

KBR EnergyManagement

SIGNALS AND ENERGY DATA | SYSTEM INTEGRATION | POWER QUALITY
Products and Solutions



One System. Best Solutions.

Monitoring



Analyzing

Recording



Optimizing

Evaluating



How companies handle their energy needs is more than ever crucial for their success. At the same time, energy management is also becoming more and more significant. The products and solutions of KBR offer you some fundamental support.

PRODUCTS AND SOLUTIONS FOR CONTEMPORARY ENERGY MANAGEMENT

For all important tasks where professional energy management is involved, KBR provides a reliable system that is coherent and consistent – efficient and at the highest quality level.



**KBR PRODUCTS
AND
SOLUTIONS**

SIGNALS AND ENERGY DATA

multimes	→ 022 – 039	Energy measuring devices
multicount	→ 040 – 047	Energy meters
multisio	→ 048 – 055	Signal recording and processing
multimax	→ 056 – 069	Load management system

SYSTEM INTEGRATION

visual energy 4	→ 072 – 079	Web-based analysis and visualization software
multisys	→ 080 – 089	System and communication components

POWER QUALITY

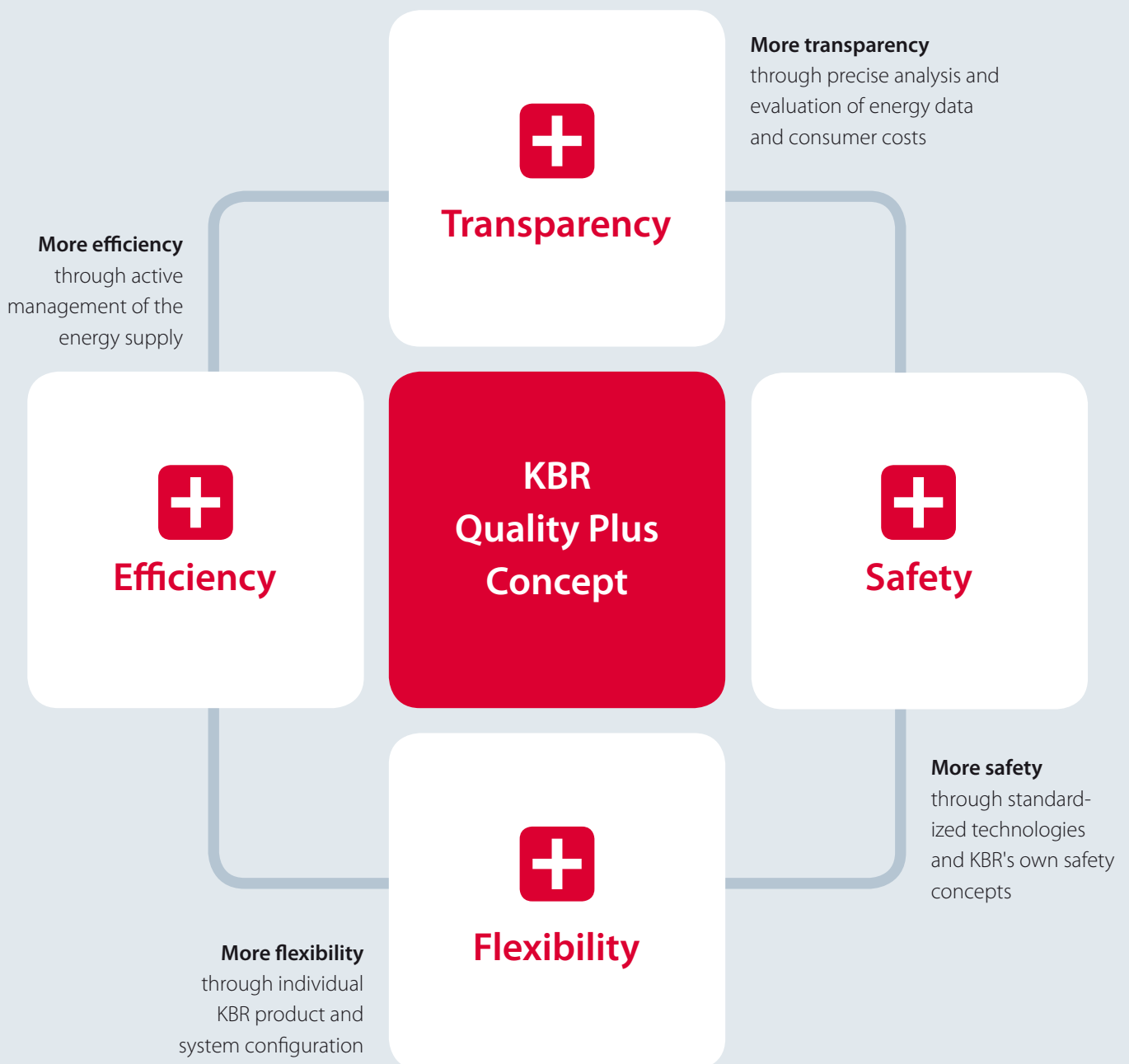
Reactive current compensation	→ 092 – 179	
secureC	→ 092 – 095	Safety and maintenance concept
multicomp	→ 096 – 107	Reactive power controller
multicond	→ 108 – 115	Power capacitors
multiind	→ 116 – 125	Filter circuit reactors
multiton	→ 126 – 131	Audio frequency blocking device
thyroswitch	→ 132 – 141	Thyristor switch
multicab-F	→ 142 – 147	Fixed capacitors
multimod-F	→ 148 – 159	Reactive current compensation module
multimod-R	→ 160 – 165	Reactive current compensation units
multicab-R	→ 166 – 179	Controlled compensation units
Network quality	→ 180 – 203	
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multilog	→ 190 – 203	Mobile network analysis device
Accessories	→ 204 – 219	
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KBR SERVICES

KBR Services	→ 226 – 227	Range of services
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THE KBR QUALITY CONCEPT

The KBR Quality Plus Concept stands for safe and efficient energy management. The basis of this quality concept is a coherent system of components and solutions – developed and produced in Germany.





More transparency

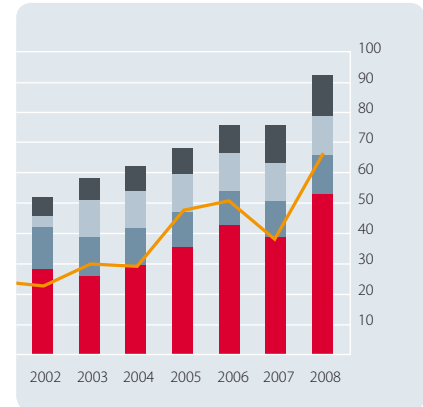
→ Control of energy data
and consumer costs

Energy costs make up a large part of operating expenditure in companies – among other things, a consequence of ever-rising electricity prices and ever more complex supply topologies in companies. The dictates of the moment are about recognizing savings potentials, making precise forecasts and developing the right strategies to reduce energy costs. A prerequisite for this is to create a maximum of transparency.

The components and solutions of KBR fulfill this task perfectly. For example, high-quality measuring devices of the product series multimess record and document consumption values precisely and comprehensively. The web-based analysis and visualization software **visual energy 4** on the other hand precisely represents the energy consumption of technical networks and facilities.

Electricity prices for industrial customers in Germany

2002 – 2008, in €/MWh



Source: DESTATIS and calculations by EEFA



More efficiency

→ Cost-effectiveness in energy consumption
and network utilization

Using existing energy as efficiently as possible is getting ever more significant for companies. It is necessary to load energy networks equally, prevent expensive load peaks and, as far as possible, avoid energy costs resulting from reactive current. This is when contemporary energy management is called for.

The KBR system does outstanding work in this field. Technically sophisticated compensation units help to reduce energy costs from reactive current, help to lower maintenance costs and minimize costs through operating failure and facility breakdowns. The multimax load management system for example monitors and optimizes the energy consumption behavior of connected loads, thereby eliminating expensive load peaks.



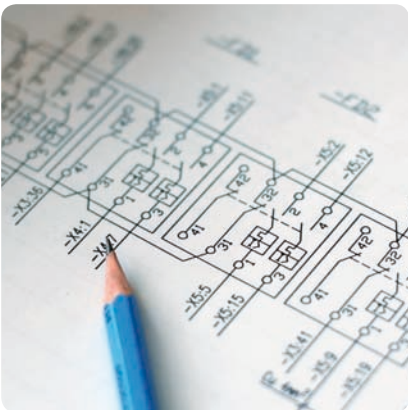


More safety

→ Reliability for processes
and production sequences

Where energy is concerned, safety is the top priority, as nothing is more expensive than a production stoppage or even the destruction of equipment. For this reason, KBR performs extensive development work and produces many components itself. Long-term tests, expensive quality checks, zero error tolerance and complying with all relevant standards are just some elements of the KBR quality program.

Special mention must be made of **secureC®**, a safety and maintenance concept from KBR, which ensures the maximum availability of compensation facilities – even in networks that are loaded heavily with harmonics: by monitoring the resonance frequency, stage back-up fuse and relay contacts, as well as a special temperature management system.



More flexibility

→ Solutions for new requirements
and tasks

KBR offers more than just a few individual components. The product spectrum forms a coherent system which has evolved from practical experience. The flexibility of the KBR energy management system ensures that customer-specific requirements can be quickly and easily implemented.

If the topology of the energy supply network is expanded or changed, the KBR system can be adjusted to the new situation without any problems, due to its modularity. The web-based concept of **visual energy 4** contributes just as much to this as does the reduced cabling expense, for example, with which the **multicomp** reactive power controller can be expanded with temperature or safety and maintenance modules.



Made in Germany.

KBR produces many components in its own production facilities in Germany: an essential aspect of an uncompromising quality concept

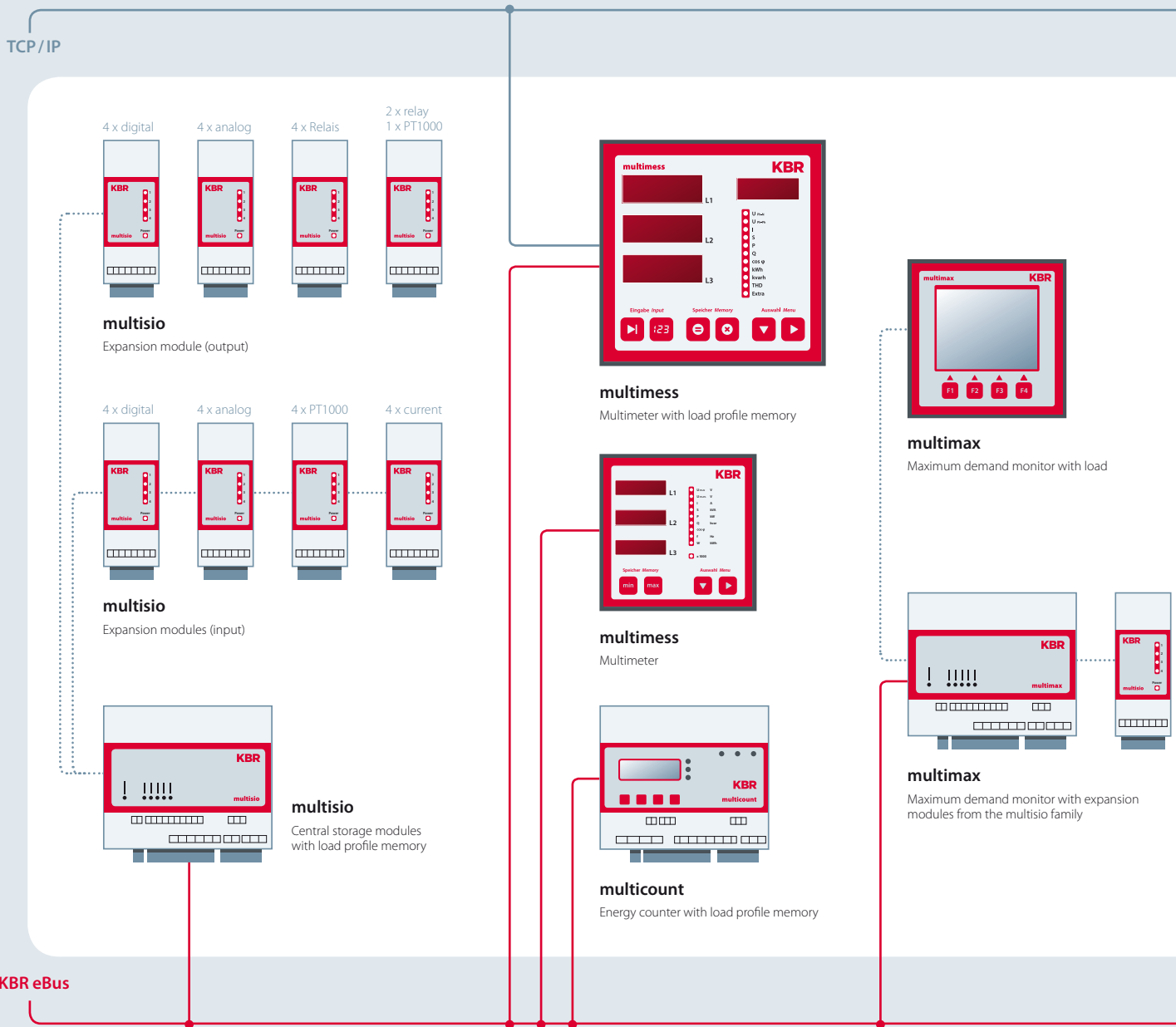


THE KBR SYSTEM



Signals and Energy Data

Recording and optimizing energy



Recording, monitoring, analyzing, optimizing and evaluating:
 With a perfectly coordinated range of products, KBR offers solutions for
 all central tasks that are demanded of contemporary energy management.



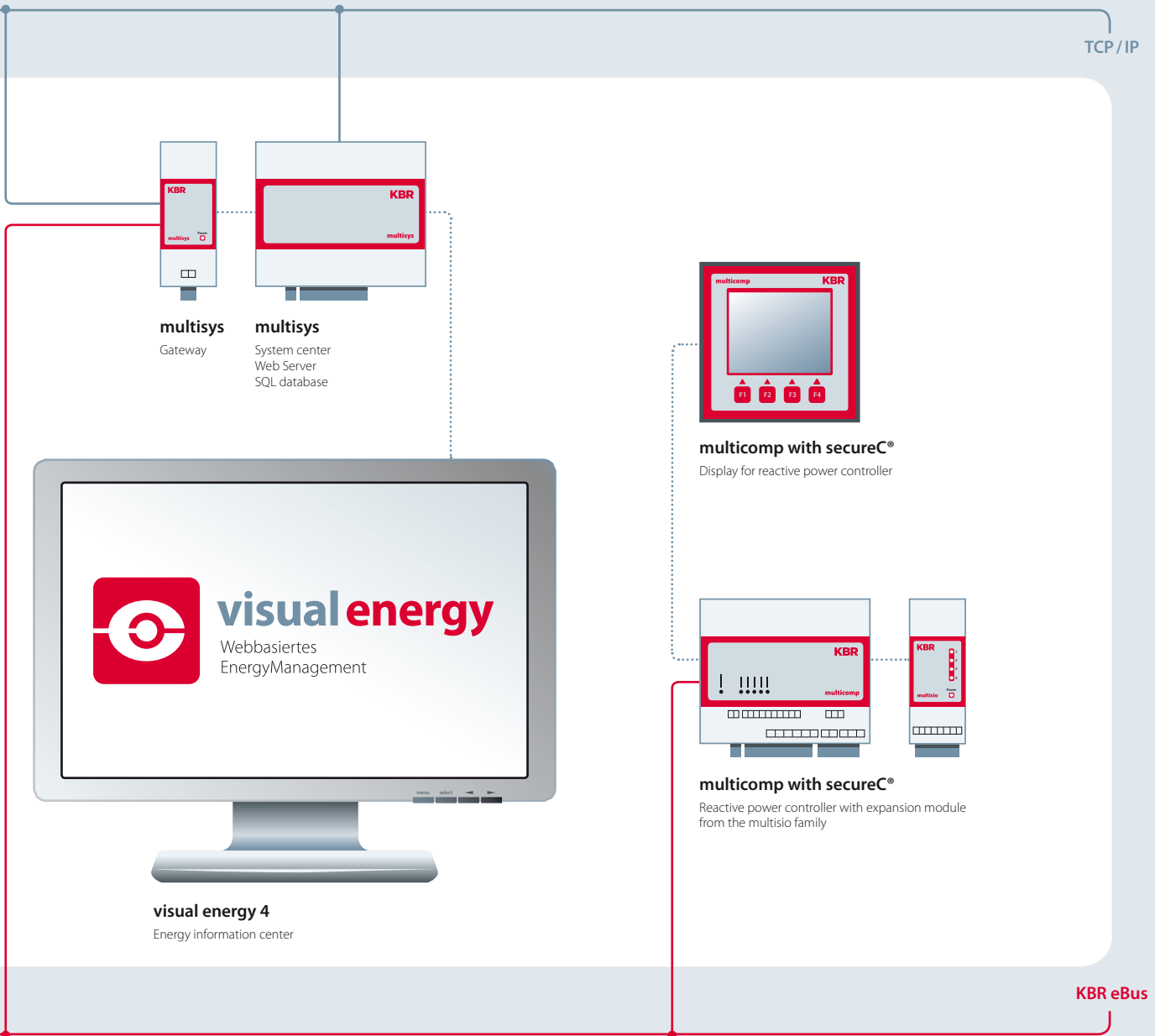
System Integration

Analyzing and controlling energy



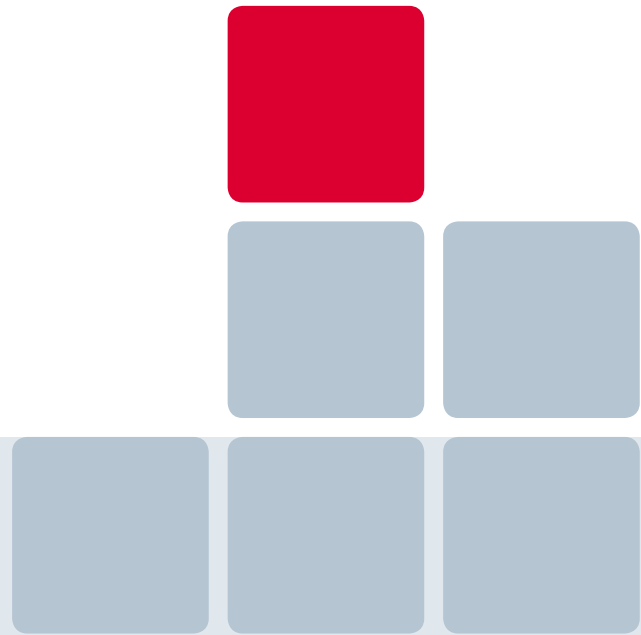
Power Quality

Compensating reactive current and
 improving network quality



SIGNALS AND ENERGY DATA

- Recording measured data
- Reducing load peaks
- Processing pulses



Energy measuring devices

multimes multimeters are suitable for any application. They are available in various performance classes and equipped with LE or LC displays.

Bus capability and load profile memory create the basis for an efficient energy monitoring and safe electricity networks.

Energy meter

multicount devices are compact and powerful Energy meters to record the consumption of active and reactive energy. They are optionally bus compatible and equipped with a load profile memory.

Signal processing

multisio components serve to record and store pulses de-centrally – for any energy forms, such as electricity, water, gas, thermal heat, cryogenic power or compressed air. In addition, temperatures and analog values can be recorded, circuit states and the operating hours of consumers logged, or relays switched.

Load management system

multimax monitors and optimizes the energy consumption behavior of connected loads, thereby eliminating expensive load peaks. Trend calculation procedures precisely determine the correct switch-off and switch-on times for optimizing consumers.



multimes
Energy measuring devices
→ page 22



multisio
Signal processing
→ page 48

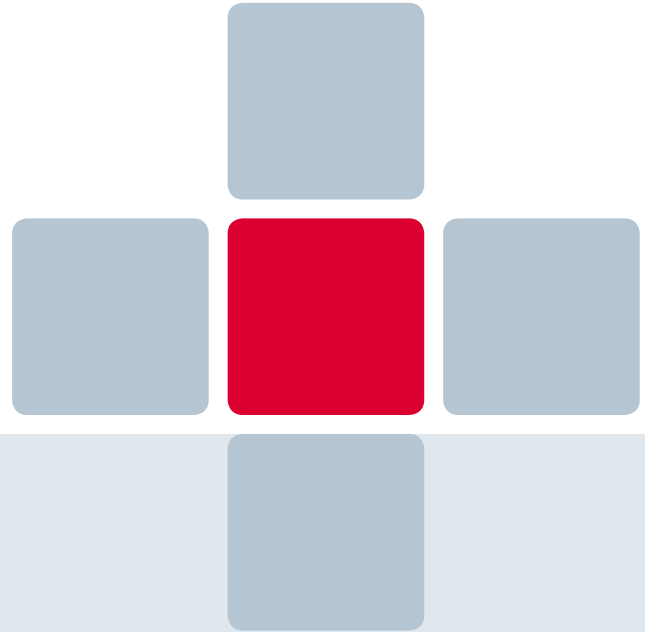


multicount
Energy meters
→ page 40



multimax
Load management system
→ page 56

SYSTEM INTEGRATION



- Analyzing energy data

- Increasing operational safety

- Recognizing savings potentials

Analysis and visualization software

visual energy 4 is the web-based information center of the KBR system. The analysis and visualization software provides extensive options for recording, monitoring, analyzing, and optimizing technical networks and facilities. Practical functions, a clearly laid out user interface, intuitive operability and ease of adaptability to specific situations make visual energy 4 a powerful component of efficient energy management. visual energy 4 provides many options for evaluating data and for passing these on to SAP or SQL databases. The data that are read out via bus and stored in a database can be handed over to the business department without any problems.

System center

The **multisys** system center controls the entire bus management. Equipped with the KBR visual energy 4 software, not only are data collected, but the system center also functions as a web server.

Bus system

The **KBR eBus** is the communication path of the KBR system. Bus devices can be integrated almost without restriction, their load profiles conveniently read out and represented in a clear layout using visual energy 4.



visual energy

Web-based
EnergyManagement



visual energy 4

Analysis and
visualization software

→ page 72

multisys

System center

→ page 80



KBR eBus

Bus system

POWER QUALITY

Reactive current compensation



- Compensating reactive current

- Increasing supply safety

- Increasing maintenance convenience

Reactive power controller

The reactive power controllers of KBR leave nothing to be desired. The compact controller **multicomp 144 LCD** is above all used in small facilities. The **multicomp 4D6** modules are bus compatible and can be integrated into the KBR system. The modular system allows a control of reactive current compensation to be set up quickly and easily. By adding a safety and maintenance module to the controller, the unique **secureC®** procedure can protect facilities from overvoltages and overcurrents.

Power capacitors

The power capacitors **multicond UHPC** stand out through their high durability at extreme ambient temperatures. 3-phase internal overpressure disconnecter and 2-fold current carrying capacity are further quality features.

Filter circuit reactors

The filter circuit reactors **multiind** are characterized by high linearity and low losses.

Audio frequency blocking devices

The audio frequency blocking devices **multiton** reliably block off the ripple signal of the energy supplier.

Thyristor switches

Rapid switch actions are no problem with the thyristor switch **thyroswitch**.



multicomp

Reactive power controller

→ page 96

**multicond
multiind
multiton**

Power capacitors
Filter circuit reactors
Audio frequency
blocking devices

→ page 108



thyroswitch

Thyristor switch

→ page 132

POWER QUALITY

Reactive current compensation network quality

- Compensating reactive current
- Improving network quality
- Increasing operational safety



Fixed capacitors

Fixed capacitors **multicab-F** are installed for large, inductive consumers and transformers for direct compensation.

Compensation modules

With its large range of modules, KBR provides solutions for every cabinet system. A fast and easy installation helps to reduce costs.

Controlled compensation facilities

Automatically controlled reactive current compensation facilities in type-tested quality achieve, through the use of high-quality components, an improved cost-effectiveness, the reduction of electricity costs, maintenance convenience and safety in operating facilities.

Mobile network analysis

multilog is a mobile network analyzer which is used to continually record a wide range of measured values, such as voltage, current, frequency, power, energy consumption, flicker emissions, harmonics and interharmonics. Small dimensions enable it to be installed in enclosed spaces and switchgear cabinets.

BLUEWAVE

The active harmonics filter **BLUEWAVE** belongs to the new generation of active harmonic filters which reliably analyze disruptions in the network and send out an opposing compensation current by means of digital control.



multicab-F

Fixed capacitors

→ page 142



multimod-F

Compensation modules

→ page 148



multicab-R

Controlled compensation facilities

→ page 166



multilog

Mobile network analysis

→ page 190

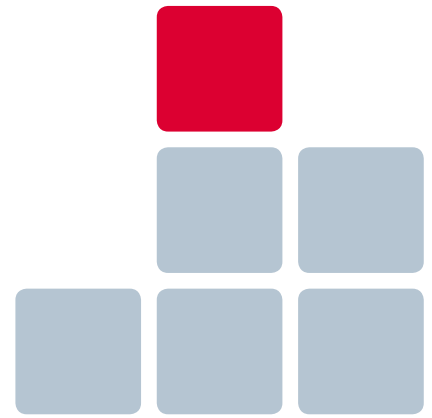


BLUEWAVE

Active harmonic filters

→ page 180

SIGNALS AND ENERGY DATA



The basis for contemporary energy management is the precise recording and processing of energy data. With its sophisticated measuring devices, energy meters, load management systems and signal components, KBR creates the best conditions for more transparency and efficiency in terms of energy.

multimes

Energy measuring devices

→ page 22



multicount

Energy meters

→ page 40



multimax

Load management system

→ page 56



multisio

Signal recording and processing

→ page 48

Energy measuring devices

multimes

Monitoring



Recording

The energy measuring devices **multimes** provide an extensive overview of all important electrical parameters in energy distribution facilities. A convenient user guidance makes operation simple and bright displays enable the relevant network parameters to be optimally read.

multimes basic/comfort 144 LCD bus

With large, high-contrast LC display for measured value and text display, bus-capable.



multimes light/basic 96 LED

Ideal for use in low-voltage energy distributions. Optionally bus capable.



multimes eco 144 LED

The low-cost alternative to standard analog instruments.



multimes light 144 LED

multimes basic/comfort 144 LED bus

Different performance classes for every field of application.

multimes light / basic 96 LED

Housing size
(H x W x D in mm) **96 x 96 x 92**

Data display **LED**

Interface * **KBR eBus**



* for multimes light 96 LED optionally through upgrade kit

3-phase network measuring instrument

Highlights

- Ideal for use in low-voltage power distributions
- Compact construction, standard installation size 96 x 96 mm
- Display neutral conductor current
- Active energy meter for energy consumption
- Bright LED displays for optimal readability

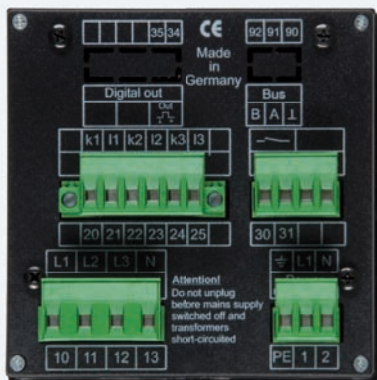
An overall view of **technical details** can be found on pages 34/35.
The **housing dimensions** are listed on pages 38/39.

multimes light / basic 96 LED is a compact network measuring device for use in low-voltage power distribution facilities and serves to measure all important parameters in 3 and 4-phase networks. Apart from reactive power meters for energy consumption, the multimes light / basic 96 LED has an extreme value memory, as well as a relay with touch-up function. Three bright LED displays guarantee optimal readability, even in poor light conditions. For the

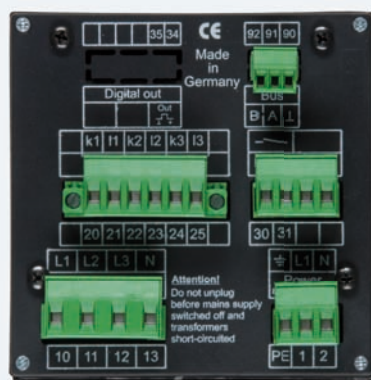
bus capable version of multimes light / basic 96 LED, other measurement parameters can be read out in addition to the measured values displayed on the device – such as the inductive reactive power meter.

Note: You can upgrade the non bus capable version of multimes light / basic 96 LED later on without any problems, using a special **upgrade kit**.

Rear side of multimes light 96 LED



Rear side of multimes basic 96 LED



Input and output configuration

DEVICE TYPE	multimes light 96 LED 1F96-0-LED-NC-US1 1F96-0-LED-NC-US1-1DO	multimes basic 96 LED bus 1F96-0-LED-ES-US1 1F96-0-LED-ES-US1-1DO 1F96-0-LED-MS-US1 1F96-0-LED-ET-US1 1F96-0-LED-MT-US1
INTERFACE	RS485 interface upgradable	RS485
KBR eBus	Upgrade option for KBR eBus	<input checked="" type="checkbox"/>
MODBUS RTU	–	<input type="checkbox"/>
PULSE OUTPUT	<input type="checkbox"/> for active energy	<input type="checkbox"/> for active or reactive energy
KBR eBus	–	<input type="checkbox"/>
MODBUS-TCP	–	<input type="checkbox"/>

Standard version Optionally available – Not available

multimessexco 144 LED

Housing size
(H x W x D in mm) **144 x 144 x 60**

Data display **LED**



3-phase network measuring instrument

- Highlights**
- Cost-effective alternative to standard analog instruments
 - Large, bright LED displays for optimal readability
 - Flexible use for low and medium-voltage facilities through switchable measuring ranges for U and I
 - Display neutral conductor current
 - Small mounting depth of only 60 mm

An overall view of **technical details** can be found on page 35.
The **housing dimensions** are listed on page 39.

multimessexco 144 LED is an affordable network measuring device for flush mounting, for the measurement of all important values in 3-phase networks. Because of its convincing price-performance ratio, the device represents a real alternative to the analog measuring devices used in energy distribution.

The device has an extreme value memory which saves, similar to a maximum indicator function, both a minimum and a maximum value for each measured value. The proven installation size of 144 x 144 mm and the large LED displays guarantee an optimal readability.

Rear side multimes eco 144 LED



multimes light 144 LED

Housing size
(H x W x D in mm) **144 x 144 x 60**

Data display **LED**



3-phase network measuring instrument

- Highlights**
- Use in low and medium-voltage facilities through switchable measuring ranges for U and I
 - Large, bright LED displays for optimal readability
 - Extensive displays, functions and storage options
 - Small mounting depth of only 60 mm

An overall view of **technical details** can be found on page 35.
The **housing dimensions** are listed on page 39.

multimes light 144 LED is a device in the lower price range and is suitable for measuring and monitoring all relevant measurement parameters in a 3-phase network. The device can be configured via a serial RS485 interface. multimes light 144 LED is equipped with an active and reactive energy meter for positive energy, as well as

an extreme value memory for all measured values. The measured values are displayed on three large and bright LED displays. In addition, the phase field display is possible in degrees, dimension and text displays are possible via 4-digit segment displays.

Rear side of multimes light 144 LED



Input and output configuration

DEVICE TYPE	multimes light 144 LED 4F144-0-LED-EP-US1/-US5
DIGITAL INPUTS	–
PULSE OUTPUT	■ (Wp+; Wq+)
RELAY OUTPUTS	2 ¹
ANALOG OUTPUTS	–
INTERFACE	RS485 (only point to point communication)
KBR eBus	Upgrade option
KBR eBus-TCP	–
MODBUS RTU/ACSII	–
MODBUS-TCP	–
PROFIBUS-DP	–
POWER SUPPLY	■ 85-265 V AC/DC; 15 VA
POWER SUPPLY	– 20-70 V AC/DC; 15 VA

■ Standard model □ Optionally available – Not available ¹ Limiting value function ² Additional switching relay function via bus

multimes basic / comfort 144 LED bus

Housing size (H x W x D in mm)	144 x 144 x 60
Data display	LED
Interface*	KBR eBus Modbus Profibus



* depends on respective device type

3-phase network measuring instrument

- Highlights**
- Many performance classes for each field of application
 - Extensive displays, functions and storage options
 - Optimal readability due to bright LED displays
 - Wide variety range of inputs and outputs (digital/analog)
 - Small mounting depth of only 60 mm

An overall view of **technical details** can be found on pages 36/37.
The **housing dimensions** are listed on page 39.

The electronic network measuring devices of the **multimes basic/comfort 144 LED** series measure and monitor all important parameters in 3-phase networks and are available in a wide range of performance classes. Saving the load profile of the facility measured at a 15-minute measuring interval is, depending on the varia-

tion, possible up to 365 days. The integrated event memory can log up to 4096 events, such as limiting value violations, mains failures, drops in voltage and many other values. A bus capability of non-bus capable devices can be implemented at a later date by means of an upgrade kit.

Rear side of multimes basic 144 LED bus



Rear side of multimes comfort 144 LED bus



Input and output configuration

	multimes basic 144 LED bus	multimes comfort 144 LED bus
DEVICE TYPE	4F144-1-LED-ESMS-US1/-US5 4F144-1-LED-ESMSET-US1/-US5 4F144-1-LED-ESMSMT-US1/-US5 4F144-1-LED-ESMSDP-US1/-US5	4F144-2-LED-ESMS-US1/-US5 4F144-2-LED-ESMSET-US1/-US5 4F144-2-LED-ESMSMT-US1/-US5 4F144-2-LED-ESMSDP-US1/-US5
DIGITAL INPUTS	1 synchronization, 1 HT/LT tariff	2 configurable
PULSE OUTPUT	<input checked="" type="checkbox"/> (Wp+; Wq+)	<input checked="" type="checkbox"/> (Wp+; Wp-; Wq+; Wq-)
RELAY OUTPUTS	2 ¹	2 ²
ANALOG OUTPUTS	–	3
INTERFACE	RS485	RS485
KBR eBUS	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
KBR eBUS-TCP	<input type="checkbox"/>	<input type="checkbox"/>
MODBUS RTU/ACSII	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
MODBUS-TCP	<input type="checkbox"/>	<input type="checkbox"/>
PROFIBUS-DP	<input type="checkbox"/>	<input type="checkbox"/>
POWER SUPPLY 85-265 V AC/DC; 15 VA	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
POWER SUPPLY 20-70 V AC/DC; 15 VA	<input type="checkbox"/>	<input type="checkbox"/>

Standard model Optionally available – Not available ¹ Limiting value function ² Additional switching relay function via bus

multimes basic / comfort 144 LCD bus

Housing size (H x W x D in mm)	144 x 144 x 60
Data display	LCD
Interface*	KBR eBus Modbus Profibus



* depends on respective device type

3-phase network measuring instrument

- Highlights**
- Many performance classes for each field of application
 - Extensive displays, functions and storage options
 - Large LCD display for measured value and text displays
 - Wide variety range of inputs and outputs (digital/analog)
 - Small mounting depth of only 60 mm

An overall view of **technical details** can be found on page 37.
The **housing dimensions** are listed on page 39.

The electronic network measuring devices **multimes basic/comfort 144 LCD bus** are used to measure and monitor all important measuring parameters in 3-phase networks. They replace all analog instruments used in conventional low-voltage distribution systems and also provide a variety of additional functions. The large, high-contrast LC display is optimally readable and easy to handle with its interactive user guidance as a combination of value and text displays.

multimes basic/comfort 144 LCD bus offers a large range of functions. Extensive measured value displays, load profile or event memories are all available in the basic version. Recording measured data for energy consumption and recovery, sending specific parameters to analog outputs, a larger memory, as well as a more flexible use of the integrated digital inputs and outputs, is reserved for the larger models.

Rear side of multimes basic 144 LED bus



Rear side of multimes comfort 144 LCD bus



Input and output configuration

DEVICE TYPE	multimes basic 144 LCD bus	multimes comfort 144 LCD bus
	4F144-1-LCD-ESMS-US1/-US5 4F144-1-LCD-ESMSET-US1/-US5 4F144-1-LCD-ESMSMT-US1/-US5 4F144-1-LCD-ESMSDP-US1/-US5	4F144-2-LCD-ESMS-US1/-US5 4F144-2-LCD-ESMSET-US1/-US5 4F144-2-LCD-ESMSMT-US1/-US5 4F144-2-LCD-ESMSDP-US1/-US5
DIGITAL INPUTS	1 synchronization, 1 HT/LT tariff	2 configurable
PULSE OUTPUT	<input checked="" type="checkbox"/> (Wp+; Wq+)	<input checked="" type="checkbox"/> (Wp+; Wp-; Wq+; Wq-)
RELAY OUTPUTS	2 ¹	2 ²
ANALOG OUTPUTS	-	3
INTERFACE	RS485	RS485
KBR eBUS	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
KBR eBUS-TCP	<input type="checkbox"/>	<input type="checkbox"/>
MODBUS-TCP	<input type="checkbox"/>	<input type="checkbox"/>
MODBUS RTU/ACSII	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
PROFIBUS-DB	<input type="checkbox"/>	<input type="checkbox"/>
POWER SUPPLY 85-265 V AC/DC; 15 VA	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
POWER SUPPLY 20-70 V AC/DC; 15 VA	<input type="checkbox"/>	<input type="checkbox"/>

Standard model Optionally available - Not available ¹ Limiting value function ² Additional switching relay function via bus

multimes

Technical details

MEASUREMENT PARAMETER (RMS)	Voltage	$U_{PH-N(L1-L3)}$	DEVICE TYPE	multimes light 96 LED
	Current	$I_{PH(L1-L3)}$		4F96-0-LED-NC-US1
	Avg. current value	$I_{PH(L1-L3)}$ 10 min or configurable		4F96-0-LED-NC-US1-1DO
	Apparent power	$S_{PH(L1-L3)}$ S_{total}		
	Active power	$P_{PH(L1-L3)}$ P_{total}		
	Frequency	$f_{NetworkL1}$		

ADDITIONAL MEASURING PARAMETERS	Distortion factor U, THD: $KF-U_{PH(L1-L3)}$ Dist. curr. strength $I_{dPH(L1-L3)}$	–
	Harmonics: Voltage (L1 – L3) Current (L1 – L3)	–
	Rotary field control: Rotary field display in degrees	■
	Neutral conductor current: I_N $I_{N-average}$	■ ■ (10 min.)
	Performance factors fund. harm. Overall performance factors	$\cos\varphi_{(L1-3)}$ $\lambda_{overall,total}$
	Q_1 = fundamental harmonic reactive power Q = fundamental and harmonic reactive power ($Q_1 + Q_D$)	$Q_1_{(L1-3)}$ $Q_1_{overall,total}$
	Active energy Reactive energy	P_+ – Continuous counter display on device
DISPLAYS	Display type	LED
MEASURING ACCURACY	U, I P, Q, S $\cos\varphi, \lambda$	1% 2% 2%
	Update speed	≈ 500 ms
MEMORY	Load profile memory $P_{overall}$ / $Q_{overall}$ (cumulated)	–
	Storage length of load profiles at 15-minute measuring interval	–
	Daily power, active and reactive power (can be read out via bus)	–
	Extreme value memory (min./max.)	For all displayed measured values + max. active power average value P_{15max}
	Maximum indicator function	Non-volatile
	Event memory	–
INPUTS	Voltage path U_{L1-L2} U_{L2-L3} U_{L3-L1}	3 x 5V...100V...120V AC and 3 x 20V...500V...600V AC
	Current path I_{L1} I_{L2} I_{L3}	3 x 0,01 A...1 A...1,2 A AC and 3 x 0,05 A...5 A...6 A AC
	Digital inputs	–
OUTPUTS	Relay outputs 250 V AC 2 A	Touch-up relay
	Analog outputs 0 (4) – 20 mA 0 (2) – 10 V	–
	Digital outputs	□ 1 working pulse output, proportional to active energy
INTERFACES	Serial port	Upgradable
	Ethernet TCP/IP	–
	Supported field bus protocol	Upgrade option for KBR eBus
POWER SUPPLY	Operating voltage Power consumption	85 – 265 V AC/DC 15 VA
DIMENSIONS	Housing: front panel mounting, size in mm (H x W x D)	96 x 96 x 92 mm

multimes basic 96 LED [1] 1F96-0-LED-ES-US1 [2] 1F96-0-LED-ES-US1-1DO [3] 1F96-0-LED-MS-US1 [4] 1F96-0-LED-ET-US1 [5] 1F96-0-LED-MT-US1	multimes eco 144 LED 4F144-0-LED-NC-US0E	multimes light 144 LED 4F144-0-LED-EP-US1 / -US5
–	● –	● –
–	3. – 19. Harm. U –	3. – 19. Harm. U –
●		
● ● (10 min.)	● ● (15 min.)	● ● (flexible interval)
$\cos\phi_{(L1-3)}$ $\lambda_{\text{overall; total}}$ $\lambda_{(L1-3)}$ only via bus $Q_{1(L1-3)}$ $Q_{1 \text{ overall; total}}$ $Q_{(L1-3)}$ $Q_{\text{overall; total}}$ only via bus P ₊ continuous counter display Q ₋ Q ₊ can be read out via bus	$\cos\phi_{(L1-3)}$ $\lambda_{\text{overall; total}}$ $Q_{1(L1-3)}/Q_{1 \text{ overall; total}}$	$\cos\phi_{(L1-3)}$ $\lambda_{(L1-3)}$ $\lambda_{\text{overall; total}}$ $Q_{1(L1-3)}$ $Q_{1 \text{ overall; total}}$ $Q_{(L1-3)}$ $Q_{(L1-3)}$ P ₊ Q ₊ (HT/LT) continuous counter display on device
LED		
1% 2% 2%		0,5% 1% 1%
≈ 500 ms		≈ 330 ms
–		
–		
–		
For all displayed measured values + max. active power average value P _{15max}	For all displayed measured values	For all displayed measured values + max. active and reactive power intervals average value P _{MPmax} and Q _{MPmax} with date and time (MP = measuring period)
Non-volatile	volatile	Non-volatile
–		
3 x 5 V... 100 V ... 120 V AC and 3 x 20 V ... 500 V ... 600 V AC		
3 x 0.01 A... 1 A ... 1.2 A AC and 3 x 0.05 A ... 5 A ... 6 A AC		
–		
Touch-up relay	–	2 relays for notification of limiting value violations
–		
<input type="checkbox"/> 1 working pulse output, proportional to active energy	–	1 working pulse output, proportional to active or reactive energy
RS485	–	RS485
<input type="checkbox"/>	–	–
[1] eBus [2] eBus [3] modbus [4] eBus + modbus eBus TCP/IP [5] eBus modbus TCP/IP	–	Only point to point communication for device configuration. Upgrade option for KBR eBus
85 – 265 V AC/DC 15 VA	115/230 V AC 109 VA	<input checked="" type="checkbox"/> 85–265 V AC/DC 15 VA <input type="checkbox"/> 20–70 V AC/DC 15 VA
96 x 96 x 92 mm	144 x 144 x 60 mm	

multimes

Technical details

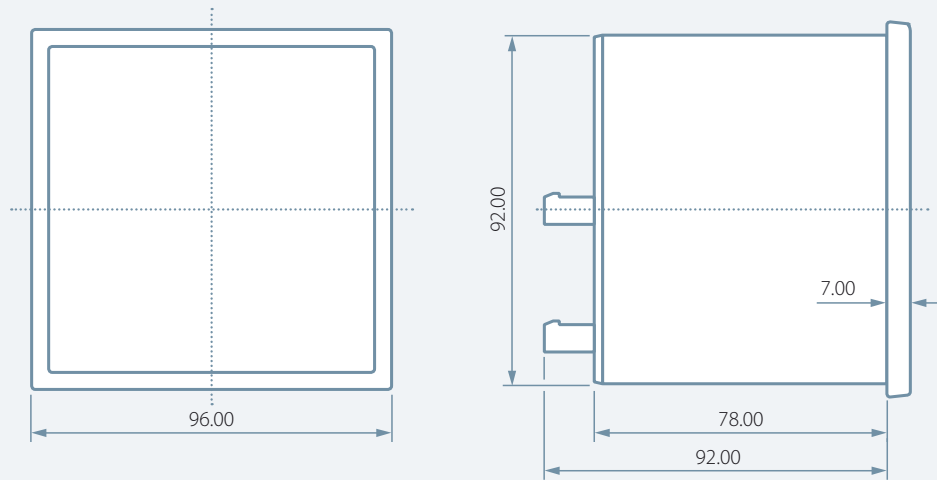
MEASUREMENT PARAMETER (RMS)	Voltage $U_{PH-N(L1-L3)}$ Current $I_{PH(L1-L3)}$ Avg. current value $I_{PH(L1-L3)}$ 10 min or configurable Apparent power $S_{PH(L1-L3)} S_{total}$ Active power $P_{PH(L1-L3)} P_{total}$ Frequency $f_{NetworkL1}$	DEVICE TYPE	multimes basic 144 LED bus [1] 4F144-1-LED-ESMS-US1 / -US5 [2] 4F144-1-LED-ESMSET-US1 / -US5 [3] 4F144-1-LED-ESMSMT-US1 / -US5 [4] 4F144-1-LED-ESMSDP-US1 / -US5
ADDITIONAL MEASURING PARAMETERS	Distortion U, dist. current strength I_d THD: $KF-U_{PH(L1-L3)} I_{dPH(L1-L3)}$	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	
	Harmonics: Voltage (L1 – L3) Current (L1 – L3)	3. – 19. Harm. U 3. – 19. Harm. I	
	Rotary field control: Rotary field display in degrees	<input checked="" type="checkbox"/>	
	Neutral conductor current: $I_N I_{N-average}$	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> (flexible interval)	
	Performance factors fund. harmonic Overall performance factors	$\cos\varphi_{(L1-3)} \lambda_{overall; total} \lambda_{(L1-3)}$ only via bus	
	Q_1 = fundamental harmonic reactive power Q = fundamental and harmonic reactive power ($Q_1 + Q_D$)	$Q_{1(L1-3)} Q_{1 overall; total}$ $Q_{(L1-3)} Q_{overall; total}$ only via bus	
	Wirkarbeit Blindarbeit	$P_+ Q_+$ (HT/LT) continuous counter display on device	
DISPLAYS	Display type	LED	
MEASURING ACCURACY	U, I P, Q, S $\cos\varphi, \lambda$	0,5% 1% 1%	
	Update speed	≈ 330 ms	
MEMORY	Load profile memory $P_{overall} / Q_{overall}$ (cumulated)	Energy consumption $P_+ P_{cum} Q_+ Q_{cum}$	
	Storage length of load profiles at 15-minute measuring interval	Ring memory for 40 days	
	Daily power, active and reactive power (can be read out via bus)	1 year for energy consumption	
	Extreme value memory (min./max.)	For all displayed measured values + max. active and reactive power intervals average value P_{MPmax} and Q_{MPmax} with date and time (MP = measuring period)	
	Maximum indicator function	Non-volatile	
	Event memory	4096 events with date, time and duration, e.g. limiting value over- and undershoots, mains failures and over/undervoltage ≥ 20 ms at 100% measuring circuit voltage dip	
INPUTS	Voltage path $U_{L1-L2} U_{L2-L3} U_{L3-L1}$	3 x 5V...100V...120V AC and 3 x 20V...500V...600V AC	
	Current path $I_{L1} I_{L2} I_{L3}$	3 x 0.01 A...1 A...1.2 A AC and 3 x 0.05 A...5 A...6 A AC	
	Digital inputs	1 input for synchr. to the energy supplier measuring period 1 tariff input for HT/LT switch	
OUTPUTS	Relay outputs 250 V AC 2 A	2 relay for notification of limiting value violations	
	Relay outputs 250 V AC 2 A	–	
	Digital outputs	1 working pulse output, proportional to active or reactive energy	
INTERFACES	Serial port	RS485	
	Ethernet TCP/IP	<input type="checkbox"/>	
	Supported field bus control	[1] eBus + modbus [2] eBus + modbus eBus TCP/IP [3] eBus + modbus modbus TCP/IP [4] eBus + modbus Profibus DP	
POWER SUPPLY	Operating voltage Power consumption	<input checked="" type="checkbox"/> 85 – 265 V AC/DC 15 VA <input type="checkbox"/> 20 – 70 V AC/DC 15 VA	
DIMENSIONS	Housing: front panel mounting, size in mm (H x W x D)	144 x 144 x 60	

	multimes comfort 144 LED bus	multimes basic 144 LCD bus	multimes comfort 144 LCD bus
	[1] 4F144-2-LED-ESMS-US1 / -US5 [2] 4F144-2-LED-ESMSET-US1 / -US5 [3] 4F144-2-LED-ESMSMT-US1 / -US5 [4] 4F144-2-LED-ESMSDP-US1 / -US5	[1] 4F144-1-LCD-ESMS-US1 / -US5 [2] 4F144-1-LCD-ESMSET-US1 / -US5 [3] 4F144-1-LCD-ESMT-US1 / -US5 [4] 4F144-1-LCD-ESMSDP-US1 / -US5	[1] 4F144-2-LCD-ESMS-US1 / -US5 [2] 4F144-2-LCD-ESMSET-US1 / -US5 [3] 4F144-2-LCD-ESMSMT-US1 / -US5 [4] 4F144-2-LCD-ESMSDP-US1 / -US5
	<ul style="list-style-type: none"> ● ● 		
	3. – 19. Harm. U 3. – 19. Harm. I		
	<ul style="list-style-type: none"> ● 		
	<ul style="list-style-type: none"> ● ● (flexible interval) 		
	cosφ _(L1-3) λ _{overall; total} λ _(L1-3) only via bus		
	Q _{1(L1-3)} Q _{1 overall; total} Q _(L1-3) Q _{overall; total} only via bus		
	P ₊ Q ₊ P ₋ Q ₋ (HT/LT) continuous counter display on device	P ₊ Q ₊ (HT/LT) continuous counter display on device	P ₊ Q ₊ P ₋ Q ₋ (HT/LT) continuous counter display on device
	LED	LCD (interactive user guidance)	LCD (interactive user guidance)
	0,5% 1% 1%		
	≈ 330 ms		
	Consumption and recovery P ₊ P ₋ P _{cum} Q ₊ Q ₋ Q _{cum}	Energy consumption P ₊ P _{cum} Q ₊ Q _{cum}	Consumption and recovery P ₊ P ₋ P _{cum} Q ₊ Q ₋ Q _{cum}
	Ring memory for 365 days	Ring memory for 40 days	Ring memory for 365 days
	1 year for energy consumption and recovery	1 year for energy consumption	1 year for energy consumption and recovery
	For all displayed measured values + max. active and reactive power intervals average value P MPmax and Q _{MP Max} with date and time (MP = measuring period)		
	Non-volatile		
	4096 events with date, time and duration, e.g. limiting value over- and undershoots, mains failures and over/undervoltage ≥ 20 ms at 100% measuring circuit voltage dip		
	3 x 5 V... 100 V ... 120 V AC and 3 x 20 V ... 500 V ... 600 V AC		
	3 x 0.01 A... 1 A ... 1.2 A AC and 3 x 0.05 A ... 5 A ... 6 A AC		
	2 digital inputs, configurable, e.g. for acquiring states, synchronization, HT/LT	1 input for synchr. to the energy supplier measuring period; 1 tariff input for HT/LT switch	2 digital inputs, configurable, e.g. for acquiring states, synchronization, HT/LT
	2 relay, configurable	2 relay for notification of limiting value violations	2 relay, configurable
	3 analog outputs with shared GND, configurable on the device and via bus	–	3 analog outputs with shared GND, configurable on the device and via bus
gy	1 digital output, configurable, e.g. as working pulse output	1 working pulse output, proportional to active or reactive energy	1 digital output, configurable via bus, e.g. as working pulse output
	RS485		
	□		
	[1] eBus + modbus [2] eBus + modbus eBus TCP/IP [3] eBus + modbus modbus TCP/IP [4] eBus + modbus Profibus DP	[1] eBus + modbus [2] eBus + modbus eBus TCP/IP [3] eBus + modbus modbus TCP/IP [4] eBus + modbus Profibus DP	[1] eBus + modbus [2] eBus + modbus eBus TCP/IP [3] eBus + modbus modbus TCP/IP [4] eBus + modbus Profibus DP
	<ul style="list-style-type: none"> ● 85 – 265 V AC/DC 15 VA □ 20 – 70 V AC/DC 15 VA 		
	144 x 144 x 60		

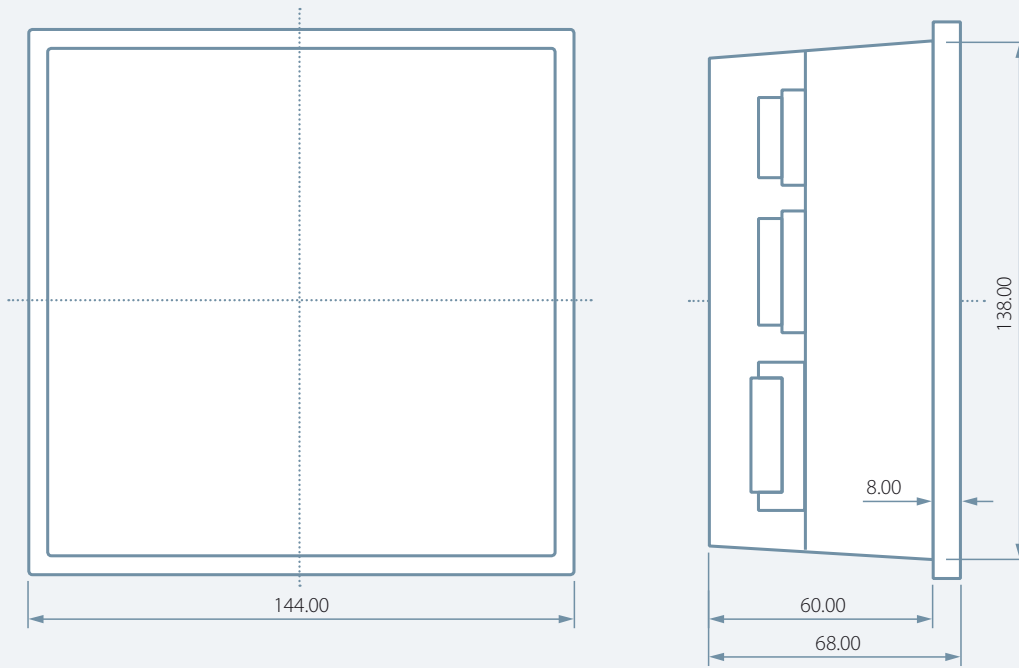
multimes

 Dimensions

multimes light / basic 96 LED



multimes eco 144 LED
multimes light 144 LED
multimes basic / comfort 144 LED bus
multimes basic / comfort 144 LCD bus



Energy meter

multicount



Recording



Monitoring

The **multicount** energy meter provides exact energy consumption data, shows load profiles and gives precise information on load peaks – an important prerequisite for higher energy efficiency. Even when space is rare, the compact construction of the appliances allows them to be installed in the switch-gear cabinet without any problems. An additional plus: the high-contrast LC display to quickly record measured values and text information.

multicount light/basic LCD bus

Electronic energy meter for active and reactive energy – bus-capable, with load profile memory and 2-tariff function.



multicount light LCD

Housing size
(H x W x D in mm) **90 x 105 x 61**

Data display **LCD**



Energy meter for positive active or reactive energy

- Highlights**
- Deployable in 3 or 4-wire networks
 - Current transformer connection for x/1A or x/5A
 - Pulse output with LED signal display
 - Standard rail assembly, also suitable for distribution board mounting
 - Measuring accuracy class 1

An overall view of **technical details** can be found on pages 44/45.
The **housing dimensions** are listed on page 46.

