



User manual Technical parameters

multimes

Three-phase network measuring device

F144-0-LED-...-5



**Your partner for
network analysis**

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Dear customer

Thank you for choosing a KBR product.

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

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

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

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

Yours sincerely,

KBR GmbH Schwabach

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



DANGEROUS VOLTAGE

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



CAUTION

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



NOTE

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

Disclaimer

The contents of this document have been checked using the hardware and software described. Nonetheless, deviations cannot be ruled out, and the manufacturer cannot guarantee 100% conformity. The information provided in this manual is checked on a regular basis; any corrections necessary will be included in the next revision.

We appreciate your corrections and comments.

Safety instructions

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

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

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

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

Incorrect connection may result in the destruction of the device!

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

and observe correct polarity!

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

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

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

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

Systems that are at risk from lightning strikes must be fitted with lightning protection for all input and output cables (see chapter "Overvoltage and lightning protection" for recommendations)!

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

Product liability

You have purchased a high-quality product.

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

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

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

The assured device properties only apply 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 device for you.

Scope of delivery

Included in the scope of delivery:

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

1 Device memory

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



NOTE

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

2 Definition of terms

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

RMS value (root mean square value):

(root mean square value):

According to its definition, an effective value is the RMS value of an alternating or pulsating quantity. multimes F144-0-LED-. -5 exclusively calculates with effective values of pure alternating quantities (RMS).

Instantaneous:

The value determined by the multimes F144-0-LED-...-5

RMS value:

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 multimes F144-0-LED-...-5.

Set measuring mum)

The measurement period containing the highest (maximum)

Maximum:

value that occurred.

Measurement period:

The period of time used to determine average power values. Typical intervals: e.g. 1, 15, 30, 60 minutes.

3 Default settings after a reset (delivery state)

Primary voltage/secondary voltage	400 V / 400 V
Primary current/secondary current	5 A / 5 A
Measuring current averaging time	10 minutes
Primary/secondary neutral conductor	5 A / 5 A
Neutral conductor measurement type	Calc (calculated)
Neutral conductor averaging time	10 minutes
Daylight saving time	from months 03 to 10
Off-peak time	Internal clock (22:00 to 06:00)
Damping coefficient for current and voltage	DF 0 (no damping)
Energy pulse	P (active power for consumption), 1 (1,000) pulse /kWh, pulse length 100 ms
Alarm relay	On delay tON = 0 sec Off delay tOFF = 0 sec
Password	9999/all functions can be accessed
Button buzzer	On
Limit hysteresis	01 %
Default menu	Deactivated
Start selection	

Unaffected by a RESET:

1. Bus communication
2. Time
3. Language

4 Setting range

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

Measuring voltage, primary	1 V to 9999 kV
Measuring voltage, secondary	100 V to 600 V
Measuring current, primary	1 A to 99.99 kA
Measuring current, secondary	1 A or 5 A
Average measuring current and neutral conductor current	Averaging period 1 to 15 minutes
Neutral conductor current, primary	1 A to 99.99 kA
Neutral conductor current, secondary	1 A or 5 A
Neutral conductor measurement type	Calculated (calc) or measured (transformer input)
Measuring current Frequency tracking	Auto (automatically 45 to 65 Hz), fixed 50 Hz, fixed 60 Hz
Off-peak time	Internal clock: Starting time hh:mm End time hh:mm
Summer time (start or end)	Month 01 to month 12
Language	German, English
Damping coefficient for current and voltage display	dF 0 (no damping) to 6 (highest damping)
Energy pulse output	Active power or reactive power, each consumption
Pulse value	0.001 to 9999 Imp/kWh or /kBh
Pulse length	30 to 990 ms
Harmonics limits	0 % to 100 %
Alarm relay delay	On delay FTS 0 to 254 sec. Off delay FTS 0 to 254 sec.
Password	4-digit number, 9999 means all functions are freely accessible
Time, date	Setting hh:mm, dd:mm:yyyy

Continued

Button buzzer	On/Off
Zero-point creator	On/Off
Limit hysteresis (in the Limit value configuration submenu)	1 % to 99 %
Default menu (start selection)	Menu 01 to 11 (U _{PH-N} to Extra), deactivatable (display ----)

5 Field of application / range of functions

The **multimes F144-0-LED-...-5** is an affordable network measuring device for switchboard installation that measures all important parameters in three-phase networks.

The microprocessor of the **multimes F144-0-LED-...-5** 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 **multimes F144-0-LED-...-5** 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 either calculated or measured by an additional connected transformer and shown on the display.

Calculating the PE leakage

When the neutral conductor current is measured, the PE leakage is calculated and displayed. When the neutral conductor current is calculated, no PE leakage is displayed.

Harmonic analysis

Harmonic analysis by Fourier transform. The **multimes F144-0-LED-...-5** measures the harmonics of the 3rd / 5th / 7th / 9th / 11th / 13th / 15th / 17th and 19th up to 63rd. Voltage network harmonic, calculates their partial harmonic content and the total distortion factor of the voltage.

Two-tariff meter function (HT/LT)

Consumption during high tariff and low tariff times is recorded separately. Switching from high to low tariff and back again is done by the internal clock.

Programmable pulse output

Active energy or reactive energy proportional pulses can be output via a programmable output laid out as an S_0 compatible interface. 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.

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 end of this user manual for contact details.

6 Connecting the multimes F144-0-LED-...-5

6.1 Installation and assembly

- The applicable VDE regulations must be observed during 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.

6.2 Installation

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

Installation position: vertical

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



CAUTION

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

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

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

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

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

The isolating switch must be UL/IEC-approved.

Voltage measurement:

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

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

**CAUTION**

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

For the wiring of the pulse output, we recommend that you only use shielded twisted pair cables to avoid interference (e.g. installation line I-Y(ST) Y 2 x 2 x 0.8 mm², with the shielding only connected on one side).

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

**NOTE**

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

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

Rotary field:

The device can be operated with a clockwise or anti-clockwise rotary field. When switching on the device power supply, the multimes F144-0-LED-...-5 automatically checks the direction of rotation. Rotary field check:

- Only connect the measuring voltage to the device (U_{meas} see nameplate).
- Switch the device on by connecting the power supply cable voltage to the power supply connections (L and N). The device checks the power supply's direction of rotation immediately after being switched on.
- The rotary field is displayed in the in the Rot.field submenu of the U_{PH-PH} menu.
- For a clockwise rotary field, the display shows L1 0, L2 120 and L3 240 degrees.

- If you want to change the direction of rotation from clockwise to anti-clockwise, simply swap two terminals, i.e. two phases, then switch the device OFF and ON again. The display now shows the correct voltage and the device starts measuring automatically.
- Check again whether the assignment of the voltage path L1 and the current path L1 as well as all other phases are still correct.

Current transformer connection:

- Direction of energy flow:

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

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

- Assigning the measuring voltage input / current transformer input:

The current transformer on terminal 20/21 (k1/I1) 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 multimes F144-0-LED-...-5, you can check the phase sequence as follows:
 - Go to the main menu "I"
 - Connect the current transformer to the corresponding wires
 - If the connection and direction of energy flow are correct, the device will only display positive currents.
 - If the device is connected incorrectly, all currents displayed will be negative. In this case, swap the connections until the display shows the correct values.

**CAUTION**

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

6.3 Connection diagram



NOTE

When connecting the phase (L1) to terminal 1 and the neutral conductor (N) to terminal 2 at US1 Ph-N 100V - 240V AC 50/60 Hz or US5 Ph-N 22.5V - 64V AC 50/60 Hz the safety device and the disconnecter in the supply line to terminal 2 (N) are not required.

The safety device and the disconnecter to terminal 2 (N) are only required for the following connection variants:

Alternating voltage:

Terminal 1 (L1) and terminal 2 (L2):

US1 Phase-Phase 100V - 240V AC 50/60 Hz or US5 Phase-Phase 22.5V - 64V AC 50/60 Hz

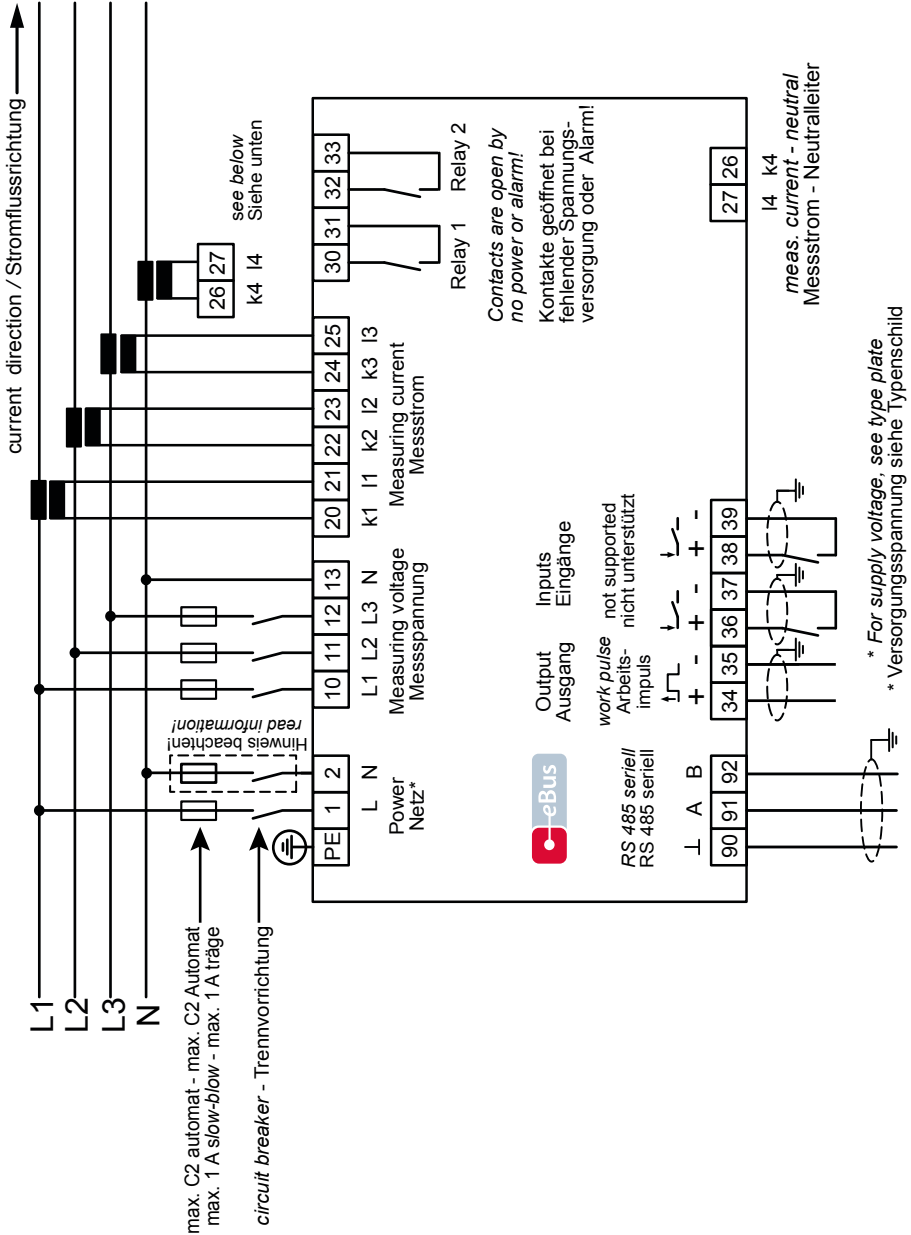
Direct voltage:

Terminal 1 (+) and terminal 2 (-):

US1 100V - 240V DC or US5 22.5V - 64V DC

Connection variants of the supply voltage:

Terminal 1	Terminal 2	Voltage		Safety device and disconnecter to Terminal 2 required
		Power supply unit US1	Power supply unit US5	
Phase L	Neutral conductor N	100V - 240V AC 50/60 Hz	22.5V - 64V AC 50/60 Hz	No
Phase L1	Phase L2	100V - 240V AC 50/60 Hz	22.5V - 64V AC 50/60 Hz	Yes
+	-	100V - 240V DC	22.5V - 64V DC	Yes



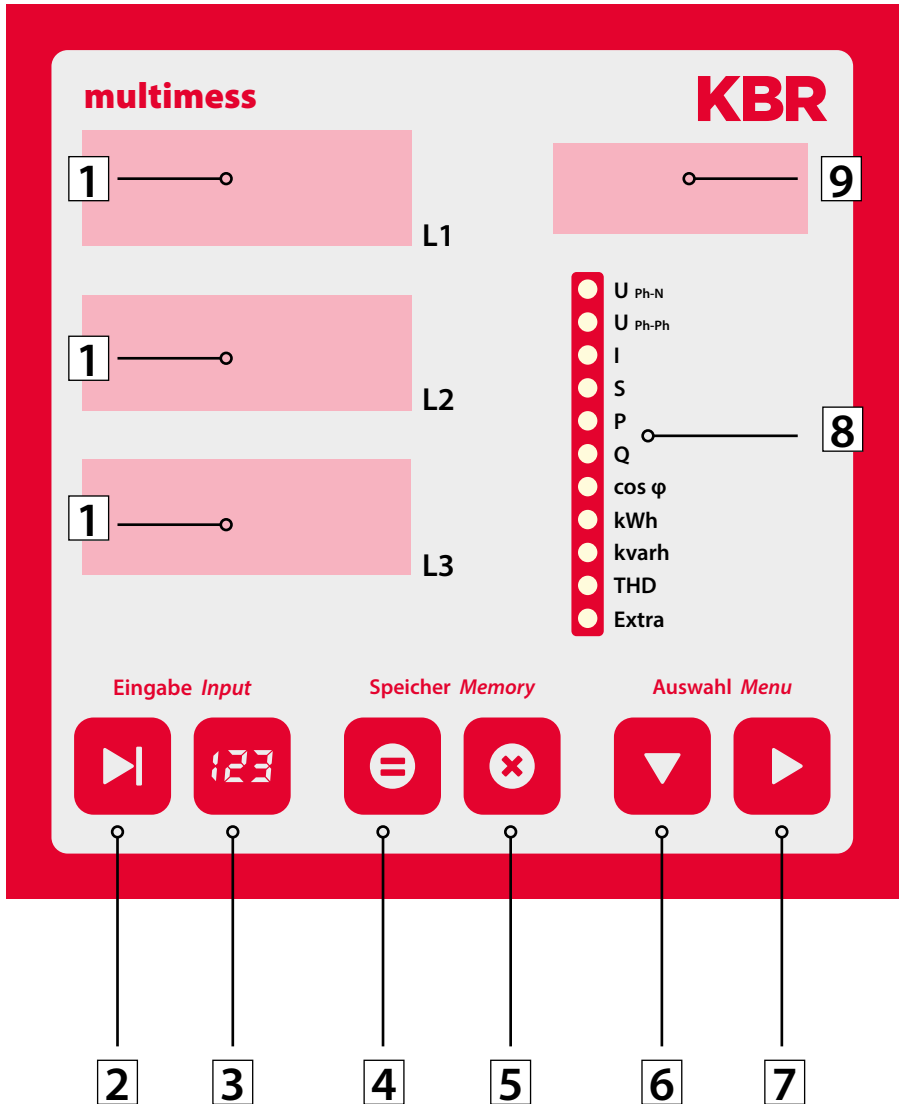
6.4 Terminal assignment

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

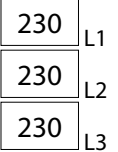









Terminal

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.
36 (+) and 37 (-):	Synchronization input Is not supported.
38 (+) and 39 (-):	Tariff input Is not supported.

7 Control and display panel



7.1 Description of sensor buttons and displays

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

**NOTE**

The display on the measuring device has a dimming function (energy saving function).

After a set time has expired (15 minutes), the display brightness is reduced unless the sensor key is pressed (value is not adjustable). If any key is pressed, the original display brightness is restored.

8 Operation

8.1 Menu structure of the multimess F144-0-LED-...-5



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.



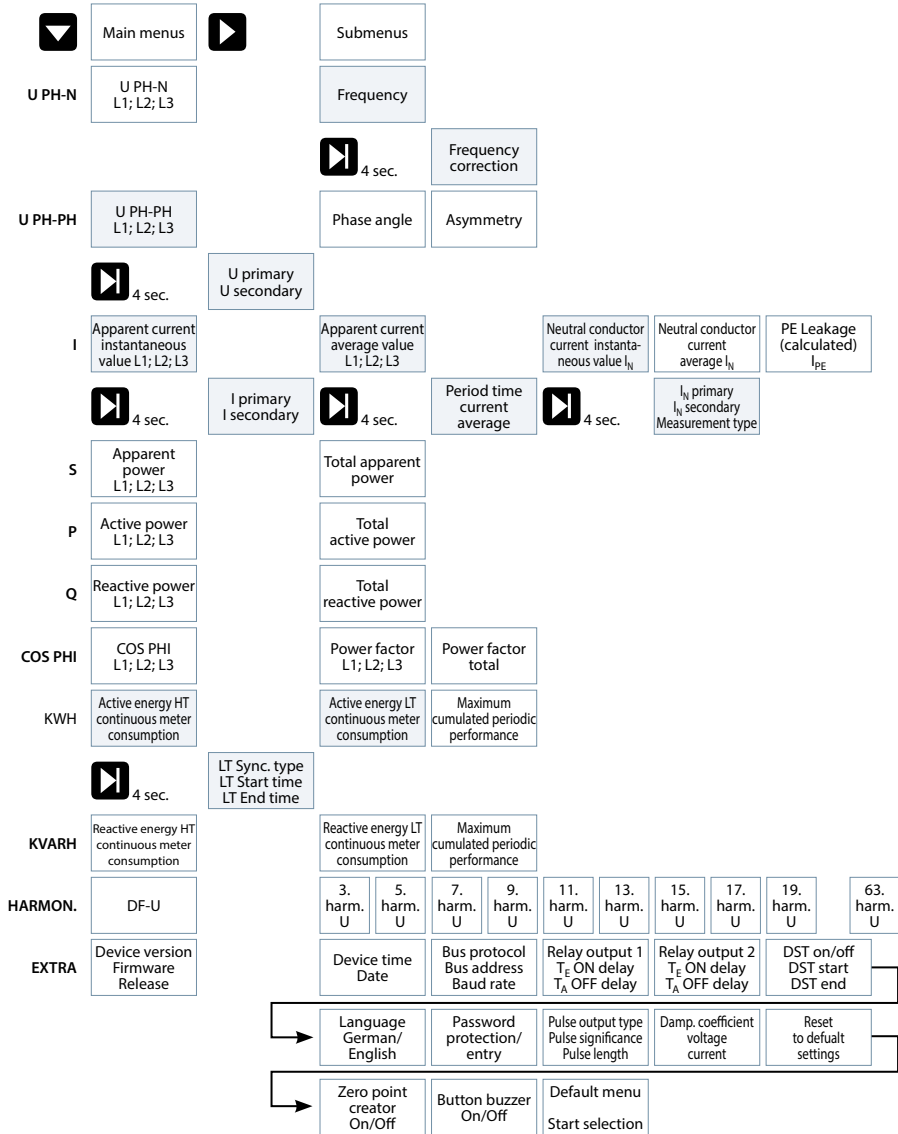
Switches to the desired submenu.

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









Switches to a parameter assignment menu.

8.2 Navigation and device displays



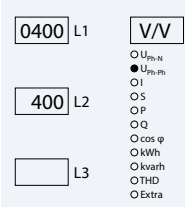




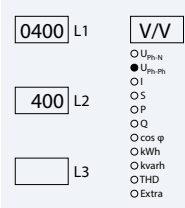










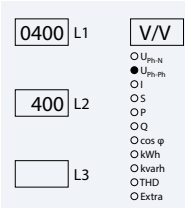









9 Setting the operating parameters

9.1 General programming scheme

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

9.2 U_{Ph-Ph} - measuring reference voltage/rated mains voltage




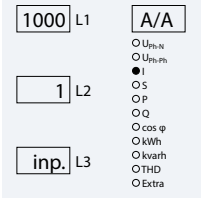






Menu	Button(s)	Device display	Description
Main menu UPh-Ph			
Sub menu Set voltage transformer ratio	<p> Press and hold button for 4 seconds</p> <p> Start input mode</p>		<p>When you open the menu, the following text is shown on the display: VOLTAGE TRANSFORMER RATIO UPRI / USEC V/V</p> <p>The display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

