

7.2 Minimum and Maximum Range Values

Select the range values

You should calibrate the controller for the minimum (0%) and maximum (100%) range values of your particular sensor. If you have a two input controller, calibrate each input separately.

Select the Voltage or Resistance equivalent for 0% and 100% range values from Table 7-1. Use these value when calibrating your controller.

Table 7-1 Voltage and Resistance Equivalents for 0% and 100% Range Values

Sensor Type	PV Input Range		Range Values	
	°F	°C	0%	100%
Thermocouples				
B	0 to 3300	-18 to 1816	-0.100 mV	13.769 mV
E	-454 to 1832	-270 to 1000	-9.835 mV	76.373 mV
E (low)	-200 to 1100	-129 to 593	-6.472 mV	44.455 mV
J	0 to 1600	-18 to 871	-0.886 mV	50.060 mV
J (low)	20 to 770	-7 to 410	-0.334 mV	22.400 mV
K	0 to 2400	-18 to 1816	-0.692 mV	52.952 mV
K (low)	-20 to 1000	-29 to 538	-1.114 mV	22.255 mV
NiNiMoly (NNM68)	32 to 2500	0 to 1371	0.000 mV	71.330 mV
NiNiMoly (low)	32 to 1260	0 to 682	0.000 mV	31.820 mV
NiMo-NiCo (NM90)	32 to 2500	0 to 1371	0.000 mV	71.773 mV
NiMo-NiCo (low)	32 to 1260	0 to 682	0.000 mV	31.825 mV
Nicrosil Nisil (Nic)	0 to 2372	-18 to 1300	-0.461 mV	47.513 mV
R	0 to 3100	-18 to 1704	-0.090 mV	20.281 mV
S	0 to 3100	-18 to 1704	-0.092 mV	17.998 mV
T	-300 to 700	-184 to 371	-5.341 mV	19.097 mV
T (low)	-200 to 500	-129 to 260	-4.149 mV	12.574 mV
W5W26	0 to 4200	-18 to 2315	-0.234 mV	37.075 mV
W5W26 (low)	0 to 2240	-18 to 1227	-0.234 mV	22.283 mV
Honeywell Radiamatic				
Type RH	0 to 3400	-18 to 1871	0.00 mV	57.12 mV
Type RI*	0 to 9999 max.	-18 to 9999 max.	0.00 mV	60.08 mV
RTD (IEC Alpha=0.00385)				
100 ohms	-300 to 1200	-184 to 649	25.18 ohms	274.96 ohms
100 ohms (low)	-300 to 300	-184 to 149	25.18 ohms	156.90 ohms
200 ohms	-300 to 1200	-184 to 649	50.36 ohms	549.92 ohms
500 ohms	-300 to 1200	-184 to 649	125.90 ohms	1374.80 ohms
Linear				
Milliamps	4 to 20 mA 0 to 20 mA		4.00 mA 0.00 mA	20.00 mA 20.00 mA
Millivolts	0 to 10 mV 0 to 50 mV		0.00 mV 0.00 mV	10.00 mV 50.00 mV
Volts	1 to 5 Volts 0 to 5 Volts 0 to 10 Volts		1.00 Volts 0.00 Volts 0.00 Volts	5.00 Volts 5.00 Volts 10.00 Volts
Carbon	0 to 1250 mV		0.00 mV	1250 mV
Oxygen	-30 to 510 mV		-30.00 mV	510.00 mV

*User must enter the range manually per RI type and application.

ATTENTION

Thermocouple voltages are for a reference junction temperature of 32°F (0°C).

7.3 Preliminary Information

Calibration steps

Use the following steps when calibrating an input.

