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Bulletin No. PAXLRT-C
Drawing No. LP0562
Released 03/10

MODEL PAXLRT - PAX LITE RTD METER



c UL US LISTED
IND. CONT. EQ.
51EB

- *ACCEPTS STANDARD 3-WIRE 100 Ω RTD SENSORS (ALPHA = 0.00385 or ALPHA = 0.00392)*
- *CONFORMS TO ITS-90 STANDARDS*
- *SELECTABLE °F OR °C WITH 0.1 OR 1 DEGREE DISPLAY RESOLUTION*
- *STATE-OF-THE-ART DIGITAL ELECTRONICS FOR GREATER ACCURACY AND RELIABILITY*
- *FULL 4-DIGIT, HIGH VISIBILITY, 0.56" (14.2 mm) HIGH RED LED DISPLAY*
- *PROGRAMMABLE TEMPERATURE OFFSET*
- *PROGRAMMABLE DIGITAL FILTERING*
- *PEAK/VALLEY (HI/LO READING) MEMORY*
- *NEMA 4X/IP65 SEALED FRONT BEZEL*
- *CUSTOM UNITS OVERLAY WITH BACKLIGHT*

CE

GENERAL DESCRIPTION

The Pax Lite RTD Meter accepts standard RTD inputs and precisely linearizes them into temperature readings. A full 4-digit display accommodates a wide range of temperature inputs. State-of-the-art digital circuitry virtually eliminates errors due to drift.

The meter features a readout choice of either Fahrenheit or Celsius with 0.1 or 1 degree resolution. English Style display prompts and front panel buttons aid the operator through set-up and operation. Programmable digital filtering enhances the stability of the reading. All set-up data is stored in EEPROM, which will hold data for a minimum of 10 years without power.

The meter provides a Peak (HI) and Valley (LO) reading memory with selectable capture delay time. The capture delay is used to prevent detection of false Peak or Valley readings that may occur during start-up or unusual process events. The Peak and Valley readings are stored at power-down to allow monitoring the process limits over any length of time (shifts, days, etc.).

The meter has several built-in diagnostic functions to alert operators of any malfunction. Extensive testing of noise interference mechanisms and full burn-in makes the meter extremely reliable in industrial environments. The front bezel meets NEMA 4X/IP65 requirements for wash down applications.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the literature or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. Do not use this unit to directly command motors, valves, or other actuators not equipped with safeguards. To do so, can be potentially harmful to persons or equipment in the event of a fault to the unit.



CAUTION: Risk of Danger
Read complete instructions prior to installation and operation of the unit.



CAUTION: Risk of electric shock.

DEFINITION OF TERMS

INSTALLATION CATEGORY (overvoltage category) **I**:
Signal level, special equipment or parts of equipment, telecommunication, electronic, etc. with smaller transient overvoltages than Installation Category (overvoltage category) II.

INSTALLATION CATEGORY (overvoltage category) **II**:
Local level, appliances, portable equipment, etc. with smaller transient overvoltages than Installation Category (overvoltage category) III.

DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.1" (53.4) H x 5" (127) W.

