

# BENNING

## Operating manual

Translation of the German original version

BENNING EV 3-2

5178 / 08/2021 en



# Legal notice

## Notes concerning the documentation

Ensure that the applicable documentation is used for this product. For safe handling, knowledge that is provided in these instructions is required.

The product may only be handled while following this documentation, particularly the safety instructions and warnings it contains. The personnel must be qualified for the respective task and have the capability to recognise risks and prevent possible dangers.

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## Copyright

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## Disclaimer

The contents of the documentation has been checked to ensure that it corresponds to the hardware and software described. Nevertheless, deviations cannot be ruled out, so Benning cannot guarantee complete correspondence. The contents of this documentation are checked at regular intervals, and any corrections that are needed are contained in the versions that follow.

## General non-discrimination

Benning is aware of the importance of language with regard to the equality of men and women, and endeavours to take this into account at all times. To improve readability, we have refrained from consistently using differentiating formulations.

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# 1 Introduction

The BENNING EV 3-2 measuring adapter described here (in the following only referred to as “device”) is an optional accessory for the BENNING IT 130 and IT 200 installation testers. The BENNING EV 3-2 measuring adapter enables you to perform safety and functional tests on certain charging stations for electric vehicles (EVSE, electric vehicle supply equipment) in compliance with DIN VDE 0100-600 (IEC 60364-6) and DIN VDE 0105-100 (EN 50110) using the corresponding installation tester.

The device is intended for testing charging stations according to DIN EN / IEC 61851-1 (VDE 0122-1) of charging mode “Mode 3” and is provided with a Type 2 connector according to IEC / EN 62196. The “Mode 3” charging mode is used for 1-phase and 3-phase charging with alternating current (AC) at permanently installed charging stations (so called “wall boxes”).

The device establishes safe contact with the BENNING installation tester and triggers the charging process of the charging station by simulating an electric vehicle (EV).

## Further information

<http://tms.benning.de/ev3-2>

On the Internet, you will find the following additional information directly at the specified link or at [www.benning.de](http://www.benning.de) (product search):

- Operating manual of the device in several languages
- Further information depending on the device (e. g. brochures, technical reports, FAQs)

## 1.1 General notes

### Target group

This operating manual is intended for the following groups of people:

- Qualified electricians and qualified technical personnel

### Required basic knowledge

To understand these operating manual, you will need general knowledge of testing and measuring equipment. Moreover, you will need basic knowledge of the following issues:

- General electrical engineering

### Purpose of the operating manual

This operating manual describes the device and provide you information about how to handle it.

Keep this operating manual in a safe place for later use. Read this operating manual before handling the device and follow the instructions.

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## NOTE

### Disclaimer of liability

Please make sure that any person using the device has read and understood the instructions of this operating manual before handling the device and that the instructions are adhered to in all points. Non-observance of this operating manual might result in product damage, property damage and/or personal injury.

Benning assumes no liability for damage and malfunctions resulting from the failure to observe the instructions in this operating manual.

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The devices are subject to continuous further development. Benning reserves the right to make changes to the device's design, configuration and technology. The information in this operating manual corresponds to the state of technical knowledge at the time of printing. For this reason, no claims for certain device characteristics can be derived from the contents of this operating manual.

Information in this operating manual can be changed at any time without prior notice. Benning is not obligated to make amendments to this operating manual or to keep it up to date.

Direct any technical questions to Technical Support [[▶ page 8](#)].

## Trademarks

All trade marks that are used are the property of their respective owners, even if they are not separately marked as such.

## 1.2 History

Release number	Updates
03/2021	<ul style="list-style-type: none"><li>• Initial publication</li></ul>
08/2021	<ul style="list-style-type: none"><li>• Revision of the operating manual</li></ul>

Table 1: History

## 1.3 Service & support

Please contact your specialty retailer or the BENNING Service Center for any repair or service work that might be required.

### Technical support

Please contact our Technical support for technical questions on handling the device.