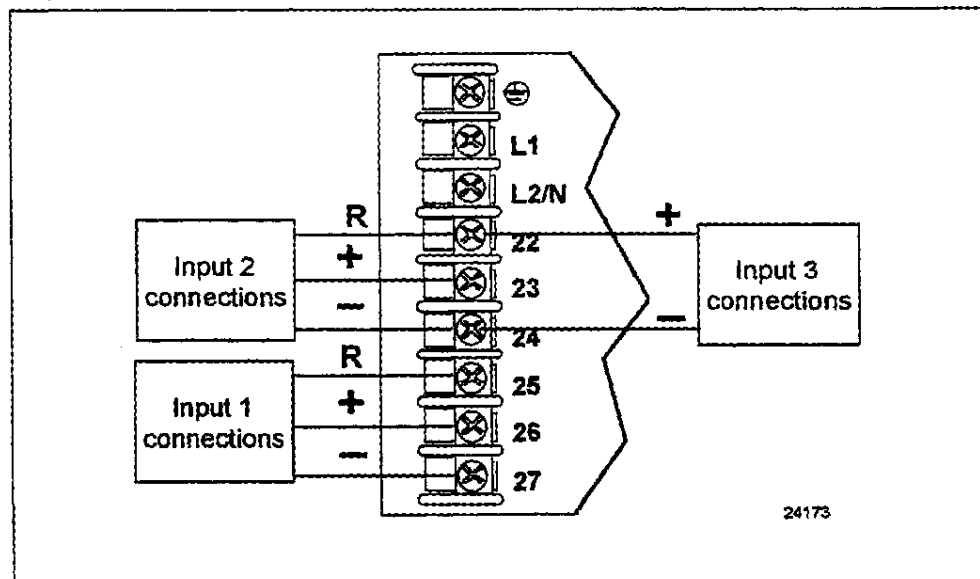
Step	Action
1	Find the minimum and maximum range values for your PV input range from Table 7-1.
2	Disconnect the field wiring and find out what equipment you will need to calibrate. DO NOT remove external resistor assemblies (if present).
3	Wire the calibrating device to your controller according to the Set Up wiring instructions for your particular input.
4	Follow the calibration procedure given for Input #1, Input #2, or Input #3, after the controller has warmed up for a minimum of 15 minutes.

Disconnect the field wiring

Depending on which input (#1, #2, or #3) you are going to calibrate, tag and disconnect any field wiring connected to the input terminals on the rear of the controller.

Figure 7-1 shows the wiring terminal designations for Input #1, Input #2, and Input #3.

Figure 7-1 Inputs #1, #2, and #3 Wiring Terminals



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Equipment needed

Table 7-2 lists the equipment you will need to calibrate the specific types of inputs that are listed in the table. You will need a screwdriver to connect these devices to your controller.

Table 7-2 Equipment Needed

Type of Input	Equipment Needed
<i>Thermocouple Inputs (Ice Bath)</i>	<ul style="list-style-type: none"> • A calibrating device with $\pm 0.02\%$ accuracy for use as a signal source such as a millivolt source. • Thermocouple extension wire that corresponds with the type of thermocouple that will be used with the controller input. • Two insulated copper leads for connecting the thermocouple extension wire from the ice baths to the precision calibrator. • Two containers of crushed ice.
<i>Thermocouple Inputs (Precision Resistor)</i>	<ul style="list-style-type: none"> • A calibrating device with $\pm 0.02\%$ accuracy for use as a signal source such as a millivolt source. • Two insulated copper leads for connecting the calibrator to the controller. • A precision 500 ohm resistor $\pm 0.1\%$ connected across input #1 terminals 25 (R) and 27 (-) or input #2 terminals 22 (R) and 24 (-).
<i>RTD (Resistance Thermometer Device)</i>	<ul style="list-style-type: none"> • A decade box, with $\pm 0.02\%$ accuracy, capable of providing stepped resistance values over a minimum range of 0 to 1400 ohms with a resolution of 0.1 ohm. • Three insulated copper leads for connecting the decade box to the controller.
<i>Milliampere, Millivolt, Volts, and Radiomatic</i>	<ul style="list-style-type: none"> • A calibrating device with $\pm 0.02\%$ accuracy for use as a signal source. • Two insulated copper leads for connecting the calibrator to the controller. • Place current source at zero before switching ON. • Do not switch current sources OFF/ON while connected to the UDC 3300 input.

