Multifunctional analyzer
for electric vehicle charging stations

# EVSE-100

index: WMGBEVSE100

MeasureEffect™

CP+ CP- f D $I_{max}$
graphs

$R_E$ $Z_S$ $R_{ISO}$ $R_{CONT}$
complex measurements of installations


CAT III
300 V

IP54
closed cover

Li-Ion BATTERY

TOUCH SCREEN

BLUETOOTH

Diagnostics and measurements of stationary AC charging stations (EVCS)

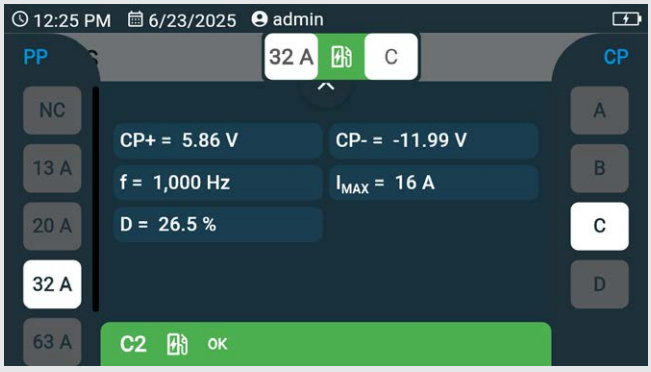
Diagnostics and measurements of portable AC charging stations (ICCB)

Testing of charging cables

# Comprehensive charging station diagnostics with a single instrument

## Capabilities

Multifunctional analyzer EVSE-100 is an instrument dedicated to diagnostics of electric vehicle charging stations and cables. Using a single device, we will perform a set of tests on these objects, ending with the generation of a professional report. Through appropriate simulation of CP and PP circuits, the meter can put the station into various operating states. This allows us to verify the correctness of the control system and perform measurements in the field of electric shock protection. We can complete the verification of functionality and safety by simulating errors on the power supply side, i.e. the charging station (ICCB), and charging side of the vehicle (CP circuit).



## Sonel MeasureEffect™

The meter is a part of the **Sonel MeasureEffect™** platform. It is a comprehensive system that enables you to take measurements, store and manage data, and provides multi-level control of your instruments.

## Applications

The meter makes it possible to carry out diagnostics on:

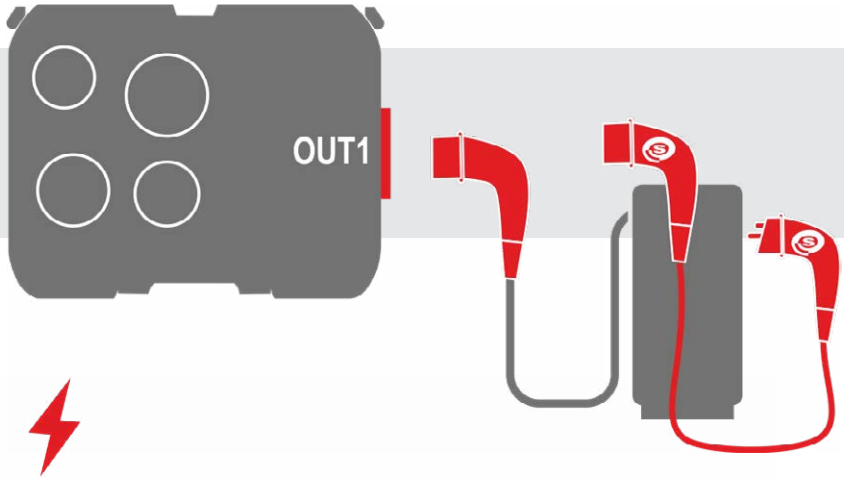
- AC electric vehicle charging stations with type 2 connector with socket or fixed charging cable (1-phase and 3-phase),
- portable electric vehicle charging stations with type 2 connector (1-phase and 3-phase),
- charging cables.



