



USER MANUAL

**ADAPTER
FOR TESTING VEHICLE CHARGING STATIONS**

EVSE-01

COMPATIBILITY



- MPI-540-PV
- MPI-540
- MPI-536
- MPI-535



- MPI-540-PV
- MPI-540
- MPI-536
- MPI-535



- MPI-530-IT
- MPI-530
- MPI-525
- MPI-520



- MPI-507
- MPI-506
- MPI-502



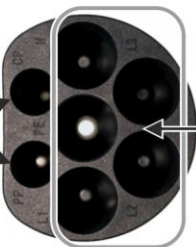
Simulation of charging cable

- NC - cable not connected
- 13...63 A - the cable's nominal current

Vehicle connection simulation

- state A - vehicle not connected
- state B - vehicle connected, not charging
- state C - charging (station without ventilation)
- state D - charging (station with ventilation)
- state E - error: CP short to PE

Communication with the charger



L1, L2, L3, N, PE lines



USER MANUAL

ADAPTER FOR TESTING VEHICLE CHARGING STATIONS

EVSE-01

FOR MPI METERS



**SONEL S.A.
Wokulskiego 11
58-100 Świdnica
Poland**

Version 1.08 23.05.2022

CONTENTS

1	Safety	3
2	Safety symbols	3
3	Introduction	3
4	Quick start	4
5	Settings	5
6	Measurements	6
6.1	MPI-540-PW MPI-540 MPI-536 MPI-535 Automatic measurements	6
6.2	Manual measurements	8
6.3	Control signal CP	10
7	Cleaning and maintenance	11
8	Storage	11
9	Dismantling and utilisation	11
10	Technical data	11
10.1	Basic data	11
10.2	Other technical data	12
10.3	Standards	12
11	Manufacturer	12

1 Safety

EVSE-01 adapter is designed for measurements on charging stations for electric vehicles. It is designed to test the operational safety and the accuracy of the charging stations used for charging in mode 3 according to EN-61851-1 with sockets compliant to IEC 62196 Type 2.

In order to provide conditions for correct operation, the following recommendations must be observed:

- Before you proceed to operate the adapter, acquaint yourself thoroughly with this manual and observe the safety regulations and specifications provided by the producer.
- Any application that differs from those specified in this manual may result in damage to the device and constitute a source of danger for the user.
- **EVSE-01** should be operated only by suitably qualified persons having the necessary permissions to carry out measurements on electrical systems. Operating the Adapter by unauthorised personnel may result in damage to the device and constitute a source of danger for the user.
- It is unacceptable that the user blocks the R button permanently in the position for R_{ISO} measurement. This will inactivate voltage controls, preventing voltage to be signalled. It is unacceptable, as in this state the device cannot be used.
- **The measuring voltage during the R_{ISO} measurement must not exceed 550 V.**
- Using this manual does not exclude the need to comply with occupational health and safety regulations and with other relevant fire regulations required during the performance of a particular type of work.
- The adapter must not be used for networks and devices in areas with special conditions, e.g. fire-risk and explosive-risk areas.
- It is unacceptable to operate the device when:
 - ⇒ it is damaged and completely or partially out of order,
 - ⇒ its cords and cables have damaged insulation,
 - ⇒ it was stored for an excessive period of time in disadvantageous conditions (e.g. excessive humidity) **If the meter has been transferred from a cool to a warm environment with a high level of relative humidity, do not start measurements until the meter is warmed up to the ambient temperature (approximately 30 minutes).**
- Repairs may be performed only by an authorised service point.



WARNING

Before each use, thoroughly inspect the insulation of the device, checking its wires for any damage (e.g. cracks, cuts, changes in structure or color). In case of discovering any faults, do not use the device and contact the service center.

2 Safety symbols



Attention, Danger - see the user manual.



Device protected by reinforced insulation.

3 Introduction

EVSE-01 adapter allows the user to conduct electrical measurements on charging stations of electric vehicles: **AC voltage station with a connector of type 2** equipped with **sockets** or a **fixed charging cable**.

