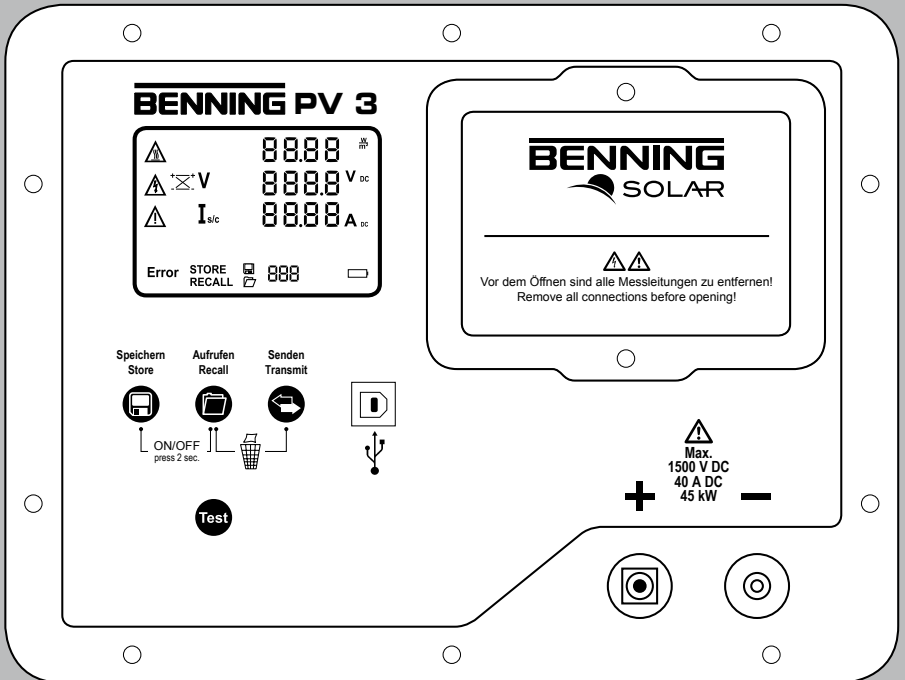


BENNING

(D) Bedienungsanleitung

(GB) Operating manual

Mehrsprachige Anleitung unter
www.benning.de
Multilingual manuals at



BENNING PV 3

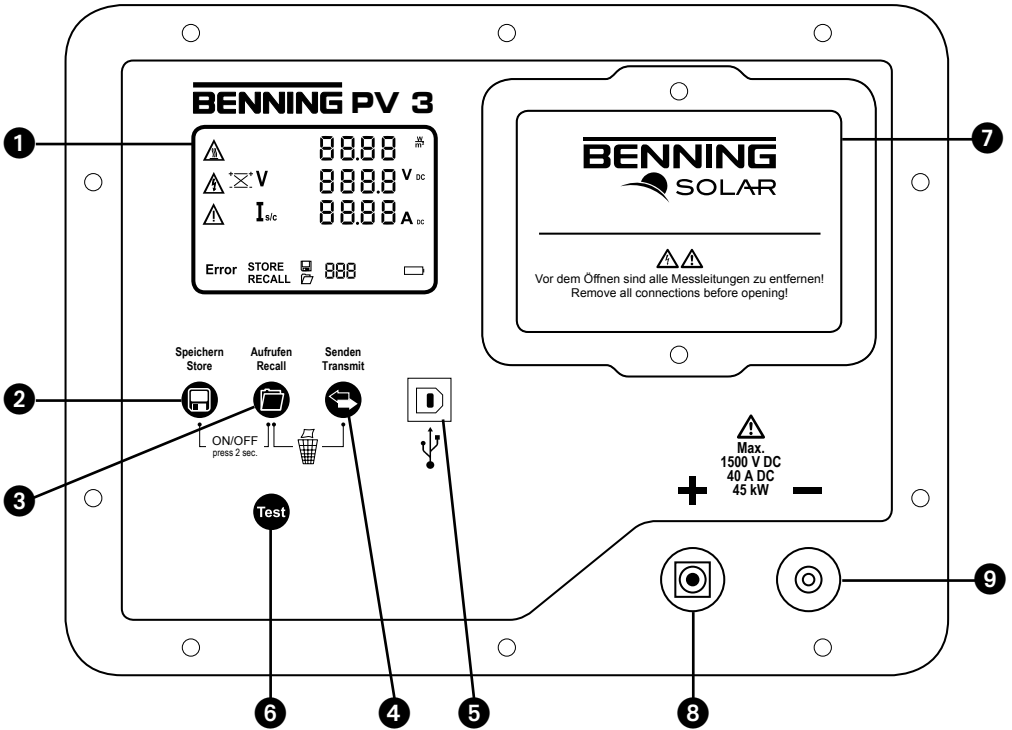


Bild 1: Geräteoberseite
Fig. 1: Top side of the device

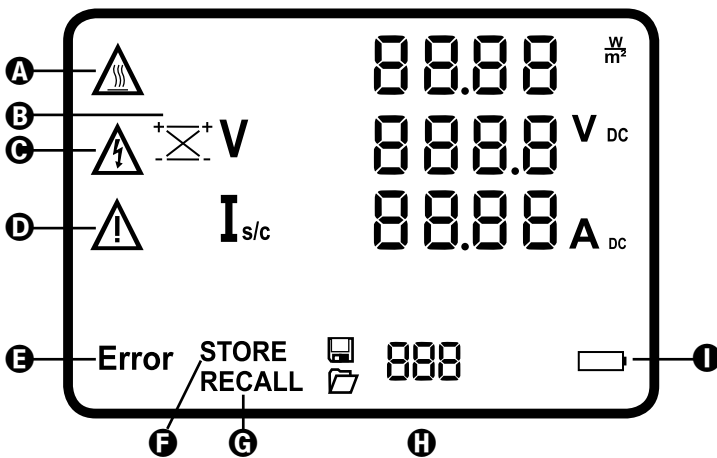


Bild 2: Digitalanzeige
Fig. 2: Digital display

