



## Quick guide Technical parameters

**multimes**

### Three-phase network measuring device

**F144-2-LED-ESMS...-5**



**Your partner for  
network analysis**

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## Dear customer,

Thank you for choosing a KBR product.

To familiarize yourself with the operation and configuration of the device, we recommend that you read this manual carefully. This will enable you to make use of the full range of functions that this high-quality product has to offer.

The individual chapters explain the technical details of the device and show you how to install and start it up properly to avoid damage.

This user manual is included in the scope of delivery of the device and must be accessible to the user at all times (e.g. in the switchgear cabinet). Even if the device is resold to third parties, the manual remains an inherent part of the device.

Although the utmost care has been taken in writing this user manual, errors may still occur. We would be very grateful if you would notify us of any errors or unclear descriptions you may notice.

Yours sincerely,

KBR GmbH Schwabach

This manual contains notes that must be observed for your personal safety and to prevent damage to the equipment. These notes are identified by a warning sign or information symbol, depending on the degree of hazard they warn about.



### DANGEROUS VOLTAGE

This means that death, serious physical injury or considerable property damage will occur if the appropriate safety precautions are not taken.



### CAUTION

This means that minor physical injury or property damage may occur if the appropriate safety precautions are not taken.



### NOTE

This is an important piece of information about the product, the handling of the product or the relevant part of the user manual to which particular attention should be drawn.

## Disclaimer

The contents of this document have been checked using the hardware and software described. However, deviations cannot be ruled out, meaning that no guarantee can be made for complete agreement. The information provided in this manual is checked on a regular basis; any corrections necessary will be included in the next revision.

We appreciate your corrections and comments.

## Safety instructions

In order to prevent operating errors, handling of the device has been kept as simple as possible. This will enable you to start use the device quickly. Be sure to carefully read the following safety instructions.

**DANGEROUS VOLTAGE****The applicable DIN/VDE regulations must be observed during installation!**

Connection to the mains, commissioning and operation of the device may only be carried out by qualified personnel. Qualified personnel as defined in the safety instructions in this user manual are personnel with electrical engineering qualifications, knowledge of the national accident prevention regulations and safety engineering standards as well as of the installation, commissioning and operation of the device.

To prevent fire and electric shock, do not expose the device to rain or moisture! Before connecting the device to the power supply, check whether the local power supply conditions comply with the specifications on the device name-plate.

Incorrect connection may result in the destruction of the device!

When connecting the device, adhere to the information given in the connection diagram (see "Connection diagram") and that the connecting cables are not live. When wiring, always ensure that all cables used are neither damaged nor faulty

and observe correct polarity!

To ensure proper and safe operation of the device, ensure that it is transported, stored, installed, assembled, and carefully operated and maintained in accordance with the specifications.

If the device has any visible damage it is considered unfit for use and must be disconnected from the power supply! Troubleshooting, repairs and maintenance work may only be carried out at our plant or after contacting our customer service team.

Unauthorized opening of the device will render your warranty null and void. Correct functioning can no longer be guaranteed!

Opening the device may expose live parts. Capacitors in the device may still be charged, even if the device has been disconnected from all power sources. Do not operate open devices under any circumstances!

All input and output cables of systems that are at risk from lightning strikes must be fitted with lightning protection (see chapter "Protective measures" for recommendations).

Do not connect external power sources to terminals 36-39, 60-63 or 90-92. Only apply safe-to-touch extra-low voltage in accordance with UL/CSA/IEC 61010-1 to terminals 34 and 35. See technical data for maximum values.

## Product liability

### **You have purchased a high-quality product.**

Only components of the highest quality and maximum reliability are used.

Each device is subject to long-term testing before delivery.

For details on product liability, please refer to our general terms and conditions for electronic equipment.

The warranty on device characteristics only applies if the device is operated in accordance with its intended use!

## Disposal

Devices that are faulty, obsolete or no longer used must be properly disposed of.

If required, we will dispose of the device for you.

## Scope of delivery

### **Included in the scope of delivery:**

- Measuring device
- Connector set
- Quick-start guide
- Mounting material for the housing

# 1 Device memory

The device is equipped with internal data memory (flash). After uninterrupted charging (device connected to the power supply) for approx. 100 hours, the buffer capacitor will have sufficient charge to protect the internal clock from failure due to disconnection from the power supply for approx. 7 days.



## NOTE

If the capacitor is discharged and it is not connected to a power source, the time settings will be lost and will need to be reset!

## 2 Connecting the multimes F144-2-LED-ESMS...-5

### 2.1 Installation and assembly

- The applicable VDE regulations must be observed during installation!
- Before connecting the device to the power supply, check whether the local mains power supply conditions comply with the specifications on the nameplate. Incorrect connection may result in the destruction of the device. A different mains frequency can also affect the measurement.
- Connect the device in accordance with the connection diagram.
- The power supply input of systems that are at risk from lightning strikes must be equipped with suitable lightning protection.

### 2.2 Installation

**Installation site:** The device is designed to be installed in fixed and weather-proof switchboards. Conductive switchboards must be grounded.

**Installation position:** Vertical

**Fixing:** Using the clamps provided, the device is attached to the switchboard from behind.

**CAUTION**

The control voltage as well as the applied measuring voltage of the device must be protected using a back-up fuse.

When connecting the current transformers, pay attention to the direction of energy flow and the correct assignment to the voltage paths!

**Power supply:** The electrical installation of the building must have a disconnect or circuit-breaker for the power supply voltage.

The disconnect must be close to the device and be easily accessible to the user.

It must be marked as an isolating switch for this device.

The isolating switch must be UL/IEC-approved.

**Voltage measurement:**

The disconnect must be close to the device and be easily accessible to the user.

It must be marked as an isolating switch for this device. The isolating switch must be UL/IEC-approved.

**CAUTION**

- Do not apply DC voltage to the voltage measurement input.
- The device is not suitable for DC voltage measurement.
- Attach the current transformer terminal to the device using the two screws provided.
- Never operate open external unloaded current transformers. Always short-circuit them. Risk of injury due to high voltages and electrical currents.

For the wiring of the pulse output, we recommend that you only use shielded twisted pair cables to avoid interference (e.g. installation line I-Y(ST) Y 2 x 2 x 0.8 mm<sup>2</sup>, with the shielding only connected on one side).

During installation, please also observe our safety instructions to protect against overvoltage and lightning in the "Protective measures" chapter of this manual.