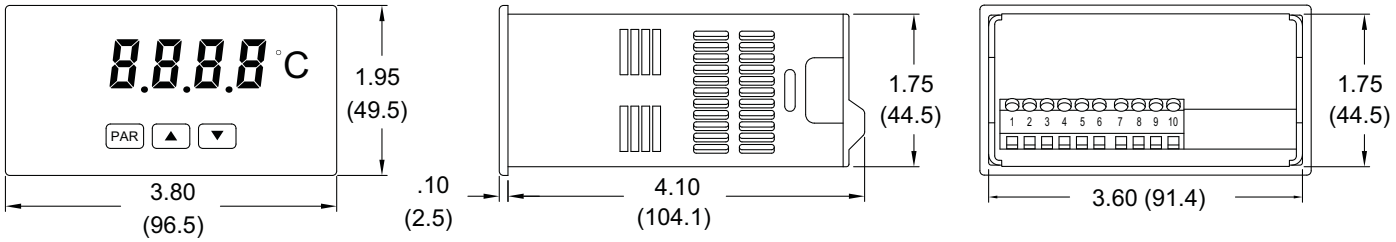


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ORDERING INFORMATION

Meter Part Numbers

PAXL	RT	0	0

RT - RTD Temperature Meter

Accessories Part Numbers*

TYPE	MODEL NO.	DESCRIPTION	PART NUMBERS
Accessories	**PAXLBK**	Units Label Kit Accessory	PAXLBK30

*This meter is shipped with °F and °C overlay labels. The label kit is only needed if another units label is desired.

GENERAL METER SPECIFICATIONS

1. **DISPLAY**: 4-digit, 0.56" (14.2 mm) high red LED, minus sign displayed for negative temperatures.
   Overrange/Underrange Input: Flashing "OLOL" or "ULUL"
   Overrange/Underrange Display: "...." or "-...."
2. **POWER**: 85 to 250 VAC, 50/60 Hz, 6 VA
   Isolation: 2300 Vrms for 1 min. between input and supply (300 V working voltage)
3. **CONTROLS**: Three front panel push buttons for meter set-up. Rear terminal input for disabling the front panel.
4. **RESOLUTION**: 0.1 or 1 degree
5. **RANGE**: Decimal Point Dependent
   0.1° res: -199.9° to 850.0 °C (-199.9° to 999.9 °F);
   1° res: -200° to 850 °C (-328° to 1562 °F)
6. **OPEN/SHORTED RTD DETECTION**: Display flashes: "OPEN" or "SHrt"
7. **LEAD RESISTANCE EFFECT**: 20 Ω max., 2.5 °C/Ω error for V exc. and common lead unbalance
8. **ACCURACY**: 0.3 °C, @ 23 °C and 30 min. warm-up
9. **READING RATE**: 2.5 readings/second
10. **RESPONSE TIME**: 2 seconds to settle for step input (increases with programmable digital filtering)
11. **LOW FREQUENCY NOISE REJECTION**:
    Normal Mode Rejection: 40 dB @ 50/60 Hz (may be improved by programmable digital filtering)
    Common Mode Rejection: 120 dB, DC to 50/60 Hz
12. **CERTIFICATIONS AND COMPLIANCES**:
    SAFETY
    UL Recognized Component, File # E179259, UL61010A-1, CSA C22.2 No. 61010-1
    Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.
    UL Listed, File # E137808, UL508, CSA C22.2 No. 14-M95
    LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
    Type 4X Enclosure rating (Face only), UL50
    IECEE CB Scheme Report # 04ME11209-20041018
    Issued by Underwriters Laboratories, Inc.
    IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
    IP65 Enclosure rating (Face only), IEC 529

ELECTROMAGNETIC COMPATIBILITY

Emissions and Immunity to EN 61326: Electrical Equipment for Measurement, Control and Laboratory use.

Immunity:		
Electrostatic discharge	EN 61000-4-2	Criterion A 4 kV contact discharge 8 kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Criterion A 10 V/m
Fast transients (burst)	EN 61000-4-4	Criterion A 2 kV power 2 kV signal
Surge	EN 61000-4-5	Criterion A 1 kV L-L, 2 kV L&N-E power 1 kV signal
RF conducted interference	EN 61000-4-6	Criterion A 3 V/rms
Voltage dip/interruptions	EN 61000-4-11	Criterion A 0.5 cycle
Emissions:		
Emissions	EN 55011	Class B

Note:

