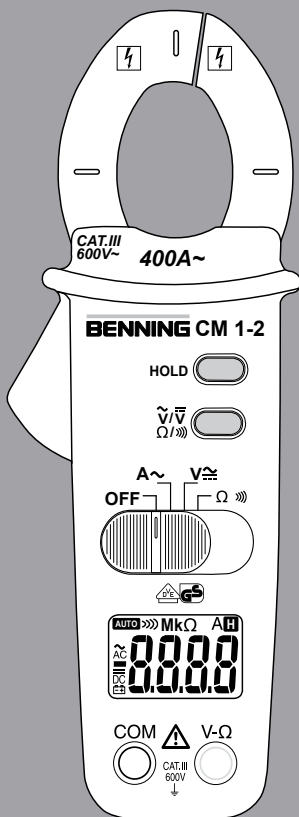


# BENNING

- (D) Bedienungsanleitung
- (GB) Operating manual
- (F) Notice d'emploi
- (E) Instrucciones de servicio
- (CZ) Návod k obsluze
- (GR) Οδηγίες χρήσεως
- (I) Istruzioni d'uso
- (NL) Gebruiksaanwijzing
- (PL) Instrukcja obsługi
- (RO) Instrucțiuni de folosire
- (RUS) Инструкция по эксплуатации  
индикатора напряжения
- (S) Användarhandbok
- (TR) Kullanma Talimatı



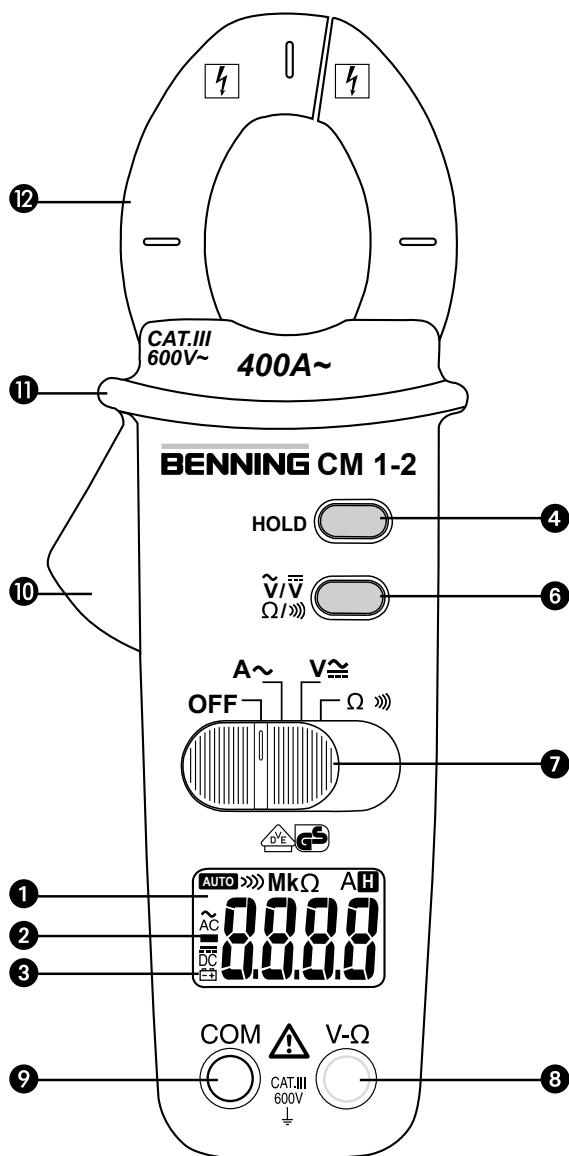
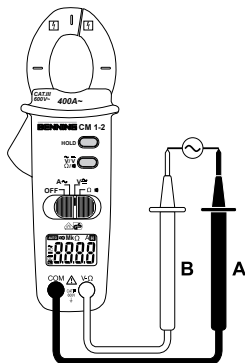
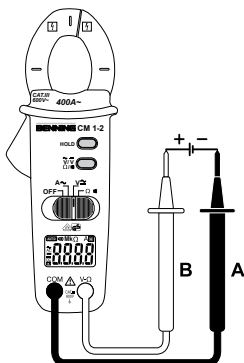


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 Fig. 1b: Panneau avant de l'appareil  
 Fig. 1b: Parte frontal del equipo  
 obr. 1b: Přední strana přístroje  
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 Imaginea 1b: Partea frontală a aparatului  
 рис. 1b: Вид спереди  
 Bild 1b: Framsida  
 Resim 1b: Cihaz önyüzü