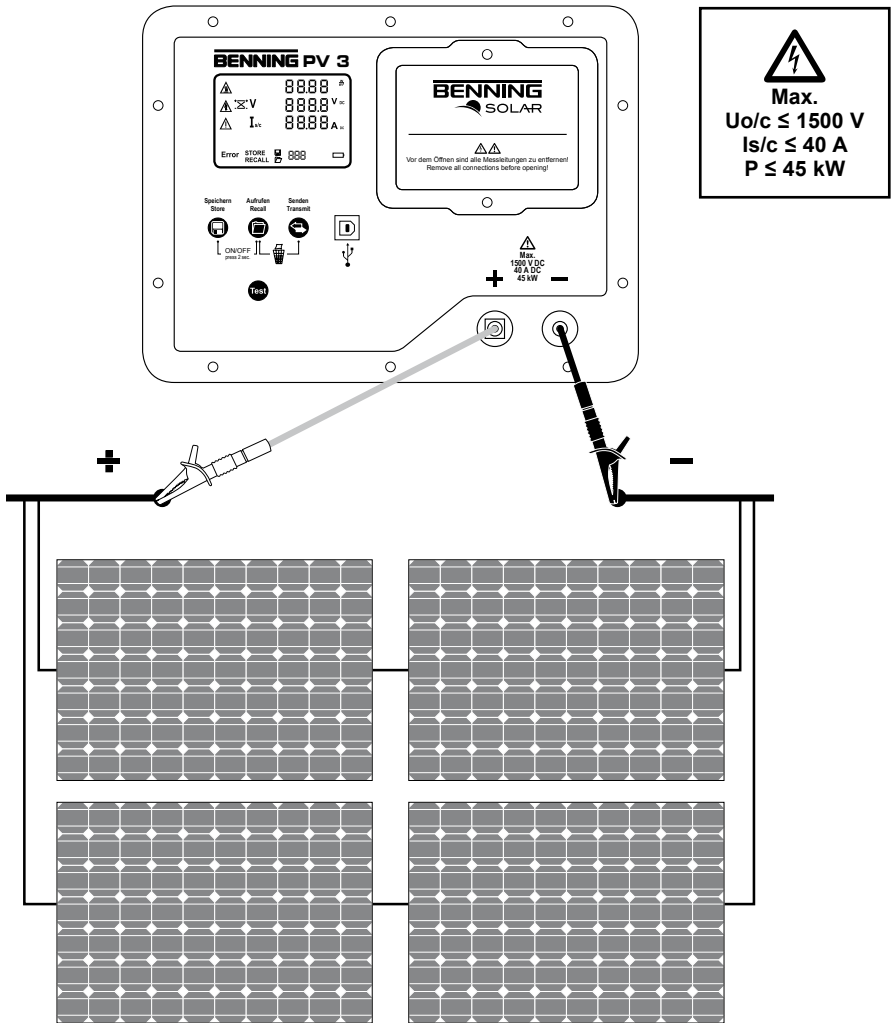


Bild 3: Messung am PV-Generator
 Fig. 3: Measurement on the PV generator

Operating instructions

BENNING PV 3

Battery-operated photovoltaic tester for installation testing and periodic inspection of mainscoupled 1500 V photovoltaic systems. The following tests according to VDE 0126-23 (DIN EN 62446) can be carried out on PV strings connected in parallel (max. 40 A):

