Operating instruction and technical description

EV Simulator for charging devices with charging plug /charging coupler /charging cable type 1 and type 2 as service case

Photo: EV simulator/tester with enclosed measuring line.

E-BoxX by walther

Contents

1 Operating instructions EV simulator/tester

These operating instructions shall be a valuable help for operation and troubleshooting of the EV simulator/ tester.

This version of the document was last updated in May 2013, version 2.0.

The manual is continuously adapted to the technical enhancement of the devices.

We would appreciate your requests and suggestions or ideas for improvement.

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2 Safety notes

Besides the technical protective measures, the following precautionary measures also help minimizing the risk of accidents. Compliance with these recommendations helps minimizing the risk of health damages, injuries, property damages and production downtimes.
Please see that these precautionary measures will be observed - it's in your own interest.

	**Train and instruct the operating personnel thoroughly!** The system must only be operated and opened by trained technical staff. Store these instructions in a way that they are clearly visible and within reach of the operating personnel. Acquaint all operators with the safety precautions. Ensure regular and professional care and maintenance of the system. Orderly workplace = safety. Do not remove or deactivate any safeguards. Damaged safeguards either have to be repaired professionally or have to be replaced.
	**Protection against electric shock!** Prior to any installation on or near electrical parts always switch off the supply or the main switch and withdraw the mains plug. Do not touch live parts. Use insulated tools. Never touch electric cables with wet hands The system (mobile version) must not be permanently exposed to rain or humidity.

3 Operating instructions

3.1 General description

By means of the EV simulator, the functions of charging devices for electric vehicles (charging stations, wall boxes etc.) and pluggable charging cables (mode 3) can be tested by simulating the electric vehicle. After installation or for service purposes, this is directly possible at the charging infrastructure.

The present version can be used for type 1 and type 2 charging devices, both with firmly connected charging cable and with charging sockets and separate charging cable. By means of the provided measuring line, 4 different cable cross sections can be simulated.

The EV simulator comprises the following functions:

- Measuring the built-in resistance inside the type 2 plug (between PP and PE)
- Measuring the built-in resistances inside plug type 1 (between CS and PE) and checking the interlock's switching function
- Ampacity simulation of a charging cable
- Checking the PE connection between PWM and vehicle
- Simulation of a leakage current > 30 mA from L1 to PE
- Simulation of vehicle status B, C, D and indication of charging voltage via LEDs
- CP test jack for PWM signal

The device simulates both faults which can occur during normal use, and different operating conditions of an electric vehicle. It only comes to a small power drain of approx. 3 mA from the connected charging device. Additionally, a load current of max. 6 A can be drawn from the built-in Schuko socket via L1 or a test device for RCD control can be connected.

Attention:

The Schuko socket shall only be used shortly for measuring purposes. Permanent usage is not allowed.

Furthermore, Walther offers EV simulators both as service-case version for type 1 or type 2 charging devices with integrated charging jack (acc. to SAE J1772 or IEC 62196, USA, Japan) and with firmly connected charging cable and charging plug type 2 (acc. to IEC 62196).

Photos: EV tester/simulator for type 2, EV tester/simulator for type 1 and type 2 with firmly connected cable (from left to right)

3.2 Hardware

3.2.1 Components

The EV simulator is built up as stable transport case and is provided with an integrated charging appliance inlet type 1 and with an integrated charging appliance inlet type 2 for electrical connection. By means of the special measuring line, the cable cross sections can be simulated. For mobile use there is a carrying strap available.

Furthermore the connections L1, N and PE are accessible from outside via integrated Schuko socket. The Schuko socket is placed on the right side of the EV tester. With this, an electric load of up to 6 A can be connected.

