TriLink

User Guide

Second Edition

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Contents

Introduction

TriLink™ is an Industrial wireless data logger from Fourier Systems, leveraging cutting edge wireless data logging for stand alone or field monitoring. TriLink has gone one step further from Fourier's RF wireless range of data loggers by integrating Bluetooth wireless technology. TriLink can communicate with all types of current and future Bluetooth enabled PocketPCs and PCs.

The TriLink is ideal for indoor mobility, for instance inside the office or factory floor, and outdoor data logging. Data can be turned into graph form, analyzed as well as exported to spreadsheets - all in the palm of the hand. Based on existing Fourier technologies, the TriLink carries all the same benefits plus more: wireless communication, 12-bit resolution and 256 K sample memory.

The TriLink's four inputs can connect to 4-20 mA and 0-5 V sensors as well as temperature and humidity probes. Using splitter cables you can record data from up to 8 sensors simultaneously. The TriLink is capable of recording at rates of up to 20,800 samples per second, and of collecting up to 170,000 samples in its internal memory.

TriLink is the ultimate multi-platform data logger, allowing both field and stand alone operation. TriLink is equipped with a simple keypad and LCD display. TriLink can connect via USB cable to a PC or via Bluetooth to a PC or PocketPC with Fourier's DaqLab analysis software.

A rechargeable battery powers the data logger, which automatically switches to standby mode 5 minutes after the time of the last data recording, the last button was pressed, or the last communication was made with the PC. While on standby, TriLink switches to a low-power state whereby the electronic circuitry and the display are turned off, using less power.

The TriLink system also comes with the powerful DaqLab for desktop computers software. When the TriLink is connected to a PC, live displays can be viewed at rates of up to 100/s, and automatic downloads can be carried out at higher rates. DaqLab can display the data in graphs, tables or meters, and can analyze data with various mathematical tools.

Chapter 1
TriLink

1.1. General

1.1.1. TriLink: Basic System Contents

1. The TriLink data logger
2. Sensors (see your package list)
3. USB communication cable
4. DaqLab software installation CD
5. An AC-DC adaptor
6. Carrying case

1.1.2. External Connections

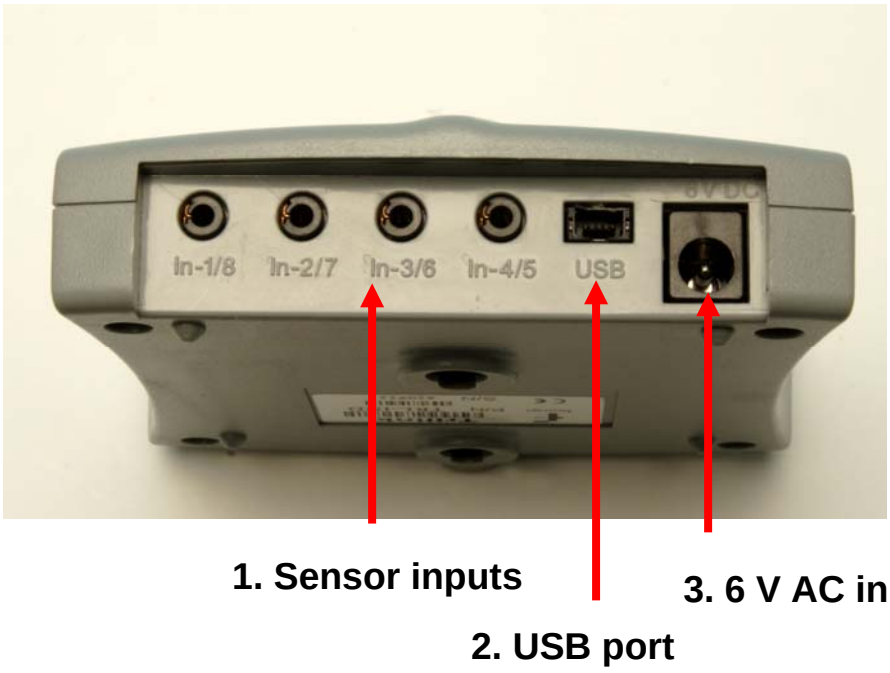


Figure 1: TriLink external connections

1. Sensor input (In) sockets marked In-1/8, In-2/7, In-3/6 and In-4/5: These sockets are used to connect the sensors. Normally, all four sockets can be used simultaneously.

   To connect a sensor to the TriLink use one of the sensor cables. Plug the stereo plug into the data logger, and the mini-din plug into the sensor - arrow facing down.

   In order to connect more than 4 sensors at a time, use the splitter cables, which will enable the connection of up to 8 sensors simultaneously. When a splitter

cable is connected, it must be connected to the socket in the correct numerical order (e.g. for 5 sensors, connect the splitter cable to In-4/5). One of the two splitter cables is marked with **P1** - that is the main input (the lower input number), the second line is marked with **P2** - indicating that it is the secondary input (the higher input number). Connect up to four input splitters (DT225) to split the TriLink's inputs starting with In-4 (the splitters **must** be connected in order):

In-4 splits into In-4 and In-5

In-3 splits into In-3 and In-6

In-2 splits into In-2 and In-7

In-1 splits into In-1 and In-8

2. PC USB communication socket: Connect the mini USB plug of the USB communication cable to the TriLink and the USB Type A plug to the computer's USB port.
3. External DC power supply socket: Plug in an AC/DC 6V adaptor whenever you want to save battery power, or to charge the battery when necessary. Connecting external power to the TriLink automatically charges the internal battery. The adaptor should meet the required specifications (see section 1.1.4).

1.1.3. Battery

TriLink is equipped with a 2.4 V/750 mAh NiMH rechargeable battery. Before you start working with TriLink for the first time, charge the unit for 10 to 12 hours while it is turned off.

The battery lifetime is about 8 hours of continuous work.

If the data logger's main battery runs out, the internal 3V Lithium battery backs up the memory, so no data will be lost.

Note: Battery shelf charge life is about 100 hours. To maximize battery shelf charge life, always disconnect sensors when not in use. Disconnect TriLink from the computer when not in use. You can continue to operate TriLink by plugging it into the wall.

1.1.4. AC/DC Adaptor

- Output: Capacitor filtered 6 VDC, 300 mA
- Female plug, center negative

1.1.5. Automatic Standby

TriLink switches automatically to standby mode after 5 minutes have passed since the time of the last data recording, the last button was pressed, or the last communication was made with the PC.

While on standby, TriLink switches to a low-power state where the electronic circuitry and the display are turned off and TriLink uses less power.

1.2. Stand-alone Operation

Programming TriLink is done via the DaqLab software. TriLink will save the setup parameters until the next time you program it. The keypad allows you to begin and stop data collection, while the LCD screen displays the recorded values or TriLink's status.

1.2.1. Front Panel Layout

Figure 2: TriLink front panel

1.2.2. Quick-Start

Before you first use TriLink, charge the unit for 10 to 12 hours while it is turned off.

1. Turn on TriLink

Press the **On/Off** button. You will see the initialization screen. TriLink performs a brief self-check and momentarily displays its version number and battery level, then its name and then the display will be changed to show the current status.

2. Plug in the sensors

Start with the first input I/O-1 on the left of the logger.

Note: Sensors must be added successively, starting with Input 1. If a single sensor is used it must be connected to In-1. If two sensors are used, they must be connected to In-1 and In-2.

3. Select setup

In DaqLab, go to **Logger > Setup** or click the Setup icon in the tool bar. Select the sensor you have connected to Input 1.

Follow the Setup process to select the sampling rate and sample size for the test you need to perform. Click **Finish**.

4. Start recording

Press the **Run/Stop** button to start recording.

TriLink will use the stored setup parameters to collect data.

The LCD screen will display:

```
Logging
```

At rates of up to 10 samples per second TriLink displays the recorded data values.

You can stop recording any time by pressing the **Run/Stop** button a second time. Otherwise logging will stop after the selected number of samples where taken. The LCD screen will display the number of the experiment in TriLink's memory:

```
_ _ _ LOGGER – RUN _ _ _
Log  01 ended
```

1.2.3. Internal Clock and Calendar

The internal clock is set the first time you use the **Setup** command from the DaqLab software to program the TriLink, and is automatically updated to the PC's time and date each time you connect your TriLink to a PC (or PocketPC).

The internal clock and calendar is kept updated even when the TriLink is turned off, but it will be erased if the 2.4 V battery is dead. It will be updated the next time TriLink will be connected to a computer.

1.2.4. Clear the Memory

TriLink automatically checks the available memory before it begins the recording. If there is not enough memory you will see this message on the display:

```
_ _ _ LOGGER-RUN _ _ _
Clear = (Run)
```

Press the **Run/Stop** button to clear the memory and begin recording.

1.2.5. Choose the Right Setup

1. Sampling rate

The sampling rate should be determined by the frequency of the phenomenon being sampled. If the phenomenon is periodic, sample at a rate of at least twice the expected frequency. For example, sound recordings should be sampled at the highest sampling rate – 20,800/sec, but changes in room temperature can be measured at slower rates such as once per second or even slower, depending on the speed of the expected changes. *There is no such thing as over-sampling*. For extremely smooth graphs, the sampling rate should be about 20 times the expected frequency.

Note: Sampling at a rate slower than the expected rate can cause *frequency aliasing*. In such a case, the graph will show a frequency much lower than expected. In Figure 3 below, the higher frequency sine wave was sampled at 1/3 of its frequency. Connecting the sampled points yielded a graph with a lower, incorrect frequency.

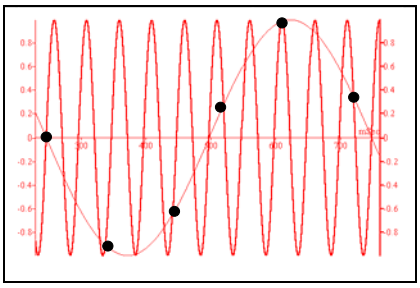


Figure 3: Frequency Aliasing

2. Sampling points

After you have chosen the sampling rate, choosing the number of points will determine the logging period: Samples / Rate = Logging time. You can also choose the duration of an experiment first, and then calculate the number of samples: Samples = Logging time × Rate.

Continuous

In the Continuous mode, TriLink does not save data, and can continue logging indefinitely.

If TriLink is connected to the PC and the DaqLab software is running, the data is automatically transferred to the computer and displayed in a real-time graph.

To operate in Continuous mode select **RATE** equal to or less than 100/s and **SAMPLES = Continuous**.

1.2.6. Programming Rules and Limitations

The following are some rules and limitations you must take into account when programming the TriLink, as TriLink integrates all programming limitations automatically. TriLink will only allow the programming of settings that comply with the rules below.

1. Sampling points:

- Increasing the number of active inputs limits the number of sampling points one can choose. The following condition must be always satisfied: Samples × Active Inputs < Memory.
- TriLink's memory is sufficient for 170,000 samples.
- When sampling at rates faster than 100 samples per second the memory can store only four experiments of 32,000 samples each.
- When sampling at rates of 100 samples per second or less, selecting **Maximum** sampling points will create up to four successive files of 42,000 points each (a total of 170,000 points), depending on the available memory.

2. Sampling rate:

The number of sensors in use limits the maximum sampling rate:

Number of sensors	Maximum sampling rate	Resolution
1 sensor	20,800 samples per second	10 bit
1 sensor	11,200 samples per second	12 bit
2 sensors	3,400 samples per second	12 bit
3 sensors	2,500 samples per second	12 bit
4 sensors	1,900 samples per second	12 bit
5 sensors	1,600 samples per second	12 bit
6 sensors	1,400 samples per second	12 bit
7 sensors	1,200 samples per second	12 bit
8 sensors	1,050 samples per second	12 bit

3. Continuous sampling

- Continuous sampling is possible up to a maximum sampling rate of 100/s.

Chapter 2 Working with Pocket PC and DaqLab

2.1. Installing the Software

2.1.1. System Requirements

To work with DaqLab on your Pocket PC via Bluetooth, ensure your PocketPC is running either:

- Pocket PC 2003

or

- Windows Mobile 5

2.1.2. Installation

1. Insert the DaqLab CD into your CD drive.
2. Navigate to the relevant Pocket PC folder located on the CD – PocketPC 2003 or Windows Mobile 5 - and double click the Setup icon.
3. Follow the on-screen instructions to install the DaqLab for Pocket PC application on your handheld device.

2.2. Overview

2.2.1. DaqLab for Pocket PC Layout

The DaqLab for Pocket PC application is designed to support seven major kinds of activities:

- Establishing wireless communication with TriLink
- Setting up TriLink
- Collecting and displaying online data
- Downloading stored data from TriLink
- Displaying the data in graphs, tables and meters
- Analyzing the data
- Exporting data to a desktop computer or the another Pocket PC device

Every time you start a new experiment, DaqLab automatically creates a new project file. All the information you collect and process for a given experiment is stored in a single project file. Each of these files contains all the data sets you collected with the TriLink, the analysis functions you've processed, and the DaqLab settings for the experiment.

Note: All data sets in a single project must be with the same sampling rate.

2.2.2. DaqLab for Pocket PC Window Layout

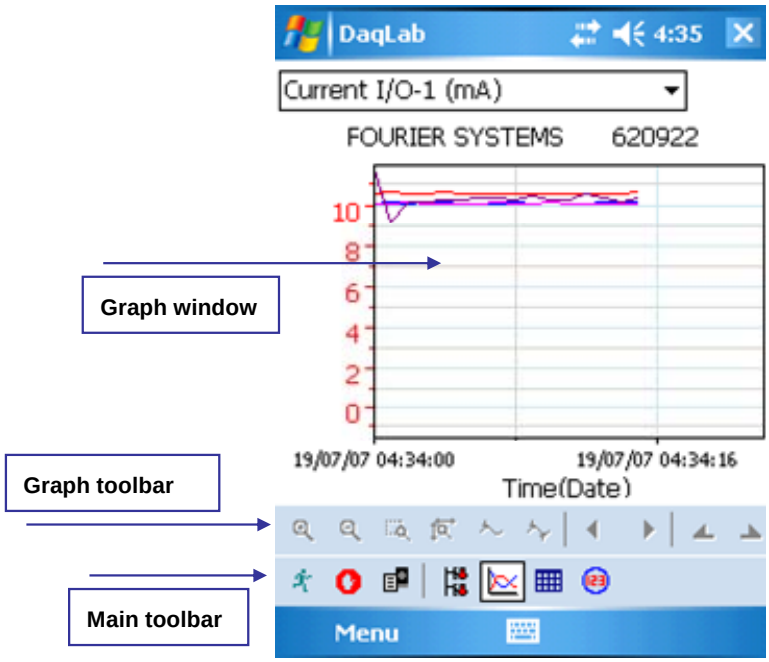


Figure 4: Main DaqLab PocketPC window

2.3. Establishing Wireless Communication

TriLink uses Bluetooth wireless technology to connect to your Pocket PC. To avoid interference between several devices TriLink employs a procedure called *pairing*[1] that allows any Pocket PC to communicate with only one specific TriLink.

