

User Manual

Force Sensor Module

Disclaimer

The information contained in this manual is provided for the purpose of operating and maintaining this Product. While every effort has been made to ensure the accuracy and completeness of this manual, Wattcrafts Engineering Ltd. assumes no responsibility for errors, omissions, or inaccuracies.

This product is designed for use by qualified personnel who are trained in its proper handling and application. Users are responsible for understanding and following all safety guidelines and instructions provided in this manual. Failure to adhere to these instructions may result in damage to the product, property, or personal injury.

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All specifications and features of the product are subject to change without prior notice. The user is responsible for ensuring that they are using the most up-to-date version of this manual.

By using this product, the user agrees to the terms of this disclaimer.

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Manufacturer and customer service

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1. Product description

Force Sensor Module for Pressure Battery Testing



The Force Sensor Module is an advanced attachment designed to enhance the capabilities of our Pouch Cell Holder. This device allows for accurate force measurement and control during battery testing, enabling studies on the effects of pressure on cell performance, safety, and longevity. The module seamlessly integrates with our Pouch Cell Holder, providing either real-time force data or the ability to set precise initial pressures for your experiments.

One of the key advantages of this module is its flexibility. It can be used for continuous in-situ pressure monitoring throughout long-term cycling tests, or to set an initial pressure and then be removed, allowing a single module to service multiple Pouch Cell Holders. This versatility makes it an economical choice for labs with multiple testing stations.

The Force Sensor Module is made from durable stainless steel, and can withstand high force of 5kN. This covers wide range of applications, from commercial pouch cells to metal anode systems (liquid electrolyte with alkali metal – Li, Na etc.), so-called ‘anode-free’ technology, to semi-solid and all-solid-state batteries.

The module's USB-PC connection offers straightforward data acquisition with included software. This feature facilitates easy logging, analysis, and correlation of pressure data with other battery performance metrics.

Whether you're investigating the impact of pressure on new electrode materials, optimizing cell designs, or studying the long-term effects of mechanical stress on battery life, the Force Sensor Module provides the precision and reliability needed for cutting-edge battery research and development.

2. Specification

- Material: Stainless steel
- max. force: 5kN
- size: 110 x 42 x 20 mm
- Weight: 700g
- USB-PC connection (other options available on request)

force sensor specification (for 5kN range):

- non-linearity: 14 N or better
- hysteresis: 12 N or better
- zero balance: 24 N or better
- overload characteristics: 6 250 N safe overload, 7 500 N ultimate overload
- storage temp.: -40 to +70 °C
- operating temp.: -20 to +70 °C
- compensated temp: +20 to +70 °C
- electrical connections: integral screened cable with USB module (2m)
- thermal sensitivity: 0.25 N/°C or better

Product includes:

- Mounting plate
- Force sensor (5 kN)
- integrated USB module with 2m cable
- set of screws
- Data Acquisition Software ([Download](#))

3. Safety precautions

Use proper safety precautions when working with batteries in pouch cell format. The pouch seal may break due to various causes, such as defect, internal pressure increase, heat etc. This can cause release (including rapid release) of hazardous substances. Wear protective glasses and gloves to protect you against substances that may be accidentally released. Beware that battery cells subject to high currents can heat up to high temperatures, particularly the electrical contacts.

4. Operation

4.1 Assembly

For assembly of the holder follow the procedure described in the Pouch Cell Holder User Manual.

