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Si50HyUdMC1-120V-32A, Single Channel, 120V 32A, Open-Loop, Hybrid, Unidirectional Motor Controller with Integrated Heat Sink, 5kHz or 20kHz PWM, T-Chip

The **Si50HyUdMC1-120V-32A** is a 120V, 32A, microprocessor based, Single, Open-Loop, Hybrid, Unidirectional, Motor-Controller board that uses 5kHz or 20kHz pulse-width modulation (**PWM**) to efficiently control the speed of a brush type DC motor (or load current) in the 0 to 3840W power range, and in 32W steps. An onboard microprocessor generates a 5kHz or 20kHz **PWM** carrier signal, controls the load-power (or motor speed) and controls the load-current rate (or motor acceleration and deceleration). The **PWM** carrier frequency is user selectable by the jumper **CN4**, 20kHz when **CN4** is open and 5kHz when short. The high frequency PWM rate provides a smooth speed control and insures a quiet motor environment. As the name hybrid (**Hy**) implies, the desired motor speed (or PWM pulse-duration) is set by a variable (0 to +5V) analog input-voltage $\mathbf{V_{I1,G}}$, providing a smooth motor-speed control from 0 to 100% in 0.833% steps; while the other control-signals are digital. This analog input ($\mathbf{V_{I1,G}}$) is zener-diode protected and includes an integrator with a time-constant of 0.01s; accordingly, this input can be driven with DC or PWM signals. A normally open switch (or an Open Collector npn Transistor) can be connected to jumper **J1** (as shown below), **J1** Open=Normal operation, **J1** Short=Load is open. The active pin on **J1** is pulled to +5V through a 4.7k Ohm resistor, while the other pin (G) is at ground. The user can choose between slow or fast motor acceleration/deceleration modes by short-circuiting or open-circuiting the pins labeled **J2**. The slow mode, with rise-time/fall-time of 0.5s, is selected by shorting **J2** (**J2** jumper installed); while the fast buildup mode, with rise-time/fall-time of 0.025s, is selected by leaving these pins open (no Jumper installed). An LCD port **CN3** (with 9600 Baud RS232 Interface Standard) is provided for display of the Set and Measured Motor data. The LCD can be order Signal under the part number of Si14LCD2L16CH-3PC (2-Line by 16-Char display with 12" cable and 3-pin connectors, and with back-light). An onboard LED (red) is used to monitor the load-voltage. A small (3.0"x4.0"x1.0") finned heat-sink is provided to operate 3840W power level (or at 120V and 32A). Higher current level levels (50A at 120V or 6000W) can be achieved with more efficient heat-sinks (5" x 5" x 1.5" finned heat sink). This board requires a single 35V to 120V DC unregulated power source at a 0A to 32A current range to operate normally. Typical applications are: DC Motor-Speed Controller, Light-Dimmer with variable delay, Power Amplifier, SPST Solid State Relay, etc. This board can be configured and programmed to perform efficiently in many customized applications.

Specification and Application for Si50HyUdMC1-120V-32A

- **Typical Operating Temperature at 32A and 5kHz:** 45^0C with MOSFETs bolted to a small (3.0"x4.0"x1.0") finned heat-sink, while the fins are exposed to air at 25^0C (as shown on photograph).
- **Source-Voltage Requirement ($\mathbf{V_P}$ from pin +P to pin -P):** Any DC voltage from 35V to 120V, unregulated and unfiltered DC.
- **Average Load-Voltage:** Linearly variable from 0 to $\mathbf{V_P}$ in 0.83% steps, using $\mathbf{V_{I1,G}}$ as control input.
- **Average Load-Current:** 0A at 0% duty-cycle and 32A max. at 100% duty-cycle.
- **Load Isolation:** The Load or Motor must be isolated from the Ground (G or -P).
- **Power-Conversion Efficiency:** Approximately 98.5% at full-load (120V and 32A).
- **PWM Switching Frequency:** 5kHz when **CN4** short and 20kHz when **CN4** open.
- **PWM Duty-Cycle:** varies linearly from 0% to 100% in 0.83% steps, using $\mathbf{V_{I1,G}}$ as control voltage (voltage at pin **I1** relative to pin **G** on connector **CN5**): where $\mathbf{V_{I1,G}}$ = 0V yields 0%, and $\mathbf{V_{I1,G}}$ = +5V, yields 100%. This input is zener-diode protected and includes an integrator with time-constant of

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10mSec. Accordingly, this control input can be driven with DC or PWM input voltage. Note that the Duty-Cycle is defined as the ratio of the load-voltage on-time (t) to the switching period (T) times 100% (i.e. Duty-Cycle = (t /T)100%). These variables are defined and shown below.

- **Kill Switch Port J1:** A normally open switch (or an Open Collector npn Transistor) can be connected to jumper **J1** (as shown below), **J1** Open=Normal operation, **J1** Short=Load is open. The active pin on **J1** is pulled to +5V through a 4.7k Ohm resistor, while the other pin (G) is at ground.
- **Load-Current Step-Response Time:** The user can choose between slow or fast motor acceleration/deceleration modes by short-circuiting or open-circuiting the pins labeled **J2**. The slow mode, with rise-time/fall-time of 0.5s, is selected by shorting **J2** (**J2** jumper installed); while the fast buildup mode, with rise-time/fall-time of 0.025s, is selected by leaving **J2** open.
- **Motor-Indicator:** An onboard LED (red) is used to monitor the motor (or load) voltage. .

A Typical Application of the Si50HyUdMC1-120V-320A

In this open-loop speed control application, the motor speed (or PWM pulse-duration) is linearly adjusted with the **Si5Pot1-5k** accessory (an external 1-turn 5kΩ pot); and efficiently controlling the motor power from 0 to 3840W in 32W steps.
The DC Motor can be purchased from Bodine, **www.bodine-electric.com** ; or from other vendors, **http://www.e-motorsonline.com/emotors/dcmproduct_list.php**.
Warning: The connecting wires to the Motor and the Power Supply must be heavy gauge copper wire (#10 AWG or heavier) to handle the rated current level. In addition, these heavy gauge wires act as a heat sink, protecting the board from overheating.

An inexpensive, unregulated DC power supply is shown in this application drawing. A wide variety of linear and switching power supplies can, also, be used with this board. Consult the most recent catalog on **www.mpja.com** to purchase these power supplies.