Every TriLink has a unique *name*. The pairing process tells the Pocket PC to address only a specific *name*.

Before you work with TriLink and a Pocket PC you have to perform this pairing procedure. DaqLab stores the TriLink's address and will automatically connect to this specific TriLink every time you open DaqLab.

You can always repeat the pairing process if you want to connect to another TriLink.

Make sure no USB cable is connected. DaqLab will not establish Bluetooth connection while the USB cable is connected even if the pairing process was successful.

1. Pairing your Pocket PC with a TriLink

1. Turn on TriLink: Push the **On/Off** button on the TriLink front panel.
2. Open the DaqLab application:
   a) Navigate to the Programs folder.
   b) Tap the DaqLab icon.
3. Tap **Logger** on the menu bar, and then tap **Comm Setup**.

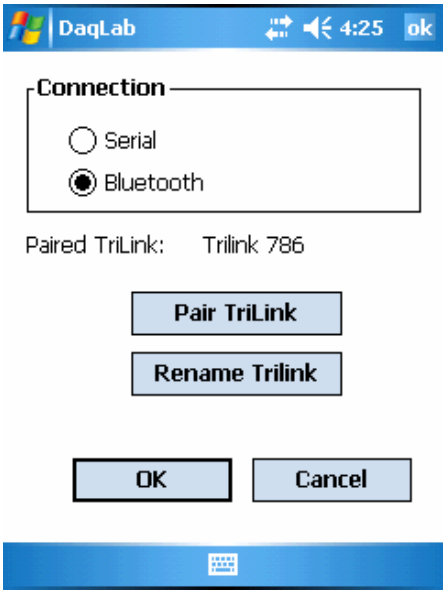


Figure 5: Bluetooth comm setup dialog

[1] Pairing (or bonding) is a concept introduced to create a first time recognition of what devices are allowed to communicate with each other or which devices belong together. Devices can usually not establish a communication session without a first time pairing.

4. Select the **Bluetooth** option in the **Connection** section, and then tap **Pair TriLink**.

5. Enter your password (the default password is 1234).

6. Tap **OK**.

DaqLab searches for Bluetooth devices and displays a list with all the devices that were found.

7. Tap the name of the TriLink you want to connect to, and then tap **Pair**.

Note: TriLink briefly displays its name when switched on.

After pairing is complete DaqLab displays the name of the paired TriLink.

8. Tap **OK**.

You are now ready to begin data logging.

From now on DaqLab will automatically connect to the paired TriLink.

2. Renaming TriLink

1. Tap **Logger** on the menu bar, and then tap **Comm Setup**.

2. Select the **Bluetooth** option in the **Connection** section, and then tap **Rename TriLink**.

3. Enter your password (the default password is 1234).

4. Tap **OK**.

5. Enter the new name, then tap **OK**

Note: The name can include up to 15 characters.

DaqLab will display the new name. You can always return to the factory name by tapping **Reset TriLink Name**.

3. Changing the password

1. Tap **Logger** on the menu bar, and then tap **Comm Setup**.

2. Select the **Bluetooth** option in the **Connection** section, and then tap either **Rename TriLink** or **Pair TriLink**.

3. Enter the current password (the default password is 1234), and then tap **Change Password**.

4. Enter a new password in the **New password** edit box.

5. Confirm the new password in the **Confirm password** edit box.

6. Tap **OK**.

2.4. Getting Started

2.4.1. Set up a Recording Session

1. Turn on TriLink

Push the **On/Off** button on the TriLink front panel.

2. Connect the sensors you want to use

See page 8 for external connections.

3. Open DaqLab application

1. Navigate to the Programs folder.
2. Tap the DaqLab icon to launch the application.

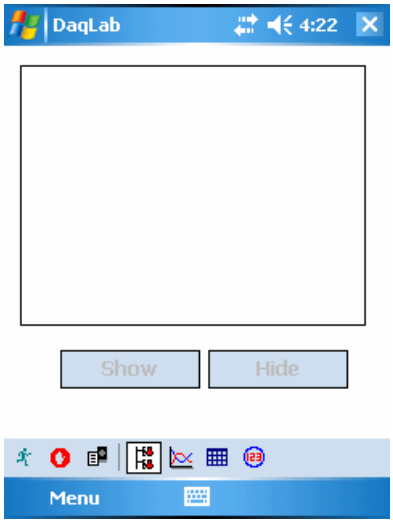


Figure 6: DaqLab main window

4. Set up TriLink

1. Tap **Setup** on the main toolbar.

DaqLab searches for a TriLink device, and then displays the Setup dialog:

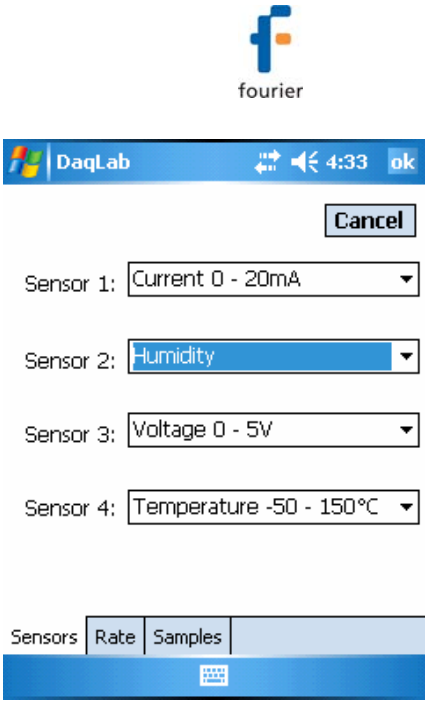


Figure 7: Setup: Selecting sensors

Note: If DaqLab does not find a TriLink, it prompts to a message saying that TriLink was not found. Make sure that the TriLink is on. If no TriLink is connected you can still work offline and open stored data files.

2. Tap the **Rate** tab and select number of samples per time unit from the Rate drop-down menu.

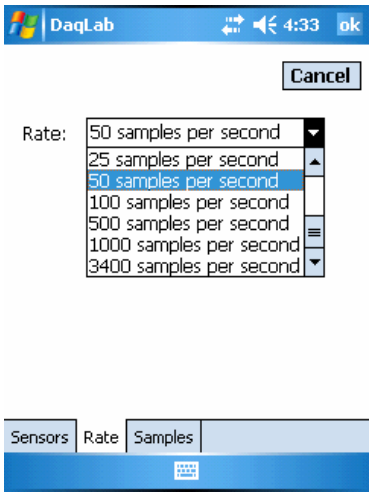


Figure 8: Setup: Selecting sampling rate

3. Tap the **Samples** tab and select the total number of samples from the Samples drop-down menu.

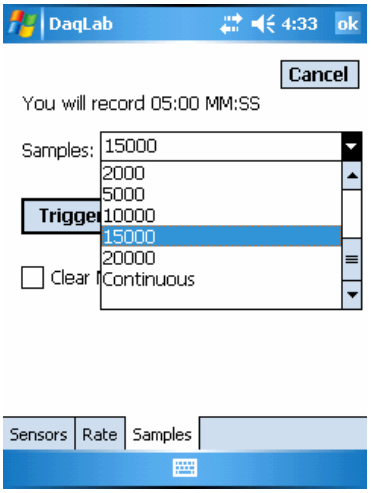


Figure 9: Setup: Selecting sample size

4. Tap **OK**.

5. Select display

Tap a display on the main toolbar:

Graph, **Table** or **Meter**

Note: If you begin collecting data from the opening screen DaqLab prompts to Graph view.

6. Start collecting data

Tap **Run** on the main toolbar.

If the recording rate is 25 measurements per second or less, DaqLab displays the data in real-time, plotting it on the graph as it is being recorded. If the recording rate is higher than 25/s, the data will be downloaded and displayed automatically, once the data recording is finished.

You can stop recording anytime by tapping **Stop** on the main toolbar.

2.4.2. Download Data

Whenever data is received from the TriLink, it is accumulated and displayed automatically by DaqLab. There are two modes of communication: Online and Post-session.

Online communication

When TriLink is connected to the Pocket PC and programmed to run at sampling rates of up to 25/s, TriLink transmits each data sample immediately, as it is recorded, to the Pocket PC. The software thus displays the data in real-time in both the Graph and Table window.

When TriLink is connected to the Pocket PC and programmed to run at a sampling rate of 50/s or higher, data is accumulated in TriLink‘s internal memory. This data is not transmitted to the Pocket PC until the recording period has ended, when the data is automatically downloaded to the Pocket PC and displayed.

Offline data logging

To download data that was recorded offline, or while TriLink was not connected to a Pocket PC device, connect TriLink to the Pocket PC, run DaqLab, tap the menu bar, tap **Logger**, and tap **Download**. This will initiate the Post-session Data Transfer communication mode. Once the transfer is complete, the data will be displayed automatically in the Graph window and in the Table window. If there are several experiments stored in the TriLink, the first download will bring up the most recent experiment; the second download will bring up the first (oldest) experiment, the third download will bring up the second experiment, and so on.

To download a particular experiment, choose **Selective download** from the **Logger** menu, then select the experiment's number in the Download dialog box.

2.4.3. Save Data

To save your project tap the menu bar, tap **Tools** on the menu bar, then tap **Save File**. This will save all the data sets under one project file.

If you made any changes to a previously saved project, tap **Save** to update the saved file or tap **Save as** to save it under another name.

2.4.4. Open a File

1. Tap **Tools** on the menu bar, and then tap **Open File**.
2. Tap the file name to open the project.

DaqLab opens the project and in the Data Map view. Use the Data Map to display the desired data set.

2.4.5. Create a New Project

There are two ways to create a new project:

1. Open the DaqLab program, which will open a new file each time.
2. Tap **Tools** on the menu bar, and then tap **Clear All**.

2.5. View the Data

2.5.1. Display Options

DaqLab features four views. Three views to display data: Graph view, Table view and Meter view. The fourth view, the Data Map enables you to navigate through the available data sets.

To switch to a certain view tap the corresponding tool on the main tool bar:

– Data Map
– Graph view
– Table view
– Meter view

2.5.2. Data Map

The Data Map displays the list of data sets that were recorded or downloaded in the current session, as well as the lists of all the processed data sets.

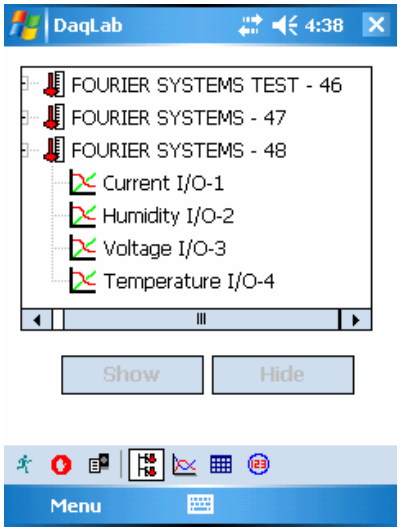


Figure 10: Data Map

To display the complete list of sensors for any individual experiment, tap the plus sign (+) next to it.

To collapse a list under an individual experiment, tap the minus sign (-) next to it.

To display a certain data set tap its name on the list, then tap **Show**.

To hide a data set tap its name on the list, then tap **Hide**.

Showing or hiding a data set with the Data Map applies both to the Graph and Table views.

2.5.3. *Graph View*

Tap **Graph** to display the graph. The default graph display is the data set or sets plotted vs. time, but you can change the X-axis to represent any of the individual data sets (see page 61).

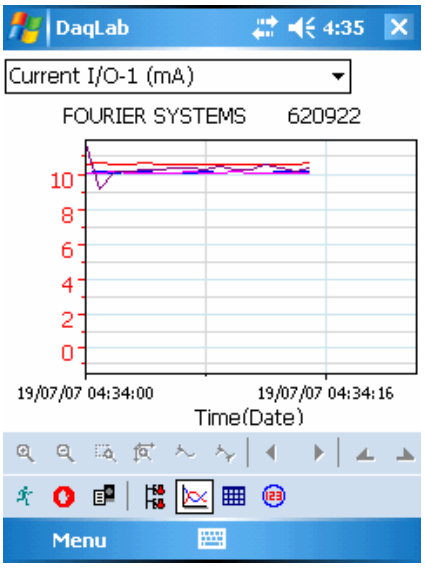


Figure 11: Graph view

The graph usually displays all the data sets of a given recording, but you can use the Data Map to remove one or more of the sets from the graph (see page 57).

In order to keep the graph clear and simple, only one Y-axis is shown on the graph. To change the Y-axis, pick the desired sensor from the drop-down list above the axis.

You can identify the Y-axis by its color, which matches the plot color.

1. The Cursor

You can display up to two cursors on the graph simultaneously.

Use the first cursor to display individual data recording values, to select a curve or to reveal the hidden Y-axis.

Use two cursors to display the difference between two coordinate values or to select a range of data points.

To display the first cursor:

Tap an individual data point on the graph or tap **1st Cursor** on the graph toolbar. You can drag the cursor with the stylus onto any other point on the plot, or onto a different plot. For finer cursor movements use the forward and backward tools on the graph tool bar.

The coordinate values of the selected point will appear at the bottom of the graph window.

