**burster**

# Battery Measuring Module
## AC/DC-IR measurement for 100% checking of battery cells in automation systems

## MODEL **2511** NEW
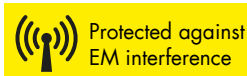
**2511**

MC
I/A
NET
PT 100

PROFI-NET
PORT 1
PORT 2

burster
RN
I/A
STAT
SUPPLY

CH 1   CH 2   CH 3   CH 4   CH 5

**PROFI NET®**

**EtherCAT®**

((( ))) Protected against EM interference

### Highlights

- Internal resistance ranges: 0 … 10 to 300 mΩ
- Measurement frequencies: 1kHz, 100 Hz, 10 Hz, 1 Hz
- Accuracy: from ±0,4% rdg. even with interference radiation
- Voltage measurement: 0 … ±5 V
- Compact design, protection class IP54
- Protected against electromagnetic interference
- Measure and evaluate in a few milliseconds
- Single to multi-channel application

### Options

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

### Areas of application

- Quality assurance of battery cells
- BoL, MoL assembly processes for battery modules, packs or cell-to-pack

### Product description

The battery measurement module type 2511 is specially designed for fast, multi-channel measurement of battery cells. The device is designed for tough industrial use in highly automated systems and also for laboratory operation. The battery measurement module type 2511 offers a compact design, a high degree of protection IP54 and a design hardened against electromagnetic interference, which is essential in automated systems in order to determine measured values with maximum repeatability and traceability.

The battery measuring module model 2511 performs an open circuit voltage measurement (OCV), including a detection of polarity. Using the well proven four wire measuring method, the internal resistance of the contacted cells is measured precisely. Therefore, the device combines the functionality of a battery tester and a battery analyzer and enables rapid testing of battery cells regardless of the technology. Important parameters are measured and evaluated quickly in just a few milliseconds. The testing can be carried out with individually adjustable parameters.

The variable fieldbus interfaces enable flexible process integration. Fully automatic testing can be carried out in this way.

**2511**

R_AC (1kHz)        mΩ
**20.742**
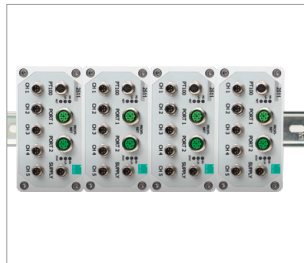R_AC (10Hz)        mΩ
**33.890**
U_CELL              V
**4.0926**
Status OK | i |

ESC

Display device

Multi-channel system with top-hat rail

**AC-IR** — Internal resistance measurement
Effect on electrolytes detectable

**DC-IR** — Internal resistance measurement
Effect on electrode detectable

**OCV** — Open circuit voltage measurement

**°C** — Temperature measurement

# Technical data

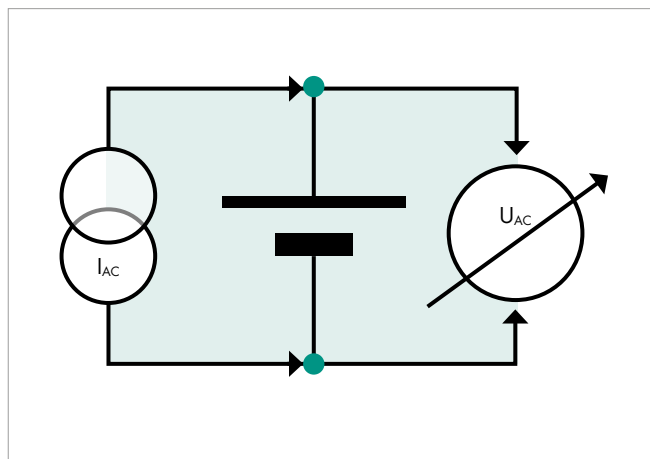| Operating modes and measuring times | | | | | | |
|---|---|---|---|---|---|---|
| Operating mode * | | 3 parameter standard | 3 parameter standard | 2 parameter standard | 3 parameter fast | 2 parameter fast |
| Parameters | | U, 1 kHz, 1 Hz | U, 1 kHz, 10 Hz | U, 1 kHz | U, 1 kHz, 100 Hz | U, 1 kHz |
| Measuring time 1 channel/ms | | 1255 | 350 | 250 | 115 | 90 |
| Measuring time 5 channel/ms | | 6325 | 1800 | 1300 | 625 | 500 |
| Measuring principle | | Internal resistance (ohmic component), discharging, polarity-independent | | | | |
| Number of measuring channels | | Up to 5 individual cells / Cascading of additional devices via PROFINET, EtherCAT possible | | | | |
| **Internal resistance** | | | | | | |
| Measuring range from 0 … | | 10 mΩ, 30 mΩ, 100 mΩ, 300 mΩ | | | | |
| Measuring frequencies | | 1kHz, 100 Hz, 10 Hz, 1 Hz | | | | |
| Resolution | | 1 µΩ | | | | |
| Measuring current | | 0 … 10 mΩ 800 mAss | 0 … 30 mΩ 660 mAss | 0 … 100 mΩ 180 mAss | 0 … 300 mΩ 30 mAss | |
| Measuring error (at 50 Hz mains frequency), (Data refer to a cell voltage of 3.6 VDC) | | ±0.25 % F.S. ±0.4 % of reading (23 °C ±5 °C, Operating mode standard) ±0.25 % F.S. ±0.6 % of reading (0 … +40 °C, Operating mode standard) Parameter 1 Hz additional ±10 µΩ (Operating mode standard, fast) Parameter 1 Hz additional ±5 µΩ (Operating mode slow) ±5 µΩ (at 0 … 5 VDC) | | | | |
| **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 range | | 0 … ±5 VDC | | | | |
| Resolution | | 0.0001 V | | | | |
| Measuring error | | ±0.01 % F.S. ±0.02 % of reading ±0.01 % F.S. ±0.04 % of reading (0 … +40 °C) | | | | |
| **Housing** | | | | | | |
| Material | | Aluminum | | | | |
| Dimensions (WxHxD) | | 104 x 54.6 x 120 mm | | | | |
| Weight | | approx. 500 g | | | | |
| Protection type | | IP54 | | | | |
| Connections | | PROFINET, EtherCAT PT100, measuring inputs, USB | | | | |
| **General data** | | | | | | |
| Supply voltage | | 24 V (11… 30 VDC) galvanic isolation, inverse polarity protection, overvoltage protection | | | | |
| Power consumption | | Approx. 3 W | | | | |
| Communication | | USB (parameterization, configuration, laboratory operation) | | | | |
| Fieldbus interfaces | | PROFINET, EtherCAT | | | | |
| Operating temperature range | | 0 °C … +40 °C | | | | |
| Storage temperature range | | -10 °C … +70 °C | | | | |
| Humidity | | 0 … 70 % non-condensing | | | | |
| Installation | | 4 rubberized feet (fitted as standard) Wall mounting (accessory only for panel mounting) Mounting rail installation (accessory, mounting rail in accordance with DIN EN 50022) | | | | |

