Field Calibration Procedure
1600 Series

LOVE CONTROLS DIVISION

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Required Equipment

Input Signal

Thermocouple inputs require a Millivolt Runup (MVR) with an output impedance of 100 ohms or less. Accuracy must be ±0.1% or better.

RTD inputs require a laboratory grade Resistance Decade box (RD) with resolution to 0.01 ohm and an accuracy of ±0.1% or better.

Voltage inputs require a variable power supply with a maximum of 10 Volts or greater.

Current inputs require a variable power supply (as Voltage inputs above) and a precision resistor of 100 ohms ± 0.1% or better. (If you have a 20 Volt variable power supply, you may use a 1000 ohm resistor ±0.1% or better. This allows reading milliamps as volts on the DVM.)

One Digital Multimeter (DMM) with resolution to 4 1/2 digits or better with an accuracy of 0.05% or better.

One Ambient Temperature Indicator with an accurcy of ±1°F or better.

One low wattage, small tip soldering iron, one pair needle nose pliers, solder, and assorted test leads.

The housing of the control can be used for test and recalibration purposes.

Caution: The components in the control are suseptable to damage from ESD, electrostatic discharge. Take appropriate action to avoid exposure to ESD. Controls damaged by ESD are not covered by warranty.

Wiring

Assemble the equipment you need with the control(s) to be calibrated on a clear work space. If you are calibrating for thermocouple inputs, make sure that the area is free from drafts or strong air currents.

For thermocouple, millivolt, or voltage inputs, wire the control as shown in figure A.

For RTD inputs wire the control as shown in Figure B.

For current inputs wire the control as shown on Figure C. If you are using a 10 volt power supply with a 100 ohm resistor, set the DMM input to read on the 2 volt scale, and read current in milliamps divided by 10. If you are using a 20 volt power supply, set the DMM to read on the 20 volt scale, and read current in milliamps.

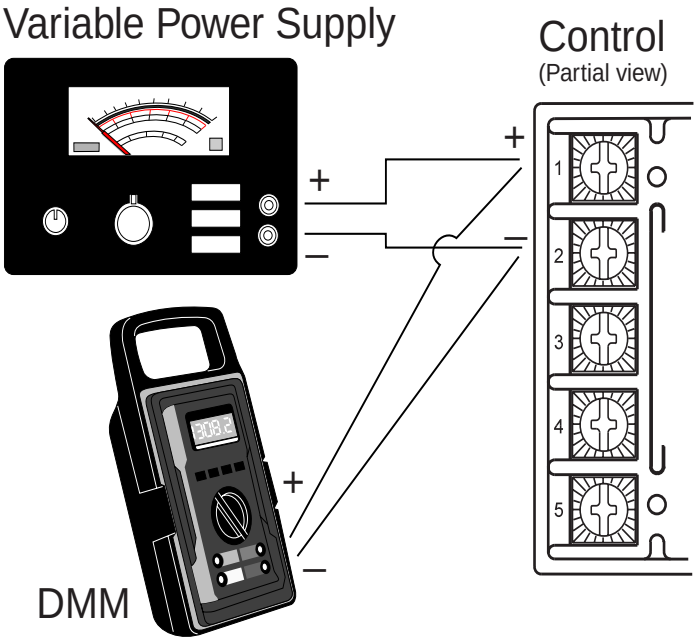

Figure A. Thermocouple, milllivolt, and voltage input wiring.

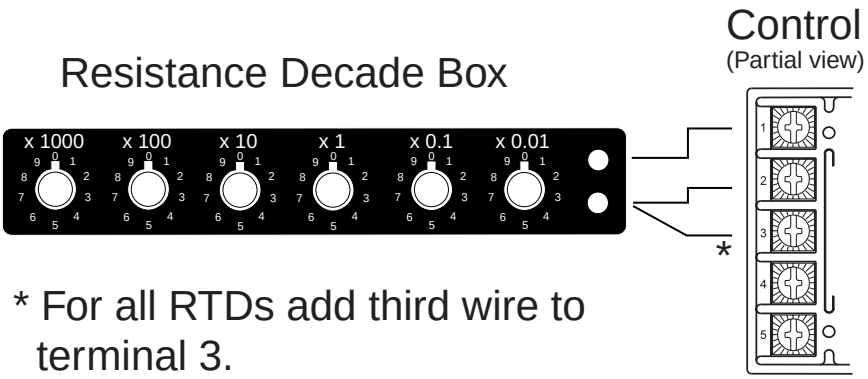

Figure B. RTD input wiring.

