Power Quality

Components for reactive power compensation

MADE IN GERMANY

Components for reactive power compensation.

- Reactive power controllers
- Power capacitors
- Filter circuit reactors
- Capacitor contactors
- Thyristor switches
- Measuring devices
- Active and passive filters
- Current transformers
- Supercapacitors

One System. Best Solutions.

KBR Energy Management


Monitoring
Optimizing
Recording

About us

KBR is a member of the German association for the power capacitors branch

About KBR

Today, energy management is crucial for a company's success and becomes increasingly important.
For 40 years, more than 110 employees have been developing, manufacturing and servicing customer-driven solutions in the energy management field. As a medium-sized company we create innovative products and system solutions in close cooperation with our customers.

KBR is certified in accordance with ISO 9001, 14001, 50001, Authorized Economic Operator (AEO) and Secure Aviation for airfreight (LBA)

By extending its ISO 9001 quality management system by ISO 14001 environmental and ISO 50001 energy management, KBR is setting a good example.

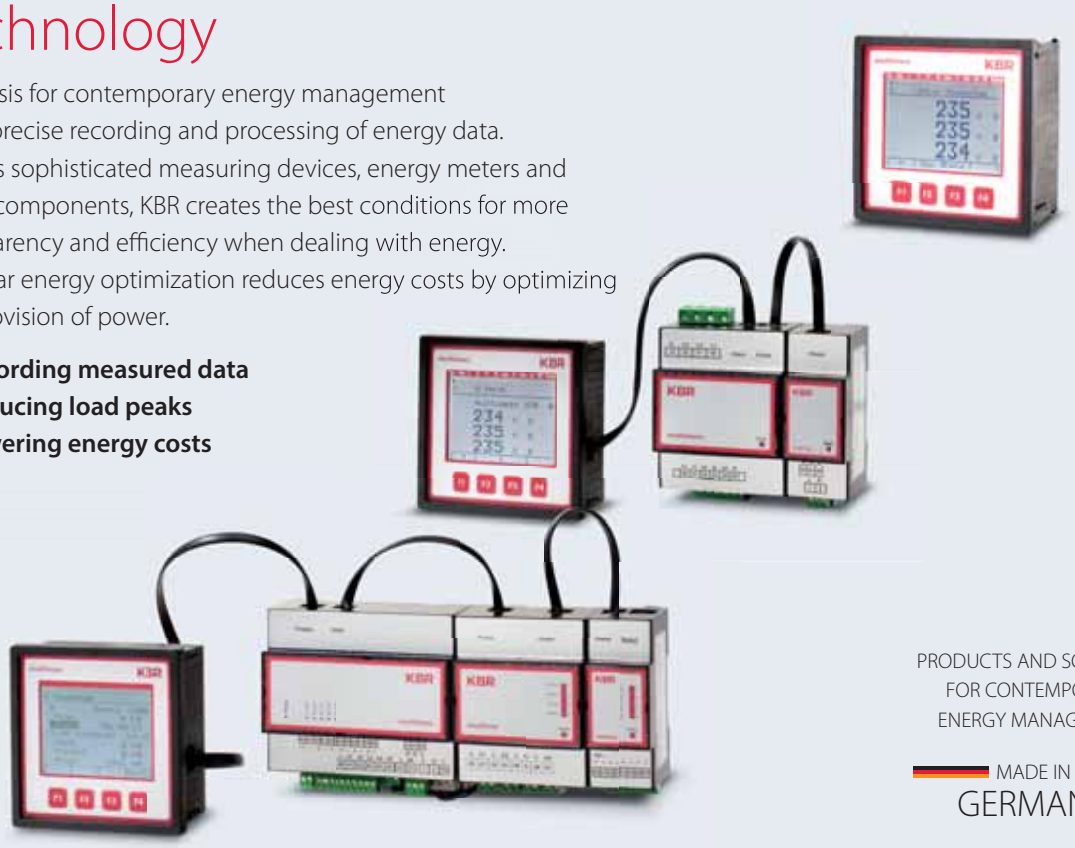
The most important components and units for power factor correction are provided by KBR first hand. Products and solutions for contemporary energy management. Energy measurement devices and energy meters as well as the certified web-based analysis and visualization software, visual energy, help to make processes and energy consumption transparent. Based on the results, evaluations and decisions are made on possible savings in the fields of energy and resources, which consequently helps to prevent emissions.

The experts at KBR pass their experience on to their customers.

Measurement optimization technology

The basis for contemporary energy management is the precise recording and processing of energy data. With its sophisticated measuring devices, energy meters and signal components, KBR creates the best conditions for more transparency and efficiency when dealing with energy. Modular energy optimization reduces energy costs by optimizing the provision of power.

- → **recording measured data**
- → **reducing load peaks**
- → **lowering energy costs**



PRODUCTS AND SOLUTIONS
FOR CONTEMPORARY
ENERGY MANAGEMENT

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GERMANY

Software

The web-based energy data management software "visual energy" creates a ready-to-use system with the KBR hardware and our service package.
This makes the energy supply transparent, increases operating safety, helps identifying savings potentials and considerably reduces energy costs.

- → **analyzing energy data**
- → **increasing operational safety**
- → **recognizing savings potentials**

visual energy

PRODUCTS AND SOLUTIONS
FOR CONTEMPORARY
ENERGY MANAGEMENT

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Power capacitors

- power from 1.5 to 37 kvar
- capacitor rated voltage of 280, 440, 480, 525 or 690 V
- single-phase or 3-phase version
- high level of safety through dry technology and 3-phase internal overpressure disconnector.
- including compact discharge resistor
- long operating life
- increase operational safety

PRODUCTS AND SOLUTIONS
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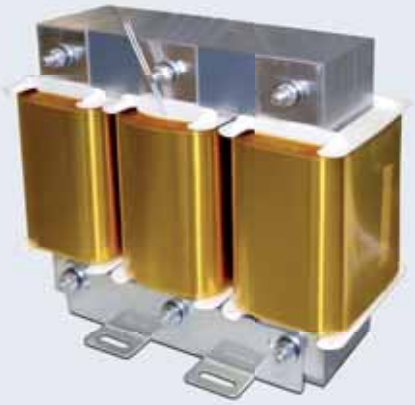

Compensation

Reactive power compensation and improvement of the network quality are essential aspects of KBR Power Quality. KBR develops and produces the components for the compensation systems in its own production facilities. Our Power Quality team offers network analyses, on-site troubleshooting and active power filters in order to improve network quality.

- reduction of reactive energy costs
- increasing supply safety
- increasing operational safety

PRODUCTS AND SOLUTIONS
FOR CONTEMPORARY
ENERGY MANAGEMENT

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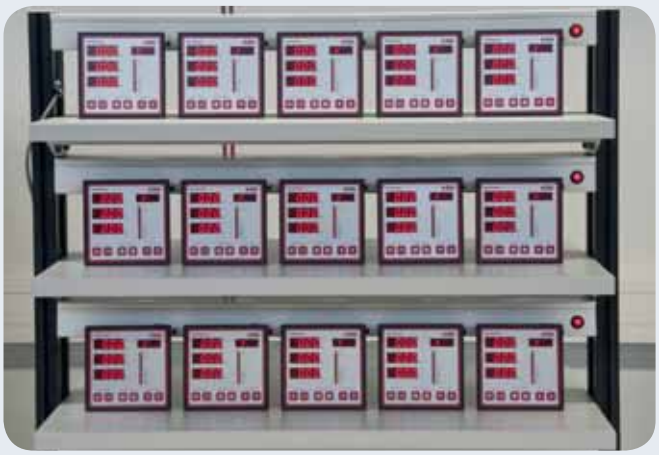
MONEY SAVERS "MADE IN GERMANY":

UNLOADS NOT ONLY THE COMPANIES ACCOUNTS...

PREMIUM QUALITY "Made in Schwabach" ALL FROM A SINGLE SOURCE



In-house development!

With its own hardware, firmware and software development, KBR is a highly flexible partner. Our customers' ideas are directly integrated in the product development.

In-house device production!

For the production of electronic components such as reactive power controllers, network measuring devices, optimization calculators, etc.

In-house reactor production!

The filter circuit reactors needed for the detuned reactive current compensation systems are developed and produced in-house.

In-house capacitor production!

We also produce the most important component ourselves: power capacitors of the highest quality with high current-carrying capacity and a long operating life.

The issues of lowering energy costs and network quality are becoming ever more relevant. The use of compensation and energy control systems does not only reduce costs but also the load on a company's own lines and distributions.

Temperature management
- Intelligent plant control

Safety and maintenance module
Diagnosis of all components

Capacitor contactors
- Developed for the highest requirements

Reactive power controllers
- Modular
- Intuitive operation

Current transformers
- For subsequent installation

Power capacitors
- 250.000 operating hours

Filter circuit inductors
- High linearity

PRODUCTS AND SOLUTIONS
FOR CONTEMPORARY
ENERGY MANAGEMENT

MADE IN
GERMANY

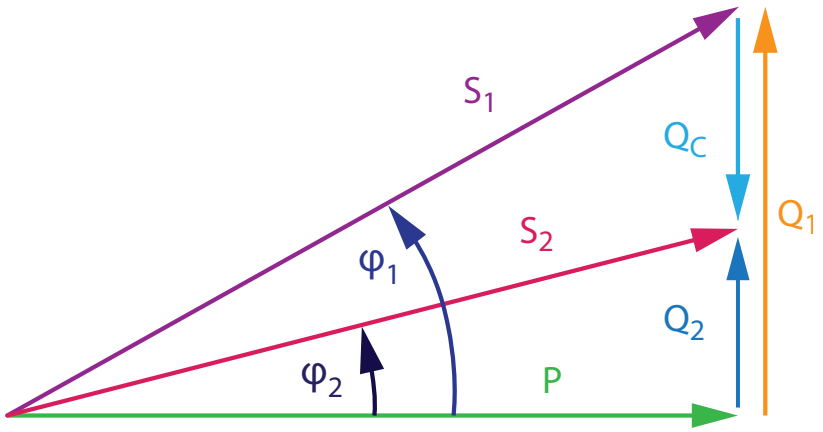
Product consulting:
+49 (0) 9122 6373-0
info@kbr.de

Need more information?
We will be happy to advise you personally.

Reactive power basics

Reactive power is the power required to create a magnetic field in inductive consumers like motors, transformers, ballasts, induction furnaces, etc., that is, coils of any design.

Reactive power is also known as magnetizing power. It oscillates between the consumer and the energy provider at twice the network frequency and thus loads cables, fuses and transformers.



Power triangle

S_1 Apparent power without compensation system
S_2 Apparent power with compensation system
Q_1 Reactive power without compensation system
Q_2 Reactive power with compensation system
Q_C Capacitor power
P Active power
φ_1 Uncompensated power factor
φ_2 Compensated power factor

As can be seen from the power triangle, using a compensation system reduces the reactive current requirement (reactive energy costs) and thus the apparent power.

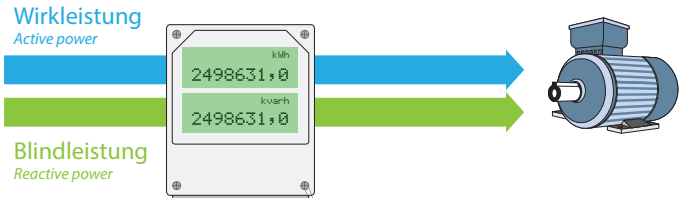
Reactive current compensation

In practical operation, reactive current compensation in commercial and industrial power networks is an issue that often raises many questions.

For technicians, the term compensation describes the interaction between different parameters which - in the best case scenario - cancel each other out. The objective of this is to reverse the negative effect of an interfering physical parameter with a second parameter. In our case, we want to compensate inductive with capacitive reactive power.

Electrical energy generated by power stations or through regenerative methods is transformed into largely usable energy such as light, heat or kinetic energy, depending on the consumer. Some consumers require inductive reactive power from the energy supply network to create a magnetic field. Typical inductive consumers are motors and transformers.

The active power resulting from the product of voltage and current is billed by the energy provider as consumed energy in kWh. Things are different with reactive power. It changes between provider and consumer and is not "consumed" in the literal sense.



Energy transfer without compensation

Why does the energy provider bill the reactive energy?

The degree of load created by network transformers, transmission lines and power plants is expressed as apparent power (S). It is calculated from the active power (P) and reactive power (Q).

$$S = \sqrt{P^2 + Q^2}$$

As can be seen from the formula, the transmission equipment of the network operator is additionally loaded by the reactive power. To keep the current-related losses to a minimum and to guarantee economic energy transport, network operators stipulate a minimum power factor cosφ. This describes the ratio of active to apparent power.

$$\cos\varphi = \frac{P}{S}$$

Energy meters for commercial and industrial use not only measure the active energy but also the reactive energy, which is billed in accordance with the electricity supply agreement. For most energy supply networks, a cosφ of 0.9 is specified. Here, 50% of the consumed active energy obtained from the power supply network may be taken as reactive energy free of charge in the billing period.

Other reasons for reactive current compensation

Thus, the main objective of compensation is to reduce the reactive current costs billed by the energy provider to "zero".

Another reason for reactive power compensation is to reduce the current load. Let's take a closer look at the formula for active power:

$$P = U \times I \times \cos\varphi \times \sqrt{3}$$

If we apply it to the current, this results in the following formula:

$$I = \frac{P}{U \times \cos\varphi \times \sqrt{3}}$$

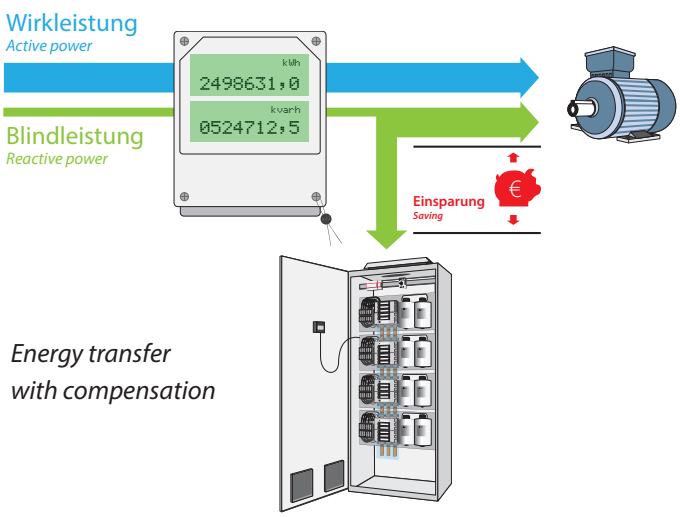
The current thus depends on the power factor cosφ. Let's calculate the current reduction using an example:

An additional consumer with a power consumption of 35 A is to be connected to a sub-distribution unit with 250 A at an outgoing line. The following values were measured:

U = 400 V
I = 238 A
cosφ = 0.72

$$P = U \times I \times \cos\varphi \times \sqrt{3} = 400\,V \times 238\,A \times 0{,}72 \times \sqrt{3} = 118.700\,W$$

If you increase the power factor to cosφ 0.97 by compensation, the current is reduced from 238 A to:



Energy transfer with compensation

$$I = \frac{P}{U \times \cos\varphi \times \sqrt{3}} = \frac{118.700\ W}{400\ V \times 0{,}97 \times \sqrt{3}} = 176\ A$$

By compensation of the reactive power, the current consumption was reduced by 62 A. Now, the consumer still required can be connected with 35 A.

Improving network quality

Reactive power compensation is also used for improving the network quality. In modern industrial installations, consumers with power electronics (e.g. frequency converters) are used for energy efficiency measures. The input current of these "linear consumers" is no longer sinusoidal. As a result, network feedback is created as harmonic voltage. This can cause malfunctions in the consumers connected to the same network.

By using a compensation system as an absorption circuit, the harmonic voltage level can be reduced, rectifying the disturbance in the consumers. The principle of an absorption circuit system corresponds to that of a detuned reactive power compensation system with the resonance frequency close to the interfering harmonic frequency.

Another possible application is renewable energy generators, such as solar and wind power plants. According to applicable laws, these energy generation plants feeding energy into the public grid with an output of more than 100 kW have to contribute to keeping the voltage constant. If the network voltage drops, the voltage can be increased by switching on capacitors. A distinction is made between medium-voltage and low-voltage systems. In low-voltage systems, a Q / P characteristic curve has to be compensated, in medium-voltage systems, a Q / U characteristic curve.

Calculating the required capacitive reactive power

The capacitive reactive power is calculated using the following formula:

$$Qc = P \times (\tan\varphi 1 - \tan\varphi 2)$$

Qc = required capacitive reactive power
P = active power
tanφ1 = tangent of the power factor cosφ prior to compensation
tanφ2 = tangent of the power factor cosφ after compensation

When calculating **central compensation**, we do not have the necessary values as would be specified on a motor. In practice, the compensation power required is calculated using the most recent electricity bills or by taking long-term readings (network analysis).

In the **electricity bill**, the energy provider provides the following values on a monthly basis.

From this, the reactive power required can already be calculated using the formula introduced earlier.

$$Q = P \times (\tan\varphi 1 - \tan\varphi 2)$$

P = the active power specified in the electricity bill
tanφ1 = tangent of the power factor cosφ before compensation
tanφ2 = tangent of the power factor cosφ after compensation

The power factor desired is defined by the operating technician. In most cases, it is between 0.92 and 0.97 inductive. In our case, we calculate the reactive power compensation at 0.95 inductive, as is common practice.

$$Q = 498\ kW \times (0{,}7025 - 0{,}3287) = \mathbf{186\ kvar}$$

Active power taken from the electricity bill

$$I = \frac{kvar}{kWh} = \frac{166.023\ kvar}{(78.608 + 157.716)\ kWh} = 0{,}7025\ A$$

(values from the electricity bill)

tanφ2 of the desired cosφ 0.95

In this example, we choose the next size up for standard systems, which is 200 kvar.

