Manual

Starlog V4 Datalogger Management Software

Model 6308B

Revision History

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1.0   INTRODUCTION

Starlog Version 4.0 (Starlog V4) is a software package designed for the management of Unidata dataloggers. Starlog V4 software is specially designed to manage a data logging scheme and data unloads.

It is intended to be installed onto a computer where you may use it to create new schemes, load, unload and process data and test logger operation.

The software has a Windows style, complete with drop down and pop menus and help messages, as well as easy access to Unidata's extensive support documentation.

The easy-to-use menus are especially helpful in setting up your data logging project. You use the Scheme Editor to define what kind of data to collect and how and when it will be logged. Then, using the Navigator Control bar, you can load the scheme into the logger.

Once data has been acquired by and stored in the logger, you can use the Starlog V4 software to unload it again using the Navigator Control bar. Logged data is transferred to your computer in Comma Separated Value (CSV) file format. This format allows easy importing of your data into 3rd Party data management and manipulation software such as Hydstra, Tideda and Magpie.

To check logger operation, the software includes a test mode. In test mode the logger displays data as it is acquired. It also displays the logger status and other important information.

Features:

-    Powerful scheme creation system
-    Comprehensive instrument library and editor
-    Multiple user profiles: basic, technical, system developer
-    Multi-buffer support
-    Telemetry support
-    Backward compatibility with Starlog version 3 schemes
-    Fully Windows XP and up compliant
-    Unloads data and converts automatically to a CSV (Comma Separated Value) file for easy data manipulation and viewing in Excel, Hydstra, or Magpie
-    View unloaded data in a graphical and textual format with the internal data viewer
-    View real-time readings from the logger in a graphical or textual format
-    Connect to remote sites via a cellular or satellite modem
-    Manage multiple sites from a single PC.
-    Configure basic parameters of the logger scheme.

Note that at present Starlog V4 is unable to:

-    Receive alarms from loggers.
-    Program/unload to/from PCMCIA memory cards.

1.1   System Requirements

- Pentium Processor 233MHz
- 64MB RAM
- 32MB hard drive space
- Windows XP or up
- SVGA monitor
- Mouse
- RS232 serial port

1.2   The Starlog Data Logging Advantage

Starlog was specifically designed to log data in remote locations. Remote locations can be geographically remote or just an inconvenient distance from common amenities and services.

Starlog's advantages in geographically remote locations can be seen when considering a task like monitoring weather conditions in some remote location in Siberia. You could install a Starlog Datalogger in a weatherproof enclosure and connect temperature, humidity, and wind speed and direction sensors. Once installed you can retrieve acquired data using satellite or cellular telemetry, making the need for site visits exceedingly rare.

Data logging is a valuable tool for researchers, resource managers and industry.

Applications include:

- Water Resource management
- Environmental Protection
- Agricultural Studies
- Alternative energy research
- Salinity Control
- Drainage and Storm Water Monitoring
- Forestry Management
- Ground Water Research
- Resource Development
- Meteorology

1.3 What Is This Software Package For?

Unidata loggers can be described as small computers with specialized I/O (Inputs and Outputs). Just as your desktop PC is not much use without an Operating System, or applications (Microsoft Office or Adobe Acrobat) a Unidata data logger is not much use without a running program or project. We refer to this program as a scheme.

When you have selected the hardware for the data logging system, five steps are required by the user for its operation.
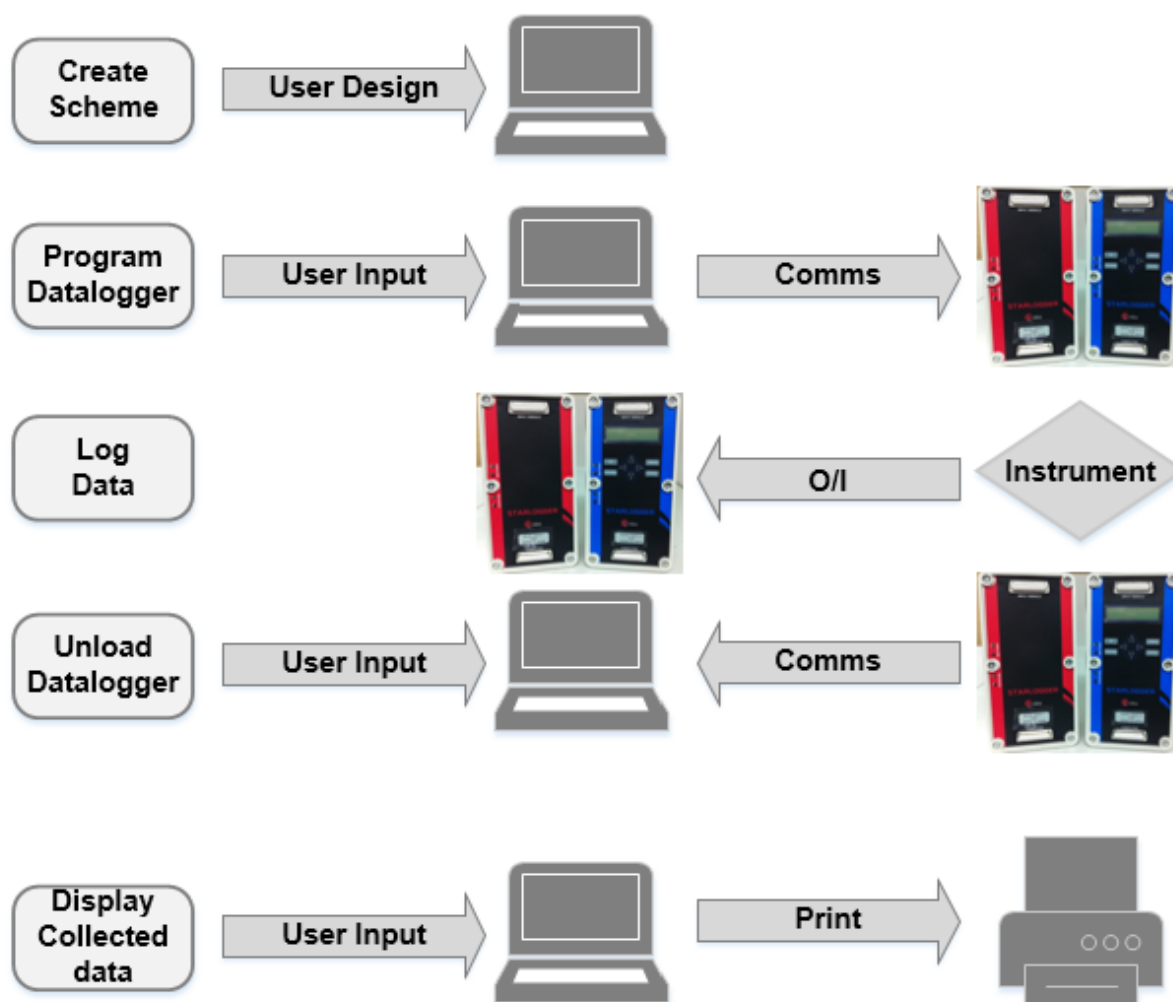
1.4   What Is A Scheme?

Using Starlog data logging systems, a data logging project is called a scheme. Elements of a scheme are grouped into the following categories:

- General Details
    - Scheme title used for reports, printouts

- Hardware Details
    - The Unidata data logger being used
    - What extensions to the logger (if any) are used, for example, relay modules, input modules, output modules, etc.

- Communications Settings
    - Logger to computer communications port and speed.
    - Modem setup strings and phone number

- Program Details
    - Program type (event-triggered?)
    - How to store data (linear or circular buffer)
    - Scan rate
    - When to log

- Log Buffer details
    - Average, minimum, maximum, total or raw data
    - The channels to log

- Instruments
    - Instruments connected, channels used, input scaling

- Events
    - Definition of events to trigger an output pulse or to log

A scheme combines these elements to generate a working program to operate the logger. The program instructs the logger, for instance, to "log the average hourly temperature measured by a thermistor probe connected to analogue channel 1.

2.0 INSTALLATION

2.1 Starting from CD-ROM
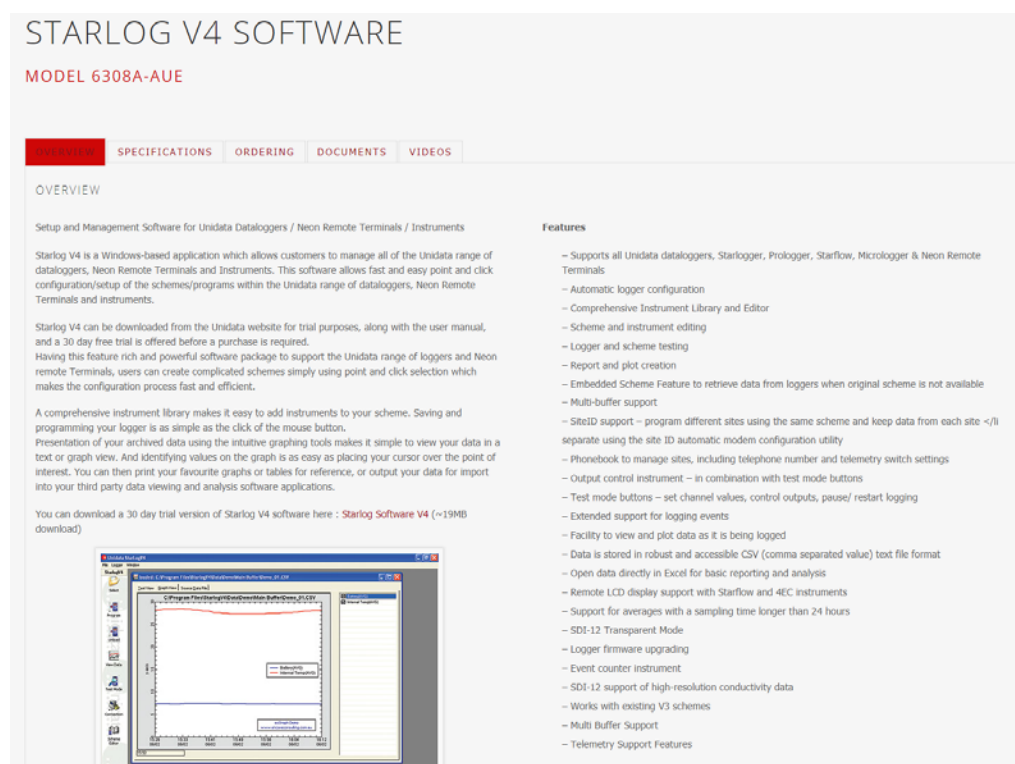
Insert the CD-ROM disc into the drive. It should start automatically. If it doesn't, go to Start → Programs/All Programs → Accessories → Windows Explorer.

Select your CD-ROM drive and double-click on Launcher.

2.2 Starting from Downloaded Files

There is a 30-day trial version of Starlog V4 available from our web site:

1. To download the required files, go to the Unidata web site:

http://www.unidata.com.au/products/starlog-dataloggers/datalogger-starlog-v4-software/

2. Click on Starlog V4 Software (~19MB download) to download starlog_v4.zip file.
3. Unzip that file into a temporary folder.
4. Open the folder and run the Setup file.

2.3 Installing the Software

Having started the installation procedure, you should be seeing the following screen:
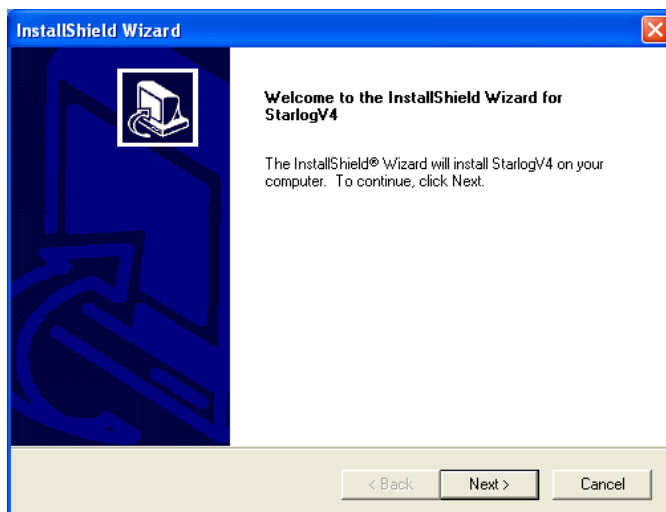
Follow the prompts to install the software. If you are asked to restart your computer, you should do so.

2.4 Using the Software for the First Time

2.4.1 Launching the Software

To start Starlog V 4, you can double-click on the icon on your desktop or alternatively, you could select the program from the start menu:
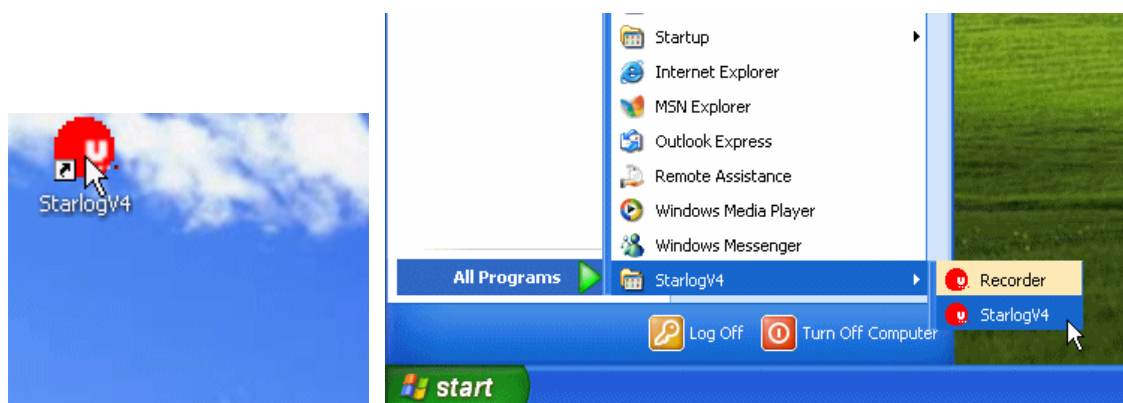
2.4.2   Support Files

The first time Starlog V4 is run, it needs to install some extra support files and configure itself, click *Extract* to install the support files.
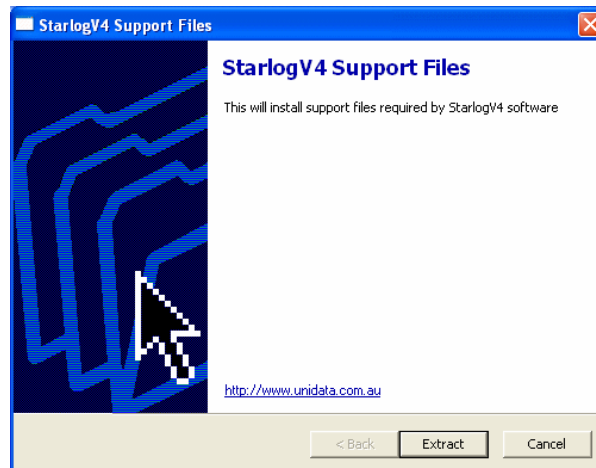
2.4.3   Backward Compatibility

The next dialog lets you configure the Compatibility support for Starlog/Starflow V3 software:
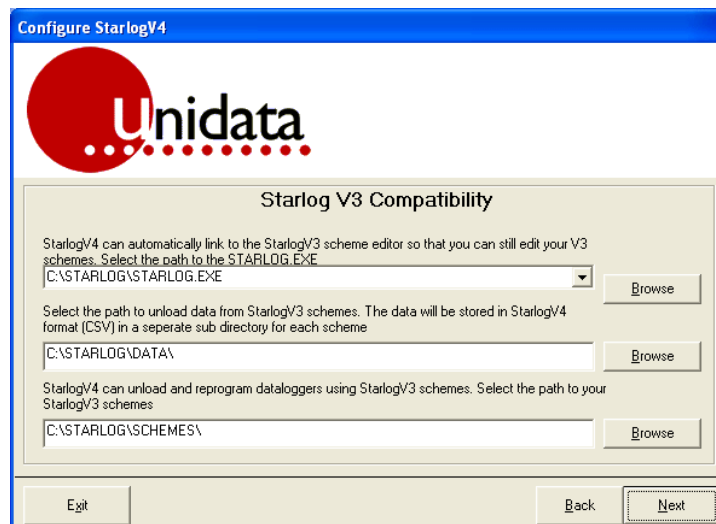
The above shows a typical configuration. You may need to change the values to suit the configuration of your Starlog/Starflow V3 installation. If you don't have Starlog V3 installed, just click *Next* to continue.

If you want to change these later, you can edit them by going to

File → Options → Configure StarlogV4 → Starlog V3.

2.4.4 Registration

The next dialog requires you to enter your *User Name* and *Code Key* to register the software. If you don't enter a valid User Name and Code Key then you have 30 days as a trial user before you are unable to use Starlog V4.

You will have the opportunity to enter a valid User Name and Code Key every time you restart Starlog V4.

There is an option to register:

- All Instruments & Loggers in Starlog 4 or
- Starflow Instrument Only

Do this accordingly based on your requirements and licence.
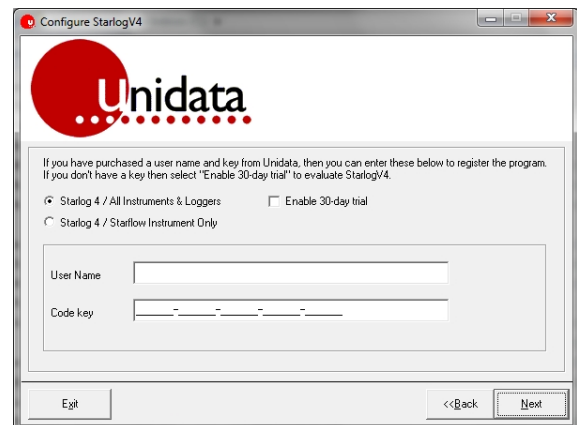
Assuming what you've entered is correct and what option you have enabled, you'll see the following:
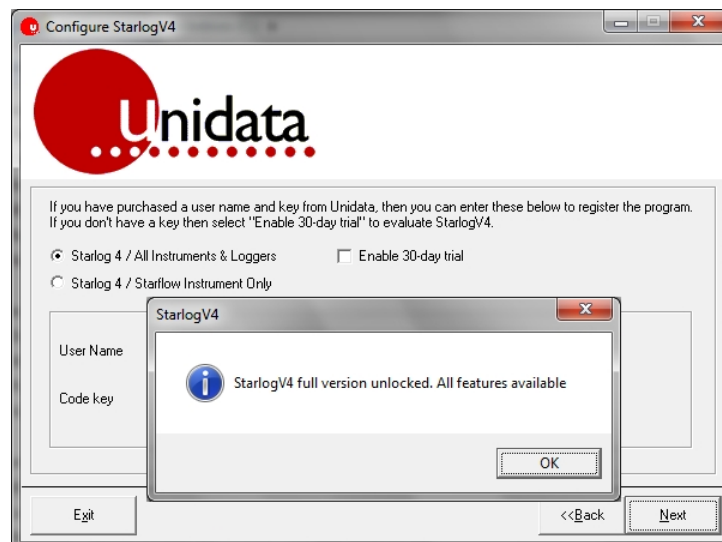
If you instead see the message *Incorrect key* or *invalid user name entered*, click OK then double-check the values you've entered. If you continue to have problems, contact your software vendor.

The next screen confirms your User Name and Code Key. Click Finish to complete the setup and enter the main software screen.

2.4.5 Un-installation

If you decided to uninstall StarlogV4 you can do so via the Windows Uninstall or change program feature.
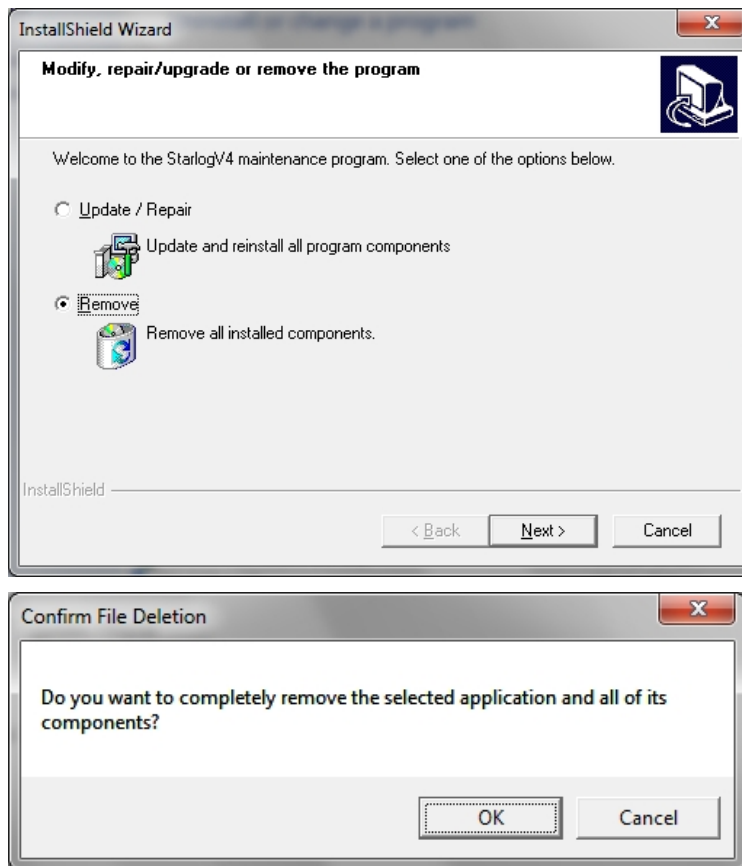
Proceed with the Remove option and you will be asked if prompted with the dialog:
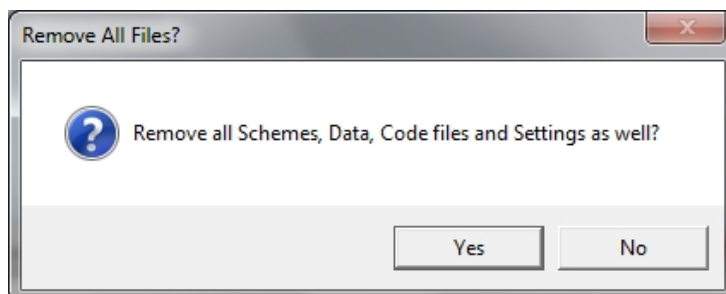
Warning! If you select *Yes* all scheme files will be purged from the system along with the whole StarlogV4 directory and it will not be recoverable. If no is selected these things will be preserved.

3.0 GENERAL INFORMATION

3.1 Starting the Software

To start Starlog V4, you can double-click on the icon on your desktop.

Alternatively, you could select the program from the start menu:
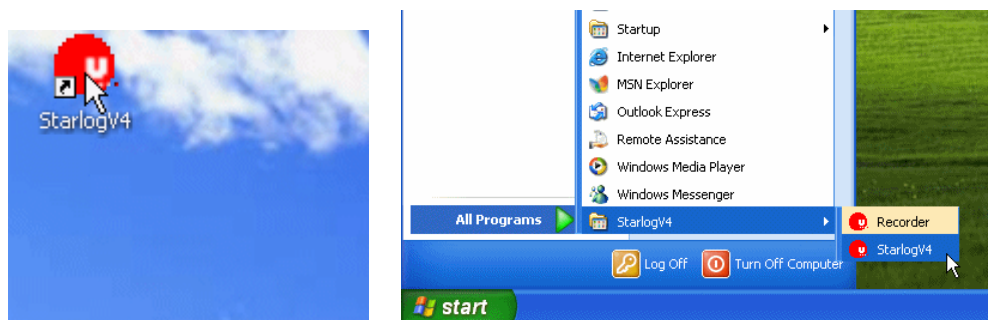
Starlog V4 has the following program structure:
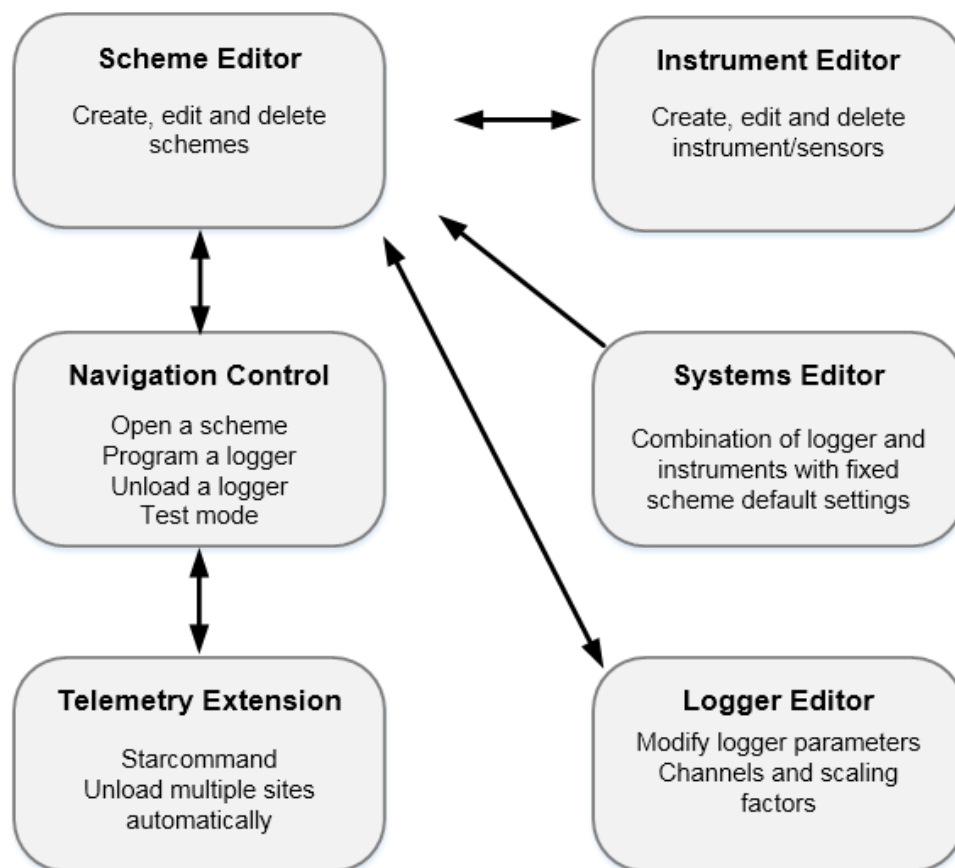
The most common logger operations are simple to start from the main Starlog window. The main Starlog V4 window and major functional areas are shown below:
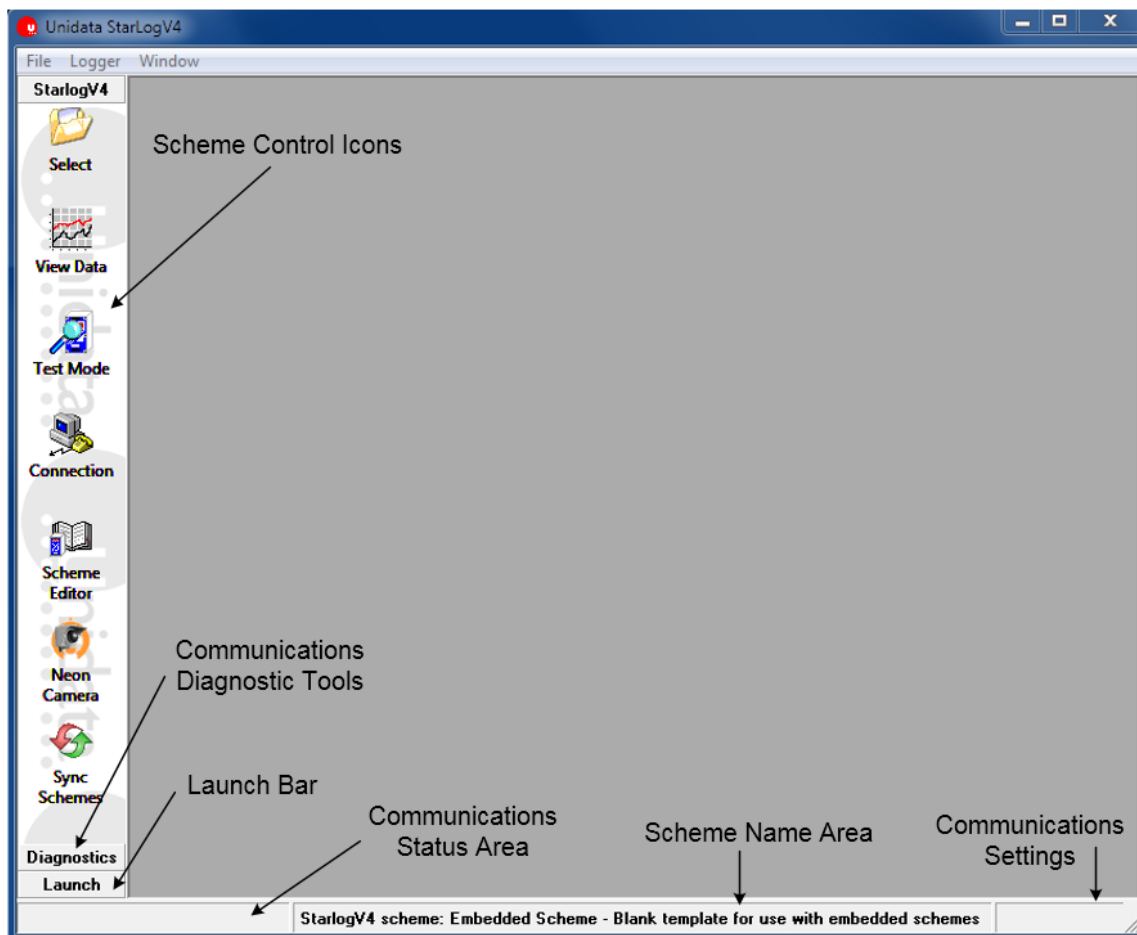
-   **Quickstart Bar**: This is the toolbar of icons down the left side. It can be toggled off/on by selecting *Show Quickstart Bar* from the *Window* menu.
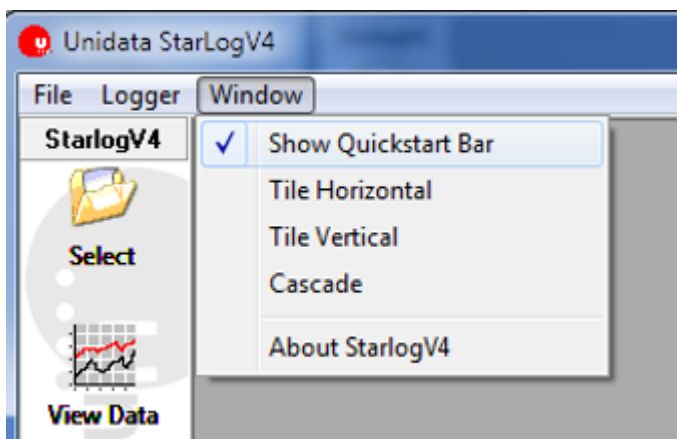
Quickstart bar contains:

1. **Scheme Control Icons**: These provide access to scheme-related functionality, such as selecting a scheme, editing a scheme, and viewing data logged by the scheme.
2. **Communications Diagnostics Tools**: These provide access to tools useful for troubleshooting communications problems. Click on the *Diagnostics* button to show them
3. **Launch Bar**: This is where you can add groups of external applications. Such applications might include custom data analysis tools you may have. When you add your first external application, the "Launch" button will be replaced with a button labelled with the name of your nominated group. As you add applications with different group names, buttons for each group will be added to the bottom of the bar.

- **Communications Status Area**: This will read *Connected* when you are connected to a logger, and Disconnected (or blank) when you are not connected to a logger.

- **Scheme Name Area**: This shows the name of the currently selected scheme.

- **Communications Settings**: When connected to a logger, this shows the used communication settings. For example: COM1:9600,N,8,1, which indicates that COM1 is the port used, the baud rate is 9600, N means no parity, 8 is the number of data bits, and 1 is the number of stop bits.

3.2   Options

Go to the *File menu* and select *Options*, then *Configure StarlogV4*.
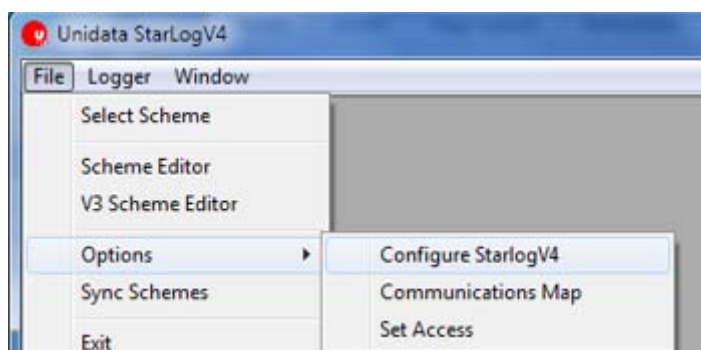
3.2.1   General Options

The *Schemes Path* is where your scheme program files will be saved. These are the scheme program definition files and not your logged data.
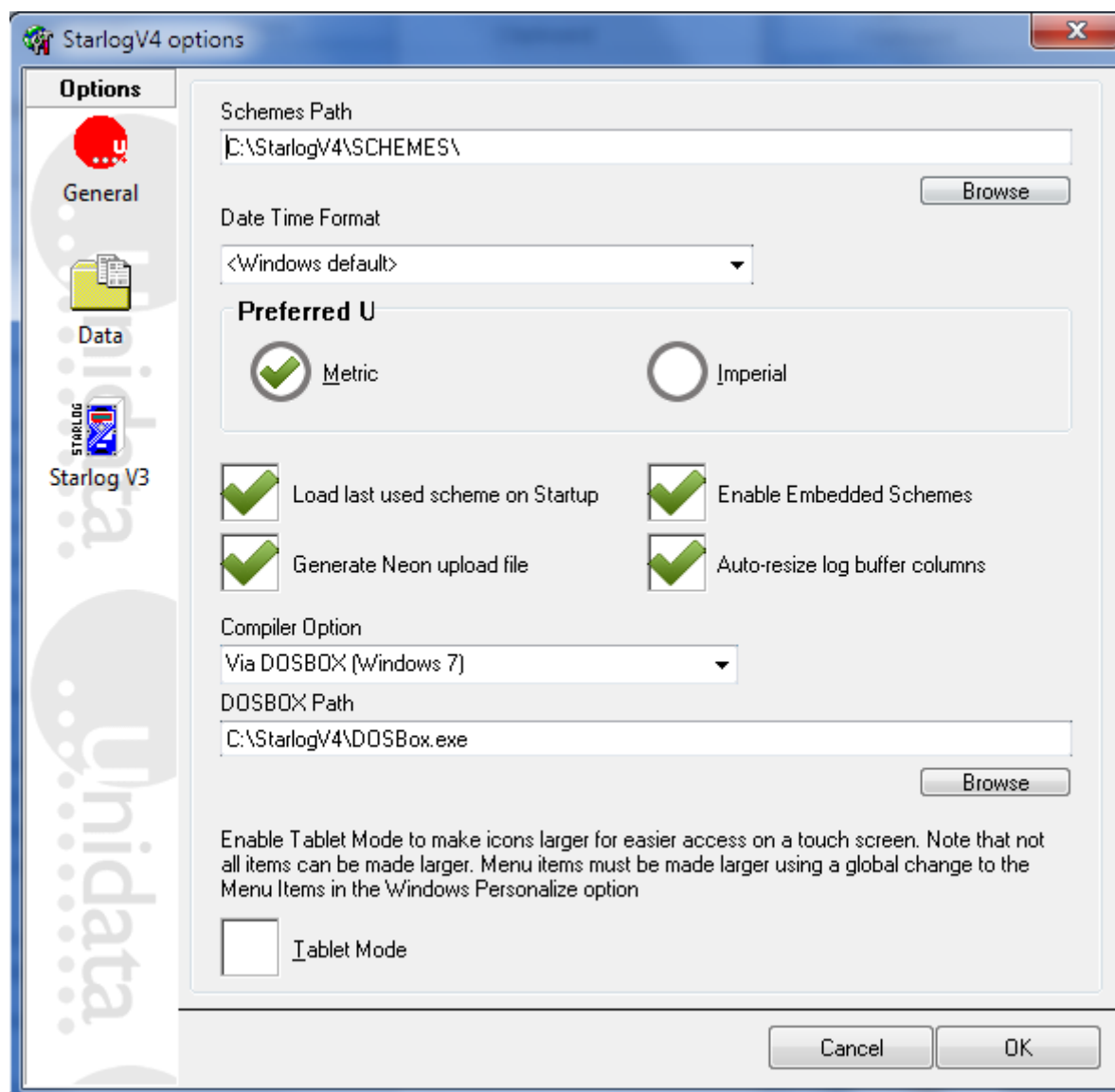
Preferred Units is where you select your preferred general type of engineering units.

Tick *Load last used scheme on Startup* if you want the same scheme you were working with when you last exited Starlog to be automatically loaded when you next run Starlog. If this setting is not ticked and *Enable Embedded Schemes* is, Starlog V4 will attempt to use a scheme that has been embedded within the data logger. If there is no embedded scheme or embedded support has been disabled, Starlog V4 will read the scheme name from the logger and attempt to load the scheme with that name.

The *Enable Embedded Schemes* checkbox controls Starlog attempts to use any embedded scheme data. If support is disabled, Starlog will not even look for embedded data. Any embedded data that may exist will be ignored.

Generate Neon Upload File controls if Starlog will create a *.neon* file ready for uploading to the Neon system. A *.neon* file is actually a Zip archive that contains a selection of scheme files so that they can be uploaded in one action.

The *Auto-resize log buffer columns* checkbox toggles the automatic resizing of the columns of logged data in the test display. Normally, the columns are re-sized every time the display updates (i.e. every scan) which results in considerable flicker. Turning this option off will greatly reduce flicker, but may result in columns sometimes not being wide enough to fit the data which will require manual adjustment. Changes to this option will not affect already opened Test Mode windows; only subsequently opened windows will be affected.

3.2.2   Data Options
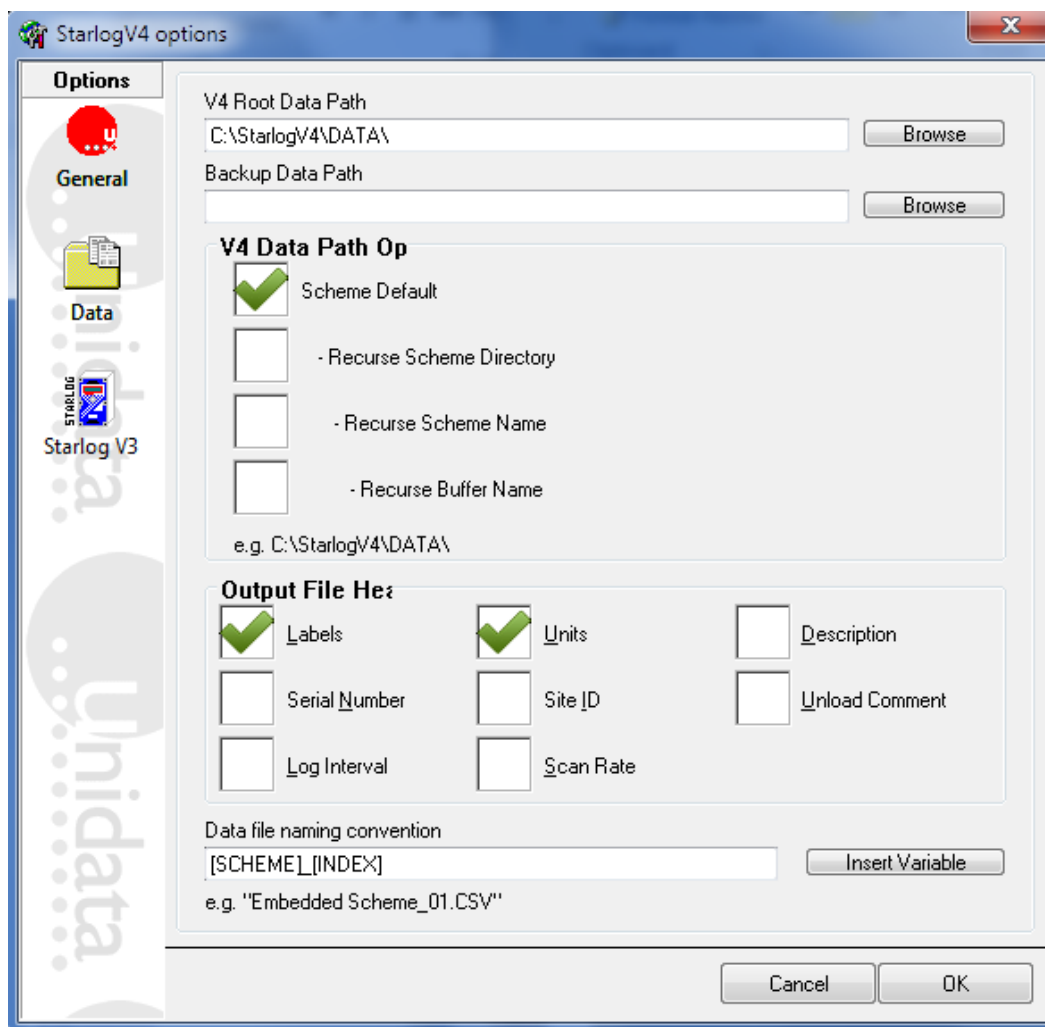
The *V4 Root Data Path* setting is already set to a suitable default and should not be adjusted. However, if you need to save your unloaded scheme data to a different location, you can set that location here. The *V4 Data Path* Options are a set of checkboxes that customise the generated data folder names. Changing them will update the example scheme name so can immediately see what effect each checkbox has.

The *Backup Data Path* is used by the Unloader function to store duplicate copies of any unloaded data.

Output File Headers controls what information is included in the headers for each column of data recorded by your log programs.

If *Unload Comment* is ticked, then each time you unload a logger, you will be asked to enter a comment.

In the following sample file:
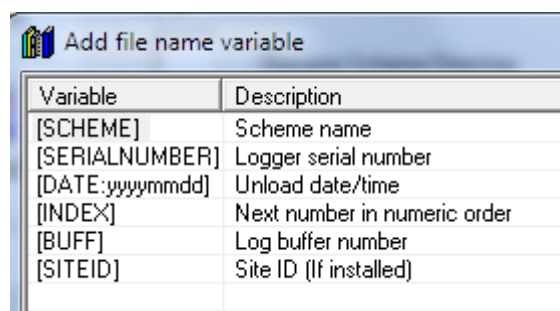
```
test –

S/N: 7434

SITEID:ABC123

COMMENT:Test comment

Time, Voltage(RAW), Voltage(RAW), Temperature(RAW), Humidity(RAW)

, mV, mV, degC, pct

04/10/2006 15:59:50, 1051.0, 896.0, 26.4, 96.1
```

test is the scheme name, *S/N: 7434* is the logger serial number, *SITEID:ABC123* is the site ID, *COMMENT:Test comment* is the comment that was entered at the time the data was unloaded, *Time, Voltage(RAW), Temperature(RAW), and Humidity(RAW)* are the Channel Labels (which also incorporates the type of logging), and *mV, degC, and pct* are the Channel Units.

The remaining lines are the logged data.

The *Data file naming convention* field allows you to control how Starlog V4 names your unload files. Unload file names must always end with a ".CSV" extension, but the entire preceding portion of the filename can be customised.

The default naming convention is "[SCHEME]_[INDEX]", where [SCHEME] and [INDEX] are *variables*. Variables are replaced with their value when the unload file is created. Click on *Insert Variable* to see a list of the available variables:

Variable	Description
[SCHEME]	Scheme name
[SERIALNUMBER]	Logger serial number
[DATE:yyyymmdd]	Unload date/time
[INDEX]	Next number in numeric order
[BUFF]	Log buffer number
[SITEID]	Site ID (If installed)

Variable	Description
[SCHEME]	The name of the scheme
[SERIALNUMBER]	The serial number of the logger
[DATE:*format*]	The date when the unload took place, in the specified format. *yyyy* is replaced with the year (eg 2017), *mm* is replaced with the month (eg 02), and *dd* is replaced with the day of month (eg 01). Inserting the variable [DATE:yyyymmdd] would be replaced with something like 20170201.
[INDEX]	A number one greater than the current largest unload index number
[BUFF]	The number of the buffer being unloaded
[SITEID]	The ID of the site

The date format may be edited after it has been inserted into the naming convention field. Supported data formatting codes include:

Format	Description
c	Combined date and time, separated by a space. The date is formatted as per the Short Date format in the Windows Control Panel Regional Settings. The time is formatted as specified in the Windows Control Panel Regional Settings
d	One to two digit day of month (1-31)
dd	Two digit day of month (01-31)
ddd	Short day of week (Sun, Mon, …, Sat)
dddd	Long day of week (Sunday, Monday, …, Saturday)
ddddd	Date formatted as per the Short Date format in the Windows Control Panel Regional Settings
dddddd	Date formatted as per the Long Date format in the Windows Control Panel Regional Settings
h	One or two digit hour (0-23)
hh	Two digit hour (00-23)
m	One or two digit month (1-12) or minute (0-59). Which value is used is determined by the context of nearby formats
mm	Two digit month (01-12) or minute (00-59). Which value is used is determined by the context of nearby formats
mmm	Short month name (Jan, Feb, …, Dec)
mmmm	Long month name (January, February, …, December)
n	One or two digit minute (0-59)
nn	Two digit minute (00-59)
q	Single digit quarter of the year (Jan-Mar=1, Apr-Jun=2, Jul-Sep=3, Oct-Dec=4)
s	One or two digit second (0-59)
ss	Two digit second (00-59)
w	Single digit day of week (Sunday=1, …, Saturday=7)
ww	Two digit week of year (01-53)
y	Day of the year, one to three digits (1-366)
yy	Two digit year (00-99)
yyyy	Four digit year

3.2.3   Communications Mapping

The Communications Map is where you create and name your required communications interfaces.   For example, you might have one communication interface for when you connect directly via a serial cable to a local data logger, and a second communication interface (possibly on the same physical serial port as your cable) for when you use a modem to connect to a remote data logger.

You will need to ensure your Communications Maps are correctly configured before you attempt to program or unload a data logger.

The Communications Map is accessed from the main Starlog V4 window via the menus *File → Options → Communications Map.*
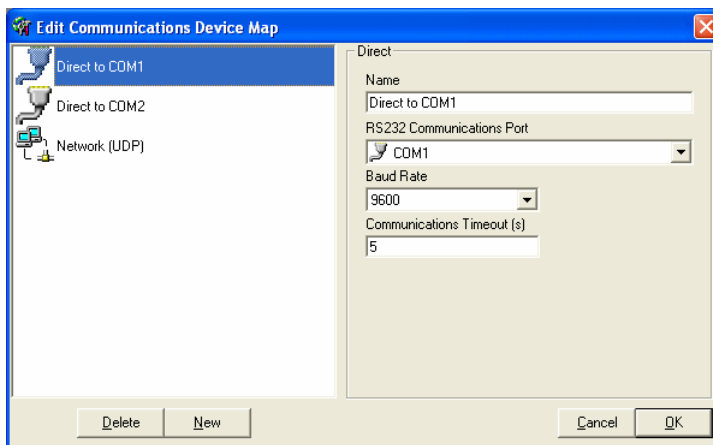
By default all your physical serial ports will be listed, plus a Network port. The default serial ports are all "direct". To support modem communication, click the *New* button and select *Phone modem (RS232)* from the list:

Click *OK*. A new communication map for a modem will be added to your list:
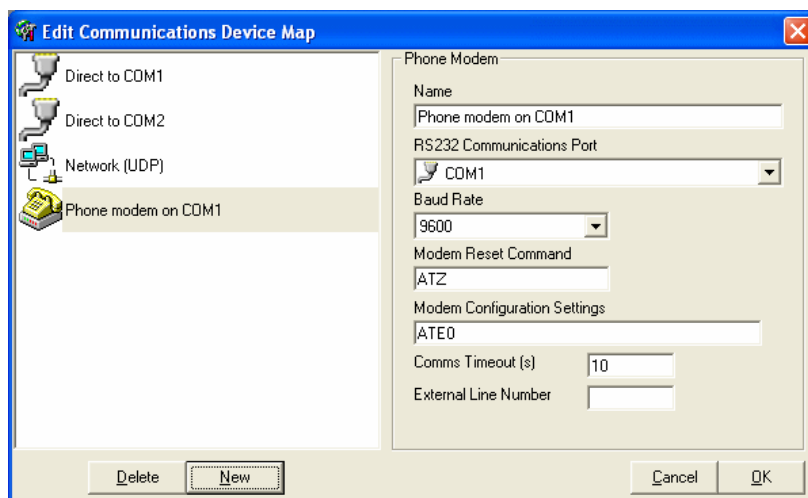
You will now need to configure it to use the correct serial port (RS232 Communications Port), preferred baud rate, and any special dialling prefix numbers to get an outside line if you're on a PABX.

Note that you do not configure any telephone numbers in this dialog. You will select the required Communications Device and set the telephone number when creating/editing a scheme via the Settings dialog in the Scheme Editor.

3.2.4 User Profiles

User profiles are used to simplify the operation of Starlog V4 by limiting the number of visible options. If you are the only person using the software, you may wish to ensure the full functionality of the software is available.

User Profiles can be adjusted from both

- the main Starlog window *File → Options→ Set Access* and
- the Scheme Editor *File → Setup → Set Access*

However you get to it, the following dialog will appear:
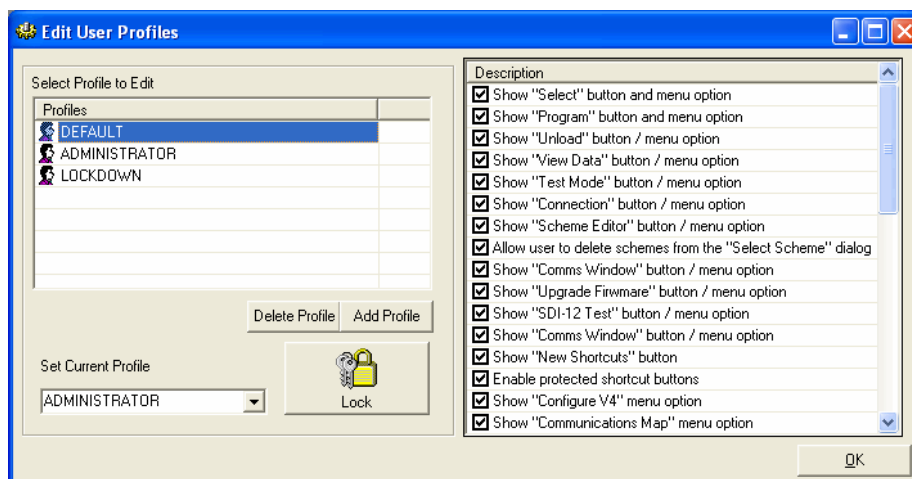
Starlog V4 starts in the *DEFAULT* profile, which only allows access to a subset of Scheme Editor functionality. The *ADMINISTRATOR* profile has complete access to all aspects of the Scheme Editor and the various libraries, including data logger definitions and the raw code generated by the Scheme Editor. The *LOCKDOWN* profile is more restrictive than the DEFAULT profile, allowing only simple scheme changes.

Select which profile to use via the *Set Current Profile* drop-down list box.

If none of the built-in options match your preferences you can create your own named profiles with the exact settings required. Click *Add Profile*, and then enter the name of your new profile. A new default profile will be added to the list. Select it, and then adjust the available features as required.

To remove a profile you don't want, select it, and then click *Delete Profile*.

Once you have made your selection, it is possible to lock the configuration so it cannot be changed. This is useful for when you are setting up a "turnkey" type system where unrestricted use of the Scheme Editor may be inappropriate.

To lock the User Profile, click the *Lock* button.
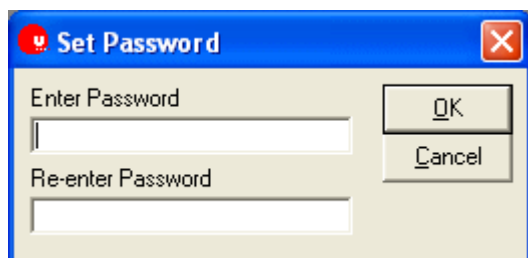
You will need to enter your password twice to make sure you've got it right. The *Lock* button will change to Unlock. If you need to change the User Profile settings in the future, click the *Unlock* button, enter your password, and make your changes.

3.3 Launch Programs Toolbar

The Launch Programs Toolbar allows you to setup icons to run external applications. Icons are put into named groups.

Click on the *Launch* button at the bottom of the main tool bar. If you've added any applications you will see one or more buttons with your nominated group names. Click on one of those instead.

Click on the *New Shortcut* icon. A small window will appear that lists all the applications you have added. It will be empty if you haven't added any.

