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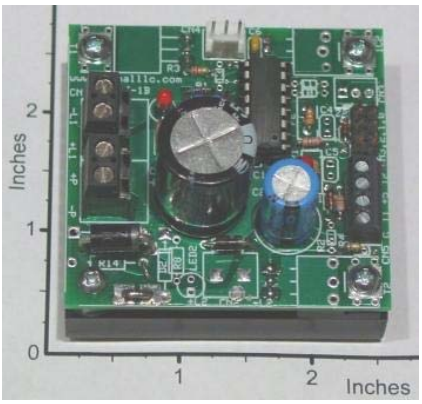
Signal Consulting, LLC

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

Si15NeUdMC1-30V-20A, Networkable, Unidirectional, Open-Loop, 30V 20A, Motor Controller with RS232 Serial Control Port, LED Display Port, Integrated Heat Sink and with 20kHz or 5kHz PWM, B-Chip



The **Si15NeUdMC1-30V-20A** is a 30V 20A, networkable, microprocessor based, high-power, Unidirectional, Motor Controller that uses a single (9V to 30V at 0 to 20A) DC power supply to control the speed of a DC motor in forward 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 4-Digit Display, monitors the user inputs and controls the RS232 Network Port. The **PWM** carrier frequency is user selectable by the jumper **J2**, 5kHz when **J2** is short and 20kHz when open. The jumper **J2** is examined only at power turn-on. 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 **J3**. The slow mode, with rise-time/fall-time of 0.5s, is selected by short-circuit (**J3** jumper installed); while the fast buildup mode, with rise-time/fall-time of 0.05s, is selected by opening these pins. All control lines are sampled approximately at 20Hz rate in the fast mode (**J3** jumper open), and at 8Hz rate in the slow mode (**J3** jumper Short). The Jumper **J4** is used to select the I/O Mode. In the Analog Mode (with **J4** jumper Short), the %PWM (PWM pulse-duration) of the motor current is variable from 0 to +100% in 0.83% steps by a(0 to +5V) analog voltage applied to the **I1** input pin (relative to pin **G** on the **CN5** Network Port, as show on the diagram below). In the Digital Mode (as the name **Ne, Networkable** implies), the %PWM (PWM pulse-duration) of the motor current is variable from 0 to +100% in 0.83% steps by using ASCII command strings on the RS232 Network Port; or it can changed by using external **UP/DOWN keys** connected to **N3 and N2**. The RS232 data format and the Local Area Network (LAN) commands are described on the next page. A "**Kill-Switch**" (connected to **J1**) is used for emergency motor-stop (switch open=Motor Runs, Switch closed=Motor Stop with zero current, as shown on the application drawing below). All control inputs are zener-diode protected. A red LED is used to monitor the motor (or load) voltage. A 9600 Baud serial port (**CN4**) with 5V RS232 Interface standard is provided for optional display of the %PWM data in a 4-Digit format. A 0.0 display represents 0.0 %PWM and 100.0 display represents 100.0 %PWM. For more information on the 4-Digit LED Display, please click on these links (**Si4Display** , **Si4Display-Spec1**). A small (2.4"x2.3"x0.5"), integrated Aluminum heat-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 30V) at max. continuous load-current of 20A.Typical applications are: Unidirectional DC Motor-Speed Controller, Flicker-free LED light intensity control, Proportional Valve-Coil Controller, etc. This board can be configured and programmed to perform efficiently in many customized applications.

Jumper Selection Table

J1 Open = Motor Runs With PWM	**J1** Short= Motor Stops
J2 Open = Choose 20kHz PWM Frequency	**J2** Short = Choose 5kHz PWM Frequency