The digital energy meter **multicount light LCD** measures the positive active and reactive energy in 3-wire and 4-wire networks. Suitable for DIN compliant standard rail assembly and distribution board mounting, the device stands out because of its compact construction. The broad input range of the supply voltage (85 – 265 V AC/DC) allows universal deployment in many switchgear units. The trans-

ducer meter complies with precision class 1. The high-contrast LC display stands out through its easy-to-read measured values. The pulse output can be configured by the user, and thus be optimally adjusted to the particular situation on site. The signaling of the pulse output is done by an LED display.

multicount basic LCD bus

Housing size
(H x W x D in mm) **90 x 105 x 61**

Data display **LCD**

Interface **KBR eBus**
Modbus
Profibus*



* via gateway

Energy meter for positive active or reactive energy

- Highlights**
- Deployable in 3- or 4-wire networks
 - Current transformer connection for x/1A or x/5A (up to 9999 A)
 - Current transformer connection for x/1A or x/5A (up to 9999 A)
 - 4-quadrant load profile memory for cumulated active and reactive power with a storage duration of 64 hours to 160 days
 - Measuring accuracy class 1

An overall view of **technical details** can be found on page 45.
The **housing dimensions** are listed on page 46.

The electronic energy meter **multicount basic LCD bus** is ideally suited for reliable deployment in 3-wire and 4-wire networks. The bus capable device is equipped with a load profile memory which can record both active and reactive energy. The consumption of active and reactive energy is stored separately for energy consumption and recovery. Apart from the internal and external tariff control for two

tariffs, as well as various synchronization possibilities, the device provides a pulse output with programmable pulse value. To display measured values, the device has a 6-digit LC display, as well as 6 status LEDs. By means of the KBR eBus, the energy consumption data of the energy memory can be retrieved, along with expanded measurement functions.

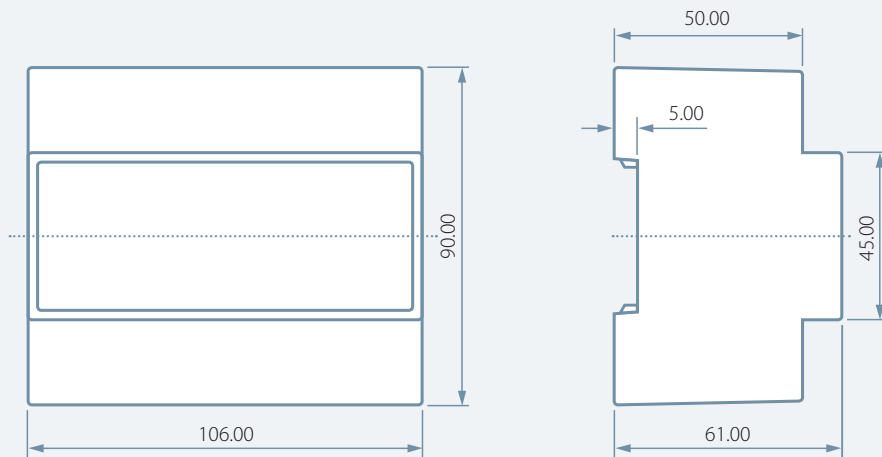
multicount Technical details

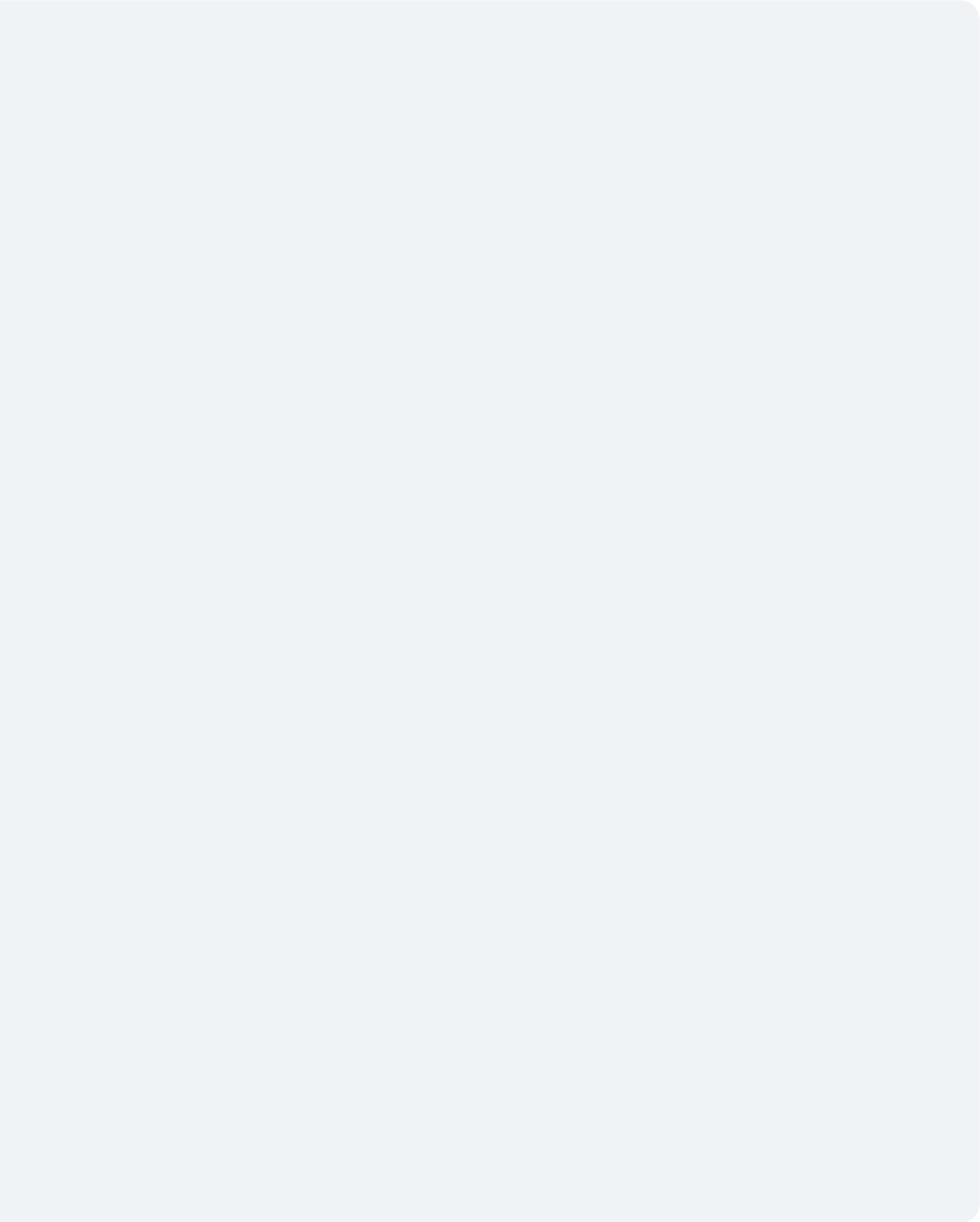
		DEVICE TYPE	multicount LCD 1D3-0-LCD-NC-3P-MID
MEASUREMENT	Measurement of positive active energy negative active energy	P ₊ –	
	Measurement of positive react. energy negative reactive energy	– –	
	Tariffs	HT	
	Deployable in 3-wire networks or 4-wire networks	– <input checked="" type="checkbox"/>	
DISPLAY	Display type	LCD	
MEASURING ACCURACY	Class	B acc. to EN 50470-3, class 1 acc. to IEC 62053-21	
	Possibility for certification for internal billing purposes	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	
MEMORY	Load profile memory P _{overall} Q _{overall} (cumulated)	–	
	Daily power and reactive power (can be read out via bus)	–	
	Event memory for monitoring tariff switch commands, mains failures, etc.	–	
INPUTS	Voltage path	3 x 230 / 400 V AC, 50 Hz	
	Current path	I _{ref} = 5 A, I _{min} = 0,05 A, I _{max} = 6A	
	Synchronization input tariff switch input	– –	
OUTPUTS	Pulse output for active energy reactive energy	<input checked="" type="checkbox"/> –	
	Pulse significance	10 pulses/kWh or 1 P./kWh, depending on device model	
INTERFACE	Serial	–	
POWER SUPPLY	Operating voltage	3 x 230 / 400 V AC, 50 Hz, tolerance: -20% /+15%	
	Power consumption	0.4 W per phase	
MECHANICAL DATA	Housing modules size in mm (H x W x D)	4 TE 78 x 65 x 56	
	Mode of protection	IP 20	
	Mounting type	Wall mounting on DIN rail 7.5 mm deep, in accordance with DIN EN 50022, suitable for distribution board mounting	
	Weight	Approx. 450 g	

multicount light LCD 3D6-0-LCD-EP-US1	multicount basic LCD bus 3D6-1-ES-LCD-ES-US1
P ₊ -	P ₊ P ₋
Q ₊ I ₋	Q ₊ Q ₋
HT	HT NT
- 	 
LCD	
1	
- 	- 
-	Consumption and recovery consumption and recovery
-	1 year for energy consumption and energy recovery
-	1024 events with date and time
3 x 5 V... 100 V ... 120 V AC and 3 x 20 V ... 500 V ... 600 V AC	
3 x 0.01 A... 1 A ... 1.2 A AC and 3 x 0.05 A ... 5 A ... 6 AC	
- -	 
 -	 
Programmable	
-	RS485
85 – 265 V AC / DC, 50 / 60 Hz	
15 VA	
6 TE 90 x 106 x 61	
IP 20	
Wall mounting on DIN rail 7.5 mm deep, in accordance with DIN EN 50022, suitable for distribution board mounting	
Approx. 650 g	

multicount Dimensions

multicount light/basic LCD and multicount LCD bus





Signal recording and processing

multisio



Recording

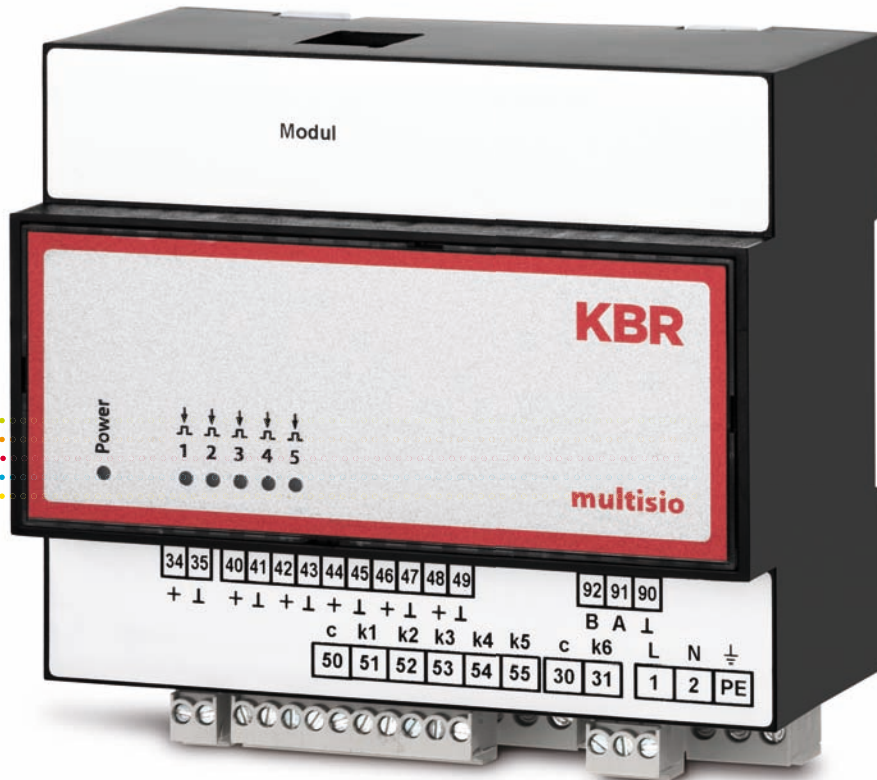


Evaluating

The modular system **multisio** provides extensive options for recording consumption and counting operating hours. The core is a central memory unit to which up to five expansion modules can be connected. Depending on the input or output type, a wide range of functions are possible here. The bus-capable **multisio** appliances can be conveniently controlled and configured via the web-based analysis software visual energy 4.

multio memory module

The bus-capable memory module is the central unit of the multio consumption recording system.



multio expansion modules

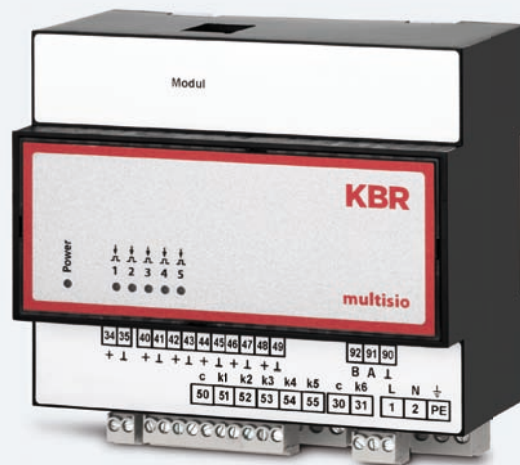
The expansion modules offer numerous options for recording and processing signals.

multisio

System center

Housing size
(H x W x D in mm) **90 x 105 x 61**

Interfaces **KBR eBus**
KBR Modulbus



Storage center and expansion modules

- Highlights**
- Ideally suited for use in installation distributions
 - Compact construction
 - Expandable on a modular basis
 - No additional power supply for expansion modules
 - Wide range of modules for digital and analog inputs/outputs

An overall view of technical details can be found on pages 52/53.
The housing dimensions are listed on page 54.

multisio is a modular system for signal recording and processing. Depending on the input or output type, a wide range of functions can be selected. It is in a position to record the pulses of consumption meters and record them both as a continuous counter status and also as standard-compliant load profile. Alternatively, a digital input can be used to record the status (switching protocol) or the operating hours, which are available here as a continu-

ous counter and as a progress recording. For expansion purposes, compact modules are available for a wide range of signal forms (0 – 20 mA, 4 – 20 mA, PT1000, 0 – 6 A, relay etc.). Up to five expansion modules each can be connected via prepared RJ45 cables to a system center.

Expansion modules

 Housing size **90 x 35 x 61**
 (H x W x D in mm)

 Interface **KBR Modulbus**

Input and output configuration

DEVICE TYPE	INPUTS	OUTPUTS	POSSIBLE FUNCTIONS
MEMORY MODULE			
5D6-ESBS-5DI6RO1DO	5 x digital	6 x relay 1 x DO	→ Consumption recording → Status logging → Recording operating hours → Pulse summation → Relay switching → Recording analog values → Temperature recording → Recording heat quantities
EXPANSION MODULES			
2D2-4DI	4 x digital	–	→ Recording consumption → status logging → Recording operating hours
2D2-4AI	4 x analog (0–20 mA / 4–20 mA / 0–10V)	–	→ Recording consumption
1D2-4CI	4 x current (0 – 6 A)	–	→ Recording current
2D2-4TI	4 x temperature (PT1000)	–	→ recording temperature
2D2-1TI2RO	4 x temperature (PT1000)	2 x relay	→ Recording temperature → Thermostat function → Relay switching
2D2-4RO	–	4 x relay	→ Relay switching
2D2-4AO	–	4 x analog (0–20 mA / 4–20 mA)	→ Analog value-output

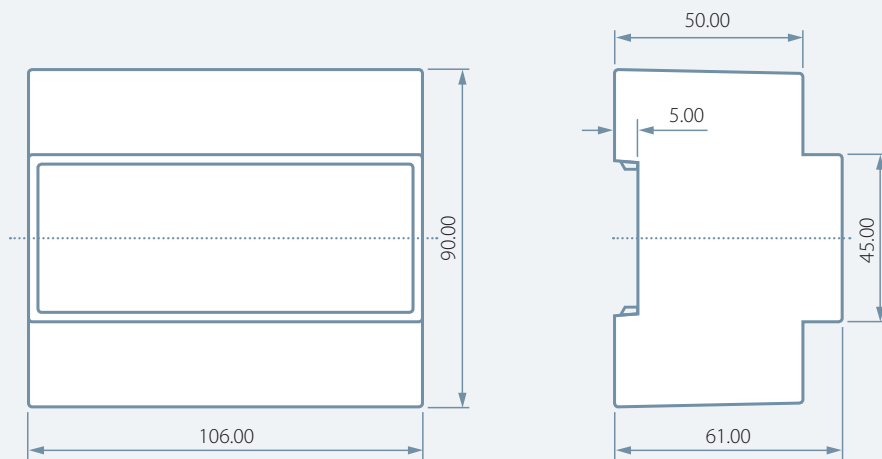
multisio Technical details

		System Center
		DEVICE TYPE
		5D6-ESBS-5DI6RO1DO
DISPLAYS	Operation	Push button for reset and scan mode
	Control display	6 green LEDs: 5 x input status 1 x operating status
MEMORY	Main, data and program memory	2 MB RAM battery-buffered / 256k EPROM
	Memory type	Ring buffer
	Long-term memory for max. 160 days min. 64 hours, depending on memory configuration	Load profile memory: Maximum 25 x 3840 entries 60/30/15/1 min Period duration for high and low tariff configurable via software
	Event memory	A maximum of 4096 entries to record tariff switching commands, mains failures, error messages etc.
INPUTS	Digital input for floating contact, S ₀ -compatible	5
	Analog input, 0 – 20 mA, 4 – 20 mA, 0 – 10 V	–
	Current input, 0 – 6 A	–
	Temperature input PT 1000	–
OUTPUTS	Relay contact, floating (shared source), switching capacity 250V AC, 2A	6
	current output, 0 – 20 mA, 4 – 20 mA	–
INTERFACE	KBR eBus (RS485)	■
	KBR Modulbus (RS485)	■
	Baud rate	38400
	Addressing	Can be addressed up to address 9999, automatically via software, scanning mode can be activated on the device
POWER SUPPLY	Operating voltage	85 – 265 V AC / DC, 50 / 60 Hz
	Power consumption	15 VA
MECHANICAL DATA	Housing modules and size in mm (H x W x D)	6 TE (90 x 106 x 61)
	Mounting type	Wall mounting on DIN rail 7.5 mm deep, in accordance with DIN EN 50022, suitable for distribution board mounting
	Weight	Approx. 650 g

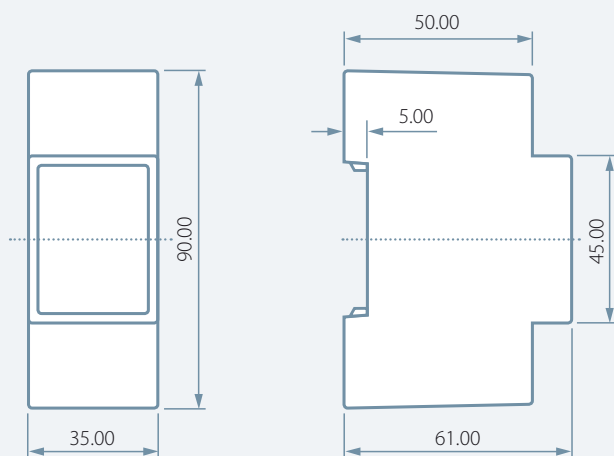
Expansion modules							
2D2-4DI	2D2-4AI	1D2-4CI	2D2-4TI	2D2-1TI2RO	2D2-4RO	2D2-4AO	
Push button for reset and scan mode							
5 LEDs: 4 x input status 1 x operating status	5 LEDs: 4 x input status 1 x operating status	1 LED: operating status	5 LEDs: 4 x input status 1 x operating status	5 LEDs: 2 x input status 2 x output status 1 x operating status	5 LEDs: 4 x output status 1 x operating status	5 LEDs: 4 x output status 1 x operating status	
–	–	–	–	–	–	–	
–	–	–	–	–	–	–	
–	–	–	–	–	–	–	
–	–	–	–	–	–	–	
4	–	–	–	–	–	–	
–	4	–	–	–	–	–	
–	–	4	–	–	–	–	
–	–	–	4	1	–	–	
–	–	–	–	2 floating, separated relays	4	–	
–	–	–	–	–	–	4	
–	–	–	–	–	–	–	
■	■	■	■	■	■	■	
38400							
Automatic module bus addressing, scan mode can be activated on the device							
24 V DC, supply via module bus							
2 VA	1 VA	1,2 VA	1 VA	1 VA	1,3 VA	2 VA	
2 TE (90 x 35 x 61)							
Wall mounting on DIN rail 7.5 mm deep, in accordance with DIN EN 50022, suitable for distribution board mounting							
Approx. 80 g							

multisio Dimensions

multisio system center



multisio expansion module



- **Meter recording**

Recording the pulses of existing energy meters is not one of the typical tasks of the digital inputs of the **multisio** system. In contrast to almost all other systems, the summation and storage does not take place only as a continuous counter, but also at medium-specific intervals. These are then also available, along with the consumption recording and later rating, for a load profile analysis.
- **Status recording:**

With the **multisio** digital inputs, states can also be optionally recorded. Each change in state (opening/closing) is logged with date and time. A typical application is the monitoring of power switches. Every switching action can be traced with this.
- **Operating hours measurement:**

There are several ways of determining the operating time of a consumer. If an energy meter is already installed to measure the consumer, a threshold can be determined and if this is crossed, the time counting is started. The current operating hours in each case can be retrieved or reset. Even more powerful is the time counting with a closed contact. The operating times determined in this way are stored in a load profile memory. This means that they can not only verify the overall operating hours, but in addition the operating time for each period retrospectively. Making a statement on how much time a machine has run in layer 1 and how much in layer 2 thus becomes child's play.
- **Recording analog values:**

Generating not only instantaneous values from analog signals, but also useful values for consumption recording is a highlight of the **multisio**. The cumulated average values are available in the period memory as a load profile.
- **Recording temperature:**

The **multisio** family provides several ways of processing standard commercial PT 1000 temperature signals. They can use instantaneous values for visualization and also store the progress history. **multisio** thus becomes an autonomous data logger because of the internal load profile memory.
- **Recording heat quantities:**

When one pulse input each and two PT 1000 temperature inputs are used, **multisio** can determine the quantity of heat independently. An expensive additional heat quantity meter can thus be avoided for many applications. The calculated heat quantities are also available in the load profile memory, so that not only the sum, but in addition the cooling behavior can be determined.

Load management system

multimax

Monitoring



Optimizing



The load management system **multimax** optimizes the energy consumption behavior of loads connected to the system, thereby avoiding the occurrence of expensive power peaks. The energy control system here functions as a central unit which by means of complicated trend calculations determines the correct switch-off or switch-on time for the devices that need to be optimized. The intervention in the operation sequence is made as carefully as possible.

multimax LCD bus

Bus-capable load management system with numerous monitoring functions for more operational safety

**RELA relay modules**

As decentralized substations, the relay modules expand the multimax load management system.

multimax LCD

Housing size
(H x W x D in mm) **144 x 144 x 120**

Data display **LCD**



Energy optimization system with trend calculation

- Highlights**
- Saving energy costs by lowering the kW peak power
 - Optimizing energy consumption by intelligent load distribution
 - Numerous monitoring functions for more operational safety
 - Four integrated floating relay outputs for the switching of consumers
 - Extendable to a maximum of 12 optimization outputs via decentralized substations

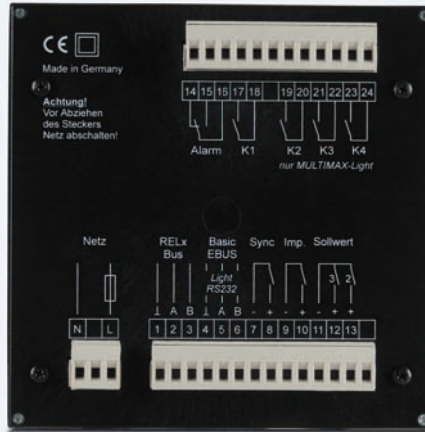
An overall view of technical details can be found on pages 64/66.
The housing dimensions are listed on page 68.

The load management system **multimax LCD** optimizes energy consumption by means of continuous setpoint/actual state comparisons and an intelligent load distribution. By taking into account the load priority, minimum connecting and disconnecting times as well as the available correction power, the device hardly affects operation, thus providing for optimal distribution of the power available. Numerous monitoring functions increase operational

safety, an extensive long-term memory records numerous relevant data, in this way creating the basis for even more energy efficiency.

Note: Different substations are available for switching the loads, depending on the individual requirements. Communication between the central unit and the substation is carried out via an optimization bus.

Rear side multimax LCD



multimax LCD bus



Energy optimization system with trend calculation

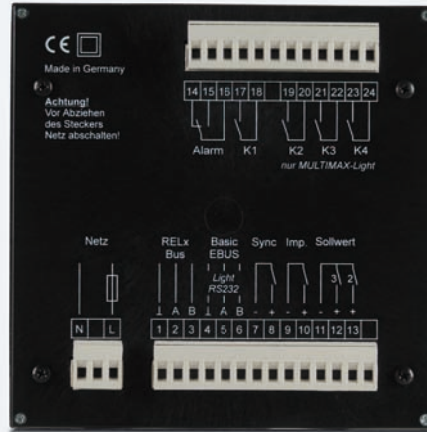
- Highlights**
- Saving energy costs by lowering the kW peak power
 - Optimizing energy consumption by intelligent load distribution
 - Numerous monitoring functions for more operational safety
 - Optimization calculation for up to 32 loads via decentralized substations
 - Serial interface via KBR eBus

An overall view of technical details can be found on pages 65/67.
The housing dimensions are listed on page 68.

The load management system **multimax LCD bus** serves to monitor electricity consumption and to maintain the specified average power value by switching consumers connected to the system on or off. As this is done, all parameters that are relevant for the energy control are transmitted with the **KBR eBus** and displayed and processed by the web-based analysis and visualization software **visual energy 4**.

Note: Different substations are available for switching the loads, depending on the individual requirements. Communication between the central unit and the substation is carried out via an optimization bus.

Rear side multimax LCD bus



RELA 04/08



Relay modules for 4 or 8 switching stages

- Highlights**
- With 4 or 8 floating switching relays
 - High switching capacity up to 500 VA (250 V/50 Hz)
 - Decentralized operation of multiple substations via serial bus line
 - Individual stations can be addressed by means of switch
 - NO or NC contacts function freely programmable
 - Suitable for standard rail assembly and distribution board mounting

An overall view of technical details can be found on pages 65/67.
The housing dimensions are listed on page 69.

The microcontroller-guided output modules **RELA 04** and **RELA 08** are used to switch the consumers to be optimized on and off. They are available as 4 or 8-channel relay modules. Via a serial data cable, the module receives switching commands and parameter data from

the **multimax** central unit. Because the modules can be addressed individually, multiple RELA devices can be connected to the bus system as decentralized substations.

RELA T2

Housing size
(H x W x D in mm) **85 x 175 x 73**

Display **2 x 3 LEDs**

Interface **serial**



Kitchen sequential control for thermoelectric loads

- Highlights**
- Exact status recording of devices - main switch and thermostat
 - Manual automatic switch, i.e. no optimization of the load with manual operation
 - Decentralized operation of multiple substations via serial bus line
 - Individual stations can be addressed by means of switch
 - Suitable for standard rail assembly and distribution board mounting

An overall view of **technical details** can be found on pages 65/67.
The **housing dimensions** are listed on page 69.

RELA T2 was developed especially for optimizing thermoelectric loads (kitchen loads). With this substation, up to two loads can be sensitively optimized when the power threatens to be exceeded. The type of optimization during the heating up phase is crucial. Depending on what thermal behavior is shown by the connected load, you can choose from three operating modes. The standard operat-

ing mode allows optimizing in the heating up phase. The second operating mode blocks optimizing during this phase, thereby preventing the operating temperature from falling. For especially critical loads with little capacity for thermal storage, the third operating mode allows optimization exclusively in the heating up phase.

multimax / RELA Technische Details

MENU AND STATUS DISPLAYS	Energy: W_{active} Trend power: P_{trend} Instantaneous power: P_{inst} Cumulated power: P_{cum} Corrective power: P_{corr} Measuring intervals-average value: P Daily and monthly maximum values: P_{day} and P_{mon} Switching operations, error and malfunction messages	DEVICE TYPE	multimax LCD 1F144-BS
OPTIMIZATION LINES	Maximum extension	12	
	Stages integrated into central unit	4	
	Expansion via decentralized substations	Maximum 8 stages	
SUBSTATIONS	Output modules for switching loads on and off	RELA04 RELA08 RELA-T2 Can be combined in any way	
SWITCHING PERFORMANCE	Self-optimizing (circuit switching of the same stages)	<input checked="" type="checkbox"/>	
	Priority can be adjusted for each optimization input and output	<input checked="" type="checkbox"/>	
OPTIMIZATION CRITERIA	Setpoint control (setpoints freely programmable)	Switching possibility between 3 setpoints (tariffs)	
	Stage power and hook up probability	<input checked="" type="checkbox"/>	
	Priority switching (circuit switching with the same priority)	<input checked="" type="checkbox"/>	
	Measuring period timeout, minimum switch on time, minimum and maximum down time	<input checked="" type="checkbox"/>	
MONITORING FUNCTIONS	Maximum prewarning in case of excessive power	<input checked="" type="checkbox"/> Only display on the device	
	Automatic emergency shutdown of selected loads in case of malfunction	<input checked="" type="checkbox"/>	
	Counter and synchronous pulse monitoring	<input checked="" type="checkbox"/>	
	Communication monitoring between central unit and substation	<input checked="" type="checkbox"/>	
DISPLAYS	Display type	Two-line, alphanumeric LCD with background illumination	
	Size of display	LEDs for menu and status displays	
MEASUREMENT	Combined pulse interval measuring procedure with trend calculation	<input checked="" type="checkbox"/>	
	Measuring directly via transformer	Only type W	
MEMORY	Load profile memory	<input checked="" type="checkbox"/>	
	Extreme value memory	<input checked="" type="checkbox"/>	
	Active energy memory for high and low tariffs	<input checked="" type="checkbox"/>	
	Memory for switching operations	<input checked="" type="checkbox"/>	
	Event memory (power failures, errors, programming interventions, etc.)	<input checked="" type="checkbox"/>	
	Memory can be read out on device memory can be read out via KBR eBus	<input checked="" type="checkbox"/> -	
MEMORY	Calendar function	<input checked="" type="checkbox"/>	
	Daylight saving time	<input checked="" type="checkbox"/>	
	Leap year recognition	<input checked="" type="checkbox"/>	
PASSWORD PROTECTION	Digit code	<input checked="" type="checkbox"/>	

multimax LCD bus 1F144-ESBS	RELA 04	RELA 08	RELA-T2
32			
–			
32 stages			
RELA04 RELA08 RELA-T2 Can be combined in any way			
■			
■			
Switching possibility between 3 setpoints (tariffs)			
■			
■			
■			
■			
■			
■			
■			
Two-line, alphanumeric LCD with background illumination			
LEDs for menu and status displays			
■			
Only type W			
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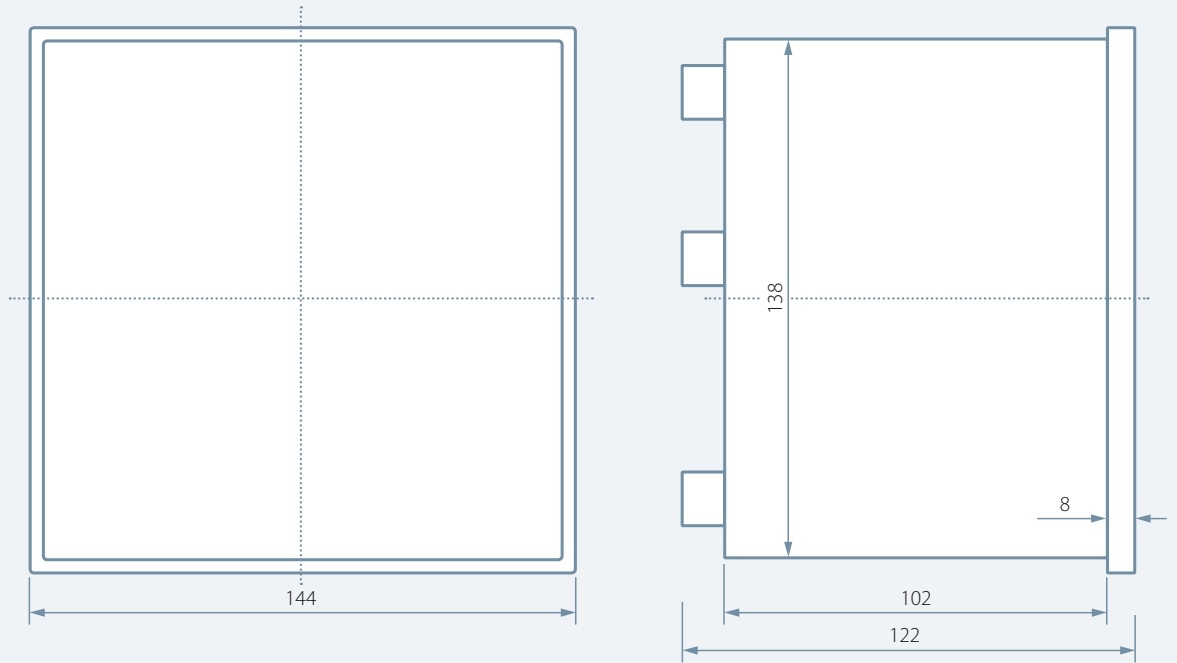
multimax / RELA Technical details

		DEVICE TYPE	multimax LCD 1F144-BS
INPUTS	Pulse inputs (working and synchronization pulse)		■
	Setpoint switching (for floating contact)		2 (to activate setpoint 2 or 3)
OUTPUTS	Relay outputs		Relay outputs with floating contacts: 4 Contact rating: 500 VA, 2 A (250 V / 50 Hz) Switching logic: NO- / NC function: can be set via central unit Manual / automatic switch: separated for each stage Status output display for each output in the LCD
	Maximum prewarning relay		–
INTERFACE	Serial port		RS232 only for programming
	KBR eBus		–
	Modem operation		–
	Printer connection		■
VISUAL ENERGY 4	Web-based analysis software for convenient operation and visualization (only Windows operating system)		–
POWER SUPPLY	Operating voltage		230 V ±10%, 50 / 60 Hz
	Power consumption		10 VA
MECHANICAL DATA	Housing modules and size in mm (H x W x D)		144 x 144 x 120 (switchboard cutout: 138 x 138)
	Mounting type		Switchboard cutout installation
	Weight		Approx. 1000 g
	Wall housing		□
AMBIENT CONDITIONS			
ELECTRICAL SAFETY			

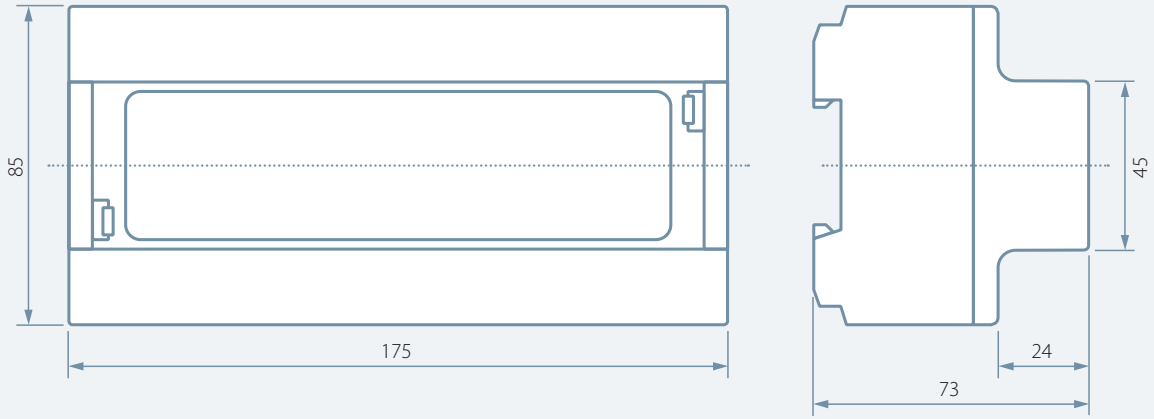
multimax LCD bus 1F144-ESBS	RELA 04	RELA 08	RELA-T2
<input type="checkbox"/>			
<input checked="" type="checkbox"/> 2 (to activate setpoint 2 or 3)			
<input checked="" type="checkbox"/>	Relay outputs with floating contacts: 4 Contact rating: 500 VA, 2 A (250 V/50 Hz) switching logic: NO/NC function: can be set via central unit Manual/automatic switch: separated for each stage Status output display for each output: 1 LED	Relay outputs with floating contacts: 4 Contact rating: 500 VA, 2 A (250 V/50 Hz) switching logic: NO/NC function: can be set via central unit Manual/automatic switch: separated for each stage Status output display for each output: 1 LED	Relay outputs with floating contacts: 2 Contact rating: 500 VA, 2 A (250 V/50 Hz) Switching logic: NO/NC function: can be set via central unit Manual/automatic switch: separated for each stage Status output display for each output: 1 LED
<input checked="" type="checkbox"/> 2 (to activate setpoint 2 or 3)			
RS232 RS485	RS 485; RELx – BUS; 38,4 kBaud		
<input checked="" type="checkbox"/>			
<input checked="" type="checkbox"/>			
<input checked="" type="checkbox"/>			
<input checked="" type="checkbox"/>			
230 V ±10%, 50 / 60 Hz	Auxiliary voltage: 230 V ±10%, 50 / 60 Hz		
10 VA			
144 x 144 x 120 (switchboard cutout: 138 x 138)	85 x 175 x 73		
Switchboard cutout installation	Standard rail mounting		
Approx. 1000 g	Approx. 600 g	Approx. 650 g	Approx. 680 g
<input type="checkbox"/>			
Standards and following amendments: DIN EN 60721-3-3/A2 (3K5 + 3Z11) Operating temperature: –5 °C to +55 °C Air humidity, non-condensing: 5 % to 95 % Storage temperature: –25 °C to +70 °C			
Standards and following amendments: DIN EN 61010-1/A2 IEC 1010-1/A2 Class of protection: I Overvoltage category: CAT II Protection class: IP 20 - DIN EN 40050 Part 9 Electromagnetic Compatibility EMC: DIN EN 50081-1 DIN EN 61000-6-2 IEC 61000-6-2			

multimax / RELA Dimensions

multimax LCD and multimax LCD bus



RELA 04, RELA 08 and RELA-T2 (DIN rail housing)





SYSTEM INTEGRATION

For the system integration, the control center, the KBR eBus and the web-based analysis software visual energy 4 interact closely. This enables the energy supply to be made transparent, allows operating safety to be increased, enables savings potentials to be detected and energy costs to be reduced considerably.

visual energy 4

Web-based analysis software

→ page 72



multisys

System center

→ page 80



multisys

Gateways

→ page 84



multisys

Repeater

→ page 84

Web-based analysis and visualization software

visual energy 4



visual energy 4 is a web-based analysis and visualization software with numerous options for recording, monitoring, analyzing, and optimizing technical networks and facilities. Extensive functions, a clearly designed user interface, intuitive operability and ease of adaptability to the respective technical infrastructure create the best prerequisites for efficient energy management.

Web-based Energy Management

visual energy 4 enables the employees of a company to access energy data via web browser. Various levels of authorization permit individual access to media and location levels, depending on the task at hand. Depending on the requirement, the display is provided as a supply diagram (e.g. circuit diagram) or PDF report. This means that

the technician is able to validate facility data at any time. Live values from the KBR eBus measuring devices always provide a view of the current status. The plans and the components contained in it can be compiled or updated very easily by the operating technician via browser.

Highlights

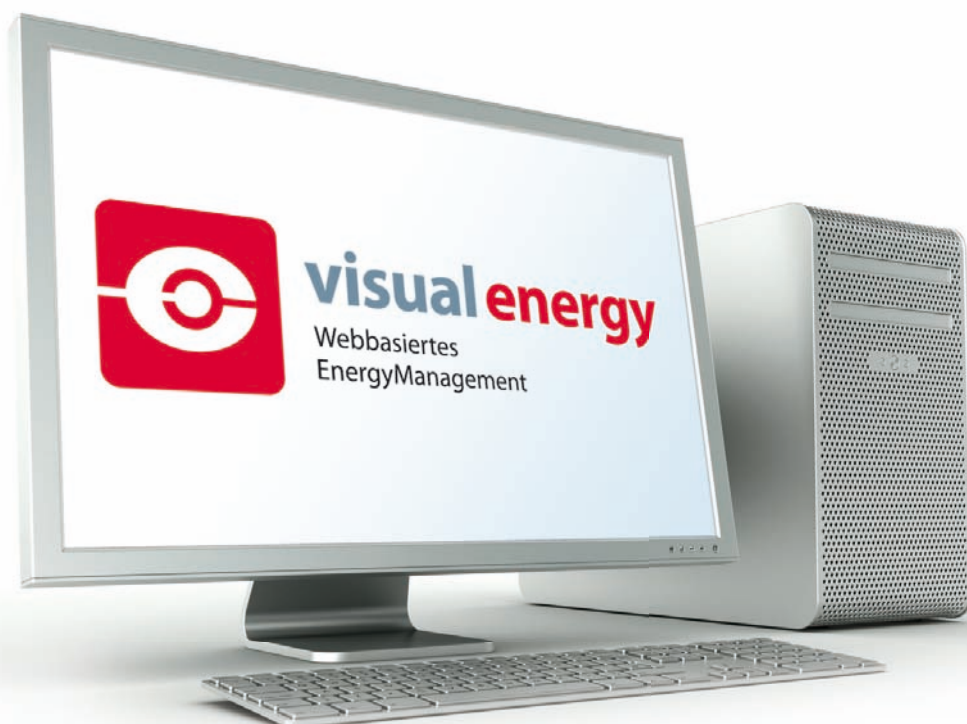
- Efficient tool for standard DIN EN 16001

- Seamless recording of all energy consumptions

- Detecting hidden savings potentials and targeted reduction of energy costs

- Convenient presentation of all energy-relevant measured values

- Plausible energy consumption data through validation via the supply structure



visual energy 4

Functional principle and applications

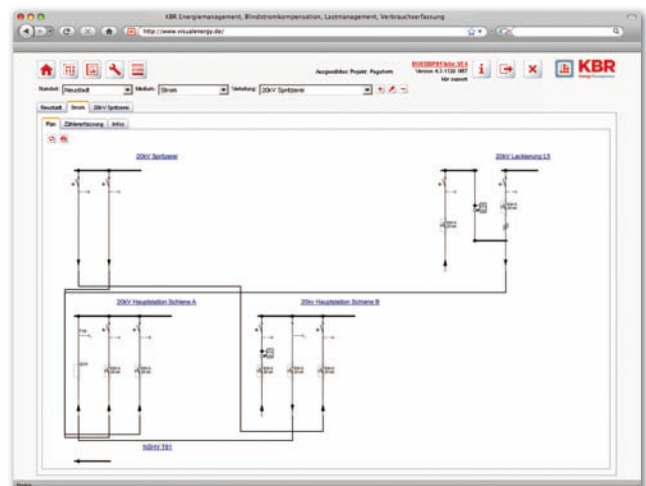
With **visual energy 4**, the meter points of a supply network can be recorded and precisely allocated. This allocation to the distribution structure allows the system to automatically generate plausible consumption reports. By means of the eBus, data from the device memories are read out and saved to the central energy database. MSCONS meter count or load profile import is also possible, along with the mobile recording and manual entry of reading meters. visual energy 4 subsequently represents these load profiles as bar, line or plane graphs. The system is set up and configured in just a few minutes, thanks to predefined standard views. As soon as the connected bus devices appear in the so-called eBus list, communication with the devices is possible and current

data can be displayed. visual energy 4 allows the allocation and evaluation of consumptions at cost centers. Alternatively, the energy benefits, e.g. consumption proportions for heating, cooling, lighting or processes can be evaluated. The sums and proportions of individual network operators can be clearly seen.

visual energy 4 is fully scalable as a distributed application. Even the largest applications, with many users and meter points, can be covered by this without any problems. A flexible licensing according to meter points ensures that the cost-benefit ratio is maintained.

