KBR
Energy Management

User manual
Technical parameters

multimess

Three-phase
network measuring device

F144-2-LED-ESMS...-4

Your partner for
network analysis

System | English

Dear customer

Thank you for choosing a KBR product.

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

The individual chapters serve to explain the technical details of the device and show how to properly install and start up the device to prevent 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 putting together this user manual, errors may still occur. We would be very grateful if you could notify us of any errors or unclear descriptions you may notice. The form included in the appendix to this manual can be used to send us corrections or suggested improvements.

Yours sincerely,

KBR GmbH Schwabach

This manual contains notes that must be observed for your personal safety and to avoid 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

means that death, major injury or substantial property damage may occur if the appropriate safety measures are not taken.

CAUTION

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

NOTE

is an important piece of information on the product, product handling or the respective part of the user manual to which special reference is made.

Disclaimer

The contents of this manual have been checked to concur with the described hardware and software components. However, deviations may occur, meaning that no guarantee can be made for complete agreement with the documentation. The specifications given in this manual are checked on a regular basis; necessary corrections will be included in the next revision.

We appreciate your corrections and comments.

Safety notes

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

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⚡ DANGEROUS VOLTAGE

The applicable DIN/VDE regulations must be observed for installation!

Power supply connection, setup and operation of the device may only be performed by qualified personnel. Qualified personnel as defined in the safety notes 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 nameplate.

A faulty connection may result in the destruction of the device!

When connecting the device, ensure that the data given in the connection chart is complied with (see "Connection diagram") and that the connection cables are not live. When wiring, always ensure that all wiring material used is neither damaged nor defective

and that the polarity is correct!

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

A visibly damaged device must generally be considered unfit for use and disconnected from the power supply. Troubleshooting, repairs and maintenance work may only be carried out in our facilities or after contacting our service team.

Opening the device without authorization will render your warranty null and void. Correct operation 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 sources of electricity. 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 sources of electricity to terminals 36-39, 60-63 and 90-92.
Only apply safe-to-touch extra-low voltage in accordance with UL/CSA/IEC 61010-1 to terminals 34 and 35. Maximum values see technical data.

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 it is delivered.

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

The warranty on device properties applies only if the device has been 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 devices for you.

Scope of delivery

Included in the scope of delivery:
- Measuring device
- CR2032 battery
- Connector set
- User manual
- Mounting material for the housing

1   Device memory, battery-buffered

NOTE

Before the initial start-up of the device, please insert the backup battery first (as described in the following), as otherwise any data stored would be lost in the event of power failure.

⚠ CAUTION

Caution: danger of explosion if battery is replaced incorrectly.

Inserting or replacing the backup battery (see image):

1. Disconnect the device from the power supply.
2. Remove the upper housing cover (frame) using a suitable tool (e.g. a small screwdriver).
3. Remove the front cover.
4. To replace it, remove the empty battery from the clamp pressing slightly against the contact spring using pliers.
   Caution! To avoid a short circuit, the tips of the pliers have to be insulated.
5. Press the new battery lightly against the contact spring and into the clamping bracket until it clicks into place. Ensure correct polarity!
6. Put the front cover back into place.
7. Put the device frame back into place and push until it clicks into place.
8. Reconnect the device to the power supply.

NOTE

As there is no power supply if the battery is empty or removed, not only the stored data are lost but also the time is no longer correct. In this case, the time has to be reset in visual energy with the corresponding command (see section "Setting time and date" in the user manual).

Contact spring

Battery holder

Battery

Front cover

Device frame
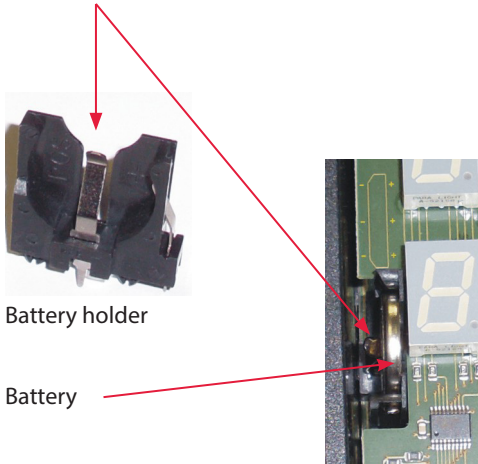
2 Definition of terms

Below, you will find a brief explanation of the terminology used in this manual.

Root mean square value:

By definition, the square mean value of a periodic or pulsating quantity is referred to as the RMS value.
The multimess F144-2-LED-ESMS-...-4 only uses the RMS values of periodic quantities.

Instantaneous root meansquare value:

The value determined by the multimess F144-2-LED-ESMS-... -4 during its measurement interval.

Measurement interval:

During a measurement interval, the electrical quantity "voltage" or "current" of a phase is scanned. The resulting sampling points are available for further calculations. This interval is mainly determined by the A/D conversion.

Measuring cycle:

The measuring cycle is the time the measuring device needs in order to measure all the values recorded by the device for all three phases.

Firmware:

The operating system implemented in the microcontroller of the multimess F144-2-LED-ESMS-...-4.

Load profile memory:

Saves the actual values of the measurement periods with timestamp.

Measurement period maximum:

The measurement period containing the highest (maximum) value that occurred.

Active/reactive power periods:

Actual active or reactive power during a measurement period

Measurement period:

The period of time used to determine average power values. Typical intervals: e.g. 15, 30, 60 minutes.

3   Field of application / range of functions

The **multimess F144-2-LED-ESMS-...-4** is an affordable network measuring device for switchboard installation that measures all important parameters in three-phase networks.

The microprocessor of the **multimess F144-2-LED-ESMS-...-4** records the mains voltage and current consumption of the meter point for all three phases via analog/digital converter inputs and calculates the active, reactive and apparent power ratio in the three-phase network.

Convenient operation and display
The LED displays L1, L2 and L3 allow you to read the measured values directly and enter the respective parameters and configuration data. In addition, eleven LEDs indicate menus and the status. Six sensor buttons facilitate navigation through the menus.

For 100 to 400 V networks
The **multimess F144-2-LED-ESMS-...-4** can be used in 3-wire and 4-wire networks. The device can be used to make measurements directly in 100 V and 400V networks. Higher voltages can only be connected via external voltage transformers, with the primary and secondary voltage being programmable. The measuring voltage inputs of the device measure directly, i.e. they are not galvanically separated by a voltage transformer!

For energy supply networks with an outer conductor to ground potential, suitable ballasts with electrical isolation must be used, e.g. voltage transformers or zero point creators.

x/5A or x/1A freely programmable
The current measurement inputs must always be supplied via current transformers; the transformer ratio is programmable. The primary current value as well as the secondary current value can be selected.

Determining the neutral conductor current
The neutral conductor current is calculated and displayed.

Harmonic analysis
Harmonic analysis by Fourier transform.
The **multimess F144-2-LED-ESMS-...-4** measures the harmonics of the 3rd / 5th / 7th / 9th / 11th / 13th / 15th / 17th and 19th voltage network harmonic, calculates their partial harmonic content, the total distortion factor of the voltage and the distortion reactive current.

Two-tariff meter function (HT/LT)
Consumption during high tariff and low tariff times is recorded separately. Switching from high to low tariff times and vice versa is either carried out by means of a digital signal to be applied externally, e.g. from the energy supplier, or via an internal clock. When operated with the KBR Energy Bus, switching can be done centrally via the ve-busmaster.

Programmable pulse output

Active energy or reactive energy proportional pulses can be output via a pro-grammable S0 interface output. The pulse output type (proportional to active or reactive energy) as well as the pulse significance (number of pulses per kWh or per kvarh) and the pulse length can be programmed. These pulses can be processed by, for example, a master system for data acquisition or optimization, a maximum-demand monitor or a central process control.

Serial interface

In its default configuration, the **multimess F144-2-LED-ESMS-...-4** has a serial interface (RS485) for operation with the KBR Energy Bus.

A variety of information that cannot be shown on the display can be read from the device via the bus.

This makes it possible to read numerous online measurement values as well as a wide range of data can from the long-term memory.

Extensive memory functions

In addition to its meter functions, the **multimess F144-2-LED-ESMS-...-4** offers extensive

memory functions:

▪ a load profile memory to record the cumulated active and reactive power

▪ a memory to record the daily energy values for 365 days

▪ and an event memory that records defined actions of the measuring device, such as power failures, tariff switching actions, delete functions and many more.

These memory functions are exclusively available via the KBR Energy Bus.

Synchronization

To synchronize the load profile memory, a separate digital input was integrated into the multimess F144-2-LED-ESMS-...-4 where you can, for example, connect the synchronization signal of the energy supplier's meter. Synchronization as well as switching between high tariff and low tariff can be done centrally via the KBR Energy Bus or the internal clock.

Analog outputs

Various parameters between 0-20 mA or 4-20 mA and between 0-10 V or 2-10 V can be output as analog values.

Depending on which quantity should be output, you can assign it for a certain phase (L1, L2, L3) or for its total value to the analog output.

Software (optional)

A series of software products that run on most Microsoft® Windows® operating systems are available for the convenient programming and storage of long-

term data.

Separate power supply
The device requires a separate auxiliary voltage for operation.
(see nameplate)

If you have any questions on this device or our software products, please don't hesitate to contact us. It is our pleasure to assist you.

See the cover of this user manual for contact details.

4 Connecting the multimess F144-2-LED-ESMS-...-4

4.1 Installation and assembly

- The applicable VDE regulations must be observed for installation!

- Before the device is connected to the power supply, check whether the local power supply conditions comply with the specifications on the nameplate. A faulty connection can destroy the device.
  A different power 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.

4.2 Installation

Installation site:
The device is designed to be installed in fixed and weatherproof 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 by means of a back-up fuse.

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

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

The disconnector 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 disconnector 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.

⚠️ **CAUTION**

The device is not suitable for DC voltage measurement.

⚠️ **CAUTION**

Attach the current transformer terminal to the device with two screws.

⚠️ **CAUTION**

Never operate open external unloaded current transformers. Always short-circuit them. Risk of injury from high voltages and currents.

For the wiring of the pulse output, we recommend to exclusively use shielded twisted pair material to avoid disturbances (e.g. installation line I-Y(ST) Y 2 x 2 x 0.8 mm. The shielding may only be connected on one side).

During installation, please also observe our notes on safety measures against overvoltage and lightning in chapter "Protective measures" of this manual.

👉 **NOTE**

Please observe the following when connecting the device to the three-phase network you want to measure:
- Energy flow direction
- Assignment of measuring voltage input / current transformer input

Rotary field:

The device can be operated with a clockwise or counter-clockwise rotary field. When switching on the device power supply, the multimess F144-2-LED-ESMS-...-4 automatically checks the direction of rotation. Rotary field check:

▪ Connect only the measuring voltage to the device (Umeas see nameplate).

▪ Switch on the device by applying voltage to the power supply connections (L and N). Immediately after the device has been switched on, it will check the power supply rotary direction.

▪ The rotary field is displayed in the menu UPH-PH, submenu Rotary field.

▪ 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 counter-clockwise, you only have to 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:

▪ Energy flow direction:

When installing the transformers, observe the current flow / energy flow direction. If the current transformer is installed the wrong way, the measured value will be negative.

The prerequisite for this is that energy be consumed.

▪ 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.

▪ With the multimess F144-2-LED-ESMS-...-4, you can check the phase sequence as follows:
  - Switch to the main menu "I"
  - Connect the current transformer to the corresponding wires
  - If connection and energy flow direction are correct, the device will only display positive currents.
  - If connections are wrong, all currents displayed will be negative. Interchange the connections until the display shows correct values.

⚠ **CAUTION**

Before any interchanging, the current transformers must be shorted out!

4.3 Connection diagram

Stromflussrichtung / *current direction*

L1
L2
L3
N

max. C2 automat - max. C2 Automat
max. 1 A slow-blow - max. 1 A träge

circuit breaker - Trennvorrichtung

PE 1 2 — L N — Power Netz* — *eBus*

10 11 12 13 — L1 L2 L3 N — *Measuring voltage* Messspannung

20 21 22 23 24 25 — k1 L1 k2 L2 k3 L3 — *Measuring current* Messstrom

30 31 32 33 — Relay 1 Relay 2

Contacts are open by no power or alarm!
Kontakte geöffnet bei fehlender Spannungsversorgung oder bei Alarm!

Output Ausgang Analog

A1 A2 A3 -
+ + +
60 61 62 63

F144-2-LED-ESMS...-4

34 35 — Output Ausgang — + -

36 37 — Sync. — - +

38 39 — T1/T2 Tariff — + -

Inputs Eingänge

90 91 92 — ⊥ A B

to other bus devices and line termination
zu weiteren Busteilnehmern bzw. Leitungsabschluss /

* For supply voltage, see type plate
* Versorgungsspannung siehe Typenschild

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4.4   Terminal assignment

Terminal

1 (L) and 2 (N):

Power supply connection
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).

10 (L1)
11 (L2)
12 (L3)
13 (N)

Voltage measurement inputs Three-phase voltage measurement in 3-wire and 4-wire three-phase networks. Direct measurement for 3 x 5...100...120 V or 3 x 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.

20 (k1) and 21 (l1)
22 (k2) and 23 (l2)
24 (k3) and 25 (l3)

Current measurement inputs
The current measurement inputs must be connected via current transformers x/1 A AC or x/5 A AC.
When connecting transformers, pay attention to the energy flow direction and the correct assignment of measuring voltage inputs to the current transformers.

30 and 31:

Floating relay contact relay 1
This contact serves as a message or alarm output. During operation, an acoustic or visual message can be activated or a consumer switched off with 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).

32 and 33:

Floating relay contact relay 2
See description of floating relay contact relay 1

90 (ground)
91 (A)
92 (B):

Interface connection
For eBus or Modbus communication.

34 (+) and 35 (-):

Pulse output
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.