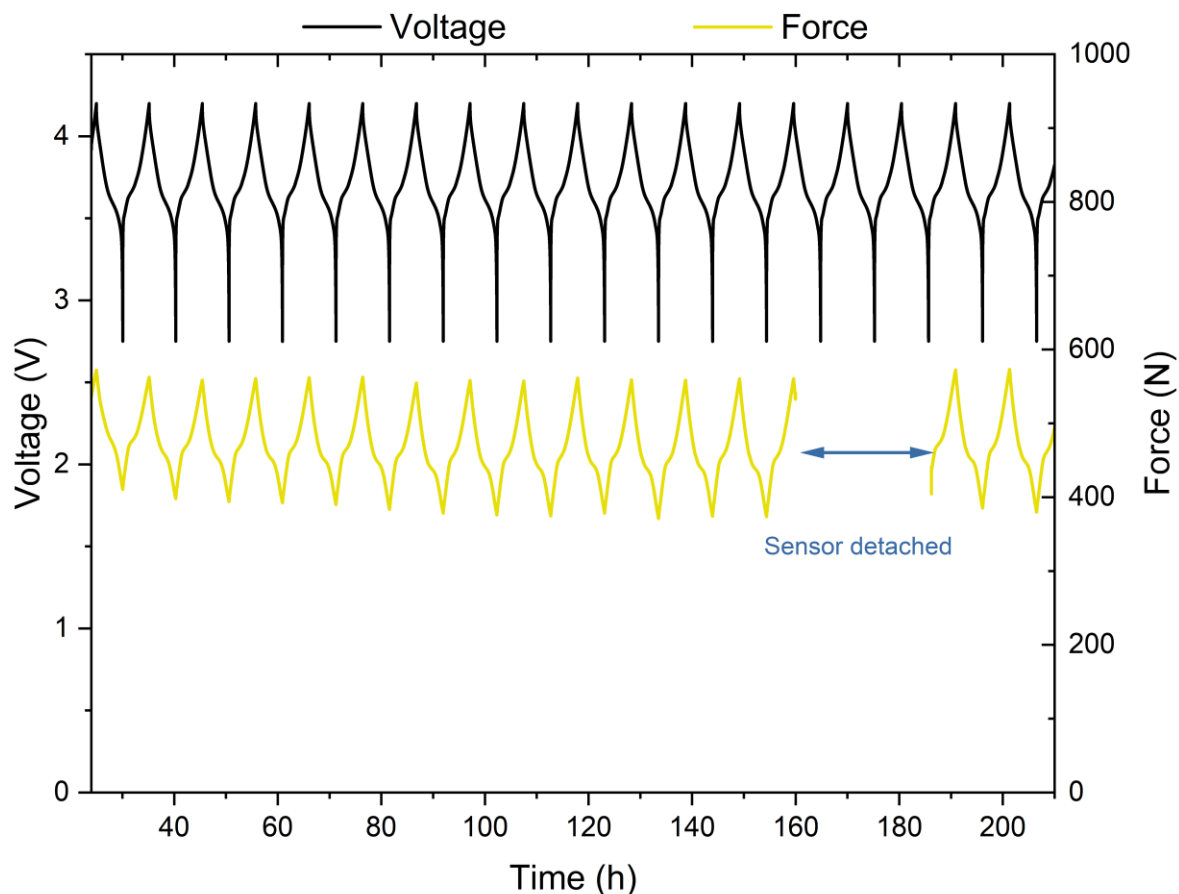


To use Force Sensor Module, mount it into the Top frame of Pouch Cell Holder with 2 socket head screws. It is recommended to do this before tightening the 4 corner screws. This way the initial pressure can be monitored during the assembly. After assembly the module can be used to monitor the pressure evolution in the cell during operation.

Note:

After assembly and applying desired pressure, the materials of the setup hold significant internal stress. Relaxation of this stress occurs, which causes the force reading to drop in a logarithmic manner. This is normal and relative stabilisation usually takes 24-48h, depending on cell materials and applied load.

Alternatively, after setting the initial pressure, the Force Sensor Module can be removed without affecting the applied pressure (withing 2% accuracy)*. The sensor can then be attached to the holder at any stage, even during cycling or after finished measurement to check the current pressure applied to the cell. This means, that with one sensor, initial pressure or its changes during cycling can be monitored on multiple test cells, by alternating sensor between them during cycling. See example measurement plot below.



***Note:**

This functionality currently is limited to 2kN maximum force. Above this value the sensor has to stay attached to the holder to maintain and monitor applied force with high accuracy.

