

SGT Engineering

<http://www.slsargent.com/>

Four Channel Period Averaging Datalogger

Introduction

SGT Engineering's four-channel period averaging datalogger was designed for measuring and recording sensors that output a variable frequency signal. Four switched 5 vdc outputs are available to enable (activate) the sensors prior to measurement. A programmable delay can be set by the user to allow for the sensor output to stabilize prior to starting the measurement.

System Requirements

Computer or laptop with available serial port running Windows 95, 98 or NT with HyperTerminal installed.

6-18 vdc power supply.

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

Getting Started

Communicating with SGT Engineering's dataloggers requires a terminal program. HyperTerminal is an easy to use program, which is provided free with virtually all Windows operating systems.

Checking to see if HyperTerminal is installed on your computer

- 1.) From the Desktop, double click on the "My Computer" Icon, 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 on 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).

Creating a new HyperTerminal connection

- 1.) The HyperTerminal folder is typically 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 Hypertrm.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 you're concerned with here is that the connection method is set to an available serial port (typically COM1 or COM2). If your computer has a modem installed, make sure you select a different serial port to use.
- 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.) 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 “wrap lines that exceed terminal width and echo typed characters locally” are checked. Also check “Append line feeds to incoming line ends”

7.) Exit HyperTerminal, being sure to save your new connection. When your new HyperTerminal connection 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 of the logger (6-18 vdc). The polarity is marked on the circuit board next to the terminal block.

