

Forest Electronic Developments

Data Logger and Battery Life Monitor

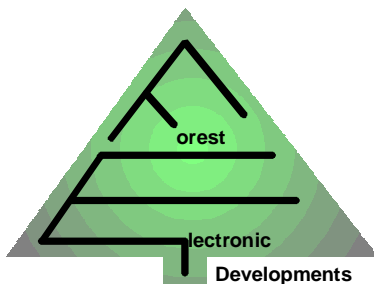
The FED Data Logger is system which measures the voltage and current used in a battery or supply on load and the characteristics of a discharging battery

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CAUTION – this system is designed to handle voltages up to 20V and currents up to 5A. The internal load can handle up to 3W.

The System will automatically disconnect either the internal or external load if any of these limits are exceeded.

However sudden transitions may exceed these limits and damage the board, apply supply and load carefully and do not change supply voltage or load value whilst under test.



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Or see the **Forest Electronic Developments** home page on the World Wide Web at the following URL:

<http://www.fored.co.uk/CAN>

Introduction

This manual describes the setup and use of the FED Voltage and Current logger, originally designed for use on battery measurement systems, but may be used to log the voltage and current characteristics of any system against time and operating from 1-20V, at 0-5A.

It may be used standalone powered through a USB charger or battery, or connected to a PC which will allow the host software to be installed which offers a more functional interface and the ability to graph and save data for other applications.

This project was born of a customer need to test a large number of rechargeable batteries in use on a system with 20 packs each of which had 4 AA NiMH cells. There was a perception that they were discharging rapidly either owing to failed cells, or due to an inadequate charging circuit. As there were well over 80 AA cells in the system it was necessary to come up with some method of testing them, and manual testing was impractical. Manual testing also has the danger that applying a fixed load whilst a battery discharges can damage or destroy one or more cells if it is allowed to completely discharge.

The key requirements for this system are that it should measure the life of a battery or cell in AmpHours, have an internal load which should be user selectable, and that it should automatically apply the load and disconnect it when the battery is discharged. However it should also allow external loads to be applied to measure greater currents as the power dissipation of the meter is around 3W maximum for heat dissipation reasons.

Installation of optional PC software

Download the LOGGER.ZIP file from this page :

<http://www.fored.co.uk/html/logger.html>

It contains the following files and folders :

1. setup.exe (Set up file for the PC software)
2. Logger.pdf (this file)

The module is installed as serial port on the PC which allows it to be used with FED software or be used with a terminal emulator or user written code. On Windows 7, 8 and 10 PC's it should install automatically. However if not auto detected, or if older versions of Windows are in use then the driver included can be used.