#### NOTE

The following points must be taken into account when connecting the device to the three-phase network you want to measure:

- Direction of energy flow
- Assignment of measuring voltage input/current transformer input

#### Rotary field:

The device can be operated with a clockwise or anti-clockwise rotary field. When power supply to the device is switched on, the multimes F144-2-LED-ESMS...-5 automatically checks the direction of rotation. Rotary field check:

- Only connect the measuring voltage to the device ( $U_{\text{meas}}$  see nameplate).
- Switch the device on by connecting the power supply cable voltage to the power supply connections (L and N). The device checks the power supply's direction of rotation immediately after being switched on.
- The rotary field is displayed in the in the Rot.field submenu of the  $U_{\text{PH-PH}}$  menu.
- For a clockwise rotary field, the display shows L1 0, L2 120 and L3 240 degrees.
- If you want to change the direction of rotation from clockwise to anti-clockwise, simply swap two terminals, i.e. two phases, then switch the device OFF and ON again. The display now shows the correct voltage and the device starts measuring automatically.
- Check again whether the assignment of the voltage path L1 and the current path L1 as well as all other phases are still correct.

**Current transformer connection:**

- Direction of energy flow:

When installing the transformers, observe the direction of current flow or energy flow. If the current transformer is installed the wrong way, the sign of the measured value will be inverted.

A prerequisite for this is that energy is supplied to the device.

- Assigning the measuring voltage input/current transformer input:

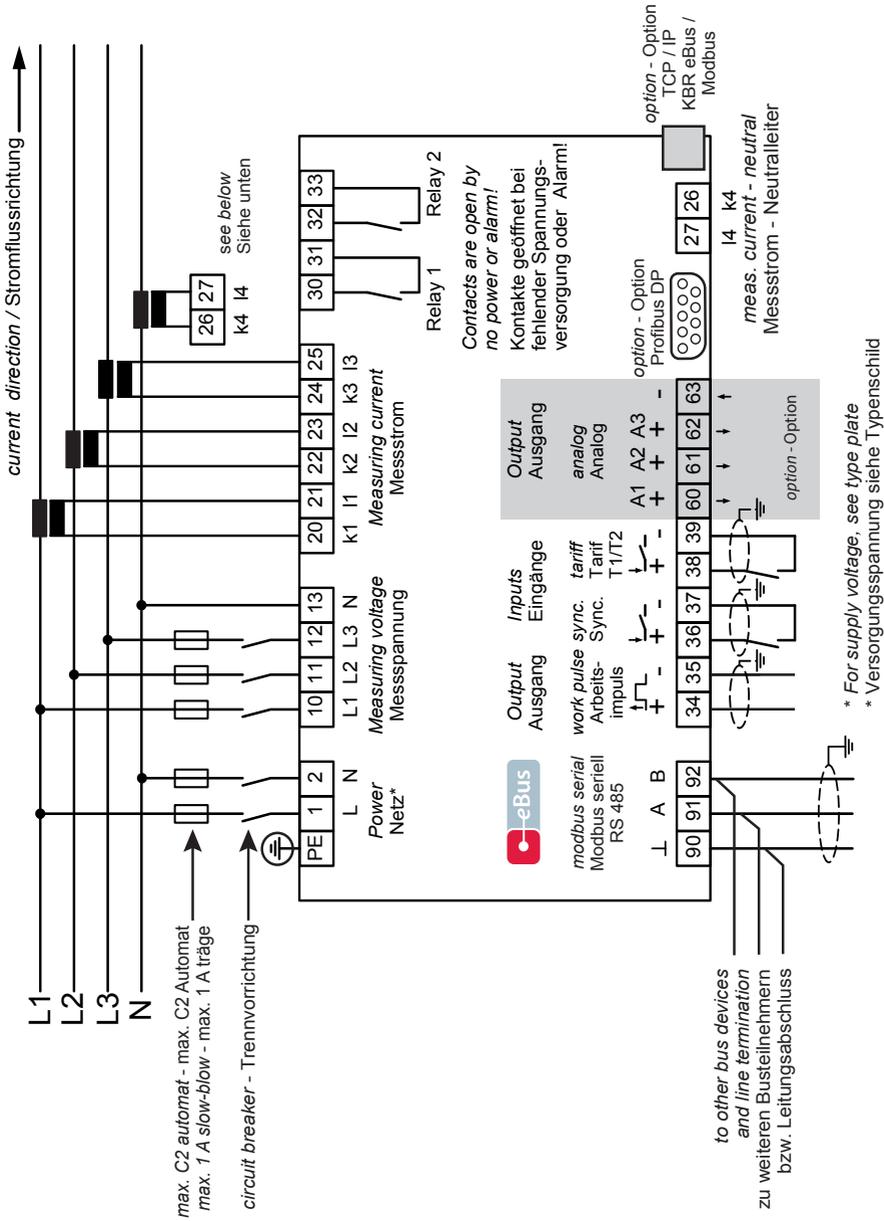
The current transformer on terminal 20/21 (k1/l1) must be installed in the phase in which the measuring voltage for terminal 10 (L1) is measured. The same applies to the other transformer and measuring voltage connections.

- You can check the phase sequence as follows using the multimess F144-2-LED-ESMS...-5:
  - Go to the main menu "I"
  - Connect the current transformer to the corresponding wires
  - If the connection and direction of energy flow are correct, the device will only display positive currents.
  - If the device is connected incorrectly, all currents displayed will be negative. In this case, swap the connections until the display shows the correct values.

**CAUTION**

The current transformers must be shorted before swapping the connections!

### 2.3 Connection diagram



## 2.4 Terminal assignment

Terminal	
PE	Protective earth
1 (L) and 2 (N):	<p><b>Power supply connection</b></p> <p>A control voltage is required to supply the device with power. The device has a multi-range power supply unit and can be supplied with different voltages (see nameplate).</p>
10 (L1) 11 (L2) 12 (L3) 13 (N)	<p><b>Voltage measurement inputs</b></p> <p>Three-phase voltage measurement in 3-wire and 4-wire three-phase networks. Direct measurement for 3x 5 - 100 - 120 V AC or 3x 20 - 500 - 600 V AC. The measuring range is configurable. If the measuring range is exceeded, an error message is displayed. For higher voltages, the device needs to be connected via a voltage transformer.</p>
20 (k1) and 21 (l1) 22 (k2) and 23 (l2) 24 (k3) and 25 (l3)	<p><b>Current measurement inputs</b></p> <p>The current measurement inputs must be connected via current transformers x/1 A AC or x/5 A AC.</p> <p>When connecting transformers, pay attention to the direction of energy flow and the correct assignment of measuring voltage inputs to the current transformers.</p>
26 (k4) and 27 (l4)	<p><b>Current measurement input for the neutral conductor</b></p> <p>The current measurement input for the neutral conductor must be connected via current transformers x/1 A AC or x/5 A AC.</p>
30 and 31:	<p><b>Floating relay contact relay 1</b></p> <p>This contact serves as a message or alarm output. During operation, an acoustic or visual message can be activated or a consumer switched off using this relay. The contact is open as long as the device is dead as well as when there is an active message. Maximum switching capacity 2 A at 250 V AC (not safe to touch).</p>
32 and 33:	<p><b>Floating relay contact relay 2</b></p> <p>See description of floating relay contact relay 1</p>
90 (ground) 91 (A) 92 (B):	<p><b>Interface connection</b></p> <p>For KBR-eBus or Modbus communication.</p>