Phone:	+49 2871 93-555
Fax:	+49 2871 93-6555
E-Mail:	helpdesk@benning.de
Internet:	www.benning.de

### Returns management

Easily and conveniently use the BENNING returns portal for a quick and smooth returns processing:

<https://www.benning.de/service-de/retourenabwicklung.html>

Phone:	+49 2871 93-554
E-Mail:	returns@benning.de

### Return address

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Retourenmanagement  
Robert-Bosch-Str. 20  
D - 46397 Bocholt

## 2 Safety

### 2.1 Warning system

This operating manual contains notes that must be taken into consideration for your personal safety and in order to avoid injuries and damage to property. Warnings about your personal safety and to prevent personal injuries are marked with a warning triangle. Warnings on sole prevention of material damage are shown without a warning triangle. The warnings are shown in descending order depending on the hazard level as follows.



#### **⚠ DANGER**

##### **Extremely dangerous situation for humans**

If you do not pay attention to this warning, irreversible or deadly injuries will occur.



#### **⚠ WARNING**

##### **Hazard to humans**

If you do not pay attention to this warning, irreversible or deadly injuries could occur.



#### **⚠ CAUTION**

##### **Minor hazard to humans**

If you do not pay attention to this warning, minor or moderate injuries could occur.



#### **NOTICE**

##### **Danger to property, not to persons**

If you do not pay attention to this warning, material damage could occur.

If multiple hazard levels occur, the warning for the highest respective hazard level will be used. In addition, a warning about personal injuries can also include a warning about material damage.

### 2.2 Standards applied

The device has been built and tested in compliance with the following standards and has left the factory in perfectly safe condition.

- IEC / DIN EN 61010-1 (VDE 0411-1)
- IEC / DIN EN 61010-2-030 (VDE 0411-2-030)
- IEC / DIN EN 61010-031 (VDE 0411-031)

## 2.3 Symbols used

### Symbols on the device

Symbol	Meaning
	Please observe the information provided in this operating manual in order to avoid dangers.
CAT II	Measuring category II is applicable to testing and measuring circuits which are directly connected to user connections (e. g. sockets) of the low-voltage mains installation.
	The device complies with EU directives.
	At the end of product life, dispose of the unserviceable device via appropriate collecting facilities provided in your community.
	The device is provided with protective insulation (protection class II).
	Please observe the operating manual.
	(AC) alternating voltage or alternating current
	Earth (voltage to earth)

Table 2: Symbols on the device

### Symbols used in the operating manual

Symbol	Meaning
	General warning
	Warning of electric voltage!

Table 3: Symbols used in the operating manual

## 2.4 Intended use

Only use the device within the framework of the corresponding technical data. Any operating conditions that deviate from this shall be considered as improper use. Solely the user of the device shall be liable for any resulting damage.

In particular, note the following:

- In case of improper use, the liability and warranty claims become void. Solely the user of the device shall be liable for any damage resulting from improper use. Uses not complying with the intended use include e. g.:
  - Use of components, accessories, spare or replacement parts that have not been released and approved for the respective application by Benning
  - Non-observance, manipulation, changes or misuse of the operating manual or the instructions and notes contained therein
  - Any form of misuse of the device
  - Any use other than or beyond that described in this operating manual
- Warranty and liability claims are generally excluded if damage is due to force majeure.
- If any prescribed services are not performed regularly or not on time according to manufacturer specifications during the warranty period, a decision about a warranty claim can only be made once the findings are available.

Direct any questions to Technical Support [► page 8].

### Using the device

Please observe the following basic obligations when using the device:

- The device may only be used in a technically perfect and safe condition. Always check the device for damages before using it.
- Make sure the personnel using the device is qualified for the respective task.
- Observe relevant regulations on occupational safety and health as well as those on environmental protection.
- The device may only be used in dry environments.
- Use the device exclusively for measuring purposes with the BENNING IT 130 and IT 200 installation testers. In addition, observe the operating manual of the installation tester.
- The test socket and the 4 mm test sockets are intended only for testing purposes and connection to the BENNING IT 130 and IT 200 installation testers.
- Do not connect any other measuring instruments, except for BENNING installation testers.
- The device is intended for short-time use only (continuous operation is not permitted). The maximum load time is 10 ms and the maximum degree of utilisation is 10 %. Disconnect the device from the test object after use.
- Use the device only in electrical circuits of overvoltage category II with a conductor for a maximum of 300 V to earth.