Terminal	
36 and 37:	**Synchronization input** A floating contact, e.g. from the energy supplier, can be connected to this input to synchronize the measurement period
38 (-) and 39 (+):	**Tariff input** 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:	**Analog outputs** Various parameters can be output as analog values, between 0-20 mA or 4-20 mA and between 0-10 V or 2-10 V. Depending on which parameter should be output, you can assign a certain phase (L1, L2, L3) or its total value to the analog output.
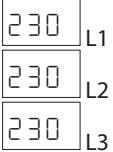
5 Control and display panel

multimess　　　　　　　　　　　　　　**KBR**

1　　　L1

1　　　L2

1　　　L3

9

○ U Ph-N
○ U Ph-Ph
○ I
○ S
○ P
○ Q
○ cos φ
○ kWh
○ kvarh
○ THD
○ Extra

8

Eingabe *Input*　　　**Speicher** *Memory*　　　**Auswahl** *Menu*

2　　**3**　　　**4**　　**5**　　　**6**　　**7**

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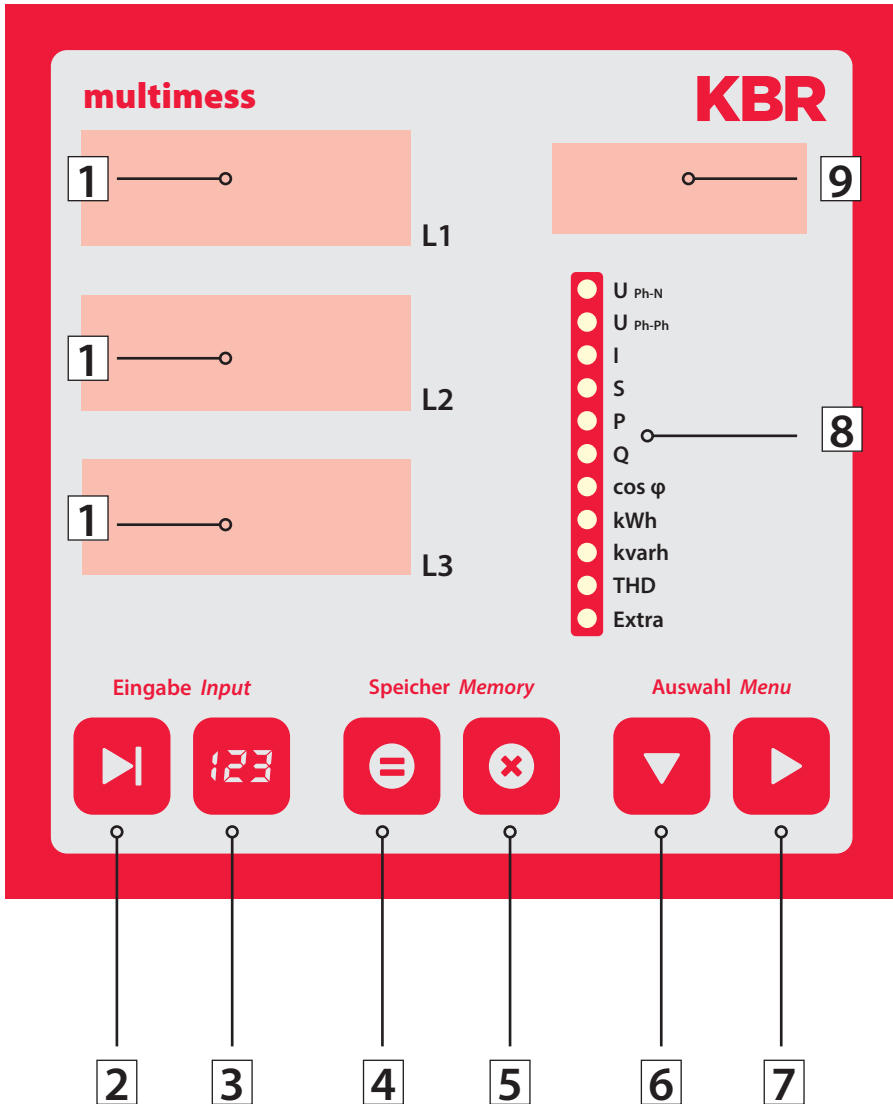
5.1 Description of sensor buttons and displays

1	`230` L1 `230` L2 `230` L3	Three 4-digit 7-segment displays to show measured, stored and programmed values (3-phase; L1-L2-L3).
2	▶|	Starts the programming mode and switches between the segments to be edited in ① and ⑨. When you select a segment to edit it, it starts to flash.
3	🔢	In programming mode, this changes the flashing value in ① or the decimal point in ① and the unit prefix in ⑨.
4	⊖	Display for saved minimum and maximum values. In programming mode, this saves the parameters or values entered.
5	⊗	Deletes the values displayed with ⊖, such as extreme values, energy etc. In programming mode, you can use this button to cancel programming without applying any changes.
6	▼	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 individual main menus. In programming mode, you can use this button to switch between the input fields L1, L2 and L3.
7	▶	Jumps to the corresponding submenu.
8	⡇	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. If the limit violation, however, occurred in the menu currently displayed, the LED does not flash.
9	`A`	The 4-digit 15-segment display shows information and dimensions of the values in ①. When reading the saved extreme values, the display switches between the unit and MIN for minimum value or MAX for maximum value. This principle applies to other menus as well and will be described in the corresponding sections of this manual.

6   Operation

6.1   Menu structure of the multimess F144-2-LED-ESMS-...-4

▼   Switches between the main menus.

When you are in a menu, the corresponding LED lights up
(not flashing).

Hold the button to automatically switch between the individual
main menus.

Press this button in a submenu to switch back to the corresponding
main menu without applying any changes.

▶   Switches to the corresponding submenu.

Press this button to switch from the last submenu back to the
corresponding main menu.

6.2   Navigation and device displays

	Main menus ▶	Submenus								
U PH-N	U PH-N L1; L2; L3	Frequency								
		▶ 2 sec.	Frequency correction							
U PH-PH	U PH-PH L1; L2; L3	Phase angle	Asymmetry							
	▶ 2 sec.	U primary U secondary								
I	Apparent current instantaneous value L1; L2; L3	Apparent current average value L1; L2; L3	Neutral conductor current instantaneous value IN	Neutral conductor current average value IN						
	▶ 2 sec.	I primary I secondary	▶ 2 sec.	Period time current average value						
S	Apparent power L1; L2; L3	Total apparent power								
P	Active power L1; L2; L3	Total active power								
Q	Reactive power L1; L2; L3	Total reactive power								
COS PHI	COS PHI L1; L2; L3	Power factor L1; L2; L3	Power factor total							
KWH	Active energy HT continuous meter consumption	Active energy LT continuous meter consumption	Active energy HT continuous meter recovery	Active energy LT continuous meter recovery	Maximum cumulated cycle power					
	▶ 2 sec.	LT Sync. type LT Start time LT End time	▶ 2 sec.	LT Sync. type Period time Rem. Period time						
KVARH	Reactive energy HT continuous meter consumption	Reactive energy LT continuous meter consumption	Reactive energy HT continuous meter recovery	Reactive energy LT continuous meter recovery	Maximum cumulated cycle power					
HARMON.	KF-U	3rd Harm U	5th Harm U	7th Harm U	9th Harm U	11th Harm U	13th Harm U	15th Harm U	17th Harm U	19th Harm U
▶		▶	▶	▶	▶	▶	▶	▶	▶	▶
	I - d	3rd Harm I	5th Harm I	7th Harm I	9th Harm I	11th Harm I	13th Harm I	15th Harm I	17th Harm I	19th Harm I
EXTRA	Device version Firmware Release	Device time Date	Bus address Baud rate	Relay output 1 T_E ON-delay T_A OFF-delay	Relay output 2 T_E ON-delay T_A OFF-delay	DST on / off DST Start DST End				
		Language German / Engl.	Password protection / entry	Pulse output type Pulse significance Pulse length	Damp. coefficient voltage current	Reset to KBR default				
		Zero point creator on / off	Analog interface output format	Analog 1 Data point Limiting value	Analog 2 Data point Limiting value	Analog 3 Data point Limiting value				

7   Setting operating parameters

7.1   General programming scheme

▶|	• Press this button for 2 seconds to switch into the programming mode from a main menu or submenu. The set parameters are displayed. • Press this button again to activate the parameter input mode. • This button is also used to switch from one segment to the next when entering values.
123	• Value input.
▼	• In programming mode, press this button to switch between the input fields L1, L2 and L3. • Return to the main menu after saving changes or canceling the programming mode.
⊖	• This button is used to save changes.
⊗	• Press this button if you want to cancel the programming mode without saving any changes.

7.2   U Ph-Ph - Measuring reference voltage / rated mains voltage

Menu	Button(s)	Device display	Description
Main menu UPh-Ph			
Submenu Voltage Set the transformer ratio	Hold the 🔼 button for 2 seconds 🔼 Start input mode	`0400` L1 `V /V` ○ U_Ph-PN ● U_Ph-Ph ○ I `400` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ○ Extra	When you open the menu, the following text is shown in the unit display: VOLTAGE TRANSFORMER RATIO UPRI / USEC V / V Display L1 shows the primary voltage. Display L2 shows the secondary voltage.
Submenu Voltage Set transformer ratio primary	🔢 ..... 🔼 next digit or ❌ cancel or ⊖ save	`0400` L1 `V /V` ○ U_Ph-PN ● U_Ph-Ph ○ I `400` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ○ Extra	The first digit in display L1 flashes. Press the 🔢 button to change the number. Press the 🔼 button to switch to the next digit. If all digits have been set, display L1 flashes. To move the decimal point, press the 🔢 button
Main menu U_ph-ph	🔼 or 🔽		
👉 **NOTE**	🔼 or 🔽		Use these buttons to switch between the individual displays in input mode (one flashing digit).
Submenu Voltage Set transformer ratio secondary	🔢 ..... 🔼 next digit or ❌ cancel or ⊖ save	`0400` L1 `V /V` ○ U_Ph-PN ● U_Ph-Ph ○ I `400` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ○ Extra	The first digit in display L2 flashes. Press the 🔢 button to change the number. Press the 🔼 button to switch to the next digit. The value can be set between 1 V and 600 V.
Main menu U_ph-ph	🔼 or 🔽		

7.3   I - Current transformer ratio

Menu	Button(s)	Device display	Description
Main menu I			
Submenu Current Set transformer ratio	Hold the 🔽 button for 2 seconds ▶ Start input mode	`1000` L1 `A/A` ○ U_{Ph-PN} ○ U_{Ph-Ph} ● I `1` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh L3 ○ Harmon. ○ Extra	When you open the menu, the following text is shown in the unit display: A/A CURRENT TRANSFORMER IPRI / ISEC A/A Display L1 shows the primary current. Display L2 shows the secondary current.
Submenu Current Set transformer ratio primary	⊞ ..... ▶ next digit or ✖ cancel or ⊟ save	`2000` L1 `A/A` ○ U_{Ph-PN} ○ U_{Ph-Ph} ● I `1` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh L3 ○ Harmon. ○ Extra	The first digit is flashing in display L1. Press the ⊞ button to change this number. Press the ▶ button to switch to the next digit. If all digits have been set, display L1 flashes. To move the decimal point, press the ⊞ button.

Main menu I   ▶ or 🔽
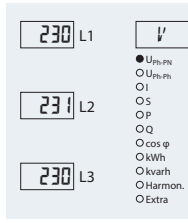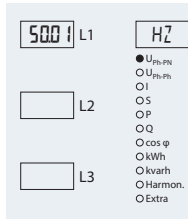
👉 **NOTE**	▶ or 🔽		Use these buttons to switch between the individual displays in input mode (one digit flashes).
Submenu Current Set transformer ratio secondary	⊞ ..... ▶ next digit or ✖ cancel or ⊟ save	`1000` L1 `A/A` ○ U_{Ph-PN} ○ U_{Ph-Ph} ● I `5` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh L3 ○ Harmon. ○ Extra	The first digit in display L2 flashes. Press ⊞ to switch between 1 A and 5 A.

Main menu I   ▶ or 🔽

8   Display functions

8.1   UPh-N - Voltage phase to neutral conductor, frequency

Menu	Button(s)	Device display	Description
Main menu U_{Ph-N}	▶ next	230 L1 V • U_{Ph-PN} ○ U_{Ph-Ph} ○ I 231 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh 230 L3 ○ kvarh ○ Harmon. ○ Extra	Displays the three phase voltages U_{L1-N}, U_{L2-N} and U_{L3-N} in the displays L1 to L3. The unit display shows the voltage unit. The measuring range automatically switches from V to KV.
Submenu Frequency		500.1 L1 HZ • U_{Ph-PN} ○ U_{Ph-Ph} ○ I L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ○ Extra	Shows the instantaneous frequency in display L1.

Main menu
U_{Ph-N} ▶ or ▼

8.2   UPh-Ph - Voltage phase to phase, rotary field display
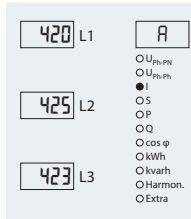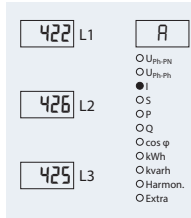
Menu	Button(s)	Device display	Description
	▼		
Main menu **U_Ph-Ph**	⏭ next	400 L1 V ○ U_Ph-PN ● U_Ph-Ph ○ I 400 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh 400 L3 ○ kvarh ○ Harmon. ○ Extra	The three phase-to-phase voltages U_{L1-L2}, U_{L2-L3} and U_{L3-L1} are shown in the displays L1 to L3. The unit display shows the voltage unit. The measuring range automatically switches from V to kV.
Submenu Rotary field Submenu Asymmetry	▶ next	0 L1 DEG. ○ U_Ph-PN ● U_Ph-Ph ○ I 120 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh 240 L3 ○ kvarh ○ Harmon. ○ Extra	Displays the three rotary field angles of the voltages. The unit display shows the unit "DEG"
Submenu Asymmetry		02 L1 ASYM ○ U_Ph-PN ● U_Ph-Ph ○ I L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ○ Extra	Display of voltage asymmetry according to the standard EN 6100-4-30:2003 Shows the asymmetric load of the three-phase network. The unit display switches between ASYM and %.

