USERS' MANUAL

RDD/TDD

RTD/Thermocouple
Digital Panel Meters

August 1993

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Illustrations & Tables

Description

This is the users' manual for Moore Industries' RTD Digital Display (RDD) and Thermocouple Digital Display (TDD), the temperature display members of Moore Industries' family of Programmable Digital Panel Meters.

Both are panel-mounted, 1/8-DIN meters housed in impact-resistant, thermoplastic cases. They feature easy-to-use, front panel controls and large, luminescent display characters. Each comes standard with independent high and low alarm indicators, an input sensor burnout warning, and a "Display Hold" function that allows the user to manually "freeze" readout processing.

The RDD is a 4-digit panel meter that accepts input from standard, 2-, 3-, and 4-wire, 100Ω platinum RTD's. It is available in versions factory-configured for either a 0.00385/°C (PT1) or 0.00392/°C coefficient (PT1A) temperature coefficient. Its digital display is microprocessor controlled; it automatically converts input to readouts of °C or °F according to user preference. It displays resistance inputs whose temperature equivalents range from -200.00 °C (-340.0°F) to +850.0 °C (+1562 °F).

The TDD is also a 4-digit display. It is available in versions that accept ISA standard thermocouple (T/C) input types E, J, K, or T. Its display is set at the factory for readouts in the appropriate range for the input type (T/C) selected, but its circuitry provides a user-selected offset capability for application-specific readouts, if desired. As with the RDD, the TDD's internal microprocessor automatically converts input to °F or °C readouts, according to user preference.

All operating parameter information is stored in non-volatile internal memory. Alarm and hysterisis settings, display unit selection (°C or °F), readout offset (TDD only), and ice point reference (RDD only) are kept safe from power outages and surges, and protected from accidental changes by a security access code.

AutoCalibration continually verifies meter readout by comparing it to a stable, internal electronic constant. The display readout is updated twice each second, with Autocal corrections every 4 seconds.

Output Options provide additional operational flexibility. Secondary analog output (4-20mA or 0-10V), Binary Coded Decimal output (BCD), or dual 5 amp relays for contact closure outputs are available.

Specifications

Table 1, on the following page, summarizes the specifications for both the RDD and the TDD panel meters.

Options

- ***AO Option – Analog Output*** provides an additional, fully adjustable, internal transmitter, factory-calibrated for 4-20mA or 0-10V output, proportional to input. Unit disassembly is not required for calibration or adjustment.
- ***C Option – Contact Closure Output*** equips units with dual, Form C relays, rated 5A @ 125Vac maximum, 0.6A @ 11Vdc, 0.1A maximum @ 50Vdc inductive. This option works with the standard unit's indication of alarms. Trip points are tied to display settings stored in unit memory.
- ***BCD Option – Binary Coded Decimal Output*** enables unit to be used with third-party software. Provides pseudo tri-state parallel output with 1500V peak isolation from the signal input.
- ***N4 Option – NEMA 4-Rated Front Panel*** is encased in a flexible, clear boot for splash protection.
- ***RD Option – Red Display*** provides compatibility with existing meters and indicators. The standard display is green.

Data Tracking & Orders for Additional Panel Meters—Unit Model and Serial Numbers

Moore Industries uses a system of model and serial numbers to keep track of all manufacturing and testing data associated with each unit we sell or service.

If you ever need additional units, "construct" a model number from the bold-face selections in the Ordering Specifications section of Table 1. A model number example is provided at the table's end.

If service assistance is ever required for one of your units, make a note of the unit model number before contacting the factory. The model and serial number is printed on an adhesive tag affixed to the top panel of each unit.

RDD/TDD

Specifications

Display **Range:** 4 1/2 digits; Refer to Ordering Specifications, below, for unit operating ranges; In some alarm conditions, display alternates between alarm message and actual input
Type: 7-segment, vacuum fluorescent readout; green (standard) or red; characters 13 mm (0.5 in) high
Indicators: "OPEn" when input sensor is burned out; "HI" and "LO" messages when input trips alarm settings

Performance **RDD Accuracy** (± least significant displayed digit @ 23°C, 0.1° resolution, C or F): 0.4°C, 0.8°F (max lead wire resistance 20Ω)
TDD Accuracy (±0.5% of least significant displayed digit @ 23°C, 1.0° resolution, C or F): E, J, or T T/C versions, ±1.0°C (1.3°F); K T/C version, ±1.0°C (1.7°F); S T/C version, ±2.0°C (3.0°F)
Ambient Temperature Effect: ±75 ppm of reading per °C change
Response Time: < 750 msec for 25% step change
Display Update: Integrating differential A/D converter; 2/sec, nominal

Performance (continued) **Overload Protection:** 150V peak
Common Mode Rejection Ratio: 60dB @ 50/60 Hz, input-to-power line, 120dB @ DC
Common Mode Voltage: ±2500V peak, input-to-line power

Ratings **Ambient Temperature Operating Range:** 0°C to +50°C (-32°F to +122°F)
Ambient Temperature Storage Range: -40°C to +85°C (-40°F to +185°F)
Ambient Relative Humidity Operating Range: 20 to 80%, non-condensing

Case NEMA 12 splash-proof, high-impact plastic

Weight 553 g (1.22 lbs)

Ordering Specifications

Unit	Input	Display (Output)	Power	Options	Housing
RDD (RTD Input)	Choose: **PT1** 0.00385°C, or **PT1A** 0.00392°C 2-, 3-, and 4-wire, 100Ω platinum RTD, -200 to +850°C (-340 to +1562°F);	**DIS** Configured at the factory to provide appropriate display for chosen sensor type/range, e.g. -167 - +1120 for J-type T/C (TDD)	**117AC** **230AC** ±10%, 10VA Internally fused (select one)	**-C** Dual, form C relays; 5A @ 125Vac maximum, 0.6A @ 110Vdc; 0.1A max @ 50Vdc inductive; 1500V peak isolation **-AO** Analog output, proportional to input display; field-selectable for 4-20mA or 0-10V; 10Vdc @ 17mA max, 20mA @ 17V compliance min; 0 to +35 °C operating range; adjustability via easy-access potentiometers; Stability 2% of span, max per °C change; Not available with -BCD option **-BCD** Binary Coded Decimal output. Used for interface with third-party drivers; Output: logic low 0=0.45V max @ 1.6mA sink; logic high 1 = 2.4V min @ 50μA source; Not available with -AO option **-N4** Front panel fitted with flexible boot affords NEMA 4 protection **-RD** Display with red characters	**P** Panel mount, corrosion-resistant, molded plastic; complete with mounting hardware
TDD (T/C Input)	Standard, ISA T/C's; choose: **E** -170 to+1000°C (-274 to +1832°F) **J** -167 to +1120°C (-269 to +2048°F) **K** -184 to 1372°C (-299 to +2502°F) **T** -180 to +400C (-292 to +752°F)				

When ordering, specify: Unit / Input / Display / Power / Option(s) [Housing]
Examples: RDD / PT1A / DIS / 117AC / -C -N4 [P]
TDD / J / DIS / 230AC / -AO -RD [P]

For fastest assistance, also note the unit serial number, job number, and, if available, the purchase order number under which it was shipped. Providing this information to our team of highly skilled factory technicians and application specialists assists them in obtaining the answers you need as efficiently as possible.