To display the second cursor:

Tap **2nd Cursor**  on the graph toolbar
DaqLab will now display the difference between the two coordinate values.

To remove the cursors:
Tap **1st Cursor** a second time.

To remove the 2nd cursor:
Tap **2nd Cursor** a second time.

2. Zooming

1. *To zoom into the center of the graph*
    1. Tap **Zoom in**  on the graph toolbar
    2. To reverse the operation, tap **Zoom out**  on the graph toolbar
2. *To zoom into a specific data point*
    1. Select the point with the cursor (see above)
    2. Tap **Zoom in**  on the graph toolbar
    3. To reverse the operation tap **Zoom out**  on the graph toolbar.
3. *To zoom into a range*
    1. Select the range with both cursors
    2. Tap **Zoom in**  on the graph toolbar
    3. To reverse the operation tap **Zoom out**  on the graph toolbar
4. *To zoom into a specific area*

Tap **Zoom to selection**  on the graph toolbar and drag the stylus diagonally to select the area you want to magnify. Remove the stylus to zoom in to the selected area.
Tap **Zoom to selection** a second time to disable the zoom tool.

5. *Autoscale*

Tap **Autoscale**  on the graph toolbar to view the full data display.

6. *Manual scaling*
    1. Tap **Tools** on the menu bar.
    2. Tap **Graph Format**, and then tap on the **Lines** tab.

3. Pick the axis you want to scale from the **Select plot** drop-down menu.

4. Uncheck the **Autoscale** check box and enter the new values in the **Min** and **Max** edit boxes.

5. Tap **OK.**

To restore auto scaling tap **Autoscale**  .

7. The stretch/compress axis tool

Move the stylus onto one of the graph axes. Drag the stylus to stretch or compress the axis scale. Repeat the procedure for the other axis if necessary.

To restore auto scaling tap **Autoscale**  .

3. Scrolling

After applying the Zoom tool you can scroll the graph while keeping the zoomed scale.

Tap **Scroll right**  on the graph toolbar in order to scroll the graph to the right.

Tap **Scroll left**  on the graph toolbar in order to scroll the graph to the left.

To restore auto scaling tap **Autoscale**  .

4. Selecting what to display on the X-axis

1. Tap **Tools** on the menu bar.

2. Tap **Graph Format**, and then tap on the **X Axis** tab.

3. Pick the data you want to display on the X axis from the **X-axis** drop-down menu.

4. Tap **OK**.

5. Formatting the graph colors

To change the data line's color:

1. Tap **Menu** then select **Tools**.

2. Tap **Graph Format**, and then tap on the **Lines** tab.

3. Pick the plot you want to format from the **Select plot** drop-down list.

4. Tap the color rectangle.

5. Tap the desired color.

6. Tap **OK**.

6. Change the graph's units and its number format

1. Tap **Tools** on the menu bar.
2. Tap **Graph Format**, and then tap on the **Units** tab.
3. Pick the plot you want to format from the **Select plot** drop-down menu.

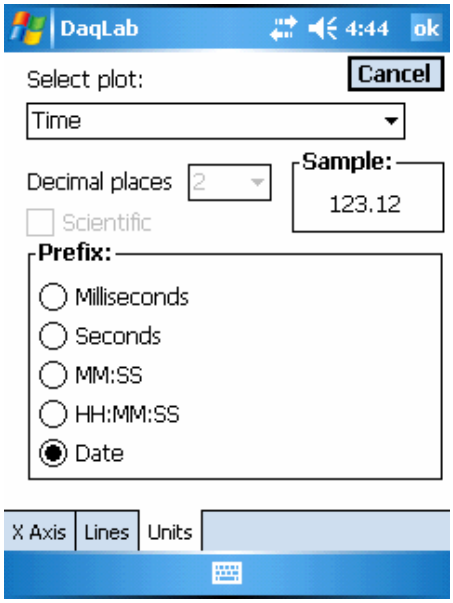


Figure 12: Selecting units

4. Choose the prefix option you want.
5. Select the desired number of decimal places.
6. To display numbers in scientific format, check the **Scientific** check box.
7. Tap **OK**.

2.5.4. Table Display

Tap **Table** to display the Table view.
The data that is displayed in the table always matches the data in the graph. Use the Data Map to change the displayed data.

2.5.5. Meter Display

Tap **Meter** to switch to Meter view.

1. Meter options

You can use the Meter mode to view data without collecting it or to display data while it is being collected.

If you switch to Meter mode without running TriLink (i.e. without tapping **Run** ), TriLink continuously takes measurements from all active sensors, DaqLab displays it but the data is not stored. A small camera icon  will be displayed on the bottom left of the screen.

You can display one meter at a time. To select what sensor to display pick it from the Sensors drop-down menu located above the meter.

To collect and store data while viewing it in Meter display, simply tap **Run**. A small running man icon  will be displayed on the bottom left of the screen.

2. Meter types

There are three meter types: **Analog**  , **Digital**  and **Bar**  .

To select a meter type, tap the corresponding icon on the Meter toolbar below the meter.

2.5.6. Preview the Data

Prior to collecting data you may wish to preview your data. In Preview you can:

- Ensure that your handheld computer, TriLink and sensors are properly connected.
- Verify that a sensor is measuring what you intended it to measure.
- Verify that a sensor has reached a stable value.

In Preview mode data is not saved.

To preview data:

1. Setup TriLink as you would normally do.
2. Tap **Logger** on the menu bar.
3. Tap **Preview**.

.

2.6. Analyzing the Data

2.6.1. Reading Data Point Coordinates

Position the cursor on a point to display its coordinates at the bottom of the graph window.

2.6.2. Reading the Difference between Two Coordinate Values

Position one cursor on the first point and a second cursor on the second point to display the difference between the two coordinate values at the bottom of the graph window.

2.6.3. Working with the Analysis Tools

The analysis tools can only be applied to data sets that are displayed in the graph window.

1. Use the cursors to select the graph and the data range to which you want to apply the analysis.
2. Select the analysis function you wish to use.

The analysis function will be added onto the graph.

To apply an analysis function:

1. Tap **Tools** on the menu bar, and then tap **Analysis** to display the Analysis dialog:

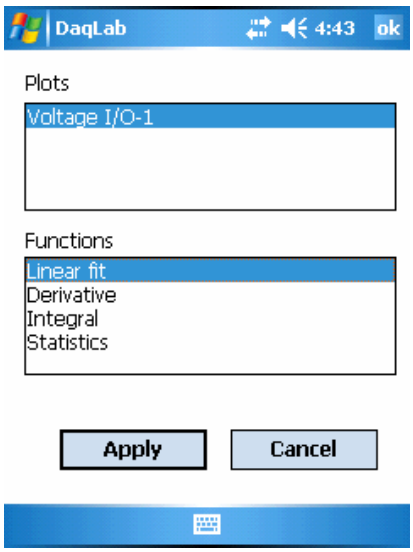


Figure 13: Analysis window

2. If you have not selected a plot with the cursor tap the desired plot in the **Select plot** drop-down menu.
3. Tap a function in the **Function** list.

4. Tap **Apply**.

DaqLab will add the analysis function onto the graph.

2.6.4. Analysis Tools

1. Linear fit

Use **Linear Fit** to draw a line of linear least square fit

$$y = ax + b$$

and to display the line's equation.

2. Derivative

Use **Derivative** to construct a graph in which each point is the slope of the three consecutive points on the source graph.

3. Integral

Choose **Integral** construct a graph in which each point is the integral of all the preceding points on the source graph.

4. Statistics

Use the **Statistics** tool to display statistics of a selected data set or a range of data. The statistics include:

Average – The average of all the numbers in the range

StDev. – The standard deviation

Minimum – The smallest value in the range

Maximum – The largest value in the range

Sum – Adds all the numbers in the range

Area – The area between the graph and the x-axis in the range

Samples – The number of data points in the range

Rate – The recording rate

2.7. Exporting the Data

2.7.1. Export to another Pocket PC by Beaming

After you have created and saved a data file:

1. Position the Pocket PC devices to enable beaming.
2. Navigate to the My Document folder and then to the DaqLab Data folder.
3. Tap and hold the file name you want to beam to display a popup menu.
4. Tap **Beam File…**
5. Follow the on-screen instructions to complete the beaming procedure.

2.7.2. Export to a Desktop Computer

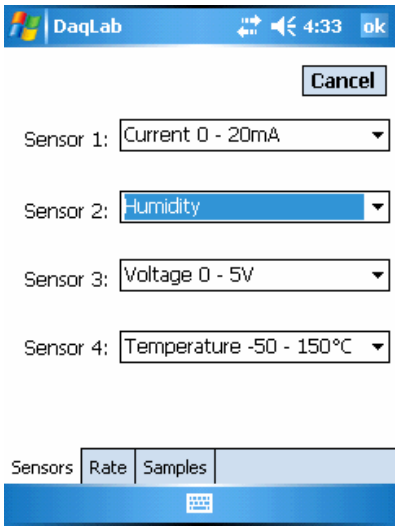
To export data from the handheld computer to a desktop computer:

1. Connect the Pocket PC to the desktop computer.
2. Open the **ActiveSync** program.
3. Click **Explore**.
4. Copy the files you want to your desktop computer.
5. Double click a file name to open it with DaqLab for PC software.

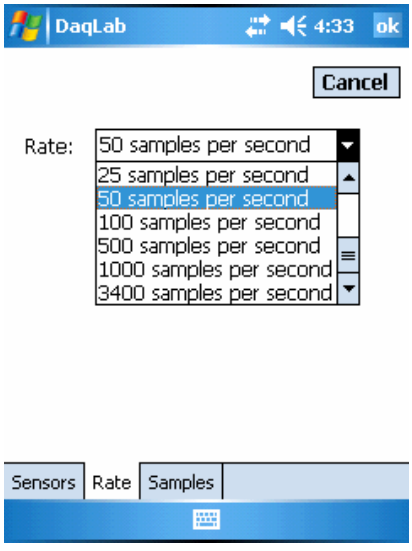
2.8. Programming TriLink

2.8.1. Set up TriLink

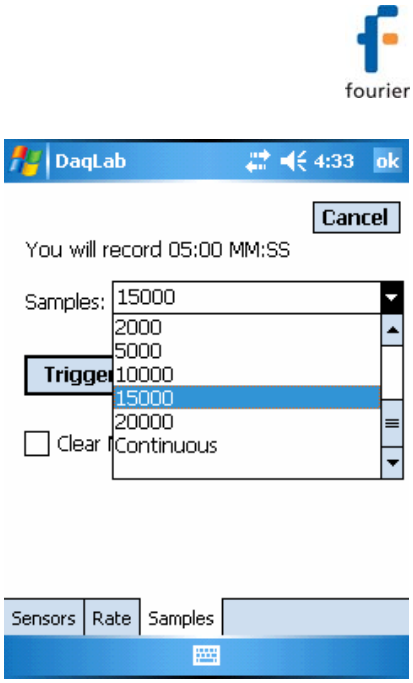
1. Establish a connection between TriLink and the Pocket PC.
2. Tap **Setup** on the main toolbar.
3. Select the sensors you will be using for this session from the **Sensor input** drop-down menu.



4. Tap the **Rate** tab and select number of samples per time unit from the **Rate** drop-down menu.



5. Tap the **Samples** tab and select the total number of samples from the Samples drop-down menu.



6. Tap **OK**.

Note: When you turn off TriLink, it will save the setup for the next session.

2.8.2. Triggering

To start the data recording only when a specific time or measurement condition has been met:

1. Establish a connection between TriLink and the Pocket PC.
2. Tap **Setup** on the main toolbar.
3. Tap the **Samples** tab.
4. Tap **Triggering**.
5. Pick the triggering sensor from the **Based on sensor** drop-down menu.
6. Pick one of the following from the **Type** drop-down menu:

- **None** - Trigger is disabled
- **Above level** - Start logging only once the measured value is HIGHER than the trigger level.
- **Below level** - Start logging only once the measured value is LOWER than the trigger level.

Note: The trigger acts on analog measurements only. The trigger condition must be fulfilled for at least 300μS.

- **Control Level** - The Control Level trigger allows you to create an automatic sense and control system. This means that you can connect a sensor measuring a certain phenomenon (for example, temperature) and connect a device that will start operating when the recorded data from the sensor falls above or below a pre-defined threshold (for example, a fan that will start operating when the temperature measured by the sensor rises above 30 °C). This function requires the use of a splitter cable and a control sensor. The cable divides each input into a sensor cable and a controller cable. After setting the control level and starting the data logging process, the sensor will

sample and record the data as usual, but when the measurement from the sensor rises above the predetermined threshold value, the controller cable will send a pulse of 5V to the control sensor, and will continue to do so until the sensor measures a value below the threshold level. When receiving the 5V pulse, the control sensor will close/open a relay capable of switching 110/220V to any load.

- **Time delay** - This trigger type enables you to set a timer that will start the logging after a predetermined amount of time. After setting the trigger to Timer Delay, click the down arrow on the **Level** combo-box, and select from the 17 different time options. The timer will start its countdown when you click **RUN**, and the actual recording will start once the countdown has ended.

7. Pick the trigger level in the **Level** drop-down menu.

8. Tap **OK**.

Note: When you turn off TriLink, it will save the setup for the next session.

2.8.3. Calibrate Sensors

DaqLab enables you to calibrate any of the linear sensors manually. This two point calibration method sets both the gain (slope) and offset (intercept) of the sensor's conversion function. The calibration procedure affects DaqLab readings only.

1. Tap **Logger** on the menu bar, then tap **Calibrate sensors**.
2. Pick a sensor from the **Choose sensor** drop-down menu.
3. Tap **OK**.
4. Enter a distinct real value in each of the **Real Value** edit boxes and the corresponding measured values in each of the **Measured Value** edit boxes (The measured values are the values displayed by DaqLab when measuring the two real values).
5. Tap **OK**.

The calibrated sensor parameters will be saved in DaqLab.

To reset to the default calibration for any sensor, repeat steps 1 to 3 above and tap **Restore defaults**.