Main menu
U_Ph-Ph   ▶ or ▼

8.3   I /IN - Current / neutral conductor current, instantaneous and average value switch-over

Menu	Button(s)	Device display	Description
	▼		
Main menu I Instanta-neous value	▶ next	`420` L1 `425` L2 `423` L3 `A` ○ U_{Ph-PN} ○ U_{Ph-Ph} ● I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ○ Extra	Displays the three conductor currents in the phases L1, L2 and L3. The values displayed are instantaneous values. The unit display switches between ACT and A.
Submenu I Average value	▶ next or ▼ Return to main menu	`422` L1 `426` L2 `425` L3 `A` ○ U_{Ph-PN} ○ U_{Ph-Ph} ● I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ○ Extra	Displays the three conductor currents in phases L1, L2 and L3. The values displayed are average values. The unit display switches between AVG and A.

👉 **NOTE**

A negative sign in front of the displayed current values indicates a negative current direction.
A positive sign indicates energy consumption.
A negative sign indicates energy recovery.

Menu	Button(s)	Device display	Description
Submenu I_N Neutral conductor current		`5.0` L1 `A` ○ U Ph-PN ○ U Ph-PN ● I L2 ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh L3 ○ Harmon. ○ Extra	Display L1 shows the instantaneous neutral conductor current. The unit display switches between `NACT` and `A`.
Submenu I_N Neutral conductor current Average value	▶ next or ▼ Return to main menu	`5.4` L1 `A` ○ U Ph-PN ○ U Ph-Ph ● I L2 ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh L3 ○ Harmon. ○ Extra	Display L1 shows the average value of the neutral conductor current. The unit display switches between `NAVG` and `A`.

8.4 S - Apparent power / total apparent power

Menu	Button(s)	Device display	Description
	▼		
Main menu S Apparent power	 ▶ next	`235` L1 `KVA` ○ U Ph-PN ○ U Ph-Ph ○ I `234` L2 ● S ○ P ○ Q ○ cos φ ○ kWh `234` L3 ○ kvarh ○ Harmon. ○ Extra	The displays L1 to L3 show the apparent power of the three phases. The unit display shows the apparent power in `KVA`. The device automatically switches from `VA` to `KVA` and `MVA`.
Submenu Total apparent power Main menu S Apparent power	 ▶ or ▼	`703` L1 `KVA` ○ U Ph-PN ○ U Ph-Ph ○ I L2 ● S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ○ Extra	Shows the total apparent power in display L1. The unit display switches between `KVA` and `STOT`. The measuring range automatically switches from `VA` to `KVA` and `MVA`.

8.5   P - Active power / total active power
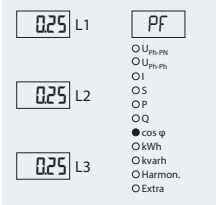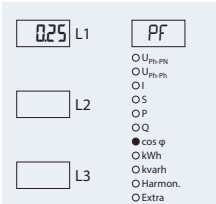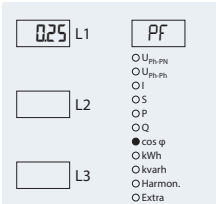
Menu	Button(s)	Device display	Description
	▼		
Main menu P Active power	▶ next	188 L1 188 L2 187 L3 KW ○ U_{Ph-PN} ○ U_{Ph-Ph} ○ I ○ S ● P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ○ Extra	The displays L1 to L3 show the active power of the three phases. The unit display shows the active power in KW. The measuring range switches from W to kW and MW automatically.
Submenu Total active power Main menu P Active power	▶ or ▼	562 L1 L2 L3 KW ○ U_{Ph-PN} ○ U_{Ph-Ph} ○ I ○ S ● P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ○ Extra	Shows the total active power in display L1. The unit display switches between PTOT and KW. The measuring range automatically switches from W to KW and MW.

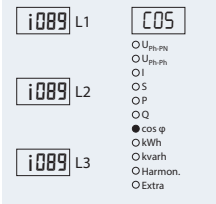## 8.6   Q - Reactive power / total reactive power

Menu	Button(s)	Device display	Description
	▼		
Main menu Q Reactive power	🔼 next	⌐	|⌐ 114| L1 |KVAR| O U_Ph-PN O U_Ph-Ph O I |114| L2 O S O P ● Q O cos φ O kWh |114| L3 O kvarh O Harmon. O Extra	Displays L1 to L3 show the reactive power of the three phases. An "i" in front of a value indicates inductive, a "c" indicates capacitive reactive power. The unit display shows the reactive power in $KVAR$. The measuring range automatically switches from VAR to $KVAR$ and $MVAR$.
Submenu Total reactive power Main menu Q Reactive power	▶ or ▼	|c 421| L1 |KVAR| O U_Ph-PN O U_Ph-Ph O I |	L2 O S O P ● Q O cos φ O kWh |	L3 O kvarh O Harmon. O Extra	Shows the total reactive power in display L1. An "i" in front of a value indicates inductive, a "c" indicates capacitive reactive power. The unit display switches between $QTOT$ and $KVAR$. The measuring range automatically switches from VAR to $KVAR$ and $MVAR$

8.7   Cos φ - Fundamental power factor, PF, total PF

Menu	Button(s)	Device display	Description
	▼		
Main menu Cos φ	▶ next	i089 L1 [COS] ○U_Ph-PN ○U_Ph-Ph ○I ○S ○P ○Q ●cos φ ○kWh ○kvarh ○Harmon. ○Extra i089 L2 i089 L3	Display of cosφ. Display L1 shows the cosφ for phase L1. (i = inductive, c = capacitive) Display L2 shows the cosφ for phase L2. (i = inductive, c = capacitive) Display L3 shows the cosφ for phase L3. (i = inductive, c = capacitive) The unit display shows [OS. (The cosφ displayed refers to the fundamental)
Submenu Power factor Submenu Total PF	▶ next	0.25 L1 [PF] ○U_Ph-PN ○U_Ph-Ph ○I ○S ○P ○Q ●cos φ ○kWh ○kvarh ○Harmon. ○Extra 0.25 L2 0.25 L3	Display of the power factor PF. Display L1 shows the power factor 1 for the phase L1. Display L2 shows the power factor 2 for phase L2. Display L3 shows the power factor 3 for phase L3. The unit display shows PF.
Submenu Total PF		0.25 L1 [PF] ○U_Ph-PN ○U_Ph-Ph ○I ○S ○P ○Q ●cos φ ○kWh ○kvarh ○Harmon. ○Extra L2 L3	Displays the power factor total. Display L1 shows the power factor total. The unit display switches between TOT and PF.

Main menu
Cos φ   ▶ or ▼

7.8 kWh - Active energy HT/LT consumption and recovery, maximum cumulated cycle active power

Menu	Button(s)	Device display	Description
	▼		
Main menu kWh Active energy High tariff Consumption	▶ next	`1234` L1 `KWh` ⃝ U_{Ph-PN} ⃝ U_{Ph-Ph} ⃝ I ⃝ S `567` L2 ⃝ P ⃝ Q ⃝ cos φ ● kWh `890.1` L3 ⃝ kvarh ⃝ Harmon. ⃝ Extra	Active energy meter for high tariff consumption. Display L3 - L1 shows the value of the continuous energy meter. The unit display switches between HT and KWh. 1234 Display L1 (G Wh display) 567 Display L2 (M Wh display) 890.1 Display L3 (k Wh display)
Submenu kWh Active energy Low tariff Consumption	▶ next or ▼ Return to main menu	`1234` L1 `KWh` ⃝ U_{Ph-PN} ⃝ U_{Ph-Ph} ⃝ I ⃝ S `567` L2 ⃝ P ⃝ Q ⃝ cos φ ● kWh `890.1` L3 ⃝ kvarh ⃝ Harmon. ⃝ Extra	Active energy meter for low tariff consumption. Display L3 - L1 shows the value of the continuous energy meter. The unit display switches between LT and KWh. 1234 Display L1 (G Wh display) 567 Display L2 (M Wh display) 890.1 Display L3 (k Wh display)
Submenu kWh Active energy High tariff Recovery	▶ next or ▼ Return to main menu	`1234` L1 `KWh` ⃝ U_{Ph-PN} ⃝ U_{Ph-Ph} ⃝ I ⃝ S `567` L2 ⃝ P ⃝ Q ⃝ cos φ ● kWh `890.1` L3 ⃝ kvarh ⃝ Harmon. ⃝ Extra	Active energy meter for high tariff recovery. Display L3 - L1 shows the value of the continuous energy meter. The unit display switches between HT and KWh. 1234 Display L1 (G Wh display) 567 Display L2 (M Wh display) 890.1 Display L3 (k Wh display)

Continued

Submenu kWh Active energy Low tariff Recovery	▶ next or ▼ Return to main menu	`1234` L1 `KWh` ○ U_{Ph-PN} ○ U_{Ph-Ph} ○ I `567` L2 ○ S ○ P ○ Q ○ cos φ ● kWh `890.1` L3 ○ kvarh ○ Harmon. ○ Extra	Active energy meter for low tariff recovery. Display L3 - L1 shows the value of the continuous energy meter. The unit display switches between LT and KWh. 1234 Display L1 (G Wh display) 567 Display L2 (M Wh display) 890.1 Display L3 (k Wh display)
Menu	**Button(s)**	**Device display**	**Description**
Submenu PCum-Max Maximum cumulated cycle power		`783` L1 `KVAR` ○ U_{Ph-PN} ○ U_{Ph-Ph} ○ I `12.10` L2 ○ S ○ P ○ Q ○ cos φ ● kWh `01.10` L3 ○ kvarh ○ Harmon. ○ Extra	When you open the menu, the following text is shown in the unit display: PCMX MAXIMUM CUMULATED POWER IN PERIOD Then the unit display switches between PCMX and KW. Display L1 shows the period value. Display L2 shows the exact time the maximum occurred (hh:mm). Display L3 shows the day and month, alternating with the year, of the maximum (dd.mm.yyyy).

Main menu   ▶ or ▼
kWh

8.9   kvarh - Reactive energy meter HT/LT consumption and recovery, maximum cumulated cycle reactive power

Menu	Button(s)	Device display	Description
	▼		
Main menu kvarh Reactive energy High tariff Consumption	▶ next	`1234` L1 `KBh` ○ U_{Ph-PN} ○ U_{Ph-Ph} ○ I `567` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh `890.1` L3 ● kvarh ○ Harmon. ○ Extra	Reactive energy meter for high tariff consumption. Display L3 - L1 shows the value of the reactive energy continuous meter. The unit display switches between HT and kBh. 1234 Display L1 (G varh display) 567 Display L2 (M varh display) 890.1 Display L3 (k varh display)
Submenu kvarh Reactive energy Low tariff Consumption	▶ next or ▼ Return to main menu	`1234` L1 `KBh` ○ U_{Ph-PN} ○ U_{Ph-Ph} ○ I `567` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh `890.1` L3 ● kvarh ○ Harmon. ○ Extra	Reactive energy meter for low tariff consumption. Display L3 - L1 shows the value of the reactive energy continuous meter. The unit display switches between LT and kBh. 1234 Display L1 (G varh display) 567 Display L2 (M varh display) 890.1 Display L3 (k varh display)
Submenu kvarh Reactive energy High tariff Recovery	▶ next or ▼ Return to main menu	`1234` L1 `KBh` ○ U_{Ph-PN} ○ U_{Ph-Ph} ○ I `567` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh `890.1` L3 ● kvarh ○ Harmon. ○ Extra	Reactive energy meter for high tariff recovery. Display L3 - L1 shows the value of the reactive energy continuous meter. The unit display switches between HT- and kBh. 1234 Display L1 (G varh display) 567 Display L2 (M varh display) 890.1 Display L3 (k varh display)

Continuation of table 8.9

Menu	Button(s)	Device display	Description
Submenu kvarh Reactive energy Low tariff Recovery	▶ next or ▼ Return to main menu	1234 L1 KBh ○ U Ph-PN ○ U Ph-Ph ○ I 567 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh 890.1 L3 ● kvarh ○ Harmon. ○ Extra	Reactive energy meter for low tariff Recovery. Display L3 - L1 shows the value of the reactive energy continuous meter. The unit display switches between LT- and kBh. 1234 Display L1 (G varh display) 567 Display L2 (M varh display) 890.1 Display L3 (k varh display)
Submenu QCum-Max Maximum cumulated cycle power		783 L1 KBh ○ U Ph-PN ○ U Ph-Ph ○ I 12.10 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh 01.10 L3 ● kvarh ○ Harmon. ○ Extra	When you open the menu, the following text is displayed in the unit display: QCMX MAXIMUM CUMULATED POWER IN PERIOD Then the unit display switches between QCMX and KVAR. Display L1 shows the period value. Display L2 shows the exact time the maximum occurred (hh:mm). Display L3 shows the day and month, alternating with the year, of the maximum (dd.mm.yyyy).

Main menu   ▶ or ▼
kvarh

NOTE

The daily energy meters (for active and reactive energy) of the device can only be read out via the KBR Energy Bus with the optionally available software.

