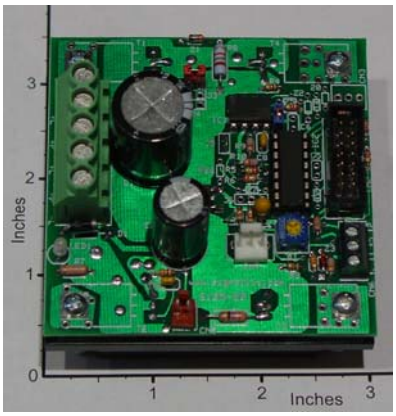
www.signalllc.com

Signal **C**onsulting, **LLC**

16 Wilelinor Drive, Edgewater, MD 21037-1003 USA
Phone: 410-224-8429, Fax: 410-510-1821, E-mail: info@signalllc.com

Si24HyBdMC1-50V-20A-FHS2, Open-Loop, 50V 20A, Hybrid, Bidirectional Motor Controller with Active Low Soft-Start and Soft-Stop Control, Integrated FHS2 Finned Heat Sink, LCD Port and with 5KHz or 20kHz PWM, Y-Chip



The **Si24HyBdMC1-50V-20A-FHS2** is a 50V 20A, microprocessor based, high-power, Hybrid, Bidirectional, Motor Controller with user selectable Soft-Start and Soft-Start features. This controller uses a single (9V to 50V at 0 to 20A) DC power supply to control the speed of a DC motor in forward or reverse direction. An onboard microprocessor generates a 5kHz or 20kHz **PWM** carrier signal, controls the load-power (or motor speed), controls the load-current rate (or motor acceleration and deceleration), updates the Liquid Crystal Display (LCD) and monitors the user inputs. The **PWM** carrier frequency is user selectable by the jumper **J2**, 20kHz when **J2** is open and 5kHz when short. This high frequency PWM rate insures a quiet motor environment. 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 1.25Sec, is selected by short-circuit (**J1** jumper installed); while the fast buildup mode, with rise-time/fall-time of 0.05s, is selected by leaving these pins open (no Jumper installed). As the name hybrid (**Hy**) implies the required motor speed (or PWM pulse-duration) is variable from 0 to 100% in 0.83% steps using the analog voltage (**$V_{I1,G}$=0V=0%PWM, $V_{I1,G}$=+5V=100%PWM,**), while the motor direction is selected using two active low digital (0 to +5V) control signals (**$V_{F,N}$** and **$V_{R,N}$**) or switches. All inputs are optically isolated or zener-diode protected. A bicolor LED is used to monitor the motor (or load) voltage (Red = Forward, Green = Reverse). An LCD port (with HITACHI HD44780 Interface Standard and with back-light) is provided for optional display of motor RPM data in a 2 line by 20 character format. A small (2.95"x2.95"x0.8") integrated finned hear-sink is used to operate at 20A current levels. Higher current-levels (25A 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 operates in a wide voltage-range (9V to 50V) at max. continuous load current of 20A. Typical applications are: Bi-directional DC Motor-Speed Controller, Peltier Effect TE Coolers, Heat Pumps, DPDT Solid State Relay, etc. This board can be configured and programmed to perform efficiently in many customized applications.

Motor Control-Action Truth Table, (Pins on Connector CN4)

($V_{F,N}$) Voltage at Pin **F** relative to pin **N**	($V_{R,N}$) Voltage at Pin **R** relative to pin **N**	**Operation Mode of Motor or Load**
$V_{F,N}$ = 5V or pin Open	$V_{R,N}$ = 5V or pin Open	Stop Rotatio (Motor Open)
$V_{F,N}$= 0V @ 2mA Sink	$V_{R,N}$ = 5V or pin Open	Forward Rotation with V_{PWM} Control
$V_{F,N}$ = 5V or pin Open	$V_{R,N}$= 0V @ 2mA Sink	Reverse Rotation with V_{PWM} Control
$V_{F,N}$= 0V @ 2mA Sink	$V_{R,N}$= 0V @ 2mA Sink	Stop Rotation (Motor Open)

The motor action or load-current direction is controlled by active low control inputs, (0 to +5V) applied to Pin **F** (Forward) and/or pin **R** (Reverse) relative to Pin **N** (Neutral) on the Connector **CN4**. These pins are optically isolated from the H-Bridge, providing good noise immunity for these inputs. The control actions and the required voltage levels are defined by the Truth-Table listed above. All control lines

www.signalllc.com

Signal **C**onsulting, **LLC**

16 Wilelinor Drive, Edgewater, MD 21037-1003 USA
Phone: 410-224-8429, Fax: 410-510-1821, E-mail: info@signalllc.com

(analog and digital) are sampled approximately at 80Hz rate in the fast mode (**J1** jumper open), and at 8Hz rate in the slow mode (**J1** jumper short).

Specification and Application of Si24HyBdMC1-50V-20A-FHS2

- **Typical Operating Temperature at 20A:** 45^{0}C with the Metal Heat-Ring Bolted to the FHS2 Finned Heat-Sink, while it is exposed to air at 25^{0}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 Voltage (from pin +L to pin -L):** 0V at 0% Duty-Cycle and **V_p** at 100% Duty-Cycle.
- **Max. Continuous Load Current:** 20A at 100% Duty-Cycle.
- **Max. Load Current for 5Sec:** 40A at 100% Duty-Cycle.
- **Two User Selectable Motor Acceleration/Deceleration Modes:** Using Jumpers, on Port **J1**.
- **Load Isolation:** The Load or Motor must be isolated from the source voltage (**V_P**).
- **Power-Conversion Efficiency:** Approximately 98.5% at full-load (50V and 20A).
- **Load-Current Indicator:** An onboard bicolor LED is used to monitor the motor (or load) voltage (Red = Forward, Green = Reverse).
- **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. Consequently, only unregulated DC input power is required in most applications.

A Typical Application of the Si24HyBdMC1-50V-20A-FHS2

In this open-loop application, the PWM or motor speed (in forward or reverse direction) is adjusted by an external linear 1-turn 5kΩ potentiometer (connected to port **CN6**, Signal Part number **Si5Pot1-5k**) and the motor direction is controlled by 4 external switches connected to port **CN4** (as shown below). The normally-open switches select the motor direction, while the optional normally-closed limit-switches are included to prevent over-rotation in window-lifting applications. The LCD module can be ordered from Signal with the part number of **Si24LCD2L20CH** (2x20 display with 8" ribbon cable and 14-pin connector, and with back-light). **Warning: The connecting wires to the Load 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.**