- automatic display of the voltage polarity with visual warning in case of wrong polarity
- open-circuit voltage measurement at the PV module/ PV string/ PV field with up to 1500 V DC
- short-circuit current measurement at the PV module/ PV string/ PV field with up to 40 A DC
- measurement of the insolation, PV module temperature and ambient temperature by means of the optional insolation and temperature measuring instrument BENNING SUN 2

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- 9.4 Battery replacement
- 9.5 Calibration
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1. User notes



This operating manual is intended for qualified technical personnel! Qualified technical personnel is competent to identify risks and to prevent possible hazards. Improper handling involves the risk of injury! Always wear personal protective equipment (PPE) when carrying out the test.

**Warning of dangerous electric voltage!
Absolutely observe all safety instructions!**

Always observe international, national and - if applicable - regional regulations of electrical engineering. Relevant skills of electrical engineering are absolutely required.

The BENNING PV 3 is intended for making measurements in dry environment (More details in chapter 6. "Environmental conditions").

The following symbols are used in these operating instructions and on the BENNING PV 3:



Warning of electrical danger!

Indicates instructions which must be followed to avoid danger to persons.



Important, comply with the documentation!

The symbol indicates that the information provided in the operating instructions must be complied with in order to avoid risks.



The tester is overheated. The "Hot" symbol is shown on the digital display **1** and measurements are interrupted until the internal temperature has dropped below the admissible limiting value. Disconnect the tester from the test object and switch off the tester.



This symbol on the BENNING PV 3 means that the BENNING PV 3 complies with the EU directives.



This symbol appears on the display to indicate discharged batteries. As soon as the battery symbol flashes, immediately replace the rechargeable batteries by charged ones.



Protection class II

2. Safety notes

The instrument is built and tested in accordance with VDE 0411 part 1/DIN EN 61010 part 1

and has left the factory in perfectly safe technical state.

To maintain this state and ensure safe operation of the appliance tester, the user must observe the notes and warnings given in these instructions at all times. Improper handling and nonobservance of the warnings might involve severe **injuries** or **danger to life**.



The connection to the PV generator is made exclusively in accordance with the connection figure of the operating instructions. Only use the included PV measuring lines or the measuring lines with attached alligator clips for safe contacting of the PV generator.



The PV generator must be isolated from the electric power supply (PV inverter)!



The PV module/ PV string must not exceed the maximum open-circuit voltage of 1500 V DC, the maximum short-circuit current of 40 A and the maximum DC power ($P = U \times I$) of 45 kW.

Measuring at PV strings connected in parallel might involve damages of the BENNING PV 3!



Do not disconnect any measuring lines from the PV generator as long as the test is being carried out. Failure to do so might result in a dangerous electric arc or damage to the BENNING PV 3!



The BENNING PV 3 must not be switched off during the test.



The PV test sockets **8 and **9** are intended exclusively for the connection with PV generators (PV module, PV string, PV field).**



Disconnect the BENNING PV 3 from the PV generator directly after the test. The tester is not designed to be permanently operated on the PV generator.



WARNING! Be careful when working with bare conductors or main line carrier! Contact with live conductors will cause an electric shock!
Remember that work on electrical components of all kinds is dangerous. Even low voltages of 30 V AC and 60 V DC may be dangerous to human life.



Before starting the appliance tester up, always check it for signs of damage. Do not use a damaged BENNING PV 3! Damaged measuring leads must be replaced!



Only use safety measuring leads, which are supplied with the BENNING PV 3.



The included measuring leads are designed for 1500 V systems which are insulated from the main electric supply (PV inverter).
Always wear personal protective equipment (PPE) when connecting or disconnecting the measuring lines!



Use the BENNING PV 3 only in compliance with the intended use specified in this documentation. If the Benning PV 3 is used in a manner not specified by this document then the protection provided by the equipment may be impaired.



Use the BENNING PV 3 under dry ambient conditions only.



Before opening the battery compartment, all measuring lines must be removed!
Electrical danger!
Before commissioning, the battery compartment must be properly closed.