* For information on other measuring times and operating modes, see operating manual

F.S. = from full scale value

# Principle of operation

Battery measuring module model 2511 is optimized for rapid testing of cells. 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 works as a current sink. It draws a relatively small DC current IDC from the test object (battery cell) in relation to the load current, converts this into an AC current IAC, applies this to the test object (battery cell) and measures the resulting voltage drop UAC 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 open source voltage) are measured within a few ms. For documentation purposes the current ambient temperature can be measured, using the integrated Pt100 interface.

# Operating modes

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

### 3 parameters slow/standard/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/standard/fast
In this operating mode, the internal resistance is measured with a preset frequency (1 kHz) and the open circuit voltage is measured.
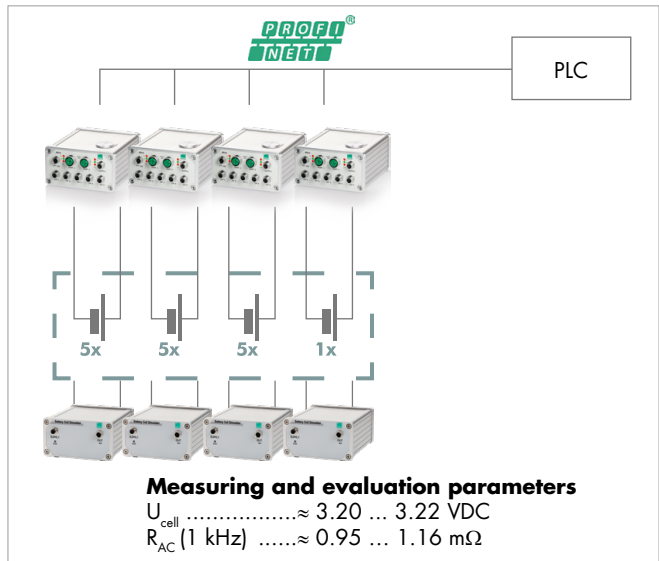
# Applications

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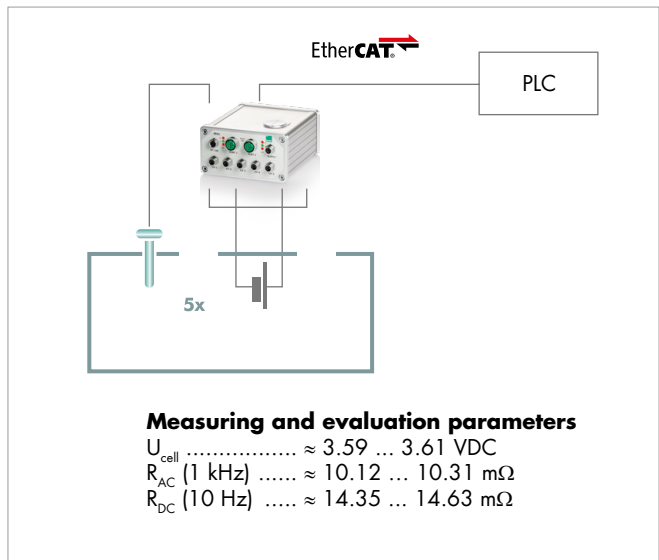
After contacting the prismatic cells, the internal resistance **with 1 kHz** and the cell voltage of **all 16 cells** are **measured and evaluated within approx. 0.5 s** with the cascadable battery measuring module and transferred to a PLC in real time.

