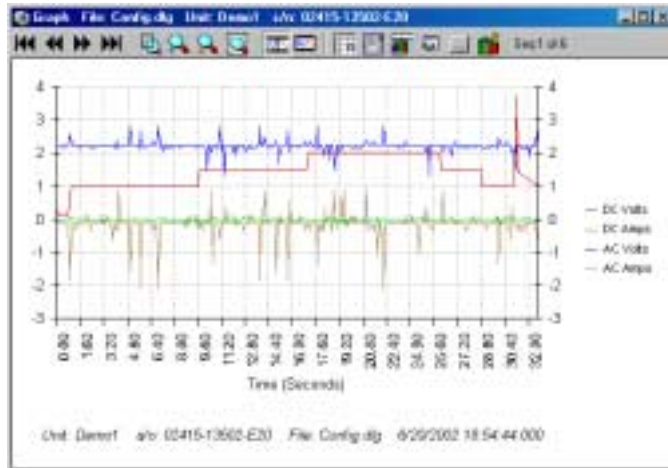


“All: Sequences Method”



Click this toggle button ‘on’ to view all recorded sequences as they were on continuous of paper. Each sequence starts right after one another, end-to-end. The x-axis values will reset and count up for each sequence. When viewing the graph this way, the next and previous sequence buttons have no effect. The Graph Start button moves to the beginning of the 1st sequence. The Graph End button moves to the end of the last sequence.

“Individual” Sequence Method



Click this toggle button ‘on’ to view each sequence individually in the graph window. The scroll bar at the bottom will scroll from the beginning of the current sequence to the end of the current sequence. If you want to view other sequences, click the next and previous buttons. This current sequence is displayed on the tool bar.

Graph “Beginning” and “End”



Click these buttons to move the graph view to the beginning of the 1st sequence, or the end of the last sequence regardless of the current graph method. If

you are viewing multiple sequences and want to move to the beginning of a particular sequence, use the scroll bar.

Graph “Next” and “Previous” Sequence



Click these buttons to move between sequences.

Zoom “In” and “Out”



Click this button to zoom in on the data by a factor of 2. The center of the graph window is the zoom point.

Open Data View (Spreadsheet)



Click this button to show the spreadsheet data view.

Create Configuration (Graph)



Use this option to open the configuration form with the parameters used to generate this data. This allows you to quickly configure a logging unit from a previous test file because all options are duplicated from the original configuration.

4.0 Feature Details

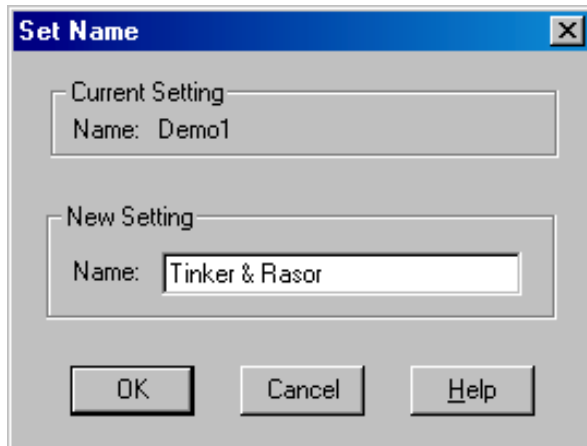
This section will discuss in detail some of the advanced features of the TRAC Configuration and Analysis software program.

4.1 Status Window

For general information about the Status Window and its function, please refer to the **Section 3.1: Operation Overview – Status Window**.

The status of the device currently connected to the communication port is displayed in the status window. (See graphic in **section 3.1, Status Window**)

A tool bar is displayed at the top of the main program window. Certain tools on the toolbar are used to communicate with devices connected to the communication port. Clicking the right mouse button while the cursor is over the status window will also bring up the menu of available communications functions.

