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Engineering Note

Topic: TR2 Information

Product Affected: TR2 Temperature Regulator, S2000 Spectrometer

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Operation

The TR2 is a Temperature Regulator unit that stacks onto the S2000 Spectrometer. The TR2 displays two temperature values (in ^{o}C), the set temperature and actual temperature. The TR2 has two controls, a set point pushbutton and a toggle switch. The display can toggle between viewing the actual temperature and the set-point temperature. With the pushbutton pushed out, the display shows the actual temperature. The set-point temperature is viewed by pressing the pushbutton in.

The temperature is set by a digitally controlled potentiometer with 100 set points. To adjust the set-point, press the pushbutton and then increment or decrement the toggle switch to the desired temperature. The set-point is stored in a volatile memory location. To store the set point permanently, press the toggle switch to the down position and then press the set button. This action will lock the set temperature into permanent memory.

A standard TR2 can be adjusted between 0°C and 37°C. However the TR2 is only capable operating 15°C below the ambient temperature. **At cool temperatures, the operator must insure that condensation does not occur on the inside of the optical bench**. By design, the maximum temperature set-point is 37°C.

The TR2 requires a regulated +12V power supply that delivers at least 2 amps. Poor results may be obtained if a non-regulated power supply or a supply that cannot deliver adequate current is used. The power connection is configured for a positive center polarity.

The TR2 indicates its status with a two color LED. The status conditions are defined as follows:

- **Green** – The TR2 has reached temperature stability (within 0.1^{o}C).
- **Red** – The TR2 has not reached temperature stability.
- **Blinking Red** – The TR2 is not running. Reset by pushing the pushbutton.

The S2000-TR2 system operates from two power supplies: the 5V from the ADC Card and the +12V from the external power supply. Depending on the order in which power is applied, the TR2 may power-up with a blinking red LED. To clear the blinking LED, press the pushbutton to reset the unit.

Pin Out

The TR2 interfaces to the S2000 using the H1 & H2 connectors. The pin-out for these signals is show below. In addition, the TR2 has a J3 connector that communicates the various temperature signals. Its pin-out is shown in Table 1 below.

When Multiple S2000-TR2 assemblies are stacked together, several signals in the J3 connector must be connected among all of the TR2 boards in the stack. The Table 1 below defines these signals. In this condition, the display will only show the actual and set-point temperatures from a single unit. Typically, this unit is the Master Spectrometer Channel.

Table 1: J3 Definition

Pin	Signal Name	Connections	Description
1	N/C		No Connect
2	VTEMP	From one TR2 (Master)	Analog signal of the current temperature. Scaling is 100mv/^{o}C
3	Reset	All	Reset signal for TR2—Active Low
4	VSET	From one TR2 (Master)	Set-point temperature signal to be displayed when pushbutton is depressed. Scaling is 100mv/^{o}C)
5	Ground	All	+5V Ground
6	Vdisplay	From one TR2 (Master)	Analog Signal that is displayed. Scaling is 100mv/^{o}C
7	Toggle Down	All	Clock signal to toggle the set-point down one increment—Active Low
8	N/C		No Connect
9	Ground	All	+5V Ground
10	Toggle Up	All	Clock signal to toggle the set-point up one increment—Active Low

Table 2: S2000-H1 Header Pins (Analog)   **Table 3: S2000-H2 Header Pins (Digital)**

1	Analog Channel 0
2	Analog Channel 1
3	Analog Channel 2
4	Analog Channel 3
5	Analog Channel 4
6	GND
7	Reserved
8	Analog Channel 7
9	Analog Channel 6
10	Analog Channel 5

D	N/C
C	A/D Trigger
B	Software Trigger In (D3)
A	Trigger Mode Select (S1)
1	GND
2	+5 VDC
3	F Clock
4	Readout Gate
5	Reserved
6	Temperature (optional)
7	Read Enable
8	Trigger Mode Select/Strobe Enable (S0)
9	Single Strobe Out
10	Continuous Strobe Out
11	Integration Clock
12	Master Clock

TR2 Control Signals

It is possible to drive the control signals (Toggle Up/Down and Reset) directly. These signals are 5V TTL Active LOW signals that are pulled HIGH on the TR2 board.

To change the current set point, drive the Reset signal LOW and then pulse the Toggle Up or Toggle Down LOW. Each falling edge of the Toggle Up/Down signal will drive the set point one position in the desired direction. Once the desired set point is reached, drive (or release) the Toggle Up/Down signals HIGH and then drive (or release) the Reset signal HIGH. The Toggle Up/Down signals are de-bounced on each TR2 and the minimum pulse width is 100ns. There is no maximum pulse width.

To change the nonvolatile power-up set point, hold the Toggle Up/Down signal LOW while the Reset signal is driven (or released) HIGH. This writes the current wiper setting to the nonvolatile memory location that is read from upon power-up of the unit.