



Installation and Configuration Manual — FEMS Package 3-Phase Sensor without Current Transformer (KDK 2PU CT)

Version:2023.7.1

Table of Contents

1. Introduction	2
1.1. Legal provisions	2
1.2. Qualification of the installer	2
1.3. Symbols used	2
1.4. Dangers and safety instructions	2
2. Product description	3
2.1. Scope of delivery	3
2.2. Prerequisites	3
2.3. Model overview	4
3. Connection	5
3.1. Terminal designation	5
3.2. Voltage tap	5
3.3. Connection of current transformers to the meter of the metering point operator	7
3.4. Connection of current transformer to generator	8
3.5. Connection of current transformer to consumer load(s)	9
4. Communication	10
5. Overview of controls	12
5.1. Menu structure	13
6. Adjust configuration via buttons on the meter	14
6.1. Configuration parameters	14
6.2. Password input	15
6.3. Input — Measuring transformer — Current ratio	15
6.4. Input RS485 Modbus address	16
6.5. Communication speed input (baud rate)	17
6.6. Communication parity input	17
7. Bluetooth smartphone app	19
7.1. Activating the BT interface on the meter	20
7.2. Bluetooth connection with the meter	21
7.3. App - device page	22
7.4. App - reading the meter data	23
7.5. App - Changing meter parameters	24
8. Troubleshooting	26
9. Contact	27
10. Directories	28
10.1. List of illustrations	28

1. Introduction

1. Introduction

1.1. Legal provisions

Unless stated otherwise, the information contained in these documents is the property of FENECON GmbH. Publication, in whole or in part, requires the written consent of FENECON GmbH.

These instructions do not claim to be complete or correct. It merely serves as an abridged version of the original instructions from KDK Dornscheidt.

Online: <https://www.kdk-dornscheidt.de/produkte/420506pro20-ct/>

Subject to changes and printing errors!

1.2. Qualification of the installer

A qualified installer is a person who has the following experience and training:

- Setting up, switching on, switching off, disconnecting, earthing, short-circuiting and repairing circuits and devices
- Standard maintenance and use of protective devices in accordance with current safety standards
- First aid/emergency care
- Current knowledge of local regulations, standards and guidelines

1.3. Symbols used

	Attention
	Important information
	Danger

1.4. Dangers and safety instructions



The meter must be installed by a qualified specialist.

The manufacturer's installation and service instructions must be observed.

2. Product description

2.1. Scope of delivery

After you have received the delivery, check that all components have been included. Inspect the scope of delivery for damage. If anything is missing or damaged, please contact the supplier immediately. The following components are included in the delivery:

- KDK Dornscheidt 2PU CT
- Installations- und Konfigurationsanleitung für FEMS Package 3-Phase Sensor without Current Transformer (KDK 2PU CT)
- Installation instructions for KDK Dornscheidt 2PU CT (Online: https://www.kdk-dornscheidt.de/wp-content/uploads/2021/08/KDK-Bedienungsanleitung_420565PRO20-U_4PU_052021V1.00.pdf)

2.2. Prerequisites

The following is required for using the 3-phase sensor:

- Current transformer



Please note! The current transformers are not included in the scope of delivery! (Online: <https://www.kdk-dornscheidt.de/produktkategorie/wandler/>)

Using the KDK meter as an example, the transformer ratio is 1 or 5.

You can read the transformer ratio on the current transformers installed on site (see e. g. type label).

- FENECON Energy Management System (FEMS)

FEMS is being developed as an open source project under the name "OpenEMS" together with many other companies and institutes in the "OpenEMS Association e.V.". More information:

FEMS: <https://fenecon.de/fenecon-fems/>

OpenEMS: <https://www.openems.io>

FEMS is a product component of the integrated FENECON power storage systems and other product combinations of battery inverters and batteries. More information can be found at <https://fenecon.de/>.

2.3. Model overview

2.3. Model overview

The KDK meter is a modular active and reactive energy meter that can count and display the energy consumed. It is designed for three-phase grids and must be operated with current transformers. The meter is equipped with a MODBUS communication bus.



Figure 1. 420506PRO20-CT (2PU CT)

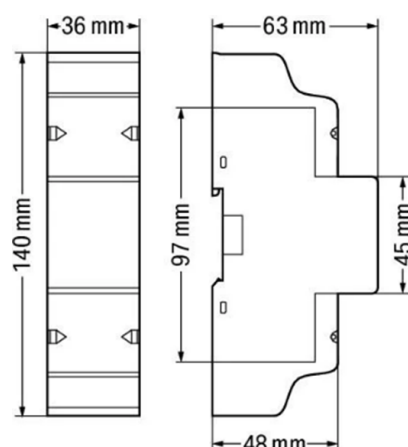


Figure 2. Dimensions

Höhe o. Abdeckung	97 mm
Höhe m. Abdeckung	140 mm
Breite	36 mm
Tiefe	63 mm

Gewicht (Netto)	0,2 kg
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3. Connection

3.1. Terminal designation

The push-in technique can be used for solid conductors, fine-stranded conductors and fine-stranded conductors with wire ferrule. For fine-stranded conductors, the levers must be opened for connection.

Cross-section of the connection terminals:

Single-wire conductors

0.2 ... 4 mm²/24 ... 12 AWG

Fine-stranded conductors

0.2 ... 4 mm²/24 ... 12 AWG

Fine-stranded conductors with wire ferrule and plastic collar

0.25 ... 2.5 mm²

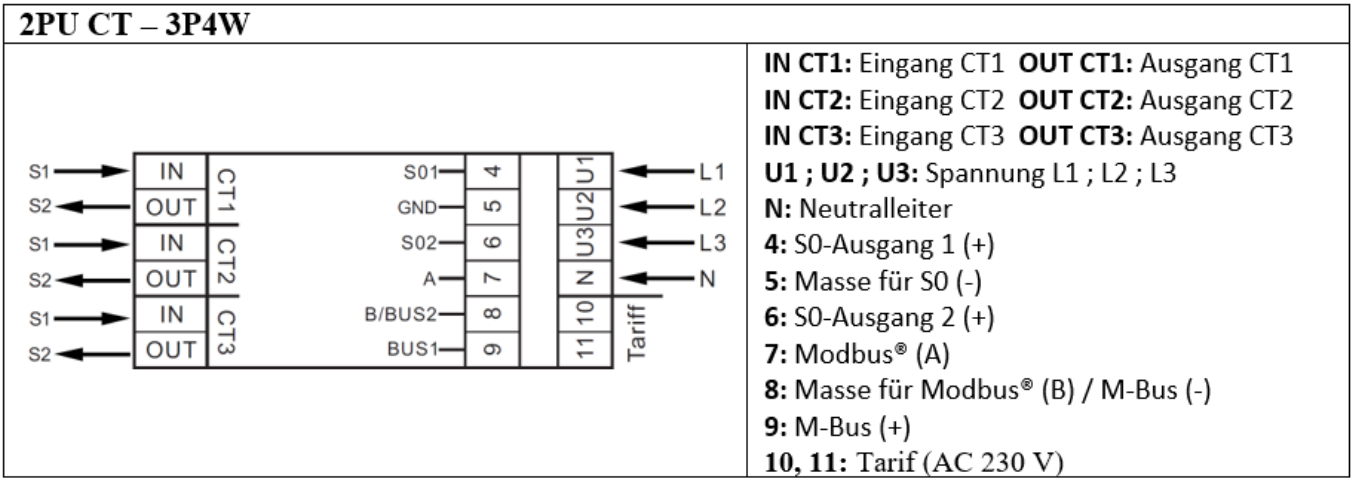


Figure 3. Terminal designations

3.2. Voltage tap

The meter is electrically connected through the three phases and the neutral conductor in accordance with the original instructions. As this type of meter can only work with external current measurement sensors, this is a voltage tap of the three phases and the neutral conductor.

