KBR
Energy Management

User manual
Technical reference

multicomp

3-phase
reactive power controller
3F144 LCD

Your partner for network analysis

System | English

EDEBDA0212-3413-2_EN

EDEBDA0212-3413-2_EN

Table of contents

EDEBDA0212-3413-2_EN

1 Introduction

Thank you for choosing this **KBR quality product**.

In order to familiarize yourself with the operation and configuration of the device, we recommend that you read this manual thoroughly, so that you are able to make use of the entire range of functions of this high-quality product.

The individual chapters serve to explain the technical details of the device and show how to avoid damage by means of proper installation and start-up.

1.1 User manual

This user manual must be accessible for the user at all times (e.g. in the switchgear cabinet). Even when the device is resold to third parties, the manual remains part of the device.

Although we used the utmost care in assembling this user manual, we would like to thank you in advance for notifying us about any errors or ambiguous descriptions you might notice.

EDEBDA0212-3413-2_EN

1.2 Explanation of safety relevant symbols

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

Warning

"Warning" means that death, major injuries or damage may occur in case the appropriate safety measures are not taken.

Caution

"Caution" means that minor injuries or damage may occur in case the appropriate safety measures are not taken.

Note

"Note" is an important information on the product, its operation or the respective part of the user manual to which special reference is made.

Disclaimer

The contents of this user manual have been carefully reviewed in terms of the hardware and software described. Certain deviations, however, cannot be excluded, and the manufacturer is not liable for complete conformity. The specifications made in this user manual are checked on a regular basis, necessary corrections will be included in the next revision.

1.3 Safety notes

In order to prevent operating errors, operation of this device is kept as simple as possible. This way, you will be able to quickly start working with the device.

In your own interest, however, you should read the following safety notes carefully. During assembly, the applicable DIN / VDE regulations must be observed!

Power supply connection, setup and operation of the device must only be performed by qualified personnel. Qualified personnel in accordance with the safety notes in this user manual are persons authorized to set up, ground and mark devices, systems and circuits in accordance with applicable standards and regulations.

To avoid the hazard of fire and electrical shock, the device must not be subject to rain or other humidity!

Before the device is connected to its power supply, you will have to check whether the local power supply conditions comply with the specifications on the manufacturer's label.

Caution

A wrong connection may destroy the device!

When connecting the device, observe the connection chart (see chapter "Connection chart") and make sure that no voltage is applied to the connection lines. Only use proper wiring material and observe the correct polarity when wiring!

In order to ensure proper and safe operation of the product, it must be transported, stored, installed and mounted in accordance with the specifications and operated and maintained carefully.

A device showing visible damage must by all means be considered as unfit for operation and must be disconnected from the power supply!

Error detection, repairs and maintenance work may only be carried out in our facilities or after contacting our service team. Every warranty obligation of the manufacturer expires if the device is opened without written consent from our service team. Proper operation can no longer be guaranteed!

Opening the device may expose parts under voltage. Capacitors in the device may still be loaded, even if the device has been disconnected from all voltage sources. It is generally not allowed to operate an open device!

EDEBDA0212-3413-2_EN

In systems subject to hazard of lightning, lightning protection must be provided for all input and output lines!

1.4 Product liability

You have acquired a high-quality product. In its manufacture, only components of the highest reliability and quality were used.

Each device is subject to long-term testing before it is delivered.

Regarding product liability, we refer to our general terms and conditions for electronic equipment, which you can find at **www.kbr.de**.

The warranted properties of the device apply only if it is operated in accordance with its intended use!

1.5 Disposal

Defective, outdated or no longer used devices must be properly disposed of.

At your request, we will dispose of the devices for you.

1.6 Overvoltage and lightning protection

It is recommended to install overvoltage protection measures to protect our high-quality devices from damage. We also recommend to protect control voltage inputs and pulse lines, if required.

2 Functional description of the multicomp 3F144

The multicomp 3F144 LCD reactive power controller works automatically in 4-quadrant operation (generator operation), i.e. even with energy recovery to the utility company network, missing compensation power is detected without a problem and compensated.

The control type of the device is optimizing, i.e. the controller selects the switching stage with the suitable compensation capacity according to the missing compensation power.

By using the parameter "maximum switching power per switching operation" (menu Extra / Commissioning / max. switching power), you can define the number of kvar the controller can switch (on and off) at the same time. This enables faster compensation. If the set value is smaller than the largest switching stage available, the value of the largest stage is automatically used as the switching criterion.

Through the integrated temperature measurement input, the ambient temperature in the reactive power compensation unit is also monitored, and if a predefined limiting temperature is exceeded, the ventilator is switched on. Furthermore, you can protect the system by setting an alarm / switch-off temperature which switches it off if there is a risk of damage due to overtemperature.

The controller is additionally equipped with a limiting value monitoring function for protection of capacitors from overvoltage and excessive harmonic load of voltage and current.

The 3-phase voltage and current recording makes it possible to not only realize 3-phase compensation as before, but also real single-phase compensation (balancing) or a mixture of single-phase and 3-phase compensation.

In this context, it is possible to separately configure 3-phase, phase-phase and single-phase stages for each of the 18 existing compensation stages. What is more, it is also possible to operate a compensation system with capacitive stages only, inductive stages only or in mixed mode.

For 3-phase measurement, the measuring values are displayed separately per phase, making it possible to evaluate the actual power supply conditions in detail. For single-phase measurement, the measuring values of the phase measured are displayed but the power values are additionally extrapolated as total power.

By using an additional digital input, it is possible to activate a second deviating target CosPhi.

EDEBDA0212-3413-2_EN

Furthermore, the device is equipped with a RS485 bus interface for operation at the KBR eBus with the **visual energy** computer software. This enables comfortable visualization of the measuring values and the controller's operating state as well as convenient configuration of the device via the PCU.

Please also observe the following notes on start-up and operation:

In case of operation in a 3-wire network, a zero point creator is required (e.g. 700/100 V AC, primary 3-phase connection, available from KBR), as the controller needs a neutral conductor for trouble-free operation.

For operation as a single-phase measuring controller, the measuring current must always be connected at the terminals 20 und 21 (k1 and l1). After changing to single-phase operation, you can configure the phase shift between the measuring current and measuring voltage (menu Commissioning / Transformer / Main current transformer / Phase l). In this case, the measuring voltage must be connected to terminals 10 (L1) und 13 (N).

For this operating mode, the compensation system must only be set up with 3-phase stages.

Note

A phase-phase measurement (2 measuring phases without neutral conductor) is not possible with this device.

For mixed operation of contactor stages and thyristor stages of the same size, the thyristor stages should be assigned to the stages in the back, as the front stages are switched first.

The thyristor stages are detected if the discharge time set is under 1 second.

In mixed operation of capacitive and inductive stages, the smallest capacitive and the smallest inductive stage must be of the same size.

For simultaneous operation of phase-phase and phase-N stages, the largest phase-N stage must not be larger than the largest phase-phase stage.

3 Connecting the multicomp

3.1 Installation and assembly

- During installation, the applicable VDE regulations must be observed.
- Before the device is connected to the power supply, you will have to check whether the local power supply conditions comply with the specifications on the nameplate. A wrong connection may destroy the device. A different power frequency influences the measurement accordingly.
- The device must be connected in accordance with the connection diagram.
- In case the system is subject to lightning hazard, lightning protection measures for the power supply input must be implemented.

Caution

The control voltage as well as the applied measurement voltage of the device must be protected by means of a back-up fuse.

When connecting the current transformers, the direction of the energy flow and the correct assignment to the voltage path must be observed!

Note

The following points must be observed when connecting the device:
- **Direction of the energy flow**
- **Assignment measuring voltage input / current transformer input**

EDEBDA0212-3413-2_EN

3.2 Connecting the current transformer:

■ **Direction of the energy flow**:

When mounting the transformer, observe the direction of the current or energy flow. If the current transformer is mounted the wrong way round, the measured current value will be negative.

Prerequisite is that energy is consumed.

■ **Assigning measuring voltage input / current transformer input:**

The current transformer on terminal 20/21 (k1/l1) must be arranged in the phase where the measuring voltage for terminal 10 (L1) is measured.

- The device will display positive current when connection and energy flow direction are correct.