Calibration

Prior to shipment, every RDD and TDD is fully tested by our trained, factory technicians. Every product Moore Industries manufactures, sells, or services is guaranteed to meet the strict quality standards that have become synonymous with our company name.

Before placing your RDD or TDD into service, however, a quick bench-check of basic operation is recommended to ensure that the unit hasn't sustained any damage during transit.

Every unit should be:

- Checked to verify the correct power input for the application in which your meter is to be used
- Programmed with the desired readout units, °C or °F
- Programmed with the desired alarm setpoints (4 of them), and hysterisis value
- Set with any desired display offset (TDD only)
- Bench-Checked for proper basic function (display, alarm trip points and relay outputs, if appropriate)
- Placed in a calibration setup and have its ice point reference (optional procedure for RDD's only) and analog output (AO option-equipped units only) set

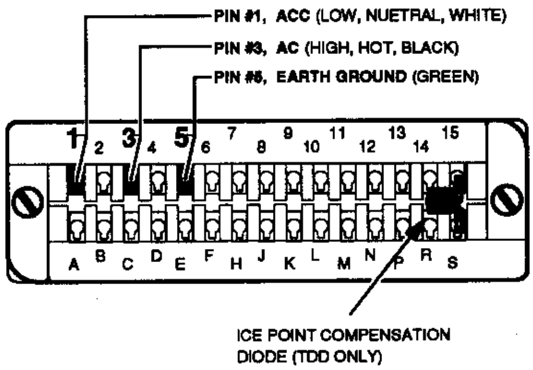
NOTE:
It is not necessary to connect the RDD or the TDD to a source of input to be able to select the °C or °F display, the alarm setpoints, or the TDD's offset.

Connecting Power

The RDD and TDD are ordered from the factory with either 117 or 230 Vac powering. Check the unit model number tag, which shows the power rating of your unit. If its power spec does not meet your requirements, contact the factory. Making changes in the field, while possible, is a somewhat involved procedure requiring unit disassembly, internal fuse swapping, and changing other, soldered components.

Figure 1 shows the P1 connector (the bottom connector, on units equipped with options), and diagrams how to wire your unit for either power input.

Figure 1. *RDD/TDD Power Connections*



To connect a lead to a terminal on the connector block, use a standard-head screwdriver to loosen the screw corresponding to the terminal. Slide the stripped end of the lead wire into the labeled terminal hole on the block face. While holding the wire in place, tighten the screw until the wire is held snugly.

CAUTION:
Never connect a 117Vac meter to a source of 230Vac.

Exercise care in handling the unit being calibrated when it is connected to power. Apply power in this order ONLY:

1. **Connect the non-power end of the power wiring to the terminal block.**
2. **Plug the terminal block in to the unit**
3. **Apply power.**

Always disconnect ac power before changing any connections of equipment in the calibration setup.

Supplying a unit with the incorrect power may blow one of its internal fuses. If this occurs, contact the factory for replacement fuses and instructions on unit disassembly.

When the unit is connected to power, allow 10-20 minutes for stabilization.

Choosing °C or °F

NOTE:
During the calibration procedure, there is a two-minute limit between keypad entries. If no key is pressed for two minutes, the unit will flash the message rUn *and erase any programming changes.*

When the unit has been connected to power and allowed to warm up...

1. **Press the** S **key once. The display will flash** SETUP**, then** 0.
2. **Press the ▲ or ▼ keys until the display reads** 26**, which is the security code for accessing the setup programming.**
3. **Press the** S **key to enter this access code.**

   When the correct code has been entered, °C – °F **is the next message to flash on the display.**
4. **Use the ▲ or ▼ keys to set the display as desired. When your selection is displayed, press** S **to enter the setting into unit memory.**

   The message SPH1 **will flash next, followed by the number** 0. **This is the parameter and setting for the first of the unit's four alarm setpoints, the #1 High Alarm (Set Point High alarm #1).**
5. **Skip to the next section for instruction on programming the setpoints and hysterisis for the four available alarm displays.**

   If your application does not require these functions...
6. **Press and hold** S. **The display will scroll through the remaining parameters. By holding** S**, the settings for each parameter will be accepted without having to view them. To view the settings, release** S **after the parameter flashes.**

   The order in which the parameters flash is:

   - SPH2 **(High Alarm Setpoint #2),**
   - SPL2 **(Low Alarm Setpoint #2),**
   - HYS **(Hysterisis),**
   - ICEPT **(Ice Point constant for RDD) or** OFFSE **(Zero Offset for TDD), and finally**
   - rUn
7. **When the** rUn **message is displayed, release** S.

   The selection for °C or F will be entered into unit memory. The display will go blank, then after a brief system pause, will be ready for installation.

Calibrating Alarm Setpoints and Hysterisis

The next set of parameters to program into the meter(s) is the alarm setpoints and hysterisis. As in the case of displayed temperature unit selection, it is not necessary to connect the meter to anything other than the appropriate power when programming these functions. No special calibration equipment is needed.

If you wish to test/verify the settings, refer to the bench-check procedure, later in this manual.

The RDD and TDD each store 4, separate alarm setpoints and a hysterisis value. There are two high alarms and two low alarms. In alarm, the unit display alternately flashes an alarm indication and the input value.

NOTE:
The "alarms" produced by the standard RDD and TDD are indications only. For contact closure output, the unit must be equipped with the -C option.

Alarm Descriptions. Here are brief descriptions of the alarm types and hysterisis:

- High Alarm - Trips when input exceeds user-set limit. Moore Industries' panel meters have 2, independent High Alarms, SP1H and SP2H.
- Low Alarm - Trips when input drops below user-set limit. Moore Industries' panel meters have 2, independent Low Alarms, SP1L and SP2L.
- Hysterisis (sometimes called deadband) - A user-set number of display counts around a setpoint within which an alarm will continue to flash, even though the input has actually returned to a non-alarm level.

An example of how the RDD and TDD alarms and hysterisis settings work follows the procedure used to set them. For more detailed information, contact Moore Industries' Marketing Communications Department for a copy of the Technical Bulletin *Alarm Trips—The Ups and Downs.*

To program setpoints and hysterisis, make sure the unit is properly connected to an appropriate source of ac power (Figure 1), and that sufficient time has been allotted for unit warm-up/stabilization (10-20 minutes).