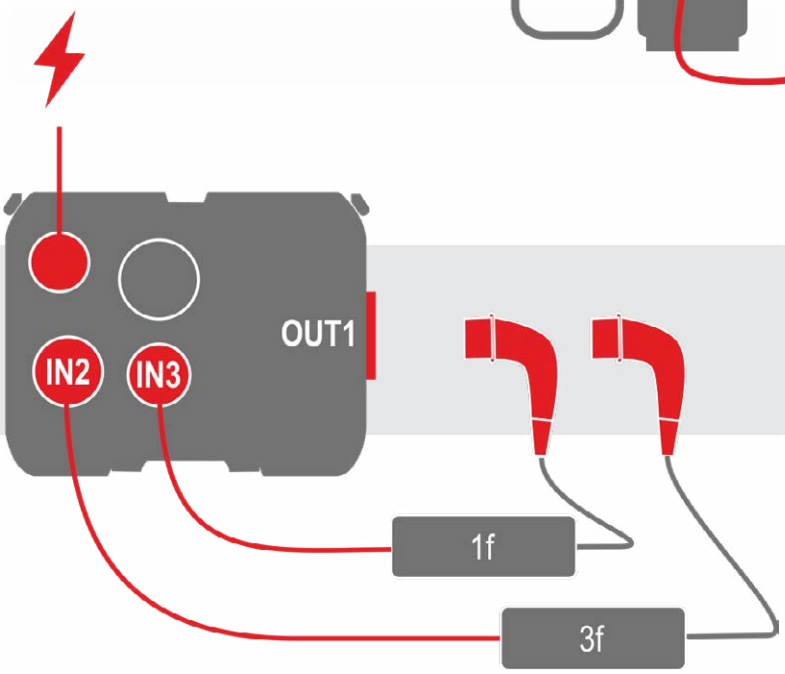

## Basic functions of the device

- Simulation of PP cable parameters:
  - open circuit,
  - 13 A, 20 A, 32 A, 63 A, 80 A.
- Simulation of CP communication:
  - state A – vehicle not connected,
  - state B – vehicle connected, not charging,
  - state C – vehicle connected, charging without ventilation.
  - state D – vehicle connected, charging with ventilation.
- Safety measurements:
  - measurement of short circuit loop Z,
  - measurement of parameters of RCD circuit breakers (AC, A, B, 6 mA DC),
  - measurement of insulation resistance $R_{ISO}$,
  - measurement of $R_{CONT}$,
  - phase sequence indication,
  - measurement of resistance of coding resistor $R_C$,
  - measurements of grounding $R_E$.
- EVSE analysis – diagnostics:
  - CP+, CP- voltage,
  - frequency f (PWM),
  - signal filling D (PWM),
  - maximum charging current $I_{MAX}$,
  - graph of CP+, CP-, f, D, $I_{MAX}$,
  - $t_{off}$ off time,
  - $t_{on}$ on time.
- EVSE analysis – simulation of errors (ICCB, EVCS):
  - CPsh – short circuit of CP to PE,
  - Dsh – diode short circuit,
  - PEop – interruption in PE.
- Simulation of power supply circuit faults (ICCB):
  - L1op – interruption in phase L1,
  - L2op – interruption in phase L2,
  - L3op – interruption in phase L3,
  - Nop – interruption in N,
  - PEop – interruption in PE,
  - L↔PE – interchanged L and PE wires,
  - $U_{EXT}$(PE) – voltage on PE wire.
- EVSE analysis – transition time between states

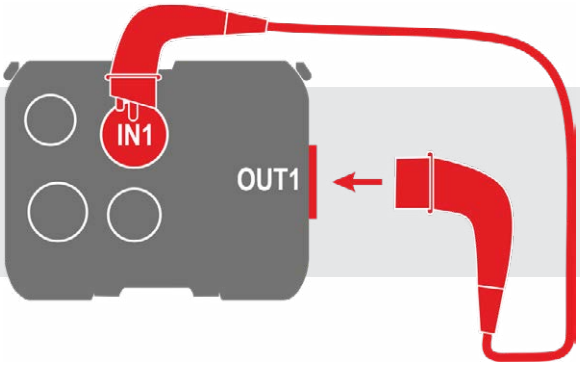
**Diagnostics and measurements of stationary, pillar-type and wall-box AC charging stations (EVCS)**