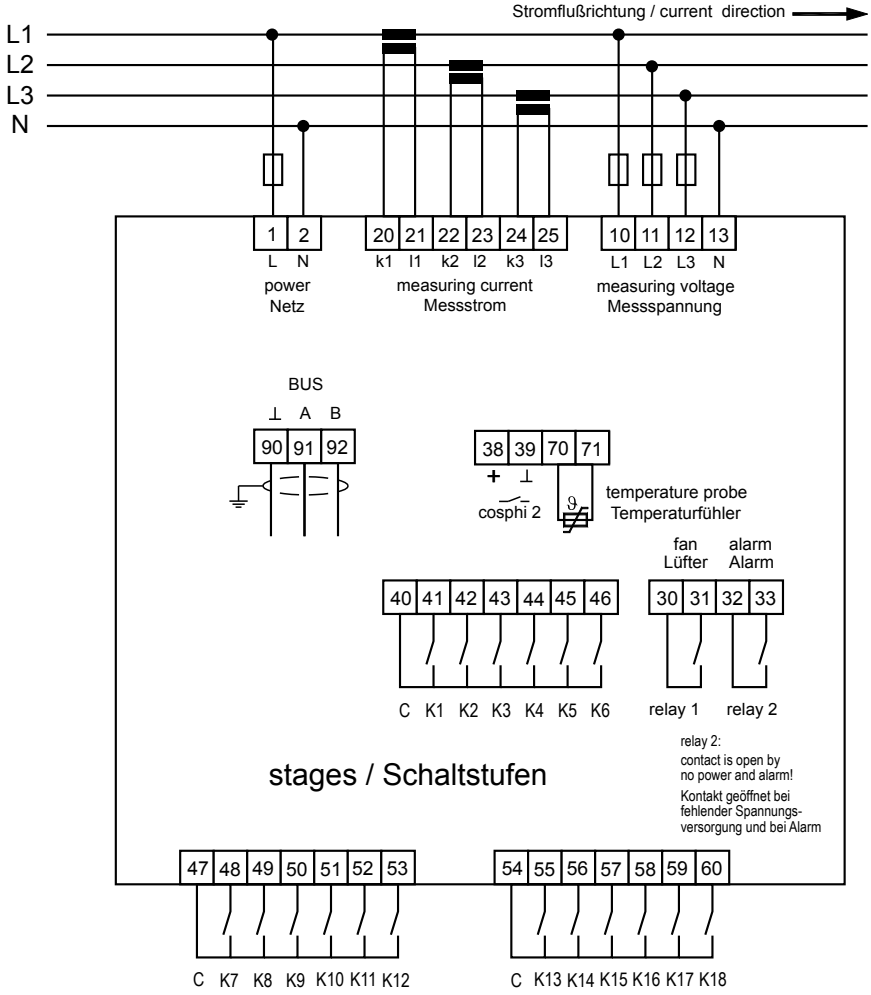
- If connected incorrectly, the current displayed is negative. Interchange the connections until the display shows correct values.

The same applies to the inputs of phases L2 and L3.

Caution

Before any interchanging, the current measuring transformer must be shorted out!

3.3 Connection diagram



3.4 Terminal assignment

Terminal	
1 (L) and 2 (N):	**Power supply connection** A control voltage is required to supply the device with power. The unit is equipped with a multirange power supply and may be supplied by voltages of 85 – 265V AC/DC (see nameplate for device voltage).
10 (L1) **11 (L2)** **12 (L3)** **13 (N):**	**Voltage measuring input** Input voltage both as PH-N and PH-PH measurement. 3-phase or single-phase measurement for 25... 230...280V AC PH-N, 50/60 Hz. The measuring range is configurable. For higher voltages, connection via voltage transformers is necessary (medium voltage measurement x/100 V), measuring range from 500V to 30.0 KV Ph-Ph.
20 (k1) and 21 (l1) **22 (k2) and 23 (l2)** **24 (k3) and 25 (l3)**	**Current measuring inputs** The measuring input for current must be connected via a current transformer x/1A AC or x/5A AC. When connecting the transformer, pay attention to the energy flow direction and the correct assignment of measuring voltage inputs to the current transformers.
30 and 31:	**Floating relay contact** The contact serves as switching output for the fan control. Maximum switching capacity of 2A at 250V AC
32 and 33:	**Floating relay contact** This contact serves as a message or alarm output. During operation, an audible or visual message may be activated, or a consumer switched off. The contact is open as long as the device is currentless, and if there is an active message. Maximum switching capacity of 2A at 250V AC
40 (C): **47 (C):** **54 (C):**	**Connection for voltage supply to the relay output terminals 41 to 46** **Connection for voltage supply to the relay output terminals 48 to 53** **Connection for voltage supply to the relay output terminals 55 to 60** The relays for the control outputs of the load contactor share the same connection to the supply voltage.

Terminal assignment

Terminal:	
41 (K1) to 46 (K6) **48 (K7) to 53 (K12)** **55 (K13) to 60 (K18):**	**Non-floating relay contacts** These contacts serve as control outputs for the load contactors of the compensation stages. In the currentless state of the device, the contacts are opened for stages that are not hooked up. Maximum switching capacity of 2A at 250V AC
38 (+) and 39 (-):	**Input for floating relay contact** This input serves as switching input for the target cos phi. During operation, you can switch from target cos phi 1 to target cos phi 2. When connecting an electronic switch, please make sure to observe polarity.
70 (+) and 71 (-):	**Temperature sensor input** A temperature sensor, e.g. PT1000, can be connected to this input to measure the switchgear cabinet temperature. Temperature measuring range from -10°C to +60°C.
90 (ground) **91 (A)** **92 (B):**	**Interface connection** For communication on the KBR eBus

EDEBDA0212-3413-2_EN

3.5 3F144 basic controller settings (default settings):

Method of measurement:	3-phase

Commissioning:	
Measuring voltage transformer:	Primary voltage 400 V Ph-Ph Secondary voltage 400 V Ph-Ph
Zero point creator:	off
Main current transformer:	Primary current 1000 A Secondary current 5 A
Rot.field I:	0° (for single-phase measurement)
Consumption target CosPhi 1:	0.95 inductive
Consumption target CosPhi 2:	0.95 inductive
Recovery target CosPhi:	1.00
Alarm CosPhi:	0.92 inductive
Stage power:	not set
Discharge time:	60 seconds
Type of connection:	3-phase
Type of stage:	Capacitor stage
Stage switching mode:	Automatic
Max. switching capacity per switching operation	1 kvar or max. programmed stage power

Display (unaffected by reset):	
LCD contrast:	50%
LCD brightness:	60%
Dimming time:	15 minutes
Dimming brightness:	0%

Basic system parameters switching performance:	
Hysteresis connection:	100% of smallest stage power
Hysteresis disconnection:	100% of smallest stage power
Alarm delay:	1200 seconds (20 minutes)
Idle time:	10 seconds
Switching interval:	8 seconds
Attenuation coefficient for current:	2
Attenuation coefficient for voltage:	2
Attenuation coefficient Qmiss:	2

Basic system temperature parameters:	
Measurement:	active
Switching thresholds:	
Fan switched on:	28°C
Fan switched off:	23°C
Stages switched on:	43°C
Stages switched off:	48°C

Basic system limit parameters:	
Limit operating cycles:	80000 connections
Operating cycle count:	Activated by set limit
Overvoltage limit:	440 VAC PhPh (corresponds to 10 %)
Current low load limit:	10 A
Average current limit:	6-fold current transformer ratio
THD limit:	8%
Harmonics monitoring:	Activated by set limit
Limit Id:	20 %
Harmonics monitoring:	Activated by set limit

EDEBDA0212-3413-2_EN

Misc.:	
Scanning frequency	Automatic
Error message dialog	In case of any errors message and alarm relay

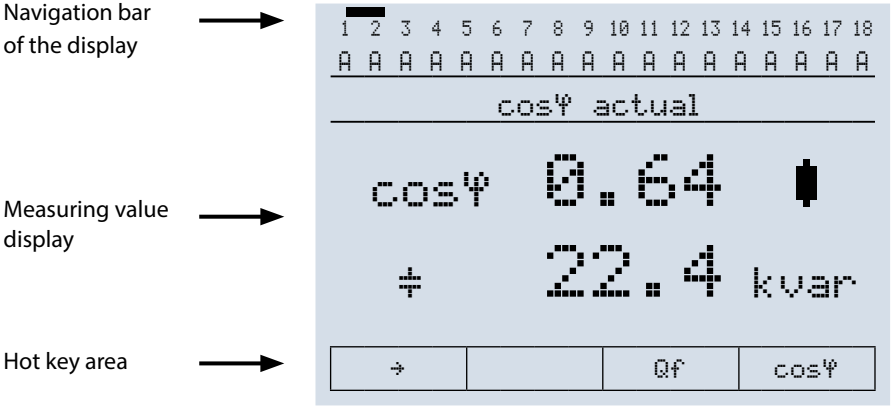
Service:	
Password:	No password (9999, meaning all functions are accessible)

LCD parameters, scanning frequency, password, bus parameters and language settings are unaffected by reset.

