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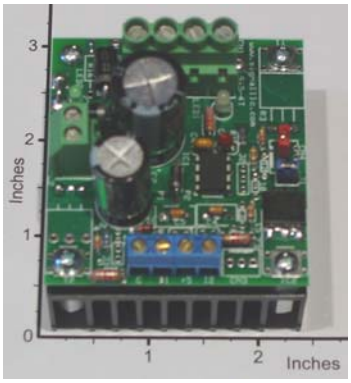
# Si5HyUdMC2-30V-2x16A, Dual, Open-Loop, Hybrid, Unidirectional 30V-2x16A Motor Controller with Integrated Heat Sink and with 5kHz or 20kHz PWM, T-Chip




The **Si5HyUdMC2-30V-2x16A** is a 30V, 2x16A, microprocessor based, Dual, Open-Loop, Hybrid, Unidirectional, Motor-Controller with an integrated heat sink that uses two independent pulse-width modulators (**PWM**) to efficiently control the speed of two brush type DC motors (or load currents ) each in the 0 to 480W power range, and in 4W steps. An onboard microprocessor generates two 5kHz or 20kHz **PWM** carrier signals, controls the load-power to each motor (or motor speeds) and controls the load-current rates (or acceleration and deceleration of each motor). The **PWM** carrier frequency is user selectable by the jumper **CN3**, both 20kHz when **CN3** is open and both 5kHz when short. The high frequency PWM rate provides a smooth speed control to each motor and insures a quiet motor environment. As the name hybrid (**Hy**) implies, the desired motor speeds (or PWM pulse-durations) are set by two variable (0 to +5V) analog input-voltages $\mathbf{V_{I1,G}}$ and $\mathbf{V_{I2,G}}$ each providing a smooth motor-speed control from 0 to 100% in 0.83% steps; while the other control-signals are digital. These analog inputs ($\mathbf{V_{I1,G}}$ and $\mathbf{V_{I2,G}}$) are zener-diode protected. The user can choose between both slow or both 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 mode, with rise-time/fall-time of 0.025s, is selected by leaving these pins open (no Jumper installed). Two onboard LEDs are used to monitor the load-voltages. 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 960W power level. Higher power-levels (30V, 2x20A or 1200W) 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 9V to 30V DC power source (unregulated and unfiltered) at a 0A to 32A current range to operate normally. Typical applications are: Dual DC Motor-Speed Controller, Dual Light-Dimmer with variable delay, Dual Power Amplifier, Dual SPST Solid State Relay, etc.

## Specification and Application for Si5HyUdMC2-30V-2x16A

- **Typical Operating Temperature at 2x16A:** $45^0$C with the Metal Heat-Ring Bolted to a small (2.4"x2.3"x0.95") Heat-Sink, while it is exposed to ambient air at $25^0$C (as shown on photograph).
- **Two DC Motors or Loads can are controlled simultaneously and independently by two Pulse Width Modulators (PWM)**.
- **One common source voltage $V_P$ (from pin +P to pin -P) for the two loads: $V_P$** can have any value between 9V to 30V (unregulated and unfiltered DC).
- **Each Average Load-Voltage is:** Linearly variable from 0 to $\mathbf{V_p}$ in 0.83% steps, using $\mathbf{V_{I1,G}}$ and $\mathbf{V_{I2,G}}$ as control inputs.
- **Max. Continuous Average Load-Current:** 16A each, with heat-sink (as shown).
- **Max. Load-Current for 5sec:** 40A each 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 98.5% at full-load (30V and 2x16A).
- **PWM Switching Frequency:** both 5kHz when **CN3** short and both 20kHz when **CN3** open.
- **Analog Control Inputs, I1, I2:** These independent analog inputs $\mathbf{V_{I1,G}}$ and $\mathbf{V_{I2,G}}$ (voltage at pin **I1** or **I2** relative to pin **G** on connector **CN5)** vary the duty-cycle of each DC motor-current (or load-

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current ) from 0% to 100% in 0.83% steps. Each duty-cycle vary linearly with $\mathbf{V_{I1,G}}$ or $\mathbf{V_{I2,G}}$ ; where $\mathbf{V_{In,G}}$ = 0V yields 0%, and $\mathbf{V_{In,G}}$ = 5V yields 100% duty-cycle. These inputs are zener-diode protected. Note that the duty-cycle is defined as the ratio of the load-voltage on-time to the switching period times 100% (i.e. Duty-Cycle = (t /T)100%).

- **Load-Current Step-Response Time:** The user can choose between both slow or both 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).
- **Motor-Indicators:** Two LEDs (Red and Green) are used to monitor each motor (or load) voltage.
- **About the Voltage Requirement:** The Si5 will work with any DC motor or load in the 9 V to 30 V voltage range. In addition, the power filters are included on this board, consequently, only unregulated DC input power is required in most applications.

## A Typical Application of the Si5HyUdMC2-30V-2x16A

In this application, two motor speeds (or PWM pulse-durations) are independently and linearly adjusted by the analog inputs $\mathbf{V_{I1,G}}$ and $\mathbf{V_{I2,G}}$ (via, two 5KOhm Linear tapered pots,**SiPot2-2x5K**) efficiently controlling the power to each DC motor (or load) in the 0 to 480W range in 4W 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 40A bridge rectifier and an optional C=2200uF, 35V capacitor ( www.digikey.com part number **493-1323-ND**). The secondary voltage and current rating of the transformer determines the DC voltage and current output of this power supply. Low-current output transformers can be purchased from www.mpja.com with the fallowing part numbers: for 33V, 10A DC output use transformer **7846-TR**; for 16V, 4A DC output use transformer **7840-TR**. 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.**