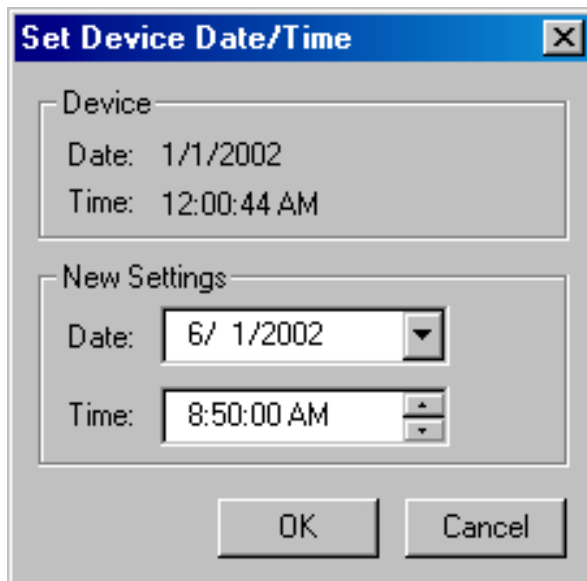


Name



The logging unit may be personalized for identification. This is especially useful when more than one DL-1 is in use for the same or similar applications. The name can have up to 15 characters and may contain any keyboard character.

The current name is listed at the top. It is also initially placed in the edit field. To change the name, just enter a new name (up to 15 characters) and then press the OK button.



Clock



The logging unit contains a real-time clock. Use this option to change the time and date.

The PC's current date and time are the default values placed in the edit fields. To synchronize the DL-1 logging unit's internal clock to the PC, just select "OK". Any other valid setting may be entered, as well. The DL-1 system is Year 2000 (Y2K) compliant.

****NOTE:** The time is in 12-hour format (AM or PM must be specified) and the date is month/day/year (2-digit year). This software recognizes the years "00" and up to be the years 2000 and up, so there is no concern for Y2K problems.

Refresh



When the program first starts up, it determines if there is a logging unit connected, and if so, it will display the status. At anytime you can press the Refresh button to get the most-up-to-date status of whichever device is connected.

Contents of the Status Window

The Status window is a direct link to the DL-1 logging unit. Information displayed here resides in memory within the logging unit, including; date and time of configuration, number and name of input channels selected, configuration parameters and available memory. If there is more information than space provided, scroll bars will appear to permit full viewing.

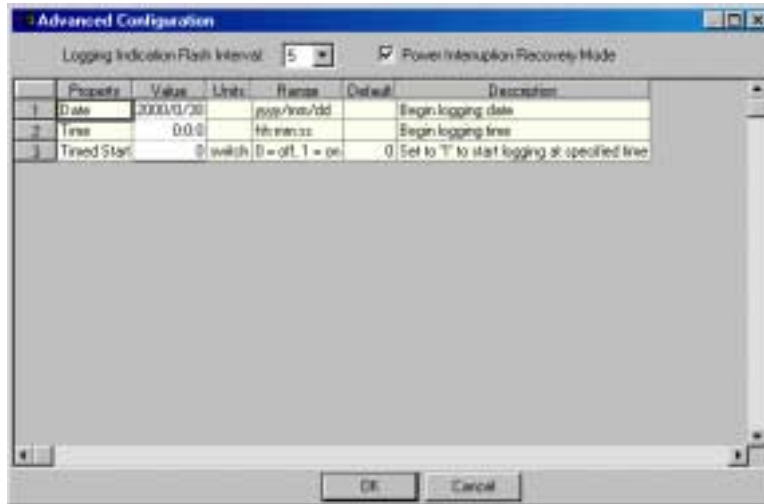
The status window is updated each time communication is established between the PC and the logging unit.

4.2 Configuration Options

Memory Use

Each analog channel requires 1 memory storage location (500,000 storage locations are available for sampled data). Selecting all 4 analog channels would use 4 storage locations each time the inputs are sampled.