Our brochure
„Reducing energy costs by reactive power compensation" is available as download online:
www.kbr.de/en/services/brochures

Reactive power basics

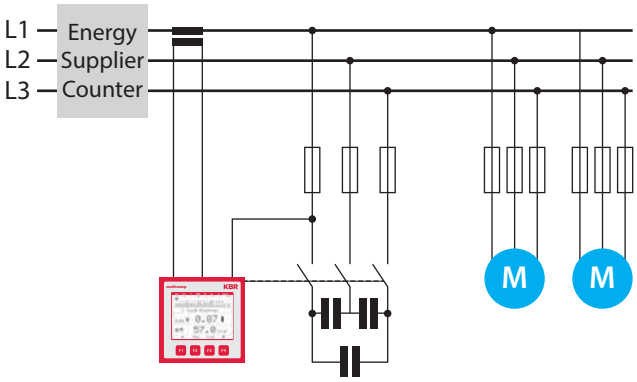
Measurement-based definition of the compensation system size

The power required can also be defined by network analysis. For this purpose, a suitable measuring device is installed in the supply line of the energy provider for one week. Installation takes place without an interruption of the energy supply. The measuring device is installed while the lines are live by a trained specialist wearing protective gear.

The measured data obtained can be used not only to define the required compensation system size but also to evaluate the network quality according to DIN EN 50001.

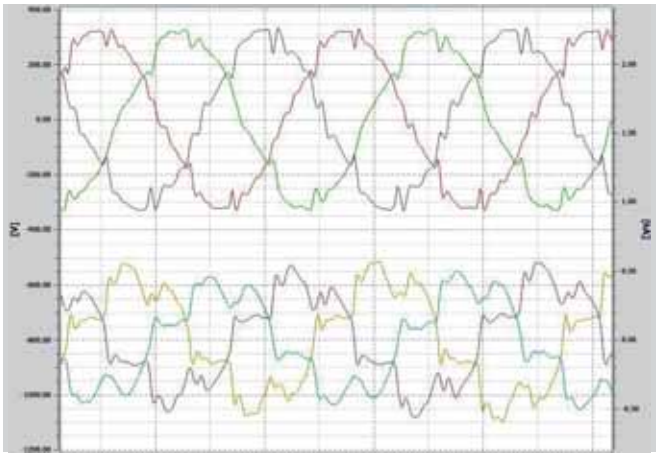
Installing reactive power compensation

Connection to the distribution is done in a similar way as for a larger consumer. The wire cross-section and back-up fuse are defined depending on the compensation selected. In our example, the 200 kvar system consumes 288 A of current (1.44 A per kvar). 3x240/120 mm² is chosen as the wire cross-section and 400 A for the back-up fuse.



Schematic structure of a reactive current compensation system

To enable automatic control, the instantaneous cosφ is needed for the controller. This is determined by way of a current and voltage measurement. The controller takes the measuring voltage from the supply voltage for compensation. With a current transformer installed in the supply line to the energy provider, the controller can now calculate the reactive power required and compensate the system of the customer.



Oscilloscope image of a network measurement with superimposed harmonic voltages

Amortization

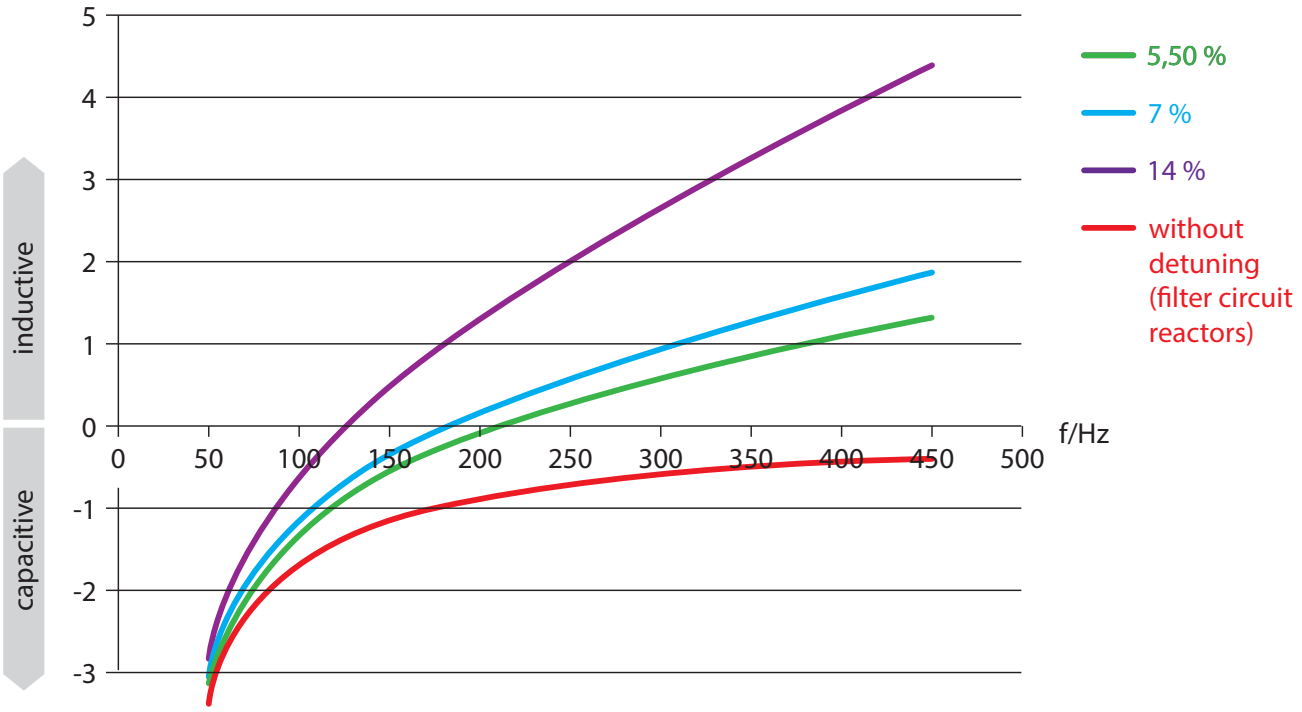
The amortization period depends on the company's operating hours. It is usually between 2 and 4 years.

Disturbances in compensation systems

Consumers have changed in recent years. Motors are for example equipped with frequency converters, electronic control gears have become standard in illumination and clocked power supply units in power electronics. The current consumption of these consumers is not sinusoidal, creating a voltage drop at the network impedances. This drop is sinusoidal but has many times the fundamental frequency. These harmonic voltages occur with frequencies of 150 Hz, 250 Hz, 350 Hz, etc.
How does a capacitor function in a network where harmonic voltage is present? The reactance Xc of a capacitor depends on the frequency.

$$Xc = \frac{1}{2 \times \pi \times f \times C}$$

Looking at the formula, it becomes clear that with higher frequencies, the reactance Xc of the capacitor decreases. What does this mean for us in practice? Depending on how much it is loaded with harmonic voltages, the amount of current a capacitor draws increases. This in turn results in a higher thermal load on the capacitor, leading to a shorter operating life. In an information brochure on the operating life of power capacitors, the ZVEI (German Electrical and Electronic Manufacturers' Association) states that a capacitor's operating life is shortened by 50 % if the maximum temperature at its surface is exceeded by 7 °C.
Another problem in this context is the possible **resonance** in low-voltage networks. In this case, the reactance of the



Curves of detuned compensation systems

inductance and capacitance is the same at the resulting resonance frequency. The resonance frequency fr can be calculated using the following formula:

$$fr = \frac{1}{2 \times \pi \times \sqrt{L \times C}}$$

Detuned compensation systems

Which measures can be taken to prevent possible resonances? To deal with the continuously increasing harmonic load, detuning compensation systems has been common practice for years. But what does "detuning" mean?

For detuning, each capacitor stage is set up as a series resonant circuit with an inductor connected in series.

Equivalent circuit diagram of a detuned compensation stage

The inductor connected upstream of the capacitor stage ensures a defined resonance frequency.

Common detuning factors are:

Detuning	5.5 %	7%	12.5%	14%
Resulting frequency	214 Hz	189 Hz	141 Hz	134 Hz

Below the resulting detuning frequency, the capacitor stage acts like a capacitor. Above that frequency, the stage is inductive. If you set up the series resonance frequency of the detuned compensation system below the smallest possible harmonic voltage (e.g. 150 Hz, 250 Hz, 350 Hz, etc.), there are no resonances, as two inductances cannot form a resonant circuit.

Reactive power controllers

The reactive power controller is the measurement and control unit of reactive power compensation systems.
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 or capacitive reactive current, and to reduce reactive consumption costs.

Reactive power controllers

multicomp F144-3

Housing dimensions (H x W x D in mm)	144 x 144 x 60
Data display	LCD illumination
Interface	Modbus

Single-phase reactive power controller

Highlights

- → Detecting and compensating for the missing compensation power in case of recovery into the energy provider network
- → Rapid compensation with few switching operations
- → Display with two-line LC display, stage status and recovery
- → Manual-0-automatic switch separately programmable for each stage
- → Integrated temperature measurement
- → Interface RS485 for Modbus

An overall view of the **technical details** can be found on pages 22-25.

The microcontroller-controlled **multicomp F144-3** records all network data relevant to the control of small systems via A/D transformer inputs. After calculating the required compensation power to achieve the desired target cos φ, the available capacitor stages are automatically switched on or off with a few switching operations. Programming is menu-assisted and is performed with two buttons. System-specific values are stored in a non-volatile memory.
Each stage can be switched individually via the built-in manual-0-automatic function.

multicomp F144-3Ph-3

Housing dimensions (H x W x D in mm)	**144 x 144 x 68**
Data display	**LCD illumination**
Interface	**KBR eBus Modbus**

3-phase reactive power controller

Highlights

- → Detecting and compensating for the missing compensation power in case of recovery into the energy provider network
- → 18 stages for single-phase and/or 3-phase compensation
- → Limit monitoring function for the protection of capacitors from overvoltage and excessive harmonic load
- → Integrated temperature measurement input for monitoring the ambient temperature and for switching on fans
- → Illuminated graphic display 128 x 96 pixels with dimming function

The **multicomp F144-3Ph-3** reactive power controller works automatically in 4-quadrant operation (generator operation), i.e. even during energy recovery to the energy provider network, missing compensation power is easily detected and compensated. Through the integrated temperature measurement input, the ambient temperature in the reactive power compensation system is also monitored and if a predefined limit temperature is exceeded, the fan is switched on. The 3-phase voltage and current recording makes it possible to not only realize 3-phase compensation as before, but also single-phase compensation or a mixture of single-phase and 3-phase compensation. Of course the device has also an interface RS485 for eBus or Modbus. Available display language in DE/EN or EN/CN.

multicomp D6

Housing dimensions (H x W x D in mm)	96 x 96 x 60
Data display	LCD display illumination
Interface	KBR eBus Modbus

4-quadrant reactive power controller

Highlights

- → Detecting and compensating for the missing compensation power in case of recovery into the energy provider network
- → Network analysis and limit value monitoring function for the protection of capacitors from overvoltage, overcurrent and excessive harmonic load.
- → Integrated temperature measurement input for monitoring the ambient temperature and for switching on fans
- → Modular up to 24 stages
- → Can be expanded by the secureC safety and maintenance module

An overview of the **technical details** is given on pages 22-25.

The **multicomp D6** reactive power controller works automatically in 4-quadrant operation (generator operation), i.e. even during energy recovery to the energy provider network, missing compensation power is easily detected and compensated. Through the integrated temperature measurement input, the ambient temperature in the reactive power compensation system is also monitored and if a predefined limit temperature is exceeded, the fan is switched on. The multicomp F96 also has an interface for connection to the KBR eBus, whereby all settings can be conveniently carried out from the PC (without the display module). In addition, the bus communication can be switched from KBR eBus to Modbus RTU/ASCII.

multicomp F96
Display module

multisio D2-4RO
Relay module

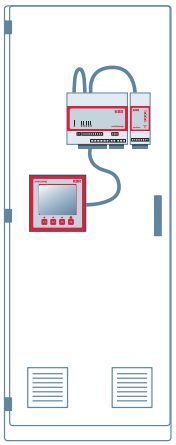
multisio D2-1TI2RO
Temperature and fan module

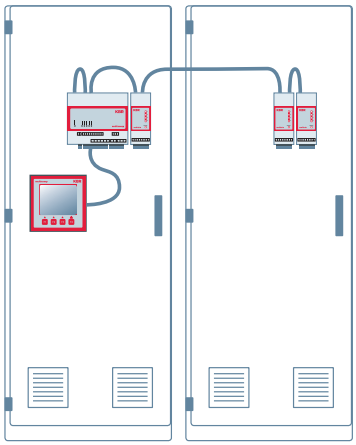
multimess D4
measuring module

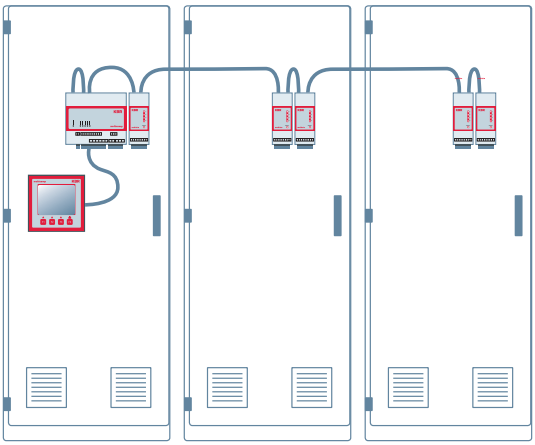
Temperature management

Conventional reactive power controllers simply switch off the system when they reach a limit temperature.
The consequences: Reactive current costs, high apparent current and the triggering of switches. The temperature management can avoid this to a great extent.

- → Simple connection of expansion systems thanks to ribbon and bus technology
- → Minimal wiring required
- → Each system cabinet can be controlled and monitored separately (control by ventilation, temperature measurement, safety shutdown)
- → Can be expanded with the KBR safety concept







Control cabinet	Control and expansion cabinet		Control 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 multicomp F96 1 x D2-4RO	1 x multicomp F96 1 x D2-4RO	1 x D2-4RO 1 x D2-1TI2RO	1 x multicomp F96 1 x D2-4RO	1 x D2-4RO 1 x D2-1TI2RO	1 x D2-4RO 1 x D2-1TI2RO

multicomp Technical details

		DEVICE TYPE **multicomp F144-3** [1] F144-MS-1V1C1TI6RO [2] F144-MS-1V1C1TI12RO [3] F144-MS-1V1C1TI6DO [4] F144-MS-1V1C1TI12DO [5] F144-MS-1V1C1TIDO6RO
SWITCHING 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	0 to 999.9 kVar cap.
	Discharge times programmable	0 ... 900 sec.
	Manual-0 automatic switch | Status display	■ | ■
	Learning function for automatic programming by induced current measurement (requirement: transformer fitted into the cable to the compensation unit)	via main current transformer
	Rotary field and phase allocation programmable	■ | ■
SWITCHING PERFORMANCE	**Self-optimizing | Circular switching of equal stages**	■ | –
	Special switching functions for	Multiple series connection
	Switch-off limit for low load operation	programmable
MONITORING FUNCTIONS	**Zero-voltage trigger**	■
	Overcurrent switch-off (only in connection with induced current measurement)	–
	Overvoltage switch-off	fixed
	Temperature measurement and monitoring with fan control and emergency shut-down	■
	Harmonics monitoring with alarm message and emergency shut-down | additional displays	■ | Voltage: KF – U, 3rd – 13th harmonic
	Error messages programmable	■
	Target cos φ monitoring; alarm if unreachable	■
	Switching operation monitoring with display per stage	■
	Controller status display (overcompensation/ undercompensation)	■
SPECIAL OPERATING MODE	**Thyristor fast circuit breaker (optocoupler outputs)**	[3], [4], [5]
	Single-phase compensation	–
DISPLAYS	**Display type**	LCD (two-line)
	Measuring parameters (RMS values | RMS)	U_{PH-N}, U_{PH-PH}, cos φ, $f_{network}$, I_{main}, S_{total}, Q_{total}, P_{total}, $Q_{total\ demand}$, temp.
	Operating time display	–
MEASUREMENT	**Measurement accuracy: Voltage | current | power**	0.5% | 0.5% | 1%
	Update speed	20 ms
	Single-phase measurement (4Q)	Phase-phase or phase-neutral
	3-phase measurement	–

■ Standard version – Not available





	multicomp F144-3Ph-3 F144-3Ph-ESMS-3V3C1TI1DI20RO	**multicomp D6, multicomp F96-DS** D6-ESMSBSDS-1-1V1C6RO	**Relay module** multisio D2-4RO	**Temperature and fan module** multisio D2-1TI2RO	**Measuring module** multimess D4
	18	Modular 4 – 24	4	2	–
	0 to 9999.9 kVar ind. or cap.	0 to 999.9 kVar ind. or cap.	–	–	–
	10 ms to 999.99 sec.	0 ... 900 sec.	–	–	–
	■ | ■	■ | ■	– | –	– | –	– | –
	–	in connection with multimess D4 using induced current transformers	–	–	–
	■ | ■	■ | ■	– | –	– | –	– | –
	■ | –	■ | ■	– | –	– | –	– | –
	Multiple series connection	Combination filter	–	–	–
	programmable	fixed	–	–	–
	■	■	–	–	–
	–	■ in connection with multimess D4	–	–	–
	programmable	programmable	–	–	–
	■	■	–	■	–
	■ | Voltage: KF – U, 3rd – 19th harmonic	■ | Voltage: KF – U; 3rd – 19th harmonic	–	–	–
	■	■	–	–	–
	■	■	–	–	–
	■	■	–	–	–
	■	■	–	–	–
	–	–	–	–	–
	■	–	–	–	–
	LCD (dot matrix 128 x 96)	LCD (dot matrix 128 x 96)	LED Status indicator	LED Status indicator	LED Status indicator
	U_{PH-N}, U_{PH-PH}, I_{main}, cos φ, $f_{network}$, S-P-Q, S-P-Q_{total}, $Q_{total\ demand}$, temp.	U_{L-N} or U_{L-L}, cos φ, $f_{network}$, I_{main}, $I_{induced}$, P_{total}, $Q_{total\ demand}$, temp.	–	–	–
	■	■	–	–	–
	0.5% | 0.5% | 1%	0.5% | 0.5% | 1%	–	–	0.5% | 0.5% | 1%
	20 ms	~ 300 ms	–	–	< 1 Sec.
	Phase-neutral	Phase-phase or phase-neutral	–	–	Phase-neutral
	3 x phase-neutral	–	–	–	3 x phase-neutral

Version: June 2017. Subject to change.

multicomp Technical details

		DEVICE TYPE	**multicomp F144** [1] F144-MS-1V1C1TI6RO [2] F144-MS-1V1C1TI12RO [3] F144-MS-1V1C1TI6DO [4] F144-MS-1V1C1TI12DO [5] F144-MS-1V1C1TIDO6RO
MEMORY	**Long-term memory**		–
PASSWORD PROTECTION	**With digit code**		■
INPUTS	**Voltage path**	Low-voltage; direct measurement	30 V … 690 V … 790 V AC 50/60 Hz
		Medium voltage	1 V … 99.9 kV programmable
	Current path	Main current transformer	1 x 0.15 A … 5 A … 6 A AC
		Induced current transformer	–
	Frequency range		40 to 70 Hz
	2. Target value cos φ2	Automatic switchover in case of energy recovery	– | to cos φ = 1
OUTPUTS	**Additional relay outputs | Error message relay / fan relay**		Stage relay/fan relay | Error message relay
INTERFACES	**Serial interface with KBR eBus protocol | Modbus**		– | Modbus RTU
POWER SUPPLY	**Operating voltage**		85 – 265 V AC / DC
	Frequency		50/60 Hz
	Power consumption		max. 15 VA, 9 W
DIMENSIONS	**Switchboard installation**	**Housing (H x W x D)** **Switchboard cutout (H x W)**	144 x 144 x 60 mm 138 x 138 mm
	DIN rail installation	**Housing (H x W x D)**	

***4-quadrant operation:** As energy costs are becoming increasingly important economically, more and more distributed power generation plants will be set up. During low-load periods, this can result in energy being fed back into the supply network. Therefore, all possible states concerning consumption and the provision of active and reactive power must be taken into account for the control system. For example, if asynchronous generators are used to generate energy, active power may be fed into the supply network and reactive power taken from the supply network.