1. **Press the** S **key once. The display will flash** SETUP**, then** 0**.**
2. **Press the ▲ or ▼ keys until the display reads** 26**, the security code for accessing the setup programming.**
3. **Press the** S **key to enter the code.**

   The display will briefly flash the °C–°F **parameter, then the selection you made in the earlier procedure.**
4. **Press the** S **key to accept your selection.**

   The display will then flash SP1H**, followed by the setting for High Alarm Setpoint #1.**
5. **Press ▲ or ▼ until the display shows the desired setpoint for the #1 High Alarm .**

   NOTE:
   *The alarm settings for both the RDD and TDD are based on the **display** (°C or °F) rather than the input itself. Base all alarm setpoint programming on the selected temperature unit (see preceding section).*
6. **Press** S **to enter setpoint #1 for the high alarm into memory.**

   Next up is the message SPL1**, then the setting for Low Alarm #1.**
7. **Repeat the procedure described in steps 5 and 6 for:**
   - SPL1 - **the setpoint for Low Alarm #1,**
   - SPH2 - **the setpoint for High Alarm #2,**
   - SPL2 - **the setpoint for Low Alarm #2.**

   When the setting for SPL2 **has been programmed in (by pressing the** S **key), the message** HYS **will flash, followed by the setting for the alarm hysterisis.**
8. **Press ▲ or ▼ until the display shows the desired number of whole counts of hysterisis around the setpoints you programmed in steps 4 through 6.**

   NOTE:
   The hysterisis setting is a whole-number count value. Thus, a setting of "10" will create a deadband of 10 whole-number counts (0.0, 1.0, 2.0, etc. to 10.0, rather than 0.0, 0.1, 0.2, etc. to 1.0).
9. **Press** S **to enter the value into non-volatile memory. The next parameter to be displayed is the unit ice point reference (RDD) or the display offset (TDD).**
10. **Press and <u>hold</u>** S **until the message** rUn **appears on the display. This temporarily accepts the parameter settings. The procedure for programming TDD offset follows this set of instructions and its example.**

    Calibrating the RDD ice point reference requires more elaborate equipment, and is included as part of the Bench Check in the next section of this manual.
11. **Release** S **when the** rUn **message is displayed. The display will go blank, then after a brief system pause, be ready for installation/ operation.**

Refer to the operation section of this manual for a list of alarm messages.

EXAMPLE - How Alarm Setpoints and Hysterisis Work

A J-type TDD for a certain application is set for °C display (–167 to +1120°C) and is programmed for low alarms at 25 and 50% of span, high alarms at 75 and 100% of span. Unit span is 1287 counts (degrees).

This means the unit is to indicate Low Alarms when the input drops below 643.5° and 321.75° (the display automatically rounds up to 321.8). High Alarms will flash when input exceeds the 965.25° level (display will round up to 965.3°) and 1287°.

The intended application also calls for hysterisis of ± 10 counts at each alarm. This means that the display will flash an alarm as the input rises past the 965.3°C mark, but will not "reset" until the input drops to 955.3°C. It will indicate a low alarm when input drops below 643.5°C, and will remain in alarm until input rises past 643° to 653.5°.

Programming Offset (TDD only)

After accepting the selection for displayed temperature units and the settings for alarm and hysterisis (steps 1 through 8 of the procedure in the previous section), the TDD flashes the message OFFSE, followed by 0. This is an optional setting for display offset.

Like alarm hysterisis, TDD Offset is a whole-number count value.

Press ▲ or ▼ to select the desired display offset, and press S to enter the selected value into TDD non-volatile memory. When S is pressed, the display will flash a rUn message, go blank for a moment, then be ready to function as programmed.

NOTE:
*Remember that the Alarm Setpoints are based on the **DISPLAYED VALUE**. Settings for Alarms will therefore be offset by any* OFFSE *programming.*

Bench Checking the RDD and TDD

Once programmed as described in the preceding sections, the RDD and TDD should be run through a quick bench check to verify proper settings, and to ensure that the unit is functioning properly.

The following section consists of the procedures for programming the RDD ice point reference, checking the basic function of the standard RDD and TDD, and verifying contact closure output in units equipped with the -C option.

The procedure for calibrating the auxiliary output in units equipped with the -AO option can also be found here.

In addition to the power source used in programming the unit, you will need the equipment listed in Table 2 to perform the procedures in this section. These materials are not supplied by Moore Industries, but should be available in those areas suitable for testing electronic gear such as these meters.

NOTE:
These procedures should be carried out in a lab or comparable testing area rather than in the field.

Programming Ice Point Reference (RDD only)

This setup parameter allows the user to program the RDD to a specific RTD ice point. Most RTD's come with a calibration certificate that lists the specific ice point for the sensor.

The following procedure should be executed after all the other setup parameters have been programmed.

Figure 2 shows the P1 (bottom) terminal block of the RDD, and the connections necessary to calibrate the unit ice point reference.

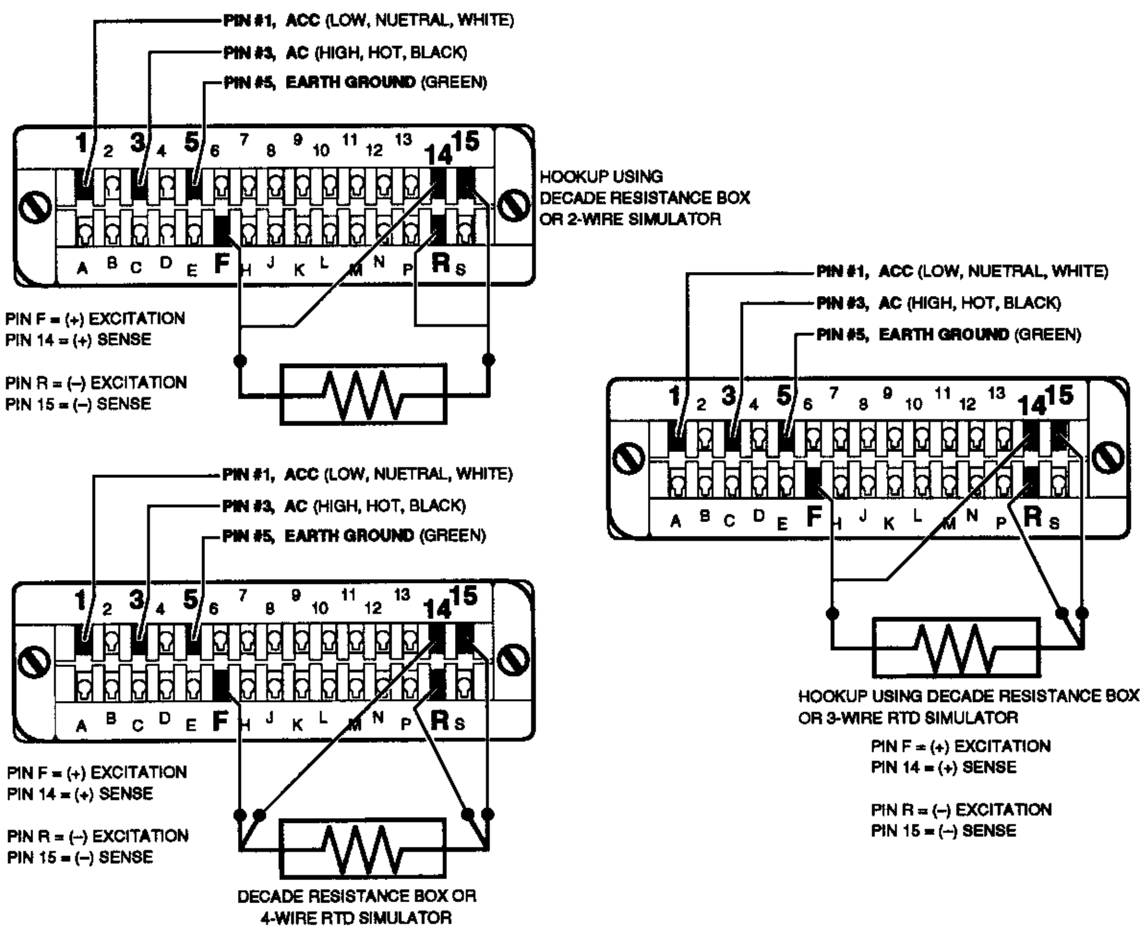
1. **When the RDD flashes the message** ICEPT, **release** S. **The display will read** no.
2. **Check the certificate that came with your RTD. Set the decade resistance box or RTD simulator in your calibration hookup to the resistance called out on the certificate, or to the equivalent resistance for 0°C or 32°F from the ISA temperature equivalency tables.**
3. **Press ▲ or ▼ so that the display reads** YES.

