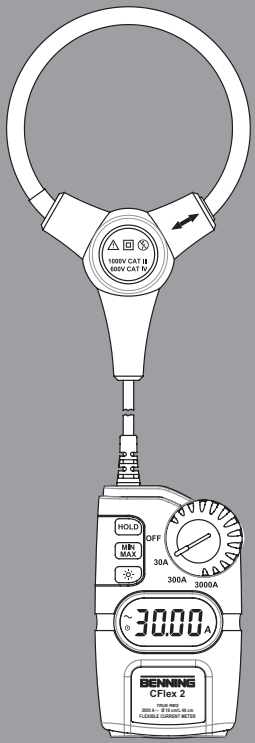
BENNING

GB **Operating manual**



BENNING CFlex 2

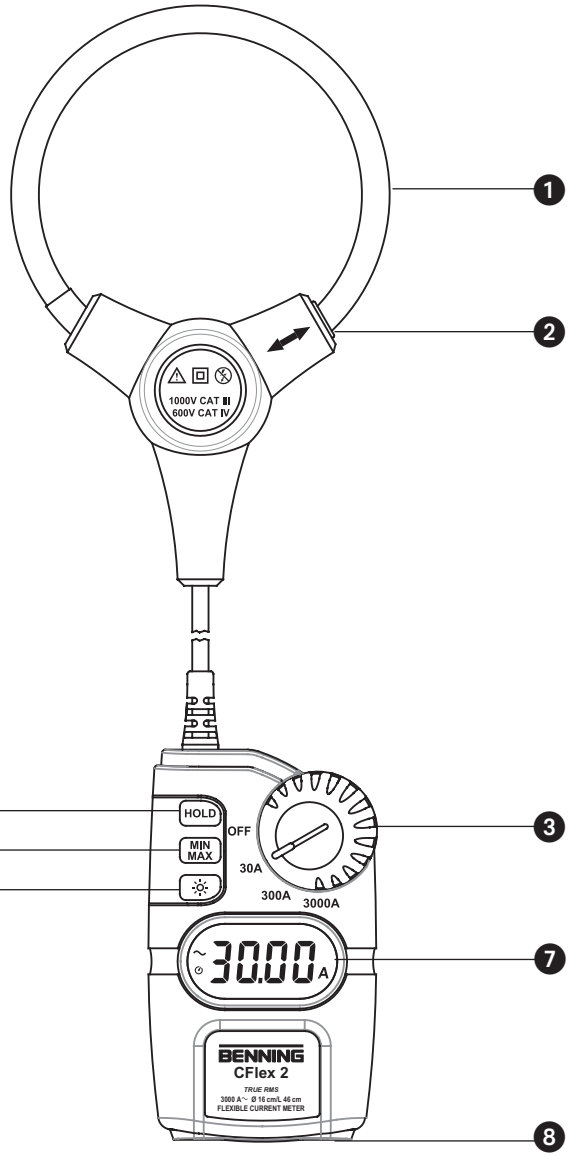


Bild 1: Gerätefrontseite
Fig. 1: Appliance front face
Fig. 1: Partie avant de l'appareil
Fig. 1: Parte frontal del equipo
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Σικόνα 1: Μπροστινή όψη
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Рис. 1: Вид спереди
Resim 1: Cihaz önyüzü

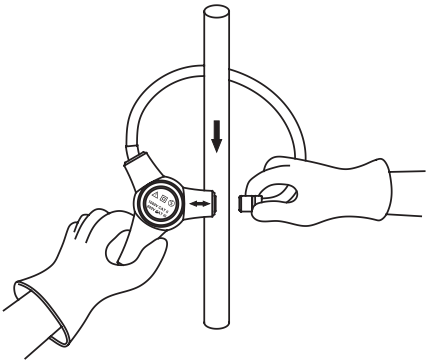

Bild 2 a: Wechselstrommessung
Fig. 2 a: Alternating current measurement
Fig. 2 a: Mesure de courant alternative
Fig 2 a: Medición de corriente alterna
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Рис. 2 a: Измерение величины переменного тока
Resim 2 a: Alternatif akım ölçümü