□ Optionally available – Not available





	multicomp F144-3Ph F144-3Ph-ESMS-3V3C1TI1DI20RO	**multicomp D6, multicomp F96-DS** D6-ESMSBSDS-1-1V1C6RO	**Relay module** multisio D2-4RO	**Temperature and fan module** multisio D2-1TI2RO	**Measuring module** multimess D4
	–	for events and error messages; battery-buffered with timestamp	–	–	–
	■	■	–	–	–
	3-phase / single-phase 25 V … 230 V … 280 V AC 50/60Hz	1 x 100 V … 500 V … 600 V AC 50/60Hz	–	–	3x 30-280 V AC, Ph-N
	1 V … 999.9 kV programmable	0.01 kV … 30 kV programmable	–	–	–
	3-phase / single-phase 0.03 A … 5 A … 6 A AC	1 x 0.01 A … 1 A … 1.2 A AC and 1 x 0.05 A … 5 A … 6 A AC	–	–	3x 0,02 A... 5A... 6A AC
	–	via multimess D4	–	–	–
	40 to 62 Hz	40 – 70 Hz	–	–	50/60 Hz
	■ | ■, value programmable	– | automatic switchover in case of energy recovery to cos φ2, value freely programmable	– | –	– | –	– | –
	■ | ■	■ | ■	4x Stage relay	Fan relay Alarm relay	–
	eBus, Modbus RTU	eBus | Modbus RTU/ASCII	Modulebus	Modulebus	Modulebus
	85 - 265 V AC/DC	85 V – 265V AC / DC	24 V DC via Modulebus	24 V DC via Modulebus	50 - 32810 V AC Phase-neutral
	50/60 Hz	50/60 Hz	–	–	50/60 Hz
	max. 5 - 15 VA / 9 W	15 VA	1 W	1,3 W	Power supply 3,2 VA Modulebus 0,3 W
	144 x 144 x 78 138 x 138 mm	96 x 96 mm, display multicomp F96 LCD 92 x 92 mm, display multicomp F96 LCD	–	–	–
		90 x 1068 x 61 mm, multicomp D6	90 x 36 x 61 mm	90 x 36 x 61 mm	90 x 72 x 61 mm

Power capacitors

Power capacitors for reactive current compensation in single-phase and 3-phase versions, developed for the highest requirements. Apart from a long operating life and high current and voltageload capacity, safety in case of overload (all-pole overpressure disconnector) is a crucial advantage of the compact dry technology components. Other features are good heat dissipation, low self-heating as well as reliable performance at high ambient temperatures.

Power capacitors

multicond

rated voltage U_n	**280, 440, 480, 525, 690 or 800 V**
rated frequency f	**50/60 Hz**

Power capacitor for reactive current compensation

Highlights

- → Power from 2.8 to 37 kvar
- → Capacitor rated voltage of 280, 440, 480, 525, 690 or 800 V
- → High level of safety through dry technology and 3-phase internal overpressure disconnector
- → Including compact discharge resistor
- → Long operating life

A **construction diagram** is shown on page 35.

multicond-UHPC power capacitors stand out through their combined safety concept with a self-restoring effect and 3-phase internal overpressure disconnector.
In low voltage networks, inadmissibly high voltage peaks of up to 3 times the rated voltage can occur through switching operations. If these loads lead to flashovers in the dielectric, the self-restoring effect is triggered. The capacitor remains fully functional as this happens. The 3-phase internal overpressure disconnector is triggered if the amount of gas released by the many self-restoring procedures causes a specific internal pressure. The lid of the aluminum casing bends slightly and the fuse disconnects all poles of the capacitor from the network.

Note: Depending on the network voltage and when used in detuned systems, a correspondingly higher capacitor rated voltage must be selected.
Beyond this, we recommend using power capacitors of the multicond-premium series in networks with increased harmonic load.

Capacitor rated voltage: **280 V – 3-phase**

FREQUENCY	POWER ON NETWORK VOLTAGE											CURRENT ON MAX. VOLTAGE	RATED CAPACITANCE	CAN SIZE in mm	TYPE	Item no.
	220 V	230 V	280V	–	–	–	–	–	–	–	–			d x H		
Hz	kvar	kvar	kvar	–	–	–	–	–	–	–	–	A	µF	(+/- 3 mm)	**multicond...**	
50	4.6	5.0	7.4	–	–	–	–	–	–	–	–	15.3	3 x 100.1	116 x 260	premium UHPC-7.4-280-3P	10279
60	5.5	6.0	8.9	–	–	–	–	–	–	–	–	18.4		95 x 260	basic UHPC-7.4-280-3P	10284
50	6.9	7.5	11.1	–	–	–	–	–	–	–	–	22.9	3 x 150.2	136 x 260	premium UHPC-11.1-280-3P	20281
60	8.2	9.0	13.3	–	–	–	–	–	–	–	–	27.5		116 x 260	basic UHPC-11.1-280-3P	10285
50	9.1	10.0	14.8	–	–	–	–	–	–	–	–	30.5	3 x 200.3	136 x 260	premium UHPC-14.8-280-3P	10280
60	11.0	12.0	17.8	–	–	–	–	–	–	–	–	36.6		136 x 260	basic UHPC-14.8-280-3P	10286

Capacitor rated voltage: **440 V – 3-phase**

FREQUENCY	POWER ON NETWORK VOLTAGE											CURRENT ON MAX. VOLTAGE	RATED CAPACITANCE	CAN SIZE in mm	TYPE	Item no.
	220 V	230 V	280V	380 V	400V	415 V	440V	–	–	–	–			d x H		
Hz	kvar	kvar	kvar	kvar	kvar	kvar	kvar	–	–	–	–	A	µF	(+/- 3 mm)	**multicond...**	
50	0.7	0.8	1.1	2.1	2.3	2.5	2.8	–	–	–	–	4.4	3 x 15.4	75 x 255	UHPC-2.8-440-3P	–
60	0.8	0.9	1.4	2.5	2.8	3.0	3.4	–	–	–	–	5.3			replaced by UHPC-4.0-525-3P	10516
50	1.4	1.5	2.3	4.2	4.6	5.0	5.6	–	–	–	–	8.8	3 x 30.8	75 x 255	UHPC-5.6-440-3P	–
60	1.7	1.8	2.7	5.0	5.6	6.0	6.7	–	–	–	–	10.6			replaced by UHPC-8.0-525-3P	10517
50	2.5	2.7	4.0	7.5	8.3	8.9	10.0	–	–	–	–	13.1	3 x 54.8	95 x 260	premium UHPC-10.0-440-3P	10506
60	3.0	3.3	4.9	8.9	9.9	10.7	12.0	–	–	–	–	15.7		95 x 260	light UHPC-10.0-440-3P	21768
50	2.8	3.1	4.5	8.4	9.3	10.0	11.2	–	–	–	–	14.7	3 x 61.4	95 x 260	premium UHPC-11.2-440-3P	10312
60	3.4	3.7	5.4	10.0	11.1	12.0	13.4	–	–	–	–	17.6		95 x 260	basic UHPC-11.2-440-3P	10318
														95 x 260	light UHPC-11.2-440-3P	21776
50	3.0	3.3	4.9	9.0	10.0	10.8	12.1	–	–	–	–	15.9	3 x 66.3	95 x 260	premium UHPC-12.1-440-3P	10313
60	3.6	4.0	5.9	10.8	12.0	12.9	14.5	–	–	–	–	19.1		95 x 260	basic UHPC-12.1-440-3P	10319
														95 x 260	light UHPC-12.1-440-3P	21769
50	3.5	3.9	5.7	10.5	11.7	12.5	14.1	–	–	–	–	18.5	3 x 77.3	95 x 260	premium UHPC-14.1-440-3P	10314
60	4.2	4.6	6.9	12.6	14.0	15.1	16.9	–	–	–	–	22.2		95 x 260	basic UHPC-14.1-440-3P	10320
														95 x 260	light UHPC-14.1-440-3P	21777
50	3.8	4.1	6.1	11.3	12.5	13.4	15.1	–	–	–	–	19.8	3 x 82.8	95 x 260	premium UHPC-15.1-440-3P	10315
60	4.5	5.0	7.3	13.5	15.0	16.1	18.1	–	–	–	–	23.8		95 x 260	basic UHPC-15.1-440-3P	10321
														95 x 260	light UHPC-15.1-440-3P	21778
50	4.3	4.7	6.9	12.8	14.1	15.2	17.1	–	–	–	–	22.4	3 x 93.7	116 x 260	premium UHPC-17.1-440-3P	10295
60	5.1	5.6	8.3	15.3	17.0	18.3	20.5	–	–	–	–	26.9		95 x 260	basic UHPC-17.1-440-3P	10323
														95 x 260	light UHPC-17.1-440-3P	21779
50	4.5	5.0	7.4	13.6	15.0	16.2	18.2	–	–	–	–	23.9	3 x 99.7	116 x 260	premium UHPC-18.2-440-3P	10296
60	5.5	6.0	8.8	16.3	18.0	19.4	21.8	–	–	–	–	28.7		95 x 260	basic UHPC-18.2-440-3P	10324
														95 x 260	light UHPC-18.2-440-3P	21770

Table continued on next page.

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Capacitor rated voltage: **440 V – 3-phase**

FREQUENCY	POWER ON NETWORK VOLTAGE											CURRENT ON MAX. VOLTAGE	RATED CAPACITANCE	CAN SIZE in mm	TYPE	Item no.
	220 V	230 V	280 V	380 V	400 V	415 V	440 V	–	–	–	–			d x H		
Hz	kvar	kvar	kvar	kvar	kvar	kvar	kvar	–	–	–	–	A	µF	(+/- 3 mm)	**multicond...**	
50	5.0	5.5	8.1	14.9	16.5	17.8	20.0	–	–	–	–	26.2	3 x 109.6	116 x 260	premium UHPC-20.0-440-3P	10297
60	6.0	6.6	9.7	17.9	19.8	21.3	24.0	–	–	–	–	31.4		116 x 260	basic UHPC-20.0-440-3P	10325
														95 x 260	light UHPC-20.0-440-3P	21412
50	5.3	5.7	8.5	15.7	17.4	19.0	21.0	–	–	–	–	27.6	3 x 115.1	116 x 260	premium UHPC-21,0-440-3P	21422
60	6.3	6.9	10.2	18.9	20.8	22.0	25.2	–	–	–	–	33.1		116 x 260	basic UHPC-21.0-4403P	10327
														95 x 260	light UHPC-21.0-440-3P	21413
50	5.3	5.8	8.6	15.8	17.5	18.9	21.2	–	–	–	–	27.8	3 x 116.2	116 x 260	premium UHPC-21.2-440-3P	10298
60	6.4	7.0	10.3	19.0	21.0	22.6	25.4	–	–	–	–	33.4		116 x 260	basic UHPC-21.2-440-3P	10328
														95 x 260	light UHPC-21.2-440-3P	21780
50	6.0	6.6	9.8	18.0	20.0	21.5	24.2	–	–	–	–	31.8	3 x 132.6	116 x 260	premium UHPC-24.2-440-3P	10299
60	7.3	7.9	11.8	21.7	24.0	25.8	29.0	–	–	–	–	38.2		116 x 260	basic UHPC-24.2-440-3P	10331
														116 x 260	light UHPC-24.2-440-3P	21772
50	6.2	6.8	10.1	18.6	20.7	22.2	25.0	–	–	–	–	32.8	3x 137.0	116 x 260	light UHPC-25.0-440-3P	21781
60	7.5	8.2	12.1	22.4	24.8	26.7	30.0	–	–	–	–	39.4				
50	6.8	7.4	11.0	20.3	22.5	24.2	27.2	–	–	–	–	35.7	3 x 149.1	136 x 260	premium UHPC-27.2-440-3P	10308
60	8.2	8.9	13.2	24.3	27.0	29.0	32.6	–	–	–	–	42.8		116 x 260	basic UHPC-27.2-440-3P	10334
														116 x 260	light UHPC-27.2-440-3P	21782
50	7.0	7.7	11.4	21.0	23.2	25.0	28.1	–	–	–	–	36.9	3 x 154.0	136 x 260	premium UHPC-28.1-440-3P	10300
60	8.4	9.2	13.7	25.2	27.9	30.0	33.7	–	–	–	–	44.3		116 x 260	basic UHPC-28.1-440-3P	10335
														116 x 260	light UHPC-28.1-440-3P	21783
50	7.6	8.3	12.3	22.6	25.0	27.0	30.3	–	–	–	–	39.8	3 x 166.1	136 x 260	premium UHPC-30.3-440-3P	10303
60	9.1	9.9	14.7	27.1	30.1	32.4	36.4	–	–	–	–	47.8		116 x 260	basic UHPC-30.3-440-3P	10336
														116 x 260	light UHPC-30.3-440-3P	21773
50	7.8	8.5	12.6	23.3	25.8	27.8	32.2	–	–	–	–	40.9	3x 171.0	116 x 260	light UHPC-31.2-440-3P	21784
60	9.4	10.2	15.2	27.9	30.9	33.3	37.4	–	–	–	–	49.1				
50	9.1	9.9	14.7	27.1	30.0	32.3	36.3	–	–	–	–	47.6	3 x 198.9	136 x 260	premium UHPC-36.3-440-3P	10305
60	10.9	11.9	17.6	32.5	36.0	38.7	43.6	–	–	–	–	57.1		136 x 260	basic UHPC-36.3-440-3P	10337
														136 x 260	light UHPC-36.3-440-3P	21774
50	10.0	10.9	16.2	29.8	33.1	35.6	40.0	–	–	–	–	52.5	3x 219.2	136 x 260	light UHPC-40.0-440-3P	21785
60	12.0	13.1	19.4	35.8	39.7	42.7	48.0	–	–	–	–	63.0				

Up to a power of 30.3 kvar, 440V capacitors are also available in single-phase version.

Other capacitor powers on request.

