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Introduction

The TEC-4000HG is a 19” rack mounted gas conditioner. It is specifically tuned to meet the gas conditioning requirements of the XC-6000 & STM-12B Mercury Sampling systems.

Front

Cooler System Information

This section contains information about the theory and configuration of the TEC-4000HG Thermoelectric System.

Operational Summary

The TEC-4000HG unit is based around the Pinnacle Thermoelectric Unit. The TEC constantly cools both input gases through a common aluminum manifold (heat exchanger). Using a built-in PID temperature controller the output gas temperature can be accurately controlled.

System Gas Flow

The heated sample line coming from the probe or heated sample box connects to the TEC-4000HG via 2 1/4” compression bulkheads on the bottom of the unit. THV tubing connects the bulk heads to the C276 (Hastoloy) condensers. The condensers are maintained at a temperature just above freezing by the Pinnacle Thermoelectric Unit. Here 99% of the moisture in the sample is quickly condensed and separated from the gas stream to be collected in glass bottles under the unit. The dry samples exit the condensers and return to the bottom of the unit via 1/4” THV tubing connected to 1/4” compression bulk heads. From here the sample flows to the SCM-11 sorbent canisters to have any remaining acids and moisture removed. The SCM-11 canisters are then connected to the sample inlet bulkheads on the XC-6000 or STM-12B systems.

TEC Operation

The TEC-4000HG system employs a Thermoelectric Chip to cool the sample gas. A TEC utilizes the Peltier effect to create a temperature difference. This is accomplished by applying a voltage across joined conductors to create an electric current. The flow of the current through the junctions of the two conductors removes heat at one junction creating a cold side. Repeating this process continues to remove heat from the cooling fins and sample gas. Refer to Figure 1 for TEC system information.