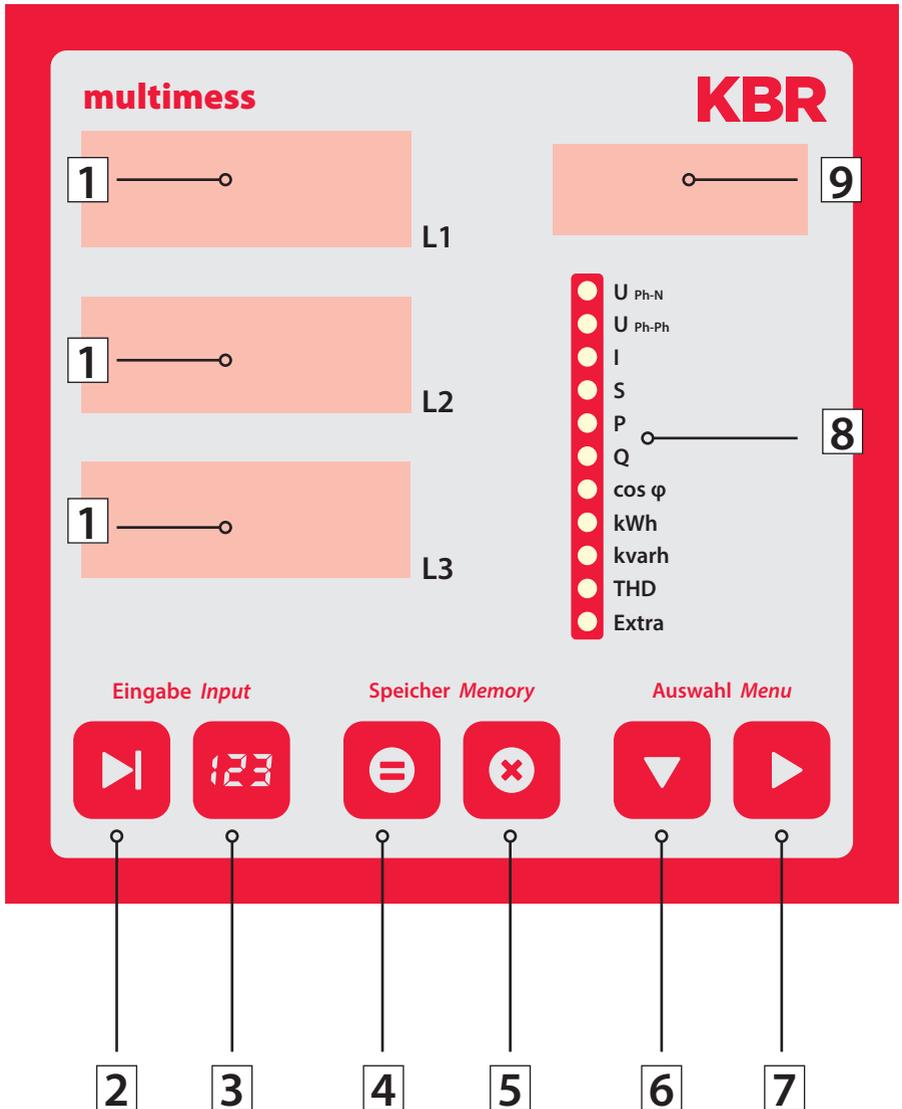
**Terminal**

34 (+) and 35 (-):	<b>Pulse output</b> Output of energy-proportional pulses via a digital contact (S0 interface in accordance with DIN 43864). Ensure that the output has the right polarity. The output signals can be processed by a maximum-demand monitor or a master central process control, for example.
36 (+) and 37 (-):	<b>Synchronization input</b> A floating contact, e.g. from the energy supplier, can be connected to this input to synchronize the measurement period
38 (+) and 39 (-):	<b>Tariff switching input</b> A floating contact, e.g. from the energy supplier, can be connected to this input to switch from high to low tariff.
60, 61, 62 (+) and 63 (-):	<b>Analog outputs (optional)</b> These three outputs can be used to output various parameters as analog values, either between 0 - 20 mA or 4 - 20 mA or between 0 - 10 V and 2 - 10 V. Depending on which parameter you wish to output, you can assign a certain phase (L1, L2, L3) or its whole value to the analog output. See the table in the menu Analog outputs (9.17) for further output values.

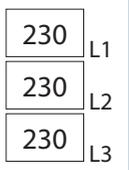
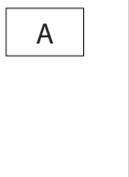
**NOTE**

The negative pole of the synchronization input, the tariff input and the analog outputs are internally connected to PE (protective earth).