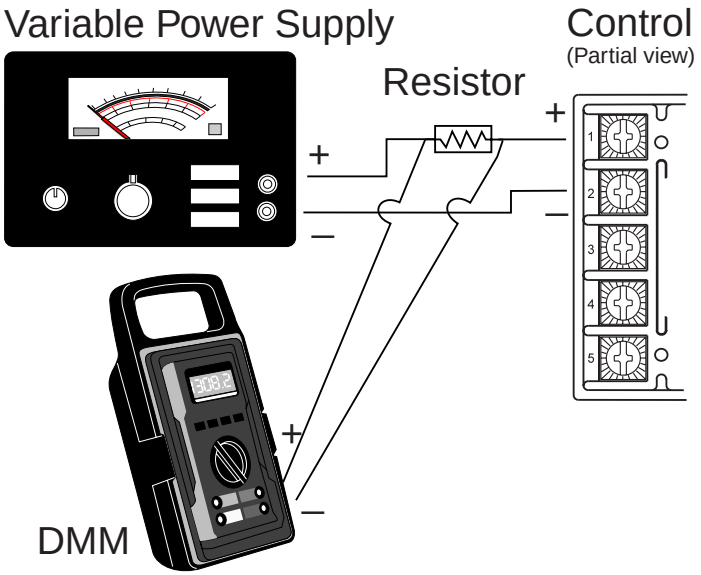

Figure C. Current input wiring.

Overview

Calibration for the various inputs fall into six different groups. Generally, for field calibration only the group that applies to your desired input needs to be checked. To select a group make sure that the input you are using is selected for the **InP** menu item in the Secure Menu. To calibrate for all groups select an input for one group, calibrate for that group, and then select an input from the next group, calibrate, and repeat for all groups.

Group 1: Low gain thermocouples: Types J, K, E, L, N.
Group 2: High gain thermocouples and millivolt input: Types T, R, S, B, C.
Group 3: 100 and 120 ohm RTD inputs.
Group 4: 0 to 20 mA input.
Group 5: 0 to 5 V input.

Procedure

1. Wire the control as shown in Figures A, B, or C for the input to be calibrated.

2. Set the Input DIP Switch for the desired input to be calibrated (See Figure D).

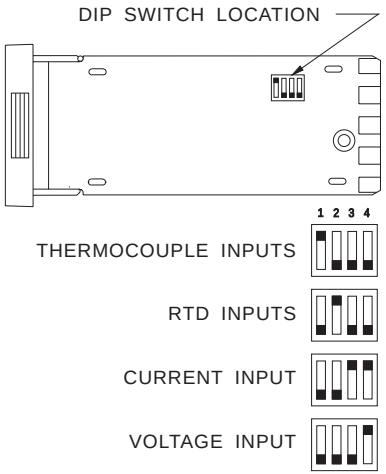

Figure D. Input DIP Switch Location and Settings

3. Allow the control to warm up for at least one hour before proceding.

4. Enter the Secure Menu by simultaneously holding the UP ARROW and ENTER keys for five seconds. The display should show **SECr** set to a value of **4**. If **SECr** is not set to **4**, press the UP ARROW key until the display reads **111** and press the ENTER key. The display will blink and show **SECr** as **4**.

5. Press the INDEX key. The display should show **InP** and the type of input you are calibrating. If the setting is not correct, press the UP ARROW or DOWN ARROW keys to display the input desired and press ENTER.

6. Press the UP ARROW or DOWN ARROW key to display **InP** and **- - - -** (four dashes). Press ENTER. The lower display will show **CAL0**.

7. Press the UP ARROW key until the lower display shows **CAL3**. Read the value in the upper display. Refer to Table 1 for the range of values appropriate for the Group you are calibrating. Please note that the values are in hexadecimal format (base 16). Hexadecimal numbers

use the letters a through f in addition to the digits 0 through 9. Count the numbers as follows: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, b, C, d, E, F, 10.

If the displayed value is out of range, the control can not be calibrated and must be returned to the Factory for service.

8. Press the UP ARROW key once. The lower display should show **CAL4**. Read the value in the upper display. Refer to Table 1 for the range of values appropriate for the Group you are calibrating.

   If the displayed value is out of range, the control can not be calibrated and must be returned to the Factory for service.

9. Press the UP ARROW key once. The lower display should show **CAL5**. Refer to Table 1 for the appropriate input value for the Group you are calibrating. Adjust the millivolt, volt, milliamp, or resistance source to the appropriate value. Read the value in the upper display. Refer to Table 1 for the range of values appropriate for the Group you are calibrating.

   If the displayed value is out of range, the control can not be calibrated and must be returned to the Factory for service.

   If the value is within the specified range, press and hold the ENTER key and the DOWN ARROW key. (Press the ENTER key first.) The display will blink to acknowledge the entry.

10. Press the UP ARROW key once. The lower display should show **CAL6**. Refer to Table 1 for the appropriate input value for the Group you are calibrating. Adjust the millivolt, volt, milliamp, or resistance source to the appropriate value. Read the value in the upper display. Refer to Table 1 for the range of values appropriate for the Group you are calibrating.