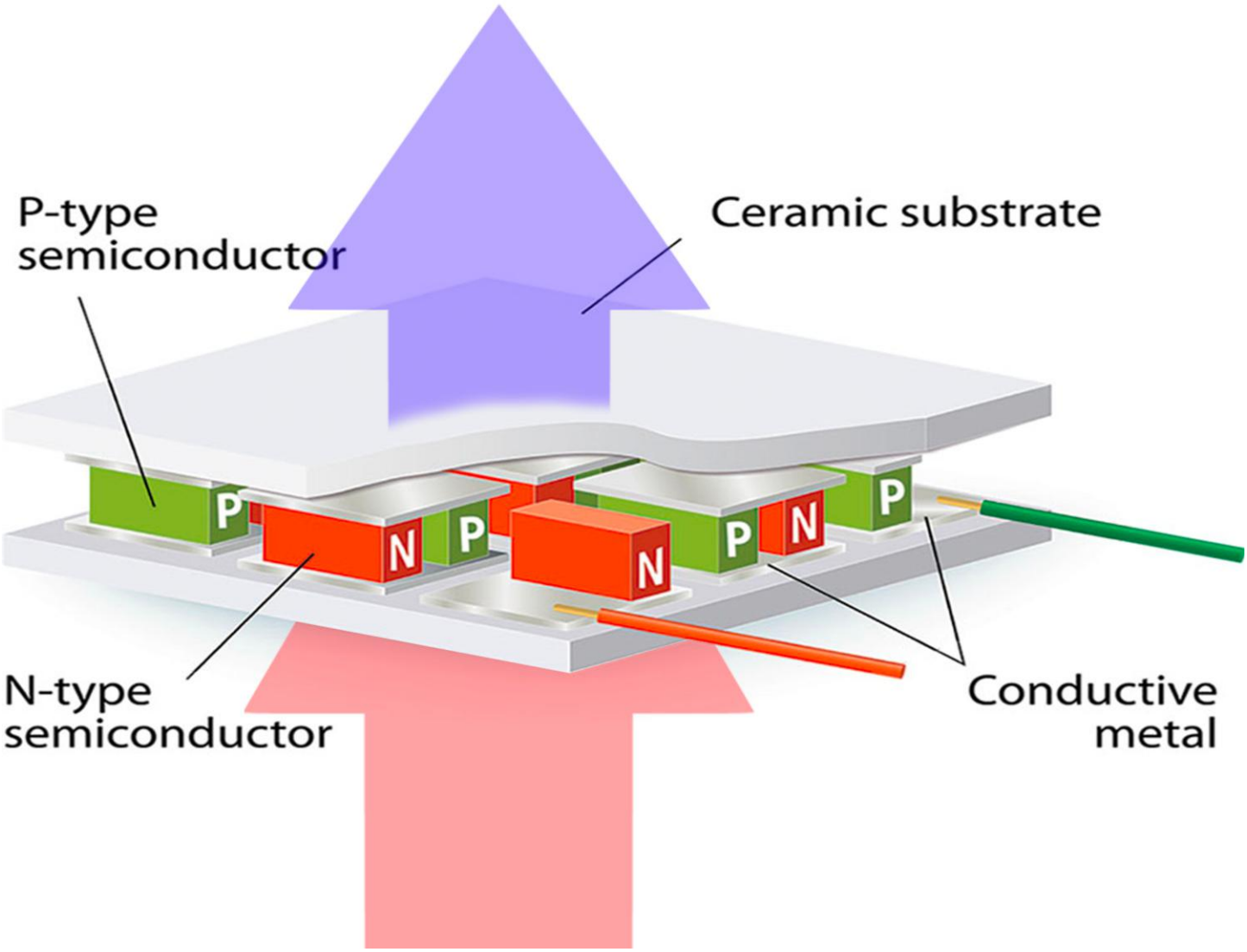
Temperature Regulation

The TEC-4000HG system is configured to maintain a desired temperature for the output sample gas. This temperature regulation is controlled by a variable voltage PID controller which extends the life of the thermoelectric chip and delivers constant stable temperatures.

Components

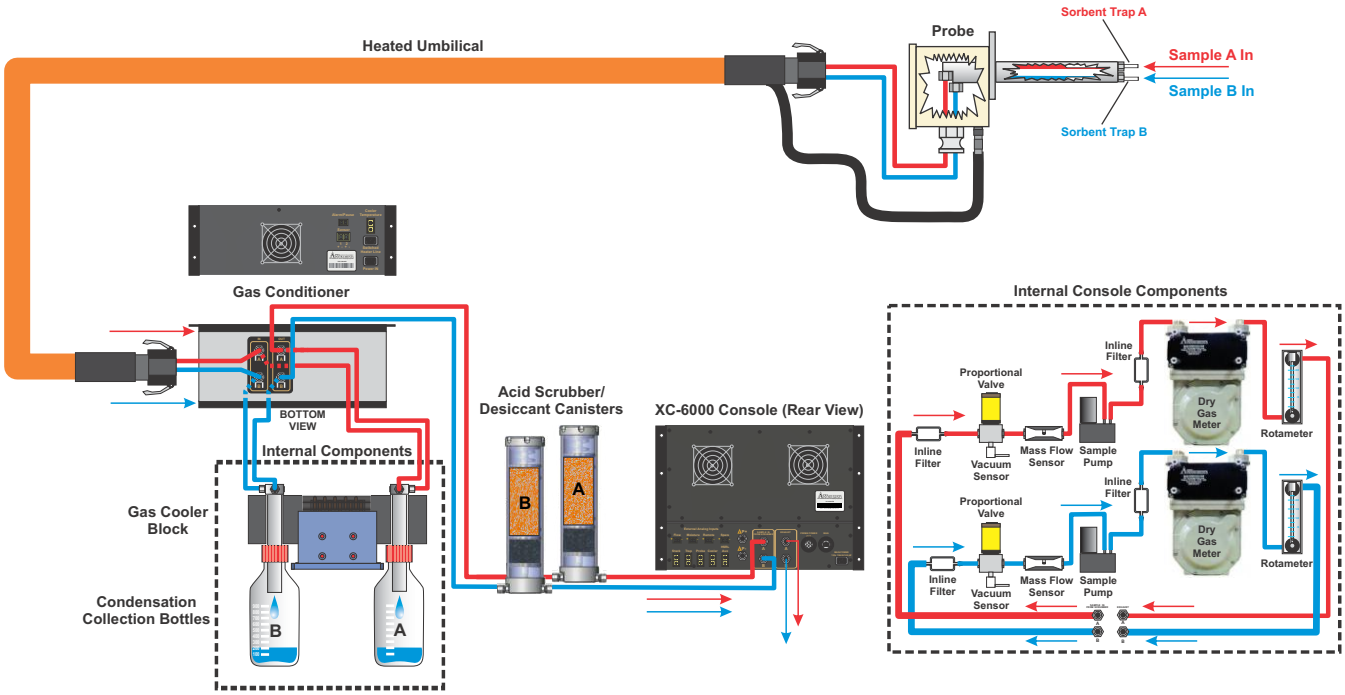
- **Pinnacle Thermoelectric Unit**
  - Thermoelectric Cooler Chip
  - Cooler Logic Board
  - Aluminum Manifold
- Glass Condensate Collector Bottle
- Desiccant Canisters

