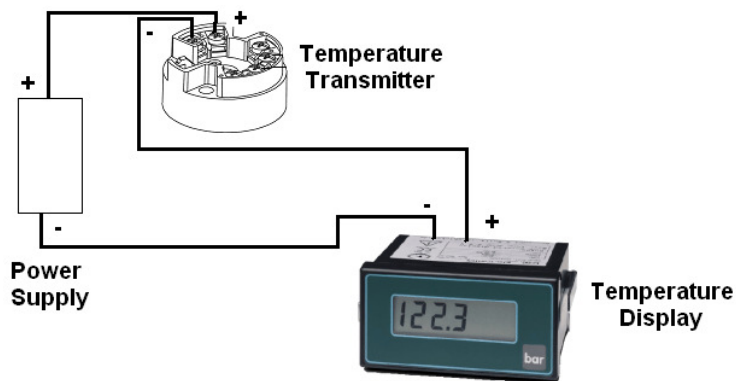


**Question:** How do you wire a 4 – 20 mA loop?

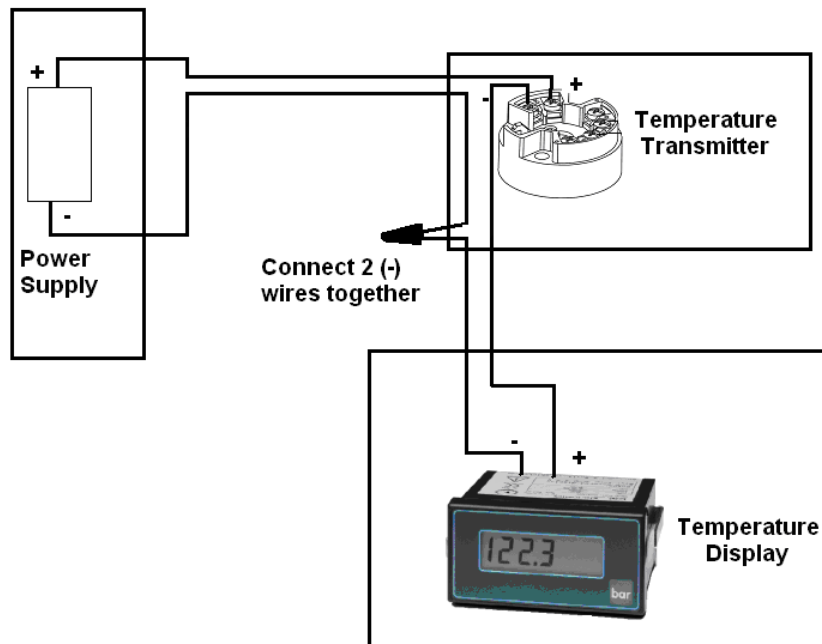
**Hook-up:**

4 – 20 mA loops are series connected elements (like flashlight batteries). A simple overview of the loop concept might help.

The elements of a current loop are connected in series. An easy way to remember the connections is (+) → (-), (-) → (+), then reverse the power supply connections (+) → (+), (-) → (-). Everything is connected in series. Although this looks easy when it is drawn like below, mistakes are often made when we go through junction boxes.