9.3 I - Current transformer ratio

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






9.4 I_N- Current transformer ratio

Menu	Button(s)	Device display	Description
Main menu I			
Submenu current I _N Set transformer ratio	<p> Press and hold button for 4 seconds</p> <p> Start input mode</p>	<p>0005 L1 A/A</p> <p> <input type="radio"/> U_{pn,n} <input type="radio"/> U_{pn,ph} <input checked="" type="radio"/> I <input type="radio"/> S <input type="radio"/> P <input type="radio"/> Q <input type="radio"/> cos φ <input type="radio"/> kWh <input type="radio"/> kvarh <input type="radio"/> THD <input type="radio"/> Extra </p>	<p>When you open this menu, the following text is shown on the display: A/A CURRENT TRANSFORMER RATIO I_N PRI/ISEK A/A</p> <p>Display L1 shows the primary current.</p> <p>Display L2 shows the secondary current.</p> <p>Display L3 shows the measurement type.</p> <p>CALC = calculated IN = transformer output terminal 26 (k4) and 27 (l4)</p>
Submenu current I _N Set primary transformer ratio	<p> Change value or</p> <p> next digit</p> <p>or</p> <p> Cancel</p> <p>or</p> <p> Save</p>	<p>1000 L1 A/A</p> <p> <input type="radio"/> U_{pn,n} <input type="radio"/> U_{pn,ph} <input checked="" type="radio"/> I <input type="radio"/> S <input type="radio"/> P <input type="radio"/> Q <input type="radio"/> cos φ <input type="radio"/> kWh <input type="radio"/> kvarh <input type="radio"/> THD <input type="radio"/> Extra </p>	<p>The first digit on the display L1 flashes. Press the button to set the number for this segment.</p> <p>Press the button to go to the next digit.</p> <p>Once all of the digits have been set, display L1 flashes.</p> <p>To move the decimal point, press the button</p>
NOTE	or	Use these buttons to switch between the displays in input mode (one digit flashes).	
Submenu current I _N Set secondary transformer ratio	<p> Change value or</p> <p> Cancel</p> <p>or</p> <p> Save</p>	<p>1000 L1 A/A</p> <p> <input type="radio"/> U_{pn,n} <input type="radio"/> U_{pn,ph} <input checked="" type="radio"/> I <input type="radio"/> S <input type="radio"/> P <input type="radio"/> Q <input type="radio"/> cos φ <input type="radio"/> kWh <input type="radio"/> kvarh <input type="radio"/> THD <input type="radio"/> Extra </p>	<p>The first digit on display L2 flashes. Press to switch between 1 A and 5 A.</p>
NOTE	or	Use these buttons to switch between the displays in input mode (one digit flashes).	

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

10 Display functions



10.1 U_{Ph-N} - Voltage phase to neutral conductor, frequency


Menu	Button(s)	Device display	Description
Main menu U_{Ph-N}	 next submenu	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">230</div> <div style="margin-right: 5px;">L1</div> <div style="margin-left: 20px; border: 1px solid black; padding: 2px 5px;">V</div> </div> <div style="margin-bottom: 5px;"> <ul style="list-style-type: none"> <input type="radio"/> U_{Ph-N} <input type="radio"/> U_{Ph-Ph} <input type="radio"/> I <input type="radio"/> S <input type="radio"/> P <input type="radio"/> Q <input type="radio"/> $\cos \varphi$ <input type="radio"/> kWh <input type="radio"/> kvarh <input type="radio"/> THD <input type="radio"/> Extra </div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">231</div> <div style="margin-right: 5px;">L2</div> </div> <div style="margin-bottom: 5px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">230</div> <div style="margin-right: 5px;">L3</div> </div> </div>	<p>Displays the three phase voltages U_{L1-N}, U_{L2-N} and U_{L3-N} in the displays L1 to L3.</p> <p>The unit display shows the voltage unit.</p> <p>The measuring range automatically switches from V to KV.</p>
Submenu Frequency		<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">50.01</div> <div style="margin-right: 5px;">L1</div> <div style="margin-left: 20px; border: 1px solid black; padding: 2px 5px;">HZ</div> </div> <div style="margin-bottom: 5px;"> <ul style="list-style-type: none"> <input type="radio"/> U_{Ph-N} <input type="radio"/> U_{Ph-Ph} <input type="radio"/> I <input type="radio"/> S <input type="radio"/> P <input type="radio"/> Q <input type="radio"/> $\cos \varphi$ <input type="radio"/> kWh <input type="radio"/> kvarh <input type="radio"/> THD <input type="radio"/> Extra </div> <div style="margin-bottom: 5px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;"></div> <div style="margin-right: 5px;">L2</div> </div> <div style="margin-bottom: 5px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;"></div> <div style="margin-right: 5px;">L3</div> </div> </div>	<p>Shows the instantaneous frequency in display L1.</p> <p>Pressing the  button for approx. 4 seconds displays the programming menu for frequency correction.</p>
 NOTE	 	<p>Return to main menu.</p> <p>Continue to the next submenu, if available, or return to the main menu.</p>	





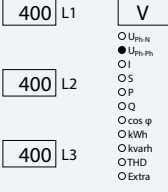

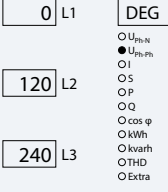
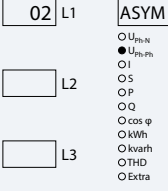



NOTE

The default setting "AUTO" means an automatic frequency correction in the range 45 Hz to 65 Hz. It is recommended that this setting is retained.

If necessary however, "fixed 50Hz" or "fixed 60 Hz" can be set using the  and  buttons.

The setting is saved by pressing the  button.

10.2 U_{Ph-Ph} - Voltage phase to phase, rotary field display

Menu	Button(s)	Device display	Description
			
Main menu U_{Ph-Ph}	 next sub-menu		<p>The three phase-to-phase voltages U_{L1-L2}, U_{L2-L3} and U_{L3-L1} are shown in the displays L1 to L3.</p> <p>The unit display shows the voltage unit.</p> <p>The device switches from V to KV etc. automatically.</p>
Submenu Rotary field	 next sub-menu		<p>Displays the three rotary field angles of the voltages.</p> <p>The unit display shows the unit "DEG."</p>
Submenu Asymmetry			<p>Display of voltage asymmetry according to the standard EN 6100-4-30:2003</p> <p>Shows the asymmetric load of the three-phase network.</p> <p>The unit display switches between ASYM and %.</p>
 NOTE	 	<p>Return to main menu.</p> <p>Continue to the next submenu, if available, or return to the main menu.</p>	

10.3 I/I_N - Current/neutral conductor current, I_{PE} (PE – leakage calculated), instantaneous- average value switching

Menu	Button(s)	Device display	Description
Main menu I Instantaneous value			<p>Displays the three conductor currents in phases L1, L2 and L3.</p> <p>The values displayed are instantaneous values.</p> <p>The unit display switches between ACT and A.</p>
Submenu I Average value			<p>Displays the three conductor currents in phases L1, L2 and L3.</p> <p>The values displayed are average values.</p> <p>The unit display switches between AVG and A.</p>

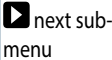
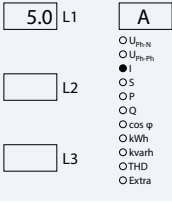
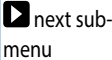
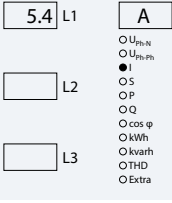
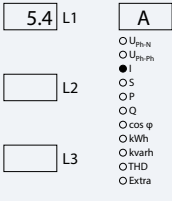





NOTE

A negative sign in front of the displayed current values indicates a negative current direction.

A positive sign indicates energy consumption.



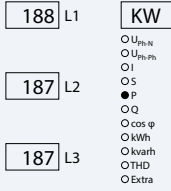
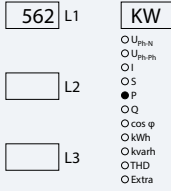



A negative sign indicates energy recovery.

Menu	Button(s)	Device display	Description
Submenu I_N Neutral conductor current			<p>Display L1 shows the instantaneous neutral conductor current.</p> <p>The unit display switches between NACT and A.</p>
Submenu I_N Neutral conductor current Average value			<p>Display L1 shows the average value of the neutral conductor current.</p> <p>The unit display switches between NAVG and A.</p>
Submenu I_{PE} (PE leakage current)			<p>Display L1 shows the calculated PE leakage current.</p> <p>The unit display switches between I PE and A.</p>
 NOTE	 	<p>Return to main menu.</p> <p>Continue to the next submenu, if available, or return to the main menu.</p>	

10.4 S - Apparent power / total apparent power

Menu	Button(s)	Device display	Description
Main menu S Apparent power			<p>The displays L1 to L3 show the apparent power of the three phases. The unit display shows the apparent power in kVA.</p> <p>The measuring range automatically switches from VA to KVA and MVA.</p>
Submenu Total apparent power			<p>Shows the total apparent power in display L1.</p> <p>The unit display switches between kva and STOT. The device automatically switches from va to kVA and Mva.</p>
 NOTE	 	<p>Return to main menu.</p> <p>Continue to the next submenu, if available, or return to the main menu.</p>	



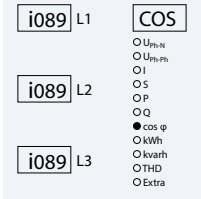

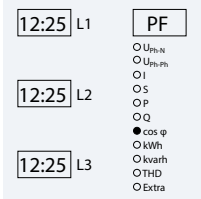
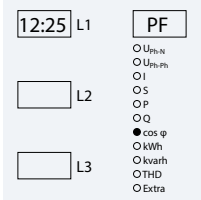



10.5 P - Active power / total active power

Menu	Button(s)	Device display	Description
			
Main menu P Active power	 next sub-menu		<p>The displays L1 to L3 show the active power of the three phases.</p> <p>The unit display shows the active power in kW.</p> <p>The device switches from W to kW or MW automatically.</p>
Submenu Total active power			<p>Shows the total active power in display L1.</p> <p>The unit display switches between PTOT and kW.</p> <p>The device switches from W to kW or MW automatically.</p>
 NOTE	 	<p>Return to main menu.</p> <p>Continue to the next submenu, if available, or return to the main menu.</p>	

10.6 Q - Reactive power / total reactive power

Menu	Button(s)	Device display	Description
Main menu Q Reactive power			<p>Displays L1 to L3 show the reactive power of the three phases.</p> <p>An "i" in front of a value indicates inductive, a "c" indicates capacitive reactive power.</p> <p>The unit display shows the reactive power in KVAR.</p> <p>The measuring range automatically switches from VAR to MVAR .</p>
Submenu Total reactive power			<p>Shows the total reactive power in display L1.</p> <p>An "i" in front of a value indicates inductive, a "c" indicates capacitive reactive power.</p> <p>The unit display switches between QTOT and KVAR. The measuring range automatically switches from VAR to MVAR .</p>
 NOTE	 	<p>Return to main menu.</p> <p>Continue to the next submenu, if available, or return to the main menu.</p>	