3.2.2 Hardware configuration

Perform the following steps consecutively:

- Remove all parts of the packaging carefully. Avoid damaging.
- Check the device thoroughly regarding transport damages and other damages.
- Supplier and forwarder have to be informed immediately about each damage.
- Check whether all parts have been delivered completely. If applicable, do also consider spare parts you may have ordered. If parts are missing, inform the supplier immediately.
- Establish the electrical connection of the EV simulator. Check whether L and N are connected correctly. Check the protective conductor before operating the unit.
- To operate the system, no separate power supply is required. The device is powered by the connection to the charging device.

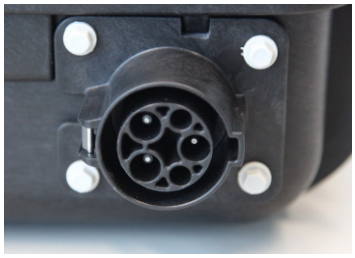
If anything is unclear, please contact the supplier.

Photo: EV tester/simulator with operating elements and measuring instrument

4 Operation

4.1 Handling

For simulation purposes, a connection between one of the two charging sockets of the EV simulator (type 1 or type 2) and the charging infrastructure has to be established - either by inserting the firmly connected charging cable or by using a separate mode 3 charging cable (without simulation of cable cross section or by means of the provided measuring line for cable cross section simulation).




Photos: Connection possibilities EV tester/simulator type 1, type 2, Schuko socket for load connection and measuring line.

Attention:

Only one of the two charging sockets may be used shortly for measure purposes without permanent load at a time. A simultaneous insertion of two cables is not permissible and may result in malfunctions and even cause a short-circuit. Toggling between the two charging sockets is made by the changeover switch in the middle of the operator panel.

The plug should only be withdrawn when the electric vehicle is switched off (EV status: B, C and D Aus/OFF). The tester has no integrated interlock.

4.2 Switching on the EV simulator

The EV simulator is switched on by inserting the charging plug into the charging socket respectively by applying the supply voltage of the charging device. There is no separate switch available. For safety reasons, the plug has to be withdrawn after termination of the test procedure.

4.3 Measuring of built-in resistances inside type 2 plug

Acc. to IEC 61851-1, there is a resistor available inside the type 2 plug which shows the ampacity of the charging cable. This resistor can be checked by means of the built-in measuring device.

Coding resistance inside charging plug and charging coupler (type 2)		
Power [A]	**Resistance [Ohm] (rated value)**	**Cross section [mm²]**
13	**1500**	**1,5**
20	**680**	**2,5**
32	**220**	**6**
63	**100**	**16**

Table : Ampacity with corresponding coding resistance and cable cross section

Attention:

When measuring the built-in resistors, the switch "simulation power values" (top right) must not be switched on. Otherwise this may lead to incorrect measurements, since several resistors are simultaneously operative.

Photo: Resistance measurement with charging cable 20 A

With inserted plug, the nominal value, depending on the allowed cross section of the charging cable should be indicated (see table).
Switch off the measuring device after successful measurement (turn rotary switch to "OFF").
If other or no measured values are indicated, the plug has to be checked.

Attention:

The integrated measuring device is for resistance measuring only and should therefore only be switched on shortly for measuring the resistances (will result in a longer battery durability). Under no circumstances leave it switched on during other test procedures with applied voltage.

4.4 Simulation of resistors' ampacity inside plug type 2

Acc. to IEC 61851-1, there is a resistor available inside the type 2 plug which shows the ampacity.
This resistor can be simulated by means of the measuring line provided with the charging device.

Coding resistance inside charging plug and charging coupler (type 2)		
Power [A]	**Resistance [Ohm] (rated value)**	**Cross section [mm²]**
13	**1500**	**1,5**
20	**680**	**2,5**
32	**220**	**6**
63	**100**	**16**

Table : Ampacity with corresponding coding resistance and cable cross section

Attention:

For simulation only the provided measuring line may be used. For simulation, the switch "Simulation Power Values" has to be switched on. Afterwards, the resistance value has to be preset by operating the corresponding switch. Always only one switch at a time may be switched on. This simulation is only possible and permissible with type 2.

