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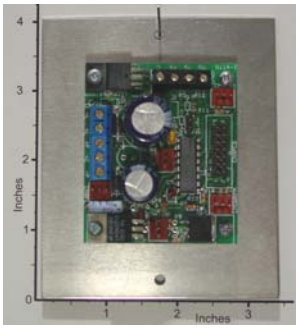
Si14HyATPC1-50V-20A Hybrid, Adjustable Ramp-Time, Power-Controller with LCD Port and 20kHz PWM, Y-Chip



The **Si14HyATPC1-50V-20A** is a single, microprocessor based, Hybrid, Adjustable Ramp-Time, Unidirectional, Power-Controller board that uses pulse-width modulation (**PWM**) to efficiently control the power flow to an inductive load or brush type DC motor, from 0 to 1000W, in 8.33W steps. The motor acceleration and deceleration is adjustable (using the Ramp-Time input) from 500ms to 23.3s in 100ms steps. An onboard microprocessor generates a 5kHz or 20kHz **PWM** carrier signal, controls the load power (or motor speed), monitors the user inputs and selects the motor acceleration delay. The **PWM** carrier frequency is user selectable by the jumper **J1M**, 20kHz when **J1M** is open and 5kHz when short. The high-frequency PWM rate provides a smooth motor-speed control, and insures a quiet motor environment. As the name hybrid (**Hy**) implies, the required motor speed (or PWM pulse-duration) and Ramp-Time are derived from a variable analog-voltages ($\mathbf{V_{P1,G}}$,$\mathbf{V_{P2,G}}$), while the other control-signals are digital. An onboard LED (red) is used to monitor the load voltage and an optional, fast-acting 20A Mini-Fuse (with socket) is used for motor/board protection. Snubbing circuits and filter capacitors are included to suppress inductive switching transients. A small Aluminum plate (3.3"x4.0"x0.065") is required to operate at 10A current level (or at 500W power levels). Higher current levels (20A) or 1000W power-levels can be achieved with more efficient heat-sinks. This can be accomplished by bolting this plate to a larger metal surface. Please click on this link and read the **Board Mounting Instructions and Heat Sink Selection Guide**. An optional 2 line by 20 characters long LCD (with HITACHI HD44780 Interface Standard) is used for Set-RPM, Measured-RPM and Ramp-Time data display. This board requires a single unregulated 9V to 30V DC power source at 0A to 20A to operate normally. At higher load voltages, two voltage sources can be used, (9 to 30V for the controller and 9 to 50V for the motor). Typical applications are: DC Motor-Speed Controller with variable acceleration/deceleration, Light-Dimmer with variable Ramp-Time, etc.

Specification and Application for Si14HyATPC1-50V-20A

- **Typical Operating Temperature at 10A:** 45^0C with the Metal Heat-Ring Bolted to a small Aluminum plate (3.3"x4.0"x0.065") acting as Heat-Sink, while the plate is exposed to air at 25^0C (as shown on photograph).
- **Source-Voltage Requirements for V_C (voltage from pin +C to pin- P):** 9V to 30V DC, **and for V_P (voltage from pin +P to pin -P):** 9V to 50V, both unregulated and unfiltered 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.
- **Adjustable Ramp-Time:** The Load-Voltage Ramp-Time is adjustable from 500mS to 23.3S in 100mS steps, with a control signal ($V_{P2,G}$) or with an internal/external potentiometer.
- **Adjustable Load Voltage V_L (voltage from pin +L to pin -L):** The average Load-Voltage is adjustable from 0V to 50V (or to Vp) in 0.833% steps, with the Pulse-Width Modulation (PWM) control signal ($\mathbf{V_{P1,G}}$) or with an internal/external potentiometer.
- **Average Load Current i_L:** 0A at 0% Duty-Cycle, 20A max. at 100% Duty-Cycle.

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- **Load Isolation :**The load (R_L) must be isolated from the source voltage (**Vs**)
- **PWM Switching Frequency:** User selectable; 20kHz when **J1M Open**, 5kHz when **J1M Short**.
- **PWM Duty-Cycle:** Varies linearly from 0% to 100% in 0.833% steps using $V_{P1,G}$ as the control voltage (where $V_{P1,G}$ = 0V yield 0%, and $V_{P1,G}$ = +5V yield 100% Duty-Cycle). **The motor speed varies linearly with the duty-cycle**. Note that the Duty-Cycle is defined as the ratio of the load-voltage on-time (τ) to the switching period (T) times 100%, (i.e. Duty-Cycle = (τ /T)x100%). These variables are defined and shown on the application drawing (on next page).
- **LCD Data Format:**

Sd=100.0% Md=100.0%	Line 1
Ramp Time=23.3 Sec	Line 2

Display Format:
Sd is the Set duty-cycle in %.
Md is the Measured duty-cycle in %.

Ramp Time is the time required for the Duty-Cycle to linearly ramp up or down from 0% to 100%.

A Typical Si14HyATPC1-50V-20A Application

In this 30V open-loop speed-control application, the PWM pulse-duration (or motor-speed) is linearly adjusted by an external 1-turn 5kΩ pot **P1**; and efficiently controlling the motor (or load) power in the 0 to 1000W range in 8.33W steps. Similarly, the motor acceleration (or Ramp-Time in the 100 mS to 25.6S range) is linearly adjusted by the Pot **P2**. This dual potentiometer can be ordered from Signal with part number of **Si5Pot2-2x5k**. A 2 line by 20 characters long LCD (with HITACHI HD44780 Interface Standard) is used for Set-RPM and Measured-RPM data display. The LCD with back-light (with 8" cable, and with two 14-pin connectors) can be ordered from Signal with part number of **Si24LCD2L20CH ;** OEM pricing is available from Sunlike Display Tech Corp. in Taiwan, **http://www.lcd-modules.com.tw**. The DC Motor can be purchased from Bodine, **www.bodine-electric.com** ; or from **http://www.e-motorsonline.com/emotors/dcmproduct_list.php**.