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

Menu	Button(s)	Device display	Description
			
Main menu Cos ϕ	 next sub-menu		<p>Display of $\cos\phi$.</p> <p>Display L1 shows the $\cos\phi$ for phase L1. (i = inductive, c = capacitive)</p> <p>Display L2 shows the $\cos\phi$ for phase L2. (i = inductive, c = capacitive)</p> <p>Display L3 shows the $\cos\phi$ for phase L3. (i = inductive, c = capacitive) The unit display shows COS. (The $\cos\phi$ displayed refers to the fundamental)</p>
Submenu Power factor	 next sub-menu		<p>Display of the power factor PF.</p> <p>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.</p>
Submenu Total PF			<p>Displays the power factor total.</p> <p>Display L1 shows the power factor total.</p> <p>The unit display switches between TOT and PF.</p>
 NOTE	 	<p>Return to main menu.</p> <p>Continue to the next submenu, if available, or return to the main menu.</p>	

10.8 kWh – Active energy HT/LT consumption, maximum cumulated active energy of the period

Menu	Button(s)	Device display	Description
Main menu kWh Active energy High tariff Consumption	next sub-menu		<p>Active energy meter for high tariff consumption.</p> <p>Display L3 - L1 shows the value of the continuous energy meter.</p> <p>The unit display switches between HT and kWh.</p> <p>1234 Display L1 (G Wh display) 567 Display L2 (M Wh display) 890.1 Display L3 (k Wh display)</p>
Submenu kWh Active energy Low tariff Con- sumption	next sub-menu		<p>Active energy meter for low tariff consumption.</p> <p>Display L3 - L1 shows the value of the continuous energy meter.</p> <p>The unit display switches between LT and kWh.</p> <p>1234 Display L1 (G Wh display) 567 Display L2 (M Wh display) 890.1 Display L3 (k Wh display)</p>


Continued

Menu	Button(s)	Device display	Description
Submenu PCum-Max Maximum cu- mulated cycle power		<div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 2px 5px;">783</div> <div style="margin: 0 5px;">L1</div> <div style="margin-left: 20px; text-align: center;"> <div style="border: 1px solid black; padding: 2px 5px;">KW</div> <ul style="list-style-type: none"> ○ U_{Ph,N} ○ U_{Ph,Ph} ○ I ○ S ○ P ○ Q ○ cos φ ● kWh ○ kvarh ○ THD ○ Extra </div> </div> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 2px 5px;">12:10</div> <div style="margin: 0 5px;">L2</div> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px;">1:10</div> <div style="margin: 0 5px;">L3</div> </div> </div>	<p>When you open the menu, the following text is shown in the unit display:</p> <p>PC.MX MAXIMUM CUMULATED POWER IN PERIOD</p> <p>Then the display switches between PC.MX and KW.</p> <p>Display L1 shows the period value.</p> <p>Display L2 shows the exact time the maximum occurred (hh:mm).</p> <p>Display L3 shows the day and month, alternating with the year, of the maximum (dd.mm.yyyy).</p>
 NOTE	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<p>Return to main menu.</p> <p>Continue to the next submenu, if available, or return to the main menu.</p>	

10.9 kvarh - Reactive energy meter HT/LT consumption, maximum cumulated cycle reactive power

Menu	Button(s)	Device display	Description
Main menu kvarh Reactive energy High tariff Consumption	next sub-menu	<p>1234 L1 kBh</p> <ul style="list-style-type: none"> <input type="radio"/> U_{rms,N} <input type="radio"/> U_{rms,m} <input type="radio"/> I <input type="radio"/> S <input type="radio"/> P <input type="radio"/> Q <input type="radio"/> cos φ <input type="radio"/> kWh <input checked="" type="radio"/> kvarh <input type="radio"/> THD <input type="radio"/> Extra 	<p>Reactive energy meter for high tariff consumption.</p> <p>Display L3 - L1 shows the value of the reactive energy continuous meter. The unit display switches between HT and kBh.</p> <p>1234 Display L1 (G varh display) 567 Display L2 (M varh display) 890.1 Display L3 (k varh display)</p>
Submenu kvarh Reactive energy Low tariff Consumption	next sub-menu	<p>1234 L1 kBh</p> <ul style="list-style-type: none"> <input type="radio"/> U_{rms,N} <input type="radio"/> U_{rms,m} <input type="radio"/> I <input type="radio"/> S <input type="radio"/> P <input type="radio"/> Q <input type="radio"/> cos φ <input type="radio"/> kWh <input checked="" type="radio"/> kvarh <input type="radio"/> THD <input type="radio"/> Extra 	<p>Reactive energy meter for low tariff consumption.</p> <p>Display L3 - L1 shows the value of the reactive energy continuous meter. The unit display switches between LT and kBh.</p> <p>1234 Display L1 (G varh display) 567 Display L2 (M varh display) 890.1 Display L3 (k varh display)</p>









Continuation of table 10.9

Menu	Button(s)	Device display	Description
Submenu Q _{Kum-Max} Maximum cumulated cycle power		<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">783</div> <div style="margin-left: 5px;">L1</div> </div> <div style="margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">12:10</div> <div style="margin-left: 5px;">L2</div> </div> <div> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">1:10</div> <div style="margin-left: 5px;">L3</div> </div> </div> <div style="margin-left: 20px; font-size: 0.8em;"> <div style="border: 1px solid black; padding: 2px 5px; margin-bottom: 5px;">kBh</div> <div style="margin-bottom: 2px;">○ U_{Ph,N}</div> <div style="margin-bottom: 2px;">○ U_{Ph,Ph}</div> <div style="margin-bottom: 2px;">○ I</div> <div style="margin-bottom: 2px;">○ S</div> <div style="margin-bottom: 2px;">○ P</div> <div style="margin-bottom: 2px;">○ Q</div> <div style="margin-bottom: 2px;">○ cos φ</div> <div style="margin-bottom: 2px;">○ kWh</div> <div style="margin-bottom: 2px;">● kvarh</div> <div style="margin-bottom: 2px;">○ THD</div> <div style="margin-bottom: 2px;">○ Extra</div> </div>	<p>When you open the menu, the following text is shown in the unit display:</p> <p>QC.MX MAXIMUM CUMULATED POWER IN PERIOD</p> <p>Then the display switches between PC.MX and KVAR.</p> <p>Display L1 shows the period value.</p> <p>Display L2 shows the exact time the maximum occurred (hh:mm).</p> <p>Display L3 shows the day and month, alternating with the year, of the maximum (dd.mm.yyyy).</p>
 NOTE	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<p>Return to main menu.</p> <p>Continue to the next submenu, if available, or return to the main menu.</p>	






10.10 THD- distortion factor and partial harmonic content of the voltage and current network harmonics

Menu	Button(s)	Device display	Description
Main menu THD voltage distortion factor	next sub-menu	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;">4.7 L1 DF</div> <div style="margin-bottom: 10px;">4.7 L2</div> <div style="margin-bottom: 10px;">4.7 L3</div> <div style="margin-left: 100px; font-size: 0.8em;"> <ul style="list-style-type: none"> <input type="radio"/> U_{RMS} <input type="radio"/> U_{RMS} <input type="radio"/> I <input type="radio"/> S <input type="radio"/> P <input type="radio"/> Q <input type="radio"/> cos φ <input type="radio"/> kWh <input type="radio"/> kvarh <input checked="" type="radio"/> THD <input type="radio"/> Extra </div> </div>	<p>Display L1 shows the distortion factor in % for the voltage of phase L1.</p> <p>Display L2 shows the distortion factor in % for the voltage of phase L2.</p> <p>Display L3 shows the distortion factor in % for the voltage of phase L3.</p> <p>The unit display switches between DF and % .</p>
Submenu 3-63. harmonic	next harmonic	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;">4.7 L1 3. U</div> <div style="margin-bottom: 10px;">4.6 L2</div> <div style="margin-bottom: 10px;">4.7 L3</div> <div style="margin-left: 100px; font-size: 0.8em;"> <ul style="list-style-type: none"> <input type="radio"/> U_{RMS} <input type="radio"/> U_{RMS} <input type="radio"/> I <input type="radio"/> S <input type="radio"/> P <input type="radio"/> Q <input type="radio"/> cos φ <input type="radio"/> kWh <input type="radio"/> kvarh <input checked="" type="radio"/> THD <input type="radio"/> Extra </div> </div>	<p>displays the 3rd harmonic.</p> <p>Display L1 shows the 3rd harmonic in % for the voltage of phase L1.</p> <p>Display L2 shows the 3rd harmonic in % for the voltage of phase L2.</p> <p>Display L3 shows the 3rd harmonic in % for the voltage of phase L3.</p> <p>The unit display switches between 3rd U and %.</p> <p>The subsequent harmonics (5th – 63th) are displayed in the same way.</p>
 NOTE	 	<p>Return to main menu.</p> <p>Continue to the next submenu, if available, or return to the main menu.</p>	