(procedure continues)

Table 2. *RDD/TDD Bench Check Equipment*

Multimeter	Keithly model 197 or equivalent, calibrated.
Decade Box (RDD only)	Dekabox model DB62 or equivalent, calibrated, adjustable resistance box or RTD simulator
Thermocouple Simulator (TDD only)	Ectron model 1120 or equivalent, calibrated, adjustable millivolt source
RTD Certificate or ISA Tables of Temperature Equivalents (RDD only)	Most RTD's include a certificate listing the ice point measurement for the sensor. If the certificate is unavailable, use 1988 ISA tables with appropriate listings for either PT1 or PT1A coefficients (100Ω platinum RTD)
RC Suppression Network (-C option units only)	Moore Industries recommends the use of simple, Resistance/Capacitance circuits with all highly inductive loads and the contact closure outputs of the -C option-equipped panel meters. Often called "snubbers", these RC suppression networks consist of a capacitor and a series resistor connected across the terminals of each relay. The values of the components used depends on the intended load, but in general values of 0.25µF for the capacitor and 100Ω for the resistor should suffice.

Figure 2. *RDD Bench Check Hookup*



4. **Press S. This enters the value into RDD memory. The display will flash the rUn message, go blank momentarily, then begin to operate with the new parameters in place.**

Standard RDD Hookup and Bench Check Procedure

To check the operation of the metering function of the standard RDD, connect a decade resistance box or RTD simulator to the meter, apply power, and input several resistance values within the unit's rated range (consult the ISA equivalency tables if necessary).

Figure 2 shows the P1 (bottom) terminal block of the RDD and the connections necessary to perform this elementary bench check of unit function. With the equipment in Table 2 connected as shown in Figures 1 and 2, apply appropriate power and allow 10-20 minutes for setup stabilization and warm-up.

At each level of resistance input, refer to the ISA tables to confirm that the RDD displays the correct temperature reading, in the units you selected (°C or °F) during programming, ±0.4°C or ±0.8°F. For example, 100Ω = 32.0°F, ±0.8°.

NOTE:

The alarm setpoints you programmed earlier in this section may trip as you input the various levels of resistance to check meter function. When the alarm trips, the meter will alternately flash the alarm indication and the actual reading. To "reset" the alarm, raise (low alarms) or lower (high alarms) the input past the alarm setpoint (allowing for any hysterisis programming).

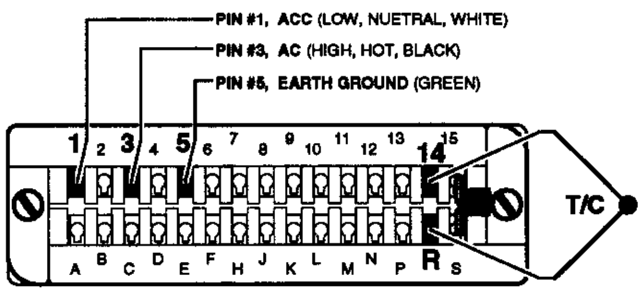
If the unit is not performing within the rated accuracy specifications (see Table 2), refer to the section on Calibrating the Ice Point Reference. If problems continue, refer to the information on Re-calibrating the RDD Analog-to-Digital Converter, in the Troubleshooting section of this manual.

Standard TDD Hookup and Bench Check Procedure

To check the metering function of the standard TDD, connect a T/C simulator to the meter, apply appropriate power, and input several levels of simulated T/C output (within the appropriate, rated range of the TDD under test) into the setup.

Figure 3 shows the P1 (bottom) terminal block of the TDD and the connections necessary to perform this elementary bench check of the unit function. With the equipment in Table 2 connected as shown in Figures 1 and 3, apply appropriate power and allow 10-20 minutes for setup stabilization and warm-up.

Figure 3. *TDD Bench Check Hookup*



At each level of simulated T/C output applied to the unit, refer to the ISA tables to confirm that the TDD displays the correct temperature, in the units you selected (°C or °F) during programming, ±1.0°C (1.3°F) for E, J, or T T/C TDD; ±1.0°C (1.7°F) for K T/C TDD; or ±2.0°C (3.0°F) for S T/C TDD.

NOTE:

The alarm setpoints you programmed earlier in this section may trip as you input the various simulated temperatures to check meter function. When the alarm trips, the meter will alternately flash the alarm indication and the actual reading. To "reset" the alarm, raise (low alarms) or lower (high alarms) the input past the alarm setpoint (allowing for any hysterisis programming).

If the unit is not performing within the rated accuracy specifications (see Table 2), refer to the information on Re-calibrating the TDD Analog-to-Digital Converter, in the Troubleshooting section of this manual.

Checking Contact Closure Outputs in -C option-equipped Units

Figures 4 and 5 show the pinouts for the terminal block of P2, the top-most PC board on RDD's with the various combinations of available options. Check the model number tag on your unit to verify that the -C option is present. While all Moore Industries Panel Meters provide alarm indication, only those units equipped with the -C option are capable of contact closure output.

Each relay is programmed with both a high and a low setpoint. Relay #1 is controlled by the settings for SPH1 and SPL1; relay #2 by SPH2 and SPL2. The programmed hysterisis value applies to all setpoints.

Snubbers. When connecting the relay outputs of the -C option-equipped panel meters to inductive loads, Moore Industries recommends the use of snubbers—simple, RC suppression networks consisting of a resistor and a capacitor in series—as a safety precaution. Relay operation with these loads can cause arcing across the meter's relay contacts, which, in turn, can show up as noise on the circuit, interfere with the microprocessor, or cause pitting of the relay contacts themselves.

Use the same calibration setup shown in the figures 4 or 5, and connect the snubbers across the desired relay output terminals.