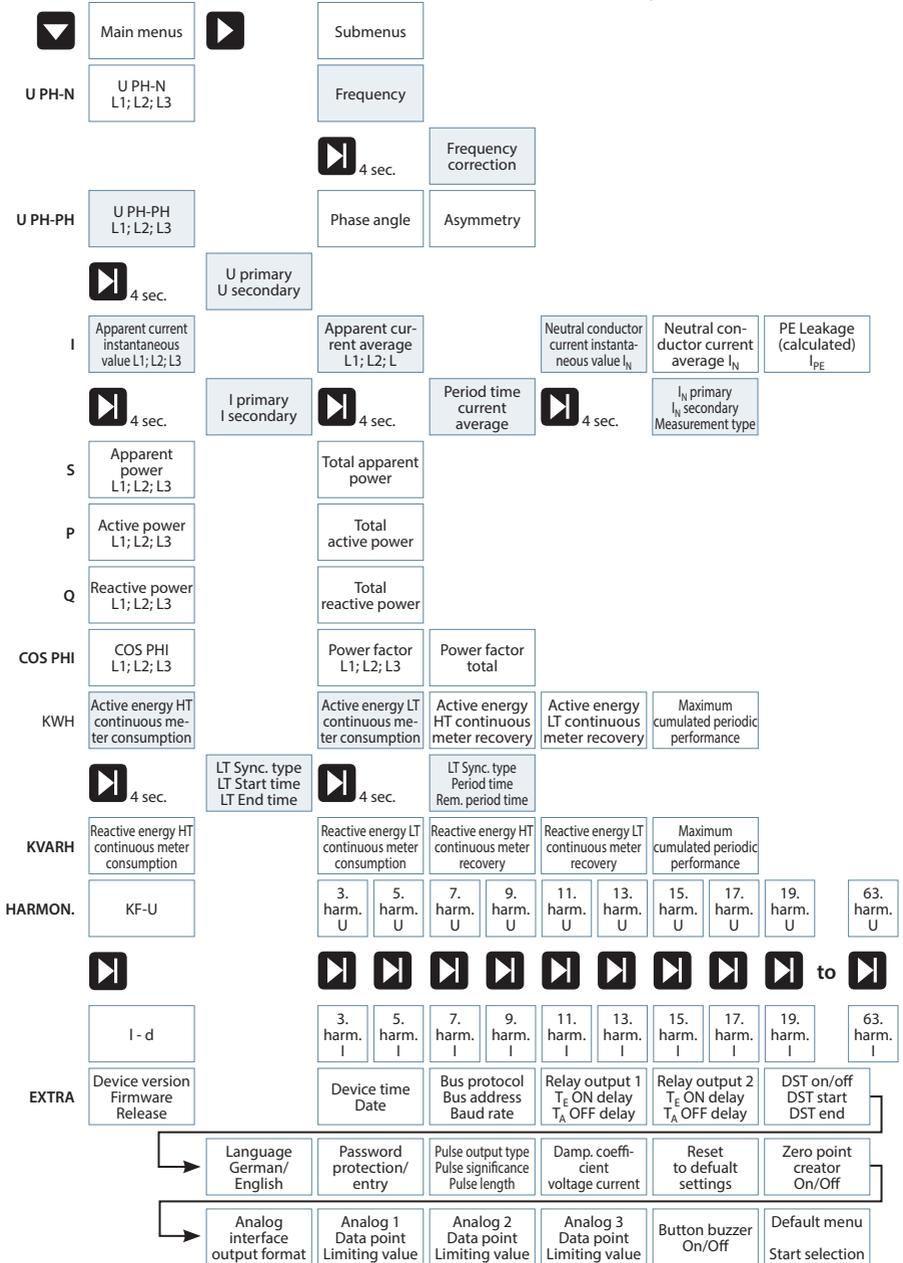
### 3 Control and display panel



### 3.1 Description of sensor buttons and displays

<p><b>1</b></p>		<p>Three 4-digit 7-segment displays are used to display the measured, stored and programmed values (3-phase; L1-L2-L3).</p>
<p><b>2</b></p>		<p>Starts the programming mode and switches between the segments to be edited in <b>1</b> and <b>9</b>. When you select a segment to edit it, it starts flashing.</p>
<p><b>3</b></p>		<p>In programming mode, this changes the flashing value to <b>1</b> or the decimal point to <b>1</b> and the unit prefix to <b>9</b>.</p>
<p><b>4</b></p>		<p>Display for saved minimum and maximum values. In programming mode, this saves the parameters or values entered.</p>
<p><b>5</b></p>		<p>Deletes the values displayed by pressing , e.g. outliers, energy etc. In programming mode, you can use this button to cancel programming without applying any changes.</p>
<p><b>6</b></p>		<p>Selects one of the 11 main menus or jumps back from a submenu to the current main menu. Hold the button to automatically switch between the main menus. In programming mode, you can use this button to switch between the input fields L1, L2 and L3.</p>
<p><b>7</b></p>		<p>Takes you to the corresponding submenu.</p>
<p><b>8</b></p>		<p>There are 11 green LEDs, one for each main menu. A steady LED indicates the currently selected menu. If an LED is flashing, a limit in the corresponding menu has been violated, but the LED does not flash if the limit violation occurred in the menu currently being displayed.</p>
<p><b>9</b></p>		<p>The 4-digit 15-segment display shows information and the dimensions of the values in <b>1</b>. When reading the saved outliers, the display switches between the unit and MIN for minimum value or MAX for maximum value. This principle also applies to the other menus and will be described in the respective sections of this manual.</p>

# 4 Navigation and device displays



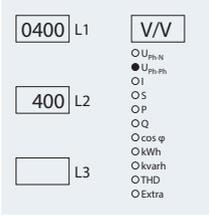
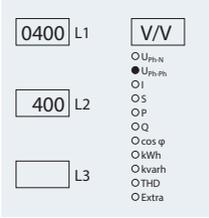
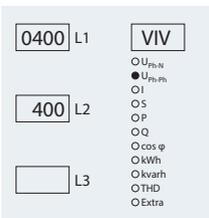
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## 5 Setting the operating parameters

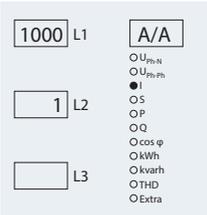
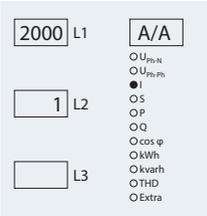
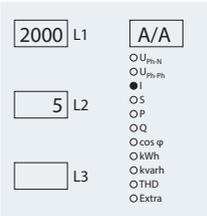
### 5.1 General programming scheme

	<ul style="list-style-type: none"> <li>▪ Press this button for 4 seconds to switch to programming mode from a main menu or submenu. The current parameters are displayed.</li> <li>▪ Press this button again to activate parameter input mode.</li> <li>▪ This button is also used to switch from one screen to the next when entering values.</li> </ul>
	<ul style="list-style-type: none"> <li>▪ Value input.</li> </ul>
	<ul style="list-style-type: none"> <li>▪ In programming mode, switch between input fields L1, L2, L3 or go to the submenu.</li> </ul>
	<ul style="list-style-type: none"> <li>▪ In programming mode, press this button to switch between input fields L1, L2 and L3.</li> <li>▪ It is also used to return to the main menu after saving changes or exiting programming mode.</li> </ul>
	<ul style="list-style-type: none"> <li>▪ This button is used to save changes.</li> </ul>
	<ul style="list-style-type: none"> <li>▪ Press this button if you want to exit programming mode without applying any changes.</li> </ul>

## 5.2 $U_{Ph-Ph}$ - measuring reference voltage/rated mains voltage

Menu	Button(s)	Device display	Description
<b>Main menu</b> <b>UPh-Ph</b>			
Sub menu Set voltage transformer ratio	 Press and hold button for 4 seconds   Start input mode		<p>When you open the menu, the following text is shown on the display: VOLTAGE TRANSFORMER UPRI/ USEK V/V</p> <p>Display L1 shows the primary voltage.</p> <p>Display L2 shows the secondary voltage.</p>
Submenu Voltage Set primary transformer ratio	 Change value or  Next digit or  Cancel or  Save		<p>The first digit on display L1 flashes. Press the  button to set the number for this segment.</p> <p>Press the  button to go to the next digit.</p> <p>Once all of the digits have been set, display L1 flashes. To move the decimal point, press the  button</p>
 <b>NOTE</b>	 or 	Use these buttons to switch between the individual displays in input mode (one digit flashes).	
Submenu Voltage Set secondary transformer ratio	 Change value or  Next digit or  Cancel or  Save		<p>The first digit on display L2 flashes. Press the  button to set the number for this segment.</p> <p>Press the  button to go to the next digit.</p> <p>The value can be set between 1 V and 600 V.</p>
 <b>NOTE</b>	    or 	<p>Return to main menu.</p> <p>Continue to the next submenu, if available, or return to the main menu.</p> <p>Use these buttons to switch between the individual displays in input mode (one digit flashes).</p>	