1. Criterion A: Normal operation within specified limits.

13. **ENVIRONMENTAL CONDITIONS**:
    Operating Temperature Range: 0 to 50 °C
    Storage Temperature Range: -40 to 80 °C
    Operating and Storage Humidity: 85% max (non-condensing) from 0 to 50 °C
    Span Drift: 50 ppm/ °C
    Zero Drift: 0.001 °C/°C
    Vibration According to IEC 68-2-6: Operational 5 to 150 Hz, in X, Y, Z direction for 1.5 hours, 2 g's.
    Shock According to IEC 68-2-27: Operational 30 g's, 11 msec in 3 directions.
    Altitude: Up to 2000 meters.
14. **CONSTRUCTION**: This unit is rated for NEMA 4X/IP65 outdoor use. One piece bezel/case. Flame resistant. Panel gasket and mounting clip included.
15. **CONNECTIONS**: High compression cage-clamp terminal block
    Wire Strip Length: 0.3" (7.5 mm)
    Wire Gage: 30-14 AWG copper wire
    Torque: 4.5 inch-lbs (0.51 N-m) max.
16. **WEIGHT**: 0.65 lbs. (0.24 Kg)

ACCESSORIES

UNITS LABEL KIT (PAXLBK)

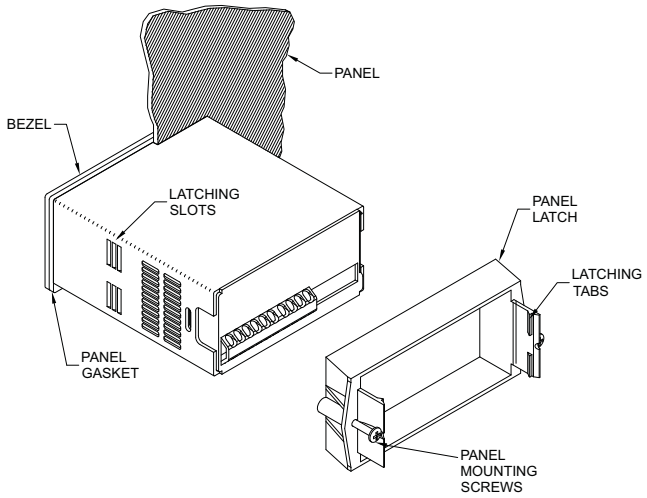
Each meter has a units indicator with backlighting that can be customized using the Units Label Kit. The backlight is controlled in the programming.

Each meter is shipped with °F and °C overlay labels which can be installed into the meter's bezel display assembly.

1.0 INSTALLING THE METER

Installation

The PAX meets NEMA 4X/IP65 requirements when properly installed. The unit is intended to be mounted into an enclosed panel. Prepare the panel cutout to the dimensions shown. Remove the panel latch from the unit. Slide the panel gasket over the rear of the unit to the back of the bezel. The unit should be installed fully assembled. Insert the unit into the panel cutout.



While holding the unit in place, push the panel latch over the rear of the unit so that the tabs of the panel latch engage in the slots on the case. The panel latch should be engaged in the farthest forward slot possible. To achieve a proper seal, tighten the latch screws evenly until the unit is snug in the panel (Torque to approximately 7 in-lbs [79N-cm]). Do not over-tighten the screws.

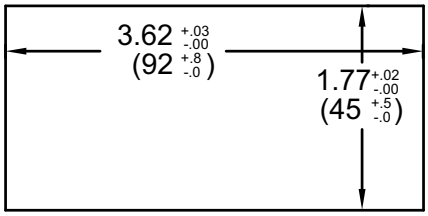
Installation Environment

The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.

PANEL CUT-OUT

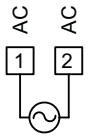


2.0 WIRING THE METER

POWER WIRING

Primary AC power is connected to Terminals 1 and 2. To reduce the chance of noise spikes entering the AC line and affecting the indicator, the AC power should be relatively "clean" and within the specified limits. Drawing power from heavily loaded circuits or circuits that also power loads that cycle on and off (contactors, relays, motors, machinery, etc.) should be avoided.