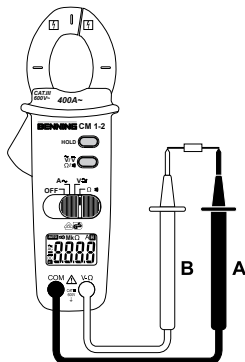
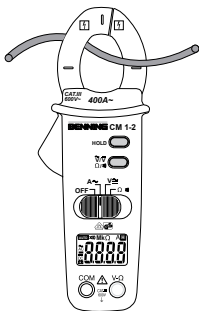


#### BENNING CM 1-2

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 Fig. 2: Direct voltage measurement  
 Fig. 2: Mesure de tension continue  
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#### BENNING CM 1-2

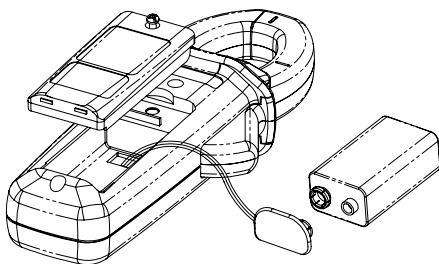
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Fig. 6a: Remplacement de la pile

Fig. 6a: Cambio de batería

obr. 6a: Výměna baterii

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ill. 6a: Sostituzione batterie

Fig. 6a: Vervanging van de batterijen

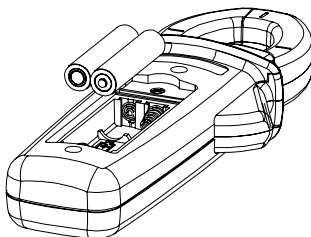
Rys.6a: Wymiana baterii

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#### BENNING CM 1-2

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ill. 6b: Sostituzione batterie

Fig. 6b: Vervanging van de batterijen

Rys.6b: Wymiana baterii

Imaginea 6b: Schimbarea bateriei

рис. 6b: Замена батареек

Bild 6b: Batteribyte

Resim 6b: Batarya Değişimi

# Operating manual

## BENNING CM 1-1/ 1-2

Digital current clamp multimeter for

- DC voltage measurements (BENNING CM 1-2)
- AC voltage measurements (BENNING CM 1-2)
- AC current measurements
- resistance measurements (BENNING CM 1-2)
- continuity tests (BENNING CM 1-2)

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1. User instructions
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### 1. User information

This operating manual is intended for

- skilled electricians and
- electrotechnically trained personnel

The BENNING CM 1-1/ 1-2 is intended for measurements under dry ambient conditions. It must not be used in electrical circuits with a nominal voltage higher than 600 V DC and 600 V AC (see section 6 "Ambient conditions" for details).

The following symbols are used in this operating manual and on the BENNING CM 1-1/ 1-2:



Application around and removal from HAZARDOUS LIVE conductors is permitted.



Warning of electrical danger!

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



Important, must comply with documentation! This symbol indicates that the information provided in the operating manual must be complied with in order to avoid risks.



This symbol on the BENNING CM 1-1/ 1-2 indicates that the BENNING CM 1-1/ 1-2 is equipped with protective insulation (protection class II).



This symbol appears on the display to indicate a discharged battery.



This symbol designates the "continuity test" field. The buzzer is intended for acoustic result output.



(DC) direct voltage



(AC) Alternating voltage or current



Ground (voltage against ground)

## 2. Safety instructions

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

and has left the factory in perfectly safe technical condition.

To preserve this condition and to ensure safe operation of the device, the user must observe the notes and warnings given in these instructions at all times.



**The BENNING CM 1-1/ 1-2 must be used in electrical circuits of overvoltage category III with a conductor for a maximum of 600 V to earth only.**

**Only use suitable measuring leads for this. With measurements within measurement category III, the projecting conductive part of a contact tip of the measuring leads must not be longer than 4 mm.**

**Prior to carrying out measurements within measurement category III, the push-on caps provided with the set and marked with CAT III and CAT IV must be pushed onto the contact tips. The purpose of this measure is user protection.**

**Please observe that work on live parts and 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 current clamp multimeter, always check the device as well as all measuring leads for damages.**

If it can be assumed that safe operation is no longer possible, switch the device off immediately and secure it against unintended operation.