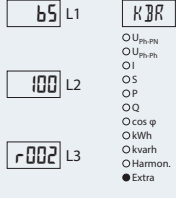## 8.10   Harmon. - distortion factor and partial harmonic content of the voltage and current network harmonics
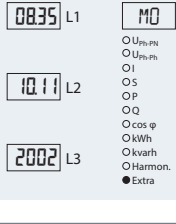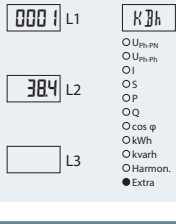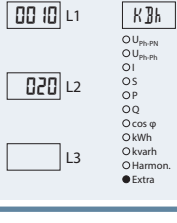
Menu	Button(s)	Device display	Description
	▼		
Main menu Harmon. Voltage distortion factor	▶ next or ⏩ Switch to the current harmonics or ⏩ Return to main menu	47 L1 ⅃F ○ U_Ph-PN ○ U_Ph-Ph ○ I 47 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh 47 L3 ○ kvarh ● Harmon. ○ Extra	Display L1 shows the distortion factor in % for the voltage of phase L1. Display L2 shows the distortion factor in % for the voltage of phase L2. Display L3 shows the distortion factor in % for the voltage of phase L3. The unit display switches between ⅃F and ᵒ/ₒ.
Submenu 3rd-19th harmon.	▶ next or ⏩ Switch to the current harmonics or ⏩ Return to main menu	47 L1 3. U ○ U_Ph-PN ○ U_Ph-Ph ○ I 46 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh 47 L3 ○ kvarh ● Harmon. ○ Extra	Displays the 3rd harmonic. Display L1 shows the 3rd harmonic in % for the voltage of phase L1. Display L2 shows the 3rd harmonic in % for the voltage of phase L2. Display L3 shows the 3rd harmonic in % for the voltage of phase L3. The unit display switches between 3rd U and ᵒ/ₒ. The subsequent harmonics (5th – 19th) are displayed in the same way. For example, when displaying the current harmonic, the display switches between 3rd I and A; when displaying the distortion current strength, it switches between Id and A.
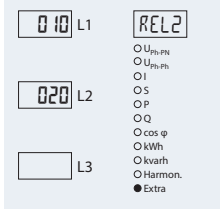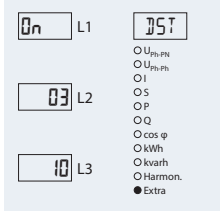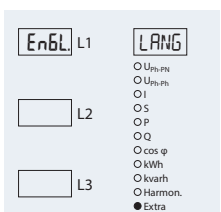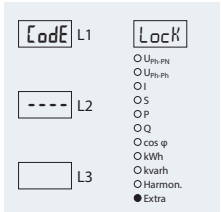
☞ **NOTE**

Use the ⏩ button to switch between the voltage harmonics and current harmonics anywhere in the menu.
The current harmonics are displayed in amperes.

8.11   Extra
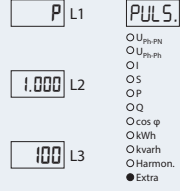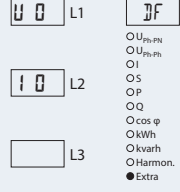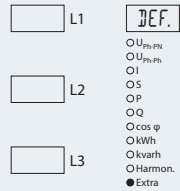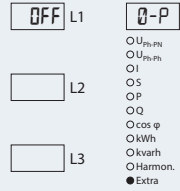
Menu	Button(s)	Device display	Description
	▼		
Main menu Extra	▶ next	**65** L1 KBR ○ U_Ph-PN ○ U_Ph-Ph ○ I **100** L2 ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh **r002** L3 ○ Harmon. ● Extra	Display L1 shows the device type (here: Basic). Display L2 shows the version number. Display L3 shows the release number. The unit display shows the name of the device.
Submenu Date and time	▶ next or ▼ Return to main menu	**08.35** L1 MO ○ U_Ph-PN ○ U_Ph-Ph ○ I **10.11** L2 ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh **2002** L3 ○ Harmon. ● Extra	Display L1 shows the time (hh.mm). Display L2 shows the date (dd.mm). Display L3 shows the year (yyyy). The unit display shows the week-day.
Submenu eBus	▶ next or ▼ Return to main menu	**0001** L1 KBh ○ U_Ph-PN ○ U_Ph-Ph ○ I **384** L2 ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh L3 ○ Harmon. ● Extra	Display L1 shows the device address. The baud rate is shown in display L2. The unit display shows eBus.
Submenu REL 1	▶ next or ▼ Return to main menu	**0010** L1 KBh ○ U_Ph-PN ○ U_Ph-Ph ○ I **020** L2 ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh L3 ○ Harmon. ● Extra	Display L1 shows the on-delay for relay 1 in seconds. Display L2 shows the off-delay for relay 1 in seconds. The unit display switches between REL 1 and TON.

Continued
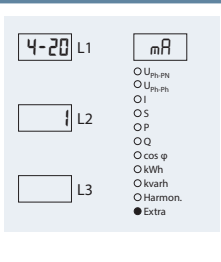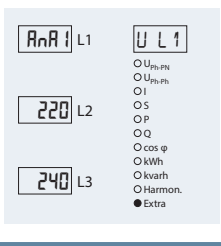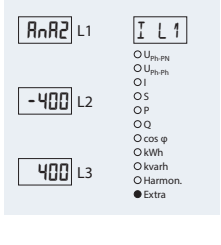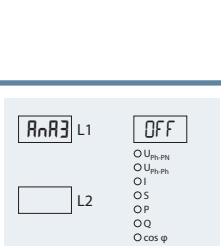
Menu	Button(s)	Device display	Description
Submenu REL 2	▶ next or ▼ Return to main menu	`0 10` L1 `REL2` ○ U_{Ph-PN} ○ U_{Ph-Ph} ○ I `020` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	Display L1 shows the on-delay for relay 2 in seconds. Display L2 shows the off-delay for relay 2 in seconds. The unit display switches between REL2 and TON.
Submenu Daylight saving time	▶ next or ▼ Return to main menu	`On` L1 `DST` ○ U_{Ph-PN} ○ U_{Ph-Ph} ○ I `03` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh `10` L3 ○ kvarh ○ Harmon. ● Extra	Display L1 indicates whether daylight saving time is activated or not. Display L2 shows the month daylight saving time begins. Display L3 shows the month daylight saving time ends. The unit display shows DAYLIGHT-SAVING PARAMETER and then DST.
Submenu Language	▶ next or ▼ Return to main menu	`EnGL.` L1 `LANG` ○ U_{Ph-PN} ○ U_{Ph-Ph} ○ I L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	Display L1 shows the user language. For German, it displays dEuT For English EnGL The unit display shows SPRA if the user language is German and LANG for English.
Submenu Password	▶ next or ▼ Return to main menu	`CodE` L1 `Lock` ○ U_{Ph-PN} ○ U_{Ph-Ph} ○ I `----` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	Display L1 shows CODE. The unit display shows LOCK or FREE. You can enter the password in L2. (4-digit code) The device is defaulted with the code 9999, i.e. all functions of the device are available.

Continued

Menu	Button(s)	Device display	Description
Submenu Pulse output	▶ next or ▼ Return to main menu	P L1 PULS. ○ U Ph-PN ○ U Ph-Ph ○ I 1.000 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh 100 L3 ○ kvarh ○ Harmon. ● Extra	Display L1 indicates whether the pulse output is deactivated (OFF) or configured for active (P) or reactive (Q) energy. Display L2 shows the pulse significance, i.e. pulse/kWh or kvarh. Display L3 displays the energy pulse length in ms.
Submenu Damp. coefficient Main menu Extra	▶ or ▼	U 0 L1 DF ○ U Ph-PN ○ U Ph-Ph ○ I 1 0 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	Display L1 shows the damping coefficient for acquiring the voltage. Display L2 shows the damping coefficient for acquiring the current.
Submenu Reset to default settings	▶ next or ▼ Return to main menu	L1 DEF. ○ U Ph-PN ○ U Ph-Ph ○ I L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	The device is reset to the default KBR factory settings. All stored values are lost. The unit display shows DEFAULT PARAMETER and then DEF.
Submenu Zero point creator	▶ next or ▼ Return to main menu	OFF L1 0-P ○ U Ph-PN ○ U Ph-Ph ○ I L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	Display L1 shows OFF if it is deactivated. If the zero point creator is activated, ON is displayed. The unit display shows ZERO-POINT CREATOR and then 0-P.
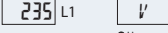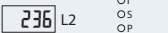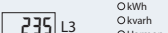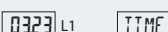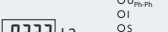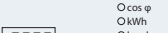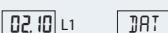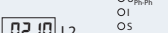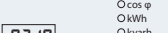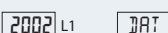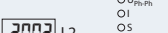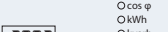
Continuation of table 8.11

Menu	Button(s)	Device display	Description
Submenu Analog interfaces	▶ next or ▼ Return to main menu	`4-20` L1 `mA` ○ U_{Ph-PN} ○ U_{Ph-Ph} ○ I `1` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh `‎` L3 ○ Harmon. ● Extra	Display L1 and the unit display show the output type. You can choose from: 0-20 mA, 4-20 mA, 0-10 V and 2-10 V, valid for all 3 outputs. The unit display shows `ANALOG TYPE` and then `mA` or `V`.
Submenu Analog 1 Data point Limiting value	▶ next or ▼ Return to main menu	`AnA1` L1 `U L1` ○ U_{Ph-PN} ○ U_{Ph-Ph} ○ I `220` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh `240` L3 ○ Harmon. ● Extra	Display L1 shows the instantaneous analog interface. Display L2 shows the lower limit, display L3 the upper limit. The unit display shows the parameter to be output.
Submenu Analog 2 Data point Limiting value	▶ next or ▼ Return to main menu	`AnA2` L1 `I L1` ○ U_{Ph-PN} ○ U_{Ph-Ph} ○ I `-400` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh `400` L3 ○ Harmon. ● Extra	Display L1 shows the instantaneous analog interface. Display L2 shows the lower limit, display L3 the upper limit. For current and active power, positive and negative values (sign in front of value) can be configured. The unit display shows the parameter to be output.
Submenu Analog 3 Data point Limiting value		`AnA3` L1 `OFF` ○ U_{Ph-PN} ○ U_{Ph-Ph} ○ I `‎` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh `‎` L3 ○ Harmon. ● Extra	Display L1 shows the instantaneous analog interface. Display L2 shows the lower limit, display L3 the upper limit. The unit display shows the parameter to be output.

Main menu Extra   ▶ or ▼

8.12   Maximum / Minimum extreme values display

The following section explains how to display the extreme values. The maximum and minimum values of the phase voltages will be used as an example.

Menu	Button(s)	Device display	Description
Main menu U$_{Ph-N}$ Voltage Maximum	▶ next or ▼ Return to main menu	`235` L1 `V` ●U$_{Ph-PN}$ ○U$_{Ph-Ph}$ ○I ○S `236` L2 ○P ○Q ○cos φ ○kWh ○kvarh `235` L3 ○Harmon. ○Extra	The maximum values that occurred for the phase to neutral voltages are shown in the displays L1 to L3 for each phase. The unit display switches between MAX and V.
Voltage Maximum	▶ next or ▼ Return to main menu	`0323` L1 `TIME` ●U$_{Ph-PN}$ ○U$_{Ph-Ph}$ ○I ○S `0323` L2 ○P ○Q ○cos φ ○kWh ○kvarh `0323` L3 ○Harmon. ○Extra	The time the maximum values occurred for the phase to neutral voltages are displayed in the displays L1 to L3. The unit display switches between MAX and TIME.
Voltage Maximum	▶ next or ▼ Return to main menu	`02.10` L1 `DAT` ●U$_{Ph-PN}$ ○U$_{Ph-Ph}$ ○I ○S `02.10` L2 ○P ○Q ○cos φ ○kWh ○kvarh `02.10` L3 ○Harmon. ○Extra	The day the maximum values occurred for the phase to neutral voltages are shown in the displays L1 to L3. The unit display switches between MAX and DAT.
Voltage Maximum		`2002` L1 `DAT` ●U$_{Ph-PN}$ ○U$_{Ph-Ph}$ ○I ○S `2002` L2 ○P ○Q ○cos φ ○kWh ○kvarh `2002` L3 ○Harmon. ○Extra	The year the maximum values occurred for the phase to neutral voltages are displayed in the displays L1 to L3. The unit display switches between MAX and DAT.
Main menu U$_{Ph-N}$	▶ or ▼		

> 👉 **NOTE**
>
> Use the 🔘 button to switch from maximum to minimum values.
> The minimum values are read the same way as the maximum values.

The following table gives an overview of all extreme values stored in the
multimess F144-2-LED-ESMS-...-4.
Stored extreme values with date and time they occurred.

Menu	Measured value	Stored extreme values	Text displayed in de and en
Main menu U_{Ph-N}	Phase-to-neutral voltage	Minimum and maximum value of L1 - L2 - L3 with date and time	Min and Max
Submenu F_{power}	Network frequency	Minimum and maximum value of L1 with date and time	Min and Max
Main menu U_{Ph-Ph}	Phase-to-phase voltage	Minimum and maximum value of L1 - L2 - L3 with date and time	Min and Max
Main menu I_{act}	Phase current instantaneous values	Minimum and maximum value of L1 - L2 - L3 with date and time	Min and Max
Submenu I_{avg}	Average values for phase current	Minimum and maximum value of L1 - L2 - L3 with date and time	Min and Max
Submenu I_{nact}	Average neutral conductor current	Minimum and maximum of the average neutral conductor current with date and time	Min and Max
Main menu S	Apparent power	Minimum and maximum value of L1 - L2 - L3 with date and time	Min and Max
Submenu S_{TOT}	Total apparent power	Minimum and maximum value of the total apparent power with date and time	Min and Max
Main menu P	Active power	Minimum and maximum value of L1 - L2 - L3 with date and time	Min and Max
Submenu P_{TOT}	Total active power	Minimum and maximum value for total apparent power with date and time	Min and Max
Main menu Q	Reactive power	Minimum and maximum value of L1 - L2 - L3 with date and time	Min and Max
Submenu Q_{TOT}	Total reactive power	Minimum and maximum value for total reactive power with date and time	Min and Max
Main menu COS φ	Fundamental power factor	Minimum and maximum value of L1 - L2 - L3 with date and time	Min and Max
Submenu Power factor	Power factor	Minimum and maximum value of L1 - L2 - L3 with date and time	Min and Max

Continued

Menu	Measured value	Stored extreme values	Text displayed in de and en
Submenu Total PF	Power factor total	Minimum and maximum value of the power factor total with date and time	Min and Max
Main menu Harmon.	Harmonics	Maximum values of the distortion factor of the voltage and the 3rd -19th network harmonic as well as the current harmonic contents and their sum; L1-L3.	Max

8.13   Displaying limits

Using the example of limits 1 and 2 of the phase voltage, the following section explains how to display limits.