AC Power
Terminal 1: VAC
Terminal 2: VAC

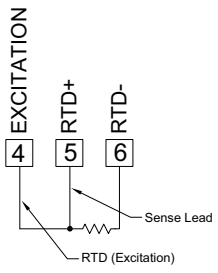


SIGNAL WIRING (RTD SENSOR)

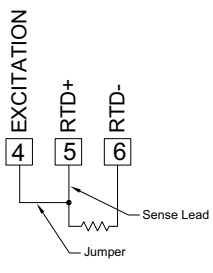
RTD sensors are used in applications where a high degree of accuracy is required. Most RTD sensors available are the 3-wire type. The 3rd additional wire is a sense lead for canceling the effects of lead resistance at the probe. The sense lead connects to Terminal 5 (RTD+), the common lead to Terminal 6 (RTD-), and the excitation lead to Terminal 4 (+ Excitation). The excitation and sense leads are generally the same color because they are functionally the same and may be interchanged at the meter. Four wire sensors have an additional sense lead connected (at the probe) to the common lead. Leave the extra sense lead disconnected when using a four wire probe with the PAXLRT meter. Always refer to the sensor manufacturer's instructions for probe wiring connections, if available. Two wire RTD sensors may be used with the PAXLRT by shorting Terminal 4 to Terminal 5, if the distance between sensor and meter is less than 30 feet. The total lead resistance can be used to predict the temperature error for 2-wire sensors, according to 2.5°C/Ω of lead resistance.

Note: Extended cable runs can be made provided the lead resistance is less than 20 Ω/lead and the resistance is equal in each lead.

3-Wire RTD



2-Wire RTD



PROGRAM DISABLE INPUT WIRING

PGM.DIS. (Terminal 3) is a digital input that is active when connected to RTD- (Terminal 6). Any form of mechanical switch or current sinking logic with less than 0.7 V saturation may be used. The use of shielded cable is recommended. Follow the EMC Installation Guidelines for shield connection.



WIRING OVERVIEW

Electrical connections are made via screw-clamp terminals located on the back of the meter. All conductors should conform to the meter's voltage and current ratings. All cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that the power supplied to the meter be protected by a fuse or circuit breaker.

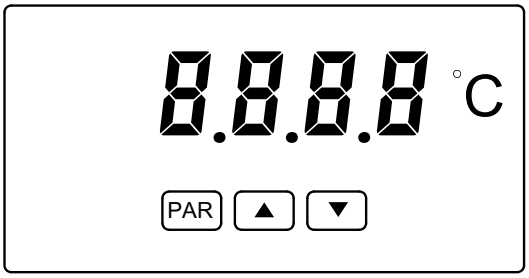
When wiring the meter, compare the numbers embossed on the back of the meter case against those shown in wiring drawings for proper wire position. Strip the wire, leaving approximately 0.3" (7.5 mm) bare lead exposed (stranded wires should be tinned with solder). Insert the lead under the correct screw-clamp terminal and tighten until the wire is secure. (Pull wire to verify tightness.)

EMC INSTALLATION GUIDELINES

Although this meter is designed with a high degree of immunity to Electro-Magnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into the meter may be different for various installations. The meter becomes more immune to EMI with fewer I/O connections. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

1. The meter should be mounted in a metal enclosure, which is properly connected to protective earth.
2. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.
   a. Connect the shield only at the panel where the unit is mounted to earth ground (protective earth).
   b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
   c. Connect the shield to common of the meter and leave the other end of the shield unconnected and insulated from earth ground.
3. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
4. Signal or Control cables within an enclosure should be routed as far as possible from contactors, control relays, transformers, and other noisy components.
5. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   Ferrite Suppression Cores for signal and control cables:
   Fair-Rite # 0443167251 (RLC# FCOR0000)
   TDK # ZCAT3035-1330A
   Steward # 28B2029-0A0
   Line Filters for input power cables:
   Schaffner # FN610-1/07 (RLC# LFIL0000)
   Schaffner # FN670-1.8/07
   Corcom # 1 VR3
   Note: Reference manufacturer's instructions when installing a line filter.
6. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.