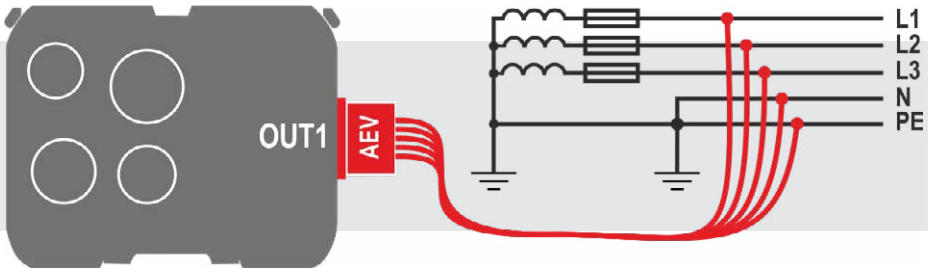

**Diagnostics and measurements of portable AC charging stations (ICCB)**




**Testing of charging cables**




**Complex measurements of installations**



# Specifications

| Measurement functions | Measurement range | Display range | Resolution | Accuracy ±(% m.v. + digits) |
|---|---|---|---|---|
| **Measurements of mains parameters** | | | | |
| Voltage | 0 V...500 V | 0 V...500 V | from 0.1 V | from ±(2% m.v. + 2 digits) |
| Frequency | 45.0...65.0 Hz | 45.0...65.0 Hz | 0.1 Hz | ±(0.1% m.v. + 1 digit) |
| **Fault loop impedance** | | | | |
| Fault loop $Z_{L-PE}$, $Z_{L-N}$, $Z_{L-L}$ | from 0.13 Ω...1999 Ω acc. to EN IEC 61557 | 0.00 Ω...1999 Ω | from 0.01 Ω | ±(5% m.v. + 3 digits) |
| Fault loop $Z_{L-PE}$ in RCD mode | from 0.5 Ω...1999 Ω acc. to EN IEC 61557 | 0.00 Ω...1999 Ω | from 0.01 Ω | ±(6% m.v. + 5 digits) |
| **Measurements of RCD parameters** | | | | |
| RCD tripping test and measurement of tripping time $t_A$ measuring current 0.5 $I_{\Delta n}$, 1 $I_{\Delta n}$, 2 $I_{\Delta n}$, 5 $I_{\Delta n}$ | | | | |
| general and short-time delay RCD | 0 ms...300 ms | 0 ms...300 ms | 1 ms | from ±(2% m.v. + 2 digits) |
| selective RCD | 0 ms...500 ms | 0 ms...500 ms | 1 ms | from ±(2% m.v. + 2 digits) |
| 6 mA DC EV RCD and RCM | 0 ms...10.0 s | 0 ms...10.0 s | from 1 ms | ±(2% m.v. + 3 digits) |
| Measurement of RCD tripping current $I_A$ measuring current 0.3 $I_{\Delta n}$...2.0 $I_{\Delta n}$ | | | | |
| for sinusoidal residual current (AC type) | 3.0 mA...500 mA | 3.0 mA...500 mA | from 0.1 mA | ±5% $I_{\Delta n}$ |
| for unidirectional residual current and unidirectional with the 6 mA DC bias (type A) | 3.5 mA...420 mA | 3.5 mA...420 mA | from 0.1 mA | ±10% $I_{\Delta n}$ |
| for direct residual current (type B) | 1.0 mA...600 mA | 1.0 mA...600 mA | from 0.1 mA | from ±6% $I_{\Delta n}$ |
| **Earth resistance** | | | | |
| 3-pole method | 0.85 Ω...1999 Ω acc. to EN IEC 61557-5 | 0.00 Ω...1999 Ω | from 0.01 Ω | from ±(3% m.v. + 5 digits) |
| Auxiliary electrodes resistance | 0 Ω...1.99 kΩ | 0 Ω...19.9 kΩ | from 1 Ω | ±(5% ($R_S$+$R_E$+$R_H$) + 8 digits) |
| **Insulation resistance** | | | | |
| Measuring voltage 50 V | 50 kΩ...49.9 MΩ acc. to EN IEC 61557-2 | 0 kΩ...49.9 MΩ | from 1 kΩ | ±(5% m.v. + 8 digits) |
| Measuring voltage 100 V | 100 kΩ...99.9 MΩ acc. to EN IEC 61557-2 | 0 kΩ...99.9 MΩ | from 1 kΩ | ±(5% m.v. + 8 digits) |
| Measuring voltage 250 V | 250 kΩ...199.9 MΩ acc. to EN IEC 61557-2 | 0 kΩ...199.9 MΩ | from 1 kΩ | ±(5% m.v. + 8 digits) |
| Measuring voltage 500 V | 500 kΩ...599.9 MΩ acc. to EN IEC 61557-2 | 0 kΩ...599.9 MΩ | from 1 kΩ | ±(5% m.v. + 8 digits) |
| Measuring voltage 1000 V | 1000 kΩ...599.9 MΩ acc. to EN IEC 61557-2 | 0 kΩ...599.9 MΩ | from 1 kΩ | ±(8% m.v. + 8 digits) |
| **Resistance of protective conductors and equipotential bondings** | | | | |
| Measurement of resistance of protective conductors and equipotential bondings with ±200 mA current | 0.12 Ω...400 Ω acc. to EN IEC 61557-4 | 0.00 Ω...400 Ω | from 0.01 Ω | ±(2% m.v. + 3 digits) |
| Continuity testing of EV cable wires L1, L2, L3, N, PE, CP | 0.20 Ω...400 Ω acc. to EN IEC 61557-4 | 0.00 Ω...400 Ω | from 0.01 Ω | ±(3% m.v. + 5 digits) |
| **Phase sequence indication** | in the same direction (correct), opposite direction (incorrect), $U_{L-L}$ voltage: 100 V...440 V (45 Hz...65 Hz) | | | |
| **Resistance of coding resistor $R_c$** | | | | |
| Resistor resistance (PP-PE) – IN PEop socket | 0.32 Ω...6000 Ω acc. to EN IEC 61557-4 | 0.00 Ω...6000 Ω | from 0.01 Ω | ±(3% m.v. + 8 digits) |
| Resistor resistance (PP-PE) – OUT PEpp socket | 0.32 Ω...6000 Ω acc. to EN IEC 61557-4 | 0.00 Ω...6000 Ω | from 0.01 Ω | ±(3% m.v. + 8 digits) |