In combination with MPI meters, the user may perform a wide range of tests. The adapter simulates the load acting on the cable connected to the charger and the status of the charger in relation to the vehicle.

The adapter is compatible with the following devices:

- MPI-540-PV / MPI-540 / MPI-536 / MPI-535,
- MPI-530-IT / MPI-530, MPI-525, MPI-520, MPI-507 / MPI-506, MPI-502.

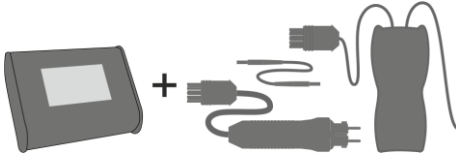


CAUTION!

- The adapters is designed for measurements performed with MPI meters. It is not recommended for using in other applications.
- The range of available measurements depends on the meter. See also **functional comparison of MPI meters** at the end of this manual.

4 Quick start

1



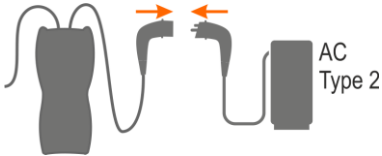
Connect the adapter to the meter.

2



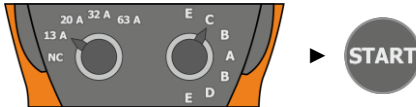
Set the adapter at:
PP = 63 A,
CP = A.

3



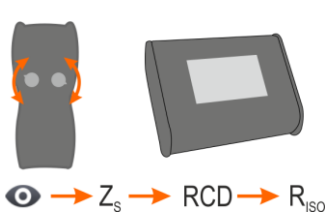
Connect the adapter to the charger (**sec. 6**).

4



Enter the simulation settings (**rsec. 5**) and start individual measurements.

5



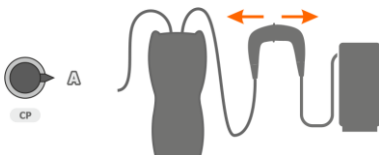
Perform measurements for all required combinations of settings.

CP = C or D – with these settings, you can measure the fault loop impedance and test residual current circuit breakers.

CP = B - with these settings, you can measure the insulation resistance.

CP = E – this setting is used to simulate an error.

6



To disconnect the adapter from the live charger, set CP = A, and - if necessary - PP = NC.

5 Settings

The chargers for electric vehicles have types of lines: communication and power supply. The charging current flows through the power supply lines. The communication lines (PP, CP) transfer information on the status of the receiver, resulting in the change of charger internal settings.

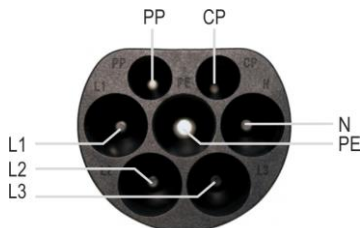


Fig. 4.1. Plug IEC 62196, Type 2.
PP, CP - communication between the charger and receiver
L1, L2, L3, N, PE – wires of the 3-phase line

PP line informs the charger about connecting/disconnecting the power supply cable to the receiver - if the cable is connected it indicates its rated current.

CP line sends information about the current state of the receiver: connected, charging etc.

EVSE-01 provides a simulation of situations when the charged object:

- is connected to the charging source via a cable with a pre-set maximum current PP
- and the charging cycle is in a mode set on CP line.

PP and CP settings are selected by using suitable knobs.

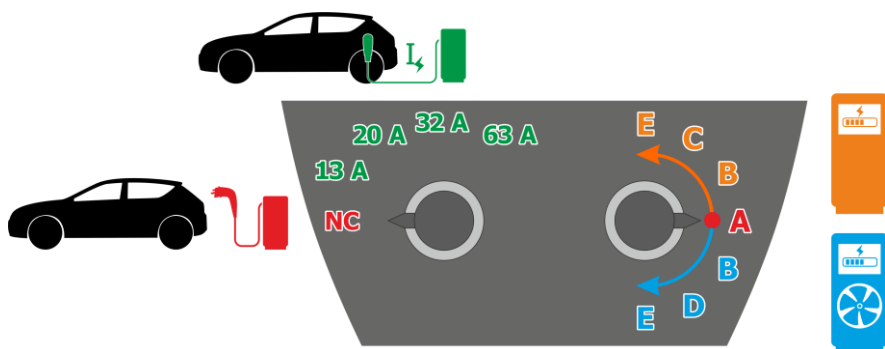


Fig. 4.2. Panel with simulation knobs

PP knob simulates the charging cable:

- ⇒ NC - the cable is not connected,
- ⇒ 13 ... 63 A - the cable is plugged and has the rated current set.