2.9. Toolbar Buttons

2.9.1. *Main Toolbar*

	**Run**	Begin collecting data
	**Stop**	Stop collecting data
	**Setup**	Set up TriLink
	**Data Map**	Display the Data Map
	**Graph**	Display the Graph
	**Table**	Display the Table
	**Meter**	Display a Meter

2.9.2. *Graph Toolbar*

	**Zoom in**	Zoom in around a selected point or in to a selected range
	**Zoom out**	Reverse the most recent zoom operation
	**Zoom to selection**	Zoom in to a selected area
	**Auto scale**	Display all the data
	**1st Cursor**	Display or remove the first cursor
	**2nd Cursor**	Display or remove the second cursor
	**Move right**	Move the cursor one point to the right
	**Move left**	Move the cursor one point to the left
	**Scroll right**	Scroll the graph one page to the right
	**Scroll left**	Scroll the graph one page to the left

2.9.3. *Meter Toolbar*

	**Analog**	Display an analog meter
	**Bar**	Display a bar meter
	**Digital**	Display a digital meter

Chapter 3 Working with a Desktop Computer and DaqLab

3.1.Installing the Software

3.1.1. System Requirements

To work with DaqLab, your system should be equipped with the following:

Windows

Software

- Windows 98, 2000, XP and Vista
- Internet Explorer 5.0 or later
- Bluetooth wireless technology (Widcom or Toshiba chipsets)

Hardware

- Pentium II 600MHz or higher (Pentium 4, 1.6GHz or higher is needed for video motion analysis recordings)
- 32 MB RAM (64 MB recommended)
- 10 MB available disk space for the DaqLab application (50 MB to install the supporting applications)
- Free USB port (if not connecting via Bluetooth)

3.1.2. Installation

1. Close all programs
2. Insert the CD labeled DaqLab into your CD-ROM drive

Installation will begin automatically. Simply follow the on-screen instructions to continue.

If **auto run** is not working, open **My Computer** and click on the CD drive folder (**d:** drive in most cases) and double-click on the setup icon, then follow the on-screen instructions.

To uninstall the software: From the Start menu select **Settings** and click on **Control Panel**, then use the **Add/Remove Programs** feature to remove the DaqLab application.

When updating the software, always remove the old version before starting a new installation.

To install the USB driver on WinXP:

1. Connect your data logger to a USB port on your PC and turn the data logger on. Windows will automatically detect the new device and open the **Found New Hardware Wizard**.

2. Select the **No, not this time** to prevent Windows from searching for software on the Internet, then click **Next**.
3. Insert the DaqLab installation CD into your CD drive. Windows will automatically detect and copy the necessary files to your system.
4. Click **Finish**. Windows will open the **Found New Hardware Wizard** for the second time.
5. Click **Next** to complete the installation. Windows will automatically install the necessary components on your system.
6. Click **Finish**.

Note to the Windows XP user:

If the **Found New Hardware** wizard prompts you to the following Hardware Installation dialog box, click **Continue Anyway** to proceed.

:

3.2. Overview

3.2.1. DaqLab On-screen Layout

DaqLab is a comprehensive program that provides you with everything you need in order to collect data from the TriLink, display the data in graphs, meters and tables, and analyze it with sophisticated analysis tools.

DaqLab connects to TriLink either with USB cable or with Bluetooth wireless communication technology.

The program includes three main windows: Graph window, Table window, and a navigation window called the Data Map. You can display all three windows simultaneously or any combination of the three.

The most commonly used tools and commands are displayed on three toolbars. Tools that relate to all aspects of the program and tools that control the TriLink are located in the main (upper) toolbar. Tools specific to the graphs are located on the graph toolbar and tools specific to the tables are located on the table toolbar.

3.2.2. DaqLab Window Layout

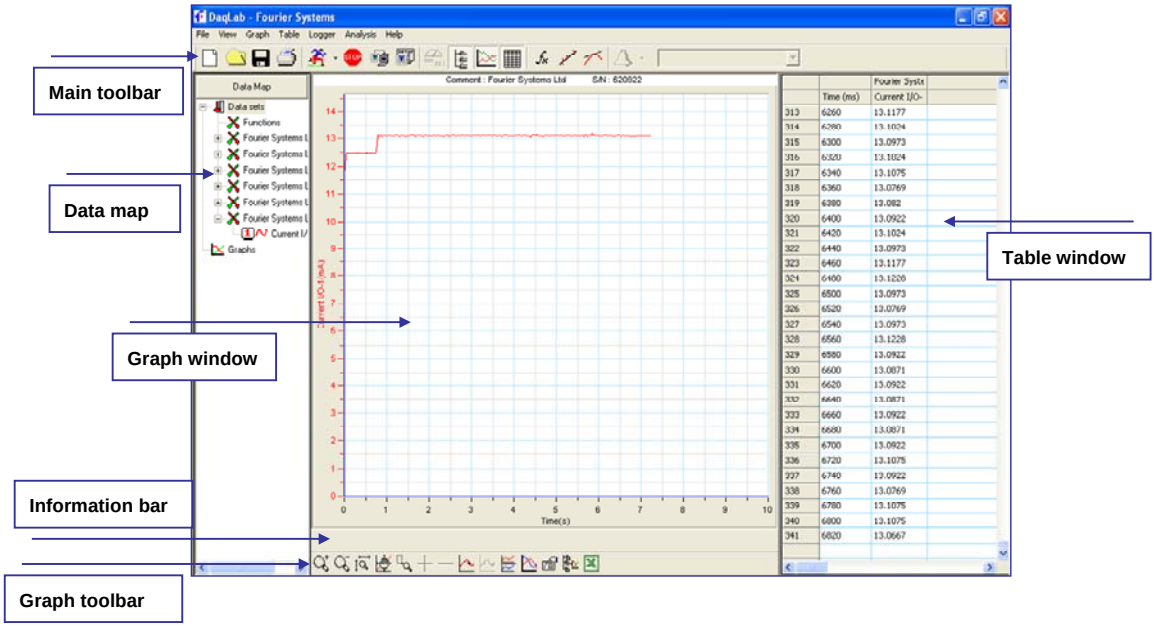


Figure 14: DaqLab window layout

3.2.3. Working with Projects

Every time you start a new session, DaqLab automatically creates a new project file. All the information you collect and process for a given session is stored in a single project file. Each of these files contains all the data sets you collected with the TriLink, the analysis functions you've processed, specific graphs and the tables you've created.

Note: All data sets in a single project must be with the same sampling rate.

3.3. Establishing Communication

TriLink uses either Bluetooth wireless technology or USB cable connection to connect to your computer. To use Bluetooth technology your computer must be equipped with Bluetooth capabilities.

DaqLab supports Bluetooth chipsets from Toshiba and Broadcom/Widcom.

To avoid interference between several devices TriLink employs a procedure called *pairing* [2] that allows any computer to communicate with only one specific TriLink.

Every TriLink has a unique *name*. The pairing process tells the computer to address only a specific *name*.

Before you work with TriLink and a computer you have to perform this pairing procedure. DaqLab stores the TriLink's address and will automatically connect to this specific TriLink every time you open DaqLab.

You can always repeat the pairing process if you want to connect to another TriLink.

Make sure no USB cable is connected. DaqLab will not establish Bluetooth connection while the USB cable is connected even if the pairing process was successful.

3.3.1. Connecting your Computer with a TriLink via USB

1. Connect the mini USB plug of the USB communication cable to the USB input at the bottom of TriLink.
2. Connect the USB plug of the USB communication cable to a free USB input at the back of your computer.
3. Turn on the TriLink. Push the **On/Off** button on the TriLink front panel.
4. Open the DaqLab application. Click the DaqLab icon on the PC desktop.
5. Go to **Logger > Com Setup** on the main menu. Select **Serial communication**.

[2] Pairing (or bonding) is a concept introduced to create a first time recognition of what devices are allowed to communicate with each other or which devices belong together. Devices can usually not establish a communication session without a first time pairing.

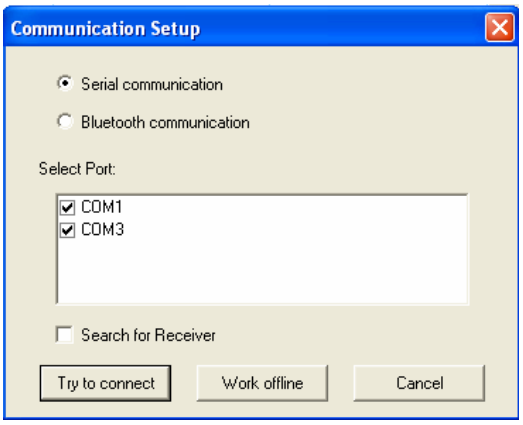
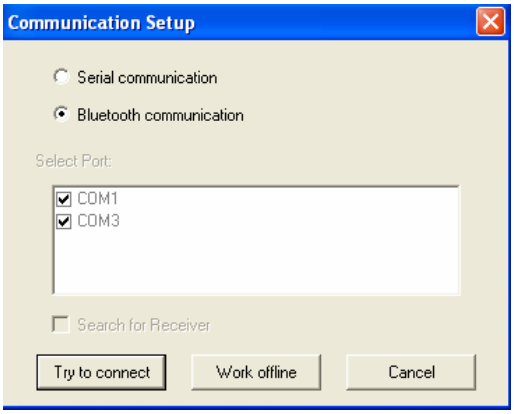


Figure 15: Com setup window

6. Click **Try to connect**. The DaqLab will establish communication with the TriLink.

3.3.2. Pairing your Computer with a TriLink via Bluetooth

1. Turn on the TriLink. Push the **On/Off** button on the TriLink front panel.
2. Open the DaqLab application. Click the DaqLab icon on the PC desktop.
3. Go to **Logger > Com Setup** on the main menu. Select **Bluetooth communication**.



4. Go to **Logger > Bluetooth Setup** on the main menu.

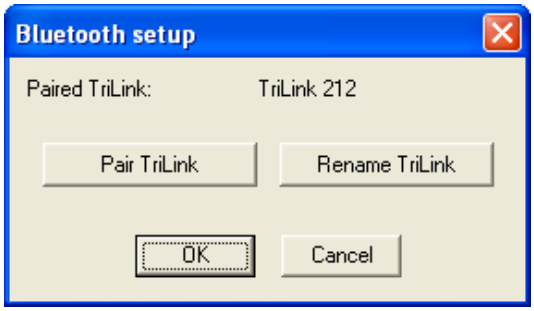


Figure 16: Bluetooth setup

5. Click **Pair TriLink**.

DaqLab searches for Bluetooth devices and displays a list with all the devices that were found.

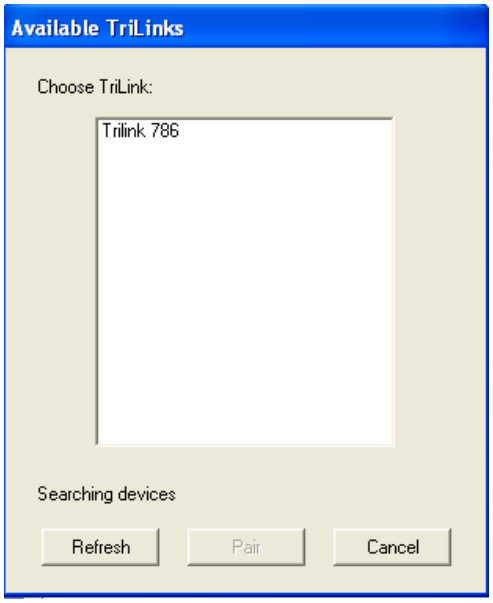


Figure 17: Searching for TriLink

6. Click the name of the TriLink you want to connect to, and then click **Pair**.

Note: TriLink briefly displays its name when switched on.

After pairing is complete DaqLab displays the name of the paired TriLink.

7. Click **OK**

You are now ready to begin data logging.

From now on DaqLab will automatically connect to the paired TriLink.

3.3.3. Renaming TriLink

1. Go to **Logger > Bluetooth Setup** on the main menu.

2. Click **Rename TriLink**.

Figure 18: Renaming TriLink

3. Enter the new name, and then click **OK**.

Note: The name can include up to 15 characters.

DaqLab will display the new name. You can always return to the factory name by clicking **Reset TriLink Name**.

3.4. Getting Started

3.4.1. Set up a Recording Session

1. Prepare TriLink

1. Turn on TriLink.
2. Open the DaqLab software.
3. Connect TriLink to the PC via USB or Bluetooth communication (as explained in previous section).
4. Plug in any external sensors.

2. Setup the TriLink

1. Click **Setup Wizard**  on the main toolbar.
2. Follow the instructions in the **Setup Wizard** (see page 99).

3. Start Recording

Click **Run**  on the toolbar to start recording.

If the recording rate is 100 measurements per second or less, DaqLab automatically opens a graph window displaying the data in real-time, plotting it on the graph as it is being recorded. If the recording rate is higher than 100/s, the data will be downloaded and displayed automatically, once the data recording is finished.

If you are recording at a rate of 500/s or 1,000/s, DaqLab displays an online preview at a rate of 25/s.

You can stop recording anytime by clicking **Stop**  on the toolbar.

3.4.2. Data Recording Options

To set the behavior of the data display when you start a new recording session, click on the **down arrow** next to the **Run** button  , and select one of the following:

1. Single measurement

DaqLab will open a new project file every time you start a new recording session.

2. Replace

DaqLab will display the new data set in place of the old one. The project's old data sets will still be available in the same project file. They will be listed in the Data Map and you can add them to the display at any time.

3. Add

DaqLab will add the new data set to the graph in addition to the old ones.

> **Note**: A maximum of 8 data sets can be displayed on the graph at the same time.

3.4.3. Download Data

Whenever data is received from the TriLink, it is accumulated and displayed automatically by DaqLab. There are two modes of communication: Online and Post-session.

Online communication

When TriLink is connected to the PC and programmed to run at sampling rates of up to 100/s, TriLink transmits each data sample immediately, as it is recorded, to the PC. The software thus displays the data in real-time in both the graph window and the table window.

When TriLink is connected to the PC and programmed to run at a sampling rate of 500/s or 1000/s, TriLink transmits every twentieth or fortieth data sample online. This means DaqLab displays data at a rate of 25/s, while the full data is accumulated in TriLink's internal memory. Once the recording has ended, the full data is automatically downloaded to the PC and displayed.