3.2. Voltage tap

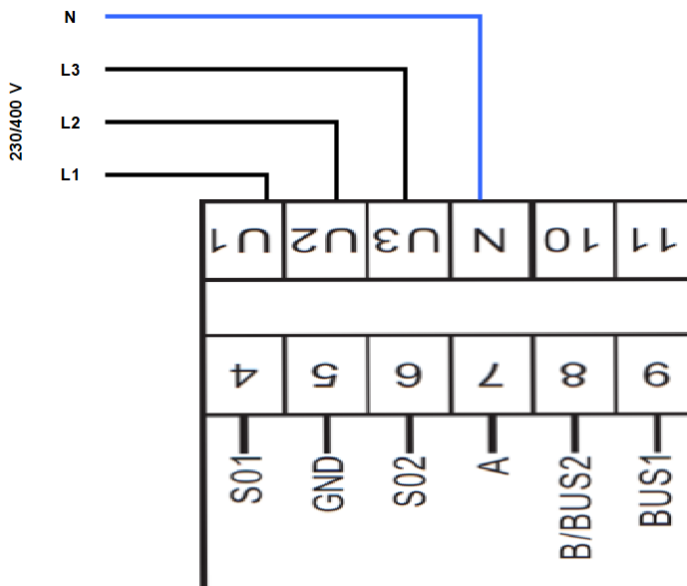


Figure 4. Voltage tap

Auxiliary table for dimensioning the secondary cables for transformers with 5 A secondary current (XXXX/5A)

Bei einem Leiterquerschnitt von $2,5\text{mm}^2$			
		Wandler mit 2,5 VA	Wandler mit 5 VA
1-fache Leitungslänge	Min.	3 Meter	3,5 Meter
	Max.	7 Meter	14 Meter

Bei einem Leiterquerschnitt von 4mm^2			
		Wandler mit 2,5 VA	Wandler mit 5 VA
1-fache Leitungslänge	Min.	4,5 Meter	6 Meter
	Max.	11 Meter	22 Meter



- 1-fold cable length means one cable with two cores! For K and L.
- For other current transformers or cable cross-sections, please contact KDK Dornscheidt for free advice. Tel.: 02244 9199447

3.3. Connection of current transformers to the meter of the metering point operator

The current transformers must be connected to the meter of the metering point operator as shown below:

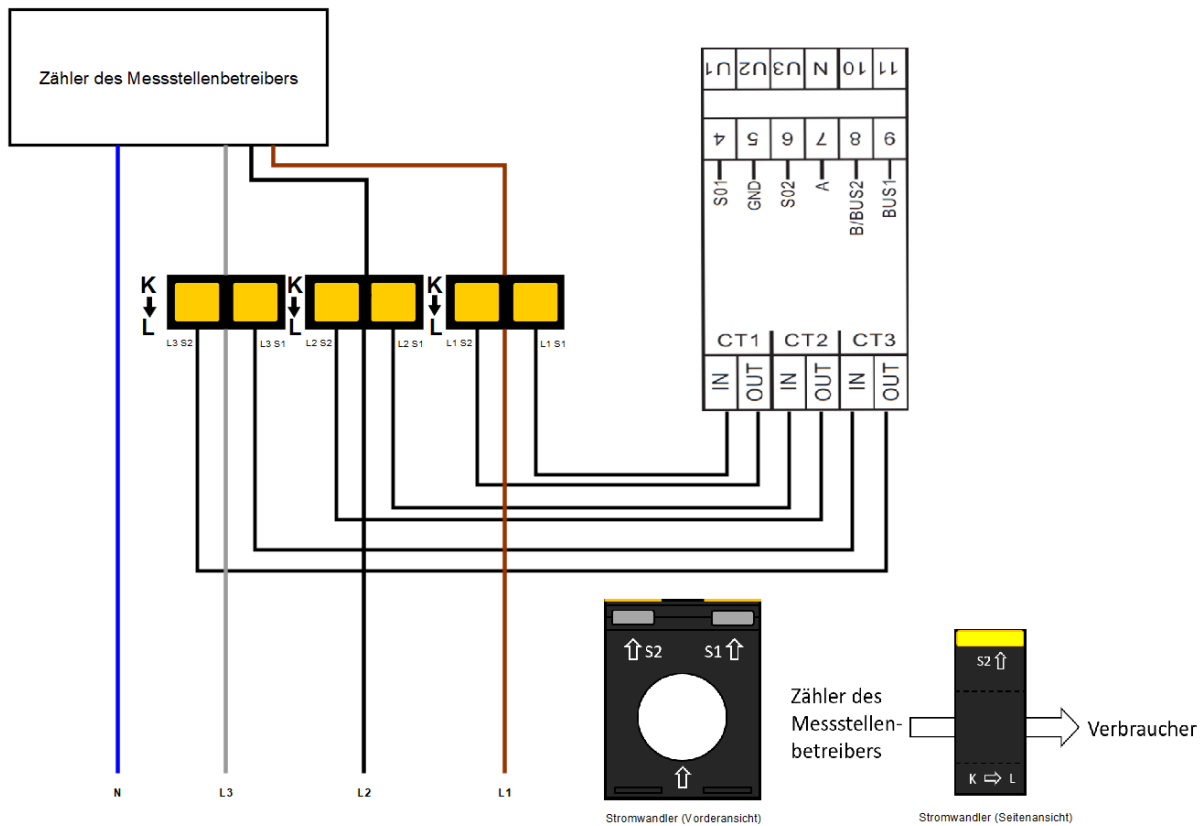


Figure 5. Connection between current transformer, meter, and metering point operator



Ensure that the transformers are aligned correctly from K to L!

3.4. Connection of current transformer to generator

3.4. Connection of current transformer to generator

The current transformers must be connected to the generator (inverter) as shown below:

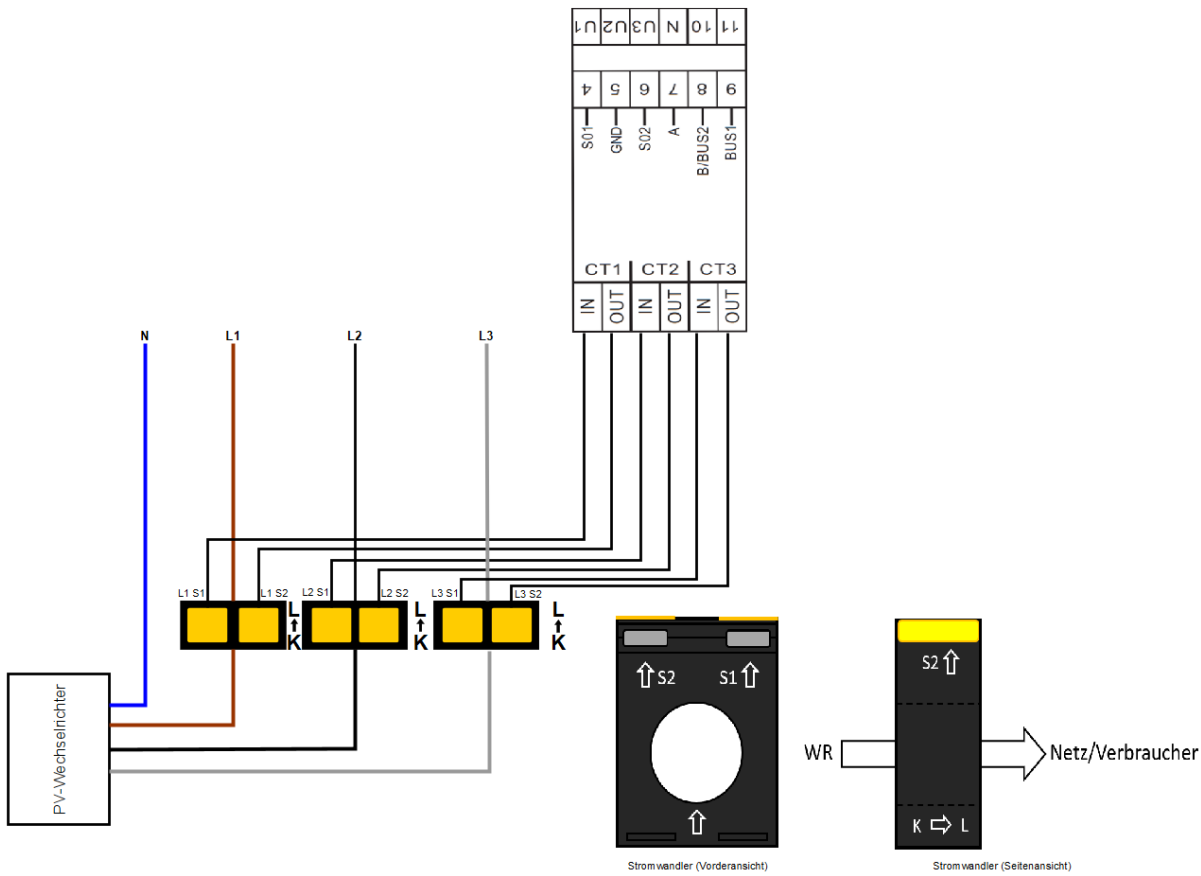


Figure 6. Connection of the generator current transformer



Ensure that the transformers are aligned correctly from K to L!

3.5. Connection of current transformer to consumer load(s)

The current transformers must be connected to a consumer load as shown below:

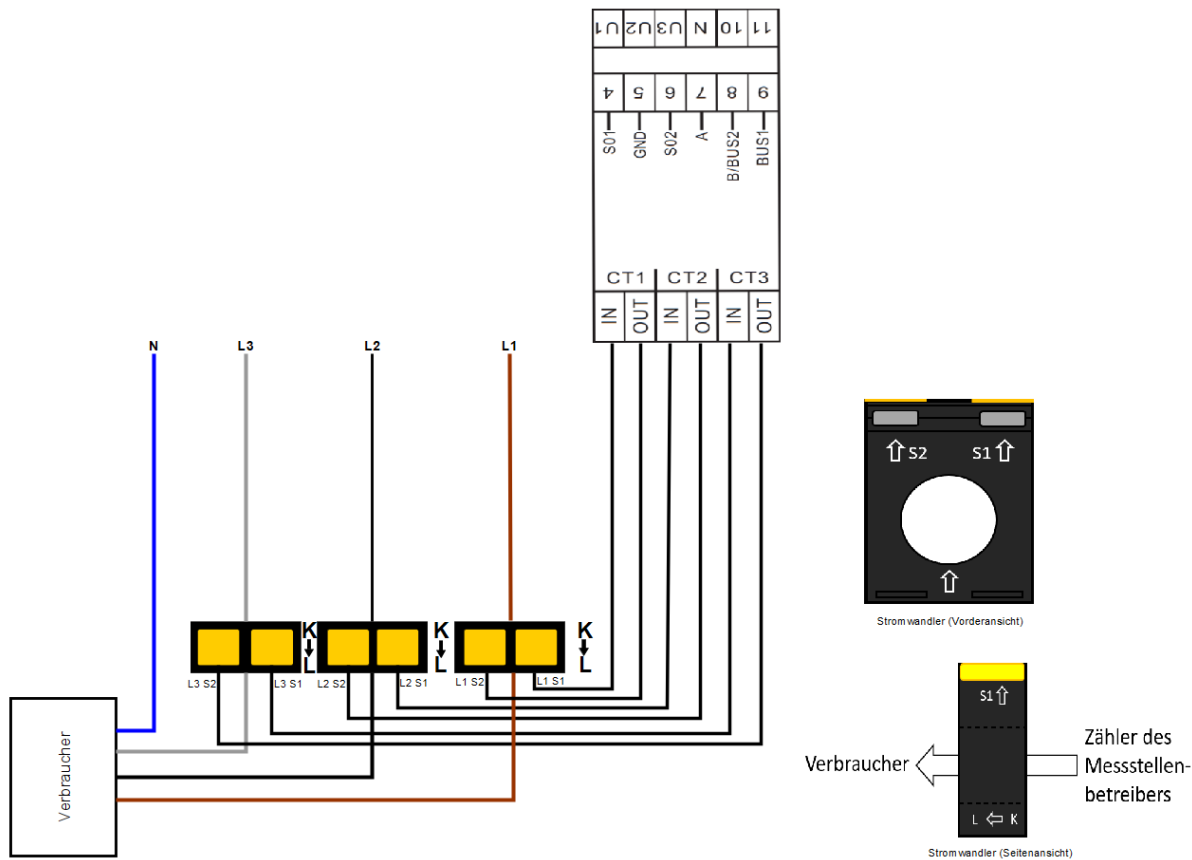


Figure 7. Connection between current transformer and consumer load



- Ensure that the transformers are aligned correctly from K to L!
- In contrast to the connection to a generator or the meter of the metering point operator, the current transformers must be installed upside down here!

4. Communication

4. Communication

The Modbus communication available with the 2PU CT takes place via a serial RS485 interface (2 or 3 wire), which enables the device to be operated from the FEMS. In the standard configuration, 64 devices can be connected to a PC or a controller over 1000 meters with one RS485 interface.

The connections for Modbus communication are located above the meter, in the front row of terminals.