Safe operation can be assumed to be no longer possible, if

- the device or the measuring leads exhibit visible damages,
- the device no longer works,
- the device has been stored under unfavourable conditions for a longer period of time,
- the device was exposed to extraordinary stress during transport.



**In order to prevent danger**

- **do not touch the bare measuring probe tips of the measuring leads,**
- **insert the measuring leads into the respectively designated measuring sockets of the multimeter.**

## 3. Scope of delivery

The scope of delivery of the BENNING CM 1-1/ 1-2 comprises:

- 3.1 One BENNING CM 1-1/ 1-2,
- 3.2 One safety measuring leads, red (L = 1.4 m), (BENNING CM 1-2)
- 3.3 One safety measuring leads, black (L = 1.4 m), (BENNING CM 1-2)
- 3.4 One compact protective pouch,
- 3.5 One 9 V block battery for initial assembly is integrated into the device (BENNING CM 1-1)  
Two 1.5 V micro (AAA) batteries for initial assembly are integrated into the device (BENNING CM 1-2)
- 3.6 One operating manual.

Parts subject to wear:

- The BENNING CM 1-1 is supplied by means of an integrated 9 V block battery (IEC 6 LR 61).
- The BENNING CM 1-2 is supplied by means of two integrated 1.5 V micro (AAA) batteries (IEC LR 03).
- The safety measuring leads mentioned above (tested accessories) comply with CAT III 1000 V and are approved for a current of 10 A.

## 4. Device description

See figure 1a, 1b: Device front

The display and operating elements shown in figures 1a and 1b are designated as follows:

- ① **Digital display**, displaying measured value and range exceedance
- ② **Polarity indication**,
- ③ **Battery indication**, appears in case of discharged battery,
- ④ **HOLD key**, storage of the displayed measured value,
- ⑤ **MAX key**, storage of the highest measured value,
- ⑥ **Key (change-over)**, for selecting AC voltage/ DC voltage or resistance

measurement/ continuity test

- 7 **Sliding switch**, for selecting the measuring function,
- 8 **Jack** (positive<sup>1)</sup>), for V and  $\Omega$
- 9 **COM jack**, common jack for voltage/ resistance measurements and continuity test,
- 10 **Opening lever**, for opening and closing the current clamp,
- 11 **Bulge for current clamp**, protects against contact with conductor,
- 12 **Measuring clamp**, for clamping on the single-wire live conductor,

<sup>1)</sup> This is what the automatic polarity indication for DC voltage refers to

## 5. General information

### 5.1 General information on the current clamp multimeter

- 5.1.1 The digital display ❶ is a 3½-digit LC display with a font size of 14 mm and a decimal point. The highest numerical value to be displayed is 2000.
- 5.1.2 The polarity indication ❷ works automatically. Only a polarity contrary to the jack definition is indicated with "-".
- 5.1.3 The range exceedance is indicated by "OL" or "- OL" and partly by an acoustic warning.  
Attention, no indication and warning in case of overload!
- 5.1.4 Measured value storage "HOLD": Press the "HOLD" key ❹ to store the measuring result. At the same time, the display shows the "H" symbol. Press the key again to switch back to the measuring mode.
- 5.1.5 The MAX key function ❺ automatically determines and stores the highest measured value. By pressing the key, the following values are displayed:  
"MAX" shows the highest stored value. The continuous determination of the MAX value can be stopped or started by pressing the "HOLD" key ❹. Press the "MAX" key to switch back to normal mode.
- 5.1.6 Press the ❻ V~/V $\overline{\sim}$  or  $\Omega$ /  $\gg$  key to select the secondary function of the sliding switch position (see indication on the display).
- 5.1.7 The nominal measuring rate of the BENNING CM 1-1 is 2.5 measurements per second for the digital display. The nominal measuring rate of the BENNING CM 1-2 is 1.5 measurements per second for the digital display.
- 5.1.8 The BENNING CM 1-1/ 1-2 can be switched on or off by means of the sliding switch ❷. Switched off: position "OFF".
- 5.1.9 The BENNING CM 1-2 is switched off automatically after approx. 10 minutes (**APO**, **Auto-Power-Off**). It is switched on again if a key or the sliding switch is operated. A buzzer tone indicates that the device is switched off automatically. The BENNING CM 1-1 is not provided with an **APO** function.
- 5.1.10 Temperature coefficient of the measured value: 0.2 x (stated measuring accuracy)/ °C < 18 °C or > 28 °C, related to the value for the reference temperature of 23 °C.
- 5.1.11 The BENNING CM 1-1 is supplied by means of a 9 V block battery (IEC 6LR61).  
The BENNING CM 1-2 is supplied by means of two integrated 1.5 V micro (AAA) batteries (IEC LR 03).
- 5.1.12 If the battery voltage falls below the specified operating voltage of the BENNING CM 1-1/ 1-2, a battery symbol appears on the display.
- 5.1.13 The battery life is approx. 580 hours for the BENNING CM 1-1 and approx. 200 hours for the BENNING CM 1-2 (alkaline battery).
- 5.1.14 Dimensions of the BENNING CM 1-1:  
(L x W x H) = 180 x 70 x 42 mm  
Weight: 200 g  
Dimensions of the BENNING CM 1-2:  
(L x W x H) = 190 x 70 x 38 mm  
Weight: 225 g
- 5.1.15 The enclosed safety measuring leads are explicitly intended for the nominal voltage and the nominal current of the BENNING CM 1-2.
- 5.1.16 Largest clamp opening: 30 mm
- 5.1.17 Largest cable diameter: 27 mm