When TriLink is connected to the PC and programmed to run at a sampling rate of 11,200/s or 20,800/s, data is accumulated in TriLink's internal memory. This data is not transmitted to the PC until the recording period has ended, when the data is automatically downloaded to the PC and displayed.

Offline data logging

To download data that was recorded offline, or while TriLink was not connected to a PC, connect TriLink to the computer, run the DaqLab program and click **Download**  on the toolbar. This will initiate the **Post-session** Data Transfer communication mode. Once the transfer is complete, the data will be displayed automatically in the graph window and in the table window. If there are several experiments stored in the TriLink, the first download will bring up the most recent experiment; the second download will bring up the earliest file, the third download will bring up the second earliest file, and so on.

To download a particular experiment, choose **Selective download** from the **Logger** menu, then select the experiment's number in the Download dialog box.

Click **Cancel** in the Download progress window at any time to stop downloading the data.

3.4.4. Save Data

Click **Save**  on the main toolbar to save your project. This will save all the data sets, graphs, and tables under one project file.

Saving the project will also save any special formatting and scaling you did.

If you made any changes to a previously saved project, click **Save** to update the saved file or select **Save as…** from the file menu to save it under another name.

> **Note:**
>
> To delete a specific data set, a graph or a table from the project, use the Data Map.
>
> To remove unwanted data from a specific data set, apply the Crop tool.

3.4.5. Open a File

1. Click **Open**  on the main toolbar
2. Navigate to the folder in which the project is stored
3. Double click the file name to open the project

DaqLab opens the project and displays the first graph on the graph list. If the project does not include saved graphs, the file opens with an empty graph window. Use the Data Map (see page 96) to display the desired data set.

3.4.6. Create a New Project

There are three ways to create a new project:

1. Open the DaqLab program, which will open a new file each time
2. When working in Single Measurement mode, a new project is opened every time you click on the **Run** button to start a new recording.
3. Any time you click **New** button  on the toolbar.

3.4.7. Import Data

Any file that is in comma separated values text format (CSV) can be imported into DaqLab.

To import a CSV file:

1. Click **File** on the menu bar, then click **Import CSV file**
2. In the dialog that opens, next to **Look in**, navigate to the drive and folder that contains the CSV file
3. Select the file

4. Click **Open**

Tips:

To create a text file in a spreadsheet:

1. Open a new spreadsheet
2. Enter your data according to the following rules:

   a) The first row should contain headers. Each header includes the name of the data set and units in brackets e.g. Voltage (V).

   b) The first column should be the time. The time interval between successive rows must match the time intervals accepted by DaqLab. You can export DaqLab files to Excel to learn about these time formats.

See for example the table below:

	A	B	C
1	t(s)	x(m)	y(m)
2	0	0	5
3	0.1	0.95	4.05
4	0.2	1.8	3.2
5	0.3	2.55	2.45
6	0.4	3.2	1.8
7	0.5	3.75	1.25
8	0.6	4.2	0.8

3. On the **File** menu, click **Save As**.
4. In the **File name** box, type a name for the workbook.
5. In the **Save as type** list, click the **CSV** format.
6. Click **Save**.

To import files that were previously exported from DaqLab, open DaqLab and import the file as described above as they are already in CSV format.

3.4.8. Date Format Settings

To set the way data will be displayed on screen, go to **File > Date format settings** to open the Date format settings dialog:

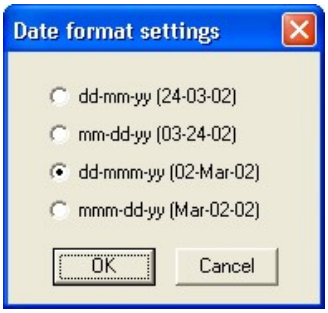


Figure 19: Date format settings dialog box

Click the desired option, and then click **OK.**

3.4.9. Print

1. Print a graph

1. Click **Print**  on the main toolbar.
2. Select the **Graph 1** option (when in split graph mode you can choose between Graph 1 and Graph 2).
3. Click **Print** to open the print dialog box.
4. Click **OK**.

DaqLab will print exactly what you see in the graph display.

2. Print a table

1. Click **Print**  on the main toolbar.
2. Select the **Table** option.
3. If you want to print only a specific range, uncheck the **Print all data** check box and type the desired row numbers into the **To** and **From** edit boxes.
4. Click **Print** to open the print dialog box.
5. Click **OK**.

3.5. Viewing the Data

3.5.1. Display Options

The DaqLab program's screen consists of three parts: the Graph window, Table window and Data Map. You can display all three parts simultaneously (the default view) or any combination of the three.

The graph window is the main window by default and is and displayed in the center of the application window.

In addition to these sections, you have the option to display an on-screen meter for each of the sensors.

3.5.2. Graph Display

Click **Graph**  to display or hide the graph. The default graph display is the data set or sets plotted vs. time, but you can change the X-axis to represent any of the individual data sets (refer to page **Error! Bookmark not defined.**).

The graph usually displays all the data sets of a given recording, but you can use the Data Map to remove one or more of the sets from the graph (refer to page **Error! Bookmark not defined.**).

In order to keep the graph clear and simple, only two Y-axes are shown on the graph at once. If there are three curves in the graph, one of the Y-axes is hidden. In order to make this axis visible, select the corresponding plot with the cursor (refer to bullet 2 below).

You can identify the Y-axis by its color, which matches the plot color.

1. Split graph view

DaqLab enables you to display your data in two separate graphs within the graph window.

1. Click **Split graph**  on the graph toolbar to split the graph window into two separate graphs.
2. Click **Edit graph**  on the graph toolbar to open the **Edit graph** dialog box.
3. Choose which data sets to display on each of the graphs (or use the Data Map to do so – refer to page **Error! Bookmark not defined.**).
4. To return to the single graph display, click **Split graph**  a second time.

2. The cursor

You can display up to two cursors on the graph simultaneously.

Use the first cursor to display individual data recording values, to select a curve or to reveal the hidden Y-axis.

Use two cursors to display the difference between two coordinate values, to display the frequency of periodic data or to select a range of data points.

To display the first cursor:

Double click on an individual data point or click **Cursor**  on the graph toolbar. You can drag the cursor with the mouse onto any other point on the plot, or onto a different plot. For finer cursor movements use the forward and backward keys on the keyboard.

The coordinate values of the selected point will appear in the information bar at the bottom of the graph window.

To display the second cursor:

Double click again anywhere on the graph area or click **2nd Cursor**  .

The information bar will now display the difference between the two coordinate values.

To remove the cursors:

Double click anywhere on the graph area, or click **1st Cursor** a second time.

To remove the 2nd cursor:

Click **2nd Cursor** a second time.

To display the cursors in split graph mode:

To display the cursors on the upper graph, use the same method as for single graph mode.

To display the cursors on the lower graph, you must first remove them from the upper graph and then double click anywhere on the lower graph to display the first cursor. Double click a second time to display the second cursor, and double click a third time to remove the cursors.

3. Zooming

To zoom in to the center of the graph

1. Click **Zoom in**  on the graph toolbar
2. To reverse the operation, click **Zoom out**  on the graph toolbar

To zoom in to a specific data point

1. Select the point with the cursor (see above)
2. Click **Zoom in**  on the graph toolbar

3. To reverse the operation click **Zoom out**  on the graph toolbar

To zoom in to a range

1. Select the range with both cursors
2. Click **Zoom in**  on the graph toolbar
3. To reverse the operation click **Zoom out**  on the graph toolbar

To zoom in to a specific area

1. Click **Zoom to selection**  on the graph toolbar and drag the cursor diagonally to select the area you want to magnify. Release the mouse button to zoom in to the selected area.
2. Click **Zoom to selection** a second time to disable the zoom tool.

Autoscale

Click **Auto scale**  on the graph toolbar to view the full data display, or double click on an axis to auto scale that axis alone.

Manual scaling

1. Click **Graph properties**  on the graph toolbar to open the **Graph properties** dialog.
2. Select the **Scale** tab, and choose the axis you want to scale in the **Select axis** drop-down menu.
3. Uncheck the **Autoscale** check box and enter the new values in the text box.
4. Click **OK**.
5. To manually scale a specific axis, right click on the axis to open its **Properties** dialog.
6. To restore auto scaling click **Autoscale**  .

The stretch/compress axis tool

1. Move the cursor onto one of the graph axes. The cursor icon changes to the double arrow symbol (↔), indicating that you can stretch or compress the axis scale. Drag the cursor to the desired location. Repeat the procedure for the other axis if necessary.
2. Double click on the axis to restore auto scaling.

4. Panning

1. Use the pan tool after zooming in to see any part of the graph that is outside the zoomed area.

2. To do this, click **Pan**  on the graph toolbar, then click anywhere on the graph and drag the mouse to view another area.

3. Click **Pan** a second time to disable the Pan tool.

5. Edit the graph

1. Use **the Edit graph** dialog box to select which data sets to display on the graph's Y-axis and to change the X-axis from time, to one of the data sets.

2. Click **Edit graph**  on the graph toolbar to open the **Edit graph** dialog box:

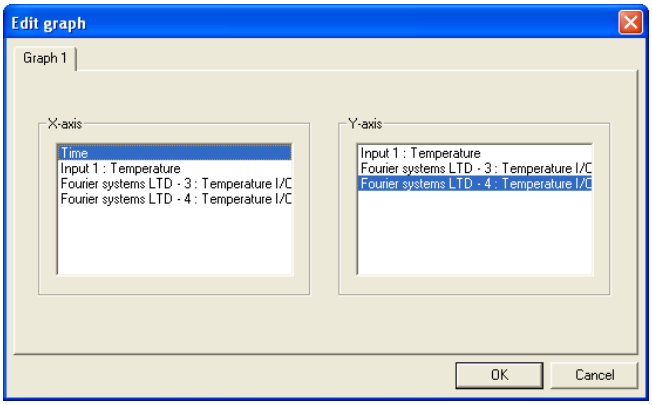


Figure 20: Edit graph dialog box

3. To select a data set to display on the Y-axis, click on the data set's name in the Y-axis list. To display more than one curve, click on the data sets you want.

4. A list entry that begins with a TriLink comment denotes a recorded data set. A list entry that begins with an input number denotes the next recording and will be displayed on the graph the next time you start a recording.

5. To deselect a data set click on it a second time.

6. To select a data set for display on the X-axis, click on the data set's name in the X-axis list. You can only select one data set at a time for the X-axis.

7. Click **OK**.

6. Format the graph

You can change the data line's color, style and width. You can also add markers that represent the data points on the graph and format their style and color.

The color of the Y-axis matches the corresponding plot's color and will automatically change with any change made to the color of the corresponding plot.

1. Click **Graph properties**  on the graph toolbar to open the **Graph properties** dialog box.
2. Select the **Lines** tab, and then select the plot or axis you want to format in the **Select plot** drop-down menu.
3. From here you can format the line's color, style and width, as well as the markers' color and style. To remove the line or the marker, uncheck the corresponding **Visible** check box.
4. Click **OK**.
5. To restore the default formatting, click **Restore default**.

7. Change the graph's units and its number format

1. Click **Graph properties**  on the graph toolbar to open the **Graph properties** dialog box.
2. Select the **Units** tab, and then select the plot or axis you want to format in the **Select plot** drop-down menu.
3. Choose the prefix option.
4. Select the desired number of decimal places.
5. To display numbers in scientific format, check the **Scientific** check box.
6. Click **OK**.

8. Add a graph to the project

DaqLab displays new data in the graph window every time you start a new recording. You can always display previous data using the **Edit graph** dialog or by double-clicking on the data's icon in the **Data Map.** If you want to save a graph that you created to your project, or to update a saved graph with changes you made, use the **Add to project** tool:

Click **Add to project**  on the graph toolbar.

3.5.3. The Table Display

Click **Table**  to display or to remove the table window.

The data in the table always matches the data that is currently displayed on the graph.

When you start a new recording, DaqLab displays the new data in the table as well as on the graph.

1. Formatting the table

Changing column width

Drag the boundary on the right side of the column heading until the column is the desired width.

Changing row height

Drag the boundary below the row heading until the row is the desired height.

Formatting the fonts

1. Click **Table** on the menu bar, and then click **Properties**.
2. Select the **Font** tab.
3. Format the font, as well as the font's style and size.
4. Click **OK.**

Changing units and number format

1. Click **Table** on the menu bar, and then click **Properties**.
2. Select the **Units** tab, and then select the plot you want to format from the **Select plot** drop-down menu.
3. Choose the prefix option.
4. Select the desired number of decimal places.
5. To display numbers in scientific format, check the **Scientific** check box.
6. Click **OK**.

3.5.4. Meters

DaqLab enables you to view data in meters format on the screen (one meter for each sensor), with up to four meters showing at once. The meters can display live data while DaqLab is recording, or saved data when a saved file is replayed.

When a cursor is displayed, the meter shows the measured values that correspond to the time of the point at which the cursor is positioned.

There are three meter types: Analog, bar and digital.

The meter's scaling automatically matches the graph's scaling.

To set up the meters:

1. Click **Meter Setup**  on the main toolbar.
2. Select the meter type, and the data set to be displayed.
3. A list entry that begins with a graph number denotes a displayed data set. A list entry that begins with an input number denotes the next recording, and will be displayed on the meter the next time you start a recording
4. Repeat this procedure for up to four meters.

5. To remove the meters click **Meter Setup**  , and click **Remove all**.

3.5.5. Data Map

Click **Data Map**  to display or remove the Data Map.

The data map is a separate window that displays the list of data sets that were recorded or downloaded in the current session, as well as the lists of all the saved graphs. Use the Data Map to navigate through the available data sets and to keep track of the data that is being displayed in the graph window.

Note: The data in the table always matches the data that is currently displayed on the graph.

1. Control the display with the Data Map

The items in the Data Map are sorted into two main categories:

- Data sets (including analysis functions)
- Saved graphs

Double click on a category to bring up the full list. Double click a second time to collapse the list. You can also use the plus (+) and minus (-) signs next to the icons to expand or collapse the categories.

