

## Signal Consulting, LLC

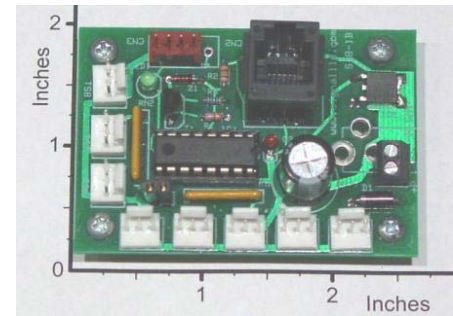
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### Si8Ne8DTS12B-30V

## Networkable, Temperature Sensor Board with 8 Digital 12-Bit sensors, and with Serial LCD Port

The **Si8Ne8DTS12B-30V** is a Networkable Temperature Sensor board where 8 independent Digital 12-Bit temperature sensors are used to monitor temperature values from 8-different locations. The 8 sensors are prompted periodically at the same time and a new temperature value is available within 1 second from each sensor at the same time (i.e. the sampling rate is 1second and the data acquisition is synchronous). **The temperature values are measured with 12-bit digital sensors in the -55°C to +125°C range with 0.0625°C resolution and 0.5°C accuracy.** An onboard microprocessor controls the data acquisition process, monitors the user inputs; and drives the LCD. Eight small 12-bit digital sensors, (Signal's part number [Si24DTsens-12B](#) or Dallas Semi., DS18B20 thermometer, connected to port **TS1,...TS8**) are used to measure temperature values. Because these sensors are digital in nature, they are virtually immune to noise and loading; ideally suited for remote sensing. Each sensor uses a unique "1-wire interface" (with parasite power mode) that requires only 2-conductors for reliable remote (typical length of 20 meters) temperature sensing. As the name (**Ne, Networkable**) implies, the measured temperature values can be captured by 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.), using ASCII command strings, and the RS232 protocol. The RS232 data format and the Local Area Network (LAN) commands are described on the next page. The measure temperature values (TS1,...,TS8) can be locally displayed on a 2 line by 16 character serial LCD. A Push button switch (connected to **J1**) selects which two sensors are displayed at one time. The LCD can be ordered from Signal under the part number of [Si14LCD2L16CH](#) (with 12" cable and 4-pin connectors and with back-light). An onboard Green LED is used to monitor the sampling process. The LED blinks each time a new group of 8 samples (from TS1,...,TS8) are available.

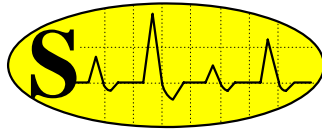


### Specification and Application of Si8Ne8DTS12B-30V

- **Overall Dimensions:** Length=2.6", Width= 1.8", Height= 1.0" .
- **Source-Voltage Requirements:**  $V_c$  (from pin +C to pin - P): 9V to 30V DC, at 30mA max.
- **Measured-Temperature** is determined in the -55°C to +125°C range, with ½° C accuracy, and with 0.0625° C precision; using the Dallas Semi. DS18B20 (in TO-92 casing) Digital Thermometer.
- **Sampling Rate:** The temperature is sampled at approximately 1Hz rate and the control-loop/display is updated with this same rate.
- **LED Indicator and Board Protection:** An onboard Green LED is used to monitor the sampling process. The LED blinks each time a new group of 8 samples (TS1,...,TS8) are available. The network input/output pins are zener-diode protected.
- **About the Voltage Requirement:** The Si8 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 Si8Ne8DTS12B-30V

In this temperature measurement application, 8 independent temperature measurements are performed with 8 digital 12-Bit sensors connected to this board. The sensors cover a temperature range of -55°C to +125°C with 0.0625°C resolution and 0.5°C accuracy. The 8 sensors are prompted periodically at the same time and a new temperature value is available within 1 second from each sensor at the same time (i.e. the sampling rate is 1