Error message dialog:	
Missing stage power:	Message and alarm relay
Power failure:	Message and alarm relay
Reset performed:	Message and alarm relay
Temperature switch-off of stages:	Message and alarm relay
Measurement current missing:	Message and alarm relay
Measurement voltage missing:	Message and alarm relay
light load operation:	Message and alarm relay
Harm. limit U exceeded:	Message and alarm relay
Harm. limit I exceeded:	Message and alarm relay
Operating cycle limit exceeded:	Message and alarm relay
Overvoltage limit exceeded:	Message and alarm relay
Average current limit exceeded:	Message and alarm relay
Facility too small:	Message and alarm relay

EDEBDA0212-3413-2_EN

4 Control and display panel



4.1 Description of buttons and displays

1 Display navigation panel
The navigation panel shows the main menu selected, considerably simplifying operation of the device. The operator can immediately see which menu he is in.

2 Measuring value display
The DOT matrix display is normally used to show measured values. In some submenus, this display area is used to show additional information to assist operation.

3 Hot key area
The text line corresponds to the function keys below it and is used to issue messages and text. The interaction of key and accompanying display enables convenient and self-explanatory operation.

Operating messages for individual switching stages:
1 = switching stage number
A = switched on in automatic operation

1 = switching stage number
= switched off in automatic operation

1 = switching stage number
H = switched on in manual operation

1 = switching stage number
0 = switched off in manual operation or no stage power is programmed

EDEBDA0212-3413-2_EN

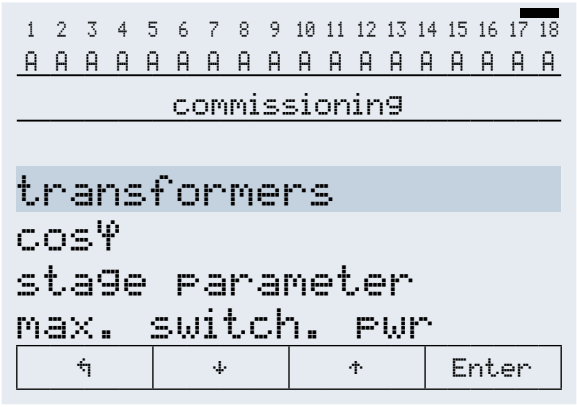
4.2 Description of general settings:

Attenuation (DC)	=	Reduction of the display fluctuations, the measuring cycle of the controller is not influenced.
Idle time (t idle)	=	Starts at compensation. After the idle time has expired, the next switching action follows.
Alarm delay (t-alarm)	=	Concerns the **FTS** message (**F**acility **t**oo **s**mall) i.e. all stages are hooked up and the set alarm CosPhi is not reached. After the set time has expired an alarm message is issued
Hysteresis (hyst.)	=	Refers to the smallest available stage power und the overcompensation or undercompensation, i.e. the hooking up or switching off starts at the percentage set
Switching interval	=	The time set defines the interval between two switching actions
Operating cycle limit	=	When the set value is reached, a message is issued. The value is based on the details from the contactor manufacturer.
Switch-off threshold Lim U	=	Overvoltage switch-off to protect the system, i.e. switching off the stages starts when the set limiting value is exceeded (hysteresis = 1 % of the limit)

4.3 Start-up guidelines for the multicomp 3F144

Start menu Commissioning:

If the multicomp is being commissioned for the first time, the menu Extra / Commissioning is displayed as the start screen (after the initialization phase) after setting up the supply voltage:



This display is used for the initial commissioning of the controller, where all the necessary settings can be made.

Controller preconfigured:

If a controller already integrated into a KBR compensation unit by default should be used, only the parameters of the current transformer have to be configured.

1. Configuring current transformer values

For the compensation controller to function properly, all current transformer parameters have to be set correctly. Primary and secondary current of the transformer have to be set. These parameters can be read on the nameplate of the current transformer. In addition, the phase allocation of the transformer has to be set correctly. In the controller, the phase (L1, L2, L3) in which the current transformer is integrated has to be set. This setting does not have to be made for 3-phase measurement.

EDEBDA0212-3413-2_EN

2. Function test

After all values have been programmed, a function test should be performed. To do so, the controller has to be taken off the voltage supply for a few seconds. After re-connecting it to the voltage supply, the controller has to start automatically. If the cosφ voltage is read out in the cosφ momentary menu immediately after switching it on, the value for cosφ should be low and inductive. After approx. 60 seconds, the controller starts to switch on the individual capacitor stages.

The cosφ, which can be read out in the cosφ act. menu, should have risen in comparison with former values, or it should rise when switching on additional stages. If the compensation unit is dimensioned correctly, the controller should compensate the set target cosine after a certain period of time.

Controller not preconfigured:

If a not yet preconfigured controller is to be commissioned, the following procedure has to be performed step by step.

1. Configuring current transformer values
For the compensation controller to function properly, all current transformer parameters have to be set correctly. Primary and secondary current of the transformer have to be set. These parameters can be read on the nameplate of the current transformer. In addition, the phase allocation of the transformer has to be set correctly. In the controller, the phase (L1, L2, L3) in which the current transformer is integrated has to be set. This setting does not have to be made for 3-phase measurement.

2. Setting target cosine
You can ask your energy supply company for the target cosine, which should be set up at this point. The target cosine is by default set to 0.95 inductive.

3. Configuring the capacitor stages
The stages can be configured manually. The most important setting to pay attention to is the stage power. The stage power can be looked up on the nameplate of the stage or the circuit diagram and then programmed manually.

4. Function test
After all values have been programmed, a function test should be performed. To do so, the controller has to be taken off the voltage supply for a few seconds.

After re-connecting it to the voltage supply, the controller has to start automatically. If the cosφ voltage is read out in the cosφ momentary menu immediately after switching it on, the value for cosφ should be low and inductive. After approx. 60 seconds, the controller starts to switch on the individual capacitor stages.

The cosφ, which can be read out in the cosφ act. menu, should have risen in comparison with former values, or it should rise when switching on additional stages. If the compensation unit is dimensioned correctly, the controller should compensate the set target cosine after a certain period of time.

4.4 Basic device programming:

The menu guidance of the multicomp is self-explanatory. The operator is guided and supported by the device through operating instructions on the display for that particular situation. The following terms are available for programming:

Enter	Return for configuration
EDIT	Perform configuration
↓	Submenu or parameter selection
+	Value input
?	Selection
YES	Confirmation to save configuration
NO	Discard configuration
↰	Return

As an example of the basic configuration procedure, the functions in the **Extra / Commissioning**menu will be looked at more closely.

Menu item: Transformers

Transformers				Menu description
F1	F2	F3	F4	
↰	↓	↑	ENTER	Display hot-key area
|	|	|	|	
|	|	|	Return for configuration	
|	|	Menu selection		
|	Menu selection			
Return				

4.5 Setting transformer ratio

After pressing the F2 and F4 buttons, the following is displayed in the hot key area:

curr. transformer				Menu description
F1	F2	F3	F4	
↰	↓	↑	ENTER	Display hot-key area
|	|	|	|	
|	|	|	Return for configuration	
|	|	Menu selection		
|	Menu selection			
Return				

After pressing the F4 button, the following appears in the hot-key area of the display:

F1	F2	F3	F4	
↰			EDIT	Display hot-key area
|			|	
|			Configuration of primary current transformer	
|				
|				
Return				

