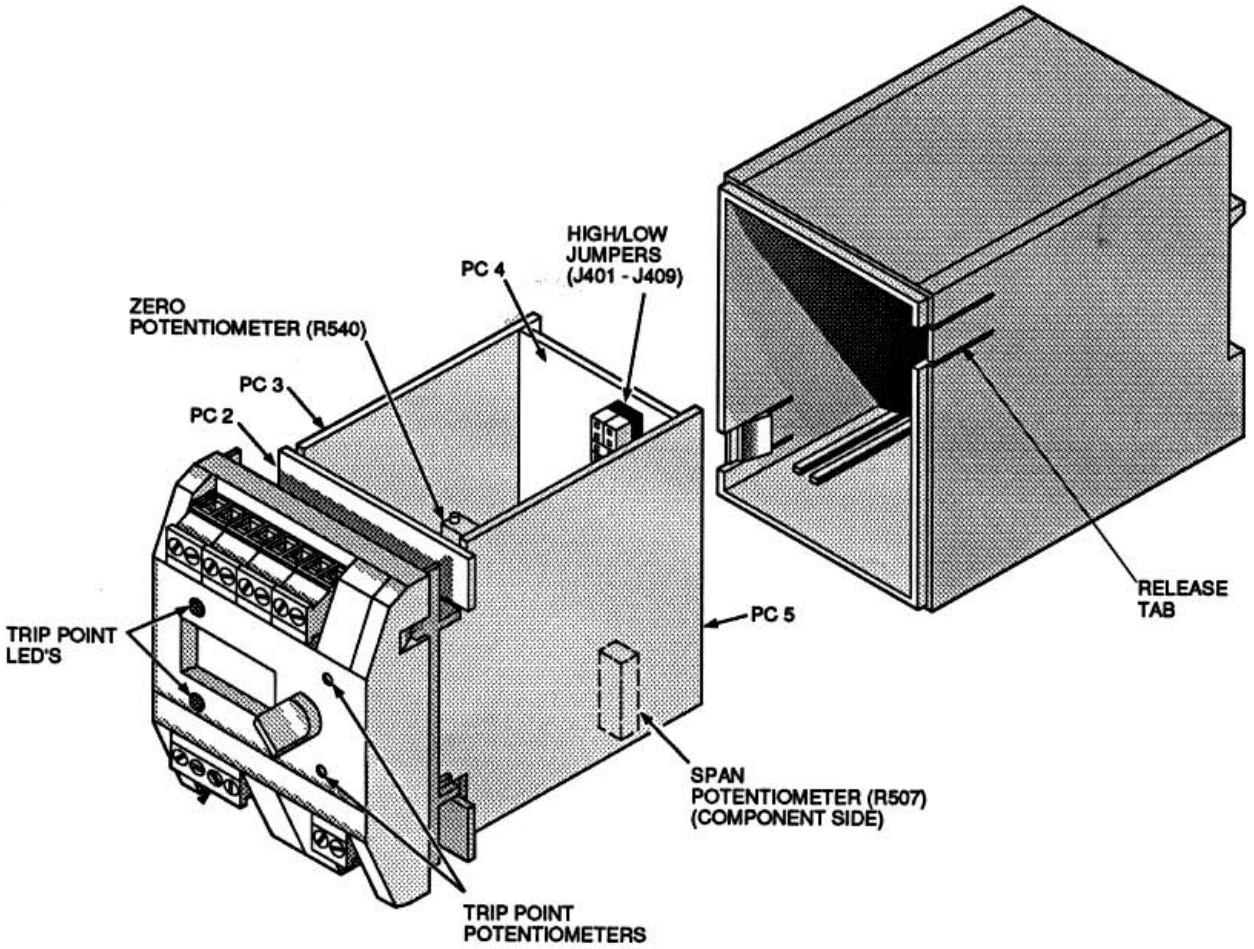


Figure 2. *Disassembly Diagram*

Dead Band. For units with the Adjustable Dead Band (AD) option, adjustment potentiometers are provided inside the unit. R424 is for single alarm units, and R424 and R425 are for dual alarm units. To adjust these potentiometers, partial disassembly of the unit is required. To access the potentiometers, use a screwdriver to release the tabs on both sides of the unit and pull the front panel straight out. Attached to the inside of the front panel are five PCBs. The dead band potentiometers are located on PC4. See figures 2 and 3.

Refer to the Calibration Procedures paragraph for step-by-step procedures to adjust the potentiometers.

Indicators

LEDs associated with each output relay are included on the front panel of the unit as a standard feature. These LEDs light when a relay is energized (see figure 1). LEDs are labeled A and B on dual alarm units, and A on single alarm units.