In every production cycle the repeat accuracy of every channel of the battery measuring modules is successfully checked. Therefore, a contacting adapter is swiveled in instead of the next batch of cells. This adapter connects all channels of one battery measuring modules model 2511 to one battery cell simulator model 2500-Z100.



**Measuring and evaluation parameters**
$U_{cell}$ ................≈ 3.20 ... 3.22 VDC
$R_{AC}$ (1 kHz) ......≈ 0.95 ... 1.16 mΩ

### 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.



**Measuring and evaluation parameters**
$U_{cell}$ ................. ≈ 3.59 ... 3.61 VDC
$R_{AC}$ (1 kHz) ...... ≈ 10.12 ... 10.31 mΩ
$R_{DC}$ (10 Hz) ..... ≈ 14.35 ... 14.63 mΩ

## 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.

- 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
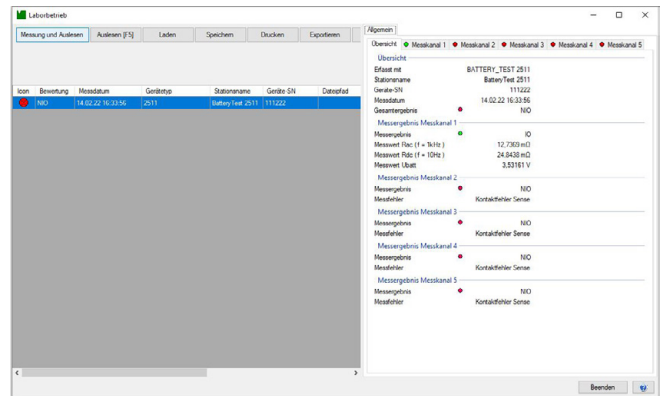


## Accessories

| 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 |
| 2500-Z001 | Single cell holder in four-wire design incl. Pt100 sensor for testing round cells 21700, 18650, ready for connection |
| 2511-Z001 | Mounting kit for wall mounting |
| 2511-Z002 | Mounting kit for mounting rail installation |
| 2500-Z100 | Battery Cell Simulator |

### Single cell holder Model 2500-Z001



Scope of delivery without cell
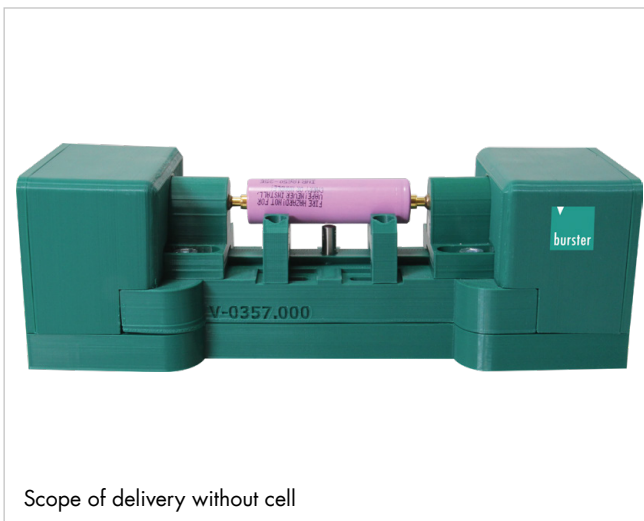
The round cell holder enables precise impedance, OCV and temperature measurements on 18650, 21700 cell formats. Contacting the test object using high-quality contact pins in four-wire technology.

# Generate order code

| | | | | | | Standard | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 2 | 5 | 0 | 3 |
| **2** | **5** | **1** | **1** | **–** | **V** | **2** | | **0** | **3** |

**Housing**

| | |
|---|---|
| ■ Panel-mount unit without display 24 V/DC | 2 |

**Number of channels**

| | |
|---|---|
| ■ 1-channel | 1 |
| ■ 2-channel | 2 |
| ■ 3-channel | 3 |
| ■ 4-channel | 4 |
| ■ 5-channel | 5 |

**Fieldbuses**

| | |
|---|---|
| ■ EtherCAT | 1 |
| ■ PROFINET | 3 |

| | | | | | | Standard | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 1 | 2 | 0 | 3 |
| **2** | **5** | **1** | **1** | **–** | **V** | **1** | **2** | **0** | **3** |

**Housing**

| | |
|---|---|
| ■ Desktop device with display 24 V/DC | 1 |

**Number of channels**

| | |
|---|---|
| ■ 2-channel | 2 |

**Fieldbuses**

| | |
|---|---|
| ■ EtherCAT | 1 |
| ■ PROFINET | 3 |