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 18:22:29      Date 10/09/01
Voltage = 12.7 vdc  ID# 11      Memory is _ % full
(1) Measure   (2) Read Data  (3) Setup    (4) Erase    (5) Log
>
```

Setting up the logger

Once communication with the logger is established you 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 or cycle the logger power off and on.

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

Typing a number between 1 and 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, pause for the excitation delay, take the measurement and display the results. Values will not be recorded during this measurement sequence.

(2) Read Data

Typing “2” takes you to the collect new (1) or collect all (2) menu. Typing “1” instructs the logger to read out the current data collected by the logger starting at the beginning of memory. Entering the data menu and selecting “2” will force the logger to unload the entire memory, ignoring the internal data storage pointers. This feature is useful for retrieving older data that was lost or not saved previously. Until the data is actually overwritten, it is still available. Commas are printed between columns so it can be brought into a spreadsheet as a comma-delineated file. The first column contains the measurements, the second contains the time it was collected (hours/minutes) and the third contains the date (month/day/year).

(3) Setup

Typing “3” takes you to the Options Menu (see below).

(4) Erase

Typing “4 ” Instructs the logger to erase the data file markers. The datalogger will ask for confirmation before erasing and then the main menu will appear. The logger does not actually erase the data, but merely resets the data storage pointer to the beginning.

(5) Log

Typing “5 ” Instructs the logger to immediately begin logging, ignoring the 65 second wait for keyboard input.

Options Menu

- (1) Set Clock**
 - (2) Logger ID# 00**
 - (3) Measurement options**
 - (4) Log Interval 5 minutes**
 - (5) Recording 4 channel(s)**
 - (6) Exit**
- >

Option #1

Setting the real time 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: It's 6:30pm on the 23rd of October, 2002, then key in “ 0 2 1 0 2 3 1 8 3 0”

Enter Year (YY):	02	enter the year
Enter Month (MM):	10	enter the month
Enter Day (DD):	23	enter the day
Enter Hour (HH):	18	enter the hour
Enter Minute (MM):	30	enter the minute

Option #2

Setting the logger ID

The Id number is the first item printed when the data is read out. Two values must be entered and must be in the range of 0-9, A-F. The characters A through F must be upper case. The logger ID# is retained in non-volatile memory until changed by the user.

Option #3

Measurement options

- (1) Channel#1 mode= 0, excitation delay= 100 ms
 - (2) Channel#2 mode= 0, excitation delay= 100 ms
 - (3) Channel#3 mode= 0, excitation delay= 100 ms
 - (4) Channel#4 mode= 0, excitation delay= 100 ms
 - (5) Exit
- >

This menu shows what the currently programmed settings are for each input and excitation channel. The input channels are labeled Fr1, Fr2, Fr3 and Fr4. The switched output channels are marked En1, En2, En3 and En4. These markings are located on the wiring strip of the logger.

Typing (1-4) allows the changing of channels (1-4) parameters. Type “1” and the following menu will appear.

- Channel#1
- (1) Change Mode
 - (2) Change delay
 - (3) Exit
- >

Pressing “1” will change the mode value from 0 to 1. Pressing “1” again will change it back.

Mode 0

For measuring low frequency signals with a period of 0.02 to 6.0 milliseconds (50,000 Hz to 167 Hz). The resolution and accuracy of the measurement is +/- 0.1 microseconds.

Mode 1

For measuring high frequency signals with a period of 3 to 200 microseconds (333.3 kHz to 5,000 kHz). The resolution and accuracy of the measurement is +/- 12.5 nanoseconds.

The logger will return a result of zero for signals that are either too fast or too slow to measure accurately.

Pressing “2” allows changing the excitation delay for the particular channel that we are working on. The delay is in units of milliseconds and can range from 0 to 9,999.

Option #4

Log interval

Log intervals can range from 1 minute to 1440 minutes in one-minute increments.
Units are in minutes (1 day = 1440 minutes)

Example

For a collection interval of three hours, type 1,8,0, then press enter.

Option #5

Number of channels to record

Here the number of channels to record is set. The channels always increment from one to four. It is not possible to record only channel one and three.

Changing the number of channels for recording will require that the internal data memory pointers be erased (set to zero). All new data collected will overwrite any previously collected data.

A warning message will be displayed prior to erasing data pointers.

Changing # of channels will reset data pointer to zero, continue y/n?

>

***** Make sure you have collected your data before changing the number of channels to measure *****

The number of channels selected for recording, measurement mode and excitation delay values are non-volatile and so are retained in the absence of power.

Collecting Data

The following is my 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 "nl070402.txt". This could stand for NelsonLake data collected on July fourth, 2002. The file must retain the *.txt extension.
- 4.) Plug the 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 (nl070402.txt), select this file and click the start button. At this point anything printed on the screen will be captured to the file.
- 6.) Press the reset button on the logger, then at the main menu, press "2" for read data, followed by a 1 or 2 depending on whether I want the current data or to dump the entire memory.
- 7.) The logger then prints the data to the screen and consequently to the text file.
- 8.) After the data has been read out, the dataloggers main menu will appear.
- 9.) Then close HyperTerminal and open the data file with Windows notepad/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 should 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 so you know which data set is from each logger. For processing the data, import it into a spreadsheet like Excel as a comma 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 is 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 12 connections. Three are for ground connections (Gnd); Four are input channels (Fr1, Fr2, Fr3 and Fr4), Four are switched outputs (En1, En2, En3 and En4) for enabling sensors. One is marked (+Ps) which reflect the dataloggers input voltage. The +Ps terminal is reverse polarity protected and is current limited at 200 milliamps. This output has a resistance of around 1-ohm. Pulling 100 milliamps from this terminal will drop the voltage approximately 100 millivolts.

Installation

The datalogger must be mounted in an enclosure to protect it from the elements, primarily moisture. A single point, earth ground should be provided to protect the logger and sensors 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	6 - 18 vdc
Current consumption	7 ma while communicating and downloading data. 7 milliamps plus sensor requirements while measuring. Less than 400 microamps while logging.
Input channels Fr1, Fr2, Fr3 and Fr4	Average of thirty-two cycles of the input signal. Signals must pass through a threshold of 0.300 vdc
Measurement accuracy	Mode 0 +/- 0.1 microseconds. Mode 1 +/- 12.5 nanoseconds.
Measurement resolution	Mode 0 +/- 0.1 microseconds. Mode 1 +/- 12.5 nanoseconds.
Input Channel Impedance	100 k ohms *
Input Voltage Range	0 to + 5.00 vdc **
Switched Outputs En1, En2, En3 and En4	Switched from ground to + 5 vdc during measurement.
Switched output impedance	500 ohms
Operational temperature range	-10 to 60 degrees Celsius
RTC accuracy	+/- 1 minute per week (typical)

* Input channel impedance is 4.7 K ohms for voltages greater than 5.7 vdc or less than -0.7 vdc

** Datalogger input channels can tolerate + - 10 vdc

All Input and output channels are protected from brief transient voltages or shorts through a combination of current limiting resistors, zener diodes and 1,500-watt transient voltage suppressors.

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 falls 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).

Data Storage

The maximum number of time and date stamped measurements that can be recorded is dependent upon the number of channels selected for recording.

Recording one channel	32,768
Recording two channels	23,824
Recording three channels	18,720
Recording four channels	15,416

If these values are reached, the datalogger will suspend logging and enter a low power state (400 microamps). The Indicator led will blink every 10 seconds when the memory is full. Data will be retained in the absence of power for up to ten years.

Indicator Led

A blue led is used as a status indicator. When the logger is first powered up, it will blink several times in quick succession. While logging, the led will blink briefly every three seconds.

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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