NOTE

Fail-safe considerations are such that the relay energizes in the normal condition and de-energizes either upon alarm or power loss to the unit. LEDs illuminate when relays are energized.

Jumpers

Solderless jumpers are used to set high or low alarms and to configure the input for 2-, 3-, or 4-wire RTDs. To verify or change jumper settings in the field, partial disassembly of the unit is required. To access the jumpers, use a screwdriver to release the tabs on the sides of the housing and slide the front panel out. Attached to the inside of the front panel are five PCBs. The alarm status jumpers are located on PC4, and the input configuration jumpers are located adjacent to the Span potentiometer on PC5. (See figures 2 and 3 and refer to table 2.)

Table 2. *Alarm Status*

Status	Install Jumpers
A Low	J402, J404
A High	J401, J403
B Low	J407, J409
B High	J406, J408

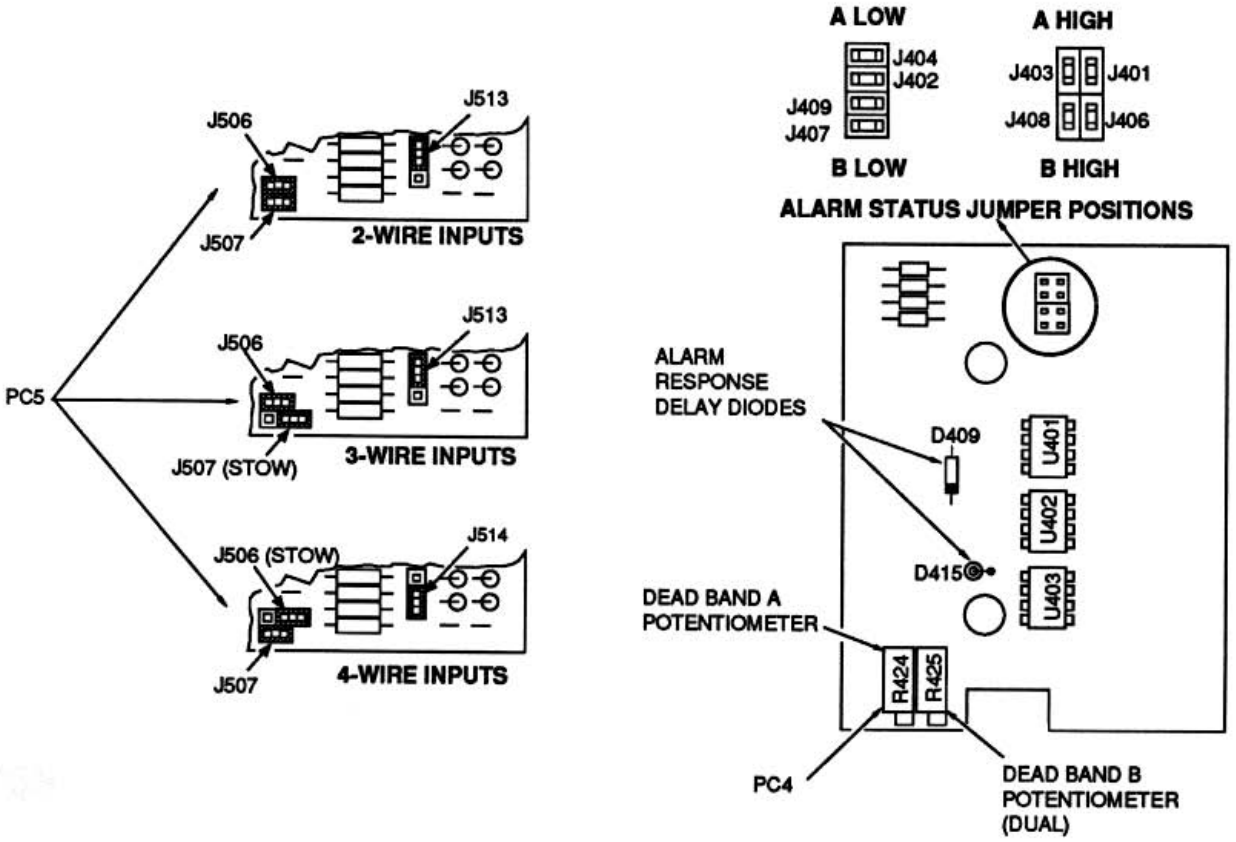


Figure 3. *Jumper and Component Location Diagram*

Equipment Requirements

Calibration equipment is listed in table 3. This equipment is not supplied with the unit and must be provided by the user.

Calibration Setup

Off-line calibration for all RDA units generally requires the same test equipment setup. Separate configurations are shown for clarity. The calibration setups for single alarm units are shown in figures 4 and 5. The calibration setups for dual alarm units are shown in figures 6 and 7.