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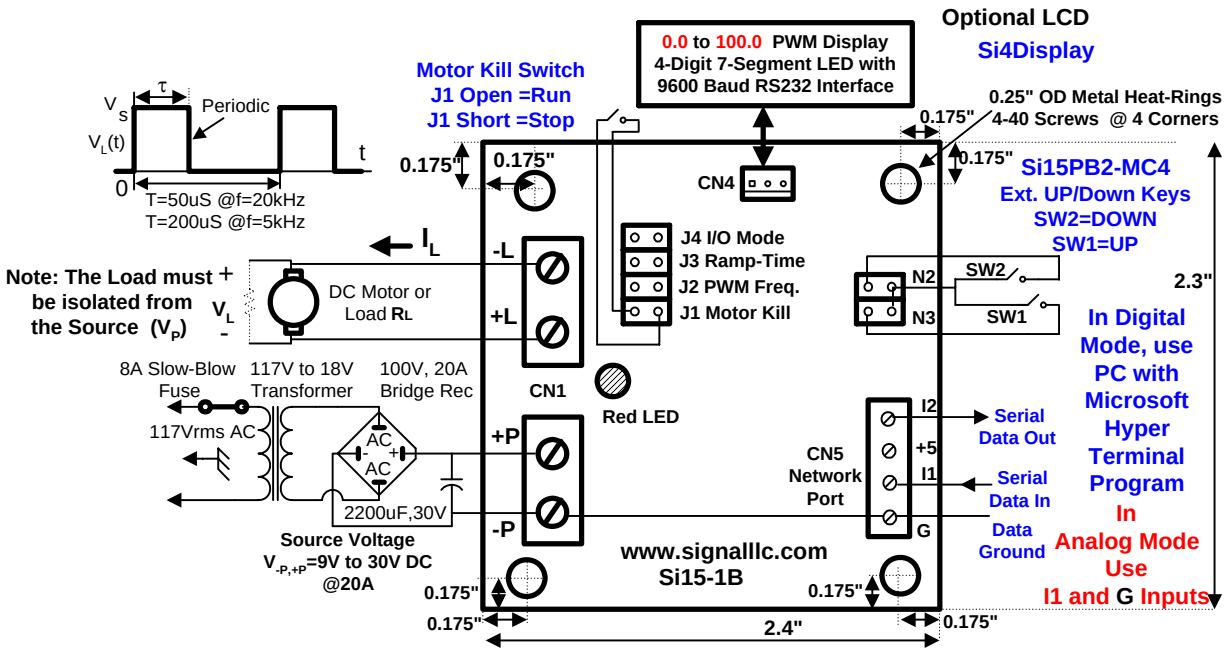
J3 Open = Choose Fast Ramp Time	**J3** Short = Choose Slow Ramp Time
J4 Open = Choose Digital I/O Mode	**J4** Short = Choose Analog Input Mode

Note: The Jumper **J1** is examined at each sampling period (loop-time). While the jumpers **J2, J3, J4** are examined only at power turn-on.

Specification and Application of Si15NeUdMC1-30V-20A

- **Lead free / RoHS Compliant,**
- **Typical Operating Temperature at 20A:** 45^{0}C with the Metal Heat-Ring Bolted to a small (2.4"x2.3"x0.5") Finned Aluminum heat-sink, while the heat-sink is exposed to ambient air at 25^{0}C (as shown on photograph).
- **Source-Voltage Requirements: V_p (from pin +P to pin -P):** 9V to 30V DC.
- **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 **J3**.
- **Load Isolation:** The Load or Motor must be isolated from the source voltage (**V_P**).
- **Power-Conversion Efficiency:** Approximately 98.5% at full-load (30V and 20A).
- **Load-Current Indicator:** An onboard red LED is used to monitor the motor (or load) voltage.
- **About the Voltage Requirement:** The Si15 will work with any DC Load in the 9V to 30V range. In addition, the power filters are included on this board. Consequently, only unregulated (full-wave rectified) DC input power is required in most applications.

A Typical Application of the Si15NeUdMC1-30V-20A



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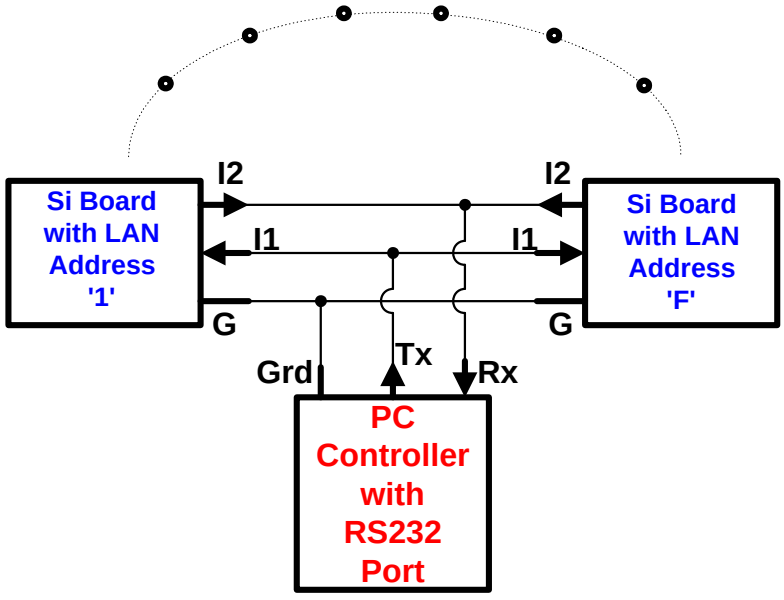
In Digital Mode (**J4** Open), the PWM or motor speed is adjusted by command strings derived from a Personal Computer (PC) using the Microsoft "Hyper Terminal" program (or any-other ASCII controller) operating at 9600 Baud, 1 start-bit, 8 data-bits, 1 stop-bit, No parity-bit. In addition, the PWM can be adjusted with Up/Down Keys (**Si15PB2-MC4**). In the Analog Mode (**J4** short) the PWM or motor speed is adjusted by a 0 to +5V analog voltage ($V_{I1,G}$) applied to **I1** and **G** on **CN5**. Or it can be adjusted by a 5k Ohm Linear taper potentiometer connected to terminals +5, I1, and G on CN5 (**Si5Pot1-1k**). An optional serial 4-Digit LED module is used to display the Measured PWM value. The display remains active in both modes. This display can be ordered from Signal as part number of **Si4Display** (4-Digit 7-Segment LED with 12" cable and 3-pin connector).