Advanced Configuration Options



Advanced Configuration options are accessed from the Advanced button located in the Status section of the Configuration window.

Logging Indication Flash Interval

The Logging Indication Flash Interval is the rate at which the Light Emitting Diode (LED) indicator flashes (green) while the logging unit is in the Logging mode.

****NOTE:** Advanced options control the general operation of the logging unit, affecting battery life and behavior following power interruptions.

Theory of Operation

Typically, the LED flashes each time a sample is logged; however, if the sample interval is very fast, .05 seconds or less, the LED will stay on constantly while the logging unit is in the logging mode.

With slower sample intervals this method of indication is less useful, as minutes could pass before a flash. For this reason, a method of forcing a “logging indication flash” is provided.

For sample intervals of one (1) second or longer, the LED will flash at a rate which is the faster of the Sample Interval or the Logging Indication Flash Interval.

For example, if the sample interval is 5 minutes, and the flash interval is 10 seconds, the LED will flash every 10 seconds, even though samples are being logged at 5-minute intervals. The indication is more meaningful if it is frequently visible.

****NOTE:** If this value is “0”, the LED will not flash at all. Use this option to conserve battery power. Faster flash rates will reduce battery life. The “0” mode functions only when the sample interval is one (1) second or greater. When faster sampling is involved, memory capacity will limit run time, rather than life.

Power Interruption Recovery Mode

When this option is selected, logging will resume following a power interruption. If this option is not selected, a loss of power will terminate recording – logging will not resume when the supply voltage returns to the normal operating level.

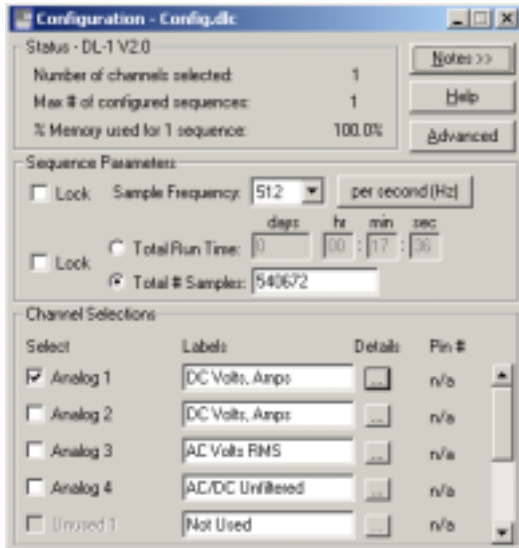
Timed Start Mode

When this option is selected, logging will start at the time and date entered. In the first field enter the year, month and day. In the second field enter the time in 24 hour format (1 P.M. = 13:00). In the third field enter “1” for the Timed Start to be enabled. Enter “0” to disable the Timed Start Mode.

****NOTE:** When the DL-1 is configured to start at a preset time, pressing the Start/Stop button will not start data logging on the DL-1. Instead when the Start/Stop button is pressed, the “Logging” LED will flash three times to indicate the DL-1 is programmed to start at a later time.

4.3 Scaling Inputs and Data

4.3.1 Channel Details



“Channel Details” are optional parameters that can be used to further customize an input channel.

Options include scaling the input voltage to engineering units, such as degrees Celsius, and defining an input or group of inputs as a “trigger”.

The Channel Label can be changed for the input channel that is currently displayed in the Channel field at the top of the window. Any change made here will be reflected in the Configuration window.

The Input Range normally will not change. Select 0 to 5 volts if you have the standard Model DL-1 logging unit. The input range is the basis for scaling calculations and it is important that the correct range is specified.

Scaling can be accomplished by applying a defined sensor “profile” to the input channel that is currently displayed in the

Channel field at the top of the Channel Details window. Once this window is displayed, any analog input channel can be scaled by first selecting an input channel and then the desired sensor to apply. Click the Scaling button to review or change scaling parameters or to define new sensor profiles. This process is described in **Section: 4.3.2: Sensors & Scaling Methods**.