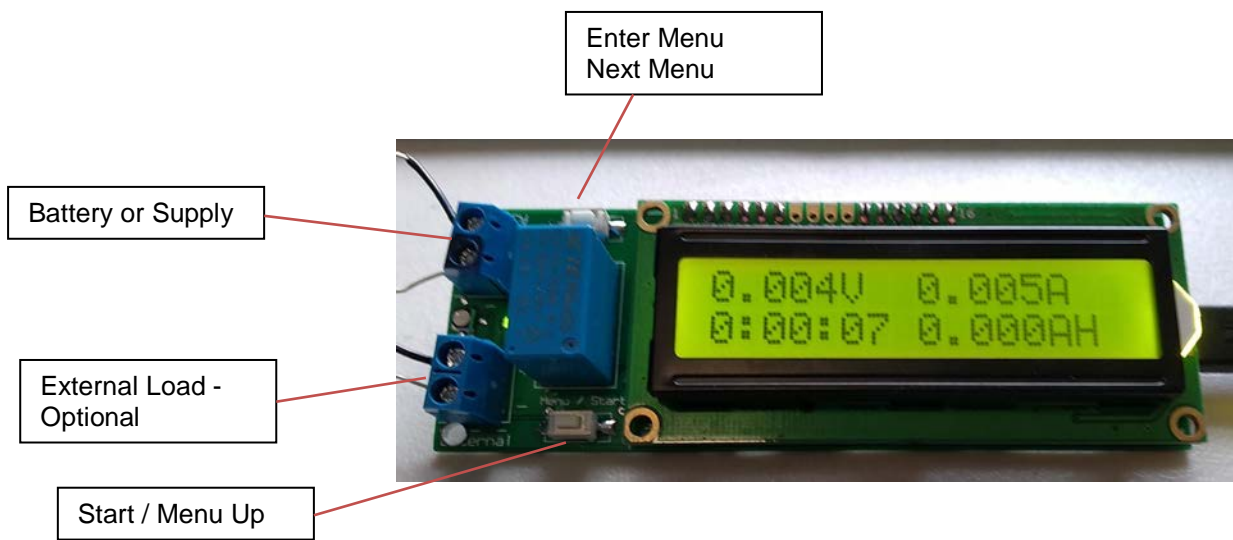
Power

The board is powered through a standard USB connector. It may be connected to a PC where the host software may be used, otherwise it can be powered through a standard USB charger or backup battery.

Board Connections

Load or battery life measurement

The board connections for a battery or load measurement are shown below:

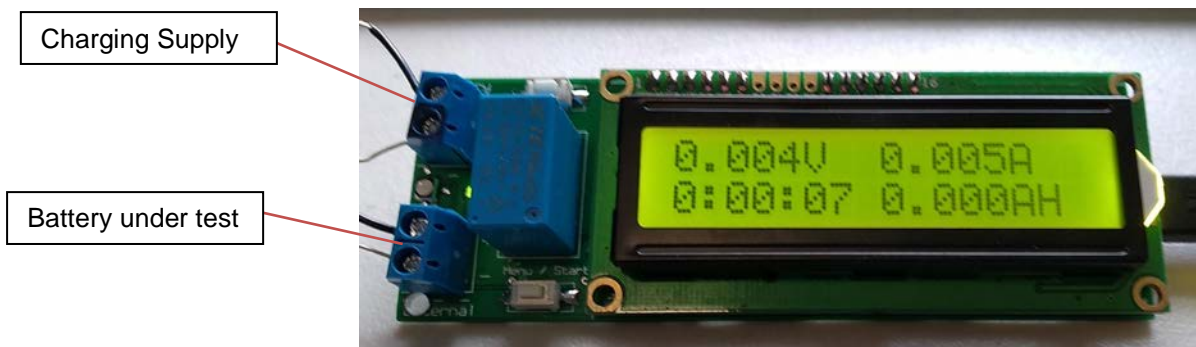


The + and – connections are clearly shown on the board. Reverse connection is unlikely to cause damage, but the circuit is not short circuit protected and it may be damaged if the external load connector is short circuited so please take care.

Always apply power before connecting the battery. After powering up, connect a fully charged battery to the battery terminals and check that the voltage is shown.

Charging measurement

To characterise a system which is charging a battery (for which the PC application should be used) then the connections are as follows :



Note that for battery charging measurement only the PC software can be used.

In this case the Charging box should be clicked on the PC application, this will prevent any internal load being applied, and sets the end conditions to be on time or when the pause button is pressed.

Operation stand alone – without the Logger software

For standalone operation the board is connected to a PC without the logger application running, or powered from a USB charger or battery supply.

Internal Load

There is an internal load which may selected using the menu syste from 200R, 100R, 47R, 20R, 10R or 4R7 may be selected. Selecting too high a resistance can result in the measurement taking days (a 3AH, 1.5V cell with a 100R load will take 200 Hours to discharge, well over a week !), too low a resistance will cause heat dissipation issues in the load resistors with high battery voltages. The board will not allow current consumed from the internal load to exceed 500mA or a total board dissipation of more than 3W. Higher loads should use the external load.

External Load

Alternatively for higher capacity batteries use an external load. The load may be applied at any time after the system starts a measuring cycle and should be connected to the external load port.

Now press and release the menu/start button, the load will be applied for 3S before the initial voltage is recorded, the load will be applied until the battery voltage drops to either a specific value or to a percentage the initial voltage at which point the load removed and the battery life showing will be the final life measured. The removal of the load is to ensure that the battery is not damaged by overload.

The percentage or absolute voltage drop at which measurement stops may be set through the menu system.

Menu System

The menu system may only be used if the system is not connected to the PC Logger software.

To enter the menu system press the Up button (The upper of the two buttons). To move from menu item to menu item use the Up button, to change the value of the current menu item use the Menu/Start button. To exit the menu system use the Exit Menu option, or wait 30S and the menu will exit automatically. All menu selections are saved through power down.