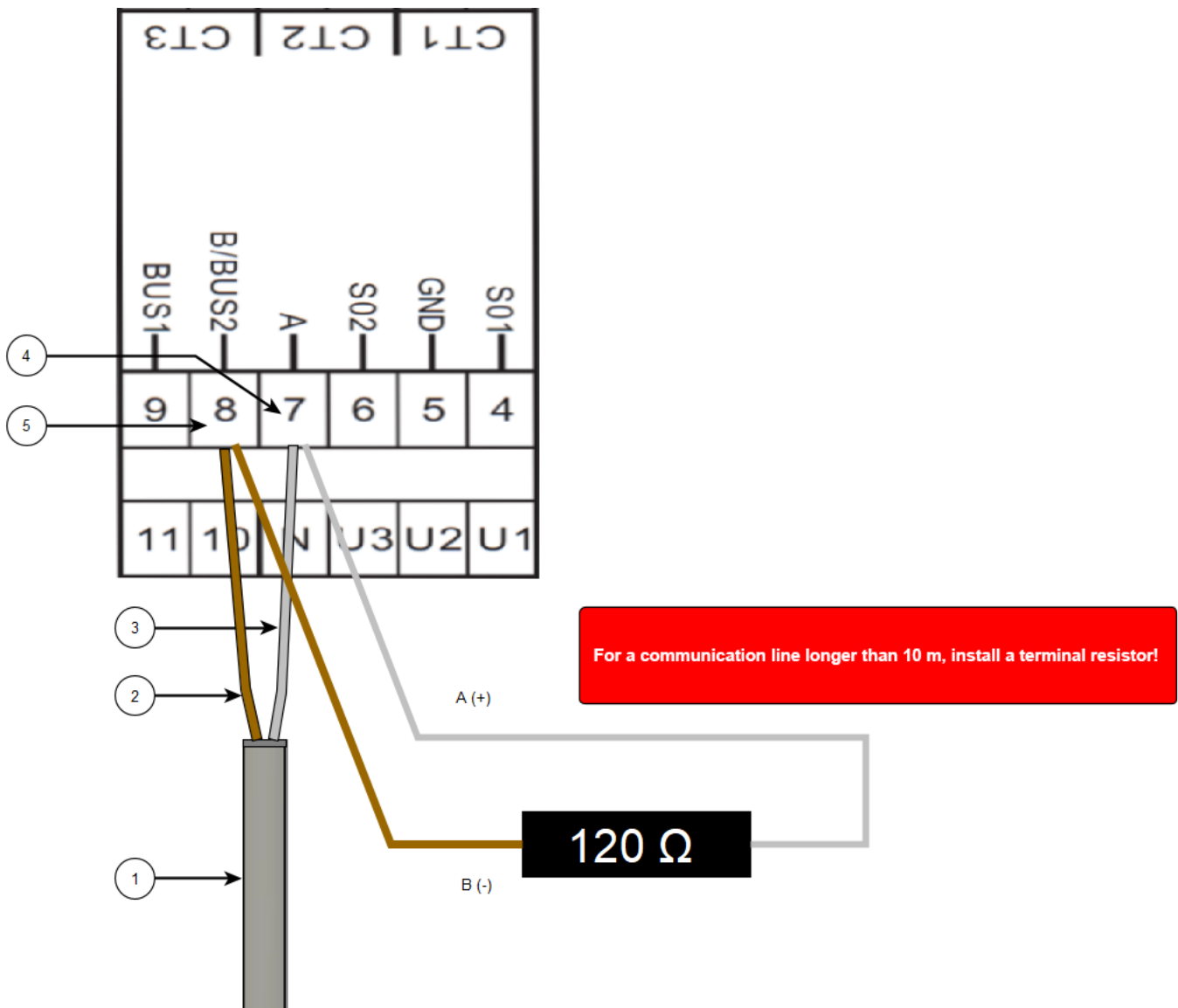


Figure 8. RS-485 connection

1. COM RS-485 connection from the FEMS direction
2. Data conductor Positive (+) (A conductor)
3. Data conductor Negative (-) (B conductor)
4. Minus (-) contact
5. Plus (+) Contact

To connect several meters in series, the RS-485 connection must be looped through, as shown in the figure below.

The diagram illustrates a multi-channel measurement system for a 120 Ohm resistor. It consists of three identical measurement channels, labeled Zähler 1, Zähler 2, and Zähler n. Each channel is connected to a common signal source. The signal source is connected to the 10 Ohm resistor, and the 120 Ohm resistor is connected to ground. The voltage across the 120 Ohm resistor is measured by a multimeter. The diagram also shows a photograph of the physical setup with a multimeter and a breadboard.

Zähler 1

IN	OUT	IN	OUT	IN	OUT
C1	C1	C1	C1	C1	C1
OUT	IN	OUT	IN	OUT	IN
C1	C1	C1	C1	C1	C1
OUT	IN	OUT	IN	OUT	IN
C1	C1	C1	C1	C1	C1
OUT	IN	OUT	IN	OUT	IN
C1	C1	C1	C1	C1	C1

Zähler 2

IN	OUT	IN	OUT	IN	OUT
C1	C1	C1	C1	C1	C1
OUT	IN	OUT	IN	OUT	IN
C1	C1	C1	C1	C1	C1
OUT	IN	OUT	IN	OUT	IN
C1	C1	C1	C1	C1	C1
OUT	IN	OUT	IN	OUT	IN
C1	C1	C1	C1	C1	C1

Zähler n

IN	OUT	IN	OUT	IN	OUT
C1	C1	C1	C1	C1	C1
OUT	IN	OUT	IN	OUT	IN
C1	C1	C1	C1	C1	C1
OUT	IN	OUT	IN	OUT	IN
C1	C1	C1	C1	C1	C1
OUT	IN	OUT	IN	OUT	IN
C1	C1	C1	C1	C1	C1

120 Ω

Figure 9. Looping through RS-485 of several meters



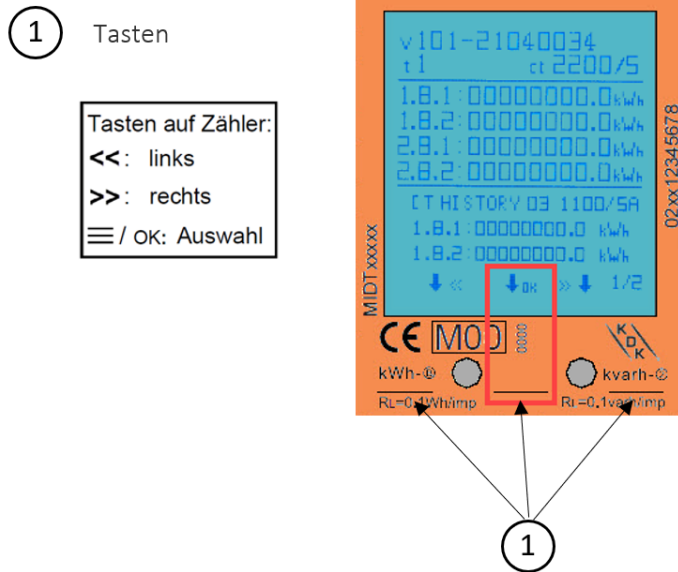
If the supplied RS485 cable is not long enough, we recommend using a LiYCY with a cross-section of 0.5 mm². This is suitable for max. 500 m. In general, the manufacturer's specifications and recommendations must be observed.

5. Overview of controls

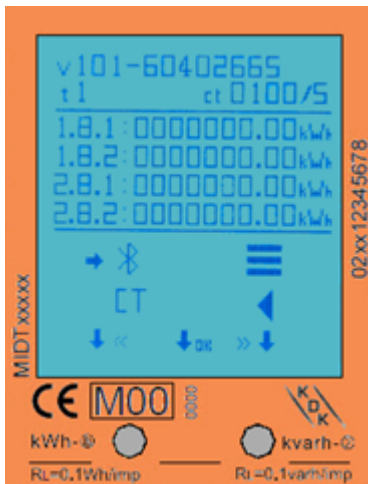
5. Overview of controls

There are three buttons on the front of the meters, marked with a line. To access the menu, press and hold the middle button for ≥ 5 seconds.