#### **⚠ WARNING**

##### **Opening the device**

Danger to life or serious injury is possible due to contact with high electric voltage when opening the device. The device might get damaged.

- Do not open the device.
- Please contact your specialty retailer or the returns management [► page 8] for any repairs.

## Securing the device

If the device is not in a technically perfect and operationally safe condition, safe operation is no longer guaranteed. Make sure that the following measures are taken:

- Switch off the device.
- Remove the device from the measuring point.
- Secure the device against unintentional operation.

The following characteristics indicate that safe operation is no longer guaranteed:

- The device (housing, test cable or plug) shows visible damage or is damp/wet.
- The device does not work properly in compliance with regulations (e. g. errors during measurements).
- The device shows recognisable consequences of prolonged storage under inadmissible conditions.
- The device shows recognisable consequences of extraordinary stress due to transport.

## 2.5 Special types of risks



### **WARNING**

#### **Dangerous voltage**

Danger to life or serious injury is possible due to contact with high electric voltage when working on live components or equipment. Even low voltages from 30 V-AC and 60 V-DC on can be dangerous to human life!

- Please observe relevant regulations on occupational safety and health.
- If necessary, use appropriate protective equipment.

### **3 Scope of delivery**

The scope of delivery of the device includes the following components:

- 1 x BENNING EV 3-2 measuring adapter
- 1 x protective pouch
- 1 x operating manual

# 4 Device description

## 4.1 Device structure



Figure 1: BENNING EV 3-2 device structure

1	4 mm test sockets (N, PE, L1, L2, L3) for connection to the installation tester	2	BNC socket (output) for testing the CP signal
3	Test cable	4	Type 2 connector (male) for connection to the charging station (EVSE)
5	Rotary switch "CP-Status/State" (control pilot)	6	Test socket for connection to the installation tester
7	Rotary switch "PP-Status/State" (proximity pilot or plug present)	8	LEDs for phase indication L1, L2 and L3 (output voltage of the charging station / EVSE)



### **⚠ WARNING**

#### **Improper use**

Danger to life or serious injury is possible due to contact with high electric voltage in case of incorrect use of the test socket or 4 mm test sockets. The device might get damaged. The test socket and the 4 mm test sockets carry mains voltage as soon as one or more LEDs for phase indication light up.

- Use the test socket, 4 mm test sockets and BNC socket only for the testing purposes described.
- Do not connect any other load to the test socket.
- The BNC socket is intended for connection to an oscilloscope.

**Pin assignment**



Figure 2: Assignment of the Type 2 connector for connection to the charging station (EVSE)

**4.2 Functions**

The device is intended for the following tasks:

- Simulating an electric vehicle (EV) for the charging station
- Providing safe contacting for the installation tester

The simulation of the charging cable and electric vehicle used is done via the rotary switches “PP-Status/State” and “CP-Status/State” of the device.

**Rotary switch “PP-Status/State” for cable simulation**

With the rotary switch “PP-Status/State” you can simulate different codings of the charging cables. The coding describes the maximum permissible current carrying capacity of the charging cable. By means of the switch position, different resistance values are switched in the device between the PP and PE contacts.

Switch position	Simulation	Resistance (PP-PE)
N.C.	No charging cable connected or error.	Open ( $\infty$ )
13 A	Coding of the charging cable or maximum charging current	1 500 $\Omega$
20 A		680 $\Omega$
32 A		220 $\Omega$
63 A		100 $\Omega$

Table 4: Switch positions of the “PP-Status/State” rotary switch

## Rotary switch “CP-Status/State” for vehicle simulation

With the rotary switch “CP-Status/State” you can simulate different vehicle conditions. By means of the switch position, different resistance values and a diode are switched in the device between the CP and PE contacts.

The communication signal (CP signal) is intended to control the charging process between the charging station and the vehicle (EV). For this purpose, the charging station applies a square-wave signal of 1 kHz to the CP contact of the charging plug. Depending on the operating status, the PWM (pulse width modulation) signal is loaded differently by the vehicle and its amplitude is changed.