CP knob simulates the vehicle-charger relation:

- ⇒ position A – no connection,
- ⇒ position B – connected, no charging,
- ⇒ position C – charging (station without ventilation)
- ⇒ position D – charging (station with ventilation)
- ⇒ position E – error: CP short-circuit with PE.



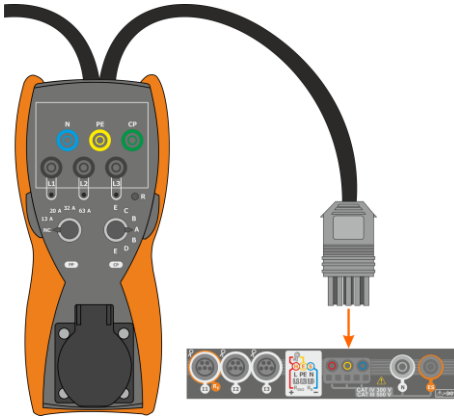
Due to the many types of electric chargers, the selection of correct settings of EVSE-01 requires from the measuring person the knowledge of the tested object and parameters of measurements to be performed.

6 Measurements

Testing of a charging station involves the R_{ISO} measurement of its insulation resistance, Z_S fault loop impedance and RCD protection at different simulated conditions of the receiver.

6.1 MPI-540-PV MPI-540 MPI-536 MPI-535 **Automatic measurements**

1



Connect the control plug to the meter.


Find the list of charger tests in section **Automatic measurements** of the meter. Select the test required for your measurements.

2





Enter the settings required during the tests.

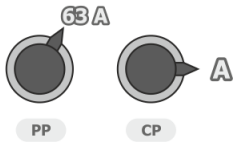
- For test Z_{L-N} , Z_{L-L} , $Z_{L-PE[RCD]}$:
 - ⇒ protection of phases L1, L2, L3 supplying the charger,
 - ⇒ method for calculating short-circuit current I_k ,
 - ⇒ RCD type.
- For RCD test:
 - ⇒ rated current $I_{\Delta n}$,
 - ⇒ testing mode
 - ⇒ protection type
 - ⇒ test voltage U_L ,
 - ⇒ currents to be measured,
 - ⇒ phases taken into account in the test.
- For R_{ISO} tests:
 - ⇒ test voltage,
 - ⇒ measurement time,
 - ⇒ bottom limit.

Save the settings using icon .

Description of function icons

-  collapsing setting fields
-  expanding setting fields

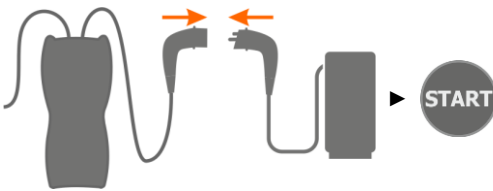
3



Set the adapter at:

- PP = 63 A,
- CP = A.

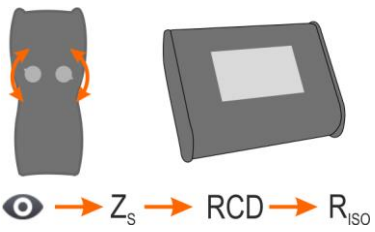
4



Connect EVSE-01 to the charger and supply it with power.

Press **START**. The automatic measurement sequence will start.

5

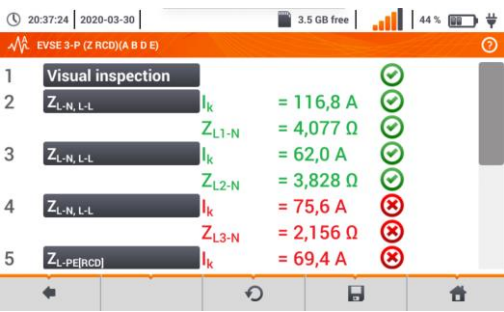


Observe the messages on the screen and follow the prompts.