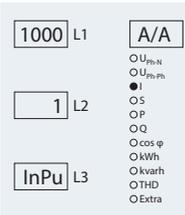
### 5.3 I - Current transformer ratio

Menu	Button(s)	Device display	Description
Main menu I			
Submenu Current Set transformer ratio	 Press and hold button for 4 seconds  Start input mode		When you open this menu, the following text is shown on the display: A/A CURRENT TRANSFORMER IPRI / ISEK A/A Display L1 shows the primary current. Display L2 displays the secondary current.
Submenu Current Transformer ratio Set primary	 Change value or next digit  or  Cancel or  Save		The first digit on the display L1 flashes. Press the  button to set the number for this segment. Press the  button to go to the next digit. Once all of the digits have been set, display L1 flashes. To move the decimal point, press the  button
 NOTE	 or 	Use these buttons to switch between the displays in input mode (one digit flashes).	
Submenu Current Set secondary transformer ratio	 Change value or next digit  Cancel or  Save		The first digit on display L2 flashes. Press  to switch between 1 A and 5 A.
 NOTE	   or 	Return to main menu. Continue to the next submenu, if available, or return to the main menu. Use these buttons to switch between the displays in input mode (one digit flashes).	

### 5.4 I<sub>N</sub>- Current transformer ratio

Menu	Button(s)	Device display	Description
<b>Main menu I</b>			
Submenu current I <sub>N</sub> Set transformer ratio	<p> Press and hold button for 4 seconds</p> <p> Start input mode</p>		<p>When you open this menu, the following text is shown on the display: A/A CURRENT TRANSFORMER I<sub>N</sub> PRI/ISEK A/A</p> <p>The display L1 shows the primary current.</p> <p>Display L2 displays the secondary current.</p> <p>Display L3 shows the measurement type.</p> <p>CALC = calculated</p> <p>INPU = transformer input terminal 26 (k4) and 27 (I4)</p>
Submenu current I <sub>N</sub> Set primary transformer ratio	<p> Change value or</p> <p> next digit</p> <p>or</p> <p> Cancel</p> <p>or</p> <p> Save</p>		<p>The first digit on display L1 flashes. Press the  button to set the number for this segment.</p> <p>Press the  button to go to the next digit.</p> <p>Once all of the digits have been set, display L1 flashes.</p> <p>To move the decimal point, press the  button</p>
 <b>NOTE</b>	or	Use these buttons to switch between the displays in input mode (one digit flashes).	
Submenu current I <sub>N</sub> Set secondary transformer ratio	<p> Change value or</p> <p> Cancel</p> <p>or</p> <p> Save</p>		<p>The first digit on display L2 flashes. Press  to switch between 1 A and 5 A.</p>
 <b>NOTE</b>	or	Use these buttons to switch between the displays in input mode (one digit flashes).	

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Menu	Button(s)	Device display	Description
	 		
Submenu current $I_N$ Set measurement type	 Change value or  Cancel or  Save		Display L3 flashes. Press the  button to set the number. Display L3 shows the measurement type. CALC = calculated INPU = transformer input terminal 26 (k4) and 27 (l4)
 <b>NOTE</b>	    or 	Return to main menu. Continue to the next submenu, if available, or return to the main menu. Use these buttons to switch between the displays in input mode (one digit flashes).	

## 6 Default settings after a reset (delivery state)

Primary voltage/secondary voltage	400 V / 400 V
Primary current/secondary current	5 A / 5 A
Measuring current averaging time	10 minutes
Primary/secondary neutral conductor	5 A / 5 A
Neutral conductor measurement type	calc (calculated)
Neutral conductor averaging time	10 minutes
Measurement period time	15 minutes
Daylight saving time	from months 03 to 10
Off-peak time	Changeover via bus communication
Damping coefficient for current and voltage	DF 0 (no damping)
Energy pulse	P (active power for consumption), 1 (1,000) pulse /kWh, pulse length 100 ms
Alarm relay	On delay tON = 0 sec Off delay tOFF = 0 sec
Analog outputs	Deactivated
Measurement period synchronization	Internal
Password	9999/all functions can be accessed
Period entries in the load profile memory	35136 inputs (8x 4392)
Button buzzer	On
Limit hysteresis	01 %
Default menu Start selection	activated, 02 ( $U_{Ph-Ph}$ )

### Unaffected by a RESET:

1. Bus communication
2. Time
3. Language

## 7 Setting range

The following setting ranges are available for configuration of the unit:

Measuring voltage, primary	1 V to 9999 kV
Measuring voltage, secondary	100 V to 500 V
Measuring current, primary	1 A to 99.99 kA
Measuring current, secondary	1 A or 5 A
Average measuring current and neutral conductor current	Averaging period 1 to 15 minutes
Neutral conductor current, primary	1 A to 99.99 kA
Neutral conductor current, secondary	1 A or 5 A
Neutral conductor measurement type	Calculated (calc) or measured (transformer input)
Measuring voltage Frequency tracking	Auto (automatically 45 to 65 Hz), fixed 50 Hz, fixed 60 Hz
Measurement period time	1, 15, 30, 60 minutes (via KBR eBus)
Measurement period synchronization	dig. Input, internal clock, KBR eBus, rate changeover
Low-tariff time	dig. Input, internal clock, KBR eBus at internal: Starting time hh:mm End time hh:mm
Daylight saving time (start or end)	Month 01 to month 12
Language	German, English
Damping coefficient for current and voltage display	dF 0 (no damping) to 6 (highest damping)
Energy pulse output	Active power or reactive power, each consumption or recovery
Pulse value	0.001 to 9999 Imp/kWh or /kBh
Pulse length	30 to 990 ms
Harmonics limits	0 % to 100 %
Alarm relay delay	On delay FTS      0 to 255 sec. Off delay FTS      0 to 255 sec.
Password	4-digit number, 9999 means all functions are freely accessible
Time, date	Setting hh:mm, dd:mm:yyyy

Continued

Button buzzer	On/Off
Zero-point creator	On/Off
Bus protocol	KBR eBus serial, Modbus serial, KBR eBus TCP, Modbus TCP, Profibus
Bus parameters KBR eBus serial	Scan mode, bus address 1 to 9999
Bus parameters Modbus serial	Bus address 1 to 247; Parity no, even, odd; Bus protocol 19200, 9600, 4800 baud; Transmission type RTU or ASCII
Bus parameters Modbus TCP (optional)	Bus address cannot be changed
Bus parameters KBR eBus TCP (optional)	Scan mode, bus address 1 to 9999
Bus parameters Profibus (optional)	Bus address 1 to 126
Analog interfaces 1 to 3	Output format: 0 to 20 mA, 4 to 20 mA 0 to 10 volts, 2 to 10 volts. See table for data points "Configuration of analog outputs" (Menu: Extra - Analog outputs). Lower limit, upper limit
Limit hysteresis (in the Limit value configuration submenu)	1 % to 99 %
Default menu (start selection)	Menu 01 to 11 ( $U_{PH-N}$ to Extra), deactivatable (display ----)