Do not use pointed objects to remove the rechargeable batteries from the BENNING PV 3. Damaged batteries can leak and increase the risk of fire!



Only use rechargeable 3.7 V 18650 lithium-ion batteries (accumulators, protected version). Unprotected 18650 lithium-ion batteries increase the risk of leakage and damage to the BENNING PV 3.

If it is assumed that safe operation is no longer possible, the device must be switched off immediately and secured against unintended operation.

It may be assumed that safe operation is no longer possible:

- if the instrument show visible signs of damage
- if the appliance tester no longer functions or a warning is shown on the display,
- after long periods of storage under unfavourable conditions
- after being subjected to rough transport
- the device is exposed to moisture.



In order to prevent danger

- do not touch the bare measuring probe tips of the measuring leads,
- plug the leads into the correspondingly marked jacks at the BENNING PV 3



Maintenance:

Do not open the device! Apart from the rechargeable batteries, it does not contain any components requiring maintenance by the user. Repair and service must be carried out by qualified personnel only!



Cleaning:

Regularly wipe the housing by means of a dry cloth and cleaning agent. Do not use any polishing agents or solvents!

3. Scope of delivery

The scope of delivery for the BENNING PV 3 comprises:

- 3.1 One BENNING PV 3,
- 3.2 Two measuring leads with probe tip (L = 1.2 m) (red/ black)
incl. two crocodile clips (red/ black), (P.no. 10208356)
- 3.3 Two measuring leads for MC4 connector (L = 1.2 m) (red/ black), (P.no. 10208355)
- 3.4 One USB connecting cable (A plug to B plug), (P.no. 10008312)
- 3.5 Three rechargeable 3.7 V 18650 lithium-ion batteries (accumulators, protected version), (P.no. 10208358)
- 3.6 One charger (P.no. 10208360)
- 3.7 One short instructions
- 3.8 One calibration certificate

Parts subject to wear:

- The BENNING PV 3 is supplied by three rechargeable 3.7 V 18650 lithium-ion batteries (accumulators, protected version, 2600 mAh)

Note on optional accessories:

- Insolation and temperature measuring instrument BENNING SUN 2 for measuring the insolation (W/ m²), the PV module temperature and the ambient temperature (P.no. 050420).
- Temperature sensor with suction cup for BENNING SUN 2 for attachment to the rear of the PV module (P.no. 050424).
- PV module holder for BENNING SUN 2 for safe attachment to the PV module (P.no. 050425).
- Test badges "next test", 300 pieces (P.no. 756212)
- Test certificate forms for "Testing of PV systems" are available for download free of charge at www.benning.de

4. Unit description

See figure 1: Top side of the device

See figure 2: Digital display

The display and operator control elements specified in Fig. 1 and 2 are designated as follows:

- ① **Digital display**, indicates the test progress and individual measuring results,
 - ② **⏏-key**, for storing the displayed measured values (display values)
 - ③ **⏪-key**, for calling stored measured values (display values)
 - ④ **➡-key**, for sending/transmitting the stored measured values (display values) to the PC
 - ⑤ **USB interface** (type B socket), for connection of the USB connecting cable
 - ⑥ **⏏-key**, for starting the automatic test procedure
 - ⑦ **Battery compartment cover**,
 - ⑧ **+ PV test socket** (red), for connecting the red PV measuring lead with PV connector
 - ⑨ **+ PV test socket** (black), for connecting the black PV measuring lead with PV connector
- ⚠ **Attention, hot surface!** If the symbol is displayed, immediately disconnect the BENNING PV 3 from the PV generator. Connect the BENNING PV 3 only after the symbol has disappeared.
- ⚡ **(polarity indication)**, indicates reversed polarity of the DC voltage on the PV test sockets ⑧ and ⑨.
- ⚠ **Attention, dangerous voltage** has been detected
- ⚠ **Attention**, if this symbol is activated, observe the instructions contained in the operating manual in order to avoid danger.
- ⚠ **Error**, see specific error codes for further details (More details in chapter 9.1. "Error codes")
- 💾 **STORE**, LCD data are stored in the internal memory
- 📂 **RECALL**, stored LCD data are loaded from the internal memory
- 📍 **Storage location indicator**, indicates the current storage location (1...999)
- 🔋 **Battery symbol**, is displayed to indicate discharged batteries

5. General information

The BENNING PV 3 is intended for electrical tests according to VDE 0126-23 (DIN EN 62446).