The procedure consists of some or all of the following steps:

- **Visual test** - results from the response of the charger to different PP and CP states
- **Zs** – results from parameters of powers supply network. Set CP = C or D,
- **RCD** - results from the safety device of the charger. Set CP = C or D,
- **RISO** – results from the basic insulation of the charger. Set CP = B.

6

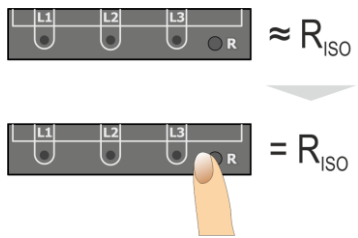


After completion of the measurement, a summary is displayed.

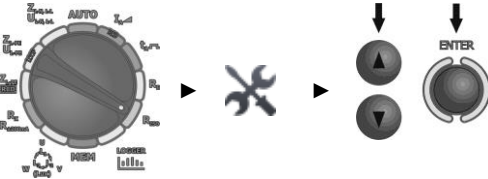
The results can be saved in memory by using icon .



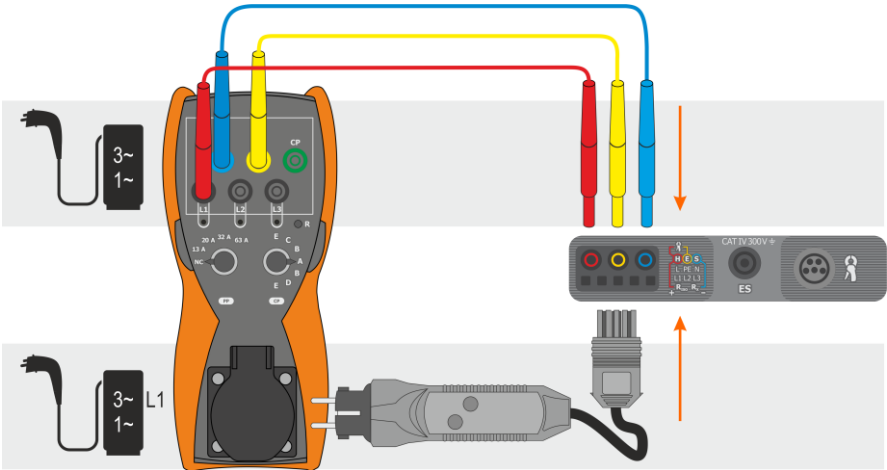
- Before and during R_{ISO} measurement, it is recommended to press and hold the 'R' button. It eliminates the effect of voltage controls on the result. ▶
- During the measurement of the insulation resistance R_{ISO}, the measuring voltage must not exceed 550 V.
- All measurements (in particular R_{ISO}!) should be carried out taking into account the documentation of the tested charger.



6.2 Manual measurements

①  Activate the desired measuring function in the meter and enter the settings required during the test.

② Connect EVSE-01 to the meter.



- ⇒ If you test **3-phase chargers**, use banana-socket cables
- ⇒ If you test **1-phase charger**, use banana-socket cables or WS adapter.

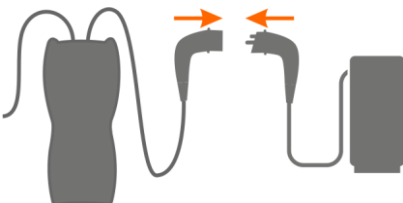


If you use the WS adapter for testing a 3-phase charger, you will be able to measure only L1 phase.

③ 

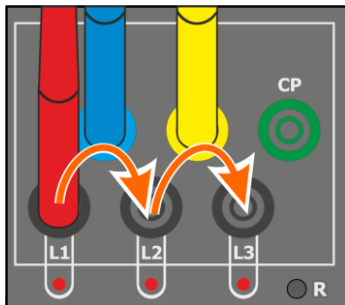
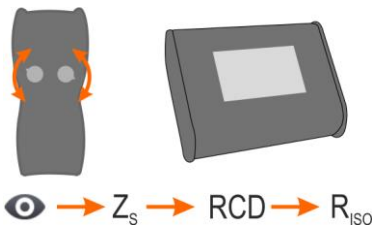
Set the adapter at:

- PP = 63A,
- CP = A.