Menu	Button(s)	Device display	Description
Main menu U_Ph-N Submenu Voltage Maximum	⊝ ▶️ Return to main menu	`235` L1 `V` ○ U_Ph-PN ○ U_Ph-Ph ○ I ○ S `235` L2 ○ P ○ Q ○ cos φ ○ kWh `235` L3 ○ kvarh ○ Harmon. ● Extra	The maximum values that occurred for the phase to neutral voltages are shown in the displays L1 to L3 for each phase. The unit display switches between MAX and V .
Submenu Limit 1	▶ go to limit 2 or ▼ Return to main menu	`235` L1 `L im 1` ○ U_Ph-PN ○ U_Ph-Ph ○ I ○ S `POS` L2 ○ P ○ Q ○ cos φ ○ kWh `OFF` L3 ○ kvarh ○ Harmon. ● Extra	Display L1 shows the limit. Display L2 shows the direction of the limit. (POS: value must not exceed this limit; NEG: value must not fall below this limit; OFF: limit deactivated.) Display L3 shows the message type for the limit: OFF message only via KBR Energy Bus: rEL 1 additional message at relay 1 rEL2 additional message at relay 2 If a limit is violated, the LED of the respective main menu starts to flash.
Submenu Limit 2	▶ go to limit 1 or ▼ Return to main menu	`190` L1 `DAT` ○ U_Ph-PN ○ U_Ph-Ph ○ I ○ S `NEG` L2 ○ P ○ Q ○ cos φ ○ kWh `OFF` L3 ○ kvarh ○ Harmon. ● Extra	Description see limit 1

👉 **NOTE**

If a relay is not configured as alarm relay but as a switching relay (setting only possible via eBus), L3 does not display anything.

The following table gives an overview of all limits available in the multimess F144-2-LED-ESMS-... -4.

Menu	Measured value	Programmed limits	Text displayed in de and en
Main menu U_{Ph-N}	Phase-to-neutral voltage	Limit 1 and limit 2 for L1 - L2 - L3	GW 1 and GW 2 Lim 1 and Lim 2
Submenu F_{power}	Network frequency	Limit 1 and limit 2	GW 1 and GW 2 Lim 1 and Lim 2
Main menu U_{Ph-Ph}	Phase-to-phase voltage	Limit 1 and limit 2 for L1 - L2 - L3	GW 1 and GW 2 Lim 1 and Lim 2
Main menu I_{act}	Phase current instantaneous values	Limit 1 and limit 2 for L1 - L2 - L3	GW 1 and GW 2 Lim 1 and Lim 2
Submenu I_{avg}	Average values for phase current	Limit 1 and limit 2 for L1 - L2 - L3	GW 1 and GW 2 Lim 1 and Lim 2
Submenu I_{nact}	Instantaneous value of neutral conductor current	Limit 1 and limit 2 for the instantaneous neutral conductor current	GW 1 and GW 2 Lim 1 and Lim 2
Submenu I_{Navg}	Average neutral conductor current	Limit 1 and limit 2 for the average neutral conductor current	GW 1 and GW 2 Lim 1 and Lim 2
Main menu S	Apparent power	Limit 1 and limit 2 for L1 - L2 - L3	GW 1 and GW 2 Lim 1 and Lim 2
Submenu S_{TOT}	Total apparent power	Limit 1 and limit 2 for total apparent power	GW 1 and GW 2 Lim 1 and Lim 2
Main menu P	Active power	Limit 1 and limit 2 for L1 - L2 - L3	GW 1 and GW 2 Lim 1 and Lim 2
Submenu P_{TOT}	Total active power	Limit 1 and limit 2 for total active power	GW 1 and GW 2 Lim 1 and Lim 2
Main menu Q	Reactive power	Limit 1 and limit 2 for L1 - L2 - L3	GW 1 and GW 2 Lim 1 and Lim 2
Submenu Q_{TOT}	Total reactive power	Limit 1 and limit 2 for total reactive power	GW 1 and GW 2 Lim 1 and Lim 2
Main menu COSφ	Fundamental power factor	Limit 1 and limit 2 for L1 - L2 - L3	GW 1 and GW 2 Lim 1 and Lim 2

Continued

Menu	Measured value	Programmed limits	Text displayed in de and en
Submenu Power factor	Power factor	Limit 1 and limit 2 for L1 - L2 - L3	GW 1 and GW 2 Lim 1 and Lim 2
Submenu Total PF	Power factor total	Limit 1 and limit 2 for the power factor total	GW 1 and GW 2 Lim 1 and Lim 2
Main menu Harmon.	Harmonics	Limit 1 and 2 of the distortion factor of the voltage and the 3rd to 19th network harmonic of L1-L3 as well as the current harmonic contents and their sum L1 - L3	GW 1 and GW 2 Lim 1 and Lim 2

9   Programming

9.1   Period time current average value

Menu	Button(s)	Device display	Description
Main menu I_{act} Submenu I average Period time	Hold the ⏩ button for 2 seconds. ⏩ Start input mode	10 L1 — TIME ○ U_{Ph-PN} ○ U_{Ph-Ph} ● I L2 ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh L3 ○ Harmon. ○ Extra	When you open the menu, the following text is shown in the unit display: TIME AVERAGE CURRENT TIME Display L1 shows the period time in minutes.
Submenu I Average value Setting the period time	123 ... ⏩ next digit or ✖ cancel or ⊜ save	10 L1 — TIME ○ U_{Ph-PN} ○ U_{Ph-Ph} ● I L2 ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh L3 ○ Harmon. ○ Extra	The first digit in display L1 flashes. Press the 123 button to set the number in this segment. Press the ⏩ button to switch to the next digit. You can set between 1 and 15 minutes.

Main menu I_{act}   ▶ or ▼

9.2   Tariff switching method

Menu	Button(s)	Device display	Description
Main menu Main menu kWh/HT Sub-menu Tariff input Tariff switching method	Hold the ▶ button for 2 seconds. ▼ Start input mode	d In L1 TARF O U_Ph-PN O U_Ph-Ph O I L2 O S O P O Q O cos φ ● kWh L3 O kvarh O Harmon. O Extra	When you open the menu, the following text is shown in the unit display: TARF LT TARIFF TIMES Display L1 shows the tariff switching method. The following switching methods can be selected: - dIn by external pulse - bUS via Energy Bus command - InT by internal time program
Submenu tariff input Set tariff switching method	🔢 next modes ▶ next digit or ▶ save	Int L1 TARF O U_Ph-PN O U_Ph-Ph O I L2 O S O P O Q O cos φ ● kWh L3 O kvarh O Harmon. O Extra	Display L1 flashes. Press the 🔢 button to switch between the above operating modes. The unit display switches between TARF and TYPE.
Main menu kWh	▶ or ▼		
Main menu kWh /HT Sub-menu Tariff input Set tariff switching time	🔢 Set start time ▼ L3 flashes 🔢 Set end time ✖ cancel or ⊖ save	Int L1 TARF O U_Ph-PN O U_Ph-Ph O I 22.00 L2 O S O P O Q O cos φ ● kWh 06.00 L3 O kvarh O Harmon. O Extra	Display L2 flashes. Press the 🔢 button to set the start or end time.
Main menu kWh/HT	▶ or ▼		

9.3   Measurement period synchronization

Menu	Button(s)	Device display	Description
Submenu kWh/LT Submenu Measurement period	Hold the ▶ button for 2 seconds ▶ Start input mode	d.In L1 5YNC ○ U_Ph-PN ○ U_Ph-Ph ○ I 15 L2 ○ S ○ P ○ Q ○ cos φ ● kWh 0357 L3 ○ kvarh ○ Harmon. ○ Extra	When you open the menu, the following text is shown in the unit display: 5YNC PARAMETER 5YNC Display L1 shows the synchronization type. Display L2 shows the measurement period in minutes. The time remaining until the next synchronization is indicated in display L3 in minutes and seconds. The following synchronization types can be selected: - InT by internal clock - dIn by external contact - bU5 via Energy Bus command - Tarf by tariff switching
Submenu Measurement period Set measurement period synchronization	123 ..... ⊗ cancel or ⊜ save	Id.In L1 TYPE ○ U_Ph-PN ○ U_Ph-Ph ○ I 15 L2 ○ S ○ P ○ Q ○ cos φ ● kWh 0357 L3 ○ kvarh ○ Harmon. ○ Extra	Display L1 flashes. Press the 123 button to switch between the above operating modes.
Main menu kWh	▶ or ▼		

👉 **NOTE**

In case of internal synchronization, you can restart the measurement period (in the kWh/LT submenu) by pressing the ⊗ button (for about 2 seconds)!

9.4   Programming limits

The following section explains how to parameterize the limits. The limits 1 and 2 of the phase voltage serve as an example.

Menu	Button(s)	Device display	Description
Submenu Voltage U_{Ph-N}	Hold the ▶ button for 2 seconds.	`235` L1 `L im 1` ● U_{Ph-PN} ○ U_{Ph-Ph} ○ I `PoS` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh `OFF` L3 ○ kvarh ○ Harmon. ○ Extra	Display L1 shows the limit value. Display L2 shows the effective direction of the limit. (`POS`: value must not exceed this limit; NEG: value must not fall below this limit; `OFF`: limit deactivated.)
Maximum	▼ Start input mode		
Submenu Voltage U_{Ph-N} Limit 1 Set value	🔢 ..... 🔼 next digit or ❌ cancel or ❌ save	`1235` L1 `L im 1` ● U_{Ph-PN} ○ U_{Ph-PN} ○ I `PoS` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh `OFF` L3 ○ kvarh ○ Harmon. ○ Extra	The first digit in display L1 flashes. Press the 🔢 button to set the number in this segment. Press the 🔼 button to switch to the next digit. Once all digits have been set, display L1 flashes. To position the decimal point, press the 🔼 button. The unit display switches between `LIM 1` and `V`.

Main menu U_{Ph-N}	▶ or ▼		
👉 **NOTE**	▶ or ▼		Use these buttons to switch between the individual displays in input mode (one flashing digit).

Menu	Button(s)	Device display	Description
Submenu Voltage U_{Ph-N} Limit 1 Set direction	▶ next digit or ✖ cancel or ⊜ save	`1235` L1 `L ım 1` ● U_{Ph-PN} ○ U_{Ph-Ph} ○ I `PoS` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh `OFF` L3 ○ kvarh ○ Harmon. ○ Extra	Display L2 flashes. Press the 🔢 button to select whether the limit is to be activated when exceeded (PoS) or when the value falls below the limit (nEG) or whether it should be locked (OFF).
Main menu U_{Ph-N}	▶ or ▼		
👉 **NOTE**	▶ or ▼		Use these buttons to switch between the individual displays in input mode (one flashing digit).
Submenu Voltage U_{Ph-N} Limit 1 Set message type	▶ next digit or ✖ cancel or ⊜ save	`1240` L1 `L ım 1` ● U_{Ph-PN} ○ U_{Ph-Ph} ○ I `nEG` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh `rEL 1` L3 ○ kvarh ○ Harmon. ○ Extra	Display L3 flashes. Use the 🔢 button to determine the message type for a limit violation. - Alarm on relay 1 (rel1) - Alarm on relay 2 (rel2) - Alarm only via KBR Energy Bus (OFF)
Main menu U_{Ph-N}	▶ or ▼		

👉 **NOTE**

If a relay is not configured as alarm relay but as a switching relay (setting only possible via eBus), L3 does not display anything.

9.5　Setting time and date

Menu	Button(s)	Device display	Description
Main menu Extra Submenu Date and time	▼ Start input mode	1432 L1　MO ○ U Ph-PN ○ U Ph-Ph ○ I 10.11 L2　○ S ○ P ○ Q ○ cos φ ○ kWh 2017 L3　○ kvarh ○ Harmon. ● Extra	Display L1 shows the time (hh.mm). Display L2 shows the date (dd.mm). Display L3 shows the year (yyyy). The unit display shows the week-day.
Submenu Set date and time	123 next modes ▶ next digit or ▶ save	1432 L1　MO ○ U Ph-PN ○ U Ph-Ph ○ I 10.11 L2　○ S ○ P ○ Q ○ cos φ ○ kWh 2017 L3　○ kvarh ○ Harmon. ● Extra	The first two digits in display L1 flash. Press the 123 button to set the numbers of these segments. Press the ▶ button to switch to the next digit. To set the day and month in display L2, proceed as described for display L1. The same applies to the year in display L3.

Main menu
Extra　　　▶ or ▼

☞　**NOTE**

Use these buttons to switch between the individual displays in input mode (one flashing digit).

