SGT Engineering

http://www.slsargent.com/

Two channel 12-bit voltage datalogger with counter channel

Introduction

SGT Engineering's two channel voltage datalogger was designed for measuring and recording 1 or 2 single ended voltages in the range of 0 to 2.500 vdc. The logger features a precision-switched output of 2.500 vdc, which can source up to 40 milliamps of current for powering sensors. A programmable excitation delay can be set by the user to allow for the sensor output to stabilize prior to starting the measurement. A 16-bit counter channel is available for recording switch closures from a tipping bucket rain gauge. Additionally the logger can be programmed to output a 5-vdc pulse if a comparison between a user set value and analog ch#1 is true.

System Requirements

1.) Personal computer/laptop running Windows 95, 98, 2000 or NT with HyperTerminal installed.

2.) 5.5-18 vdc power supply.

3.) 9 pin RS-232 cable (male/female connectors).

Checking to see if HyperTerminal is installed on your computer.

1.) Open the control panel folder and double click on the add/remove programs icon.

2.) Select the windows setup tab.

3.) Highlight the communications row, and click details.

4.) If the HyperTerminal box is checked, you're all set. If not, place a check in the box, press ok, then ok again to begin the installation (you may need your Windows disk/CD to complete the installation).

The Included CD contains a pre-configured HyperTerminal connection named sgt.ht. This file can be copied to your HyperTerminal directory and all the settings should be correct except for the COM port selection.

Creating a new HyperTerminal connection.

1.) The HyperTerminal folder is usually located in c:\programs\windows\accessories. If you cannot find it try doing a file search for HyperTerminal.

2.) Open the HyperTerminal folder and double click on the HyperTerminal.exe icon.

3.) You will be asked to give your new connection a name and icon.

4.) Next the phone settings box will appear. All your concerned with here is that the connection method is set to the serial port you will be using (typically COM1 or COM2).

5.) Next the COM port settings box will appear. Set the bits per second to 19,200-baud, no parity, 8 data bits, 1 stop bit and no flow control. Press ok when finished.

6.) Now select the file tab at the top left of the screen. Choose properties/settings/emulation. Under emulation select auto detect. Click the ASCII setup button, make sure the boxes “append line feeds to incoming line ends, wrap lines that exceed terminal width and echo typed characters locally” are checked.

7.) Exit HyperTerminal, being sure to save your new connection. When HyperTerminal is restarted, the new settings will be in effect.

8.) Plug a 9-pin serial cable into the logger and to the appropriate serial port (step 4) on the computer.

9.) Attach a suitable power supply to the 2-input terminal block located next to the serial port of the logger (5.5-18 vdc). The polarity is marked on the circuit board next to the terminal block (+, -).

The dataloggers blue led will flash several times when powered up correctly.

10.) Start your new HyperTerminal connection.

*** A shortcut can be added to the desktop for running your new HyperTerminal connection.**

11.) Press the reset button located on the logger. The led should flash several times and the dataloggers current time, date, voltage, identification number and the percent of memory used should appear on the screen, followed by the main menu.

Time 20:08:39 Date 12/15/01

Voltage 12.9 vdc ID# 01 Memory is 10 % Full

(1) Measure (2) Data (3) Setup (4) Erase (5) Log
>

Setting up the logger

Once communication with the logger is established you will have sixty-five seconds to make a selection before the logger begins logging. Pressing any key before the sixty-five seconds expires will reset the timer back to zero. If your not finished communicating with the logger and its begun logging, simply push the small reset button on the circuit board to reset the logger or cycle the power supply off and on.

Main Menu

(1) Measure (2) Data (3) Setup (4) Erase (5) Log

Typing "1- 5" will execute the corresponding instruction. To abort an instruction, simply push the reset button.

(1) Measure

Typing “1” instructs the logger to enable the sensor(s), pause a specified period of time before beginning the measurement(s), take the measurement(s) and display the result(s) in counts. Values will not be recorded during this measurement sequence. The measurement value returned is in counts. The analog to digital converter is 12 bits, outputting a number between zero (0.000-vdc input) to 4,095 (2.500-vdc input). To convert from counts to volts, multiply the counts by 0.6104.

If enabled, the logger will also display the number of switch closures, which have occurred since the logger was reset or powered up. The logger will then reset the counter to zero.

(2) Data

Typing “2” takes you to the collect new (1) or collect all (2) data menu. Typing “1” instructs the logger to read out all the data collected from the beginning through to the last data point collected. Pressing “2” instructs the logger to dump the entire memory. It takes four minutes to read out the entire memory. The data is output as “comma” delineated so it’s easily brought into a spreadsheet such as Excel. The first column(s) contains the measurement(s), the next column contains the time it was collected (hours/minutes) and the last column contains the date (month/day/year).

(3) Setup

Allows changing the dataloggers operating parameters. See logger configuration options.