7.4 Input #1, #2, or #3 Set Up Wiring

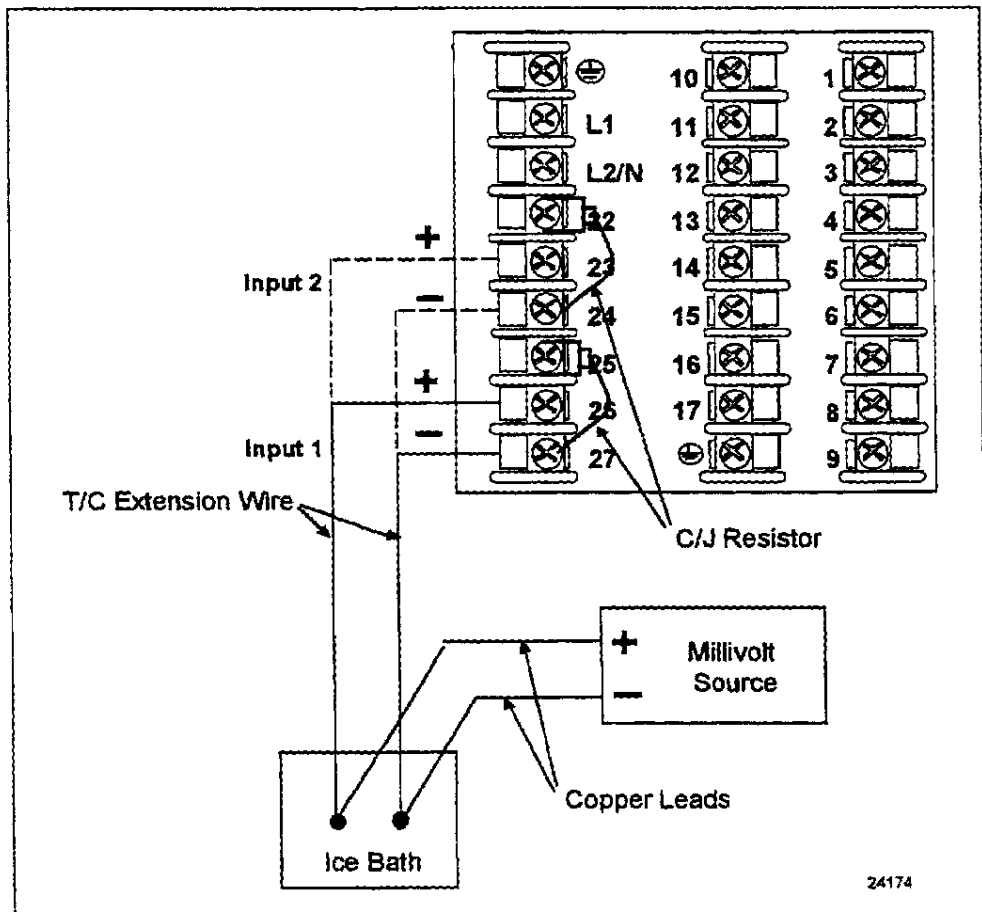
Thermocouple inputs using an ice bath

Referring to Figure 7-2, wire the controller according to the procedure given in Table 7-3.

Table 7-3 Set Up Wiring Procedure for Thermocouple Inputs Using an Ice Bath

Step	Action
1	Connect the copper leads to the calibrator.
2	Connect a length of thermocouple extension wire to the end of each copper lead and insert the junction points into the ice bath.
3	Connect the thermocouple extension wires to the terminals for Input #1 or Input #2. See Figure 7-2.
4	Connect a cold junction resistor to terminals 25 and 27 for Input #1 or terminals 22 and 24 for Input #2. See Figure 7-2.

