

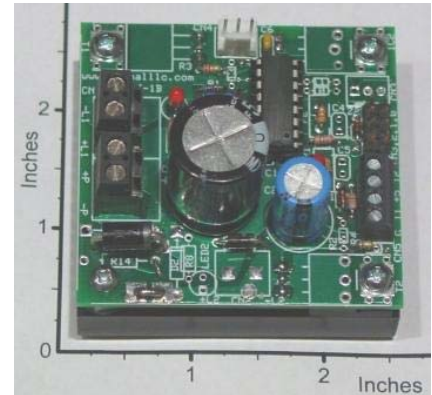
## Signal Consulting, LLC

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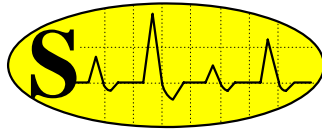
### Si15NeUdPC1-30V-20A, Networkable, Unidirectional, Open-Loop, 30V 20A, Power Controller with RS232 Serial Control Port, LED Display Port, Integrated Heat Sink and with 20kHz or 5kHz PWM, B-Chip

The **Si15NeUdPC1-30V-20A** is a 30V 20A, networkable, microprocessor based, high-power, Unidirectional, Power Controller that uses a single (9V to 30V at 0 to 20A) DC power supply to control the average current to a load in one 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

<b>J1</b> Open = Motor Runs With PWM	<b>J1</b> Short= Motor Stops
<b>J2</b> Open = Choose 20kHz PWM Frequency	<b>J2</b> Short = Choose 5kHz PWM Frequency



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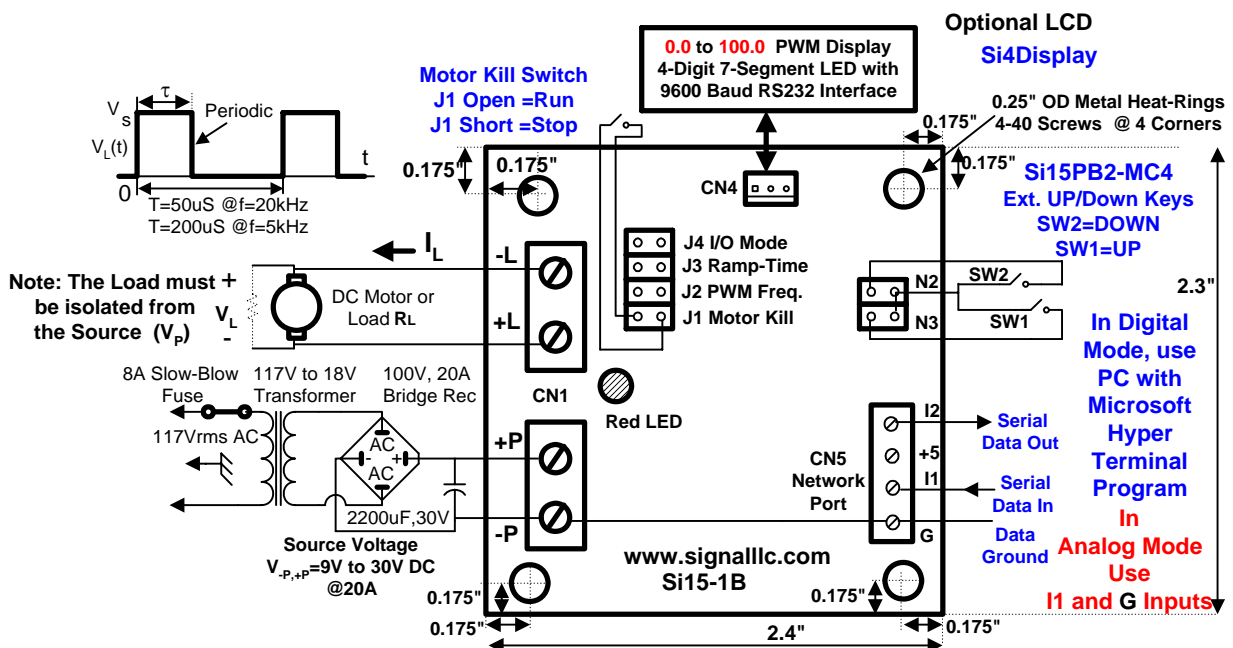
J3 Open = Choose Fast Ramp Time	J3 Short = Choose Slow Ramp Time
J4 Open = Choose Digital I/O Mode	J4 Short = Choose Analog Input Mode