4.2 Software operation

Note:

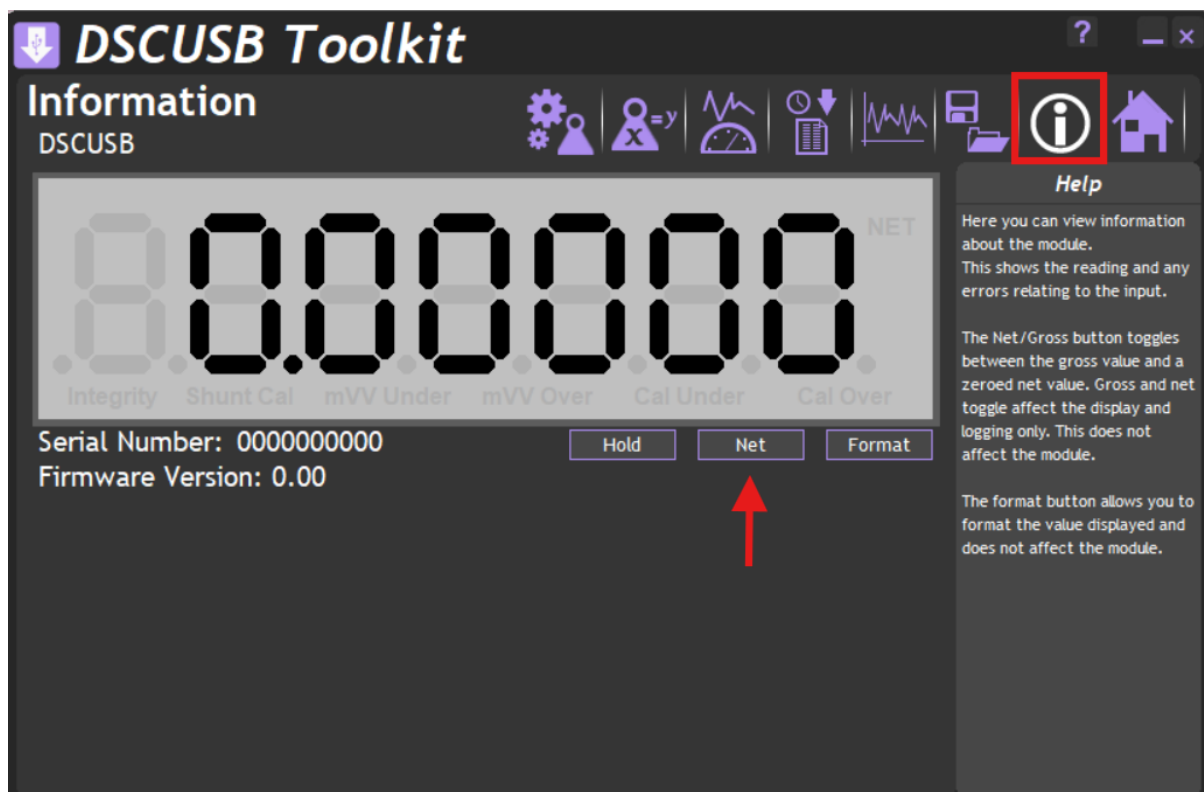
This is simplified manual of the included data logging software, that covers most common use cases. For full software manual please see attached dscusb manual.

Install the DSCUSB Toolkit software by downloading the latest installer from the [product website](#). After the software has been installed please connect the module and launch the DSCUSB Toolkit.

If there is only one Force Sensor Module connected when you launch the software, it will be automatically selected and the Information Page will be displayed.

This is most useful screen for live reading of the applied force. You can select it during the assembly of the holder to precisely control the initial pressure. Press 'Net/Gross' button to zero the reading before applying load.

