

# Battery Measuring Module for fast 100% checking of battery cells and modules in automation systems

## MODEL 2511 NEW

Preliminary data sheet



Display device

### Highlights

- Internal resistance ranges: 10 ... 300 mΩ
- Frequency ranges: 1 kHz, 100 Hz, 10 Hz, 1 Hz
- Resolution: up to 0.01 μΩ
- Single to multi-channel applications, temperature measurement via PT100
- Accuracy: from ±0.2 % of reading ±0.4 % d.A.
- Measuring and evaluation results in a few milliseconds
- Compact design, state of the art interfaces
- Voltage measurement: 0 ... ±5 VDC or ±60 VDC

### Options

- Desktop device with display
- Wall mounting
- Top hat rail mounting

### Areas of application

- Manufacture of battery cells and modules
- Quality assurance of battery cells and modules
- Checking of contact weld connections

### Product description

The 2511 battery measuring module is particularly suitable for fast, multi-channel measurement of battery cells and modules in automation systems. The device operates in accordance with the well-tried four-conductor measuring method, and combines the functionality of a battery tester and a battery analyzer, making it possible to carry out rapid testing of batteries and accumulators irrespective of the technology. Fast measurement and evaluation of important parameters takes place in just a few milliseconds (73 ms). The testing can be carried out with individually adjustable parameters.

The device corresponds with the latest CE directives, and is designed for laboratory operation and also for deployment under harsh industrial conditions in automation systems.

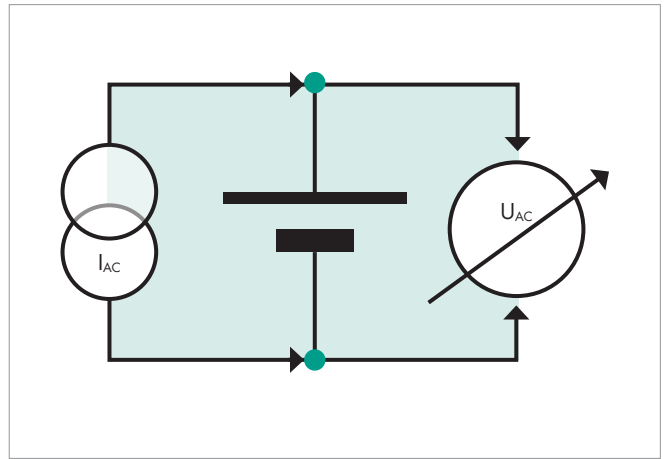
The PROFINET fieldbus interface makes it easy to integrate into your production sequence control. Fully automatic testing can be carried out in this way.

