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User Manual

Temperature Sensor Module

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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.

Manufacturer and customer service

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1. Product description

Temperature Sensor Module for the Pouch Cell Holder

Our Temperature Sensor Module provides precise thermal monitoring capabilities for battery research, complementing the Pouch Cell Holder with critical temperature data during electrochemical testing. Accurate temperature measurement is fundamental to understanding battery behaviour — from capacity fade and rate capability to thermal runaway onset — and this module makes that measurement straightforward to integrate into any test setup.

The module features two Type K thermocouples enabling simultaneous monitoring of multiple points on the cell surface, or comparison between cell surface and ambient temperatures. The integrated signal conditioner ensures stable, noise-free data transmission with fast response times essential for detecting rapid thermal events and temperature gradients during testing.

USB-PC connectivity enables seamless integration with existing test setups, providing real-time temperature logging and visualisation through the included Omnisense data acquisition software. This allows synchronised data collection with other measurement parameters, creating comprehensive datasets that combine thermal, mechanical (displacement or force), and electrochemical data for complete battery characterisation.

The module is particularly valuable for thermal safety studies, performance optimisation under different temperature conditions, and investigating temperature effects on capacity and ageing mechanisms across a wide range of battery chemistries and cell formats.

2. Specification

- Sensor type: Type K thermocouples (2x)
- Thermocouple temperature range: -75°C to +260°C
- Accuracy: ±1°C / 1%
- Sensitivity: ±0.1°C
- Response time: <1 second
- Output: USB-PC connection
- Operating environment: 5 to +40°C (module electronics)

Product includes:

- Temperature Sensor Module with signal conditioner
- 2x Type K thermocouples with PFA insulated leads
- USB cable (0.5m)
- Self-adhesive attachment pads for thermocouples
- Data logging software (Omnisense)

Note:

This device ships with two 1m fine-wire twisted-pair thermocouple cables type K, which can be used to measure temperatures between -75°C and 260°C (PFA insulated, measure point non-insulated). To use a wider measuring range with the device, you can use any of the more sophisticated thermocouples that you can find on a specialized shop.

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.

Battery cells subject to high currents can heat up to elevated temperatures, particularly at the electrical contacts and tabs. Exercise caution when handling the assembly during or immediately after testing.

Do not exceed the temperature range specified for the module electronics (5°C to +40°C). The Type K thermocouples themselves may be used over the full −75°C to +260°C range; however, operating the signal conditioner electronics outside the specified ambient range may result in inaccurate readings or damage to the module.

Do not bend or pinch thermocouple leads sharply. Route cables carefully to avoid contact with hot surfaces or moving parts. Inspect leads and connectors for damage before each use.

4. Operation

4.1 Assembly

The Temperature Sensor Module is designed to attach directly to the Pouch Cell Holder without additional tools. Follow the procedure below to set up the hardware.

1. Assemble the Pouch Cell Holder with the cell in place, following the procedure described in the Pouch Cell Holder User Manual.
2. Decide on thermocouple placement before closing the holder. Common positions include the centre of the cell face, adjacent to the tabs, or one sensor on the cell surface and one measuring ambient temperature nearby.
3. Route the thermocouple leads out through the appropriate channel in the Pouch Cell Holder frame, taking care not to pinch or sharply bend the leads.
4. Attach each thermocouple to the desired measurement point using the supplied self-adhesive pads. Press firmly and allow a few seconds for the adhesive to seat before closing the holder.
5. Connect the thermocouple leads to the corresponding inputs on the Temperature Sensor Module (labelled T1 and T2). Polarity must be observed – green wire is plus (+) and white wire is minus (-).
6. Connect the module to the PC using the supplied USB cable.

4.2 Software – Omnisense

Temperature data is recorded and visualised using Omnisense, Wattcrafts' data acquisition software. Omnisense is available to download via the product page on the Wattcrafts website.

This is shortened quick start guide. For full Omnisense manual refer to installation folder.

1. Download the latest version of Omnisense from the product page at www.wattcrafts.com.
2. Run the installer and follow the on-screen instructions. Administrator privileges may be required. The required drivers will be installed automatically on Windows 10 and later.
3. Connect the Temperature Sensor Module via USB.
4. Launch Omnisense. The connected module will appear automatically in the device selection panel.
5. Select desired sensors from the list (click '+' button to add more temperature sensors) and click connect.
6. Once all sensors are connected, use 'Start Measurement' button to begin data recording – software will prompt you for sampling frequency and data file location. Data is saved as a CSV file.

Synchronised Logging with Other Modules

When used alongside the Force Sensor Module or Thickness Sensor Module, Omnisense can log data from multiple modules simultaneously. Each channel is time-stamped to a common clock, enabling direct correlation of thermal, mechanical, and electrochemical data.

4.3 Typical Measurement Scenarios

Cell Surface Temperature Monitoring

Both thermocouples placed on the cell surface at different locations (e.g. centre and near tabs) allow temperature gradients to be mapped during charge and discharge cycles. This is particularly useful for high-rate testing where local heating at tabs can be significant.

Cell vs. Ambient Temperature

Positioning T1 on the cell surface and T2 away from the cell (measuring ambient or chamber temperature) gives a continuous differential reading. This makes it straightforward to identify the onset of self-heating and to quantify the temperature rise above ambient as a function of state of charge or cycle number.

Combined Thermal and Mechanical Measurement

For a comprehensive picture of cell behaviour during cycling, the Temperature Sensor Module can be used simultaneously with the Force Sensor Module (fixed thickness mode) or the Thickness Sensor Module (fixed pressure mode). Correlating temperature changes with force or thickness evolution provides insight into the coupling between electrochemical activity, mechanical stress, and thermal behaviour — key relationships in ageing and safety studies.

5. Maintenance

The Temperature Sensor Module requires minimal maintenance. The following checks are recommended before each use:

- Inspect thermocouple leads for kinks, cuts, or exposed conductors. Do not use a damaged thermocouple as this will result in inaccurate readings.
- Inspect the thermocouple connectors for corrosion or contamination. Clean gently with a dry cloth if required.
- Confirm that the USB connector seats firmly in the module and in the PC port.
- Replace self-adhesive pads as needed; fresh adhesive ensures reliable thermal contact between the thermocouple junction and the cell surface.

No user-serviceable components are present inside the signal conditioner enclosure. Do not attempt to open the enclosure. Contact Wattcrafts Engineering Ltd. if the module is suspected to be faulty.

6. 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.

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