## 6. Ambient conditions

- The BENNING CM 1-1/ 1-2 is intended for measurements under dry ambient conditions,
- Maximum barometric height for measurements: 2000 m,
- Overvoltage category / installation category: IEC 60664-1/ IEC 61010-1 → 600 V category III,
- Contamination class: 2,
- Protection category: IP 30 (DIN VDE 0470-1 IEC/ EN 60529)  
3 – first index: protection against access to dangerous parts and protection

- against solid impurities of a diameter > 2.5 mm  
 0 – second index: no protection against water,
- Operating temperature and relative air humidity:  
 For operating temperatures from 0 °C to 30 °C: relative air humidity less than 80 %,  
 For operating temperatures from 31 °C to 40 °C: relative air humidity less than 75 %,  
 For operating temperatures from 41 °C to 50 °C: relative air humidity less than 45 %,
  - Storage temperature: The BENNING CM 1-1/ 1-2 can be stored at temperatures between - 20 °C and + 60 °C (air humidity of 0 to 80 %). During storage, the battery should be removed.

## 7. Electrical specifications

Note: The measuring accuracy is specified as the sum of:

- a relative part of the measured value and
- a number of digits (i.e. counting Steps of the last digit).

This measuring accuracy applies for temperatures from 18 °C to 28 °C and a relative air humidity less than 80 %.

### 7.1 DC voltage ranges (BENNING CM 1-2)

The input resistance is 10 MΩ.

Measuring range	Resolution	Measuring accuracy	Overload protection
200 V	0.1 V	± (1.0 % of the measured value + 2 digits)	600 V <sub>eff</sub>
600 V	1 V	± (1.0 % of the measured value + 2 digits)	600 V <sub>eff</sub>

### 7.2 AC voltage ranges (BENNING CM 1-2)

The input resistance is 10 MΩ in parallel 100 pF.

Measuring range	Resolution	Measuring accuracy *1 within the frequency range 50 Hz - 500 Hz	Overload protection
200 V	0.1 V	± (1.5 % of the measured value + 5 digits)	600 V <sub>eff</sub>
600 V	1 V	± (1.5 % of the measured value + 5 digits)	600 V <sub>eff</sub>

### 7.3 AC current ranges

BENNING CM 1-1

Measuring range	Resolution	Measuring accuracy *1 within the frequency range 50 Hz - 60 Hz	Overload protection
20 A	0.01 A	± (3.0 % of the measured value + 5 digits)	600 A <sub>eff</sub>
200 A	0.1 A	± (2.0 % of the measured value + 5 digits)	600 A <sub>eff</sub>
400 A	1 A	± (2.0 % of the measured value + 5 digits)	600 A <sub>eff</sub>

BENNING CM 1-2

Measuring range	Resolution	Measuring accuracy *1 *2 within the frequency range 50 Hz - 60 Hz	Overload protection
40 A	0.1 A	± (1.9 % of the measured value + 10 digits)	600 A <sub>eff</sub>
200 A	0.1 A	± (1.9 % of the measured value + 5 digits)	600 A <sub>eff</sub>
400 A	1 A	± (1.9 % of the measured value + 5 digits)	600 A <sub>eff</sub>

\*1 The measured value is obtained by mean value rectification and is displayed as r.m.s. value. Its calibration is adapted to a sinusoidal curve.