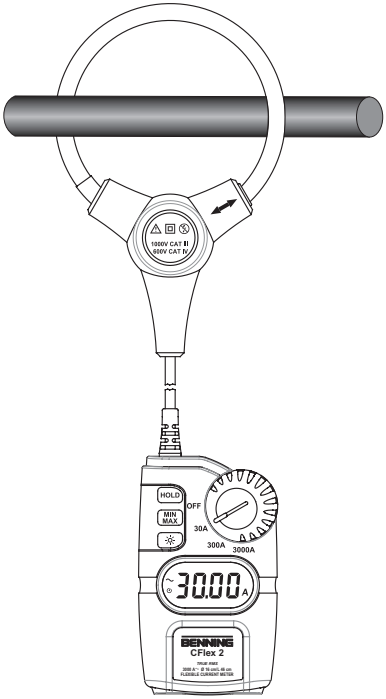

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Fig. 2 b: Mesure de courant alternatif
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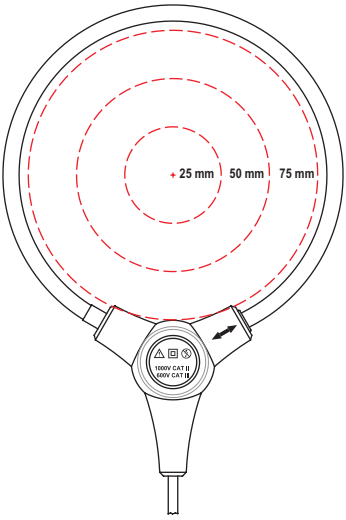
Resim 2 b: Alternatif akım ölçümü



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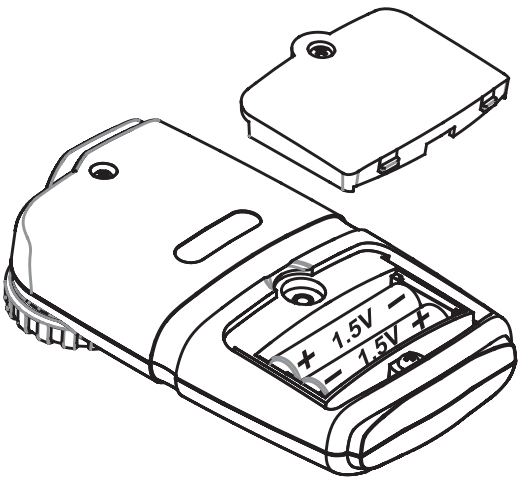

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Operating Instructions
BENNING CFlex 2

Flexible digital TRUE-RMS AC current transformer for AC current measurement

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1. User notes

These operating instructions are intended for

- qualified electricians and
- electrotechnically trained persons.

The BENNING CFlex 2 is intended for making measurements in dry environment. It must not be used in power circuits with a nominal voltage higher than 600 V AC CAT IV/ 1000 V AC CAT III (More details in Section 6. “Ambient conditions”).

The following symbols are used in these operating instructions and on the BENNING CFlex 2:

Application around and removal from NON-INSULATED HAZARDOUS LIVE conductors is NOT permitted.

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 followed with in order to avoid risks.

This symbol on the BENNING CFlex 2 means that the BENNING CFlex 2 is totally insulated (protection class II).

This symbol on the BENNING CFlex 2 means that the BENNING CFlex 2 complies with the EU directives.

(AC) Alternating voltage or current.

Ground (Voltage against ground).

2. Safety note

The instrument is built and tested in accordance with
DIN VDE 0411 part 1/ EN 61010-1
DIN VDE 0411 part 2-032/ EN 61010-2-032
DIN VDE 0411 part 031/ EN 61010-031
and has left the factory in perfectly safe technical condition.
To maintain this condition and to ensure safe operation of the unit, the user must observe the notes and warnings given in these instructions at all times. Improper handling and non-observance of the warnings might involve severe **injuries** or **danger to life**.

WARNING! Be extremely careful when working with bare conductors or main line carrier! Contact with live conductors will cause an electric shock!

The BENNING CFlex 2 may be used only in electrical circuits of over voltage category IV with a maximum voltage of 600 V or of over voltage category III with a maximum voltage of 1000 V between the conductor and ground. 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 unit, always check it as well as all measuring lead and wires for signs of damage.

Should it appear that safe operation of the unit is no longer possible, it should be shut down immediately and secured to prevent that it is switched on accidentally.

It may be assumed that safe operation is no longer possible:
- if the device or the measuring lead exhibit visible damages,
- if the unit no longer works,
- after long periods of storage under unfavourable conditions,
- after being subject to rough transportation, or
- if the device or the measuring lead are exposed to moisture.