There are two options shown in the calibration setup diagrams. If the unit has relay outputs, an ohmmeter is used to monitor output states. If the unit has opto-isolated transistor switch outputs, a dc voltmeter and load resistor are used.

When connecting this equipment to the RDA, a slotted screwdriver of the appropriate size should be used. Wire terminations are clearly marked on the RDA.

Table 3. *Calibration Equipment*

Equipment	Description
Screwdriver (slotted)	Head width no greater than 2.54 mm (0.1 inch).
Precision Decade Resistance Box	Must be capable of producing signal ranges defined by input level requirements.
Ohmmeter (optional)	Accurate to within 1%.
Power Supply	24 Vdc @ 1 A.

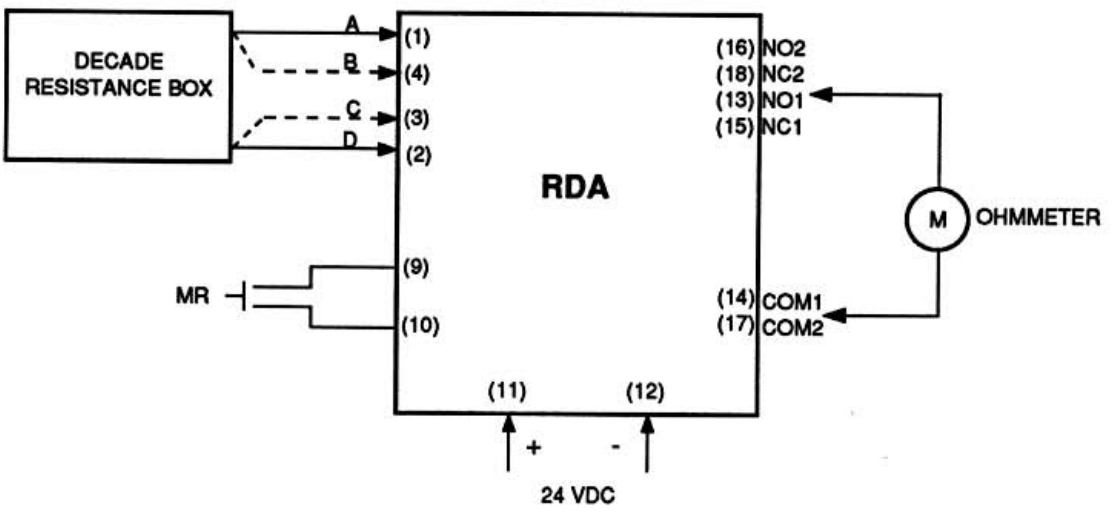


Figure 4. *Calibration Setup for Single Alarm Units with Relay Outputs*