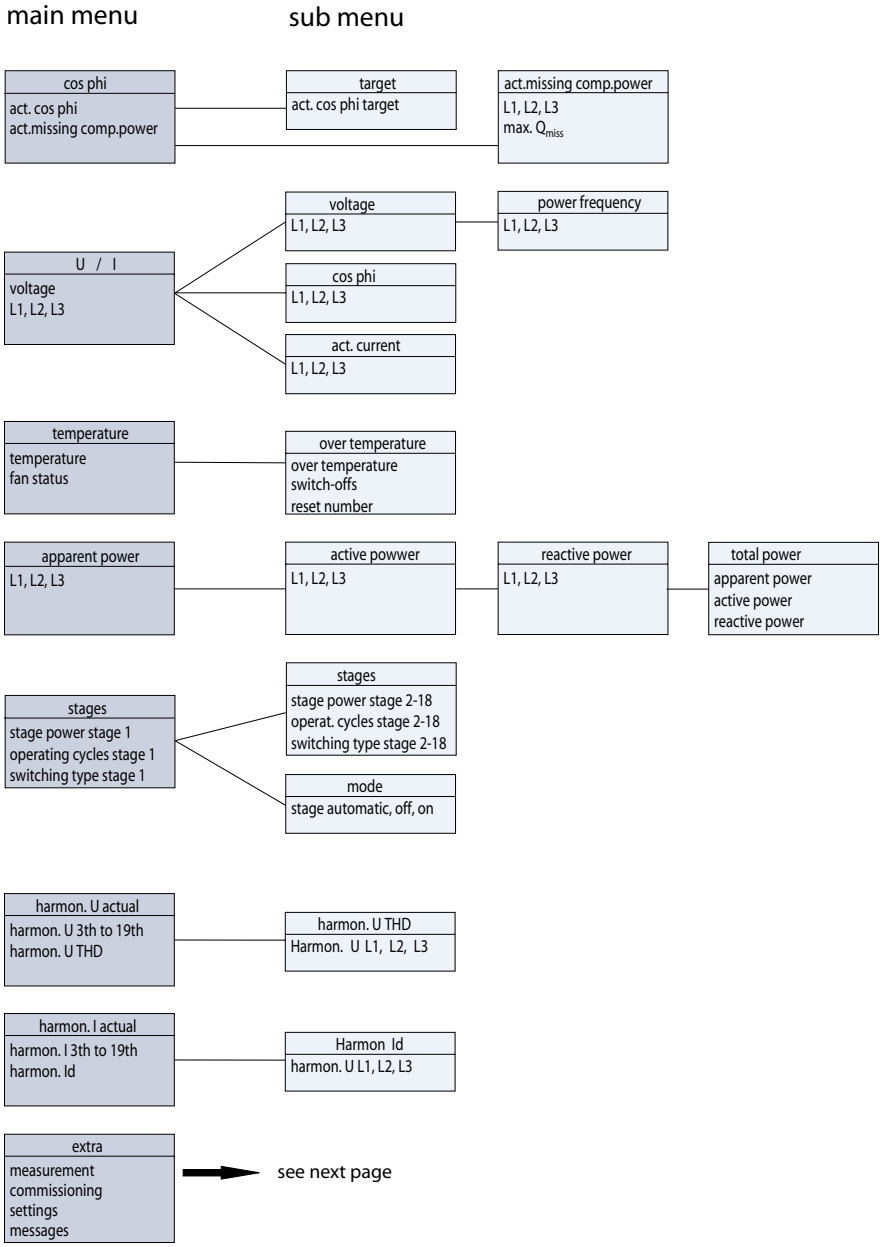
After pressing the F4 (EDIT) button, the following appears in the hot-key area of the display:

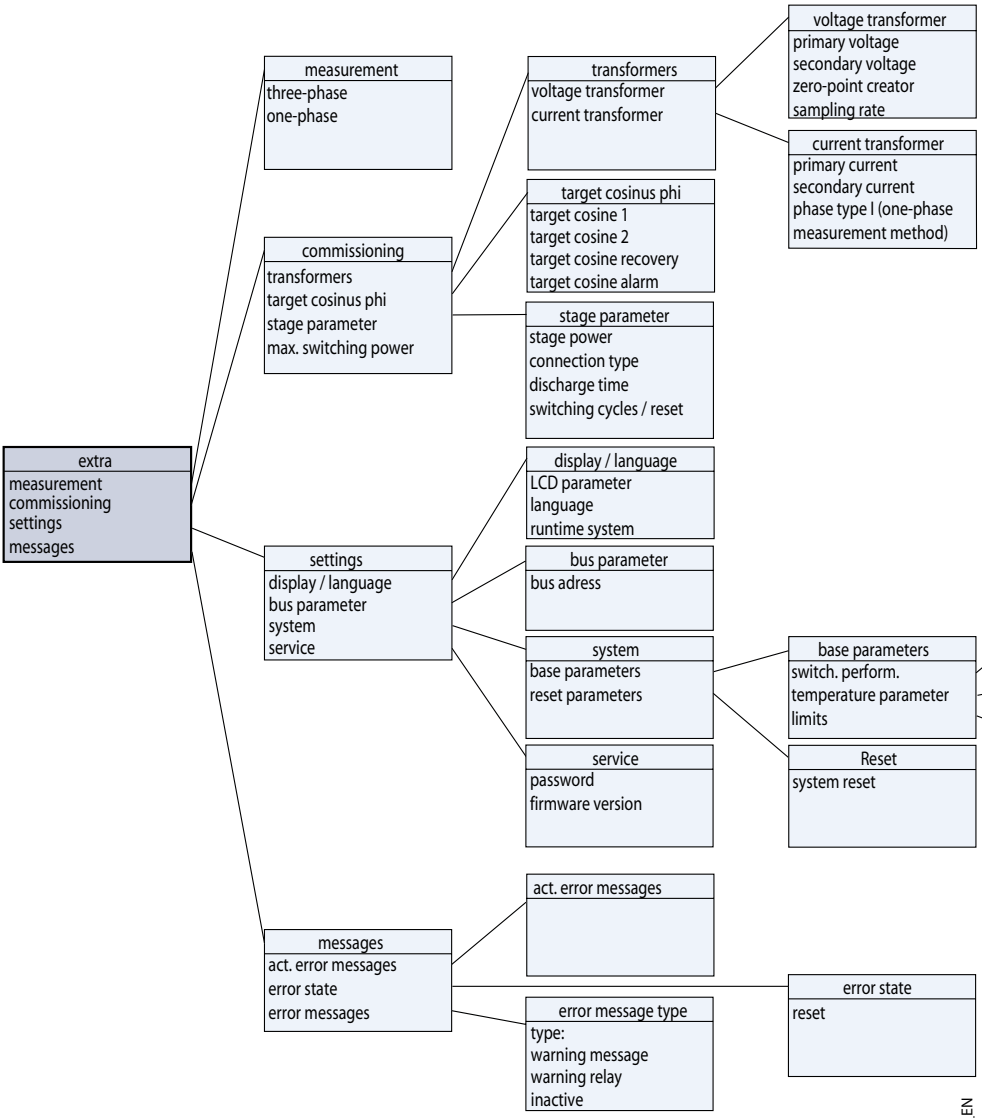
F1	F2	F3	F4	
↰		→	+	Display hot-key area
|		|	|	
|		|	Enter value	
|		Continue to next digit		
|				
Return				

If the **setting was changed**, the following appears in the hot-key area of the display:

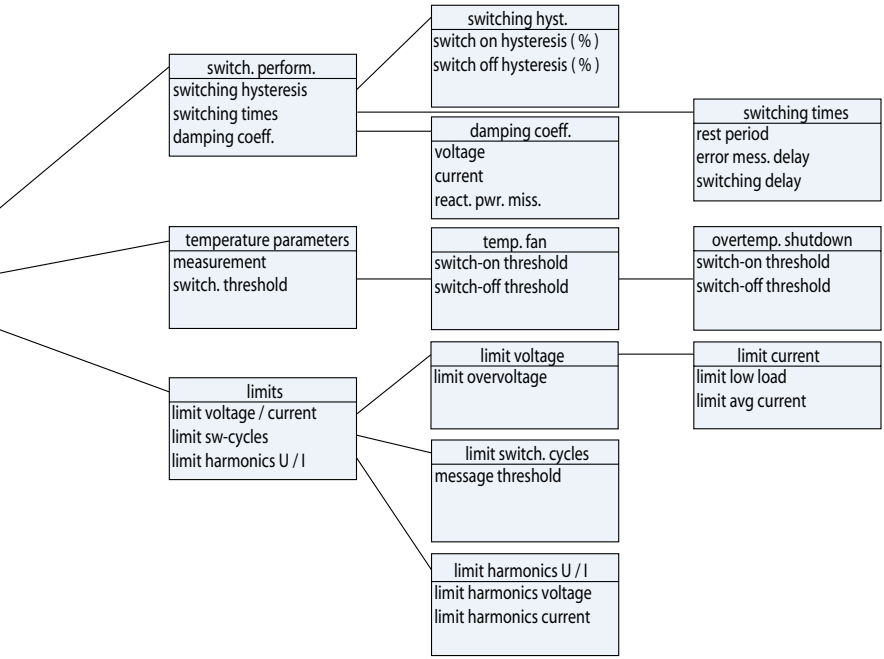
F1	F2	F3	F4	
NO	YES	→	+	Display hot-key area
|		|	|	
|		|	Enter value	
|		Continue to next digit		
|	Saving the last changes			
Leave setting menu without saving				