The measuring line may only be used for this purpose. Charging an electric vehicle with this measuring line is not permissible / not possible.

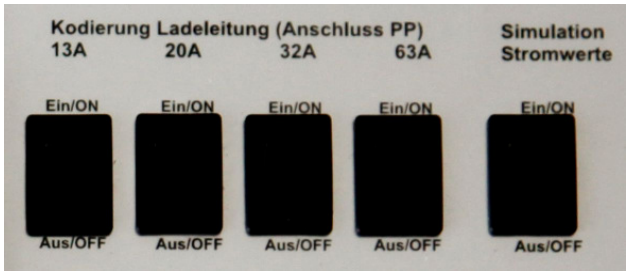
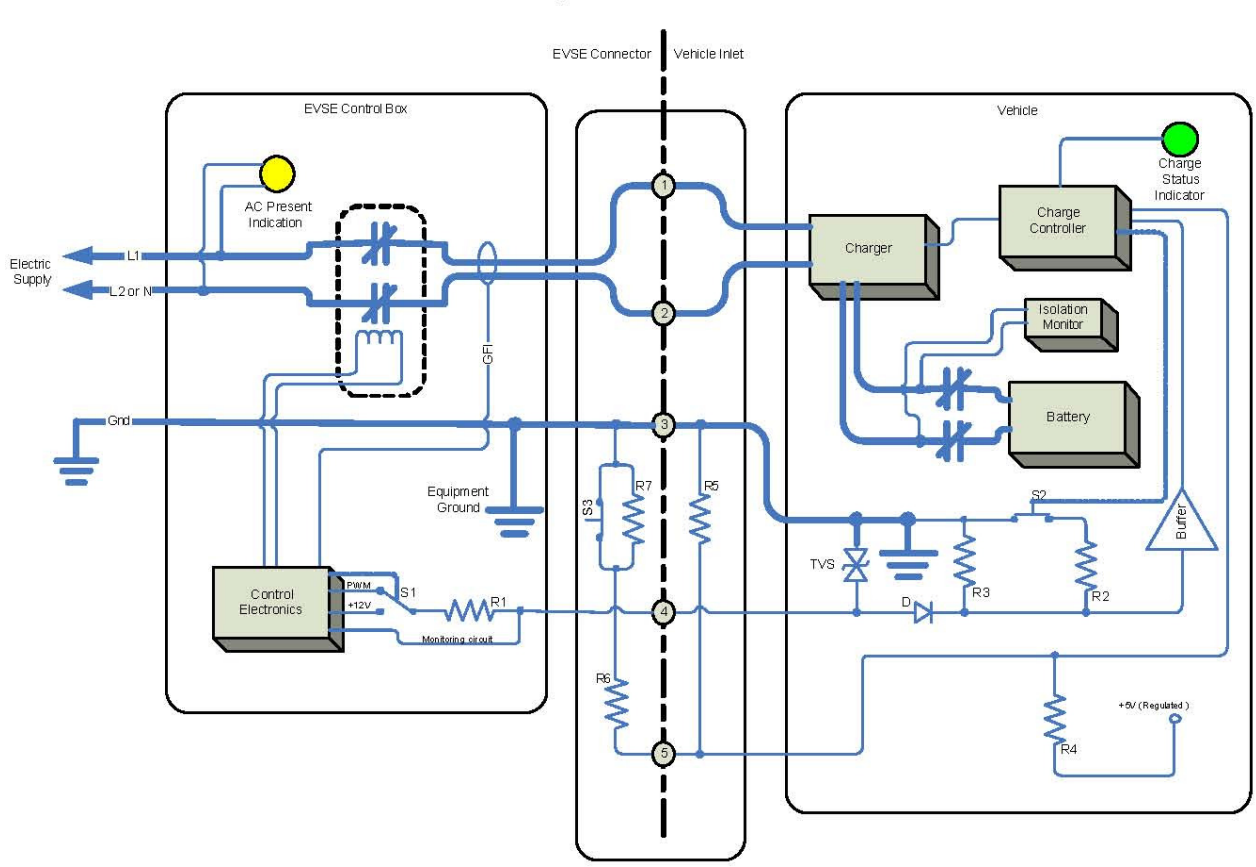