Triggering parameters are set in the Trigger Setup window. Bring up this window by clicking the Triggering button. The trigger setup process is described in **Section 4.4: Triggering, Event-Based Recording**.

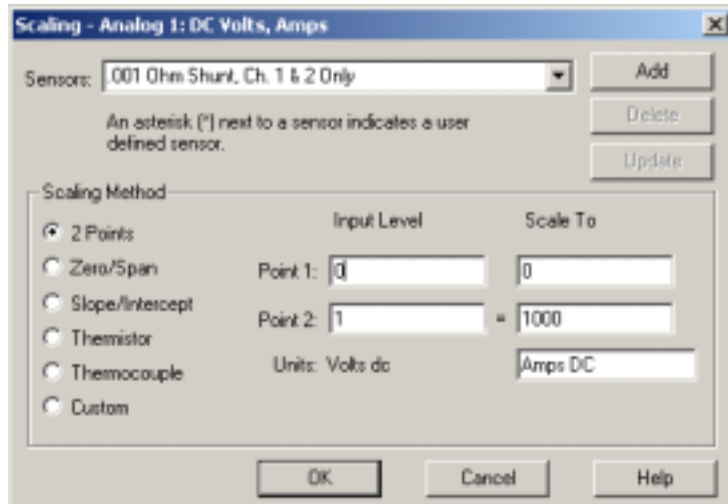
4.3.2 Sensors & Scaling Methods



****IMPORTANT:** Care should be taken in naming, modifying and deleting sensor profiles as this will affect the interpretation and presentation of preexisting data and graph files that use these sensor profiles. Sensor profiles that have been applied to input channels and indexed by unique sensor names, and changing the scale parameters provide more information related to sensor profile management.

In order to scale an input channel to engineering units, a sensor profile with the desired scale parameters must be applied to that channel. Sensor profiles are created and ‘managed’ in the Scaling window. This window, in combination with the files that store the profiles, forms a sensor profile database. This database is ‘managed’ by adding, changing or deleting sensor profiles.

A sensor name is used as a reference to identify the scaling



equations needed to support scaling an individual sensor output to meaningful units. Once you have entered an equation for scaling, you now only have to reference it by name.

Use the Scaling dialog box to define new scaling equations if the scaling equations you need are not already defined.

For convenience and brevity, sensor profiles will be referred to as “sensors”.

Two sensor types are available: 1) user-defined sensors that can be created deleted or modified, and 2) factory defined sensors that cannot be modified or deleted. User-defined

sensors are preceded by an asterisk (*) in the sensor name field, for easy identification.

A sensor cannot be added with the same name as an existing sensor. Each sensor must have a unique name, consisting of at least one different character. Though you may not be recording the input of a sensor at all, the sensor database and management convention provides a way to organize and reuse scaling profiles, trimming keystrokes from future applications.

Add a sensor by typing a unique name in the Sensors: field at the top of the Scaling window, and then click the Add button once the desired scale parameters have been entered. You may find it helpful to first select an existing sensor that is similar to the desired new sensor. You should then change the name in the sensor field before modifying scale parameters so that you don’t accidentally “update” the original sensor. However, this will not occur unless you click on the Update button, specifically.

Delete a sensor by making it the currently selected sensor in the Sensors: field, and then click the Delete button.

Modify a sensor by making it the currently selected sensor in the Sensor: field. Then, change the scale parameters as needed, and click the Update button.

2 Points Scaling Method

To define a scale using the 2-point method, you may use any 2 known values for converting the input signal (volts) to the desired engineering units (i.e. degrees Celsius). You will get the best results by using the 2 known values that are closest to the Input Range extremes (0 to 5 volts for the standard Model DL-1 logging unit).

Zero-Span Scaling Method

Many sensors are shipped from the manufacturer with scaling information provided in the form of a Zero and a Span value. To use this method, select Zero-Span and fill in the fields accordingly.