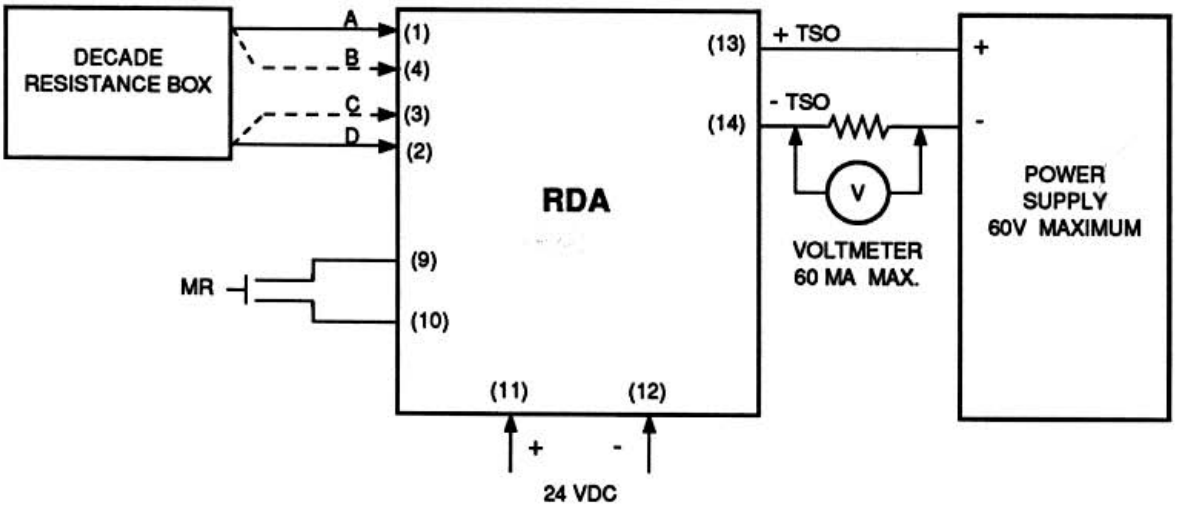


Figure 5. *Calibration Setup for Single Alarm Units with Opto-isolated Outputs*

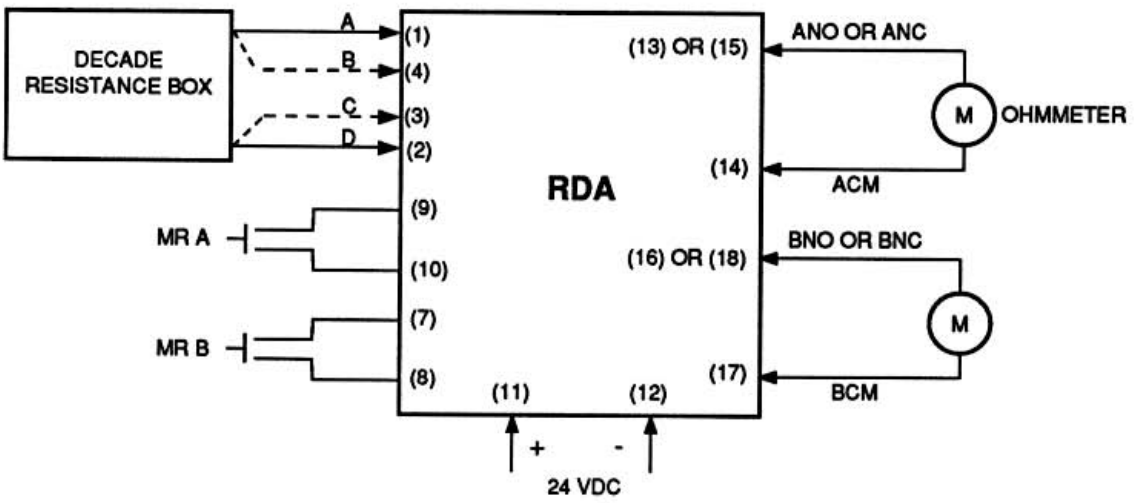


Figure 6. *Calibration Setup for Dual Alarm Units with Relay Outputs (SPDT)*

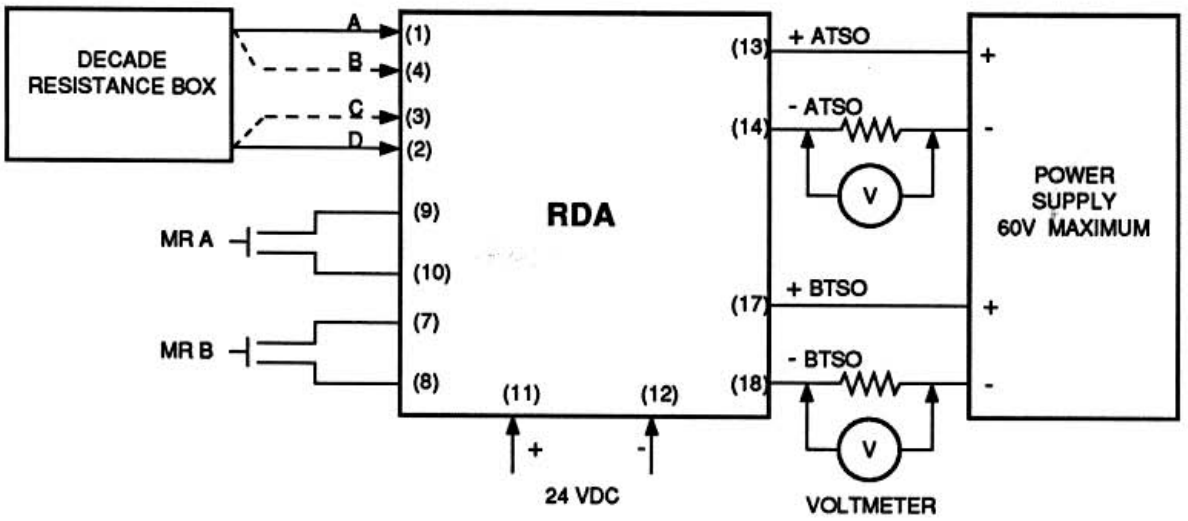


***Figure 7.** Calibration Setup for Dual Alarm Units with Opto-isolated Outputs*

Calibration Procedures

Calibration consists of simulating an input signal to the RDA, monitoring the input value on the LCD, and adjusting the controls to obtain the desired value. Trip point settings are also set and verified. The RDA has an LCD, which shows the trip point value and input value as a percent of span.

To calibrate an RDA, the unit must be partially disassembled. Refer to the Adjustments paragraph and see figures 2 and 3.