Press and hold Menu/Start for more than 10 counts to move more quickly through options.

The following Menu Items may be set :

Menu Item	Values	Notes
Set Load	200R 100R 47R 20R 10R 4R7 External	Select internal load value, or external load which is relay switched
-> Volts or %age	Drain to %age Drain to Voltage	The battery will be measured until it reaches a percentage of the original voltage. Typically 75% but this may be set. The battery will be measured and load applied until it reaches a specific voltage
Set Threshold V	May be set between 0.5V and 20V	This menu option is only available if the Drain to Voltage option is selected. The battery will be discharged until this voltage is reached when measurement will be stopped
Set Threshold %	May be set between 25 and 95.	This menu option is only available if the Drain to %age option is selected. The battery will be discharged until the voltage is reached as a percentage of the original voltage when measurement will be stopped. For example if the original voltage is 5V and 50% is selected then measurement will stop when the battery voltage drops to 2.5V.
Set Log Mode	Battery Life Log Always Log Volts+Load	This mode controls the transmission of logs from the system over the USB serial port when the PC application is not in use Log only when battery life measurement is in use, or all the time..
Set Log Tx Time	May be set between 1S and 180S	The time between transmission of log time over the serial port to the PC if the PC logger application is not in use.
LED Brightness	1-10	Sets the multicolour LED brightness.
ADC Offset	0-10	This sets the zero offset of the ADC used internally. It is factory set and should not be altered. Typical value is 3.

Exit Menu	Tap to Exit	Tap the Up button to exit the menu system or press the Menu button to step back to the next option
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Standalone operation - PC Interface and logging

When the PC logging software is not used, but the system is connected to a PC it will install itself as a standard serial port. This can be monitored in a terminal emulator or an application such as Visual Basic or MatLab. The serial port may be identified in the PC Device manager and the port may also be set through the Device Manager. Any serial rate may be used.

The system does not respond until it receives a command which is a single letter. The commands are:

- K Returns a 'K' character, verifies the system is connected
- X Start logging - returns a logging string regularly in line with the time set in the menu. When in logging mode the string is returned at all times. When measuring battery life it is returned only during battery measurement
- Y Return a log string immediately.
- Z Turn off logging

The format of the logging string is shown in the example below, it is sent in ASCII :

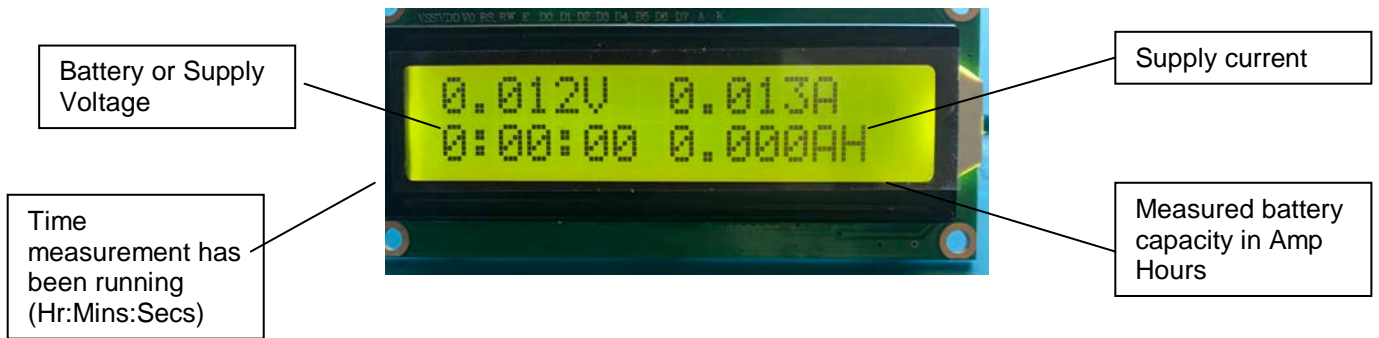
#0:00:06, 6 , 0.001, 0.611, 1.558, 1, 0, 0, 0, 6

Representing 10 fields separated with commas. The start of the field is represented with a # symbol.