Overview applications

- Energy data management for complex supply structures
- Cost center management and billing
- Time-controlled readout and archiving of measured data
- MSCONS meter count and load profile import
- Plausibility check
- Substitute value formation according to BDEW metering code
- Live updating and rendering of measured data
- Convenient configuration of measuring devices
- Monitoring preset limiting values and alarm function if limiting values are exceeded (notification via SMS or email) *



Graphic representation visual energy 4: Supply structure

* Expected to be available from the 4th quarter 2010.

Visualization of measured data

visual energy 4 stands out through its clear and intuitive user interface. A library with drawing objects and icons forms the basis for quickly implementing more complex energy distribution structures. Live values and states provide a current visualization of the energy supply structure at any time. This portrayal can be freely scaled in the Web browser.

Much more information can be quickly and easily read out from the connected eBus devices and visualized. All important consumer data is documented without interruption. The causes of problems in the energy network, such as voltage fluctuations, harmonics or mains failures,

can also be quickly detected and uniquely assigned.

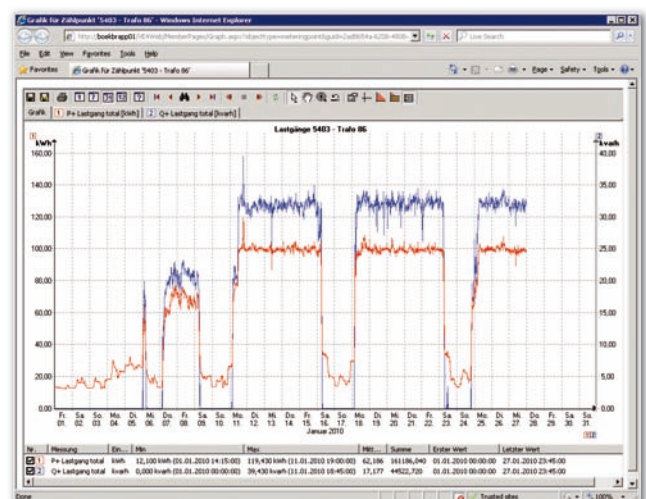
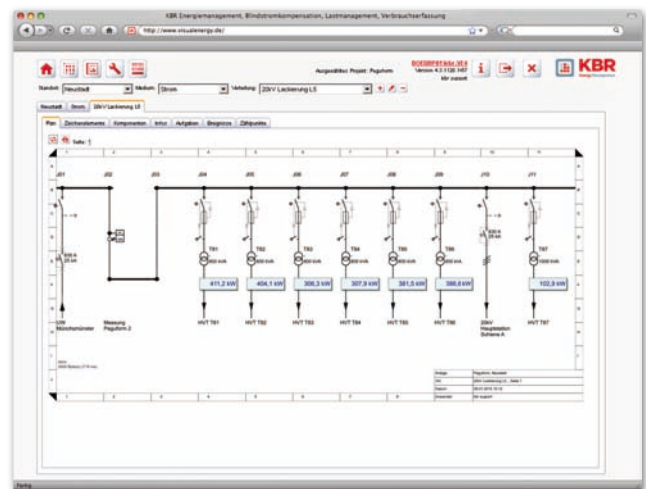
Due to the long-term storage of measured data, comparisons and analysis with historic data can be made: an important prerequisite for efficient energy management.

A component database that can be expanded by the user allows fuses, switches or other components to be selected, thereby ensuring that the current plan can be shown at any time.

Overview visualization

- Graphic representation of consumption values, peak load values and load profile data in freely definable periods
- Representation of the complete energy supply as a topological diagram
- Supports the illustration of the energy forms of electricity, gas, water and heat
- Clear tab system with navigation elements for a quick and targeted navigation
- Multiple measured values can be combined and presented in a graph
- Library for icons and drawing objects
- Component database

Graphic representation visual energy 4:
Energy distribution (top) and load profile

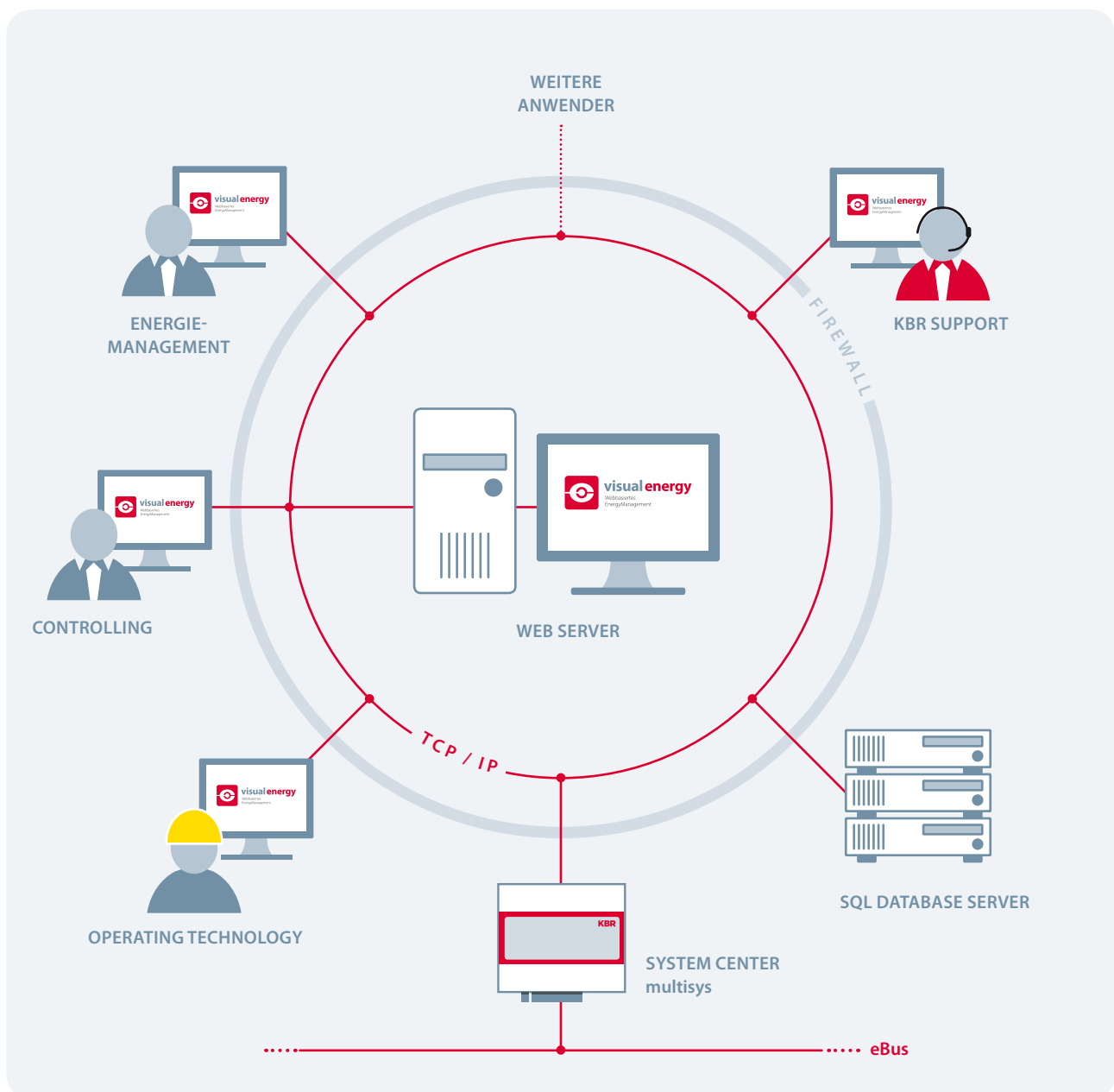


visual energy 4

System Integration

System Integration in KBR is a combination of various hardware and software components exactly matched to one another. The **multisys system center** controls the entire bus management. Equipped with visual energy 4, the system center not only gathers data from network analyzers, such as multimes or multisio, it can also function in smaller applications as a web server. Since access to the multisys system center can be gained from any workplace

with Web capability, various scenarios are possible for managing energy data. For this, visual energy 4 provides a convenient permissions assignment for users, making administration easier. The Web-based principle of visual energy 4 also allows KBR to provide fast and direct support via online diagnosis.



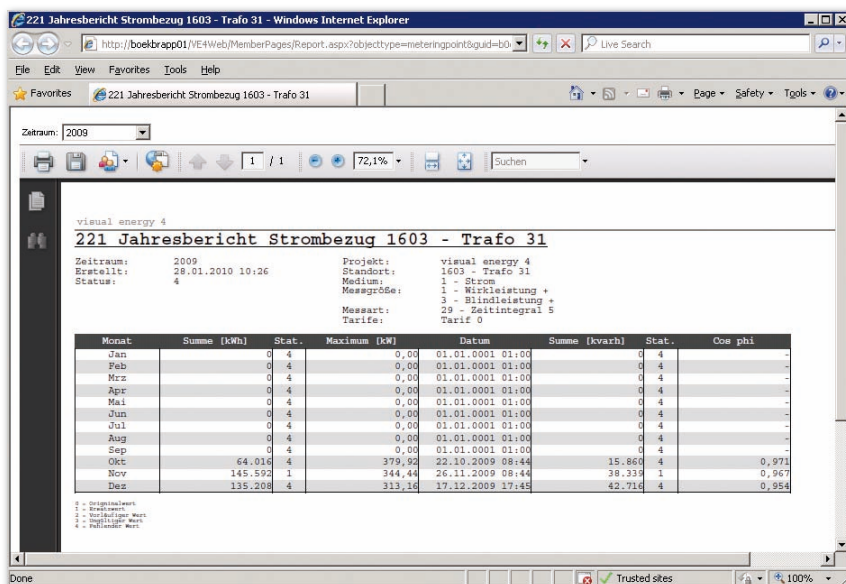
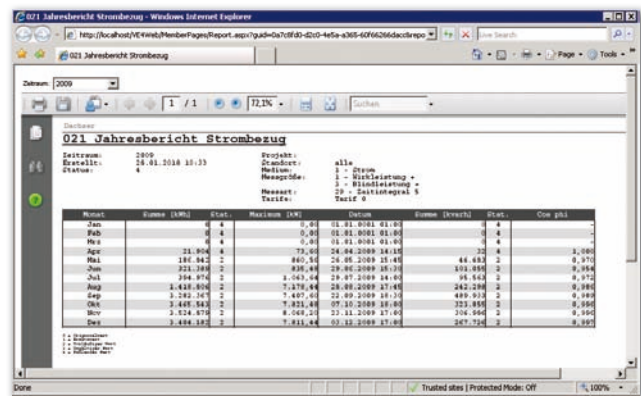
Report functions

Report generation and evaluation take place automatically, based on the supply structure. This ensures that the consumption values are plausible. Typical errors which occur in other systems, with multiple, missing or incorrect measurement channels in the consumption sums can therefore be practically ruled out. In addition, recording and processing consumption values itself ensures plausible values, since the status for each single measured value is recorded from the beginning to its evaluation. The viewer can therefore at any time recognize whether the sum contains missing or

supplementary data. Formation of the supplementary data is done in accordance with the guidelines of the BDEW. For each measurement object (consumption meters, section meters, billing meters), the existing information can also be displayed in report form and printed out. Since the entire report formatting is performed using modern XML- / XSL technology, flexible adjustment to the corporate reporting is possible.

Overview report functions

- Complete listing of relevant tariffs with power type and other tariff components
- Extensive overview of all existing cost centers in the network topology
- PDF report
- Substitute value formation according to BDEW metering code
- Status labeling of consumption values



Graphic representation visual energy 4: Report

visual energy 4

Network capability and data exchange

visual energy 4 is a distributed application and consists of an MS IIS Web server, an MS SQL database server and one or more multisys system centers as eBus-Master. This creates a very robust and powerful basis that is scalable. Communication between individual components follows as a rule on the basis of the http protocol, which is also permitted for strict firewall rules. KBR support can access most components directly via VPN, and is thus in a position to quickly and simply provide help – a significant advantage for continuous energy supply and data recording. Users can access the energy data system easily with a Web browser. The number of users is not restricted, and no licenses are required. Free of charge plug-ins for SVG vector graphics,

KBR load profile graphics and PDF documents provide for efficient handling. The integration of manual reading meters is also supported. In the simplest case, the meter counts can be entered in a form via the Web page. But it is also possible to read and enter data with the support of **mobile PDAs**. A plausibility check takes place when data is entered, which avoids typical entry errors.

Overview network capability

- Scalable, distributed application
- Firewall-friendly architecture
- No restrictions and licensing according to numbers of users
- Integration of manual reading meters



Reading energy data is also possible on mobile devices. Moreover, visual energy 4 supports open web standards such as SVG.

Support of open Web standards

visual energy 4 supports recognized Web standards. For the display of supply plans and device views, the **W3C Standard SVG** (scalable vector graphics) is used. SVG is based on XML and enables status displays and changes to be displayed live. Most browsers support SVG directly. One exception is MS Internet Explorer,

which requires an appropriate plug-in. KBR recommends the use of the free of charge Renesis Player. The report can be exported, saved and forwarded directly as a PDF. Various free plug-ins for viewing PDFs are available for download on the Internet.

Technical specifications

FUNKTIONEN	multisys ... -AIO with visual energy 4	visual energy 4 Standard
Maximum number of bus devices	20	unlimited
Maximum number of supported eBus masters	1	unlimited
Maximum number of meter points	100	unlimited
Maximum number of users	unlimited	unlimited
Maximum number of locations	unlimited	unlimited
Maximum number of distributions	unlimited	unlimited

SYSTEM REQUIREMENTS SERVER

The **visual energy 4 software standard** as a distributed application requires the following components

- MS Internet information server (IIS from version 5.1 to 7)
- MS SQL Server (SQL 2005 / SQL 2008)
- MS Message Queue (MSMQ)
- .NET Framework 3.5

SYSTEM REQUIREMENTS CLIENT

- MS Internet Explorer (from version 7)
- Plug-ins for PDF, SVG and KBR load profile graphics (also available as MSI installation packets)

→ MSCONS meter count and load profile import

The liberalization of the electricity market has resulted in the need for energy data to be exchanged between computer systems in a structured form. EDIFACT reproduces worldwide uniform rules for data exchange between IT systems, with various message types. The MSCONS message type is used for communication in the energy market. With this, all information relevant to energy amounts which involve metering and measuring issues can be exchanged. Since 2008, the German Bundesnetzagentur [Federal Grid Agency] has stipulated how the message type MSCONS is used.

→ BDEW metering code

The BDEW represents some 1,800 companies and in Germany is the central contact partner for questions concerning natural gas, electricity and district heat, as well as water and waste water. In the metering code, the minimum requirements made of the measuring point operation and of the measurement in terms of the Energy Industry Act (reading, making data available) are specified. This is part of the network access and network usage regulations.

System and communication components

multisys

Monitoring



Recording

Optimizing



The device family **multisys** combines different communication levels with one another and forms an essential part within the KBR visual energy 4 architecture. The high flexibility and scalability of multisys enables a precise adjustment to be made to the respective technical infrastructure.

System center multisys 3D6-ET-8-EBM

The central component for energy management solutions based on the KBR eBus and visual energy 4. Up to 200 KBR eBus or KBR module bus devices each can be recorded and monitored per unit.

System center multisys 3D6-ET-16-AIO

Equipped with the web-based analysis and visualization software visual energy 4, this system center controls the entire bus management and functions at the same time as a web server.



multisys Gateways

The gateway allows the transition from the serial RS485 eBus/ module bus to eBus/TCP.



multisys Repeater

The repeater enables serial RS485-eBus segments to be augmented by an additional 32 devices or lengthened by 1,200 m.

multisys eBus-Master

Housing size
(H x W x D in mm) **90 x 106 x 61**

Interface **TCP / IP**



System center multisys 3D5-ET-8-EBM

System center for visual energy 4 Standard

Highlights

- Up to 200 BUS devices on one system center
- Simple expansion of the energy management system through the simultaneous use of several system centers
- Smooth communication via TCP/IP and KBR eBus
- Storage of energy data for up to one year
- Clock time and period-synchronous control of all measuring devices
- MSCONS Export (loads, meter counts)

An overall view of **technical details** can be found on page 86.
The **housing dimensions** are listed on page 88.

The **multisys system center ... 8-EBM** is the central component for energy management solutions based on the KBR eBus and visual energy 4. Up to 200 KBR eBus or KBR module bus devices each can be recorded and monitored per system center. If this number is not sufficient, as many centers as you want can be deployed. Communication with system components takes place via TCP / IP. The eBus

system centers ensure that all connected devices are time- and period synchronous. The energy data is stored for up to one year, so that no data losses occur even if communication to the database is interrupted.


visual energy

 Webbasiertes
EnergyManagement

System center multisys 3D5-ET-16-AIO

System center with visual energy 4 Standard preinstalled

Highlights

- Up to 20 BUS devices on one system center
- Smooth communication via TCP/IP and KBR eBus
- Storage of energy data for up to one year
- Clock time and period-synchronous control of all measuring devices
- visual energy 4 incl. Web server and database server preinstalled

An overall view of **technical details** can be found on page 86.
The **housing dimensions** are listed on page 88.

The system center **multisys ...16-AIO** is especially suited to small projects since – in contrast to the multisys ... 8-EBM – visual energy 4 is already preinstalled with the Web server and database server, so that the installation on the service system of the customer is not necessary.

Due to the restricted performance of the embedded system, the number of eBus devices is restricted to 20. The system cannot be expanded by additional system centers.

multisys Gateways / Repeater

Housing sizes (H x W x D in mm)	90 x 35 x 61 90 x 53 x 61	
Interfaces	eBus TCP / IP eBus serial Modulbus Profibus DP	

multisys
Gateway 2D2-ESET

multisys
Gateway 2D2-BSET

Gateways and repeater for connection of serial eBus / module bus devices

- Highlights**
- Compact construction
 - No additional power supply unit necessary ¹
 - No configuration necessary ²

¹ With the exception of the multisys Gateway 1D3 ESDP.

² Only the TCP/IP configuration must be adjusted to local conditions.

An overall view of **technical details** can be found on pages 86/87.

The **housing dimensions** are listed on pages 88/89.

The **KBR gateways** and **KBR repeater** have been specifically developed for the construction of complex energy management systems. Depending on the type, they allow the connection of serial eBus or module bus devices to a TCP/IP network, in many cases thereby avoiding the need for additional cables to be laid. Additionally, the connection of module bus devices directly to the eBus or extend-

ing module bus and eBus segments is possible with the appropriate repeater modules. Typical communication requirements can be fulfilled with adjusted and tested components – without the functional risk of additional purchased parts. The respective setup guidelines (eBus / module bus) must be observed when this is done.



multisys
Gateway 2D2-ESBS

multisys
Gateway 2D2-BSES

multisys
Gateway 1D3-ESDP

multisys
Repeater 2D2-BSBS

multisys
Repeater 2D2-ESES

Technical specifications

DEVICE TYPE	INTERFACE A	INTERFACE B	INTENDED PURPOSE
GATEWAYS			
multisys 2D2-ESET	eBus serial RS485	eBus TCP / IP	→ Connection of eBus segments to Ethernet TCP / IP
multisys 2D2-BSET	Module bus serial RS485	eBus TCP / IP	→ Connection of Module bus segments to Ethernet TCP / IP
multisys 2D2-ESBS	eBus serial RS485	Module bus serial RS485	→ Gateway for lengthening and electrical isolation of Module bus segments via eBus. On the opposite side the use of a multisys ...-BSES is necessary.
multisys 2D2-BSES	Module bus serial RS485	eBus serial RS485	→ Connection of module bus devices to eBus
multisys 1D3-ESDP	eBus serial RS485	Profibus DP	→ Connection of multcomp, BK12, multicount and multimes ... F96 to Profibus DP
REPEATER			
multisys 2D2-BSBS	Module bus serial RS485	Module bus serial RS485	→ Expansion of module bus by further devices
multisys 2D2-ESES	eBus serial RS485	eBus serial RS485	→ Expansion of eBus by 31 devices or 1,200 m

multisys Technical details

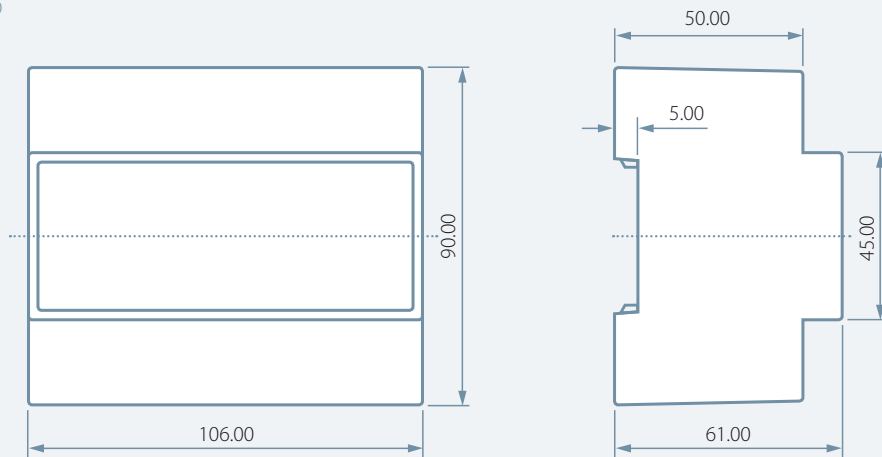
		multisys			
DEVICE TYPE		3D6-ET-8-EBM	3D6-ET-8-AIO	1D3-NT5V	2D2-ESET
FUNCTION	System center	■	■	–	–
	Gateway	–	–	–	■
	Repeater	–	–	–	–
	Power supply unit	–	–	■	–
FUNCTION		5V DC via 1D3-NT5V		85 – 265 V AC / DC	
INTERFACES	eBus serial	–	–	–	■
	eBus TCP/IP	■	■	–	■
	Module bus supplying	–	–	–	–
	Module bus	–	–	–	–
	Profibus DP (Sub-D)	–	–	–	–
MECHANICAL DATA	Housing size Module size in mm (H x W x D)	6 TE 90 x 106 x 61		3 TE 90 x 53 x 61	2 TE 90 x 35 x 61
	Weight	Approx. 580 g		Approx. 250 g	Approx. 120 g
STANDARDS AND MISCELLANEOUS	Standards	DIN EN 60721-3-3/A2: 1997 – 07 3K5+3Z11 (IEC 721-3-3 3K5 + 3Z11)			
	Operating temperature	– 5 °C ... + 45 °C		– 5 °C ... + 60 °C	
	Humidity	5 % ... 95 %			
	Protection class	I in accordance with DIN EN 61010-1 : 2002 – 08			
	Mode of protection	IP20 in accordance with DIN EN 40050 Part 9: 1993 – 05			
	Electromagnetic compatibility	DIN EN 61000-6-3: 2005 – 06 (IEC 61000-6-3) DIN EN 61000-6-2: 2006 – 03 (IEC 61000-6-2)			

	2D2-BSET	2D2-ESBS	2D2-BSES	1D3-ESDP	2D2-BSBS	2D2-ESES
	–	–	–	–	–	–
	■	■	■	■	–	–
	–	–	–	–	■	■
	–	–	–	–	–	–
	85 – 265 V AC / DC			24 V AC / DC	85 – 265 V AC / DC	
	–	■	■	■	–	■
	■	–	–	–	–	–
	■	–	■	–	–	–
	–	■	–	–	■	–
	–	–	–	■	–	–
	2 TE 90 x 35 x 61			3 TE 90 x 53 x 61	2 TE 90 x 35 x 61	
	Approx. 120 g			Approx. 140 g	Approx. 120 g	
	DIN EN 60721-3-3/A2: 1997 – 07 3K5+3Z11 (IEC721-3-3 3K5 + 3Z11)					
	– 5 °C ... + 60 °C					
	5 % ... 95 %					
	I in accordance with DIN EN 61010-1 : 2002 – 08					
	IP20 in accordance with DIN EN 40050 Part 9: 1993 – 05					
	DIN EN 61000-6-3: 2005 – 06 (IEC 61000-6-3) DIN EN 61000-6-2: 2006 – 03 (IEC 61000-6-2)					

multisys Dimensions

multisys eBus-Master

3D6-ET-8-EBM
3D6-ET-8-AIO

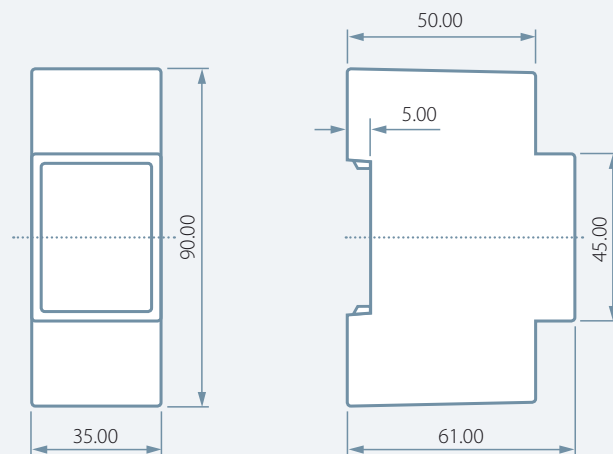


multisys Gateways

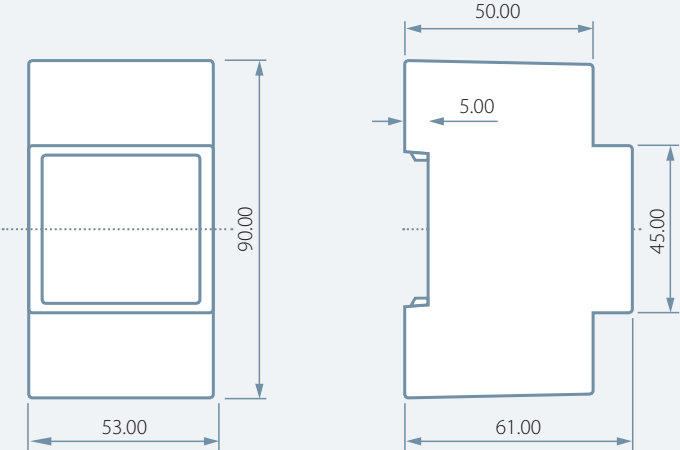
2D2-ESET
2D2-BSET
2D2-ESBS
2D2-BSES

multisys Repeater

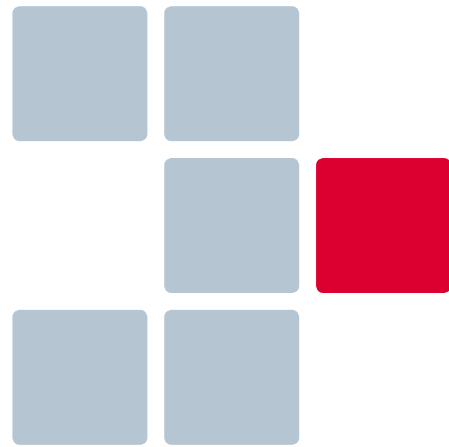
2D2-BSBS
2D2-ESES



multisys Gateway
1D3-ESDP



POWER



QUALITY

Reactive current compensation and improvement of network quality are essential aspects of the KBR Energy Management. The components of the compensation facilities are developed by and manufactured by KBR in its own production facilities, for switching elements KBR relies on renowned manufacturers: an important prerequisite for stable and safe processes.

secureC[®]

Safety concept

→ page 92



multicomp

Reactive power controller

→ page 96



multicond

Power capacitors

→ page 108



multiind

Filter circuit reactors

→ page 116



multiton

Audio frequency blocking devices

→ page 126



thyroswitch

Thyristor switch for capacitors

→ page 132



multicab-F

Fixed capacitors

→ page 142



multimod-F

Reactive current compensation modules

→ page 148



multimod-R

Controlled compensation facilities on assembly plate

→ page 160



multicab-R

Controlled compensation facilities

→ page 166



multilog

Mobile network analysis device

→ page 190



BLUEWAVE

Active filter

→ page 180



Accessories

→ page 204

The safety and maintenance concept of KBR

secureC

Monitoring



secureC[®]

KBR Safty Concept

Compensation systems with
certified quality products
from KBR

Analyzing



Optimizing



The safety aspect is crucial for the operation of reactive current facilities. Here, the **secureC safety and maintenance concept** is used. Special monitoring functions ensure, together with KBR quality products, a high degree of availability. If the web-based analysis software **visual energy 4** is used, a detailed error analysis is possible from the workplace.



The concept

Safety is of central importance for reactive current compensation facilities. This is why KBR has developed the **safety and maintenance concept secureC**, which ensures the maximum availability of a compensation facility – even in networks that are loaded heavily with harmonics. The concept is based on KBR quality products, which enable a reliable monitoring of resonance frequency, stage backup

fuses and relay contacts. A special temperature management system provides additional protection from breakdown. Moreover, if the web-based analysis software **visual energy 4** is used, a detailed error analysis is possible from the workplace. The secureC label of quality distinguishes such compensation facilities.

Advantages

- Maximum availability of the facility
- High degree of safety through the use of quality components
- More transparency through web-based analysis and visualization software **visual energy 4**
- The best KBR service provision in the context of the maintenance contract



secureC Safety and maintenance concept



The elements

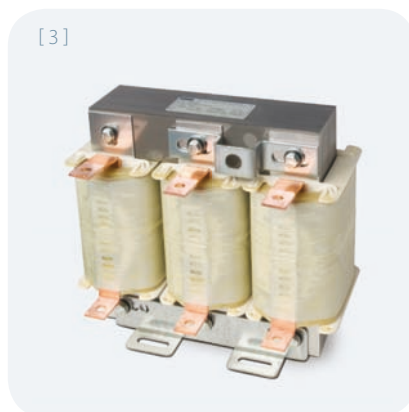
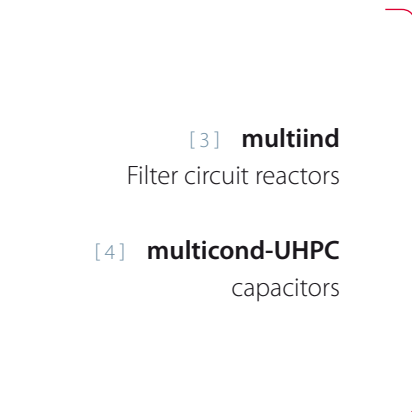
secureC can be deployed with the reactive power controller **multicomp** – to set up a compensation facility with up to 6 cabinets. **multisio** expansion modules can be connected to the basic module – for each basic module, 5 relay modules multisio 1D2-4RO, 5 temperature modules multisio 1D2-1TI2RO and 6 current measuring modules multisio 1D2-0-BS-4CI. This makes it possible to control up

to 24 stages. Other components of the secureC concept: **multicond-UHPC** capacitors and **multiind** filter circuit reactors – also developed and produced by KBR. The KBR ventilation concept, the web-based analysis software **visual energy 4** and the **KBR support**, based on a maintenance contract, complete the secureC concept.



[1] **multicomp**
Reactive power controller

[2] **multisio**
Basic modules and expansion modules (relay modules, temperature modules, current measuring modules)



[3] **multiind**
Filter circuit reactors

[4] **multicond-UHPC**
capacitors



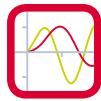
[5] **KBR ventilation concept**

[6] **KBR Support**
maintenance contract with service provisions visual energy 4



How it works

→ **Monitoring resonance frequency, stage backup fuse and relay contacts**



Because capacity during operation is reduced by damaged capacitors in heavily loaded networks, the **resonance frequency** is continually changing. This means that a facility that was correctly set up can become a latent danger the longer it is in operation. The unavoidable shifting of the resonance points through capacity loss is accounted for by **secureC** as it calculates the resulting new resonance frequency.

Evaluating the resonance frequency is done taking into account the programmed reactor factor. If critical frequencies are reached, the display issues corresponding warnings which are logged in the event memory. If previously defined resonance frequencies are exceeded, there is a switch-off, and if necessary, the stages involved are blocked. The **secureC** concept also detects the setting off of individual **fuses** (no current increase when switching – message »Check fuse«) or »sticking« **relay contacts** (no drop in current when switching off – message »contactor defect«).

→ **Temperature management**



The **secureC** concept furthermore contains a special **temperature management** system. Conventional controllers simply switch off the entire facility if a limiting temperature is reached, and put up with not only reactive current costs, but also very high apparent current, which can also trigger switches. The temperature management system of **secureC** on the other hand ensures that such cases are avoided as far as possible. As before, the fans are activated when the first temperature threshold is reached – separately for each cabinet, of course. If this is not sufficient, and an equivalent stage is available in another cabinet (stage power, detuning, thyristor/contactor), this is used as an alternative. Even if the emergency switch-off temperature is reached, despite these preventive switching operations, not all stages are taken out simultaneously, but one after another, with a delay of two minutes.

→ **Error analysis with visual energy 4**



visual energy 4 as the web-based information headquarters of the KBR system, completes the **secureC** concept. The analysis and visualization software provides extensive functions for recording, monitoring, analyzing, and optimizing technical networks and facilities. Practical functions, a clearly laid out user interface, intuitive operability and ease of adaptability to specific situations make **visual energy 4** a genuine highlight. **visual energy 4** provides numerous options for evaluating data and for passing these on to SAP or SQL databases. The data that are read out via bus and stored in a database can be handed easily over to the business department: for rapid evaluation and billing – based on a proper distribution of the energy data to the respective cost centers.

Reactive power controller

multicomp

Monitoring



Recording

Optimizing



multicomp reactive power controllers are the main component of reactive power compensation facilities. After calculating the compensation power, they automatically switch capacitor stages on or off in order to reduce the strain on electrical supply installations loaded unnecessarily by inductive reactive current, and to reduce reactive consumption costs.

multicomp 96 LCD bus

Intelligent control for 4-quadrant operation, with freely programmable stage power and KBR eBus interface.



multicomp 144 LCD

Self-optimizing system through freely programmable stage powers



multicomp 96 LCD bus

4 to 24 switch relays to control the compensation modules.

multicomp 144 LCD

Housing size
(H x W x D in mm) **144 x 144 x 60**

Data display **LCD**



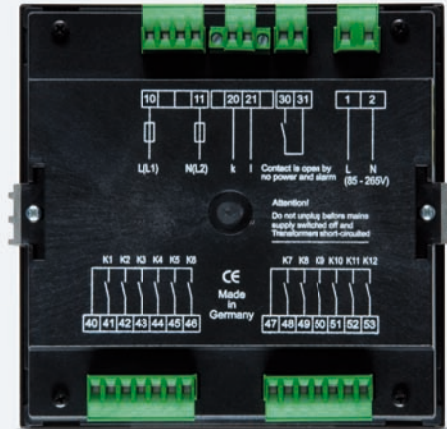
4 quadrant - reactive power controllers

- Highlights**
- Real reactive power measurement and calculation of the necessary compensation power in 4-quadrant operation
 - Rapid compensation with few switching operations
 - Display with two-line LC display, stage status and recovery
 - Control logic always circuit switching for the same stages
 - Manual-0-automatic switch separately programmable for each stage

An overall view of **technical details** can be found on pages 102/104.
The **housing dimensions** are listed on page 106.

The microcontroller-controlled **multicomp 144 LCD** records all network data relevant to the control of small facilities via A/D transformer inputs. After calculating the required compensation power to achieve the desired target $\cos \varphi$, the available capacitor stages are automatically switched on or off with a few switching operations. The multicomp 144 LCD switches capacitors of the same

powers in circuit switching. Programming is menu assisted and performed with two buttons. Facility-specific values are stored in a non-volatile memory. Each stage can be switched individually via the built-in manual-0-automatic function.



Rear side multicond 144 LCD

→ 4-quadrant operation

Through the increasing economic exposure of energy costs, more and more own generation plants will be setup. This can result, in low load periods of companies, in energy being fed back into the supply network. All possible conditions concerning consumption and the delivery of active and reactive power must therefore be taken into account at the control system. If for example, asynchronous generators are used to generate energy, it may happen that active power is fed into the supply network and reactive power is taken from the supply network.

multicomp 96 LCD bus



4 quadrant - reactive power controllers

- Highlights**
- Detecting and compensating the missing compensation power in case of recovery into the energy supplier network
 - The network analysis and limiting value monitoring function for the protection of capacitors from overvoltages, overcurrents and excessive harmonic load.
 - Integrated temperature measurement input for monitoring the ambient temperature and switching on ventilators if the limiting values are exceeded
 - Modular up to 24 stages

An overall view of **technical details** can be found on pages 103/105.
The **housing dimensions** are listed on page 106.

The **multicomp 96 LCD bus** reactive power controller works automatically in 4-quadrant operation (generator operation), i.e. even with energy feedback to the utility company network, missing compensated power is detected without a problem and compensated. Through the integrated temperature measurement input, the ambient temperature in the reactive power compensation

equipment is also monitored, and if a predefined limiting temperature is exceeded, the fan is switched on. The multicomp 96 LCD also has an interface for connection to the KBR Energybus, whereby all settings can be conveniently made from the PC (without the display module). In addition, the bus communication can be adjusted from the KBR eBus to the Modbus RTU/ASCII.



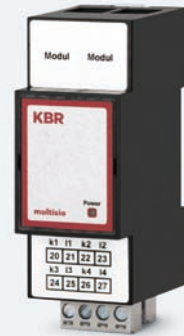
Display module **multicond 96 LCD bus**



Relay module **2D2-4RO**



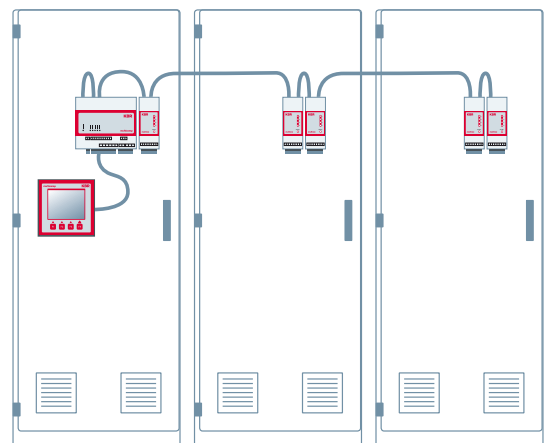
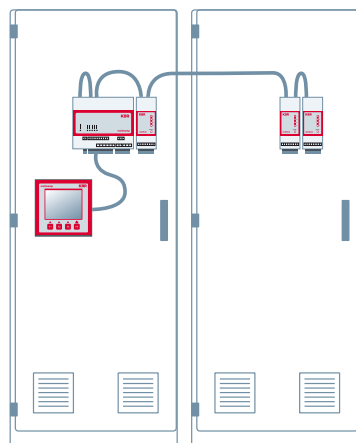
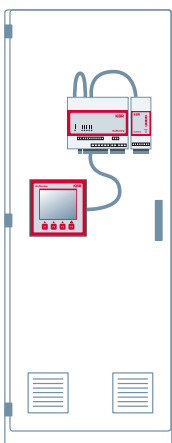
2D2-1TI2RO



1D2-4CI

The **multicond 96 LCD bus** and the **multicond safety and maintenance module**, in combination with the **temperature module multi-tm** and the **relay module multi-ro**, perform reliable monitoring and switching functions during reactive current compensation. Thanks to the use of ribbon cables, a simple expansion of the facility is possible.

- Simple connection of expansion facilities thanks to ribbon and bus technology
- Each cabinet can be represented separately with the web-based analysis software visual energy 4
- Smaller cabling expense
- Each facility cabinet can be controlled and monitored individually (control via ventilation, temperature measurement, safety shutdown)



Controller cabinet		Controller and expansion cabinet		Controller cabinet and 2 expansion cabinets		
400/16		400/8	400/4	400/16	400/4	400/4
2 x 25, 3 x 50, 2 x 100 kvar		4 x 50, 2 x 100 kvar	4 x 100 kvar	4 x 50, 2 x 100 kvar	4 x 100 kvar	4 x 100 kvar
1 x multicond 96 LCD bus 1 x 2D2-4RO		1 x multicond 96 LCD bus 1 x 2D2-4RO	1 x 2D2-4RO 1 x 2D2-1TI2RO	1 x multicond 96 LCD bus 1 x 2D2-4RO	1 x 2D2-4RO 1 x 2D2-1TI2RO	1 x 2D2-4RO 1 x 2D2-1TI2RO


multicomp Technical details

		DEVICE TYPE	multicomp 144 LCD
			[1] 2F144-1V1C6RO [2] 2F144-1V1C12RO [3] 3F144-1V1C6DO [4] 3F144-1V1C12DO [5] 3F144-1V1C6DO6RO
STAGES	Relay outputs; 250 VA per output; 250 V AC: 50/60 Hz		[1] 6 [2] 12 [3] 6 optocoupler outputs [4] 12 optocoupler outputs [5] 6 relay and 6 optocoupler outputs
	Power per stage [kvar] programmable		free
	Discharge times programmable		0 ... 900 sec.
	Manual-0-automatic switch Status display		
	Learning function for automatic programming via induced current measurement (requirement: transformer x/1A fitted into the cable to the compensation facility)		Via series transformer
	Rotary field and phase allocation programmable		■
SWITCHING PERFORMANCE	Self-optimizing (circuit switching of the same stages)		■
	Special switching functions for		–
	Switch-off limit for light load operation		Fixed
MONITORING FUNCTIONS	No-voltage trigger		■
	Excess current switch-off (only in connection with induced current measurement)		–
	Excess current switch-off		Fixed
	Temperature measurement and monitoring with fan control and emergency switch-off		–
	Harmonics monitoring with alarm message and emergency switch-off Additional displays		■
	Alarm messages programmable		■
	Target cos φ monitoring; alarm if unreachable		■
	Switching operation monitoring with display per stage		■
Controller status display (over/ undercompensation)		■	
SPECIAL OPERATING MODE	Thyristor high-speed circuit breaker		■
DISPLAYS	Display type		LCD
	Measurement parameters (RMS values)		U_{PH-N} , U_{PH-PH} , $\cos \varphi$, $f_{network}$, I_{main} , $P_{overall}$, $Q_{overall}$ requirement
	Operating time display		–
MEASUREMENT	Measuring precision: Voltage Current Power		2% 2% 4%
	Update speed		200 ms
	Single phase measurement (4Q)		Phase-phase or phase-neutral

multicomp 96 LCD bus 4D6-ESBDS-1-1V1C6RO	Relay module 2D2-4RO	Temperature module 2D2-1TI2RO	Current measurement module 1D2-4CI
Modular 4 – 24	4	2	–
free			
0 ... 900 sec.			
For each stage <input checked="" type="checkbox"/>			
Via series transformer or in connection with multisio 1D2-4CI via induced current transformer			
<input checked="" type="checkbox"/>			
<input checked="" type="checkbox"/>			
Combination filter			
Fixed			
<input checked="" type="checkbox"/>			
<input checked="" type="checkbox"/> In connection with 1D2-4CI			
<input checked="" type="checkbox"/>			
<input checked="" type="checkbox"/>			
<input checked="" type="checkbox"/>			
<input checked="" type="checkbox"/> Voltage: DF – U; 3rd – 19th harm.			
<input checked="" type="checkbox"/>			
<input checked="" type="checkbox"/>			
<input checked="" type="checkbox"/>			
<input checked="" type="checkbox"/>			
<input checked="" type="checkbox"/>			
<input checked="" type="checkbox"/>			
–			
LCD (dot matrix 128 x 96)			
U_{L-N} or U_{L-L} $\cos \varphi$ δ $f_{network}$ I_{main} $I_{induced}$ $P_{tot.}$ $Q_{overall\ requirement}$			
<input checked="" type="checkbox"/>			
2% 2% 4%			
~ 300 ms			
Phase-phase or phase-neutral			

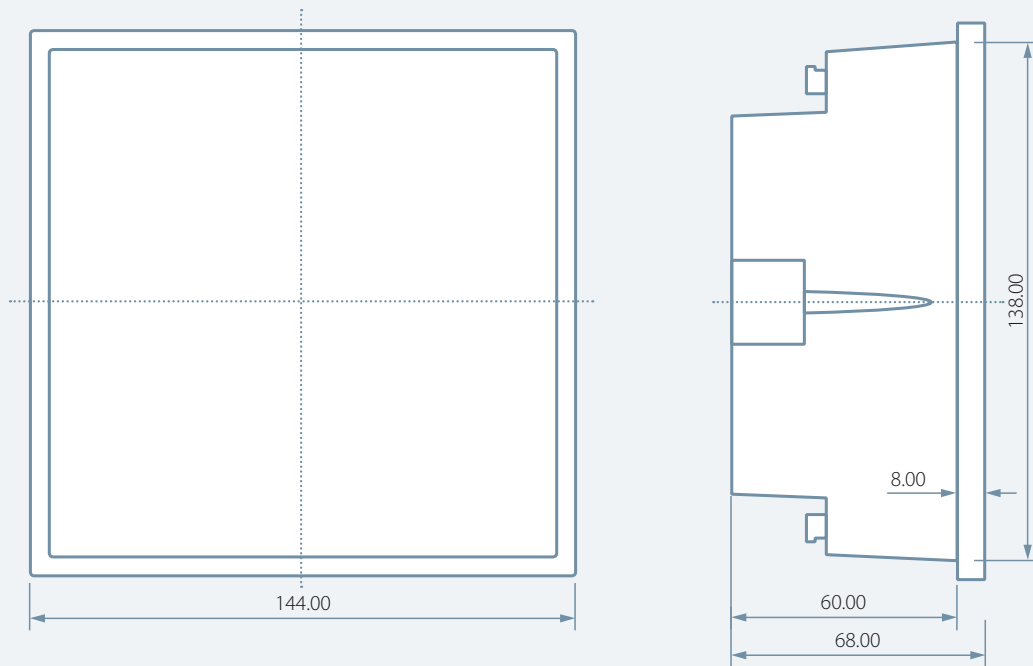
multicomp Technical details

		DEVICE TYPE	multicomp 144 LCD
MEMORY	Long-term memory for switching operations		–
PASSWORD PROTECTION	With digit code		■
INPUTS	Voltage path	Low voltage; direct measurement	30 V ... 690 V ... 790 V AC
		Medium voltage	–
	Current path	Series transformer	1 x 0,05 A ... 5 A ... 6 A AC
		Induced current transformer	–
	Frequency range	50 or 60 Hz	
2. Setpoint $\cos \varphi 2$	Automatic switchover in case of energy recovery	To $\cos \varphi = 1$	
OUTPUTS	Additional relay outputs Error message relay / fan relay	■	Error message relay
INTERFACES	Serial interface with KBR eBus protocol		–
POWER SUPPLY	Operating voltage Frequency Power consumption	85 – 265 V AC/DC 50 – 60 Hz 12 VA	
DIMENSIONS	Housing: Flush mounting, size in mm (H x W x D)		144 x 144 x 60

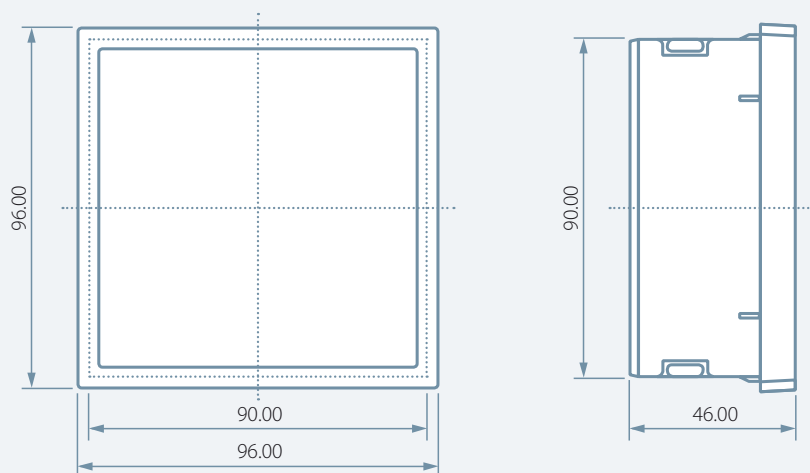
multicomp 96 LCD bus 4D6-ESBDS-1-1V1C6RO	Relay module 1D2-BS-4RO	Temperature module 1D2-BS-4TI	Current measurement module 1D2-4CI
For events and error messages; battery-buffered with timestamp			
1 x 100 V ... 500 V ... 600 V AC			
0.01 kV ... 30 kV programmable			
1 x 0.01 A ... 1 A ... 1.2 A AC and 1 x 0.05 A ... 5 A ... 6 A AC			
–			
40 – 70 Hz			
– automatic switchover in case of energy recovery to $\cos \phi_2$, value freely programmable			
			
RS485 Modbus			
85 V – 265 V AC/DC 50 – 60 Hz 15 VA			
90 x 106 x 60	90 x 35 x 60	90 x 35 x 60	90 x 35 x 60

multicomp Dimensions

multicomp 144 LCD

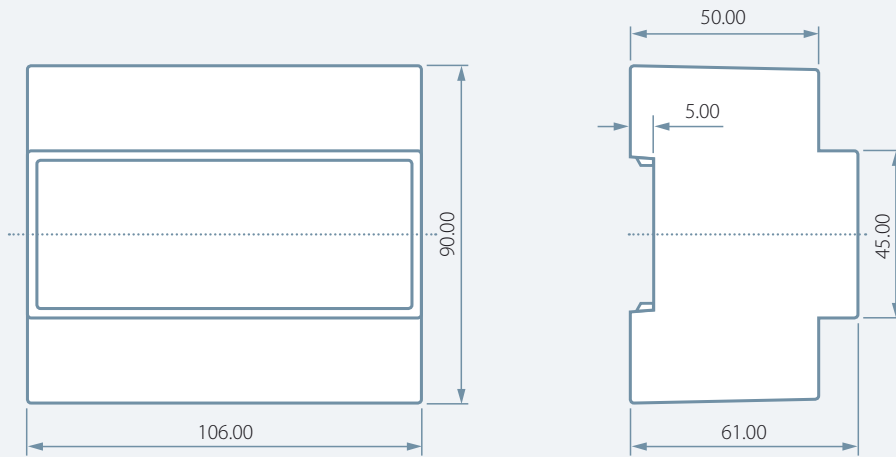


multicomp 96 LCD bus

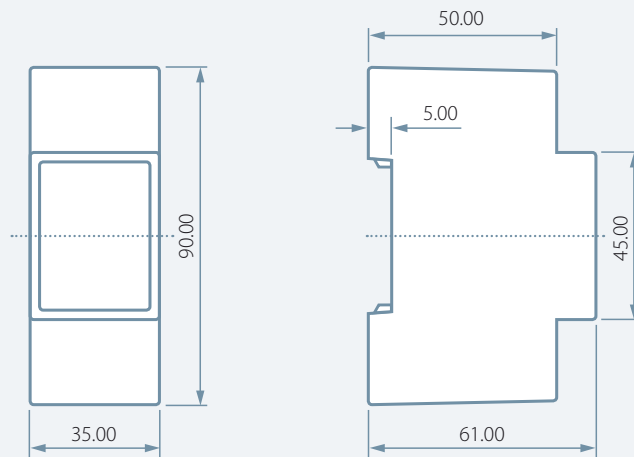


Switchboard cutout (H x W x D) 90 x 90

multicomp controller module



multisio relay, temperature and current measuring module



Power capacitors

multicond



multicond are 3-phase power capacitors for reactive current compensation, developed for networks with many harmonics. Apart from a long working life and high current and voltage load capacity, safety in case of overload (3-phase internal overpressure disconnecter) is a crucial advantage of the compact components, constructed according to dry safety concepts. Other features: good thermal conduction, low build-up of heat as well as reliable performance at high ambient temperatures.

multicond-UHPC 30.0-440-3P

Power capacitor with a power of > 15 kvar.