The Data sets' list expands to sub-categories of recorded data and functions. To display the complete list of measurements, or the complete list of analysis functions performed on the measurements for any individual data capture, double click the file's icon or click the plus sign (+) next to it.

To collapse a list under an individual data capture, double click the corresponding icon or click the minus sign (-) next to it.

To display a data set or a saved graph double click its icon. Double click a second time to remove it.

You can also use a shortcut menu to display or remove a data set from the graph. Simply right-click an icon, then click **Display on graph #1** or **Display on graph #2.**

To delete an individual item from the Data Map and from the project, right-click on its icon and click **Delete**. To permanently delete the item, click **Save**  on the main toolbar.

To remove all data sets from the Data Map, right-click the Data sets icon  and click **Clear All Data**.

2. Understanding Data Map icons

 **Data sets list**

 Functions – Includes all the analysis functions of the project

 Individual function – Currently not on display

 Individual function – Currently displayed on graph 1

 Individual function – Currently displayed on graph 2

 Individual function – Currently displayed both on graphs 1 and 2

 Function

Data capture – Includes all recorded data of the recording

- Individual data set – Currently not on display
- Individual data set – Currently displayed on graph 1
- Individual data set – Currently displayed on graph 2
- Individual data set – Currently displayed both on graphs 1 and 2
- Raw data

List of saved graphs

- Saved graph – Data sets vs. time
- Saved graph – Data sets vs. data set
- Graph currently not on display
- Graph currently displayed on graph 1
- Graph currently displayed on graph 2
- Graph currently displayed both on graphs 1 and 2

3.5.6. Exporting Data to Excel

Click **Export to Excel**  on the graph toolbar, or go to **Graph > Export to Excel**, to export the data that is currently displayed on the graph to Excel. DaqLab will then open a new Excel workbook displaying the data as well as the TriLink comment, serial number and the alarm level setup. Data that exceeds any of the alarm levels will be highlighted by arrows.

1. Export all open data sets

You can easily export all open data sets in the Data Map to the same Excel file, at once, rather than individually as in previous versions of DaqLab. Each data set will be exported to a separate worksheet.

Go to **File > Export project to Excel**.

2. Exporting over 64,000 samples to Excel

Each worksheet in the Excel application allows up to 64,000 rows of data to be imported. If your data set contains over 64,000 sampling points, then additional worksheets will be created when exporting this data to Excel. For instance, if you have a data set containing 100,000 points then Excel will create two worksheets, one containing the maximum 64,000 points and the second containing the remaining 36,000 points.

3. Export file settings

If DaqLab fails to export the data properly, try to change the export file settings:

1. Click **File** on the menu bar, and then click **Export file settings.**
2. Check the **Ignore regional settings** check box and click **OK**.

3.5.7. Copying the Graph as a Picture

You can copy the graph to the clipboard as a picture and then paste it to other Windows programs such as Word or PowerPoint:

1. In the **Graph** menu, click **Copy graph**.
2. Open the destination file.
3. In the destination file, right click and select **Paste**.

3.6. Programming TriLink

3.6.1. Setup

1. Quick setup

Use the Setup wizard to guide you through the setup process.

1. Click **Setup wizard** on the main toolbar to open the Setup wizard:

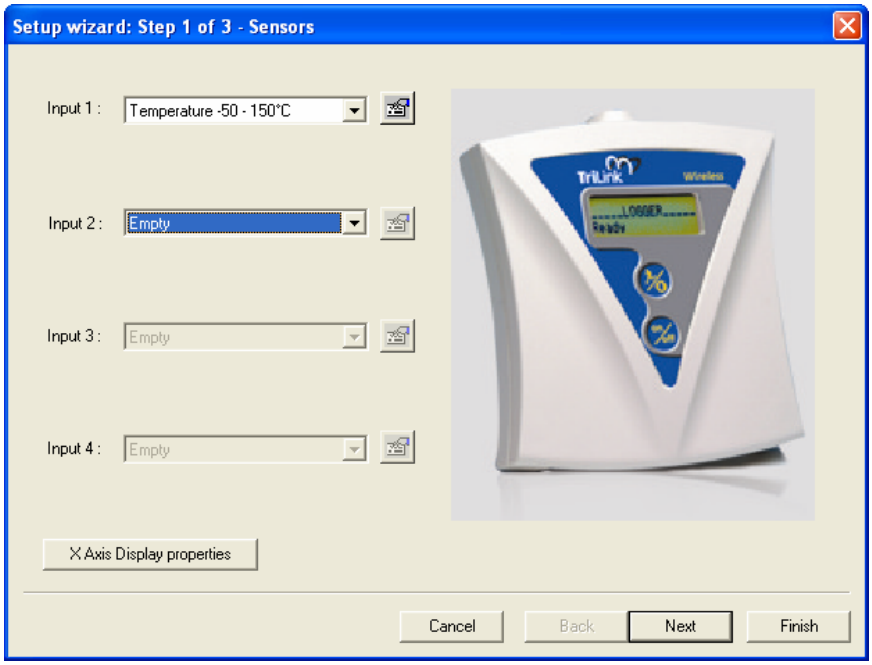


Figure 21: Setup wizard: Step 1 of 3

The first step is to assign sensors to each input. You can manually select the sensors you are using from the corresponding input drop-down menus.

2. Click **Next** to move to the second step:

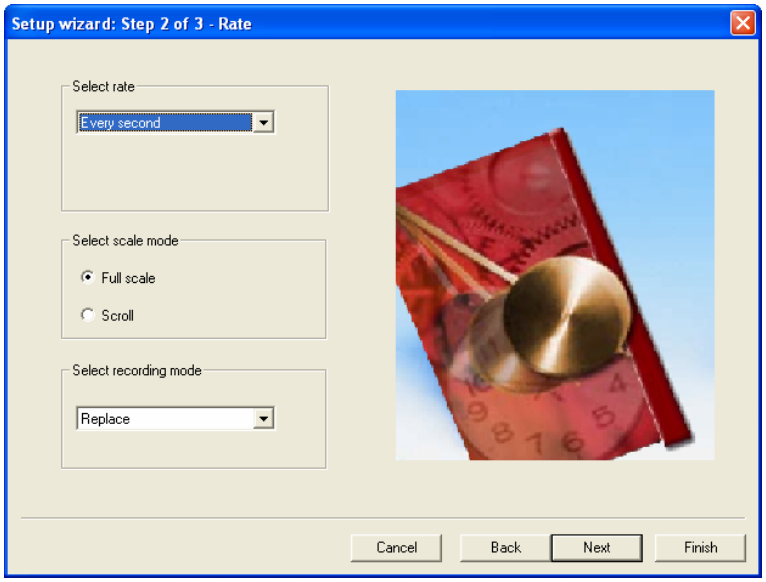


Figure 22: Setup wizard: Step 2 of 3

3. Select the desired recording rate in the **Select rate** drop-down menu.

4. Select the **Scroll** option if you want the graph window to scroll as the data recording progresses.

5. Select the desired data recording mode in the **Select recording mode** drop-down menu.

6. Click **Next** to move to the third step:

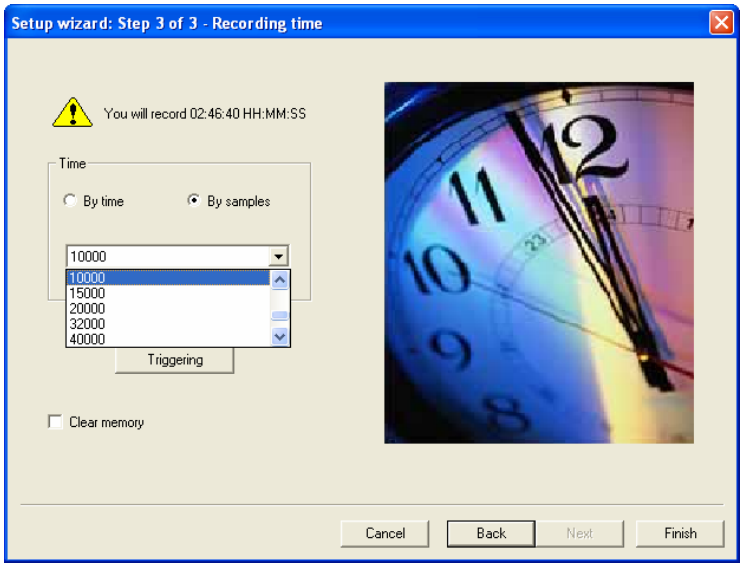


Figure 23: Setup wizard: Step 3 of 3

7. Select the desired length of the recording period in the **Select recording time** drop-down menu.
   The recording period is displayed as a unit of time by default. To display the recording period as the number of recording samples,

select the **By samples** option. The number of samples is calculated with the following formula:

Total recording samples = Recording rate × Recording period

8. To start the data recording only when a specific time or measurement condition has been met click **Triggering** to open the Triggering dialog box (see page 102)
9. Click **Finish** to complete the setup and to send the setup command to the TriLink.

2. Define sensor properties

Some of the sensors can display their data in different units. For example, the Temperature sensor can display in C or F.

You can define the properties of each sensor individually in the first step of the Setup wizard.

1. Click **Setup wizard** on the main toolbar to open the Setup wizard.
2. Click **Properties**  next to the input you want to set.
3. Click the check boxes next to the desired measurements.
4. To change more properties, click the tab at the top of the dialog box.
5. Click **OK**.

3. Presetting the display

You may want to define the graph's settings, such as formatting and scaling the graph and selecting the axes, and to define the meters' settings prior to beginning a recording session. You can define the settings of each sensor input individually in the first step of the **Setup wizard**:

1. Click **Setup Wizard** on the main toolbar to open the setup wizard
2. Click **Properties**  next to the input you want to set.
3. Click the **Display properties** tab.

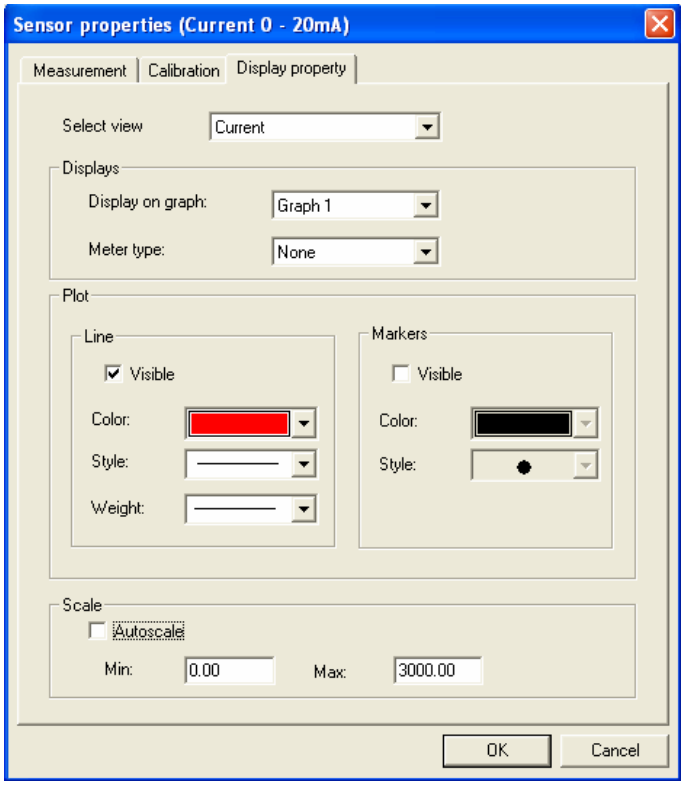


Figure 24: Display property dialog box

4. Select a measurement from the **Select view** drop-down menu.
5. Select the graph or graphs in which you would like to display the data, from the **Display on graph** drop-down menu.
6. Select a meter in the **Meter type** drop list if you want to display the data in a meter as well as on the graph.
7. Format the line and markers in the **Plot** section.
8. If you want a specific scale, uncheck the **Autoscale** check box and enter the desired minimum and maximum values of the axis.
9. Click **OK**.

4. Preset the graph's X-axis

1. Click **X-Axis display properties** in the first step of the Setup wizard to open the dialog box:

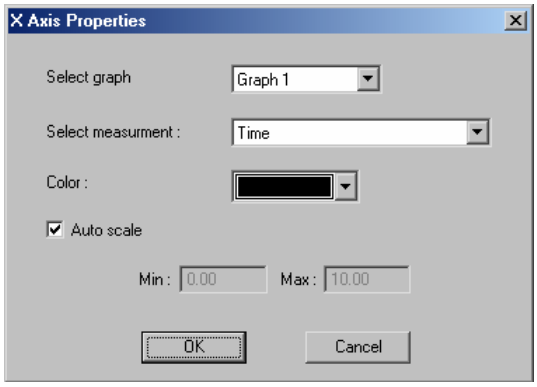


Figure 25: X-axis properties dialog box

2. Select the graph you wish to modify.
3. Select the measurement you'd like to display in the X-axis.
4. If you want a specific scale, uncheck the **Auto scale** check box and enter the minimum and maximum values of the axis.
5. Click **OK**.

5. Triggering

To start the data recording only when a specific time or measurement condition has been met, click **Triggering** in step 3 of the Setup wizard to open the triggering dialog box:

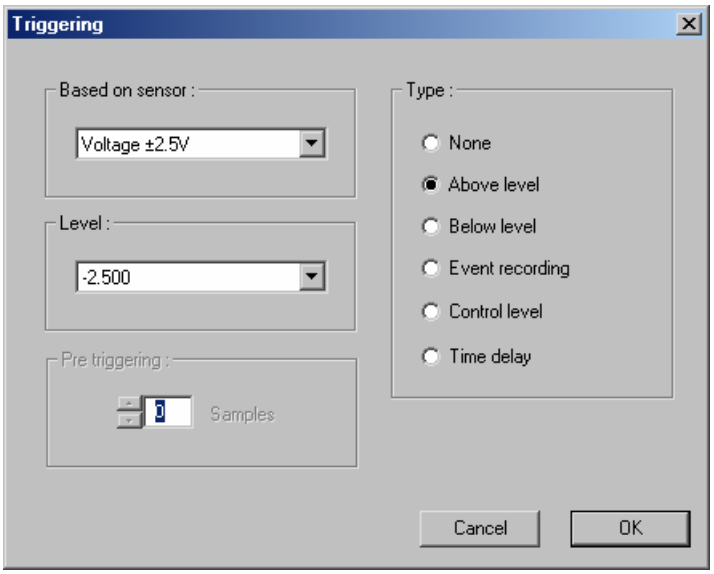


Figure 26: Triggering dialog box

Choose one of the following from the **Type** options:

- **None** - Trigger is disabled
- **Above level** - Start logging only once the measured value is **Higher** than the trigger level.
- **Below level** - Start logging only once the measured value is **LOWER** than the trigger level.