There are three buttons down the right side of the window. If there are no applications in the list, the bottom two (*Edit Program* and *Delete Program*) will be greyed out.
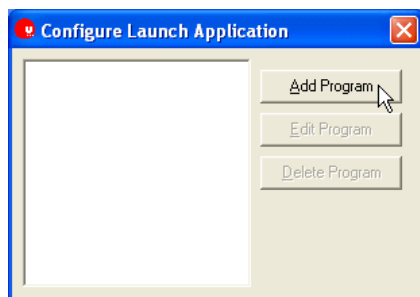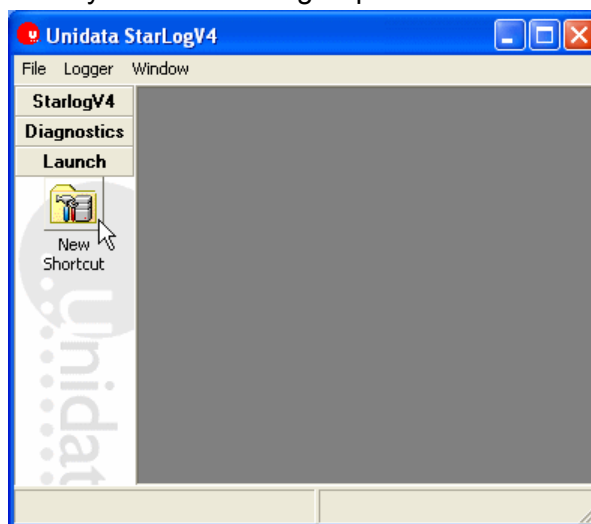
Click on *Add Program*. Fill in the fields as required, and then click *OK*. An example is shown below:
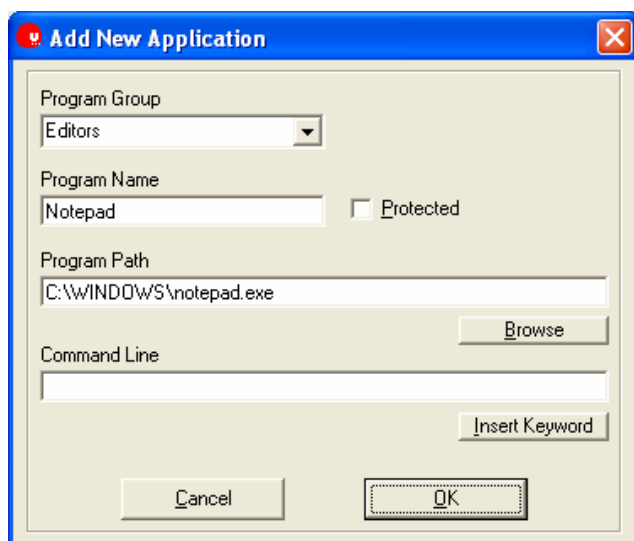
- *Program Group* specifies the toolbar group into which the shortcut will be placed.
- *Program Name* is the title that will appear under the program icon in the toolbar.
- *Protected* checkbox in combination with the User Profile option "Enable protected shortcut buttons" controls whether or not the shortcut will be visible.
- *Program Path* is the full pathname of the application executable file.
- *Command Line* field supports special Keyword/Placeholder variables.

Click Insert Keyword to select the keyword/placeholder you want from a list:
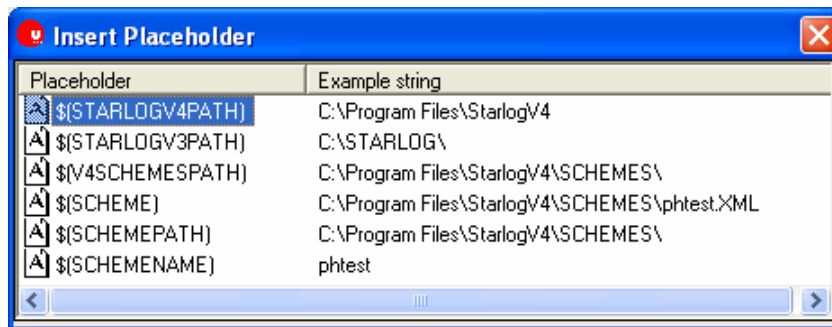
Double-click on the item to insert it into the *Command Line* field.

Once an application has been added, the *Edit Program* and *Delete Program* buttons become active. Clicking *Edit Program* takes you to a dialog the same as for *Add Program*. Clicking *Delete Program* will immediately delete the selected application.
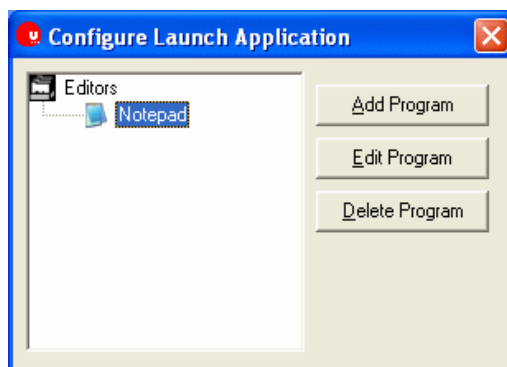
3.4   Arranging Windows

All open windows within the Starlog application may be arranged by selecting the *Tile* or *Cascade* options from the Window menu.

3.5   Finding the Version of the Software

To find out what version of Starlog V4 you have, select *About StarlogV4* from the Window menu. A window similar to the following will appear:
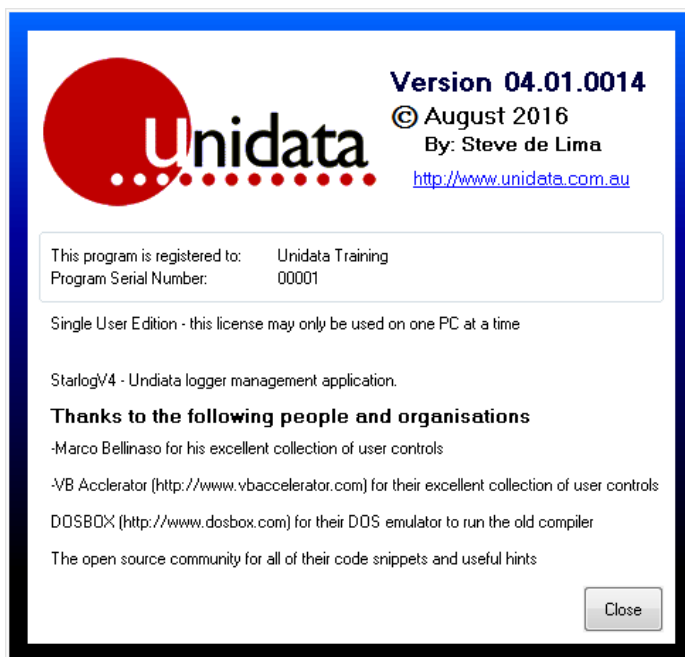
The version number is shown at the top right ("04.01.0014"). When requesting technical support in relation to the software or your schemes, always mention the version of your software.

3.6   Manually Connecting to a Logger

Although you would typically configure the logger communications in the scheme, it is also possible to manually connect to a logger.

On the main StarlogV4 window, click either the *Connection icon* in the StarlogV4 group or select *Connection* from the Logger menu.

The following window will appear:
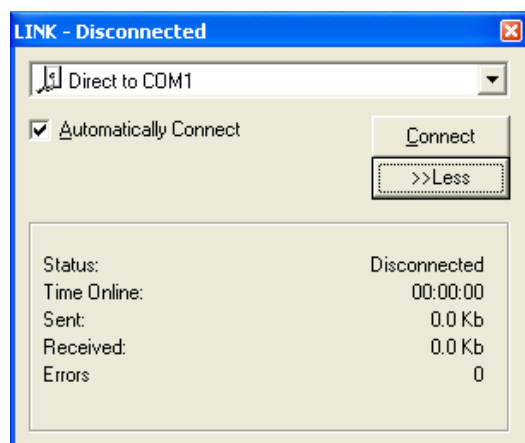
Select the COM port to connect to using the drop-down list. Click *Connect* to connect to that port. You may then process to program, unload, or test the logger.

When connected, the Connect button will change into a Disconnect button. Click that button to disconnect from the logger.

There is also a *More>>* button. Click that to display statistics related to the connection (as shown above). When clicked, it will change into a *>>Less* button. Click that to hide the statistics.

4.0   SCHEME MANAGEMENT

4.1   Selecting a Scheme

To select a scheme, click on *Select Scheme* from the *File* menu, or click the *Select icon* (shown to the right). The following window will appear:
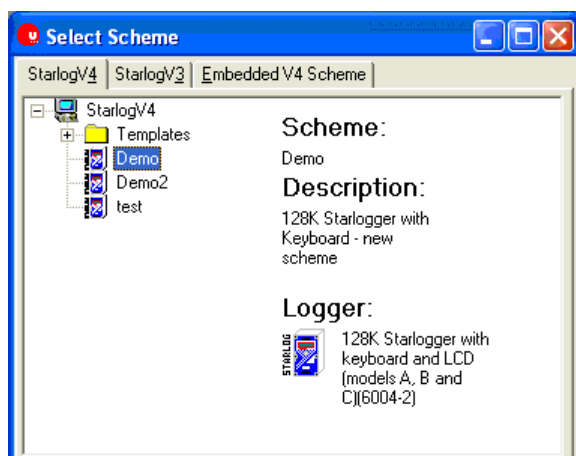
The tabs at the top allow you to view all your V4 schemes, all your V3 schemes (if you have any), or to select the scheme embedded into logger (the logger must have been programmed with the "SCHEME" instrument). Select a scheme by double-clicking its name.

4.2   Creating / Editing a Scheme

The Scheme Editor is used to create, edit and delete schemes.   It can also create templates and data logging systems. The program structure is shown below:
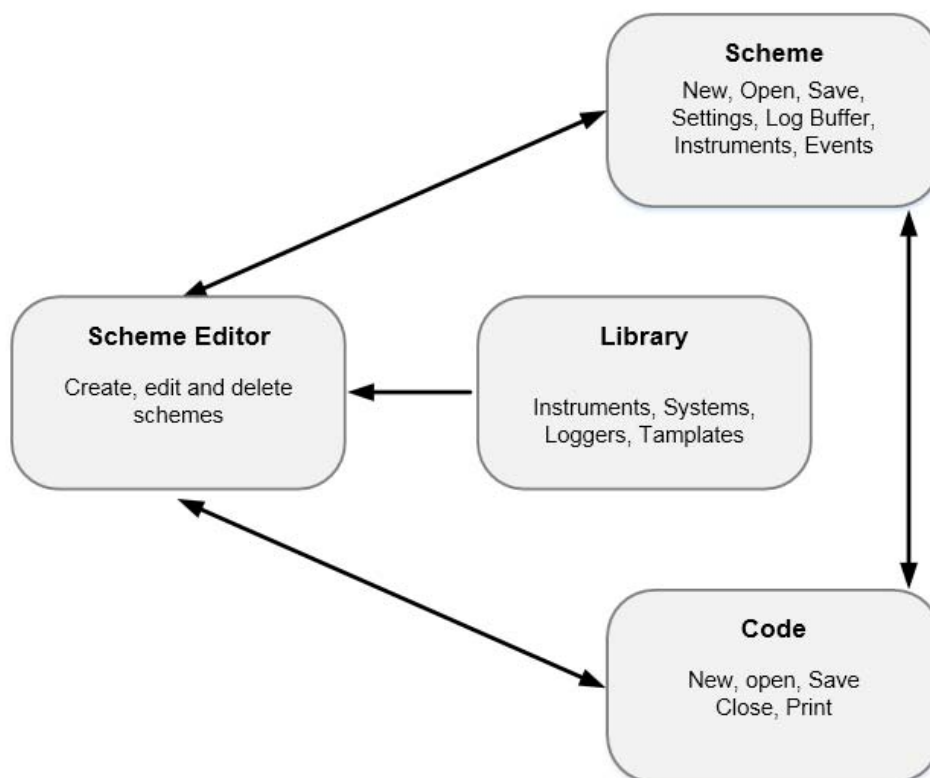
- Scheme section is mainly used for creating and editing schemes with standard functionality.
- Library section is used for modifying the available libraries. Organisations with standard logging systems can create templates to suit those systems. There is essentially no limit to the systems that can be built.
- Code section is for those schemes with extended functionality that require custom code. It contains a Code editor with tools that assist layout and increase readability.

To create a scheme, you need to open the *Scheme Editor*. Click on Scheme Editor from the File menu, or click on the Scheme Editor icon in the main window.

NOTE: V4 software cannot edit V3 schemes.

You must keep a copy of V3 software installed if you want to edit your old schemes. If you select a V3 scheme, Starlog V4 will automatically launch the V3 scheme editor to edit the scheme. You can also manually launch the V3 scheme editor by clicking V3 Scheme Editor from the File menu.

When the Scheme Editor is open, select *New Scheme* from the *File* menu, or click the New icon on either of the toolbars:
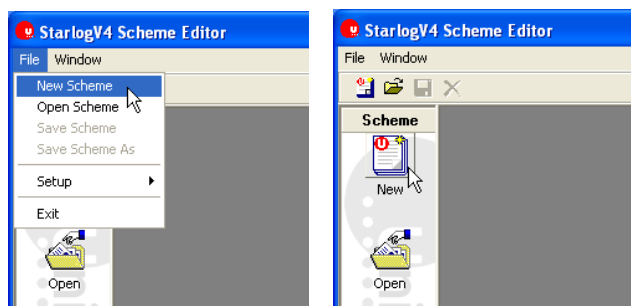
A list of data loggers will appear. Select the data logger you will be using by double-clicking on it. For example, a "6004-2" is selected below:
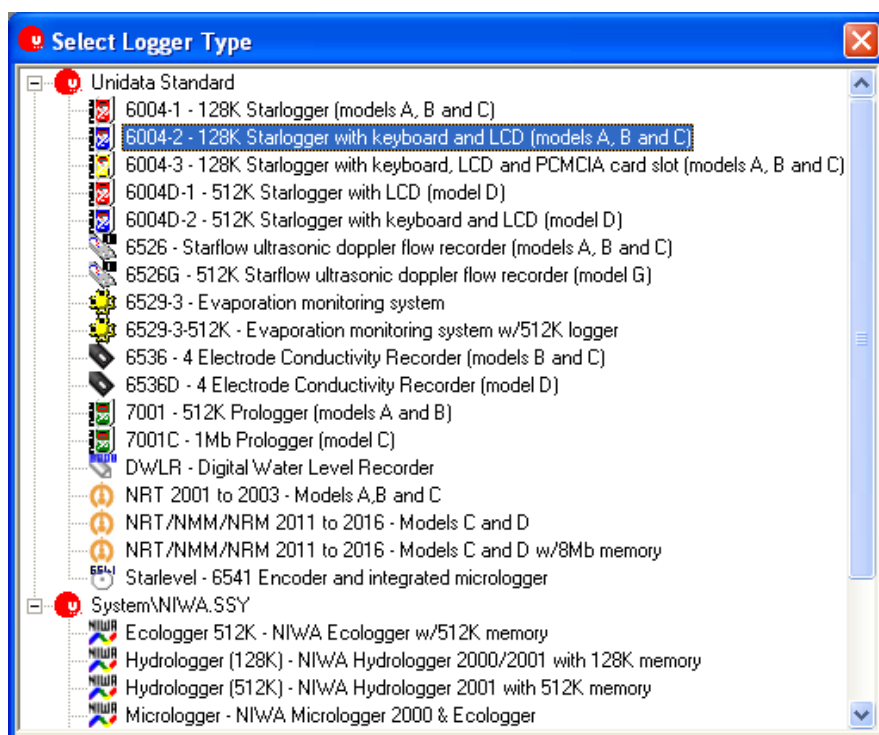
Three new icons will appear inside the left toolbar: Settings, Instruments, and Log Buffer.

4.2.1   Settings

These are settings for controlling basic logger functionality.

Click on the *Settings* icon:
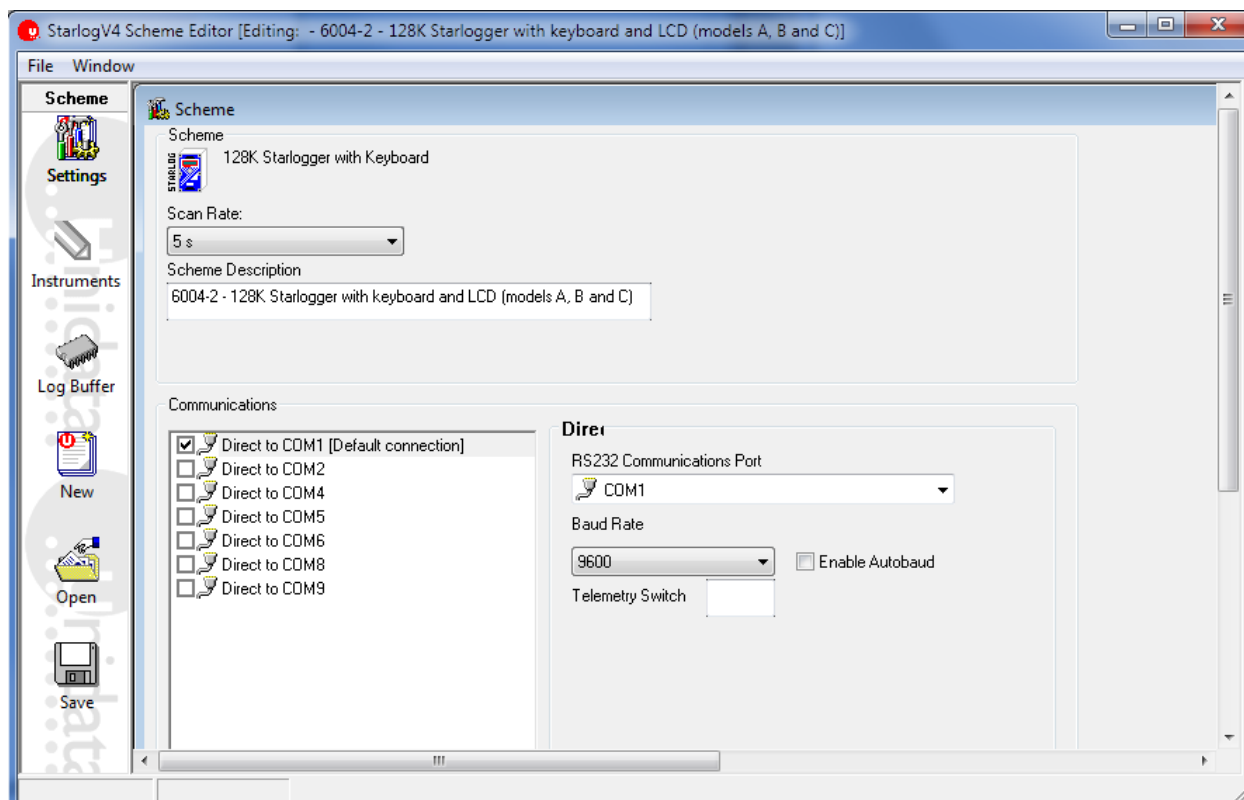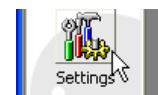
One of the most important settings is the *Scan Rate*. This defines how often the logger scans (samples) its inputs. Faster scan rates make it more likely the data logger will capture accurate minima and maxima, but will shorten the battery life. The scan rate also influences averaging. If you want to log average data every 15 minutes, then a 5 second scan rate implies 15×60÷5=180 samples. If you don't need that many samples, you could increase the scan rate to maximize battery life.

Another limit the scan rate imposes is on the maximum logging interval. The maximum log interval is 65535 times the scan rate. For example, if you set the scan rate to 1 second, the maximum logging interval is 65535 seconds, or 18 hours 12 minutes 15 seconds. If you want a log interval of 1 day, you would need a scan rate of at least 2 seconds.

The *Scheme Description* should be set to something that will assist you in remember what the scheme is for.

Apart from the Scan Rate, the *Communication settings* are the next most critical. If they're wrong, you won't be able to program or unload your logger! You should have configured your communications settings earlier under *Communications Mapping*.

The *Telemetry Switch* field lets you enter the code to select the logger if you have a telemetry switch installed. You must include the "Q" in the field, for example, "Q01".

The *Advanced button* allows you to directly edit various communications settings. Double-click on the Value fields to edit them.
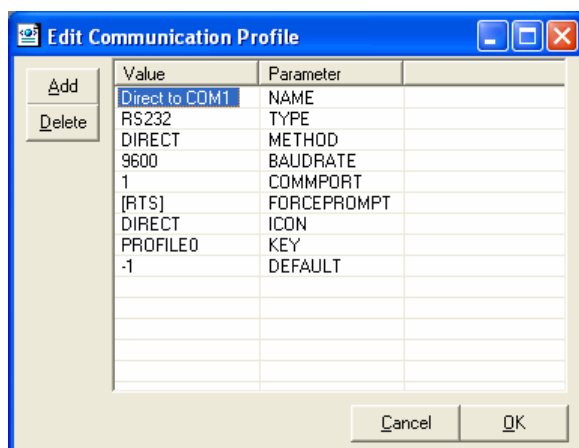
For detailed information on each of the settings, see *Appendix A – Communications Variables on page 83.*

4.2.2   Instruments

The Instruments window lets you define what instruments are connected to the logger. Instruments define the relationship between what the logger measures (voltages, pulses/counts, digital data) and what the instrument measures (temperature, depth, wind speed, etc).

Click on the Instruments icon (shown to the right):
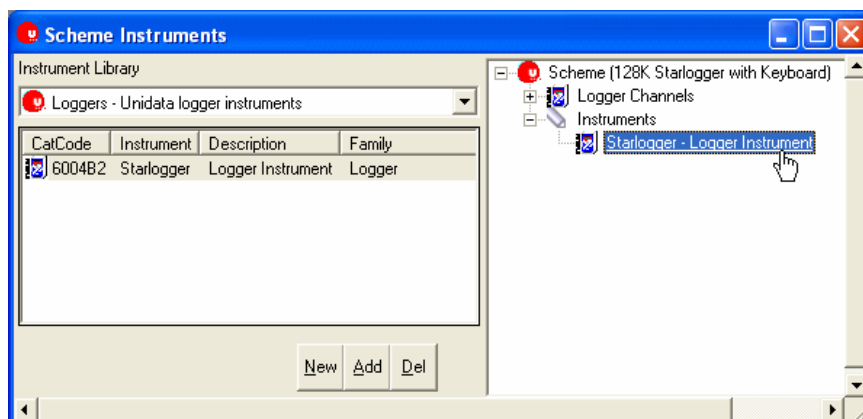
The Instrument Library lets you select from major groups of instruments.

Starlog V4 Software comes with the following predefined groups:

- Loggers – Unidata logger instruments
- PDLTRANS – Unidata Instrument Library
- NIWA – NIWA Instrument Library

It is possible for you to create custom instruments and libraries to keep them in.
When you select an Instrument Library, all the instruments in the library relevant to the selected logger are shown.

The right half of the Instruments window shows the instruments that have been added to your scheme.

4.2.2.1 Adding an Instrument

To add an instrument to your scheme, either double-click on its line in the left half of the window, or select it then click the *Add* button at the bottom of the window. A copy of the instrument will be added to the list in the right half of the window.

For example, to add the SMS instrument to your scheme:

1. Edit the scheme and select the Instruments icon.
2. Select the **PDLTRANS** library.
3. Select the *SMS* instrument in the list.
4. Click the *Add* button to add the instrument to the scheme.
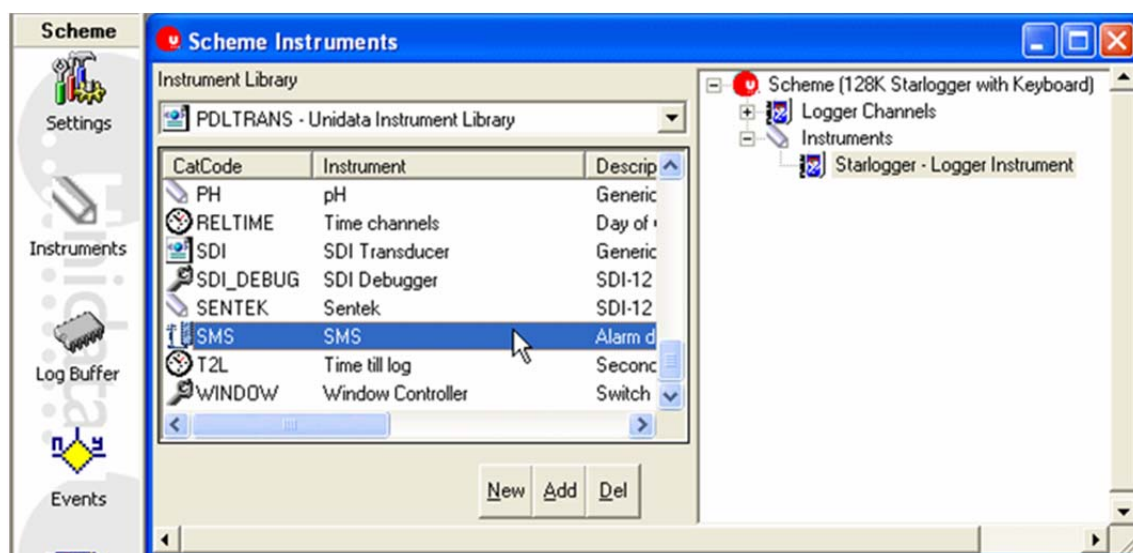
4.2.2.2   Removing an Instrument

To remove an instrument from your scheme, select it from the list in the right half of the instrument window and click the *Del* button at the bottom of the window, or right-click on it and select *Delete* from the menu.

4.2.2.3   Configuring an Instrument

To configure an instrument, double-click on its line in the right half of the window, or right-click on it and select *Edit* from the menu. Different instruments have different configuration windows and options.

4.2.3   Configuring the Logger

Data loggers are configured just as if they were a regular instrument. When you create a scheme, an instrument for the selected logger is always added as the first instrument. Double-click on it. For Starloggers, the following window will appear. Other loggers will be similar:
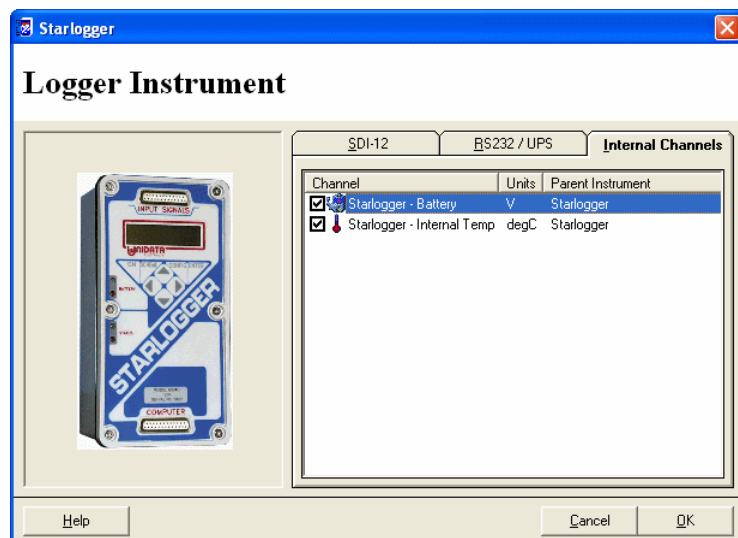
The various tabs show the options available. If you want internal logger channels to be available for logging (e.g. the temperature sensor), you will need to make sure their entries on the *Internal Channels* tab are ticked.

4.2.3.1   Configuring the Logger as an SDI-12 Sensor

When the logger is an SDI-12 sensor, other SDI-12 recorders can access and log data sensed by it. This can be useful if you have something with a limited number of inputs, such as a Starflow, but would prefer to have all data at a site logged by a single logger. You could configure the Starflow as an SDI-12 sensor, and use a Starlogger as an SDI-12

recorder to log the depth/velocity/flow from the Starflow, as well as whatever other instruments you have (eg wind speed/direction, air temperature, rainfall).