Thermoelectric Cooler Chip



Sample Flow Schematic

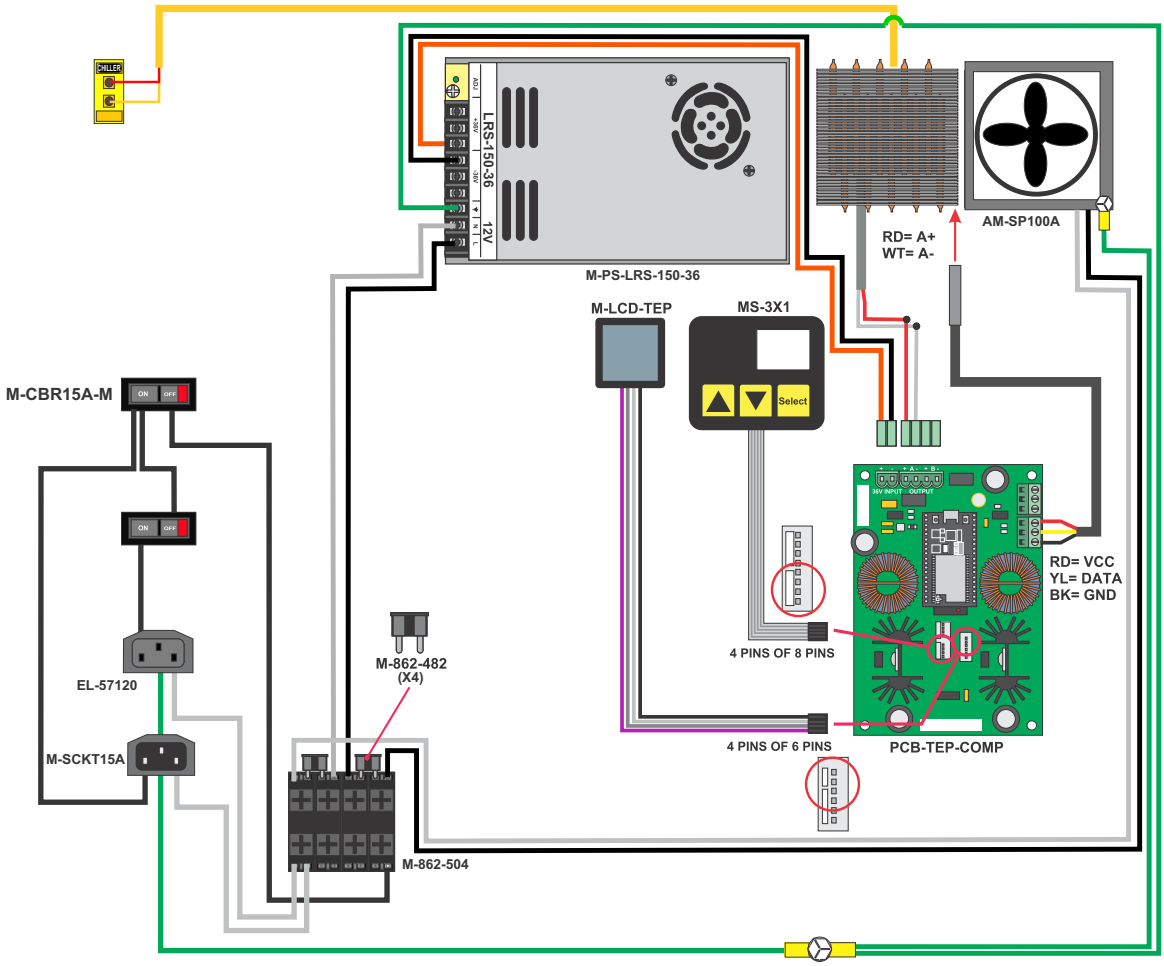
This section contains the flow schematic of the TEC-4000HG Thermoelectric Cooler system used in conjunction with the XC-6000 MercSampler.