m.v. - measured value

# Specifications

| Measurement functions | Measurement range | Display range | Resolution | Accuracy ±(% m.v. + digits) |
|---|---|---|---|---|
| **Simulation of PP cable parameters** | | | | |
| NC | Open circuit | Open circuit | - | - |
| 13 A | 1500 Ω | 1500 Ω | - | ±2% |
| 20 A | 680 Ω | 680 Ω | - | ±2% |
| 32 A | 220 Ω | 220 Ω | - | ±2% |
| 63 A | 100 Ω | 100 Ω | - | ±2% |
| 80 A | 56 Ω | 56 Ω | - | ±3% |
| **Simulation of CP communication** | | | | |
| State A – vehicle not connected | Open circuit | Open circuit | - | - |
| State B – vehicle connected, not charging | 2740 Ω | 2740 Ω | - | ±1% |
| State C – vehicle connected, charging without ventilation | 882 Ω | 882 Ω | - | ±1% |
| State D – vehicle connected, charging with ventilation | 246 Ω | 246 Ω | - | ±1% |
| **$EVSE_{DIAG}$ diagnostics** | | | | |
| Voltage CP+, CP- | -19.99 V...19.99 V | -19.99 V...19.99 V | 0.01 V | ±(1% m.v. + 8 digits) |
| Frequency f (PWM) | 950 Hz...1050 Hz | 800 Hz...1200 Hz | 1 Hz | ±1 digit |
| Duty cycle D (PWM) | 3%...97% | 1.0%...99.0% | 0.1% | ±3 digits |
| Maximum charging current $I_{MAX}$ | 0 A...80 A | 0 A...80 A | 1 A | - |
| **Simulation of ERR OUT errors (ICCB, EVCS)** | | | | |
| CPsh – short circuit of CP to PE | 0...3100 ms | 0...3100 ms | 1 ms | ±(3% m.v. + 3 digits) |
| Dsh – diode short circuit | 0...3100 ms | 0...3100 ms | 1 ms | ±(3% m.v. + 3 digits) |
| PEop – interruption in PE | 0...1000 ms | 0...1000 ms | 1 ms | ±(3% m.v. + 3 digits) |
| **Simulation of ERR IN errors (ICCB)** | | | | |
| L/L1op – interruption in phase L/L1 | as in $EVSE_{DIAG}$ | as in $EVSE_{DIAG}$ | - | as in $EVSE_{DIAG}$ |
| L/L2op – interruption in phase L/L2 | as in $EVSE_{DIAG}$ | as in $EVSE_{DIAG}$ | - | as in $EVSE_{DIAG}$ |
| L/L3op – interruption in phase L/L3 | as in $EVSE_{DIAG}$ | as in $EVSE_{DIAG}$ | - | as in $EVSE_{DIAG}$ |
| Nop – interruption in N | as in $EVSE_{DIAG}$ | as in $EVSE_{DIAG}$ | - | as in $EVSE_{DIAG}$ |
| PEop – interruption in PE | as in $EVSE_{DIAG}$ | as in $EVSE_{DIAG}$ | - | as in $EVSE_{DIAG}$ |
| L1↔PE – interchanged L1 and PE wires | as in $EVSE_{DIAG}$ | as in $EVSE_{DIAG}$ | - | as in $EVSE_{DIAG}$ |
| L2↔PE – interchanged L2 and PE wires | as in $EVSE_{DIAG}$ | as in $EVSE_{DIAG}$ | - | as in $EVSE_{DIAG}$ |
| L3↔PE – interchanged L3 and PE wires | as in $EVSE_{DIAG}$ | as in $EVSE_{DIAG}$ | - | as in $EVSE_{DIAG}$ |
| $U_{EXT}$(PE) – voltage on PE wire | as in $EVSE_{DIAG}$ | as in $EVSE_{DIAG}$ | - | as in $EVSE_{DIAG}$ |
| **Transition time between states** | | | | |
| A → C, B → C, A → D, B → D | 0...3100 ms | 0...3100 ms | 1 ms | ±(3% m.v. + 3 digits) |
| C → A, C → B, D → A, D → B | 0...1000 ms | 0...1000 ms | 1 ms | ±(3% m.v. + 3 digits) |