Figure 7-2 Wiring Connections for Thermocouple Inputs Using an Ice Bath



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7.4 Input #1, #2, or #3 Set Up Wiring, Continued

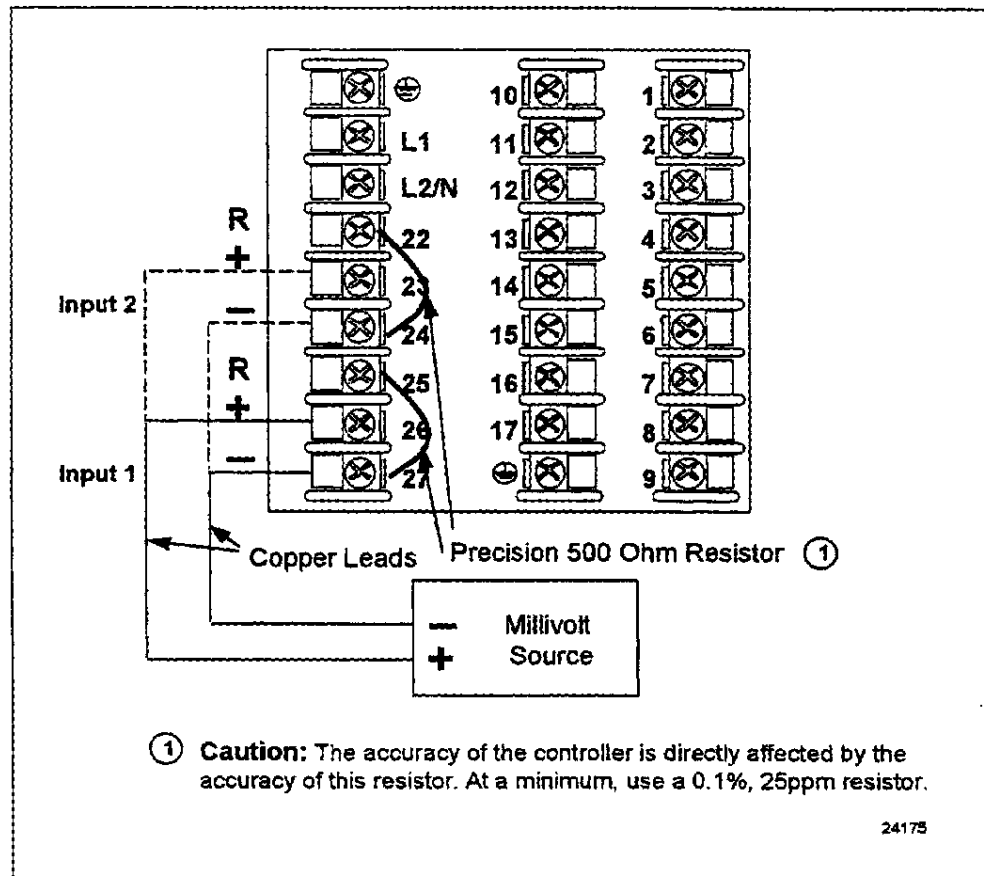
Thermocouple inputs using a precision resistor

Referring to Figure 7-3, wire the controller according to the procedure given in Table 7-4.

Table 7-4 Set Up Wiring Procedure for Thermocouple Inputs Using a Precision Resistor

Step	Action
1	Connect the copper leads to the calibrator.
2	Disconnect the cold junction resistor.
3	Install a 500-ohm precision resistor across Input 1 terminals 25 (R) and 27 (-) or Input 2 terminals 22 (R) and 24 (-). See Figure 7-3.
4	Subtract the millivolt value for 77°F (25°C) from the zero and span value for your range (see Table 7-1 for zero and span values) and use the adjusted value when calibrating.