Slope/Intercept

Signal or Sensor characteristics may be understood in the form of a line equation, $y=mx + b$, where ‘m’ is the Slope and ‘b’ is the Intercept. Choose Slope/Intercept to use this method of scaling.

Sensor Database

Sensor database files have the “.sen” extension and are located in the same directory as the Tinker & Rasor TRAC software. Care should be taken so that these files are not damaged or deleted. If you perform regular backups to protect information on your computer you should include these files, but make sure that you are always using the latest version.

4.4 Triggering, Event-Based Recording

Enable Trigger

Other than using the Start/Stop button on the logging unit, you can use the trigger mode, causing a recording sequence to begin when a specific “event” occurs. To use this event-based recording mode, click in the Enable Trigger checkbox.

Analog

The Analog option allows you to trigger recording when an analog input exceeds a specified threshold. In addition, you can specify the trigger to occur when the signal is increasing or decreasing when it crosses the threshold. Behavior is similar to the trigger feature of most oscilloscopes.

Single Sequence/Repetitive

Select Single Sequence to record only at the first occurrence of the event. Use repetitive triggering to record every time the event occurs, indefinitely or until memory is full.

Each trigger method requires that the trigger is first “cocked”. That is, in order for the trigger condition occur, the inputs must first be in a state other than the trigger condition. In order to trigger when a state match occurs, the inputs must first be in a non-matching state - specifically, for at a time period of at least 1 millisecond (0.001 second). This is partly to avoid Repetitive Triggering during the same “event”. To trigger when an analog input rises above 1 volt, it must first be below 1 volt.

Trigger Channel

The Trigger Channel does not have to be input that is selected for recording. Select any channel to be the trigger input.

Sensor

The trigger input can be scaled. Use a sensor from the sensor database to define the scale and then specify the threshold in terms of the scale for that sensor. If a compatible sensor is not available, the sensor must first be created. This can be done from within the Channel Details box. You can get the Channel Details box from the Configuration window. The Sensor field only applies with the Analog trigger method.

Threshold

Specify the desired threshold for the trigger event to occur. The valid range and units are displayed to the right of this field. The Threshold field only applies to analog trigger methods.

Low to High, High to Low

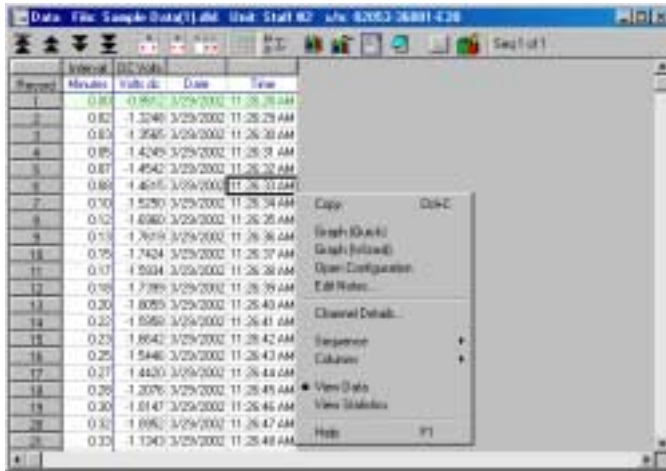
Select the polarity of the trigger event here. This parameter does not apply to State triggering.

4.5 Spreadsheet View Features

For general information on using the Spreadsheet View, please refer to **Section 3.5: Spreadsheet Data View**. Additional features are described here that relate to formatting, analyzing, printing and exporting of spreadsheet data.

All options are available on the right mouse menu and also on the main menu bar under Options | Data. Position the mouse over the spreadsheet, click the right mouse button and the menu will appear. (As shown below)

4.5.1 Scaling Spreadsheet Data



Data records that appear in the Spreadsheet window can be scaled in the same way as the logging unit input channels are scaled prior to recording data. Each column of data is treated as a “channel” and scaled as described in **Section 4.3: Scaling Inputs & Data**. The Channel Details window contains only the fields that apply to the Spreadsheet View, but has a similar format as when selected from the Configuration window.