**multicond-UHPC 15.0-440-3P**

Power capacitor with a power range from 1.5 to 15 kvar.

multicond

Rated voltage U_n **280, 440, 480,
525 oder 690 V**

Rated frequency f **50/60 Hz**



Power capacitor for reactive current compensation

- Highlights**
- Power from 1.5 to 37 kvar
 - Capacitor rated voltage of 280, 440, 480, 525 or 690 V
 - High level of safety through drying technology and 3-phase internal overpressure disconnecter
 - Including compact discharge resistor
 - Long working life

An overall view of **technical details** can be found on page 115
A **construction diagram** can be found on page 114.

multicond-UHPC power capacitors stand out through their combined safety concept of a self-restoring effect and 3-phase internal overpressure disconnecter. In low voltage networks, inadmissibly high voltage peaks up to 3 times the rated voltage can occur through switching procedures. If these loads lead to flashovers in the dielectric, the self-restoring effect comes into play. The capacitor remains fully functional as this happens. The 3-phase internal overpressure disconnecter starts to func-

tion if the gas amount released by the many self-restoring procedures causes a specific internal pressure. The lid of the aluminum casing bends slightly and the fuse disconnects the capacitor from the network.

Note: Depending on the network voltage and when used in detuned units, a correspondingly higher capacitor rated voltage must be selected.

Specifications multicond-UHPC

Capacitor rated voltage: **280 V**

FREQUENCY	POWER ON NETWORK VOLTAGE									CURRENT ON MAX. VOLTAGE	RATED CAPACITY	CAN SIZE in mm	WEIGHT	TYPE
	230V	280V	400V	415V	440V	480V	525V	600V	690V					
Hz	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	A	μF	d x h (h+t+12)	kg	multicond- ...
50	5.0	7.4	–	–	–	–	–	–	–	15.3	3 x 100.1	116 x 255	2,6	UHPC-7.4-280-3P
60	6.0	8.9	–	–	–	–	–	–	–	18.4				
50	10.0	14.8	–	–	–	–	–	–	–	30.5	3 x 200.3	136 x 255	3,3	UHPC-14.8-280-3P
60	12.0	17.8	–	–	–	–	–	–	–	36.7				

Capacitor rated voltage: **440 V**

FREQUENCY	POWER ON NETWORK VOLTAGE									CURRENT ON MAX. VOLTAGE	RATED CAPACITY	CAN SIZE in mm	WEIGHT	TYPE
	230V	280V	400V	415V	440V	480V	525V	600V	690V					
Hz	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	A	μF	d x h (h+t+12)	kg	multicond- ...
50	–	–	1.5	1.6	1.8	–	–	–	–	2.4	3 x 9.9	70 x 215	1,0	UHPC-1.8-440-3P
60	–	–	1.8	1.9	2.2	–	–	–	–	2.9				
50	–	–	2.0	2.1	2.4	–	–	–	–	3.1	3 x 13.2	70 x 215	1,1	UHPC-2.4-440-3P
60	–	–	2.4	2.6	2.9	–	–	–	–	3.8				
50	–	–	2.5	2.7	3.0	–	–	–	–	3.9	3 x 16.4	70 x 215	1,2	UHPC-3.0-440-3P
60	–	–	3.0	3.2	3.6	–	–	–	–	4.7				
50	–	–	4.1	4.4	5.0	–	–	–	–	6.6	3 x 27.4	70 x 215	1,3	UHPC-5.0-440-3P
60	–	–	5.0	5.3	6.0	–	–	–	–	7.9				
50	–	–	5.0	5.4	6.1	–	–	–	–	8.0	3 x 33.4	70 x 215	1,4	UHPC-6.1-440-3P
60	–	–	6.0	6.5	7.3	–	–	–	–	9.6				
50	–	–	6.2	6.7	7.5	–	–	–	–	9.8	3 x 41.1	85 x 215	1,8	UHPC-7.5-440-3P
60	–	–	7.4	8.0	9.0	–	–	–	–	11.8				
50	–	–	7.5	8.1	9.1	–	–	–	–	11.9	3 x 49.9	85 x 215	2,0	UHPC-9.1-440-3P
60	–	–	9.0	9.7	10.9	–	–	–	–	14.3				
50	–	–	8.3	8.9	10.0	–	–	–	–	13.1	3 x 54.8	85 x 215	2,2	UHPC-10.0-440-3P
60	–	–	9.9	10.7	12.0	–	–	–	–	15.7				
50	–	–	9.3	10.0	11.2	–	–	–	–	14.7	3 x 61.4	85 x 215	2,3	UHPC-11.2-440-3P
60	–	–	11.1	12.0	13.4	–	–	–	–	17.6				
50	–	–	10.0	10.8	12.1	–	–	–	–	15.9	3 x 66.3	100 x 215	2,5	UHPC-12.1-440-3P
60	–	–	12.0	12.9	14.5	–	–	–	–	19.0				
50	–	–	11.7	12.5	14.1	–	–	–	–	18.5	3 x 77.3	100 x 215	2,7	UHPC-14.1-440-3P
60	–	–	14.0	15.1	16.9	–	–	–	–	22.2				
50	–	–	12.5	13.4	15.1	–	–	–	–	19.8	3 x 82.8	100 x 215	2,8	UHPC-15.1-440-3P
60	–	–	15.0	16.1	18.1	–	–	–	–	23.8				
50	–	–	14.1	15.2	17.1	–	–	–	–	22.4	3 x 93.7	116 x 255	2,6	UHPC-17.1-440-3P
60	–	–	17.0	18.3	20.5	–	–	–	–	26.9				
50	–	–	15.0	16.2	18.2	–	–	–	–	23.9	3 x 99.7	116 x 255	2,6	UHPC-18.2-440-3P
60	–	–	18.0	19.4	21.8	–	–	–	–	28.6				
50	–	–	16.5	17.8	20.0	–	–	–	–	26.2	3 x 109.6	116 x 255	2,4	UHPC-20.0-440-3P
60	–	–	19.8	21.3	24.0	–	–	–	–	31.5				

Table continued on next page.

multicond

and: Capacitor rated voltage: 440 V

FREQUENCY	POWER ON NETWORK VOLTAGE									CURRENT ON MAX. VOLTAGE	RATED CAPACITY	CAN SIZE in mm	WEIGHT	TYPE
	230V	280V	400V	415V	440V	480V	525V	600V	690V					
Hz	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	A	μF	d x h (h + t + 12)	kg	multicond- ...
50	-	-	17.5	18.9	21.2	-	-	-	-	27.8	3 x 116.2	116 x 255	2,5	UHPC-21.2-440-3P
60	-	-	21.0	22.6	25.4	-	-	-	-	33.3				
50	-	-	20.0	21.5	24.2	-	-	-	-	31.8	3 x 132.6	116 x 255	2,5	UHPC-24.2-440-3P
60	-	-	24.0	25.8	29.0	-	-	-	-	38.1				
50	-	-	22.5	24.2	27.2	-	-	-	-	35.7	3 x 149.1	136 x 255	3,4	UHPC-27.2-440-3P
60	-	-	27.0	29.0	32.6	-	-	-	-	42.8				
50	-	-	23.2	25.0	28.1	-	-	-	-	36.9	3 x 154.0	136 x 255	3,5	UHPC-28.1-440-3P
60	-	-	27.9	30.0	33.7	-	-	-	-	44.2				
50	-	-	25.0	27.0	30.3	-	-	-	-	39.8	3 x 166.1	136 x 255	3,5	UHPC-30.3-440-3P
60	-	-	30.1	32.4	36.4	-	-	-	-	47.8				
50	-	-	30.0	32.3	36.3	-	-	-	-	47.6	3 x 198.9	136 x 255	3,3	UHPC-36.3-440-3P
60	-	-	36.0	38.7	43.6	-	-	-	-	57.2				

Capacitor rated voltage: **480 V**

FREQUENCY	POWER ON NETWORK VOLTAGE									CURRENT ON MAX. VOLTAGE	RATED CAPACITY	CAN SIZE in mm	WEIGHT	TYPE
	230V	280V	400V	415V	440V	480V	525V	600V	690V					
Hz	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	A	μF	d x h (h + t + 12)	kg	multicond- ...
50	-	-	2.5	2.7	3.0	3.6	-	-	-	4.3	3 x 16.6	70 x 215	1,2	UHPC-3.6-480-3P
60	-	-	3.0	3.2	3.6	4.3	-	-	-	5.2				
50	-	-	4.2	4.5	5.0	6.0	-	-	-	7.2	3 x 27.6	70 x 215	1,4	UHPC-6.0-480-3P
60	-	-	5.0	5.4	6.0	7.2	-	-	-	8.7				
50	-	-	4.9	5.3	6.0	7.1	-	-	-	8.5	3 x 32.7	85 x 215	1,8	UHPC-7.1-480-3P
60	-	-	5.9	6.4	7.2	8.5	-	-	-	10.2				
50	-	-	6.2	6.7	7.6	9.0	-	-	-	10.8	3 x 41.4	85 x 215	2,0	UHPC-9.0-480-3P
60	-	-	7.5	8.1	9.1	10.8	-	-	-	13.0				
50	-	-	7.5	8.1	9.1	10.8	-	-	-	13.0	3 x 49.7	100 x 215	2,3	UHPC-10.8-480-3P
60	-	-	9.0	9.7	10.9	13.0	-	-	-	15.6				
50	-	-	8.3	8.9	10.0	11.9	-	-	-	14.3	3 x 54.8	100 x 215	2,3	UHPC-11.9-480-3P
60	-	-	9.9	10.7	12.0	14.3	-	-	-	17.2				
50	-	-	8.7	9.3	10.5	12.5	-	-	-	15.0	3 x 57.6	100 x 215	2,5	UHPC-12.5-480-3P
60	-	-	10.4	11.2	12.6	15.0	-	-	-	18.0				
50	-	-	9.9	10.7	12.0	14.3	-	-	-	17.2	3 x 65.9	100 x 215	2,7	UHPC-14.3-480-3P
60	-	-	11.9	12.8	14.4	17.2	-	-	-	20.7				
50	-	-	11.6	12.5	14.0	16.7	-	-	-	20.1	3 x 76.9	116 x 255	2,7	UHPC-16.7-480-3P
60	-	-	13.9	15.0	16.8	20.0	-	-	-	24.1				
50	-	-	12.4	13.4	15.0	17.9	-	-	-	21.5	3 x 82.4	116 x 255	2,7	UHPC-17.9-480-3P
60	-	-	14.9	16.1	18.0	21.5	-	-	-	25.9				
50	-	-	16.5	17.8	20.0	23.8	-	-	-	28.6	3 x 109.6	116 x 255	2,5	UHPC-23.8-480-3P
60	-	-	19.8	21.3	24.0	28.6	-	-	-	34.4				
50	-	-	17.4	18.7	21.0	25.0	-	-	-	30.1	3 x 115.1	116 x 255	2,5	UHPC-25.0-480-3P
60	-	-	20.8	22.4	25.2	30.0	-	-	-	36.1				
50	-	-	20.7	22.3	25.0	29.8	-	-	-	35.8	3 x 137.2	136 x 255	3,5	UHPC-29.8-480-3P
60	-	-	24.8	26.7	30.0	35.8	-	-	-	43.1				

Table continued on next page.

and: Capacitor rated voltage: 480 V

FREQUENCY	POWER ON NETWORK VOLTAGE									CURRENT ON MAX. VOLTAGE	RATED CAPACITY	CAN SIZE in mm	WEIGHT	TYPE
	230V	280V	400V	415V	440V	480V	525V	600V	690V					
Hz	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	A	µF	d x h (h + t + 12)	kg	multicond- ...
50	-	-	23.2	25.0	28.1	33.4	-	-	-	40.2	3 x 153.8	136 x 255	3,5	UHPC-33.4-480-3P
60	-	-	27.8	30.0	33.7	40.1	-	-	-	48.2				
50	-	-	24.8	26.7	30.0	35.7	-	-	-	42.9	3 x 164.4	136 x 255	3,6	UHPC-35.7-480-3P
60	-	-	29.7	32.0	36.0	42.8	-	-	-	51.5				

Capacitor rated voltage: 525 V

FREQUENCY	POWER ON NETWORK VOLTAGE									CURRENT ON MAX. VOLTAGE	RATED CAPACITY	CAN SIZE in mm	WEIGHT	TYPE
	230V	280V	400V	415V	440V	480V	525V	600V	690V					
Hz	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	A	µF	d x h (h + t + 12)	kg	multicond- ...
50	-	-	2.3	2.5	2.8	3.3	4.0	-	-	4.4	3 x 15.4	70 x 215	1,3	UHPC-4.0-525-3P
60	-	-	2.8	3.0	3.4	4.0	4.8	-	-	5.3				
50	-	-	2.5	2.7	3.0	3.6	4.3	-	-	4.7	3 x 16.6	70 x 215	1,3	UHPC-4.3-525-3P
60	-	-	3.0	3.2	3.6	4.3	5.2	-	-	5.7				
50	-	-	2.9	3.1	3.5	4.2	5.0	-	-	5.5	3 x 19.2	70 x 215	1,3	UHPC-5.0-525-3P
60	-	-	3.5	3.7	4.2	5.0	6.0	-	-	6.6				
50	-	-	3.5	3.7	4.2	5.0	6.0	-	-	6.6	3 x 23.1	70 x 215	1,4	UHPC-6.0-525-3P
60	-	-	4.2	4.5	5.1	6.0	7.2	-	-	7.9				
50	-	-	4.4	4.7	5.3	6.3	7.5	-	-	8.2	3 x 28.9	85 x 215	1,8	UHPC-7.5-525-3P
60	-	-	5.2	5.6	6.3	7.5	9.0	-	-	9.9				
50	-	-	4.6	5.0	5.6	6.7	8.0	-	-	8.8	3 x 30.8	85 x 215	1,9	UHPC-8.0-525-3P
60	-	-	5.6	6.0	6.7	8.0	9.6	-	-	10.6				
50	-	-	5.0	5.4	6.0	7.2	8.6	-	-	9.5	3 x 33.1	85 x 215	1,9	UHPC-8.6-525-3P
60	-	-	6.0	6.4	7.2	8.6	10.3	-	-	11.3				
50	-	-	5.8	6.2	7.0	8.4	10.0	-	-	11.0	3 x 38.5	85 x 215	2,2	UHPC-10.0-525-3P
60	-	-	7.0	7.5	8.4	10.0	12.0	-	-	13.2				
50	-	-	7.3	7.8	8.8	10.4	12.5	-	-	13.7	3 x 48.1	100 x 215	2,5	UHPC-12.5-525-3P
60	-	-	8.7	9.4	10.5	12.5	15.0	-	-	16.5				
50	-	-	7.5	8.1	9.1	10.9	13.0	-	-	14.3	3 x 50.0	100 x 215	2,5	UHPC-13.0-525-3P
60	-	-	9.0	9.7	10.9	13.0	15.6	-	-	17.2				
50	-	-	8.7	9.4	10.5	12.5	15.0	-	-	16.5	3 x 57.7	100 x 215	2,6	UHPC-15.0-525-3P
60	-	-	10.4	11.2	12.6	15.0	18.0	-	-	19.8				
50	-	-	9.9	10.6	11.9	14.2	17.0	-	-	18.7	3 x 65.4	116 x 255	2,7	UHPC-17.0-525-3P
60	-	-	11.8	12.7	14.3	17.0	20.4	-	-	22.4				
50	-	-	10.5	11.2	12.6	15.0	18.0	-	-	19.8	3 x 69.3	116 x 255	2,7	UHPC-18.0-525-3P
60	-	-	12.5	13.5	15.2	18.1	21.6	-	-	23.8				
50	-	-	11.6	12.5	14.0	16.7	20.0	-	-	22.0	3 x 77.0	116 x 255	2,7	UHPC-20.0-525-3P
60	-	-	13.9	15.0	16.9	20.1	24.0	-	-	26.4				
50	-	-	12.2	13.1	14.7	17.5	21.0	-	-	23.1	3 x 80.8	116 x 255	2,6	UHPC-21.0-525-3P
60	-	-	14.6	15.7	17.7	21.1	25.2	-	-	27.7				
50	-	-	14.5	15.6	17.6	20.9	25.0	-	-	27.5	3 x 96.2	116 x 255	2,5	UHPC-25.0-525-3P
60	-	-	17.4	18.7	21.1	25.1	30.0	-	-	33.0				
50	-	-	17.4	18.7	21.1	25.1	30.0	-	-	33.0	3 x 115.5	136 x 255	3,5	UHPC-30.0-525-3P
60	-	-	20.9	22.5	25.3	30.1	36.0	-	-	39.6				
50	-	-	21.5	23.1	26.0	30.9	37.0	-	-	40.7	3 x 142.4	136 x 255	3,4	UHPC-37.0-525-3P
60	-	-	25.8	27.7	31.2	37.1	44.4	-	-	48.8				

multicond

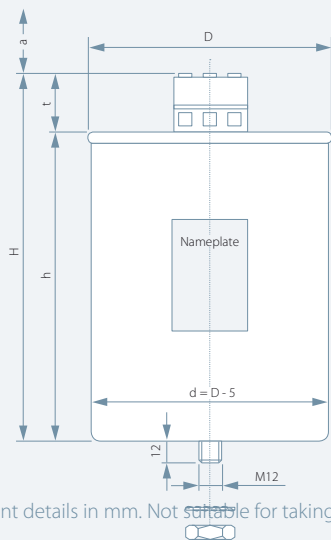
Capacitor rated voltage: **690 V** star-connected

FREQUENCY	POWER ON NETWORK VOLTAGE									CURRENT ON MAX. VOLTAGE	RATED CAPACITY	CAN SIZE in mm	WEIGHT	TYPE
	230V	280V	400V	415V	440V	480V	525V	600V	690V					
Hz	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	A	μF	d x h (h+t+12)	kg	multicond- ...
50	-	-	-	-	-	-	-	3.8	5.0	4.2	3 x 11.1	75 x 215	1,4	UHPC-5.0-690-3S
60	-	-	-	-	-	-	-	4.5	6.0	5.0				
50	-	-	-	-	-	-	-	7.6	10.0	8.4	3 x 22.3	85 x 215	2,6	UHPC-10.0-690-3S
60	-	-	-	-	-	-	-	9.1	12.0	10.0				
50	-	-	-	-	-	-	-	9.5	12.5	10.5	3 x 27.9	100 x 215	2,8	UHPC-12.5-690-3S
60	-	-	-	-	-	-	-	11.4	15.0	12.6				
50	-	-	-	-	-	-	-	11.3	15.0	12.6	3 x 33.4	116 x 255	2,2	UHPC-15.0-690-3S
60	-	-	-	-	-	-	-	13.6	18.0	15.1				
50	-	-	-	-	-	-	-	15.1	20.0	16.7	3 x 44.6	116 x 255	3,0	UHPC-20.0-690-3S
60	-	-	-	-	-	-	-	18.2	24.0	20.1				
50	-	-	-	-	-	-	-	18.9	25.0	20.9	3 x 55.7	136 x 255	3,6	UHPC-25.0-690-3S
60	-	-	-	-	-	-	-	22.7	30.0	25.1				

Performances and sizes deviating from the standard are available on request. All changes reserved.

Example for order: Power capacitor, 30.3 kvar to 440 V. The corresponding order detail is as follows: **Type multicond-UHPC-30.3-440-3P**

Construction diagram



All measurement details in mm. Not suitable for taking measurements.

General:

- Adapter box, safe to touch
- Expansion (a) maximum 12 mm
- Minimum clearance upwards 13 mm

Mounting:

- M12 threaded bolts
- Tightening torque $T = 10 \text{ Nm}$
- Serrated lock washer J12 DIN 6797
- Hexagonal nut BM12 DIN 439

Adapter box:

D 116 (16 mm²)

- Terminal screw M4
- Adapter box $t = 30 \text{ mm}$
- Tightening torque $T = 1.3 \text{ Nm}$

D 136 (25 mm²)

- Terminal screw M5
- Adapter box $t = 33 \text{ mm}$
- Tightening torque $T = 2.5 \text{ Nm}$

multicond Technical details

Power capacitors for reactive current compensation

Rated voltage Frequency	$U_n = 280, 440, 480, 525$ or 690 V 50/60 Hz
Maximum permissible operating voltage	$1.0 \times U_n$ lasting $1.1 \times U_n$ on 8 hours/day $1.15 \times U_n$ on 30 minutes/day $1.2 \times U_n$ 200 x 5 minutes $1.3 \times U_n$ on 200 x 1 minute
Maximum permissible operating current	$1,5 \times I_n$ bei 0 – 15,9 kvar $2,0 \times I_n$ bei > 15,9 kvar
Maximum inrush current	$400 \times I_n$
Capacity tolerance	+/- 5 %
Power dissipation	< 0.25 W/kvar, without discharge resistors
Voltage test (terminal – terminal)	$2,15 \times U_{nenn}$ (AC), 2 sec
Voltage test (terminal – housing)	≤ 600 V : 3000 V (AC), 10 sec > 600 V : 6000 V (AC), 10 sec
Life expectancy	> 150000 h
Temperature class (ambient temperature)	-40/60 °C
Maximum permissible temperature on housing	65 °C on housing surface
Cooling	Natural cooling
Permissible humidity	95 %
Maximum deployment altitude	4000 m above sea-level
Installation site, installation position	M12 threaded bolts on ground
Fixing	M12 Gewindebolzen am Boden
Safety features	→ Drying technology → Self-restoring → Internal overpressure disconnecter 3-phase
Housing	Aluminum
Schutzart	IP 20
Mode of protection	Polypropylene
Dielectric	High-purity gas, SF6-free, PCB-free
Terminal strips	Double-sided terminal strip, safe to touch
Discharge	Discharge resistors on outside of strip
Standards	IEC 60831-1 + 2, EN 60831-1 + 2, VDE 0560-46 + 47

Filter circuit reactors

multiind

Monitoring



Recording

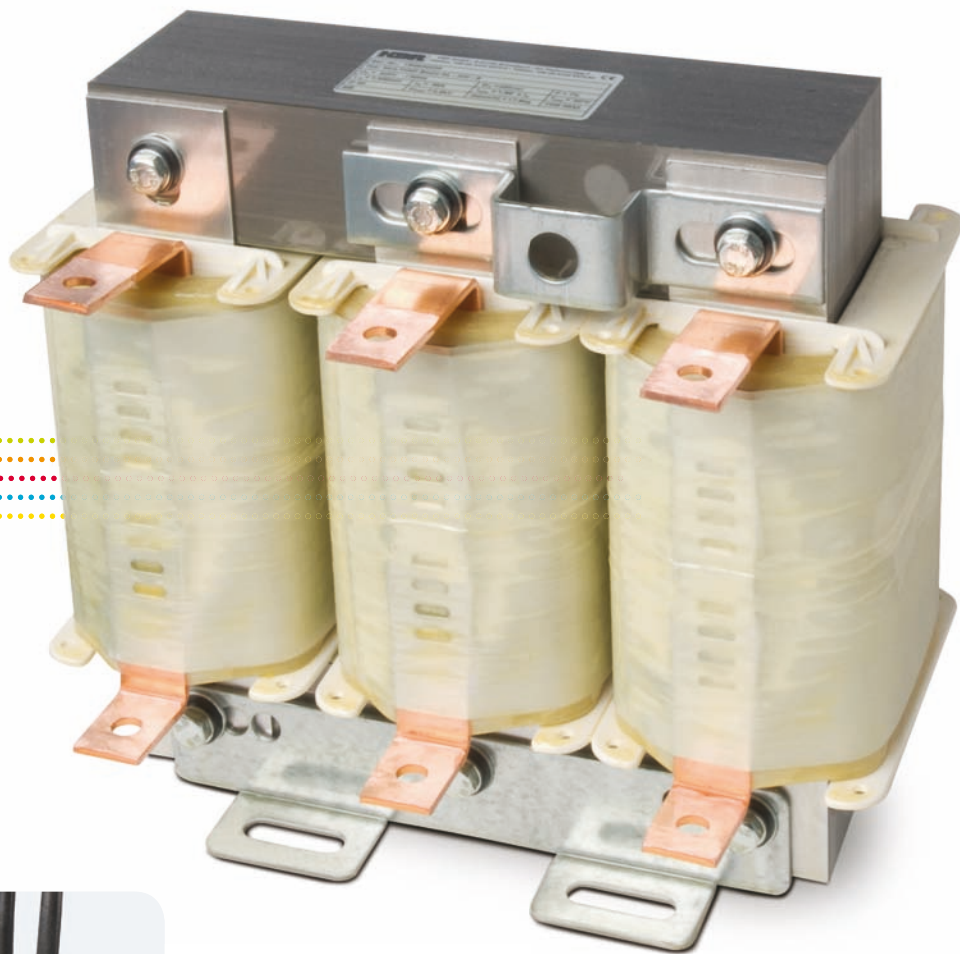
Optimizing



multiind filter circuit reactors are suitable for constructing detuned reactive current compensation units to prevent resonance phenomena through harmonics. High linearities here guarantee a functional stability even in the overload area.

multiind ... Al

Filter circuit reactors with aluminum winding.




multiind ... Cu

Filter circuit reactors with copper winding.

multiind

Power	2,5 – 75 kvar
Reactor factor	5.5, 7 oder 8 % 12.5 oder 14 %



Filter circuit reactors for reactive current compensation

- Highlights**
- Power values from 2.5 to 75 kvar
 - High linearity, low power dissipation
 - Overload protection through temperature switch
 - Low-noise through impregnation
 - Long working life
 - Improvement of impedance behavior

An overall view of the **technical data** can be found on pages 124/125.
Construction diagrams can be found on page 123.

Note on the temperature switch

For a trouble-free function and long working life, the in-built temperature sensor must interrupt the main circuit of the filter circuit reactor.

Note on assembly

- Observe the applicable DIN/VDE regulations.
- Network connection, setup and operation of a device only by qualified personnel.
- Stay within the maximum current, voltage and temperature range.
- Ensure sufficient ventilation.
- Tighten connections with torque.

Specifications multiind-basic ... 5.5 %

Reactor factor: **5.5 %** Resonance frequency: **214 Hz**

POWER kvar	TYPE multiind-basic ... 5.5 %	INDUCTIVITY		RATED CURRENT A	DIMENSIONS in mm							CONNECTION			DIA- GRAM	WEIGHT kg	CAPACITY µF	CAPACITOR multicond UHPC... -440-3P
		Cu	Al		mH	H	W	D	W1	W2	LL	L	AW	RK				
2,5	multiind-basic 400-02.5-5.5-Cu-L-S	x		11,15	3,6	165	180	86	95	62,5	9	x			A	5,3	3 x 16,7	3.0
5	multiind-basic 400-05.0-5.5-Cu-L-S	x		5,57	7,2	165	180	106	95	82,5	9	x			A	6,8	3 x 33,3	6.0
7,5	multiind-basic 400-07.5-5.5-Cu-L-S	x		3,74	10,8	165	180	106	95	83	9	x			A	9,6	3 x 49,7	9.0
10	multiind-basic 400-10.0-5.5-Cu-L-S	x		2,80	14,4	195	210	109	95	86	9	x			A	12,9	3 x 66,3	12.1
12,5	multiind-basic 400-12.5-5.5-Cu-L-S	x		2,24	18	220	240	95	95	71	9	x			A	14,5	3 x 83,0	15.1
15	multiind-basic 400-15.0-5.5-Cu-L-S	x		1,98	21,6	220	240	105	95	81	9	x			A	16,8	3 x 93,7	17.1
20	multiind-basic 400-20.0-5.5-Cu-L-S	x		1,40	28,8	220	240	125	95	81	9	x			A	18,5	3 x 132,7	24.2
25	multiind-basic 400-25.0-5.5-Cu-L-S	x		1,21	36	220	240	135	95	91	9	x			A	21	3 x 154,0	25.0
30	multiind-basic 400-30.0-5.5-Cu-L-S	x		0,99	43,2	220	240	125	95	81	9	x			A	19,4	3 x 187,3	2 x 17.1
40	multiind-basic 400-40.0-5.5-Cu-L-S	x		0,75	57,6	220	240	135	95	91	9	x			A	22,3	3 x 249,0	1 x 21.1 + 1 x 24.2
50	multiind-basic 400-50.0-5.5-Cu-L-S	x		0,60	72	270	300	107	95	82	9	x			A	28,5	3 x 307,0	2 x 28.1
60	multiind-basic 400-60.0-5.5-Cu-L-S	x		0,51	86,4	270	300	145	95	145	9	x			A	36	3 x 364,7	1 x 6.1 + 2 x 30.3
75	multiind-basic 400-75.0-5.5-Cu-L-S	x		0,40	108	270	300	150	95	107	9	x			A	40,4	3 x 461,7	3 x 28.1

Specifications multiind-light ... 7 %

Reactor factor: **7 %** Resonance frequency: **189 Hz**

POWER kvar	TYPE multiind-light ... 7 %	INDUCTIVITY		RATED CURRENT A	DIMENSIONS in mm							CONNECTION			DIA- GRAM	WEIGHT kg	CAPACITY µF	CAPACITOR multicond UHPC... -440-3P
		Cu	Al		mH	H	W	D	W1	W2	LL	L	AW	RK				
2,5	multiind-light 400-02.5-7-Cu-L-S	x		14,19	3,6	165	180	86	95	62,5	9	x			A	5,1	3 x 16,7	3.0
5	multiind-light 400-05.0-7-Cu-L-S	x		7,09	7,2	165	180	86	95	62,5	9	x			A	6,1	3 x 33,3	6.0
7,5	multiind-light 400-07.5-7-Cu-L-S	x		4,76	10,8	165	180	96	95	72,5	9	x			A	7,8	3 x 49,7	9.0
10	multiind-light 400-10.0-7-Cu-L-S	x		3,56	14,4	165	180	106	95	82,5	9	x			A	9,2	3 x 66,3	12.1
12,5	multiind-light 400-12.5-7-Cu-L-S	x		2,85	18	195	210	109	95	86	9	x			A	12,4	3 x 83,0	15.1
15	multiind-light 400-15.0-7-Cu-L-S	x		2,52	21,6	195	210	109	95	86	9	x			A	12,9	3 x 93,7	17.1
20	multiind-light 400-20.0-7-Cu-L-S	x		1,78	28,8	195	210	109	95	86	9	x			A	14,0	3 x 132,7	24.2
25	multiind-light 400-25.0-7-Cu-L-S	x		1,54	36	220	240	115	95	91	9	x			A	19,1	3 x 154,0	25.0
25	multiind-light 400-25.0-7-Al-AW-S		x	1,54	36	220	240	145	95	91	9		x		C	17,4	3 x 154,0	25.0
30	multiind-light 400-30.0-7-Cu-L-S	x		1,26	43,2	220	240	135	95	91	9	x			A	20,2	3 x 187,3	2 x 17.1
30	multiind-light 400-30.0-7-Al-AW-S		x	1,26	43,2	220	240	145	95	91	9		x		C	17,4	3 x 187,3	2 x 17.1
40	multiind-light 400-40.0-7-Cu-L-S	x		0,95	57,6	220	240	145	95	101	9	x			A	35,0	3 x 248,7	1 x 21.2 + 1 x 24.2
40	multiind-light 400-40.0-7-Al-AW-S		x	0,95	57,6	240	260	167	95	112	9		x		C	27,0	3 x 248,7	1 x 21.2 + 1 x 24.2
50	multiind-light 400-50.0-7-Cu-L-S	x		0,77	72	270	300	145	95	95	9	x			A	32,0	3 x 308,0	2 x 28.1
50	multiind-light 400-50.0-7-Al-AW-S		x	0,77	72	240	260	167	95	112	9		x		C	26,0	3 x 308,0	2 x 28.1
60	multiind-light 400-60.0-7-Cu-L-S	x		0,65	86,4	270	300	145	95	95	9	x			A	39,4	3 x 364,7	1 x 6.1 + 2 x 30.3
60	multiind-light 400-60.0-7-Al-AW-S		x	0,65	86,4	270	300	180	95	95	9		x		C	36,0	3 x 364,7	1 x 6.1 + 2 x 30.3
75	multiind-light 400-75.0-7-Cu-L-S	x		0,51	108	270	300	180	95	122	9	x			A	47,1	3 x 461,7	3 x 28.1
75	multiind-light 400-75.0-7-Al-AW-S		x	0,51	108	270	300	180	95	122	9		x		C	36,0	3 x 461,7	3 x 28.1

multiind

Specifications multiind-basic ... 7%

Reactor factor: **7%** Resonance frequency: **189 Hz**

POWER kvar	TYPE multiind-basic ... 7%	INDUCTIVITY		RATED CURRENT A	DIMENSIONS in mm							CONNECTION			DIA- GRAM	WEIGHT kg	CAPACITY µF	CAPACITOR multicond UHPC ... -440-3P
		Cu	Al		mH	H	W	D	W1	W2	LL	L	AW	RK				
2,5	multiind-basic 400-02.5-7-Cu-L-S	x		14,19	3,6	165	180	86	95	62,5	9	x			A	5,1	3 x 16,7	3.0
5	multiind-basic 400-05.0-7-Cu-L-S	x		7,09	7,2	165	180	86	95	62,5	9	x			A	6,1	3 x 33,3	6.0
7,5	multiind-basic 400-07.5-7-Cu-L-S	x		4,76	10,8	165	180	96	95	72,5	9	x			A	7,8	3 x 49,7	9.0
10	multiind-basic 400-10.0-7-Cu-L-S	x		3,56	14,4	165	180	106	95	82,5	9	x			A	9,2	3 x 66,3	12.1
12,5	multiind-basic 400-12.5-7-Cu-L-S	x		2,85	18	195	210	109	95	86	9	x			A	12,4	3 x 83,0	15.1
15	multiind-basic 400-15.0-7-Cu-L-S	x		2,52	21,6	195	210	109	95	86	9	x			A	12,9	3 x 93,7	17.1
20	multiind-basic 400-20.0-7-Cu-L-S	x		1,78	28,8	220	240	105	95	81	9	x			A	14,0	3 x 132,7	24.2
25	multiind-basic 400-25.0-7-Cu-L-S	x		1,54	36	220	240	115	95	91	9	x			A	19,1	3 x 154,0	25.0
25	multiind-basic 400-25.0-7-Al-AW-S		x	1,54	36	220	240	145	95	91	9		x		C	17,4	3 x 154,0	25.0
30	multiind-basic 400-30.0-7-Cu-L-S	x		1,26	43,2	220	240	135	95	91	9	x			A	20,2	3 x 187,3	2 x 17.1
30	multiind-basic 400-30.0-7-Al-AW-S		x	1,26	43,2	220	240	145	95	91	9		x		C	17,4	3 x 187,3	2 x 17.1
40	multiind-basic 400-40.0-7-Cu-L-S	x		0,95	57,6	220	240	145	95	101	9	x			A	35,0	3 x 248,7	1 x 21.2 + 1 x 24.2
40	multiind-basic 400-40.0-7-Al-AW-S		x	0,95	57,6	240	260	167	95	112	9		x		C	27,0	3 x 248,7	1 x 21.2 + 1 x 24.2
50	multiind-basic 400-50.0-7-Cu-L-S	x		0,77	72	270	300	145	95	95	9	x			A	32,0	3 x 308,0	2 x 28.1
50	multiind-basic 400-50.0-7-Al-AW-S		x	0,77	72	240	260	167	95	112	9		x		C	26,0	3 x 308,0	2 x 28.1
60	multiind-basic 400-60.0-7-Cu-L-S	x		0,65	86,4	270	300	145	95	95	9	x			A	39,4	3 x 364,7	1 x 6.1 + 2 x 30.3
60	multiind-basic 400-60.0-7-Al-AW-S		x	0,65	86,4	270	300	180	95	95	9		x		C	36,0	3 x 364,7	1 x 6.1 + 2 x 30.3
75	multiind-basic 400-75.0-7-Cu-L-S	x		0,51	108	270	300	180	95	122	9	x			A	47,1	3 x 461,7	3 x 28.1
75	multiind-basic 400-75.0-7-Al-AW-S		x	0,51	108	270	300	180	95	122	9		x		C	36,0	3 x 461,7	3 x 28.1

Specifications multiind-light ... 8%

Reactor factor: **8%** Resonance frequency: **177 Hz**

POWER kvar	TYPE multiind-light ... 8%	INDUCTIVITY		RATED CURRENT A	DIMENSIONS in mm							CONNECTION			DIA- GRAM	WEIGHT kg	CAPACITY µF	CAPACITOR multicond UHPC ... -440-3P
		Cu	Al		mH	H	W	D	W1	W2	LL	L	AW	RK				
2,5	multiind-light 400-02.5-8-Cu-L-S	x		16,21	3,6	165	180	86	95	62,5	9	x			A	5,1	3 x 16,7	3.0
5	multiind-light 400-05.0-8-Cu-L-S	x		8,11	7,2	165	180	86	95	62,5	9	x			A	6,1	3 x 33,3	6.0
7,5	multiind-light 400-07.5-8-Cu-L-S	x		5,44	10,8	165	180	96	95	72,5	9	x			A	7,8	3 x 49,7	9.0
10	multiind-light 400-10.0-8-Cu-L-S	x		4,07	14,4	195	210	92	95	68,5	9	x			A	9,2	3 x 66,3	12.1
12,5	multiind-light 400-12.5-8-Cu-L-S	x		3,26	18	195	210	109	95	86	9	x			A	12,4	3 x 83,0	15.1
15	multiind-light 400-15.0-8-Cu-L-S	x		2,88	21,6	195	210	109	95	86	9	x			A	12,7	3 x 93,7	17.1
20	multiind-light 400-20.0-8-Cu-L-S	x		2,04	28,8	220	240	105	95	81	9	x			A	14,0	3 x 132,7	24.2
25	multiind-light 400-25.0-8-Cu-L-S	x		1,75	36	220	240	115	95	91	9	x			A	19,1	3 x 154,0	25.0
30	multiind-light 400-30.0-8-Cu-L-S	x		1,44	43,2	220	240	135	95	91	9	x			A	20,3	3 x 187,3	2 x 17.1
30	multiind-light 400-30.0-8-Al-AW-S		x	1,44	43,2	220	240	145	95	91	9		x		C	18,1	3 x 187,3	2 x 17.1
40	multiind-light 400-40.0-8-Cu-L-S	x		1,09	57,6	220	240	155	95	105	9	x			A	25,0	3 x 248,7	1 x 21.2 + 1 x 24.2
40	multiind-light 400-40.0-8-Al-AW-S		x	1,09	57,6	220	240	185	95	105	9		x		C	27,0	3 x 248,7	1 x 21.2 + 1 x 24.2
50	multiind-light 400-50.0-8-Cu-L-S	x		0,88	72	270	300	145	95	95	9	x			A	32,0	3 x 308,0	2 x 28.1
50	multiind-light 400-50.0-8-Al-AW-S		x	0,88	72	240	260	167	95	112	9		x		C	26,0	3 x 308,0	2 x 28.1
60	multiind-light 400-60.0-8-Cu-L-S	x		0,74	86,4	270	300	145	95	95	9	x			A	39,4	3 x 364,7	1 x 6.1 + 2 x 30.3
60	multiind-light 400-60.0-8-Al-AW-S		x	0,74	86,4	270	300	210	95	122	9		x		C	36,0	3 x 364,7	1 x 6.1 + 2 x 30.3
75	multiind-light 400-75.0-8-Cu-L-S	x		0,59	108	270	300	180	95	122	9	x			A	47,1	3 x 461,7	3 x 28.1
75	multiind-light 400-75.0-8-Al-AW-S		x	0,59	108	270	300	210	95	122	9		x		C	36,0	3 x 461,7	3 x 28.1

Specifications multiind-basic ... 8%

Reactor factor: **8%** Resonance frequency: **177 Hz**

POWER kvar	TYPE multiind-basic ... 8%	INDUCTIVITY		RATED CURRENT A	DIMENSIONS in mm							CONNECTION			DIA- GRAM	WEIGHT kg	CAPACITY µF	CAPACITOR multicond UHPC... -440-3P
		Cu	Al		mH	H	W	D	W1	W2	LL	L	AW	RK				
2,5	multiind-basic 400-02.5-8-Cu-L-S	x		16,21	3,6	165	180	86	95	62,5	9	x			A	5,1	3 x 16,7	3.0
5	multiind-basic 400-05.0-8-Cu-L-S	x		8,11	7,2	165	180	86	95	62,5	9	x			A	6,1	3 x 33,3	6.0
7,5	multiind-basic 400-07.5-8-Cu-L-S	x		5,44	10,8	165	180	96	95	72,5	9	x			A	7,8	3 x 49,7	9.0
10	multiind-basic 400-10.0-8-Cu-L-S	x		4,07	14,4	195	210	92	95	68,5	9	x			A	9,2	3 x 66,3	12.1
12,5	multiind-basic 400-12.5-8-Cu-L-S	x		3,26	18	195	210	109	95	86	9	x			A	12,4	3 x 83,0	15.1
15	multiind-basic 400-15.0-8-Cu-L-S	x		2,88	21,6	195	210	109	95	86	9	x			A	12,7	3 x 93,7	17.1
20	multiind-basic 400-20.0-8-Cu-L-S	x		2,04	28,8	195	210	109	95	86	9	x			A	14,0	3 x 132,7	24.2
25	multiind-basic 400-25.0-8-Cu-L-S	x		1,75	36	220	240	115	95	91	9	x			A	19,1	3 x 154,0	25.0
30	multiind-basic 400-30.0-8-Cu-L-S	x		1,44	43,2	220	240	135	95	91	9	x			A	20,3	3 x 187,3	2 x 17.1
30	multiind-basic 400-30.0-8-Al-AW-S		x	1,44	43,2	220	240	145	95	91	9		x		C	18,1	3 x 187,3	2 x 17.1
40	multiind-basic 400-40.0-8-Cu-L-S	x		1,09	57,6	220	240	155	95	105	9	x			A	25,0	3 x 248,7	1 x 21.2 + 1 x 24.2
40	multiind-basic 400-40.0-8-Al-AW-S		x	1,09	57,6	220	240	185	95	105	9		x		C	27,0	3 x 248,7	1 x 21.2 + 1 x 24.2
50	multiind-basic 400-50.0-8-Cu-L-S	x		0,88	72	270	300	145	95	95	9	x			A	32,0	3 x 308,0	2 x 28.1
50	multiind-basic 400-50.0-8-Al-AW-S		x	0,88	72	240	260	167	95	112	9		x		C	26,0	3 x 308,0	2 x 28.1
60	multiind-basic 400-60.0-8-Cu-L-S	x		0,74	86,4	270	300	145	95	95	9	x			A	39,4	3 x 364,7	1 x 6.1 + 2 x 30.3
60	multiind-basic 400-60.0-8-Al-AW-S		x	0,74	86,4	270	300	210	95	122	9		x		C	36,0	3 x 364,7	1 x 6.1 + 2 x 30.3
75	multiind-basic 400-75.0-8-Cu-L-S	x		0,59	108	270	300	180	95	122	9	x			A	47,1	3 x 461,7	3 x 28.1
75	multiind-basic 400-75.0-8-Al-AW-S		x	0,59	108	270	300	210	95	122	9		x		C	36,0	3 x 461,7	3 x 28.1