Capacitor rated voltage: **480 V – 3-phase**

FREQUENCY	POWER ON NETWORK VOLTAGE											CURRENT ON MAX. VOLTAGE	RATED CAPACITANCE	CAN SIZE in mm	TYPE	Item no.
	220 V	230 V	280V	380 V	400V	415 V	440V	480V	–	–	–			d x H		
Hz	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	–	–	–	A	µF	(+/- 3 mm)	**multicond...**	
50	2.3	2.5	3.7	6.8	7.5	8.1	9.1	10.8	–	–	–	13.0	3 x 49.7	95 x 260	premium UHPC-10.8-480-3P	10377
60	2.7	3.0	4.4	8.1	9.0	9.7	10.9	13.0	–	–	–	15.6		95 x 260	basic UHPC-10.8-480-3P	10386
														95 x 260	light UHPC-10.8-480-3P	21786
50	2.5	2.7	4.0	7.5	8.3	8.9	10.0	11.9	–	–	–	14.3	3 x 54.8	95 x 260	premium UHPC-11.9-480-3P	10378
60	3.0	3.3	4.9	8.9	9.9	10.7	12.0	14.3	–	–	–	17.2		95 x 260	basic UHPC-11.9-480-3P	10387
														95 x 260	light UHPC-11.9-480-3P	21787
50	2.6	2.9	4.3	7.8	8.7	9.3	10.5	12.5	–	–	–	15.0	3 x 57.6	95 x 260	premium UHPC-12.5-480-3P	10379
60	3.2	3.4	5.1	9.4	10.4	11.2	12.6	15.0	–	–	–	18.0		95 x 260	basic UHPC-12.5-480-3P	10388
														95 x 260	light UHPC-12.5-480-3P	21788
50	3.0	3.3	4.9	9.0	9.9	10.7	12.0	14.3	–	–	–	17.2	3 x 65.9	95 x 260	premium UHPC-14.3-480-3P	10380
60	3.6	3.9	5.8	10.8	11.9	12.8	14.4	17.2	–	–	–	20.6		95 x 260	basic UHPC-14.3-480-3P	10389
														95 x 260	light UHPC-14.3-480-3P	21789
50	3.5	3.8	5.7	10.5	11.6	12.5	14.0	16.7	–	–	–	20.1	3 x 76.9	116 x 260	premium UHPC-16.7-480-3P	10365
60	4.2	4.6	6.8	12.6	13.9	15.0	16.8	20.0	–	–	–	24.1		95 x 260	basic UHPC-16.7-480-3P	10390
														95 x 260	light UHPC-16.7-480-3P	21790
50	3.8	4.1	6.1	11.2	12.4	13.4	15.0	17.9	–	–	–	21.5	3 x 82.4	116 x 260	premium UHPC-17.9-480-3P	10366
60	4.5	4.9	7.3	13.5	14.9	16.1	18.0	21.5	–	–	–	25.8		95 x 260	basic UHPC-17.9-480-3P	10391
														95 x 260	light UHPC-17.9-480-3P	21791
50	4.4	4.8	7.1	13.0	14.4	16.0	17.5	20.8				25.0	3 x 95.8	116 x 260	premium UHPC20.8-480-3P	21425
60	5.2	5.7	8.5	15.6	17.3	19.0	21.0	25.0				30.0		116 x 260	basic UHPC20.8-480-3P	10392
														95 x 260	light UHPC-20.8-480-3P	21414
50	5.0	5.5	8.1	14.9	16.5	17.8	20.0	23.8	–	–	–	28.6	3 x 109.6	116 x 260	premium UHPC-23.8-480-3P	10367
60	6.0	6.6	9.7	17.9	19.8	21.3	24.0	28.6	–	–	–	34.3		116 x 260	basic UHPC-23.8-480-3P	10393
															light UHPC-23.8-480-3P	21792
50	5.3	5.7	8.5	15.7	17.4	18.7	21.0	25.0	–	–	–	30.1	3 x 115.1	116 x 260	premium UHPC-25.0-480-3P	10368
60	6.3	6.9	10.2	18.8	20.8	22.4	25.2	30.0	–	–	–	36.1		116 x 260	basic UHPC-25.0-480-3P	10394
														116 x 260	light UHPC-25.0-480-3P	21794
50	5,8	6,4	9,5	17,4	19,3	20,8	23,4	27,8	–	–	–	33,4	3 x 128,0	116 x 255	light UHPC-27,8-480-3P	21795
60	7,0	7,7	11,3	20,9	23,2	24,9	28,0	33,4	–	–	–	40,2				
50	6.3	6.8	10.1	18.7	20.7	22.3	25.0	29.8	–	–	–	35.8	3 x 137.2	136 x 260	premium UHPC-29.8-480-3P	10369
60	7.5	8.2	12.2	22.4	24.8	26.7	30.0	35.8	–	–	–	43.0		116 x 260	basic UHPC-29.8-480-3P	10395
														116 x 260	light UHPC-29.8-480-3P	21797
50	7.0	7.7	11.4	20.9	23.2	25.0	28.1	33.4	–	–	–	40.2	3 x 153.8	136 x 260	premium UHPC-33.4-480-3P	10371
60	8.4	9.2	13.6	25.1	27.8	30.0	33.7	40.1	–	–	–	48.2		136 x 260	basic UHPC-33.4-480-3P	10396
														116 x 260	light UHPC-33.4-480-3P	21415
50	7.5	8.2	12.1	22.4	24.8	26.7	30.0	35.7	–	–	–	42.9	3 x 164.4	136 x 260	premium UHPC-35.7-480-3P	10374
60	9.0	9.8	14.6	26.8	29.7	32.0	36.0	42.8	–	–	–	51.5		136 x 260	basic UHPC-35.7-480-3P	10397
														116 x 260	lightUHPC-35.7-480-3P	21416

Up to a power of 33.4 kvar, 480V capacitors are also available in single-phase version.

Other capacitor powers on request.

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Capacitor rated voltage: **525 V – 3-phase**

FREQUENCY	POWER ON NETWORK VOLTAGE											CURRENT ON MAX. VOLTAGE	RATED CAPACITANCE	CAN SIZE in mm	TYPE	Item no.
	220 V	230 V	280 V	380 V	400 V	415 V	440 V	480 V	525 V	–	–			d x H		
Hz	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	–	–	A	µF	(+/- 3 mm)	**multicond...**	
50	0.7	0.8	1.1	2.1	2.3	2.5	2.8	3.3	4.0	–	–	4.4	3 x 15.4	75 x 255	UHPC-4.0-525-3P	10516
60	0.8	0.9	1.4	2.5	2.8	3.0	3.4	4.0	4.8	–	–	5.3				
50	1.4	1.5	2.3	4.2	4.6	5.0	5.6	6.7	8.0	–	–	8.8	3 x 30.8	75 x 255	UHPC-8.0-525-3P	10517
60	1.7	1.8	2.7	5.0	5.6	6.0	6.7	8.0	9.6	–	–	10.6				
50	1.8	1.9	2.8	5.2	5.8	6.2	7.0	8.4	10.0	–	–	11.0	3 x 38.5	95 x 260	premium UHPC-10.0-525-3P	10435
60	2.1	2.3	3.4	6.3	7.0	7.5	8.4	10.0	12.8	–	–	13.2		95 x 260	basic UHPC-10.0-525-3P	10444
50	2.2	2.4	3.6	6.5	7.3	7.8	8.8	10.4	12.5	–	–	13.7	3 x 48.1	95 x 260	premium UHPC-12.5-525-3P	10436
60	2.6	2.9	4.3	7.9	8.7	9.4	10.5	12.5	15.0	–	–	16.4		95 x 260	basic UHPC-12.5-525-3P	10445
														95 x 260	light UHPC-12.5-525-3P	21800
50	2.3	2.5	3.7	6.8	7.5	8.1	9.1	10.9	13.0	–	–	14.3	3 x 50.0	95 x 260	premium UHPC-13.0-525-3P	10437
60	2.7	3.0	4.4	8.2	9.0	9.7	10.9	13.0	15.6	–	–	17.2		95 x 260	basic UHPC-13.0-525-3P	10446
														95 x 260	light UHPC-13.0-525-3P	21801
50	2.6	2.9	4.3	7.9	8.7	9.4	10.5	12.5	15.0	–	–	16.5	3 x 57.7	95 x 260	premium UHPC-15.0-525-3P	10438
60	3.2	3.5	5.1	9.4	10.4	11.2	12.6	15.0	18.0	–	–	19.8		95 x 260	basic UHPC-15.0-525-3P	10447
														95 x 260	light UHPC-15.0-525-3P	21802
50	3.0	3.3	4.8	8.9	9.9	10.6	11.9	14.2	17.0	–	–	18.7	3 x 65.4	116 x 260	premium UHPC-17.0-525-3P	10418
60	3.6	3.9	5.8	10.7	11.8	12.7	14.3	17.0	20.	–	–	22.4		95 x 260	basic UHPC-17.0-525-3P	10448
														95 x 260	light UHPC-17.0-525-3P	21803
50	3.2	3.5	5.1	9.4	10.5	11.2	12.6	15.0	18.	–	–	19.8	3 x 69.3	116 x 260	premium UHPC-18.0-525-3P	10430
60	3.8	4.1	6.1	11.3	12.5	13.5	15.	18.0	21.6	–	–	23.8		95 x 260	basic UHPC-18.0-525-3P	10449
														95 x 260	light UHPC-18.0-525-3P	21804
50	3.3	3.6	5.4	9.9	11.0	11.9	13.3	15.9	19.0	–	–	20.9	3 x 73.1	116 x 260	premium UHPC-19.0-525-3P	19867
60	4.0	4.4	6.5	11.9	13.2	14.2	16.0	19.0	22.8	–	–	25.1		95 x 260	basic UHPC-19.0-525-3P	10450
														95 x 260	light UHPC-19.0-525-3P	21805
50	3.5	3.8	5.7	10.5	11.6	12.5	14.0	16.7	20.0	–	–	22.0	3 x 77.0	116 x 260	premium UHPC-20.0-525-3P	10431
60	4.2	4.6	6.8	12.6	13.9	15.0	16.9	20.1	24.0	–	–	26.4		116 x 260	basic UHPC-20.0-525-3P	10451
														95 x 260	light UHPC-20.0-525-3P	21417
50	3.7	4.0	6.0	11.0	12.2	13.1	14.7	17.5	21.0	–	–	23.1	3 x 80.8	116 x 260	premium UHPC-21.0-525-3P	10419
60	4.4	4.8	7.2	13.2	14.6	15.7	17.7	21.1	25.2	–	–	27.7		116 x 260	basic UHPC-21.0-525-3P	10452
														95 x 260	light UHPC-21.0-525-3P	21420
50	4.4	4.8	7.1	13.1	14.5	15.6	17.6	20.9	25.0	–	–	27.5	3 x 96.2	116 x 260	premium UHPC-25.0-525-3P	10420
60	5.3	5.8	8.5	15.7	17.4	18.7	21.1	25.1	30.0	–	–	33.0		116 x 260	basic UHPC-25.0-525-3P	10453
														116 x 260	light UHPC-25.0-525-3P	21808
50	5.3	5.8	8.5	15.7	17.4	18.7	21.1	25.1	30.0	–	–	33.0	3 x 115.5	136 x 260	premium UHPC-30.0-525-3P	10421
60	6.3	6.9	10.2	18.9	20.9	22.5	25.3	30.1	36.0	–	–	39.6		116 x 260	basic UHPC-30.0-525-3P	10454
														116 x 260	light UHPC-30.0-525-3P	21810
50	6.5	7.1	10.5	19.4	21.5	23.1	26.0	30.9	37.0	–	–	40.7	3 x 142.4	136 x 260	premium UHPC-37.0-525-3P	10422
60	7.8	8.5	12.6	23.3	25.8	27.7	31.2	37.1	44.4	–	–	48.8		136 x 260	basic UHPC-37.0-525-3P	10455
														116 x 260	light UHPC-37.0-525-3P	21421

Up to a power of 34.0 kvar, 525V capacitors are also available in single-phase version.

Other capacitor powers on request

Capacitor rated voltage: **690 V – 3-phase**

FREQUENCY	POWER ON NETWORK VOLTAGE											CURRENT ON MAX. VOLTAGE	RATED CAPACITANCE	CAN SIZE in mm	TYPE	Item no.
	220 V	230 V	280 V	380 V	400 V	415 V	440 V	480 V	525 V	600 V	690 V			d x H		
Hz	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	A	µF	(+/- 3 mm)	**multicond...**	
50	1.0	1.1	1.6	3.0	3.4	3.6	4.1	4.8	5.8	7.6	10.0	8.4	3 x 22.3	95 x 260	premium UHPC-10.0-690-3S	10481
60	1.2	1.3	2.0	3.6	4.0	4.3	4.9	5.8	7.0	9.1	12.0	10.		95 x 260	basic UHPC-10.0-690-3S	10482
50	1.3	1.4	2.1	3.8	4.2	4.5	5.1	6.1	7.2	9.5	12.5	10.5	3 x 27.9	95 x 260	premium UHPC-12.5-690-3S	10475
60	1.5	1.7	2.5	4.6	5.0	5.4	6.1	7.3	8.7	11.3	15.0	12.6		95 x 260	basic UHPC-12.5-690-3S	10483
50	1.5	1.7	2.5	4.5	5.0	5.4	6.1	7.3	8.7	11.3	15.0	12.6	3 x 33.4	116 x 260	premium UHPC-15.0-690-3S	10468
60	1.8	2.0	3.0	5.5	6.0	6.5	7.3	8.7	10.4	13.6	18.0	15.1		95 x 260	basic UHPC-15.0-690-3S	10484
50	2.0	2.2	3.3	6.1	6.7	7.2	8.1	9.7	11.6	15.1	20.0	16.7	3 x 44.6	136 x 260	premium UHPC-20.0-690-3S	10474
60	2.4	2.7	4.0	7.3	8.1	8.7	9.8	11.6	13.9	18.1	24.0	20.1		116 x 260	basic UHPC-20.0-690-3S	10485
50	2.1	2.3	3.4	6.3	7.0	7.5	8.5	10.1	12.1	15.7	20.8	17.4	3 x 46.4	136 x 260	premium UHPC-20.8-690-3S	10469
60	2.5	2.8	4.1	7.6	8.4	9.0	10.2	12.1	14.5	18.9	25.0	20.9		116 x 260	basic UHPC-20.8-690-3S	10486
50	2.5	2.8	4.1	7.6	8.4	9.0	10.2	12.1	14.5	18.9	25.0	20.9	3 x 55.7	136 x 260	premium UHPC-25.0-690-3S	10470
60	3.0	3.3	4.9	9.1	10.1	10.8	12.2	14.5	17.4	22.7	30.0	25.1		116 x 260	basic UHPC-25.0-690-3S	10487
50	2.7	2.9	4.3	8.0	8.8	9.5	10.7	12.7	15.2	19.9	26.3	22.0	3 x 58.6	136 x 260	premium UHPC-26.3-690-3S	10476
60	3.2	3.5	5.2	9.6	10.6	11.4	12.8	15.3	18.3	23.9	31.6	26.4		136 x 260	basic UHPC-26.3-690-3S	10488
50	2.8	3.1	4.6	8.4	9.3	10.1	11.3	13.5	16.1	21.0	27.8	23.3	3 x 62.0	136 x 260	premium UHPC-27.8-690-3S	10478
60	3.4	3.7	5.5	10.1	11.2	12.1	13.6	16.1	19.3	25.2	33.4	27.9		136 x 260	basic UHPC-27.8-690-3S	10489
50	3.0	3.3	4.9	9.0	10.0	10.7	12.0	14.3	17.1	22.4	29.6	24.8	3 x 66.0	136 x 260	premium UHPC-29.6-690-3S	10477
60	3.6	4.0	5.9	10.8	11.9	12.9	14.4	17.2	20.6	26.9	35.5	29.7		136 x 260	basic UHPC-29.6-690-3S	10490

Performance data and sizes deviating from the standard are available on request.
Misprints and printing errors as well as technical changes reserved.

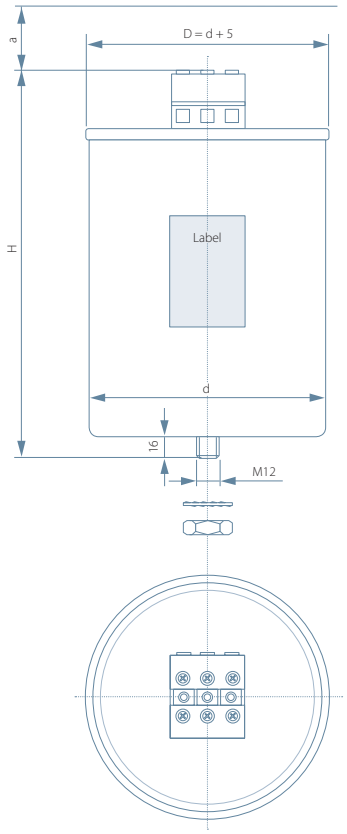
Example for order: Power capacitor, 30.3 kvar to 440 V.
The corresponding order detail is as follows:**Type multicond premium UHPC-30.3-440-3P (3-phase version) = item number 10303**
Type multicond basic UHPC-30.3-440-3P (3-phase version) = product number 10336

multicond

Capacitor rated voltage: **800 V – Basic and Premium Y-circuit**

FREQUENCY	280 V	380 V	400 V	415 V	440 V	480 V	525 V	600 V	660 V	690 V	800 V	CURRENT ON MAX. VOLTAGE	RATED CAPACITANCE	CAN SIZE in mm	TYPE	Item no.
Hz	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar	A	µF	d x H (+/- 3 mm)	**multicond...**	
50	–	–	3,3	3,6	4,0	4,8	5,7	7,5	9,1	9,9	13,3	9,6	3 x 22.1	95 x 260	premium UHPC-13.3-800-3S	21818
60	–	–	4,0	4,3	4,8	5,8	6,9	9,0	10,9	11,9	16,0	11,5		95 x 260	basic UHPC-13.3-800-3S	21806
50	–	–	4,2	4,5	5,0	6,0	7,2	9,4	11,3	12,4	16,6	12,0	3 x 27.6	95 x 260	premium UHPC-16.6-800-3S	21819
60	–	–	5,0	5,4	6,0	7,2	8,6	11,2	13,6	14,9	20,0	14,4		95 x 260	basic UHPC-16.6-800-3S	21807
50	–	–	5,0	5,4	6,1	7,2	8,6	11,3	13,7	14,9	20,1	14,5	3 x 33.3	116 x 260	premium UHPC-20.1-800-3S	21820
60	–	–	6,0	6,5	7,3	8,7	10,4	13,5	16,4	17,9	24,1	17,4		95 x 260	basic UHPC-20.1-800-3S	21809
50	–	–	5,7	6,2	6,9	8,2	9,8	12,9	15,6	17,0	22,9	16,5	3 x 37.9	136 x 260	premium UHPC-22.9-800-3S	21821
60	–	–	6,9	7,4	8,3	9,9	11,8	15,4	18,7	20,4	27,4	19,8		116 x 260	basic UHPC-22.9-800-3S	21811
50	–	–	6,7	7,2	8,1	9,6	11,5	15,0	18,1	19,8	26,7	19,3	3 x 44.2	136 x 260	premium UHPC-26.7-800-3S	21822
60	–	–	8,0	8,6	9,7	11,5	13,8	18,0	21,8	23,8	32,0	23,1		116 x 260	basic UHPC-26.7-800-3S	21812
50	–	–	7,0	7,5	8,4	10,0	12,0	15,7	19,0	20,7	27,9	20,1	3 x 46.2	136 x 260	premium UHPC-27.9-800-3S	21823
60	–	–	8,4	9,0	10,1	12,0	14,4	18,8	22,8	24,9	33,4	24,1		116 x 260	basic UHPC-27.9-800-S	21813
50	–	–	8,3	9,0	10,1	12,0	14,4	18,8	22,7	24,8	33,4	24,1	3 x 55.4	136 x 260	premium UHPC-33.4-800-3S	21824
60	–	–	10,0	10,8	12,1	14,4	17,3	22,5	27,3	29,8	40,1	28,9		136 x 260	basic UHPC-33.4-800-3S	21814
50	–	–	8,8	9,5	10,7	12,7	15,2	19,9	24,1	26,3	35,4	25,5	3 x 58.6	136 x 260	premium UHPC-35.4-800-3S	21825
60	–	–	10,6	11,4	12,8	15,3	18,3	23,9	28,9	31,6	42,4	30,6		136 x 260	basic UHPC-35.4-800-3S	21815
50	–	–	9,1	9,8	11,0	13,1	15,6	20,4	24,7	27,0	36,3	26,2	3 x 60.2	136 x 260	premium UHPC-36.3-800-3S	21826
60	–	–	10,9	11,7	13,2	15,7	18,8	24,5	29,6	32,4	43,6	31,5				
50	–	–	9,3	10,1	11,3	13,4	16,1	21,0	25,4	27,8	37,4	27,0	3 x 61,9	136 x 260	basic UHPC-37.4-800-3S	21816
60	–	–	11,2	12,1	13,6	16,1	19,3	25,2	30,5	33,3	44,8	32,3				
50	–	–	9,9	10,7	12,0	14,3	17,1	22,4	27,1	29,6	39,8	28,7	3 x 66,0	136 x 260	basic UHPC-39.8-800-3S	21817
60	–	–	11,9	12,8	14,4	17,2	20,6	26,9	32,5	35,5	47,7	34,4				