The BENNING PV 3 is not intended for continuous use. The useful life of the device is limited by software and via temperature monitoring. If the internal temperature reaches the set limits then functionality will be

reduced in order to allow the BENNING PV 3 to cool down. Do not leave the BENNING PV 3 attached to a hazardous voltage for extended periods of time or while waiting for the BENNING PV 3 to cool down. The BENNING PV 3 automatically tests connected PV modules, PV strings or PV fields. All measuring results are displayed on the large LC display.

- Appliance dimensions: (L x W x H) = 340 x 300 x 152 mm
- Appliance weight: 5000 g
- Power supply: 3 x 3.7 V rechargeable lithium-ion batteries
- Interface: USB type B
- Internal memory: up to 999 data records
- Display: LC display with background lighting
- PC software: Download program BENNING Datalogger (CSV format)
- Radio range to BENNING SUN 2: 30 m in open space, frequency: 433 MHz

6. Environment conditions

- The BENNING PV 3 is intended for making measurements in dry environment.
- Maximum barometric elevation for making measurements: 2000 m,
- Over voltage category/ Siting category: IEC/ EN 61010-1 →1500 V for systems without a specified measuring category,
- Pollution Class 2,
- Protection Class: IP 40 (DIN VDE 0470-1, IEC/ EN 60529) with the cover being open
IP 40 means: Protected against objects >1mm, (4 - first index). No protection against water, (0 - second index).
IP 64 with the cover being closed
- IP 64 means: Protection against access to dangerous parts and protection against solid impurities, dustproof, (6 - first index). Splash proof, (4 - second index). Can also be used in case of precipitation.
- EMC: IEC/ EN 61326-1,
- Operating temperature and relative humidity: For operating temperature from 0 °C to 40 °C: non-condensing
- Storage temperature: The BENNING PV 3 can be stored at any temperature in the range from - 25 °C to + 65 °C (relative humidity from 0 to 90 %). The battery should be taken out of the instrument for storage.

7. Electrical specifications

Note: The measuring precision is specified as the sum of

- a relative fraction of the measured value and
- a number of digits (counting steps of the least significant digit).

This specified measuring precision is valid for temperatures in the range from 18 °C to 30 °C and relative humidity less than 80 %.

7.1 PV module/ PV string/ PV field, open-circuit voltage (Vo/c)

Measuring range	Resolution	Measuring accuracy
5.0 V - 1500 V	0.1 V	± (0.5 % + 2 digits)

7.2 PV module/ PV string/ PV field, short-circuit current (Is/c)

Measuring range	Resolution	Measuring accuracy
0.50 A - 40.00 A (maximum power: 45 kW)	0.01 A	± (1 % + 2 digits)

8. Measuring with the BENNING PV 3

8.1 Preparation for measuring

Operate and store the BENNING PV 3 only at the specified storage and operating temperatures conditions. Do not permanently expose the device to sunlight.

- Strong sources of interference in the vicinity of the BENNING PV 3 can lead to unstable readings and measuring errors.




Before commissioning, always check the BENNING PV 3 and the measuring leads for damages.


8.1.1 Charging the rechargeable batteries

Before the first use and before each use, fully charge the rechargeable 3.7 V 18650 lithium-ion batteries. Use the included automatic charger (New i4, NITECORE®) to do this.

- Use the charger only to charge the rechargeable 3.7 V 18650 lithium-ion batteries (2600 mAh, protected version) included in the delivery.
- Connect the charger to a protected shock-proof socket (230 V, 50 Hz) using the included mains connection cable and insert the three rechargeable batteries into the battery holders observing correct polarity.
- Charging starts automatically when the batteries are inserted.
- Depending on the battery type and capacity, the charging current/voltage is automatically set for each battery holder. For lithium-ion batteries, the charging voltage is preset to 4.2 V.
- The state of charge of the batteries is indicated by three green LEDs for each battery holder. Charging is complete when the three LEDs (100 %) of each battery holder light permanently.

Note on manually setting the charging current/voltage:





After inserting the batteries, briefly press button  to select the battery holder used.

- As long as the green LED of the selected battery holder lights, the charging current can be increased to 1.5 A (red LED lights up) by pressing and holding button . If several battery holders are selected for a charging current of 1.5 A, charging with increased current takes place subsequently from left to right.
- As long as the green LED of the selected battery holder lights, a charging voltage of 3.7 V, 4.2 V and 4.35 V (green LED) can be set by pressing and holding button V.











Please note that the charging voltage for the included rechargeable batteries must be set to 4.2 V!