1. Verify that jumpers J401 through J409, located on PC4, are set for a high or low alarm, as required. Also, verify that jumpers J506, J507, J513, and J514, located on PC5, are set for 2-, 3-, or 4-wire RTD input, as needed. Refer to table 2 and see figure 3.
2. Connect decade resistance box to input of RDA. Connect an 18- to 30-Vdc power source. See figures 4 through 7. (See figure 9 in the Installation Section for 2-, 3-, and 4-wire RTD hookups.)
3. Set selector switch to INPUT.
4. Apply power to unit and apply input resistance equal to zero percent of input range.
5. Ensure LCD displays 00.0 (percent).
6. If LCD does not display 00.0, adjust Zero potentiometer (R540) located on PC5 for 00.0 (percent). See figure 2.

CAUTION

To avoid damaging the potentiometers, use a screwdriver with a head no wider than 2.54 mm (0.1 inch) to adjust Zero and Span potentiometers.

7. Adjust input resistance to 100 percent of resistance range.
8. Ensure LCD displays 100.0 (percent).
9. If LCD does not read 100.0, adjust Span potentiometer (R507) located on PC5 for 100.0. See figure 2.
10. Repeat steps 4 through 6 to verify zero-percent display.
11. Apply 0, 25, 50, and 75 percent resistance.

12. Observe LCD at each setting in step 11 and verify that reading is linear for resistance range selected.

13. Set selector switch on front panel to TRIP A.

14. Turn TRIP A potentiometer on front panel to desired trip point value in percent of span.

NOTE
The LCD display shows readings in percent and tenths of percent so trip settings are very accurate.

15. For dual alarm units, repeat steps 13 and 14 for TRIP B potentiometer.

Calibrating a Unit with the AD Option

The Adjustable Dead Band (AD) option provides an adjustable 1-20 percent dead band from the trip point (available to 100 percent). When the controlled variable is within this range, no control action takes place.

1. Turn dead band A potentiometer (R424) fully clockwise. See figure 3.

2. Turn TRIP A potentiometer to mid-range.

3. Apply power to unit.

4. Apply an input resistance equal to value of TRIP A (in percent).

5. Slowly turn TRIP A potentiometer until unit alarms.

6. Increase or decrease the input resistance by an amount equal to percent of desired dead band. Slowly turn dead band A potentiometer counter-clockwise until alarm resets.

7. Re-check trip and reset action of alarm.

8. For dual alarm units, repeat steps 1 through 7 for TRIP B potentiometer and dead band B potentiometer (R425).

Calibrating a Unit with the AR Option

CAUTION
Take extreme care in shorting diodes, as damage may occur if diodes are accidentally shorted to other parts.

The Alarm Response Delay (AR) option introduces a time delay in the unit. This makes calibration difficult because the user must wait for the delay time to see if the trip points have been tripped. The delay may be defeated by short-circuiting diodes D409 and/or D415. See figure 3.

Calibrating a Unit with the MR Option

If the Manual Reset (MR) option is present on your unit, the dead band circuit is not available. Verify that the unit latches upon alarm and does not reset for any input level within the input rage.

Verify that the unit resets by changing the input signal to a non-alarm level and then shorting the MR terminals together with an external, normally open (NO) momentary switch.

Installation

This section contains physical mounting dimensions, installation procedures, electrical connections, and operation. The units are designed to operate in free air at a high ambient temperature. However, it is recommended that if a large number of units are mounted together on a rail or in a cabinet, attention should be given to providing adequate access to the screwdriver slot underneath the unit, which permits releasing the unit from the rail (see figure 8). In addition, input and output values should be checked, on-site, before the unit is placed into service.

Mounting

The RDA is enclosed in a thermoplastic, DIN-style rail-mount housing with removable terminal blocks; this housing allows for high-density control-room or field-mount installation. Approximately 1.25 inches of clearance should be maintained above and below the unit for ease of installation and removal. Figure 8 shows the mounting dimensions of the unit.

To mount or remove the housing from the top hat-rail, insert a slotted screwdriver into the space provided underneath the unit as shown in figure 8. Use a lever-type action to release the catch.