# 8. Programming

## 8.1 Setting the bus address

Menu	Button(s)	Device display	Description
Main menu Extra  eBus submenu	Start input mode (bus scan)	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">0001</div> <div style="margin-right: 5px;">L1</div> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">EBUS</div> <div style="font-size: 8px; margin-left: 5px;"> <ul style="list-style-type: none"> <li>○ U<sub>PH,N</sub></li> <li>○ U<sub>PH,PH</sub></li> <li>○ I</li> <li>○ S</li> <li>○ P</li> <li>○ Q</li> <li>○ cos φ</li> <li>○ kWh</li> <li>○ kvarh</li> <li>○ THD</li> <li>● Extra</li> </ul> </div> </div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">38.4</div> <div style="margin-right: 5px;">L2</div> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px; width: 30px; height: 20px;"></div> <div style="margin-right: 5px;">L3</div> </div> </div>	Display L1 shows the device address. The baud rate is displayed on display L2.
eBus submenu  Assign address	Start input mode	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">SCAN</div> <div style="margin-right: 5px;">L1</div> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">EBUS</div> <div style="font-size: 8px; margin-left: 5px;"> <ul style="list-style-type: none"> <li>○ U<sub>PH,N</sub></li> <li>○ U<sub>PH,PH</sub></li> <li>○ I</li> <li>○ S</li> <li>○ P</li> <li>○ Q</li> <li>○ cos φ</li> <li>○ kWh</li> <li>○ kvarh</li> <li>○ THD</li> <li>● Extra</li> </ul> </div> </div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">38.4</div> <div style="margin-right: 5px;">L2</div> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px; width: 30px; height: 20px;"></div> <div style="margin-right: 5px;">L3</div> </div> </div>	Display L1 indicates that the device is in scan mode.  As soon as the device is recognized at the KBR-eBus, an address is assigned automatically by the software and the address is entered in the device memory.  The baud rate is displayed on display L2.
 <b>NOTE</b>	or	Use these buttons to switch between the individual displays in input mode (one digit flashes).	
eBus submenu  Assign address manually	Change value or Next digit or Cancel or Save	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">0001</div> <div style="margin-right: 5px;">L1</div> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">EBUS</div> <div style="font-size: 8px; margin-left: 5px;"> <ul style="list-style-type: none"> <li>○ U<sub>PH,N</sub></li> <li>○ U<sub>PH,PH</sub></li> <li>○ I</li> <li>○ S</li> <li>○ P</li> <li>○ Q</li> <li>○ cos φ</li> <li>○ kWh</li> <li>○ kvarh</li> <li>○ THD</li> <li>● Extra</li> </ul> </div> </div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">38.4</div> <div style="margin-right: 5px;">L2</div> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px; width: 30px; height: 20px;"></div> <div style="margin-right: 5px;">L3</div> </div> </div>	The first digit on display L1 flashes. Press the  button to set the number for this segment.  Press the  button to go to the next digit.
 <b>NOTE</b>	 	Return to main menu.  Continue to the next submenu, if available, or return to the main menu.	

## 8.2 Setting the bus protocol

Menu	Button(s)	Device display	Description
eBus submenu	Start input mode (bus scan)		Display L1 shows the device address. The baud rate is displayed on display L2. The unit display shows the current bus protocol (e.g. KBR-eBus)
eBus submenu Assign address	Start input mode		Display L1 indicates that the device is in scan mode.  Press the  button to enter the input mode for setting the bus protocol.
eBus submenu Changing the bus protocol	To change the bus protocol Changing the bus protocol		The first digit on display L1 flashes. The bus protocol display flashes (EBUS). The button  can be used to change the bus protocol, for example: KBR-eBus (serial) Modbus RTU (serial) Modbus TCP (optional) KBR-eBus TCP (optional) Profibus (optional)
eBus submenu Save bus protocol	Cancel or Save		The display indicates the selected bus protocol, e.g. Modbus RTU. The baud rate is displayed on display 2. Display 3 shows the Modbus protocol (RTU).
 NOTE	 	Return to main menu. Continue to the next submenu, if available, or return to the main menu.	

### 8.3 Setting the Modbus bus address and baud rate

Menu	Button(s)	Device display	Description
Modbus submenu	Start input mode		Display L1 shows the device address. The baud rate is displayed on display L2. Display L3 shows the selected bus protocol (RTU or ASC).
Modbus submenu Assign address	Change value or Next digit or Cancel or Save		The first digit on display L1 flashes. Press the  button to set the number for this segment. Press the  button to go to the next digit.
NOTE	or	In input mode (one digit flashes) you can switch between the displays with these buttons.	
Modbus submenu Assign transmission mode	Next mode or Cancel or Save		Display L3 flashes. Press the  button to choose between the different modes (RTU or ASC).
NOTE	or	In input mode (one digit flashes) you can switch between the individual displays with these buttons.	

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<p>Modbus submenu</p> <p>Assign baud rate</p>	<p> Next Baud rate</p> <p>or</p> <p> Cancel</p> <p>or</p> <p> Save</p>	<p><input type="text" value="0001"/> L1</p> <p><input type="text" value="19.2"/> L2</p> <p><input type="text" value="rtu"/> L3</p> <p><b>MBUS</b></p> <ul style="list-style-type: none"> <li><input type="radio"/> U<sub>7b,N</sub></li> <li><input type="radio"/> U<sub>7b,Ps</sub></li> <li><input type="radio"/> I</li> <li><input type="radio"/> S</li> <li><input type="radio"/> P</li> <li><input type="radio"/> Q</li> <li><input type="radio"/> Q</li> <li><input type="radio"/> cos φ</li> <li><input type="radio"/> kWh</li> <li><input type="radio"/> kvarh</li> <li><input type="radio"/> THD</li> <li><input checked="" type="radio"/> Extra</li> </ul>	<p>Display L2 flashes.</p> <p>Press the  button to choose from different baud rates with the respective even/odd parity or no parity.</p> <p>4.8 k baud   9.6 k baud   19.2 k baud</p>
<p></p> <p><b>NOTE</b></p>	<p></p> <p></p> <p> or </p>	<p>Return to main menu</p> <p>Continue to the next submenu, if available, or Return to main menu.</p> <p>Use these buttons to switch between the displays in input mode (one digit flashes).</p>	

## 9 Profibus

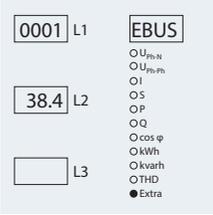
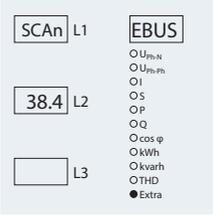
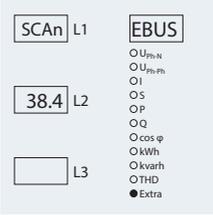
### 9.1 Added functionality: Profibus

The multimes F144-2-LED-ESMS ...- 5 is available with the Profibus option

The additional functions are described in this appendix (Configuring Profibus).