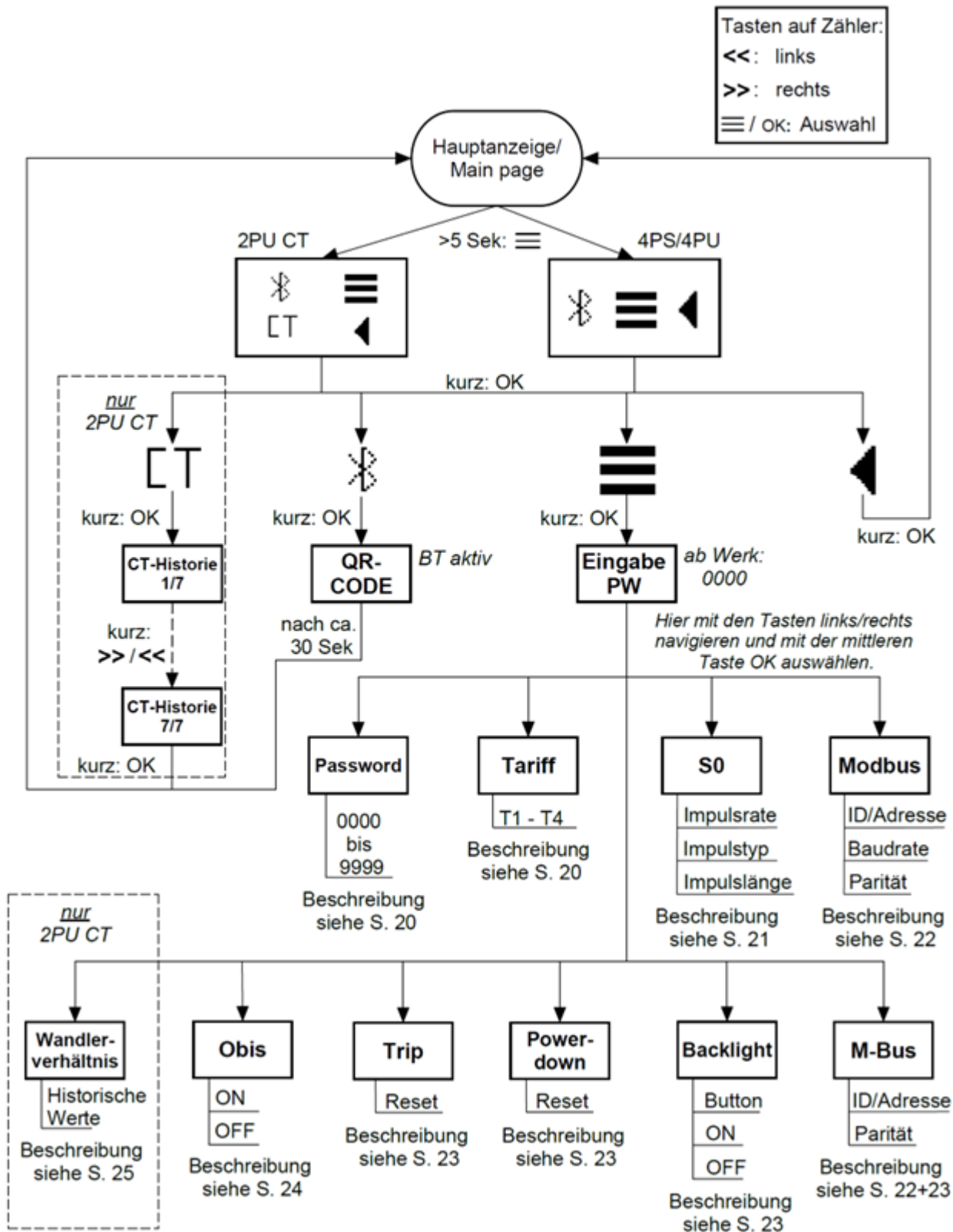
The following display appears:



Here you have the option of activating the meter's Bluetooth, on the far left in the picture. The symbol in the middle, three dashes, takes you to the actual menu where you can make adjustments to the meter settings. The arrow to the left, on the right in the picture, takes you back to the measured values.



5.1. Menu structure



6. Adjust configuration via buttons on the meter

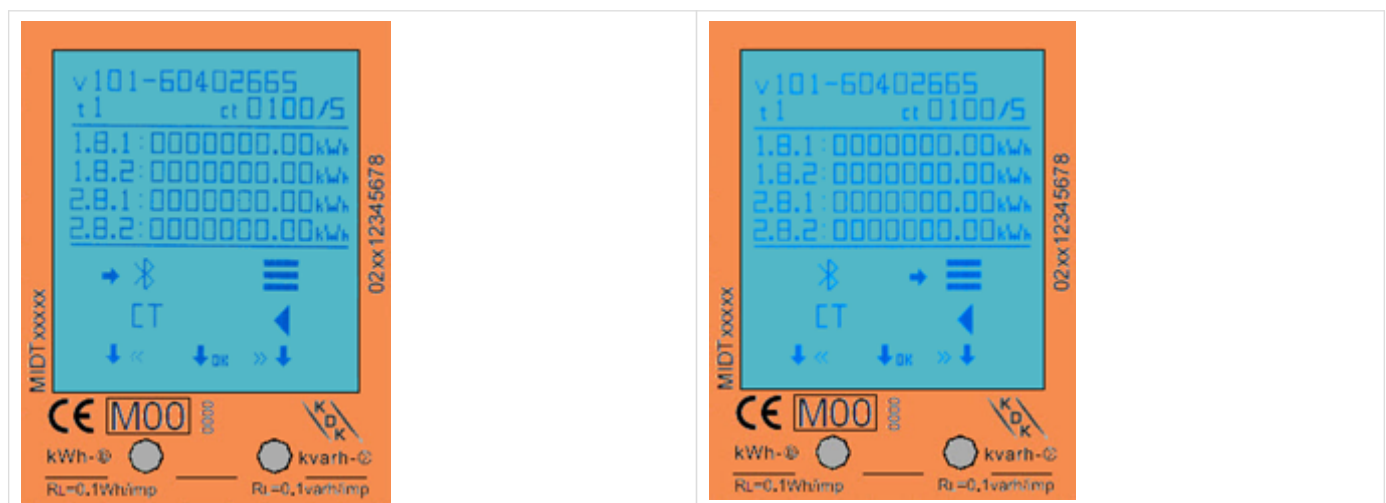
6. Adjust configuration via buttons on the meter

6.1. Configuration parameters

The following configuration settings must be used for use with FEMS:

Measuring transformer current ratio	.../5 e. g. 500/5 = 500 A.
RS485 Modbus address grid connection point	005
RS485 Modbus address PV generation	006
RS485 Modbus address — other generators/consumers	007...246
Baud rate for communication	9600
Parity	None

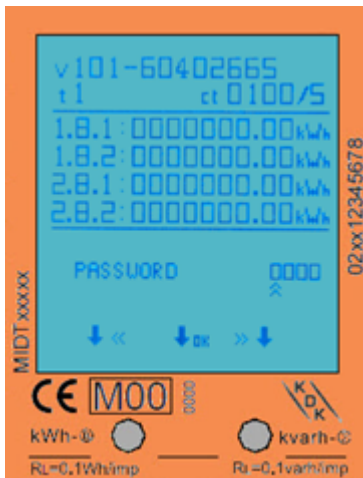
The symbol in the display, with three dashes, takes you to the actual menu where you can make adjustments to the counter settings. The arrow to the left, on the right in the picture, takes you back to the measured values.



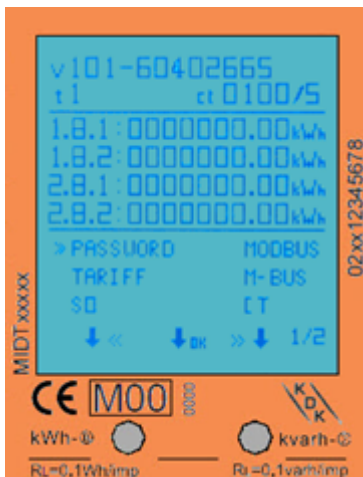
6.2. Password input

The settings can be made using the sensitive push-buttons on the front of the meter. Use the left and right buttons to scroll through the options. Confirm the setting with the middle button. Select the menu symbol (3 horizontal lines) to access the settings menu:

To access the settings menu, enter the 4-digit password (factory set to 0000). Confirm each digit (0-9) by pressing the middle button:



Once the password has been entered correctly, the settings menu appears:



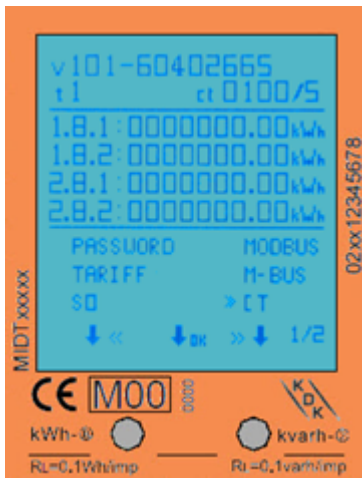
6.3. Input — Measuring transformer — Current ratio

The following steps describe the procedure for configuring the measuring transformer current ratio.