Photo: Switch for simulating the ampacity of the charging cable

4.5 Measuring of built-in resistors inside type 1 plug

Acc. to SAE J1772, the type 1 plug contains two resistors (R 6 = 150 Ohm, R 7 = 330 Ohm) and a push button (S 3). These can be checked by means of the built-in metering device.



Photos: Diagram for type 1 from SAE J1772.

Setting the rotary switch of the measuring device to the measuring range Ω (Ohm) activates the measuring process. If there is no indication please check or replace the batteries of the measuring device.

Photos: Resistance measurement with connected cable and actuated pushbutton

With inserted plug, the nominal value 150 Ω should be indicated. In this case, the pushbutton on the plug is not pressed. By pressing the pushbutton on the plug, the nominal value 480 Ω should be indicated. After successful measurement, switch off the measuring device (turn rotary switch to OFF).

If other or no measured values are indicated, the plug and the relevant switch positions have to be checked.

Attention:

The integrated measuring device is for resistance measuring only and should therefore only be switched on shortly for measuring the resistances (will result in a longer battery durability). Under no circumstances leave it switched on during other test procedures with applied voltage.

4.6 Checking the PE connection between PWM and vehicle

The PE EV switch is used to check the PE connection. In switch position Ein/ON the PE is connected, in switch position Aus/OFF it is interrupted. Thus the connection between PE and CP on the vehicle side is interrupted and the charging process should be switched off by the charging device. Now the charging device should no longer react to operating the switches Status EV (signal CP) B, C or D.

4.7 Simulation of a fault by means of switchable fault current

To test the triggering of the RCD in case of error, a switchable leakage current (> 30 mA) is created. This leakage current is conducted from L1 to PE via an integrated resistance (3,3 kΩ). The leakage current is created by pressing the FI/RCD pushbutton shortly (switch position Ein/ON). The protective device inside the charging infrastructure has to trigger immediately. In case of correct switching off the red LED flashes shortly and the RCD triggers. The charging process should be interrupted directly.

Attention:

If the LED FI/RCD shines permanently while the pushbutton is pressed, release the pushbutton immediately. Then the protective device FI/RCD respectively the wiring of the installation has to be checked.

In case of single-phase use of the charging infrastructure, care must be taken to ensure that L1 and N have not been interchanged on the charging device, i.e. it must be possible that a leakage current can flow to PE. (L1 = L and N = N). Only under these circumstances can the test be carried out correctly.

4.8 Simulation of vehicle status B, C, D and display of charging voltage

The vehicle status can be simulated by means of different switch positions of the switches B, C and D.

Status B	Switch B	Ein/ON
Status C	Switch **B and C**	Ein/ON
Status D	Switch **B and D**	Ein/ON

Table : EV status and switch position

On single-phase charging devices, the switched-on charging voltage is only indicated at LED L1.
On three-phase charging devices, the switched-on charging voltage is indicated at LEDs L1, L2 and L3.

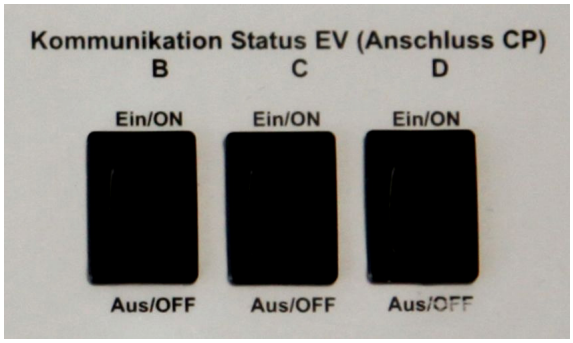


Photo: Switch for EV status simulation

By operating switch B, vehicle status B is simulated. In this status, the electric vehicle is connected to the charging device and is ready to be charged (PWM signal: 9 V).