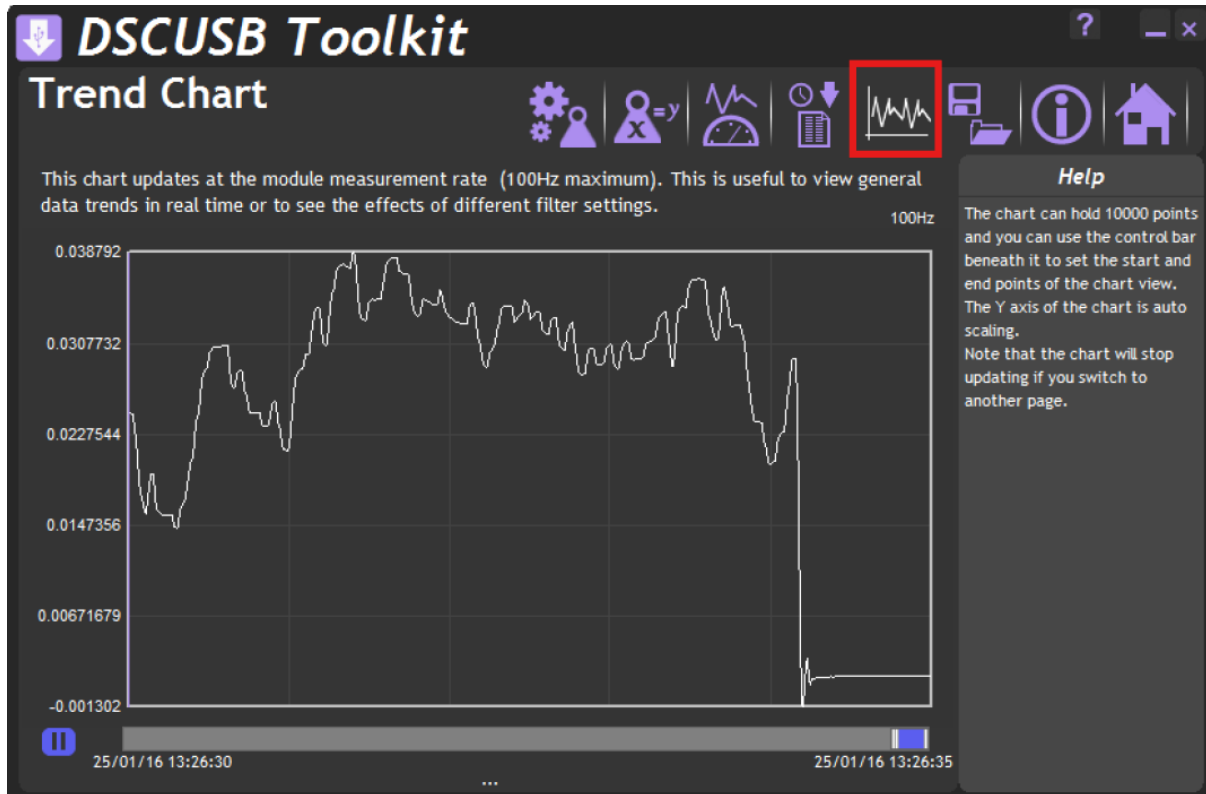
Information page:




Alternatively, the live reading can be observed on a timeseries graph on the Trend Chart screen. The Measurement Rate can be selected in the Data Rates and Filter page by clicking



Trend Chart:



Clicking the Pause button  to the left of the view control will pause the chart. This will stop data being added to the chart. Please note that data will also cease to be added to the chart if you switch to another page by clicking any of the icons on the toolbar.

Right clicking the chart will display a pop-up menu allowing the following

Copy Chart Image

A graphic image of the chart will be copied to the clipboard.

Copy Chart Data


All the data points in the chart will be copied to the clipboard in a suitable format to be pasted into Microsoft Excel and many other applications. The columns will be separated with Tab characters and each line terminated with a carriage return.