To set a logger up as an SDI-12 sensor, first add any required instruments to the logger. Then open the logger instrument and select the SDI-12 tab. Tick *Enable SDI-12 Sensor Mode* to enable the controls. Next, select the SDI-12 Address to assign to the logger. Finally, for each channel you want to make available as an SDI-12 reading, click the *Add* button to add it. The following window will appear allowing you to select from the available channels:
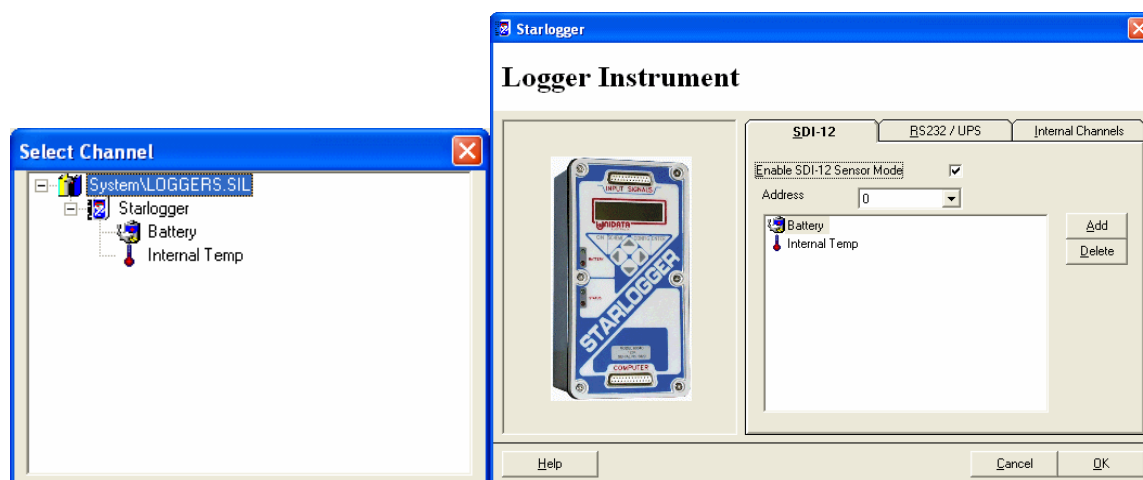
Double-click on a channel to add it to the list. Each added channel becomes an SDI-12 value, numbered from zero starting at the top.
The following shows "Battery" as parameter 0 and "Internal Temp" as parameter 1

4.2.3.2   Configuring the Logger RS232/UPS

Open the logger instrument and select the *RS232/UPS* tab.

The *RS232 Timeout* controls how long the logger will remain powered on and ready to communicate at each scan interval.   The factory default for most loggers is 1 second, which is adequate for direct serial cable connections. However, if communications is to take place via a modem, then this should be extended to 3-5 seconds (or more, as required). Longer timeouts will lead to increased power consumption while the logger is communicating.

The *Scan Synchronous Communications* checkbox fine-tunes when the logger checks for a computer attempting to communicate with it.   When this checkbox is ticked, the logger will wait until the end of a scan before checking to see if there is a computer wanting to communicate with it. When this checkbox is not ticked, the logger does not wait.

After this first check, the logger will only check that the computer is still connected at the end of each scan, regardless of the setting of this checkbox. For quick scan rates, this setting does not do much, however, for slower scan rates, clearing this checkbox (to select asynchronous communication) may improve the logger's responsiveness to communications.

The *Programmable UPS* checkbox controls whether or not the scheme is allowed to program the UPS (User Power Supply). This functionality is currently only available using custom scheme instructions.

The *UPS Prescan (ms)* setting control how long the UPS is switched on before the usual scan processing is started, such the reading of the inputs. Some instruments powered from the UPS may need more time to start than the factory default of 15ms allows. This setting allows the prescan delay to be extended as necessary for those instruments to work correctly.

4.3 Log Buffer

Open the Log Buffer window by clicking on the icon shown to the right:

The Log Buffer window is shown below:
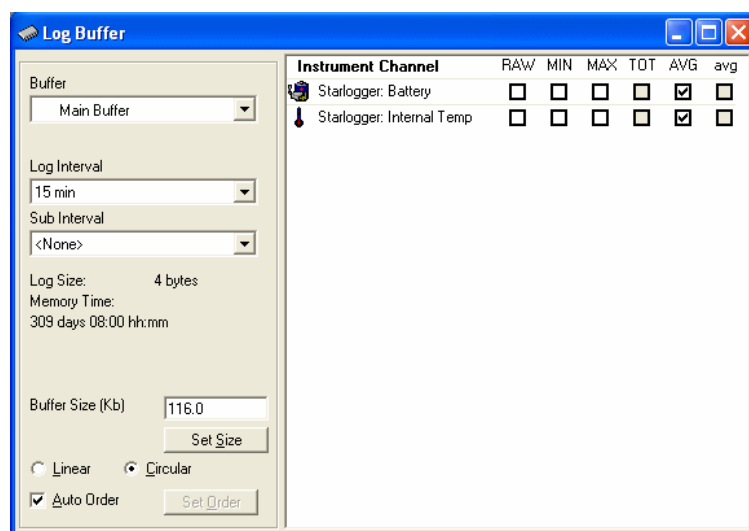
The Log Buffer window is where you set up the logger memory for recording data by selecting what to log and how often to log it.

Data loggers have one Main Buffer and multiple Event Buffers. Event Buffers tend to be small and are used to store data logged on an ad-hoc basis. Whatever memory is not allocated to Event Buffers is allocated to the Main Buffer. Since Event Buffers default to zero bytes, the default Main Buffer size is all the available memory.

4.3.1 Instrument Channels

Each Buffer has its own set of the Instrument Channel checkboxes. You control which of the available channels gets logged into each buffer. The following channel logging options are available; however, some instrument channels may not support all of them (for example, temperature cannot be totalised)

Option	Description
RAW	The instantaneous value of the channel at the time of the log.
MIN	The minimum of the values sampled at each scan over the **log interval**
MAX	The maximum of the values sampled at each scan over the **log interval**
TOT	The total of the values sampled at each scan over the **log interval**
AVG	The average (arithmetic mean) of the values sampled at each scan over the **log interval**
avg	The average (arithmetic mean) of the values sampled at each scan over the **sub interval**

In the example screenshot shown above, both the Battery and Internal Temperature channels are logging the "AVG" (average of the full log interval).

As you tick channels to log, or adjust the Log Interval, the software will automatically update the Memory Time to show you an estimate for how long the memory will last. The estimate does not take into account logging forced by events.

4.3.2 Log Intervals

The *Log Interval* is the time between logs. Only the Main Buffer has a Log Interval setting. Event Buffers do not have a Log Interval because logging into them is always triggered by events.

At each log, all the Instrument Channels ticked will be recorded into the Log Buffer.

In the screenshot above, the average internal Battery and Temperature Channels will be logged every 15 minutes.

The maximum log interval is limited by the scan rate. The maximum log interval is 65535 times the scan rate. For example, if you set the scan rate to 1 second, the maximum logging interval is 65535 seconds, or 18 hours 12 minutes 15 seconds. If you want a log interval of 1 day, you would need a scan rate of at least 2 seconds.
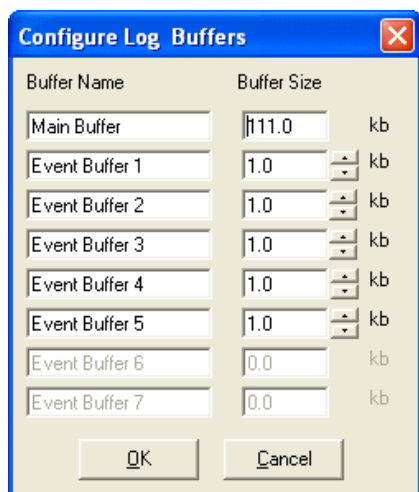
4.3.3 Sub Intervals

The Sub Interval setting only relates to the "avg" column of Instrument Channel checkboxes (not the "AVG" column, or any other column). Rather than take samples at each scan like the "AVG" column, the "avg" column only takes samples during the Sub Interval. The Sub Interval is always the time immediately before a Log. Event Buffers do not support the Log Interval or Sub Interval settings.

For example, if the Log Interval is 60 seconds, and the Sub Interval is 20 seconds, for the first 40 seconds of the 60 second log cycle only the "MIN", "MAX", and "AVG" channels will take samples. For the remaining 20 seconds before the log occurs (the Sub Interval), all channels (including the "avg" channel) will be taking samples.

4.3.4   Buffer Sizes

Event Buffers must have their size manually allocated. The Main Buffer size cannot – it is always allocated whatever memory is left after memory has been allocated to the Event Buffers. Click the *Set Size* button to configure the buffers:
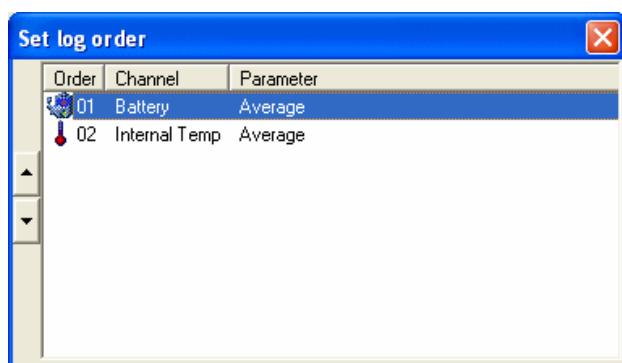
You can adjust the sizes of the Event Buffers in 1KB increments by clicking on the small up/down buttons to the right of the Event Buffer Size field.   Increasing the size of an Event Buffer will decrease the size of the Main Buffer by a corresponding amount, and vice versa.

Note that the total capacity of all the buffers will always be less than the quoted memory capacity of your data logger.   The data logger reserves some memory for the scheme program, working variables, communications buffers and configuration data.

4.3.5   Other Buffer Settings

Settings common to all buffers are:

- **Linear / Circular**: When Linear buffers fill up, they stop accepting new logged data. When Circular buffers full up, they wrap around to the beginning and start overwriting the oldest data.
- **Instrument Channel Ordering:** This defaults to Auto Order, however, you can untick the checkbox and click on the Set Order button to manually set the logging order of the channels:

Click on the channel to select it, and then click on the up/down buttons on the left to nudge it up/down the list.

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4.4 Events

Events allow the logger to act on changes on its inputs. Various actions include triggered logging, SMS alerts and relay control. A maximum of 32 events are supported.

4.4.1 Types of Events

There are many different types of events:

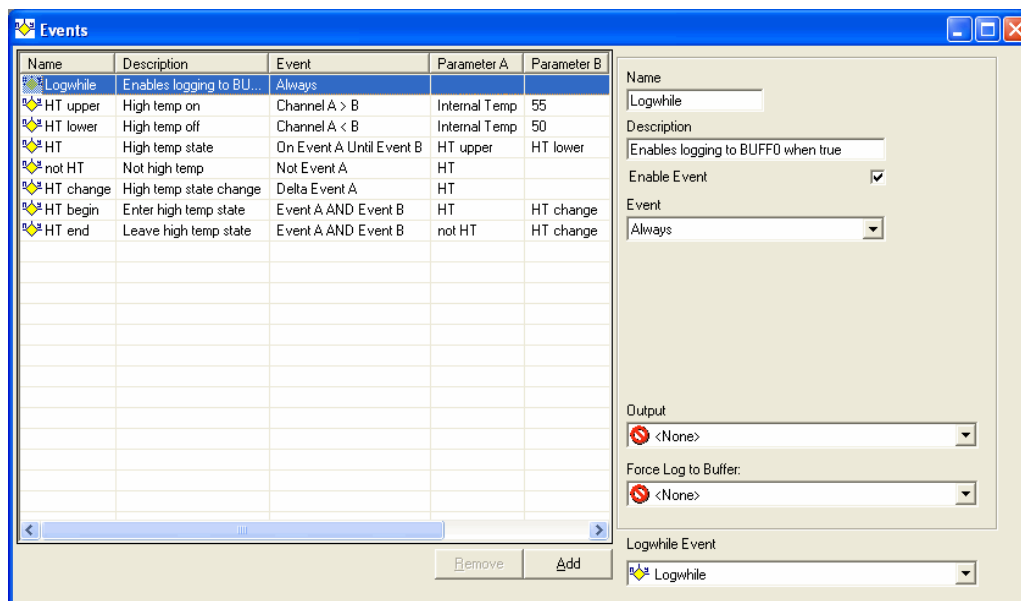| Event Type	Description
None	
Always	An event that is always TRUE.
Channel A > B	
Channel A >= B	
Channel A < B	Compares channel A with a fixed value B
Channel A <= B	
Channel A = B	NOTE: "<>" is "not equal" (≠).
Channel A <> B	
Channel A > Channel B	
Channel A >= Channel B	Compares a channel A with a second channel B.
Channel A = Channel B	NOTE: There are no "less than" comparisons as "Channel B < Channel A"
Channel A <> Channel B	is the same as "Channel A > Channel B".
Delta Channel A > B	Monitors channel A and becomes TRUE for one scan when that channel has changed by more than B since the last time the event was triggered. If channel A has changed by more than B since the event was last true, the extra difference is forgotten for determining when the event will next be true. If the remainder is important, use the "Every B on Channel A" event.
Event A AND Event B	Becomes TRUE when both event A and event B are TRUE
Event A OR Event B	Becomes TRUE when either or both of event A or event B are TRUE
Delta Event A	Becomes TRUE for one scan when event A changes state (from FALSE to TRUE, or from TRUE to FALSE)
Every B on Channel A	Every scan the absolute difference between the current channel A reading and that of the previous scan is added to an accumulator. When that accumulator exceeds B, the event is true for that scan and B is subtracted from the accumulator. Both rises and falls add to the accumulator, so that a rise of 3 units and a fall of 2 would result in an accumulation of 5 units.
NOT Event A	Evaluates to the opposite of event A. If event A is TRUE, this event is FALSE, and vice versa.
On Event A for B Scans	This event becomes TRUE when event A becomes TRUE, and is held TRUE for B scans.
On Event A Until Event B	This event becomes TRUE when event A becomes TRUE, and stays TRUE until event B becomes TRUE.
Event A TRUE for B Scans	This event becomes TRUE for one scan whenever event A has been TRUE for B consecutive scans.
Channel A between B and C	This event is TRUE whenever channel A is between the values B and C inclusive.
Channel A bit B set	This event is TRUE when bit B of channel A is set.
Channel A bit B not set	This event is TRUE when bit B of channel A is not set.
Channel A High (A > B, Reset A < C)	This is a channel A high event with hysteresis. When Channel A rises above the value B, the event becomes true. It will then not become false until channel A falls below value C. C must be less than B.
Channel A Low (A < B, Reset A > C)	This is a channel A low event with hysteresis. When Channel A falls below the value B, the event becomes true. It will then not become false until channel A rises above value C. C must be greater than B.

4.4.2   Event Settings

To edit events, click on the *Events* icon. The default Basic **User Profile** is configured to hide the *Events* icon. You will need to enable it by following the instructions under *User Profiles*. Make sure the *Scheme → Events* option is ticked. The following window will appear:

Each event has a name, a description, a type, between zero and three parameters, an output action, and a force log action:

-   **Name**: While there is no particular length limit, this should be a short mnemonic of the event. It is what is shown when another event refers to the event, and in the parameter list boxes for those events that take other events as parameters. You don't see the description in those list boxes, so make sure the name will be enough to remember the purpose of each event.
-   **Description**: This can be a longer description of the event.
-   **Event**: This specifies the type of the event.   See the table under *Types of Events* above
-   **Parameter A**: Depending on the type of event this may be a channel or another event.
-   **Parameter B**: Depending on the type of event this may be a channel, another event, or a constant value.
-   **Parameter C**: So far, only the "Channel A between B and C" uses this parameter (as a constant value).
-   **Output**: This is a list of the possible actions the logger can perform for every scan that the event is true.
-   **Force Log to Buffer**: For every scan the event is true, this will force the selected log buffer to log the channels as configured in the Log Buffer window.
-   **Logwhile Event:** selects which event is used by the scheme to control when data sampling and logging is allowed to occur. When the *Logwhile* event is true, the logger will take instrument samples, eg for averaging, and will log data as programmed. When the *Logwhile* event is false, the logger will still read its inputs, but they will not count towards averages, nor will any data be logged.

4.4.3   Using Events

Using events can become complicated because while each event by itself is very simple, to get even moderately complex behaviour several events may need to be combined to obtain the required functionality. To demonstrate this, the following example describes how to implement hysteresis:

Imagine a logger monitoring temperature and being able to control a cooling system. When the temperature exceeds some threshold, the logger should turn the cooling system on until the temperature is lowered to some other threshold whereupon it will turn the cooling system off. The two thresholds provide the hysteresis to prevent the fan from being rapidly turned on and off.   For this example the upper threshold is 55°C and the lower threshold 50°C.

Start by defining the threshold events:

Name	Description	Event	A	B
HT upper	High temp on	Channel A > B	Internal Temp	55
HT lower	High temp off	Channel A < B	Internal Temp	50

Next are the two events that reflect whether or not the logger is in the high temperature state:

Name	Description	Event	A	B
HT	High temp state	On Event A Until Event B	HT upper	HT lower
not HT	Not high temp	Not Event A	HT	

The "HT" event is true from the time the logger exceeds the "HT upper" threshold (55°C) until the time it falls below the "HT lower" threshold (50°C). In other words, it's the "temperature is too hot and needs cooling" state. The "not HT" event is true whenever the "HT" is not true, i.e. when the system is not "too hot".

If all you wanted to do was control a cooling system via relays, the above events are all you need.   You would attach a latching relay to the logger (such as the 6525 relay control module), then add a "switch relay on" output to the "HT" event and a "switch relay off" output to the "not HT" event.   There's no harm in the logger continuously sending "relay on/off" commands every scan those events are true.

What if you wanted to send an SMS alarm when the system got too hot?   In that case sending multiple messages while the system stayed hot wouldn't be a good idea.   To only send a message when the system flips from "temperature OK" to "too hot" requires a few more events:

Name	Description	Event	A	B
HT change	High temp state change	Delta Event A	HT	
HT begin	Enter high temp state	Event A AND Event B	HT	HT change
HT end	Leave high temp state	Event A AND Event B	not HT	HT change

The "HT change" event detects when the system is flipping between "temperature OK" and "too hot". It detects a change in either direction, but cannot by itself tell which direction the system is changing. To determine the direction a second event is needed.

The "HT begin" event detects when the system is going from "temperature OK" to "too hot". If the high temperature state has changed (the "HT change" event) AND the system is in the high temperature state (the "HT" event) then the system has just changed from "temperature OK" to "too hot".

The "HT end" event is similar to the "HT begin" event, except it detects the change from "too hot" to "temperature OK". It isn't needed if all you want to do is perform an action on the switch from "temperature OK" to "too hot".

To send an SMS when the system becomes hot, add the "SMS" instrument to the scheme, configure the message, then add the corresponding dialout group as the Output for the "HT begin" event.

Note that if all you wanted to do was send the message when the system became too hot, and didn't need to worry about when it cooled down, you'd be able to discard the "not HT" event, leaving the following five events: "HT upper", "HT lower", "HT", "HT change" and "HT begin". If you DID want to send a "cooled down" message, then you'd leave in the "not HT" and "HT end" events, create a second message on the SMS instrument, then set the "HT end" output to activate that second dialout group.

To summarize:

Name	Description	Event	A	B	Output
HT upper	High temp on	Channel A > B	Internal Temp	55	
HT lower	High temp off	Channel A < B	Internal Temp	50	
HT	High temp state	On Event A Until Event B	HT upper	HT lower	Cooling on
not HT	Not high temp	Not Event A	HT		Cooling off
HT change	High temp state change	Delta Event A	HT		
HT begin	Enter high temp state	Event A AND Event B	HT	HT change	High temp SMS
HT end	Leave high temp state	Event A AND Event B	not HT	HT change	OK temp SMS

4.5   Saving the Scheme

Save your scheme by clicking on the Save icon (shown to the right).

If you've saved your scheme before it will immediately save. If you've never saved the scheme before, the dialog shown below will appear. You can get the same dialog at any time by selecting *Save Scheme As* from the *File* menu.
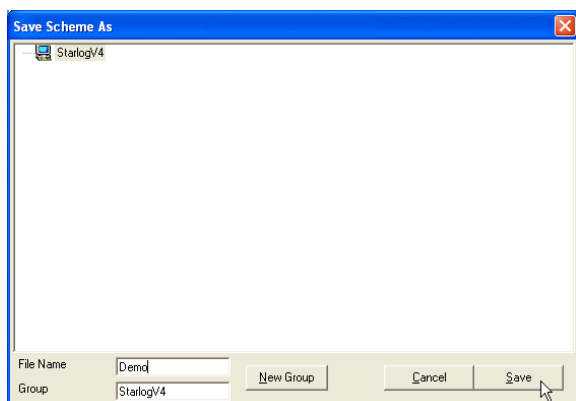
Enter the scheme name in the *File Name* field. There is a maximum length of eight characters.

The *New Group* button allows you to create sub-folders of schemes.

Groups may be created inside groups, too.
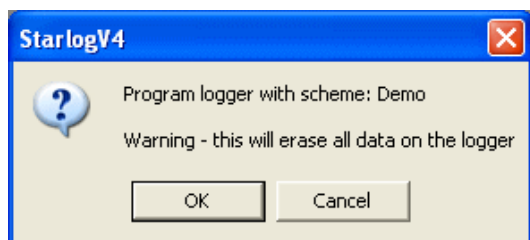
5.0 PROGRAMMING LOGGERS

Loggers can be divided into two types: Standard Loggers and Neon Loggers.

Standard loggers are programmed directly with Starlog V4 via a serial cable, while Neon loggers are programmed through the Neon web interface.
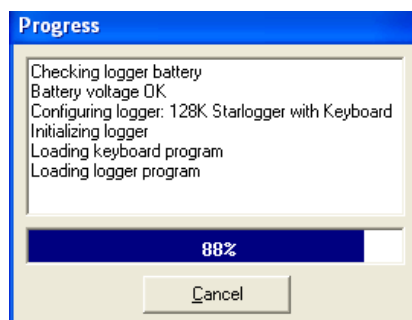
5.1 Standard Loggers

Standard loggers are programmed from the main screen, by clicking on *Program* under the Logger menu, or by clicking on the *Program icon*, shown to the right. You will be asked to confirm before the programming will proceed:

Clicking *OK* will open a new window that shows the progress of the programming:

If all goes well, a *Logger successfully re-programmed* message will appear (with Disconnected as the final message). Click *OK* to close the progress window.

5.2 Neon Loggers

Neon loggers are programmed through the Neon web interface. These include Neon Remote Terminals (NRTs), Neon Metering Modules (NMMs) and Neon Remote Loggers (NRLs). Starlog V4 must be configured to generate Neon files. See *General Options* on page 15. The "Generate Neon upload file" option must be ticked.

In the Neon web interface, select the Loggers tab of your node, then under the Internal Logger tab, select the generated ".neon" file for your scheme. Click the "Upload" button to send it to Neon. The screenshot below highlights the important controls:
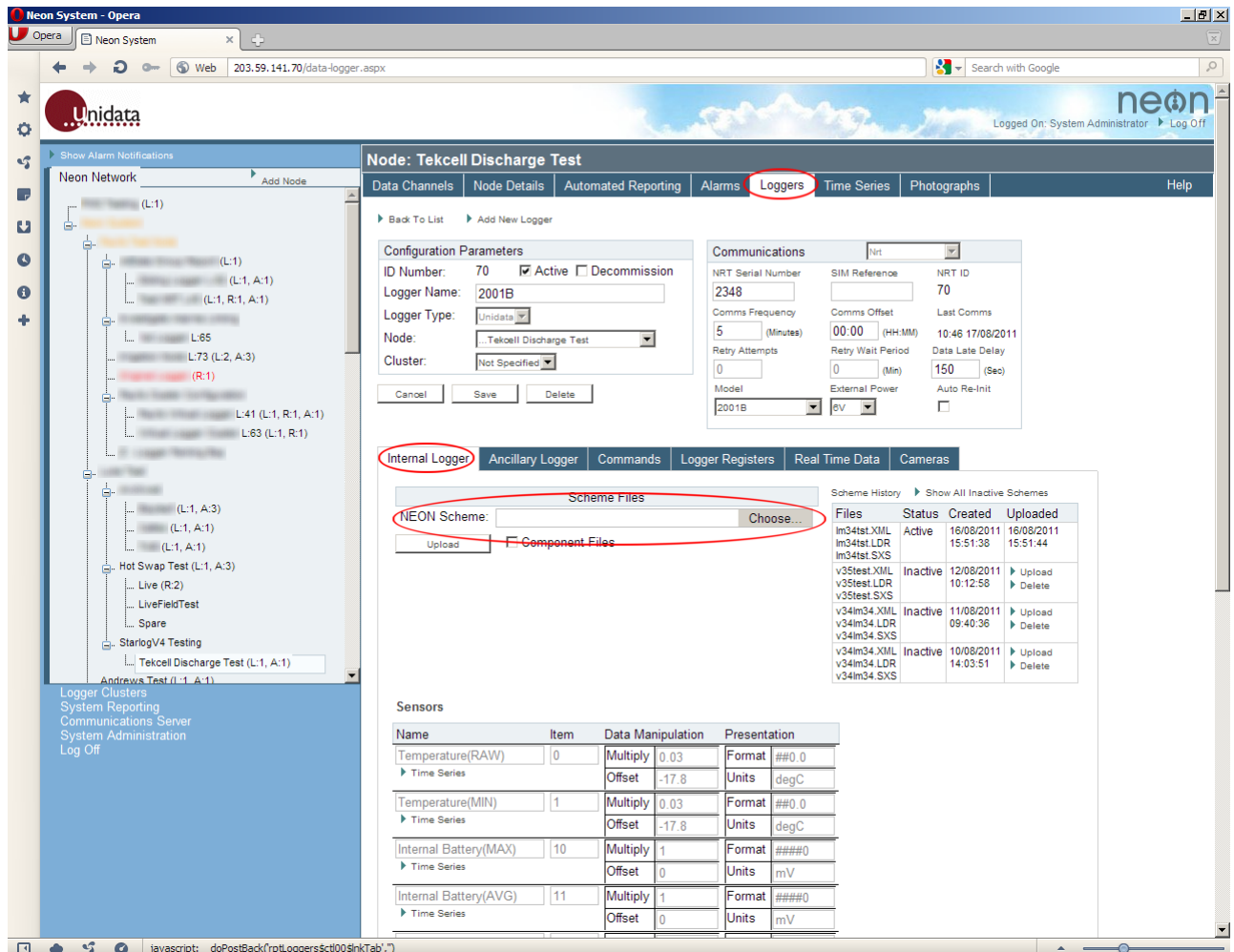
To force the scheme to be loaded immediately by the logger, the Starlog Configure/Initialise tool should be used. See the icon to the right.
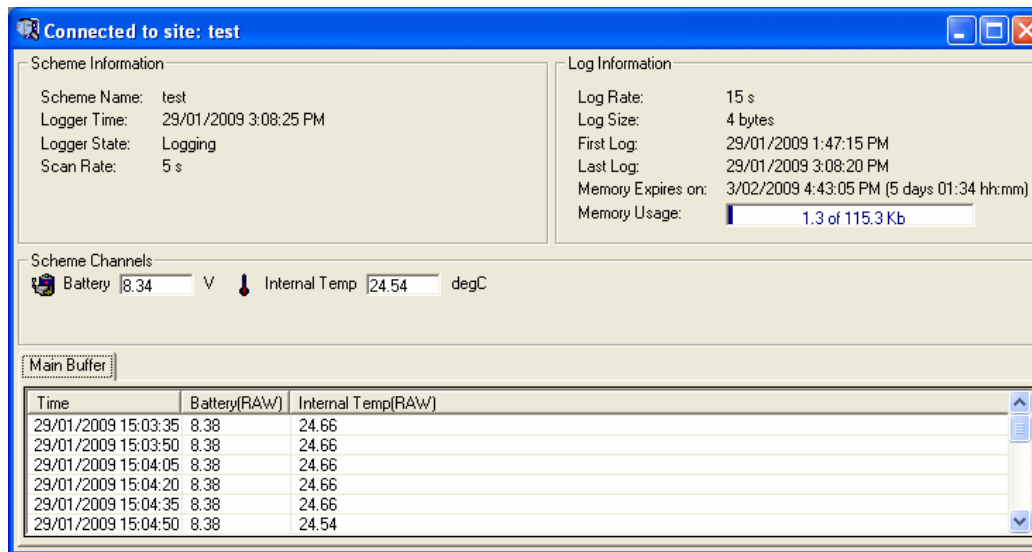
Connect the Neon logger to the computer using a serial cable. Click the *Retrieve NRT Settings* button to get the current settings, and then click the "Initialise" button to have the logger to synchronise with the Neon server and start using the scheme loaded above.
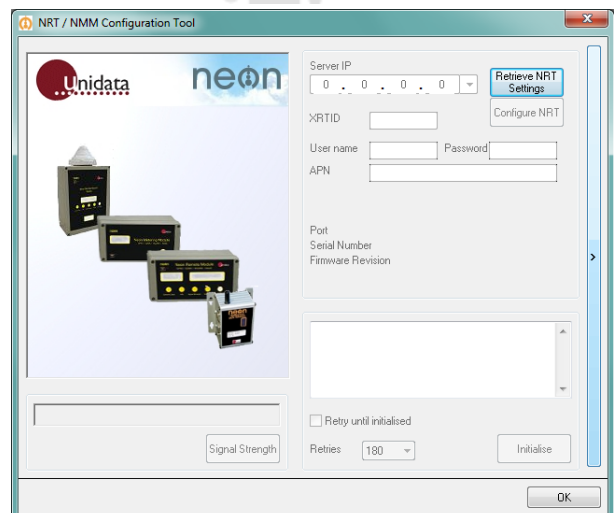
6.0   TEST MODE

Test Mode is used to check the status of the logger, and to monitor its logging progress.