m.v. - measured value

# Other technical data

| Technical data | |
|---|---|
| **Display type** | LCD 5” 1280 x 720 px |
| **Power supply** | mains: 220…240 V / 380…415 V, 50…60 Hz<br>rechargeable battery: Li-Ion 7.2 V 9.8 Ah |
| **Safety and work conditions** | |
| **Measuring category according to EN IEC 61010-2-030** | |
| Altitude ≤2000 m a.s.l. | CAT III 300 V |
| Altitude ≤3000 m a.s.l. | CAT II 300 V |
| **Ingress protection** | |
| Open cover | IP20 |
| Closed cover | IP54 |
| **Type of insulation according to EN 61010-1 and EN IEC 61557** | double |
| **Dimensions** | 429 x 328 x 236 mm |
| **Weight** | 8.7 kg |
| **Operating temperature** | -10…+45°C |
| **Storage temperature** | -20…+70°C |
| **Humidity** | 20…90% |
| **Nominal temperature** | +23°C ± 2°C |
| **Reference humidity** | 40%…60% |
| **Memory and communication** | |
| **Memory of measurement results** | 9999 records |
| **Data transmission** | USB, RJ-45, Bluetooth, Wi-Fi |
| **Other information** | |
| **Quality standard - development, design and production** | ISO 9001<br>ISO 14001<br>ISO 45001 |
| **The product meets the EMC (emission for industrial environment) requirements according to standards** | EN IEC 61326-1<br>EN IEC 61326-2-2 |

# Standard accessories

| | | |
|---|---|---|
|  | **AEV-100 adapter**<br>WAADAAEV100 | 1 |
|  | **Test lead 1.2 m (banana plugs) blue / yellow / black**<br>WAPRZ1X2BUBB / WAPRZ1X2YEBB / WAPRZ1X2BLBB | 1 / 1 / 1 |
|  | **BNC transmission cable**<br>WAPRZBNC | 1 |
|  | **Pin probe 1 kV (banana socket) blue / yellow / black**<br>WASONBUOGB1 / WASONYEOGB1 / WASONBLOGB1 | 1 / 1 / 1 |
|  | **Crocodile clip 1 kV 20 A yellow**<br>WAKROYE20K02 | 1 |
|  | **EVCAB cable 2.2 m (type 2 male/type 2 female)**<br>WAKABEVT2T2 | 1 |
|  | **Mains cable 230 V (16 A 5P socket)**<br>WAPRZZAS16P | 1 |
|  | **L-4 carrying case**<br>WAFUTL4 | 1 |
|  | **USB cable**<br>WAPRZUSB | 1 |
|  | **Factory calibration certificate** | 1 |

# Optional accessories

**CMP-100 leakage current digital clamp meter**

WMGBCMP100

**Crocodile clip, blue, 1 kV, 20 A**

WAKROBU20K02

**Crocodile clip, black, 1 kV, 20 A**

WAKROBL20K01

**Earth contact test probe (rod), 25 cm**

WASONG25

**Test lead 15 m, blue (banana plugs, on H-frame reel)**

WAPRZ015BUBBN

**Test lead 30 m, red (banana plugs, on H-frame reel)**

WAPRZ030REBBN

**Three-phase mains cable (16 A 5P socket)**

WAPRZZAS16P3F


**Sonel Reader software**

WAPROREADER


**Sonel Reports Plus software**

WAPROREPORTSPLUS

**Calibration certificate with accreditation**