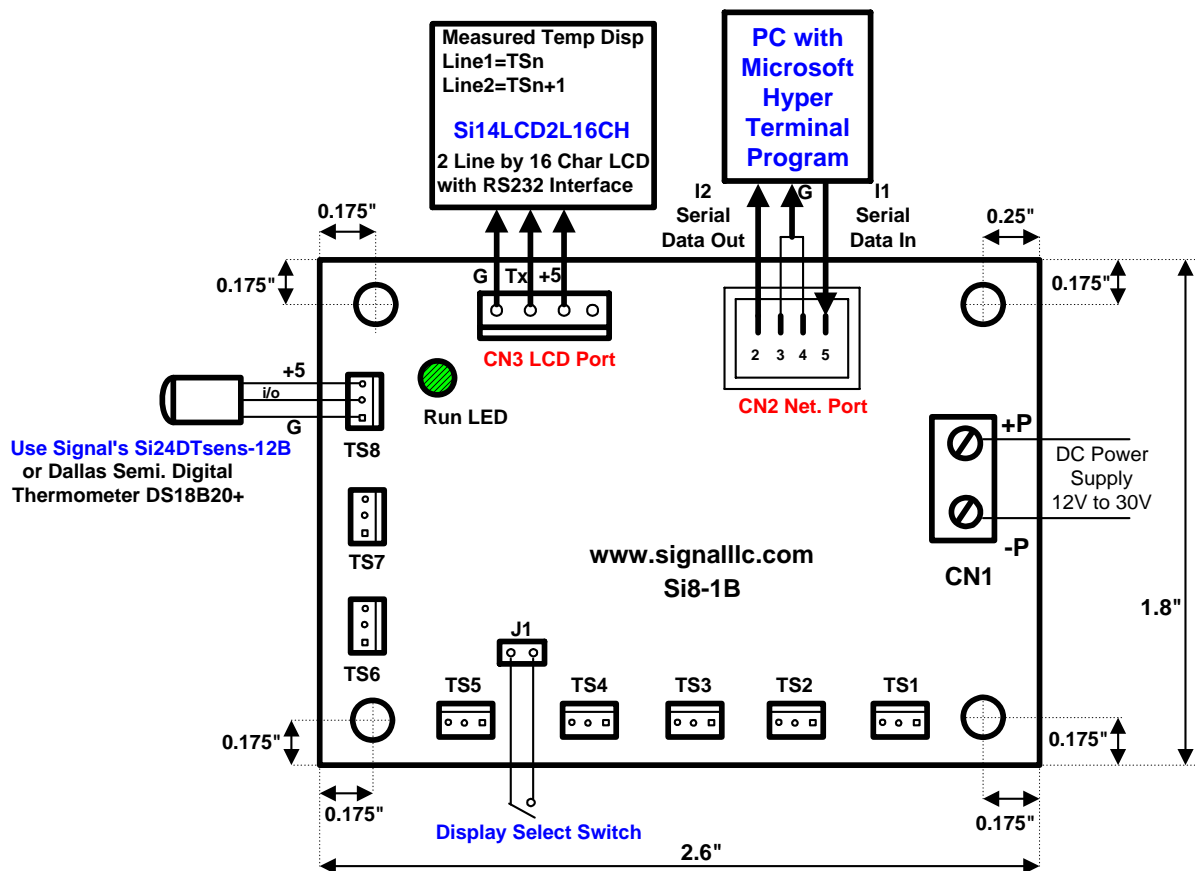


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second and the temperature samples are synchronous). The acquired temperature values are displayed on the LCD (from 2 sensors at one time) as selected by the display push-button switch (shown below). The samples can be captured by a Personal Computer (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. The sensors can be purchased from Signal Consulting, LLC as [Si24DTsens-12B](#) (DS18B20 in TO-92 casing, with 12" leads and with 3-pin connector) or ordered from vendors as: DS18B20, Digital Thermometer. The specification of this sensor can be view by clicking by this link: [Si24DTsens-Spec1-DS18B20](#). The optional LCD module can be ordered from Signal using the part number of [Si14LCD2L16CH](#) (2-lines by 16-character display with 12" cable and 4-pin connectors, and with back-light).