To enter Test Mode, click on *Test Mode* under the *Logger menu*, or click on its icon. A window similar to the following will appear:

The *Scheme Name* shows the name of the scheme that has been programmed into the logger. If the scheme in the logger isn't the same as the currently selected scheme, the following message will be displayed:
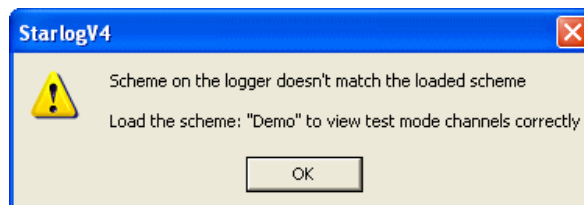
You should select the named scheme (in this case "Demo") and load its Test Display.
The entire display may be zoomed by pressing the + (plus) or = (equals) keys.
To un-zoom the display, press the – (minus) key.
This is also accessible from the *Text Size* menu item of the *Test Mode* menu.

The Test Mode window is divided into four sections:

1.   Scheme Information
2.   Log Information
3.   Scheme Channels
4.   Log Buffers

Each of these items is explained in detail below.

6.1 Scheme Information

The Scheme Information section has the
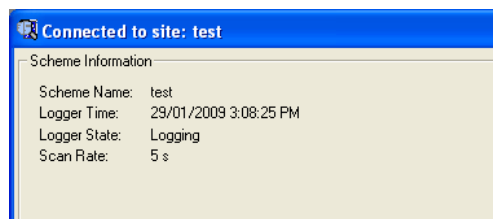following items:

- **Scheme Name**: The name of the scheme programmed into the logger.
- **Logger Time**: The date/time of the logger.
- **Logger State**: One of *Primed, Logging, or Stopped*:
    - *Primed*: The logger hasn't yet started logging. Loggers with no built-in instruments (excluding internal battery and temperature sensors) will not start logging until three scans have passed since a plug was connected to their "Input Signals" connector.
    - *Logging*: The logging is sampling and recording data.
    - *Stopped*: The logger is not recording. This may be because the inputs have been unplugged, or the logger Main Buffer has filled (only applicable to Linear types).
- **Scan Rate**: The time between consecutive samples of the inputs.

6.2 Log Information

The Log Information section has the following
items:
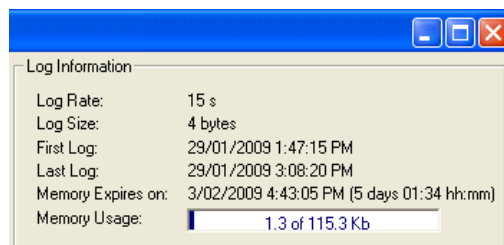
- **Log Rate**: This is the time between consecutive logs.
- **Log Size**: This is the size of each log entry in the Main Buffer in bytes.
- **First Log**: This is the date/time when the first log was recorded.
- **Last Log**: This is the date/time when the most recent log was recorded.
- **Memory Expires on**: This is the estimated date/time when the Main Buffer will fill up and either stops logging (Linear) or starts overwriting the oldest data (Circular).
  How long it will take to reach that date/time is shown in brackets.
- **Memory Usage**: This shows how much of the loggers buffers are currently being used.

6.3 Scheme Channels
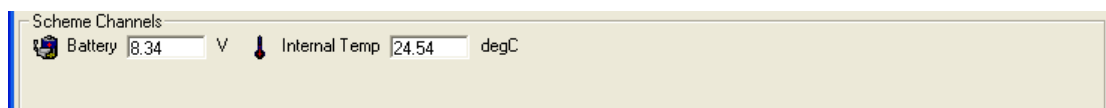
The Scheme Channels display the current readings of the instruments connected to the logger. Double-click on the display field to set the corresponding value on the logger.

The available channels may be changed via the *Edit Channels* item of the *Test Mode* menu. Selecting that item will open the following window:
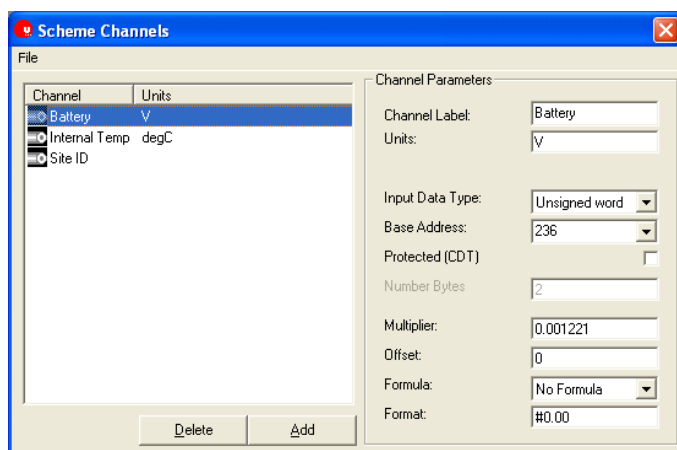
Channels defined in the scheme cannot be edited or deleted, but you are able to define your own channels.
Click the *Add* button to create new channels.
Clicking the *Delete* button will delete the selected custom channel.

The channel parameters are:

- **Channel Label**: The label of the channel. It is shown in front of the value field.
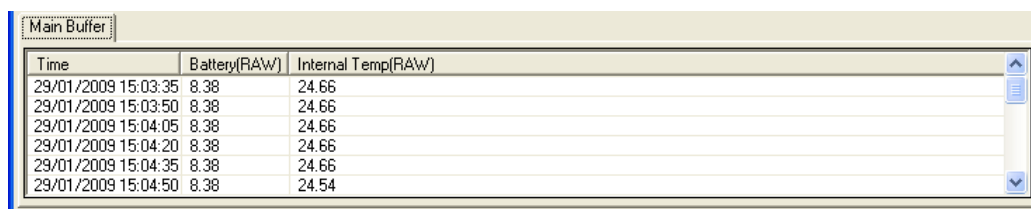- **Units**: The display units of the channel. It is shown after the value field.
- **Input Data Type**: Specifies how the channel data is stored in the logger. One of:
    - *Unsigned Byte*: One byte. Has the range 0…255
    - *Signed Byte*: One byte. Has the range -128…127
    - *Unsigned Word*: Two bytes. Has the range 0…65,535
    - *Signed Word*: Two bytes. Has the range -32,768…32,767
    - *Unsigned Long*: Four bytes. Has the range 0…4,294,967,295
    - *Signed Long*: Four bytes. Has the range -2,147,483,648…2,147,483,647
    - *String*: Variable number of bytes. The end of the string is marked with a zero byte.
    - *Floating point*: Single precision floating point. Four bytes.
      Has the range $\pm 3.4 \times 10^{-38} \ldots \pm 3.4 \times 10^{38}$ and 7-digit precision.
      Note that Unidata data loggers cannot process floating point data – it cannot be totalised or averaged. It is currently supported only for reading SDI-12 sensors.
- **Base Address**:
- **Protected(CDT)**: Indicates that this channel is reading protected logger memory, typically a configuration setting.
- **Number Bytes**: The number of bytes required to store the channel value.
  This field is only editable for string Input Data Types; it otherwise corresponds to the selected Input Data Type.
- **Multiplier**: The amount to multiply the logged data before displaying. The Multiplier is applied before the Offset. The multiplier is independent of any logger bit scaling for analogue channels the multiplier is applied to the mV reading of the channel.
- **Offset**: The amount to add to the logged data before displaying.
  The Offset is applied after the Multiplier.
- **Formula**: Some applications require a formula to transform logged data into a viewable form.
- **Format**: The display format of data associated with this channel.
  Allowed characters are: "#" (hash), "0" (zero) and "." (decimal point).
  A "#" will reserve space for a digit (zeroes will be shown as spaces), a "0" will always show a digit in that position.

To save your changes into the scheme files, select the *Save* option from the *File* menu.
Note that when you next save the scheme in the scheme editor, your changes will be lost.

6.4 Log Buffers

The Log Buffers are displayed across the bottom half of the window.
The Main Buffer plus any Event Buffers are each given their own tab.
Click on the tab to select the buffer to view.
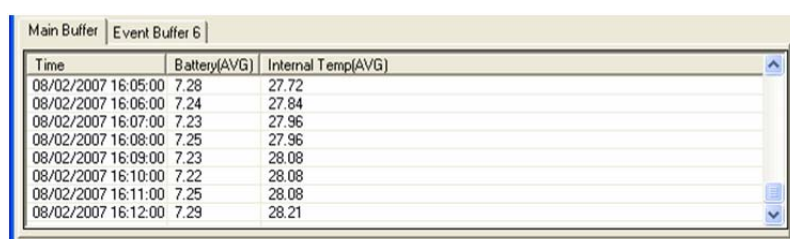
Each buffer viewer operates in one of two modes:

- **Table**: This displays the logged data in tabular form.
- **Graph**: This display the logged data in a graphical form as a line plot of data.
     Each logged item forms a series and each can be individually turned on and off.

Select the mode using the *Logged Data* option under the *Test Mode* menu.

6.4.1 Log Buffer Table View

This is the default Log Buffer view.   Each column is a different logged data item.   Each row is a log record.

To change to the Graph view, right-click anywhere over the table data and select *Graph* from the menu.

To change the number of log records shown, right-click anywhere over the table data and select the required number of records from the *View* sub-menu. The data selected is always from the most recently logged records. Since 100 records is the largest number available, data logged more than 100 records ago cannot be viewed in Test Mode. You will have to unload the logger to see older data.

6.4.2 Log Buffer Graph View

The Graph View displays the logged data in the form of a series line plot. Each logged item forms a different series. The time of log is the X-axis, the Y-axis is the value of the logged items.
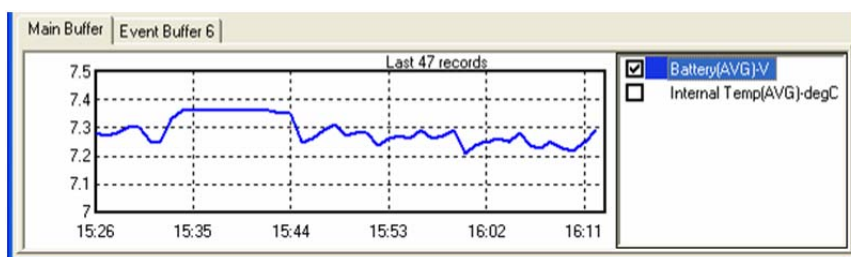
To change to the Table view, right-click anywhere **outside** the plot area (either of the axes or the *Last N records* title) and select *Table* from the menu.

To change the number of log records shown, right-click anywhere **outside** the plot area (either of the axes or the *Last N records* title) and select the required number of records from the *View* sub-menu. The data selected is always from the most recently logged records. Since 100 records is the largest number available, data logged more than 100 records ago cannot be viewed in Test Mode. You will have to unload the logger to see older data.

To adjust which data series are plotted, either use the checkboxes to the right of the plot area, or right-click in the plot area and select/deselect the series from the *Filter* sub-menu.

To see the specific value at a point on the graph, move the mouse over the graph and line up the vertical line that moves with the mouse pointer over the point of the graph that you're interested in. After a short delay a popup tooltip will appear showing the date/time and value of the data at that position.

The following shows that at 18/11/2008 14:50:00 a value of 8.61 was logged:
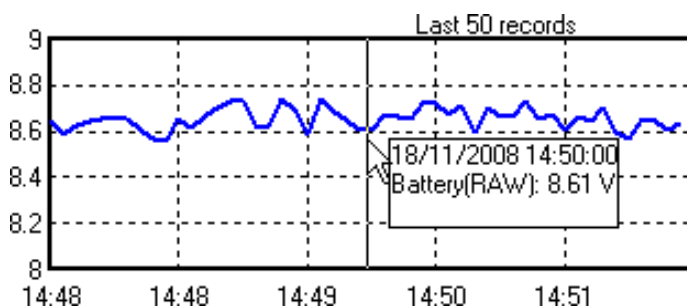
Note that the mouse doesn't have to be on the plotted line – any position vertically above or below, but inside the graph area, will work.

6.5   Menu Commands

When in Test Mode, a new main menu item called *Test Mode* is made available.   The commands are:

- **Correct Time**: Programs the logger with a time correction factor that over a period of time adjusts the internal logger clock to the correct time.   This correction may take hours or even days, depending on the size of the correction and the logger scan rate.
- **Put Value**: Allows you to put a specific byte value at a specific address in logger memory.
- **Edit Channels**: See *Scheme Channels*
- **Logged Data**: See *Log Buffers*
- **Text Size**: Allows selection of *Normal* (the default) or *High Visibility* (large) sized text in the test display.
- **Stop Logging**: This will stop the logger scheme and put the logger to sleep. The logger can only be restarted by re-programming it.

7.0   UNLOADING DATA FROM LOGGERS

Once you've had your logger operating for a while, it will have recorded some data. Unloading is the action of copying the data stored in the data logger into a file on your PC.

7.1   Unload File Format

Unload files are CSV (comma separated value) files. CSV files can be directly opened in Excel, and are also a common format supported by other software such as Tideda and Hydsys.

NOTE: Version 4 software can only produce CSV files.
It cannot generate V3 compatible *.Unn files.

7.2   Automatic Backups

The unloader supports the creation of backup unload files automatically at the time of unload. The backup folder is specified by the *Backup Data Path* option (see *General Options* on page 15).

If the backup media is not available at the time of unload, Starlog V4 will display an error message and you can either retry the backup, or cancel it. If you cancel it, you will have to manually backup the unload file yourself at a later time.

7.3   V4 Data Folders

Data unloaded for V4 schemes is stored in a buffer sub-folder in a scheme sub-folder of the folder specified by the *Data Path* option. For example, if the Data Path is the default of "*C:\Program Files\StarlogV4\DATA*", the scheme name is "TinCreek" and the data was logged in the main buffer, then the CSV files will be stored in the folder "*C:\Program Files\StarlogV4\DATA\TinCreek\Main Buffer*".

Backup data is handled similarly. If the backup path is set to "E:\", backup CSV files for the example above would be stored in "*E:\TinCreek\Main Buffer*".

7.4   File Naming Convention

Unload files are named according to the configured file naming convention. By default unload filenames include the scheme name and unload index number, but may be configured to also include the site ID and date/time. See *Data Options* on page 17.

7.5   Unload Procedure

To unload logged data from your data logger to your PC, click on *Unload Data* under the *Logger* menu, or click on the *Unload* icon. The following window will appear:
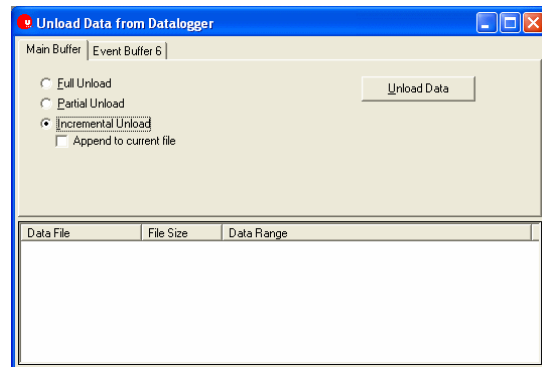
If your scheme has defined multiple buffers, you must unload each one in turn.   There are three options for downloading each buffer:

- **Full Unload**: This unloads all the data available on the logger into a new CSV file.
- **Partial Unload**: For fixed log interval buffers, this unloads all the data between two dates into a new CSV file.   For event-based buffers, this unloads into a new CSV file a selectable number of log records, starting at the most recent.
- **Incremental Unload**: This unloads all data logged since the last time you unloaded the logger. If you've never unloaded the logger since you programmed it, this will be a Full Unload. Tick the *Append to current file* checkbox if you want the data to be appended to the most recently unloaded data, otherwise the data will be stored in a new file.

When you have selected the unload method you want, click the *Unload Data* button.
If you have ticked Unload Comment in the StarlogV4 Data Options (see *Data Options* on page 17), then a dialog will pop up asking you to enter a comment:
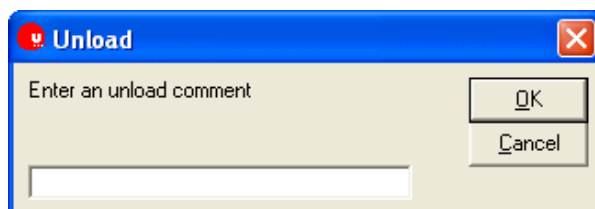
While data unloads, a window will appear showing you the progress of the unload:
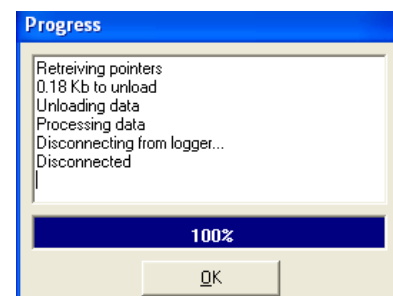
When the unload completes, several things occur:

- You are asked if you want to save the current log record position for the next incremental unload. See the Incremental Unload option above.
- If you have a backup path set a copy of the just unloaded data will be stored under the specified path.
- The just unloaded data will be added to the list of files:

You can view a CSV file by double-clicking on it in the list.

8.0   VIEWING DATA

Starlog is not data processing software. We recommend that you use Tideda, Hydsys, or Magpie to process data. The data viewer is for functional testing only.

To view data that you have previously unloaded, click on *Data Viewer* under the *Logger* menu, or click the *View Data* icon. The following window will appear:
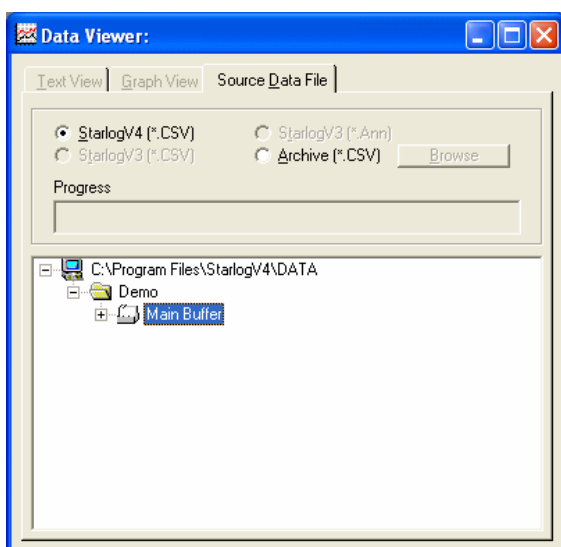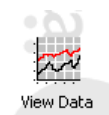
Initially, only the *Source Data File* tab is available. This is where you select the data you want to view.

8.1 Source Data File

Before selecting the file to view, you must first select the type of data you want to view. There are four supported types:

- **StarlogV4 (*.CSV)**: V4 data files generated by V4 software from V4 schemes.
- **Archive (*.CSV)**: Arbitrary CSV files.
- **StarlogV3 (*.CSV)**: V4 data files generated by V4 software from V3 schemes.
- **StarlogV3 (*.Ann)**: V3 data files generated by V3 software.

NOTE: V4 cannot directly view V3 unload files. Before you can view V3 data, you must create *.Ann files for each *.Unn file using an ASCII report created in the V3 Report Editor and then displaying that report in V3 to create the file(s).

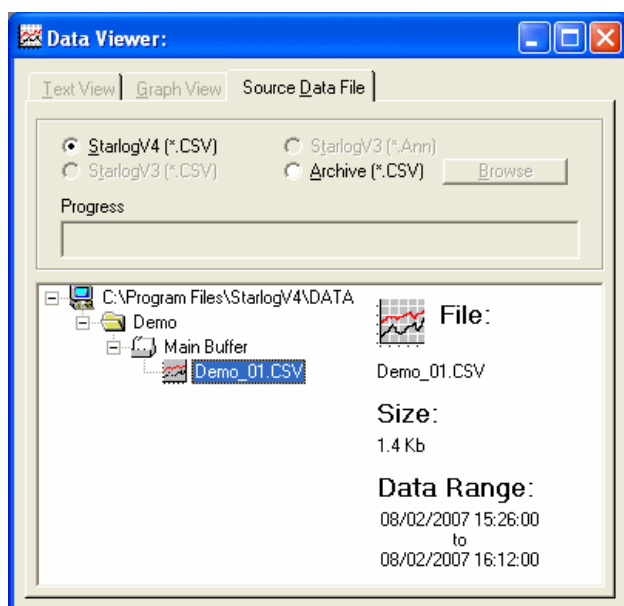Selecting the type of data will change the tree of available files in the bottom of the window. The first line of the window will show the folder that Starlog V4 is looking in for data files. In the sample screenshot above Starlog V4 is looking under *C:\Program Files\StarlogV4\DATA.*

8.1.1 Starlog V4 (*.CSV) Files

These files are grouped by scheme, each scheme will have one or more buffers, and each buffer will have its own set of logged data files.

The following screenshot shows that there is a scheme called *Demo*, which has available data from its *Main Buffer*, and the only data file available is a file called *Demo_01.CSV.*

8.1.2 Archive (*.CSV) Files

These are whatever CSV files Starlog V4 can find in the specified folder. CSV files to be viewed in the Data Viewer have some formatting requirements:

- The first line in the file assigns a name to each column consisting of the channel name and the logging method (raw, average, etc).
- The second line in the file assigns the units to each column (mm, degC, etc).
- The third line and beyond is the unloaded data.

8.1.3   Starlog V3 (*.CSV) Files
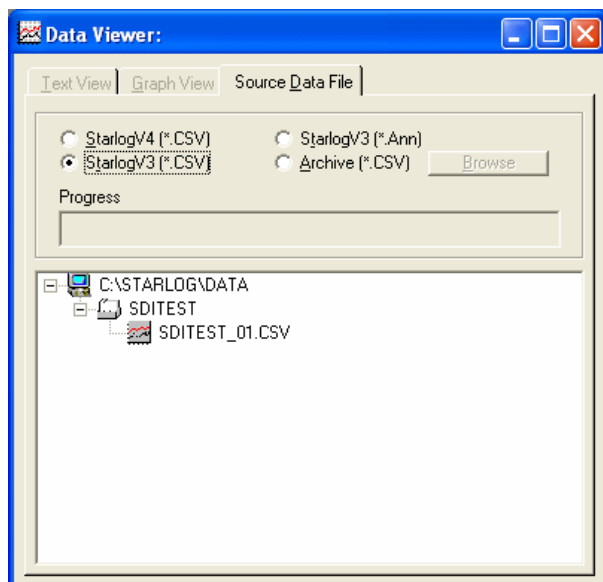
These files are all the CSV files, grouped by scheme, stored in the scheme folders under the folder specified by the *Starlog V3 Data Path*

The following screenshot shows a single scheme called *SDITEST* with a single data file called *SDITEST_01.CSV*

8.1.4   Starlog V3 (*.Ann) Files
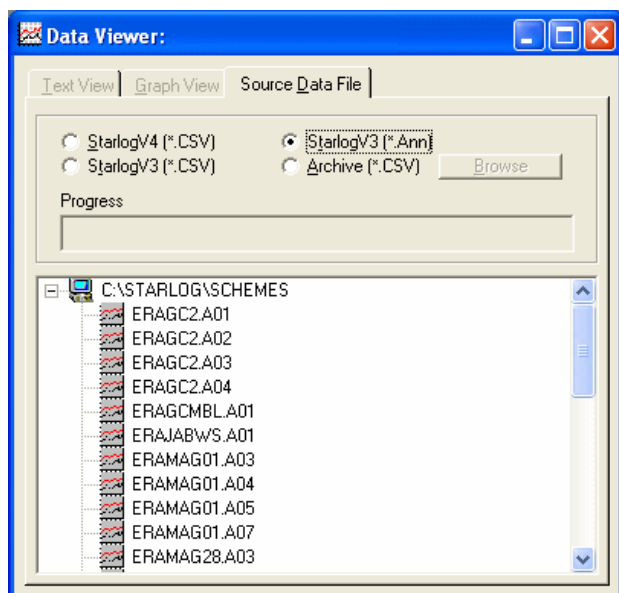
These files are all the *.Ann files stored in the folder specified by the *StarlogV3 Schemes Path*. They are listed in alphabetical order, but not grouped by scheme.

The following screenshot shows files from five different schemes:

ERAGC2 (4 files),

ERAGCMBL (1 file),

ERAJABWA (1 file),

ERAMAG01 (4 files),

ERAMAG28 (1 file)

8.2   Viewing the Data File

Once you've located the data file you want to view, there are a number of ways to open it:

- Double-click on it to open it using the Starlog V4 built-in Data Viewer (see *Opening with the Built-In Data Viewer* below).
- Right-click on it to open a context menu:

The "Open with" options are described below. The Send To, Copy, Delete, and Open containing folder are all handled exactly the same as when you right-click on a file in the standard Windows file Explorer.

