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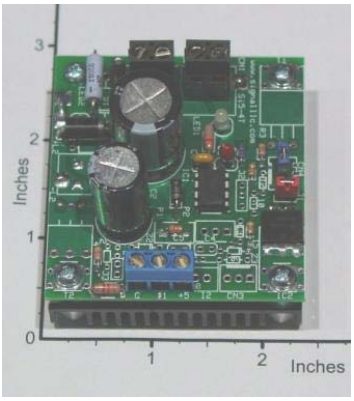
Si5HyUdMC1-90V-20A, Single, Open-Loop, Hybrid, Unidirectional 90V-20A Motor Controller with Integrated Heat Sink and with 5kHz or 20kHz PWM, T-Chip



The **Si5HyUdMC1-90V-20A** is a 90V, 20A, microprocessor based, Single, Open-Loop, Hybrid, Unidirectional Motor-Controller board that uses pulse-width modulation (**PWM**) to efficiently control the speed of a brush type DC motor (or load current) in the 0 to 1800W power range, with 15W 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. The user can choose between slow or fast motor acceleration/deceleration modes by short-circuiting or open-circuiting the pins labeled **J1**. The slow mode, with rise-time/fall-time of 0.5s, is selected by short-circuit (**J1** 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). All control lines (analog and digital) are sampled approximately at 700Hz rate in the fast mode, and at 20Hz rate in the slow mode. An onboard LED (red) is used to monitor the load-voltage. A small (2.3"x2.4"x0.45") finned integrated heat sink is included with mounting hardware (as shown on the photograph) to operate at 20A or 1800W power levels. Higher power-levels (90V, 30A or 2700W) can be achieved with more efficient heat-sinks. Please click on this link and read the **Board Mounting Instructions and Heat Sink Selection Guide**. This board requires a single 2V to 90V DC power source (unregulated) at a 0A to 20A 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 Si5HyUdMC1-90V-20A

- **Typical Operating Temperature at 20A:** 45^0C with the Metal Heat-Ring Bolted to a small (2.3"x2.4"x0.45") finned Aluminum Heat-Sink, while it is exposed to ambient air at 25^0C (as shown on photograph).
- **Source-Voltage Requirement ($\mathbf{V_P}$ from pin +P to pin -P):** Any DC voltage from 20V to 90V, unregulated DC.
- **Average Load-Voltage:** Linearly variable from 0 to $\mathbf{V_P}$ in 0.83% steps, using $\mathbf{V_{I1,G}}$ as control input.
- **Max. Continuous Average Load-Current:** 20A at 100% duty-cycle, with heat-sink (as shown).
- **Max. Load-Current for 5sec:** 40A at 100% duty-cycle, with heat-sink (as shown).
- **Load Isolation:** The Load or Motor must be isolated from the source voltage ($\mathbf{V_P}$).
- **Power-Conversion Efficiency:** Approximately 97.5% at full-load (90V and 20A).
- **PWM Switching Frequency:** 5kHz when **CN4** short and 20kHz when **CN4** open.
- **PWM Duty-Cycle:** varies linearly from 0% to 100% in 0.833% 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. Note that the Duty-Cycle is defined as the ratio of

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the load-voltage on-time to the switching period times 100% (i.e. Duty-Cycle = (t /T)100%). These variables are defined and shown below.

- **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 **J1**. The slow mode, with rise-time/fall-time of 0.5s, is selected by short-circuit (**J1** jumper installed); while the fast buildup mode, with rise-time/fall-time of 0.025s, is selected by leaving these pins open.
- **Jumper Selection:** The **J1** and **CN4** control jumpers are examined only when the power is turned on, consequently the power must be turned off for 10 sec when these jumpers are reconfigured.
- **Motor-Indicator and Board Protection:** An onboard LED (red) is used to monitor the motor (or load) voltage, and the analog control inputs are zener diode protected.

About the Voltage Requirement: The Si5 will work with any DC motor or load in the 20 V to 90 V voltage range. In addition, the power filters are included on this board, consequently, only unfiltered (full-wave rectified) DC input power is required in most applications.

A Typical Application of the Si5HyUdMC1-90V-20A

In this 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 1800W in 15W 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** .

An inexpensive, unregulated DC power supply design is shown in this application drawing. This power supply consists of a transformer, a 25A bridge rectifier (purchased from www.digikey.com with part number **MB256-ND**) and an optional C=1200uF, 100V capacitor. The secondary voltage and current rating of the transformer determines the DC voltage and current output of this power supply. 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. **Warning: The connecting wires to the Motor and the Power Supply must be heavy gauge copper wire (#12 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.**