\*2 The stated accuracy is specified for conductors that are centrally clamped by means of the current clamp ⑫ (see figure 4 AC current measurement). For conductors that are not centrally clamped, an additional error of 1,5 % of the displayed value has to be considered.

### 7.4 Resistance measuring range and acoustic continuity test

(BENNING CM 1-2)

Overload protection: 600 V<sub>eff</sub>

Measuring range	Resolution	Measuring accuracy	Max. open-circuit voltage
200 Ω	0.1 Ω	± (1,0 % of the measured value + 5 digits)	1.3 V
2 kΩ	1 Ω	± (0.7 % of the measured value + 2 digits)	1.3 V



20 k $\Omega$	10 $\Omega$	$\pm$ (0.7 % of the measured value + 2 digits)	1.3 V
200 k $\Omega$	100 $\Omega$	$\pm$ (0.7 % of the measured value + 2 digits)	1.3 V
2 M $\Omega$	1 k $\Omega$	$\pm$ (1.0 % of the measured value + 2 digits)	1.3 V
20 M $\Omega$	10 k $\Omega$	$\pm$ (1.9 % of the measured value + 5 digits)	1.3 V

The integrated buzzer sounds if the resistance R is lower than 20  $\Omega$ .

The change-over point of the range selection might be already at a value of 1400!

## 8. Measuring with the BENNING CM 1-1/ 1-2

### 8.1 Preparing the measurement

Operate and store the BENNING CM 1-1/ 1-2 at the specified storage and operating temperatures only! Do not permanently expose the device to sunlight.

- Check stated nominal voltage and nominal current on the safety measuring leads. Nominal voltage and current of the enclosed safety measuring leads comply with the respective values of the BENNING CM 1-1/ 1-2.
- Check insulation of the safety measuring leads. If the insulation is damaged, the safety measuring leads must be replaced immediately.
- Check the safety measuring leads for continuity. If the conductor in the safety measuring lead is interrupted, replace the safety measuring leads immediately.
- Before selecting another function by means of the sliding switch **7**, disconnect the safety measuring leads from the measuring point.
- Strong sources of interference in the vicinity of the BENNING CM 1-1/ 1-2 might involve unstable readings and measuring errors.

### 8.2 Voltage measurement (BENNING CM 1-2)



**Do not exceed the maximum permitted voltage with respect to earth potential! Electrical danger!**

The highest voltage which may be applied to the

- COM jack **9**
- jack for V and  $\Omega$  **8**

of the BENNING CM 1-2 against ground is 600 V.

- Select the desired function (V AC/ DC) by means of the sliding switch **7** of the BENNING CM 1-2. Select the desired function AC or DC by means of the shift key (V~/ V=).
- Connect the black safety measuring lead to the COM jack **9** of the BENNING CM 1-2.
- Connect the red safety measuring lead to the jack for V and  $\Omega$  **8** of the BENNING CM 1-2.
- Bring the safety measuring leads into contact with the measuring points and read the measured value on the digital display **1** of the BENNING CM 1-2.

See figure 2: DC voltage measurement

See figure 3: AC voltage measurement

### 8.3 AC current measurement

#### 8.3.1 Preparing the measurement

Operate and store the BENNING CM 1-1/ 1-2 at the specified storage and operating temperatures only. Do not expose the device to permanent sunlight.

- Strong sources of interference in the vicinity of the BENNING CM 1-1/ 1-2 might involve unstable readings and measuring errors.



**Do not apply any voltage to the output contacts of the BENNING CM 1-1/ 1-2! Any possibly connected safety measuring leads have to be removed.**

#### 8.3.2 AC current measurement

- Use the sliding switch **7** to select the desired range on the BENNING CM 1-1 or the desired function (AAC) on the BENNING CM 1-2.
- Operate the opening lever **10** and clamp the single-wire live conductor centrally by means of the clamp of the BENNING CM 1-1/ 1-2.
- Read the value indicated on the digital display **1**.

See figure 4: AC current measurement

### 8.4 Resistance measurement and acoustic continuity test (BENNING CM 1-2)

- Select the desired function ( $\Omega$  »)) by means of the sliding switch **7** of the BENNING CM 1-2.
- Connect the black safety measuring lead to the COM jack **9** of the

BENNING CM 1-2.