3. Scope of delivery

The scope of delivery for the BENNING CFlex 2 comprises:
3.1 One BENNING CFlex 2,
3.2 One compact protective pouch,
3.3 Two 1.5 V batteries of type AAA (IEC LR 03)
3.4 One operating manual

4. Description of AC current transformer

The BENNING CFlex 2 is a flexible digital TRUE-RMS AC current transformer for measuring AC currents of up to 3000 A.
See figure 1: Appliance front face

The display and operator control elements specified in Fig. 1 are designated as follows:
❶ **Flexible measuring loop**, for clamping the single-wire AC current-carrying (live) conductor
❷ **Closing mechanism** of the measuring loop
❸ **Rotary switch**, for selecting the measuring ranges
❹ **HOLD button**, storage of the indicated measured value,
❺ **MIN/MAX button**, storage of the highest and lowest measured values
❻ **Illumination key**, activates the display illumination for approx. 30 seconds
❼ **Digital display**, for displaying the measured value and range exceedance,
❽ **Battery compartment cover**

5. General information

5.1 General details on the AC current transformer

5.1.1 The digital display ❼ is a 4-digit liquid crystal display with 13 mm high numerals, complete with decimal point. The largest numerical value which can be displayed is 3150.
5.1.2 In case of a range exceedance (overflow), "-0.L-" is displayed.
Warning, no indication and prior warning in the event of an overload condition!
5.1.3 The rotary switch ❸ is intended for selecting the measuring ranges of 30 A, 300 A and 3000 A AC.
5.1.4 HOLD key function: The measuring result can be stored by pressing the HOLD key ❹. The "HOLD" symbol simultaneously appears on the display ❼. Press the key again to switch the device back to measuring mode.
5.1.5 The MIN / MAX key function ❺ automatically records and stores the highest and the

lowest measured value. By pressing the key, the following values are displayed: “MAX” shows the highest value stored, “MIN” shows the lowest value stored and “MIN/MAX” shows the current measured value. Press the key for approx. 2 seconds to switch the device back to normal operating mode.

5.1.6 The illumination key ❻ activates the illumination of the display ❼. It is switched off by pressing the key again or automatically after approx. 30 seconds.

5.1.7 The measuring rate of the BENNING CFlex 2 amounts nominally to 2 measurements per second for the digital display.

5.1.8 The BENNING CFlex 2 is switched on and off with the rotary switch ❸. Shutdown position “OFF”.

5.1.9 The BENNING CFlex 2 switches off automatically after approx. 15 minutes (**APO**, **A**uto-**P**ower-**O**ff is activated, if the ⏲ symbol is shown on the display ❼). It switches on again, if the HOLD key ❹ or another key is actuated. Automatic switch-off can be deactivated by pressing the HOLD key ❹ and by simultaneously switching on the BENNING CFlex 2 from the switching position “OFF”. The ⏲ symbol disappears from the display ❼.

5.1.10 The BENNING CFlex 2 is supplied by two 1.5 V batteries (IEC LR03/ AAA/ micro).

5.1.11 If the battery voltage drops below the specified operating voltage of the BENNING CFlex 2, then a battery symbol appears in the display ❼.

5.1.12 The battery life is approx. 120 hours (alkaline battery).

5.1.13 Temperature coefficient of the measured value:
0.1 x (stated measuring accuracy)/ °C < 18 °C or > 28 °C, related to the value for the reference temperature of 23 °C

5.1.14 Length of the measuring loop: approx. 46 cm

5.1.15 Cable diameter of the measuring loop: approx. 8.5 mm

5.1.16 Cable length from measuring loop to housing: approx. 1.8 m

5.1.17 Housing dimensions: (L x W x H) = 120 x 70 x 26 mm

5.1.18 Weight of the device: 286 g

6. Ambient conditions

- The BENNING CFlex 2 is intended for making measurements in dry environment.
- Maximum barometric elevation for making measurements: 2000 m,
- Overvoltage category: IEC 60664/ IEC 61010 → 600 V category IV, 1000 V category III
- Contamination class: 2 (EN 61010-1),
- Protection class: IP 30 (DIN VDE 0470-1, IEC/ EN 60529)
  IP 30 means: Protection against access to dangerous parts and protection against solid impurities of a diameter > 2.5 mm, (3 - first index). No protection against water, (0 - second index).
- Operating temperature and relative humidity:
  For operating temperatures from 0 °C to 50 °C: relative air humidity lower than 80 %, non-condensing
- Storage temperature: The BENNING CFlex 2 can be stored at temperatures between - 10 °C and + 60 °C, at a relative air humidity lower than 70 % without batteries.