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 levels. In addition, these heavy gauge wires act as a heat sink, protecting the board from overheating.

Command Format and Local Area Network (LAN) for the Si15NeUdMC1-30V-20A

Each board has a unique, 8-bit, ASCII, **none-volatile,** Node-Address ranging from 1….9, A..Z, a,…z (or a total of 61 Units can be networked).The address can be changed by a **LAN** command (the factory default address is 1). The board uses a modified version of the RS232 serial-data communication standard, where the output-voltage (on pin **I2, CN5**) ranges from 0 to +5V (rather than the usual -12V to +12V). In addition, this output pin is normally an open circuit and it will only output a serial TTL binary bit-stream when properly referenced by its Node-Address. The serial data input-voltage (on pin **I1, CN5**) has the standard range of -12V to +12V. The serial data-format is: 9600 Baud Rate, 1 Start-Bit, 8 Data-Bits, 1 Stop-Bit, and no Parity-Bit.

These features allow the creation of a Local Area Network (**LAN**) with up to 61 nodes (boards). A typical 3-wire **LAN** with "Star Topology" is shown below. Note that the control lines (**G, I1, I2**) with the same name are connected together (or the boards are connected in parallel) and driven by an **ASCII** controller (or **PC**), equipped with an RS232 serial port, operating at 9600 Baud rate.



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Command Rules:

1. All Commands are **ASCII** character strings (Chars.). An ASCII string is denoted here with **Bold Red Letters (Characters).**

2. Each string is terminated by a Carriage Return Character, **(CR)**. The only exception is the **#** command.

3. Upper-Case Letters are used for Output Commands; and Lower-Case Letters are used for Input Commands.

4. The 1st Char. in a string is either ASCII **#** or a Node Address (**1**, **.**,**9,A..Z, a,..,z**). If the 1st Char. is an **#**, it denotes a query to all boards on the LAN to output their Node Address and Program Name.

5. If the 1st Char. is an ASCII (**1..,9,A,..Z, a,…,z**), it directs the rest of the command string to the board that has this address.

6. The 2nd Char. in the string is the Command Character that operates on the addressed board.

7. The 3rd, 4th, 5th Chars. represents the value of the input data.

8. The last Char. in the sequence is always the string terminator, **(CR)**.

Command Examples:

Ex#1. Com. String: **#** Action: All boards on the LAN will output their Address and Program Name.

Ex#2. Com. String: **1u5(CR)** Action: Change Board 1 Address in EPROM from 1 to 5.

Ex#3. Com. String: **1M(CR)** Action: Board 1 outputs its Set and Measured Values (0,..120).

Ex#4. Com. String: **1m120(CR**) Action: Change Board 1 Load Value to 120 = 100% PWM.

Ex#5. Com. String: **2m60(CR)** Action: Change Board 2 Motor Value to 60 = 50% PWM.

Note1: The **m** command inputs decimal integer Motor Values, ranging from 0,….+120. The positive values are used for forward speed control. The PWM duty-cycle varies linearly with the input values; 0 value is equal to 0% PWM, while 120 value is equal to 100% PWM.

Note2: The **m** command **is NOT** subject to round-off" errors!!!

Note3: The last set value entered with the m command or with the Up/Down keys is saved when the power is turned off, and this value is restored when the power is turned back on.

4-Digit LED Display Format:

LED display **reads** **50.0** or 50.0% PWM.

The baud-rate and the board address (uid) are displayed for 5 seconds when the power is turned on.