- Connect the red safety measuring lead to the jack for V and  $\Omega$  ⑧ of the BENNING CM 1-2.
- Bring the safety measuring leads into contact with the measuring points and read the measured value on the digital display ① of the BENNING CM 1-2.
- If the conductor resistance between the COM jack ⑨ and the jack for V and  $\Omega$  ⑧ falls below 20  $\Omega$ , the integrated buzzer of the BENNING CM 1-2 sounds.

See figure 5: Resistance measurement

## 9. Maintenance



**Before opening the BENNING CM 1-1/ 1-2, strictly observe that the device is free of voltage! Electrical danger!**

Working on the opened BENNING CM 1-1/ 1-2 under voltage must be carried out by **skilled electricians with special precautions for the prevention of accidents only!**

Make sure that the BENNING CM 1-1/ 1-2 is free of voltage as described below before opening the device:

- First, remove both safety measuring leads from the object to be measured.
- Then, remove both safety measuring leads from the BENNING CM 1-1/ 1-2.
- Switch the sliding switch ⑦ to position „OFF“.

### 9.1 Securing the device

Under certain circumstances, safe operation of the BENNING CM 1-1/ 1-2 might no longer be ensured, e.g. in case of:

- visible damages of the housing,
- incorrect measuring results,
- recognizable consequences of prolonged storage under inadmissible conditions and
- recognizable consequences of extraordinary stress due to transport.

In such cases, immediately switch off the BENNING CM 1-1/ 1-2, disconnect it from the measuring points and secure it against further use.

### 9.2 Cleaning

Clean the exterior of the device with a clean dry cloth (exception: special cleaning wipers). Do not use any solvents and/ or abrasives to clean the device. Strictly observe that the battery compartment and the battery contacts are not contaminated by leaking battery electrolyte. If there are electrolyte contamination or white deposits in the area of the battery or the battery compartment, clean these areas as well by means of a dry cloth.

### 9.3 Battery replacement



**Before opening the BENNING CM 1-1/ 1-2, strictly observe that the device is free of voltage! Electrical danger!**

The BENNING CM 1-1 is supplied by means of an integrated 9 V block battery, the BENNING CM 1-2 is supplied by means of two integrated 1.5 V micro batteries. Battery replacement (see figure 6) is required, if the battery symbol ① appears on the display ③.

Proceed as follows to replace the battery:

- Disconnect the safety measuring leads from the measuring circuit (BENNING CM 1-2).
- Disconnect the safety measuring leads from the BENNING CM 1-2.
- Switch the sliding switch ⑦ to position „OFF“.
- Put the BENNING CM 1-1/ 1-2 face down and unscrew the screw of the battery compartment cover.
- Lift off the battery compartment cover (in the area of the housing slots) from the bottom part of the battery compartment.
- Remove the discharged battery/batteries from the battery compartment and carefully disconnect the battery supply lines (BENNING CM 1-1) from the battery.
- Connect the new battery/batteries to the battery supply lines and arrange them in such a way that they are not crushed between the housing parts (BENNING CM 1-1). Then, place the batteries into the battery compartment at the provided place.
- Lock the battery compartment cover into place on the bottom part and tighten the screws.

See figure 6a, 6b: Battery replacement



**Make your contribution for environmental protection! Do not dispose of discharged batteries via the household waste. Instead, return them to a collecting point for discharged batteries or special waste. Please look for information in your community's facilities.**

#### 9.4 Calibration

To maintain accuracy of the measuring results, the device must be recalibrated in regular intervals by our factory service. We recommend recalibrating the device once a year. For this purpose, send the device to the following address:

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

#### 10. Technical data of the measuring accessories (BENNING CM 1-2)

- Standard: EN 61010-031,
- Maximum rated voltage to earth ( $\perp$ ) and measuring category:  
With push-on caps: 1000 V CAT III, 600 V CAT IV,  
Without push-on caps: 1000 V CAT II,
- Maximum rated current: 10 A,
- Protection class II ( $\square$ ), continuous double or reinforced insulation,
- Contamination class: 2,
- Length: 1.4 m, AWG 18,
- Ambient conditions:  
Barometric height for measurements: max. 2000 m,  
Temperature: 0 °C to + 50 °C, humidity 50 % to 80 %
- Use the measuring leads in perfect and clean condition as well as according to these operating instructions only, as otherwise the protection provided might be impaired.
- Replace the measuring leads, if the insulation is damaged or if the conductor/ connector is interrupted.
- Do not touch the bare contact tips of the measuring leads. Only touch the area intended for your hands!
- Insert the bent terminals into the testing or measuring device.

#### 11. Environmental note



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