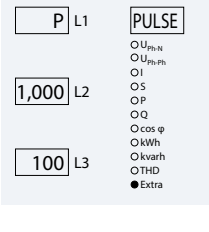

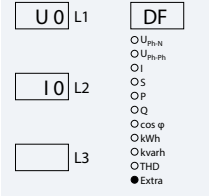

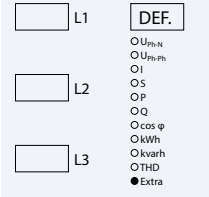

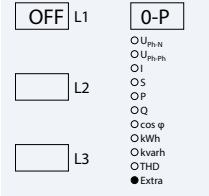



10.11 Extra

Menu	Button(s)	Device display	Description
			
Main menu Extra	 next sub-menu	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; gap: 20px;"> <div style="border: 1px solid black; padding: 2px 5px;">CF</div> L1 <div style="border: 1px solid black; padding: 2px 5px;">KBR</div> </div> <div style="margin-top: 10px;"> <small> O U_{Ph-N} O U_{Ph-Pb} O I O S O P O Q O cos φ O kWh O kvarh O THD ● Extra </small> </div> </div> <div style="margin-top: 20px;"> <div style="display: flex; gap: 20px;"> <div style="border: 1px solid black; padding: 2px 5px;">5:00</div> L2 </div> <div style="margin-top: 10px;"> <div style="border: 1px solid black; padding: 2px 5px;">r001</div> L3 </div> </div>	<p>Display L1 shows the device type (here: Comfort).</p> <p>Display L2 shows the version number. Display L3 shows the release number. The unit display shows the name of the device.</p>
Submenu Date and time	 next sub-menu	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; gap: 20px;"> <div style="border: 1px solid black; padding: 2px 5px;">8:35</div> L1 <div style="border: 1px solid black; padding: 2px 5px;">MO</div> </div> <div style="margin-top: 10px;"> <small> O U_{Ph-N} O U_{Ph-Pb} O I O S O P O Q O cos φ O kWh O kvarh O THD ● Extra </small> </div> </div> <div style="margin-top: 20px;"> <div style="display: flex; gap: 20px;"> <div style="border: 1px solid black; padding: 2px 5px;">10:11</div> L2 </div> <div style="margin-top: 10px;"> <div style="border: 1px solid black; padding: 2px 5px;">2018</div> L3 </div> </div>	<p>Display L1 shows the time (hh.mm).</p> <p>Display L2 shows the date (dd.mm).</p> <p>Display L3 shows the year (yyyy).</p> <p>The unit display shows the week-day.</p>
eBus submenu	 next sub-menu	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; gap: 20px;"> <div style="border: 1px solid black; padding: 2px 5px;">0001</div> L1 <div style="border: 1px solid black; padding: 2px 5px;">EBUS</div> </div> <div style="margin-top: 10px;"> <small> O U_{Ph-N} O U_{Ph-Pb} O I O S O P O Q O cos φ O kWh O kvarh O THD ● Extra </small> </div> </div> <div style="margin-top: 20px;"> <div style="display: flex; gap: 20px;"> <div style="border: 1px solid black; padding: 2px 5px;">38.4</div> L2 </div> <div style="margin-top: 10px;"> <div style="border: 1px solid black; padding: 2px 5px;"> </div> L3 </div> </div>	<p>Display L1 shows the device address.</p> <p>The baud rate is shown on display L2</p> <p>The unit display shows eBus.</p>
Submenu REL 1	 next sub-menu	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; gap: 20px;"> <div style="border: 1px solid black; padding: 2px 5px;">0010</div> L1 <div style="border: 1px solid black; padding: 2px 5px;">REL1</div> </div> <div style="margin-top: 10px;"> <small> O U_{Ph-N} O U_{Ph-Pb} O I O S O P O Q O cos φ O kWh O kvarh O THD ● Extra </small> </div> </div> <div style="margin-top: 20px;"> <div style="display: flex; gap: 20px;"> <div style="border: 1px solid black; padding: 2px 5px;">020</div> L2 </div> <div style="margin-top: 10px;"> <div style="border: 1px solid black; padding: 2px 5px;"> </div> L3 </div> </div>	<p>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 REL1 and tON.</p>
 NOTE	 	<p>Return to main menu.</p> <p>Continue to the next submenu, if available, or return to the main menu.</p>	


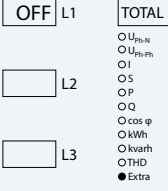
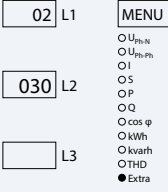



Continuation of table 10.11

Menu	Button(s)	Device display	Description
Submenu REL 2	 next submenu	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;"><input type="text" value="010"/> L1</div> <div style="margin-bottom: 10px;"><input type="text" value="020"/> L2</div> <div><input type="text" value=""/> L3</div> </div> <div style="margin-left: 20px;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">REL2</div> <small> O U_{PH,N} O U_{PH,m} O I O S O P O Q O cos φ O kWh O kvarh O THD ● Extra </small> </div>	<p>Display L1 shows the on-delay for relay 2 in seconds.</p> <p>Display L2 shows the off-delay for relay 2 in seconds.</p> <p>The unit display switches between REL2 and tON.</p>
Submenu Daylight saving time	 next submenu	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;"><input type="text" value="On"/> L1</div> <div style="margin-bottom: 10px;"><input type="text" value="03"/> L2</div> <div><input type="text" value="10"/> L3</div> </div> <div style="margin-left: 20px;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">DST</div> <small> O U_{PH,N} O U_{PH,m} O I O S O P O Q O cos φ O kWh O kvarh O THD ● Extra </small> </div>	<p>Display L1 indicates whether daylight saving time is activated or not.</p> <p>Display L2: shows the month daylight saving time begins.</p> <p>Display L3: shows the month daylight saving time ends.</p> <p>The unit display shows DAYLIGHTSAVING PARAMETER and then DST.</p>
Submenu Language	 next submenu	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;"><input type="text" value="dEut"/> L1</div> <div style="margin-bottom: 10px;"><input type="text" value=""/> L2</div> <div><input type="text" value=""/> L3</div> </div> <div style="margin-left: 20px;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">LANG</div> <small> O U_{PH,N} O U_{PH,m} O I O S O P O Q O cos φ O kWh O kvarh O THD ● Extra </small> </div>	<p>Display L1 shows the user language. For German, it displays deut..</p> <p>For English, it displays engl..</p> <p>The unit display shows SPRA if the user language is German and LANG if it is English.</p>
Submenu Password	 next submenu	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;"><input type="text" value="COdE"/> L1</div> <div style="margin-bottom: 10px;"><input type="text" value="----"/> L2</div> <div><input type="text" value=""/> L3</div> </div> <div style="margin-left: 20px;"> <div style="border: 1px solid black; padding: 2px; display: inline-block;">LOCK</div> <small> O U_{PH,N} O U_{PH,m} O I O S O P O Q O cos φ O kWh O kvarh O THD ● Extra </small> </div>	<p>Display L1 shows CODE.</p> <p>The unit display shows LOCK or FREE.</p> <p>You can enter the password in L2. (4-digit code)</p> <p>The device is defaulted with the code 9999, i.e. all functions of the device are available.</p>
 NOTE	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="margin-bottom: 10px;"><input checked="" type="checkbox"/></div> <div><input checked="" type="checkbox"/></div> </div>	<p>Return to main menu.</p> <p>Continue to the next submenu, if available, or return to the main menu.</p>	

Continuation of table 10.11



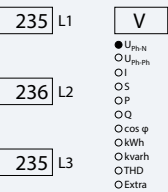

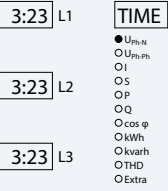

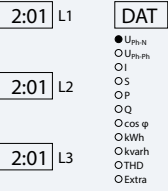




Menu	Button(s)	Device display	Description
Submenu Pulse output	 next sub- menu	 <p>Display L1 indicates whether the pulse output is deactivated (OFF) or configured for active (P) or reactive (Q) energy.</p> <p>Display L2 shows the pulse significance, i.e. pulse/kWh or kvarh.</p> <p>Display L3 displays the energy pulse length in ms.</p>	<p>Display L1 indicates whether the pulse output is deactivated (OFF) or configured for active (P) or reactive (Q) energy.</p> <p>Display L2 shows the pulse significance, i.e. pulse/kWh or kvarh.</p> <p>Display L3 displays the energy pulse length in ms.</p>
Submenu Damp. coeffi- cient	 next sub- menu	 <p>Display L1 shows the damping coefficient for acquiring the voltage.</p> <p>Display L2 shows the damping coefficient for acquiring the current.</p>	<p>Display L1 shows the damping coefficient for acquiring the voltage.</p> <p>Display L2 shows the damping coefficient for acquiring the current.</p>
Submenu Re- set to default settings	 next sub- menu	 <p>The device is reset to the default KBR factory settings. All stored values are lost.</p> <p>The unit display shows DEFAULT PARAMETER and then DEF.</p>	<p>The device is reset to the default KBR factory settings. All stored values are lost.</p> <p>The unit display shows DEFAULT PARAMETER and then DEF.</p>
Submenu Zero point creator	 next sub- menu	 <p>Display L1 shows OFF if it is deactivated. If the zero point creator is activated, ON is displayed.</p> <p>The unit display shows ZERO-POINT CREATOR and then 0-P.</p>	<p>Display L1 shows OFF if it is deactivated. If the zero point creator is activated, ON is displayed.</p> <p>The unit display shows ZERO-POINT CREATOR and then 0-P.</p>
 NOTE	 	<p>Return to main menu.</p> <p>Continue to the next submenu, if available, or return to the main menu.</p>	

Continuation of table 10.11

Menu	Button(s)	Device display	Description
Submenu button buzzer	 next submenu		<p>Display L1 shows the status of the button buzzer. You can choose from "ON" or "OFF".</p> <p>The unit display shows SUMMER and then SUMM.</p> <p>The default setting is "ON".</p>
Submenu Default menu Start selection			<p>Display L1 shows the selected default menu (02 = U_{PH-PH}).</p> <p>Display L2 shows the return time in seconds in the default menu.</p> <p>The unit display shows DEFAULT MENU then MENU.</p>
 NOTE	 	<p>Return to main menu.</p> <p>Continue to the next submenu, if available, or return to the main menu.</p>	


10.12 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	 Maximum  Display the time	 235 L1 V 236 L2 235 L3 ● U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ F ○ Q ○ cos φ ○ kWh ○ kvarh ○ THD ○ Extra	The maximum values that occurred for the phase voltages are shown in the displays L1 to L3 for each phase. The unit display switches between MAX and V.
Voltage Maximum	 Display the date (dd.mm)	 3:23 L1 TIME 3:23 L2 3:23 L3 ● U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ F ○ Q ○ cos φ ○ kWh ○ kvarh ○ THD ○ 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	 Display the date (yyyy)	 2:01 L1 DAT 2:01 L2 2:01 L3 ● U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ F ○ Q ○ cos φ ○ kWh ○ kvarh ○ THD ○ 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		 2018 L1 DAT 2018 L2 2018 L3 ● U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ F ○ Q ○ cos φ ○ kWh ○ kvarh ○ THD ○ 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.
 NOTE	 	Return to main menu. Continue to the next submenu, if available, or return to the main menu.	



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 F144-0-LED-...-5.

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 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}	Outer conductor 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}	Instantaneous value of neutral conductor current	Minimum and maximum value for neutral conductor current with date and time	Min and Max
Submenu I_{Navg}	Average neutral conductor current	Minimum and maximum value for neutral conductor current with date and time	Min and Max
Submenu I_{PE}	PE Leakage calculated	Minimum and maximum value for PE leakage 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

Continued

Menu	Measured value	Stored extreme values	Text displayed in de and en
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
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 harmonics.	Max