    If the displayed value is out of range, the control can not be calibrated and must be returned to the Factory for service.

    If the value is within the specified range, press and hold the ENTER key and the DOWN ARROW key. (Press the ENTER key first.) The display will blink to acknowledge the entry.

11. The following steps are not required for Groups 3 through 5. Groups 1 and 2 must continue.

Caution: The components in the control are suseptable to damage from ESD, electrostatic discharge. Take appropriate action to avoid exposure to ESD. Controls damaged by ESD are not covered by warranty.

12. Remove the control chassis from the housing. Using Figure E carefully solder a small jumper wire across the RJC sensor on the A/D printed cirsuit board. Allow the board to fully cool before proceding.

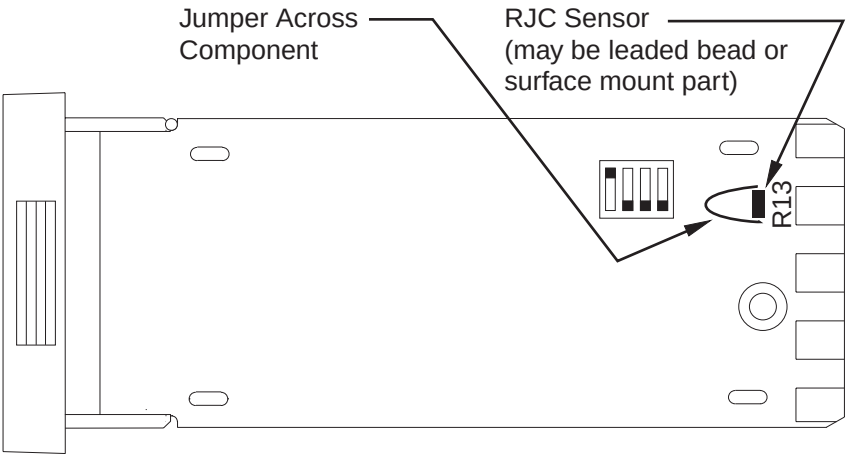

Figure E. RJC sensor and jumper location for 1600 Series

13. Return to the calibration mode using steps 3, 4, and 5. Press the UP ARROW key so the lower display reads **CAL2**. Wait for the reading in the upper display to stablize.

14. Press the UP ARROW key until the lower display reads **CAL7**. Refer to Table 1 for the appropriate input value for the Group you are calibrating. Read the value in the upper display. Refer to Table 1 for the range of values appropriate for the Group you are calibrating.

    If the displayed value is out of range, the control can not be calibrated and must be returned to the Factory for service.

    If the value is within the specified range, press and hold the ENTER key and the DOWN ARROW key. (Press the ENTER key first.) The display will blink to acknowledge the entry.

15. Carefully remove the jumper installed in step 12. Allow time for the RJC to return to ambient temperature. Return to the calibration mode using steps 3, 4, and 5. Press the UP ARROW key so the lower dis-

play reads **CAL2**. Wait for the reading in the upper display to stablize. Use the Ambient Temperature Indicator to measure the temperature at terminal 2 on the instrument housing.

15. Press the UP ARROW key so the lower display reads **CAL8**. Press ENTER. The display will flash. Use the UP ARROW and DOWN ARROW keys to raise or lower the displayed value to match the value measured in step 13. When the value is correct, press and hold the ENTER key and the DOWN ARROW key. (Press the ENTER key first.) The display will blink to acknowledge the entry.

Calibration is complete.

		Group 1	Group 2	Group 3	Group 4	Group 5
CAL0		Input Value	Input Value	Input Value	Input Value	Input Value
CAL1		Input less RJC	Input less RJC	Input less RJC	Input less RJC	Input less RJC
CAL2		RJC	RJC	RJC	RJC	RJC
CAL3		12C3-16C3	2d46-3146	12C3-16C3	12C3-16C3	12C3-16C3
CAL4		4F41-5341	AA4A-b24A	4F41-5341	4F41-5341	4F41-5341
CAL5	Input	+4.663mV	-4.090mV	25.60 Ω	1.094mA	0.2734V
	Read	1b4C-1F4C	1b4C-1F4C	1b4C-1F4C	1b4C-1F4C	1b4C-1F4C
CAL6	Input	73.953mV	28.410mV	417.63 Ω	17.341mA	4.3352V
	Read	9A40-9E40	9A40-9E40	9A40-9E40	9A40-9E40	9A40-9E40
CAL7		19EC-3140	19EC-3140	19EC-3140	19EC-3140	19EC-3140
CAL8		Temp @ Terminal 2	Temp @ Terminal 2	*Temp @ Terminal 2	*Temp @ Terminal 2	*Temp @ Terminal 2

* Groups 3 through 5 do not require RJC calibration.

Table 1. Calibration Reference Chart