Limpet

User Manual

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1. General Information

About this Manual

This manual is intended as a general guide for installing, wiring and using a Limpet and LimpetXL data loggers (from here on, both referred to as Limpet). The information contained in this manual may not cover all aspects of Limpet applications. Please refer to associated equipment manuals or consult papers and technical notes on the EML website (www.emltd.net).

Version Information

Table 1 - Document Revisions

EML Document Number:	Description:
UM-155-290-Limpet User Manual	Version 1.0 – 21st September 2017
	Version 1.1 – 13th March 2019
UM-155-290-Limpet User Manual	Version 2.0 – 31st May 2019

2. Introduction

The EML Limpet logger provides an efficient and economical method of logging rainfall at a remote location without external power. The Limpet fits inside all EML rain gauges and works for all tipping bucket rain gauges with simple contact closure/pulse output. It records rainfall in 'event' mode, and provides the option to post-process the data to different timed intervals, from 1min to 24 hours. For initial configuration or data collection, the logger is connected to the USB port of a computer. Using the 'EML Rain Logger GUI' software the user can collects data and configures the logger.

The EML Limpet Logger GUI has been designed to offer full control of the Limpet. Using the software, you can configure your logger, download, convert and save the data in Text or CSV file formats.

The Limpet logger contains a microcontroller, a real-time clock, 2Mbytes of non-volatile memory, a contact input and a USB port for communication with a computer. The Limpet is powered using a 2/3 A 3.6V lithium battery. Measurements from a tipping bucket rain gauge are logged.

3. Technical specification

Operating Range	-40° to 60°C (-40° to 140°F)
Logging Interval	Event based logging triggered by a contact closure switch, with timed data conversion after downloading: 1min – 24 hr
Data sample	Day-Month-Year,Hour:Min:Sec,CF,Count
Memory Mode	Two memory modes: - Stop when full, - Loop memory
No. of Channels	1
Time Accuracy	±8 seconds per month in 0° to 40°C (32°F to 104°F) range; ±30 seconds per month in -40° to 60°C (-40° to 140°F) range
Battery Type / Power Source	2/3 A 3.6V Lithium Battery
Battery Service Life	6-12 months
Memory details	256 Kb of Non-volatile EEPROM memory. (retains recorded data even after loss of power). Max: 8513 readings. E.g. The logger stores 8513 events at 1 count per event.
Size	Limpet – 75mm(w) x 50mm(d) x 80mm(h) Limpet-XL - 120mm(w) x 55mm(d) x 95mm(h)
Weight	110g (Limpet) and 220g (Limpet-XL)
Environmental Rating	IP65

4. Installing the software

- Insert the EML USB stick received with the EML Limpet Logger (or download from the EML website – www.emltd.net).
- Run the '.exe' file contained on the device or the download.
- Follow the instructions to install the software.
- After installation, run the 'EML Limpet Logger GUI.exe' to open the software.

5. Configuring the logger

Connect logger to a PC
- Connect one end of the serial cable to the Limpet Logger and the other end to a free serial USB port on the Computer.
- Select 'Auto detect' on the Port combo box then Press the 'Connect' button. This will automatically select the appropriate COM port and connect the logger GUI to it.

Run the 'Configuration wizard'
Press the **'Config Wizard'** button. This guides the user through the main requirements for configuring the logger. These are summarised below:

- Clear logger memory
- Set date-time
- Select measurement unit
- Select calibration factor
- Select memory mode

Manually configure the logger
This section describes in more detail the steps carried out in the Configuration Wizard. For manual configuration of the logger, it is recommended that the user carries out the following tasks in order:

Clear logger memory:
Press **'Clear memory'** button on the main screen of the software and, if you are sure, press **'Yes'** when prompted.

This ensures that the new logger configuration makes use of the whole logger memory. Note that the memory must be cleared before a new configuration is loaded. Therefore, if there are data on the logger which are needed, exit the configuration wizard at this point, download the data, and then return to the configuration wizard.

Set date-time:
Automatically set the date-time: Press **'Auto set date-time'** button on the main screen of the software. This will set the logger's time to the PC time.

Manually set the date-time: Go to **'Options'** then **'Set Date and Time Manually'**. Use the drop-down menus to set the logger's time manually.

Select measurement unit:

Go to **'Options'** then **'Select Measurement Unit'**. Select either millimetres or inches.

Select calibration factor:

Go to **'Options'** then **'Select Calibration Factor'**. This is the precipitation multiplier and is known as the 'resolution'. It can be set to any value, but it must be matched up with the appropriate rain gauge. The resolutions EML tipping bucket rain gauges are shown in the table below:

Rain Gauge Model	Calibration Factor
Kalyx	0.2
SBS-314/0.2	0.2
SBS-314/0.5	0.5
SBS-500/0.2	0.2
SBS-1000	0.1
UPG-1000	0.1

Select memory mode:

Go to **'Options'** then **'Select Memory Mode'**. There are two options for configuring the logger's memory mode. These are described as follows:

Loop memory (overwrite oldest data): This option means that the logger will continue indefinitely. However, whenever the memory capacity is full, the oldest data will begin to be overwritten. A unique feature of this logger is that if this happens, a record of the total rainfall including the 'old data' is kept, even after the memory has been erased.