(4) Erase

Typing "4" instructs the datalogger to erase the internal data pointers. The logger features a fill and stop memory, so the data pointers should be erased before the memory fills. If the memory fills up, the logger will suspend logging and enter a low power state.

(5) Log

Typing "5" instructs the logger to immediately begin logging, bypassing the 65 seconds time period while its waiting for user input.

Configuration Options

(1) Set Clock
(2) Logger ID# 16
(3) Counter channel
(4) Log Interval 1 minutes
(5) Recording 2 channel(s)
(6) Excitation delay 100 milliseconds
(7) Acquisition delay 1500 microseconds
(8) Trigger menu
(9) Main menu
>
Choose from one of the following nine options

Set Clock

The clock runs on a 24-hr format. The clock uses only two digits for the year, 2001 would be set as 01.

Example: If it’s 6:30pm on the 23rd of October, 1988, then key in “ 8 8 1 0 2 3 1 8 3 0”

Year: 88 **enter the year**
Month: 10 **enter the month**
Day: 23 **enter the day**
Hour: 18 **enter the hour**
Minute: 30 **enter the minute**

The real time clock is battery backed by a 3-volt lithium battery for up to ten years in the absence of power.

The RTC also stores the dataloggers data pointers. Anytime the 3-volt lithium battery is removed or replaced, the datalogger memory **must** be erased.

Logger ID#

The logger ID number is the first item printed when data is read out from the logger. Two values must be entered and must be in the range of 0 – 9, A-F. Letters entered must be capitalized.

Counter Channel

For selecting whether the counter channel is active. When not being used, the counter channel should be disabled to free up data storage space. The counter channel is designed for measuring switch closures from a tipping bucket rain gauge. To use a rain gauge with the logger, attach one of the switch leads to the terminal marked Cnt and the other to a ground terminal.

If you change the counter configuration, the logger will reset the data pointer to the beginning, causing new measurements to be recorded over the older data. A warning will be given from the datalogger prior to resetting the data pointer. **Changing configuration will reset data pointer to zero, continue y/n?**

Log Interval

Enter log Interval in minutes, then press enter
>
Log intervals can range from 1 minute to 1440 minutes in one-minute increments (24 hrs = 1440 minutes).

Recording (x) channels

Enter # of channels to record (1-2)
>
If you change the number of channels set for recording, the logger will reset the data pointer to the beginning, causing new measurements to be recorded over the older data. A warning will be given from the datalogger prior to resetting the data pointers.
Changing configuration will reset data pointer to zero, continue y/n?

Excitation delay

The excitation delay allows changing the time delay to be set from when the switched 2.500 vdc output is turned on to when the measurement is started.

Enter excitation delay in milliseconds (1 - 9999)
>

Acquisition delay

Allows changing the analog to digital converters acquisition time.

Enter acquisition delay in microseconds (1000 - 65535)
>

The minimum time is 1000 microseconds and can be increased to 65,535 microseconds. The analog to digital converter features an internally switched sample and hold capacitor. The longer the time period given, the more time is allowed for the analog to digital sample and hold capacitor to charge. If sensors with a high output resistance are used, more time should be allowed for the analog to digital converter to sample the signal. For accurate conversions sensors with an output impedance in excess of 50 K ohms should not be used without external signal conditioning.

Trigger menu

Takes you to the switched output setup menu

(1) Test table
(2) Current total
(3) Show table values
(4) Change table values
(5) Trigger value 35880
(6) Return
>

This menu is for configuring the logger to output a 100-millisecond pulse when a user entered value is reached or exceeded. This 5-vdc pulse is output on the terminal marked Sw. Every time the logger logs data, the value from analog channel # 1 is used to pull a value from a look up table. The logger keeps a running sum of these values, when this sum exceeds a user entered threshold (the trigger value), a pulse is output, the sum is reset to zero and the process starts over.

The test table routines mimics the log routine, the user can enter a value between 0 and 4095 (the range of the a to d converter) and the logger will pull the corresponding value from the table and print it on the screen.

Pressing “2” will show the current sum value.

Pressing “3” will instruct the logger to print out the 33 table entries.

Pressing “4” will take you to a menu where the user can enter new table entries. These values need to fall in the range of 0 to 65,535 and must be increasing or equal. Linear interpolation is used to calculate the values, which lie in between the table values. These values can be programmed automatically by creating a text file of values, and sending them to the logger with the send text file option in Hyper Terminal. Under the Hyper Terminal’s file/ properties/settings/ascii setup make sure you provide a 50-millisecond character delay while sending.

An example file “table.txt” is included on the CD.

To program new values into the table, choose the menu selection “change table values”

Enter 33 table entries
>

Then from Hyper Terminal, choose transfer/send text file and select the file, which contains your values. After sending the file, choose “show table values” to assure they were received correctly.