4.5.2 Spreadsheet Statistics

A statistical summary of data recorded from each input channel is displayed at the bottom of the spreadsheet. The statistical quantities include: Minimum, Maximum, Average (Mean), Standard Deviation-Sample, and Standard Deviation-

Population. The statistical summary applies to all data in the current “sheet” for the associated channel column.

4.5.3 Printing Spreadsheet Data

Highlight the desired cells, and select File | Print...from the menu bar. Additional options are available for printing the entire spreadsheet, in color, border, and gridlines and for setting page margins. Printing the entire spreadsheet includes the statistical summary and the channel names and labels.

4.5.4 Exporting Spreadsheet Data

Data can be exported using either of two methods:

Method 1 – Copy Directly to Another Program

Highlight the desired cells, and select Edit | Copy from the menu bar or Copy from the right mouse button pop-up menu (or Control C). In the application to which the information is to be copied, select Paste from the edit menu (or Control V).

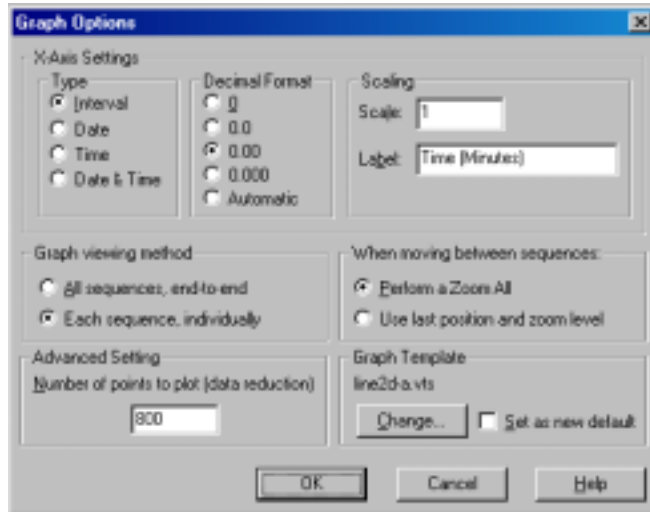
****NOTE:** The entire spreadsheet can be highlighted by clicking in the top left cell in the spreadsheet (just to the left of the “Interval” label). The statistical summary is included when you do this, as are all of the channel names and labels.

Method 2 – Export as an ACSII File

Select File | Save As...from the menu bar. In the File Type field, choose *.txt. Enter a file name with a “.txt” extension and click on “OK”. Select a column delimiter – Comma, Space or Tab.

4.6 Graph View Features

For general information on using the Graph View, please refer to **Section 3.6: Graph Data View**. Additional features are described here that relate to formatting, analyzing, printing and exporting of graph data.