Stop when full: This option stops the logger from recording any more data when the memory becomes full.

6. Event-based memory

The time of the contact closure (e.g. one tip of a tipping bucket rain gauge) is recorded to the nearest second. The logger 'wakes up' to record each rain gauge tip before returning to a sleep state. This mode is ideal for precipitation intensity measurements, and is also the lowest power mode.

7. Deploying the logger

The logger has now been configured. Now it must be connected to the rain gauge and made ready for field deployment.

Disconnect the serial cable from the logger and replace the blue cap on the end of the connection point. Any tips of the gauge that occur after this point will be recorded.

Attach the two wires to the connection points on the rain gauge and fit the logger into place. On the Kalyx this process involves pushing the base of the logger onto the raised bar of the gauge until the logger clicks into place and a firm attachment is achieved.

The logger is now fully set up and the gauge is ready for field deployment. For details of how to carry out this task refer to the individual rain gauge manual.

8. Data collection

Data can be downloaded from the logger and saved as .txt or .csv file. The data format is simple and easily accessible. The data is separated by a comma by default. When saved as a .csv it will therefore look like the following:

Date	Time	Calibration Factor	Count
07-10-2016	12:03:56	0.200	001
07-10-2016	12:05:02	0.200	001
07-10-2016	12:07:06	0.200	001

Downloading the data

Connect the datalogger to the PC using the method outlined in Section 4.1.

Press **'Download Data'** button on the main screen of the software.

The data will appear in the output box in the centre of the main software screen

Saving the event data

When downloading is complete, the data should be visible in the output screen on the main page of the software. These data can now be saved as one of two file types.

On the main toolbar, press **'File'**. There will be two options, **'Save As txt'** or **'Save As csv'**.

Select the preferable file type.

A Windows Explorer box will appear, requesting the user to navigate to the location in which they wish to save the file.

Select a suitable location and choose an appropriate file name and click **'Save'**.

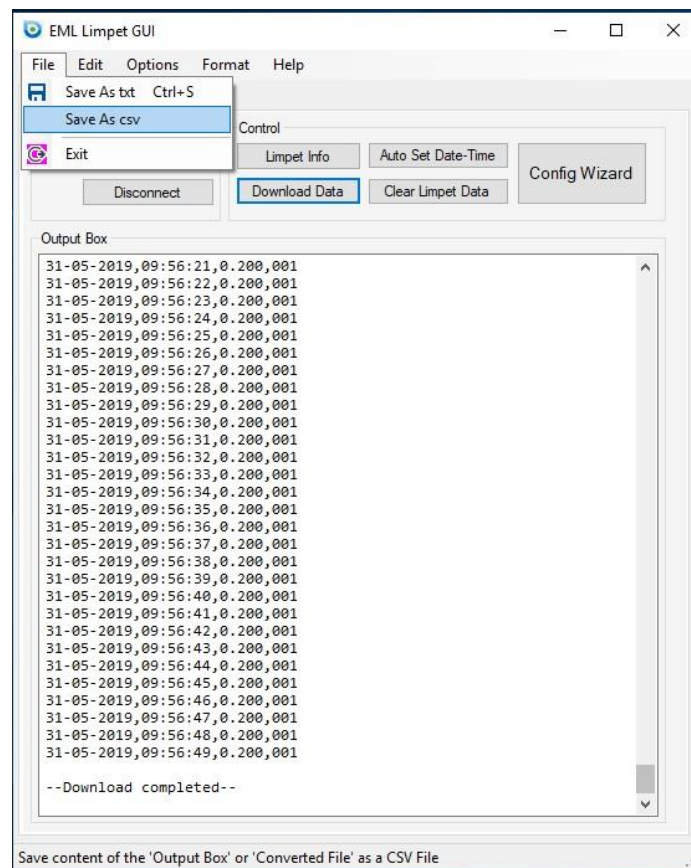See Figure 1 for a screen grab of the software when saving the event data.

Figure 1: Saving the event data

9. Data Conversion

The event data can be converted to any aggregation interval between 1 minute and 24 hours. This means that all the events recorded within a specified interval are aggregated and recorded as a total number of events within the specified time period.

Select the "Data Conversion" tab on the software screen.