3.0 REVIEWING THE FRONT BUTTONS AND DISPLAY



KEY	DISPLAY MODE OPERATION	PROGRAMMING MODE OPERATION
PAR	Access Programming Mode or Display Input Reading	Store selected parameter and index to next parameter
▲	Display Peak (HI) Reading	Increment value or change selection
▼	Display Valley (LO) Reading	Decrement value or change selection

PEAK/VALLEY DETECTION

The meter will automatically record the highest input reading (peak) and the lowest input reading (valley) for later recall. These values are stored at power-down to allow monitoring the process limits over any length of time (shifts, days, etc.). A selectable capture delay time is used to prevent detection of false peak or valley readings caused by sudden short spikes or unusual process events.

The peak and valley readings can be viewed and reset using the front panel keys as described below.

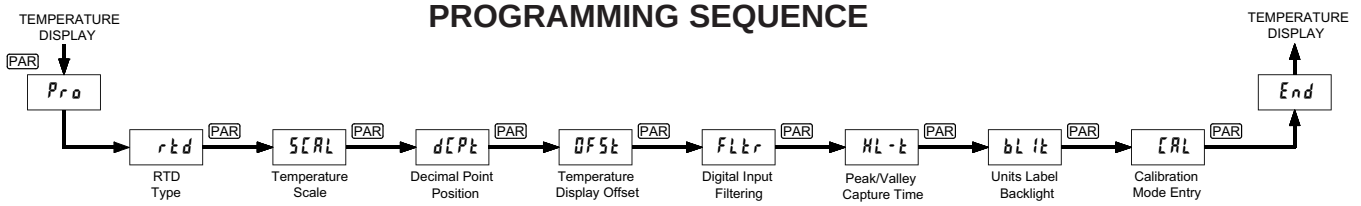
View Peak, Valley and Input readings:
To view Peak, press ▲. Meter displays HI followed by the Peak reading.
To view Valley, press ▼. Meter displays LO followed by the Valley reading.
To view Input, press **PAR**. Meter displays INPt followed by the current Input reading.

Note: The decimal point to the right of digit 1 flashes while the peak or valley reading is displayed.

Reset Peak and/or Valley to the current Input reading:
To reset Peak and Valley, press ▲ and ▼ simultaneously.
To reset Peak only, press and hold ▲ then press **PAR**.
To reset Valley only, press and hold ▼ then press **PAR**.
In each case, the meter displays rSEt followed by the current Input reading.

4.0 PROGRAMMING THE METER

PROGRAMMING SEQUENCE



The RTD Meter has seven programmable parameters that are entered in the sequence shown above, using the front panel push buttons.

The last programming step offers the choice of entering calibration mode. From this mode, the user can restore the meter to factory default settings or recalibrate the signal input if necessary. To prevent inadvertent entries, an access code must be keyed-in to perform any operations in calibration mode.

Note: Programming mode can be locked out using the Program Disable input terminal. With the PGM.DIS. terminal connected to RTD-, the meter displays "LOC" when the **PAR** *key is pressed, and will not enter programming mode.*

PROGRAMMING MODE ENTRY

Press the **PAR** key to enter Programming Mode. The meter briefly displays Pro followed by the first programming parameter described below.

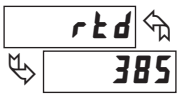
PROGRAMMING MODE TIMEOUT

The Programming Mode has an automatic timeout feature. If no keypad activity is detected for approximately 60 seconds, the meter automatically exits Programming Mode. The meter briefly displays End and returns to the normal display mode. When automatic timeout occurs, any changes that were made to the parameter currently being programmed will not be saved.