Figure 7-3 Wiring Connections for Thermocouple Inputs Using a Precision Resistor



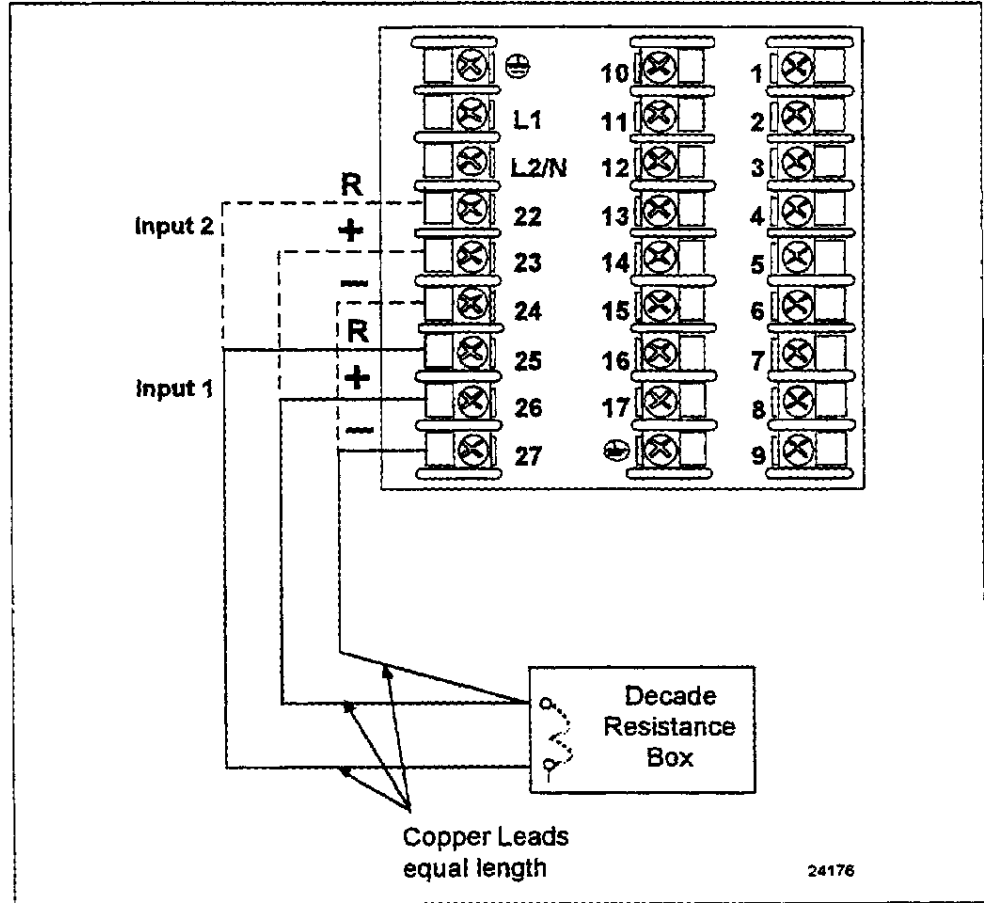
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7.4 Input #1, #2, or #3 Set Up Wiring, Continued

RTD inputs

Use the copper leads and connect the calibrator to the rear terminals of Input #1 or #2. See Figure 7-4.

Figure 7-4 Wiring Connections for RTD (Resistance Thermometer Device)