Figure 4. Pinouts for RDD/TDD Equipped with -C Option, -AO Option, and -C with -AO Options

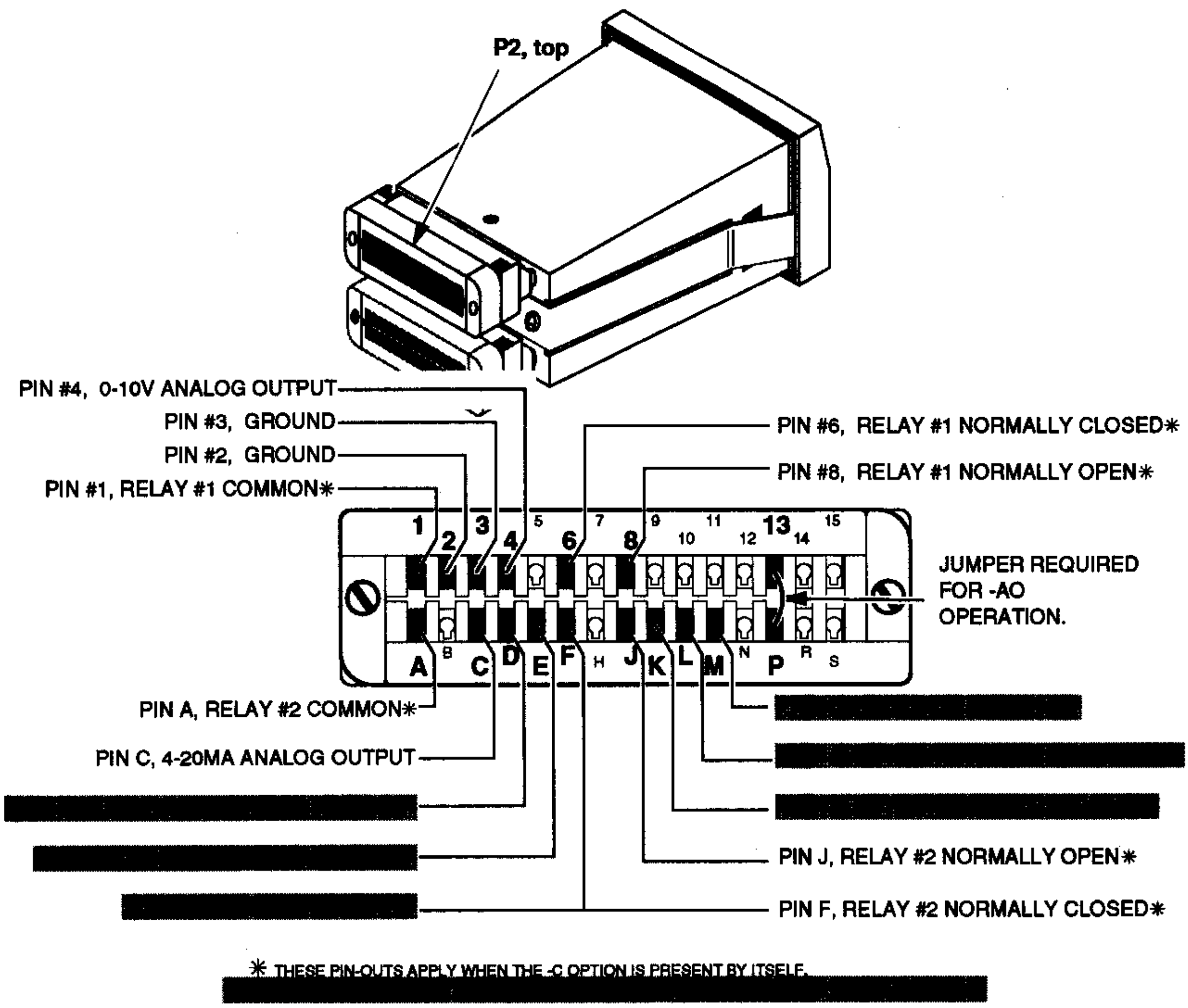
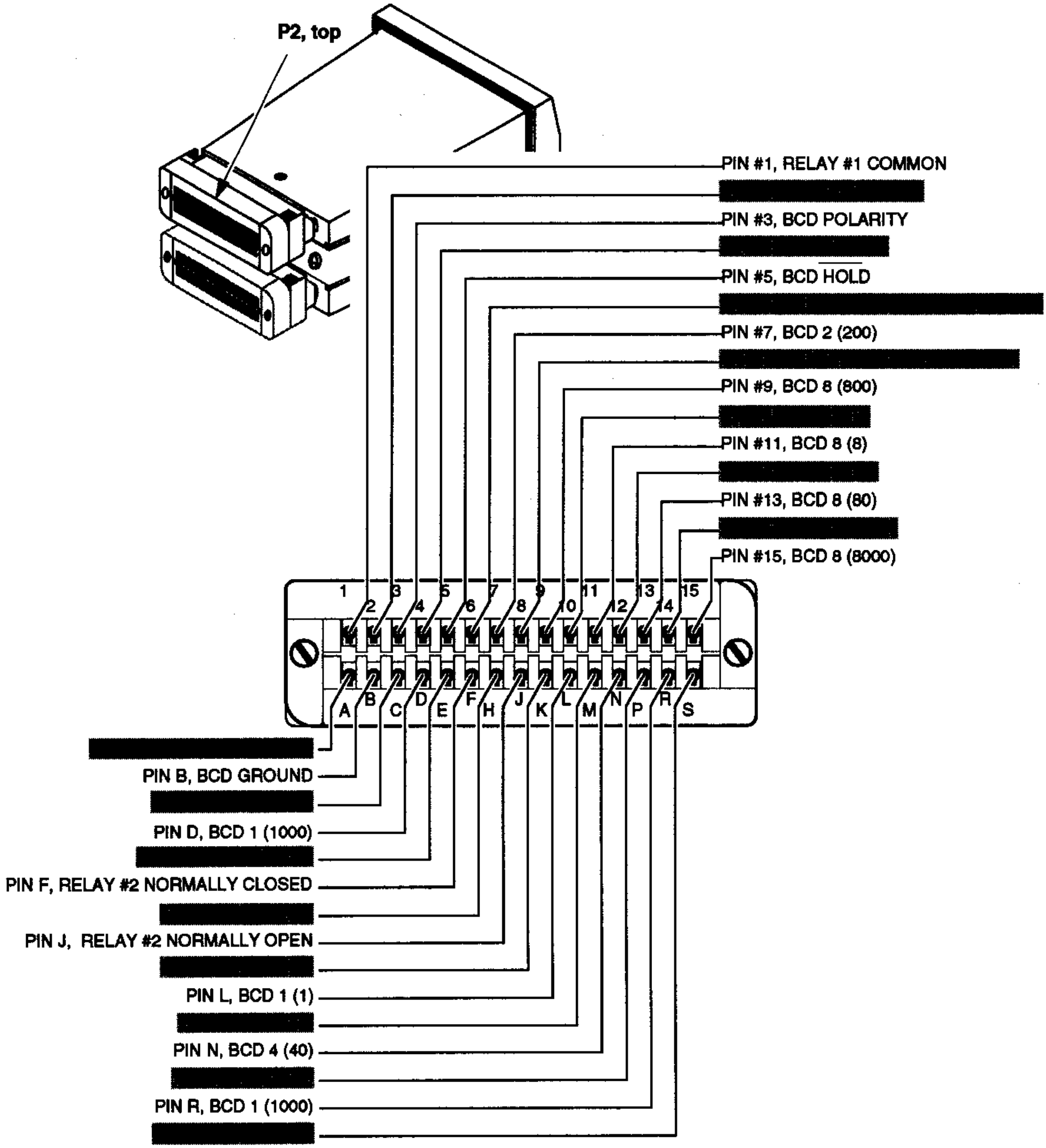


Figure 5. *Pinouts for RDD/TDD Equipped with -BCD Option (Alone), and -BCD with -C Option*



NOTE:
The relays used in the RDD and TDD are energized in an alarm condition (non-failsafe). "Normally Open" relay contacts are open in non-alarm (including power off). "Normally Closed" relay contacts are closed in non-alarm (including power off).

Once the bench check setup is complete, allow 10-20 minutes for warm-up/stabilization.