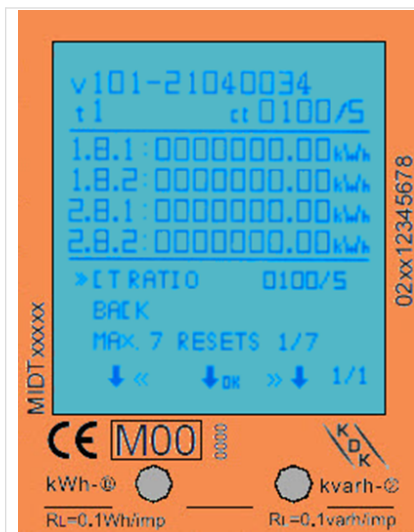
The primary current can be set to 0001 - 9999 A (with a secondary current of 1A) or 0005 - 9995 A (with a secondary current of 5 A). The secondary current can be set to /1A or /5A. A transformer ratio of CT=5/5A is preset at the factory.

You can store the transformer ratio under the CT menu item.

6.4. Input RS485 Modbus address



The transformer ratio (CT RATION) is displayed in the form XXXX/5 or XXX/1. You can read the CT ratio on site (e. g. on the type label).



6.4. Input RS485 Modbus address

To do this, use the sensitive touch buttons to go to the settings menu and select Modbus. Then navigate to Modbus ID and press the middle button; you can now use the right and left buttons to lock the values. When the desired Modbus address is displayed, press the middle button to confirm it.

Die werksseitig eingestellte Modbusadresse ist 001.
Folgende Adressen werden für die Kommunikation benötigt.

RS485 Modbus address grid connection point

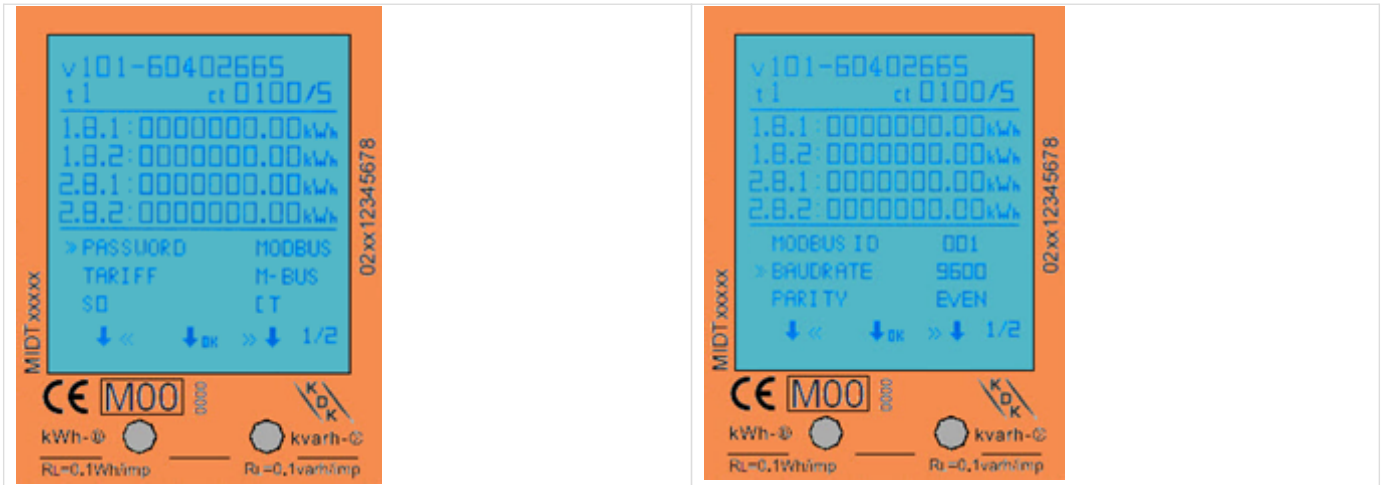
005

RS485 Modbus address PV generation

006

RS485 Modbus address — other generators/consumers

007...246



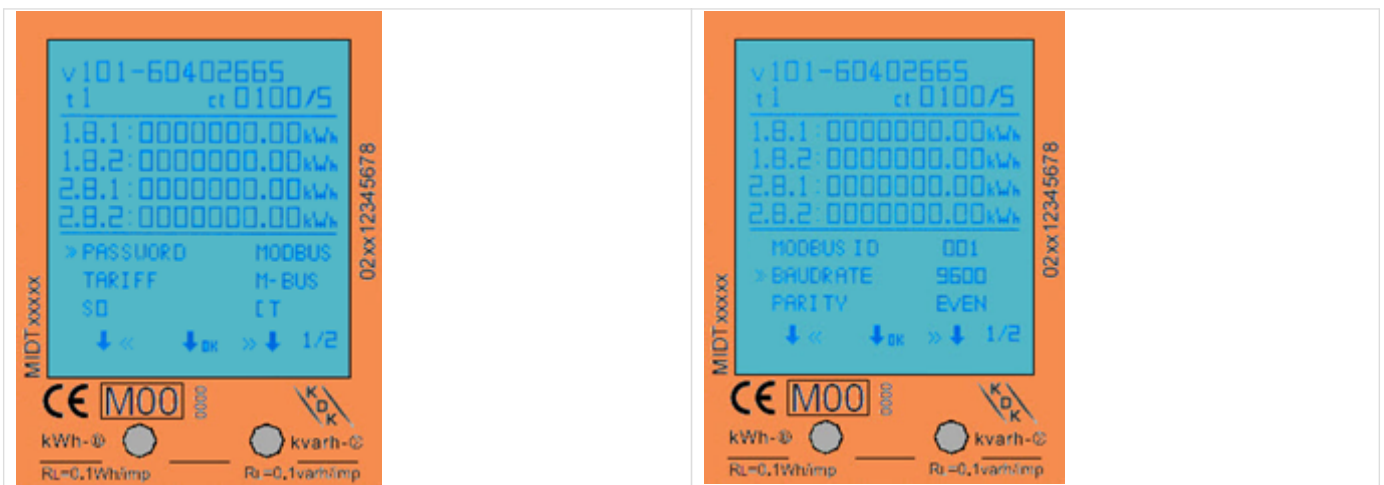
6.5. Communication speed input (baud rate)

To do this, use the sensitive touch buttons to go to the settings menu and select Modbus. Then navigate to Baud rate and press the middle button; you can now use the right and left buttons to lock the values. When the desired baud rate is displayed, press the middle button to confirm it.

Die werkseitig eingestellte Modbus®-Baudrate ist 9600 Bd. Kontrollieren Sie bitte die Baudrate.