Details of how to configure the Send To context menu are contained in Appendix B on page 85.

| Open with Data Viewer |
| Open with Notepad |
| Open with Excel |
| Send To ▶ |
| Copy |
| Delete |
| Open containing folder |
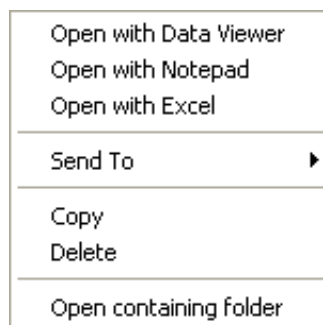
8.2.1   Opening with the Built-In Data Viewer

Opening a data file using the built-in data viewer will open the file in the *Graph View*. There is also a *Table View* where you can view the data as text. You can freely switch between these two modes and the *Source Data File* mode (see *Source Data File* on page 53) by selecting the appropriate tab at the top of the window.

8.2.1.1   Graph View

The default mode for viewing your data is the *Graph View*. This shows a zoomable graph on the left and graph control buttons on the right. The legend may be moved by dragging it to a new position.

The graph is zoomable by clicking and dragging out the rectangular area you want to zoom in to. Reset the zoom by right-clicking on the graph. The zoom level is also reset when you make a change to the visibility of any channel. When you hover your mouse over the graph, the time of log of the data you're hovering is shown at the bottom left, next to the scrollbar.

The example below has the Battery channel turned off, leaving the Internal Temp. It also shows the hidden controls that appear when the Channel Filter, Cumulative Totals, and Set Y-Axis buttons are pressed:
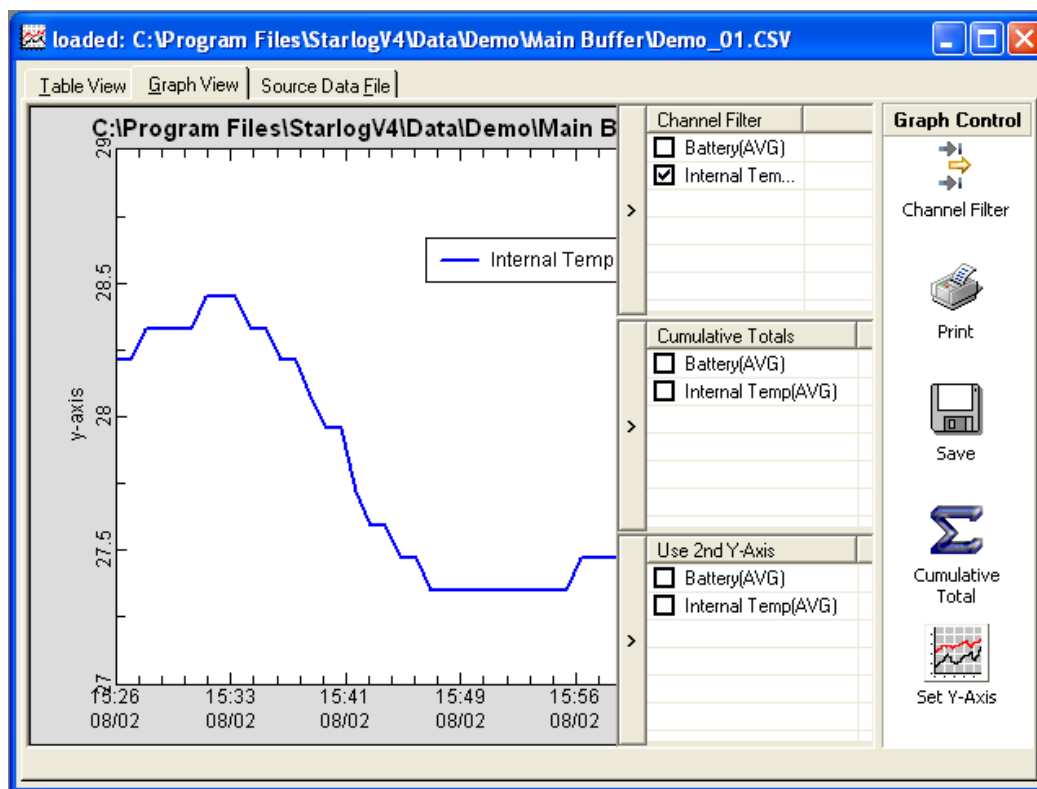
The Channel Filter controls which channels are plotted on the graph.
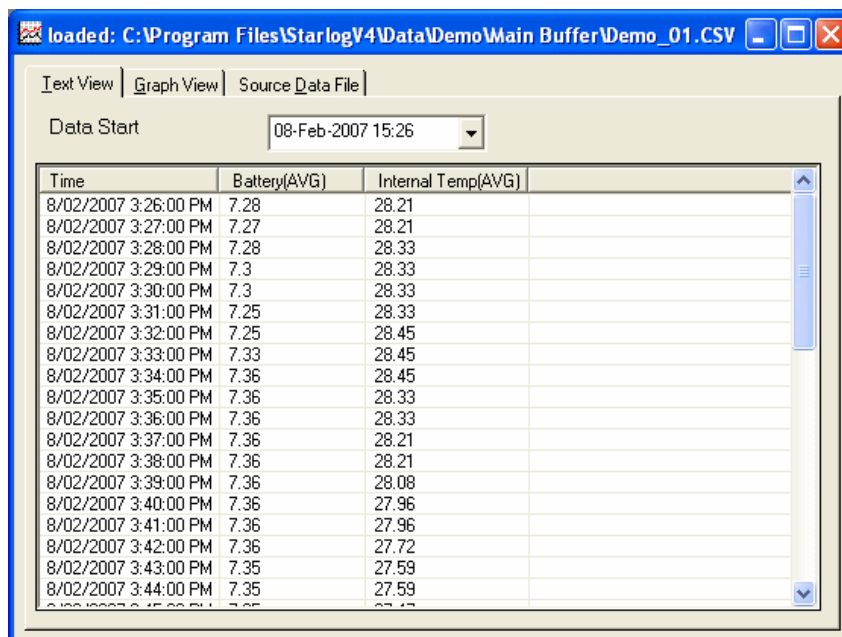
For each Cumulative Total item that is ticked, a new series is added to the graph that plots the cumulative total of the values of the selected channel.

The Set Y-Axis button opens a list of channels titled "Use 2nd Y-Axis".   Each channel ticked is taken into consideration when determining the scaling used for the 2nd Y-Axis that runs down the right side of the graph.

The Print button will print the graph. The Save buttons allows the graph to be saved as a Windows Bitmap (BMP) file.

8.2.1.2 Text View
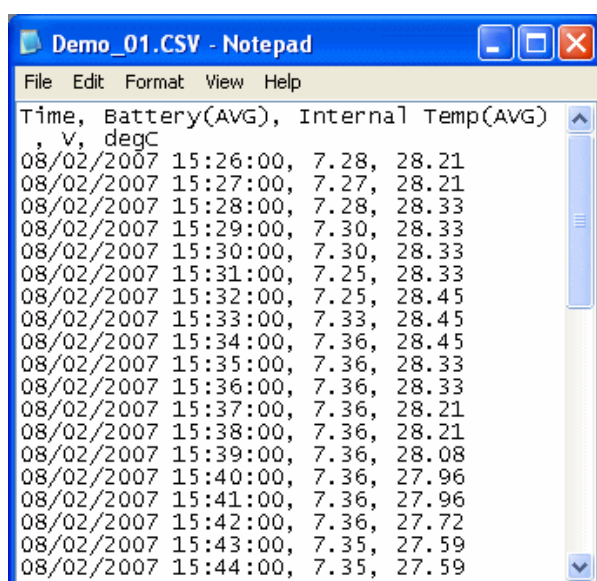
The *Text View* shows your logged data in a tabular form. The column widths are adjustable by dragging the divider between them. Use the scroll bar to select the data to view.

8.2.2 Opening with Notepad
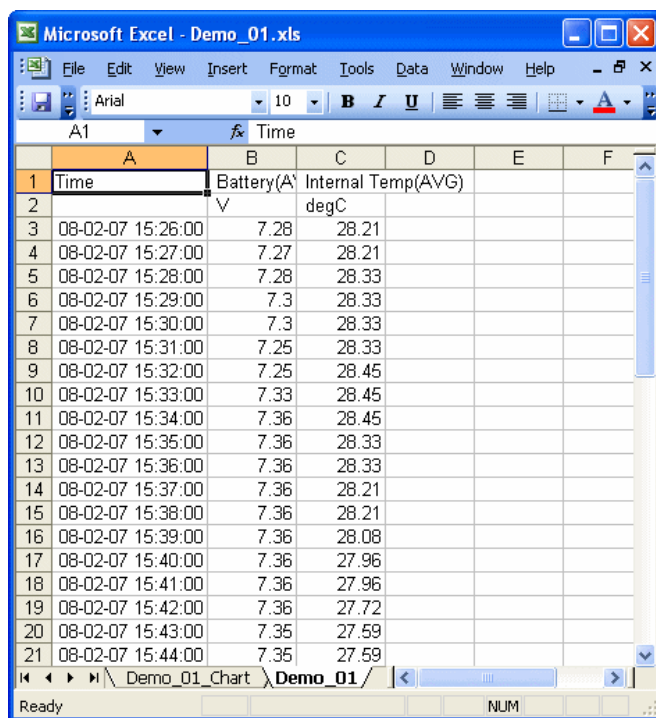
Opening your data file in Notepad can be useful if you suspect some file corruption. Notepad doesn't try to interpret the data, so you can scan through it and manually correct any anomalies.

8.2.3 Opening with Excel

Opening your data in Excel gives you a lot more power to display, format, print, and analyse your data. When opened in Excel, two sheets are created; the first one is for viewing the data in a tabular format:

There is also a second sheet called "*filename*_Chart" that displays the data as a graph:
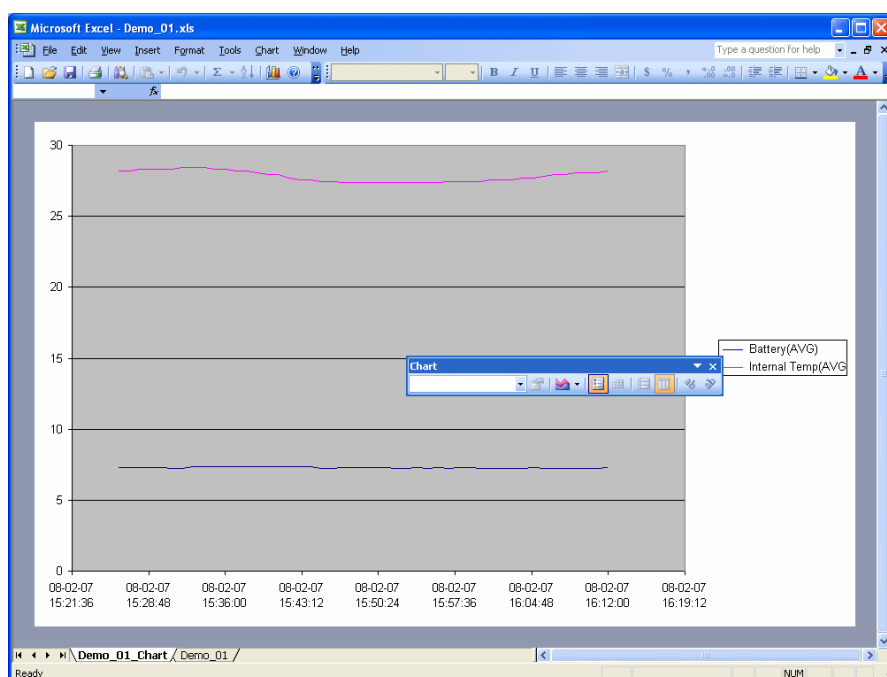
9.0   DIAGNOSTICS

Diagnostics are accessed from the main Starlog V4 window by selecting the Diagnostics tab on the left toolbar.   See the screenshot to the right:

Diagnostics provides several functions to assist you with various problems you may encounter using data loggers.   Each function is explained below.

9.1   Comms Window

The *Comms Window* function may be accessed by clicking the *Comms Windows* item under the *Logger → Diagnostics* menu, or by clicking the icon shown to the right.   It allows you to watch the communications between your PC and your data logger.   You can watch the progress of logger programming or unloading, or you can watch the commands issued during the test display.

The *Comms Window* is frequently useful for diagnosing modem problems and logger baud rate mismatches.
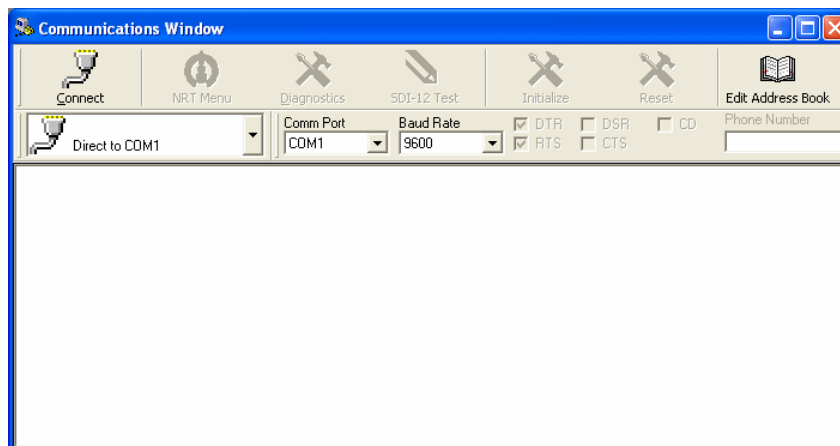
Data sent from the PC to the logger is shown in green, while data sent from the logger to the PC is shown in blue. The above screenshot shows communications that result from a typical test display. If no communication was taking place, you'd just expect to see regular star (asterisk '*') prompts from the logger.

The top of the window lets you control the serial port, and provides some status indicators:

- **Connect/Disconnect**: Click to connect/disconnect to/from the selected comms port.
- **NRT Menu**: Provides access to the NRT configuration menu.
- **Diagnostics**: This will activate the logger diagnostics mode.
- **SDI-12 Test**: This will enter the SDI-12 Test mode.
- **Initialize**: This will reinitialise the logger. If the logger is asleep, this will wake it up.
  The scheme and logged data are not affected.
- **Reset**: This will reset the logger to its default configuration.
- **Edit Address Book**: See Address Book on page 61.
- **Direct to COM1**: Selects the type of communications port to use.

Different selections affect what remaining controls are visible:

- **Direct to COMx**: Physical RS-232 serial comms ports available on the local PC.
  - **Comm Port**: The local communications port to use.
  - **Baud rate**: The baud rate to use. If no star prompts are detected, the software will automatically cycle through all the baud rates until a star prompt is detected.
  - **DTR**: Controls the Data Terminal Ready signal. Modems require this signal to be on (ticked) to enable dialling out to other modems.
  - **RTS**: Controls the Request To Send signal. Unidata data loggers require this signal to be on (ticked) to wake up for communication.
  - **DSR**: Indicates the current state of the Data Set Ready signal.
    The DSR state usually reflects the DTR signal.
  - **CTS**: Indicates the current state of the Clear To Send signal.
    The CTS state usually reflects the RTS signal.
  - **CD**: Indicates the current state of the Carrier Detect signal.
    Modems turn this signal on when they are connected to another modem.
  - **Phone Number**: The telephone number to dial when establishing the connection.
- **Network (UDP)**: Virtual communications ports provided over a TCP/IP network.
  - **IP Address**: The TCP/IP address of the remote communications port.
  - **Port**: The TCP/IP port number of the remote communications port.
- **Use Address Book**: Select a site defined in the Address Book to connect to.
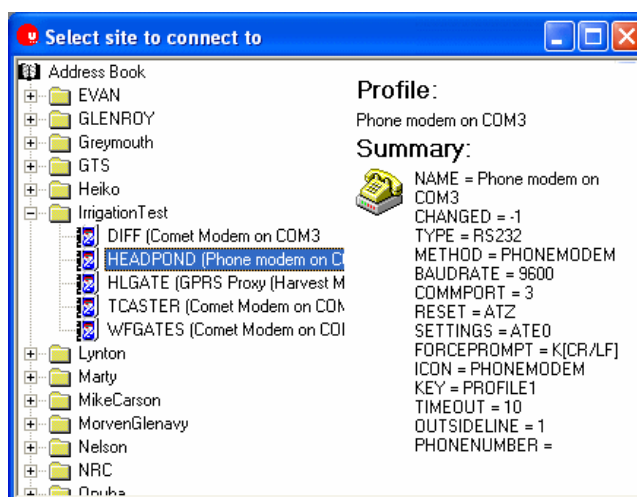
9.1.1 Address Book

The Address Book allows you to manage the connection details for many sites all in one place. It allows you to create a single generic scheme, and then connect to many different sites to use it.
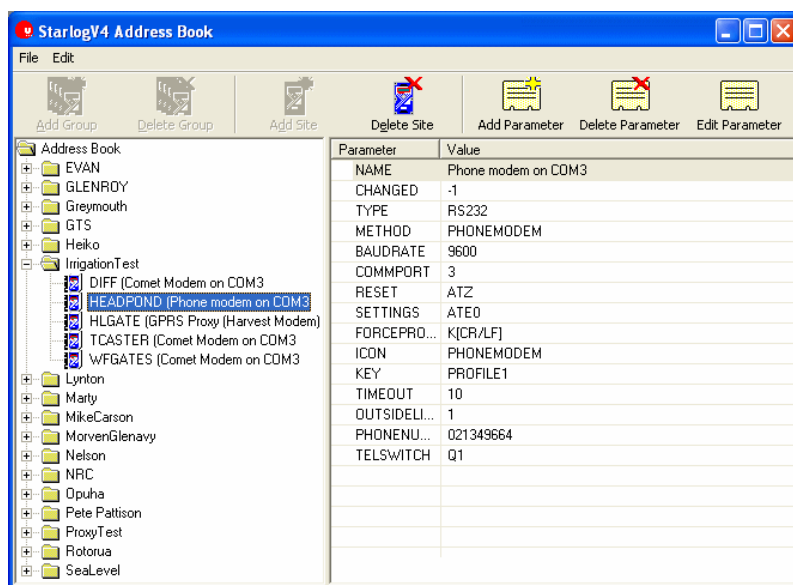
Sites can be gathered into groups. Groups may contain other groups. Create groups by first selecting either the top-level "Address Book" item or the containing group.
Then click "Add Group" on the toolbar.

Add sites by selecting the top-level "Address Book" item or the containing group, then click "Add Site" on the toolbar.
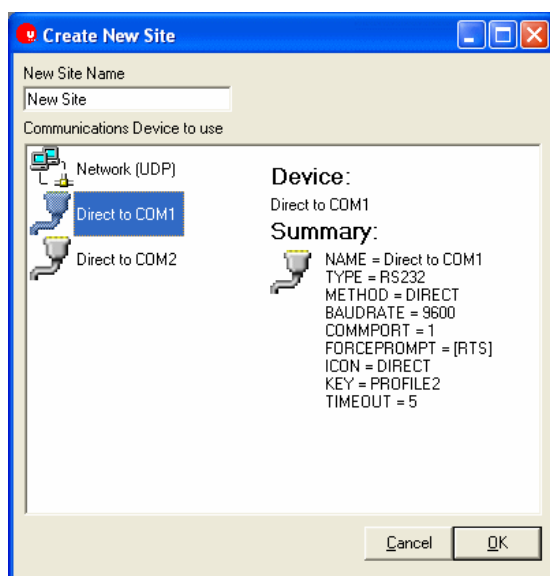
Enter the site name, select the communications device and click OK. Suitable default parameters for the selected communications device will already have been filled in.

Other parameters will need to be set.
For sites that connect directly to a serial port or modem, the important parameters are:

- **RESET**: The command string used to initialize the modem.
  A typical setting would be "ATZ", the modem initialization command.
- **SETTINGS**: The command string used to set any further modem parameters.
  A typical setting might be "ATE0" to turn off local echo on the modem, which may
  otherwise interfere with communications.
- **OUTSIDELINE**: The number used by the modem to access an outside line through
  a PABX. May be left blank if using a direct line.
- **PHONENUMBER**: The telephone number to dial.
  May be left blank for direct connections.
- **TELSWITCH**: The telemetry switch code to use. May be left blank.

For sites that connect via a TCP/IP network (UDP), the important parameters are:

- **ADDRESS**: The TCP/IP address of the remote communications port.
- **PORT**: The TCP/IP port number of the remote communications port.

Sites can be renamed by clicking twice on their name in the tree in the left window pane.

9.2   Velocity Trace

The *Velocity Trace* function may be accessed by clicking the *Velocity Trace*
item under the *Logger → Diagnostics* menu, or by clicking the icon shown to the
right.   It is only available for schemes built for the Starflow data logger.
The Velocity Trace allows you to examine to profile of water velocities detected by the
Starflow.

Starflow Velocity Trace

Scheme = oldfirm
Depth = 55 mm

Median = 262 mm/s
Quartile = 95 %
Average = 263 mm/s
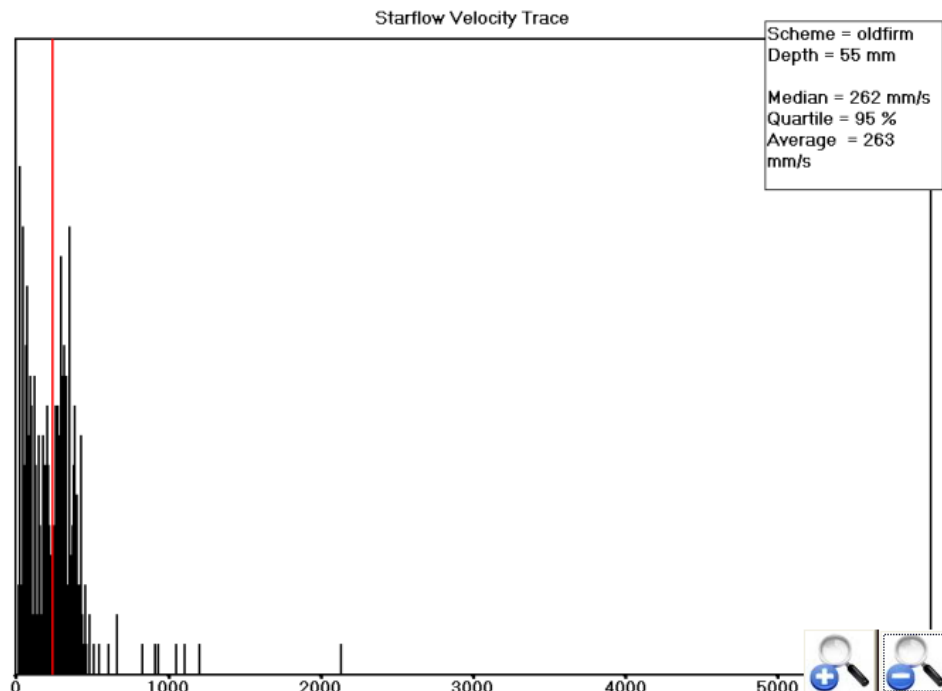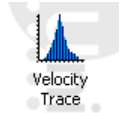
The horizontal axis is the velocity in mm/s, the vertical axis is the number of samples detected.   The red line indicates the median velocity, which is the velocity used by the Starflow.

The plus/minus magnifying glass buttons adjust the horizontal axis through a number of different scales.   For example, the above screenshot shows all the velocity data bunched up between 0 and 1000mm/s. The plus button would expand that to show greater detail.

9.3   Upgrade Firmware

The *Upgrade Firmware* function may be accessed by clicking the *Upgrade Firmware* item under the *Logger → Diagnostics* menu, or by clicking the icon shown to the right.   It allows you to upgrade the internal firmware of most Unidata data loggers.

Click the *Query Logger* button to have the software determine what type of logger is currently connected, and what version of firmware it is currently running. The following screenshot shows the results of querying a Yellow Memory Card Starlogger:
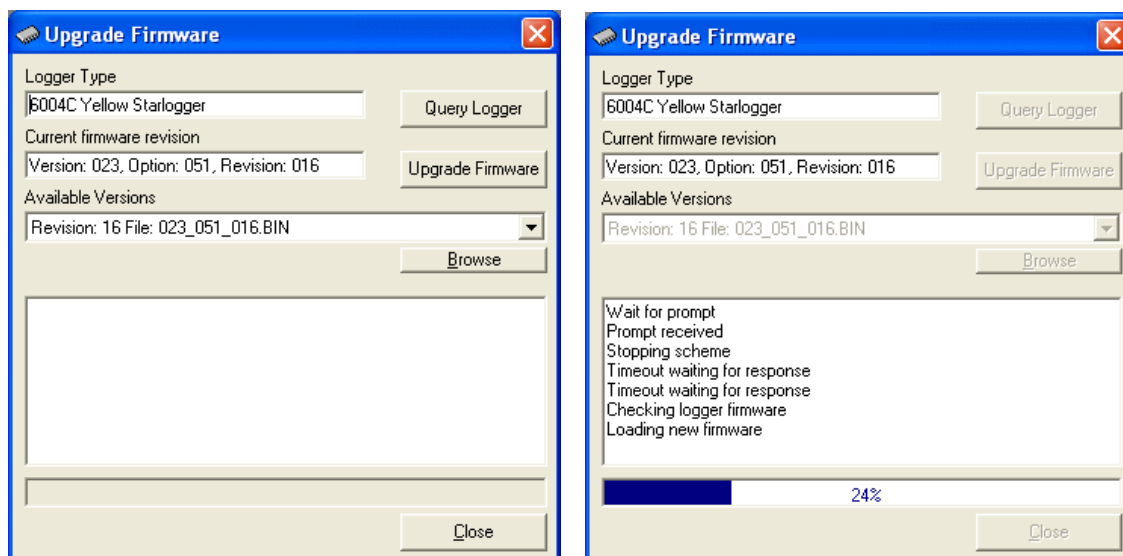
- - **Logger Type**: Shows the logger type identified by the Query Logger function.
- - **Current firmware revision**: Shows the firmware version currently programmed in the connected data logger.
- - **Available Versions**: Lists all the firmware available to the Starlog software that is compatible with the connected data logger. You may click the *Browse* button to manually select an unlisted firmware, but updating a logger with unlisted firmware may make the logger unusable or even damage it!
- - **Query Logger**: Automatically identifies the logger connected to the PC.
- - **Upgrade Firmware**: Click to upgrade the connected data logger to the firmware selected in the Available Versions field. The window will indicate the progress of the upgrade

9.4   SDI-12 Test

The *SDI-12 Test* function may be accessed by clicking the *SDI-12 Test* item under the *Logger → Diagnostics* menu, or by clicking the icon shown to the right. It allows you to check the operation of the data logger as an SDI-12 recorder and the operation of any SDI-12 sensors connected to it. You are able to issue identify, measurement, and read commands.