9.6 Setting the bus address

Menu	Button(s)	Device display	Description
Main menu Extra Submenu eBus	▼ Start input mode (bus scan)	`000 1` L1 `EBUS` ○ U_Ph-PN ○ U_Ph-Ph ○ I ○ S `384` L2 ○ P ○ Q ○ cos φ ○ kWh ○ kvarh L3 ○ Harmon. ● Extra	Display L1 shows the device address. The baud rate is displayed in display L2.
Submenu eBus Assign address	▼ Start input mode	`SCAn` L1 `EBUS` ○ U_Ph-PN ○ U_Ph-Ph ○ I ○ S `384` L2 ○ P ○ Q ○ cos φ ○ kWh ○ kvarh L3 ○ Harmon. ● Extra	Display L1 indicates that the device is in scan mode. As soon as the device is recognized at the bus, it is automatically assigned an address by the software and this address is entered in the device memory. The baud rate is displayed in display L2.
👉 **NOTE**	▶ or ▼		Use these buttons to switch between the individual displays in input mode (one flashing digit).
Submenu eBus Assign address manually	🔢 Set start time ▼ L3 flashes 🔢 Set end time ✖ cancel or ⊜ save	`000 1` L1 `EBUS` ○ U_Ph-PN ○ U_Ph-Ph ○ I ○ S `384` L2 ○ P ○ Q ○ cos φ ○ kWh ○ kvarh L3 ○ Harmon. ● Extra	The first two digits in display L1 flash. Press the 🔢 button to set the value of these digits. Press the ▶ button to switch to the next digit.
Main menu Extra	▶ or ▼		

9.7   Setting the bus protocol

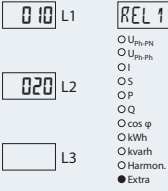| Menu	Button(s)	Device display	Description
Submenu eBus	▼ Start input mode (bus scan)	L1 `0001` `EBUS` ○ U_Ph-PN ○ U_Ph-Ph ○ I L2 `384` ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh L3 ○ Harmon. ● Extra	Display L1 shows the device address. The baud rate is displayed in display L2. The unit display shows the current bus protocol. (e.g. eBus).
Submenu eBus Assign address	▼ Start input mode	L1 `SCAn` `EBUS` ○ U_Ph-PN ○ U_Ph-Ph ○ I L2 `384` ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh L3 ○ Harmon. ● Extra	The first digit in display L1 flashes. Press the 🔼 button to enter the input mode to set the bus protocol.
Submenu eBus Assign bus protocol	▼ ▼ ..... 🔢 select ✖ cancel or 💾 save	L1 `0001` `EBUS` ○ U_Ph-PN ○ U_Ph-Ph ○ I L2 `384` ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh L3 ○ Harmon. ● Extra	Display L1 shows the device address. The baud rate is displayed in display L2. The unit display flashes. Press the 🔢 button to choose from different bus protocols. (eBus or Modbus).

Main menu Extra   ▶ or ▼
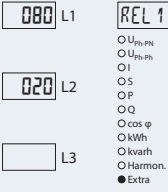
9.8   Setting the Modbus bus address and baud rate

Menu	Button(s)	Device display	Description
Submenu Modbus	▼ Start input mode	000 1 L1 MBUS ○ U Ph-PN ○ U Ph-Ph ○ I 192 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh rtu L3 ○ kvarh ○ Harmon. ● Extra	Display L1 shows the device address. The baud rate is displayed in display L2. Display L3 shows the selected bus protocol (RTU or ASC).
Submenu Modbus Assign address	🔢 ..... ▶ next digit or ✖ cancel or ⊜ save	000 1 L1 MBUS ○ U Ph-PN ○ U Ph-Ph ○ I 192 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh rtu L3 ○ kvarh ○ Harmon. ● Extra	The first digit in display L1 flashes. Press the 🔢 button to set the number of this segment. Press the ▶ button to switch to the next digit.
Main menu Extra	▶ or ▼		
Submenu Modbus Assign baud rate	🔢 next baud rate ✖ cancel or ⊜ save	000 1 L1 MBUS ○ U Ph-PN ○ U Ph-Ph ○ I 192 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh rtu L3 ○ kvarh ○ Harmon. ● Extra	Display L2 flashes. Press the 🔢 button to choose from different baud rates with the respective even/odd parity or no parity. 4.8 k baud 9.6 k baud 19.2 k baud
Main menu Extra	▶ or ▼		
Submenu Modbus Assign transmission mode	▼ next baud rate ✖ cancel or 🔢 select ⊜ save	000 1 L1 MBUS ○ U Ph-PN ○ U Ph-Ph ○ I 192 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh rtu L3 ○ kvarh ○ Harmon. ● Extra	Display L3 flashes. Press the 🔢 button to choose between the different modes (RTU or ASC).
Main menu Extra	▶ or ▼		
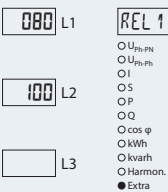
9.9   Setting the relay on-delay and off-delay

Menu	Button(s)	Device display	Description
Submenu REL 1	⬇ Start input mode	`0 10` L1 `REL 1` ○ U Ph-PN ○ U Ph-Ph ○ I `020` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh L3 ○ Harmon. ● Extra	Display L1 shows the on-delay for relay 1 in seconds. Display L2 shows the off-delay for relay 1 in seconds. The unit display switches between REL 1 and TON.
Submenu REL 1 Set on-delay	🔢 ..... ◀ next digit or ✖ cancel or ⊜ save	`080` L1 `REL 1` ○ U Ph-PN ○ U Ph-Ph ○ I `020` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh L3 ○ Harmon. ● Extra	The first digit in display L1 flashes. Press the 🔢 button to set the number of this segment. (max. 255 seconds). Press the ◀ button to switch to the next digit.
Main menu Extra	▶ or ⬇		
👉 **NOTE**	▶ or ⬇		Use these buttons to switch between the individual displays in input mode (one flashing digit).
Submenu REL 1 Set off-delay	🔢 ..... ◀ next digit or ✖ cancel or ⊜ save	`080` L1 `REL 1` ○ U Ph-PN ○ U Ph-Ph ○ I `100` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh L3 ○ Harmon. ● Extra	The first digit in display L2 flashes. Press the 🔢 button to set the number of this segment. (max. 255 seconds). Press the ◀ button to switch to the next digit. The assignment as switching relay is shown in display L1 ----, L2 ---- and L3 BUS. Configuration is only possible via eBus using optionally available software.
Main menu Extra	▶ or ⬇		

NOTE

Relay 2 is set the same way as relay 1.

9.10   Activating daylight saving time and setting the relay off-delay

Menu	Button(s)	Device display	Description
Submenu Daylight saving time	▼ Start input mode	On L1 DST O U_{Ph-PN} O U_{Ph-Ph} O I 03 L2 O S O P O Q O cos φ O kWh 10 L3 O kvarh O Harmon. ● Extra	Display L1 indicates whether daylight saving time is activated or not. Display L2 shows the month daylight saving time begins. Display L3 shows the month daylight saving time ends. The unit display shows $DAYLIGHTSAVING$ $PARAMETER$ and then DST.
Submenu Daylight saving time on/off	🔢 ..... ▶ next digit or ✖ cancel or ⊖ save	On L1 DST O U_{Ph-PN} O U_{Ph-Ph} O I 03 L2 O S O P O Q O cos φ O kWh 10 L3 O kvarh O Harmon. ● Extra	Display L1 flashes. Press the 🔢 button to activate (on) or deactivate (oFF) daylight saving time.
Main menu Extra	▶ or ▼		
👉 **NOTE**	▶ or ▼		Use these buttons to switch between the individual displays in input mode (one flashing digit).
Submenu Daylight saving time on/off Start	🔢 ..... ▶ next digit or ✖ cancel or ⊖ save	On L1 DST O U_{Ph-PN} O U_{Ph-Ph} O I 03 L2 O S O P O Q O cos φ O kWh 10 L3 O kvarh O Harmon. ● Extra	Display L2 flashes. Press the 🔢 button to set the month daylight saving time begins. The unit display switches between $BEG.$ and DST.
Main menu Extra	▶ or ▼		
👉 **NOTE**	▶ or ▼		Use these buttons to switch between the individual displays in input mode (one flashing digit).

Continued

Menu	Button(s)	Device display	Description
Submenu Daylight saving time on/off End	🔢 ..... ▶ next digit or ✖ cancel or ⊖ save	`On` L1 `DST` ○ U_Ph-PN ○ U_Ph-Ph ○ I `03` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh `10` L3 ○ kvarh ○ Harmon. ● Extra	Display L3 flashes. Press the V button to set the month daylight saving time ends. The unit display switched between `END` and `DST`.
Main menu Extra	▶ or ▼		
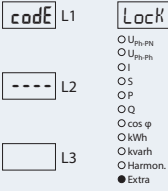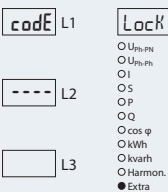
9.11   Language settings

Menu	Button(s)	Device display	Description
Submenu Language	▼ Start input mode	`EnGL` L1 `LANG` ○ U_Ph-PN ○ U_Ph-Ph ○ I ☐ L2 ○ S ○ P ○ Q ○ cos φ ○ kWh ☐ L3 ○ kvarh ○ Harmon. ● Extra	Display L1 flashes. For German, it displays `dEuT` For English `EnGL` The unit display shows `SPRA` if the user language is German and `LANG` if it is English.
Submenu Language set	🔢 ..... or ✖ cancel or ⊖ save	`EnGL` L1 `LanG` ○ U_Ph-PN ○ U_Ph-Ph ○ I ☐ L2 ○ S ○ P ○ Q ○ cos φ ○ kWh ☐ L3 ○ kvarh ○ Harmon. ● Extra	Display L1 shows the user language. Press the 🔢 button to select the operating language. For German, it displays `dEuT` For English `EnGL` The unit display shows `SPRA` if the user language is German and `LANG` if it is English.
Main menu Extra	▶ or ▼		

9.12 Password

Menu	Button(s)	Device display	Description
Submenu Password	⬇ Start input mode	codE L1 LocK ---- L2 L3 ○ U_Ph-PN ○ U_Ph-Ph ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ● Extra	Display L1 shows CODE. The unit display shows LOCK or FREE. If the device is unlocked, the code number will be displayed in L2. If the device is locked, ---- will be displayed. The device is delivered with the release code 9999, i.e. all functions of the device are available.
Submenu Password set	🔢 ..... ▶ next digit or ✖ cancel or ⊖ save	codE L1 LocK ---- L2 L3 ○ U_Ph-PN ○ U_Ph-Ph ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ● Extra	Display L1 shows CODE. The unit display shows LOCK or FREE. Display L2 shows 9999. Display L2 flashes. Press the 🔢 button to set the number of this segment. Press the ▶ button to switch to the next digit.

Main menu Extra	▶ or ⬇	

9.13   Configuring the pulse output

Menu	Button(s)	Device display	Description
Submenu Pulse output	▼ Start input mode	P L1 PULS. ○ U_Ph-PN ○ U_Ph-Ph ○ I 1.000 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh 100 L3 ○ kvarh ○ Harmon. ● Extra	Display L1 indicates whether the pulse output is deactivated (OFF) or configured for active (P) or reactive (q) energy Display L2 shows the pulse significance, i.e. pulse/kWh or kvarh. Display L3 shows the energy pulse length in ms.
Submenu Pulse output Set pulse source	🔢 ..... ▶ next digit or ✖ cancel or ⊜ save	P L1 SRC. ○ U_Ph-PN ○ U_Ph-Ph ○ I 1000 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh 100 L3 ○ kvarh ○ Harmon. ● Extra	When you open the menu, the following text is displayed in the unit display: SRC. SOURCE SRC. Display L1 flashes. Press the 🔢 button to select the active energy (P consumption or P- recovery), the reactive energy (q consumption or q- recovery) or deactivate (OFF) the energy pulse.
Main menu Extra	▶ or ▼		
👉 **NOTE**	▶ or ▼		Use these buttons to switch between the individual displays in input mode (one flashing digit).
Submenu Pulse output Set pulse significance	🔢 ..... ▶ next digit or ✖ cancel or ⊜ save	P L1 VAL. ○ U_Ph-PN ○ U_Ph-Ph ○ I 1000 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh 100 L3 ○ kvarh ○ Harmon. ● Extra	When you open the menu, the following text is displayed in the unit display: VAL. VALENCY VAL. The first digit in display L2 flashes. Press the 🔢 button to set the number of this segment. Press the ▶ button to switch to the next digit. If all digits are flashing, you can move the decimal point with the 🔢 button.

Continued

Menu	Button(s)	Device display	Description
Main menu Extra	▶ or ▼		
👉 **NOTE**	▶ or ▼		Use these buttons to switch between the individual displays in input mode (one flashing digit).
Submenu Pulse output Set pulse length	🔢 ..... ▶ next digit or ✖ cancel or ⊜ save	P L1 VAL. ○ U~Ph-PN~ ○ U~Ph-Ph~ ○ I 1000 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh 100 L3 ○ kvarh ○ Harmon. ● Extra	When you open the menu, the following text is displayed in the unit display: LEN LENGTH LEN The first digit in display L3 flashes. Press the 🔢 button to set the number of this segment. Press the ▶ button to switch to the next digit.
Main menu Extra	▶ or ▼		

👉 **NOTE**

If the "Extra" LED flashes after the pulse significance is entered, follow the instructions below. The "Extra" LED flashes until a matching (lower) pulse count or pulse length is entered.

Check the pulse significance in relation to the pulse length. Correct the pulse length or the pulse significance if required.

The maximum processable active or reactive energy can be estimated with the following calculation.

$$\frac{3600\ s}{2 \times IL \times pulse/kWh\ (kvarh)} = \text{maximum value}$$

Explanation:

3600   Constant [s]

IL   Required pulse length [s]

pulse/kWh (kvarh) Required pulse count per kWh or per kvarh [pulse/kWh or pulse/kvarh]

Maximum value   Maximum active or reactive energy output [kWh or kvarh].

