

BD 300 alarm on open (broken) thermocouple wires

When measuring a temperature with the BD 300 it can be very important to know that the actual thermocouple wire is properly connected and not broken.

This can be achieved by adding a pull-up resistor from the Pt-100 source to the Voltage input and setting an input (or pen) alarm on temperature overrange on the BD 300.

The pull-up resistor R_p will give a Voltage on the input when the thermocouple circuit is broken. The effect of this pull-up resistor on the temperature reading can be neglected when the value of R_p is a factor 10^6 higher than the thermocouple wire resistance.

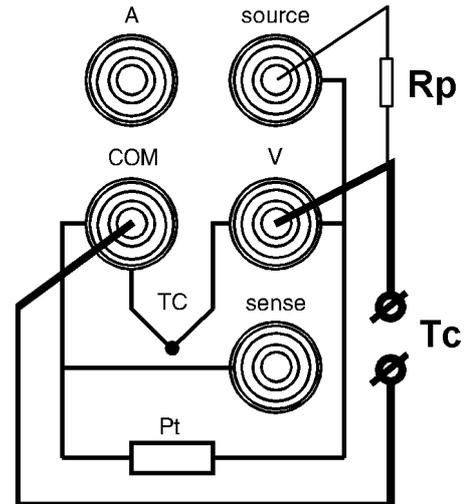
Technical specifications:

Source Voltage: 2.5 Volt
 $R_p = R_{pull-up} : \gg 10 \text{ MOhm}$
 $R_{tc} : < 100 \text{ Ohm}$

During normal temperature measurement the Voltage divider formed by R_p and R_{tc} will add a few μV on the Voltage input. This additional error can be calculated with the following formula:

$$\frac{R_{tc}}{R_p} * 2.5 \text{ Volt}$$

The exact offset introduced by this pull-up resistor in $^{\circ}\text{C}$, $^{\circ}\text{F}$ or K depends on the used thermocouple and the temperature range.



Example

Thermocouple J measuring at a temperature of 200°C
 (V_{tc} at 200°C is 10.777 mV , and 10.832 mV at 201°C)

$R_p = 44 \text{ MOhm}$

$R_{tc} = 35 \text{ Ohm}$ (depending on length and thickness of thermocouple wire)

$$\frac{35}{44000000} * 2.5 \approx 2 \mu\text{V}$$

On an input of 200°C this will give an error of $\frac{2}{832 - 777} \approx 0.04^{\circ}\text{C}$

For thermocouples like R and S with a lower output Voltage per $^{\circ}\text{C}$, the error will be higher. The same conditions for thermocouple S would give an error of 0.25°C

Realising that the normal thermocouple wire has an accuracy of 2°C this is an acceptable solution.

Example of BD 300 settings

When the normal process temperature varies between 0 and 200 °C, the (open thermocouple) alarm can be put on 300 °C. Because the BD 300 can accept an alarm on both the input and pen, there can be one relay specially assigned for indication open thermocouple wires and another relay can indicate a high temperature.

The channel 1 and 2 input alarms are set to indicate an open thermocouple wire. They activate (both) relay 1 and print an error message on paper.

ALARMS INPUT 1		
	LOW	HIGH
ALARM ON:	0.000 °C	300.0 °C
ALARM OFF:	0.200 °C	299.9 °C
ACTION 1:	NONE	RELAY 1
ACTION 2:	NONE	MESSAGE 10

Message 10 e.g: open TC on input 1

ALARMS INPUT 2		
	LOW	HIGH
ALARM ON:	0.000 °C	300.0 °C
ALARM OFF:	0.200 °C	299.9 °C
ACTION 1:	NONE	RELAY 1
ACTION 2:	NONE	MESSAGE 11

Message 11 e.g.: open TC on input 2

Apart from this open thermocouple alarm, a normal high and low temperature alarm can be set on the pen, as percentage of the full scale.

In this example the full scale is set to 200 °C (100%) therefore a temperature above this value will generate an alarm (activate relay 2 and print message 3)

ALARMS PEN 1		
	LOW	HIGH
ALARM ON:	0.000%	100.0%
ALARM OFF:	0.10 %	99.9%
ACTION 1:	RELAY 1	RELAY 2
ACTION 2:	MESSAGE 2	MESSAGE 3

Message 2 e.g.: Low temp. process 1

Message 3 e.g.: High temp. process 1

Relay 1 and message 2 indicate a low temperature alarm and relay 2 and message 3 indicate a high temperature alarm for pen 1.