4.6 Menu overview



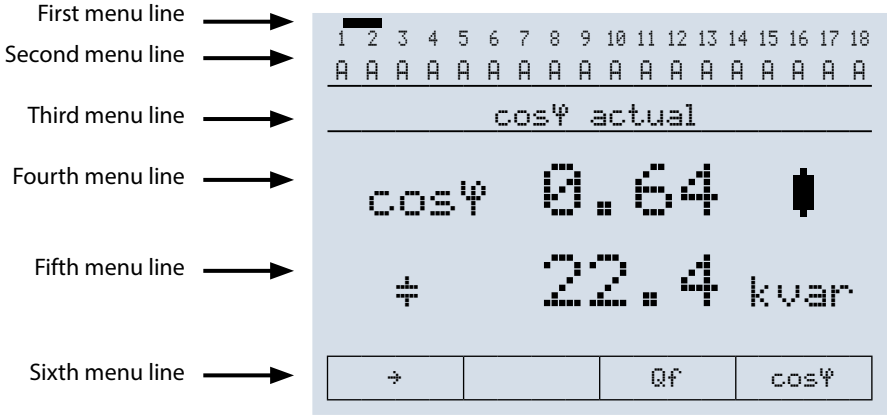


EDEBDA0212-3413-2_EN



EDEBDA0212-3413-2_EN

4.6 Main menu cos φ



The display is divided into various menu lines. The number of lines depends on which main or submenu item is selected:

First menu line:	Shows which of the eight main menus is being displayed
Second menu line:	Status display of the output lines
Third menu line:	Description of the menu and messages currently displayed
Fourth and fifth menu line:	Display of values of the current menu
Sixth menu line:	Navigation in the menu displayed

cosϕ actual				Menu description
F1	F2	F3	F4	
→		Qf	cosϕ	Display hot-key area
|		|	|	
|		|	Displaying the current target cosphi	
|		Display of the missing compensation power or maximum value		
|				
Scroll through main menu				

EDEBDA0212-3413-2_EN

Display as example:

Main menu:	= cosφ actual (instantaneous)
Stage mode:	= all stages automatic on
Menu description:	= cosφ actual (instantaneous)
Measured cosφ:	= 0.64 inductive
Missing compensation power:	= 22.4 kvar

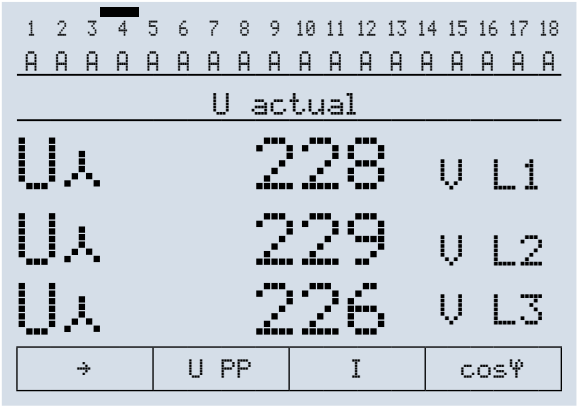
By pressing the button F3 twice, you can display the **maximum value of the missing compensation power**. The value is displayed in kvar. The value is only displayed if all available stages are switched on and the configured alarm CosPhi is not reached when the set alarm delay time has elapsed.

As soon as the value has been entered, the status **Facility too small** is displayed in the Messages sub menu.

Note

In case of a 3-phase measurement, the values in the measurement display areas are displayed separately per individual phase. In case of single-phase measurement, only the value of the phase measured is displayed

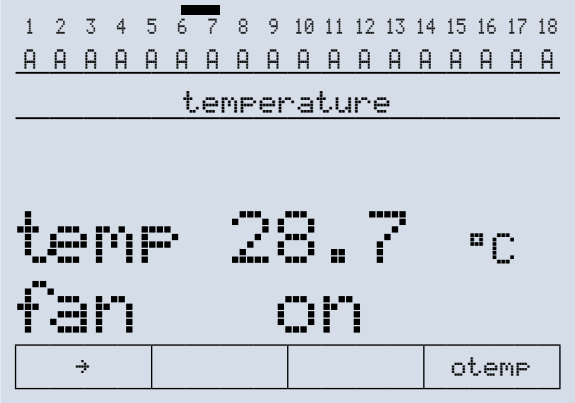
4.6.1 Main menu voltage / current



U actual				Menu description
F1	F2	F3	F4	
→	U PP	I	cosφ	Display hot-key area
|	|	|	|	
|	|	|	Display of Cosine Phi	
|	|	Display of the apparent current		
|	Display of voltage phase-phase and the power frequency			
Scroll through main menu				

Display as example:
measured voltage per phase (phase-N)

4.6.2 Main menu temperature



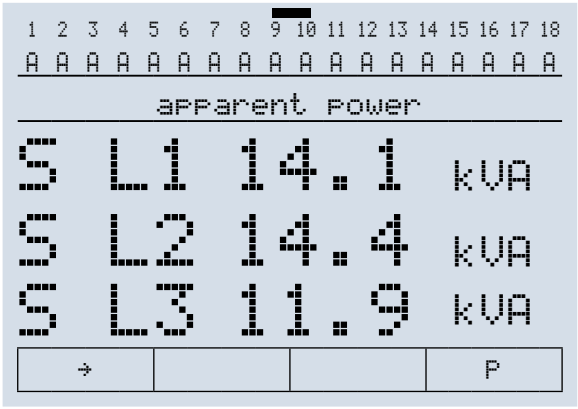
temperature				Menu description
F1	F2	F3	F4	
→			otemp	Display hot-key area
|			|	
|			Display of overtemperature switch-offs	
|				
|				
Scroll through main menu				

Display as example:
measured temperature: is 28,7°
Fan status = switched on

Note

For the error message **temperature sensor short circuit or broken wire**, the following message is displayed in the **Temperature** main menu:
sc = Short circuit
br = Broken wire
The following message is displayed if temperature measurement is deactivated:
na = Temperature measurement not activated

4.6.3 Main menu power



apparent power				Menu description
F1	F2	F3	F4	
→			P	Display hot-key area
|			|	
|			Display of active power, reactive power and total power	
|				
|				
Scroll through main menu				

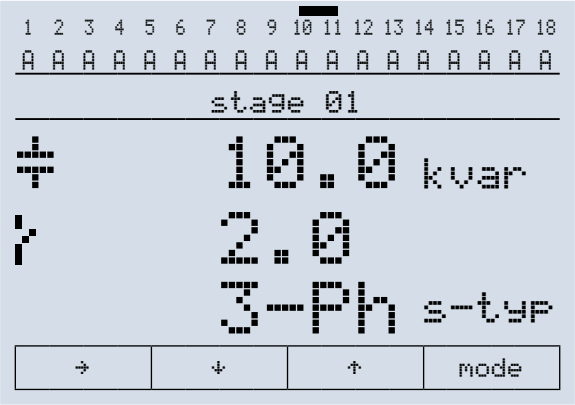
Display as example:

Apparent power L1:	14.1 kVA
Apparent power L2:	14.4 kVA
Apparent power L3:	11.9 kVA

By pressing the F4 button, the active power, the fundamental reactive power and the total values of apparent power, active power and fundamental reactive power are displayed.

EDEBDA0212-3413-2_EN

4.6.4 Main menu stages



stage parameters				Menu description
F1	F2	F3	F4	
→	↓	↑	mode	Display hot-key area
|	|	|	|	
|	|	|	Set switch mode of stages (On, Off, Automatic mode)	
|	|	Additional stages descending		
|	Additional stage display ascending			
Scroll through main menu				

Display as example:

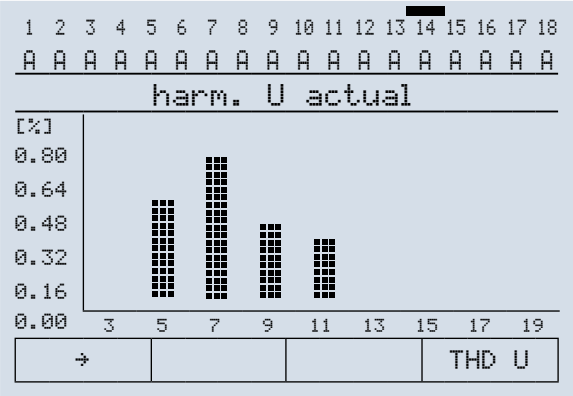
Stage No.: = Stage 01
Stage type: = Capacitor stage
Stage power: = 10 kvar
Operating cycles: = 2
Type of connection: = 3-phase

By pressing the F4 button, the Mode sub menu can be selected, in which you can individually configure the switching mode per stage.

The following options are available:

On = the stage is switched on permanently
Off = the stage is switched off permanently
Auto = the stage is operated automatically, i.e. the stage can be switched on or off depending on the required compensation power.