Other capacitor powers on request



Construction diagram

General:

→ Adapter box safe from finger-touch
→ Expansion by 12 mm maximum
→ Clearance above (a) 13 mm minimum

Installation:

→ M12 threaded bolts
→ tightening torque T = 10 Nm
→ serrated lock washer J12 DIN 6797
→ hexagonal nut BM12 DIN 439

Adapter box:

d 95/116/136 (25 mm²)

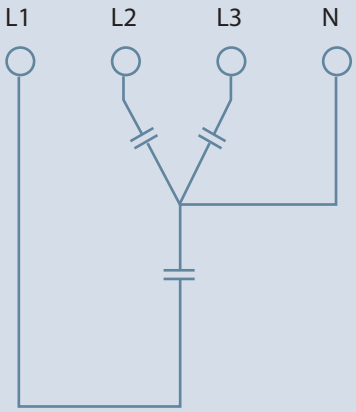
→ M5 connection screw
→ tightening torque T = 2.5 Nm

d 75 (16 mm²)

→ M4 connection screw
→ tightening torque T = 1.3 Nm

All dimensions are in mm. Not suitable for measurement purposes.

On request a 4 pole terminal with lead out neutral wire is available.
(suitable for 3 phase controlled pfc units)
Those capacitors can also be used as 3 one phase capacitors in one can.
Only available with diameter of 136mm.



multicond Technical details

	multicond premium UHPC	multicond basic UHPC	multicond light UHPC
Rated voltage	U_n = 280, 440, 480, 525 or 690 V	U_n = 280, 440, 480, 525 or 690 V	U_n = 280, 440, 480, 525 or 690 V
Frequency	50/60 Hz	50/60 Hz	50/60 Hz
Maximum permissible operating voltage	1.0 x U_n continuous | 1.1 x U_n 8 hours/day | 1.15 x U_n 30 minutes/day 1.2 x U_n 200 x 5 minutes | 1.3 x U_n 200 x 1 minute		
Maximum permissible operating current	1.5 x I_n at 0 - 15.9 kvar 2.0 x I_n at > 15.9 kvar	1.5 x I_n at 0 - 15.9 kvar 2.0 x I_n at > 15.9 kvar	1.8 x I_n at > 15.9 kvar
Maximum inrush current	400 x I_n	400 x I_n	250 x I_n
Capacitance tolerance	+/- 5 %	+/- 5 %	+/- 5 %
Power dissipation	< 0.20 W/kvar, without discharge resistors	< 0.25 W/kvar, without discharge resistors	< 0.25 W/kvar, without discharge resistors
Voltage test (terminal – terminal)	2.15 x U_{rated} (AC), 10 sec	2.15 x U_{rated} (AC), 10 sec	2.15 x U_{rated} (AC), 10 sec
Voltage test (terminal – housing)	≤ 690 V : 3600 V (AC), 2.5 sec | > 690 V : 6000 V (AC), 10 sec - acc. to standard		
Cooling	Natural cooling	Natural cooling	Natural cooling
Permissible humidity	95 %	95 %	95 %
Maximum altitude	4000 m above sea level	4000 m above sea level	4000 m above sea level
Installation site, installation position	Indoors, anywhere	Indoors, anywhere	Indoors, anywhere
Attachment	M12 threaded bolts on the ground	M12 threaded bolts on the ground	M12 threaded bolts on the ground
Safety features	→ Dry technology, resin-filled → Self-restoring → Overpressure disconnector (all-pole) → SF6-free, PCB-free	→ Dry technology, resin-filled → Self-restoring → Overpressure disconnector (all-pole) → SF6-free, PCB-free	→ Dry technology, resin-filled → Self-restoring → Overpressure disconnector (all-pole) → SF6-free, PCB-free
Housing	Aluminum		
Protection type	IP 20		
Dielectric	Polypropylene		
Terminal strips	double-sided terminal strip, safe from finger-touch		
Discharge	Discharge resistors on the outside of the strip		
Standards	IEC 60831-1 + 2, EN 60831-1 + 2, VDE 0560-46 + 47		

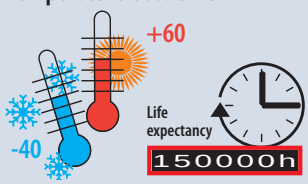
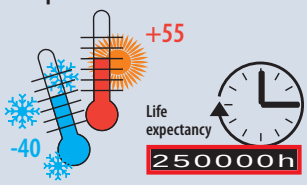
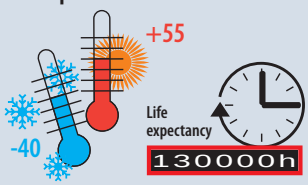
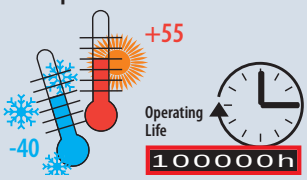
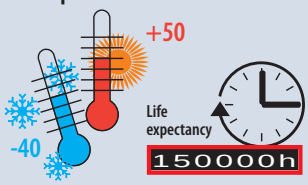
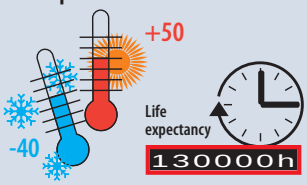
The discharge of the capacitors takes place via discharge resistors or discharge reactors.

The standard requires a discharge of the capacitor that, as a rule, is realized via discharge resistors.

If faster discharge is necessary, the capacitor can be discharged with a discharge reactor within a very short time.

The capacitor is thus available again for compensation after a short time.

Type	Item no.	Power	Dimensions (H x W x D) in mm	Connection
multidis-EW 120k-3P-5W	17141	5 W	4 x 39 x 30	Terminal lugs
multidis-EW 120k-3P-9W	19410	9 W	4 x 39 x 46	Terminal lugs
multidis-EW 300k-3P	17142	5W	4 x 39 x 30	Terminal lugs
multidis-EW 400k-3P	17143	9W	4 x 39 x 46	Terminal lugs
multidis-ED 100-900V	15464		35 x 60 x 90	cable 600 mm

	multicond premium UHPC	multicond basic UHPC	multicond light UHPC
Temperature class D+5: Operating life*	Temperature class D+5  **-40/60** **> 150,000 h** max. ambient temperature: 60 °C max. average over 24 hours: 50 °C max. average over 1 year: 40 °C		
Temperature class D: Operating life*	Temperature class D  **-40/55** **> 250,000 h** max. ambient temperature: 55 °C max. average over 24 hours 45 °C max. average over 1 year: 35 °C	Temperature class D  **-40/55** **> 130,000 h** max. ambient temperature: 55 °C max. average over 24 hours: 45 °C max. average over 1 year: 35 °C	Temperatureclass D  **-40/55** **> 100,000 h** max. ambient temperature: 55 °C max. average over 24 hours 45 °C max. average over 1 year: 35 °C
Temperature class C: Operating life*		Temperature class C  **-40/50** **> 150,000 h** max. ambient temperature: 50 °C max. average over 24 hours: 40 °C max. average over 1 year: 30 °C	Temperature class C  **-40/50** **> 130,000 h** max. ambient temperature: 50 °C max. average over 24 hours: 40 °C max. average over 1 year: 30 °C

***The maximum operating life depends on the type of the application and the temperature class**

Storage conditions for capacitors:

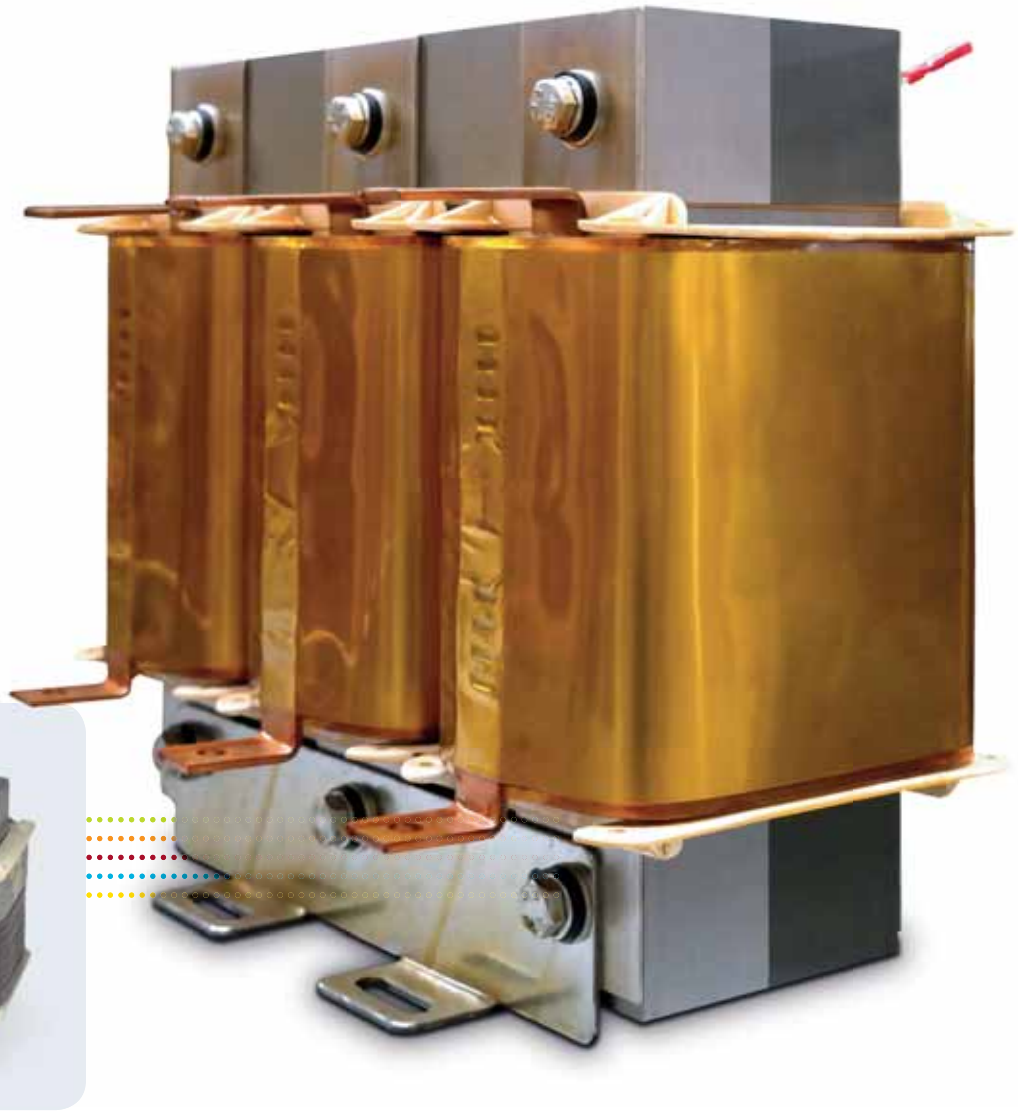
min. / max. temp.: -40 - + 85 °C
max. air humidity: <95% without condensation

Do not store in corrosive atmosphere containing aerosols, especially if chloride gas, sulfur compounds, salts (marine air) or similar is present.

Filter circuit reactors

To prevent resonance phenomena caused by harmonic content in the power supply system, filter circuit reactors are required to set up detuned compensation systems. Here, high linearities guarantee the necessary functional stability even in the overload range.

Filter circuit reactors



multiind 50Hz

Power	2.5 – 75 kvar
Detuning factors	5.5, 7 or 8 % 12.5 or 14 %

Filter circuit reactors for reactive current compensation

Highlights

- → Power from 2.5 to 75 kvar
- → High linearity, low power dissipation
- → Overload protection through temperature switch
- → Low-noise through impregnation
- → Long operating life
- → Improved impedance behavior

An overview of the **technical details** is provided on pages 44-45.
Construction diagrams are provided on page 43.

Note on the temperature switch

For smooth operation and a long operating life, the integrated temperature sensor must interrupt the main circuit of the filter circuit reactor in case of overload.

Notes on installation

- → Observe the applicable DIN / VDE regulations.
- → Power supply connection, setup and device operation must be performed by qualified personnel only.
- → Maintain maximum current, voltage and temperature ranges.
- → Ensure sufficient ventilation.
- → Tighten connections with the right torque.

Specifications multiind-basic ... 5.5 %

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

POWER	TYPE multiind-basic ... 5.5 %			INDUC-TIVITY	RATED CUR-RENT	DIMENSIONS in mm						CONNECTION			DIA-GRAM	WEIGHT	CAPACI-TANCE	CAPACITOR multicond
kvar		Cu	Al	mH	A	H	B	T	W1	W2	LL	L	AW	RK		kg	µF	UHPC ... -440-3P
2.5	multiind-basic 400-02.5-5.5-Cu-L-S	x		12.11	3.5	165	180	86	95	62.5	9	x			A	5.3	3 x 15.4	4.0 / 525
5	multiind-basic 400-05.0-5.5-Cu-L-S	x		6.06	7.2	165	180	106	95	82.5	9	x			A	8.1	3 x 30.8	8.0 / 525
7.5	multiind-basic 400-07.5-5.5-Cu-L-S	x		3.74	11.4	165	180	106	95	83	9	x			A	9.5	3 x 50.0	13.0 / 525
10	multiind-basic 400-10.0-5.5-Cu-L-S	x		2.80	15.3	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	19.1	220	240	95	95	71	9	x			A	14.5	3 x 82.8	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	17.0	3 x 93.7	17.1
20	multiind-basic 400-20.0-5.5-Cu-L-S	x		1.40	30.6	220	240	125	95	81	9	x			A	18.5	3 x 132.6	24.2
25	multiind-basic 400-25.0-5.5-Cu-L-S	x		1.21	35.5	220	240	135	95	91	9	x			A	21.0	3 x 154.0	28.1
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 187.4	2 x 17.1
40	multiind-basic 400-40.0-5.5-Cu-L-S	x		0.75	57.4	220	240	135	95	91	9	x			A	20.8	3 x 248.8	1 x 21.1 +1 x 24.2
50	multiind-basic 400-50.0-5.5-Cu-L-S	x		0.60	71.0	220	240	155	95	82	9	x			A	26.6	3 x 308.0	2 x 28.1
60	multiind-basic 400-60.0-5.5-Cu-L-S	x		0.51	84.0	270	300	145	95	145	9	x			A	31.5	3 x 364.7	1 x 10.0/ 525 + 2 x 3 0.3/ 120
75	multiind-basic 400-75.0-5.5-Cu-L-S	x		0.40	106.3	270	300	150	95	107	9	x			A	38.0	3 x 461.7	3 x 28.1