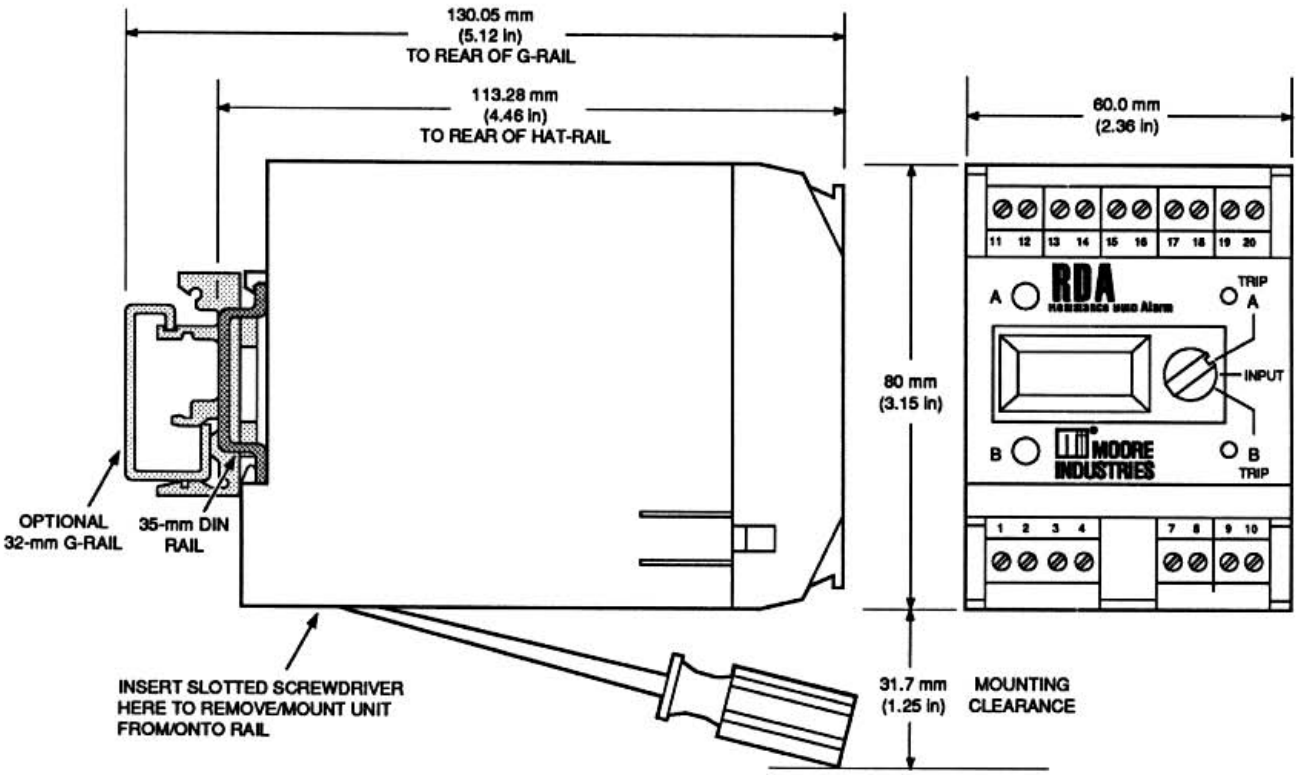


Figure 8. *RDA Outline Mounting Dimensions*

Electrical Connections

All electrical connections to the RDA are made to the terminals on the front of the unit. The terminals are clearly marked on the unit. Table 4 lists terminal designations for the RDA. Special wire or cable is not required for signal connections to the unit (the terminals are designed for 16 AWG, maximum).

Figure 9 is a typical hookup diagram for a unit with relay outputs. Figure 10 is a typical hookup diagram for a unit with opto-isolated outputs and a load resistor. Figure 11 is a typical hookup diagram for a unit with opto-isolated outputs and a relay coil. Note that a diode must be put in parallel with the relay coil as shown in figure 11 to prevent damaging the transistor. The diode "clamps" the applicable voltage in the event of a coil-induced switching transient. The RDA operates from an 18- to 30-Vdc power source.

Operation

Once the RDA has been calibrated and installed, it may be left unattended. The only controls for the unit are the trip point potentiometers, which after initial adjustment require no further attention. The LEDs on the front of the unit indicate when a relay is energized. Because the circuit uses highly reliable solid-state components with no moving parts, the RDA operates maintenance-free for extended periods.

The RDA may become warm during operation, especially when a large number of units are mounted together on a rail or in a cabinet, and the ambient temperature is above normal. This is perfectly acceptable and should not be cause for concern, unless a malfunction is also observed.

A periodic check of terminal connections is recommended every six months to ensure continued dependability of service.

Table 4. *Terminal Designations*

Configuration	Terminals																	
	1	2	3	4	5 and 6	7*	8*	9*	10*	11	12	13	14	15	16	17	18	19	20
Single/Standard	A	D	C	B	NOT USED			MR	MR	DC	DCC	NO1	CM1	NC1	NO2	CM2	NC2		
Single/Switch Out	A	D	C	B	NOT USED			MR	MR	DC	DCC	+TSO	-TSO						
Dual/Standard	A	D	C	B	NOT USED	BMR	BMR	AMR	AMR	DC	DCC	ANO	ACM	ANC	BNO	BCM	BNC		
Dual/Switch Out	A	D	C	B	NOT USED	BMR	BMR	AMR	AMR	DC	DCC	+ATSO	-ATSO			+BTSO	-BTSO		
Dual/DPST/NO	A	D	C	B	NOT USED	BMR	BMR	AMR	AMR	DC	DCC	ANO1	ACM1	ANO2	ACM2	BNO1	BCM1	BNO2	BCM2
Dual/DPST/NC	A	D	C	B	NOT USED	BMR	BMR	AMR	AMR	DC	DCC	ANC1	ACM1	ANC2	ACM2	BNC1	BCM1	BNC2	BCM2
Dual/DPST/NONC	A	D	C	B	NOT USED	BMR	BMR	AMR	AMR	DC	DCC	ANO1	ACM1	ANC2	ACM2	BNO1	BCM1	BNC2	BCM2