- **Event Recording** - This function enables you to record the exact time and date at which a certain phenomenon occurred: The trigger level set for this option is actually a threshold setting. Each time the threshold is crossed, TriLink will record the exact time and date of the occurrence, and will continue to do so until the desired number of samples has been obtained.

Note: The trigger acts on analog measurements only. The trigger condition must be fulfilled for at least 300μS.

- **Control Level** - The Control Level trigger allows you to create an automatic sense and control system. This means that you can connect a sensor measuring a certain phenomenon (for example, temperature) and connect a device that will start operating when the recorded data from the sensor falls above or below a pre-defined threshold (for example, a fan that will start operating when the temperature measured by the sensor rises above 30 °C). This function requires the use of a splitter cable and a control sensor. The cable divides each input into a sensor cable and a controller cable. After setting the control level and starting the data logging process, the sensor will sample and record the data as usual, but when the measurement from the sensor rises above the predetermined threshold value, the controller cable will send a pulse of 5V to the control sensor, and will continue to do so until the sensor measures a value below the threshold level. When receiving the 5V pulse, the control sensor will close/open a relay capable of switching 110/220V to any load.
- **Time delay** - This trigger type enables you to set a timer that will start the logging after a predetermined amount of time. After setting the trigger to Timer Delay, click the down arrow on the **Level** combo-box, and select from the 17 different time options. The timer will start its countdown when you click **RUN**, and the actual recording will start once the countdown has ended.

1. Select the trigger level in the **Level** drop list
2. Click **OK**

Note: When you turn off TriLink, it will save the setup for the next session.

3.6.2. Start Recording

Click **Run**  on the main toolbar. Click the **down arrow** to change the recording mode.

3.6.3. Stop Recording

Click **Stop**  on the main toolbar

3.6.4. Clear TriLink's Memory

To erase all recorded data currently stored in the TriLink, click **Clear memory** in the **Logger** menu (TriLink must first be connected to the PC).

3.6.5. Adding a Comment to TriLink

You can add a comment to each TriLink. The comment will serve as a name to identify the specific TriLink in addition to its serial number. Every time data is being downloaded from a TriLink, its comment and the serial number will be displayed in the graph title and on the corresponding icon in the Data Map.

The comment and the serial number will also be displayed in prints and exported files.

The comment can include up to 20 characters.

To add a comment:

1. Connect TriLink to the PC.
2. Click **Logger** on the main menu, and then click **Set comment**.
3. Click the **Comment** text box and type a comment (e.g. its location).
4. Click **OK**.

3.6.6. Calibrating the Sensors

DaqLab enables you to calibrate any of the linear sensors manually. This two point calibration method sets both the gain (slope) and offset (intercept) of the sensor's conversion function. The calibration procedure affects DaqLab readings only.

1. Select the **Calibrate sensors** option from the **Logger** menu.
2. You will be prompted to enter a password to access the Calibration feature. Enter the default DaqLab password: 1234.

   It is recommended to change this password to protect your calibrated sensor values from unauthorized calibrations by other users.

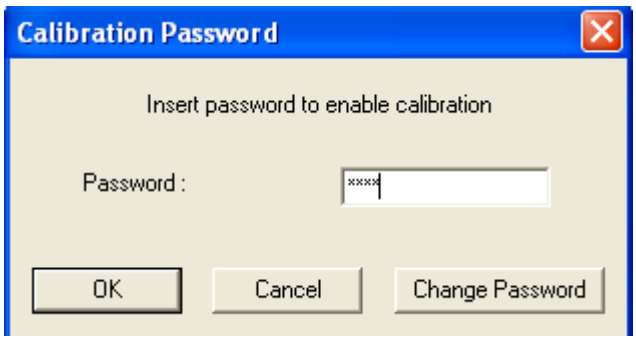


Figure 27: Calibration password dialog

3. Choose a sensor from the **Select sensor** drop list and click **OK**.
4. Click the **Calibration** tab.

5. Enter a distinct real value in each of the **Real Value** edit boxes and the corresponding measured values in each of the **Measured Value** edit boxes (The measured values are the values displayed by DaqLab when measuring the two real values).

6. Click **OK**.

The calibrated sensor parameters will be saved in DaqLab.

To reset to the default calibration for any sensor, select the sensor and click **Restore defaults**.

3.6.7. Define a Custom Sensor

DaqLab enables the user to define additional custom sensors. This is a useful tool for when TriLink is communicating with many sensors from different vendors for example.

Any additional sensor that you would like to connect to TriLink must comply with the following restrictions:

1) The sensor's output must be greater than or equal to **0V** or **0 mA** and less than or equal to **5V** or **20 mA**. Remember that all sensors transform actual data into electrical data, so the electrical output should remain between 0 and 5 volts or 0 and 20 mA.
2) The sensor Transfer Function (sensor output voltage changes vs. the sampled phenomenon changes) must be a linear Transfer Function.

To define a new sensor:

1. Connect TriLink to the PC

2. Select **Define new sensor** from the **Logger** menu to open the Define new sensor dialog box:

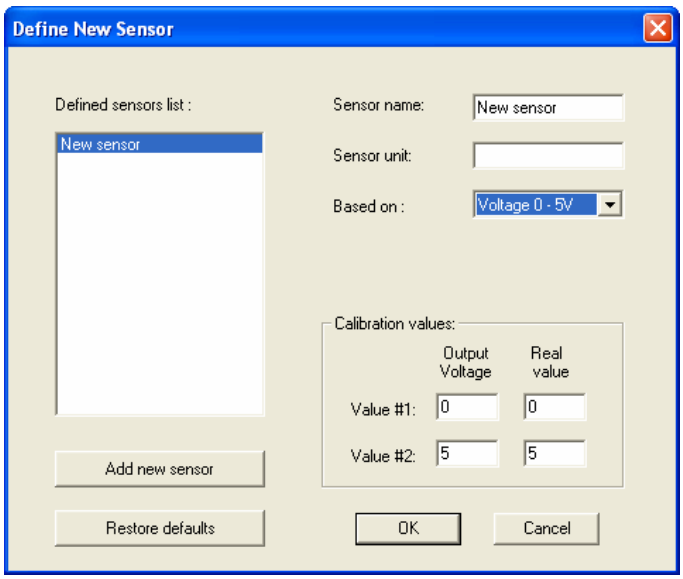


Figure 28: Define New Sensor dialog box

3. Click **Add New Sensor**.

4. Type in a sensor name and a sensor unit.

5. Type in two calibration values (two real values and the corresponding output voltages of the sensor).

6. Click **OK**.

3.6.8. Communication Setup

TriLink communicates with the DaqLab software via a serial communication port. Some users may find it difficult to select the correct port, in which case DaqLab can perform an automatic port selection, and can also report on the status of all available ports.

Automatic COM Port recognition

The standard PC has 4 communication ports, COM-1 to COM-4. One of these ports is usually available for external communication. It is not necessary to know which port is available, since **DaqLab can find it for you.**

Connect the communication cable from TriLink to one of the PC COM Port connectors.

Turn on TriLink and run the DaqLab software. DaqLab will automatically attempt to communicate with the data logger. If communication is achieved, the selected port becomes designated as TriLink's communication port

If communication fails:

1. Select **Comm Setup** from the **Logger** menu. DaqLab will display a dialog box reporting what COM Ports are already in use, and which port is recommended for use with TriLink.

2. Click **Try to connect** and DaqLab will try to communicate with TriLink. If communication is achieved, DaqLab will designate the selected port as TriLink's communication port

You can override the DaqLab recommendation and choose the COM Port yourself by clicking the check box button to the left of the desired port, and clicking **Try to connect**.

3. You can click **Work offline** if you wish to work without TriLink. While working offline, you can still open saved files to view and analyze them.

3.7. Analyzing the Data

3.7.1. Reading Data Point Coordinates

Position the cursor (refer to page **Error! Bookmark not defined.**) on a point to display its coordinates on the information bar at the bottom of the graph window.

If more than one curve is displayed, and you want to read the Y coordinates of all of the curves simultaneously, bring up digital meters (refer to page **Error! Bookmark not defined.**) for each of the curves. When you position a cursor on one curve, the meters will show the corresponding Y-coordinates for the other curves.

3.7.2. Reading the Difference between two Coordinate Values

Position one cursor on the first point and a second cursor on the second point to display the difference between the two coordinate values on the information bar at the bottom of the graph window.

3.7.3. Working with the Analysis Tools

The analysis tools can only be applied to data sets that are displayed in the graph window.

1. Use the cursors (refer to page **Error! Bookmark not defined.**) to select the graph and the data range to which you want to apply the analysis.
2. Select the analysis function you wish to use.

The analysis function will be added onto the graph, with the exception of the smoothing (averaging) function, which will replace the original data set.

3.7.4. Smoothing

The smoothing tool is very useful in reducing random *noises*, especially if you want to apply any analysis functions to the data. The smoothing process replaces every data point with the average of its neighboring points.

1. Use the cursor to select the function on the graph that you want to smooth.
2. Click **More smoothing**  on the graph toolbar.
3. You can repeat the procedure to further smooth the data.
4. Click **Less smoothing** to reduce the amount of smoothing.

3.7.5. Statistics

Use the statistics tool to display statistics of a selected data set or a range of data. The statistics include:

Average – The average of all the numbers in the range

StDev. – The standard deviation

Minimum – The smallest value in the range

Maximum – The largest value in the range

Sum – Adds all the numbers in the range

Area – The area between the graph and the x-axis in the range

Samples – The number of data points in the range

Rate – The recording rate

To display statistics:

1. Use the cursors to select the graph and the data range to which you want to apply the statistics
2. Click **Analysis** on the main menu, and then click **Statistics**.
3. DaqLab will open a statistics window in which it will display the results.

3.7.6. Most Common Analysis Functions

1. Linear Fit

Click **Linear Fit**  on the main toolbar to draw a line of linear least square fit and to display the line's equation $y = ax + b$

Note: If you want the automatic curve fit equation to start at $t = 0$, apply the Crop tool before applying the linear fit (refer to page 73).

2. Derivative

Click **Derivative**  on the main toolbar to construct a graph in which each point is the slope of the 3 consecutive points on the source graph.

3. Integral

Choose **Integral** from the **Analysis** menu to construct a graph in which each point is the integral of all the preceding points on the source graph.

3.7.7. The Analysis Wizard

1. Using the Analysis Wizard

The Analysis Wizard will guide you through the various analysis functions available in the DaqLab program. The analysis functions are grouped into three main categories: Curve fit (regression), averaging, and mathematical and trigonometric functions.

To apply an analysis function to a data set:

1. Use the cursors to select the graph or data range to which you would like to apply the analysis.
2. Click **Analysis Wizard**  on the main toolbar.
3. Click a Category tab:
   - Curve fit
   - Averaging
   - Functions

2. Curve Fit

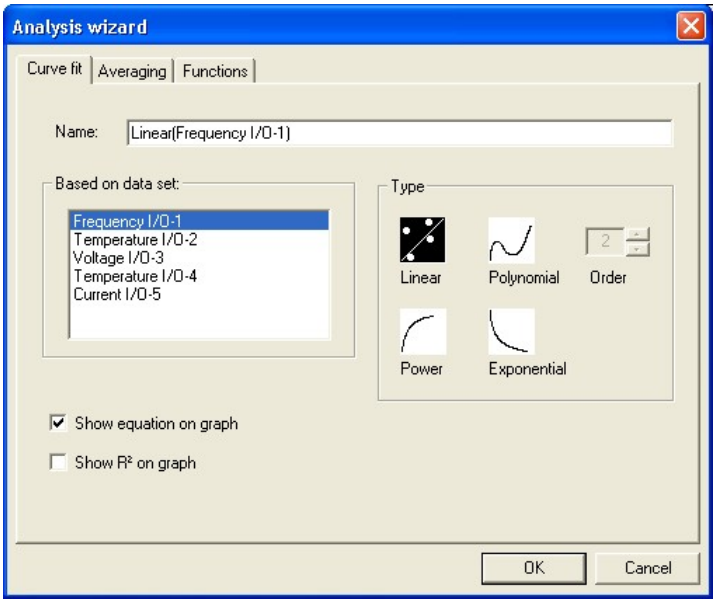


Figure 29: Analysis wizard – Curve fit

1. Select a fit Type by clicking its icon (if you choose polynomial fit, select the order you want).
2. If you use the cursor to select a data set, it will be highlighted in the **Based on data set** list, but you have the option of selecting a different data set.
3. Type a name in the **Name** box (optional - the default name includes both the function and the data set names).

4. Click the **Show equation on graph** check box to display the line's equation on the information bar.

5. Click the **Show R2 on graph** check box to display the correlation coefficient on the information bar.

6. Click **OK.**

Note: If you want the automatic curve fit equation to start at *t = 0*, apply the Crop tool before any type of curve fitting (refer to page 73).