④ 

Connect EVSE-01 to the charger and supply it with power.

5



Perform measurements for all required combinations of settings.

- **Visual test** - results from the response of the charger to different PP and CP states
- **Z_s** – results from parameters of powers supply network. Set CP = C or D,
- **RCD** - results from the safety device of the charger. Set CP = C or D,
- **R_{iso}** – results from the basic insulation of the charger. Set CP = B.

If you test **Z_s**, you need to measure

- ⇒ L1-N, L2-N, L3-N or
- ⇒ L1-PE, PE-L2, L3-PE.

If you test **RCD**, you need to measure L1-PE, L2-PE, L3-PE.

If you test **R_{iso}**, you need to measure:

- ⇒ L1-PE, L2-PE, L3-PE, N-PE or
- ⇒ L1+L2+L3+N-PE.

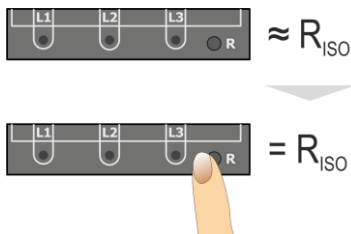
6



Enter settings to EVSE-01 and start the measurement.



- Before and during R_{iso} measurement, it is recommended to press and hold the 'R' button. It eliminates the effect of voltage controls on the result. ►
- During the measurement of the insulation resistance R_{iso} , the measuring voltage must not exceed 550 V.
- All measurements (in particular R_{iso} !) should be carried out taking into account the documentation of the tested charger.
- Not all models of the MPI meters provide the parameter measurements of RCDs type EV.



6.3 Control signal CP

Connect the oscilloscope to the CP socket, in order to obtain information about the Pulse-Width Modulation (PWM) of the control signal. The signal has a frequency of 1 kHz. Signal duty cycle indicates the status of the charging station or the maximum current that the station can supply. The current value can be determined based on the following table, contained in EN 61851-1 standard.

Nominal duty cycle interpretation by vehicle	Maximum current to be drawn by vehicle
Duty cycle < 3 %	Charging not allowed
$3 \% \leq \text{duty cycle} \leq 7 \%$	Indicates that digital communication will be used to control an off-board DC charger or communicate available line current for an on-board charger. Digital communication may also be used with other duty cycles. Charging is not allowed without digital communication. 5 % duty cycle shall be used if the pilot function wire is used for digital communication
$7 \% < \text{duty cycle} < 8 \%$	Charging not allowed
$8 \% \leq \text{duty cycle} < 10 \%$	6 A
$10 \% \leq \text{duty cycle} \leq 85 \%$	Available current = (% duty cycle) \times 0,6 A
$85 \% < \text{duty cycle} \leq 96 \%$	Available current = (% duty cycle - 64) \times 2,5 A
$96 \% < \text{duty cycle} \leq 97 \%$	80 A
Duty cycle > 97 %	charging not allowed
If the PWM signal is between 8 % and 97 %, the maximum current may not exceed the values indicated by the PWM even if the digital signal indicates a higher current.	



NOTE!

- Test CP signal in relation to the PE line.
- We recommend using a battery-powered portable oscilloscopes with isolated input and differential probes that ensure galvanic isolation of the oscilloscope.
- If the ground wire of the oscilloscope is not isolated from its casing, then before connecting the oscilloscope, make sure that the PE line of the charging station is free from dangerous voltage!

7 Cleaning and maintenance



NOTE!

Use only the maintenance methods specified by the manufacturer in this manual.

The casing of the meter may be cleaned with a soft, damp cloth using all-purpose detergents. Do not use any solvents or cleaning agents which might damage the casing (powders, pastes, etc.).

Clean the probe with water and dry it.

The test leads should be cleaned with water and detergents, and then dried.