Baud rate for communication

9600



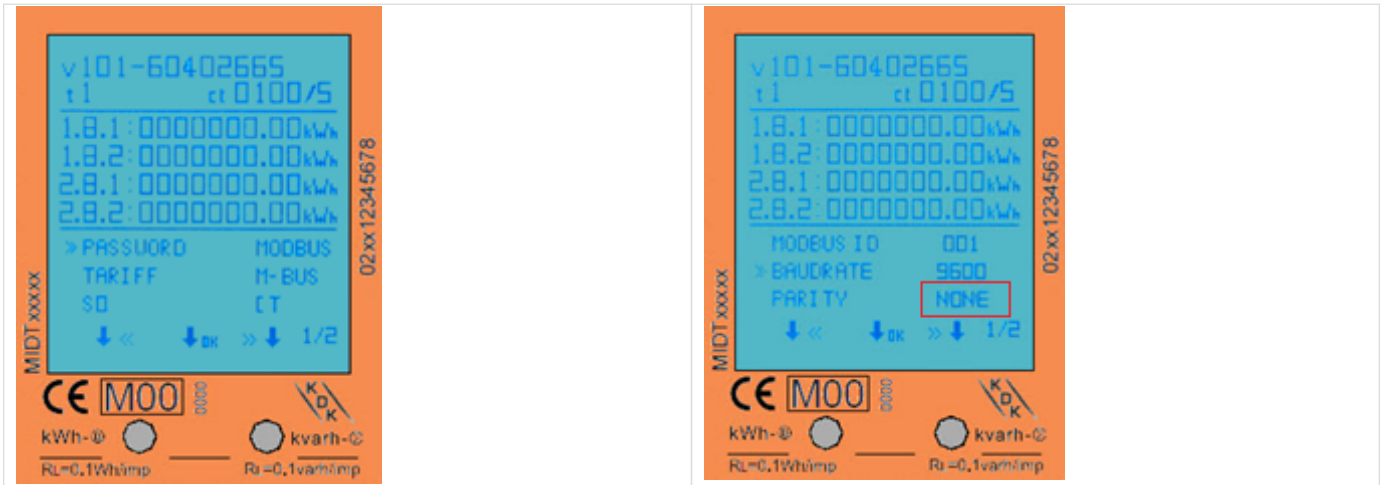
6.6. Communication parity input

To do this, use the sensitive touch buttons to go to the settings menu and select Modbus. Then navigate to Parity and press the middle button; you can now use the right and left buttons to adjust the setting. When the desired parity is displayed, press the middle button to confirm it.



The factory-set parity is EVEN. This must be changed to NONE.

6.6. Communication parity input



7. Bluetooth smartphone app



Alle Push-in-CAGE CLAMP® Zähler sind in der Lage, per Bluetooth® ausgelesen und konfiguriert zu werden. Der verwendete Standard ist BLE 4.2. Sie können die Smartphone-App für Android und IOS kostenlos in den jeweiligen Stores herunterladen. Die Smartphone-App finden Sie unter dem Namen KDK Meter Manager.

iOS



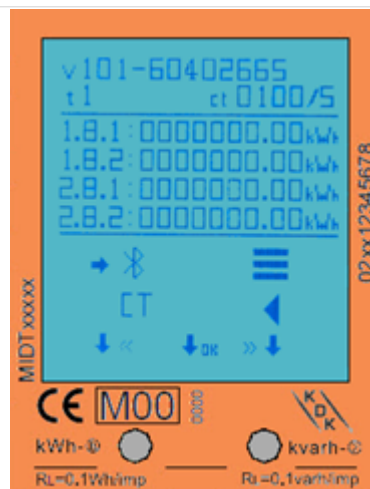
Below you will find a QR code for the explanatory video on how to activate Bluetooth and the options via the app:

7.1. Activating the BT interface on the meter



7.1. Activating the BT interface on the meter

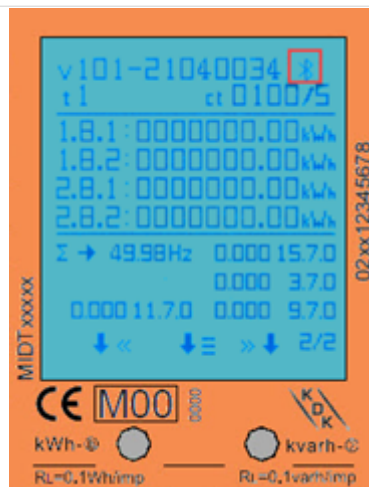
1. When the arrows >> point to the Bluetooth® symbol, briefly press the center button:



2. The Bluetooth® interface of the meter is now activated and ready for communication with the KDK Meter Configurator App. To establish the connection with the meter, scan the QR code via the camera of your smartphone or browse the Bluetooth® environment by selecting the corresponding menu item in the app.



3. When a Bluetooth® connection is established, the Bluetooth® symbol is shown at the top right of the display.



7.2. Bluetooth connection with the meter

1. Start the smartphone app. The desired language can be set in the settings menu (cogwheel) at the top right of the display.



2. The energy meter can be connected with the *Scan Bluetooth* or *Scan QR* function.

7.3. App - device page

- a. *Scan Bluetooth*: The app scans for all Bluetooth measuring devices in the vicinity.
Select the correct serial number for the connection.
- b. *Scan QR*: The app opens the camera of the cell phone to scan the QR code on the meter display. As soon as the code has been scanned, the meter is connected.

7.3. App - device page

The energy meter is now connected to the smartphone app. The meter type, serial number, software version and checksums are displayed on the device page.



7.4. App - reading the meter data

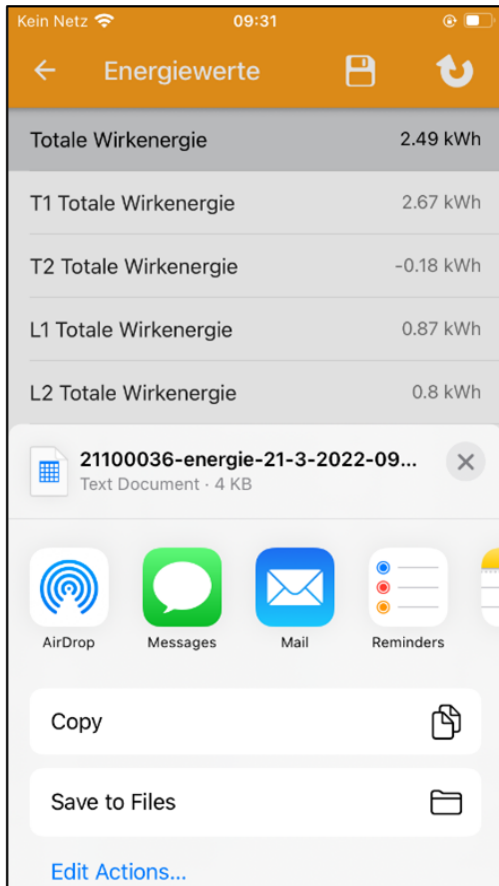
All energy values can be found under "Energy" and all instantaneous values under "Instantaneous".

Refresh the data using the refresh arrow in the top right-hand corner.

Kein Netz 09:29 ← Energiewerte   <table> <tr> <td>Totale Wirkenergie</td> <td>2.49 kWh</td> </tr> <tr> <td>T1 Totale Wirkenergie</td> <td>2.67 kWh</td> </tr> <tr> <td>T2 Totale Wirkenergie</td> <td>-0.18 kWh</td> </tr> <tr> <td>L1 Totale Wirkenergie</td> <td>0.87 kWh</td> </tr> <tr> <td>L2 Totale Wirkenergie</td> <td>0.8 kWh</td> </tr> <tr> <td>L3 Totale Wirkenergie</td> <td>0.81 kWh</td> </tr> <tr> <td>Wirkenergie Bezug</td> <td>3.19 kWh</td> </tr> <tr> <td>T1 Wirkenergie Bezug</td> <td>3.18 kWh</td> </tr> <tr> <td>T2 Wirkenergie Bezug</td> <td>0.01 kWh</td> </tr> <tr> <td>L1 Wirkenergie Bezug</td> <td>1.18 kWh</td> </tr> <tr> <td>L2 Wirkenergie Bezug</td> <td>1.02 kWh</td> </tr> <tr> <td>L3 Wirkenergie Bezug</td> <td>1 kWh</td> </tr> </table>	Totale Wirkenergie	2.49 kWh	T1 Totale Wirkenergie	2.67 kWh	T2 Totale Wirkenergie	-0.18 kWh	L1 Totale Wirkenergie	0.87 kWh	L2 Totale Wirkenergie	0.8 kWh	L3 Totale Wirkenergie	0.81 kWh	Wirkenergie Bezug	3.19 kWh	T1 Wirkenergie Bezug	3.18 kWh	T2 Wirkenergie Bezug	0.01 kWh	L1 Wirkenergie Bezug	1.18 kWh	L2 Wirkenergie Bezug	1.02 kWh	L3 Wirkenergie Bezug	1 kWh	Kein Netz 09:31 ← Momentanwerte   <table> <tr> <td>Spannung</td> <td>0 V</td> </tr> <tr> <td>L1 Spannung</td> <td>234.54 V</td> </tr> <tr> <td>L2 Spannung</td> <td>0 V</td> </tr> <tr> <td>L3 Spannung</td> <td>0 V</td> </tr> <tr> <td>Frequenz</td> <td>49.99 Hz</td> </tr> <tr> <td>Strom</td> <td>0 A</td> </tr> <tr> <td>L1 Strom</td> <td>0 A</td> </tr> <tr> <td>L2 Strom</td> <td>0 A</td> </tr> <tr> <td>L3 Strom</td> <td>0 A</td> </tr> <tr> <td>Totale Wirkleistung</td> <td>0 kW</td> </tr> <tr> <td>L1 Wirkleistung</td> <td>0 kW</td> </tr> <tr> <td>L2 Wirkleistung</td> <td>0 kW</td> </tr> </table>	Spannung	0 V	L1 Spannung	234.54 V	L2 Spannung	0 V	L3 Spannung	0 V	Frequenz	49.99 Hz	Strom	0 A	L1 Strom	0 A	L2 Strom	0 A	L3 Strom	0 A	Totale Wirkleistung	0 kW	L1 Wirkleistung	0 kW	L2 Wirkleistung	0 kW
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L2 Wirkleistung	0 kW																																																