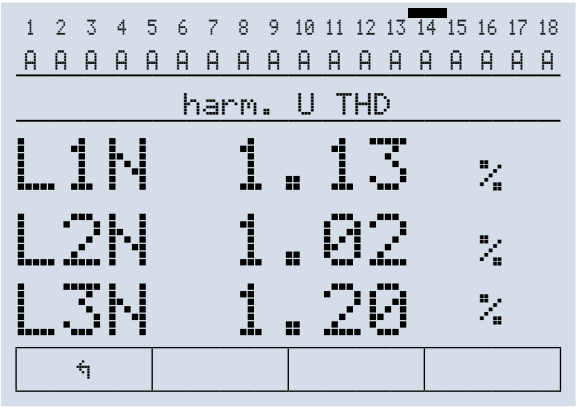
4.6.5 Main menu Uh voltage harmonics



harm. U act.				Menu description
F1	F2	F3	F4	
→			THD U	Display hot-key area
|			|	
|			continue with THD U (in %)	
|				
|				
Scroll through main menu				

Display as example:= 3-phase bar chart

4.6.6 Sub menu THD voltage



harm. U THD				Menu description
F1	F2	F3	F4	
↰				Display hot-key area
|				
|				
|				
|				
Back to main menu				

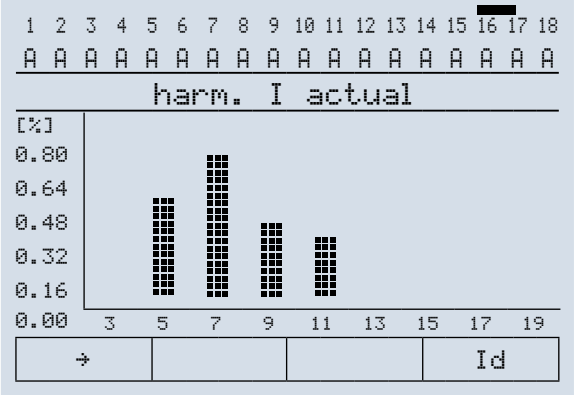
Display as example:

harm. U THD L1N: = 1.13 %
Harm. U THD L2N: = 1.02 %
Harm. U THD L3N: = 1.20 %

Note

The percentage value displayed refers to the measured voltage value of the fundamental!

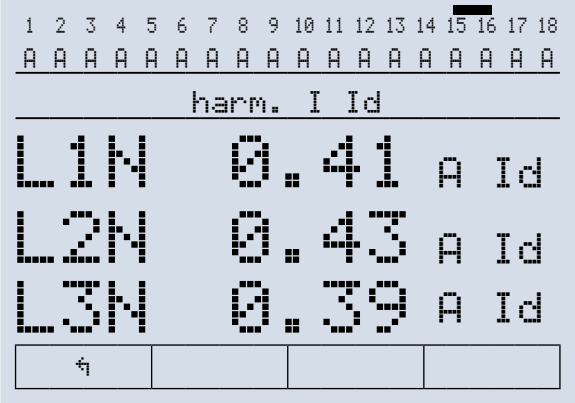
4.6.7 Main menu Ih current harmonics



harm. I act.				Menu description
F1	F2	F3	F4	
→			Id	Display hot-key area
|			|	
|			continue with Id (in Ampere)	
|				
|				
Scroll through main menu				

Display as example: = 3-phase bar chart

4.6.8 Sub menu ID current

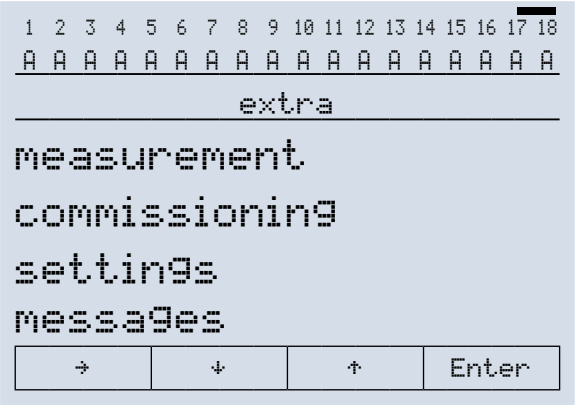


harm. I Id				Menu description
F1	F2	F3	F4	
↰				Display hot-key area
|				
|				
|				
|				
Back to main menu				

Display as example:

harm. Id L1N: = 0.41 A
Harm. Id L2N: = 0.43 A
Harm. Id L3N: = 0.39 A

4.6.9 Main menu Extra



Extra				Menu description
F1	F2	F3	F4	
→	↓	↑	Enter	Display hot-key area
|	|	|	|	
|	|	|	Call up menu	
|	|	Menu selection		
|	Menu selection			
Scroll through main menu				

Note

The percentage value displayed refers to the measured voltage value of the fundamental!

4.7 Sub menus

4.7.1 The Methods of measurement submenu contains the following items:

1. Single-phase measurement
2. 3-phase measurement

4.7.2 The Commissioning submenu contains the following items:

1. Transformer settings (voltage, current)

a. Voltage transformer

i. Primary voltage
ii. Secondary voltage
iii. Zero point creator
iv. Scanning frequency

b. Main current transformer

i. Primary current
ii. Secondary current
iii. Phase allocation (for single-phase measurement)

Setting ranges:

Primary voltage	1 V bis 999999 V Ph-Ph
Secondary voltage	1 V bis 999999 V Ph-Ph
Zero point creator	On, Off
Scanning frequency	Auto, 50 Hz, 60 Hz
Primary current	1 A to 999999 A
Secondary current	1 A or 5 A
Phase I	0°, 120°, 240°

For the items **primary voltage and secondary voltage**, the respective parameter for the voltage transformer must be given, e.g. transformer 10,000/100V means a primary voltage of 10,000V and a secondary voltage of 100V.

The input field ranges from 1V to 999kV for the primary and secondary voltage.

Using the item **Zero point creator**, the controller can be activated via a zero point creator. For energy supply networks with outer conductor connected to the earth potential, suitable control gear with electrical isolation (e.g. voltage transformer) must be used.

These transducer adaptors (zero-point creator) are suitable for creating a virtual low-impedance neutral point for the device in a three-phase network without neutral conductor.

In the 700 V variant, this also serves to adapt the measurement voltage to the device. Make sure that the device is configured for the operation with a zero-point creator.

Transformers are available in the following variants:

Variant 400/100:	Primary: 400 V phase-phase voltage
Variant 700/100	Primary: 700 V phase-phase voltage
Secondary:	100 V phase-phase voltage

2. Target cosine - setting

a. Target cosφ 1 for energy consumption
b. Target cosφ 2 for energy consumption
c. Target cosφ for power output
d. Alarm cosφ for FTS message (facility too small)

Setting ranges:

Consumption target Cosφ 1.2	ind. 0.50 to cap. 0.50
Recovery target cosφ	ind. 0.50 to cap. 0.50
FTS alarm cosφ	ind. 0.50 to cap. 0.50 setting range:

If active power recovery is detected, this is signaled by the symbol in the display. In order to avoid alternating switching operations, the target cosφ for power output stays active until 15 minutes after the end of the power output.

3. **Stage parameters**

a. Stage selection, stage power
b. Type of connection
c. Discharge time
d. Operating cycles

Setting ranges:

Stage power	0 to 9999.9 kvar, inductive or capacitive
Type of connection	3-phase, phase-phase, single-phase
Discharge time	10 ms to 999.99 sec. (Thyro < 1 second)

Note

The setting capacitive or inductive stage is indicated by the or symbol.