## Command Format and Local Area Network (LAN) for the Si8Ne8DTS12B-30V

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, CN3) 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, CN2) 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

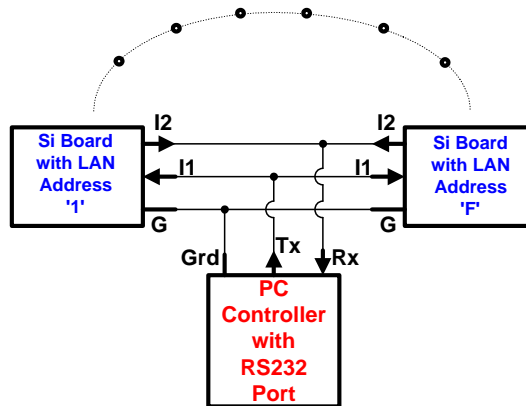


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boards are connected in parallel) and driven by an **ASCII** controller (or **PC**), equipped with an RS232 serial port, operating at 9600 Baud rate.



## 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 an ASCII **#** or a Node Address (**1, ..,9,A..Z, a,..,z**). If the 1<sup>st</sup> Char. is a **#**, 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 last Char. in the sequence is always the string terminator, **(CR)**.

## Command Examples on Input Line I1:

- 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: **1A(CR)** Action: Board 1 outputs Measured Temperature from **TS1,..,TS4**.
- Ex#4. Com. String: **1B(CR)** Action: Board 1 outputs Measured Temperature from **TS5,..TS8**.

**You must use approximately 25msec (or longer) delays between characters when inputting a command string ("1t..(CR)", "1T(CR)" or "1Q(CR)") to this controller board.**

Occasionally, a transient character may be captured and buffered by one more board on the LAN. This **transient character can be cleared by sending one or more (CR) prior to a valid command string.**



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Valid Measured Temperature values are given at 1Hz rate; consequently commands strings can be sent at 0.66Hz rate.

### Response to Commands on Output Line I2:

The response to a "**1A(CR)**" command is an ASCII character string (or a line of characters). Each string is terminated with carriage return and line feed characters. An example is shown below:

**N=1 T1=+025.00 C T2=+023.87 C T3=+025.00 C T4=+023.87 C**

Where **N=1** is the node (or unit) address of the board (can be changed with the **u** command), and **T1=+023.87 C** is the current Measured-Temperature in degree Centigrade from sensor **TS1**,..... Note that there are two space characters between **N=1** and **T**; and there are two space characters between each **C** and **T**. The length of this character string is 61, including carriage return and line feed characters (not shown in this example).

Similarly, the response to a "**1B(CR)**" command is an ASCII character string (or a line of characters). Each string is terminated with carriage return and line feed characters. An example is shown below:

**N=1 T5=+025.00 C T6=+023.87 C T7=+025.00 C T8=+023.87 C**

### 2-Line by 16-Character LCD Display Format:

An optional 2-Line by 16-Character serial LCD ([Si14LCD2L16CH](#)) can be connected to port **CN3**. This +5V, RS232 serial LCD operate at 9600 Baud rate with: 1 Start-Bit, 8 Data-Bits, 1 Stop-Bit, No Parity-Bit. A typical LCD display is given below:

Line 1: **NTn=+025.00 C**

Line 2: **NTk=+025.00 C**

Where **n** is a sensor number as selected by the push button switch (Connected to **J1**, Shown on the Application diagram) and **k=n+1**

### Network Configuration:

**The on-board microprocessor provides the bus arbitration, required to avoid data collisions on the 3-wire LAN bus.** The **Si..Ne..** boards can be arranged in many Local Area Network (LAN) topologies: Star, Daisy-Chain, etc. You may create your own network or you may order one or more of the Network Cable Assemblies listed in the Application Note. **Before you build your network, click on this blue link and read this Application Note:** [SigNote on Configuring a LAN-2](#).