Note: Condensation collection bottles must be emptied periodically. Failure to do so can result in immediate failure of XC-6000 console. Desiccant/adsorbent must also be replaced periodically. Failure to do so will result in calibration drift due to component corrosion.

Thermoelectric Cooler

TEC Electrical Schematic



TEC-4000HG Electrical Connections and Controls

The TEC-4000HG connects to a 110V/15A circuit at the back of the unit and is controlled by a switch labeled Main on the front panel. The Main switch is also a circuit breaker. In the event the circuit breaker is tripped it can be reset by turning off then back on.

A 110V outlet is provided to power the HSRL (Heated Self Regulated Line) and is controlled by a switch labeled AUX on the front panel. The AUX switch is also a circuit breaker. In the event the circuit breaker is tripped it can be reset by turning off then back on.

A female Type-K TC is provided to connect the TEC-4000HG to the XC-6000 for monitoring the TEC-4000HG temperature.

The Temperature Controller displays the TEC-4000HG current temperature and is used to set the desired temperature. See the section for Temperature Controller Instructions for additional information.

Bottom

Rear

TEC-4000 Plumbing Connections

The HSRL from the Probe contains 2 sample lines. The A line is marked with RED and the B line is marked with BLUE. This color scheme is followed throughout the TEC-4000HG.

The sample lines from the Probe to the TEC-4000HG are connected to the Input A and Input B connectors, following the RED-BLUE color coding, which internally are connected to the Cooler and the condensate bottles before passing to the sorbent canisters/bottles.

Another jumper line is connected from the TEC-4000HG to the XC-6000. Using the RED-BLUE color coding, connect the jumper from the TEC-4000HG sorbent canisters/bottles outlet to the XC-6000 Sample Line A and B inlet connectors. Also connect the TC in the jumper to the back of the TEC-4000HG and the back of the XC-6000 to monitor the TEC-4000HG temperature on the XC-6000. Note: This jumper line needs to be purchased separately. See Page 7 **Flow Schematic** for more details.

TEC-4000HG Setup

Prior to use the condensate bottles need to be checked and emptied, if required. The beads in the sorbent canisters must be checked for discoloration and changed if required.

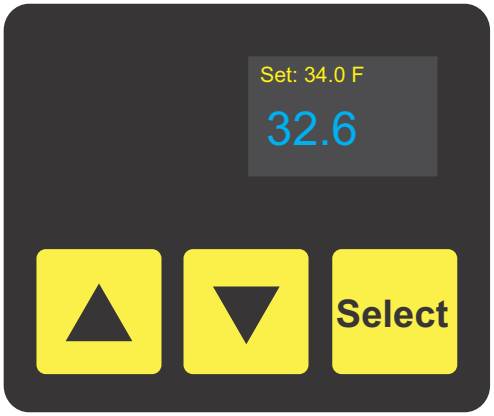
Connect the TEC-4000HG to the Probe and the XC-6000 per site-specific configurations.

Power on the unit and verify the temperature displayed on the OLED display is approaching the set point.

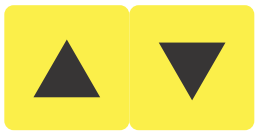
Setup the test profile on the XC-6000 and perform the pre-test leak check, correct any leaks if required. Select Set Probe and verify the TEC-4000HG temperature is correct. Refer to the XC-6000 MercSampler Operators Manual for information setting up the XC-6000 and running tests.