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 23 °C ± 5 °C and relative humidity less than 80 %.

7.1 Alternating current ranges

The measured value is obtained and displayed as real r.m.s. value (True RMS, AC coupling). Its calibration is adapted to sinusoidal curves. In case of deviations from this curve shape, the accuracy of the displayed value decreases.
Crest factor < 1.6 up to 100 % of the final measuring range value
Crest factor < 3.2 up to 50 % of the final measuring range value

Measuring Range	Resolution	Meas. precision* within the frequency range 45 Hz - 500 Hz protection	Overload
30 A	10 mA	± (3.0 % of the measuring value + 5 digit)	3000 A
300 A	100 mA	± (3.0 % of the measuring value + 5 digit)	3000 A
3000 A	1 A	± (3.0 % of the measuring value + 5 digit)	3000 A

* The measuring accuracy is specified for a sinusoidal curve. The stated accuracy is specified for conductors that are centrally clamped by means of the measuring loop ❶ (see figure 3). For conductors that are not centrally clamped, an additional error has to be considered.

Distance from the middle	Positioning error
25 mm	± (1.0 % of the final measuring range value)
50 mm	± (2.0 % of the final measuring range value)
75 mm	± (3.0 % of the final measuring range value)

8. Measuring with the BENNING CFlex 2

8.1 Preparing the measurement

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

- Nominal voltage and nominal current of the enclosed safety measuring lead comply with the respective values of the BENNING CFlex 2. The safety measuring lead is firmly connected with the BENNING CFlex 2 and is not detachable.
- Check the insulation of the safety measuring lead. If the insulation is damaged, the BENNING CFlex 2 must be scrapped immediately.
- Strong sources of interference in the vicinity of the BENNING CFlex 2 might involve unstable readings and measuring errors.

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

The highest voltage that may be applied to the BENNING CFlex 2 with respect to earth potential is 600 V CAT IV / 1000 V CAT III.

8.2 AC current measurement

- Select the measuring range (30 A, 300 A or 3000 A) by means of the rotary switch ❸.
- Clamp the single-wire live conductor centrally by means of the flexible measuring loop ❶.
- Read the measured value from the digital display ❼.

See Figure 2 a: Alternating current measurement
See Figure 2 b: Alternating current measurement

9. Maintenance

Before opening the BENNING CFlex 2, make sure that it is free of voltage! Electrical danger!

Work on the opened BENNING CFlex 2 under voltage may be carried out only **by skilled electricians with special precautions for the prevention of accidents.**
Make sure that the BENNING CFlex 2 is free of voltage as described below before opening the instrument:

- First, remove the BENNING CFlex 2 from the object to be measured.

The BENNING CFlex 2 AC current transformer is not equipped with a fuse.

9.1 Securing the instrument

Under certain circumstances safe operation of the BENNING CFlex 2 is no longer ensured, for example in the case of:

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

In such cases, immediately disconnect the BENNING CFlex 2 from the measuring point and secure it against further use.

9.2 Cleaning

Clean the exterior of the housing 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 occur in the area of the batteries or battery compartment, clean them too with a dry cloth.

9.3 Battery replacement

Before opening the BENNING CFlex 2, make sure that it is free of voltage! Electrical danger!

The BENNING CFlex 2 is supplied by means of two 1.5 V batteries of type AAA (IEC LR03). Battery replacement (see figure 4) is required, if the battery symbol appears on the display ❼.
Proceed as follows to replace the batteries:

- Remove the BENNING CFlex 2 from the object to be measured.
- Switch the rotary switch ❸ to position “OFF”.
- Put the BENNING CFlex 2 face down and unscrew the screw of the battery compartment cover ❽.
- Lift off the battery compartment cover (in the area of the housing slots) at the bottom part of the battery compartment.
- Replace the exhausted batteries by two new ones of type AAA (LR03). Make sure that the new batteries are inserted with correct polarity!
- Place the battery compartment cover onto the bottom part and tighten the screw.

See figure 4: Battery replacement

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.

9.4 Calibration

To maintain the specified accuracy 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 unit to the following address:

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

10. Environmental note

At the end of the product’s useful life, please dispose of the device at collection points provided in your community.

Benning Elektrotechnik & Elektronik GmbH & Co. KG
Münsterstraße 135 - 137
D - 46397 Bocholt
Telefon ++49 (0) 2871 - 93 - 0 • Fax ++49 (0) 2871 - 93 - 429
www.benning.de • eMail: duspol@benning.de