10.13 Displaying limits

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



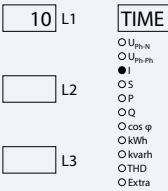




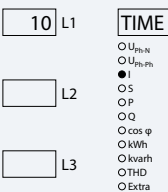





Menu	Button(s)	Device display	Description
Main menu U _{Ph-N} Submenu Voltage Maximum	Display max/min value	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="border: 1px solid black; padding: 2px 5px;">235</div> L1 <div style="margin-left: 20px; border: 1px solid black; padding: 2px 5px;">V</div> </div> <div style="margin-bottom: 5px;"> <ul style="list-style-type: none"> ● U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ THD ○ Extra </div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="border: 1px solid black; padding: 2px 5px;">235</div> L2 </div> <div style="margin-bottom: 5px;"> <ul style="list-style-type: none"> ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ THD ○ Extra </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px;">235</div> L3 </div> </div>	<p>The maximum values that occurred for the phase voltages are shown in the displays L1 to L3 for each phase.</p> <p>The unit display switches between MAX and V .</p>
Submenu Limit 1	<p> Press for 4 seconds for limit setting (LIM 1)</p> <p>or</p> <p> on to limit 2</p>	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="border: 1px solid black; padding: 2px 5px;">235</div> L1 <div style="margin-left: 20px; border: 1px solid black; padding: 2px 5px;">Lim1</div> </div> <div style="margin-bottom: 5px;"> <ul style="list-style-type: none"> ● U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ THD ○ Extra </div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="border: 1px solid black; padding: 2px 5px;">POS</div> L2 </div> <div style="margin-bottom: 5px;"> <ul style="list-style-type: none"> ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ THD ○ Extra </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px;">OFF</div> L3 </div> </div>	<p>Display L1 shows the limit.</p> <p>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.)</p> <p>Display L3 shows the message type for the limit:</p> <p>OFF: Message only via the KBR-eBus, REL1 additional message at relay 1 REL2 additional message at relay 2</p> <p>If a limit is violated, the LED of the respective main menu starts to flash.</p>
Submenu Limit 2	on to Lim1	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="border: 1px solid black; padding: 2px 5px;">190</div> L1 <div style="margin-left: 20px; border: 1px solid black; padding: 2px 5px;">Lim2</div> </div> <div style="margin-bottom: 5px;"> <ul style="list-style-type: none"> ● U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ THD ○ Extra </div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="border: 1px solid black; padding: 2px 5px;">nEG</div> L2 </div> <div style="margin-bottom: 5px;"> <ul style="list-style-type: none"> ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ THD ○ Extra </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px;">OFF</div> L3 </div> </div>	Description see limit 1
 NOTE	<p></p> <p></p>	<p>Return to main menu.</p> <p>Continue to the next submenu, if available, or return to the main menu.</p>	

The following table gives an overview of all limits available in the multimess F144-0-LED-...-5.



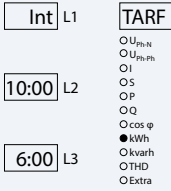




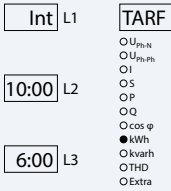





Menu	Measured value	Programmed limits	Text displayed in de and en
Main menu U_{Ph-N}	Phase voltage	Limit 1 and limit 2 for L1 - L2 - L3	GW 1 and GW 2 Lim 1 and Lim 2
Submenu F_{power}	Network frequency	Limit 1 and limit 2	GW 1 and GW 2 Lim 1 and Lim 2
Main menu U_{Ph-Ph}	Outer conductor voltage	Limit 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
Submenu I_{PE}	PE Leakage calculated	Limit 1 and limit 2 calculated for PE leakage 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 $COS\phi$	Fundamental power factor	Limit 1 and limit 2 for L1 - L2 - L3	GW 1 and GW 2 Lim 1 and Lim 2
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 THD	Harmonics	Limit 1 and 2 of the distortion factor of the voltage and the 3rd to 13th network harmonics for L1-L3.	GW 1 and GW 2 Lim 1 and Lim 2

11 Programming

11.1 Period time current average value

Menu	Button(s)	Device display	Description
Main menu I _{act} Submenu I average Period time	<p> Hold the button for 4 seconds.</p> <p> Start input mode</p>		<p>When you open this menu, the following text is shown on the display:</p> <p>TIME AVERAGE CURRENT TIME</p> <p>Display L1 shows the period time in minutes.</p>
Submenu I Average value Setting the period time	<p> Change value</p> <p>or</p> <p> Next digit</p> <p>or</p> <p> Cancel</p> <p>or</p> <p> Save</p>		<p>The first digit on the display L1 flashes. Press the  button to set the number for this segment.</p> <p>Press the  button to go to the next digit.</p> <p>You can set between 1 and 15 minutes.</p>
 NOTE	<p></p> <p></p>	<p>Return to main menu</p> <p>Continue to the next submenu, if available, or return to the main menu.</p>	



11.2 Tariff switching method

Menu	Button(s)	Device display	Description
Main menu kWh/HT Sub-menu Tariff input Tariff switching method	<p> Hold the button for 4 seconds.</p> <p> Start input mode</p>		<p>When you open this menu, the following text is shown on the display: TARF LT TARIFF TIMES</p> <p>Display L1: shows the tariff switching method (internal clock)</p> <p>Display L2: Start time</p> <p>Display L3: End time</p>
Main menu kWh /HT Sub-menu Tariff input Set tariff switching time	<p> Change value</p> <p>or</p> <p> Next digit</p> <p>or</p> <p> Cancel</p> <p>or</p> <p> Save</p>		<p>The start and end time can be set using the  and  buttons.</p>
 NOTE	 or 	Use these buttons to switch between the displays in input mode (one digit flashes).	

11.3 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} maximum	<ul style="list-style-type: none"> Maximum Hold the button for 4 seconds. Start input mode 		<p>Display L1 shows the limit.</p> <p>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.)</p> <p>The display L3 shows how the limit violation is communicated.</p> <ul style="list-style-type: none"> - Alarm on relay 1 (REL1) - Alarm on relay 2 (REL2) - Alarm only via KBR eBus (OFF)
Submenu Voltage U_{Ph-N} Limit 1 Set value	<ul style="list-style-type: none"> Change value or next digit or cancel or Save 		<p>The first digit on the display L1 flashes. Press the button to set the number for this segment.</p> <p>Press the button to go to the next digit.</p> <p>Once all of the digits have been set, display L1 flashes.</p> <p>To move the decimal point, press the button .</p> <p>The unit display switches between LIM 1 and V.</p>
NOTE	or	Use these buttons to switch between the displays in input mode (one digit flashes).	

Menu	Button(s)	Device display	Description
Submenu Voltage U_{Ph-N} Limit 1 Set direction	▶ next digit or ⊗ cancel or ⏻ Save	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;">235 L1 Lim1</div> <div style="margin-bottom: 10px;">POS L2</div> <div>OFF L3</div> </div> <div style="font-size: 8px; margin-top: 10px;"> <ul style="list-style-type: none"> ● U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ THD ○ Extra </div>	Display L2 flashes. Press the button 123 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).
 NOTE	▶ or ▼	In input mode (one digit flashes) you can switch between the displays with these buttons.	
Submenu Voltage U_{Ph-N} Limit 1 Set message type	▶ next digit or ⊗ cancel or ⏻ Save	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;">240 L1 Lim1</div> <div style="margin-bottom: 10px;">nEG L2</div> <div>rEL1 L3</div> </div> <div style="font-size: 8px; margin-top: 10px;"> <ul style="list-style-type: none"> ● U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ THD ○ Extra </div>	Display L3 flashes. Use the 123 button to determine the message type for a limit violation. <ul style="list-style-type: none"> - Alarm on relay 1 (REL1) - Alarm on relay 2 (REL2) - Alarm only via KBR eBus (OFF)
 NOTE	▼ ▶ ▶ or ▼	Return to main menu. Continue to the next submenu, if available, or return to the main menu. Use these buttons to switch between the displays in input mode (one digit flashes).	

11.3.1 Parameterizing hysteresis for programming limits

The following section explains how to parameterize the hysteresis of the limits. Limit 1 of the phase voltage serves as an example.

Menu	Button(s)	Device display	Description
Submenu Voltage U_{Ph-N} Limit 1	<ul style="list-style-type: none"> Maximum Hold the button for 4 seconds. Display hysteresis 	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;"><input type="text" value="235"/> L1 Lim1</div> <div style="margin-bottom: 10px;"><input type="text" value="POS"/> L2</div> <div><input type="text" value="OFF"/> L3</div> </div> <ul style="list-style-type: none"> ● $U_{Ph,N}$ ○ $U_{Ph,m}$ ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ THD ○ Extra 	
Display hysteresis	<ul style="list-style-type: none"> Start input mode 	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;"><input type="text" value="05"/> L1 HYST</div> <div style="margin-bottom: 10px;"><input type="text"/> L2</div> <div><input type="text"/> L3</div> </div> <ul style="list-style-type: none"> ● $U_{Ph,N}$ ○ $U_{Ph,m}$ ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ THD ○ Extra 	Display hysteresis in % (based on the measured value)
Submenu hys- teresis Limit 1	<ul style="list-style-type: none"> Change value or Next digit 	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;"><input type="text" value="01"/> L1 HYST</div> <div style="margin-bottom: 10px;"><input type="text"/> L2</div> <div><input type="text"/> L3</div> </div> <ul style="list-style-type: none"> ● $U_{Ph,N}$ ○ $U_{Ph,m}$ ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ THD ○ Extra 	Change hysteresis value in % for limit 1 (setting range 1 to 99%)
	<ul style="list-style-type: none"> Save or Cancel 	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;"><input type="text" value="05"/> L1 HYST</div> <div style="margin-bottom: 10px;"><input type="text"/> L2</div> <div><input type="text"/> L3</div> </div> <ul style="list-style-type: none"> ● $U_{Ph,N}$ ○ $U_{Ph,m}$ ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ THD ○ Extra 	

Continued


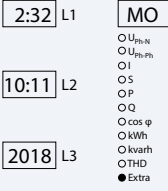




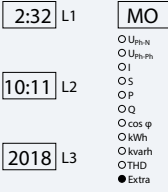







Menu	Button(s)	Device display	Description
	With [2] back to the limit input.	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">235</div> <div style="margin-left: 5px;">L1</div> </div> <div style="margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">POS</div> <div style="margin-left: 5px;">L2</div> </div> <div> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">OFF</div> <div style="margin-left: 5px;">L3</div> </div> </div> <div style="margin-left: 20px; margin-top: 10px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-bottom: 5px;">HYST</div> <ul style="list-style-type: none"> ● U_{Ph,N} ○ U_{Ph,Ph} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ THD ○ Extra </div>	



NOTE

Programming the hysteresis for limit 2 is identical.

11.4 Setting time and date

Menu	Button(s)	Device display	Description
Main menu Extra Submenu Date and time	 Start input mode		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 weekday.
Submenu Set date and time	 Change value  next digit or  Save or  Cancel		The first two digits in display L1 flash. Press the  button to set the number for this segment. To switch to the next digit press the  button. To set the day and month in display L2, proceed as described for display L1. The same applies to the year in display L3.
 NOTE	   or 	Return to main menu Continue to the next submenu, if available, or Return to main menu. Use these buttons to switch between the displays in input mode (one digit flashes).	

