

Signal Consulting, LLC

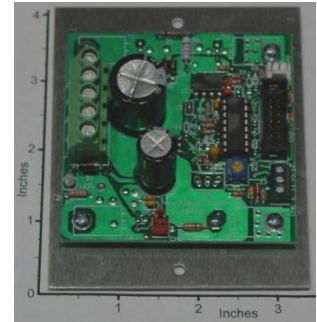
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Si24HyTEPTC1-12B-50V-20A

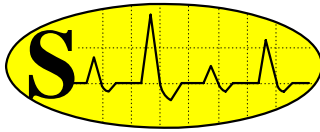
12-Bit Hybrid, Thermo-Electric (TE), Proportional, Temperature Controller with LCD Port and with PWM, Y-Chip

The **Si24HyTEPTC1-12B-50V-20A** is a 50V 20A, microprocessor based, closed-loop, Hybrid, Thermo-Electric, Proportional Temperature Controller board that heats or cools a thermal-zone. **The temperature is measured with a 12-bit digital sensor and proportionally controlled with 0.0625°C steps in the -25°C to +102°C range.** An efficient high-power H-bridge controls the current (in the 0 to +/- 20A range) to Peltier type Thermo-Electric (TE) cells, functioning as a bidirectional heat-pump. By proportional control, we mean that the amount of correction used in the closed-loop is proportional to the difference between the set and measured temperature values. Two user selectable proportional control grids **G8** or **G9** are used to control a wide range of thermal loads. Grid **G8** is used for small loads (selected when **J3** is installed) and **G9** is used for large loads (selected when **J3** is open). Each control grid consists of sixteen non-uniformly spaced temperature levels (centered at the set-temperature value) with eight PWM duty-cycle values are used to control the temperature in 0.0625° C steps. **The temperature overshoots and oscillations (“hunting”) are limited to approximately + or - 0. 5°C.** The temperature is sampled at approximately 1Hz rate and the control-loop/display is updated with the same rate. An onboard microprocessor measures and controls the temperature; monitors the user inputs; and drives a 2 line x 20 character LCD. A small 12-bit digital thermometer, Signal’s part number [Si24DTsens-12B](#) (connected to port **CN3** and uses the Dallas Semi., DS18B20 sensor) is used to measure and control the temperature in the -25°C to +102°C range, with ½° C accuracy. Because this sensor is digital, it is virtually immune to noise and loading; ideally suited for remote sensing. This sensor uses a unique “1-wire interface” (with parasite power mode) that requires only 2-conductors for reliable remote (typical length of 20 meters) temperature sensing. As the name Hybrid (**Hy**) implies, the desired set-temperature is linearly adjusted with the [Si5Pot1-5k](#) potentiometer in the -25°C=0V to +102°C=+5V range, with ½° C=19.68mV steps. An LCD port (with HITACHI HD44780 Interface Standard) is provided for display of the Set and Measured temperature data. The 2 line x 20 character LCD can be ordered from Signal under the part number of [Si24LCD2L20CH](#) (2x20 display with 8” ribbon cable and 14-pin connectors and with back-light). A bicolor LED is used to monitor the TE cell (or load) voltage (Red = Heat, Green = Cold). This board operates with a single unregulated voltage source (9V to 50V range). A small Aluminum plate (3.3”x4.0”x0.065”) is required to operate at 1000W power level. Higher power-levels can be achieved with more efficient heat-sinks. Typical applications are: Peltier Effect TE Coolers, Heat Pumps, etc. This board can be configured and programmed to perform efficiently in many customized applications.



Specification and Application of **Si24HyTEPTC1-12B-50V-20A**

- **Typical Operating Temperature at 20A:** 45°C with the Metal Heat-Ring Bolted to a small Aluminum plate (3.3”x4.0”x0.065”) acting as a Heat-Sink, while the plate is exposed to air at 25°C (as shown on photograph).
- **Source-Voltage Requirements:** V_C (from pin **+C** to pin **-P**): 9V to 30V DC, and for V_P (from pin **+P** to pin **-P**) 9V to 50V, both unregulated DC voltages. For low-voltage applications (9V to 30V) a single DC power supply can be used by connecting pin **+P** and pin **+C** together.
- **Average Load Current of $i_L(t)$:** 0A at 0% Duty-Cycle and 20A max. at 100% Duty-Cycle.
- **Load Isolation:** The Load or TE cell must be isolated from the source voltage (V_P).
- **Power-Conversion Efficiency:** Approximately 98.5% at full-load (50V and 20A).



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- **Set-Temperature** is adjustable with [Si24Pot1-5kMC3](#) potentiometer in the -25°C to $+102^{\circ}\text{C}$ range, with 0.5°C steps.
- **Measured-Temperature** is determined in the -25°C to $+102^{\circ}\text{C}$ range, with $\frac{1}{2}^{\circ}\text{C}$ accuracy using the Dallas Semi. DS18B20 (in TO-92 casing) Digital Thermometer.
- **Two User Selectable Proportional Temperature Control Grids G8 or G9 are Used:** Grid G8 is used for small thermal loads (selected when J3 is installed) and G9 is used for large loads (selected when J3 is open). Each control grid uses sixteen non-uniformly spaced temperature levels with eight PWM duty-cycle values, controlling the temperature with 0.0625°C steps. The temperature overshoots and oscillations (“hunting”) are limited to approximately $\pm 0.5^{\circ}\text{C}$.
- **Sampling Rate:** The temperature is sampled at approximately 1Hz rate and the control-loop/display is updated with this same rate.
- **Load-Current Indicator and Protection:** An onboard bicolor LED is used to monitor the motor (or load) voltage (red = heat, green = cold). The analog control inputs are zener-diode protected.
- **Alarm Kill Switch:** A normally open switch (or an Open Collector npn Transistor) can be connected to jumper **J2** (as shown below), **J2** Open=Normal operation, **J2** Short=Load (TE Cell) is open. The active pin on **J2** is pulled to +5V through a 4.7k Ohm resistor, while the other pin (G) is at ground.

About the Voltage Requirement: The Si24 will work with any DC Load in the 9 V to 50 V range. In addition, the power filters are included on this board. Only unregulated DC input power is required in most applications.

A Typical Application of the [Si24HyTEPTC1-12B-50V-20A](#)

In this 12-bit, closed-loop, proportional temperature control application, the Set-Temperature is linearly adjusted (in the $-25^{\circ}\text{C}=0\text{V}$ to $+102^{\circ}\text{C}=+5\text{V}$ range, with $0.5^{\circ}\text{C}=19.68\text{mV}$ steps) with the [Si5Pot1-5k](#) potentiometer, connected to port **CN6**. The Peltier type Thermo-Electric (TE) cell is functioning as a bidirectional heat-pump; operating with 12VDC (unregulated) at 20A max. TE cells can be purchased from Melcor Corp. Trenton, NJ 08648 USA, WEB: www.melcor.com. The temperature of the enclosed and insulated Hot/Cold Environment is measured with the Dallas Semi. DS18B20 (in TO-92 casing) Digital Thermometer, [Si24DTsens-Spec1-DS18B20](#). This sensor can be purchased from Signal Consulting, LLC as [Si24DTsens-12B](#) (DS18B20 with 12” leads and connector). The LCD module can be ordered from Signal with the part number of [Si24LCD2L20CH](#) (2x20 display with 8” ribbon cable and 14-pin connectors, and with back-light). **Warning: The connecting wires to the Load and the Power Supply must be heavy gage copper wire (#12 AWG or heavier) to handle the rated current level. In addition, these heavy gage wires act as a heat sink, protecting the board from overheating.**