Switch position	Simulation	Description	Resistance (CP-PE)	PWM voltage at CP contact
A	No vehicle (EV) connected.	No power supply from charging station.	Open	±12 V, 1 kHz
B	Vehicle (EV) connected but not ready for charging.	Charging station detects vehicle, but no power is provided.	2 740 Ω	+9 / -12 V, 1 kHz
C	Vehicle (EV) connected and ready for charging. Ventilation of the charging area is not required.	Charging station provides power supply for vehicle.	882 Ω	+6 / -12 V, 1 kHz
D	Vehicle (EV) connected and ready for charging. Ventilation of the charging area is required.	Charging station provides power supply when ventilation of the charging area is given.	246 Ω	+3 / -12 V, 1 kHz
E	Error, short-circuit CP-PE via internal resistor.	Charging station stops the power supply and unlocks the charging cable within 30 s.	-	-

Table 5: Switch positions of the “CP-Status/State” rotary switch

## Recommended test sequence

- Switch positions A-B-C: simulation of the charging process without ventilation of the charging area
- Switch positions A-B-D: simulation of the charging process with ventilation of the charging area
- Switch position E: error simulation

# 5 Operation

You can perform tests with an installation tester [▶ page 17] or an oscilloscope [▶ page 18].

## 5.1 Testing with an installation tester

### Requirements

- BENNING installation tester  
With the device alone (without installation tester) you can only check the functions of the PP signal and CP signal of the charging station (EVSE).
- Charging station (EVSE) compatible with the device

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### NOTE

#### Test socket

You can only test the phase L1 of 3-phase charging stations (EVSE) via the test socket of the device.

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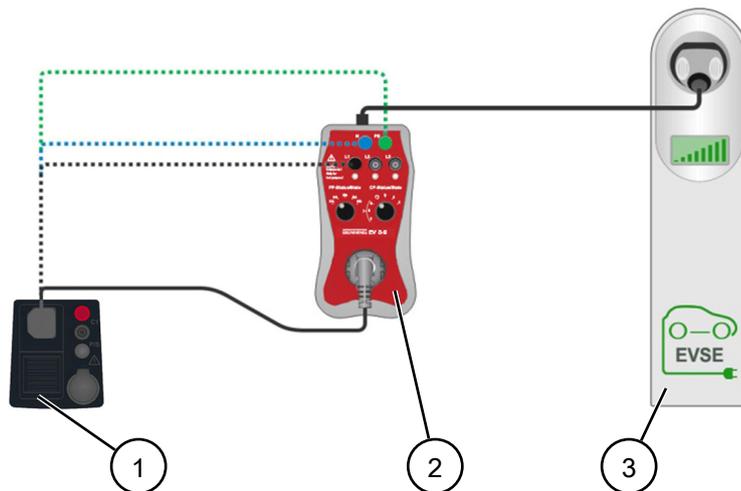


Figure 3: Connecting the device

1	BENNING installation tester
2	BENNING EV 3-2
3	Charging station (EVSE)

## Procedure

1. Connect the installation tester to the device via the test socket or the 4 mm test sockets.
2. Select the desired positions of the rotary switches.
  - “PP-Status/State”: switch position “N.C.”
  - “CP-Status/State”: switch position “A”
3. Connect the device to the output of the charging station (EVSE) via the Type 2 connector.
4. Use the installation tester to perform the prescribed safety tests in a voltage-free condition at the output of the charging station (EVSE).
5. Simulate the different charging states using the switch positions of the rotary switches “PP-Status/State” and “CP-Status/State” and check the feedback from the charging station (EVSE).
6. Use the installation tester to perform the prescribed safety tests at the output of the charging station (EVSE) with the mains voltage being applied. For this, select the desired positions of the rotary switches at the device.
  - “PP-Status/State”: switching position according to the maximum charging current from 13 to 64 A
  - “CP-Status/State”: switch position “C” or “D”
7. Before disconnecting the device from the charging station (EVSE), set the rotary switch “CP-Status/State” to the switch position “A”.

## 5.2 Testing with an oscilloscope

You can measure the CP signal of the charging station (EVSE) with an oscilloscope via the BNC socket of the device.