8.1.2 Switching the BENNING PV 3 ON/ OFF

- Press and hold the keys  **2** and  **3** for approx. 2 seconds to switch the BENNING PV 3 on. Acoustic signals confirm that the device is switched on. Press the keys again for approx. 2 seconds to switch the device off.
- After approx. 1 minute, the BENNING PV 3 switches off automatically (**APO, Auto Power-Off**). It switches on again when the keys  **2** and  **3** are pressed. An acoustic signal indicates that the device has switched off automatically.






8.1.3 Setting the automatic switch-off time (APO, Auto-Power-Off)

- Switch the BENNING PV 3 off by simultaneously pressing the keys  **2** and  **3**.
- Press and hold the  key **6** and simultaneously press the keys  **2** and  **3**. Keep the  key **6** pressed.
- The LC display **1** shows "OFF" in the first line and the switch-off time (in minutes) in the second line.
- Each time pressing the  key **2** increases the switch-off time by one minute up to a maximum time of 10 minutes.
- Release the  key **6** to store the setting.

8.1.4 Setting the date and the time

The BENNING PV 3 is equipped with an integrated real-time clock which automatically adds a date / time stamp to each storage process or storage location (see chapter 8.3 "Measured value memory").

To set the date and the time, carry out the following steps:

- Switch the BENNING PV 3 off by simultaneously pressing the keys  **2** and  **3**.
- Press and hold the  key **4** and simultaneously press the keys  **2** and  **3**.
- The date / time format is displayed as follows:
MM.DD = month (1-12).day (1-31)
YYYY = year
HH.mm = hours (0-23).minutes (0-59)
SS = seconds (0-59)

- Press the **Test** key **6** to select a date / time field.
- As soon as the field is flashing, the value for that field can be set.
- Press the keys **2** and **3** to increase or decrease the value.
Every change resets the field for the seconds to zero.
- Switch the device off by simultaneously pressing the keys **2** and **3** to store the setting.

Note:

If the BENNING PV 3 has established a radio connection to the BENNING SUN 2, the date/ time of the BENNING PV 3 will be synchronized automatically after 10 seconds to the date/ time of the BENNING SUN 2, if the device detects a deviation of more than 1 minute. BENNING SUN 2 (master) → BENNING PV 3 (slave).

8.1.5 Testing the battery condition

During switch-on and operation, the BENNING PV 3 carries out an automatic battery test. Discharged batteries are indicated by a battery symbol **1** on the LC display **1**. As soon as the battery symbol is flashing, the batteries have to be recharged immediately. (see chapter 9.4, "Battery replacement").

8.2 Measurement of open-circuit voltage and short-circuit current of the PV generator



The PV module/ PV string must not exceed the maximum opencircuit voltage of 1500 V DC, the maximum short-circuit current of 40 A and the maximum DC power ($P = U \times I$) of 45 kW.

Measuring at PV strings connected in parallel might involve damages of the BENNING PV 3!



The PV generator must be isolated from the electric power supply (PV inverter)! Neither the positive nor the negative pole of the PV generator must be earthed!



Do not disconnect any measuring lines from the PV generator as long as the test is being carried out. Failure to do so might result in a dangerous electric arc or damage to the BENNING PV 3!



Only use the included PV measuring lines or the measuring lines with attached alligator clips for safe contacting of the PV generator.



In case DC polarity is wrong or DC voltage is within the range of < 5 V or > 1500 V, it is not possible to make an automatic PV measurement.

- Connect the BENNING PV 3 to the PV generator using the included PV measuring leads or the measuring leads with attached alligator clips.
 - Measurement of the PV open-circuit voltage is made automatically, if a DC voltage is applied.
 - In case of reversed polarity of the DC voltage, the polarity indication „*×*“ **5** is flashing and the symbol is displayed. Automatic measurement will be blocked until the polarity of the DC voltage is correct.
 - As soon as a voltage of > 30 V is applied to the PV measuring leads, the **⚠** warning symbol **6** (Attention, dangerous voltage) is flashing.
 - Press the **Test** key **6** to start short-circuit current measurement.
 - The measured values will be shown on the display **1** for approx. 20 seconds or until a key is pressed.
- See figure 3: Measurement on the PV generator

8.3 Measured value memory

8.3.1 Storing measured values

The BENNING PV 3 can store up to 999 display indications. For each memory location, the open-circuit voltage and the short-circuit current are stored with a date/time stamp. If there is a radio connection to the BENNING SUN 2, the insolation and the PV module/ambient temperature are additionally stored for each storage location.