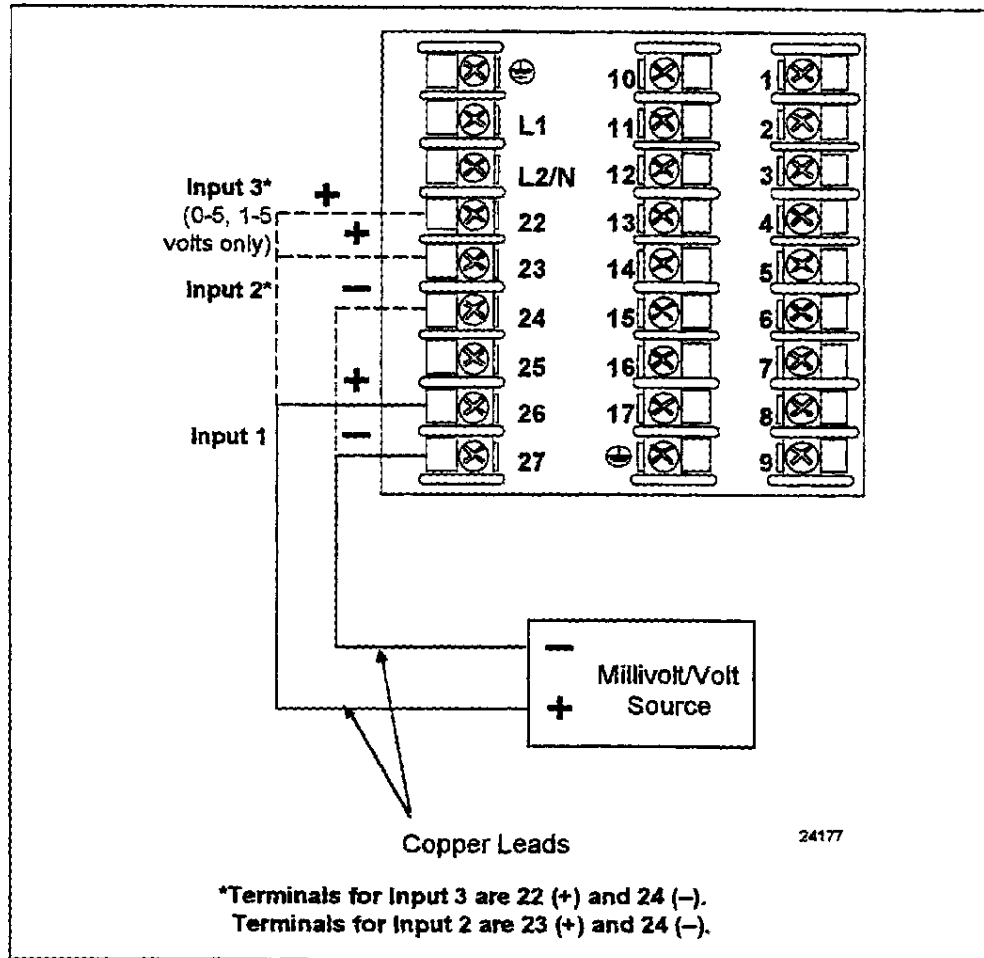
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7.4 Input #1, #2, or #3 Set Up Wiring, Continued

Radiamatic, millivolts, or volts (except 0 to 10 volts) inputs

Use the copper leads and connect the calibrator to the rear terminals of Input #1, #2, or #3. See Figure 7-5.

Figure 7-5 Wiring Connections for Radiamatic, Millivolts, or Volts (except 0 to 10 Volts)



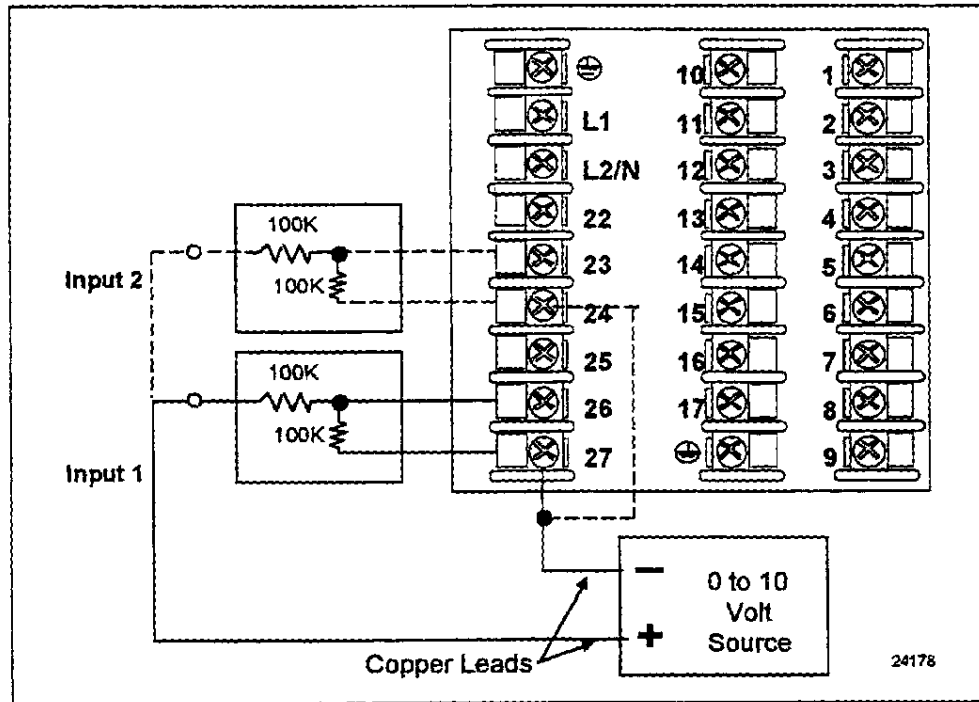
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7.4 Input #1, #2, or #3 Set Up Wiring, *Continued*

0 to 10 volt inputs

Use the copper leads and connect the calibrator to the rear terminals of Input #1 or #2. See Figure 7-6.