11.5 Setting the relay on-delay and off-delay

Menu	Button(s)	Device display	Description
Submenu REL 1	Start input mode	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">010</div> <div style="margin-right: 5px;">L1</div> <div style="border: 1px solid black; padding: 2px 5px; margin-left: 10px;">REL1</div> </div> <div style="font-size: 8px; margin-bottom: 5px;"> <ul style="list-style-type: none"> ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kWh_h ○ THD ● Extra </div> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">020</div> <div style="margin-right: 5px;">L2</div> </div> <div style="border: 1px solid black; padding: 2px 5px; width: 30px; height: 20px; margin-bottom: 10px;">L3</div> </div>	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 REL1 and tON.
Submenu REL 1 Set on-delay	Change value or Next digit or Cancel or Save	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">080</div> <div style="margin-right: 5px;">L1</div> <div style="border: 1px solid black; padding: 2px 5px; margin-left: 10px;">REL1</div> </div> <div style="font-size: 8px; margin-bottom: 5px;"> <ul style="list-style-type: none"> ○ U_{Ph-N} ○ U_{Ph-Ph} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kWh_h ○ THD ● Extra </div> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 2px 5px; margin-right: 5px;">020</div> <div style="margin-right: 5px;">L2</div> </div> <div style="border: 1px solid black; padding: 2px 5px; width: 30px; height: 20px; margin-bottom: 10px;">L3</div> </div>	The first digit on the display L1 flashes. Press the button to set the number for this segment. (max. 255 sec.) Press the button to go to the next digit.
 NOTE	or	In input mode (one digit flashes) you can switch between the displays with these buttons.	

Continued overleaf

Continued

<p>Submenu REL 1</p> <p>Set off-delay</p>	<p> Change value</p> <p>or</p> <p> Next digit</p> <p>or</p> <p> Cancel</p> <p>or</p> <p> Save</p>	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <input style="width: 40px; text-align: center;" type="text" value="080"/> L1 <div style="margin-left: 20px; border: 1px solid black; padding: 2px;">REL1</div> </div> <div style="font-size: 8px; margin-bottom: 10px;"> O U_{1/2,N} O U_{1/2,Ph} O I O S O P O Q O cos φ O kWh O kvarh O THD ● Extra </div> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <input style="width: 40px; text-align: center;" type="text" value="100"/> L2 </div> <div style="display: flex; align-items: center;"> <input style="width: 40px; text-align: center;" type="text"/> L3 </div> </div>	<p>The first digit on display L2 flashes. Press the button to set the number for this segment. (max. 255 sec.)</p> <p>Press the button to go to the next digit.</p> <p>The assignment as switching relay is shown in display L1 ----, L2 ---- and L3 BUS.</p> <p>Configuration is only possible via KBR eBus using optionally available software.</p>
<p></p> <p>NOTE</p>	<p></p> <p></p> <p> or </p>	<p>Return to main menu</p> <p>Continue to the next submenu, if available, or Return to main menu.</p> <p>Use these buttons to switch between the displays in input mode (one digit flashes).</p>	



NOTE

Relay 2 is set the same way as relay 1.

11.6 Activating daylight saving time

Menu	Button(s)	Device display	Description
Submenu Daylight saving time	Start input mode		<p>Display L1 indicates whether daylight saving time is activated or not.</p> <p>Display L2: shows the month daylight saving time begins.</p> <p>Display L3: shows the month daylight saving time ends.</p> <p>The unit display shows Daylight saving and then DST</p>
Submenu Daylight saving time on/off	Change value or Cancel or Save		<p>Display L1 flashes.</p> <p>Press the button to activate (on) or deactivate (off) daylight saving time.</p>
NOTE	or	In input mode (one digit flashes) you can switch between the displays with these buttons.	
Submenu Daylight saving time on/off Start	Change value or Cancel or Save		<p>Display L2 flashes.</p> <p>Press the button to set the month daylight saving time begins.</p> <p>The unit display switches between BEG. and DST.</p>
NOTE	or	In input mode (one digit flashes) you can switch between the displays with these buttons.	

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Menu	Button(s)	Device display	Description
Submenu Daylight sav- ing time on/off End	Change value or Cancel or Save	 ○ U _{PH,N} ○ U _{PH,m} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ THD ● Extra	Display L3 flashes. Press the button to set the month daylight saving time ends. The unit display switched between END and DST.
 NOTE	 or	Return to main menu Continue to the next submenu, if available, or Return to main menu. Use these buttons to switch between the displays in input mode (one digit flashes).	

11.7 Language settings

Menu	Button(s)	Device display	Description
Submenu Language	Start input mode	 ○ U _{PH,N} ○ U _{PH,m} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ THD ● Extra	Display L1 flashes. For German, it displays: DEUT For English, it displays: ENGL The unit display shows SPRA if the user language is German and LANG if it is English.
Submenu Language set	Change value or Cancel or Save	 ○ U _{PH,N} ○ U _{PH,m} ○ I ○ S ○ P ○ Q ○ cos φ ○ kWh ○ kvarh ○ THD ● Extra	Display L1 shows the user language. Press the button to select the operating language. For German, it displays: ENGL For English, it displays: ENGL The unit display shows SPRA if the user language is German and LANG if it is English.
 NOTE	 	Return to main menu Continue to the next submenu, if available, or return to the main menu.	

11.8 Password

Menu	Button(s)	Device display	Description
Submenu Password	Start input mode		Display L1 shows CODE. The unit display shows LOCK or FREE. L2 shows ---- The device is defaulted with the code 9999, i.e. all functions of the device are available.
Submenu Password set	Change value or Next digit or Cancel or Save		Display L1 shows CODE. The unit display shows LOCK or FREE. Display L2 shows 9999. The first position on display L2 flashes. Press the button to set the number for this segment. Press the button to go to the next digit.
NOTE	 	Return to main menu Continue to the next submenu, if available, or return to the main menu.	



NOTE

If the password should get lost, the device can be unlocked with the master password 1976.

In the configuration of a password protected device, it is possible to press a button for up to 300 seconds, after the controller has been unlocked. If no buttons are pressed during this time, the controller is then locked again.

After a power supply failure, the device is password protected again.

After the default settings are reset, the password protection is lifted.

11.9 Configuring the pulse output

Menu	Button(s)	Device display	Description
Submenu Pulse output	Start input mode		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. (e.g. 1.000 for 1 pulse/kWh). Display L3 shows the energy pulse length in msec.
Submenu Pulse output Set pulse source	Change value or Cancel or Save		When you open this menu, the following text is shown on the display: SRC. SOURCE Display L1 flashes. By pressing the button , you can choose from active energy (P consumption), reactive energy (Q consumption) or deactivated (OFF) energy pulse.
NOTE	or	In input mode (one digit flashes) you can switch between the displays with these buttons.	
Submenu Pulse output Set pulse significance	Change value or Next digit or Cancel or Save		When you open the menu, the following text is displayed in the unit display: VAL. VALENCY VAL. The first digit on display L2 flashes. Press the button to set the number for this segment. If all digits are flashing, you can move the decimal point with the button.
NOTE	or	In input mode (one digit flashes) you can switch between the displays with these buttons.	

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Menu	Button(s)	Device display	Description
Submenu Pulse output Set pulse length	Change value or Next digit or Cancel or Save		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 for this segment.
 NOTE	 or	Return to main menu Continue to the next submenu, if available, or Return to main menu. Use these buttons to switch between the displays in input mode (one digit flashes).	



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.

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

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 output active or reactive energy [kWh or kvarh].

11.10 Damping coefficient

Menu	Button(s)	Device display	Description
Submenu Damp. Factor DF	Start input mode		Display L1 shows the damping coefficient for acquiring the voltage. Display L2 shows the damping coefficient for acquiring the current.
Submenu Damp. coefficient Set DF voltage	Change value or Cancel or Save		When you open the menu, the following text is displayed in the unit display: DF DAMPINGFACTOR DF The first digit on the display L1 flashes. Press the button to set the number for this segment. Range of values: 0 - 6
 NOTE	or	In input mode (one digit flashes) you can switch between the displays with these buttons.	
Submenu Damp. coefficient Set DF current	Change value or Cancel or Save		The first digit on display L2 flashes. Press the button to set the number for this segment. Range of values: 0 - 6
 NOTE	 or	Return to main menu Continue to the next submenu, if available, or Return to main menu. Use these buttons to switch between the displays in input mode (one digit flashes).	

11.11 Default settings

Menu	Button(s)	Device display	Description
Submenu Default settings			The unit display shows DEF.
Submenu Default settings Perform a re- set to default settings	Press at the same time		<p>When you press these three buttons at the same time, the following text is shown in the unit display: KILL.</p> <p>Whilst this is displayed (duration approx. 10 seconds) the device is reset to its default parameters (default settings) and all stored data are deleted.</p>
 NOTE	 	<p>Return to main menu</p> <p>Continue to the next submenu, if available, or return to the main menu.</p>	

11.12 Zero point creator

Menu	Button(s)	Device display	Description
Submenu Zero point creator	Start input mode		Display L1 shows the state of the zero point creator.
Submenu Zero point creator activate	Change value or Cancel or Save		When you open the menu: Display L1 flashes. Press the button to activate this function. Range of values: OFF, ON.
 NOTE	 	Return to main menu. Continue to the next submenu, if available, or return to the main menu.	

11.13 Key sounds (button buzzer)




Menu	Button(s)	Device display	Description
Submenu button buzzer	Start input mode		Display L1 shows the state of the button buzzer.
Activate / deactivate submenu buttons summer	Change value or Cancel or Save		When you open the menu: Display L1 flashes. Press the button to activate this function. Range of values: ON, OFF
NOTE	 	Return to main menu. Continue to the next submenu, if available, or return to the main menu.	