1. **Raise the calibration input source (decade resistance box or RTD simulator for RDD, T/C simulator for TDD) to a level above one of the high alarm setpoints (SPH1 or SPH2) you programmed in unit setup.**

   The display will flash either HI **or** HI HI **(depending upon the input value you chose and any offset programming). Refer to the Operation section of this manual for an explanation of alarm displays.**

2. **Connect the multimeter, set to measure resistance, between one set of the normally open or normally closed terminals and the appropriate alarm common terminal of the unit being checked. Refer to figures 4 or 5 for the appropriate pin-outs.**

   NOTE:
   *Use the pin-outs in Figure 4 if your unit is equipped with the -C option **only**.*

   If connected between normally open and common, the multimeter will indicate continuity(closed contacts, negligible resistance) as long as the input is maintained at an alarm level. If between a normally closed and common terminal, the multimeter will indicate discontinuity (open contacts, infinite resistance).

3. **Lower the input to a non-alarm level, and note that once beyond the hysterisis setting, the display returns to normal readouts (no reset is necessary), and that the multimeter indicates a change of state at the terminal block.**

4. **Continue to lower the input to a point below the low alarm trip point setting (SPL1 or SPL2) and repeat the procedure described in step 2.**

5. **Raise the input to a non-alarm level, and note that once beyond the hysterisis setting, the display returns to normal readouts (no reset is necessary), and that the multimeter indicates a change of state at the terminals.**

Calibrating Analog Output in -AO option-equipped units

4-20mA:
Use the same calibration setup described in the procedure for bench checking the standard unit, earlier, and refer to Figure 4 for the pin-outs used with this option. When all applicable connections have been made as illustrated in appropriate figures, allow 10-20 minutes for warm-up/stabilization.

1. **Connect a jumper between pins 13 and P on the P2 (top) pc board connector.**

2. **Adjust the input to the RDD/TDD to the intended zero level from the application.**

   For example, if the unit being tested is configured to provide current output proportional to type J T/C (−167°C to +1120°C) in, the input source would be set to simulate −167°C in this step.

3. **Connect the multimeter, configured to measure voltage (millivolts), to pins 1 (+) and 2 (−) on the option board, P2 (top terminal block).**

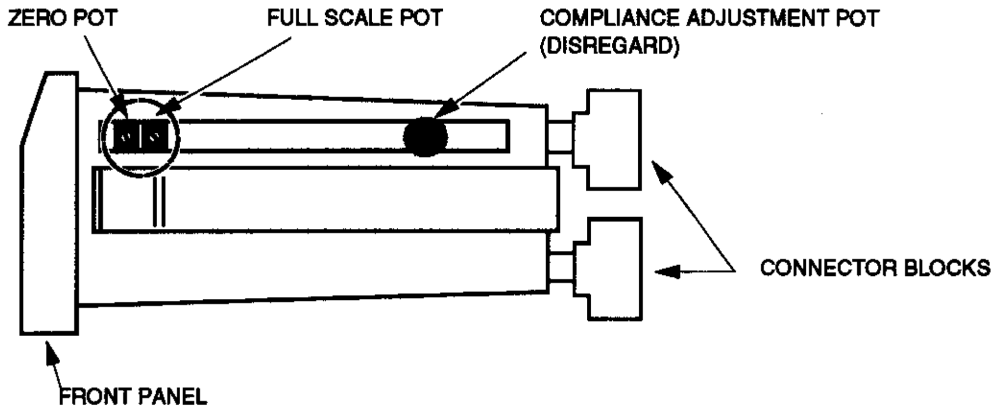
4. **Adjust the Zero Potentiometer (pot), shown in Figure 6, until the multimeter indicates that the voltage at pin 1 is approximately −100mV.**

5. **Move the multimeter to pins C (+) and 3 (−), and configure it for monitoring current.**

6. **Fine-tune the Zero pot until the multimeter indicates a current flow between 0 and +100μA (roughly zero).**

(procedure continues)

Figure 6. -AO Option Calibration Potentiometer Locations



7. **Adjust the input to the RDD/TDD to the intended full scale level from the application.**

   For example, if the unit being tested is configured to provide current output proportional to RTD in (–200.0 °C to +850.0°C), the input source would be set to the millivolt equivalent for +850.0°C in this step.

8. **Adjust the Full Scale pot, shown in Figure 6, until the multimeter indicates 16mA of current. Turning the pot clockwise decreases current.**

9. **Adjust the Zero pot until the multimeter indicates 20mA. Turning clockwise will increase current.**

10. **Set input to the intended zero and verify that current, as indicated by the multimeter, is 4mA. Some slight adjustment of the zero pot may be necessary.**

11. **Repeat steps 7 through 10 until the multimeter indicates 4mA at zero input, 20mA at full scale.**

0-10V:

Use the same calibration setup described in the procedure for bench checking the standard unit, earlier, and refer to Figure 4 for the pin-outs used with this option. When all applicable connections have been made as illustrated in appropriate figures, allow 10-20 minutes for warm-up/stabilization.

1. **Connect a jumper between pins 13 and P on the P2 (top) pc board connector.**

2. **Adjust the input to the RDD/TDD to the intended zero level from the application.**

   For example, if the unit being tested is configured to provide voltage output proportional to a J-type T/C in (–167°C to +1120°C), the input source would be set to simulate –167°C in this step.

3. **Connect the multimeter, configured to measure voltage (millivolts), to pins 1 (–) and 2 (+) on the option board, P2 (top terminal block).**

4. **Adjust the Zero pot, shown in Figure 6, until the multimeter indicates that the voltage at pin 2 is approximately –100mV.**
5. **Move the multimeter to pins 4 (+) and 3 (–).**
6. **Fine-tune the Zero pot until the multimeter indicates a minimal positive voltage, (less than +10mV).**
7. **Adjust the input to the RDD/TDD to the intended full scale level from the application.**

   For example, if the unit being tested is configured to provide voltage output proportional to RTD in (–200.0 °C to +850.0°C), the input source would be set to the millivolt equivalent for +850.0°C in this step.
8. **Adjust the Full Scale pot, shown in Figure 6, until the multimeter indicates between 0 and 10V out at pin 4. Turning the pot clockwise decreases voltage.**
9. **Set input back to the intended zero and verify that voltage output, as indicated by the multimeter, is +10mV (roughly zero). Some slight adjustment of the Zero pot may be necessary.**
10. **Repeat steps 7 through 9 until the multimeter indicates 0V at zero input, 10V at full scale.**

Installation

Figure 7 shows the outline dimensions for the RDD and TDD. Note that because the front panel is larger than the body of the meter, it is necessary to cut larger holes in the panel when mounting units one atop another. Refer to figure 8 for typical cutout dimensions.

To install the RDD or TDD:

1. **Loosen the two Phillips-head, mounting bracket screws located on the back of the unit.**
2. **Make the appropriate-sized cutout in your mounting panel, and from the display side of that mounting panel, slide the meter in to position in the cutout.**
3. **Holding the meter in place, from the back side of the mounting panel, position the meter's mounting bracket so that its flared ends "pinch" the mounting panel between the meter's front and the bracket ends (see figure 8).**
4. **Tighten the mounting bracket screws.**

CAUTION:

Over-tightening the mounting bracket screws will crack the RDD/TDD front panel.