Specifications multiind-basic ... 12.5%

Reactor factor: **12.5%** Resonance frequency: **142 Hz**

POWER kvar	TYPE multiind-basic ... 12.5%	INDUCTIVITY		RATED CURRENT A	DIMENSIONS in mm							CONNECTION			DIA- GRAM	WEIGHT kg	CAPACITY µF	CAPACITOR multicond UHPC... -525-3P
		Cu	Al		mH	H	W	D	W1	W2	LL	L	AW	RK				
2,5	multiind-basic 400-02.5-12.5-Cu-L-S	x		27,53	3,6	165	180	86	95	62,5	9	x			A	5,3	3 x 15,3	4.0
5	multiind-basic 400-05.0-12.5-Cu-L-S	x		13,77	7,2	165	180	86	95	72,5	9	x			A	8,7	3 x 30,7	8.0
7,5	multiind-basic 400-07.5-12.5-Cu-L-S	x		8,44	10,8	195	210	92	95	68,5	9	x			A	9,9	3 x 50,0	13.0
10	multiind-basic 400-10.0-12.5-Cu-L-S	x		7,32	14,4	195	210	109	95	86	9	x			A	14,0	3 x 57,7	15.0
12,5	multiind-basic 400-12.5-12.5-Cu-L-S	x		6,089	18	220	240	95	95	71	9	x			A	15,1	3 x 69,3	18.0
15	multiind-basic 400-15.0-12.5-Cu-L-S	x		5,23	21,6	220	240	95	95	71	9	x			A	15,1	3 x 80,7	21.0
20	multiind-basic 400-20.0-12.5-Cu-L-S	x		3,65	28,8	220	240	125	95	101	9	x			A	23,9	3 x 115,7	30.0
20	multiind-basic 400-20.0-12.5-Al-AW-S		x	3,65	28,8	240	260	167	95	112	9			x	C	23,2	3 x 115,7	30.0
25	multiind-basic 400-25.0-12.5-Cu-L-S	x		2,97	36	220	240	145	95	101	9	x			A	24,7	3 x 142,3	37.0
25	multiind-basic 400-25.0-12.5-Al-AW-S		x	2,97	36	240	260	167	95	112	9		x		C	26,7	3 x 142,3	37.0
30	multiind-basic 400-30.0-12.5-Cu-L-S	x		2,44	43,2	220	240	145	95	101	9	x			A	24,7	3 x 173,3	1 x 15.0 + 1 x 30.0
30	multiind-basic 400-30.0-12.5-Al-AW-S		x	2,44	43,2	240	260	167	95	112	9		x		C	25,7	3 x 173,3	1 x 15.0 + 1 x 30.0
40	multiind-basic 400-40.0-12.5-Cu-L-S	x		1,83	57,6	270	300	145	95	95	9	x			A	39,4	3 x 231,0	2 x 30.0
40	multiind-basic 400-40.0-12.5-Al-AW-S		x	1,83	57,6	270	300	180	95	107	9		x		C	36,2	3 x 231,0	2 x 30.0
50	multiind-basic 400-50.0-12.5-Cu-L-S	x		1,48	72	270	300	150	95	107	9	x			A	45,9	3 x 284,7	2 x 37.0
50	multiind-basic 400-50.0-12.5-Al-AW-S		x	1,48	72	270	300	210	95	112	9		x		C	41,3	3 x 284,7	2 x 37.0
60	multiind-basic 400-60.0-12.5-Cu-L-S	x		1,22	86,4	270	300	180	95	112	9	x			A	48,6	3 x 346,7	3 x 30.0
75	multiind-basic 400-75.0-12.5-Cu-L-S	x		0,91	108	270	300	180	95	122	9	x			A	50,0	3 x 462,0	3 x 37.0

multiind

Specifications multiind-light ... 14%

Reactor factor: **14%** Resonance frequency: **134 Hz**

POWER kvar	TYPE multiind-light ... 14%	INDUCTIVITY		RATED CURRENT A	DIMENSIONS in mm							CONNECTION			DIA- GRAM	WEIGHT kg	CAPACITY µF	CAPACITOR multicond UHPC... -525-3P
		Cu	Al		mH	H	W	D	W1	W2	LL	L	AW	RK				
2,5	multiind-light 400-02.5-14-Cu-L-S	x		30,84	3,6	165	180	86	95	62,5	9	x			A	5,3	3 x 15,3	4.0
5	multiind-light 400-05.0-14-Cu-L-S	x		15,42	7,2	165	180	96	95	72,5	9	x			A	8,3	3 x 30,7	8.0
7,5	multiind-light 400-07.5-14-Cu-L-S	x		9,46	10,8	195	210	109	95	86	9	x			A	13,4	3 x 50,0	13.0
10	multiind-light 400-10.0-14-Cu-L-S	x		8,20	14,4	195	210	109	95	86	9	x			A	14,1	3 x 57,7	15.0
12,5	multiind-light 400-12.5-14-Cu-L-S	x		6,82	18	220	240	105	95	81	9	x			A	16,9	3 x 69,3	18.0
15	multiind-light 400-15.0-14-Cu-L-S	x		5,86	21,6	220	240	105	95	81	9	x			A	17,9	3 x 80,7	21.0
20	multiind-light 400-20.0-14-Cu-L-S	x		4,09	28,8	220	240	125	95	101	9	x			A	24,3	3 x 115,7	30.0
25	multiind-light 400-25.0-14-Cu-L-S	x		3,32	36	220	240	145	95	101	9	x			A	24,2	3 x 142,3	37.0
25	multiind-light 400-25.0-14-Al-AW-S		x	3,32	36	240	260	167	95	112	9		x		C	24,9	3 x 142,3	37.0
30	multiind-light 400-30.0-14-Cu-L-S	x		2,73	43,2	220	240	145	95	101	9	x			A	24,6	3 x 173,3	1 x 15.0 + 1 x 30.0
30	multiind-light 400-30.0-14-Al-AW-S		x	2,73	43,2	240	260	167	95	112	9		x		C	23,9	3 x 173,3	1 x 15.0 + 1 x 30.0
40	multiind-light 400-40.0-14-Cu-L-S	x		2,05	57,6	270	300	145	95	95	9	x			A	37,1	3 x 231,0	2 x 30.0
40	multiind-light 400-40.0-14-Al-AW-S		x	2,05	57,6	270	300	180	95	107	9		x		C	36,2	3 x 231,0	2 x 30.0
50	multiind-light 400-50.0-14-Cu-L-S	x		1,66	72	270	300	150	95	107	9	x			A	46,5	3 x 284,7	2 x 37.0
50	multiind-light 400-50.0-14-Al-AW-S		x	1,66	72	270	300	210	95	112	9		x		C	39,0	3 x 284,7	2 x 37.0
60	multiind-light 400-60.0-14-Cu-L-S	x		1,36	86,4	270	300	180	95	112	9	x			A	50,0	3 x 346,7	3 x 30.0
75	multiind-light 400-75.0-14-Cu-L-S	x		1,11	108	270	300	180	95	122	9	x			A	50,0	3 x 462,0	3 x 37.0

Specifications multiind-basic ... 14%

Reactor factor: **14%** Resonance frequency: **134 Hz**

POWER kvar	TYPE multiind-basic ... 14%	INDUCTIVITY		RATED CURRENT A	DIMENSIONS in mm							CONNECTION			DIA- GRAM	WEIGHT kg	CAPACITY µF	CAPACITOR multicond UHPC... -525-3P
		Cu	Al		mH	H	W	D	W1	W2	LL	L	AW	RK				
2,5	multiind-basic 400-02.5-14-Cu-L-S	x		30,84	3,6	165	180	86	95	62,5	9	x			A	5,3	3 x 15,3	4.0
5	multiind-basic 400-05.0-14-Cu-L-S	x		15,42	7,2	165	180	96	95	72,5	9	x			A	8,3	3 x 30,7	8.0
7,5	multiind-basic 400-07.5-14-Cu-L-S	x		9,46	10,8	195	210	109	95	86	9	x			A	13,4	3 x 50,0	13.0
10	multiind-basic 400-10.0-14-Cu-L-S	x		8,20	14,4	195	210	109	95	86	9	x			A	14,1	3 x 57,7	15.0
12,5	multiind-basic 400-12.5-14-Cu-L-S	x		5,86	18	220	240	105	95	81	9	x			A	16,9	3 x 80,7	21.0
15	multiind-basic 400-15.0-14-Cu-L-S	x		5,86	21,6	220	240	105	95	81	9	x			A	17,9	3 x 80,7	21.0
20	multiind-basic 400-20.0-14-Cu-L-S	x		4,09	28,8	220	240	125	95	101	9	x			A	24,3	3 x 115,7	30.0
25	multiind-basic 400-25.0-14-Cu-L-S	x		3,32	36	220	240	145	95	101	9	x			A	24,2	3 x 142,3	37.0
25	multiind-basic 400-25.0-14-Al-AW-S		x	3,32	36	240	260	167	95	112	9		x		C	24,9	3 x 142,3	37.0
30	multiind-basic 400-30.0-14-Cu-L-S	x		2,73	43,2	220	240	145	95	101	9	x			A	24,6	3 x 173,3	1 x 15.0 + 1 x 30.0
30	multiind-basic 400-30.0-14-Al-AW-S		x	2,73	43,2	240	260	167	95	112	9		x		C	23,9	3 x 173,3	1 x 15.0 + 1 x 30.0
40	multiind-basic 400-40.0-14-Cu-L-S	x		2,05	57,6	270	300	145	95	95	9	x			A	37,1	3 x 231,0	2 x 30.0
40	multiind-basic 400-40.0-14-Al-AW-S		x	2,05	57,6	270	300	180	95	107	9		x		C	36,2	3 x 231,0	2 x 30.0
50	multiind-basic 400-50.0-14-Cu-L-S	x		1,66	72	270	300	150	95	107	9	x			A	46,5	3 x 284,7	2 x 37.0
50	multiind-basic 400-50.0-14-Al-AW-S		x	1,66	72	270	300	210	95	112	9		x		C	39,0	3 x 284,7	2 x 37.0
60	multiind-basic 400-60.0-14-Cu-L-S	x		1,36	86,4	270	300	180	95	112	9	x			A	50,0	3 x 346,7	3 x 30.0
75	multiind-basic 400-75.0-14-Cu-L-S	x		1,11	108	270	300	180	95	122	9	x			A	50,0	3 x 462,0	3 x 37.0

Construction diagrams

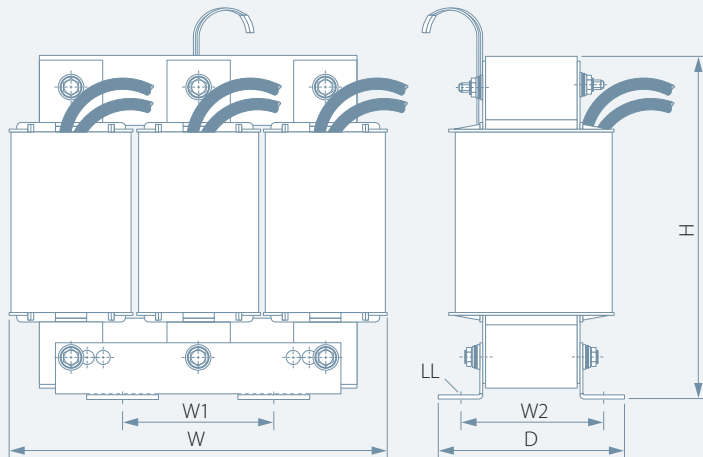


Diagram A

Design with connection leads
Type L

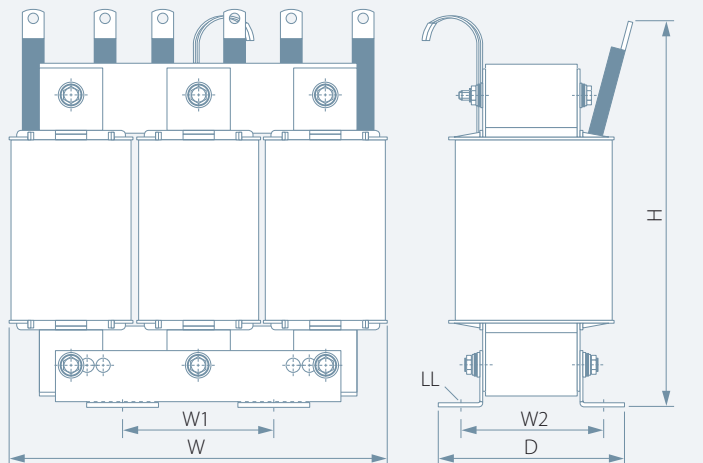


Diagram B

Design with tubular cable socket
Type RK

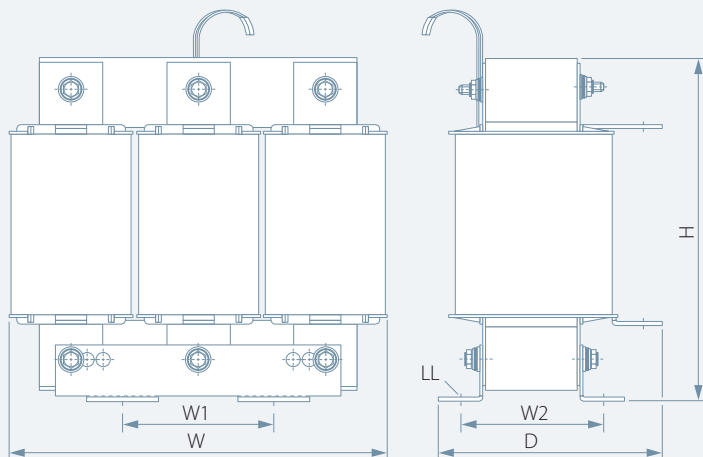


Diagram C

Design with elbow coupling
Type AW

Not suitable for taking measurements. Please also observe assembly notes → Pages 220 – 223.

multiind Technical details

DEVICE TYPE	multiind 5.5		multiind 7.0	
	light $\rho = 5.5\%$	basic $\rho = 5.5\%$	light $\rho = 7\%$	basic $\rho = 7\%$
Rated voltage Frequency	$U_n = 400\text{ V} \quad \quad 50\text{ Hz}$			
Maximum permissible operating voltage	$U_n = 400\text{ V} \pm 10\%$			
Power	2,5 – 75 kvar			
Inductivity stability Inductivity tolerance	$L (I_{Lm}) \geq 0,95 L_N \quad \quad \pm 3\%$			
Overtemperature protection	Break contact at 125 °C (250 V – 50 Hz – 2.5 A), with aluminum winding 145°C			
Mode of protection	IP 00			
Protection class	I			
Ambient temperature	Maximum 40 °C			
Cooling type	Natural cooling			
Impregnation	Vacuum-impregnated			
Reactor factor Resonance frequency	5.5 % 214 Hz		7 % 189 Hz	
Linearity	– $2.1 \times I_{rated}$		$1.6 \times I_{rated}$ $1.85 \times I_{rated}$	
Standards	DIN EN 60289 (VDE 0532-289)			
Designs	Cu = Copper Al = Aluminum L = Connection lead AW = Elbow coupling RK = Tubular cable socket			

	multiind 8.0 light $\rho = 8\%$	multiind 12.5 light $\rho = 12.5\%$	multiind 14.0 light $\rho = 14\%$
	basic $\rho = 8\%$	basic $\rho = 12.5\%$	basic $\rho = 14\%$
$U_n = 400\text{ V}$ 50 Hz			
$U_n = 400\text{ V} \pm 10\%$			
2,5 – 75 kvar	2,5 – 50 kvar		
$L (I_{Lin}) \geq 0,95 L_N$ $\pm 3\%$			
Break contact at $125\text{ }^\circ\text{C}$ ($250\text{ V} - 50\text{ Hz} - 2.5\text{ A}$), with aluminum winding $145\text{ }^\circ\text{C}$			
IP 00			
I			
Maximum $40\text{ }^\circ\text{C}$			
Natural cooling			
Vacuum-impregnated			
8 % 176 Hz	12.5 % 142 Hz	14 % 134 Hz	
$1.6 \times I_{rated}$ $1.85 \times I_{rated}$	$1.4 \times I_{rated}$ $1.5 \times I_{rated}$	$1.4 \times I_{rated}$ $1.5 \times I_{rated}$	
DIN EN 60289 (VDE 0532-289)			
Cu = Copper Al = Aluminum L = Connection lead AW = Elbow coupling RK = Tubular cable socket			

Audio frequency blocking devices

multiton



Recording



Monitoring

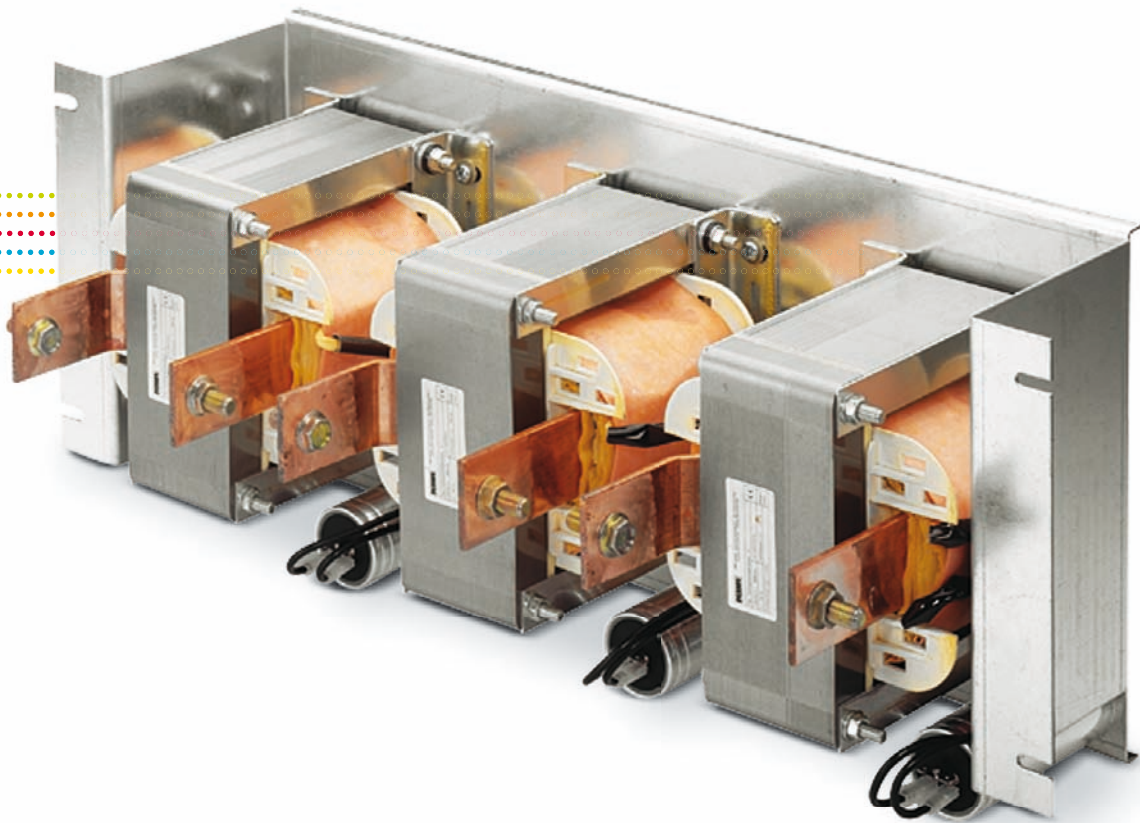


Optimizing

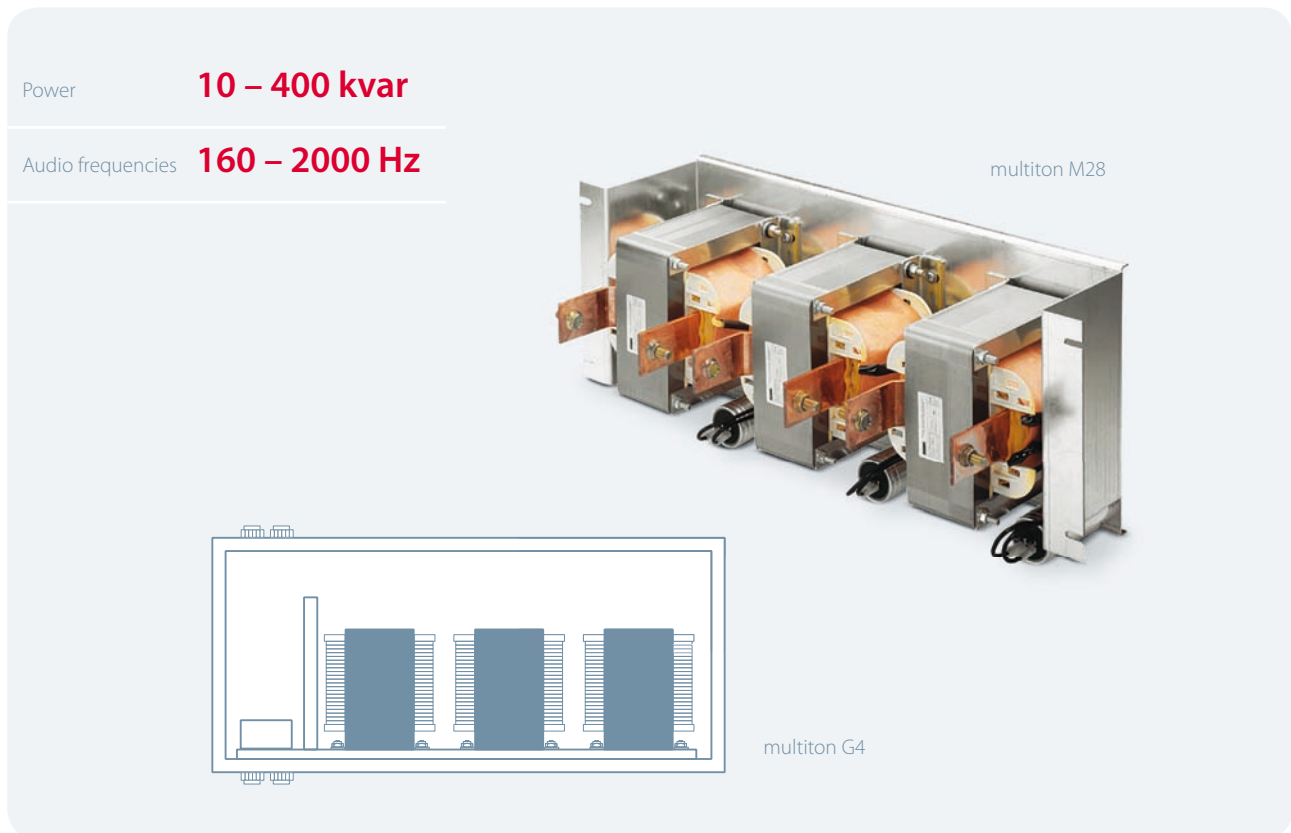
multiton audio frequency blocking devices effectively supplement reactive current compensation units. Ripple signals that arise, which can impair the function of the ripple control system, are reliably blocked off by the quality products manufactured by KBR.

multiton-M28

Audio frequency blocking device in module design for 800 mm wide cabinets.



multiton



Audio frequency blocking devices for reactive current compensation

- Highlights**
- Power from 10 to 400 kvar
 - For audio frequencies from 160 to 2000 Hz
 - Temperature class F

Selection of back-up fuses and supply lines for complete facilities can be found on pages 224/225.

An overall view of **technical details** can be found on page 130.

A **construction diagram** can be found on page 131.

Specifications multiton-TFS1-M/-G

Frequency range: **160 – 350 Hz** and **450 – 2000 Hz**

Audio frequency blocking device in modular construction for 800 mm wide cabinets				Audio frequency blocking device in housing		
POWER ¹ in kvar	TYPE multiton-TFS1-M	CONSTRUCTION TYPE ²	WEIGHT approx. in kg	TYPE multiton-TFS1-G	CONSTRUCTION TYPE ²	WEIGHT approx. in kg
10	multiton-TFS1-M10	M28	19	multiton-TFS1-G10	G4	29
20	multiton-TFS1-M20	M28	20	multiton-TFS1-G20	G4	30
30	multiton-TFS1-M30	M28	22	multiton-TFS1-G30	G4	32
40	multiton-TFS1-M40	M28	23	multiton-TFS1-G40	G4	33
50	multiton-TFS1-M50	M28	29	multiton-TFS1-G50	G4	39
60	multiton-TFS1-M60	M28	30	multiton-TFS1-G60	G4	40
75	multiton-TFS1-M75	M28	31	multiton-TFS1-G75	G4	41
100	multiton-TFS1-M100	M28	40	multiton-TFS1-G100	G4	50
125	multiton-TFS1-M125	M28	40	multiton-TFS1-G125	G4	50
150	multiton-TFS1-M150	M28	41	multiton-TFS1-G150	G4	51
200	multiton-TFS1-M200	M28	48	multiton-TFS1-G200	G4	58
250	multiton-TFS1-M250	M28	51	multiton-TFS1-G250	G4	61
300	multiton-TFS1-M300	M28	70	multiton-TFS1-G300	G4	80
400	multiton-TFS1-M400	M28	75	multiton-TFS1-G400	G4	85

Specifications multiton-TFS2-M/-G

Frequenzbereich: **351 – 449 Hz**

Audio frequency blocking device in modular construction for 800 mm wide cabinets				Audio frequency blocking device in housing		
POWER ¹ in kvar	TYPE multiton-TFS1-M	CONSTRUCTION TYPE ²	WEIGHT approx. in kg	TYPE multiton-TFS1-G	CONSTRUCTION TYPE ²	WEIGHT approx. in kg
10	multiton-TFS2-M10	M28	22	multiton-TFS2-G10	G4	32
20	multiton-TFS2-M20	M28	29	multiton-TFS2-G20	G4	39
30	multiton-TFS2-M30	M28	30	multiton-TFS2-G30	G4	40
40	multiton-TFS2-M40	M28	40	multiton-TFS2-G40	G4	50
50	multiton-TFS2-M50	M28	41	multiton-TFS2-G50	G4	51
60	multiton-TFS2-M60	M28	42	multiton-TFS2-G60	G4	52
75	multiton-TFS2-M75	M28	43	multiton-TFS2-G75	G4	53
100	multiton-TFS2-M100	M28	49	multiton-TFS2-G100	G4	59
125	multiton-TFS2-M125	M28	50	multiton-TFS2-G125	G4	60
150	multiton-TFS2-M150	M28	52	multiton-TFS2-G150	G4	62
200	multiton-TFS2-M200	M28	63	multiton-TFS2-G200	G4	73
250	multiton-TFS2-M250	M28	68	multiton-TFS2-G250	G4	78
300	multiton-TFS2-M300	M28	73	multiton-TFS2-G300	G4	83
400	multiton-TFS2-M400	M28	78	multiton-TFS2-G400	G4	88

¹ Power at 400 V, 50 Hz ² Measurement details and other details on the construction can be found on page 131

The exact frequency must be specified when ordering.

Example for order: Audio frequency blocking device 250 kvar für 216.67 Hz on module plate.
The appropriate ordering detail is as follows: **Type multiton-TSF1-M250-216**.

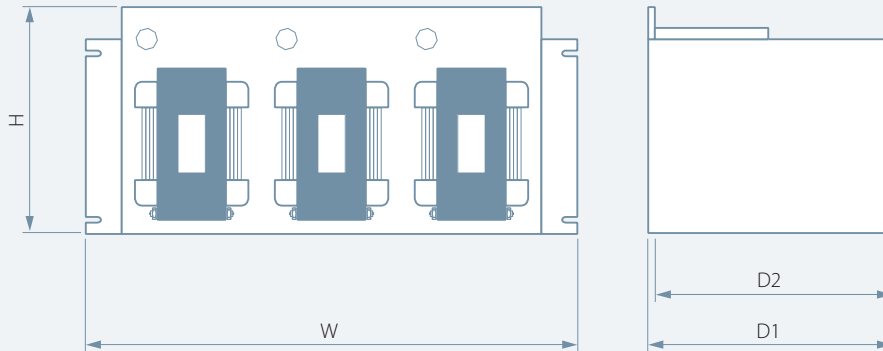
All changes reserved.

multiton Technical details

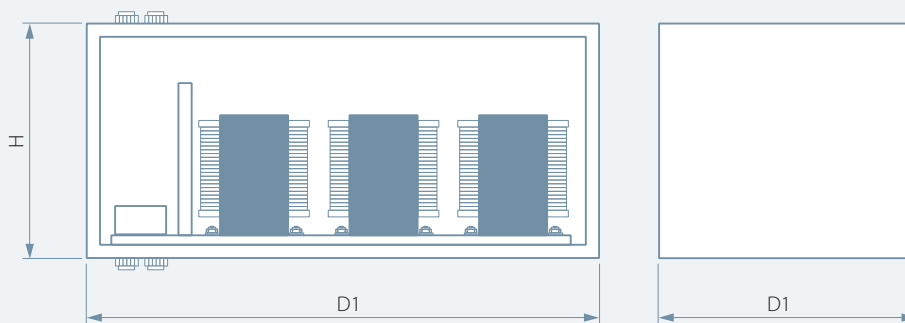
DEVICE TYPE		multiton audio frequency blocking devices	
		multiton-TSF1 Frequency range 160 – 350 and 450 – 2000 Hz	multiton-TSF2 Frequency range 351 – 449 Hz
Rated voltage	Frequency	U _n = 400 V 50 Hz	
Maximum permissible operating voltage		U _n = 400 V ± 10 %	
Maximum permissible operating current		1.3 x I _n permanently	
Power		10 – 400 kvar	
Mode of protection		Typ TSF-L, TSF-M: IP 00	Type TSF-G: IP 30 IP 54 on request
Ambient temperature		max. 40 °C	
Cooling type		Natural cooling	
Impregnation		Vacuum-impregnated	
Frequency range		160 – 2000 Hz	
Standards		DIN EN 60289 (VDE 0532-289)	
Types		Typ TSF-L: loose, without housing Typ TSF-M: on module plate, without housing Typ TSF-G: Steel plate housing, Protection class I, Painted inside and outside: RAL 7035 (other paints possible) Module plates galvanized	

multiton Construction diagram

multiton
in modular design (construction type M28)



multiton
in steel sheet housing (construction type G4)



CONSTRUCTION TYPE	HEIGHT (H) in mm	WIDTH (W) in mm	DEPTH 1 (D1) in mm	DEPTH 2 (D2) in mm
M28	305	735	270	265
G4	400	800	400	–

Alle Maßangaben in mm. Nicht zur Maßentnahme geeignet.

Thyristor switches

thyroswitch

Monitoring



Recording

Optimizing



thyroswitch thyristor switches enable capacitors to be connected and disconnected quickly and without wear and tear. Unlimited switching frequency, no peak inrush current when switching on, rapid out-compensation, no noise formation are just some of the advantages of this technology.

thyroswitch 3P

Thyristor switch with three thyristors, each of which can switch alone or together..

**thyroswitch 2P**

3-phase thyristor switch with two thyristors.

thyroswitch 2P

Current

70 – 115 A

3-phase thyristor switch with two thyristors

- Highlights**
- Unlimited switching frequency without load on capacitors
 - No peak inrush current when switching on capacitors
 - Low operating delay
 - Compensation almost in real-time
 - No operating noise

An overall view of **technical details** can be found on page 138.
The **housing dimensions** are listed on page 140.

The 3-phase thyristor switch **thyroswitch 2P** is a compact unit ready for connection and enables tuned and detuned capacitors to be connected and disconnected quickly and with no wear and tear. thyroswitch offers significant advantages over conventional standard protections. Among other things, load on the capacitors is reduced by controlled switching, which increases their working life. When switched on, there is no peak inrush current, wear and tear on the switch contacts does not occur.

The thyroswitch is controlled via the **multicomp** reactive

power controller or directly via the machine control. The thyroswitch 2P has two thyristors which switch phases L1 and L3. Phase L2 is connected, but not switched on. If the switch-on procedure is activated via a reactive power controller or a control, there is a voltage comparison between the capacitor voltage and the mains voltage. If there is a slight difference, the stage is switched on.

Specifications

DEVICE TYPE	ARTICLE NUMBER	VOLTAGE in V	FREQUENCY in Hz	CURRENT in A
thyroswitch 2ph-400-50-90	V108-10-0001	400	50	90*
thyroswitch 2ph-400-60-90	V108-10-0002	400	60	90
thyroswitch 2ph-400-50-115	V108-10-0003	400	50	115*
thyroswitch 2ph-400-60-115	V108-10-0004	400	60	115
thyroswitch 2ph-500-50-70	V108-10-0005	500	50	70*
thyroswitch 2ph-500-60-70	V108-10-0006	500	60	70
thyroswitch 2ph-120-50-90	V108-10-0007	120	50	90
thyroswitch 2ph-120-60-90	V108-10-0008	120	60	90
thyroswitch 2ph-120-50-115	V108-10-0009	120	50	115
thyroswitch 2ph-120-60-115	V108-10-0010	120	60	115
thyroswitch 2ph-240-50-90	V108-10-0011	240	50	90
thyroswitch 2ph-240-60-90	V108-10-0012	240	60	90
thyroswitch 2ph-240-50-115	V108-10-0013	240	50	115
thyroswitch 2ph-240-60-115	V108-10-0014	240	60	115

* Standard

thyroswitch 3P

Current

70 – 100 A

3-phase thyristor switch with three thyristors

- Highlights**
- Unlimited switching frequency without load on capacitors
 - No peak inrush current when switching on capacitors
 - Low operating delay
 - Compensation almost in real-time
 - No operating noise

An overall view of **technical details** can be found on page 139.
The **housing dimensions** are listed on page 141.

The thyristor switch **thyroswitch 3P** combines functional features already distinguished in the thyroswitch 2P: fast and wear and tear-free connecting and disconnecting of capacitors, unlimited switch frequency with low switch delay and compensation almost in real-time. The device generates no operating noise whatsoever and has a compact construction ready for connection.

thyroswitch 3P has three thyristors, each of which can switch alone or together. If the switch-on procedure is activated via a reactive power controller or a control, there is a voltage comparison between the capacitor voltage and the mains voltage. If there is a slight difference, the stage is switched on.

Specifications

DEVICE TYPE	ARTICLE NUMBER	VOLTAGE in V	FREQUENCY in Hz	CURRENT in A
thyroswitch 3ph-690/400-50-100	V108-20-0001	690/400 Y/Δ	50	100*
thyroswitch 3ph-690/400-60-100	V108-20-0002	690/400 Y/Δ	60	100
thyroswitch 3ph-690/500-50-70	V108-20-0003	690/500 Y/Δ	50	70
thyroswitch 3ph-690/500-60-70	V108-20-0004	690/500 Y/Δ	60	70
thyroswitch 3ph-400/230-50-100	V108-20-0005	400/230 Y/Δ	50	100*
thyroswitch 3ph-400/230-60-100	V108-20-0006	400/230 Y/Δ	60	100
thyroswitch 3ph-240/140-50-100	V108-20-0007	240/140 Y/Δ	50	100
thyroswitch 3ph-240/140-60-100	V108-20-0014	240/140 Y/Δ	60	100

* Standard

thyroswitch Technical details

DEVICE TYPE		thyroswitch 2P
INPUT	Control input	10 – 30 V DC max. 30 mA 180 – 260 V AC 50/60 Hz max. 20 mA
	Fuse protection	Max. 6 A
POWER SUPPLY	Auxiliary voltage	230 V AC 50/60 Hz max. 18 VA
	Fuse protection	Max. 6 A
LOAD CIRCUIT	Connection voltage U_N	400/500 V 50/60 Hz (type-dependent → Table)
	Load current	70/90/115 A (type-dependent → Table)
	Power dissipation	70 A type approx. 2.2 W pro A 90/115 A type approx. 2.1 W pro A
FIELD OF APPLICATION	Creepage distances from control input to power circuit	> 10.5 mm for SELV voltages
	Rated voltage	$U_N \pm 10\%$
	Harmonics voltage	DIN EN 61000-2-4 Klasse 3 THD Max. 10%
CLOSING DELAY: SWITCH-OFF TIME > 5s	Input	DC: 0 up to max. 20 ms AC: 10 up to max. 30 ms
RECLOSURE DELAY CHOPPING OPERATION	Input	DC: 0 up to max. 33 ms AC: 10 up to max. 43 ms
ELECTRICAL SAFETY	Standards and amendments	
	Protection class	I
	Clearances	EN61010:2001 for contamination degree II Measurement category III
	Mode of protection	IP 10
AMBIENT CONDITIONS	Standards and amendments	DIN EN 60721-3-3/A2 (3K5 + 3Z11) EC 721-3-3 (3K5 + 3Z11)
	Air humidity, non-condensing	5% bis 95%
	Operating temperature	-5 °C to +55 °C → observe performance restriction depending on ambient temperature.
	Storage temperature	25 °C to +70 °C
INSTALLATION	Installation position	Vertical or horizontal
	Cooling clearances	Minimum 50 mm to the fan and Minimum 150 mm to the heat sink outlet
HOUSING	Sizes in mm (H x W x D)	220 x 105 x 185 mm 220 x 105 x 198 mm (type 115 A)
WEIGHT		Approx. 2900 g Approx. 3600 g (type 115 A)

thyroswitch

3P

10 – 30 V DC | 3 inputs each max. 30 mA

Max. 6 A

230 V AC $\pm 10\%$ | 50/60 Hz | max. 35 VA

Max. 6 A

 Δ 400 V/50 Hz | Υ 690 V/50 Hz

Max. 100 A

70 A type approx 3 x 1.1 W pro A

100 A type approx 3 x 1.05 W pro A

> 10.5 mm for SELV voltages

 $U_N \pm 10\%$

DIN EN 61000-2-4 Klasse 3 | THD Max. 10%

0 up to max. 20 ms

0 up to max. 33 ms

I

EN61010:2001 for contamination degree II

Measurement category III

IP 10

DIN EN 60721-3-3/A2

(3K5 + 3Z11)

IEC 721-3-3 (3K5 + 3Z11)

5% to 95%

-5°C to +55°C

-25°C to +70°C

Vertical or horizontal

Minimum 50 mm to the fan and

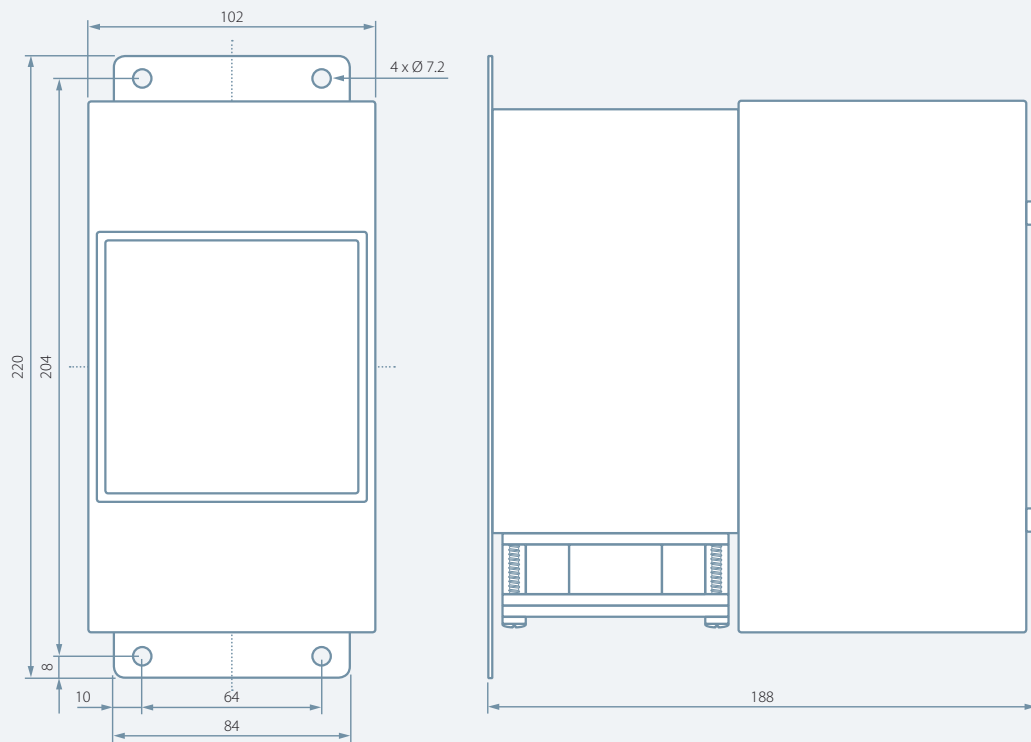
Minimum 150 mm to the heat sink outlet

220 x 182 x 188 mm

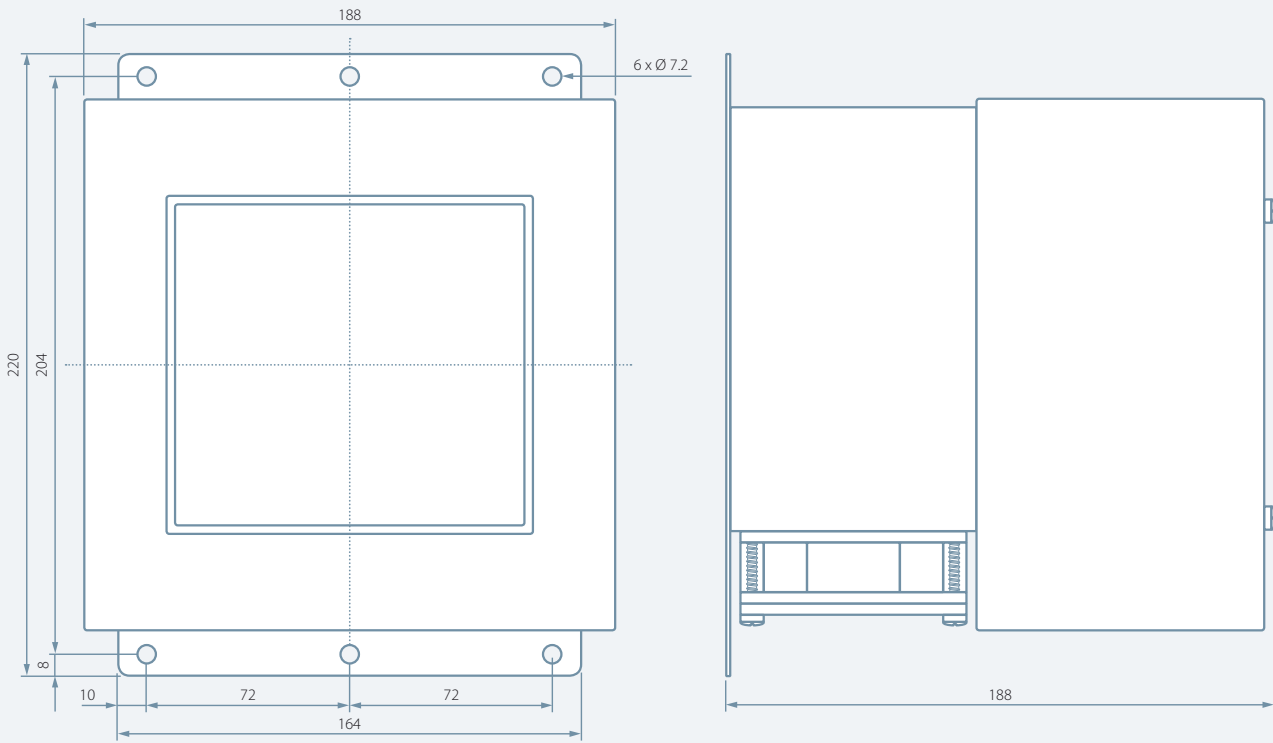
Approx. 204.59 oz

thyroswitch dimensions

thyroswitch 2P



thyroswitch 3P



Fixed capacitors

multicab-F

Monitoring



Optimizing



multicab-F fixed capacitors compensate the inductive reactive power directly at the place it occurs, which relieves the supply lines considerably. Fixed capacitors are used for consumers with relatively large power, such as transformers and motors.

multicab-F ... SWSH

Detuned fixed capacitor with a capacitor rated voltage of 525 V and reactor factors of 12.5 and 14 %. Standard version in sheet steel wall cabinet.



multicab-F

Power

5 – 60 kvarFacility cabinet*
(H x W x D in mm)**S1 (600 x 600 x 350)****S2 (800 x 800 x 400)**

* Steel sheet wall cabinet, standard version without base

Detuned capacitors (wall cabinet)

Highlights

- Power from 5 to 60 kvar
- Reactor factors 5.5, 7 or 8 % and 12.5 or 14 %
- Capacitor rated voltage with 440 V or 525 V
- Optional: Contactor and NH disconnecter

Accessories such as base current transformer, etc. can be found from page 204.

Audio frequency blocking devices can be found on pages 126 – 131.

A selection of back-up fuses and supply lines for complete facilities can be found on pages 224/225.

An overall view of **technical details** can be found on page 146.

The **housing dimensions** are listed on page 147.

Specifications multicab-F ... SWSH

Facility with plug-in design Reactor factors: **5.5, 7 or 8%** Capacitor rated voltage: **440 V**

POWER ¹ in kvar	TYPE	CONSTRUCTION TYPE ²	WEIGHT approx. in kg
5	multicab-F 005/01-1000- XX -SWSH	S1	45
10	multicab-F 010/01-1000- XX -SWSH	S1	47
12,5	multicab-F 012/01-1000- XX -SWSH	S1	51
15	multicab-F 015/01-1000- XX -SWSH	S1	52
20	multicab-F 020/01-1000- XX -SWSH	S1	53
25	multicab-F 025/01-1000- XX -SWSH	S1	59
30	multicab-F 030/01-1000- XX -SWSH	S1	65
40	multicab-F 040/01-1000- XX -SWSH	S1	70
50	multicab-F 050/01-1000- XX -SWSH	S1	70
60	multicab-F 060/01-1000- XX -SWSH	S2	95

Specifications multicab-F ... SWSB

Facility with plug-in design Reactor factors: **12.5 or 14 %** Capacitor rated voltage: **525 V**

POWER ¹ in kvar	TYPE	CONSTRUCTION TYPE ²	WEIGHT approx. in kg
5	multicab-F 005/01-1000- XX -SWSB	S1	47
10	multicab-F 010/01-1000- XX -SWSB	S1	53
12,5	multicab-F 012/01-1000- XX -SWSB	S1	56
15	multicab-F 015/01-1000- XX -SWSB	S1	57
20	multicab-F 020/01-1000- XX -SWSB	S1	65
25	multicab-F 025/01-1000- XX -SWSB	S1	68
30	multicab-F 030/01-1000- XX -SWSB	S1	68
40	multicab-F 040/01-1000- XX -SWSB	S2	91
50	multicab-F 050/01-1000- XX -SWSB	S2	103
60	multicab-F 060/01-1000- XX -SWSB	S2	111

¹ Power at 400 V, 50 Hz ² Measurement details and other details on the construction can be found on page 147

XX = It is important that you state the reactor factor when ordering (see also following order example).

Performances and sizes deviating from the standard are available on request. All changes reserved.

Example for order: Fixed capacitor, 20 kvar, 440 V capacitors, 7 % detuned with NH disconnecter and contactor.

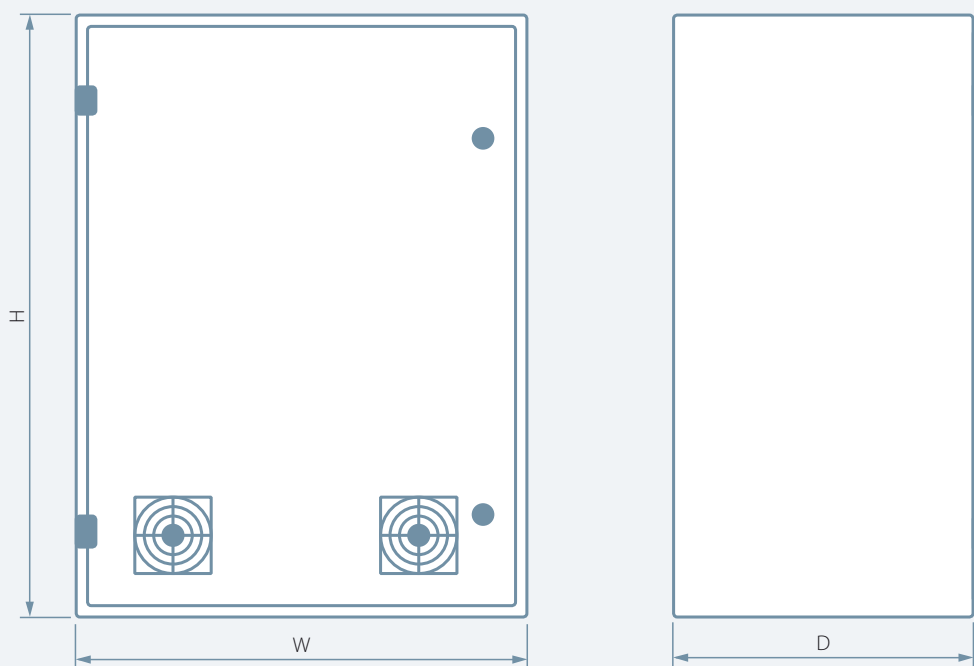
The appropriate ordering detail is as follows: **Type multicab-F 020/01-1000-07-SWSH-NH-LS.**

multicab-F Technical details

DEVICE TYPE	multicab-F Fixed capacitors	
	SWSH p = 5.5, 7 or 8 %	SWSB p = 12.5 or 14 %
Rated voltage Frequency	U _n = 400 V 50 Hz	
Maximum permissible operating voltage	U _n = 400 V ± 10 %	
Maximum permissible operating current	1.3 x I _n permanently	
CAPACITORS	Low-loss multicond-UHPC power capacitors, MTK technology	
Capacitor rated voltage	U _{Meas.} = 440 V	U _{Meas.} = 525 V
Discharge of capacitors	Discharge resistors t < 60 s Optional discharge reactors t < 3 s	
FILTER CIRCUIT REACTORS	Linear filter circuit reactors to avoid resonances in networks with harmonics, built-in temperature monitoring	
Reactor factors	p = 5.5, 7 oder 8 %	p = 12.5 oder 14 %
HOUSING DESIGN	Steel sheet cabinet, painted inside and outside with color RAL 7035 (other colors on request), module plates galvanized	
Mode of protection	IP 20 (IP 54 on request), the components used correspond to BGV-A2	
AMBIENT TEMPERATURES	+ 40 °C highest value, briefly + 35 °C in 24-hour average + 20 °C in annual average – 10 °C lowest value	
OPTION: Back-up fuse additional NH	With NH disconnecter and NH fuses	
OPTION: Switch element additional LS	Capacitor switching contactors U _{control} = 230 V, 50 Hz Control voltage transformer required if operating voltage deviates	
OPTION: Apparent current relay additional LSR	For automatic switchgear operation, connecting and disconnecting is done by contactor	

multicab-F Dimensions

multicab-F
Steel sheet wall cabinet (construction type S2)



CONSTRUCTION TYPE	HEIGHT (H) in mm	WIDTH (W) in mm	DEPTH (D) in mm
S1	600	600	350
S2	800	800	400

Standard version without NH disconnecter, without contactor.

Reactive current
compensation modules

multimod-F

Monitoring



Optimizing



multimod-F compensation modules are suitable for building compensation facilities in existing cabinets and are available for all cabinet systems on the market. As KBR quality products, the modules stand out through their long working life.

multimod-F ... GH/GB

Detuned reactive current compensation modules with power from 12.5 to 100 kvar and reactor factors of 5.5, 7, 8, 12.5 or 14 %.



multimod-F ... SH/SB

Detuned reactive current compensation module with power from 10 to 100 kvar and reactor factors of 5.5, 7, 8, 12.5 or 14%.



multimod-F ... 08TB

Thyristor switched reactive current compensation module with power from 12.5 to 50 kvar and reactor factors of 5.5, 7, 8, 12.5 or 14 %.

multimod-F Plug-in design



Detuned reactive current compensation modules in plug-in design

- Highlights**
- Power from 10 to 100 kvar
 - Reactor factors 5.5, 7 or 8 % and 12.5 or 14 %
 - Capacitor rated voltage with 440 V or 525 V
 - For cabinet widths of 600 or 800 mm
 - For cabinet depths of 400, 500 or 600 mm

Accessories: If there are several modules, the bus bar connector and covers are also delivered.
Selection of back-up fuses and supply lines for complete facilities can be found on pages 224/225.