## Technical data

| Operating modes and measuring times |  |  |                      |                      |                  |                  |
|-------------------------------------|--|--|----------------------|----------------------|------------------|------------------|
| Operating mode                      |  | 3 parameter slow   | 3 parameter standard | 2 parameter standard | 3 parameter fast | 2 parameter fast |
| Parameters                          |  | U, 1 kHz, 1 Hz   | U, 1 kHz, 10 Hz      | U, 1 kHz             | U, 1 kHz, 100 Hz | U, 1 kHz         |
| Measuring time 1 channel/ms         |  | 1233   | 333                  | 233                  | 93               | 73               |
| Measuring time 5 channel/ms         |  | 6215   | 1715                 | 1215                 | 515              | 415              |
| Measuring principle                 |  | Internal resistance (ohmic component), discharging, polarity-independent   |                      |                      |                  |                  |
| Number of measuring channels        |  | Up to 5 individual cells, one module measuring channel (60 V)  |                      |                      |                  |                  |
| Internal resistance                 |  |  |                      |                      |                  |                  |
| Measuring ranges                    |  | 10 mΩ, 30 mΩ, 100 mΩ, 300 mΩ   |                      |                      |                  |                  |
| Measuring frequencies               |  | 1kHz, 100 Hz, 10 Hz, 1 Hz  |                      |                      |                  |                  |
| Resolution                          |  | 0.01 μΩ  |                      |                      |                  |                  |
| Measuring current                   |  | 200 mA   |                      |                      |                  |                  |
| Measuring error                     |  | from ±0.2 % of reading ±0.4 % d.A. (23 ±5 °C)<br>(Standard measuring time)   |                      |                      |                  |                  |
| Temperature measurement (PT100)     |  |  |                      |                      |                  |                  |
| Measuring range                     |  | 0 ... 100 °C   |                      |                      |                  |                  |
| Resolution                          |  | 0.1 °C   |                      |                      |                  |                  |
| Measuring error                     |  | 0.1 °C   |                      |                      |                  |                  |
| Temperature recording               |  | via external PT100 sensor  |                      |                      |                  |                  |
| Voltage                             |  |  |                      |                      |                  |                  |
| Measuring ranges                    |  | 0 ... ±5 VDC<br>0 ... ±60 VDC single channel   |                      |                      |                  |                  |
| Resolution                          |  | 1 μV or 10 μV  |                      |                      |                  |                  |
| Measuring error                     |  | from ±0.01 % d.A. ± 0.005 % of reading (0 ... ±5 V)<br>from ±0.03 % d.A. ± 0.005 % of reading (0 ... ±60 V)  |                      |                      |                  |                  |
| Housing                             |  |  |                      |                      |                  |                  |
| Material                            |  | Aluminum   |                      |                      |                  |                  |
| Dimensions (WxHxD)                  |  | 104 x 54.6 x 120 mm  |                      |                      |                  |                  |
| Weight                              |  | approx. 500 g  |                      |                      |                  |                  |
| Protection type                     |  | IP54   |                      |                      |                  |                  |
| Connections                         |  | PROFINET, PT100, measuring inputs, USB   |                      |                      |                  |                  |
| General data                        |  |  |                      |                      |                  |                  |
| Supply voltage                      |  | 11... 30 VDC,<br>galvanic isolation, inverse polarity protection, overvoltage protection   |                      |                      |                  |                  |
| Power consumption                   |  | Approx. 3 W  |                      |                      |                  |                  |
| Communication                       |  | PROFINET, EtherCAT   |                      |                      |                  |                  |
| Operating temperature range         |  | 0 °C ... +50 °C  |                      |                      |                  |                  |
| Storage temperature range           |  | -10 °C ... +70 °C  |                      |                      |                  |                  |
| Humidity                            |  | 0 ... 70 % non-condensing  |                      |                      |                  |                  |
| Installation                        |  | 4 rubberized feet (fitted as standard)<br>Wall mounting (accessory only for panel mounting)<br>Mounting rail installation (accessory)<br>(Mounting rail in accordance with DIN EN 50022) |                      |                      |                  |                  |

## Principle of operation

Battery measuring module model 2511 is optimized for rapid testing of cells and for testing welded connections. It operates in accordance with the well-tried four-conductor method (Kelvin connection) and has 4 connections for impedance measurement: 2 cables for supplying the test current and 2 cables for the voltage measurement. The battery tester applies an AC current  $I_{AC}$  that is relatively small in relation to the load current to the test object (battery cell or module), and measures the resulting voltage drop  $U_{AC}$  in the mV range. The AC voltage measurement takes place selectively and synchronously, with results in accordance with the real and imaginary component. Dividing the AC voltage and the AC current results in the complex (AC current) impedance  $Z$ . The real component represents the ohmic component, whereby a negative imaginary component means capacitance, and a positive proportion means inductance. The input voltage is measured in parallel to this.



The 3 main battery parameters (AC internal resistance, DC internal resistance and battery voltage) are measured within  $< 0.1$  seconds. Another measuring mode makes a temperature measurement and automatic temperature compensation possible.

## Operating modes

The 2511 battery measuring module and the associated PC software provide a large number of measuring and evaluation functions.

### 3 parameters slow/fast

In this operating mode, the internal resistance is measured with 2 preset frequencies (1 Hz ... 1 kHz) and the open circuit voltage.

### 2 parameters slow/fast

In this operating mode, the internal resistance is measured with a preset frequency (1 Hz ... 1 kHz) and the open circuit voltage is measured.

### Voltage measurement

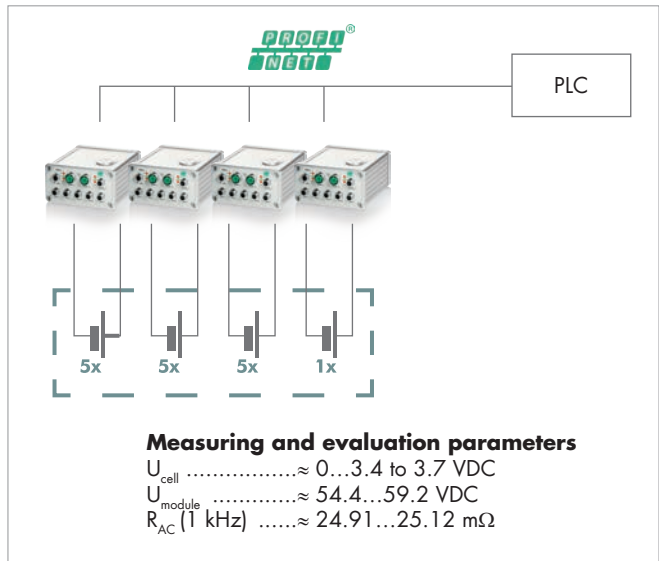
In a separate operating mode, the voltage of a battery module (0 ... 60 VDC) can be measured via measuring channel 1.