11.14 Default menu (start selection)

Menu	Button(s)	Device display	Description
Submenu Default menu (start selection)	Start input mode	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;"><input type="text" value="02"/> L1</div> <div style="margin-bottom: 10px;"><input type="text" value="030"/> L2</div> <div><input type="text"/> L3</div> </div> <div style="margin-left: 20px;"> <div style="border: 1px solid black; padding: 2px; width: 40px; text-align: center; margin-bottom: 5px;">MENU</div> <div style="font-size: 8px; line-height: 1.2;"> O U_{PH,N} O U_{PH,PH} O I O S O P O Q O cos φ O kWh O kvarh O THD ● Extra </div> </div>	<p>Display L1 shows the selected default menu (02 = U_{PH,PH}).</p> <p>Display L2 shows the return time in seconds in the default menu.</p>
Submenu Default menu (start selection)	Change value or Cancel or Save	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;"><input type="text" value="01"/> L1</div> <div style="margin-bottom: 10px;"><input type="text" value="030"/> L2</div> <div><input type="text"/> L3</div> </div> <div style="margin-left: 20px;"> <div style="border: 1px solid black; padding: 2px; width: 40px; text-align: center; margin-bottom: 5px;">MENU</div> <div style="font-size: 8px; line-height: 1.2;"> O U_{PH,N} O U_{PH,PH} O I O S O P O Q O cos φ O kWh O kvarh O THD ● Extra </div> </div>	<p>Display L1 flashes.</p> <p>Press the button to select the default menu</p> <p>Range of values: 01 to 11, the LED on the selected menu flashes.</p>
Submenu Default menu (start selection) Set return time	Change value or Next digit or Cancel or Save	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;"><input type="text" value="01"/> L1</div> <div style="margin-bottom: 10px;"><input type="text" value="030"/> L2</div> <div><input type="text"/> L3</div> </div> <div style="margin-left: 20px;"> <div style="border: 1px solid black; padding: 2px; width: 40px; text-align: center; margin-bottom: 5px;">MENU</div> <div style="font-size: 8px; line-height: 1.2;"> O U_{PH,N} O U_{PH,PH} O I O S O P O Q O cos φ O kWh O kvarh O THD ● Extra </div> </div>	<p>The first digit on display L2 flashes.</p> <p>Set the return time in the default menu from 0 seconds (0 = function deactivated) to 255 seconds.</p>
NOTE	 or	<p>Return to main menu</p> <p>Continue to the next submenu, if available, or Return to main menu.</p> <p>Use these buttons to switch between the displays in input mode (one digit flashes).</p>	


12 Reset and delete function

12.1 Reset

<p> +  + </p> <p>Only reset the energy meter during setup or if the device is completely reprogrammed</p> <p>Caution! Reset will reset all programmed values to the default settings!</p>	<p>To reset, go to the Default settings submenu of the Extra menu.</p> <p>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!</p> <p>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.</p> <p>The settings for time, date, language and bus communication are not affected by a reset.</p> <p>Check all operating parameters for correctness!</p>
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12.2 Delete energy meter

12.2.1 Delete energy meter manually


Hold the button  for approximately 4 seconds to delete the value that is currently displayed in the continuous energy count (active or reactive energy, HT or LT).

12.2.2 Delete all energy meters



All energy meters at a time can only be deleted by a device reset.

12.3 Deleting extreme values

12.3.1 Deleting individual extreme values

Press the button  for approximately 4 seconds to delete the extreme values (minimum or maximum values) currently displayed.

12.3.2 Deleting all extreme values

To delete all minimum and maximum values, hold the buttons  and  for about 4 seconds while any minimum or maximum value is displayed.

12.4 Deleting limit settings

12.4.1 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".

12.4.2 Deleting all limit settings

To delete all limits, hold the buttons  and  for about 4 seconds while any limit is displayed.

13 Memory functions

13.1 Device settings

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

13.2 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 voltage, secondary	can be programmed by user in the range from 0001 V to 600V
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
Average current value	Period duration of the average value calculation
Transformer ratio neutral conductor current primary / secondary	Primary can be programmed in the range from 0001 V ... 999.9 kV Secondary can be selected by user: 1 A or 5 A
Neutral conductor current	measured (inp.) or calculated (calc)
Pulse output type / pulse significance / pulse length	acc. to user settings
Tariff switching	Internal clock
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

14 Technical data

14.1 Measuring and display values

Wave form for U and I		any
Voltage	RMS value of a measuring interval	Phase - N: $U_{L1-N}; U_{L2-N}; U_{L3-N}$ / phase - phase: $U_{L1-2}; U_{L2-3}; U_{L3-1}$
	Units	[V, kV]; display switches automatically
	Measuring period memory	0.00V to 999.9kV
Current (apparent current)	RMS value of a measuring interval	$I_{L1 \text{ act}}; I_{L2 \text{ act}}; I_{L3 \text{ act}}$; instantaneous value for each phase
	Average value determination	$I_{L1 \text{ avg}}; I_{L2 \text{ avg}}; I_{L3 \text{ avg}}$; floating average value of RMS values over a set period of time
	Units	[A;kA;MA]; display switches automatically
	Measuring period memory	0.00A to 999kA
Neutral conductor current	RMS value of a measuring interval	$I_{N \text{ act}} / I_{N \text{ avg}}$ Instantaneous and average value - cf. "Phase current"
	Units	[A;kA;MA]; display switches automatically
	Measuring period memory	0.00A to 999kA
Frequency	Power frequency measurement	f_{Net} ; measured with mains tracking, either 50 Hz fixed or 60 Hz fixed
	Units	[Hz]
	Measuring period memory	45 - 65 Hz
Apparent power	Calculation	$S_{L1}; S_{L2}; S_{L3}; S_{\text{tot}}$
	Units	[VA; kVA; MVA] display switches automatically
	Measuring period memory	0.00VA to 999MVA
Active power	Calculation	$P_{L1}; P_{L2}; P_{L3}; P_{\text{total}}$
	Units	[W; kW; MW] display switches automatically
	Measuring period memory	0.00W to 999MW
Power factor	Calculation ind. & cap.	$\cos_{\phi L1}; \cos_{\phi L2}; \cos_{\phi L3}; PF_{L1}; PF_{L2}; PF_{L3}; PF_{\text{Tot}}$; distinction between ind./cap. \cos_{ϕ} on the display
	Measuring period memory	CosPhi 0.1 ind. - 1 - 0,1 cap., LF 0,1 - 1

Continued overleaf

Continued

Reactive power	Calculation ind. & cap.	$Q_{L1}; Q_{L2}; Q_{L3}; Q_{total}$; distinction between ind./cap.
	Units	[var; kvar; Mvar]; display switches automatically.
	Measuring period memory	0.00VAr to 999Mvar
Active energy	Calculation	W(HT/LT)
	Units	[Wh; kWh; MWh; GWh]; display switches automatically
	Measuring period memory	0.0 Wh to 9999 GWh
Reactive energy	Calculation	W_{React} (HT/LT) → ind. or cap.
	Units	[varh; kvarh; Mvarh; Gvarh]; display switches automatically
	Measuring period memory	0.0 varh to 9999 Gvarh
Harmonics	Distortion factor (THD) for voltage	Voltage: DF- U_{L1} ; DF- U_{L2} ; DF- U_{L3} ;
	Partial distortion factors	3 rd ; 5 th ; 7 th ; 9 th ; 11 th ; 13 th ; 15 th ; 17 th to 63 rd harmonic of the voltage separated for each phase
	Units	[%]
	Measuring period memory	0.00% to 100%
Current harmonics	Current harmonics, Current harmonics total	3 rd ; 5 th ; 7 th ; 9 th ; 11 th ; 13 th ; 15 th ; 17 th to 63 rd harmonic of the current separated for each phase I_{SumL1} ; I_{SumL2} ; I_{SumL3}
	Units	[A; kA] display is switched automatically
	Measuring period memory	0.00A to 999.9kA

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

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

14.3 Measuring principle

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

14.4 Device memory

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

14.5 Power supply

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

14.6 Hardware inputs and outputs

14.6.1 Inputs

Voltage measuring inputs	$U_{L1-L2}; U_{L2-L3}; U_{L3-L1}$	3 x 5 V - 100 V - 120 V AC (measuring range 1) 3 x 20 V - 500 V - 600 V AC (measuring range 2)
	Input impedance	1.2 MOHM (Ph-Ph)
	Measuring period memory	can be configured using voltage and current transformers
Current measurement inputs	$I_{L1}; I_{L2}; I_{L3}; I_N$	4 x 0.01 A - 1 A - 1.2 A AC (measuring range 1) 4 x 0.05 A - 5 A - 6 A AC (measuring range 2)
	Power consumption	≤ 0.3 VA per input at 6 A
	Measuring period memory	can be configured using voltage and current transformers
Digital inputs	Rate 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

14.6.2 Outputs

Signal relay for limit violations	Number	2
	Contact	floating, open in case of limit violation
	Reaction speed	programmable, max. 254 sec.
	Switching capacity	Max. 250 V (AC) / 2 A floating - not safe to touch. Both relays must be in the same phase.
Pulse output	Output type	Proportional to active or reactive energy, configurable on the device from 0.001 to 9990 pulse(s) per kWh
	Optocoupler output	15 mA at max. 35 V; interface S_0 -compatible
	Accuracy class	2
	Pulse length	configurable, min. 30 ms, max. 990 ms
	Power supply	external

14.7 Electrical connection

Connection elements		Plug-in terminals
Permissible cross-section of the connecting cables		2.5 mm ²
Measurement voltage inputs	Fuse protection	max. 1 A slow-blow max. C2 automatic isolating switch UL/IEC-approved
Measurement current inputs	Fuse protection	NONE!!! Always short-circuit current transformer terminals k and l before opening the circuit!
Input control voltage	Fuse protection	max. 1 A slow-blow max. C2 automatic isolating switch UL/IEC-approved
Relay output	Fuse protection	max 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	Observe correct polarity! To ensure proper operation, only use shielded twisted-pair cables; e.g. I-Y-St-Y2x2x0.8 EIB
Transformer connection	Connections	See wiring diagram
Analog output	Connections	Ensure correct polarity!
Interface connection	RS485 BUS connector pins	Terminal 90 (L) Terminal 91 (A) Terminal 92 (B)

14.8 Mechanical data

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

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14.9 Ambient conditions, electrical safety and standards

Ambient conditions	Standards	DIN EN 60721-3-3:1995-09 + DIN EN 60721-3-3/A2:1997-07; 3K5+3Z11; (IEC721-3-3;3K5+3Z11)	
	Operating temperature	K55 (-5 °C - +55 °C)	
	Humidity	5% - 95% non-condensing	
	Storage temperature	K55 (-25°C ... +70°C)	
	Operating altitude	0 to 2000 m above sea level	
Electrical safety	Standards	DIN EN 61010-1:2011-07; DIN EN 61010-2-030:2011-07	
	Protection category	I	
	Oversvoltage category, measurement category	Voltage measurement: Current measurement: Power supply:	CAT III: 300 V; CAT II: 400 V CAT III: 300V CAT III: 300V
	Rated surge voltage	4kV	
Protection type	Standards	DIN EN 60529:2014-09	
	Front	IP 40, with IP 51 seal	
	Terminals	IP 20	
EMC	Standards	DIN EN 61000-6-2:2006-03 + amendment 1:2011-03 DIN EN 611326-1:2013-07 Devices without Profibus DP DIN EN 61000-6-3:2011-09 + amendment 1:2012-11 Devices with Profibus DP DIN EN 61000-6-4:2011-09	

16 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.

17 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.

An LED flashes.

There has been a limit violation in the menu that corresponds to the flashing LED. Description of sensor buttons and displays in [8](#), Chapter 7.1.

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 chooses the measuring range depending on the programmed secondary voltage. MULTIMESS F144-0-LED-...-5 works in the measuring range 1 if the programmed value of the secondary voltage does not exceed 120V. If it does, multimes F144-0-LED-...-5 operates in measuring range 2.

Measuring range 1: 5V to 120V AC, measuring range 2: 20V to 600V AC.

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.



A series of 20 horizontal lines providing a space for handwritten notes.

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