The Profibus bus protocol is only available if the device is equipped with a Profibus interface.

### 9.2 Setting the bus protocol

Menu	Button(s)	Device display	Description
Main menu Extra			
eBus submenu	 Start input mode (eBus Scan)		Display L1 shows the device address. The baud rate is displayed on display L2. The unit display shows the current bus protocol (e.g. eBus)
Assign eBus submenu address	 Start input mode		Display L1 shows SCAN, i.e. the scan address has been set. Press the  button to enter the input mode for setting the bus address.
Change eBus submenu protocol	 To the change bus protocol  Changing the bus protocol		The first digit on display L1 flashes. Press the  button to go to the bus protocol display (bus protocol display flashes). The  button can be used to change the bus protocol, e.g. from KBR-eBus to Profibus

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Menu	Button(s)	Device display	Description
eBus submenu Save bus protocol	Cancel or Save		The unit display shows the selected bus protocol. The bus address is displayed on display L1.
 NOTE	 	Return to main menu Continue to the next submenu, if available, or return to the main menu.	



**NOTE**

Change the bus address with the button (input), select the segment with the button, change the address with the button, press to save.

## 10 Technical data

### 10.1 Measuring and display values

Wave form for U and I		any
Voltage	RMS value of a measuring interval	Phase - N: $U_{L1-N}; U_{L2-N}; U_{L3-N}$ / phase - phase: $U_{L1-2}; U_{L2-3}; U_{L3-1}$
	Units	[V, kV]; display switches automatically
	Measuring period memory	0.00 V to 999.9 kV
Current (apparent current)	RMS value of a measuring interval	$I_{L1\ act}; I_{L2\ act}; I_{L3\ act}$ ; instantaneous value for each phase
	Average value determination	$I_{L1\ avg}; I_{L2\ avg}; I_{L3\ avg}$ ; floating average value of RMS values over a set period of time
	Units	[A;kA;MA]; display switches automatically
	Measuring period memory	0.00 A to 999 kA
Neutral conductor current	RMS value of a measuring interval	$I_{N\ act} / I_{N\ avg}$ Instantaneous and average value - cf. "Phase current"
	Units	[A;kA;MA]; display switches automatically
	Measuring period memory	0.00 A to 999 kA
Frequency	Power frequency measurement	$f_{\text{Power}}$ ; measured with mains tracking, either 50 Hz fixed or 60 Hz fixed
	Units	[Hz]
	Measuring period memory	45 - 65 Hz
Apparent power	Calculation	$S_{L1}; S_{L2}; S_{L3}; S_{\text{tot}}$
	Units	[VA; kVA; MVA]; display switches automatically
	Measuring period memory	0.00 VA to 999 MVA
Active power	Calculation	$P_{L1}; P_{L2}; P_{L3}; P_{\text{total}}$
	Units	[W; kW; MW]; display switches automatically
	Measuring period memory	0.00 W to 999 MW
Reactive power	Calculation ind. & cap.	$Q_{L1}; Q_{L2}; Q_{L3}; Q_{\text{total}}$ ; distinction between ind./cap.
	Units	[var; kvar; Mvar]; display switches automatically.
	Measuring period memory	0.00 var to 999 Mvar

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Power factor	Calculation ind. & cap.	$\cos_{\phi L1}; \cos_{\phi L2}; \cos_{\phi L3}; PF_{L1}; PF_{L2}; PF_{L3}; PF_{Tot};$ distinction between ind./cap. $\cos_{\phi}$ on the display
	Measuring period memory	CosPhi 0.1 ind. - 1 - 0,1 cap., LF 0,1 - 1
Active energy	Calculation	W (HT/LT)
	Units	[Wh; kWh; MWh; GWh]; display switches automatically
	Measuring period memory	0.0 Wh to 9999 GWh
Reactive energy	Calculation	$W_{React}$ (HT/LT) → ind. or cap.
	Units	[varh; kvarh; Mvarh; Gvarh]; display switches automatically
	Measuring period memory	0.0 varh to 9999 Gvarh
voltage harmonics	Distortion factor (THD) for voltage	Voltage: DF- $U_{L1}$ ; DF- $U_{L2}$ ; DF- $U_{L3}$ ;
	Partial distortion factors	3 <sup>rd</sup> ; 5 <sup>th</sup> ; 7 <sup>th</sup> ; 9 <sup>th</sup> ; 11 <sup>th</sup> ; 13 <sup>th</sup> ; 15 <sup>th</sup> ; 17 <sup>th</sup> to 63 <sup>rd</sup> harmonic of the voltage separated for each phase
	Units	[%]
	Measuring period memory	0.00 % to 100 %
Current harmonics	Current harmonics, Current harmonics total	3 <sup>rd</sup> ; 5 <sup>th</sup> ; 7 <sup>th</sup> ; 9 <sup>th</sup> ; 11 <sup>th</sup> ; 13 <sup>th</sup> ; 15 <sup>th</sup> ; 17 <sup>th</sup> to 63 <sup>rd</sup> harmonic of the current separated for each phase $I_{SumL1}; I_{SumL2}; I_{SumL3}$
	Units	[A; kA]; displays switches automatically
	Measuring period memory	0.00 A to 999.9 kA

## 10.2 Measurement accuracy class (in accordance with DIN EN 61557-12)

Measured value	Symbol	Accuracy class
Voltage	$U_{PHN}$	0.2 / $\pm 1$ digit
Voltage	$U_{PHPH}$	0.2 / $\pm 1$ digit
Phase current	$I$	0.5 / $\pm 1$ digit
Neutral conductor current measured	$I_N$	0.5 / $\pm 1$ digit
Neutral conductor current calculated	$I_{Nc}$	2 / $\pm 1$ digit
Power factor	$PF_A$	1 / $\pm 1$ digit
CosPhi of the basic oscillation		1 / $\pm 1$ digit
Frequency	$f$	0.02 / $\pm 1$ digit
Total apparent power	$S_A$	1 / $\pm 1$ digit
Total active power	$P$	1 / $\pm 1$ digit
Total reactive power	$E_a$	1 / $\pm 1$ digit
Total reactive power basic oscillation	$Q_a$	1 / $\pm 1$ digit
Total reactive energy consumption and recovery	$Q_a$	1 / $\pm 1$ digit
Voltage harmonics	$U_h$	1 / $\pm 1$ digit
THD of the voltage	THD- $R_u$	1 / $\pm 1$ digit
Current harmonics	$I_h$	1 / $\pm 1$ digit