3. Averaging

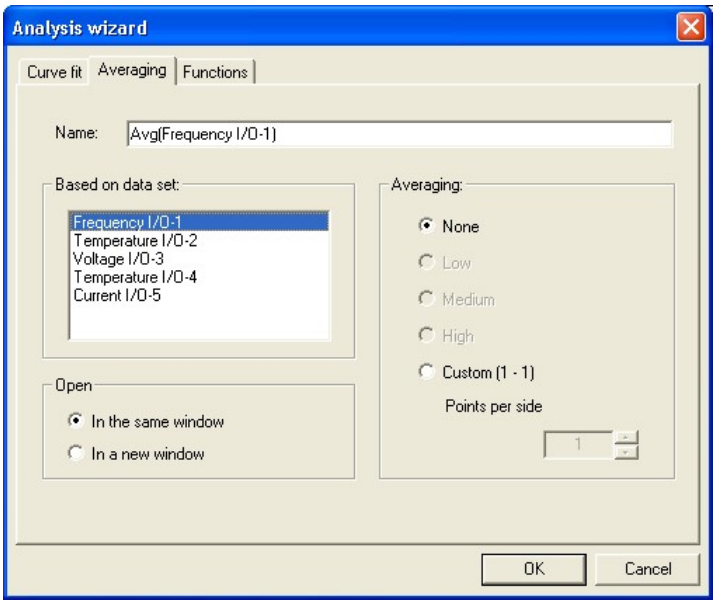


Figure 30: Analysis wizard – averaging

1. If you use the cursor to select a data set, it will be highlighted in the **Based on data set** list, but you have the option of selecting a different data set.

2. Select an averaging option (if you choose custom averaging, choose the number of averaging points in the **Points** box).

3. Enter a name in the **Name** text box (optional - the default name includes both the function and the data set names).

4. Select an **Open** option.

5. Click **OK.**

4. Functions

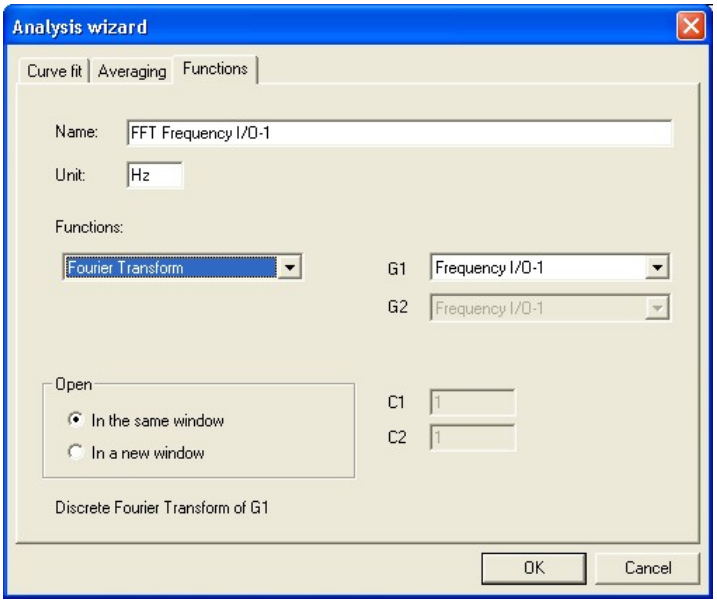


Figure 31: Analysis wizard – functions

1. Select a function from the **Functions** list. DaqLab displays the function's formula at the bottom of the dialog.
2. If you use the cursor to select a data set, it will be highlighted in the G1 drop-down menu, but you have the option of selecting a different data set.
3. If the analysis function involves two data sets, select the second data set from the G2 drop-down menu.
4. Enter a constant in each of the C1 and C2 boxes (optional).
5. Enter a name in the **Name** text box (optional – the default name includes both the function's formula and the data set name).
6. Enter a unit (optional).
7. Select an **Open** option.
8. Click **OK.**

3.7.8. Available Analysis Tools

This section includes a brief description of each of DaqLab's analysis functions.

1. Curve Fit

Linear $y = ax + b$

Draws a line of linear least square fit

Polynomial $y = a_0 x^n + a_1 x^{n-1} + \cdots + a_n$

Draws a line of polynomial least square fit (you must select an order between 1 and 6.)

Power $y = \frac{a}{x^n}$

Draws a line of power least square fit

Exponential $y = ae^{bx}$

Draws a line of exponential least square fit

DaqLab displays the curve fit equation and the correlation coefficient (R^2) on the information bar below the graph.

2. Averaging

The average function replaces every point with the average of *n* neighboring points from both sides of the point.

Low averaging: $n = 5$, Medium averaging: $n = 11$, High averaging: $n = 41$

3. Functions

In the formulas below, G_1 and G_2 represent selected data sets, and C_1 and C_2 are constants that you can enter. The constant's default value is 1.

Absolute $y = C_1 \left| C_2 G_1 \right|$

Draws a line of the absolute values of a data set

Add $y = C_1 G_1 + C_2 G_2$

Draws a line of the addition of two data sets

Arccosine $y = C_1 \arccos(C_2 G_1)$

Draws a line of the arccosine values of a data set (in radians). Arccosine is the angle whose cosine is $C_2 G_1$. The argument $C_2 G_1$ must be between –1 and 1.

Arcsine $y = C_1 \arcsin(C_2 G_1)$

Draws a line of the arcsine values of a data set in radians. Arcsine is the angle whose sine is $C_2 G_1$. The argument $C_2 G_1$ must be between –1 and 1.

Average

$C_1 \cdot$\{average of C_2 *points around* G_1\}

Replaces every point with the averaging of C_2 neighboring points

Cosine

$$y = C_1 \cos(C_2 G_1)$$

Draws a line of the cosine values of a data set. The argument $C_2 G_1$ must be expressed in radians.

Delta Y

$$y = G_1 - G_1(t = 0)$$

Draws a line of the difference between the Y-coordinate of every point and Y-coordinate of the first point. Use this function to move the data set along the Y-axis so that the point will intersect the Y- axis at the origin.

Derivative

$$y_n = \frac{y_{n+1} - y_{n-1}}{2\Delta t}, \Delta t = \frac{1}{sampling\ rate}$$

Draws a line of the slopes of every three consecutive points of a data set. For high recording rates and small Δt, this line may be very noisy, which is why smoothing the data set is recommended before applying the derivative function.

Divide

$$y = C_1 G_1 \Big/ C_2 G_2$$

Draws a line of the division of two data sets

Envelope (lower)

Lower envelope of G_1 with tolerance of C_1 points

Draws a line that connects the minimum values of a data set. The tolerance defines the minimum distance (in sampling points) between two minima, so that the envelope function is able to ignore random *noises*.

Envelope (upper)

Upper envelope of G_1 with tolerance of C_1 points

Draws a line that connects the maximum values of a data set. The tolerance defines the minimum distance (in sampling points) between two maxima, so that the envelope function will be able to ignore random *noises*.

Exp. $y = C_1 e^{C_2 G_1}$

Draws a line of e raised to the power of a data set

Fourier transform Discrete Fourier transform of G_1.

Draws a line of the amplitudes of the harmonics of Fourier transform vs. frequency

Frequency The frequency of G1 (minimum of C_1 points in one cycle).

Draws a line of the frequency of a periodic data set vs. time. The constant C_1 defines the minimum data points in one cycle.

Integral $y = C_1 + C_2 \sum G_1 \Delta t$

Draws a line in which each point is the discrete integral of all the preceding points in a data set

Linear $y = C_1 + C_2 G_1$

Draws a line of a linear displacement of a data set. This function is useful when you want to change the point of origin of a data set.

Ln $y = C_1 \ln(C_2 G_1)$

Draws a line of the natural logarithm of a data set. The argument $C_2 G_1$ must be positive.

Log $y = C_1 \log_{10}(C_2 G_1)$

Draws a line of the logarithm of a data set to base 10. The argument $C_2 G_1$ must be positive.

Multiply $y = C_1 G_1 \cdot C_2 G_2$

Draws a line of the multiplication of two data sets

Reciprocal (1/X) $y = \frac{C_1}{G_1}$

Draws a line of the reciprocal values of a data set

Sine $y = C_1 \sin(C_2 G_1)$

Draws a line of the sine values of a data set. The argument $C_2 G_1$ must be expressed in radians.

Square (X^2) $y = C_1 (C_2 G_1)^2$

Draws a line of the squares of a data set.

Square root $y = C_1 \sqrt{C_2 G_1}$

Draws a line of the square root values of a data set. The argument $C_2 G_1$ must be greater than or equal to zero.

Subtract $y = C_1 G_1 - C_2 G_2$

Draws a line the subtraction of two data sets.

Tan $y = C_1 \tan(C_2 G_1)$

Draws a line of the tangent values of a data set. The argument $C_2 G_1$ must be expressed in radians.

Position the cursor (see page 89) on a point to display its coordinates on the information bar at the bottom of the graph window.

If more than one curve is displayed, and you want to read the Y- coordinates of all of the curves simultaneously, bring up digital meters (see page 95) for each of the curves. When you position a cursor on one curve, the meters will show the corresponding Y-coordinates for the other curves.

3.7.9. Reading the Difference between two Coordinate Values

Position one cursor on the first point and a second cursor on the second point to display the difference between the two coordinate values on the information bar at the bottom of the graph window.

3.8. Special Tools

3.8.1. Crop Tool

The Crop tool enables you to trim the edges of a data set. Use it to remove unwanted data.

The time scale of the trimmed data is shifted so that it will start at $t = 0$.

If you want the automatic curve fit equation to start at $t = 0$, apply the Crop tool before any type of curve fitting

After applying the Crop tool, the trimmed data set replaces the original set on the graph display and a new icon is added to the Data Map under cropped data.

1. To trim all data up to a point

1. Position a cursor (refer to page **Error! Bookmark not defined.**) on the data point.
2. Click on the **Graph** menu, and then click **Crop**.

2. To trim all data outside a selected range

1. Use the cursors to select the range you want to keep.
2. Click on the **Graph** menu, and then click **Crop**.

3.9. Toolbar Buttons

3.9.1. Main (Upper) Toolbar

	**New**	Start new project
	**Open**	Open saved project
	**Save**	Save project
	**Print**	Select print options
	**Run**	Start a data recording session. Click on the down-arrow to select recording mode.
	**Stop**	Stop recording
	**Download**	Download the data from the most recent recording session
	**Setup**	Open the Setup dialog
	**Meter Setup**	Open the Meter setup dialog
	**Data Map**	Display the Data Map
	**Graph**	Display the graph window
	**Table**	Display the table window
	**Analysis**	Open the Analysis wizard
	**Linear Fit**	Draw a line of linear fit of the selected data set
	**Derivative**	Draw a line of the derivative of the selected curve

3.9.2. Graph Toolbar

	**Zoom In**	Zoom in around a selected point or in to a selected range
	**Zoom Out**	Reverse the most recent zoom operation
	**Autoscale**	Display all the data
	**Zoom to Selection**	Zoom in to a selected area
	**Pan**	Pan in all directions while in zoom mode
	**More Smoothing**	Smooth (average) the selected curve
	Less Smoothing	Reverse the most recent smoothing operation
	**1st Cursor**	Display or remove the first cursor
	**2nd Cursor**	Display or remove the second cursor
	**Split Graph**	Switch to a split graph display
	**Edit Graph**	Select the data to display on the axes
	**Graph Properties**	Graph formatting, scaling and units selection
	**Add to Project**	Add the displayed graph to the project
	**Export to Excel**	Export the displayed graph to Excel

Chapter 4
Troubleshooting Guide

Symptom	*Cause of problem*
I pressed the ON key on TriLink and it did not turn on.	• After pressing the ON key wait 3 seconds for TriLink to *wake up* • Try charging the battery, it may be weak. • You are using unsuitable AC/DC adaptor.
TriLink displays BT_fail during startup	• The USB cable is connected
Bluetooth connections is denied (even after pairing)	• The USB cable is connected
I started a new logging and the data logger stopped immediately afterwards.	• First check if the sampling rate was so fast that the experiment began and ended in less than a second. If this is not the reason, recharge the 2.4V battery and try again. TriLink monitors the battery power during the logging. If the battery voltage is not sufficient, the logging is stopped automatically.
The recorded data is *noisy*	• With voltage or current sensors, use short connections between the circuit being tested and the sensor. In some cases it is advisable to connect the (-) of the current sensor to the ground terminal • Avoid working near strong electromagnetic fields. (e.g. engines, fluorescent lights)
TriLink's memory is empty – there is nothing stored	• The internal 3V disk battery is dead.
TriLink battery running low, unable to continue	• Charge TriLink completely (12 hours) • Use TriLink while connected to a wall outlet

TriLink has stopped responding	• TriLink has disconnected from the computer but continues to run independently as a data logger. • Press the Run/Stop button on TriLink. (LCD screen on TriLink shows changing data values) • Reconnect TriLink to the computer

Chapter 5
Specifications

Inputs	Up to 4 simultaneous analog inputs	
	External sensors	Temperature -50 °C to 150 °C
		Current 0-20 mA, Voltage 0-5 V, Pulse Counter, combined Relative Humidity and Temperature Sensor
Outputs	Bluetooth 1.2 wireless communication link (Toshiba and Broadcom/Widcom chipsets)	
	USB PC host interface at 1.1 Mbps	
Sampling	Resolution:	12-bit (4096 Levels)
	Capacity:	Up to 256,000 samples
	Analog sampling rate:	1 sample/hr to 20,800 sample/sec
	Digital sampling rate:	>200 kHz
Features	User interface: Alfa Numeric LCD, 2 lines by 16 characters each	
	Stand alone operation without connection to a PC	
	Automatic or manual sensor identification	
	Saving and loading of last setup	
	Triggering	
	Built-in battery charger for charging the 2.4 V internal battery	
	Event recording	
	User-defined sensors	
Power supply	Voltage:	Internal rechargeable 2.4 V NiMH battery
		External 6 V DC input
Software	DaqLab for Windows 98/2000/XP and Vista, Pocket PC	
Operating temp. range	0 °C to 50 °C	
Dimensions	93 x 100 x 27mm	
Weight	160 gr	
Standard compliance	CE, FCC	

Ordering information	**Part No.**	**Description**
TriLink basic pack	TRL1	TriLink data logger, one USB communication cable, DaqLab software for PC and PocketPC, carrying case, AC/DC adaptor
Accessories	DT 231	Mini USB Communication Cable
	DT241	Temperature sensor
	DT234	Current sensor
	DT228	Voltage sensor
	DT041	Humidity and Temperature sensor

Appendix A: Figures


fourier