Specifications multiind-light ... 7 %

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

POWER	TYPE multiind-light... 7 %			INDUC-TIVITY	RATED CUR-RENT	DIMENSIONS IN MM in mm						CONNECTION			DIA-GRAM	WEIGHT	CAPACI-TANCE	CAPACITOR multicond
kvar		Cu	Al	mH	A	H	B	T	W1	W2	LL	L	AW	RK		kg	µF	UHPC ... -440-3P
2.5	multiind-light 400-02.5-7-Cu-L-S	x		15.42	3.6	165	180	86	95	62.5	9	x			A	5.1	3 x 15.4	4.0 / 525
5	multiind-light 400-05.0-7-Cu-L-S	x		7.71	7.8	165	180	86	95	62.5	9	x			A	6.1	3 x 30.8	8.0 / 525
7.5	multiind-light 400-07.5-7-Cu-L-S	x		4.76	11.6	165	180	96	95	72.5	9	x			A	7.8	3 x 50.0	13.0 / 525
10	multiind-light 400-10.0-7-Cu-L-S	x		3.56	15.5	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	18.0	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	21.9	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	36.0	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	36.0	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	72.0	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	72.0	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	108.0	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	108.0	270	300	180	95	122	9		x		C	36.0	3 x 461.7	3 x 28.1

multiind 50Hz

Specifications multiind-basic ... 7 %

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

POWER	TYPE multiind-basic ... 7 %			INDUC-TIVITY	RATED CUR-RENT	DIMENSIONS in mm						CONNECTION			DIA-GRAM	WEIGHT	CAPACI-TANCE	CAPACITOR multicond
kvar		Cu	Al	mH	A	H	B	T	W1	W2	LL	L	AW	RK		kg	µF	UHPC ... -440-3P
2.5	multiind-basic 400-02.5-7-Cu-L-S	x		15.42	3.6	165	180	86	95	62.5	9	x			A	5.2	3 x 15.4	4.0 / 525
5	multiind-basic 400-05.0-7-Cu-L-S	x		7.709	7.2	165	180	86	95	62.5	9	x			A	6.4	3 x 30.8	8.0 / 525
7.5	multiind-basic 400-07.5-7-Cu-L-S	x		4.76	11.6	165	180	96	95	72.5	9	x			A	8.1	3 x 50.0	13.0 / 525
10	multiind-basic 400-10.0-7-Cu-L-S	x		3.56	15.5	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	19.4	195	210	109	95	86	9	x			A	12.5	3 x 82.8	15.1
15	multiind-basic 400-15.0-7-Cu-L-S	x		2.52	21.9	195	210	109	95	86	9	x			A	13.0	3 x 93.7	17.1
20	multiind-basic 400-20.0-7-Cu-L-S	x		1.78	31.1	195	210	109	95	86	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	20.0	3 x 154.0	28.1
25	multiind-basic 400-25.0-7-Al-AW-S		x	1.54	36	220	240	145	95	91	9		x		C	17.1	3 x 154.0	28.1
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 187.4	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	17.8	3 x 187.3	2 x 17.1
40	multiind-basic 400-40.0-7-Cu-L-S	x		0.95	58.2	220	240	145	95	101	9	x			A	26.5	3 x 248.8	1 x 21.2 + 1 x 24.2
40	multiind-basic 400-40.0-7-Al-AW-S		x	0.95	58.2	240	260	167	95	112	9		x		C	26.0	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	32.5	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	86.8	270	300	145	95	95	9	x			A	35.0	3 x 364.7	1 x 10 / 525 + 2 x 30.3 / 440
60	multiind-basic 400-60.0-7-Al-AW-S		x	0.65	86.8	270	300	180	95	95	9		x		C	35.0	3 x 364.7	1 x 10 / 525 + 2 x 30.3 / 440
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	37.5	3 x 461.7	3 x 28.1

Specifications multiind-light ... 8 %

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

POWER	TYPE multiind-light... 8 %			INDUC-TIVITY	RATED CUR-RENT	DIMENSIONS in mm						CONNECTION			DIA-GRAM	WEIGHT	CAPACI-TANCE	CAPACITOR multicond
kvar		Cu	Al	mH	A	H	B	T	W1	W2	LL	L	AW	RK		kg	µF	UHPC ... -440-3P
2.5	multiind-light 400-02.5-8-Cu-L-S	x		17.62	3.6	165	180	86	95	62.5	9	x			A	5.1	3 x 15.4	4.0 / 525
5	multiind-light 400-05.0-8-Cu-L-S	x		8.811	7.3	165	180	86	95	62.5	9	x			A	6.1	3 x 30.8	8.0 / 525
7.5	multiind-light 400-07.5-8-Cu-L-S	x		5.44	11.8	165	180	96	95	72.5	9	x			A	7.8	3 x 50.0	13.0 / 525
10	multiind-light 400-10.0-8-Cu-L-S	x		4.073	15.7	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	19.6	195	210	109	95	86	9	x			A	12.4	3 x 82.8	15.1
15	multiind-light 400-15.0-8-Cu-L-S	x		2.88	22.2	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	31.4	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	36.4	220	240	115	95	91	9	x			A	19.1	3 x 154.0	28.1
30	multiind-light 400-30.0-8-Cu-L-S	x		1.44	44.3	220	240	135	95	91	9	x			A	20.3	3 x 187.4	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	58.8	220	240	155	95	105	9	x			A	25.0	3 x 248.8	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	72.9	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	72.0	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 10 / 525 + 2 x 30.3 / 440
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 10 / 525 + 2 x 30.3 / 440
75	multiind-light 400-75.0-8-Cu-L-S	x		0.59	109.2	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	108.0	270	300	210	95	122	9		x		C	36.0	3 x 461.7	3 x 28.1

Specifications multiind-basic ... 8 %

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

POWER	TYPE multiind-basic ... 8 %			INDUC-TIVITY	RATED CUR-RENT	DIMENSIONS in mm						CONNECTION			DIA-GRAM	WEIGHT	CAPACI-TANCE	CAPACITOR multicond
kvar		Cu	Al	mH	A	H	B	T	W1	W2	LL	L	AW	RK		kg	µF	UHPC ... -440-3P
2.5	multiind-basic 400-02.5-8-Cu-L-S	x		17.62	3.6	165	180	86	95	62.5	9	x			A	5.2	3 x 15.4	4.0 / 525
5	multiind-basic 400-05.0-8-Cu-L-S	x		8.811	7.3	165	180	96	95	72.5	9	x			A	7.6	3 x 30.8	8.0 / 525
7.5	multiind-basic 400-07.5-8-Cu-L-S	x		5.44	11.8	165	180	96	95	72.5	9	x			A	8.3	3 x 50.0	13.0 / 525
10	multiind-basic 400-10.0-8-Cu-L-S	x		4.07	15.7	195	210	92	95	68.5	9	x			A	10.0	3 x 66.3	12.1
12.5	multiind-basic 400-12.5-8-Cu-L-S	x		3.26	19.6	195	210	109	95	86	9	x			A	13.0	3 x 82.8	15.1
15	multiind-basic 400-15.0-8-Cu-L-S	x		2.88	22.2	195	210	109	95	86	9	x			A	14.0	3 x 93.7	17.1
20	multiind-basic 400-20.0-8-Cu-L-S	x		2.04	31.4	220	240	105	95	86	9	x			A	19.0	3 x 132.7	24.2
25	multiind-basic 400-25.0-8-Cu-L-S	x		1.75	36.4	220	240	115	95	91	9	x			A	20.5	3 x 154.0	28.1
30	multiind-basic 400-30.0-8-Cu-L-S	x		1.44	44.3	220	240	135	95	91	9	x			A	21.0	3 x 187.4	2 x 17.1
30	multiind-basic 400-30.0-8-Al-AW-S		x	1.44	44.3	220	240	145	95	91	9		x		C	17.8	3 x 187.3	2 x 17.1
40	multiind-basic 400-40.0-8-Cu-L-S	x		1.09	58.8	220	240	155	95	105	9	x			A	25.5	3 x 248.8	1 x 21.2 + 1 x 24.2
40	multiind-basic 400-40.0-8-Al-AW-S		x	1.09	58.8	220	240	167	95	105	9		x		C	26.0	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	72.9	270	300	145	95	95	9	x			A	33.0	3 x 308.0	2 x 28.1
50	multiind-basic 400-50.0-8-Al-AW-S		x	0.88	72.9	220	240	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	37.0	3 x 364.7	1 x 10 / 525 + 2 x 30.3 / 440
60	multiind-basic 400-60.0-8-Al-AW-S		x	0.74	86.4	270	300	210	95	122	9		x		C	35.6	3 x 364.7	1 x 10 / 525 + 2 x 30.3 / 440
75	multiind-basic 400-75.0-8-Cu-L-S	x		0.59	109.2	270	300	180	95	122	9	x			A	38.8	3 x 461.7	3 x 28.1
75	multiind-basic 400-75.0-8-Al-AW-S		x	0.59	109.2	270	300	210	95	122	9		x		C	38.7	3 x 461.7	3 x 28.1

Specifications multiind-basic ... 12.5 %

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

POWER	TYPE multiind-basic ... 12.5 %			INDUC-TIVITY	RATED CUR-RENT	DIMENSIONS in mm						CONNECTION			DIA-GRAM	WEIGHT	CAPACI-TANCE	CAPACITOR multicond
kvar		Cu	Al	mH	A	H	B	T	W1	W2	LL	L	AW	RK		kg	µF	UHPC ... -525-3P
2.5	multiind-basic 400-02.5-12.5-Cu-L-S	x		27.53	3.8	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	7.6	165	180	96	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	12.4	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	14.3	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	17.3	220	240	105	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	20.1	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	35.4	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	35.4	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	43.1	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	43.1	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	57.5	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	57.5	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	70.8	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	70.8	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	86.2	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-Al-AW-S		X	0.988	106.3	260	300	175	95	122	9		X		C	49.7	3 x 462.0	3 x 37.0

multiind 50Hz

Specifications multiind-light ... 14 %

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

POWER	TYPE multiind-light... 14 %			INDUC-TIVITY	RATED CUR-RENT	DIMENSIONS						CONNECTION			DIA-GRAM	WEIGHT	CAPACI-TANCE	CAPACITOR multicond
kvar		Cu	Al	mH	A	H	B	T	W1	W2	LL	L	AW	RK		kg	µF	UHPC ... -525-3P
2.5	multiind-light 400-02.5-14-Cu-L-S	x		30.84	3.9	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	7.8	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	12.7	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	14.6	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	17.6	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	20.4	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	29.3	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	36.0	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	36.0	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	43.9	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	43.9	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	58.5	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	58.5	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	72.1	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	72.1	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	87.7	270	300	180	95	112	9	x			A	50.0	3 x 346.7	3 x 30.0

Specifications multiind-basic ... 14 %

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

POWER	TYPE multiind-basic ... 14 %			INDUC-TIVITY	RATED CUR-RENT	DIMENSIONS						CONNECTION			DIA-GRAM	WEIGHT	CAPACI-TANCE	CAPACITOR multicond
kvar		Cu	Al	mH	A	H	B	T	W1	W2	LL	L	AW	RK		kg	µF	UHPC ... -525-3P
2.5	multiind-basic 400-02.5-14-Cu-L-S	x		30.84	3.9	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	7.8	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	12.7	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	14.6	195	210	109	95	86	9	x			A	14.4	3 x 57.7	15.0
12.5	multiind-basic 400-12.5-14-Cu-L-S	x		5.86	17.6	220	240	105	95	81	9	x			A	17.9	3 x 80.7	21.0
15	multiind-basic 400-15.0-14-Cu-L-S	x		5.86	20.4	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	29.3	220	240	125	95	101	9	x			A	23.5	3 x 115.7	30.0
25	multiind-basic 400-25.0-14-Cu-L-S	x		3.32	36.0	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	36.0	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	43.9	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	43.9	270	300	180	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	58.5	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	58.5	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	72.1	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	72.1	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	87.7	270	300	210	95	112	9	x			A	47.6	3 x 346.7	3 x 30.0

Construction diagrams

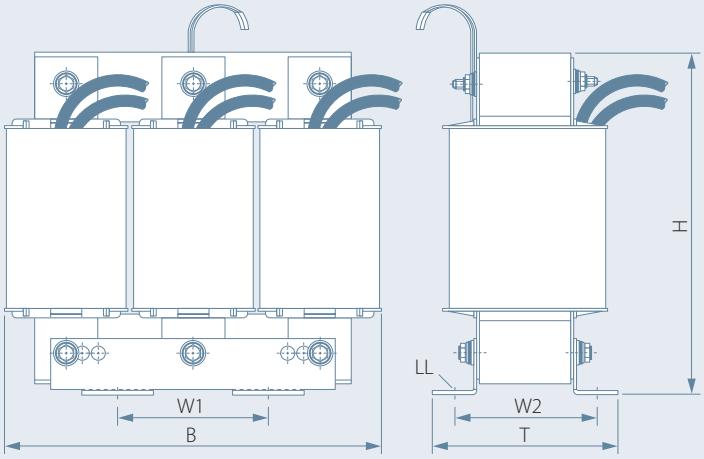


Diagram A

Design with connection lines
Type L

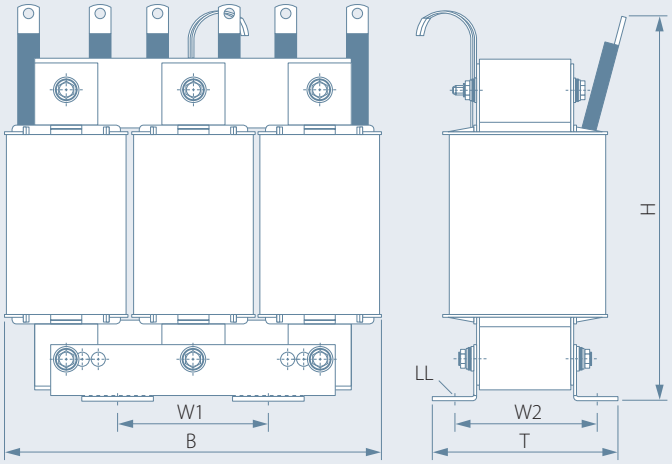


Diagram B

Design with tubular cable lug
Type RK

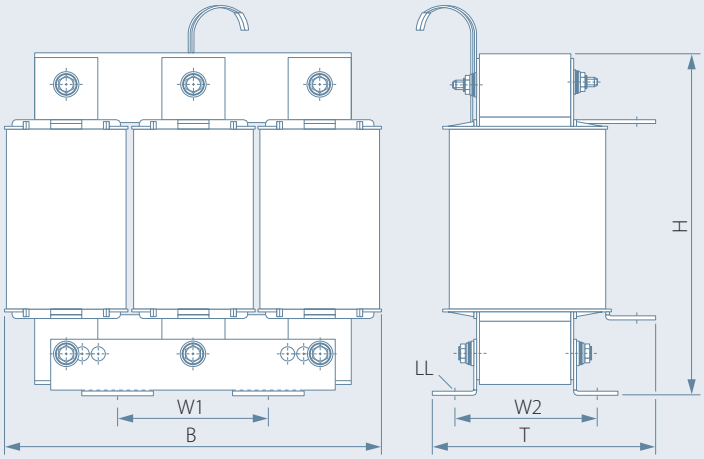


Diagram C

Design with connection angle
Type AW

Not suitable for measurement purposes.

multiind 50Hz Technical details

DEVICE TYPE	multiind 5.5 **basic** p = 5.5 %	multiind 7.0 **light** p = 7 %	 **basic** p = 7 %
Rated voltage | frequency	U_n = 400 V | 50Hz	U_n = 400 V | 50Hz	U_n = 400 V | 50Hz
Maximum permissible operating voltage	U_n = 400 V ± 10 %	U_n = 400 V ± 10 %	U_n = 400 V ± 10 %
Power	2.5 – 75 kvar	2.5 – 75 kvar	2.5 – 75 kvar
Inductive stability | Inductive tolerance	L (I_{Lin}) ≥ 0.95 L_N | ± 3 %	L (I_{Lin}) ≥ 0.95 L_N | ± 3 %	L (I_{Lin}) ≥ 0.95 L_N | ± 3 %
Overtemperature protection	Break contact at 125 °C (250 V – 50 Hz – 2.5 A), temperature class B	Break contact at 125 °C (250 V – 50 Hz – 2.5 A), temperature class B	
Protection type	IP 00	IP 00	IP 00
Protection class	I	I	I
Ambient temperature	maximum 40 °C	maximum 40 °C	maximum 40 °C
Cooling type	Natural cooling	Natural cooling	Natural cooling
Impregnation	vacuum-impregnated	vacuum-impregnated	vacuum-impregnated
Detuning factor | Resonance frequency	5.5 % | 214 Hz	7 % | 189 Hz	7 % | 189 Hz
Linearity	2.1 x I_{rated}	1.6 x I_{rated}	1.85 x I_{rated}
Standards	DIN EN 60076-6 (VDE 0532-76-6) DIN EN 61558-1-A1 (VDE 0570-1-A1) DIN EN 61558-2-20 (VDE 0570-2-20)	DIN EN 60076-6 (VDE 0532-76-6) DIN EN 61558-1-A1 (VDE 0570-1-A1) DIN EN 61558-2-20 (VDE 0570-2-20)	
Designs	Cu = copper Al = aluminum L = cable connection AW = connection angle RK = tubular cable lug	Cu = copper Al = aluminum L = cable connection AW = connection angle RK = tubular cable lug	

	multiind 8.0		multiind 12.5	multiind 14.0	
	light p = 8 %	**basic** p = 8 %	**basic** p = 12.5 %	**light** p = 14 %	**basic** p = 14 %
	U_n = 400 V | 50 Hz	U_n = 400 V | 50 Hz	U_n = 400 V | 50 Hz	U_n = 400 V | 50 Hz	U_n = 400 V | 50 Hz
	U_n = 400 V ± 10 %	U_n = 400 V ± 10 %	U_n = 400 V ± 10 %	U_n = 400 V ± 10 %	U_n = 400 V ± 10 %
	2.5 – 75 kvar	2.5 – 75 kvar	2.5 – 50 kvar	2.5 – 50 kvar	2.5 – 50 kvar
	L (I_{Lin}) ≥ 0.95 L_N | ± 3 %	L (I_{Lin}) ≥ 0.95 L_N | ± 3 %	L (I_{Lin}) ≥ 0.95 L_N | ± 3 %	L (I_{Lin}) ≥ 0.95 L_N | ± 3 %	L (I_{Lin}) ≥ 0.95 L_N | ± 3 %
	Break contact at 125 °C (250 V – 50 Hz – 2.5 A), temperature class B		Break contact at 125 °C (250 V – 50 Hz – 2.5 A), temperature class B	Break contact at 125 °C (250 V – 50 Hz – 2.5 A), temperature class B	
	IP 00	IP 00	IP 00	IP 00	IP 00
	I	I	I	I	I
	maximum 40 °C	maximum 40 °C	maximum 40 °C	maximum 40 °C	maximum 40 °C
	Natural cooling	Natural cooling	Natural cooling	Natural cooling	Natural cooling
	vacuum-impregnated	vacuum-impregnated	vacuum-impregnated	vacuum-impregnated	vacuum-impregnated
	8 % | 176 Hz	8 % | 176 Hz	12.5 % | 142 Hz	14 % | 134 Hz	14 % | 134 Hz
	1.6 x I_{rated}	1.85 x I_{rated}	1.5 x I_{rated}	1.4 x I_{rated}	1.5 x I_{rated}
	DIN EN 60076-6 (VDE 0532-76-6) DIN EN 61558-1-A1 (VDE 0570-1-A1) DIN EN 61558-2-20 (VDE 0570-2-20)		DIN EN 60076-6 (VDE 0532-76-6) DIN EN 61558-1-A1 (VDE 0570-1-A1) DIN EN 61558-2-20 (VDE 0570-2-20)	DIN EN 60076-6 (VDE 0532-76-6) DIN EN 61558-1-A1 (VDE 0570-1-A1) DIN EN 61558-2-20 (VDE 0570-2-20)	
	Cu = copper Al = aluminum L = cable connection AW = connection angle RK = tubular cable lug		Cu = copper Al = aluminum L = cable connection AW = connection angle RK = tubular cable lug	Cu = copper Al = aluminum L = cable connection AW = connection angle RK = tubular cable lug	