## Applications

### 16-channel high-speed application – 100 % monitoring in vehicle battery module received goods checking

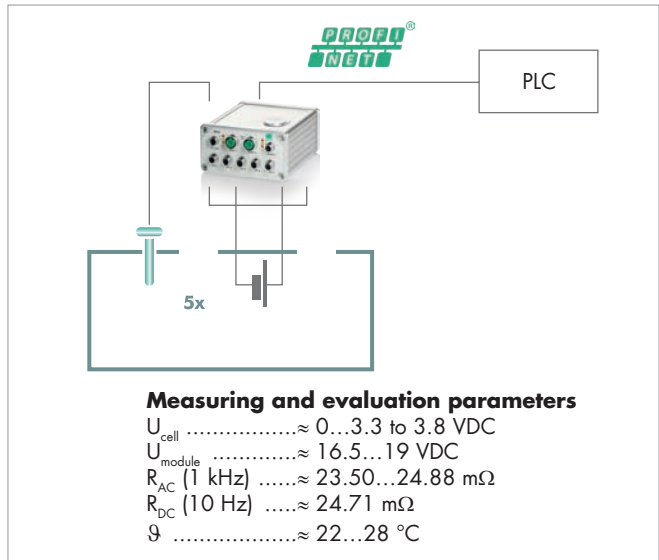
Many battery cells are required to manufacture and install high-performance battery modules for electric vehicles. In the received goods checking area, important battery parameters of each individual cell must be reliably measured and evaluated within very short cycle times.

After contacting the prismatic cells, the internal resistance **with 1 kHz** and the cell and module voltage of **all 16 cells** are **measured and evaluated within approx. 0.5 s** with the cascadable battery measuring module and transferred to a PLC in real time.



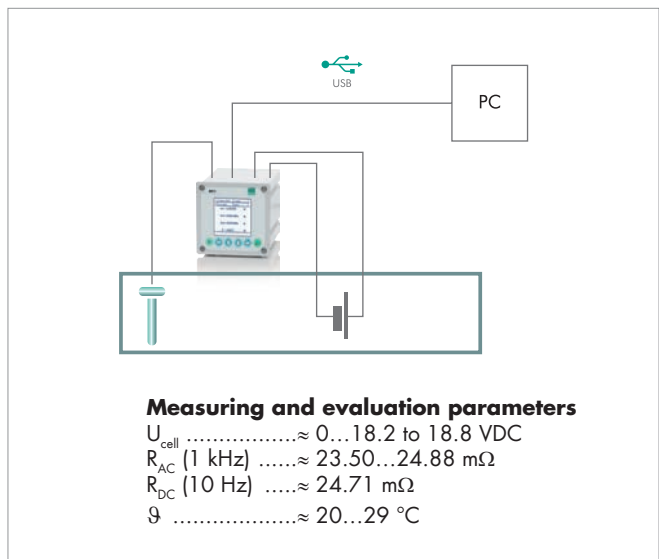
### 5-channel application – matching of battery cells for large-scale storage

Many round cells are often used in battery operated large-scale storage systems. Before these are installed, different battery parameters of each individual cell must be exactly and quickly measured and evaluated in order to achieve qualitative matching. The contacting of the round cells takes place using the **four-conductor measuring method** (for each current and voltage cable). The two-frequency impedance measurement is used to determine the **series resistance (electrolyte)** and the **parallel resistance (electrodes)**. In parallel to this, the respective **cell voltage** and **temperature** are recorded and evaluated. At the control side, the data is transferred via PROFINET. All measuring and evaluation data is archived for traceability.