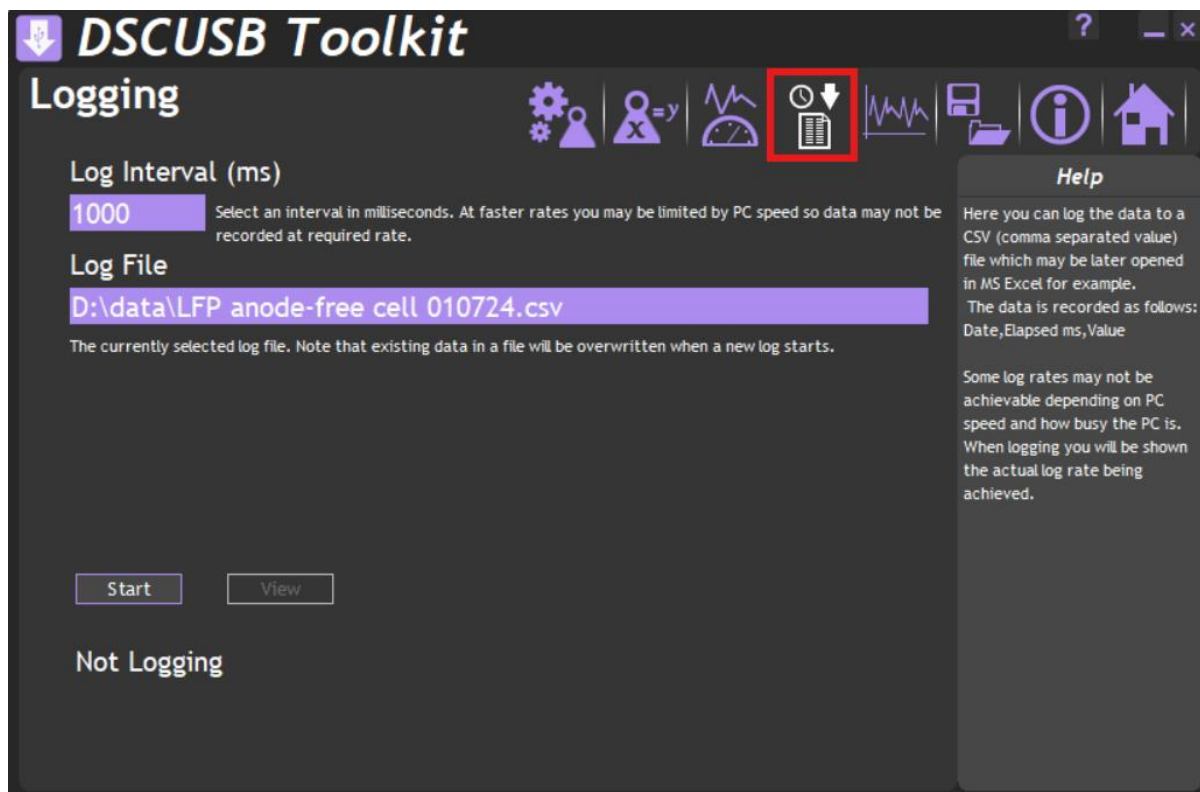
This may take a few seconds to copy to the clipboard.

Clear Chart

You will be asked to confirm this action and if accepted the chart will be cleared of all data.

For long duration measurements, such as in situ tests, the force data can be saved in a .csv format.

Click on the  icon to open the Logging page.



Log Interval

Choose a Log Interval in milliseconds between 10 and 32000. 10mS will enable a log at 100Hz.

Log File

Select a file to log to. Note that each time the log starts it will erase any data already in the file.

Start

Clicking this button will start the log.

Stop

Clicking this button will stop the log.

View

When a log has just been stopped this button will launch the application associated with CSV files.

5. Warranty

Wattcrafts Engineering Ltd. warrants that the product is free from defects in materials and workmanship under normal use for a period of 12 months from the date of purchase. During the warranty period, if the product is found to be defective, Wattcrafts Engineering Ltd. will, at its discretion, repair or replace the product at no charge to the customer.

This warranty does not cover:

- Damage resulting from misuse, abuse, accidents, or unauthorized modifications.
- Wear and tear from normal usage.
- Products that have been altered or repaired by unauthorized personnel.
- Damage caused by improper installation or failure to follow the instructions in the manual.

To make a warranty claim, please contact Wattcrafts Engineering Ltd. at info@wattcrafts.com with a description of the issue.

This warranty is non-transferable and is limited to the original purchaser. It is provided in lieu of any other warranties, express or implied, including any implied warranty of merchantability or fitness for a particular purpose.

Wattcrafts Engineering Ltd. liability under this warranty is limited to the repair or replacement of the product. In no event shall Wattcrafts Engineering Ltd. be liable for any indirect, incidental, or consequential damages arising from the use of this product. This Limited Warranty shall be governed by and construed in accordance with the laws of England and Wales.