An overall view of **technical details** can be found on page 156.
 The **housing dimensions** are listed on page 158.

Specifications multimod-F ... SH

Modules with plug-in design Reactor factors: **5.5, 7 or 8 %** Capacitor rated voltage: **440 V**

POWER ¹ in kvar	STAGES in kvar	WEIGHT approx. in kg	TYPE multimod-F ... 64SH for cabinet width 600 mm	CON- STRUC- TION TYPE ²	TYPE multimod-F ... 8.SH for cabinet width 800 mm	CON- STRUC- TION TYPE ²
10	10	20	multimod-F 010/01-1000-XX-64SH	M12	multimod-F 010/01-1000-XX-84SH	M22
12,5	12,5	25	multimod-F 012/01-1000-XX-64SH	M12	multimod-F 012/01-1000-XX-84SH	M22
15	5 – 10	27	multimod-F 015/03-1200-XX-64SH	M12	multimod-F 015/03-1200-XX-84SH	M22
20	20	26	multimod-F 020/01-1000-XX-64SH	M12	multimod-F 020/01-1000-XX-84SH	M22
20	10 – 10	29	multimod-F 020/02-1100-XX-64SH	M12	multimod-F 020/02-1100-XX-84SH	M22
25	25	31	multimod-F 025/01-1000-XX-64SH	M12	multimod-F 025/01-1000-XX-84SH	M22
25	12,5 – 12,5	33	–	–	multimod-F 025/02-1100-XX-84SH	M22
30	30	34	multimod-F 030/01-1000-XX-64SH	M12	multimod-F 030/01-1000-XX-84SH	M22
30	15 – 15	39	–	–	multimod-F 030/02-1100-XX-84SH	M22
30	5 – 10 – 15	41	–	–	multimod-F 030/06-1230-XX-84SH	M24
40	40	38	multimod-F 040/01-1000-XX-64SH	M13	multimod-F 040/01-1000-XX-84SH	M23
40	20 – 20	41	–	–	multimod-F 040/02-1100-XX-84SH	M22
50	50	40	multimod-F 050/01-1000-XX-64SH	M13	multimod-F 050/01-1000-XX-84SH	M23
50	25 – 25	51	–	–	multimod-F 050/02-1100-XX-84SH	M22
75	25 – 50	60	–	–	multimod-F 075/03-1200-XX-84SH	M23
100	50 – 50	98	–	–	multimod-F 100/02-1100-XX-85SH	M29

Specifications multimod-F ... SB

Modules with plug-in design Reactor factors: **12.5 or 14 %** Capacitor rated voltage: **525 V**

POWER ¹ in kvar	STAGES in kvar	WEIGHT approx. in kg	TYPE multimod-F ... 64SB for cabinet width 600 mm	CON- STRUC- TION TYPE ²	TYPE multimod-F ... 64SB for cabinet width 800 mm	CON- STRUC- TION TYPE ²
10	10	26	multimod-F 010/01-1000-XX-64SB	M12	multimod-F 010/01-1000-XX-84SB	M22
12,5	12,5	30	multimod-F 012/01-1000-XX-64SB	M12	multimod-F 012/01-1000-XX-84SB	M22
20	20	38	multimod-F 020/01-1000-XX-64SB	M12	multimod-F 020/01-1000-XX-84SB	M22
20	10 – 10	42	–	M12	multimod-F 020/01-1100-XX-84SB	M22
25	25	39	multimod-F 025/01-1000-XX-64SB	M12	multimod-F 025/01-1000-XX-84SB	M22
25	12,5 – 12,5	51	–	M12	multimod-F 025/02-1000-XX-84SB	M22
30	30	46	multimod-F 030/01-1000-XX-64SB	–	multimod-F 030/01-1000-XX-84SB	M22
30	15 – 15	54	–	M12	multimod-F 030/02-1100-XX-84SB	M22
40	40	50	multimod-F 040/01-1000-XX-64SB	–	multimod-F 040/01-1000-XX-84SB	M22
40	20 – 20	66	–	–	multimod-F 040/02-1100-XX-84SB	M24
50	50	61	multimod-F 050/01-1000-XX-65SB	M13	multimod-F 050/01-1000-XX-84SB	M23
50	25 – 25	71	–	–	multimod-F 050/02-1100-XX-84SB	M22

¹ Power at 400 V, 50 Hz ² Measurement details and other details on the construction type can be found on page 158
– construction type not possible

XX = It is important that you state the reactor factor when ordering (see also following order example).

Performances and sizes deviating from the standard are available on request. All changes reserved.

Example for order: Detuned module in plug-in design for cabinet width 800 mm, for cabinet depth 400 mm, 50 kvar in 2 stages, 440 V capacitors, 7 % detuned. The appropriate ordering detail is as follows: **Type multimod-F 050/02-1100-07-84SH**.

multimod-F Rack-mounted design



Detuned reactive current compensation modules in rack-mounted design

- Highlights**
- Power from 12.5 to 100 kvar
 - Reactor factors 5.5, 7 or 8 % and 12.5 or 14 %
 - Capacitor rated voltage with 440 V or 525 V
 - For cabinet widths of 600 or 800 mm
 - For cabinet depths of 400, 500 or 600 mm

Accessories: If there are several modules, the bus bar connector and covers are also delivered.
Selection of back-up fuses and supply lines for complete facilities can be found on pages 224/225.

An overall view of **technical details** can be found on pages 156/157.
 The **housing dimensions** are listed on page 159.

Specifications multimod-F ... GH

Modules with rack-mounted design Reactor factors: **5.5, 7 or 8 %** Capacitor rated voltage: **440 V**

POWER ¹ in kvar	STAGES in kvar	WEIGHT approx. in kg	TYPE multimod-F ... 6yGH for cabinet width 600 mm	CONSTRUCTION TYPE ²			TYPE multimod-F ... 8yGH for cabinet width 800 mm	CONSTRUCTION TYPE ²		
				yy	64	65		66	yy	84
12,5	12,5	27	multimod-F 012/01-1000-XX-yyGH	x	x	x	multimod-F 012/01-1000-XX-yyGH	x	x	x
25	25	32	multimod-F 025/01-1000-XX-yyGH	x	x	x	multimod-F 025/01-1000-XX-yyGH	x	x	x
25	12,5 – 12,5	42	multimod-F 025/02-1100-XX-yyGH	–	–	x	multimod-F 025/02-1100-XX-yyGH	x	x	x
50	50	44	multimod-F 050/01-1000-XX-yyGH	x	x	x	multimod-F 050/01-1000-XX-yyGH	x	x	x
50	25 – 25	54	multimod-F 050/02-1100-XX-yyGH	–	–	x	multimod-F 050/02-1100-XX-yyGH	x	x	x
75	25 – 50	65	–	–	–	–	multimod-F 075/03-1200-XX-yyGH	–	x	x
100	50 – 50	76	–	–	–	–	multimod-F 100/02-1100-XX-yyGH	–	x	x
100	25 – 25 – 50	86	–	–	–	–	multimod-F 100/04-1120-XX-yyGH	–	–	x

Specifications multimod-F ... GB

Modules with rack-mounted design Reactor factors: **12.5 or 14 %** Capacitor rated voltage: **525 V**

POWER ¹ in kvar	STAGES in kvar	WEIGHT approx. in kg	TYPE multimod-F ... 6yGH for cabinet width 600 mm	CONSTRUCTION TYPE ²			TYPE multimod-F ... 8yGH for cabinet width 800 mm	CONSTRUCTION TYPE ²		
				yy	64	65		66	yy	84
12,5	12,5	32	multimod-F 012/01-1000-XX-yyGB	x	x	x	multimod-F 012/01-1000-XX-yyGB	x	x	x
25	25	42	multimod-F 025/01-1000-XX-yyGB	x	x	x	multimod-F 025/01-1000-XX-yyGB	x	x	x
25	12,5 – 12,5	52	multimod-F 025/02-1100-XX-yyGB	–	–	x	multimod-F 025/02-1100-XX-yyGB	x	x	x
50	50	65	multimod-F 050/01-1000-XX-yyGB	x	x	x	multimod-F 050/01-1000-XX-yyGB	x	x	x
50	25 – 25	72	multimod-F 050/02-1100-XX-yyGB	–	–	x	multimod-F 050/02-1100-XX-yyGB	x	x	x
75	25 – 50	95	–	–	–	–	multimod-F 075/03-1200-XX-yyGB	–	x	x
100	50 – 50	118	–	–	–	–	multimod-F 100/02-1100-XX-yyGB	–	x	x
100	25 – 25 – 50	125	–	–	–	–	multimod-F 100/04-1120-XX-yyGB	–	–	x

¹ Power at 400 V, 50 Hz ² Measurement details and other details on the construction type can be found on page 159
– construction type not possible

XX = reactor factor yy = construction type

It is important that you state the reactor factor when ordering (see also following order example).

Performances and sizes deviating from the standard are available on request. All changes reserved.

Example for order: Detuned module in rack-mounted design for cabinet width 800 mm, for cabinet depth 500 mm, 50 kvar in 2 stages, 440 V capacitors, 7 % detuned. The appropriate ordering detail is as follows: **Type multimod-F 050/02-1100-07-85GH**.

multimod-F Thyristor-switched / plug-in design

Power **12,5 – 50 kvar**

Reactor factors
5.5, 7 or 8 %
12.5 or 14 %



Detuned reactive current compensation modules in plug-in design

- Highlights**
- Power from 12.5 to 50 kvar
 - Reactor factors 5.5, 7 or 8 % and 12.5 or 14 %
 - Capacitor rated voltage 525 V
 - For cabinet widths 800 mm
 - Long working life through unlimited frequency of operations
 - No noise formation
 - Short switching times

Accessories: If there are several modules, the bus bar connector and covers are also delivered.
Selection of back-up fuses and supply lines for complete facilities can be found on pages 224/225.

An overall view of **technical details** can be found on page 157.
The **housing dimensions** are listed on page 158.

Specifications multimod-F ... 08TB

Modules with plug-in design Reactor factors: **5.5, 7 or 8 %** Capacitor rated voltage: **525 V**

POWER ¹ in kvar	STAGES in kvar	WEIGHT approx. in kg	TYPE multimod-F ... 08TB for cabinet width 800 mm	CONSTRUCTION TYPE ²
12,5	12,5	27	multimod-F 012/01-1000-XX-08TB	M27
25	25	33	multimod-F 025/01-1000-XX-08TB	M27
50	50	44	multimod-F 050/01-1000-XX-08TB	M27

Specifications multimod-F ... 08TB

Modules with plug-in design Reactor factors: **12.5 or 14 %** Capacitor rated voltage: **525 V**

POWER ¹ in kvar	STAGES in kvar	WEIGHT approx. in kg	TYPE multimod-F ... 08TB for cabinet width 800 mm	CONSTRUCTION TYPE ²
12,5	12,5	32	multimod-F 012/01-1000-XX-08TB	M27
25	25	42	multimod-F 025/01-1000-XX-08TB	M27
50	50	65	multimod-F 050/01-1000-XX-08TB	M27

¹ Power at 400 V, 50 Hz ² Measurement details and other details on the construction can be found on page 158

XX = It is important that you state the reactor factor when ordering (see also following order example).
Performances and sizes deviating from the standard are available on request. All changes reserved.

Example for order: Thyristor-switched modules for cabinet width 800 mm, 50 kvar, 525 V capacitors, 14 % detuned.
The appropriate ordering detail is as follows: **Type multimod-F 050/01-14 08TB**.

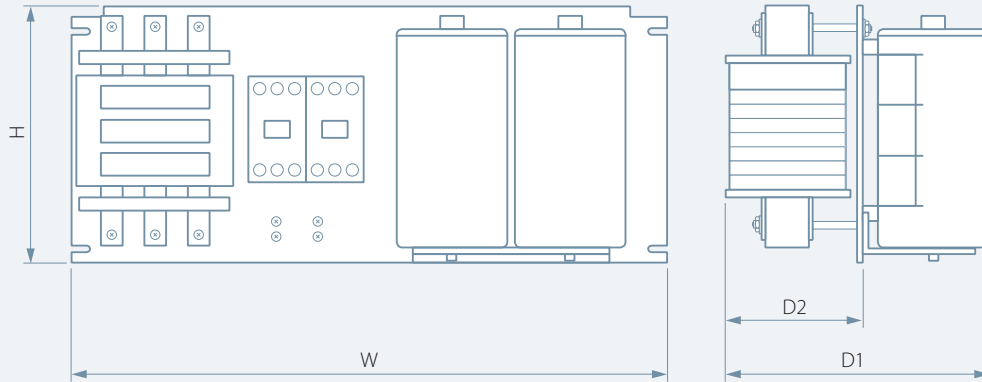
multimod-F Technical details

DEVICE TYPE	multimod-F Plug-in design		multimod-F Rack-mounted design
	SH p = 5.5, 7 or 8%	SB p = 12.5 or 14 %	GH p = 5.5, 7 or 8%
Rated voltage Frequency	U _n = 400 V 50 Hz		
Maximum permissible operating voltage	U _n = 400 V ± 10%		
Maximum permissible operating current	1.3 × I _n , permanently		
SWITCH ELEMENT	Capacitor contactors		Capacitor contactors
Control voltage	U _{Control} = 230 V, 50 Hz		U _{Control} = 230 V, 50 Hz
	Control voltage transformer required for deviating operating voltage		
Switch delay	60 s		60 s
CAPACITORS	Low-loss multicond-UHPC power capacitors, MTK technology		
Capacitor rated voltage	U _{Meas.} = 440 V	U _{Meas.} = 525 V	U _{Meas.} = 440 V
Discharge of capacitors	Discharge resistors t < 60 s Optional discharge inductors t < 3 s		Discharge resistors t < 60 s Optional discharge inductors t < 3 s
Discharge of capacitors	Linear filter circuit reactors to avoid resonances in networks with harmonics, built-in temperature monitoring		
Reactor factors	p = 5.5, 7 or 8%	p = 12.5 or 14 %	p = 5.5, 7 or 8%
MODULE VERSION	Module plates galvanized		
MODE OF PROTECTION	IP 00, the components used correspond to BGV-A2		
AMBIENT TEMPERATURES	+40 °C highest value, briefly +35 °C in 24-hour average +20 °C in annual average −10 °C lowest value		
FUSE PROTECTION	Group back-up fuse with NH fuses and fuse socket (NH-disconnector on request)		

GB p = 12.5 or 14 %	multimod-F Combination filter K1 Note: Selection tables can be found on pages 172/173	multimod-F Thyros witch p = 5.5, 7 or 8% p = 12.5 or 14 %
	U _n = 400 V 50 Hz	
	U _n = 400 V ± 10 %	
	1,3 x I _n dauernd	
	Capacitor contactors	Thyristor switches
	U _{Control} = 230 V, 50 Hz	DC gating: U _{Control} = 10 – 30 V AC gating: U _{Control} = 230 V, 50/60 Hz Gating via reactive power controller or directly via SPS or process sliders
	Control voltage transformer required for deviating operating voltage	
	60 s	DC gating: 1 – 15 ms, dynamic controller required AC gating: 10 – 25 ms with direct gating 500 ms for gating via standard reactive power controller
	Low-loss multicond-UHPC power capacitors, MTK technology	
U _{Meas.} = 525 V	U _{Meas.} = 525 V	U _{Meas.} = 525 V U _{Meas.} = 525 V
	Discharge resistors t < 60 s Optional discharge inductors t < 3 s	Through the EPL technology, no discharge time can be maintained during operation. Discharge resistors t < 60 s No discharge reactor possible
	linear filter circuit reactors to avoid resonances in networks with harmonics, built-in temperature monitoring	
p = 12.5 or 14 %	p = 5.5 and 12.5 %	p = 5.5, 7 or 8 % p = 12.5 or 14 %
	Module plates galvanized	
	IP 00, the components used correspond to BGV-A2	
	+40 °C highest value, briefly +35 °C in 24-hour average +20 °C in annual average –10 °C lowest value	
	Group back-up fuse with NH fuses and fuse socket (NH-disconnector on request)	

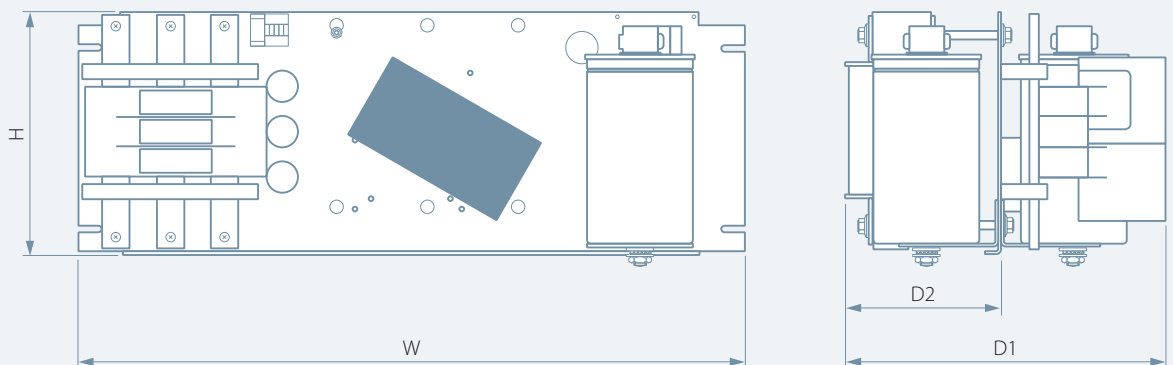
multimod-F Sizes

multimod-F ... SH/SB Modules in rack-mounted design



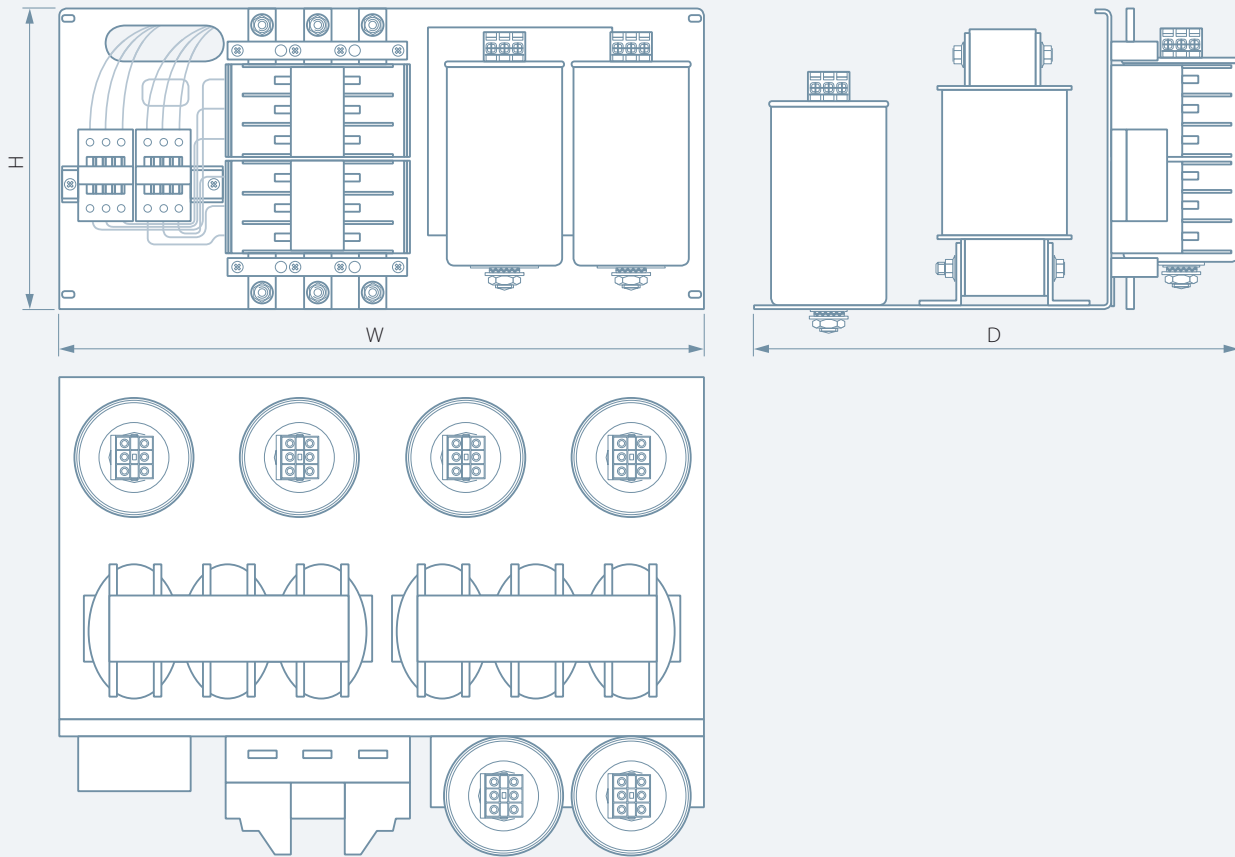
CONSTRUCTION TYPE	HEIGHT (H) in mm	WIDTH (W) in mm	DEPTH (D) in mm
M12	265	535	130
M13	265	535	170
M14	265	535	190
M15	265	535	195
M22	265	535	130
M23	265	735	170
M24	265	735	190
M29	350	735	195

multimod-F ... 08TB Modules in rack-mounted design



CONSTRUCTION TYPE	HEIGHT (H) in mm	WIDTH (W) in mm	DEPTH 1 (D1) in mm	DEPTH 2 (D2) in mm	MIN. CABINET DEPTH in mm
M27	265	735	400	190	600

multimod-F ... GH/GB Modules with rack-mounted design
 multimod-F ... K combination filter



CONSTRUCTION TYPE	HEIGHT (H) in mm	WIDTH (W) in mm	DEPTH (D) in mm	MIN. CABINET DEPTH in mm
M64	325	495	350	400
M65	325	495	450	500
M66	325	495	550	600
M84	325	695	350	400
M85	325	695	450	500
M86	325	695	550	600

Reactive current
compensation units

multimod-R

Monitoring



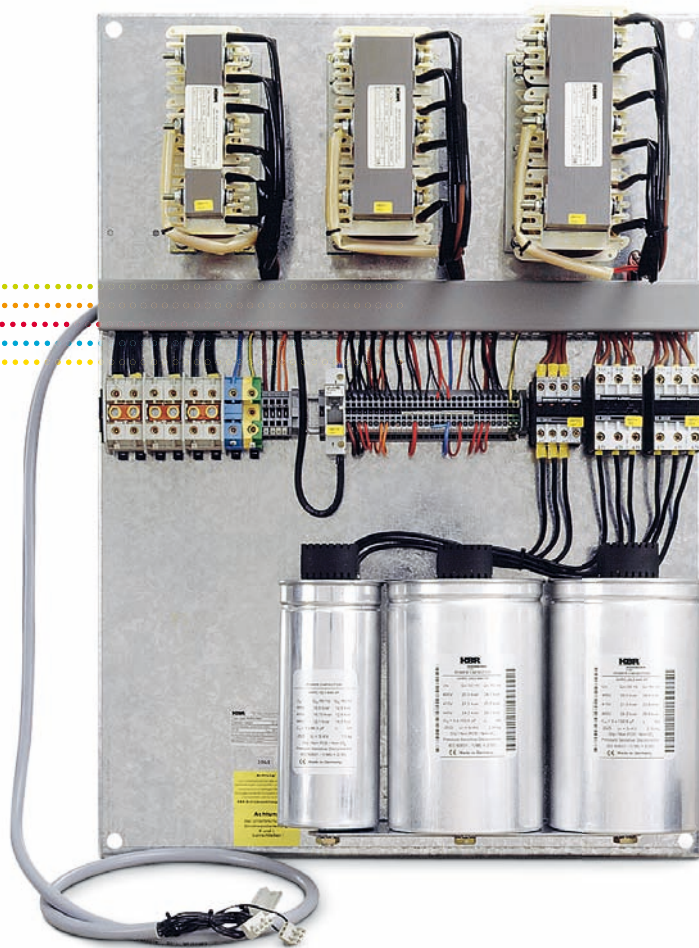
Optimizing



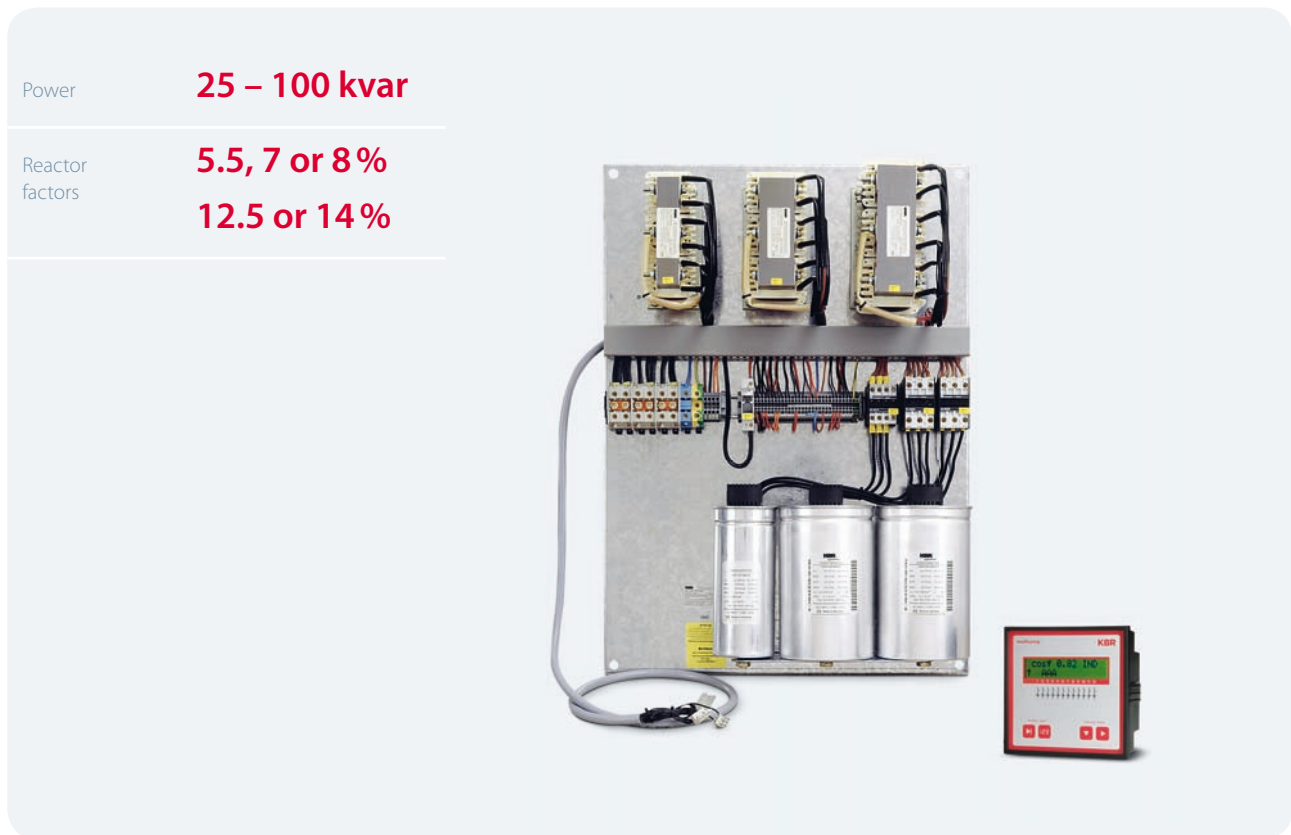
multimod-R reactive current compensation units are delivered on an assembly plate. The complete units, wired and ready for connection, are suitable for installation in existing switchgear cabinets and stand out because of their quick and easy assembly.

multimod-R ... AH

Detuned reactive current compensation unit with power from 25 to 100 kvar and reactor factors of 5.5, 7, 8, 12.5 or 14%. On assembly plate, completely wired and ready for connection for quick and uncomplicated installation.



multimod-R Assembly plate



Detuned reactive current compensation unit on assembly plate

- Highlights**
- Power from 25 to 100 kvar
 - Reactor factors 5.5, 7 or 8 % and 12.5 or 14 %
 - Capacitor rated voltage with 440 V or 525 V
 - Completely wired
 - Simple assembly
 - Facility with reactive current controller

Selection of back-up fuses and supply lines for complete facilities can be found on pages 224/225.

An overall view of **technical details** can be found on page 164.

The **housing dimensions** are listed on page 165.

Specifications multimod-R ... AH

Fitting unit on assembly plate Reactor factors: **5.5, 7 or 8 %** Capacitor rated voltage: **440 V**

POWER ¹ in kvar	TYPE (facility with controller)	STAGES in kvar	CONTROL- LER STAGES	CONSTRUC- TION TYPE ²	WEIGHT approx. in kg
25	multimod-R 025/05-1220- XX -60AH	5 – 10 – 10	6	P1	43
30	multimod-R 030/06-1230- XX -60AH	5 – 10 – 15	6	P1	47
35	multimod-R 035/07-1240- XX -60AH	5 – 10 – 20	6	P1	48
40	multimod-R 040/04-1120- XX -60AH	10 – 10 – 20	6	P1	52
50	multimod-R 050/05-1220- XX -80AH	10 – 20 – 20	6	P2	63
50	multimod-R 050/10-1234- XX -80AH	5 – 10 – 15 – 20	6	P2	69
60	multimod-R 060/06-1230- XX -80AH	10 – 20 – 30	6	P2	74
70	multimod-R 070/07-1240- XX -80AH	10 – 20 – 40	6	P2	79
75	multimod-R 075/06-1122- XX -80AH	12,5 – 12,5 – 25 – 25	6	P2	92
100	multimod-R 100/05-1220- XX -80AH	20 – 40 – 40	6	P2	100
100	multimod-R 100/08-1124- XX -80AH	12,5 – 12,5 – 25 – 50	6	P2	103

Specifications multimod-R ... AB

Fitting unit on assembly plate Reactor factors: **12.5 or 14 %** Capacitor rated voltage: **525 V**

POWER ¹ in kvar	TYPE (facility with controller)	STAGES in kvar	CONTROL- LER STAGES	CONSTRUC- TION TYPE ²	WEIGHT approx. in kg
25	multimod-R 025/05-1220- XX -60AB	5 – 10 – 10	6	P1	57
30	multimod-R 030/06-1230- XX -60AB	5 – 10 – 15	6	P1	60
35	multimod-R 035/07-1240- XX -60AB	5 – 10 – 20	6	P1	68
40	multimod-R 040/04-1120- XX -60AB	10 – 10 – 20	6	P1	76
50	multimod-R 050/04-1120- XX -80AB	12,5 – 12,5 – 25	6	P2	90
50	multimod-R 050/05-1220- XX -80AB	10 – 20 – 20	6	P2	93
60	multimod-R 060/04-1120- XX -80AB	15 – 15 – 30	6	P2	91

¹ Power at 400 V, 50 Hz ² Measurement details and other details on the construction can be found on page 165

XX = It is important that you state the reactor factor when ordering (see also following order example).

Performances and sizes deviating from the standard are available on request. All changes reserved.

Example for order: Fitting unit on assembly plate, 75 kvar in 6 stages, 440 V capacitors, 7 % detuned.

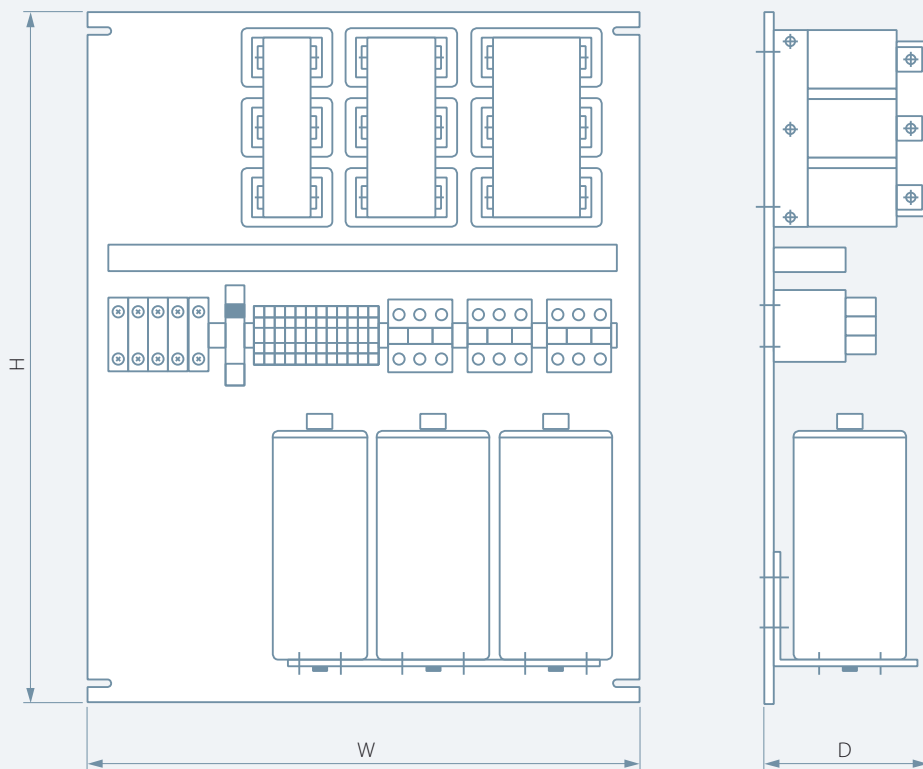
The appropriate ordering detail is as follows: **Type multimod-R 075/06-1122-07-80AH.**

multimod-R Technical details

DIVICE TYPE	multimod-R fitting units	
	AH p = 5.5, 7 or 8 %	AB p = 12.5 or 14 %
Rated voltage Frequency	U _n = 400 V 50 Hz	
Maximum permissible operating voltage	U _n = 400 V ± 10 %	
Maximum permissible operating current	1.3 x I _n permanently	
REACTIVE POWER CONTROLLER	multicomp 144 LCD 4-quadrant operation Optimizing controller behavior Circuit switching	
Current transformer connection	1 A and 5 A	
Safety and maintenance concept secureC	Only in connection with multicomp 4D6	
SWITCH ELEMENT	Capacitor contactors	
Control voltage	U _{control} = 230 V, 50 Hz control voltage transformer required if operating voltage deviates	
Switch delay	60 s	
CAPACITORS	Low-loss multicond-UHPC power capacitors, MTK technology	
Capacitor rated voltage	U _{Meas.} = 440 V	U _{Meas.} = 525 V
Discharge of capacitors	Discharge resistors t < 60 s Optional discharge inductors t < 3 s	
FILTER CIRCUIT REACTORS	Linear filter circuit reactors to avoid resonances in networks with harmonics, built-in temperature monitoring	
Reactor factors	p = 5.5, 7 or 8 %	p = 12.5 or 14 %
FITTING UNITS - DESIGN	Module plates galvanized	
Mode of protection	IP 00, the components used correspond to BGV-A2	
AMBIENT TEMPERATURES	+ 40 °C highest value, briefly + 35 °C in 24-hour average + 20 °C in annual average - 10 °C lowest value	
FUSE PROTECTION	Group back-up fuse with NH fuses and fuse sockets (NH-disconnector on request)	

multimod-R Sizes

multimod-R
Fitting unit on assembly plate



CONSTRUCTION TYPE	HEIGHT (H) in mm	WIDTH (W) in mm	DEPTH (D) in mm
P1	770	550	280
P2	970	750	280

All measurement details in mm. Not suitable for taking measurements.

Controlled
compensation systems

multicab-R

Monitoring



Recording

Optimizing



In the automatically controlled reactive current compensation devices **multicab-R**, only type-tested quality components are used. The system cabinets contain a temperature-controlled ventilation system which protects the devices from damage through overheating. Thanks to convenient rack-mounted technology, system expansions can be undertaken quickly and simply. All system modules can be used flexibly in any cabinet system.

multicab-R 400

Induced reactive current compensation system with up to 400 kvar power and an induction factor of 14 %.




multicab-R 150

Induced reactive current compensation system with up to 150 kvar power.

multicab-R Wall housing

Power	25 – 150 kvar
System cabinet* (H x W x D in mm)	S2 (800 x 800 x 400) S3 (1200 x 800 x 600)
Module spaces	2 (S2) 3 (S3)



* Steel sheet wall cabinet, standard version without base

Detuned reactive current compensation system (wall cabinet)

- Highlights**
- Power from 25 to 150 kvar
 - Reactor factors 5.5, 7 or 8 % and 12.5 or 14 %
 - Capacitors **multicond-UHPC** with 440 V or 525 V
 - Reactive power controller **multicomp 144 LCD** with display
 - Simple system expansion through plug-in design
 - Optional: Safety and maintenance concept **secureC**[®]

Advantages and capabilities of the **safety and maintenance concept secureC** can be found on pages 92 – 95.

Accessories such as base, current transformer, etc. can be found from page 204.

Audio frequency blocking devices can be found on pages 126 – 131.

A selection of back-up fuses and supply lines for complete systems can be found on pages 224/225.

An overall view of **technical details** can be found on page 176.

The **housing dimensions** are listed on page 178.

Specifications multicab-R ... SWSH

System with plug-in design Reactor factors: **5.5, 7 or 8 %** Capacitor rated voltage: **440 V**

POWER ¹ in kvar	SYSTEM WITH CONTROLLER	STAGE POWER PER MODULE PLACE in kvar			CONTROL- LER STAGES	CONSTRUC- TION TYPE ²	WEIGHT approx. in kg
		1	2	3			
25	multicab-R 025/05-1220- XX -SWSH	5 10 10	+	–	6	S2	79
30	multicab-R 030/06-1230- XX -SWSH	5 10 15	+	–	6	S2	83
35	multicab-R 035/07-1240- XX -SWSH	5 10 20	+	–	6	S2	84
40	multicab-R 040/04-1120- XX -SWSH	10 10 20	+	–	6	S2	88
50	multicab-R 050/05-1220- XX -SWSH	10 20 20	+	–	6	S2	93
50	multicab-R 050/10-1234- XX -SWSH	5 10	15 20	–	6	S2	109
60	multicab-R 060/06-1230- XX -SWSH	10 20	30	–	6	S2	114
70	multicab-R 070/07-1240- XX -SWSH	10 20	40	–	6	S2	119
75	multicab-R 075/06-1122- XX -SWSH	12,5 12,5	25 25	–	6	S2	132
100	multicab-R 100/05-1220- XX -SWSH	20 40	40	+	6	S3	154
100	multicab-R 100/08-1122- XX -SWSH	12,5 12,5 25	25 25	+	6	S3	168
125	multicab-R 125/05-1220- XX -SWSH	25 50	50	+	6	S3	159
150	multicab-R 150/06-1122- XX -SWSH	25 50	25 50	+	6	S3	180

Specifications multicab-R ... SWSB

System with plug-in design Reactor factors: **12.5 or 14 %** Capacitor rated voltage: **525 V**

POWER ¹ in kvar	SYSTEM WITH CONTROLLER	STAGE POWER PER MODULE PLACE in kvar			CONTROL- LER STAGES	CONSTRUC- TION TYPE ²	WEIGHT approx. in kg
		1	2	3			
25	multicab-R 025/05-1220- XX -SWSB	5 10	10	–	6	S2	103
30	multicab-R 030/06-1230- XX -SWSB	5 10	15	–	6	S2	106
35	multicab-R 035/07-1240- XX -SWSB	5 10	20	–	6	S2	114
40	multicab-R 040/04-1120- XX -SWSB	10 10	20	–	6	S2	122
50	multicab-R 050/05-1220- XX -SWSB	10 20	20	–	6	S2	133
50	multicab-R 050/10-1234- XX -SWSB	5 10	15 20	–	6	S2	134
60	multicab-R 060/06-1230- XX -SWSB	10 20	30	–	6	S2	135
70	multicab-R 070/07-1240- XX -SWSB	10 20	40	–	6	S2	146
75	multicab-R 075/06-1122- XX -SWSB	12,5 12,5	25 25	–	6	S2	160
100	multicab-R 100/05-1220- XX -SWSB	20	40	40	6	S3	194
100	multicab-R 100/08-1122- XX -SWSB	12,5 12,5	25 25	25	6	S3	214
125	multicab-R 125/05-1220- XX -SWSB	25	50	50	6	S3	220
150	multicab-R 150/06-1122- XX -SWSB	25 25	50	50	6	S3	230

– **No expansion possibility** + **system expansion possible** with modules of type multimod-F ... SH/SB → page 151

¹ Power at 400 V, 50 Hz ² Measurement details and other details on the construction can be found on page 178

XX = It is important that you state the reactor factor when ordering (see also following order example).


Powers and sizes deviating from the standard are available on request. All changes reserved.

Example for order: Automatically controlled compensation system, 75 kvar in 6 stages, 440 V capacitors, 7 % detuned.

The appropriate ordering detail is as follows: **Type multicab-R 075/06-1122-07-SWGH.**

multicab-R Free-standing cabinet

Power	75 – 400 kvar
System cabinet* (H x W x D in mm)	S4 (2000 x 800 x 400) S5 (2000 x 800 x 600)
Module spaces	4



* Steel sheet free-standing cabinet, standard version without base

Detuned reactive current compensation system (free-standing cabinet)

- Highlights**
- Power from 75 to 400 kvar
 - Reactor factors 5.5, 7 or 8 % and 12.5 or 14 %
 - Capacitors **multicond-UHPC** with 440 V or 525 V
 - Reactive power controller **multicomp 4D6** with display
 - Simple system expansion through rack-mounted design
 - Optional: Safety and maintenance concept **secureC**®

Advantages and capabilities of the **safety and maintenance concept secureC** can be found on pages 92 – 95.

Accessories such as base, current transformer, etc. can be found from page 204.

Audio frequency blocking devices can be found on pages 126 – 131.

A selection of back-up fuses and supply lines for complete systems can be found on pages 224/225.

An overall view of **technical details** can be found on pages 176/177.

The **housing dimensions** are listed on page 179.

Specifications multicab-R ... SSGH

System with rack-mounted design Reactor factors: **5.5, 7 or 8 %** Capacitor rated voltage: **440 V**

POWER ¹ in kvar	SYSTEM WITH CONTROLLER	STAGE POWER PER MODULE PLACE in kvar				CONTROL- LER STAGES	CONSTRUC- TION TYPE ²	WEIGHT approx. in kg
		1	2	3	4			
75	multicab-R 075/06-1122- XX -SSGH	12,5 12,5	25 25	+	+	4	S4	249
100	multicab-R 100/08-1224- XX -SSGH	12,5 12,5	25	50	+	4	S4	256
125	multicab-R 125/05-1220- XX -SSGH	25	50	50	+	4	S4	262
125	multicab-R 125/10-1124- XX -SSGH	12,5 12,5	25 25	50	+	8	S4	282
150	multicab-R 150/06-1122- XX -SSGH	25 25	50	50	+	4	S4	294
150	multicab-R 150/12-1124- XX -SSGH	12,5 12,5	25	50	50	8	S4	314
175	multicab-R 175/07-1222- XX -SSGH	25	50	50	50	4	S4	306
200	multicab-R 200/04-1111- XX -SSGH	50	50	50	50	4	S4	318
200	multicab-R 200/04-1111- XX -SSGH	50 50	50 50	+	+	4	S5	335
200	multicab-R 200/08-1122- XX -SSGH	25 25	50	50	50	8	S4	338
200	multicab-R 200/08-1122- XX -SSGH	25 25 50	50 50	+	+	8	S5	355
250	multicab-R 250/05-1111- XX -SSGH	50 50	50 50	50	+	8	S5	364
250	multicab-R 250/10-1122- XX -SSGH	25 25 50	50 50	50	+	8	S5	374
300	multicab-R 300/06-1111- XX -SSGH	50 50	50 50	50 50	+	8	S5	396
300	multicab-R 300/12-1122- XX -SSGH	25 25 50	50 50	50 50	+	8	S5	406
350	multicab-R 350/07-1111- XX -SSGH	50 50	50 50	50 50	50	8	S5	440
400	multicab-R 400/08-1111- XX -SSGH	50 50	50 50	50 50	50 50	8	S5	472
400	multicab-R 400/16-1122- XX -SSGH	25 25 50	50 50	50 50	50 50	12	S5	482

Specifications multicab-R ... SSGB

System with rack-mounted design Reactor factors: **12.5 or 14 %** Capacitor rated voltage: **525 V**

POWER ¹ in kvar	SYSTEM WITH CONTROLLER	STAGE POWER PER MODULE PLACE in kvar				CONTROL- LER STAGES	CONSTRUC- TION TYPE ²	WEIGHT approx. in kg
		1	2	3	4			
75	multicab-R 075/06-1122- XX -SSGB	12,5 12,5	25 25	+	+	4	S4	298
100	multicab-R 100/08-1224- XX -SSGB	12,5 12,5	25	50	+	4	S4	306
125	multicab-R 125/05-1220- XX -SSGB	25	50	50	+	4	S4	314
125	multicab-R 125/10-1124- XX -SSGB	12,5 12,5	25 25	50	+	8	S4	331
150	multicab-R 150/06-1122- XX -SSGB	25 25	50	50	+	4	S4	334
150	multicab-R 150/12-1124- XX -SSGB	12,5 12,5	25	50	50	8	S4	373
175	multicab-R 175/07-1222- XX -SSGB	25	50	50	50	4	S4	379
200	multicab-R 200/04-1111- XX -SSGB	50	50	50	50	4	S4	402
200	multicab-R 200/04-1111- XX -SSGB	50 50	50 50	+	+	4	S5	419
200	multicab-R 200/08-1122- XX -SSGB	25 25	50	50	50	8	S4	409
200	multicab-R 200/08-1122- XX -SSGB	25 25 50	50 50	+	+	8	S5	426
250	multicab-R 250/05-1111- XX -SSGB	50 50	50 50	50	+	8	S5	469
250	multicab-R 250/10-1122- XX -SSGB	25 25 50	50 50	50	+	8	S5	476
300	multicab-R 300/06-1111- XX -SSGB	50 50	50 50	50 50	+	8	S5	522
300	multicab-R 300/12-1122- XX -SSGB	25 25 50	50 50	50 50	+	8	S5	541
350	multicab-R 350/07-1111- XX -SSGB	50 50	50 50	50 50	50	8	S5	587
400	multicab-R 400/08-1111- XX -SSGB	50 50	50 50	50 50	50 50	8	S5	640
400	multicab-R 400/16-1122- XX -SSGB	25 25 50	50 50	50 50	50 50	12	S5	647

– No expansion possibility + system expansion possible with modules of type **multimod-F** GH/GB → page 153

¹ Power at 400 V, 50 Hz ² Measurement details and other details on the construction can be found on page 179

XX = It is important that you state the reactor factor when ordering (see also following order example).


Powers and sizes deviating from the standard are available on request. All changes reserved.

Example for order: Automatically controlled compensation system, 300 kvar in 6 stages, 525 V capacitors, 12.5 % detuned.

The appropriate ordering detail is as follows: **Type multicab-R 300/06-1111-12-SSGB**

multicab-R Combination filter / free-standing cabinet

Power	50 – 400 kvar
System cabinet* (H x W x D in mm)	S4 (2000 x 800 x 400) S5 (2000 x 800 x 600) M84 (325 x 695 x 350) M84 (325 x 695 x 450)
Module spaces	4 (S4 und S5)



* Steel sheet free-standing cabinet, standard version without base

Reactive current compensation system with combination filter

- Highlights**
- Blocking of audio frequencies from 165 to 190 Hz
 - Power from 50 to 400 kvar
 - Capacitors **multicond-UHPC** with 525 V
 - Reactive power controller **multicomp 4D6** with display
 - Genuine combination filter (two reactors per stage)
 - Optional: Safety and maintenance concept **secureC**®

Advantages and capabilities of the **safety and maintenance concept secureC** can be found on pages 92 – 95.

Accessories such as base, current transformer, etc. can be found from page 204.

Audio frequency blocking devices can be found on pages 126 – 135.

A selection of back-up fuses and supply lines for complete systems can be found on pages 224/225.

An overall view of **technical details** can be found on page 177.

The **housing dimensions** are listed on page 179.

Specifications multicab-R combination filter

System with rack-mounted design Reactor factors: »Kombi« Capacitor rated voltage: **525 V**

POWER ¹ in kvar	SYSTEM WITH CONTROLLER	STAGE POWER PER MODULE PLACE in kvar				CONTROL- LER STAGES	CONSTRUC- TION TYPE ²	WEIGHT approx. in kg
		1	2	3	4			
50	multicab-R 050/04-1120- XX -SSGB	12,5	12,5	25	+	4	S4	257
75	multicab-R 075/06-1122- XX -SSGB	12,5	12,5	25	25	4	S4	304
100	multicab-R 100/04-1120- XX -SSGB	25	25	50	+	4	S4	314
125	multicab-R 125/05-1220- XX -SSGB	25	50	50	+	4	S4	321
150	multicab-R 150/06-1122- XX -SSGB	25	25	50	50	4	S4	294
175	multicab-R 175/07-1222- XX -SSGB	25	50	50	50	4	S4	368
200	multicab-R 200/04-1111- XX -SSGB	50	50	50	50	4	S4	387
250	multicab-R 250/05-1220- XX -SSGB	50	100	100	+	8	S5	406
300	multicab-R 300/06-1122- XX -SSGB	50	50	100	100	8	S5	435
350	multicab-R 350/07-1222- XX -SSGB	50	100	100	100	8	S5	534
400	multicab-R 400/04-1111- XX -SSGB	100	100	100	100	8	S5	572

Specifications multimod-F ... K1 ... 08GB

Expansion modules for combination filter system with rack-mounted design Reactor factors: »Kombi«
Capacitor rated voltage: **525 V**

POWER ¹ in kvar	STAGE POWER in kvar	COMBINATION FILTER SYSTEM for cabinet width 800 mm	CONSTRUC- TION TYPE ²	WEIGHT approx. in kg
12,5	12,5	multimod-F 012/01-1000-K1-84GB	M84	34
25	25	multicab-R 025/01-1000-K1-84GB	M84	47
50	50	multicab-R 050/01-1000-K1-84GB	M84	66
100	100	multicab-R 100/01-1000-K1-85GB	M85	122

– **No expansion possibility** + **system expansion possible** with modules of type **multimod-F ... GH/GB** → page 153

¹ Power at 400 V, 50 Hz ² Measurement details and other details on the construction can be found on page 179

XX = It is important that you state the reactor factor when ordering (see also following order example).