Select the data file you wish to perform the conversion for. The file name data file is as follows:

{Logger name}_{Date downloaded}_{Time downloaded}_Event

The screen grab in Figure 2 shows the file being selected for data conversion.
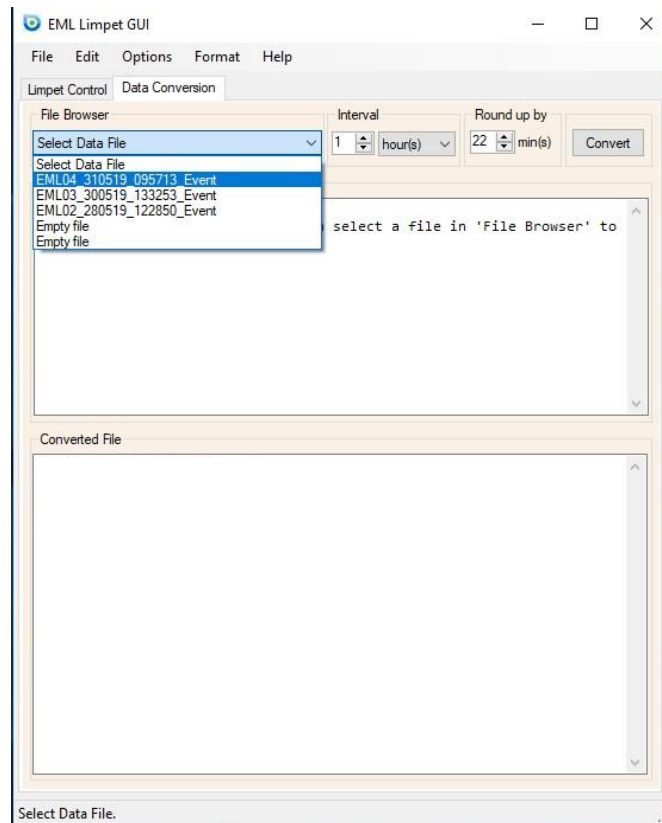
Figure 2: Select the event data file to perform the data conversion on

The next step is to select the interval to which the event data should be aggregated. This can be anywhere between **1 minute and 24 hours.**

After this has been done, it is necessary to select the timing interval to which the user would like to round to. For example, in Figure 3 below a time interval of 5 minutes has been selected and the "Round up by" tool is set to 3 minutes. This is calculated by looking at the time of the first data point (highlighted in blue below) and rounding up to the time interval at which the user would like to start the aggregations.

For example, the first event in the figure below is recorded at 09:47:28. To aggregate the data to a 5 minute interval, starting at 09:50:00 would be a typical approach. Rounding 09:47:28 up to 09:50:00 requires a "Round up by" value of 3 minutes to be entered.

Once the "Convert" button has been pressed, the newly aggregated data appears in the window at the bottom of the screen entitled "Converted File".

Don't worry, if you get this interval wrong initially, it is simple and quick to amend the "Round up by" value and reconvert the data correctly.

Then, the data can be saved in the usual way (as described in Section 8 of this manual), as shown on the right-hand side of Figure 3 below.

It is good practice to save the data with the interval at the end of the file, instead of "Event". E.g.

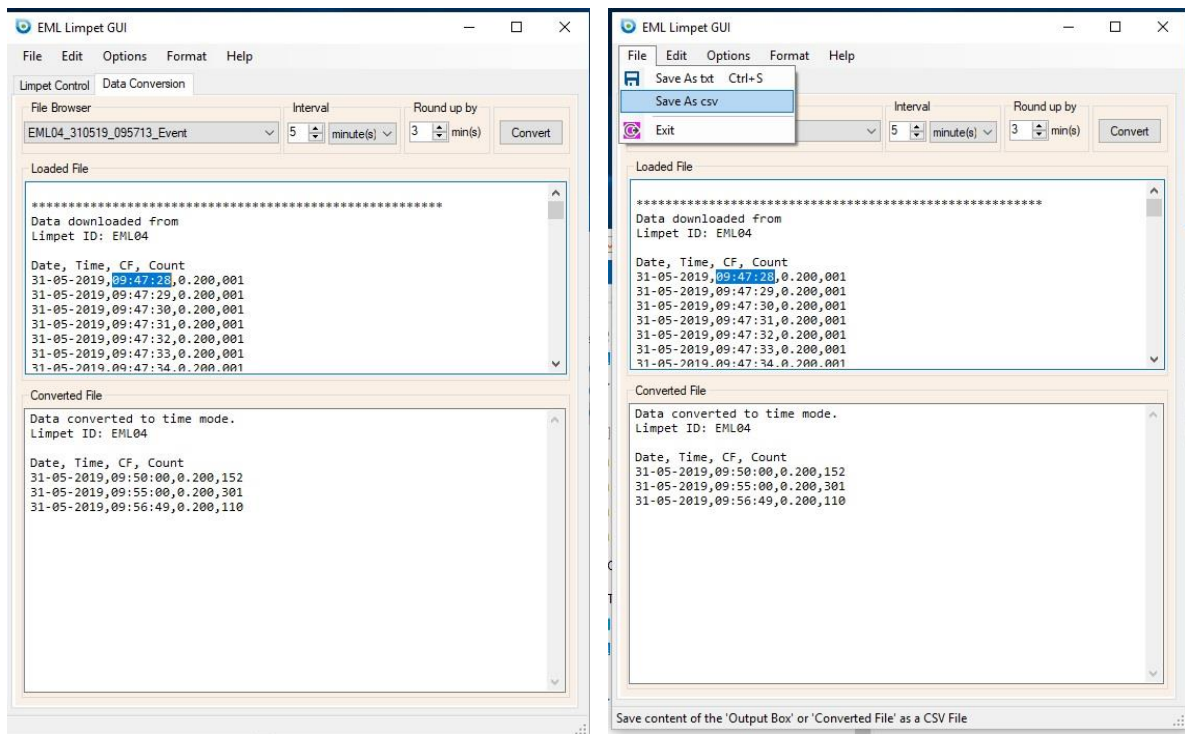**{Logger name}_{Date downloaded}_{Time downloaded}_5mins**