Temperature Configuration

This section will describe how to specify the desired maintenance temperature on the TEC-4000HG

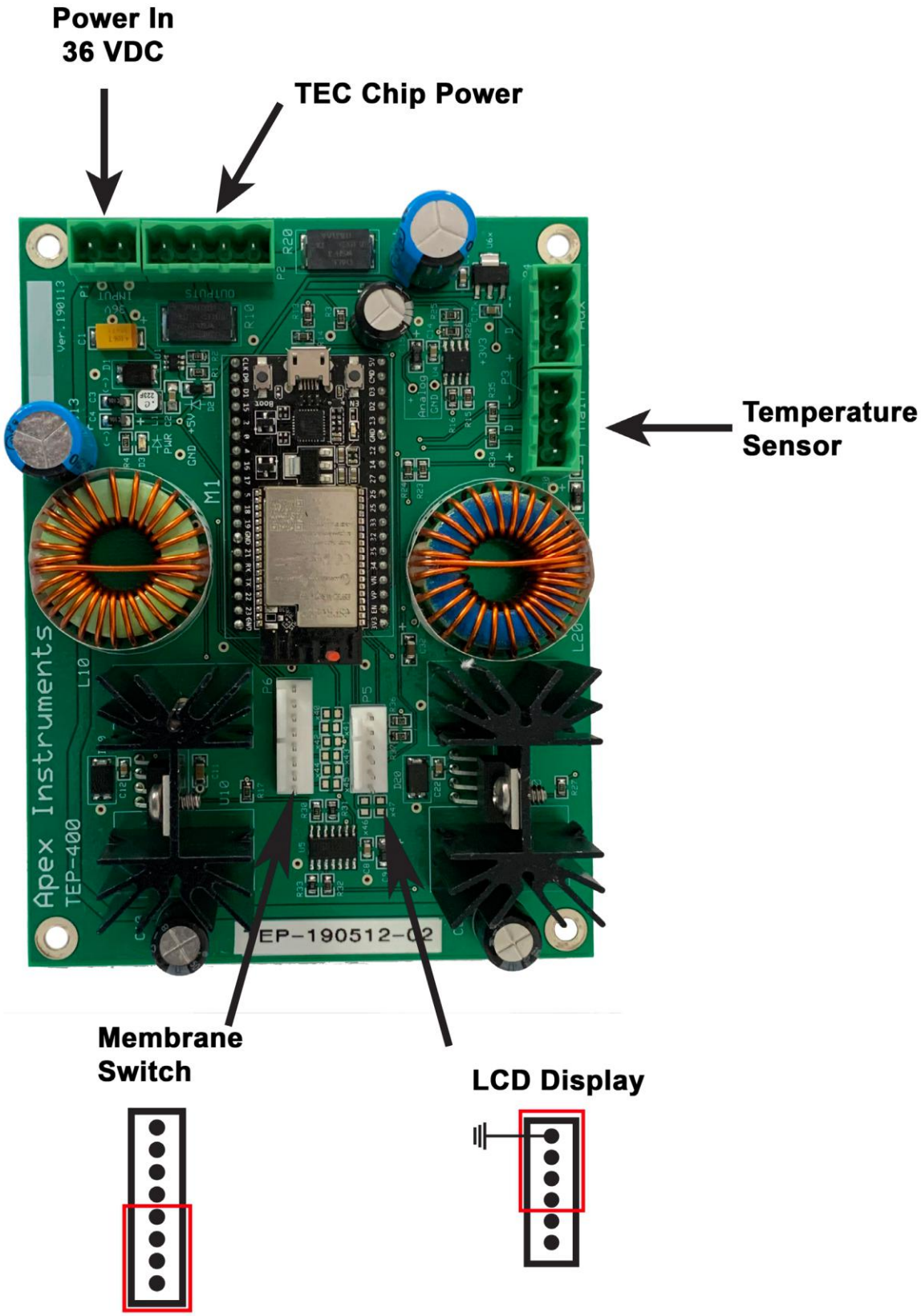


The membrane switch on the faceplate of the TEC-4000HG has three buttons and a display. The yellow text displays the current temperature set point. The blue text displays the current temperature of the cooler block.



The up and down arrows are used to change the temperature set point. Pressing either button once changes the temperature by 0.1° in the currently displayed temperature unit. Holding the buttons down changes the set point faster.

Holding the “select” button for 3 seconds changes the temperature units.

To adjust the temperature display reading, hold the Select button for 6 seconds to enter the display offset menu. Remove the temperature sensor and place it in an ice bath accompanied by a calibrated, NIST-traceable thermometer. To change the displayed value, press the Up or Down buttons until the desired temperature displayed in yellow is reached. This should match what the reference thermometer is displaying.

TEC-4000HG Controller Board Connections and Settings