Figure 7. RDD/TDD Outline Dimensions

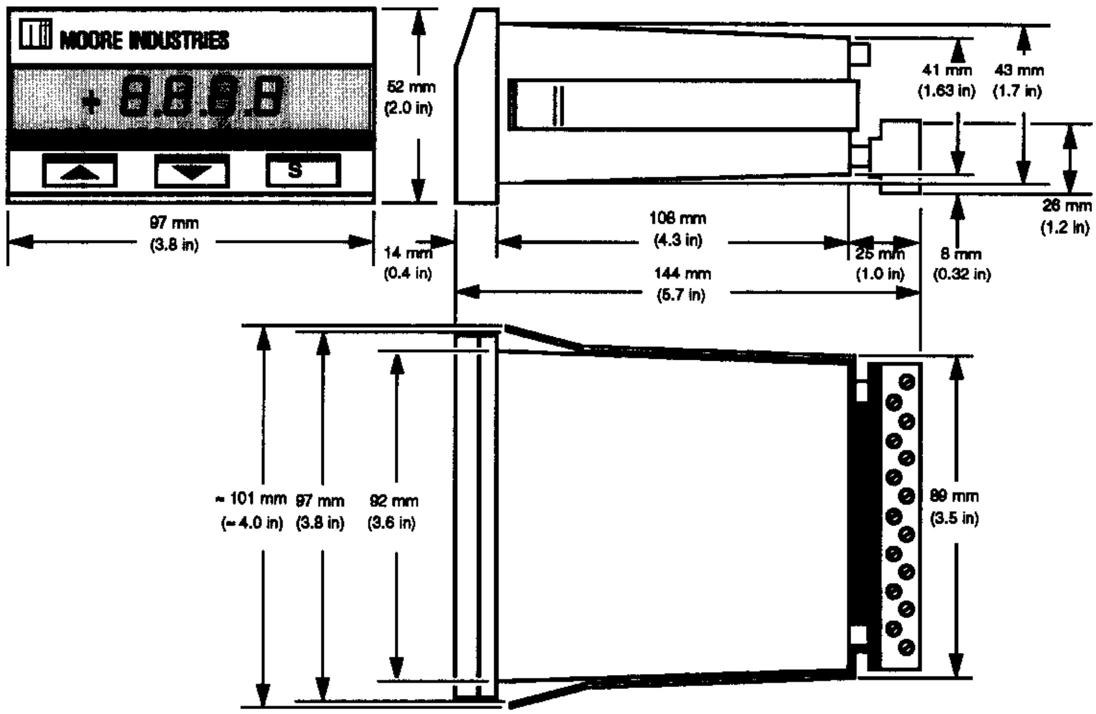
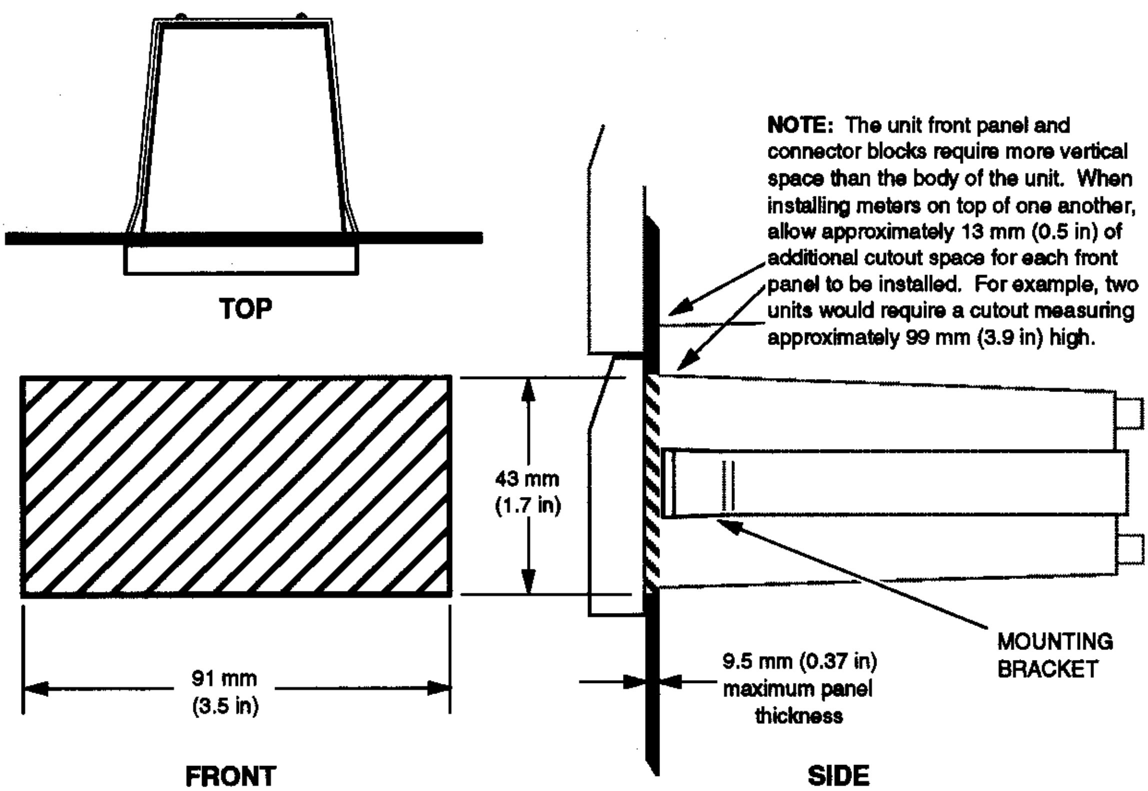


Figure 8. RDD/TDD Panel Cutout Dimensions



Electrical Connections

Figures 2 through 5 illustrate the various pin-outs used by the RDD and TDD for power and input connections, and optional outputs.

Table 3 summarizes the pin-outs for the main PC board connector, P1.

Snubbers. When connecting the relay outputs of the -C option-equipped panel meters to inductive loads, Moore Industries recommends the use of snubbers—simple, RC suppression networks consisting of a resistor and a capacitor in series—as a safety precaution. Relay operation with these loads can cause arcing across the meter's relay contacts, which, in turn, can show up as noise on the circuit, interfere with the microprocessor, or cause pitting of the relay contacts themselves.

Use the setup shown in the figures 4 or 5 as a guide, connecting the snubbers across the desired relay output terminals.

NOTE:
The relays used in the RDD and TDD are energized in an alarm condition (non-failsafe). "Normally Open" relay contacts are open in non-alarm (including power off). "Normally Closed" relay contacts are closed in non-alarm (including power off).