*Special wiring rules apply for I.S.

Key to Abbreviations

1 (suffix)	Contact 1	**DC**	+DC power input
2 (suffix)	Contact 2	**A, B, C, D**	RTD inputs
A (prefix)	Channel A, dual alarm	**MR**	Manual reset
B (prefix)	Channel B, dual alarm	**NC**	Relay contact, normally closed
CM	Common	**NO**	Relay contact, normally open
DCC	-DC power input	**TSO**	Transistor switch output

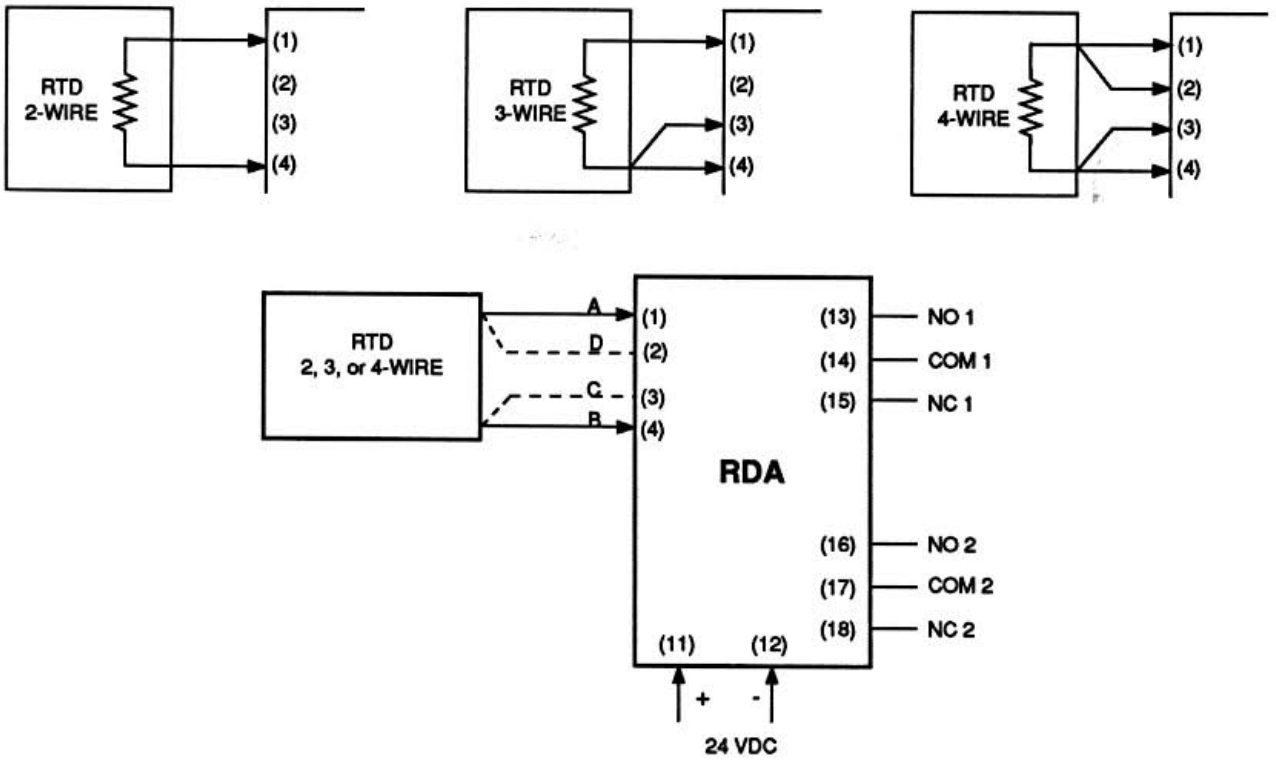


Figure 9. *Hookup Diagram for 2-, 3-, or 4-Wire RDA with Relay Outputs*

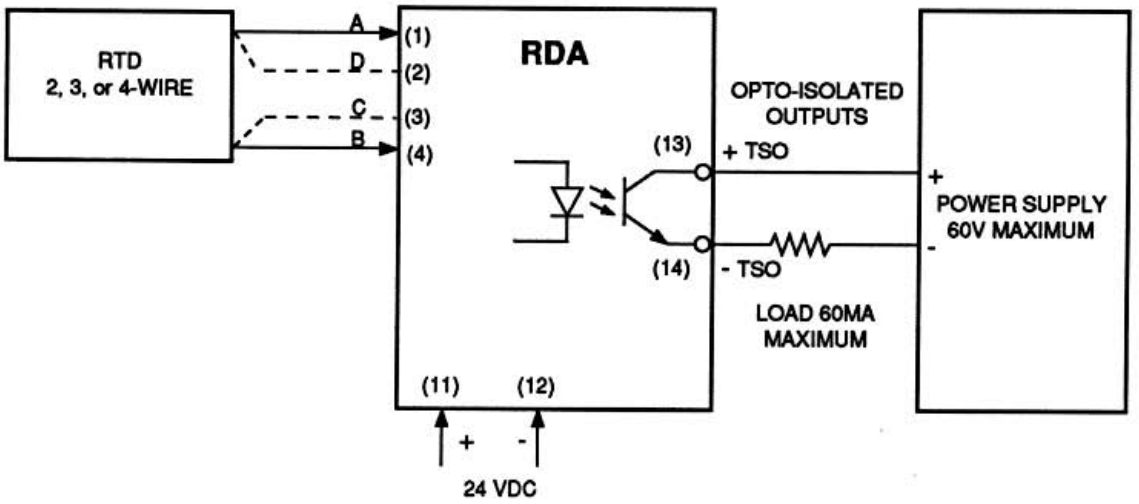


Figure 10. *Hookup Diagram for Opto-isolated Outputs and Load Resistor*

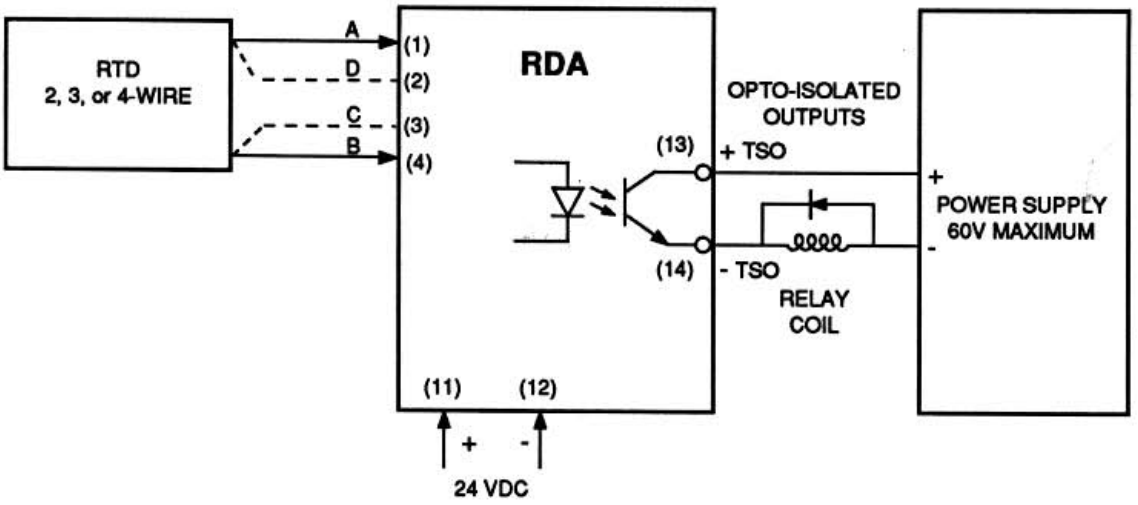


Figure 11. *Hookup Diagram for Opto-isolated Outputs and Relay Coil*

Maintenance

Maintenance of the RDA is limited to keeping the terminals clean and tight, and ensuring there is adequate ventilation or heat dissipation for the unit. It is recommended that the user check the terminals every six months.

Troubleshooting

Troubleshooting the RDA involves determining whether the unit is functioning abnormally. The calibration equipment listed in table 3 can be used to verify that the RDA outputs are within specified limits. Refer to table 1. It is recommended that any unit found performing below specifications be returned to the factory for service in accordance with the instructions on the back cover of this manual.

If a problem is suspected with the RDA, it is suggested that the following checklist be reviewed as a preliminary step:

1. Verify that all electrical connections are clean and tight.
2. Verify that measuring instrument used for input voltage or current is of the proper range and accuracy.
3. Verify that output circuit is electrically isolated from input circuit.

For additional technical assistance, contact Moore Industries' Customer Service Department by calling toll free 1-800-999-2900.

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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