4. Max. switching capacity

Setting ranges:	Max. switching capacity
per switching operation	0 to 999999 kVar

4.7.3 The Settings submenu contains the following items:

1) Display / language

- i) LCD parameters
  - (a) LCD contrast
  - (b) LCD brightness
  - (c) Dimming time
  - (d) Dimming brightness
- ii) Language
- iii) Runtime

Setting ranges:

Contrast setting	00% to 99%
Brightness setting	00% to 99%
Dimming time	1 to 255 minutes
Dimming brightness	00% to 99%
Language selection text display	German, English

2) Bus parameters

Setting range:

Bus parameters	bus address, scan mode

3) System

- i) Basic parameters
  - (a) Switching performance
    1. Switching hysteresis
       - i. Hook-up
       - ii. Disconnection
    2. Switching times
       - i. Idle time
       - ii. Alarm delay
       - iii. Switching interval
    3. Attenuation coefficients
       - i. Voltage
       - ii. Current
       - iii. Qmiss
  - (b) Temperature parameters
    1. Activate measurement
    2. Switching thresholds
       - i. Switching on fan
       - ii. Switching off fan
       - iii. Switching on system
       - iv. Switching off system

(c) Limits
1. Voltage
2. Current
i. Low load
ii. Average current value
3. Operating cycles
4. Harmonics
i. Voltage
ii. Current

ii) Reset parameters

Setting ranges:

Hysteresis connection	70 to 150 %
Hysteresis disconnection	70 to 150 %
Idle time	0 to 999.99 sec.
Alarm delay FTS	1 to 9999 sec.
Switching interval	10 to 999.99 sec.
Attenuation coefficient current	0 to 9
Attenuation coefficient voltage	0 to 9
Attenuation coefficient Qmiss	0 to 9
Temperature measurement	active, inactive
Switching threshold for switching on fan	0 to 70°C
Switching threshold for switching off fan	0 to 70°C
Switching threshold for switching on stages	0 to 70°C
Switching threshold for switching off stages	0 to 70°C
Overvoltage switch-off limit	up to 150%, dependent on primary voltage
Low load limit	0 to primary current transformer (in A)
Average current limit	0 to primary current transformer +20% (in A)
Operating cycle limit	0 to 999999
THD limit	0 to 100%, deactivatable (0%)
Limit value I d	0 to 100%, deactivatable (0%)
Reset parameters	Reset to factory settings (default settings)

The **temperature parameters** contain the basic enabling and disabling of the temperature measurement and the switching performance resulting from this. In addition, the switching threshold and hysteresis for the fan control and the switching threshold and hysteresis for the overtemperature switch-off can be set here. The following parameters are available for switching thresholds and hystereses:

Switching threshold fan	= 0 to 70 °C
Switching threshold overtemperature	= 0 to 70 °C

The default settings are:

Switching threshold fan	= 28 °C / hysteresis = 5 °C
Switching threshold overtemperature	= 48°C / hysteresis = 5°C

This means that the fan switches on when 28°C are exceeded and switches off again when the temperature drops below 23°C.

The overtemperature stage switch-off is activated when 48 °C are exceeded.

After the temperature has dropped below 43 °C, the stages are hooked up again if required, after the discharge time has elapsed.

The setting range of the overvoltage switch-off goes up to 150% of the measuring voltage, i.e. for a programmed measuring voltage of primarily 400V Ph/Ph, the setting range is 400V to 600V Ph/N. The setting range is dependent on the programmed primary measurement voltage.

When the limit for the overvoltage switch-off is exceeded, the hooked up compensation stages are immediately switched off. After the temperature has dropped below the limit by 1% of the limit, the compensation stages are hooked up again after the discharge time has elapsed.

Note

The default setting for the overvoltage limit is, for a measurement voltage of 400V PH-Ph 10% more, i.e. 440 V PH-PH. In case of operation via voltage transformer, the limit is set respectively higher!

Example: For a voltage transformer of 700V PH-PH primary and 100 V PH-PH secondary, the limit has to be set to 770V PH-PH (770 V PH-PH + 10% (=70 V) equals 770 V PH-PH).

This limit is dependent on the primary voltage!

4) Service

i) Password
ii) Firmware version

Setting ranges:
Password 4-digits, numerical (9999, meaning all functions are accessible)

Under the item Password, changes to the controller parameters can be password-protected. The password can be any 4-digit number code.

The controller is defaulted with the code 9999, i.e. all functions of the device are available.

4.7.4 The Messages submenu contains the following items:

1) Active error messages
2) Error states
3) Alarm messages
i) Missing stage power
ii) Power failure
iii) Reset performed
iv) Temperature switch-off
v) Missing measurement current
vi) Missing measurement voltage
vii) Light load operation
viii) Limit harmonics U
ix) Limit harmonics I
x) Operating cycle limit
xi) Overvoltage limit
xii) Average current limit
xiii) Facility too small (FTS)

Error message setting range:
display message
display message + alarm relay switches
no output

At the point error status messages are displayed which must be manually deleted. This ensures that these relevant for proper system operation messages are not inadvertently lost.

The following status messages may be displayed::

- Power failure has occurred
- Reset has been performed
- Operating cycles of a stage above limiting value (contactor stage)
- Limit violation of measuring voltage
- Limit violation of measuring current average
- Limit violation of voltage harmonics (THD U)
- Limit violation of current harmonics (Id)
- **F**acility **t**oo **s**mall (FTS)

5. Notes on detecting errors:

Undercompensation, not enough stages are switched on.
Check controller for error messages If the target cos phi is set to 0.8 capacitive, you need to start switching on capacitors. If the system is not over dimensioned, almost all stages need to be switched on.

Check the main fuse and group fuses of the system. All values are entered in the enclosed documents. The group fuses must display at least 1.7-times the value of the capacitor power.

If the fuses do not hold, despite being correctly selected, the groups must be checked individually for **excessive current input** and for **defective contactors**.

Undercompensation, all stages are switched on.
The existing system is not sufficient (e.g. due to new inductive consumers).

Undercompensation, too many stages are switched on.
Check controller settings (target cos phi capacitive?).
Transformer connected in the wrong position?

Controller switches a lot, in particular during low load (at the weekend, during the night).

Check programming of the transformer ratio. Switch on a small stage permanently (manually), if required.

6. System and safety devices maintenance

In order to ensure proper function and a long service life of your system, the following checks have to be performed after commissioning and then once a year!

- Check and retighten all connections. Screw connections may become loose at the beginning due to thermal stress.
- Check fuses, safety devices and switching equipment. Contactors are wearing parts. If the contactor is intact, switching must take place without excessive formation of sparks.
- Check the controller behavior in automatic mode.
- Examine the cool air proportions
  (ventilators, temperature monitoring function):
  - Temperature relay of controller switches ventilators on at 28°C,
  - Temperature monitoring switches system off via controller at 48°C.
- Clean filter mats, depending on how dirty they are.
- Visual inspection of capacitors for leaks (a reliable encapsulation of the dielectric is a prerequisite for the long life of the capacitor).
- Examine the current input and capacitor terminal voltage every three months.
- Inspect the reactive energy consumption by means of the electricity bill.

Limit temperatures:

Valid for systems in cabinets:
+ 35° C in a 24-hour average
+ 20° C in annual average
+ 40° C highest value, briefly
- 10° C lowest value

The above information applies particularly to reactor-connected systems. The input current and the temperature of these systems must be checked regularly so that an overload on the capacitors can be detected at an early stage. A higher input current can be caused by an increasing proportion of harmonics or by a change in capacitance of capacitors.

EDEBDA0212-3413-2_EN

7. Technical data multicomp 3F144

7.1 Measuring and display values

Voltage	Units	[V, kV;] display is switched automatically
	Display range	0 V to 999 kV
	Measuring range	3-phase 25 … 230 … 280 VAC, 50 / 60 Hz
Current (apparent current)	Units	[A;kA] display is switched automatically
	Display range	0 A to 999 kA
	Measuring range	3-phase 0.03 … 5 … 6 A
Frequency	Power frequency measurement	fpower ; measured with power supply correction
	Units	[Hz]
	Measuring range	40.....62 Hz
Apparent power	Calculation	Stotal , single-phase / 3-phase
	Units	kVA
	Display range	0 VA to 999 MVA
Active power	Calculation	Ptotal , single-phase / 3-phase
	Units	kW
	Display range	0.00W to 999 MW
Reactive power	Calculation ÷ ind. & cap.	Qtotal; Qmiss; distinction between ind./cap.
	Units	kvar
	Display range	0.00Var to 999 MVar
Power factor	Calculation ÷ ind. & cap.	cosφ; distinction between ind./cap. cosφ in the display
	Display range	CosPhi 0.1ind. ÷ 1 ÷ 0.1cap.
Harmonic harmonics	Distortion factor (THD) for voltage; Id for current	Voltage: KF-U Current: Id
	Partial distortion factors	3rd; 5th; 7th; 9th; 11th; 13th; 15th; 17th; 19th; voltage and current harmonics
	Units	[%] for voltage, [A] for current
	Measuring range	0% to 100% for voltage, 0 to 999 kA for current

7.2 Measuring accuracy

Current	± 1 % / ± 1 digit
Voltage	± 1 % / ± 1 digit
Power	± 2 % / ± 1 digit
Power factor	± 2 % / ± 1 digit
Frequency	± 0.1 Hz / ± 1 digit

7.3 Measuring principle

Reading	128 measured values per period
A/D converter	12 bit
Measurement of U and I	acquiring measuring values for U and I simultaneously;
Update speed (complete measuring cycle)	20 ms
Harmonics calculation	FFT with 128 points over one period
Frequency measurement	Mode: Voltage measurement between phase Lx - N