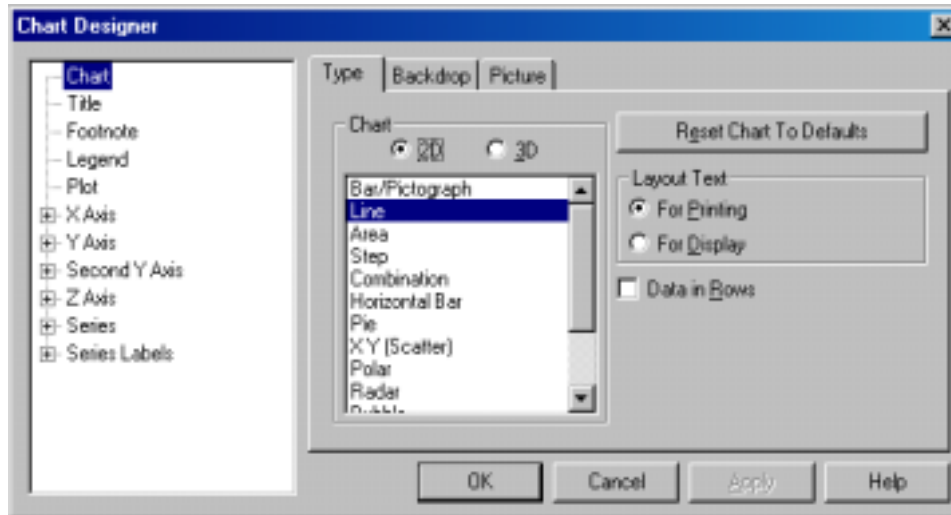


****NOTE:** The graph view offers presentation quality output for copying and printing – in color or black ink – but can be significantly degraded by the limited resolution of most monitors and graphics controllers. Though the display may look poor, especially when viewing 3D graphs, the print should be crisp.

Selected, commonly used features are described in this section, but many powerful presentation features are available and can be discovered by exploring the options with a real data file. All formatting options are available on the right mouse menu (click the right mouse button and the menu will appear) and also on the main menu bar under Graph | Options. Several features are worth noting, such as 3D plotting and rotating, placing images on a graph, adding background colors and gradients.

****Tip:** To rotate a 3D graph, hold down Control+Shift, click the left mouse button wherever you want a “handle” on the graph, and then drag the mouse.

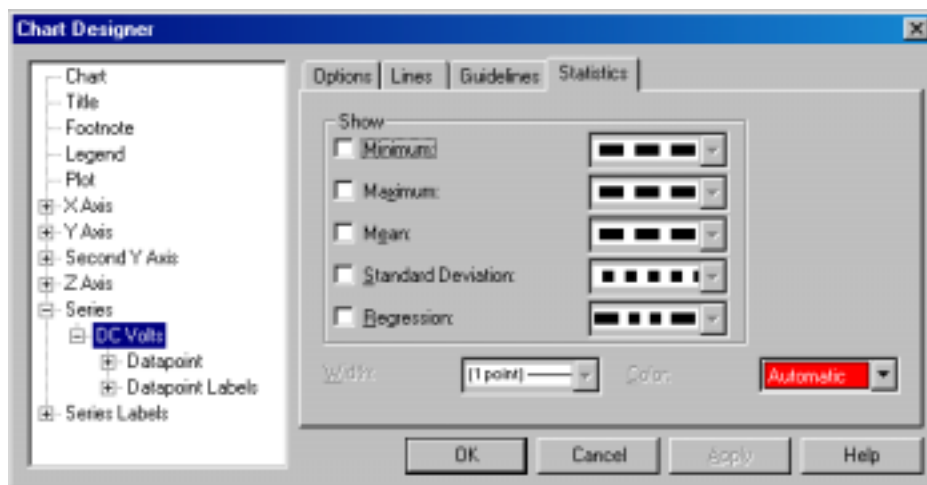
4.6.1 Scaling Graph Data



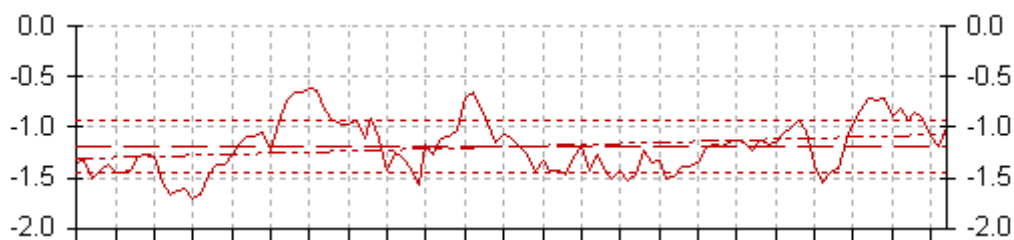
Data records that appear in the graph window can be scaled in the same way as the logging unit input channels are scaled prior to recording data. Each data series is treated as a “channel” and scaled as described in **Section 4.3: Scaling Inputs & Data**. The Channel Details window contains only the fields that apply to the Graph View, but has a similar format as when selected from the Configuration window.