9.14   Damping coefficient

Menu	Button(s)	Device display	Description
Submenu Damp. coefficient	**▶** Start input mode	U 0 L1 JF ○ U_Ph-PN ○ U_Ph-Ph ○ I 1 0 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	Display L1 shows the damping coefficient used to record the voltage. Display L2 shows the damping coefficient to calculate the current.
Submenu Damp. coefficient Set voltage	**⊞** ..... **▶** next digit or **✕** cancel or **⊜** save	U 0 L1 JF ○ U_Ph-PN ○ U_Ph-Ph ○ I 1 0 L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	When you open the menu, the following text is displayed in the unit display: JF JAMPINGFACTOR JF The first digit in display L1 flashes. Press the **⊞** button to set the number of this segment. Range of values: 0 - 8

| Main menu Extra | **▶** or **▼** | | |

| 👉 **NOTE** | **▶** or **▼** | | Use these buttons to switch between the individual displays in input mode (one flashing digit). |

| Submenu Damp. coefficient

Set current | **⊞** .....
▶ next digit
or
✕ cancel
or
⊜ save | U 0 L1   JF
○ U_Ph-PN
○ U_Ph-Ph
○ I
1 0 L2 ○ S
○ P
○ Q
○ cos φ
○ kWh
L3 ○ kvarh
○ Harmon.
● Extra | The first digit in display L2 flashes. Press the **⊞** button to set the number of this segment.
Range of values: 0 - 8 |

| Main menu Extra | **▶** or **▼** | | |

9.15   Default settings

Menu	Button(s)	Device display	Description
Submenu Default settings		L1 DEF. O U_{Ph-PN} O U_{Ph-Ph} O I O S O P L2 O Q O cos φ O kWh O kvarh L3 O Harmon. ● Extra	The unit display shows DEF.
Submenu Default settings Reset to default settings	Press 🔢 + ✖ + ▶ at the same time	L1 KILL O U_{Ph-PN} O U_{Ph-Ph} O I O S O P L2 O Q O cos φ O kWh O kvarh L3 O Harmon. ● Extra	When you press these three buttons at the same time, the following text is shown in the unit display: KILL The device is now reset to its default parameters (default settings) and all stored data are deleted.

Main menu
Extra or next   ▶ or ▼
submenu

9.16 Zero point creator

Menu	Button(s)	Device display	Description
Submenu Zero point creator	▶ Start input mode	OFF L1 0-P ○ U_{Ph-PN} ○ U_{Ph-Ph} ○ I L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	Display L1 shows the state of the zero point creator.
Submenu Zero point creator activate	🔢 ..... ⊗ cancel or ⊖ save	OFF L1 0-P ○ U_{Ph-PN} ○ U_{Ph-Ph} ○ I L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	When you open the menu: Display L1 flashes. Press the 🔢 button to activate this function. Range of values: oFF, on

Main menu
Extra or next   ▶ or ▼
submenu

9.17   Analog outputs

Menu	Button(s)	Device display	Description
Submenu Analog outputs	▶ Start input mode	4-20 L1 mA ○ U_Ph-PN ○ U_Ph-Ph ○ I ○ S L2 ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	Display L1 shows the output value of the analog outputs 1 to 3.
Submenu Analog outputs Set output type	123 ..... or ✕ cancel or ⊝ save	4-20 L1 mA ○ U_Ph-PN ○ U_Ph-Ph ○ I ○ S L2 ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	When you open the menu, 4-20 flashes in display L1. Press the 123 button to select the output type. **Range of values:** 0 - 20 mA 4 - 20 mA 0 - 10 V 2 - 10 V
Main menu Extra or next submenu	▶ or ▼		
next submenu	▶ Start input mode		
Submenu Analog outputs Activate output 1 and select output data point	123 ..... ✕ cancel or ⊝ save	AnA1 L1 OFF ○ U_Ph-PN ○ U_Ph-Ph ○ I ○ S L2 ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	When you open the menu, OFF flashes in the unit display. Press the 123 button to activate the output and to set the output data point. **Range of values:** see following output data points
Set lower limit	▶ or ▼		
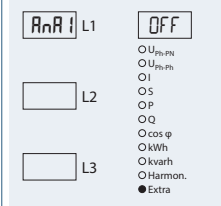
The following output data points are available:

Off (output deactivated)

Voltage U PH-N L1	Reactive power L1
Voltage U PH-N L2	Reactive power L2
Voltage U PH-N L3	Reactive power L3
Voltage U PH-PH L12	CosPhi L1
Voltage U PH-PH L23	CosPhi L2
Voltage U PH-PH L31	CosPhi L3
Apparent current Is L1	Power factor L1
Apparent current Is L2	Power factor L2
Apparent current Is L3	Power factor L3
Average apparent current L1	Network frequency
Average apparent current L2	Neutral conductor apparent current
Average apparent current L3	Average neutral conductor apparent current
	Total active power
Apparent power L1	Total reactive power
Apparent power L2	Total apparent power
Apparent power L3	Power factor total
Active power L1	
Active power L2	
Active power L3	

Menu	Button(s)	Device display	Description
Submenu Analog outputs Set lower limit		`AnA1` L1 `U L1` ○ U_{Ph-PN} ○ U_{Ph-Ph} `0.00` L2 ○ I ○ S ○ P ○ Q ○ cos φ `0.00` L3 ○ kWh ○ kvarh ○ Harmon. ● Extra	Display L1 shows the analog output 1. Display L2 shows the lower limit and flashes (`0.00`) Display L3 shows the upper limit.
👉 **NOTE**	⏭		Use these buttons to switch between the individual displays in input mode (one flashing digit).
Submenu Analog outputs Set lower limit	🔢 ..... ❌ cancel or 💾 save or	`AnA1` L1 `U L1` ○ U_{Ph-PN} ○ U_{Ph-Ph} `1.00` L2 ○ I ○ S ○ P ○ Q ○ cos φ `460` L3 ○ kWh ○ kvarh ○ Harmon. ● Extra	The first digit in display L2 flashes. Press the 🔢 button to set the number of this segment. Press the ⏭ button to switch between the individual digits. If all digits are flashing, you can move the decimal point with the 🔢 button. The unit display is also changed.
Set upper limit	▶ or ▼		
👉 **NOTE**	⏭		Use these buttons to switch between the individual displays in input mode (one flashing digit).
Submenu Analog outputs Set upper limit	🔢 ..... ❌ cancel or 💾 save or	`AnA1` L1 `U L1` ○ U_{Ph-PN} ○ U_{Ph-Ph} `1.00` L2 ○ I ○ S ○ P ○ Q ○ cos φ `460` L3 ○ kWh ○ kvarh ○ Harmon. ● Extra	The first digit in display L3 flashes. Press the 🔢 button to set the number of this segment. Press the ⏭ button to switch between the individual digits. If all digits are flashing, you can move the decimal point with the 🔢 button. The unit display is also changed.
Set output data point	▶ or ▼		

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Continued

Menu	Button(s)	Device display	Description
Main menu Extra or next sub-menu	▶ or ▼		
next submenu	▶❘		
Submenu Analog outputs Activate output 2 and select output data point	🔢 ..... ▶❘ next digit or ✖ cancel or ⊟ save	[AnA2] L1 [OFF] [ ] L2 [❘] L3 ○ U_{Ph-PN} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ Harmon. ● Extra	When you open the menu, OFF flashes in the unit display. Press the 🔢 button to set the output data point.
Set lower limit	▶ or ▼		

👉 **NOTE**

The analog outputs AnA2 and AnA3 can be set the same way as analog output AnA1

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Reset and delete function

10 Reset and delete function

10.1 Reset

⒓ + ⊗ + ▶	To reset, go to the Default settings submenu of the Extra menu.
Only reset the energy meter during setup or if the device is completely reprogrammed	Hold the buttons digit, delete and right arrow at the same time. The 15-segment display will show "KILL" during reset. The device is reset to its default settings, i.e. all stored data are lost!
Caution! Reset will reset all programmed values to the default settings!	This includes all operating parameters, limits and extreme values as well as the off-delay of the signaling relays. The memory for limit violations is deleted.
	The settings for time, date and bus address are not affected by a reset.
	Check all operating parameters for correctness!

10.2 Delete energy meter

10.2.1 Delete energy meter manually

Hold the ⊗ button for about 2 seconds to delete the continuous energy meter value currently displayed (active or reactive energy, HT or LT, consumption or recovery).

10.2.2 Delete all energy meters

To delete all energy meters, you can either reset the device or use the optionally available software and KBR Energy Bus.

10.3 Deleting extreme values

10.3.1 Deleting individual extreme values

Press the ⊗ button for about 2 seconds to delete the extreme values (minimum or maximum values) currently displayed.

10.3.2   Deleting all extreme values

To delete all minimum and maximum values, hold the buttons and for about 2 seconds while any minimum or maximum value is displayed. The function is also available via the KBR Energy Bus.

10.4   Deleting limit settings

10.4.1   Deleting individual limit settings

You can only deactivate individual limits in programming mode.

In programming mode, set the type of the limit you want to deactivate to "OFF".

10.4.2   Deleting all limit settings

To delete all limits, hold the buttons and for about 2 seconds while any limit is displayed. The function is also available via the KBR Energy Bus.

11   Memory functions

11.1   Device settings

All device settings and configuration data for the memory function are stored in the device.

11.2   Basic device parameters

Parameter	Stored by user
Measuring voltage	can be programmed by user in the range from 0001 V to 999.9 kV
Measuring current; transformer primary current	can be programmed by user in the range from 0001 A to 999.9 kA
Measuring current (at the input side, i.e. secondary transformer!)	can be selected by user: 1A or 5A
Pulse output type / pulse significance / pulse length	acc. to user settings
Tariff switching	the user can select digital input, switching via Energy Bus or switching at times programmed in the device
Synchronization settings	Setting options see measurement period synchronization
Bus address	acc. to user settings between 0001 and 9999
Time	acc. to user settings in hh:mm:ss
Password	according to user settings password is a 4-digit number (leading zeros) 9999 means: Device is not password-protected
Device name	can be defined by the user [1*]
Event name	each event is given an unique name[1*]
Measurement period	1 / 15 / 30 / 60 min [1*]
Analog outputs	can be set by user to 0-10 V, 2-10 V 0-20 mA or 4-20 mA

[1*] This function can only be set using a computer with optionally available software (e.g. visual energy).

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11.3   Long-term memory

The multimess F144-2-LED-ESMS-...-4 supports the long-term memory functionality described in the following section.

11.4   Load profile memory

The measuring device has a load profile memory that can record a maximum of up to 35136 entries depending on the number of parameters to be stored (active power periods for HT and LT, consumption and recovery, reactive power periods for HT and LT, capacitive and inductive) and the measurement period selected by the user (period values of 60 / 30 / 15 / 1 minute(s) are possible). This means that a period of 15 minutes results in a maximum storage duration of 365 days.

The measurement period and the selection of the parameters to be saved can be parameterized using a computer with the optionally available software.

> 👉 **NOTE**

Setting the internal clock:
If the time of the multimess F144-2-LED-ESMS-...-4 is set to less than the duration of one period, the measurement for the instantaneous period is finished and saved the next time the device synchronizes.
If the time of the multimess F144-2-LED-ESMS-...-4 is adjusted by more than the period time, the load profile memory is deleted and restarted.
In both cases, a clock adjustment event is created and saved in the event memory. Adjusting the period time:
If the period time is adjusted, the load profile memory is deleted and restarted.
An adjustment event (adjustment of the parameters) is created and entered in the event memory.

11.5   Annual energy memory

The daily energy values of the past 365 days for W_{Act} consumption, W_{Act} recovery, W_{React} inductive and W_{React} capacitive are stored separately for high and low tariff in an annual energy memory.

11.6 Event memory

The event memory saves 4096 events with date, time and status in a ring buffer. The following events are acquired:

Event	Recording
Tariff input	Switchover signal HT => LT with date and time Switchover signal LT => HT with date and time
Sync input	Subsequent synchronization with date and time, information on the synchronization type
Power failures	with date, time and duration of the power failure
Error	Error type with date and time
Changed settings/deletions (powerfail entry)	e.g. reset via EBUS / set clock / deletions / parameter changes leading to deletions
Measuring voltage failures	If the power is reduced to 85 % of the rated voltage for longer than 20 ms (can be set using the computer).

☞ NOTE

The memories described can only be read or configured via the Energy Bus and optionally available software (e.g. visual energy).

11.7 Measurement period synchronization

The measurement period of the multimess F144-2-LED-ESMS-...-4 can be synchronized in four ways, with the measurement period being adjustable. The measurement period and the synchronization always affect all period significance values.

The following 4 types of synchronization are possible:

11.8 Synchronization only by internal clock

Synchronization by internal clock is started with the factory reset. From this start time, the clock will synchronize the measurement period every 15 minutes.

☞ **NOTE**

The memories described can only be read or configured via the Energy Bus with optionally available software (e.g. visual energy).

11.9   Synchronization by the energy supplier's synchronous pulse

If the synchronous pulse is available as floating contact from the energy supplier, it can be connected to the synchronization input. If the contact closes for at least 250 ms, it is detected as a synchronous pulse and the measurement period is restarted.

Under certain operating conditions, the energy supplier may carry out a subsequent synchronization while a measurement period is still running. The multimess F144-2-LED-ESMS-...-4 ends the running period measurement and saves the period value with a timestamp. The time pattern is shifted to the new start time and a new measurement is started immediately.

Example:

The period time is set to 15 minutes, i.e. 20 kW input power results in a period value of 20 kW (15-minute period). If there is a subsequent synchronization 3 minutes after the period starts and this 3-minute period is saved, the period value recorded is 4 kW.

If the energy supplier's synchronous pulse is not available, the status message "ext. synchronous pulse missing" is issued and the internal clock continues the time frame.

11.10   Synchronization by KBR eBus

Synchronization is carried out via a telex created either by the computer or the bus master and sent to the selected recipients via the KBR ENERGY BUS .

Under certain operating conditions, a subsequent synchronization may be carried out while a measurement period is still running. The multimess F144-2-LED-ESMS-...-4 ends the current period measurement and saves the period value with a timestamp. The time pattern is shifted to the new start time and a new measurement is started immediately.