- Press the **2** key **2** to store the displayed measured values to the first free storage location. Successful storage will be confirmed by the "STORE" symbol **7** on the LC display **1**.

8.3.2 Calling measured values

- Press the **3** key **3** to recall the stored measured values with the corresponding storage location

number **1**. The symbol "RECALL" **6** is displayed **1**. The storage location number **1** is shown on the display **1**.

- Press the **←** key **3** to go to the previous storage location.
- Press the **→** key **2** to go to the next storage location.

8.3.3 Deleting the measured value memory

- To delete the entire measured value memory, press the **←** key **2** and the **→** key **3**.

8.3.4 Reading out the measured value memory via the USB interface

To read the measured values via the USB interface **5**, you must install a hardware driver and the BENNING SOLAR Datalogger software on your PC once.

The latest versions are available for free download on the product page of the BENNING PV 3.

<http://tms.benning.de/pv3>

In order to download the measuring data from the BENNING PV 3, proceed as follows:

- Disconnect all measuring leads from the BENNING PV 3.
- Connect the BENNING PV 3 to your PC by means of the USB connecting cable.
- The hardware driver is installed automatically on a free COM port and confirms that the new hardware can be used.
- The COM port used can be viewed by means of the Device Manager of your system.
- Start the "BENNING SOLAR Datalogger" program, in the "Tools" menu click "Refresh Ports" and select the corresponding COM port. Then, click "Download".
- Press the **→** key **4** at the BENNING PV 3 for approx. 2 seconds until the download is made and the complete measured value memory will be read out.
- The measured values can be stored as (*.csv) or (*.txt) file.
- Click "Open" to open the measured series e. g. via a spreadsheet.

8.4 Radio connection to insolation / temperature measuring instrument BENNING SUN 2

The BENNING PV 3 is able to receive the measured values (insolation, PV module / ambient temperature and date / time stamp) of the insolation and temperature measuring instrument BENNING SUN 2 (optional) via radio connection.

For this purpose, the BENNING PV 3 has to be coupled with the BENNING SUN 2 once.

Typical radio range of the BENNING SUN 2 in open space: approx. 30 m

Buildings / metal structures or interfering signals can reduce the radio range.

8.4.1 Coupling with BENNING SUN 2

- Remove all electronic devices in direct vicinity.
- Switch the BENNING PV 3 and the BENNING SUN 2 off.
- Press and hold the two ON/OFF keys of the BENNING SUN 2.
- Press and hold simultaneously the **←** key **2** and the **→** key **3** of the BENNING PV 3.
- The BENNING SUN 2 sends a coupling signal with the individual serial number of the device.
- The BENNING PV 3 stores the signal for future radio connection and signals successful coupling via an acoustic signal and by showing "connected" on the display. The coupling process only takes a few seconds.
- The "W/m²" symbol is shown on the LC display **1** of the BENNING PV 3.

8.4.2 Decoupling from the BENNING SUN 2

- Remove all electronic devices in direct vicinity.
- Switch the BENNING PV 3 off.
- Press and hold the **←** key **2** and the **→** key **3** of the BENNING PV 3 for approx. 10 seconds.
- The BENNING PV 3 indicates the decoupling from the BENNING SUN 2 by means of an acoustic signal and by clearing the LC display.
- On the LC display **1** of the BENNING PV 3, the "W/m²" symbol is hidden.

8.4.3 Activating / deactivating the radio transmission of the BENNING SUN 2

- Couple the BENNING PV 3 with the BENNING SUN 2.

- To activate / deactivate the radio transmission, press and hold the **[1]** key of the BENNING SUN 2 and simultaneously press the **[mode]** key. A flashing triangle **▽** above the **[1]** key shows that the radio transmission has been activated.
- If the BENNING PV 3 is within the radio range of the BENNING SUN 2, the measured insolation value (W/m²) is shown on the LC display **①** of the BENNING PV 3.
- Besides the electric variables (Vo/c, Is/c), an AUTO measurement by means of the BENNING PV 3 additionally measures the insolation, the module and ambient temperature as well as the date / time stamp of the BENNING SUN 2.
- If the BENNING PV 3 is outside the radio range of the BENNING SUN 2, the “W/m²” symbol on the LC display starts flashing. Moreover, “_ _ _ _” is shown on the LC display **①**, if the measured insolation value is outside the measuring range.

Note:

If the BENNING PV 3 does not receive any radio signal from the BENNING SUN 2, the display indications are stored with the date / time stamp of the BENNING PV 3.