PROGRAMMING PARAMETERS

In Programming Mode, the display alternates between the parameter and the current selection or value for that parameter. The dual display with arrows is used below to illustrate the alternating display. The selection choices or value range for each parameter is shown to the right of the alternating display.

RTD TYPE



385 392

Select the RTD type by pressing the up or down arrow keys (▲ or ▼). When the desired selection is displayed, press the **PAR** key to save the selection and advance to the next parameter.

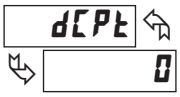
TEMPERATURE SCALE



°F °C

Select the desired temperature scale by pressing the up or down arrow keys. This setting does not change the Custom Units Overlay display (if installed). Press the **PAR** key to save the selection and advance to the next parameter.

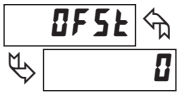
DECIMAL POINT POSITION



0 0.0

Select the decimal point position by pressing the up or down arrow keys. This sets the display resolution to 1 or 0.1 degree. Press the **PAR** key to save the selection and advance to the next parameter.

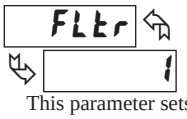
TEMPERATURE DISPLAY OFFSET



-1999 to 9999

The temperature display can be corrected with an offset value. This can be used to compensate for probe errors or errors due to variances in probe placement, or to adjust the readout to a reference thermometer. Set the desired display offset value by pressing (and/or holding) the up or down arrow keys. When the desired offset value is displayed, press the **PAR** key to save the selection and advance to the next parameter. The display resolution for the offset value is the same as the decimal point position programmed above.

DIGITAL FILTERING



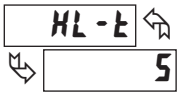
0 1 2 3

This parameter sets the amount of digital filtering applied to the input signal. If the temperature display is difficult to read due to small variations or noise, increased levels of filtering will help to stabilize the display. Although the digital filter features a "moving window" to help minimize response time, higher levels of filtering will result in slightly longer response times.

0 - no digital filtering
1 - normal filtering
2 - increased filtering
3 - maximum filtering

Set the desired level of input filtering by pressing the up or down arrow keys. Press the **PAR** key to save the selection and advance to the next parameter.

PEAK (HI)/ VALLEY (LO) CAPTURE DELAY TIME

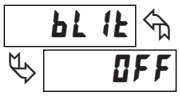


0 2 5 10 20 seconds

When the Input display is above the present HI value or below the present LO value for the entered delay time, the meter will capture the Input display as the new HI or LO reading. A delay time helps to avoid false captures of sudden short spikes or Input display variations that may occur during start-up.

Set the desired capture delay time by pressing the up or down arrow keys. Press the **PAR** key to save the selection and advance to the next parameter.

UNITS LABEL BACKLIGHT



ON OFF

The Units Label Kit Accessory contains a sheet of custom unit overlays, which can be installed in the meter bezel display assembly. The unit of measure for the meter display is then visible when the label backlight is illuminated. The two most commonly used temperature unit labels (°F and °C) are supplied with the meter. Press the up or down arrow keys to select whether the units label backlight is illuminated. Press the **PAR** key to save the selection and advance to the next parameter.

PROGRAMMING MODE EXIT



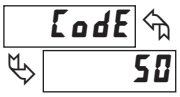
YES NO

Before exiting Programming Mode, The meter offers the choice of entering Calibration Mode. To exit Programming Mode without entering Calibration Mode, select NO and press the **PAR** key. The meter briefly displays End and returns to the normal display mode. All programmed selections are now transferred to non-volatile memory and are retained if power is removed from the meter.

(If power loss occurs during Programming Mode, verify parameter changes and reprogram, if necessary, when power is restored.)

5.0 CALIBRATING THE METER

CALIBRATION MODE

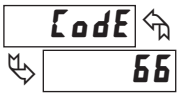


0 to 99

To enter Calibration Mode, select CAL < > YES at the end of Programming Mode, and press the **PAR** key. In Calibration Mode, the user can restore the meter to factory default settings or recalibrate the signal input if necessary.