multiind 60Hz

Specifications multiind-basic ... 6%

Detuning: **6%** Resonance frequency: **245 Hz**

VOLTAGE V	POWER kvar	TYPE multiind-basic ... 6 %	Cu	Al	INDUCTIVITY mH	RATED CURRENT A	DIMENSIONS H	W	D	W1	W2	LL	CONNECTION L	AW	RK	DIAGRAM	WEIGHT kg	CAPACITANCE µF	CAPACITOR multicond UHPC
380V/60Hz	12.5	multiind-basic 380-60-12.5-6-CU-RK-S	x		1.8280	20.3	215	210	109	95	85	9			x	B	13.5	231	1x 20.0-525-3P
380V/60Hz	13.4	multiind-basic 380-60-13.4-6-CU-RK-S	x		1.8250	20.3	215	210	109	95	85	9			x	B	13.5	231	1x 16.7-480-3P
380V/60Hz	25	multiind-basic 380-60-25.0-6-AL-AW-S		x	0.9490	39.2	240	260	167	95	112	9		x		C	24.5	445	1x 17.9-480-3P 1x 14.3-480-3P
380V/60Hz	26.7	multiind-basic 380-60-26.7-6-CU-RK-S	x		0.9160	40.6	250	240	115	95	92	9			x	B	21	461	1x 33.4-480-3P
380V/60Hz	50	multiind-basic 380-60-50.0-6-CU-RK-S	x		0.484	76.8	305	300	150	95	117	9			x	B	34.1	873	1x 29.8-480-3P 2x 33.4-480-3P
440V/60Hz	12.5	multiind-basic 440-60-12.5-6-CU-RK-S	x		2.4403	17.6	215	210	109	95	85	9			x	B	11.8	173	1x 15.0-525-3P
440V/60Hz	25	multiind-basic 440-60-25.0-6-AL-AW-S		x	1.2166	35.4	220	240	145	95	92	9		x		C	17.6	347	1x 30.0-525-3P
440V/60Hz	50	multiind-basic 440-60-50.0-6-AL-AW-S		x	0.6416	67	270	300	180	95	117	9		x		C	33	658	1x 20.0-525-3P 1x 37.0-525-3P

Specifications multiind-basic ... 7%

Detuning: **7%** Resonance frequency: **227Hz**

VOLTAGE V	POWER kvar	TYPE multiind-basic ... 7 %	Cu	Al	INDUCTIVITY mH	RATED CURRENT A	DIMENSIONS H	W	D	W1	W2	LL	CONNECTION L	AW	RK	DIAGRAM	WEIGHT kg	CAPACITANCE µF	CAPACITOR multicond UHPC
230V/60Hz	10	multiind-basic 230-60-10-7-CU-RK-S	x		1.0661	24.9	215	210	109	95	85	9			x	B	13.8	462	1x 28.1-440-3P
230V/60Hz	20	multiind-basic 230-60-20-7-CU-RK-S	x		0.5319	49.9	250	240	129	95	105	9			x	B	22.2	925.5	1x 20.0-440-3P 1x 36.3-440-3P
480V/60Hz	25	multiind-basic 480-60-25.0-7-AL-AW-S		x	1.7043	32.5	220	240	145	95	92	9		x		C	17.3	289	1x 25.0-525-3P
480V/60Hz	50	multiind-basic 480-60-50.0-7-AL-AW-S		x	0.9276	59.7	240	260	167	95	112	9		x		C	27.0	531	1x 21.0-525-3P 1x 25.0-525-3P

Specifications multiind-basic ... 13%

Detuning: **13%** Resonance frequency: **167 Hz**

VOLTAGE V	POWER kvar	TYPE multiind-basic ... 13 %	Cu	Al	INDUCTIVITY mH	RATED CURRENT A	DIMENSIONS H	W	D	W1	W2	LL	CONNECTION L	AW	RK	DIAGRAM	WEIGHT kg	CAPACITANCE µF	CAPACITOR multicond UHPC
380V/60Hz	12.5	multiind-basic 380-60-12.5-13-CU-RK-S	x		4.3976	19.8	250	240	105	95	82	9			x	B	16	207.9	1x 18.0-525-3P
380V/60Hz	25	multiind-basic 380-60-25.0-13-AL-AW-S		x	2.1988	39.5	270	300	180	95	117	9		x		C	32	416	2x 18.0-525-3P
380V/60Hz	50	multiind-basic 380-60-50.0-13-AL-AW-S		x	1.0698	81.3	270	300	180	95	117	9		x		C	33	855	2x 37.0-525-3P
440V/60Hz	12.5	multiind-basic 440-60-12.5-13-CU-RK-S	x		6.0980	16.5	215	210	109	95	85	9			x	B	15	150	1x 13.0-525-3P
440V/60Hz	25	multiind-basic 440-60-25.0-13-AL-AW-S		x	3.0490	33	240	260	167	95	112	9		x		C	24	300	2x 13.0-525-3P
440V/60Hz	50	multiind-basic 440-60-50.0-13-AL-AW-S		x	1.5250	66	270	300	180	95	117	9		x		C	33	600	1x 15.0-525-3P 1x 37.0-525-3P

multiind 60Hz technical details

DEVICE TYPE	multiind 6 %		multiind 7 %		multiind 13 %	
	basic p = 6 %	**basic** p = 6 %	**basic** p = 7 %	**basic** p = 7 %	**basic** p = 13 %	**basic** p = 13 %
Rated voltage	U_n = 380 V	U_n = 440 V	U_n = 230 V	U_n = 480 V	U_n = 380 V	U_n = 440 V
Frequency	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz
Maximum permissible operating voltage	U_n = 380 V ± 10 %	U_n = 440 V ± 10 %	U_n = 230 V ± 10 %	U_n = 480 V ± 10 %	U_n = 380 V ± 10 %	U_n = 440 V ± 10 %
Power	12.5 x 13.4, 25; 26.7; x 50 kvar	12.5 x 25; 50 kvar	10; 20 kvar	25; 50 kvar	12.5 x 25; 50 kvar	12.5 x 25; 50 kvar
Inductive stability	L (I_{Lin}) ≥ 0.95 L_N		L (I_{Lin}) ≥ 0.95 L_N		L (I_{Lin}) ≥ 0.95 L_N	
Inductive tolerance	± 3 %		± 3 %		± 3 %	
Overtemperature protection	Break contact at 125 °C (250 V – 50 Hz – 2.5 A)		Break contact at 125 °C (250 V – 50 Hz – 2.5 A)		Break contact at 125 °C (250 V – 50 Hz – 2.5 A)	
Protection type	IP 00		IP 00		IP 00	
Protection class	I		I		I	
Ambient temperature	Maximum 40 °C		Maximum 40 °C		Maximum 40 °C	
Cooling type	Natural cooling		Natural cooling		Natural cooling	
Impregnation	Vacuum-impregnated		Vacuum-impregnated		Vacuum-impregnated	
Detuning	6 %	6 %	7 %	7 %	13 %	13 %
Resonance frequency	245 Hz	245 Hz	227 Hz	227 Hz	167 Hz	167 Hz
Linearity	1.85 x I_{rated}	1.85 x I_{rated}	1.85 x I_{rated}	1.85 x I_{rated}	1.5 x I_{rated}	1.5 x I_{rated}
Standards	DIN EN 60289 (VDE 0532-289)		DIN EN 60289 (VDE 0532-289)		DIN EN 60289 (VDE 0532-289)	
Designs	Cu = copper Al = aluminum L = cable connection AW = connection angle RK = tubular cable lug					

Version: June 2017. Subject to change.

Capacitor contactors

multiswitch low-voltage switching devices are produced and tested according to the relevant national and international rules and regulations. All of the devices correspond to all important German regulations, such as VDE, BS and the relevant international standards, such as IEC 60947 and UL508. This is why our low-voltage switching devices can be used worldwide.

Thyristor switches

With thyristor switches, you can connect and disconnect capacitors quickly and without wear and tear.
Unlimited switching frequency, no peak inrush current when switching on capacitors, rapid compensation and no noise formation during switching are just some of the advantages of this technology.

BENEDICT GMBH
www.benedict.at

KBR
Energy Management

multiswitch capacitor contactor

K3-10N…
K3-14N…
K3-18N…
K3-22N…

K3-24…
K3-32…
K3-40…

K3-50…
K3-62…
K3-74…

K3-90…
K3-115…

Capacitor contactors without early make contacts

Specifications:

K3 power contactors… are well-suited for switching of de-tuned filter circuit capacitor batteries (IEC 70 and 831) with reactors.

Operating conditions:

Only for use in detuned compensation systems! Power contactors do not have early make contacts and damping resistors.

TYPE	Item no.	Power in kvar at 50 °C
K3-18ND-10-230	10521	12.5
K3-32A-00-230	10524	25.0
K3-62A-00-230	10527	50.0
K3-74A-00-230	10532	75.0
K3-90A-00-230	10528	80.0
K3-115A-00-230	10533	100.0

Technical data in accordance with IEC 947, EN 60947

	TYPE		10ND	14ND	18ND	22ND	24A	32A	40A	50A	62A	74A	90A	115A
AC3	400 V	Motor	10A	14A	18A	22A	24A	32A	40A	50A	62A	74A	90A	115A
		380-400 V	4 kW	5.5 kW	7.5 kW	11 kW	11 kW	15 kW	18.5 kW	22 kW	30 kW	37 kW	45 kW	55 kW
		660-690 V	5.5 kW	7.5 kW	10 kW	10 kW	15 W	18.5 kW	18.5 kW	30 kW	37 kW	45 kW	55 kW	55 kW
AC1	690V at 40 °C		25A	25A	32A	32A	50A	65A	80A	110A	120A	1230A	160A	200A
TYPE	K3-		10ND10	14ND10	18ND10	22ND10	24A00	32A00	40A00	50A00	62A00	74A00	90A00	115A00
	Auxiliary contacts		1S	1S	1S	1S	–	–	–	–	–	–	–	–
	K3-		10ND01	10ND01	18ND01	22ND01								
			1Ö	1Ö	1Ö	1Ö								
Connection cross sections	single-wire or multi-wire	mm^2	0.75 - 6				1.5 - 25			4 - 50			10 - 120	
	fine-wire	mm^2	1 - 4				2.5 - 16			10 - 35			10 - 95	
Auxiliary contact	I_{th} 40 °C	A	10				–			–			–	
	AC15 230 V	A	3				–			–			–	
	400 V	A	2				–			–			–	
Power of the magnetic coils		VA	33 - 45				90 - 115			140 - 165			28/0	
		VA	7 - 10				9 - 13			13 - 18			5	
	Control voltage range		0.85 - 1.1				0.85 - 1.1			0.85 - 1.1			0.85 - 1.1	
Assembly			Quick fastening on 35 mm DIN rail and screw fastening										2 rails or screws	

K3-18NK…

K3-24K…
K3-32K…

K3-50K…
K3-62K…
K3-74K…

K3-90K…
K3-115K…

Capacitor contactors for switching detuned and not detuned (without filter circuit reactors) compensation systems with early make contacts

Specifications:

K3-..K capacitor contactors are well-suited for detuned and not detuned batteries (IEC70 and 831, VDE 0560) with and without filter circuit reactors. Capacitor contactors are equipped with early make contacts switches and damping resistors in order to reduce inrush peaks to <70 x I_e.

Conditions of use:

Capacitor contactors are weld-resistant to a prospective maximum inrush current of 200 x I_e.

TYPE	Item no.	Power in kvar at 50 °C
K3-18K-10-230	10520	12.5
K3-32K-00-230	10523	25.0
K3-62K-00-230	10526	50.0
K3-74K-00-230	10525	75.0
K3-90K-00-230	10531	80.0
K3-115K-00-230	21592	100.0

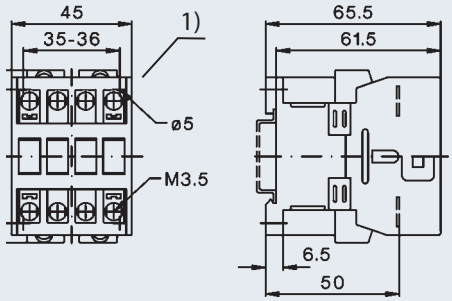
Technical data in accordance with IEC 947-4-1, IEC 947-5-1, EN 60947-4-1, EN 60947-5-1, VDE 0660

TYPE			K3-18NK	K3-24K	K3-32K	K3-50K	K3-62K	K3-74K	K3-90K	K3-115K
Switching frequency z		1/h	120	120	120	120	120	80	80	80
Contact life of untuned capacitors		S x 10^3	250	150	150	150	150	120	120	120
Contact life of detuned capacitors		S x 10^3	400	300	300	300	300	200	200	200
Rated operating current I_e AC6b	at 50 °C	A	0-18	14-28	14-36	30-48	30-72	30-108	50-115	50-144
	at 60 °C	A	0-18	14-28	14-36	30-48	30-72	30-87	50-108	50-130
Rated thermal current I_{th} AC1	at 50 °C	A	32	45	60	100	110	120	155	190
	at 60 °C	A	32	40	55	90	100	110	145	170
Overload factor	at 50 °C	%	78	60	67	108	53	11	35	32
according to EN 61921 at least 30%	at 60 °C	%	78	43	53	88	39	26	34	31
Fuses gL (gG)	from/to	A	35/63	50/80	63/100	80/160	125/160	160/200	160/200	160/250

multiswitch capacitor contactor

Capacitor contactors without early make contacts

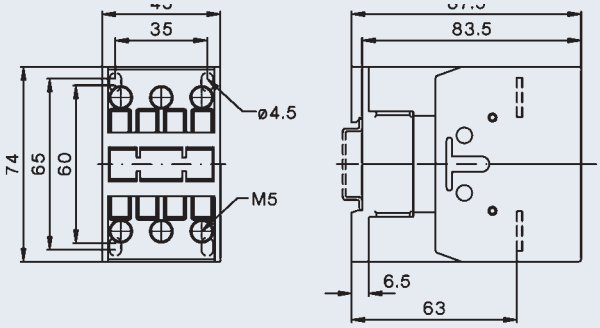
K3-10N…
K3-14N…
K3-18N…
K3-22N…



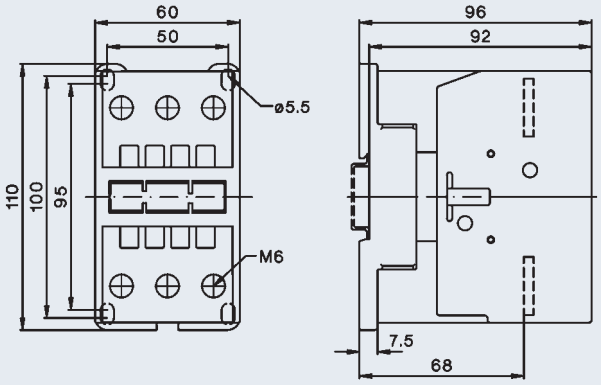
1) Minimum side clearance to conductive parts at coil voltages:

500 V	Uimp = 6 kV	2 mm
660-690 V	Uimp = 8 kV	4.5 mm

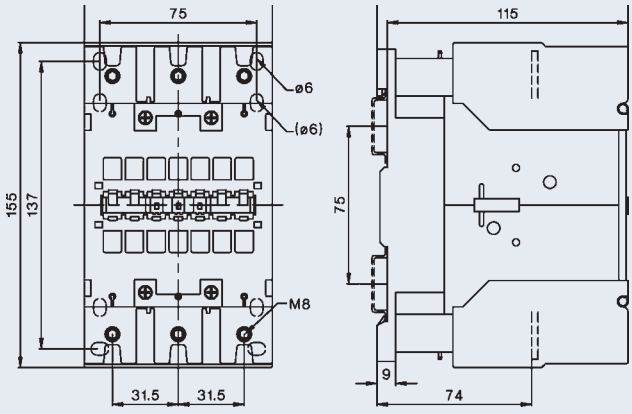
K3-24…
K3-32…
K3-40…



K3-50…
K3-62…
K3-74…

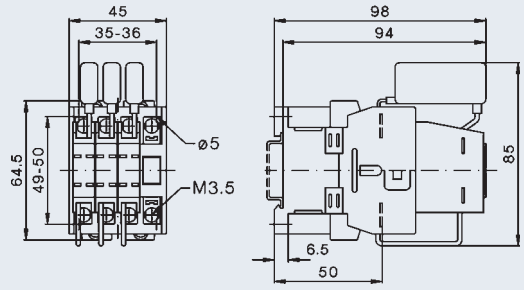


K3-90…
K3-115…

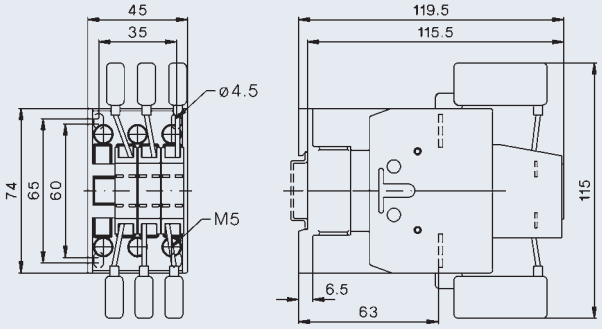


Capacitor contactors for switching detuned and not detuned (without filter reactors) compensation systems with early make contacts

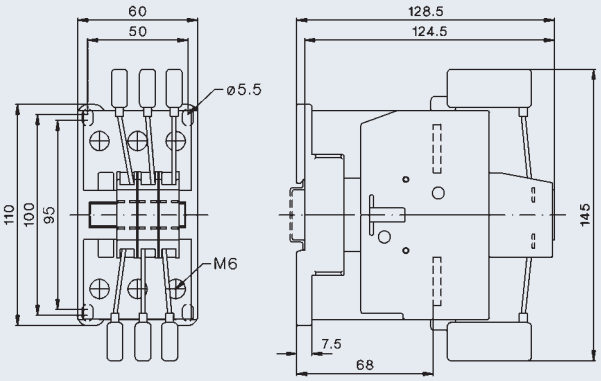
K3-18NK…



K3-24K…
K3-32K…



K3-50K…
K3-62K…
K3-74K…



K3-90K…
K3-115K…

thyroswitch 2P

Current **70 – 115 A**

Three-phase thyristor switch with two thyristors

Highlights

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

An overview of the **technical details** is provided on pages 58-59.