When the window is first opened, click *Connect* to connect to the data logger and start SDI-12 diagnostics:
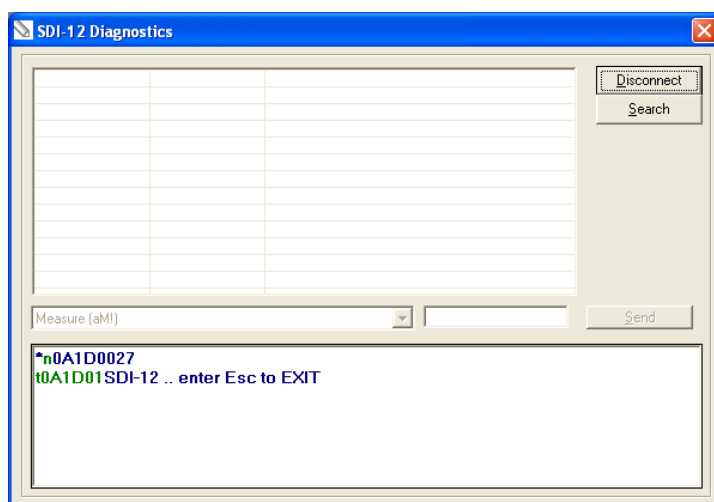
Next, click `Search` to send identification requests to the first ten sensors. The window will list any sensors found:
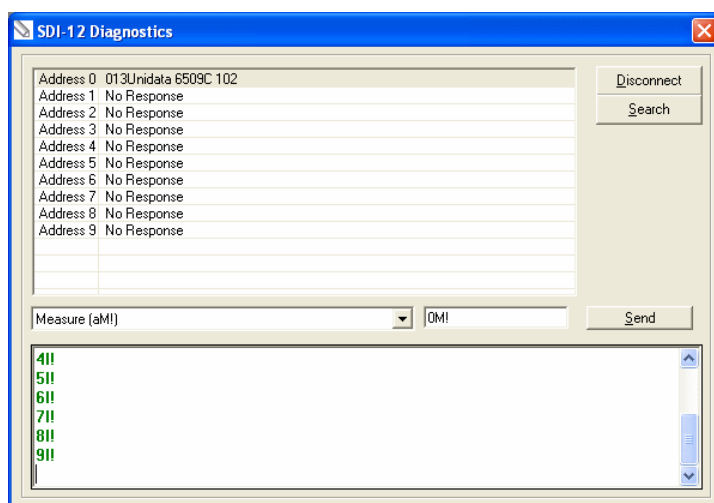
The above screenshot shows that there is a Unidata 6509C Water Level instrument, connected on address 0, and no other instruments on any other channel.

To send commands to a sensor, select it from the list, then select the command to send from the drop-down list (the "Measure (aM!)" in the above screenshot). When you select a command, the actually command that will be sent on the SDI-12 bus is shown next to it (the "0M!" in the above screenshot). Click *Send* to send the command on to the SDI-12 bus.
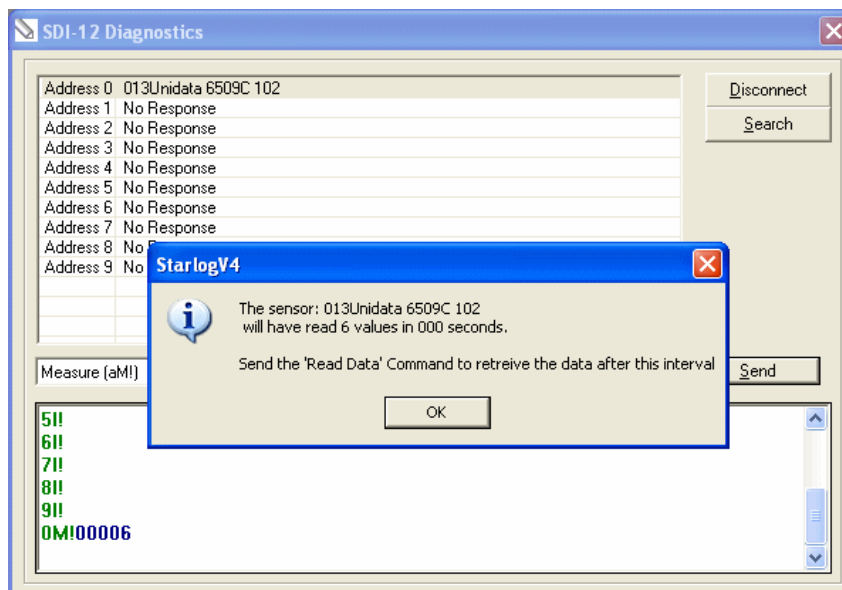
If there is a response, it will appear in the communication log area, and the software will also provide an interpretation of the response. The above shows the response to a Measure command, the following is the response to a subsequent Read:
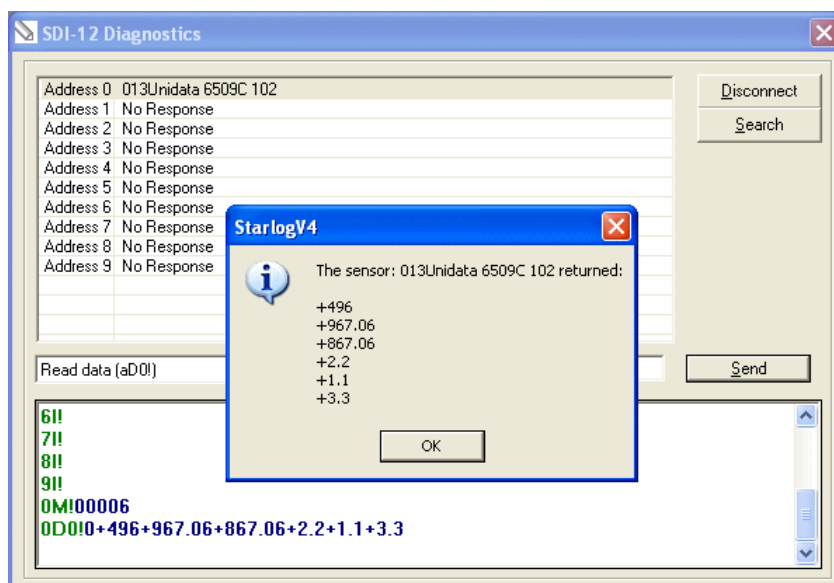
Note that different sensors may return not just different values, but different numbers of values. Most sensors will only return a single value.

9.5 Configure Modem

Configure Modem is used to program a modem with the settings appropriate for use either locally (to dial out to remote sites), or remotely (to be dialled into from your computer). For example, a remote modem must be configured to auto-answer.

Click on the icon to run it. The following window will appear:

Select the correct Serial Port and Baud rate, then click *Local* to setup the modem for local use (i.e. to dial out to remote sites), or click *Remote* to setup the modem for remote use (i.e. to be dialled into). A progress bar will fill in across the bottom of the window while the modem is identified and configured.
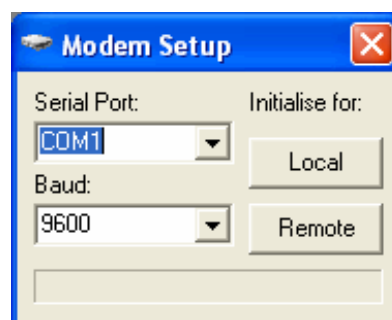
10.0 GENERAL PURPOSE INSTRUMENTS

See also *Instruments* on page 31 for a general discussion of instrument support and management.

10.1 BUTTONS: Configurable Test Mode Buttons

The Test Mode Button instrument lets you add buttons to the scheme test mode display that will perform a variety of actions.

10.1.1 Configuration
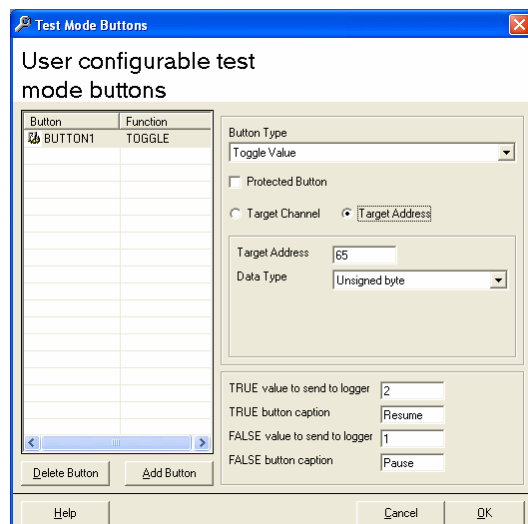
- **Button Type**: The different button types have different parameters, explained below:

    - **Set Channel**: A button that will ask for a value to set the specified channel/memory when clicked.
    - **PUT Value**: A button that will put a specified value into the set channel/memory address when clicked.
    - **Toggle Value**: A button that will toggle the specified channel/memory between two values when it is clicked.

- **Protected Button**: Protected buttons may be blocked from use via the User Profile option "Enable/disable locked test mode buttons" setting

- **Target**: Select either "Target Channel" or "Target Address":

    - **Channel**: Set the "Target Channel" to the channel to alter.
    - **Address**: Set the "Target Address" to the address in logger memory to be affected by the button. Set the "Data Type" to the type of data at the given address. Set Channel Buttons
        - **Button Caption**: The text that will appear on the button. PUT Value Buttons
        - **Value to PUT to logger**: The value sent to the logger when the button is pressed. Toggle Value Buttons

- **TRUE Value to send to logger**: This is the value sent to the logger when the button state becomes "TRUE".
- **TRUE button caption**: The button text shown while the button is in its "TRUE" state.
- **FALSE value to send to logger**: This is the value sent to the logger when the button state becomes "FALSE".
- **FALSE button caption**: The button text shown while the button is in its "FALSE" state.

The example shown in the configuration screenshot shows the settings for a toggle button that will restart a data logger logging after it has stopped, and stop the logger if already logging. It is only suitable for use with event logging, where the date/time is logged with each item.
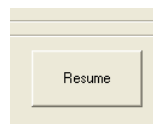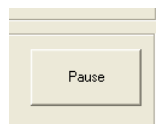
While the logger is logging, the byte at address 65 has the value of 1. That corresponds to the FALSE state, and so the FALSE caption "Pause" is shown. Pressing the button toggles the state of the button to TRUE and Starlog will put the TRUE value (2) into the byte at address 65, then update the button to show the TRUE caption "Resume".

Note that the example configured the TRUE value/caption to be 2/"Resume" and the FALSE value/caption to be 1/"Pause". The opposite configuration (TRUE as 1/"Pause" and FALSE as 2/"Resume") would have worked exactly the same.

10.2 CUSTOMACTION: Custom Visual Basic Actions

NOTE: This instrument is intended for use only by Unidata engineers. It is documented here for completeness, but technical support cannot be provided for its use.

The custom action instrument allows arbitrary Visual Basic code to be processed in response to various V4 tasks.   Each task requires a Sub Main routine be defined. The tasks are:

- **Before Program**: Called after V4 confirms that programming will erase logger memory, but before any communications takes place. Requires that *Process.Continue* be set to *True* in order for the programming to take place.
- **After Program OK**: Called after V4 successfully reprograms and disconnects from the logger.
- **After Program Error**: Called after V4 disconnects from the logger when the logger cannot be programmed for some reason.
- **Before Unload**: Called before V4 connects to the logger to perform an unload, and before the unload comment is requested.   Requires that *Process.Continue* be set to *True* in order for the unload to take place.
- **After Unload OK**: Called after V4 disconnects from the logger when the logger has been successfully unloaded.   Requires that *Process.Continue* be set to *True* in order for the unloaded data to be saved.
- **After Unload Error**: Called after V4 disconnects from the logger when the logger cannot be unloaded for some reason.
- **Testmode Start**: Called after V4 has connected to the logger and successfully read the display data.
- **Testmode Stop**: Called before V4 disconnects from the logger. Requires that *Process.Continue* be set to *True* in order to disconnect from the logger and allow the test mode window to be closed.

10.3   EVENTCNTR: Event Counter

The event counter instrument counts the number of scans a selected event is true.
It supports a variety of counter sizes (larger sizes support higher maximum count values),
and supports a number of different methods to reset the count, including never.

10.3.1   Requirements

One event to count.

10.3.2   Configuration
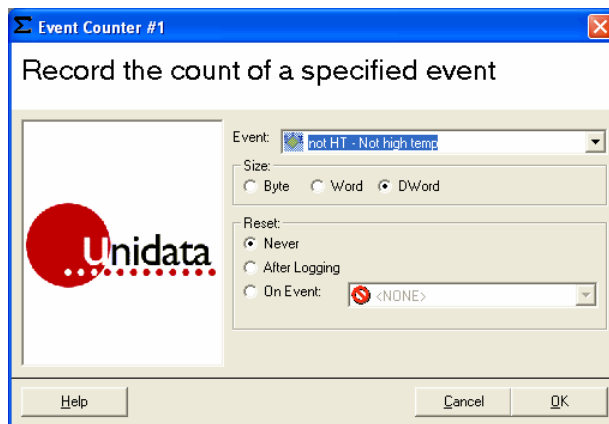
- **Event**: The event to count.
- **Size**: How big a count to support:
    - **Byte**: One byte, maximum count of 255.
    - **Word**: Two bytes, maximum count of 65,535.
    - **DWord**: Four bytes, maximum count of 4,294,967,295.
- **Reset**: When to reset the count value to zero. This setting may be overridden via the reset event output (see below).
    - **Never**: The counter will never be reset to zero.
    - **After Logging**: The counter will be reset to zero after it is logged.
    - **On Event**: The counter will be reset to zero when the selected event is true.

In addition to the above controls, the event counter instrument creates an event output
that may be used to reset the counter. It is functionally identical to the "On Event" reset
option above.
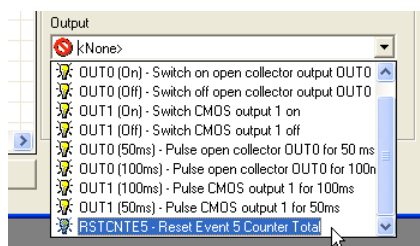
10.4   FREQUENCY: Generic Frequency

The generic frequency instrument lets you read any rate based input from a counter channel.   The instrument automatically incorporates the logger scan rate into the channel scaling so that the scaler is the conversion factor for degrees to required units.

NOTE: The scan rate is incorporated when you click on OK. If you later change the scan rate you will have to re-open the setup window to update this instrument with the new scan rate.

10.4.1   Requirements

One counter channel.

10.4.2   Configuration
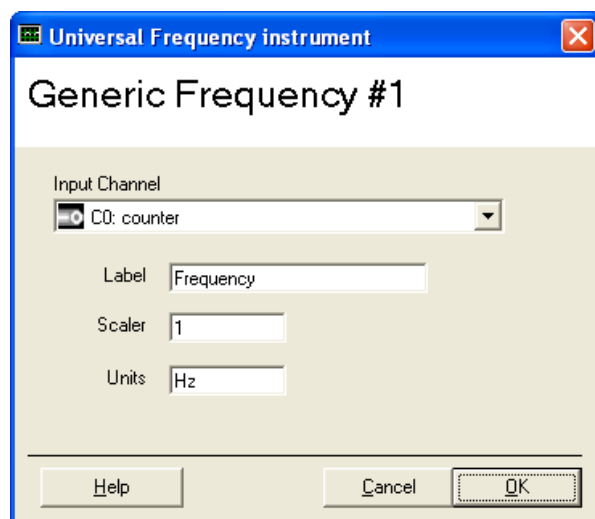
- **Input Channel**: Select the counter channel to measure the sensor on.
- **Label**: Enter a label for display in Test Mode and the Data Viewer.
- **Scaler**: Enter the conversion factor for Hz to specified units.
- **Units**: Enter the units for display in Test Mode and the Data Viewer.

10.5 GENPT: Pressure Transducer

The Generic Pressure Transducer instrument can be used to read a range of analogue pressure transducers.   The output will be scaled to read directly in mm based on the selected Range and Output.

10.5.1 Requirements

One analogue channel.

10.5.2 Configuration
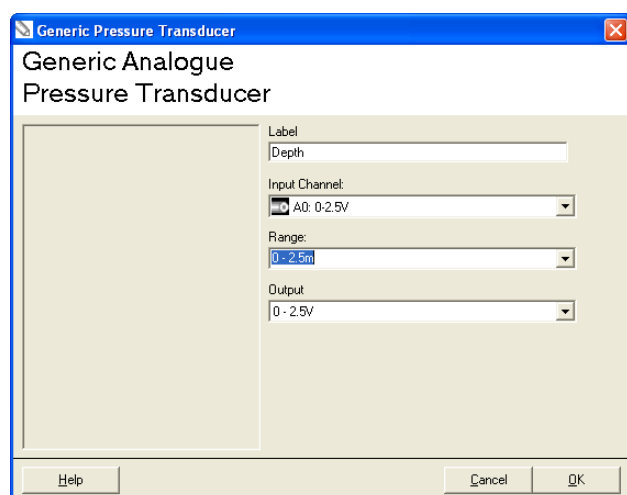
- **Label**: Enter a label for channel display in Test Mode and in the Data Viewer.
- **Input Channel**: Select the channel to measure the current.
- **Range**: Select the range of the sensor.
- **Output**: Select the output type of the sensor.
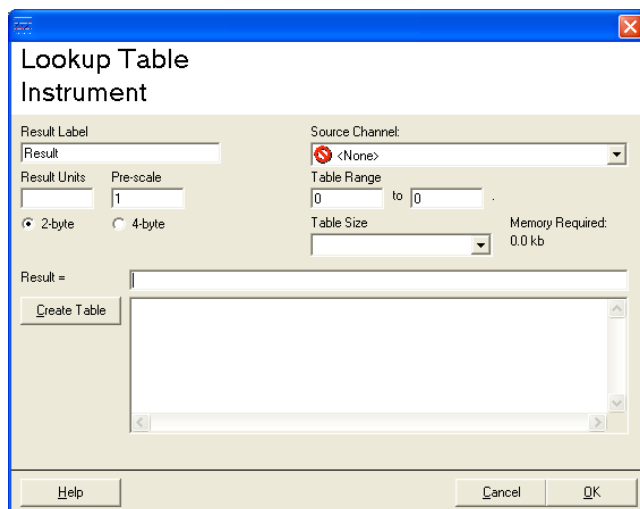
10.6 LOOKUP: Lookup Table

The Lookup Table instrument lets you solve a complex mathematical function on the logger. This could be a non-linear function such as a thermistor, or stage-flow relationship over a fixed weir.   Solving these functions on the logger offers advantages to the user such as true display of parameters on the Starlogger LCD, easy processing of data on the logger e.g. volume accumulation of flow, or easy transfer of true value via SDI-12, Modbus etc.

The Lookup table instrument lets you enter a formula directly and generates a lookup table that covers the range selected. The instrument automatically takes into account the scaling applied to the source channel.

A lookup table can use quite a large amount of memory so it's important to only define the lookup table of the required range to minimize memory requirements.

10.6.1 Configuration

- **Result Label**: Enter the label for display in StarlogV4 Test Mode and Data Viewer.
- **Result Units**: Enter the units for display in StarlogV4 Test Mode and Data Viewer.
- **Pre-scale**: Enter the amount to pre-multiply the values to be stored in the logger. Since the logger can only store integer values, we can "pre-scale" the values by "x" and then divide the value again by "x" for display.
  For example, with a pre-scale of 10, a flow of 145.6 would be internally stored as 1456 and divided by 10 for display and data unloads.
- **2-byte**: Select 2-byte if the pre-scaled results are all between 0 and 65535 (for example, the result 1456 above qualifies).
- **4-byte**: Select 4-byte if any of the pre scaled results are more than 65535.
- **Source Channel**: Select the channel to use as the input to the lookup table.
- **Table Range**: Enter the range of "Source Channel" where the lookup table is valid.
- **Table Size**: Select the number of bytes for the table. A smaller table size will have less resolution but will require less logger memory.
- **Result =**: Enter the Formula to solve. Reference the Source Channel using its label.
- **Create Table**: Click on Create Table to test the formula and generate the lookup table
- **Lookup table window:** This is a display of the results of the lookup table process.

10.6.2 Example – Weir Flow

Formula	Result Field
Flow = $125.65h^{1.8}$-12.34 Where "h" is the water height (or Depth)	125.65*Depth^1.8-12.34

10.6.3   Example – Flow Scaling

Formula	Result Field (all on one line)
Depth is unscaled less than 100, multiplied by 1.2 between 100 and 200, and multiplied by 1.5 above 200.	Depth*(Depth>=0)*(Depth<100)+ Depth*(Depth>=100)*(Depth<200)*1.2+ Depth*(Depth>=200)*-1*1.5

NOTE: Comparison operators evaluate as -1 for "true" and 0 for "false". The "*-1" in the last result line above is to handle the previous condition values.

10.7   MINMAXTIME: Time of minimum/maximum

This instrument allows the time of a channel minimum/maximum to be logged. The time and corresponding minimum/maximum value is reset on every log.

10.7.1   Configuration
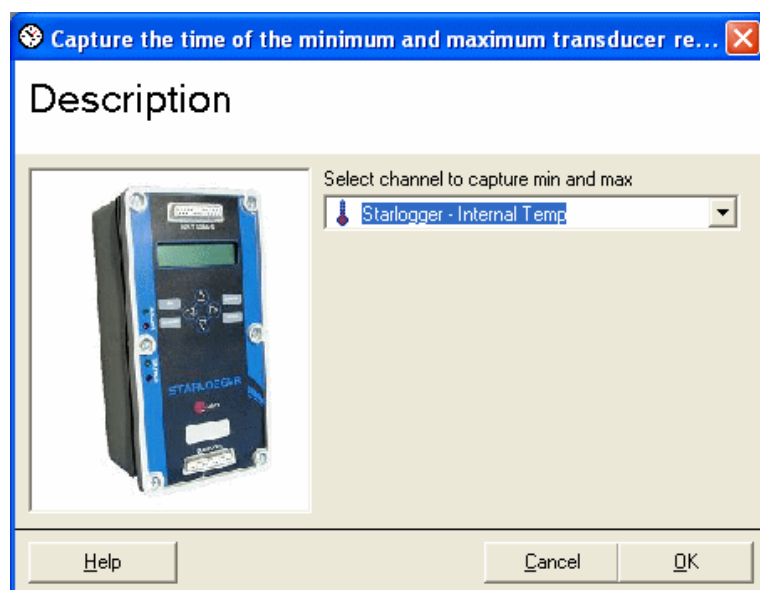
The configuration is simple – select the channel for which you want to capture the minimum and maximum, and then click *OK*. If the instrument for the selected channel has an associated picture, that picture will be shown on the left.

Next, go to the Log Buffer window:
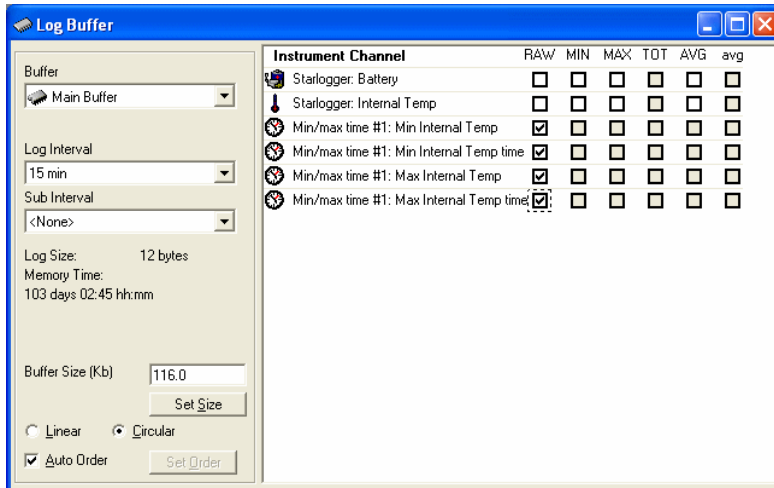
From there you can select what to log.   Note that while you can still select the MIN / MAX boxes for the original channel, it is recommended that you log the RAW min/max channels of the min/max time instrument, as shown above.

10.8   RELTIME: Relative Time Channels

The Relative Time Channels provide channels for the following:

- Time of Day (TOD) in HHMM format, e.g. 1030 = 10:30.
- Minute of Day (MOD) in the number of minutes passed since midnight in the range 0…1439.
- Day of Week (DOW) in the range of 0…6 (0 = Sunday).

10.8.1   Configuration
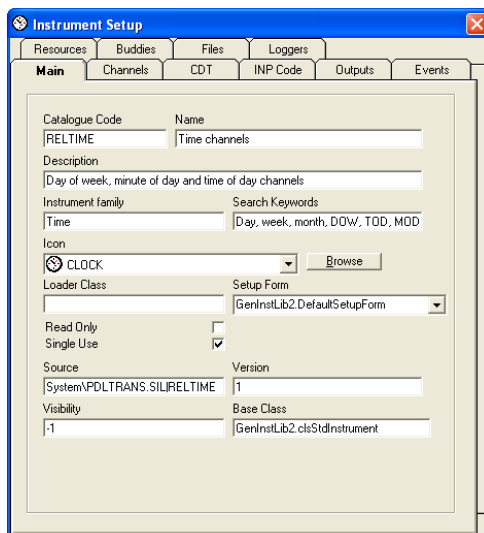
See page 65 for details on the Generic Instrument Setup Window.

10.9 SCHEME: Embedded Scheme Information

The embedded scheme information instrument saves some of the scheme definition inside the logger program, so that when the logger is programmed, the saved portion of the scheme definition is programmed as well.

The saved scheme information can be subsequently used by Version 4 to unload the logger or display the test mode without needing the original scheme.   The saved data will be read from the logger and used directly.

To use the embedded scheme information, select the "Embedded V4 Scheme" tab when selecting a scheme, then the "Direct Connection" item:
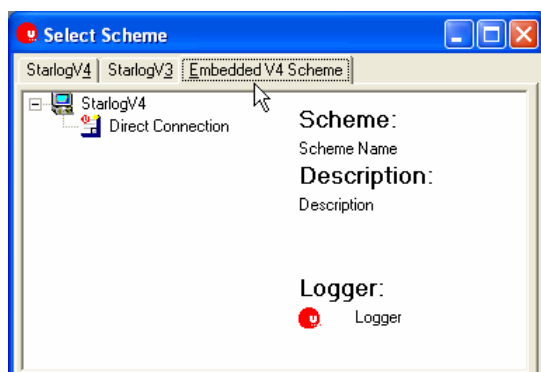
10.10 SCHEME_INFO: Scheme Information Report

The Scheme Information Report instrument generates a text report of the scheme settings, instruments, log buffer, etc.   This report is generated whenever the scheme is saved.   To view the report, double click on the instrument.   A window similar to the following will appear:
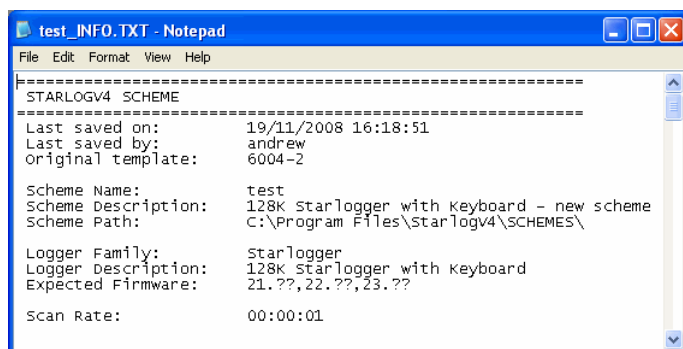
The report can be re-saved elsewhere, printed, etc.