Example:

The period time is set to 15 min

i.e. 20 kW input power results in a period value of 20 kW (15 min period)

If a subsequent synchronization is performed 3 minutes after the period starts and this 3-minute period is saved, the period value recorded is 4 kW.

If the bus synchronous pulse is not available, the status message "ext. synchronous pulse missing" is issued and the internal clock continues the time frame.

11.11   Synchronization at tariff change

This type of synchronization makes it possible for the measuring device to change tariffs immediately after the tariff HT/LT has been switched instead of waiting until the end of the measurement period.

The internal clock synchronizes the measurement period. Depending on the configuration by contact at the HT/LT input or by bus signal, this event will also synchronize the measurement period if the tariff is changed. Under certain operating conditions, the synchronization pulse and the internal measurement period synchronization may not be in accordance with the same time pattern. The multimess F144-2-LED-ESMS-...-4 ends the current period measurement and saves the period value with a time stamp. The time pattern is shifted to the new start time and a new measurement is started immediately.

Example:

The period time is set to 15 minutes, i.e. 20 kW input power results in a period value of 20 kW (15-minute period). If synchronization is performed 3 minutes after the period starts and this 3-minute period is saved, the period value recorded is 4 kW.

12 Technical data

12.1 Measuring and display values

Wave form for U and I		any
Voltage	RMS value of a measuring interval	Phase - 0: $U_{L1\text{-}N}$; $U_{L2\text{-}N}$; $U_{L3\text{-}N}$ / phase - phase: $U_{L1\text{-}2}$; $U_{L2\text{-}3}$; $U_{L3\text{-}1}$
	Units	[V, kV] display is switched automatically
	Measuring range	0.00kV to 999.9kV
Current (apparent current)	RMS value of a measuring interval	$I_{L1\ act}$; $I_{L2\ act}$; $I_{L3\ act}$; instantaneous value for each phase
	Averaging	$I_{L1\ avg}$; $I_{L2\ avg}$; $I_{L3\ avg}$; floating average value of RMS values over a set period of time
	Units	[A;kA;MA]; display is switched automatically
	Measuring range	0.00A to 999.9kA
Neutral conductor current	RMS value of a measuring interval	$I_{N\ act}$ / $I_{N\ avg}$ instantaneous and average value - see "Phase current"
	Units	[A;kA;MA] display is switched automatically
	Measuring range	0.00A to 1.2 MA
Frequency	Power frequency measurement	f_{power} ; measured with power supply correction
	Units	[Hz]
	Measuring range	40....70 Hz
Apparent power	Calculation	S_{L1}; S_{L2}; S_{L3}; S_{tot}
	Units	[VA; kVA; MVA] display is switched automatically
	Measuring range	0.00 VA to 999 MVA
Active power	Calculation	P_{L1}; P_{L2}; P_{L3} ; P_{total};
	Units	[W; kW; MW] display is switched automatically
	Measuring range	0.00W to 999MW
Reactive power	Calculation →ind. and cap.	Q_{L1}; Q_{L2}; Q_{L3}; Q_{total}; distinction between ind./cap.
	Units	[Var; kvar; Mvar]; display is switched automatically.
	Measuring range	0.00 Var to 999 MVar
Power factor	Calculation →ind. and cap.	$\cos_{\varphi L1}$; $\cos_{\varphi L2}$; $\cos_{\varphi L3}$; PF_{L1}; PF_{L2}; PF_{L3}; PF_{Tot}; distinction between ind./cap. $\cos_{\varphi}$ in the display
	Measuring range	CosPhi 0.1ind. ← 1 → 0 1cap., PF 0.1 - 1

Continued

Active energy	Calculation	W (HT/LT); $P_{\text{average max. of a measurement period}}$
	Units	[Wh; kWh; MWh]; display is switched automatically
	Measuring range	0.0kWh to 9999999999.9kWh
Reactive energy	Calculation	W_{React} (HT/LT) → ind. or cap. $Q_{\text{average max. of a measurement period}}$;
	Units	[varh; kvarh; Mvarh]; display is switched automatically
	Measuring range	0.0kvarh to 9999999999.9kvarh
Harmonics	Distortion factor (THD) for voltage	Voltage: DF-UL1; DF-UL2; DF-UL3,
	Partial distortion factors	3rd; 5th; 7th; 9th; 11th; 13th; 15th; 17th and 19th Harmonics of the voltage
	Units	[%]
	Measuring range	0.00% to 100%
Current harmonics	Current harmonics Current harmonics total	3rd; 5th; 7th; 9th; 11th; 13th; 15th; 17th and 19th Harmonic for each phase of current: I_{TotL1}; I_{TotL2}; I_{TotL3} for each phase separately
	Units	[A]
	Measuring range	0.00A to 999.9kA

12.2 Measurement accuracy

Current	± 0.5 % / ± 1 digit
Voltage	± 0.5 % / ± 1 digit
Apparent power	± 1 % / ± 1 digit
Active power	± 1 % / ± 1 digit
Reactive power	± 1 % / ± 1 digit
Power factor	± 1 % / ± 1 digit
Frequency	± 0.1 Hz / ± 1 digit

12.3   Measuring principle

Sampling	128 readings per period
A/D converter	10 bit
Measurement of U and I	Simultaneous recording of U and I readings;
Update speed (complete measuring cycle)	~ 330 ms
Harmonics calculation	DFT with 128 points over one period
Frequency measurement	Consumption: Voltage measured between phases L1, L2, L3 - N; correct frequency measurement with power supply correction

12.4   Device memory

Main and data memory		2 MB RAM battery-buffered
Program and parameter memory		256 kB flash
Memory type		Ring buffer
Long-term memory (1 year) - only for Comfort		Daily values for active and reactive energy (HT and LT) for consumption and recovery
Long-term memory for 160 / 80 / 40 days / 64 hours		60 / 30 / 15 / 1 minute – average values of: P_{total}; Q_{total}
Extreme values (max./min.)		Extreme values that occurred after connecting the unit to the power supply or after the extreme value memory was deleted manually (maximum indicator function) including date and time
Event memory:	Memory size	4096 events including date and time they occurred
Limit violation	Time for acquisition	≥ 550 ms
Measuring voltage dips	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).
Measuring voltage		approx. 5 years acc. to manufacturer's specifications

12.5   Power supply

Power supply Power consumption <15 VA, 10 W	US1: ⎓ 110 - 240V ±10 % DC/50/60 Hz US5: ⎓ 22.5 - 64 V ±10 % DC/50/60 Hz

12.6 Hardware inputs and outputs

12.6.1 Inputs

Voltage measurement 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	IL1; IL2; IL3	3 x 0.01 A...1 A...1.2 A AC (measuring range 1) 3 x 0.05 A...5 A...6 A AC (measuring range 2)
	Power consumption	≤ 0.3 VA per input at 6 A
	Measuring range	can be configured using voltage and current transformers
Digital inputs	Tariff 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 ≥ 250 ms
	Power supply	27 V / 15 mA DC internal

12.6.2 Outputs

Signaling 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; the same phase must be applied to both relays
Pulse output	Output type	proportional to active or reactive energy, configurable on the device from min. 0.001 to max. 9990 pulse(s) per kWh
	Optocoupler output	15 mA at max. 35 V; S0 interface
	Accuracy class	2
	Pulse length	configurable, min. 30 ms, max. 999 ms
	Power supply	external

Continued

Analog output	Number	3
	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 0-10V, 2-10V or 0-20mA, 4-20 mA
Serial interface	BUS	RS485 for connection to the KBR eBus or Modbus; max. 32 devices, up to 1000 devices with bus repeater
	Baud rate	38,400
	Addressing	Can be addressed automatically with software or manually on the device up to address 9999

12.7 Electrical connection

Connection elements		Plug terminals
Permissible cross section of the connection lines		2.5 mm^2
Measuring voltage inputs	Fuse protection	max. 1 A slow-blow max. C2 automatic isolating switch UL/IEC-approved
Measuring 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 2A 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	Ensure correct polarity! To ensure proper operation, only use shielded twisted-pair cables; e.g. I-Y-St-Y2x2x0.8 EIB

Continued

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

12.8 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	750 g

12.9   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 class	I	
	Overvoltage category, measurement category	Voltage measurement: Current measurement: Power supply:	CAT III: 300 V; CAT II: 400 V CAT III: 300 V CAT III: 300 V
	Rated surge voltage	4kV	
Protection type	Standards	DIN EN 60529:2014-09	
	Front	IP 40, with housing seal IP 51	
	Terminals	IP 20	
EMC	Standards	DIN EN 61000-6-2:2006-03 + amendment 1:2011-03 DIN EN 61000-6-3:2011-09 + amendment 1:2012-11 DIN EN 61326-1:2013-07	
Synchronization	Type	internal, manual, tariff switching or by KBR eBus	
Synchronization time	Adjustable	manually once per measurement period if internal synchronization is selected on the device.	

12.10 Default settings after reset

Primary voltage / secondary voltage	400 V
Primary current / Secondary current	5 A
Measurement period time	15Min. Measurement period
Daylight saving time	from months 03 to 10
Low tariff time	Switching activated via hardware input on the device,
	Programmed time for internal switching between HT and LT: int. 00.00 to 00.00 (no low tariff time activated)
Language	deut. (German text display)
Damping coefficient for current and voltage	DF 0 (no damping)
Energy pulse	P. (active power for consumption), 1 pulse /kWh, pulse length 100 ms
Alarm relay	ON-delay tON = 0 sec OFF-delay tOFF = 0 sec
Analog output	Deactivated
Measurement period synchronization	Energy bus
Password	9999 / all functions can be accessed
Period entries in the load profile memory	35136 entries

Unaffected by a RESET:

    1. Bus address

    2. Time

13 Serial interface

13.1 RS 485 bus operation

The RS485 port of the multimess F144-2-LED-ESMS-...-4 is designed for operation at the eBus. With the eBus, you can operate one or several multimess F144-2-LED-ESMS-...-4 devices across great distances. The bus is connected to the computer via the RS 485 interface converter. Using the relevant Windows® software, all bus devices can be configured and visualized. Please contact us to obtain information on which other devices you can connect to the eBus and on the functions of our Windows® software.

You can find information on the structure and technical parameters of the Energy Bus in our eBus installation guide. You are welcome to request this installation guide from us at any time.

14 Overvoltage and lightning protection

To protect your purchased high-quality devices from damage, we strongly recommend that you take overvoltage protection measures. Protect control voltage inputs, pulse and bus lines.

15   Troubleshooting

No function.

Check the power supply, back-up fuse, isolating switch and supply line.

The measuring voltage of a phase is 0V.

Check the back-up fuse and isolating switch of the phase.

A phase of the current display has a different sign.

Check k and l of current measurement and correct if necessary.

Compared to the measurement of the energy supplier, the measured values for energy and power are too small.

Check k and l of the current measurement as well as if the phases of the transformers are correct and adjust if required.

One of the 8 LEDs is flashing.

There has been a limit violation in the menu that corresponds to the flashing LED.

ErrU OVERLOAD or ErrI OVERLOAD.

ErrU: Voltage input of the measuring amplifier overloaded
Switch off measuring voltage and check set transformer ratio. In case of direct measurement, the programmed secondary voltage value must correspond to the mains voltage.

Note: The device selects the measuring range depending on the secondary voltage configured. The multimess F144-2-LED-ESMS-...-4 operates in measuring range 1 as long as the configured secondary voltage value does not exceed 110 V. If it does, multimess F144-2-LED-ESMS-...-4 operates in measuring range 2.

ErrI: Current input of the measuring amplifier overloaded
Adjust programming and select larger measuring range. Alternatively, switch off the measuring current and check the transformer ratio.

Note: The device selects the measuring range depending on the secondary current that was set, i.e. either measuring range 1 at 1 A or measuring range 2 at 5 A.
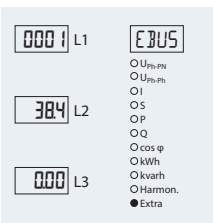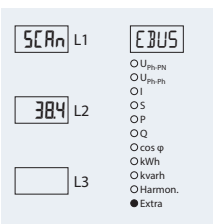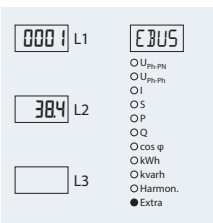
16 Appendix

16.1 Added functionality: Profibus

The multimess F144-2-LED-ESMS-...-4 is now also available with the Profibus option (new name multimess F144-2-LED-ESMSDP-...-4).

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

16.2 Setting the bus protocol

Menu	Button(s)	Device display	Description
Main menu Extra			
Submenu eBus	▶ Start input mode (eBus scan)	`0001` L1 `EBUS` ○ U Ph-PN ○ U Ph-Ph ○ I `384` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh `0.00` L3 ○ kvarh ○ Harmon. ● Extra	Display L1 shows the device address. The baud rate is displayed in display L2. The unit display shows the current bus protocol. (e. g. eBus)
Submenu eBus Assign address	▶ Start input mode	`SCAn` L1 `EBUS` ○ U Ph-PN ○ U Ph-Ph ○ I `384` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	The first digit in display L1 flashes. Press the ▶ button to enter the input mode and set the bus protocol.
Submenu eBus Assign bus protocol	▼▼ ..... 🔢 Start input mode ✕ cancel or	`0001` L1 `EBUS` ○ U Ph-PN ○ U Ph-Ph ○ I `384` L2 ○ S ○ P ○ Q ○ cos φ ○ kWh L3 ○ kvarh ○ Harmon. ● Extra	Display L1 shows the device address. The baud rate is displayed in display L2. The unit display flashes. You can choose from different bus protocols by pressing the 🔢 button. (eBus or Modbus) If the device is equipped with the Profibus option, the Profibus protocol is also available for selection.
Main menu Extra	✕ save		