Save the data using the electrical energy storage icon in the top right-hand corner. The data can be saved locally on the smartphone or forwarded via various channels such as e-mail, Bluetooth or other programs.

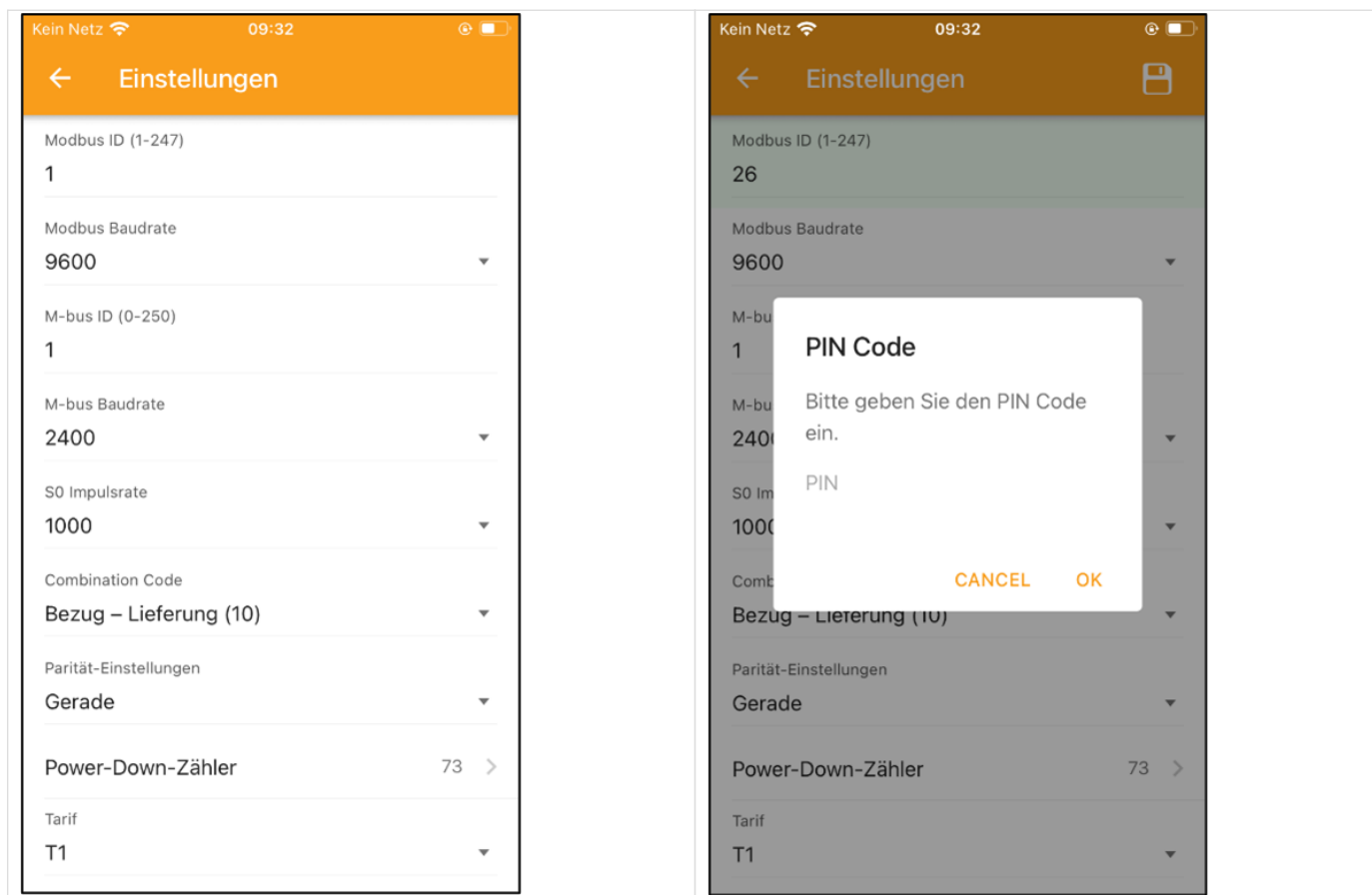
7.5. App - Changing meter parameters



7.5. App - Changing meter parameters

Settings can be selected individually and/or saved all at once.

1. Select the settings you want to change. The changed settings are highlighted in green.
2. Save the values via the storage disk in the top right-hand corner.
3. A pop-up menu for the password appears first. By default, the password is always 0000.
4. The password can only be changed on the meter using the buttons. After entering the correct password, the new settings are saved in the meter.



The following configuration settings must be used for use with FEMS:

Measuring transformer current ratio	.../5 e. g. 500/5 = 500 A.
RS485 Modbus address grid connection point	005
RS485 Modbus address PV generation	006
RS485 Modbus address — other generators/consumers	007...246
Baud rate for communication	9600
Parity	None

8. Troubleshooting

8. Troubleshooting

Problem	Possible cause	Check/solution
*The red consumption LED on the front is not flashing or the meter is not counting up.	There is no load connected to the meter or the load on the line is very low.	Connect a consumer load to the meter and use a measuring device e. g. ammeter to measure whether the load is present and the LED is flashing.
The meter is not counting.	No consumer load is connected to the meter.	Check whether the red consumption LED is flashing.
No pulse output.	The pulse output is not supplied with DC voltage. The pulse output is not connected correctly.	Use a voltmeter to check whether the external voltage source (Ui) is DC 5 - 27 V. Check whether the connection is correct: see section 6.6.3 S0 pulse output.
If none of the above points have led to a solution, please contact technical support. Phone: 02244 / 91994-47 E-mail: support@kdk-dornscheidt.com .		

The configuration is now complete.

9. Contact

For support, please contact:

FENECON GmbH
Gewerbepark 6
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10. Directories

10.1. List of illustrations

Figure 1. 420506PRO20-CT (2PU CT)

Figure 2. Dimensions

Figure 3. Terminal designations

Figure 4. Voltage tap

Figure 5. Connection between current transformer, meter, and metering point operator

Figure 6. Connection of the generator current transformer

Figure 7. Connection between current transformer and consumer load

Figure 8. RS-485 connection

Figure 9. Looping through RS-485 of several meters