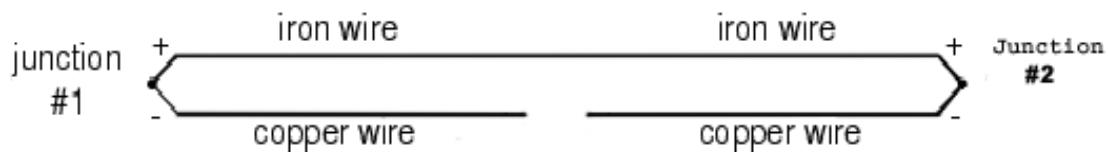




## How to control using the difference in temperature between two points.

### Two thermocouples and one controller

The following example uses the theory of connecting two thermocouples together as shown below to measure the difference in temperature between the two points. Thermocouples involve two laws of thermoelectrics, namely the Seebeck/Peltier effect and the Thompson effect. Anyway for simplicity's sake, when two thermocouples are connected as shown below, the resultant EMF signal is proportional to the difference between the two temperatures measured. When doing this you are measuring a difference, one point with reference to another, and not one point with reference to an "absolute" reference and so do not need cJc to be taken into account. CJc must be de-activated on the controller you are using. On our VD series controllers you must remove the cJc thermistor and replace it with a 120 ohm resistor and recalibrate the controller.



An example where this has been used before is in a solar panel heating system. It was required to switch a circulating pump on when the temperature in the solar panel was a number of degrees higher than the temperature of the water in the holding tank. Another was to use the controller to switch an alarm when the temperature difference exceeded a certain amount.

Here's how to set up a simple Vertex VD2000 controller to work in this fashion. (As an alarm) You must have two of the same type thermocouples to start with. Connect the two positive wires of the thermocouples together and the other two ends of each thermocouple onto terminals 7 and 8 of the VD2000 temperature controller.

Connect a mains supply to terminals 1 and 2 to power the controller. The normally open contact output from the controller will be on terminals 11 and 12. This could be set up to be a simple alarm or used, as in the example above to switch the circulating pump on and off.

You need to first check that the controller is set to work with the type of thermocouples you have chosen to work with. When you turn the power on the controller/indicator will perform a self test and display the input type. After the display test it will flash the following information. The thermocouple type, then the units being used i.e. °C or °F, then the upper limit of the range set and finally the lower limit. Make sure that the thermocouple type suits the ones you are using and

that the range is close to your working temperature. In this case you are measuring a difference in temperatures so for example a low temperature of  $-10$  and a high limit of  $100$  °C would be fine.

Now you need to “zero” the controller to work with your two thermocouples in your application. To do this connect the two probes as shown and then to the controller. Now place both probes in a bucket of tap water and allow at least 10 minutes for the temperatures to settle down. When the two probes are measuring the same temperature (as in the same bucket of water) the display should read “0°C” If not use the “PyoF” parameter to subtract (or add) the amount off the measurement to get it to read “0°C” Say once you connected it up and the probes have stabilised in the bucket that the temperature reads  $20$  °C. Simply press the “SEL” button once to access the “PyoF” parameter and then use the down button to make the value  $-20$  °C. After doing this when the two probes are in the same bucket the display should read “0°C”

Now using a second bucket of water at a higher temperature than the first, transfer the probe that will be reading the higher temperature into this bucket and check that the temperature controller display shows a rising temperature. If the display goes down into negative values simply swap the two wires on terminal 7 and 8.

You are now all set for alarming or control.

In this case all you require is an alarm to sound when the difference goes above a certain amount. To use the main output you must check that certain parameters are set so that the main output can function as an alarm.

1. “Pb” must be = 0
2. Action (act) must be set to “Dir”
3. “HySt” must be set to 1
4. Now simply give the up or down button one press to access the setpoint.
5. When you press the button you will notice that the PV led goes off and that the SV led will light up indication that you are looking at the setpoint, in this case the alarm setpoint.
6. Now using the up and down buttons adjust the setpoint to be the difference in temperature at which you wish the output to alarm. (say 5 or 10 or whatever degrees C difference)
7. The second alarm is set using the A1Sp setting. To access press the SEL button twice. The display will show A1Sp. Press the up or down button once to see the value. Use the up or down buttons to adjust.

You are all set to install and use the system.

For any other applications please give us a call. +44 (0) 1244 539295

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