Field	Example Meaning
#	Start of line
Time in H:M:S,	0 Hours, 0 Mins, 6 Seconds
Total time in Seconds,	6 Seconds total running time
Amp Hours,	0.001 Amp Hours
Current,	0.611 Amps
Voltage,	1.558 Volts
Running (Flag),	The battery is under load and measurement
Finished (Flag),	The battery measurement is not complete
State of Start Button,	Start button not pressed
State of Up Button,	Up button not pressed
State of LED (bottom 3 bits are RGB with B as bit 0).	LED has Red and Green elements lit (Amber)

A program such as PUTTY may be used to log the serial stream and then cut and paste it into a spreadsheet for graphing.

The menu system allows the system to be set up as a voltage logger or a current logger. In this mode the current and voltage are transmitted over the serial link every 60 seconds (the period can be altered through the menu).



Operation Notes

Always apply power before connecting the battery. After powering up, connect a fully charged battery to the battery terminals and check that the voltage is shown.

When the menu/start button is pressed the load will be applied for 3S before the initial voltage is recorded, the load will be applied until the battery voltage drops to the selected voltage at which point the load removed and the battery life showing will be the final life measured.

If the external load is used then it will be disconnected after measurement is completed as some battery technologies will be damaged if discharged too far.

Hardware

The circuit diagram is shown for reference in Annex A.

The single Red LED shows the USB connection. It will be solid red if the USB is not connected (normally standalone operation), it will flash when connected as a serial port to a PC.

The tri-color status LED shows the bus activity. It will show:

- White on start up to show the unit is working
- Green when a battery or supply of more than 0.5V is connected,
- Green/Amber flashing during a measurement.
- Blue when a measurement is complete.

Software

Start up

When the programme is started it will search for the Logger. If not found then connect it and use the **File | Auto Detect** menu option. Manually select the port to use by using the **File | Setup Com Port** menu option. This will only be necessary if two ports are in use.

Use

The software is quite easy to use. There are two tabs, the first is the Battery Life / Logger tab. Here the logger can be started or paused and the end conditions set. The logging can be ended when the voltage reaches a percentage of the original, the absolute voltage, after a specific time, or will run until the pause button is pressed.

The system will log the voltage, current, power, time and current at a selectable period from 1 second to 1 hour. The logs will be saved and shown on the graph, or may be saved to a CSV file for spreadsheet analysis.

Input Voltage, Measured Current Measured Power

Time logged and Measured Amp Hours

Status Window

Set up internal load

Set up logging operation.

End on :

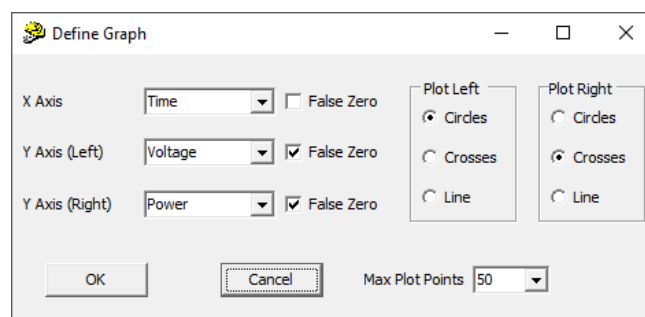
1. Voltage reducing to a %age of the start voltage,
2. An absolute voltage,
3. After a time,
4. When the pause button is pressed.

Graph

The graph tab shows the voltage, current, amp hours or power for the current logs. It is possible to show two variables against a dependant. Normally time. The example below shows a sample log for a 1 AH, 12V battery with an external log which is an LED lamp – this device attempts to provide a constant power and therefore current draw increases as the voltage decreases. The finish point was set as 10V.



To set up the graph click anywhere on it, or use the Set Up Graph button.



Using this set up it is possible to set the variables for the X and both Y axes. The graph will plot a maximum number of points to avoid becoming a forest of check marks it's possible to limit the number shown.

Finally a false zero may be used which will show an amplified view of the measured values as shown in the graph above.

Saving Data

It is possible to save the graph to the clipboard (right click the graph or use the Graph Z| Copy graph to clipboard option). Or the entire log can be saved to the clipboard using eth Graph Menu.

The log file can be saved as a CSV file using the File | Save Log File option. It can be opened using the Load Log File and the points shown on the graph as for a measured log.

Further Developments

The Logger application will be further developed.

Watch the FED support pages for further information : <http://www.fored.co.uk/html/Logger>

Support

Contact us using email :

info@fored.co.uk

Annex A – Circuit