Powers and sizes deviating from the standard are available on request. All changes reserved.

Example for order: Automatically controlled compensation system, 175 kvar in 7 stages, 525 V capacitors, combination filter.
The appropriate ordering detail is as follows: **Type multicab-R 175/07-1222-K1-SSGB**

multicab-R Thyroswitch / free-standing cabinet

Power	75 – 250 kvar
System cabinet* (H x W x D in mm)	S5 (2000 x 800 x 600)
Module spaces	5



* Steel sheet free-standing cabinet, standard version without base

Detuned reactive current compensation system with thyristor switch

- Highlights**
- Power from 75 to 250 kvar
 - Reactor factors 5.5, 7 or 8% and 12.5 or 14%
 - Capacitors **multicond-UHPC** with 525 V
 - High-speed reactive power controller **BR 6000T**
 - Long working life through unlimited frequency of operations
 - No noise produced when switching stages

Accessories such as base current transformer, etc. can be found from page 204.

Audio frequency blocking devices can be found on pages 126 – 131.

A selection of back-up fuses and supply lines for complete systems can be found on pages 224/225.

An overall view of **technical details** can be found on page 177.

The **housing dimensions** are listed on page 179.

Specifications multicab-R thyroswitch

Thyristor-switched system Reactor factors: **5.5, 7 or 8 %** Capacitor rated voltage: **525 V**

POWER ¹ in kvar	SYSTEM WITH CONTROLLER	STAGE POWER PER MODULE PLACE in kvar					CONTROL- LER STAGES	CONSTRUC- TION TYPE ²	WEIGHT approx. in kg
		1	2	3	4	5			
75	multicab-R 075/06-1122- XX -SSTB	12,5	12,5	25	25	+	4	S5	236
100	multicab-R 100/04-1120- XX -SSTB	25	25	50	+	+	4	S5	226
100	multicab-R 100/08-1124- XX -SSTB	12,5	12,5	25	50	+	4	S5	247
150	multicab-R 150/06-1122- XX -SSTB	25	25	50	50	+	4	S5	259
200	multicab-R 200/04-1111- XX -SSTB	50	50	50	50	+	4	S5	292
250	multicab-R 250/05-1111- XX -SSTB	50	50	50	50	50	8	S5	336

Specifications multicab-R thyroswitch

Thyristor-switched system Reactor factors: **12.5 or 14 %** Capacitor rated voltage: **525 V**

POWER ¹ in kvar	SYSTEM WITH CONTROLLER	STAGE POWER PER MODULE PLACE in kvar					CONTROL- LER STAGES	CONSTRUC- TION TYPE ²	WEIGHT approx. in kg
		1	2	3	4	5			
75	multicab-R 075/06-1122- XX -SSTB	12,5	12,5	25	25	+	4	S5	264
100	multicab-R 100/04-1120- XX -SSTB	25	25	50	+	+	4	S5	265
100	multicab-R 100/08-1124- XX -SSTB	12,5	12,5	25	50	+	4	S5	287
150	multicab-R 150/06-1122- XX -SSTB	25	25	50	50	+	4	S5	330
200	multicab-R 200/04-1111- XX -SSTB	50	50	50	50	+	4	S5	276
250	multicab-R 250/05-1111- XX -SSTB	50	50	50	50	50	8	S5	441

– **No expansion possibility** + **system expansion possible** with modules of type **multimod-F** ... GH/GB → page 153

¹ Power at 400 V, 50 Hz ² Measurement details and other details on the construction can be found on page 179

XX = It is important that you state the reactor factor when ordering (see also following order example).

Powers and sizes deviating from the standard are available on request. All changes reserved.

Example for order: Automatically controlled compensation system, 200 kvar in 4 stages, 525 V capacitors, 12.5 % detuned.

The appropriate ordering detail is as follows: **Type multicab-R 200/04-1111-12-SSTB**.

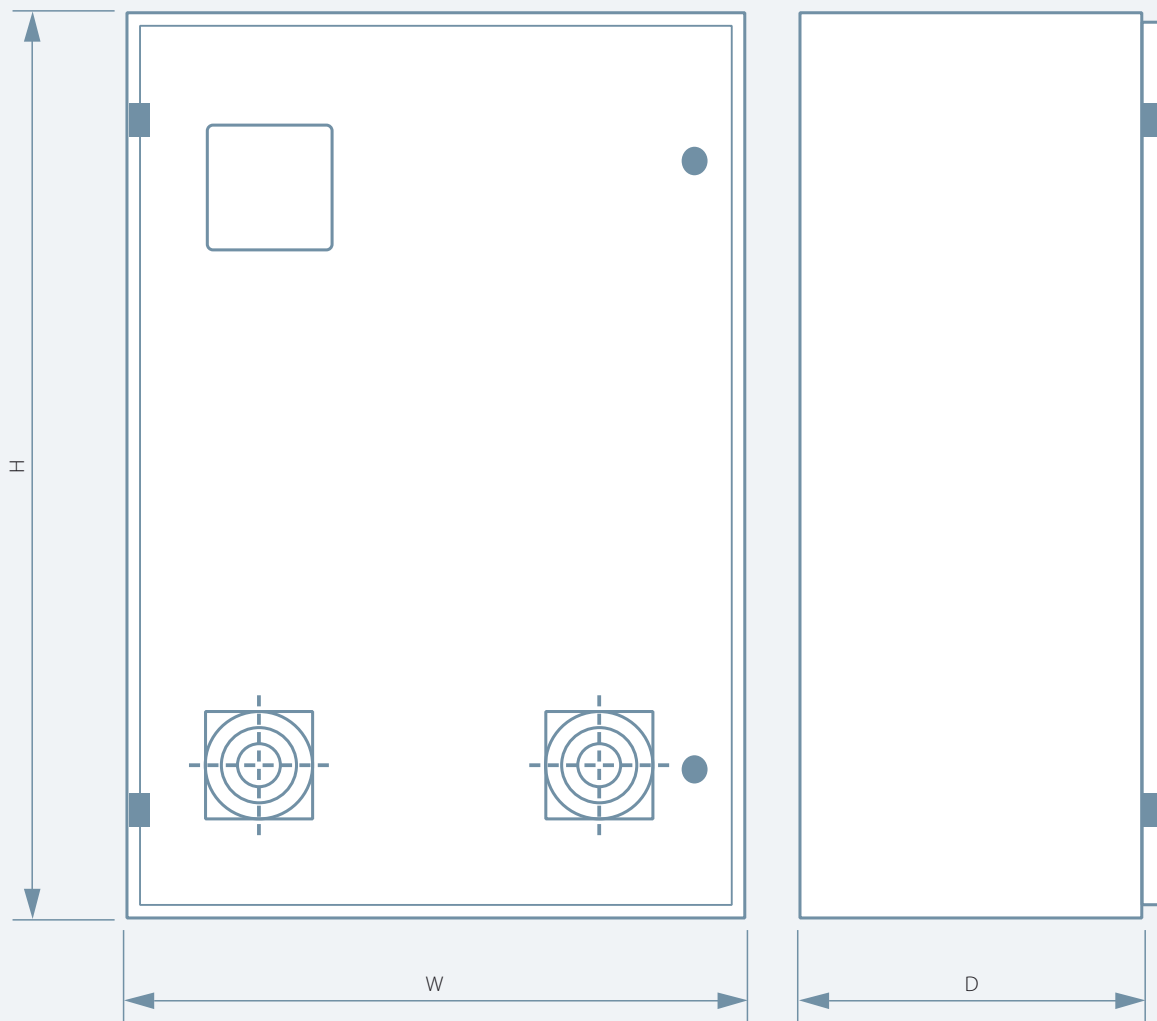
multicab-R Technical details

DEVICE TYPE	multicab-R small systems		Group back-up fuse with NH fuses and fuse sockets (NH-disconnector on request)
	SWSH $p = 5.5, 7$ or 8%	SWSB $p = 12.5$ or 14%	
Rated voltage Frequency	$U_n = 400\text{ V}$ 50 Hz		
Maximum permissible operating voltage	$U_n = 400\text{ V} \pm 10\%$		
Maximum permissible operating current	$1.3 \times I_n$, permanently		
REACTIVE POWER CONTROLLER	multicomp 144 LCD 4-quadrant operation Optimizing controller behavior Circuit switching	multicomp 4D6 with display 4-quadrant operation Optimizing controller behavior Circuit switching	
Current transformer connection	1 A and 5 A		
Safety and maintenance concept secureC	Only in connection with multicomp 4D6		<input type="checkbox"/>
SWITCH ELEMENT	Capacitor contactors		Capacitor contactors
Control voltage	$U_{\text{Control}} = 230\text{ V}$, 50 Hz		$U_{\text{Control}} = 230\text{ V}$, 50 Hz
	Control voltage transformer required for deviating operating voltage		
Switch delay	60 s		60 s
CAPACITORS	Low-loss multicond-UHPC power capacitors, MTK technology		
Capacitor rated voltage	$U_{\text{Meas.}} = 440\text{ V}$	$U_{\text{Meas.}} = 525\text{ V}$	$U_{\text{Meas.}} = 440\text{ V}$
Discharge of capacitors	Discharge resistors $t < 60\text{ s}$ Optional discharge inductors $t < 3\text{ s}$		Discharge resistors $t < 60\text{ s}$ Optional discharge inductors $t < 3\text{ s}$
FILTER CIRCUIT REACTORS	Linear filter circuit reactors to avoid resonances in networks with harmonics, built-in temperature monitoring		
Reactor factors	$p = 5.5, 7$ or 8%	$p = 12.5$ or 14%	$p = 5.5, 7$ or 8%
HOUSING DESIGN	Steel sheet cabinet, painted inside and outside with color RAL 7035 (other colors on request), Module plates galvanized, Door hinge on left (optionally on right), energy supply below (above on request), Protection class I		
Mode of protection	IP 20 (IP 54 on request), the components used correspond to BGV-A2		
AMBIENT TEMPERATURES	+40 °C highest value, briefly +35 °C in 24-hour average +20 °C in annual average -10 °C lowest value		
VENTILATION	Built-in ceiling ventilation, temperature-controlled		
FUSE PROTECTION	Group back-up fuse with NH fuses and fuse sockets (NH-disconnector on request)		

e sockets	multicab-R combination filter	multicab-R thyroswitch p = 5.5, 7 or 8% p = 12.5 or 14 %
	U _n = 400 V 50 Hz	
	U _n = 400 V ± 10 %	
	1.3 x I _n permanently	
	multicomp 4D6 with display 4-quadrant operation Optimizing controller behavior Circuit switching	BR 6000T High-speed controller
	1 A and 5 A	
	□	–
	Capacitor contactors	Thyristors
	U _{Control} = 230 V, 50 Hz	DC gating: U _{Control} = 10 – 30 V AC gating: U _{Control} = 230 V, 50/60 Hz Gating via reactive power controller or directly via SPS or process sliders
	Control voltage transformer required for deviating operating voltage	
	60 s	DC gating: 1 – 15 ms, dynamic controller required AC gating: 10 – 25 ms with direct gating 500 ms for gating via standard reactive power controller
	Low-loss multicond-UHPC power capacitors, MTK technology	
U _{Meas.} = 525 V	U _{Meas.} = 525 V	U _{Meas.} = 525 V
	Discharge resistors t < 60 s Optional discharge inductors t < 3 s	Through EPL technology, no discharge time can be maintained during operation. Discharge resistors t < 60 s No discharge reactor possible
ing	Linear filter circuit reactors to avoid resonances in networks with harmonics, built-in temperature monitoring	
p = 12.5 or 14 %	p = 5.5 and 12.5 %	p = 12.5 or 14 % p = 12.5 or 14 %
	Steel sheet cabinet, painted inside and outside with color RAL 7035 (other colors on request), Module plates galvanized, Door hinge on left (optionally on right), energy supply below (above on request), Protection class I	
	IP 20 (IP 54 on request), the components used correspond to BGV-A2	
	+40 °C highest value, briefly +35 °C in 24-hour average +20 °C in annual average –10 °C lowest value	
	Built-in ceiling ventilation, temperature-controlled	
	Group back-up fuse with NH fuses and fuse sockets (NH-disconnector on request)	

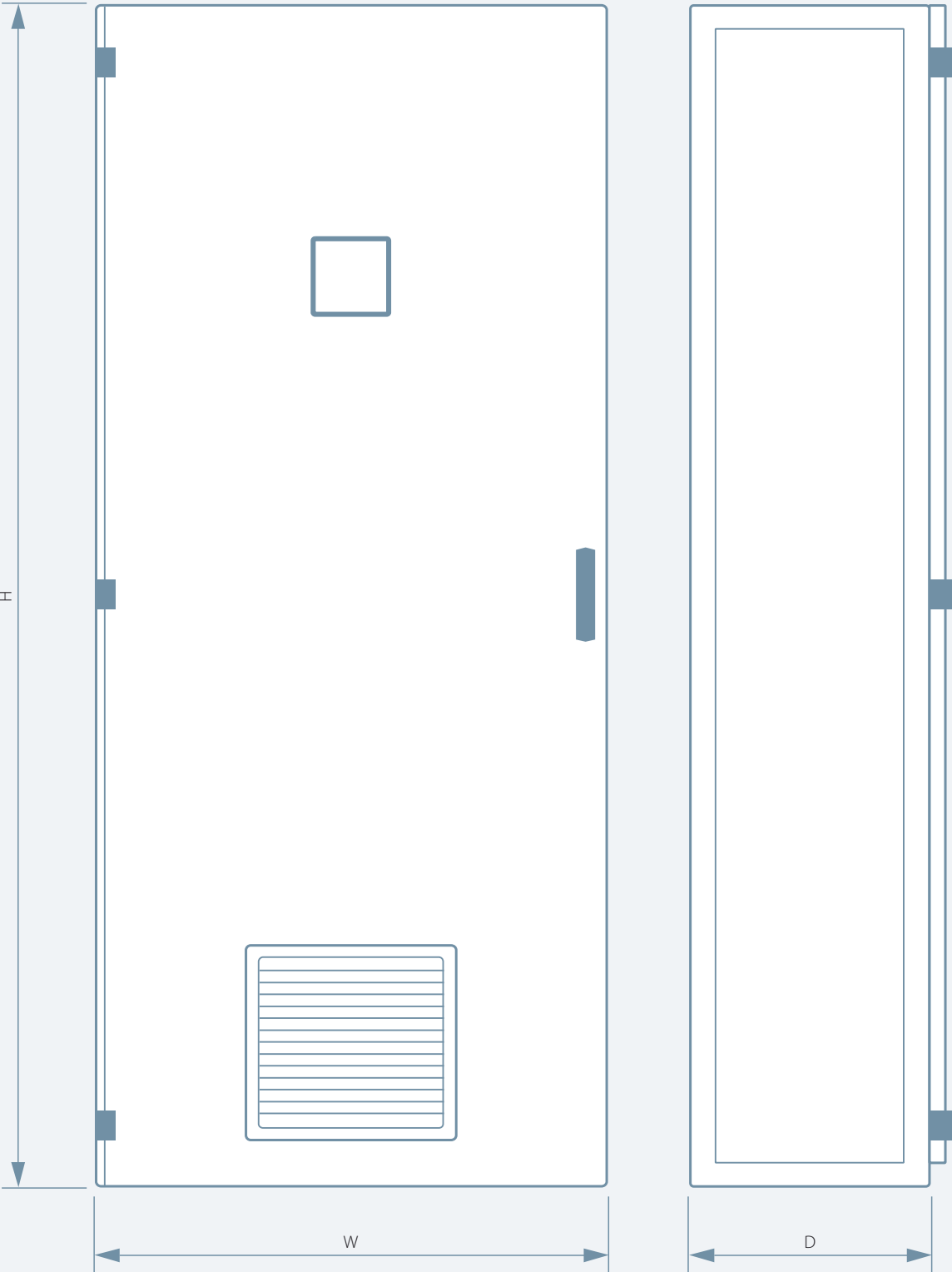
multicab-R Dimensions

multicab-R
Steel sheet wall cabinet (construction type S3)



CONSTRUCTION TYPE	HEIGHT (H) in mm	WIDTH (W) in mm	DEPTH (D) in mm
S2	800	800	400
S3	1200	800	400
S4	2000	800	400
S5	2000	800	600
M84	325	695	350
M85	325	695	450

multicab-R
Steel sheet free-standing cabinet (construction type S4)



Active harmonic filter

BLUEWAVE

Monitoring



Recording

Optimizing



The active harmonic filter BLUEWAVE analyzes the measured consumer current in terms of the phase length and harmonic proportion. After this is calculated, an inverted current signal with the same spectrum is fed into the relevant current node point. BLUEWAVE thereby controls the mains current in terms of minimal mains pollution and harmonics currents. This guarantees an optimal network quality without other consumers being impaired in their function.

BLUEWAVE 200 A / 250 A / 300 A

The largest model, for industrial purposes, provides the highest possible power in a compact space. The cabinet version contains interior air cooling and internal fluid cooling for the power electronics.



BLUEWAVE 30 A / 50 A (3-wire)

Space-saving through compact construction and with a power dissipation of only 1300 W, extremely economical.



BLUEWAVE 30 A / 60 A (4-wire)

Compensates the harmonics occurring in the neutral conductor. Optimal for building engineering due to low noise development.



BLUEWAVE 100 A / 120 A

The perfect standard solution in 3 and 4-wire networks with central coupling to the consumer.

BLUEWAVE

Power	30 – 300 A 400 – 480 V
Technology	3 / 4-wire



BLUEWAVE 30A / 50 A (3-wire)



BLUEWAVE 30A / 60 A (4-wire)

Active harmonics filter

Highlights

- Power from 30 A to 300 A
- Upgrading through parallel switching (up to 5 devices)
- Extremely fast reaction time of less than 300 μ s
- Easy and space-saving installation through compact construction
- Fully digitized controls
- IP 54 standard ensures protection against dust and environmental influences
- Automatic adjustment to network topologies and targeted compensation of individual disruption patterns

An overall view of **technical details** can be found on pages 188/189.



BLUEWAVE 100A / 120 A



BLUEWAVE 200A / 250 A / 300 A

Suitable products for every requirement

BLUEWAVE 30A / 50A (3-wire)

Even the smallest version of BLUEWAVE guarantees compensation of harmonics up to the 50th harmonic, as well as reactive energy. Small dimensions and low weight enable a simple and space-saving installation in every situation: both wall-mounted and switchgear cabinet are possible up to protection type IP 54. With a power dissipation of only 1300 W, this model is extremely economical. The reaction time of less than 300 μ s in the UltraFast mode makes it possible to optimally compensate even dynamic consumers.

BLUEWAVE 30A / 60A (4-wire)

BLUEWAVE 30A/60A also compensates the harmonics occurring in the neutral and is particularly suitable for compensating the third harmonic and all those above that dividable by three, up to the 50th harmonic. Due to its low noise development, this device is ideal for building technology – e.g. for banks, computer centers and hospitals.

BLUEWAVE 100A / 120A

Although hardly larger in weight and size than the compact versions of BLUEWAVE, this device is dimensioned for a current strength twice as high. This makes this filter an excellent solution for all those who require more power and are looking for a central coupling to their consumers. The 3 and 4-wire technology enables it to be used in almost all surroundings.

BLUEWAVE 200A / 250A / 300A

Dimensioned for a current strength up to 300 amps, this version of BLUEWAVE is suitable for the highest technical requirements as can be found in large production plants – for example in the automobile industry. So that it can work reliably even under extrem conditions, the filter in the cabinet version contains an interior air fan and in addition has an internal fluid cooling for the power electronics, with an integrated water-air heat exchanger.

BLUEWAVE

The solution for better network quality

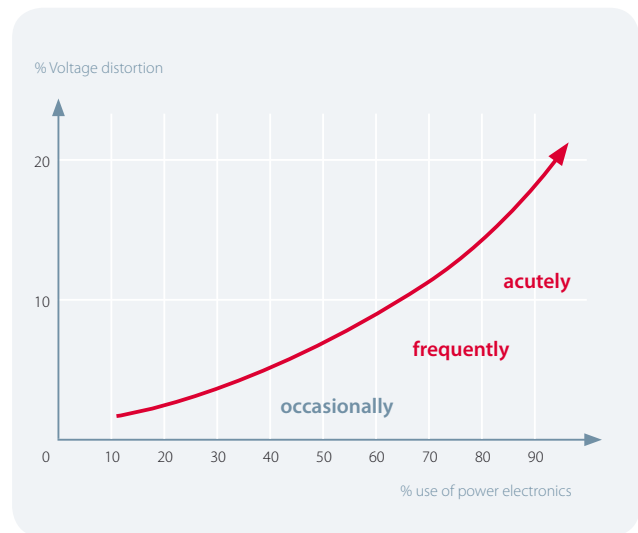
Situation:

There is a quality problem in the energy network of many companies.

Safety and cost-effectiveness are central factors in companies. One prerequisite of this is that technical infrastructures in the form of machines, production systems or office equipment function without trouble. This is often not the case: usually without a directly apparent reason, and despite UPS back-up and emergency generators. The consequences are:

- **Distribution lines and networks cannot be fully utilized**
- **High percentage of energy losses in the networks**
- **Increased wear and tear and limited availability of systems**
- **Downtime for units and systems**

Often the reason for breakdowns and premature wear and tear are power quality problems in the internal energy network. Measurements and network analyses can often detect the sources of the underlying problem.



A clear global tendency: Voltage distortion increases along with the growing use of power electronics.



A clearly constructed and easily readable display represents the values.

Solution:

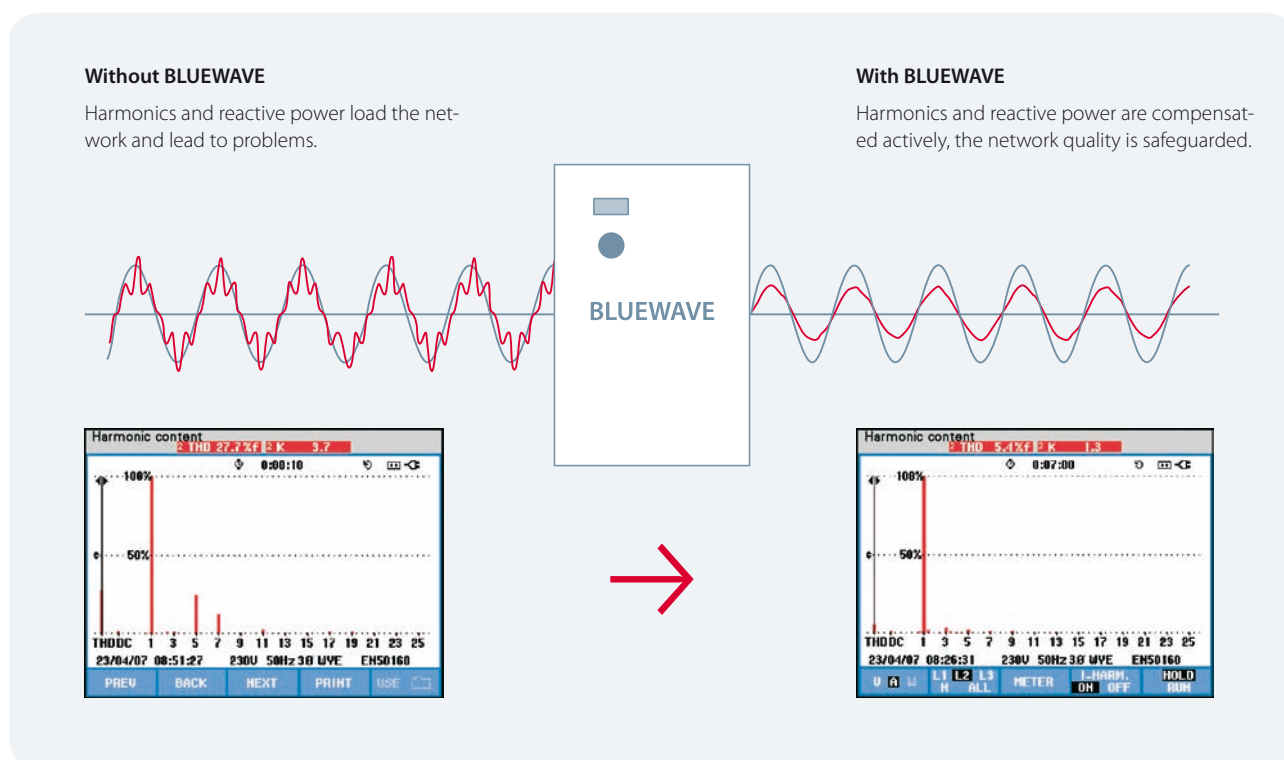
BLUEWAVE eliminates harmonic and reduces the costs for reactive power

Nearly all non-linear consumers in the industrial world cause massive voltage distortions of the original pure sinus curve. This is where BLUEWAVE is applied. Harmonic up to the 50th harmonic, as well as cost intensive reactive power, are eliminated directly and reliably. This ensures a high network quality and reduces costs. Even saving reactive power is reflected in lower operating costs. Savings made as a consequence of lower equipment wear, fewer error searches or the prevention of production stoppages have a significantly higher impact. For this reason, BLUEWAVE pays for itself within a short time.

The advantages

As an active harmonic filter of the newest generation, BLUEWAVE offers many advantages over conventional technology. BLUEWAVE is powerful, compact and fully digital, reacts within microseconds and reliably compensates

current harmonics and reactive power. With these features, the active harmonic filter presents itself as an all-in-one device for excellent power quality



→ Compact models for every requirement

Whether building technology or automation technology: with its extensive range of models, BLUEWAVE is ideal for the most diverse applications. Versions of the devices range from 30 to 300 Ampere and 380 to 480 Volts – and this in 3 or 4-wire technology.

→ Rapid compensation almost in real-time

The faster an active harmonic filter reacts to disruptions in the network, the more exactly does it compensate them. Since BLUEWAVE is fully digital, a reaction time of less than 300 microseconds is possible. This way, BLUEWAVE ensures an excellent power quality and protects network components, cables and machines.

→ Resistant towards external influences

In industrial environments, clean room atmospheres do not always prevail. The high-tech components in BLUEWAVE are therefore protected from external influences. The 30 and 50-Ampere versions are equipped by default with protection type IP20, and thus protected from dust. The 300 Ampere version also resists spray water, thanks to protection class IP54.

→ High-performance in a confined space

In comparison with other active power filters, BLUEWAVE requires little space. In its 50-Ampere version, the device has external dimensions of only 36 x 59 x 29 cm and weighs less than 50 kg. This makes wall assembly possible without any problems.

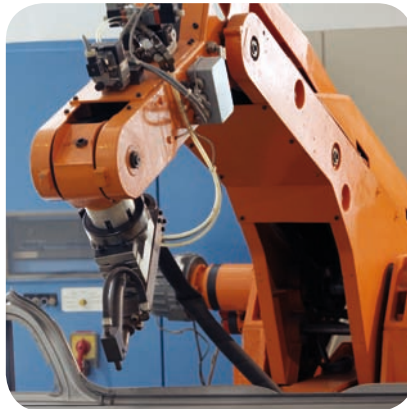
BLUEWAVE

Areas of deployment

The number of companies and institutions that could clearly optimize their network quality with BLUEWAVE is huge. An efficient use of the active harmonic filter and building technology, as well as in machine and automation technology, is highly recommended. It makes sense

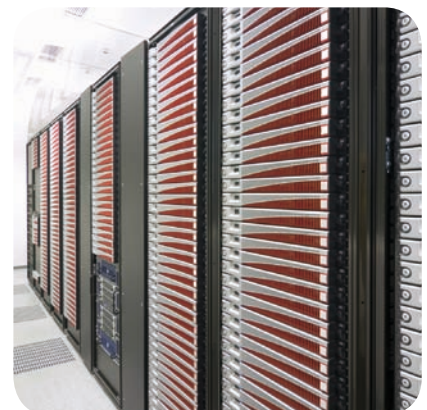
to include the device in the planning and implementation stages of new systems. Of course BLUEWAVE can be intelligently integrated into existing systems and plants in which power quality problems occur.

- Building technology
- Lifts
- Computer centers
- Machines and drives



- Automobile industry
- Oil and gas drilling rigs
- Paper industry
- Ship engines
- Welding equipment
- Steel industry

- Tunnel ventilation systems
- Uninterruptible power supplies (UPS)
- Water purification plants
- Wind turbines
- Cement industry



Operating comfort

- **Click-and-start configuration** BLUEWAVE demonstrates flexibility in the fact that it can be coupled on the load or network side to the energy supply via a numerous of current transformers. Configured with just a few clicks, the existing network current is permanently measured, and any harmonics or phase shifts that occur are actively compensated. Within microseconds, BLUEWAVE calculates the appropriate compensation currents, makes these available and feeds them into the network. Fully digitized controls make this possible, along with a high level of computer processing power.
- **Multilanguage menu and control via software** Using a multi-language, menu-guided operating panel and display, the setup, selection and adjustment of individual parameters is very user-friendly for all BLUEWAVE device types. With the BLUETRACE firmware, installation and maintenance can be performed conveniently via PC. In remote operation via Ethernet and TCP/IP interface, the current status of the network quality can optionally be retrieved online, so that adjustments can be made.

The service solutions

- **Individual solutions and comprehensive service** So that you can find the optimal solution for excellent network quality, KBR is at your service as a competent BLUEWAVE system partner: from consultation about the network analysis and planning down to implementation and after sales service. **24 months warranty** from KBR provide you with additional security.
- **Safe energy supply** In accordance with the new German low-voltage connection directive (NAV), grid subscribers in Germany must operate their devices so that disruptions to other subscribers are ruled out. Otherwise the network operator is allowed to interrupt connections without any warning, to prevent disruptive feedback effects on systems of the network operator or other connection participants. Energy-consuming companies and institutions are for this reason forced to check their internal networks and ensure that limiting values are maintained. With BLUEWAVE, specified deviations can be reduced so that the value again lies within tolerance. This provides more safety.

BLUEWAVE Technical details

DEVICE TYPE	3-WIRE 4-WIRE	BLUEWAVE 030-480-3 BLUEWAVE 030-400-4	BLUEWAVE 050-480-3 –	– BLUEWAVE 060-400-4
COMPENSATION CURRENT	3-wire	30 A	50 A	–
	4-wire	30/90 A	–	60 / 180 A
SWITCHING FREQUENCY		16 kHz		
OVERLOAD CAPACITY ¹		75 A for 10 ms	125 A für 10 ms	150 A für 10 ms
COOLING TYPE		Air cooling		
AMBIENT TEMPERATURE		40 °C ³		30 °C ³
PARALLEL OPERATION		With up to five devices		
INTERFACES		Modbus RTU (RS485), Modbus TCP/IP (Ethernet)		
POWER DISSIPATION	3-wire	< 900 W	< 1.300 W	–
	4-wire	< 950 W	–	< 1800 W
COOLING AIR REQUIREMENT fan speed-controlled	3-wire	< 350 m ³ /h	< 550 m ³ /h	–
	4-wire	< 400 m ³ /h	–	< 600 m ³ /h
NOISE LEVEL (1 m)	3-wire	65 dBA	65 dBA	–
	4-wire	63 dBA	–	63 dBA
FILTER CAPACITY		Up to 50th harmonic number		
INSTALL HEIGHT		1.000 m/derating bis 4.000 m, 1 %/100 m		
MAINS VOLTAGE	3-wire	380 V (AC) ± 15 % ... 480 V (AC) ± 10 %		
	4-wire	380 V (AC) ± 15 % ... 415 V (AC) ± 10 %		
MAINS FREQUENCY		47 bis 63 Hz		
REACTION TIME		300 µs		
CONTROLLER TOPOLOGY		Digital with FFT analysis		
CURRENT RESTRICTION		Rated current		
CURRENT TRANSFORMER		100 : 5 bis 50.000 : 5		
DIMENSIONS (H x W x D in mm)	3-wire	360 x 590 x 290	360 x 590 x 290	–
	4-wire	415 x 840 x 300	–	415 x 840 x 300
WEIGHT	3-wire	47 kg	47 kg	–
	4-wire	70 kg	–	70 kg
MODE OF PROTECTION		Standard IP20, optional IP54		
REGISTRATION		CE, UL ⁵		

¹ peak value ² Derating to 40 °C, 1,2 %/K ³ Derating to 55 °C ⁴ Other network voltages on request ⁵ UL only for 3-phase types

⁶ Available as version without UL license (FN 3420-xxx-480-3) and as UL-listed version (FN 3420-xxx-480-3-UL) – Not available

	BLUEWAVE 100-480-3 BLUEWAVE 100-400-4	BLUEWAVE 120-480-3 BLUEWAVE 120-400-4	BLUEWAVE 200-480-3 BLUEWAVE 200-400-4	BLUEWAVE 250-480-3 BLUEWAVE 250-400-4	BLUEWAVE 300-480-3 BLUEWAVE 300-400-4
	100 A	120 A	200 A	250 A	300 A
	100 / 300 A	120 / 360 A	200 / 600 A	250 / 750 A	300 / 750 A
	16 kHz				
	250 A for 10 ms	250 A for 10 ms	500 A for 10 ms	625 A for 10 ms	750 A for 10 ms
	Air cooling		Air cooling (internal fluid cooling)		
	40 °C ³	30 °C ^{2,3}	40 °C ³		
	With up to five devices				
	Modbus RTU (RS485), Modbus TCP/IP (Ethernet)				
	< 2.200 W	< 2.500 W	< 5.000 W	< 6.000 W	< 7.500 W
	< 3.000 W	< 3.000 W	< 5.500 W	< 6.300 W	< 8.500 W
	< 1.400 m ³ /h	< 1.400 m ³ /h	< 2.600 m ³ /h	< 3.100 m ³ /h	< 3.400 m ³ /h
	< 1.700 m ³ /h	< 1.700 m ³ /h	< 2.800 m ³ /h	< 3.300 m ³ /h	< 3.600 m ³ /h
	68 dBA	68 dBA	70 dBA	70 dBA	70 dBA
	69 dBA	69 dBA	70 dBA	70 dBA	70 dBA
	Up to 50th harmonic number				
	1,000 m/derating to 4,000 m, 1 %/100 m				
	380 V (AC) ± 15 % ... 480 V (AC) ± 10 %		50 Hz: 380 V (AC) ± 15 % ... 415 V (AC) ± 10 % 60 Hz: 480 V (AC) ± 10 %		
	380 V (AC) ± 15 % ... 415 V (AC) ± 10 %		50 Hz: 380 V (AC) ± 15 % ... 415 V (AC) ± 10 %		
	47 to 63 Hz		50 Hz or 60 Hz ± 5 %		
	300 µs				
	Digital with FFT analysis				
	Rated current				
	100 : 5 to 50,000: 5				
	468 x 970 x 412	468 x 970 x 412	800 x 2.000 x 600 Height plus base (200 mm standard) Depth including heat exchanger 760 mm		
	468 x 1460 x 412	468 x 1460 x 412			
	150 kg	150 kg	415 kg	415 kg	415 kg
	145 kg	145 kg	495 kg	495 kg	495 kg
	Standard IP20, optional IP54		IP54		
	CE, UL ⁵	–	CE, UL ^{5,6}		

Mobile network analysis device

multilog



multilog records all relevant data for creating extensive network analyses. More than 2,000 different measured values can be recorded. In addition, extensive trigger options for fast oscilloscope images and for recording 10 ms RMS values are available. Numerous archiving functions enhance the performance spectrum of the mobile network analysis device.

multilog expert

With extensive trigger options for fast oscilloscope images and 10 ms RMS values.



multilog

Recording

Over 2000 measured values

Measuring voltage

Up to 690 V

Protection class

IP65



multilog light/expert

Mobile network analyzer for low, medium and high voltage networks

Highlights

- Full recording of all electrical parameters
- Long-term and online measurements can be performed simultaneously
- Simple and quick setup without PC
- Evaluation of voltage quality in accordance with EN50160 and IEC61000-2-2
- Extensive evaluation functions
- Convenient graphic and tabular presentation of measurement results
- Company and project details on every printout

An overall view of **technical details** can be found on page 199.
The **housing dimensions** are listed on page 202.



multilog light/expert with accessories and transport case

Class A device in two versions

multilog is a powerful mobile network analyzer, active power meter and transient recorder with a high level of operating comfort. **multilog** was developed for mobile operation (protection class IP65) and is suitable for measurements in public networks (CAT IV) and for measurements in industrial surroundings up to 690 V measuring voltage. The device meets the requirements of the measuring device standard IEC61000-4-30 for a class A device for the following parameters:

PARAMETER	CLASS
Accuracy of voltage measurement	A
Determining the time interval	A
Marking measured values for events	A
Harmonics, interharmonics	A
Frequency	A
Voltage unbalance	A
Event recording	A
Time synchronization	A

Its small dimensions enable it to be installed in enclosed spaces and switchgear cabinets, and even right next to live components. Because of the voltage supply via measuring circuits and the application-related defaults of all trigger conditions, the device is very easy to handle. It is equipped with a wide range of trigger options so that the cause

of network disruptions can be quickly located. For data transmission, a fast USB 2.0 interface is available. In case of power failure, the built-in, uninterruptible power supply takes over operation.

multilog is available in **two versions**:

multilog light *

Suitable for performance analysis and for voltage quality analysis in accordance with EN50160 and IEC61000-2-2.

multilog expert

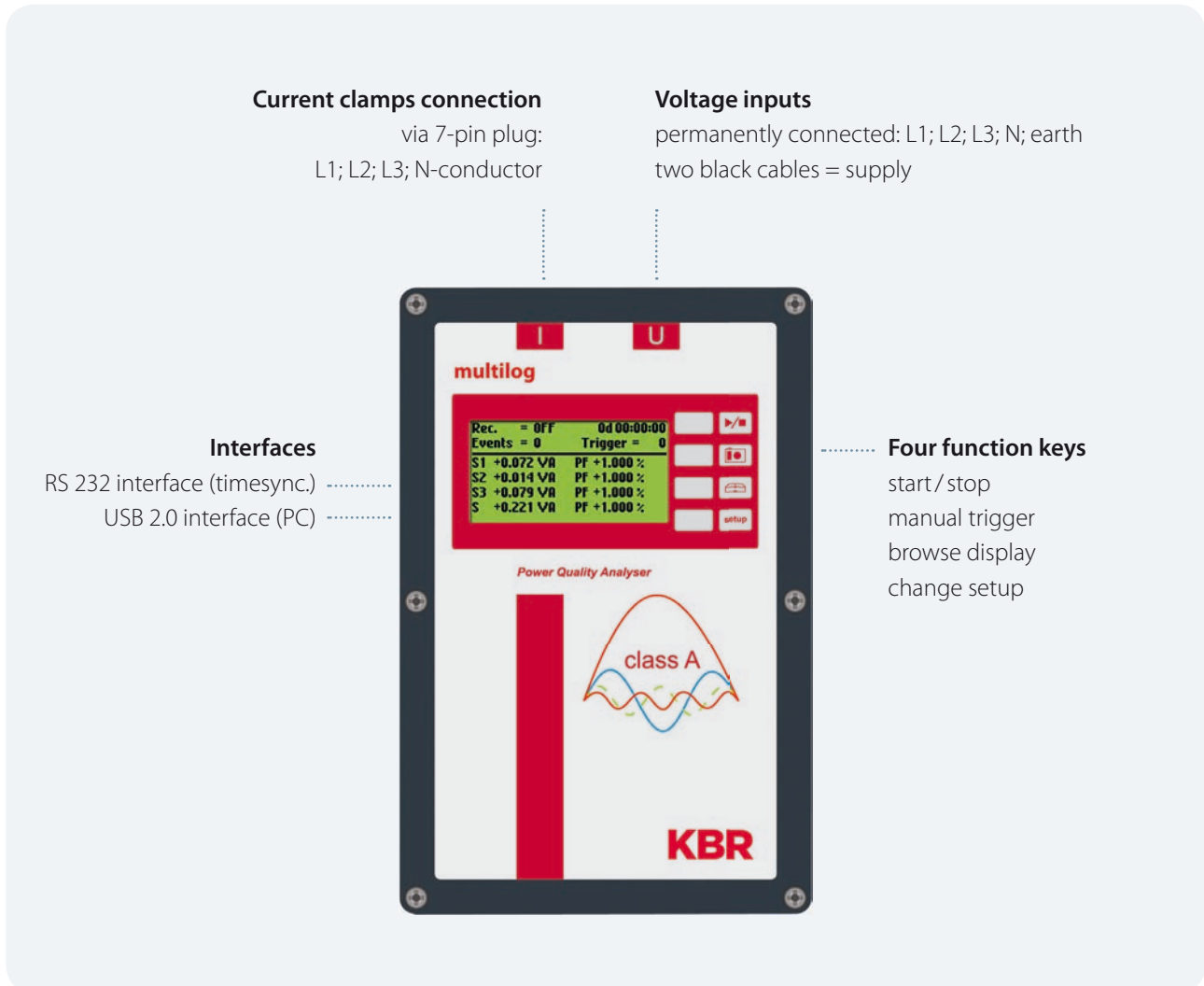
Extensive trigger options. Fast oscilloscope images and 10 ms RMS values can be recorded.

The **multilog** can hold over 2000 different measured values in one continuous recording: voltage, current, frequency, power, energy consumption, unbalance, flicker, harmonics and interharmonics. Without a restriction on the number of parameters, the measuring interval for the permanent recording can be set to a minimum of one second.

* Via a license, multilog light can be subsequently upgraded to the "expert" model.

multilog

Device fittings and power supply



→ Sturdy housing

The sturdy mechanical construction and the protection class IP 65, as well as having no rotating parts such as fan or hard drive, make **multilog** suitable for the toughest fieldwork.

→ Large storage capacity

multilog is equipped with a large memory of 1 GB. This allows measurement values to be recorded over long periods of time, up to one year.

→ Direct voltage supply

No separate plug is required for the voltage supply, this can be taken directly from the measuring circuits. In case of power failure, an internal UPS bridges the voltage supply of the network analyzer for one minute.

→ All relevant interfaces

multilog is equipped with all-important interfaces. The RS232 interface allows for time synchronization. Among other things the USB 2.0 interface enables the evaluation of data via PC.

Wide range of measuring and presentation options

MEASURING PARAMETERS AND FUNCTIONS	multilog light	multilog expert
STANDARDS STATISTICS ACC. TO EN50160/ IEC61000-2-2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
CONTINUOUS RECORDING		
Voltage: average, min. max. value	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Current, average, min. max. value	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Power P, Q, S, PF, cos φ	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Distortion reactive power D	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Energy P, Q, P+, P-, Q+, Q-	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Flicker (Pst, Plt, output 5)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Unbalance (U, I)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Voltage / current harmonics, THD	50.	50.
Interharmonic groups (U, I)	50.	50.
Ripple signal		
Frequency	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
ONLINE MODE		
Oscilloscope image	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
RMS values	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Voltage-, current harmonics (to 5 kHz)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Interharmonic groups (U, I)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Direction of energy flow of harmonic	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
TRIGGER FUNCTIONS		
Manual trigger via button	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
RMS value underrange (U, I)	–	<input checked="" type="checkbox"/>
RMS value overrange (U, I)	–	<input checked="" type="checkbox"/>
RMS value step change (U, I)	–	<input checked="" type="checkbox"/>
Phase shift	–	<input checked="" type="checkbox"/>
Envelope trigger	–	<input checked="" type="checkbox"/>

Standard version – Not available

→ Clear Display

The device display gives you information about the correct connection of the measuring circuits and current clamps, displays online data of voltage, current, THD (Total Harmonic Distortion), and power. The number of events that have occurred and the measurement period recorded are shown to the user in the display. To prevent the measuring device from being manipulated by third parties, a keyboard lock can be switched on.

Rec.	= OFF	Od 00:00:00
Events	= 0	Trigger = 0
S1	+0.072 VA	PF +1.000 %
S2	+0.014 VA	PF +1.000 %
S3	+0.079 VA	PF +1.000 %
S	+0.221 VA	PF +1.000 %

Rec.	= OFF	Od 00:00:00
Events	= 0	Trigger = 0
THD U1	+0.000 %	THD I1 +24.96 %
THD U2	+0.000 %	THD I2 +20.13 %
THD U3	+0.000 %	THD I3 +19.42 %
		THD IN +21.53 %

multilog

Simple evaluation of measured data

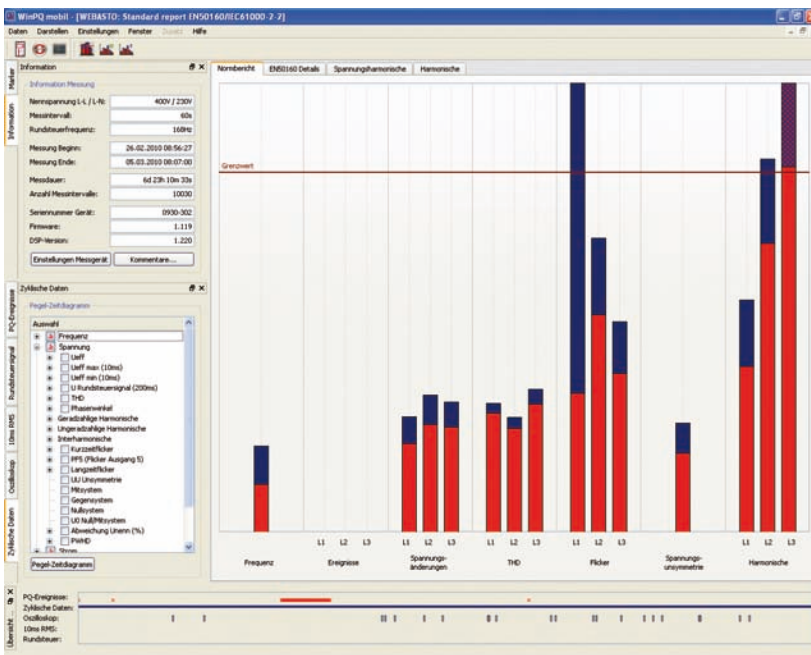
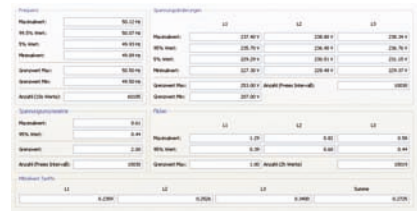
Evaluating measured data in multilog is easy and practical. Any number of measurements can be recorded out without having to read out the device first. The "manual trigger" key allows the current status of a system to be stored as an oscilloscope image and a 10 ms RMS value recording. In addition, settings can be made to the device – e.g. transformer configurations for current-, voltage transformer, measuring interval, rated voltage and network shape. Recorded data are transferred to the PC via a fast USB interface.

Powerful software is available to evaluate and archive recorded data, with extensive evaluation options such as load analysis, determining the cause of network disruptions, automatic reports in accordance with EN 50160/IEC61000-2-2 and which has many online functions.

The evaluation software is included in the delivery and may be installed on as many computers as you like. Regular updates for the evaluation software are available free of charge via the Internet.

→ Output as EN50160/IEC61000-2-2 Report

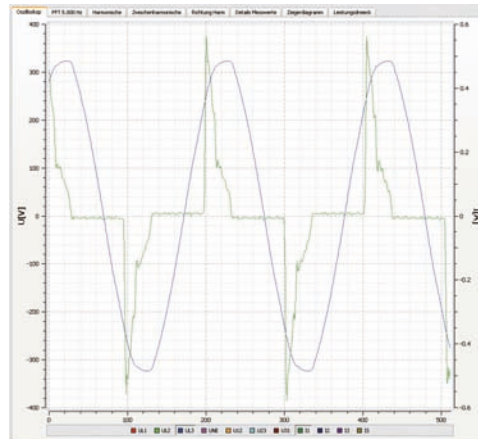
This evaluation provides a quick interview of supply quality. By means of the red and blue bars, it can be immediately decided what measured data are important for closer examination.