By additionally operating switch C (i.e. **B and C**), the electric vehicle requests charging current and it is switched on by the charging device. Please note that no thereby no charging power is withdrawn. The electric vehicle which is simulated by the EV tester would be charged now (PWM signal: 6 V)

By operating switch D instead of C (i.e. **B and D**), the electric vehicle requests ventilation during the charging process (PWM signal: 3 V). The charging device has to react accordingly.

Frequency and pulse width of the PWM signal remain constant during simulation.

4.9 Measuring of PWM signal (CP test jack)

On the BCN female jack, there is the PWM signal available for display and measuring. It can for example be evaluated with an oscilloscope.

Attention:

This measurement has to be carried out "unearthed, without PE". Otherwise checking the PE connection (chapter 4.6) is not possible.

5 Troubleshooting

Error, fault	Cause	Remedy
Measuring device of EV simulator does not react	Batteries are empty	Exchange batteries of measuring device (see maintenance). Attach the device correctly.
EV simulator does not react	Voltage supply is missing	Check voltage supply of charging infrastructure Check pre-fuses
	Plugs are not inserted correctly	Check plug connection
	Switch positions are wrong	Check switch positions
RCD does not trigger; LED is shining permanently while pushbutton FI/RCD is pressed	Plugs are not inserted correctly	Check plug connection Release pushbutton immediately
	RCD does not work correctly or is not available.	Check RCD and switch on again Check wiring of the installation
The oscilloscope connected to the BNC female jack delivers no signal	BNC plug is not inserted correctly	Check switch positions B,C,D Check position of switch type 1 – type 2
	Switch positions are wrong	Check BNC plug Check oscilloscope settings
Charging device does not react to simulation	Plug is not inserted correctly	Check connection. Only one connection may be occupied.
	Switch type 1 – type 2 in wrong position	Check position of switch type 1 – type 2
	Switch PE is Off	Switch on the PE switch
	PE is interrupted	Check PE
No line simulation possible	Measuring line defective or not available	Use measuring line Switch on the "simulation power values" switch
	Switch positions during simulation of power values are wrong	More than one switch (13, 20, 32 63 A) is switched on
Wrong measuring values with the coding resistor	Measuring line inserted	Remove measuring line
	Switch "Simulation power values" wrong	Switch off the "simulation power values" switch
		Faulty resistor inside the cable

6 Maintenance

The EV simulator does not require any considerable maintenance. If necessary the battery of the built-in measuring device has to be exchanged.

6.1 Battery change

Loosen the two PVC screws and carefully open the measuring device by loosening the screws on the backside. Exchange the used batteries (LR 44 or identical in construction). Close the device and fix it on the front plate.

Attention:

In any case, the EV tester has to be separated from the charging device prior to any maintenance work!

Maintenance work may only be carried out by trained specialised staff.

To avoid increased contact resistances, the contacts on the charging sockets of the EV tester and on the plugs of the charging cable and the measuring line have to be checked.

7 General technical specifications

Length	approx. 360 mm
Width	approx. 310 mm
Height	approx. 200 mm
Weight	approx. 2,7 kg
Voltage supply	230V / 400V 50 Hz
Switchable leakage current (from L 1 to PE)	> 30 mA corresponding to resistance 3,3 kΩ
Charging sockets for connection with infrastructure	Type 1 (5-pole) Type 2 (7-pole)
Measuring line, special version	Plug type 2 Coupler type 2 7-pole wired through
Schuko socket for load connection on L 1.	230 VAC, max. 6 A