Via the duty cycle, the charging station (EVSE) gives the electric vehicle (EV) the maximum current value that can be drawn from the charging station. For further information, refer to Table A7 of DIN EN 61851-1 (VDE 0122-1).

$$D = \frac{PW}{T} \times 100 \%$$

- D: Duty cycle
- PW: Pulse duration
- T: Period duration

## Requirements

- Oscilloscope (probe: 10:1, input resistance: 10 M $\Omega$ )
- Charging station (EVSE) compatible with the device

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## NOTE

### Oscilloscope

- Using a 1 M $\Omega$  input resistor instead of the recommended 10 M $\Omega$  will reduce the amplitude of the CP signal by approx. 17 % compared to the actual value.
  - Compensate the oscilloscope and probe for correct signal representations.
  - It is recommended to use a portable and battery-operated oscilloscope.
- 



## **⚠ WARNING**

### Dangerous voltage

Danger to life or serious injury is possible due to contact with high electric voltage. An existing 50 Hz / 60 Hz interfering signal can be suppressed by connecting the 4 mm PE test socket of the device to the earth connection of the oscilloscope.

- Make sure that there is no dangerous voltage potential at the PE contact of the charging station (EVSE).
  - Use safe accessories.
- 

## Procedure

1. Connect the oscilloscope to the device via the BNC socket.
2. Select the desired positions of the rotary switches.
  - “PP-Status/State”: switch position according to the desired coding of the charging cable (maximum current carrying capacity)
  - “CP-Status/State”: switch position “A”
3. Connect the device to the output of the charging station (EVSE) via the Type 2 connector.
4. Simulate the different codings of the charging cables. For this, select the desired positions of the rotary switches at the device.
  - “PP-Status/State”: switch position according to the desired coding of the charging cable (maximum current carrying capacity)
  - “CP-Status/State”: switch position “B” or “C”
5. Check the waveform and amplitude of the CP signal on the oscilloscope. If necessary, repeat the test for other codings of the charging cable.
6. Before disconnecting the device from the charging station (EVSE), set the rotary switch “CP-Status/State” to the switch position “A”.

## 6 Maintenance

There are no components in the device that you can replace.



### **WARNING**

#### **Opening the device**

Danger to life or serious injury is possible due to contact with high electric voltage when opening the device. The device might get damaged.

- Do not open the device.
- Please contact your specialty retailer or the returns management [▶ page 8] for any repairs.

## 6.1 Cleaning the device

Clean the device regularly and as the need arises.

### Requirements

- A clean and dry cloth or special cleaning cloth



### **NOTICE**

#### **Wrong cleaning agents**

Using the wrong cleaning agents can damage the device.

- Do not use any solvents, abrasives or polishing agents.

### Procedure

Clean the exterior of the device with a clean and dry cloth or a special cleaning cloth.

# 7 Technical data

Input voltage	Single-phase: up to 250 V Three-phase: up to 430 V
Frequency	50 Hz, 60 Hz
Max. testing current	40 A (10 ms) periodic operation
Protection class	II (double insulation)
Contamination level	2
Protection category (DIN VDE 0470-1, IEC / EN 60529)	IP 40 1st digit: 4 = protection against granular foreign objects 2nd digit: 0 = no protection against water
Overvoltage category	CAT II 300 V to earth
Housing dimensions (Length x width x height)	200 mm x 100 mm x 70 mm
Length of test cable	0.3 m
Weight	0.82 kg
<b>BNC socket</b>	
Resistance BNC housing to PE	100 kΩ
Resistance BNC contact to CP	100 kΩ
Amplitude error	-2 %
<b>Operation</b>	
Max. barometric altitude	3 000 m
Operating temperature	0 ... 40 °C
Maximum relative air humidity	95 % RH (0 ... 40 °C), non-condensing
<b>Storage</b>	
Ambient temperature	-10 ... 70 °C
Maximum relative air humidity	90 % RH (-10 ... 40 °C) 80 % RH (40 ... 60 °C) 70 % RH (60 ... 70 °C)

Table 6: Technical data

## 8 Disposal and environmental protection



At the end of product life, dispose of the unserviceable device via appropriate collecting facilities provided in your community.

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