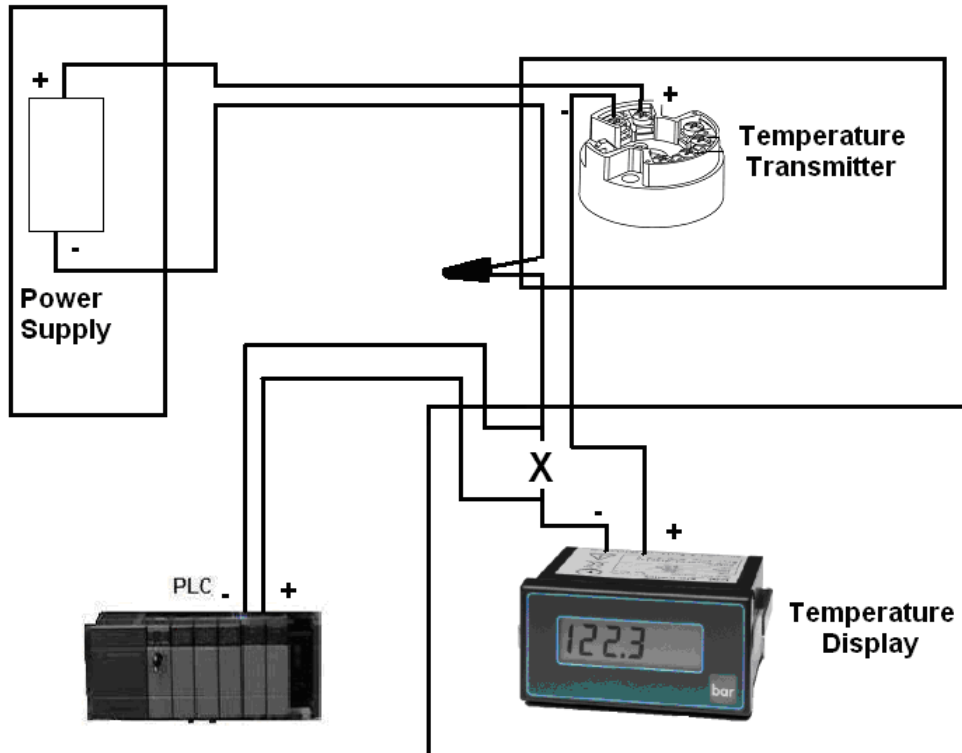


Redrawing the circuit above we can see how to wire into a junction box:



**What if I need a PLC input?** This is a common question. To add a PLC or computer input, just insert it in the loop. Remember (+) → (-), (-) → (+) except at the power supply.

Adding a computer or PLC input is done as follows:.



### Grounding:

It is important to note that there can only be one ground in a 4 – 20 mA system. Multiple grounds will cause erroneous readings.

### Compliance Voltage or Loop Power Supply Voltage:

Compliance of loop power supply voltage required must be greater than the maximum voltage in the loop. In the diagram above the available compliance voltage is the power supply voltage. There are three items that must be checked when determining loop compliance or power supply voltage.

1. The compliance voltage must be great enough to fully power all of the loop devices at 20 mA. It is usually better to assume 25mA max to allow yourself some “head room”. You must also have enough voltage available to account for the drop in the wires. (250' of # 20 instrument wire = 5Ω. Voltage drop at 25mA = 125 mV).
2. The loop power supply voltage must not exceed the maximum voltage rating of any device in the loop. (For instance the transmitter above has a maximum loop voltage of 30 VDC.)
3. Be aware of safety. If you are using low voltage wiring, you generally want to keep the loop voltage below 28V DC.

To calculate the required loop power supply (compliance) voltage you add up the voltage drops around the loop at the highest expected current. Add a little to make sure everything works. Loop powered devices (like the transmitter and meter above) will tell you their required voltage on the data sheet. For the system above:

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<b>Device</b>	<b>Voltage Drop</b>	<b>Info Source</b>
Temperature Transmitter	8 V	From Data Sheet
Loop Powered Display	2.5 V	From Data Sheet
PLC Input	6.25 V	250 $\Omega$ input resistor x 25 mA
<b>Total Required Power Supply Voltage</b>	<b>16.75 V</b>	

If you used a powered transmitter (one that has its own self contained power supply) it would have to have a minimum output or compliance voltage of 8.75V (the sum of the Loop Powered Display and the PLC Input). You could get by with a little less since we have allowed a 25% safety factor, but be sure your loop works at the top of its range.

For additional information contact: [David@AdvIndSys.com](mailto:David@AdvIndSys.com) .

Additional Applications Notes and Tables are available at [www.AdvIndSys.com/ApplicationsNotes.htm](http://www.AdvIndSys.com/ApplicationsNotes.htm) .

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