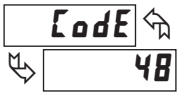
To prevent inadvertent entries, an access code must be entered to perform any operation in Calibration Mode. Upon entering Calibration Mode, the meter initially displays Code 50. Press the up or down arrow keys to select the access code for the desired operation. If an access code other than those shown below is entered, the meter exits Calibration Mode and returns to normal display mode.

FACTORY SETTINGS



The factory settings for the programming parameters are shown in the previous section in the alternating display illustrations. All programming parameters can be restored to the factory default settings by entering the access Code 66 and pressing the **PAR** key. The meter briefly displays rSEt and then returns to Code 50. This procedure resets only parameters that are accessed through Programming Mode. The Calibration Mode settings (input calibration levels) are not affected.

METER INPUT CALIBRATION



The meter has been fully calibrated at the factory. If the meter appears to be indicating incorrectly or inaccurately, refer to the troubleshooting section before attempting this procedure. When re-calibration is required *(generally every 2 years)*, the procedure should only be performed by qualified technicians using appropriate equipment. Resistance source accuracies of 0.02% or better are required.

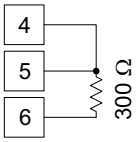
The procedure consists of applying accurate signal levels to the meter input in a series of two steps. Allow a 30-minute warm-up period before starting calibration. To begin the input calibration, enter access Code 48 and press the **PAR** key.

ENTER ZERO REFERENCE

Meter displays 0r. Apply 0 ohms to the meter input by shorting Terminals 4, 5, and 6. Allow the meter to stabilize at least 20 seconds after shorting the terminals, and then press **PAR**.

APPLY PRECISION RESISTANCE

Meter displays 300r. Connect a precision 300 ohm resistor across Terminals 5 and 6. Terminals 4 and 5 remain shorted. *(Note: Be certain to short Terminals 4 and 5 at the resistor as shown in the drawing below. Shorting terminals may lead to incorrect calibration.)*



Allow the meter to stabilize at least 20 seconds after making the connections, and then press **PAR**. The meter briefly displays End and returns to the normal display mode. Calibration is now complete. It is recommended to check calibration by comparing the displayed temperature with a precision thermometer.

TROUBLESHOOTING

The majority of all problems with the meter can be traced to improper connections or improper programming set-ups. Be sure all connections are clean and tight and check the programming set-ups for correct data.

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

PROBLEM	POSSIBLE CAUSE	REMEDIES
NO DISPLAY	1. Power off, improperly connected, or brown-out.	1a. Check wiring. 1b. Verify power.
"EEEE" IN DISPLAY	1. Program data error.	1. Press **PAR** and check data set-ups.
". . . ." or "-. . . ." IN DISPLAY	1. Input display out of range. 2. Loss of data set-ups.	1a. Change display resolution to "1" degree. 1b. Reduce offset value. 2a. Check data set-ups. 2b. Check for electrical disturbance. 2c. Disconnect and reconnect power.
DISPLAY WANDERS	1. Loss of data set-ups.	1a. Check data set-ups. 1b. Disconnect and reconnect power. 1c. Check for electrical disturbance.
JITTERY DISPLAY	1. Electrical "Noise" in process or sensor lines. 2. Process inherently unstable.	1a. Increase digital filtering. 1b. Re-route signal wires. 2. Dampen process to eliminate oscillations.
"OPEn" IN DISPLAY	1. Probe unconnencted. 2. Broken or burnout probe. 3. Excessive probe temperature. 4. Input overload.	1. Connect probe. 2. Repair or obtain new probe. 3. Reduce temperature. 4. Check input levels.
"SHrt" IN DISPLAY	1. Input shorted.	1. Check input connections.

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