10.11   SDI: SDI Transducer

The SDI transducer instrument lets you read any SDI-12 sensor connected to the data logger using the SDI-12 protocol. The SDI instrument lets you configure the scheme to read the sensor on the specified address, retrieve the specified parameter set, specify the data type to store the reading in, how often the read the sensor, and what channels the sensor will return.

If multiple SDI-12 sensors are connected to the logger then multiple SDI instruments can be added to the scheme. Each instrument can be individually configured and all the sensors will be placed on a queue system. If an instrument requests a read when the SDI bus is busy with another instrument then the request will be placed on the queue and serviced when the bus is free. All sensors are checked on turn and therefore none will be "missed out" if an earlier sensor initiated another read before the previous request was serviced.

The SDI instrument will also add an "init SDI-12 read on address a parameter n" output to the scheme outputs list. If you use this output, you must select Manual as the Refresh Rate. Note that because the logger can only read one sensor at a time you have to ensure that sufficient time is allocated to read all sensors
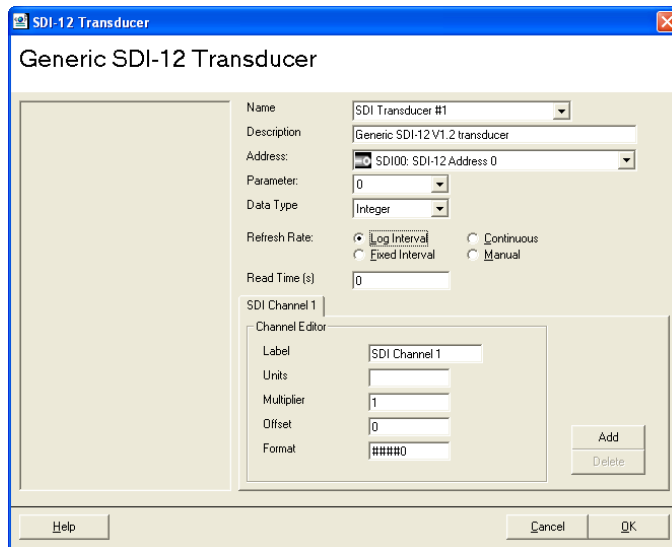
Warning: The settings in the instrument setup window must match the sensor i.e. Sensor address, number of channels returned for the instrument to function correctly. Defining fewer channels than the sensor actually returns can corrupt other instrument readings on the logger. Use the SDI-12 Test

 mode (described on page 64) to determine how long the sensor will take to return a reading, and how many channels it will return.

10.11.1 Requirements

6004B, C or D Starlogger, Prologger or Micrologger based data logger.

10.11.2 Configuration

- **Name**: Enter the name of the SDI-12 sensor (for display only).
- **Description**: Enter the description of the SDI-12 sensor (for display only).
- **Address**: Select the SDI-12 address of the sensor.
- **Parameter**: Select the parameter set to return from the sensor. Many sensors can return more than one parameter set e.g. main readings in parameter set 0 and diagnostic information in parameter set 1. Each parameter set has to be treated as a separate instrument.   By default you would generally use parameter set 0.
  This correlates to a SDI-12 measure command of "aM!".
- **Data Type**: Select the data type to use for the stored readings:
    - **Integer**: Store the values as 2-byte integers.   Integer values are easy to manipulate (e.g. calculate average), however, to convert the floating point received by the sensor to integer values the logger simply removes the decimal point.
      Therefore "123.45" becomes "12345". For this reason the response of the sensor must have a fixed number of decimal points.   Also the converted value must fit within the range -32768 to 32767. Values that fall outside of this range will be incorrectly interpreted by the logger.
      You also have to enter a multiplier and format string to revert the converted values back to values for display.
      For example, "123.45" will be stored as 12345.
      Therefore the multiplier must be 0.01 and format must be "##0.00".
    - **Floating point**: Store the channels as 4 byte floating point values. Note that this will work for all instrument types, but you will not be able to manipulate the channels in any way (e.g. calculation of averages).
- **Refresh Rate**: Select how often to read the sensor.
    - **Log Interval**: Read the sensor once just before the log scan.
    - **Fixed Interval**: Read the sensor every "n" seconds.
    - **Continuous**: Read the sensor as fast as possible.
    - **Manual**: Manually initiate the SDI-12 via the Scheme Editor Events window.
- **Read Time**: This field is only used when the Refresh Rate field (above) is set to Log Interval. Enter the amount of time to allow for the sensor to complete its reading. Note that since all sensors are read in turn, if you require all of the sensors read in time for the log scan then the easiest way is to add the time each sensor requires (rounded up to the nearest scan interval) + 1 scan for extra processing time e.g. Sensor 1 takes 14 seconds, sensor 2 takes 23 seconds, scan rate is 5 seconds. Sensor 1 would be set a read time of

15+5=20 seconds, and sensor 2 would be set a read time of 25+5=30 seconds. The software would automatically query Sensor 1 50 seconds before the log, and Sensor 2 20 seconds later at 30 seconds before the log.

- **Refresh Interval**: This field is only used when the Refresh Rate field (above) is set to Fixed Interval. Enter the number of seconds between initiating a read from the sensor.
- **SDI channel tab**: Select the channel to edit.
- **Label**: Enter a label for channel display in Test Mode and in the Data Viewer.
- **Units**: Enter the units for channel display in Test Mode and in the Data Viewer.
- **Multiplier**: Enter the multiplier to scale the result by. When using Integer Data Type refer to Data Type (see above) for correct calculation of multiplier.
- **Offset**: Enter the offset to scale the result by.
- **Format**: Specify the display format. When using Integer Data Type refer to Data Type for the correct format.
- **Add**: Click on Add to add a new channel to the instrument. Note that you must define a channel for every parameter the sensor returns whether you need the channel or not.
- **Delete**: Click to remove the currently selected channel from the instrument.

10.12 SDI_DEBUG: SDI Debugger

The SDI Debugger instrument can be used to monitor the SDI-12 queue system.
The SDI Queue channel is the bit-mapped representation of the SDI-12 queue. The MSB (far LHS) indicates that a read is in progress, and the other bits represent requests for data for each SDI-12 instrument in the scheme. The SDI Data channel indicates that new data is available for that instrument.

10.12.1 Requirements

6004B, C or D Starlogger, Prologger or Micrologger data logger.

10.12.2 Configuration
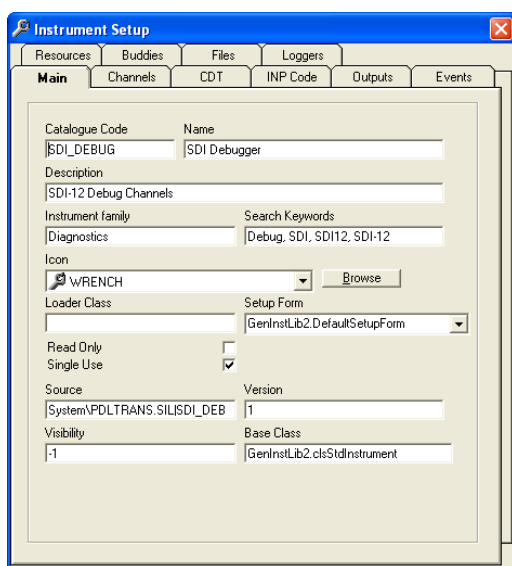
See page 65 for details on the Generic Instrument Setup Window

10.13   SITEID: Site Identifier

The site identifier instrument creates a special data channel that can be programmed with an arbitrary text string. The site ID is set after the logger has been programmed.   Open the Test Mode display, and then double-click on the "Site ID" field. Enter your site identifier and click OK.

The Site ID can be logged like any other data channel on the logger.   It can also be used to name unload files.   See *Data Options* on page 17.

10.13.1 Configuration
The only configuration option is adjusting the size of the site ID. The size does not include a trailing zero that marks the end of the ID, therefore, if you need to be able to enter, for example, an eight character identifier, the site ID will take up nine bytes of logger memory.

10.14   SMS: SMS Dialout Group Manager

The SMS Dialout Group Manager is used to send SMS messages in response to events. The instrument allows an event to be associated with a message and a group of telephone numbers. When the event occurs, the message is sent to every number in the group Different messages will require a separate dialout group for each message.

10.14.1 Requirements

An SMS capable cellular modem.
An Event is required to trigger each dial group.   See *Events* on page 38.

10.14.2 Configuration

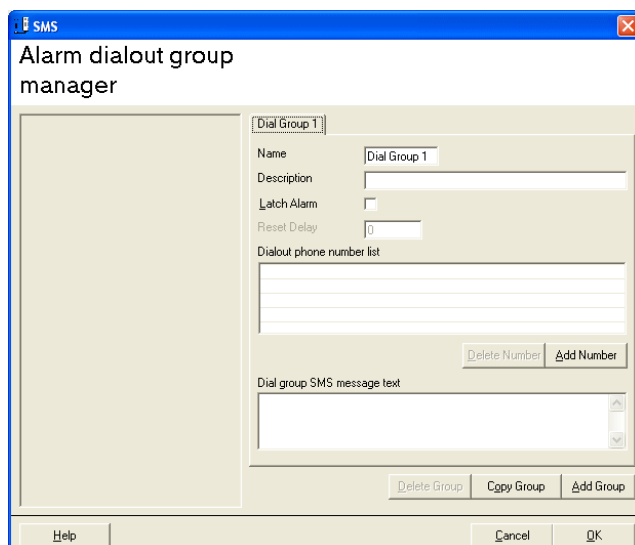Edit the SMS instrument by either double-clicking it, or right-clicking on it and selecting *Edit* from the menu. The following window will appear:

- **Name**: This is the label for the dialog tab for each group. It also appears in the Event Output selection list.
- **Description**: This is also shown in the Event Output selection list.
- **Latch Alarm**: Tick to latch the alarm. Once latched, the alarm is always sent even if the alarm condition clears on the following scan.
- **Reset Delay**: Only available when the Latch option is selected.
  It is the number of seconds to wait before allowing a re-triggering of the alarm.
- **Dialout phone number list**: This lists the telephone numbers the message will be sent to.
  - **Adding**: Click *Add Number* to add a number to the list. When adding a number you may also add a short bit of text about the number, such as a name.
  - **Editing**: Select the number in the list, and then click on it again (double-clicking won't work). After a short delay the number will become editable.
  - **Deleting**: Click *Delete* Number to remove the selected number from the list.

- **Dial group SMS message text**: This is the message that will be sent to the listed telephone numbers. There is no way to incorporate live readings or logged data into the message.

  Along the bottom of the window are buttons for managing the dial out groups:

- **Delete Group**: This will delete the currently visible group.
  It is not available when there is only one group defined.
- **Copy Group**: Click this to create a duplicate of the current group.
  It will be given the name "Copy of *Name*", where *Name* is the name of the current group.
- **Add Group**: Click this to create a new empty group.
  It will be given the name "Dial Group #", where # is a number equal to the number of groups now defined. For example, if you have two groups defined and click this button, the new group will be named "Dial Group 3".

10.14.3 Triggering a Dial Group

To trigger a dial group so it sends its message to the listed numbers, it must be added as an Output of an Event. See *Events* on page 38 for a detailed description of how to create and manage events.
When you have set up your events, make sure the event Output is set to the required SMS Alarm Dial Group:
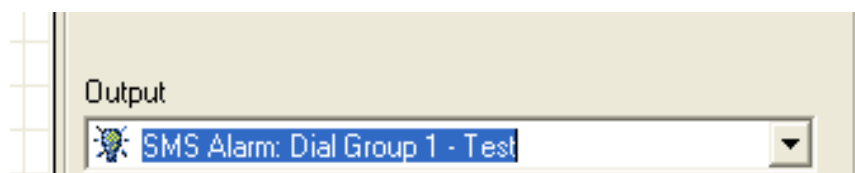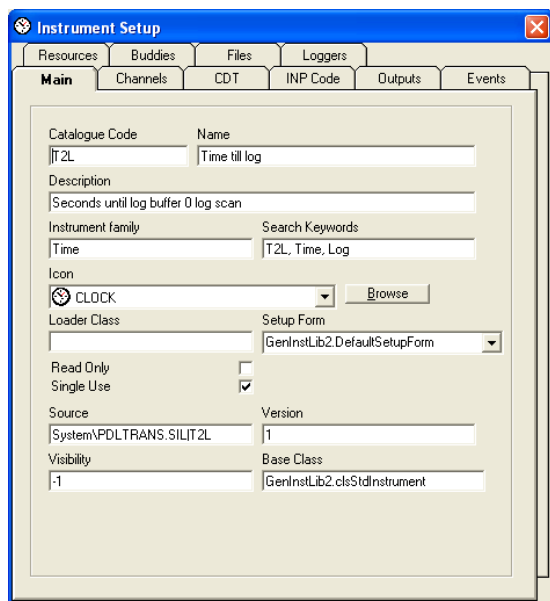
10.15   T2L: Time Till Log

The Time Till [Until] Log instrument provides a channel that contains the number of seconds until the next log interval. This is typically used to synchronize events around the log interval, for example, to switch a device on 30 seconds before the log interval to give it time to take a reading.

10.15.1 Requirements

A scheme with a fixed logging interval.
This instrument will not work correctly with event-based schemes

10.15.2 Configuration

See page 65 for details on the Generic Instrument Setup Window

10.16   WINDOW: Window Controller

The Window Controller instrument is a utility to let you switch an output on/off over several windows over the day e.g. for switching modem on for certain hours over the day. The Window instrument also requires the RELTIME instrument and will add this instrument to the scheme for you automatically.

Note that the output from the logger may need a relay or similar device to provide sufficient power to switch the required load.

10.16.1 Requirements

Spare output channel.
Additional switching (relay) for large loads.
RELTIME Instrument (see *RELTIME: Relative Time Channels* on page 72).

10.16.2 Configuration
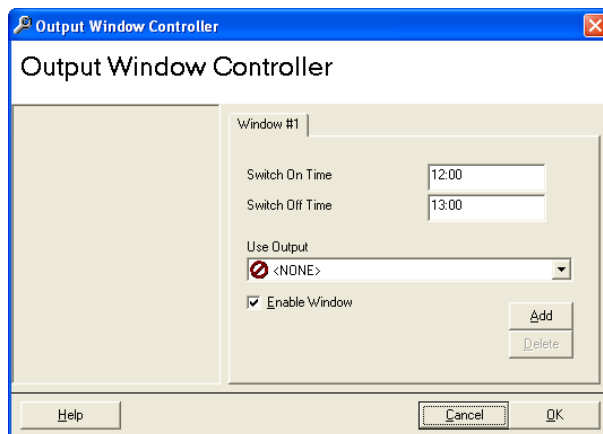
- **Window Tab**: Select the Window to edit.
- **Switch On Time**: Enter the time to switch on the selected output in 24hr time format.
- **Switch Off Time**: Enter the time to switch off the selected output in 24hr time format.
- **Use Output**: Select the output to switch On/Off.
- **Enable Window**: Select this to use the window in the scheme. Disabled windows are saved in the scheme so that you can easily re-enable them at a later date but are not included into the data logger program.
- **Add**: Click Add to add a new window to the scheme.
- **Delete**: Click on Delete to remove the selected window from the scheme.

11.0   APPENDIX A – COMMUNICATIONS VARIABLES

Communications variables are used in the scheme settings.

11.1   General Variables

Variable	Default	Description
DEFAULT	-1	When a communications profile is marked as DEFAULT = -1 then this is the default communications method used to connect to the logger.
FORCEPROMPT	[RTS]	Action to take to try to solicit a prompt from the logger. -[RTS] = toggle RTS -[nnn] = wait for time nnn in ms -[CR/LF] = send carriage/return character
MAXTESTMODECHANNELGAP	30	To speed up communications, requests to logger memory addresses that are close to each other are consolidated into a single request. How close they need to be is measured by the number of bytes specified in this setting. The default value is suitable for high-speed, low latency connections. For low-speed, high latency connections (e.g. satellite), this value could be increased.
PROMPTRETRIES	2	Number of times to wait for a prompt.
PROMPTTIMEOUT	20	Time in seconds to wait for prompt.
RECEIVEBLOCKSIZE	256 for NRT loggers 1024 for other loggers	The amount of bytes requested at a time from the logger. During unload this value is halved for each timeout to a minimum of 256 bytes.
SENDBLOCKSIZE	256	The amount of bytes sent at a time to the logger
TIMEOUT	5	Time in seconds to wait for any received communications. This timer is reset each time any new data arrives.
TYPE	RS232	The type of communications: - RS232 – Serial RS-232. - IP – Internet TCP/IP.

11.2   Type RS232 Specific Variables

Variable	Default	Description
AUTOBAUD	-1	When set to -1 (true) on receipt of an unexpected character BAUDRATE is automatically changed to try to synchronise to the correct baud rate. Expected characters are 0-9, A-F * and <CR>.
BAUDRATE	9600	RS232 serial port baud rate.
COMMPORT	1	RS232 communications port number (1 to 16).
METHOD	DIRECT	DIRECT = Connect direct to the RS232 serial port. PHONEMODEM = Connect via a phone modem on an RS232 serial port.
OUTSIDELINE		Number to dial to reach an external line. Only prefixed to phone number if PHONENUMBER doesn't start with OUTSIDELINE.
PHONENUMBER		Number for phone modem to dial to connect to remote logger.
RESET		String to send to modem to reset configuration.
SETTINGS		Settings to configure modem.
TELSWITCH		Telemetry switch number.
TERMCHAR	<CR/LF>	Set the expected termination character from a phone modem.

11.3   Type IP Specific Variables

Variable	Default	Description
ADDRESS		IP address of the remote site to connect to.
METHOD	UDP	UDP = Connect over network using UDP protocol. TCP = Connect over network using TCP/IP protocol. GPRSPROXY = Connect over network routing through the NIWA GPRS proxy server for remote cellular access.
PASSWORD		Password to access the NIWA GPRS proxy server.
PORT		Port of the remote site to connect to.
PROXYADDRESS		IP address of the NIWA GPRS proxy server.
PROXYCONNECTRETRIES	15	Number of times to check for a connection to the NIWA GPRS proxy server. The connection is checked once per second.
PROXYPORT		Port to connect to on the NIWA GPRS proxy server.
USERNAME		Username to access the NIWA GPRS proxy server.

11.4 For NRT type loggers In the ENT buffer node

Variable	Default	Description
MEMORYOFFSET	4736	Magic offset to apply to the buffer control table registers to covert absolute address to logger virtual memory address.

12.0 APPENDIX B – "SEND TO" CONTEXT MENU CONFIGURATION

This appendix details how to configure the "Send To" context menu available when viewing Data files.

Add a file named *DATAPROC.XML* to the StarlogV4 System directory (typically "*C:\Program Files\StarlogV4\System*").

An example will be used to add four menu items to the "Send To" context menu as per the picture below.
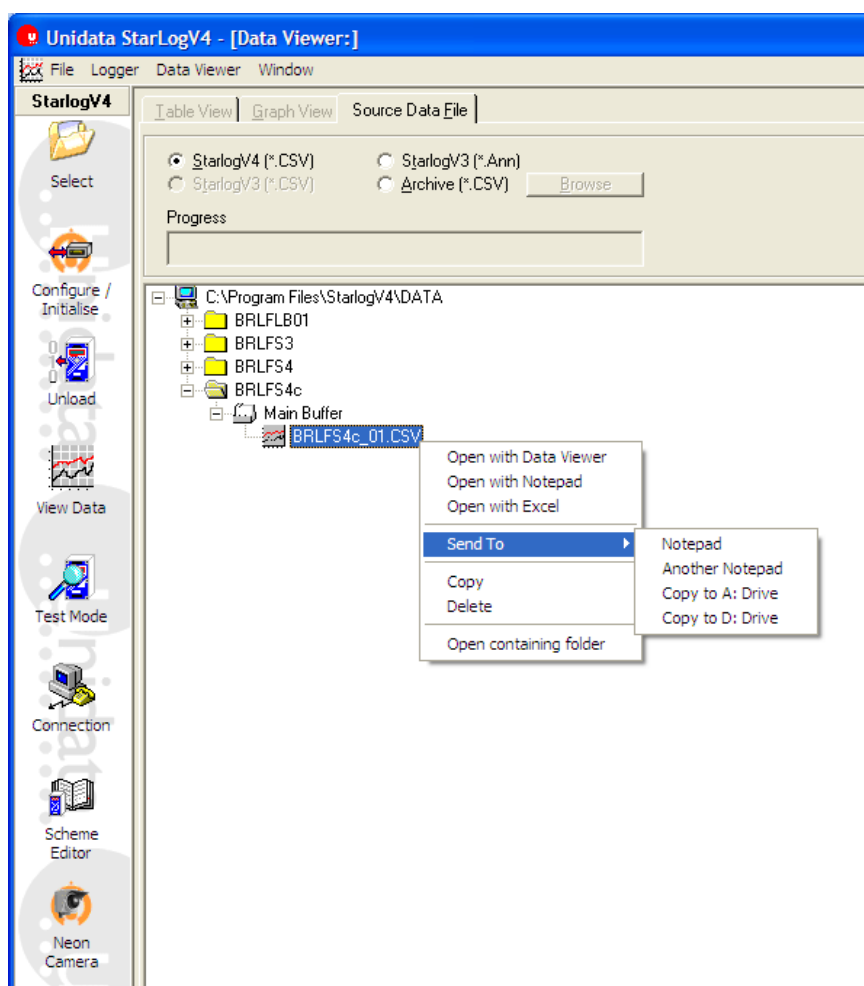
The DATAPROC.XML file must be edited to contain the following details.
[An XML file is just a text file with a .XML extension rather than the conventional .TXT extension].

Tip: One way to create the XML file is to open a text file named DATAPROC.TXT in any text editor, modify the contents as required, save the file and then rename the file to DATAPROC.XML. Otherwise any XML Editor may be used. Goggle is your friend.

```
<APPLICATIONS>
    <APPLICATION>
        <NAME>Notepad</NAME>
        <KEY>NOTEPAD</KEY>
        <PATH>C:\WINDOWS\NOTEPAD.EXE</PATH>
        <COMMANDLINE>$(DATAFILE)</COMMANDLINE>
    </APPLICATION>
    <APPLICATION>
        <NAME>Another Notepad</NAME>
        <KEY>NOTEPAD</KEY>
        <PATH>C:\WINDOWS\NOTEPAD.EXE</PATH>
        <COMMANDLINE>$(DATAFILE)</COMMANDLINE>
    </APPLICATION>
    <APPLICATION>
        <NAME>Copy to A: Drive</NAME>
        <KEY>COPY</KEY>
        <PATH>C:\copy_to_a_drive.bat</PATH>
        <COMMANDLINE>"$(DATAFILE)"</COMMANDLINE>
    </APPLICATION>
    <APPLICATION>
        <NAME>Copy to D: Drive</NAME>
        <KEY>COPY</KEY>
        <PATH>C:\copy_to_d_drive.bat</PATH>
        <COMMANDLINE>"$(DATAFILE)"</COMMANDLINE>
    </APPLICATION>
</APPLICATIONS>
```

Each <APPLICATION> node in the XML file describes one context menu item.
The <NAME> node names the item in the "Send To" context menu.
The <PATH> node tells StarlogV4 which program to call when the context menu item is clicked.
The <COMMANDLINE> node tells StarlogV4 to pass the selected file to the configured program as the first parameter.
*$(DATAFILE)*is the full path name to the selected DATA.CSV file.
The "$(DATAFILE)" entry is double quoted when calling batch files so that directory paths containing space characters are passed as one item to the called batch file.

The batch file "C:\copy_to_d_drive.bat" in the example above contains the following text.

```
echo off
copy %1 d:\
```

13.0   GLOSSARY

Term	Definition

Term	Definition
CDT	Configuration Data Table. A set of configuration values inside the logger.
Channel	An input that has been given an identifier and is able to be read and logged by the scheme program
Dump file	Originally the same as an unload file. Now more often refers to a file that contains an image of the loggers internal memory, used by Unidata engineers to provide technical support in some cases
Event	A calculation that results in a true/false answer. Based on that answer, other actions can be performed, such as switching a relay, or logging data
FTU	Originally Field Test Unit – a handheld device used to test the operation of data loggers in the field. Now used to refer to test displays on the PC that show the status of running schemes.
Input	An input into a logger. Typical inputs are analogue (voltage), digital (counter pulses, on/off states and data such as SDI-12)
Load	"Load a scheme" – the programming of a data logger with a scheme program.
Log	When the logger records data into its memory (buffer).Typically, this occurs at a fixed interval controlled by the scheme program, but can also be triggered by events to occurs at arbitrary times. The time between the fixed logging intervals is called the log interval.
Log start	Data loggers without internal sensors (excluding the internal battery and temperature sensors) reserve one pin on their input connector to detect when an instrument has been connected before starting to log, and to stop logging when the instrument is disconnected.
Logger	An electronic device that keeps a record of data. In the context of the Starlog system, this includes many instruments with a built-in logger (such as the 6526 Starflow and 6541 Water Level Instrument) as well as dedicated standalone loggers such as the Starlogger and ProLogger.
NMM	Neon Metering Module. In general, the range of Neon loggers housed in plastic enclosures
NRT	Neon Remote Terminal. In general, the range of Neon loggers housed in metal enclosures
Output	The actions taken as the result of an event. As well as typical outputs such a signal sent to control a relay, outputs can also be entirely software in nature, such as forcing some data to be recorded.
Prescale	The dividing down of counter inputs to ensure a counter value will not exceed its maximum value before being read. Prescaling allows for a greater range, but at the cost of reduced resolution.
Prescan	A brief period of time before the logger scan where the logger is able to switch on its power supplies to instruments and allow them to stabilize before the scan wakes up the logger to take readings.
Scan	When the logger "wakes up" to read (scan) all of its inputs and perform the instructions specified by the scheme program. A scan always occurs at a fixed interval specified by the scheme program at the time of programming. Once programmed, the scan rate can only be changed by reprogramming the logger with a scheme. Between scans, the logger is asleep and not performing any processing or monitoring any of its inputs, with the exception of the counter channels. The scan can be likened to the ticking of a clock; everything the logger does occurs on each tick. The time between scans is referred to as the scan interval.

Term	Definition
Scheme	The instructions programmed into the logger telling it what to log, when to log, and any other actions or processing that it is required to perform.
SDI-12	A standard that allows many instruments to be connected to a data logger via a common connection.
Sleep	The time the logger spends between scans. When asleep the logger consumes almost no power and is only monitoring its counter channels.
Sub-interval	When logging a standard average, all the values read during each scan of the log interval are used in the calculation. A sub-interval alters that by using a subset of the most recently scanned values. For example, with a 1 hour log interval, a 1 minute scan interval and a 15 minute sub-interval, only those values read in the 15 minutes before the log are used in the calculation of the average. The values read during the other 45 minutes are ignored.
Unload	"Unload a logger" – the transfer of logged data from the logger to outside storage, typically a PC, but potentially a handheld device, or an intermediate data server.
Unload file	A data file containing data unloaded from a data logger.