### Single-channel application for quick testing of battery cells

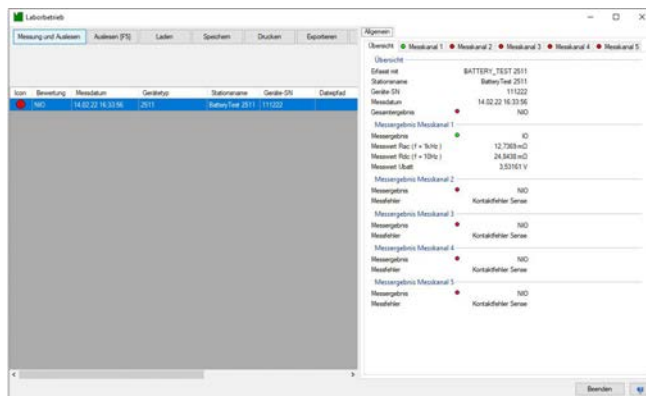
Battery cells with a relatively high internal resistance can generate more heat; chemical processes can accelerate the capacitance reduction and the internal resistance increases. The resistance can change due to transport or handling movements. In order to ensure that there is consistent quality in the assembly of power tools and the integration of the batteries, test objects are taken at random at individual workplaces and subjected to a quick test with regard to impedance and temperature behavior, including a cell voltage measurement.



## DigiControl PC software

The innovative, intuitively operated PC software for battery measuring module 2511 is used wherever diagnoses, battery condition determination or target/actual comparisons are to be carried out on battery cells or battery modules.

- Convenient device configuration via USB interface
- Management/configuration of different operating modes
- Backup of settings
- Measurement data logging
- Entry of test object designations for measurement data logging
- Exporting the measurement data in an Excel file or as plain text
- Evaluation of the measuring results



## Accessories

| Order code |  |
|------------|--|
| 9900-K251  | Supply cable 2 m in length, 3-pin M8 socket, one end with free ferrules    |
| 9900-K252  | Measuring cable 2 m in length, 4-pin M8 socket, one end with free ferrules |
| 9900-K259  | Pt100 temperature, 2 m in length, 4-pin M8 connector                       |
| 2511-Z001  | Mounting kit for wall mounting   |
| 2511-Z002  | Mounting kit for mounting rail installation                                |
|            | 4-pin M8 socket for the measuring inputs                                   |
|            | 3-pin M8 socket for the power supply                                       |
|            | 4-Pin M12 connector, D-coded   |



## Generate order code

|  |   |   |   |   |   |   | Standard |   |   |   |
|--|---|---|---|---|---|---|----------|---|---|---|
|  |   |   |   |   |   |   | 2        | 5 | 0 | 3 |
| 2  | 5 | 1 | 1 | - | V | 2 |          | 0 | 3 |   |
| <b>Housing</b>                             |   |   |   |   |   |   |          |   |   |   |
| ■ Panel-mount unit without display 24 V/DC |   |   |   |   |   |   | 2        |   |   |   |
| <b>Number of channels</b>                  |   |   |   |   |   |   |          |   |   |   |
| ■ 1-channel                                |   |   |   |   |   |   | 1        |   |   |   |
| ■ 2-channel                                |   |   |   |   |   |   | 2        |   |   |   |
| ■ 3-channel                                |   |   |   |   |   |   | 3        |   |   |   |
| ■ 4-channel                                |   |   |   |   |   |   | 4        |   |   |   |
| ■ 5-channel                                |   |   |   |   |   |   | 5        |   |   |   |
| <b>Fieldbuses</b>                          |   |   |   |   |   |   |          |   |   |   |
| ■ PROFINET                                 |   |   |   |   |   |   |          |   |   | 3 |

|  |   |   |   |   |   |   | Standard |   |   |   |
|--|---|---|---|---|---|---|----------|---|---|---|
|  |   |   |   |   |   |   | 1        | 2 | 0 | 3 |
| 2  | 5 | 1 | 1 | - | V | 1 | 2        | 0 | 3 |   |
| <b>Housing</b>                               |   |   |   |   |   |   |          |   |   |   |
| ■ Desktop device with display 24 V/DC        |   |   |   |   |   |   | 1        |   |   |   |
| <b>Number of channels</b>                    |   |   |   |   |   |   |          |   |   |   |
| ■ 2-channel                                  |   |   |   |   |   |   | 2        |   |   |   |
| Channel 1 voltage measuring range 0 ... ±60V |   |   |   |   |   |   |          |   |   |   |
| <b>Fieldbuses</b>                            |   |   |   |   |   |   |          |   |   |   |
| ■ PROFINET                                   |   |   |   |   |   |   |          |   |   | 3 |