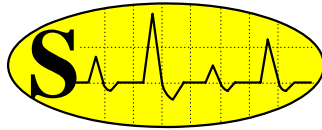
**Note:** The Jumper **J1** is examined at each sampling period (loop-time). While the jumpers **J2, J3, J4** are examined only at power turn-on.

## Specification and Application of Si15NeUdPC1-30V-20A

- **Lead free / RoHS Compliant,**
- **Typical Operating Temperature at 20A:** 45°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°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 Si15NeUdPC1-30V-20A





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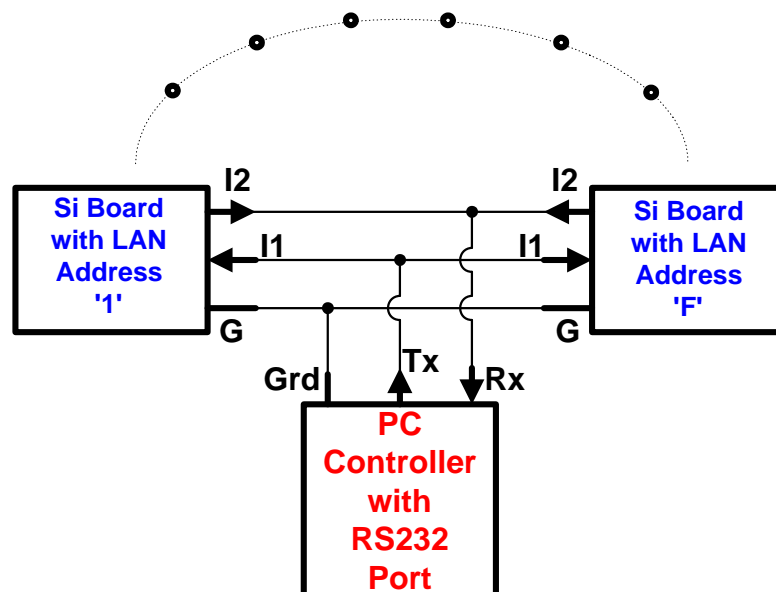
In Digital Mode (**J4** Open), the PWM or motor speed is adjusted by command strings derived from a Personal Computer (PC) using the Microsoft "Hyper Terminal" program (or any-other ASCII controller) operating at 9600 Baud, 1 start-bit, 8 data-bits, 1 stop-bit, No parity-bit. In addition, the PWM can 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 [Si15NeUdPC1-30V-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 1<sup>st</sup> Char. in a string is either ASCII **#** or a Node Address (**1**, to **z**). If the 1<sup>st</sup> Char. is an **#**, it denotes a query to all boards on the LAN to output their Node Address and Program Name.
5. If the 1<sup>st</sup> 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 2<sup>nd</sup> Char. in the string is the Command Character that operates on the addressed board.
7. The 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup> 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: **1P(CR)** Action: Board 1 outputs its Set and Measured Values (0,..120).

Ex#4. Com. String: **1p120(CR)** Action: Change Board 1 Load Value to 120 = 100% PWM.

Ex#5. Com. String: **2p60(CR)** Action: Change Board 2 Motor Value to 60 = 50% PWM.

**Note1:** The **p** 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 **p** command is **NOT** subject to round-off" errors!!!

**Note3:** The last set value entered with the **p** 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.