Pressing “5” allows for you to enter a target value, which when the loggers running total exceeds, a pulse will be output on the Sw terminal.

Pressing "6" returns you to the previous menu.

All parameters are stored in non-volatile memory, until changed by the user.

Collecting Data

The following is a generalized procedure for using HyperTerminal for data collection.

1.) Create a folder on the desktop to keep the data files in.

2.) When I'm ready to collect data, I open my data folder and choose file/new/text document.

3.) I name the new text document something like "NL0704.txt". This could stand for NelsonLake data collected on July fourth. The important thing is that the file retains the *.txt extension.

4.) I plug in my RS232 cable into the logger and to the PC.

5.) I start my new HyperTerminal connection, then select transfer, capture text and browse to the folder, which contains my text file (NL0704.txt), select this file and click the start button. At this point anything printed on the screen will be captured to the file.

6.) Reset the logger and from the main menu, press "2" for data, followed by a "1 or 2" depending on whether I want the current data set or to dump the entire memory.

7.) The logger then prints the data to the screen and consequently to the text file.

8.) Close HyperTerminal and open the data file with notepad or wordpad to make sure the data was successfully transferred.

I generally download multiple loggers in the field on the same day. Once you have created your data file and have transferred your first data file, HyperTerminal will default to this file the next time it's started. This is a good thing, when I reach my next logger, I plug it in, start HyperTerminal, choose transfer/text capture/start and I'm ready to download the data. The data from this logger will be appended to the end of the original text file.

This is where the logger ID# comes in handy so you know which data set is from each logger.

For processing the data, import it into a spreadsheet as a tab delineated file. Then it's easy to create a formula, which can be applied to the entire column of data for converting it to the appropriate units.

Wiring Panel

Power to the logger should be applied to the 2-terminal block connector. The polarity is marked on the circuit board. The rear of the logger has a terminal block with 8 connectors. Two are for ground connections (Gnd); one analog ground connection (Ang), two for analog inputs (Ch1, Ch2), one is the excitation output (switched + 2.500 vdc), one is the counter channel input (Cnt) and the last one is the switched output (Sw).

Installation

The datalogger should be mounted in an enclosure to protect it from the elements, primarily moisture. A single point, earth ground should be provided to protect from nearby lightning activity. A 12 gauge wire should be connected from the grounding rod to one of the terminal blocks labeled Gnd.

Electrical Specifications

Logger operating voltage	5.5 - 18 vdc
Current consumption	7 ma while communicating and downloading data 8 milliamps plus sensor requirements while measuring/recording Less than 200 microamps while logging
Input Channel Impedance	Ch1, Ch2 > 1 megaohm
Input channel leakage	0.1 microamp typical, 1 microamp maximum.
Input voltage range	0 to 2.500 vdc
Measurement accuracy	± 0.6104 mV ±0.1% of reading
Measurement resolution	0.6104 millivolts
Switched 2.5 vdc output	± 2.5 millivolts (worst case over line, load and temperature). Sources up to 40 milliamps. Can withstand an indefinite short to ground.
Switched 5.0 vdc output Impedance	100 ohms
Counter channel 16-bits	Minimum switch closed and open time is 5 milliseconds. Maximum input frequency is 60 Hz.
Operational temperature range	-10 to 60 degrees Celsius
Real time clock accuracy	± 1 minute per week (typical)

Real Time Clock

A 3-volt lithium coin cell backs up the real time clock when the datalogger is not powered. The coin cell will keep the clock running for up to ten years in the absence of power. The voltage of this battery should be checked periodically. To test the battery voltage, a voltmeter is required. Make sure the voltmeter is set to read volts dc, and that the range covers up to 3.5 vdc. Attach the negative lead of the meter to one of the loggers ground terminals, and the positive lead to the top of the battery. Replace the battery if the voltage is below 2.60 vdc.

Suitable replacement batteries: **CR1225, BR1225** Available at RadioShack

The real time clock stores the memory address pointer in its internal ram. Anytime the battery is removed or replaced, the erase command “4” must be executed to initialize the data pointer to a known location (zero).

The Datalogger Input channels are protected from brief transient voltages through a combination of current limiting resistors and 1,500-watt transorbs.

Data Storage

The maximum number of time and date stamped measurements is dependent upon the number of channels being recorded.

Recording one channel	18,724
Recording two channels	14,560
Recording three channels	11,912

If these values are reached, the datalogger will stop logging and enter a low power state.
Data will be retained in the absence of power for up to ten years.

Warranty

SGT Engineering warrants its products against defects in materials and workmanship for a period of 12 months from the date of purchase. If you discover a defect, SGT Engineering will, at its option, repair, replace, or refund the purchase price. This warranty does not apply if the product has been modified or damaged by accident, abuse, or misuse.

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