9. Maintenance

9.1 Error codes

Error code	Remedy
HOT	The electronic components of the BENNING PV 3 have reached the maximum admissible temperature. Disconnect the BENNING PV 3 from the object to be measured and let it cool down.
H ISC H ICU	The DC short-circuit current exceeds the maximum value of 40 A. Measurement has been stopped.
H VOC	The DC open circuit voltage has exceeded the maximum value of 1500 V. The measurement has been stopped.
CAL	The BENNING PV 3 is not correctly calibrated, please return the instrument to an authorized service center, see chapter 9.5 “Calibration”.
Er 12	Please return the BENNING PV 3 to an authorized service center, see chapter 9.5 “Calibration” for the address.
HOT F	Please return the BENNING PV 3 to an authorized service center, see chapter 9.5 “Calibration” for the address.
FET	Please return the BENNING PV 3 to an authorized service center, see chapter 9.5 “Calibration” for the address.
FUSE	Please return the BENNING PV 3 to an authorized service center, see chapter 9.5 “Calibration” for the address.
d IS-CONNECT	Immediately disconnect the BENNING PV 3 from the PV generator! Please return the BENNING PV 3 to an authorized service center, see chapter 9.5 “Calibration” for the address.
do NOT USE	Please return the BENNING PV 3 to an authorized service center, see chapter 9.5 “Calibration” for the address.
rL 1,2,3 or 4	Please return the BENNING PV 3 to an authorized service center, see chapter 9.6 “Calibration” for the address.

9.2 Securing the instrument

Under certain circumstances safe operation of the BENNING PV 3 is no longer ensured, for example in the case of:

- Visible damages of the housing or the measuring leads,

- Incorrect measurement results.
- Recognisable consequences of prolonged storage under improper conditions.
- Recognisable consequences of extraordinary transportation stress.

In such cases the BENNING PV 3 must be switched off immediately, disconnected from the measuring points and secured to prevent further utilisation.

9.3 Cleaning

Clean the casing externally with a clean dry cloth (exception: special cleaning wipers). Avoid using solvents and/ or scouring agents for cleaning the instrument. It is important to make sure that the battery compartment and battery contacts are not contaminated by leaking electrolyte.



If electrolyte contamination or white deposits are present in the region of the batteries or battery casing, clean them too with a dry cloth.

9.4 Battery replacement



Before opening the BENNING PV 3 ensure that all the test leads have been disconnected from the BENNING PV 3. Danger of electric shock!

The BENNING PV 3 is supplied by means of three rechargeable 3.7 V 18650 lithium-ion batteries (accumulators, protected version).

A battery replacement is required, if the battery symbol  appears in the display .

Proceed as follows to replace the batteries:

- Switch the BENNING PV 3 off.
- Disconnect all measuring leads from the device.
- Unscrew the two screws from the battery compartment cover.
- Lift off the battery compartment cover from the bottom part of the battery compartment.
- Remove the discharged batteries from the battery compartment.
- Then, insert the fully charged batteries into the battery compartment at the provided places (please observe correct polarity of the batteries).
- Lock the battery compartment cover into place on the bottom part and tighten the screws.



Make your contribution to environmental protection! Do not dispose of discharged batteries in the household garbage. Instead, take them to a collecting point for discharged batteries and special waste material. Please inform yourself in your community.

9.5 Calibration

Benning guarantees compliance with the technical and accuracy specifications stated in the operating manual for the first 12 months after the delivery date. To maintain the specified precision of the measurement results, the instrument must be recalibrated at regular intervals by our factory service. We recommend a recalibration interval of one year. Send the appliance to the following address:

Benning Elektrotechnik & Elektronik GmbH & Co. KG
Service Center
Robert-Bosch-Str. 20
D – 46397 Bocholt

Technical Support/ Helpdesk:

Phone: +49 (0) 2871 93-555
Telefax: +49 (0) 2871 93-417
E-Mail: helpdesk@benning.de

9.6 Spare parts

- Set of measuring leads with probe tip (L = 1.2 m) (red/black) incl. set of alligator clips (red/black), P.no. 10208356
- Set of PV measuring leads for MC4 connector (L = 1.2 m) (red/ black), P.no. 10208355
- Three rechargeable 3.7 V 18650 lithium-ion batteries (accumulators, protected version), P.no. 10208358
- Charger, P.No. 10208360
- USB connecting cable (A plug to B plug), P.no. 10000315

10. Environmental notice



At the end of the product's useful life, please dispose of it at appropriate collection points provided in your country.