The electronic system of the meter does not require maintenance.

8 Storage

In the case of storage of the device, the following recommendations must be observed:

- disconnect all the test leads from the meter,
- clean the meter and all its accessories thoroughly,
- wind the test leads.

9 Dismantling and utilisation

Worn-out electric and electronic equipment should be gathered selectively, i.e. it must not be placed with waste of another kind.

Worn-out electronic equipment should be sent to a collection point in accordance with the law of waste electrical and electronic equipment.

Before the equipment is sent to a collection point, do not dismantle any elements.

Observe the local regulations concerning disposal of packages and used batteries/rechargeable batteries.

10 Technical data

10.1 Basic data

Fault loop Z	Measurement mode	Test range Z_s acc. to IEC 61557-3	Accuracy	Test range R_{ISO}	Accuracy
Z_{L-PE} Z_{L-N} Z_{L-L}	Automatic	0.30 Ω ...1999.9 Ω	$\pm(5\% \text{ m.v.} + 0.06 \Omega)$...99.9 M Ω	As in the meter
	Manual (1.2 m test leads)	0.170 Ω ...1999.9 Ω	As in the meter	100...199.9 M Ω	-5% m.v. ... + as in the meter
$Z_{L-PE(RCD)}$	Automatic	0.54 Ω ...1999 Ω	$\pm(6\% \text{ m.v.} + 0.12 \Omega)$	200...999 M Ω	-13% m.v. ... + as in the meter
	Manual (1.2 m test leads)	0.51 Ω ...1999 Ω	As in the meter	1...2 G Ω	Unspecified

⇒ Abbreviation "m.v." used in the specification of basic uncertainty means standard measured value

10.2 Other technical data

- a) type of insulation according to EN 61010-1..... double
- b) measurement category according to EN 61010-1 CAT II 300 V
- c) ingress protection according to EN 60529 IP40
- d) pollution degree 2
- e) input voltage 400 V (3-phase)
- f) frequency 50 Hz, 60 Hz
- g) simulation of charging cable PP open circuit, 13 A, 20 A, 32 A, 63 A
- h) vehicle connection simulation CP
 - 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
 - state E error – CP short to PE
- i) socket types..... measuring sockets: L1, L2, L3, N, PE
..... 1-phase socket
..... CP signal socket – PWM communication
- j) test lead length
 - EVSE 1 m
 - MPI 0.5 m
- k) operating temperature..... -5...+45°C
- l) storage temperature..... -20...+60°C
- m) dimensions 220 x 100 x 60 mm
- n) weight 1.4 kg
- o) the product meets EMC requirements acc. to the following standards ... EN 61326-1, EN 61326-2-2

10.3 Standards

Safety

EN 61010-1
EN 61010-2-030
EN 61010-031

Functionality

EN 61851-1

11 Manufacturer

The manufacturer of the device and provider of guarantee and post-guarantee service:

SONEL S.A.

Wokulskiego 11
58-100 Świdnica
Poland

tel. +48 74 858 38 60

fax +48 74 858 38 09

E-mail: export@sonel.pl

Web page: www.sonel.pl



NOTE!

Service repairs must be performed only by the manufacturer.

FUNCTIONAL COMPARISON OF MPI METERS

Meter	MPI-540-PV MPI-540 MPI-536 MPI-535	MPI-530-IT MPI-530 MPI-525 MPI-520	MPI-507 MPI-506	MPI-502
Auto measurements	√	–	–	–
Automatic three-phase measurement via multiplug	√	–	–	–
Visual inspection	√	–	–	–
Fault loop Z_{L-PE} , Z_{L-N} parameters measurement	√	√	√	√
6 mA RCD test	√	–	–	–
RCD test	AC, A, F, B, B+, EV	AC, A, F, B, B+	AC, A	AC, A
Insulation resistance R_{iso} measurement	√	√	√	–
Measurements report	√	√	√	√



SONEL S.A.
Wokulskiego 11
58-100 Świdnica
Poland



+48 74 858 38 60
+48 74 858 38 00
fax +48 74 858 38 09

e-mail: export@sonel.pl
www.sonel.pl