4.6.2 Graph Statistics

A graphic representation of a statistical summary can be applied to any data series, or “channel”. The statistical quantities available are: Minimum, Maximum, Mean (Average), Standard Deviation and Regression (“best-fit” linear approximation). These statistical quantities apply to the data that is currently in view.



The Statistics options can be accessed by double clicking on the data series for which you want to apply the statistic formula, or by clicking the right mouse button and selecting Series, Series Type, and the desired channel (series) name. The Statistics tab will then be available, as shown in the dialog box above. The result of Minimum, Maximum and Mean applied to a data series is shown in the graph below represented by dotted and dashed lines.



4.6.3 Printing Graphs

Make sure the graph window is active and select File | Print... from the menu bar. Options are available on the Print dialog box for: 1) layout, and 2) fitting the graph to the paper. The default options have been set to those that are most widely used, and generally give good results.

****Tip:** Do not resize the ‘plot’ area of the graph by dragging the mouse. This indicates a manual “fix” of the graph size and disables optimal scaling of the graph to the printer page size. If you wish to enlarge the graph for viewing on the screen, try maximizing the graph window first.

Additional options are available for centering the graph on the printer page and setting page margins.

4.6.4 Exporting Graphs

Graphs can be exported using either of two methods:

Method 1 – Copy Directly to Another Program

Make sure the graph window is active, and select Edit | Copy from the menu bar or Copy from the right mouse button pop-up menu (or Control C). In the application to which the information is to be copied, select Paste from the edit menu (or Control V).

****NOTE:** Many programs offer options for pasting, usually if you select Edit | Paste Special... in the target program before pasting. The TRAC program exports the graph in three formats that may be used by another program; Metafile, Bitmap and JPEG. The metafile is generally preferred when you wish to be able to resize the image and retain high quality fonts and graphic components, since it is vector-based. Bitmaps allow for editing images at the pixel level, and can

be used in programs that do not accept vector-based images. JPEG format is useful for images that will be placed on the web or e-mailed.

Method 2 – Save as an Image File

Select File | Save As... from the menu bar. In the File Type field, choose Metafile, Bitmap or JPEG. Enter a file name with the appropriate extension and click on “OK”.

4.6.5 Formatting Graphs

Graph objects (axis scale, data series, footnote, and titles) can be formatted by double clicking on the object. Some useful, but not so obvious, features and methods are described here to get you started.

Format Chart Options

Position the mouse over the graph window and click the right button. Select Chart Designer. Options include the display format for the title, footnote, legend and second Y-axis on the current chart. From tree view in the left panel of this dialog you can also format any other feature of the chart.

Plot On 2nd Y-Axis

When viewing more than one data series and the magnitude of the scaled data differs greatly, one signal may be “in the dirt” or out of view, depending on how the Y-axis is scaled. It may be helpful to plot one or more data series on the 2nd Y-axis, so that two scales can be used. To do this, double-click on any data series to pop up the Chart Designer with the Options tab selected for that particular data series. Then select Plot on 2nd Y-Axis.

Format Axis/Scale

To change the scale of an axis, double-click on the axis to pop up the Chart Designer with the Scale tab selected for that particular axis.

5.0 DL-1 Data Logger Unit Operation

The panel of the logging unit includes a color legend for the two-color LED display. As seen below, this legend describes the operating mode associated with each color displayed by the LED. A flashing display is differentiated from a solid color.



OFF

No display – the logging unit is currently idle. This is the state the DL-1 should be in when connected to a computer.

START

Green, momentary – a logging sequence has been initiated from the “Start/Stop” button on the panel.