Figure 7-6 Wiring Connections for 0 to 10 Volt Inputs



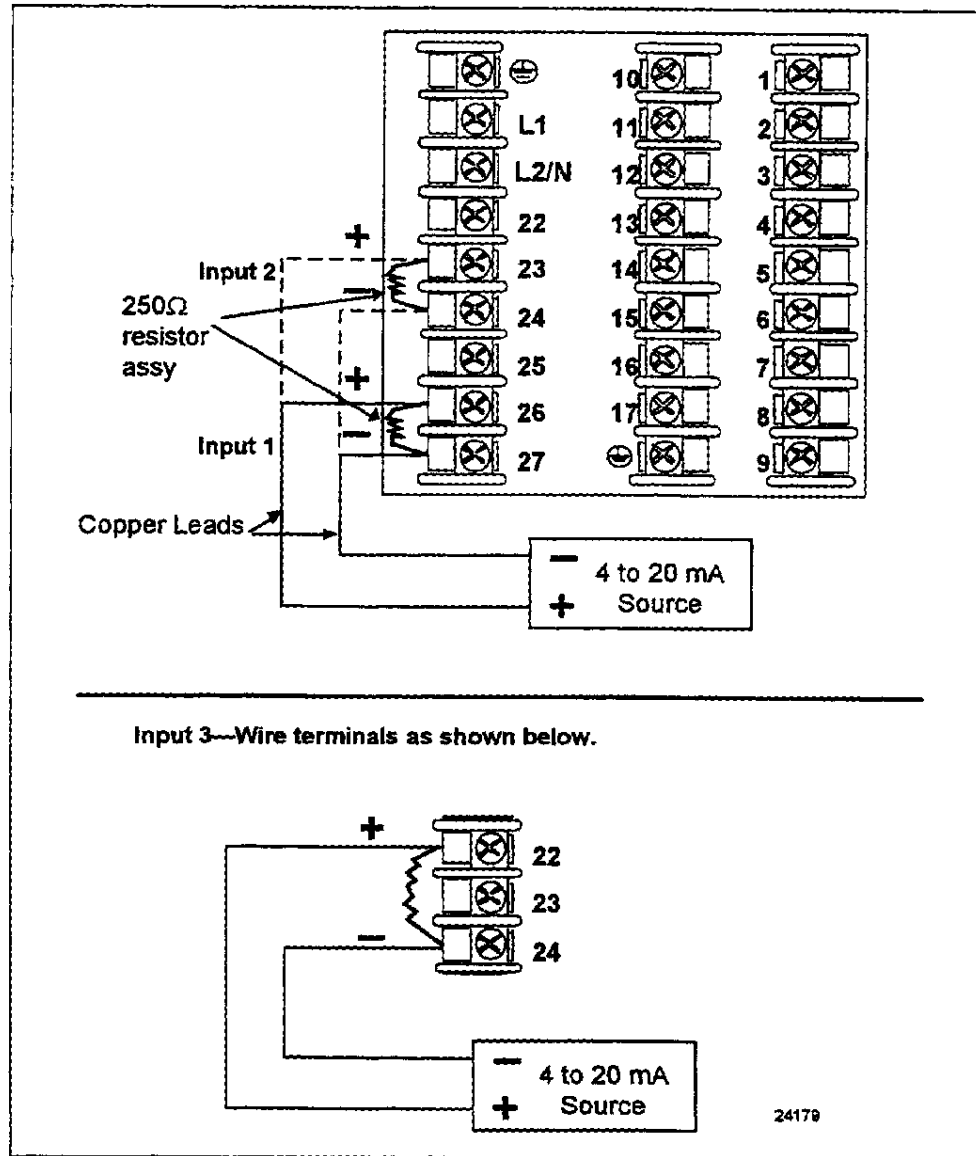
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7.4 Input #1, #2, or #3 Set Up Wiring, Continued

4 to 20 mA inputs

Use the copper leads and connect the calibrator to the rear terminals of Input #1, #2, or #3. See Figure 7-7.