Figure 3: Data conversion from event data to 5 minute data, rounding up by 3 minutes to the appropriate "correct" interval

10.   Troubleshooting

If the computer is not detecting the Limpet, check the serial connection.

If the Limpet Logger GUI is connected to the COM port and the Limpet is not responding, check if the right COM port has been selected by selecting a different port. This can be done only if the Limpet GUI is displaying more than one COM port.

If the Limpet GUI was communicating with the Limpet, and has just stop communicating, the Limpet Logger might be in sleep mode. Press the "Disconnect" button and then press the "Connect" button to re-establish the link.

Appendix A - Frequently ask questions

Installer to run EML Limpet Logger GUI Application

To run this application, you first must install one of the following versions of the .NET Framework: v4.0

Symptoms:

When installing or accessing EML Limpet Logger GUI Software, Windows may display a message:

"To run this application, you first must install one of the following versions of .NET Framework: v4.0

Contact your application publisher for instructions about obtaining the appropriate version of the .NET Framework."

Cause:

This message appears when the computer onto which "EML Limpet Logger GUI" Software is being installed (or has been installed) does not have Microsoft .NET Framework 4.0 - part of Windows OS (Operating System) - installed or activated on it.

EML Limpet Logger GUI Software required Microsoft .NET Framework 4.0, which is usually installed on most Microsoft Windows OS (including Microsoft Windows 7 to Windows 10).

Some reasons why a Windows OS may not have Microsoft .NET Framework 4.0:

An out of date Windows OS (such as Windows XP or Vista) which is not supplied with Microsoft .NET Framework 4.0 as standard.

Windows updates for Microsoft .NET Framework 4.0 have not been installed, or Microsoft .NET Framework 4.0 on the computer has been corrupted or removed.

Microsoft .NET Framework 2.0, 3.5 and 4.0 Features have been turned off (disabled) in Windows Control Panel - Programs - Programs and Features.

Solution:

Installer message does suggest installation of Microsoft .NET Framework 4.0.

Close all the programs

Download and install Microsoft .NET Framework 4.0
https://www.microsoft.com/en-gb/download/details.aspx?id=17851

Follow Microsoft Installer prompts to complete installation

Once installation of Microsoft .NET Framework 4.0 is complete, you may need to restart your computer, install or open EML Limpet Logger GUI Software.

You should also be able to find other solutions for this issue on Microsoft website and the internet.

FTDI driver auto installation

The USB cable provided with the Limpet logger is build using a FTDI chip. When the USB cable is first connected to a computer, Window Update will automatically detect the FTDI driver for the USB cable online and install it on the computer, if the driver is not already present.

If no suitable driver is automatically found via Window Update, then the user should manually install the driver.

The FTDI drivers may be downloaded on the following link –
http://www.ftdichip.com/Drivers/D2XX.htm

The installation guide of FTDI driver for all Window operating system is available on the following link –
http://www.ftdichip.com/Support/Documents/InstallGuides.htm

The installation guide of FTDI driver for all Window 10 system is available on the following link –
http://www.ftdichip.com/Support/Documents/InstallGuides/AN_396%20FTDI%20Drivers%20Installation%20Guide%20for%20Windows%2010.pdf

The installation guide of FTDI driver for all Window 8 system is available on the following link –
http://www.ftdichip.com/Support/Documents/AppNotes/AN_234_FTDI_Drivers_Installation_Guide_for_Windows_8.pdf

The installation guide of FTDI driver for all Window 7 system is available on the following link –
http://www.ftdichip.com/Support/Documents/AppNotes/AN_119_FTDI_Drivers_Installation_Guide_for_Windows7.pdf