## 10.3 Measuring principle

Sampling	205 readings per period (50 Hz) 170 readings per period (60 Hz)
A/D converter	16 Bit
Measurement of V and I	Simultaneous recording of V and I readings
Harmonics calculation	FFT with 2048 points over 10 periods (50 Hz) FFT with 2048 points over 12 periods (60 Hz)
Frequency measurement	Consumption: Voltage measurement between phases L1, L2, L3 - N; correct frequency measurement with power supply correction

### 10.4 Device memory

Energy, data and parameter memory		2 MB Flash
Program memory		512 kB flash
Memory type		Ring buffer
Long-term memory (1 year)		Daily values for active and reactive energy (HT and LT) for consumption and recovery
Long-term memory (load profile) for 1464 / 732 / 366 / 24 days		60 / 30 / 15 / 1-minutes - Values from: active energy, reactive energy (in each case recovery and delivery)
Extreme values (max./min.)		Extreme values that occurred after connecting the unit to the power supply or after the extreme values memory was deleted manually (maximum indicator function) including date and time
Event memory:	Memory size	1500 events including date and time of their occurrence
Operation logbook	Memory size	500 listings including date and time of their occurrence
Limit violation	Time for acquisition	≥ 200 ms
Voltage dips of the measuring voltage	Time for acquisition	≥ 20 ms; threshold can be set using the computer, value after reset 85 % of rated voltage (in accordance with EN 61000-4-30).

### 10.5 Power supply

Power consumption <18 VA, 10 W	US1: ≈ 100 - 240 V ±10 % DC/50/60 Hz
Power consumption <15 VA, 10 W	US5: ≈ 22.5 - 64 V ±10 % DC/50/60 Hz

## 10.6 Hardware inputs and outputs

### 10.6.1 Inputs

Voltage measuring inputs	$U_{L1-L2}; U_{L2-L3}; U_{L3-L1}$	3 x 5 V - 100 V - 120 V AC (measuring range 1) 3 x 20 V - 500 V - 600 V AC (measuring range 2)
	Input impedance	1.2 MOHM (Ph-Ph)
	Measuring range	can be configured using voltage and current transformers
Current measurement inputs	$I_{L1}; I_{L2}; I_{L3}; I_N$	4 x 0.01 A - 1 A - 1.2 A AC (measuring range 1) 4 x 0.05 A - 5 A - 6 A AC (measuring range 2)
	Power consumption	$\leq 0.3$ VA per input at 6 A
	Measuring range	can be configured using voltage and current transformers
Digital inputs	Tariff switching input	Digital input for floating contact, HT/LT switching, signal e.g. from energy supplier, contact open => HT, contact closed => LT
	Synchronous input	Digital input for floating contact Measurement period synchronization; pulse length $\geq 250$ ms
	Power supply	27 V / 15 mA DC internal

### 10.6.2 Outputs

Signal relay for limit violations	Number	2
	Contact	floating, open in case of limit violation
	Reaction speed	programmable, max. 255 sec.
	Switching capacity	Max. 250 V (AC) / 2 A floating - not safe to touch. Both relays must be in the same phase.
Pulse output	Output type	Proportional to active or reactive energy, configurable on the device from 0.001 to 9990 pulse(s) per kWh
	Optocoupler output	15 mA at max. 35 V; interface $S_0$ -compatible
	Accuracy class	2
	Pulse length	configurable, min. 30 ms, max. 990 ms
	Power supply	external

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Analog output	Number	3, common negative pole
	Load capacity	Max. 20 mA at current output (max. resistance 500 ohms) Max. 10 V at voltage output (min. resistance 1000 ohms)
	Signal	Can be set to 0-10 V, 2-10 V or 0-20 mA, 4-20mA
Serial interface	BUS	RS485 for connection to the KBR-eBus or Modbus; max. 32 devices, up to 1000 devices with bus repeater
	Baud rate	38400 fixed at KBR eBus, configurable with Modbus
	Addressing	For KBR-eBus: can be addressed automatically with software or manually on the device up to address 9999 For Modbus: Adr. 1 to 247 manually on the device.

### 10.7 Electrical connection

Connection elements		Plug-in terminals
Permissible cross-section of the connecting cables		2.5 mm <sup>2</sup>
Measurement voltage inputs	Fuse protection	max. 1 A slow-blow max. C2 automatic isolating switch UL/IEC-approved
Measurement current inputs	Fuse protection	NONE!!! Always short-circuit current transformer terminals k and l before opening the circuit!
Input control voltage	Fuse protection	max. 1 A slow-blow max. C2 automatic isolating switch UL/IEC-approved
Relay output	Fuse protection	max 2 A medium time-lag
BUS connection	Connection material	To ensure proper operation, only use shielded twisted-pair cables; e.g. I-Y-St-Y2x2x0.8 EIB
Pulse output	Connection and cables	Observe correct polarity! To ensure proper operation, only use shielded twisted-pair cables; e.g. I-Y-St-Y2x2x0.8 EIB

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Transformer connection	Connections	See wiring diagram
Analog output	Connections	Ensure correct polarity!
Interface connection	RS485 BUS connector pins	Terminal 90 (L) Terminal 91 (A) Terminal 92 (B)

## 10.8 Mechanical data

Switchboard installation	Housing dimensions	144 x 144 x 60 mm (H x W x D)
	Installation cut-out	138 x 138 mm
	Weight	700 g

### 10.9 Ambient conditions, electrical safety and standards

Ambient conditions	Standards	DIN EN 60721-3-3:1995-09 + DIN EN 60721-3-3/A2:1997-07; 3K5+3Z11; (IEC721-3-3;3K5+3Z11)	
	Operating temperature	K55 (-5 °C - +55 °C)	
	Humidity	5% - 95% non-condensing	
	Storage temperature	K55 (-25 °C - +70 °C)	
	Operating altitude	0 to 2000 m above sea level	
Electrical safety	Standards	DIN EN 61010-1:2011-07; DIN EN 61010-2-030:2011-07	
	Protection category	I	
	Oversvoltage category, measurement category	Voltage measurement: Current measurement: Power supply:	CAT III: 300 V; CAT II: 400 V CAT III: 300V CAT III: 300 V
	Rated surge voltage	4kV	
Protection type	Standards	DIN EN 60529:2014-09	
	Front	IP 40, with IP 51 seal	
	Terminals	IP 20	
EMC	Standards	DIN EN 61000-6-2:2006-03 + amendment 1:2011-03 DIN EN 61326-1:2013-07 <b>Device without Profibus DP:</b> DIN EN 61000-6-3:2011-09 + amendment 1:2012-11 <b>Device with Profibus DP:</b> DIN EN 61000-6-4:2011-09	
Synchronization	Type	internal, manual, tariff switching or by KBR-eBus	
Synchronization time		With internal synchronization based on the full hour	

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