Figure 7-7 Wiring Connections for 4 to 20 mA inputs



7.5 Input #1, #2, or #3 Calibration Procedure

Introduction

Apply power and allow the controller to warm up for 15 minutes before you calibrate. Read *“Set Up Wiring”* before beginning the procedure. Make sure you have LOCKOUT set to NONE. See *Section 3 – Configuration*.

CAUTION For linear inputs, avoid step changes in inputs. Vary smoothly from initial value to final 100% value.

Procedure

The Calibration procedure for Input #1, #2, or #3 is listed in Table 7-5.

Table 7-5 Input #1, #2, or #3 Calibration Procedure




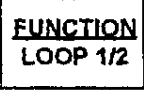
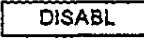





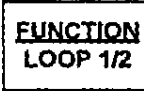


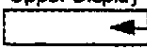
Step	Description	Press	Action
1	Enter Calibration Mode		until you see Upper Display  Lower Display  n = 1, 2, or 3
			You will see: Upper Display  Lower Display  n = 1, 2, or 3
		 or 	The calibration sequence is enabled and you will see: Upper Display  Lower Display  n = 1, 2, or 3 At the completion of the sequence, the selection automatically reverts to disable.
2	Calibrate 0%		You will see: Upper Display  Lower Display  n = 1, 2, or 3 Adjust your calibration device to an output signal equal to the 0% range value for your particular input sensor. See Table 7-1 for Voltage or Resistance equivalents. Wait 15 seconds, then go to the next step.

Table 7-5 is continued on the next page

7.5 Input #1, #2, or #3 Calibration Procedure, Continued

Procedure, continued

Table 7-5 Input #1 or #2 Calibration Procedure, Continued

Step	Description	Press	Action						
3	Calibrate 100%	FUNCTION LOOP 1/2	<p>You will see:</p> <p>Upper Display APPLY</p> <p>Lower Display INn SPAN n = 1, 2, or 3</p> <p>Adjust your calibration device to an output signal equal to the 100% range value for your particular input sensor. See Table 7-1 for Voltage or Resistance equivalents.</p> <p>Wait 15 seconds, and</p> <table border="1"> <thead> <tr> <th>If...</th> <th>Then...</th> </tr> </thead> <tbody> <tr> <td>you are calibrating a thermocouple input (Input 1 or 2)</td> <td>Go to step 4</td> </tr> <tr> <td>you are calibrating other than a thermocouple input</td> <td>Go to step 5</td> </tr> </tbody> </table>	If...	Then...	you are calibrating a thermocouple input (Input 1 or 2)	Go to step 4	you are calibrating other than a thermocouple input	Go to step 5
If...	Then...								
you are calibrating a thermocouple input (Input 1 or 2)	Go to step 4								
you are calibrating other than a thermocouple input	Go to step 5								
4	<p>Check the Cold Junction Temperature</p> <p>CAUTION The accuracy of the controller is directly affected by the accuracy of this value. Change this value only if the zero and span calibration procedures did not bring the controller within the specified accuracy requirements.</p>	FUNCTION LOOP 1/2	<p>The calculations for zero and span are now stored and you will see:</p> <p>Upper Display  ← The cold junction temperature at the rear terminals</p> <p>Lower Display C-J TEMP</p> <p>The value in the upper display is in the tenths of a degree. It is the current reading of the temperature as measured at the thermocouple terminals and recognized by the controller. You can change this value, if it is in error, using the ▲ or ▼ key.</p> <p>ATTENTION When calibrating T/C inputs using a precision 500-ohm resistor, calibrate the cold junction as 77°F (25°C).</p>						
5	Exit the Calibration Mode	FUNCTION LOOP 1/2	The controller will store the calibration constants and exit calibration mode.						