	Grenzwert	L1 - 95%	L1 - Max	L2 - 95%	L2 - Max	L3 - 95%	L3 - Max
THD	8.0000	2.6543	2.8685	2.3182	2.5634	2.8549	3.1815
2	2.0000	0.0260	0.0407	0.0272	0.0422	0.0237	0.0433
3	5.0000	0.5201	0.6116	0.2341	0.3093	0.6965	0.7670
4	1.0000	0.0280	0.0547	0.0201	0.0461	0.0193	0.0486
5	6.0000	2.4398	2.6693	2.2128	2.4712	2.6744	3.0314
6	0.5000	0.0201	0.0399	0.0144	0.0299	0.0136	0.0232
7	5.0000	0.6012	0.7335	0.4339	0.5912	0.3842	0.5446
8	0.5000	0.0124	0.0371	0.0149	0.0392	0.0172	0.0410
9	1.5000	0.5246	0.6057	0.2973	0.3605	0.3111	0.3858
10	0.5000	0.0166	0.0233	0.0165	0.0241	0.0123	0.0192
11	3.5000	0.7088	0.8368	0.5535	0.6797	0.6922	0.8164
12	0.5000	0.0114	0.0172	0.0138	0.0208	0.0098	0.0154
13	3.0000	0.3159	0.3828	0.2549	0.3356	0.2289	0.2949
14	0.5000	0.0153	0.0204	0.0148	0.0244	0.0123	0.0189
15	0.5000	0.1981	0.3038	0.2067	0.2818	0.1914	0.3050
16	0.5000	0.0142	0.0205	0.0125	0.0217	0.0109	0.0228
17	2.0000	0.1858	0.2378	0.2188	0.2900	0.2314	0.2774
18	0.5000	0.0078	0.0137	0.0078	0.0138	0.0069	0.0154
19	1.5000	0.2023	0.3094	0.2004	0.3001	0.2179	0.3407
20	0.5000	0.0140	0.0222	0.0097	0.0153	0.0109	0.0172
21	0.5000	0.1186	0.1943	0.0898	0.1401	0.1129	0.1473
22	0.5000	0.0170	0.0265	0.0151	0.0221	0.0142	0.0182
23	1.5000	0.1801	0.2574	0.0942	0.1516	0.1769	0.2353
24	0.5000	0.0128	0.0191	0.0172	0.0239	0.0109	0.0239
25	1.5000	0.1011	0.1653	0.1451	0.1829	0.2488	0.3244
26	0.3500	0.0064	0.0129	0.0104	0.0169	0.0065	0.0161
27	0.2000	0.0924	0.1291	0.1608	0.2079	0.2033	0.3017
28	0.3400	0.0063	0.0147	0.0164	0.0344	0.0072	0.0224
29	1.0600	0.0599	0.0848	0.0843	0.1340	0.1342	0.2079
30	0.3300	0.0041	0.0059	0.0114	0.0191	0.0058	0.0110
31	0.9700	0.0334	0.0571	0.0763	0.1346	0.0521	0.0781
32	0.3300	0.0049	0.0058	0.0169	0.0258	0.0095	0.0132
33	0.2000	0.0250	0.0525	0.0727	0.1251	0.0283	0.0533
34	0.3200	0.0038	0.0052	0.0063	0.0093	0.0049	0.0075

→ Online analysis software on the PC

An extensive online analysis software shows in real-time the existing curve shape of current and voltage signals and represents harmonics and interharmonics of direct voltage up to 5000 Hz. The direction of power flow of the harmonic at the measuring point as well as the current power values are displayed (active power, reactive power, distorted reactive power, $\cos \varphi$, phase angle, power factor).

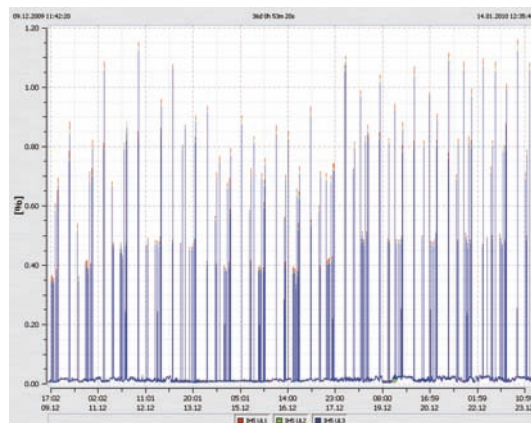


Online-Oszilloskopbild

→ Analysis of ripple signals

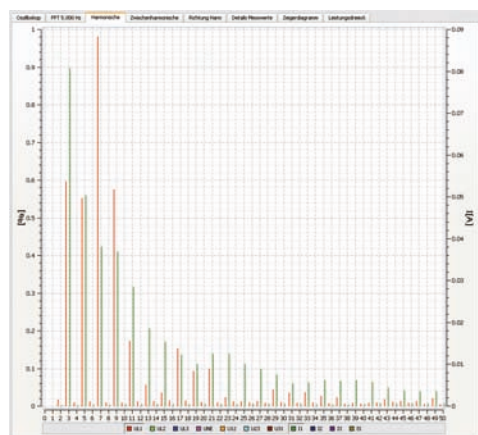
multilog can record any frequency between 0 to 5 kHz in addition to the harmonic. This function is suitable for evaluation of the signal height of ripple signals.

Parameter	Value	Unit
U _{eff}	230.00	V
I _{eff}	1.50	A
P _{eff}	345.00	W
Q _{eff}	0.00	var
S _{eff}	345.00	VA
cos φ	1.00	
φ	0.00	rad
φ _U	0.00	rad
φ _I	0.00	rad
φ _Q	0.00	rad
φ _S	0.00	rad
φ _P	0.00	rad
φ _{Qd}	0.00	rad
φ _{Qr}	0.00	rad
φ _{Qs}	0.00	rad
φ _{Qd}	0.00	rad
φ _{Qr}	0.00	rad
φ _{Qs}	0.00	rad
φ _{Qd}	0.00	rad
φ _{Qr}	0.00	rad
φ _{Qs}	0.00	rad



→ Time synchronization

A time synchronization is necessary for the correlation of measured data from different devices. For this purpose, radio clocks for GPS and DCF77 signals are available.



Online harmonic voltage and current

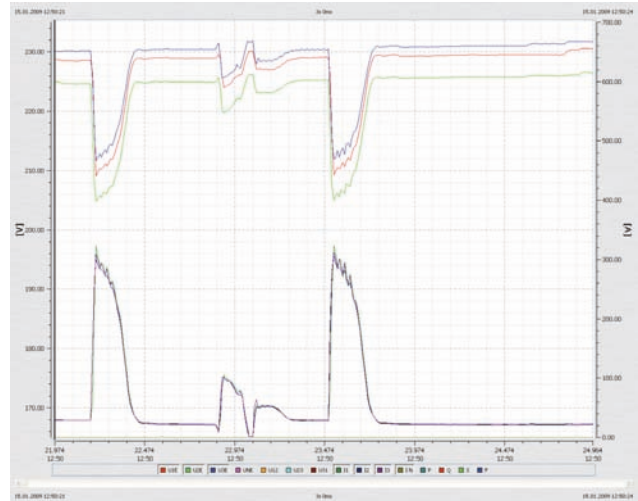
multilog

Simple evaluation of measured data

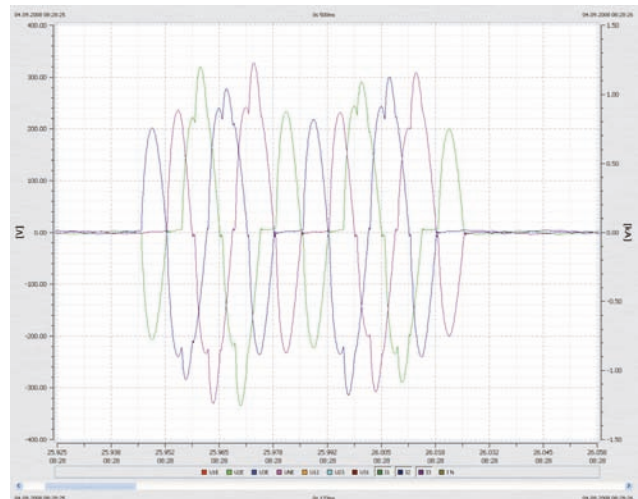
→ Fault records as oscilloscope image and 10 ms RMS record

In order to quickly locate the cause of network disruptions, **multilog** makes it possible to store the current status of a system as an oscilloscope image and a 10 ms RMS value recording.

10 ms RMS record

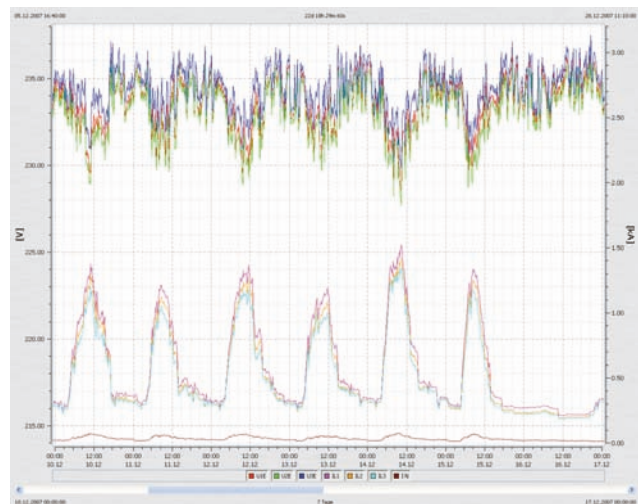


Oscilloscope image



→ Continuous recording

Up to 2,000 different measured values can be recorded continuously. Without a restriction on the number of parameters, it is possible to set the measuring interval for continuous recording to a minimum of one second.



multilog Technical details

DEVICE TYPE	multilog light and expert		
DEVICE TYPE	L1, L2, L3, N, PE; 400 V L-N; 690 V L – L AC / DC		
Current inputs	230 mV input for mini current clamps and Rogowski current clamps		
Scanning rate	10.24 kHz at 50 Hz		
Automatic synchronization to fundamental	45 Hz to 65 Hz		
Measuring interval	Settings between 1 sec. and 30 minutes are possible		
Data storage	1 GByte		
Interfaces	RS232, USB 2.0		
Time synchronization	DCF77 or GPS radio clock		
Dimensions	220 x 146 x 57 mm		
Weight	1,7 kg		
Mode of protection	IP 65		
Standard IEC 61000-4-30	Class A		
Accuracy	< 0,1 %		
Insulation category	CAT IV		
Converter	24 Bit		
Weathering resistance / temperature	Function: – 20 – 70 °C		
Storage	– 30 – 80 °C		
Display	LCD		
Supply voltage	100 V ... 400 V AC or 100 V ... 220 V DC		
EMV			
CE CONFORMITY	Interference resistance	EN 61326	EN 61000-6-2
	Noise emissions	EN 61326	EN 61000-6-4
ROGOWSKI CURRENT CLAMPS			
Current range	2650 A AC RMS		
Measuring range	10 A to 2650 A RMS		
Output voltage	85 mV / 1000 A		
Frequency range	10 Hz to 10 kHz		
Operating voltage	600 V AC / DC CAT IV		
Accuracy (at 25° and 50 Hz)	+/- 1,5 % v. M (50 A – 2650 A) / +/- 0,1 % v. E (< 50 A)		
Angle error (45 – 65 Hz)	+/- 1° v. M (50 A – 2650 A) / +/- 2,5° v. E (< 50 A)		
Positioning accuracy	2 % v. M (50 A – 2650 A) / +/- 0,2 % v. E (< 50 A)		
Length of Rogowski coil	610 mm		
Length of connection cable	2 m		

multilog Accessories

Frequency range **40 Hz to 10 kHz**

Measuring range **100 mA to 20 A RMS**



Mini current clamp set

TYPE	Mini current clamp set 20 A		
Current range	20 A AC RMS		
Measuring range	100 mA to 20 A RMS		
Output voltage	10 mV/A		
Frequency range	40 Hz to 10 kHz		
Operating voltage	600 V AC/DC		
Current 50Hz			
Strom 50Hz	100 mA	1 A	10 A
Accuracy	1,5 %	1 %	0,5 %
Angle error	1,5	1	0,5

With the **mini current clamps, multilog** automatically detects the current clamp set connected via a coding in the plug and sets the appropriate measurement range. The transmission ratio for the respective clamp does not have

to be entered in the device. The clamps are especially suitable for measurements at secondary transformers in MV or HV networks. They combine high accuracy with small angle errors.

Frequency range **40 Hz to 10 kHz**Measuring range **1 A to 200 A RMS**

Mini current clamp set 200 A

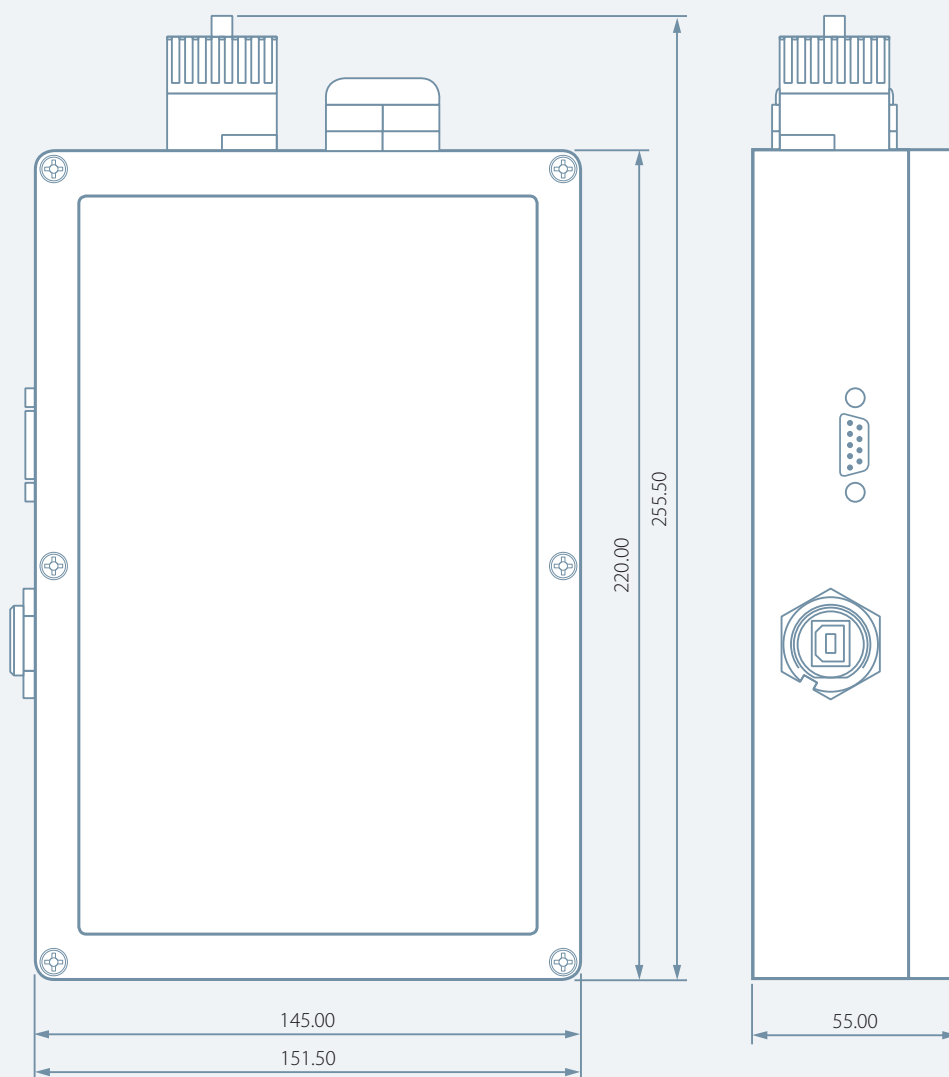
TYPE	Mini current clamp set 200 A		
Current range	200 A AC RMS		
Measuring range	1 A to 200 A RMS		
Output voltage	1 mV / A		
Frequency range	40 Hz to 10 kHz		
Operating voltage	600 V AC/DC		
Current 50Hz			
Strom 50Hz	1 A	10 A	100 A
Accuracy	1,5 %	1 %	0,5 %
Angle error	1,5	1	0,5

The **current clamps set 200 A** consists of four highly precise current clamps and an adapter cable set which in principle allows other calipers to be connected. This set is intended specifically for use in distributions of low voltage

networks with low power. Through the use of four current clamps, measurement of neutral conductor currents is also accounted for.

multilog Dimensions

multilog light and expert



multilog **Ordering details**

FEATURES

CODE

Fault recorder and network analyzer
in accordance with DIN EN 50160 and IEC 61000-2-2
Class A

multilog

Mobile power quality network analyzer and power meter
for low, medium and high voltage networks
in accordance with DIN EN-50160/ IEC 61000-4-30
Class A

- 1 GByte Flash memory
- USB interface
- Display
- IP65; with uninterruptible power supply
- USB cable set
- Connection cable for voltage
- 2 supply lines
- Dolphin clamps
- Rogowski coils set of 4 1 ... 2650 A
- Robust transport case
- Evaluation software

Version

- Network analyzer light
- Network analyzer and fault recorder expert

User manual and display

- German
- English
- French
- Spanish
- Italian
- Dutch
- Czech
- Russian
- Polish

multilog Upgrade

- Upgrade of light version (→ B1) to expert (→ B2)

Accessories

- Mini current clamps set of 4 0 ... 20 A
- Mini current clamps set of 3 0 ... 20 A
- Mini current clamps set of 4 0 ... 200 A

Accessories, other systems
and assembly

Accessories

Monitoring



Recording

Optimizing



The KBR product spectrum for power quality stands out because of a high degree of modularity and uncompromising quality. All system components for reactive current compensation are perfectly matched to one another and can be assembled quickly and easily.

multimod-SM

Assembly consisting of controller module, display units and connection line.
The functional construction enables a quick and easy assembly.

**multicab-SO**

Cabinet base to raise the height of compensation systems.

**multimod-FAN**

Optionally as a door or ceiling fan to increase the functional duration of the compensation system.

**multict-TA**

Plug-on current transformer to record current for reactive power controller, energy control systems and measuring devices.

multimod-SM

Figure: multimod-SM ... R

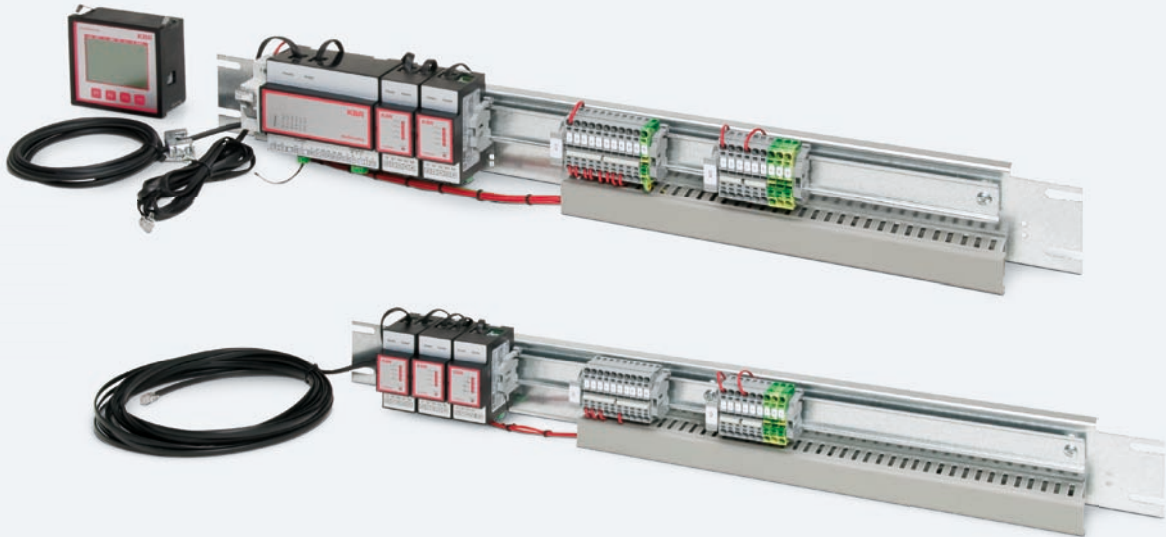


Figure: multimod-SM ... E

Control modules

TYPE	PURPOSE	WIDTH in mm
multimod-SM 6/8/0-R04 -R08 -R12	For control systems 4 8 12-stage	600 800 1000
multimod-SM 6/8/0-E04 -E08 -E12	For expansions	600 800 1000
Additional T	Temperature module for expansions	
Additional S	Current measurement module for expansions	
Additional Å	Analog module	

Example for order: Control module for cabinet width 800 mm and 8 stages.
The appropriate ordering detail is as follows: **Type multimod-SM 8-R08.**

The **multimod-SM** assembly consists of a controller module, display unit and connection line – equipped with control fuse, connection clamps for capacitor modules and transformers, as well as a thermal element for fans and safety shutdown. The functional construction enables

a quick and easy assembly. The controller and display modules do not apply for the modules for expansion. If temperature recording is required for the expansions, the temperature module (additional T) should be chosen.

multicab-SO



Figure: multicab-SO 284

Cabinet base

TYPE	H x W x D in mm
multicab-SO 164	100 x 600 x 400
multicab-SO 264	200 x 600 x 400
multicab-SO 184	100 x 800 x 400
multicab-SO 284	200 x 800 x 400
multicab-SO 186	100 x 800 x 600
multicab-SO 286	200 x 800 x 600

The cabinet base **multicab-SO** serves to increase the height of compensation systems stands out through its sturdy construction and high degree of stability. The side, front and rear panels can be removed if necessary.

multimod-FSP



Assembly set

TYPE	PURPOSE	POSSIBLE CABINET SYSTEMS *
multimod-FSP XXX XX	Please specify cabinet type and dimensions.	Hensel (HE)
		Moeller (MO)
		Rittal (RT)
		Siemens (SI)
		Striebel & John (SJ)

* Other cabinet systems on request.

XXX XX = Cabinet size and cabinet system. Please specify when ordering (see also following order example).

Example for order: Cabinet system: Rittal TS, dimensions: 2000 x 800 x 600 mm.

The appropriate ordering detail is as follows: **Type multimod-FSP 086 RT.**

The assembly set **multimod-FSP** is used for the simple assembly of KBR modules in existing system cabinets. The installation set is fully equipped with cable duct, PEN rail and transformer connection clamps.

multimod-FAN / -FIL / -FMA



Fan / inlet and outlet filter / Filter mat

FAN TYPE	INSTALLATION SITE	AIR DIRECTION	MODE OF PROTECTION	AIR POWER	SUITABLE INLET-/OUTLET FILTER TYPE
multimod-FAN FL1-S	Ceiling	suction	IP 20	150 m ³ /h	multimod-FIL LG 1
multimod-FAN FL2-B	Door	blowing	IP 20	250 m ³ /h	multimod-FIL LG 2
multimod-FAN FL3-B	Door	blowing	IP 20	730 m ³ /h	multimod-FIL LG 3
multimod-FAN FL4-S	Ceiling	suction	IP 33	1000 m ³ /h	multimod-FIL LG 3
multimod-FAN FL5-S	Ceiling	suction	IP 54	750 m ³ /h	multimod-FIL LG 3
multimod-FAN FL6-S	Ceiling	suction	IP 54	730 m ³ /h	multimod-FIL LG 3

FILTER MAT TYPE	DEPLOYMENT
multimod-FMA	For all fans and filters

The correct ventilation increases the working life of a reactive current compensation system. Depending on the version, the **multimod-FAN** fans can be used as door or

ceiling fans with the corresponding **multimod-FIL** inlet and outlet filters.

multicool-WT / multicool-KLA



Figure: Compensation system with multicool-KLA 1000 top part

Heat exchanger / air-conditioning systems

HEAT EXCHANGER		AIR-CONDITIONING SYSTEM	
TYPE	COOLING CAPACITY	TYPE	COOLING CAPACITY
multicool-WT 1000	1000 W	multicool-KLA 1000	1000 W
multicool-WT 1900	1900 W	multicool-KLA 2000	2000 W
		multicool-KLA 3000	3000 W

If ambient temperatures are too high, not enough cold air can be introduced by the filter fans.

The heat exchangers **multicool-WT** or air-conditioners **multicool-KLA** ensure in such cases that the reactive current compensation system is sufficiently cooled.

multigate



Figure: multigate-PROFI

Gateway

TYPE	POWER SUPPLY	MODE OF PROTECTION
multigate-PROFI	20 – 36 V AC/DC 4 VA	IP 20

The gateway **multigate-PROFI** guarantees a smooth connection of the reactive power controller **multicomp** to other bus systems.

multidis-ED 100

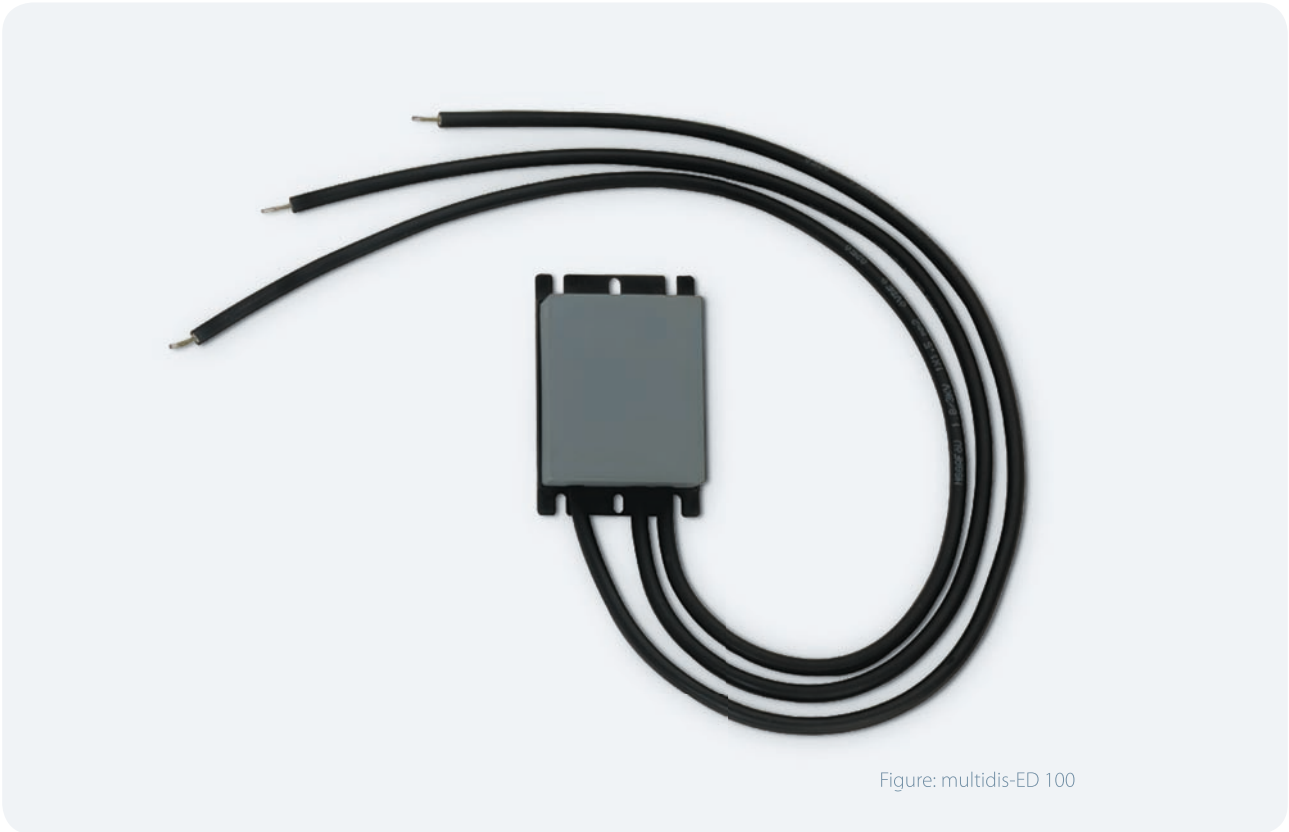


Figure: multidis-ED 100

Discharge reactor

TYPE	Discharge reactor multidis-ED 100
Discharge	Discharge time $t < 3$ s
Voltage	$U_{\text{Meas}} = 690$ V
Capacitor power	max. 100 kvar
Size (H x W x D)	35 x 60 x 90 mm
Cable length	600 mm

With the **multidis-ED 100** discharge reactors, capacitors can be discharged within a very short time. In the compensation of high-speed consumers, the capacitor is then available again after a short time.

multicomp-SMR 5



Figure: multicomp-SMR 5

Current relay

TYPE	Apparent current relay multicomp-SMR 5
Control voltage	U control = 230 V, 50 Hz
Transformer connection	5 A
Operating current	Adjustable 0.5 – 5 A
Dropout current	Adjustable in % of operating current (50 – 99 %)
Switching capacity	1 changeover contact, 250 V, 5 A
Fixing	Screw attachment or 35-mm DIN rail
Size (H x W x D)	120 x 45 x 75 mm

The apparent current relay **multicomp-SMR 5** is used to automatically switch fixed capacitors on and off. Current is recorded via a current transformer.

multict-TA / multict-SW / multict-TP



Figure: multict-TA 30-400/5

Bushing type current transformer / totalizing current transformer / split core current transformer

TYPE	Bushing type current transformer multict-TA	Totalizing current transformer multict-SW	Split core current transformer multict-TP
Secondary rated current	5 A	1 A oder 5 A	5 A
Rated frequency	50 ... 60 Hz	50 ... 60 Hz	50 ... 60 Hz
overcurrent factor	F5	F5	F5
Operating voltage	to 700 V class 1 $I_{th} = 60 \times I_N$	to 720 V class 1 $I_{th} = 20 \times I_N$	to 720 V class 1 $I_{th} = 20 \times I_N$
Option	Transformer with 1 A secondary current	–	Other transmission ratios on request
Dimensions	See respective »specifications« on page opposite		

The bushing type current transformer **multict-TA** is designed for assembly on busbars or circular conductors and records the current for the reactive power controllers, energy control systems and measuring devices.

The totalizing current transformer **multict-SW** is used to form the totals of two or more series transformers, e.g. with

parallel in-feed via two or more transformers. It is attached onto an assembly plate. The split core current transformer **multict-TP** is intended for assembly later on, without it being necessary to open up the busbars or circular conductors.

Specifications multict-TA

PLUG-ON CURRENT TRANSFORMER

RATED CURRENT in A	TYPE	multict-TA 30		multict-TA 40		multict-TA 60	
	POWER in VA	DIMENSIONS H x W x D in mm	POWER in VA	DIMENSIONS H x W x D in mm	POWER in VA	DIMENSIONS H x W x D in mm	
100	2,5	80 x 60 x 30					
250	5	80 x 60 x 30					
400	5	80 x 60 x 30	5	90 x 70 x 30			
600	5	80 x 60 x 30			10	108 x 85 x 30	
1000			10	90 x 70 x 30			
1200					10	108 x 85 x 30	

Specifications multict-SW

TOTALIZING CURRENT TRANSFORMER

TYPE	POWER in VA	DIMENSIONS H x W x D in mm
multict-SW 2-1A	10	1 + 1 1 A
multict-SW 3-1A	10	1 + 1 + 1 1 A
multict-SW 2-5A	10	5 + 5 5 A
multict-SW 3-5A	10	5 + 5 + 5 5 A

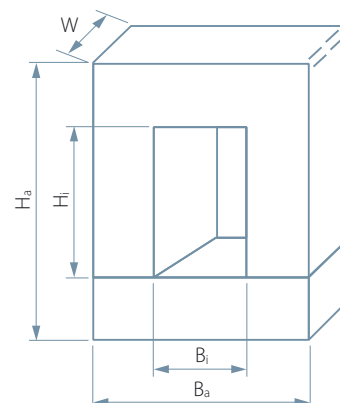
Important note:

Please use series transformers of the same type. If the transmission ratios of the series transformers are unequal, a special construction is possible.

Specifications multict-TP

SPLIT CORE CURRENT TRANSFORMER

TYPE	RATED CURRENT in A	DIMENSIONS H _a x W _a x D in mm	DIMENSIONS H _i x W _i x D in mm
multict-TP 58-250/5	250	145 x 114 x 33	80 x 50 x 33
multict-TP 58-400/5	400	145 x 114 x 33	80 x 50 x 33
multict-TP 58-600/5	600	145 x 114 x 33	80 x 50 x 33
multict-TP 58-800/5	800	145 x 114 x 33	80 x 50 x 33
multict-TP 58-1000/5	1000	145 x 114 x 33	80 x 50 x 33
multict-TP 812-1250/5	1200	185 x 141 x 33	120 x 80 x 33
multict-TP 812-1500/5	1500	185 x 141 x 33	120 x 80 x 33



multicab-F Other systems



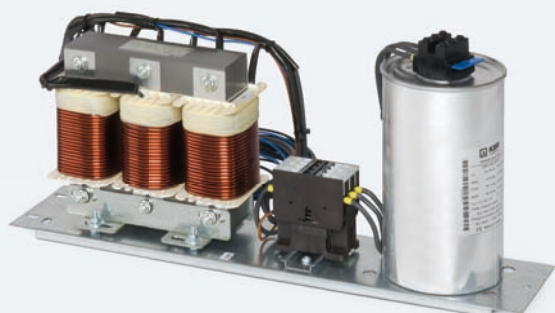
Figure: multicab-F ... -00 SGAH

Fixed capacitors

TYPE	CONSTRUCTION TYPE	POWER	REACTOR FACTORS	CAPACITOR RATED VOLTAGE
multicab-F ... -00 SGAH	Sheet steel casing	5 ... 60 kvar	–	440 V
multicab-F ... -00 IWAH	ISO wall housing	5 ... 60 kvar	–	440 V
multicab-F ... -XX IWAH	ISO wall housing	5 ... 60 kvar	5.5, 7, 8 %	440 V
multicab-F ... -XX IWAB	ISO wall housing	5 ... 60 kvar	12.5, 14 %	525 V

multimod-F / -R other systems

multimod-F ... -XX-00A ...



multimod-R ... -XX ... AH



multimod-F ... 06K ...

Modules

TYPE	CONSTRUCTION TYPE	POWER	REACTOR FACTORS	CAPACITOR RATED VOLTAGE
multimod-F ... -XX 00AH	Modules for small systems	5 ... 25 kvar	5.5, 7, 8 %	440 V
multimod-F ... -XX 00AB	Modules for small systems	5 ... 20 kvar	12.5, 14 %	525 V
multimod-F ... -00 ... GH	Rack-mounted design	20 ... 100 kvar	–	440 V
multimod-F ... -00 ... AH	Assembly unit	25 ... 150 kvar	–	440 V
multimod-F ... -00 ... 06KH	Module with contact system	12,5 ... 75 kvar	–	440 V
multimod-F ... -XX ... 06KH	Module with contact system	12,5 ... 50 kvar	5.5, 7, 8 %	440 V
multimod-F ... -XX 06KB	Module with contact system	12,5 ... 50 kvar	12.5, 14 %	525 V

multicab-R Other systems



multicab-R ... -00 SWSH



multicab-R ... -00 IWAH



multicab-R ... -XX IWA ...

Controlled systems

TYPE	CONSTRUCTION TYPE	POWER	REACTOR FACTORS	CAPACITOR RATED VOLTAGE
multicab-R ... -00 SWSH	Steel sheet wall housing	20 ... 150 kvar	–	440 V
multicab-R ... -00 SSSH	Steel sheet free-standing cabinet	125 ... 500 kvar	–	440 V
multicab-R ... -00 IWAH	ISO wall housing	20 ... 100 kvar	–	440 V
multicab-R ... -XX IWAH	ISO wall housing	25 ... 100 kvar	5.5, 7, 8 %	440 V
multicab-R ... -XX IWAB	ISO wall housing	25 ... 75 kvar	12.5, 14 %	525 V
multicab-R ... -XX SGEH	Steel sheet cabinet	300 ... 500 kvar	5.5, 7, 8 %	440 V
multicab-F ... -XX SGEB	Steel sheet cabinet	320 ... 400 kvar	12.5, 14 %	525 V
multicab-F ... -K2 ... GB	Steel sheet cabinet	50 ... 300 kvar	Combination filter 2	525 V

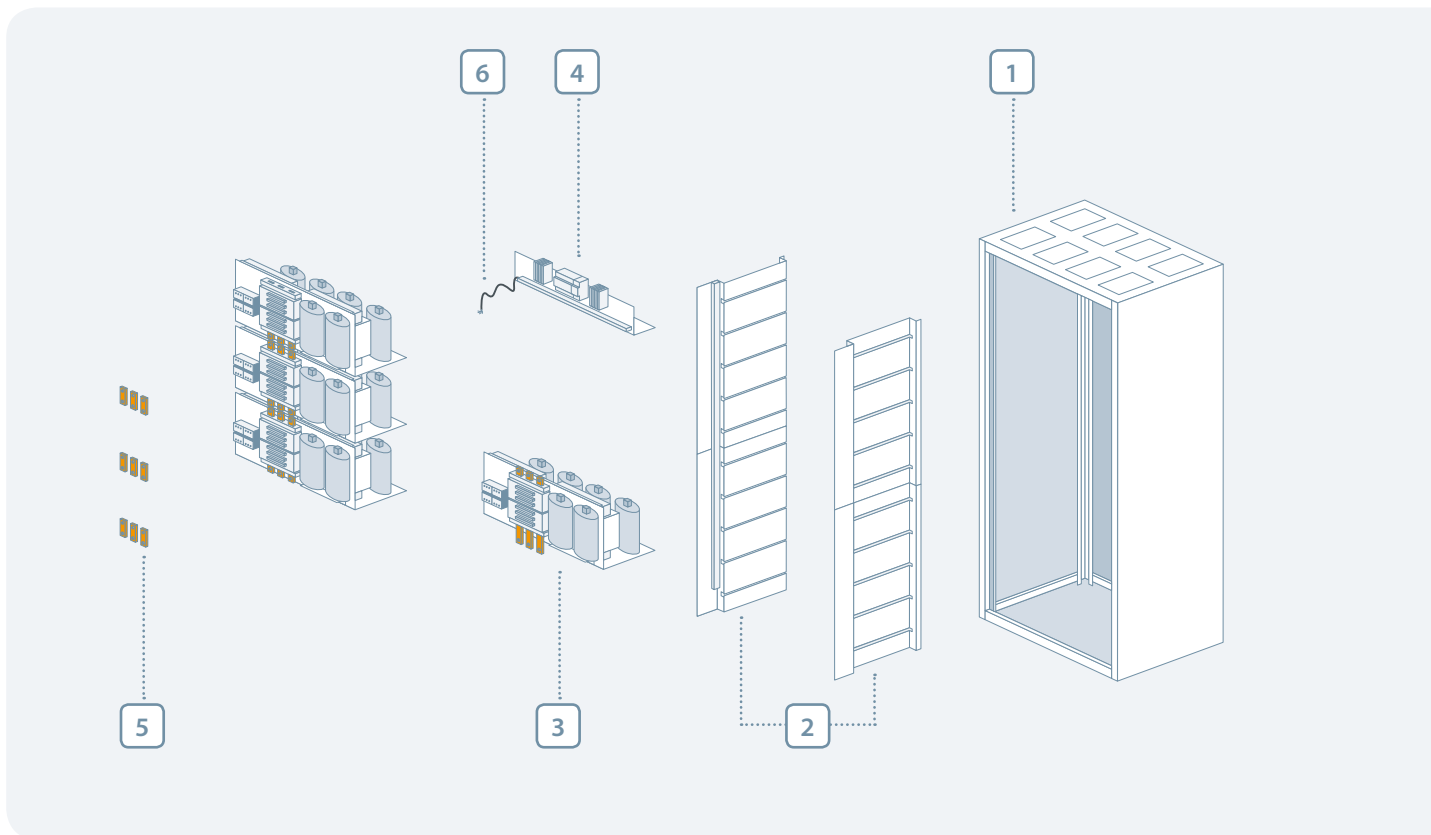


multicab-R ... -00 SSSH



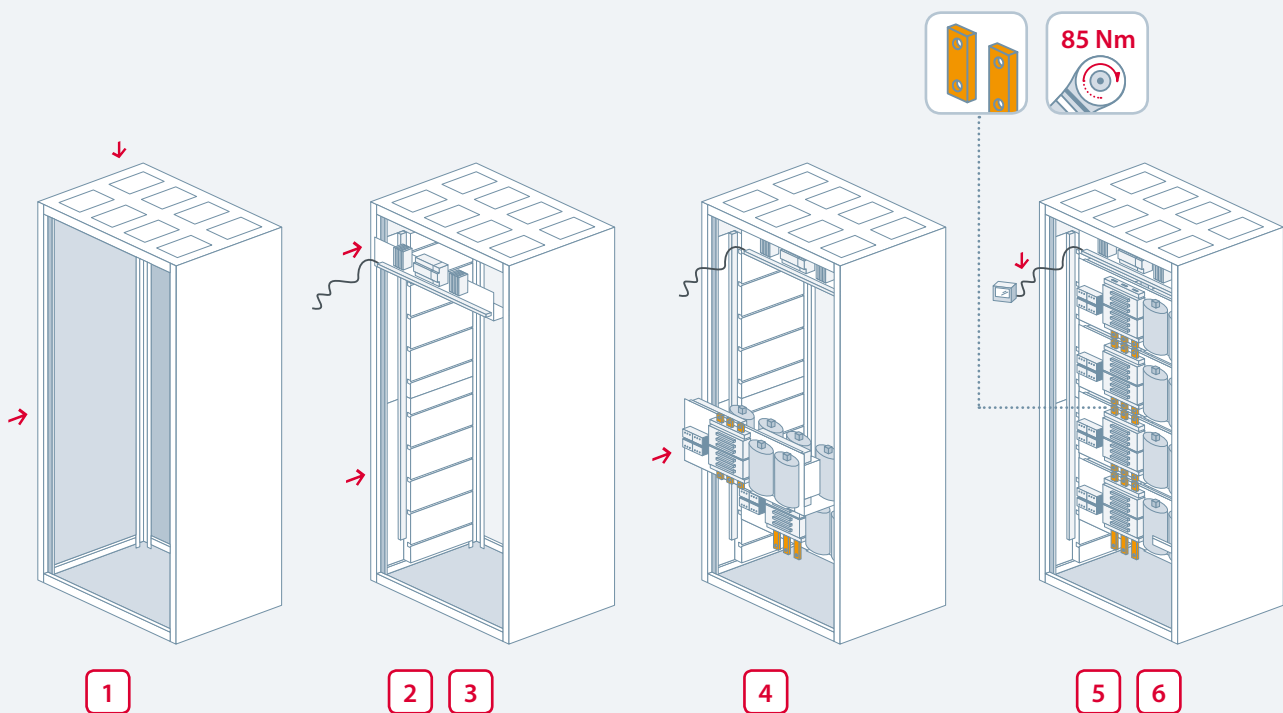
multicab-R ... -XX SGE ...

Mounting



Components of a reactive current compensation system

1. Empty cabinet
2. Assembly rails multimod-FSP
3. Capacitor modules multimod-R
4. Control modules multimod-SM
5. **Busbars** (including nuts and bolts)
6. **Connection cable** (control unit – display unit)



Simple installation in six steps

1. Prepare empty cabinet

- Prepare roof, e.g. install ceiling fan, outlet filter and flange for cable feed-through
- Prepare door (plan for controller cutout 90 x 90 mm, install fan or inlet filter)

2. Assemble multimod-FSP module rails

3. Fasten module multimod-SM

4. Capacitor modules

- Push in modules (start at bottom) and fasten with screws.

5. Attach busbar connector

- Tighten busbar connector with 85 Nm.
- **Ensure connections are exact.**

6. Connect connection cable of control unit – display unit

- The control cable is already attached to the control module.

Mounting



Example of installation and expansion of a system cabinet

The diagrams on this page show the quick and convenient assembly of the KBR modules and equipment.

Parameters used	Power 400 kvar Stage power: 8 x 50 kvar Detuning factor: 7%
System cabinet (H x W x D in mm)	2000 x 800 x 600
Modules and devices used (→ Fig. 1)	Module 4 x multimod-F 100/02-1100-07-08GH Reactive power controller 1 x multicom LCD bus Control module 1 x multimod-SM Assembly rails 1 x set multimod-FSP Fan 8 x multimod-FAN FL 1 Filter 2 x multimod-FIL LG 3

Controller cables and busbar connections are included in the standard delivery.

Preparing the cabinet

- First, the assembly rails **multimod-FSP** are attached to the hole profiles in the cabinet (→ Figure 2).
- Then the fan and filter are installed.
- Then the control module **multimod-SM** in the upper cabinet area is screwed tight to the drill holes provided in the assembly rails.
- In the next step, the control leads for the contactors as well as the transformer and alarm message cables are laid from the control module through the cable duct to where they are to be installed.
- To connect, the reactive power controller **multicom LCD bus** is installed into the



Installing KBR modules

- The modules ready for connection are simply slotted into the system cabinet (→ Figures 3 and 4).
- Cabinets are fitted from top to bottom. Done this way, if expansions are made later on, only the busbar connectors need to be installed.
- After aligning the modules, they are attached with two screws.

The finished KBR system

- Any cabinet at all can be fitted with the KBR modules within a very short time. Quick assembly and ease of expansion distinguish the KBR module system (→ Figures 5 and 6).

Connection module

- To connect two cables laid in parallel an installation set is available which allows all cables to be easily connected (→ Figure 5).

Mounting

Recommendations for selection of lines and fuses

The recommendation for the supply lines (NYY; four-core; Cu) is in accordance with DIN VDE 0298-4 (Table 3, laying type C, without bundling). Ambient temperature +35 °C. The recommendation of the fuse strengths are for short-circuit protection. If conditions are different (including

harmonics), appropriate reduction factors must be taken into account.

The system installer is responsible for measuring and selecting cables and fuses.

CAPACITOR POWER (400 V/50 Hz) in kvar	CURRENT CONSUMPTION I (A) per phase	SUPPLY LINE Cu mm ²	FUSE NH system gL per phase
1	1,44	4 x 1,5	10
1,5	2,16	4 x 1,5	10
2	2,88	4 x 1,5	10
2,5	3,60	4 x 1,5	10
3	4,32	4 x 1,5	10
4	5,76	4 x 1,5	10
5	7,20	4 x 2,5	16
6	8,64	4 x 2,5	16
7,5	10,80	4 x 2,5	20
10	14,40	4 x 4	25
12,5	18,00	4 x 6	35
15	21,60	4 x 6	35
17,5	25,20	4 x 10	35
20	28,80	4 x 10	50
25	36,00	4 x 16	63
30	43,20	4 x 25	80
35	50,40	4 x 25	80
40	57,60	3 x 35/16	100
50	72,00	3 x 35/16	125
60	86,40	3 x 50/25	125
70	100,80	3 x 70/35	160
75	108,00	3 x 70/35	160
80	115,20	3 x 95/50	200
90	129,60	3 x 95/50	200
100	144,00	3 x 120/70	250
120	172,80	3 x 120/70	250
125	180,00	3 x 150/70	315
150	216,00	3 x 185/95	315
175	252,00	3 x 240/120	400
200	288,00	3 x 240/120	400
250	360,00	2 x 3 x 150/70	500
300	432,00	2 x 3 x 185/95	630
350	504,00	2 x 3 x 240/120	2 x 400
400	576,00	2 x 3 x 240/120	2 x 400
450	648,00	4 x 3 x 120/70	2 x 500
500	720,00	4 x 3 x 150/70	2 x 500

Recommendations for operating compensation systems

- When installing modules in third party cabinets, ensure that there is a particularly **good heat dissipation**. For powers greater than 100 kvar, KBR recommends the installation of a fan with thermostat control.
- In existing systems, **regularly clean the filter mats**.
- Detuned facilities may not be operated with non-detuned capacitors on the **same busbar**, since there is a danger here of a parallel resonance.
- The **ripple signal** must be taken into account when dimensioning a compensation system.
- Detuned facilities need to be **regularly checked**, since overloads could occur through changes in capacity.
- Power capacitors are manufactured and tested in accordance with VDE 0560 Part 46. The temperature class T40 (temperature of the surrounding air) applies for the deployment:
 - maximum briefly: 40 °C**
 - highest average over 24 hours: 30 °C**
 - highest average over 1 year: 20 °C.**

KBR Services



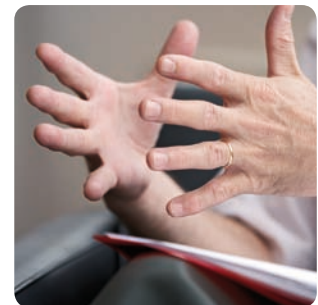
KBR is a reliable partner in terms of energy management. Apart from sophisticated technical components and solutions, KBR also provides an extensive range of services. These include the commissioning and maintenance of devices and systems, as well as regular seminars or network analyses in the field of power quality, for example.

Extensive range of services

→ **Competent from consultation to after sales service** From consultation and conception, down to commissioning and subsequent technical support, KBR provides tailor-made solutions. Even after commissioning, maintenance and supervision of the systems are a matter of course.



→ **Seminars and workshops** From load management to power quality: KBR organizes regular seminars, training courses and workshops which are based on the requirements of daily practical situations.



→ **Power Quality: Network analyses** KBR performs precise network analyses in which high-resolution thermography pictures and digital memory oscilloscopes are deployed. Based on the measurement data recorded, recommendations are developed for possible compensation and conversion measures – for the field of active power filters as well. On request, the commissioning of the dimensioned compensation systems can also be performed and their effect monitored.



→ **Power Quality: Type-testing of compensation systems** The compensation systems of KBR meet the highest quality standards. For this reason, type tests are undertaken by the renowned **IPH Berlin**.

→ **Technical support** An experienced team of **hardware and software specialists** are available throughout Germany at local phone rates to support you with competent advice on questions on the KBR system.

→ **KBR Support Hotlines in Germany**

Hardware	+(49) 01805 527-049
Software	+(49) 01805 527-079



Recording



Monitoring



Analyzing



Optimizing



Evaluating



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