Table 3. *RDD/TDD P1 Terminals*

RDD	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
	POWER (NOTE 1)	*	POWER (NOTE 1)	*	GND (NOTE 2)	*	*	*	▲ (NOTE 3)	TEST POINT (+5V)	TEST POINT (-15V)	TEST POINT (+15V)	*	+SENSE (NOTE 4)	-SENSE (NOTE 4)
	A	**B**	**C**	**D**	**E**	**F**	**H**	**J**	**K**	**L**	**M**	**N**	**P**	**R**	**S**
	*	*	*	*	*	+EXCIT (NOTE 4)	▼ (NOTE 5)	S (NOTE 6)	Display Hold	Display Hold	*	POWER SUPPLY COMMON	*	-EXCIT. (NOTE 4)	ANALOG GND.
TDD	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
	POWER (NOTE 1)	*	POWER (NOTE 1)	*	GND (NOTE 2)	*	*	*	▲ (NOTE 3)	TEST POINT (+5V)	TEST POINT (-15V)	TEST POINT (+15V)	*	+T/C (NOTE 5)	ICE POINT CATHODE (-)
	A	**B**	**C**	**D**	**E**	**F**	**H**	**J**	**K**	**L**	**M**	**N**	**P**	**R**	**S**
	*	*	*	*	*	*	▼ (NOTE 5)	S (NOTE 6)	Display Hold	Display Hold	*	POWER SUPPLY COMMON	*	-T/C	ICE POINT ANODE (+)

NOTES:
1. Refer to Figure 1 for instructions.
2. Tie to power input ground. Do not allow to float.
3. Connect this pin to pin K (Display Hold) to duplicate the function of the "▲" key.
4. Refer to Figure 2 for instructions.
5. Connect this pin to pin K (Display Hold) to duplicate the function of the "▼" key.
6. Connect this pin to pin K (Display Hold) to duplicate the function of the "S" key.

* Do not use.

Operation

Once calibrated, properly installed, and supplied with appropriate power and input, the RDD and TDD operate unattended.

Display Hold

To stop display processing and "hold" the unit readout at the displayed value, connect pin K to pin L on the main processor PC board, P1.

Breaking the connection between the Hold pins restores normal processing/readouts.

Alarm Display

Table 4 lists the possible alarm displays and the corresponding -C option outputs.

BCD Output Notes

Refer to Figure 5.

- The "PRINT" pin, pin C, is low for valid BCD data. It goes high for 100 seconds while new data is being written to data lines. Use the falling edge for a print command ("PRINT" is sometimes referred to as "BUSY" in other manufacturers' documentation).
- When "POLARITY" pin, pin 3, is logic low, a positive reading is indicated.
- When "HOLD" pin, pin 5, receives a logic low for at least 10 milliseconds, the unit maintains the present BCD output until a logic high is applied. Processing continues while unit is in hold.
- When "SELECT" pin, pin E, receives a logic low for at least 10 milliseconds, the status of all 20 BCD lines is checked. If all lines are tri-state, the unit ties to BCD lines and "PRINT", pin C, goes low. If any BCD lines are active, the unit does not write and "PRINT" stays high.
- When reading is greater than full scale, OVERFLOW/DATA VALID pin, pin 2, goes logic high.

Troubleshooting

The RDD and TDD are maintenance-free units. A periodic check for terminal tightness and general overall unit condition is all that is recommended to assure reliable unit function indefinitely.

Re-Calibration. It is not unusual for some settling of components to occur during the first year of unit operation. This phenomenon will not affect the operation of the RDD or TDD under normal circumstances.

If performance does fall outside rated tolerances, the microprocessor can be re-calibrated.

See Figures 1 through 4 show how to hook up the appropriate power and input simulators you will need to re-calibrate either the RDD or TDD microprocessor. After the equipment has been set up according to the appropriate figure, apply the rated power and allow 10-20 minutes for warm-up/stabilization.

1. **Press** S. **The display will flash the** SETUP **message, followed by the number** 0.
2. **Press ▲ or ▼ to set the display to** 40, **the access code for processor re-calibration.**
3. **Press** S **to accept the code. The next message to flash is** CAlib.
4. **Set input simulator to...**

   RDD: 400Ω, ±0.01Ω

   TDD (except S-type T/C version): +80mV, dc, ±0.1 mV

   S-type T/C TDD: +24mV, dc, ±0.1mV, dc

   <u>***NOTE:***</u>
   Readout will not change as input is changed.

5. **Press** S **to register input.**

Table 4. *RDD/TDD Alarm Display Messages*

Display		Indicates
HI		Input has risen above the trip point setting for SP1H. The readout will alternately flash this indication and the actual reading. The high alarm relay, on units equipped with the -C option will be energized.
LO		Input has dropped below the trip point setting for SP1L. The readout will alternately flash this indication and the actual reading. The low alarm relay, on units equipped with the -C option will be energized.
	HI	Input has risen above the trip point setting for SP2H. The readout will alternately flash this indication and the actual reading. The high alarm relay, on units equipped with the -C option will be energized.
	LO	Input has dropped below the trip point setting for SP2L. The readout will alternately flash this indication and the actual reading. The low alarm relay, on units equipped with the -C option will be energized.
HI	HI	Input has risen above the trip point settings for both SP1H and SP2H. The readout will alternately flash this indication and the actual reading. The high alarm relay, on units equipped with the -C option will be energized.
LO	LO	Input has dropped below the trip point settings for both SP1L and SP2L. The readout will alternately flash this indication and the actual reading. The low alarm relay, on units equipped with the -C option will be energized.
HI	LO	Input has risen above the trip point setting for SP1H. It is also below the setting for SP2L. The readout will alternately flash this indication and the actual reading. Both relays, on units equipped with the -C option, will be energized.
LO	HI	Input has dropped below the trip point setting for SP1L. It is also above the setting for SP2H. The readout will alternately flash this indication and the actual reading. Both relays, on units equipped with the -C option, will be energized.

False Alarms — When setting or changing TDD offset and RDD ice point reference the alarms may be tripped because the setpoints are based on the display (not the actual input). Since the alarms reset automatically when display (input) goes into a non-alarm condition, these may be ignored.

If process input tends to vary in the vicinity of the setpoint, wavering into and out of an alarm condition, the alarm (and associated relays, in units equipped with the -C option) may "chatter". Counteract this by increasing the hysterisis setting (deadband).

Erroneous Readouts — Re-calibrating the A/D Converter. The RDD and TDD are calibrated at the factory according to the input type ordered. If the unit configuration is changed by the user in the field, to operate with another type of input, A/D re-calibration probably will be required.

If, after performing this procedure as described, the readout of the unit is not appropriate or does not meet the accuracy specifications for the type of input being used, contact the factory.

Error Codes

OPEn - Indicates that the connected sensor has burned out, or that one of the wires connecting it to the meter has been severed.

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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ANY CAUSE OF ACTION FOR BREACH OF ANY WARRANTY BY THE COMPANY SHALL BE BARRED UNLESS THE COMPANY RECEIVES FROM THE BUYER A WRITTEN NOTICE OF THE ALLEGED DEFECT OR BREACH WITHIN TEN DAYS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH, AND NO ACTION FOR THE BREACH OF ANY WARRANTY SHALL BE COMMENCED BY THE BUYER ANY LATER THAN TWELVE MONTHS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH.

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For a period of thirty-six (36) months from the date of shipment, and under normal conditions of use and service, Moore Industries ("The Company") will at its option replace, repair or refund the purchase price for any of its manufactured products found, upon return to the Company (transportation charges prepaid and otherwise in accordance with the return procedures established by The Company), to be defective in material or workmanship. This policy extends to the original Buyer only and not to Buyer's customers or the users of Buyer's products, unless Buyer is an engineering contractor in which case the policy shall extend to Buyer's immediate customer only. This policy shall not apply if the product has been subject to alteration, misuse, accident, neglect or improper application, installation, or operation. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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