7.4 Device memory

Data storage		30 KB RAM volatile
Program and parameter memory		256 kB flash
Extreme value (max.)		Missing compensation power Qmax
Harmonic limit violation	Time for acquisition	approx. 100 ms
Overvoltage switch-off	Time for acquisition	approx. 40 ms
No voltage switch-off	Time for acquisition	approx. 40 ms (for measuring voltage)

7.5 Power supply

Power supply	85 – 265V AC/DC; max. 15VA, 9 W, 50/60 Hz

EDEBDA0212-3413-2_EN

7.6 Hardware inputs and outputs

7.6.1 Inputs

Voltage measuring input	UPH-N	25V... 230 ... 280V AC, 50/60 Hz
	Input impedance	750 kOhm
	Measuring range	1 measuring range, measuring voltage transformer
Current measuring input	IL1 and IL2 and IL3	0.03A...5A...6A AC
	Power consumption	≤ 0.3VA at 6A per measuring inputs
	Measuring range	1 measuring range, current transformer programmable
Analog input	Measurement sensor PT 1000	Temperature measuring -10°C to 60°C, +/- 2°C
		max. length of connecting cables < 3 meters
Digital input	S0 compatible	< 2 mA = off, > 10 mA = on
	Output voltage	approx. 15 VDC, (observe polarity
	Output current	<= 15 mA

7.6.2 Outputs

Alarm relay, fan relay	Switching capacity	250V (AC) / 2A potential-free
Compen-sation stage relay	Switching capacity	250V (AC) / 2A potential-free
Bus connection	Serial interface	RS 485 for connection to the KBR eBus; a maximum of 32 devices per bus segment, up to 1000 m without bus repeater if placed accordingly. For additional information see installation guide KBR eBus.
	Transmission speed	38400 baud
	Bus protocol	KBR eBus
	KBR eBus address assignment	Can be addressed up to address 9999, scan mode can be activated on the device

7.7 Electrical connection

Connection elements		Plug terminals
Permissible cross section of the connection lines		max. 2.5 mm^2 at 5 mm steps, 1,5 mm^2 at 3.5 mm steps
Measurement voltage input	Fuse protection	max. 6 A
Measurement current inputs	Fuse protection	NONE!!! Always short-circuit current transformer terminals k and l prior to opening the circuit!
Input control voltage	Fuse protection	max. 6 A
Relay output	Fuse protection	max 2 A medium time-lag
Connection of KBR eBus	Connection material	For proper operation, please only use shielded twisted-pair cables, e.g. I-Y(St)Y 2x2x0.8
Transformer connection	Connections	see connection diagram

7.8 Mechanical data

Flush-mounted device	Housing dimensions	144 x 144 x 60 mm (H x W x D), without plug terminals 144 x 144 x 70 mm (H x W x D), with plug terminals
	Assembly cut-out	138 x 138 mm
	Weight	approx. 800 g
Operation and display	Operation	4x sensor buttons
	Display	128 x 96 pixel graphic LCD with illumination

EDEBDA0212-3413-2_EN

7.9 Standards and miscellaneous

Environ-mental conditions	Standards	DIN EN 60721-3-3/A2: 1997-07; 3K5+3Z11; (IEC721-3- 3; 3K5+3Z11)
	Operating temperature	-5°C … +55°C
	Humidity	5% … 95%, non-condensing
	Storage temperature	-25°C … +70°C
	Operating altitude	up to max. 2000m above sea-level
Electrical safety	Standards	DIN EN 61010-1: 2011-06; (IEC 61010-1:2011-06)
	Protection class	II in accordance with DIN EN 61010-1: 2011-06; (IEC 61010-1:2011-06)
	Overvoltage category	Umeas : CAT III
	Protection type	Frontside IP51
		with optionally available front door max. IP54
		Backside IP20
		for DIN EN 60529:2000-09
	Electromagnetic compatibility	DIN EN 61000-6-3: 2011-09; + correction 2012-11 (IEC 61000-6-3: 2011-09)
		DIN EN 61000-6-2: 2006-03; + correction 2011-06 (IEC 61000-6-2: 2006-03)
Password protection	4-digits, numerical	Deleting and programming parameters on the device is not enabled if password protection is active.

7.10 Setting ranges:

Primary voltage	1 V to 999999 V Ph-Ph
Secondary voltage	1 V to 999999 V Ph-Ph
Zero point creator	On, Off
Scanning frequency	Auto, 50 Hz, 60 Hz
Primary current	1 A to 999999 A
Secondary current	1 A or 5 A
Phase I	0°, 120°, 240°
Consumption target cosφ 1.2	ind. 0.50 to cap. 0.50
Recovery target cosφ	ind. 0.50 to cap. 0.50
FTS alarm cosφ	ind. 0.50 to cap. 0.50
Stage power	0 to 9999.9 kvar, inductive or capacitive
Type of connection	3-phase, phase-phase, single-phase
Discharge time	10 ms to 999.99 sec. (thyro < 1 second)
Max. switching capacity per switching operation	0 to 999999 kVar
Contrast setting	00% to 99%
Brightness setting	00% to 99%
Dimming time	1 to 255 minutes
Dimming brightness	00% to 99%
Language selection text display	German, English
Hysteresis connection	70 to 150 %
Hysteresis disconnection	70 to 150 %
Idle time	0 to 999.99 sec.
Alarm delay FTS	1 to 9999 sec.
Switching interval	10 ms to 999.99 sec.
Attenuation coefficient current	0 to 9
Attenuation coefficient voltage	0 to 9
Attenuation coefficient Qmiss	0 to 9
Temperature measurement	active, inactive
Switching threshold for switching on fan	0 to 70°C
Switching threshold for switching off fan	0 to 70°C
Switching threshold for switching on stages	0 to 70°C
Switching threshold for switching off stages	0 to 70°C
Overvoltage switch-off limit	up to 150%, dependent on primary voltage
Low load limit	0 to primary current transformer (in A)
Average current limit	0 to primary current transformer +20% (in A)
Operating cycle limit	0 to 999999
THD limit	0 to 100%, cannot be deactivated (0%)
Limit value I d	0 to 100%, cannot be deactivated (0%)
Reset parameters	Reset to factory settings (default setting)
Password	4-digits, numerical (9999, meaning all functions are accessible)

EDEBDA0212-3413-2_EN

ERKLÄRUNG DER KONFORMITÄT
DECLARATION OF CONFORMITY
DÉCLARATION DE CONFORMITÉ

Wir
We/Nous

KBR GmbH Schwabach

(Name des Anbieters / supplier´s name / norm du fournisseur)

Am Kiefernschlag 7
D-91126 Schwabach

(Anschrift / address / addresse)

erklären in alleiniger Verantwortung, dass das (die) Produkt(e) /
declare under our sole responsibility that the product(s) / Déclarons sous notre seule responsabilité, ques le(s) produit(s)

multicomp 3F144

(Bezeichnung, Typ oder Modell oder Seriennummer / name, type or model or serial number / nom, type ou modèle, N° de lot ou de série)

mit folgenden Europäischen Richtlinien übereinstimmt (übereinstimmen)
is (are) in conformity with the following directives / Répondet(ent) aux directives suivantes

Niederspannungsrichtline Nr. **Low Voltage Directive No.** **Directive Basse Tension N°**	**EMV-Richtlinie Nr.** **EMV Directive No.** **EMV Directive N°**
2006/95/EG **2006/95/EC** **2006/95/CE**	**2004/108/EG** **2004/108/EC** **2004/108/CE**

Dies wird nachgewiesen durch die Einhaltung folgender Norm(en)
This is documented by the accordance with the following standard(s) / Justifié par le respect de la (des) norme(s) suivante(s)

DIN EN 61010-1-2011-07
DIN EN 61000-6-1:2007-10
DIN EN 61000-6-2:2006-03 + Berichtigung 1 2011-06
DIN EN 61000-6-3:2011-09 + Berichtigung 1 2012-11
DIN EN 61000-6-4:2011-09

(Titel und/oder Nr. sowie Ausgabedatum der Norm(en)
Title and/or number and date of issue of the standard(s)
Titre et/ou numéro et date d´édition de la (des) norme(s)

CE

Schwabach, 26.08.2013
(Ort und Datum der Ausstellung
Place and date of issue
Lieu et date de l´édition)

Geschäftsführer
General manager

KBR Kompensationsanlagenbau GmbH

Am Kiefernschlag 7
D-91126 Schwabach,
Germany

T +49 (0) 9122 6373 - 0
F +49 (0) 9122 6373 - 83
E info@kbr.de

www.kbr.de
www.visualenergy.de

EDEBDA0212-3413-2_EN