The **thyroswitch 2P** 3-phase thyristor switch is a ready-to-install compact unit with which you can connect and disconnect untuned and detuned capacitors quickly and without wear and tear. thyroswitch offers significant advantages over standard contactors.
Among other things, the load on the capacitors is reduced by controlled switching, which increases their operating life. When switched on, there is no peak inrush current and no wear and tear on the switch contacts.

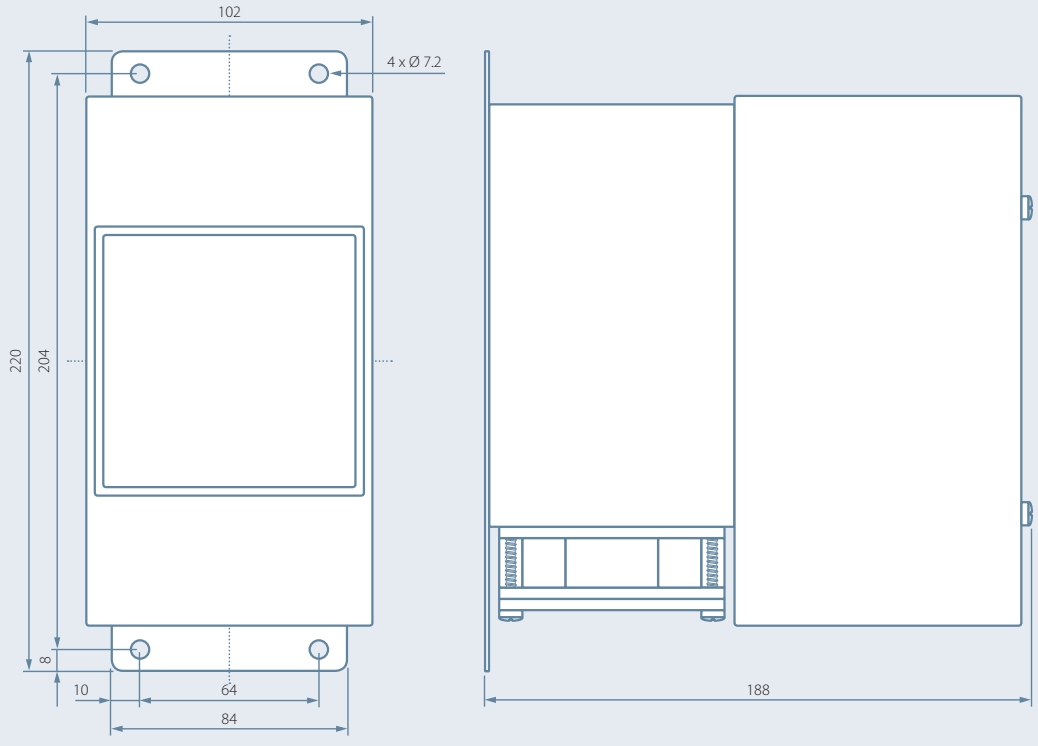
The thyroswitch is controlled via the **multicomp** reactive power controller or directly via the machine control. thyroswitch 2P has two thyristors which switch phases L1 and L3. Phase L2 is connected but not switched on. If the switch-on procedure is activated via a reactive power controller or a control,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

Specifications

DEVICE TYPE	ITEM NUMBER	VOLTAGE in V	FREQUENCY in Hz	CURRENT in A
thyroswitch 2ph-400-50-90	14338	400	50	90 *
thyroswitch 2ph-400-60-90	14339	400	60	90
thyroswitch 2ph-400-50-115	14340	400	50	115 *
thyroswitch 2ph-400-60-115	–	400	60	115
thyroswitch 2ph-500-50-70	14341	500	50	70 *
thyroswitch 2ph-500-60-70	14342	500	60	70
thyroswitch 2ph-240-60-90	14343	240	60	90

* Standard

thyroswitch 2P



All dimensions are in mm. Not suitable for measurement purposes.

thyroswitch 3P

Current **70 – 100 A**

Three-phase thyristor switch with three thyristors

Highlights

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

An overview of the **technical details** is provided on pages 58-59.

The **thyroswitch 3P** thyristor switch combines functional features that already stand out in the thyroswitch 2P: quick and wear-free connection and disconnection of capacitors, unlimited switching frequency with short switching delay and compensation almost in real time. The device generates no operating noise at all and has a compact design ready for connection.

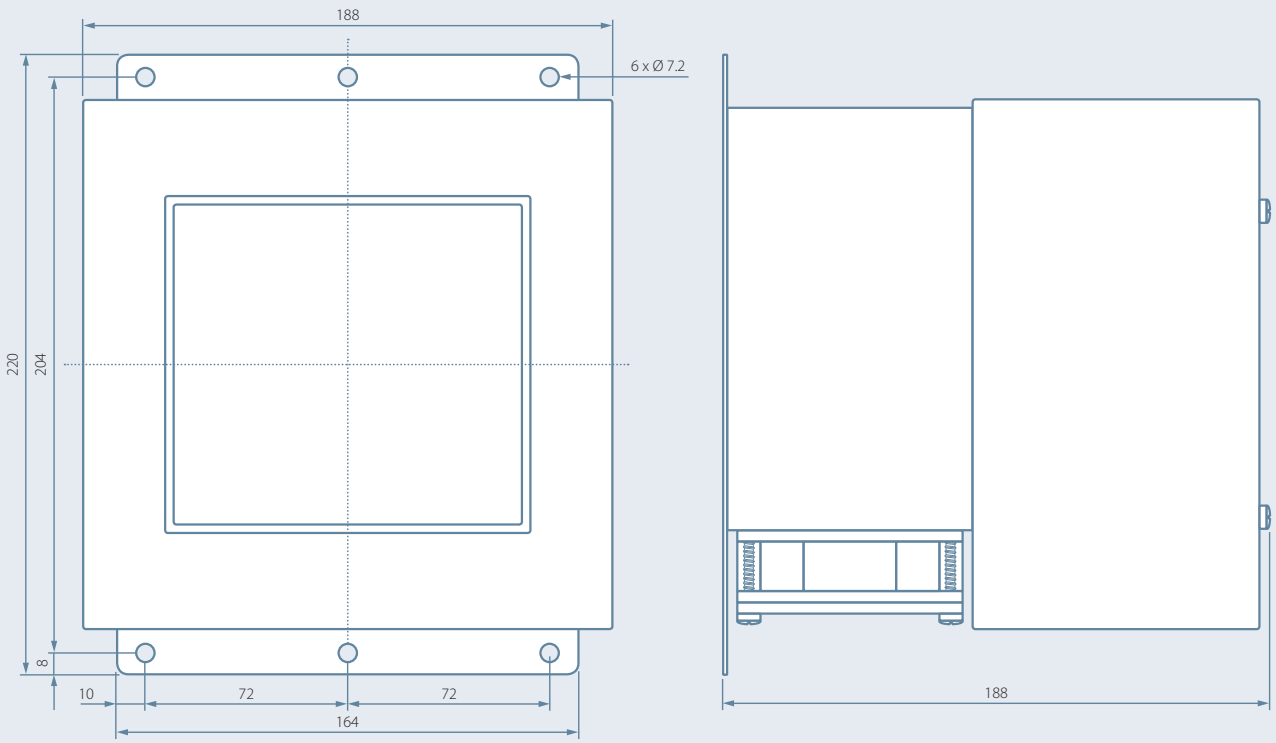
thyroswitch 3P has three thyristors that switch separately or together. If the switch-on procedure is activated via a reactive power controller or a control, a voltage comparison between the capacitor voltage and the mains voltage is made. If there is a slight difference, the stage is switched on.

Specifications

DEVICE TYPE	ITEM NUMBER	VOLTAGE in V	FREQUENCY in Hz	CURRENT in A
thyroswitch 3ph-690/400-50-100	14344	690/400 Y/Δ	50	100*
thyroswitch 3ph-690/400-60-100	14345	690/400 Y/Δ	60	100
thyroswitch 3ph-690/500-50-70	14346	690/500 Y/Δ	50	70
thyroswitch 3ph-690/500-60-70	14347	690/500 Y/Δ	60	70

* Standard

thyroswitch 3P



All dimensions are in mm. Not suitable for measurement purposes.

thyroswitch Technical details

	DEVICE TYPE
INPUT	Control input
	Fuse protection
POWER SUPPLY	Auxiliary voltage
	Fuse protection
LOAD CIRCUIT	Connection voltage U_N
	Load current
	Power dissipation
FIELD OF APPLICATION	Creepage distances from control input to power circuit
	Rated voltage
	Harmonic voltage
ON DELAY: TURN-OFF TIME > 5s	Input
RECLOSURE DELAY: CYCLIC OPERATION	Input
ELECTRICAL SAFETY	Standards and subsequent amendments
	Protection class
	Clearances
	Protection type
AMBIENT CONDITIONS	Standards and subsequent amendments
	Air humidity, non-condensing
	Operating temperature
	Storage temperature
INSTALLATION	Installation position
	Cooling clearances
HOUSING	Sizes in mm (H x W x D)
WEIGHT	

thyroswitch 2P	thyroswitch 3P
10 – 30 V DC | max. 30 mA 180 – 260 V AC | 50/60 Hz | max. 20 mA	10 – 30 V DC | 3 inputs, max. 30 mA each
max. 6 A	max. 6 A
230 V AC | 50/60 Hz | max. 18 VA	230 V AC ± 10 % | 50/60 Hz | max. 35 VA
max. 6 A	max. 6 A
400/500 V | 50/60 Hz (type-dependent → table)	Δ 400 V/50 Hz | Y 690 V/50 Hz
70/90/115 A (type-dependent → table)	max. 100 A
70 A type approx. 2.2 W per A 90/115 A type approx. 2.1 W per A	70 A type approx. 3 x 1.1 W per A 100 A type approx. 3 x 1.05 W per A
> 10.5 mm for SELV voltages	> 10.5 mm for SELV voltages
U_N ± 10 %	U_N ± 10 %
DIN EN 61000-2-4 Class 3 | THD max. 10%	DIN EN 61000-2-4 Class 3 | THD max. 10%
DC: 0 up to max. 20 ms AC: 10 up to max. 30 ms	0 up to max. 20 ms
DC: 0 up to max. 33 ms AC: 10 up to max. 43 ms	0 up to max. 33 ms
I	I
EN61010:2001 for contamination degree II measurement category III	EN61010:2001 for contamination degree II measurement category III
IP 10	IP 10
DIN EN 60721-3-3/A2 (3K5 + 3Z11) EC 721-3-3 (3K5 + 3Z11)	DIN EN 60721-3-3/A2 (3K5 + 3Z11) IEC 721-3-3 (3K5 + 3Z11)
5 % to 95 %	5 % to 95 %
–5 °C to +55 °C → Observe the performance limitation depending on the ambient temperature.	–5 °C to +55 °C
25 °C to +70 °C	-25 °C to +70 °C
vertical or horizontal	vertical or horizontal
min. 50 mm to the fan and min. 150 mm to the heat sink outlet	min. 50 mm to the fan and min. 150 mm to the heat sink outlet
220 x 105 x 185 mm 220 x 105 x 198 mm (type 115 A)	220 x 182 x 188 mm
approx. 2900 g approx. 3600 g (type 115 A)	Approx. 5800 g

Power quality

Clean electrical networks ensure operational safety. Modern manufacturing processes are based on electronic power drives and controls. Thus, considerably higher energy savings, better process optimization and an increase in production can be achieved. However, the requirements placed on clean energy are increasing and quality is more and more influenced by the power electronics used. Precise planning as well as qualified error detection and trouble-shooting in case of problems is required in advance.

multi Wave® Active Filter Solution

multiwave active

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

multilog 2 class A
mobile network analyzer

Mobile network analysis

multilog is a mobile network analyzer which is used to continuously record a wide range of measured values, such as voltage, current, frequency, power, energy consumption, flicker emissions, harmonics and interharmonics. With its small dimensions, it can be installed in tight spaces and switchgear cabinets.

multi Wave Passive Filter Solution

multiwave passive

With high-quality and precisely matched components, the passive filters are an excellent and affordable solution for reducing harmonic loads in the network.

MULTILOG 2:

ANALYZE NETWORKS WITH EASE USING MOBILE DEVICES.

multilog 2 light/expert with many accessories and convenient transport case

- **V** Voltage
- **A** Current
- average, min. and max. values
- **cos φ** **sin φ**
- **P** **Q** **V** Power
- **D** Distortion reactive power
- **P st** **P lt** Flicker
- **Harm. U** Voltage harmonics, THD
- **Harm. A** Current harmonics
- **Hz** Frequency
- **+** … and many other parameters

Comprehensive measurement options

- Complete recording of more than 2000 measured values
- Simultaneous long-term and online measurements
- Storage capacity of 2 GB allows for long-term storage for up to one year
- All relevant interfaces available, for example RS232 for time synchronization or fast USB port for data transfer

multilog 2 is available in two versions:

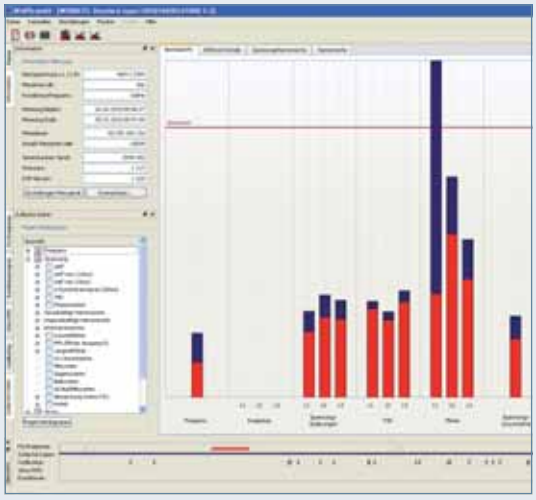
multilog 2 light
The powerful base device for comprehensive network analysis and storage of measured data. Upgradeable to the expert version with a license

multilog 2 expert
With more trigger functions than the light version.
Fast oscilloscope images are recorded automatically

multilog 2 – Mobile network analysis device

The multilog 2 class A mobile network analyzer stands out with a strong performance range: Recording of more than 2000 measured values, numerous trigger functions as well as comprehensive analysis and archiving options. The device is easy to operate and mobile, which makes it perfect for measurements in public and industrial networks.

Clear design and standard compliance: Assessment of the voltage quality in accordance with EN 50160 and IEC 61000-2-2



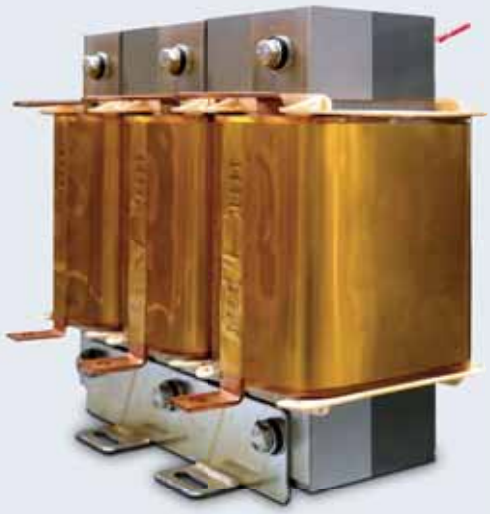
Easy evaluation

- Automatic report EN 50160/IEC 61000-2-2 for a fast and precise overview of the voltage quality
- The online analysis software provides a graphical real-time representation of current and voltage signals, as well as harmonics and interharmonics of voltages of up to 5000 Hz (software included in the scope of delivery)
- Ripple-control signal analysis (optional)
- Time synchronization for the correlation of measured data of different devices
- Fault recording as oscilloscope images and as 10 ms RMS reports to detect the causes of network interference
- Continuous recording of more than 2000 different measured values per measurement interval

For detailed information and technical specifications, please refer to our **multilog 2 brochure**.
You can **download it as a PDF online at kbr.de** or request the printed version by calling **+49 (9122) 6373-0**

multiwave passive

KBR UHPC premium capacitors



KBR high-power reactor

multiwave with passive harmonics solutions

The loads in industrial networks are increasingly dominated by a large number of small and large converters. These are introduced with the new acquisition of machines or the retrofitting of existing machines to increase the energy efficiency.

In this context, two effects can be observed. Due to the falling number of motors operated directly on the grid, the need for inductive fundamental reactive power is decreasing. At the same time, however, there is more and more reactive power caused by the harmonic currents of the converters.

The impedance of the network transformer plays a decisive role. A large part of the harmonic voltage is created here, leading to faults in the consumers. Frequently, the standard limit values for harmonics are already violated in the main distribution. This results in unreliable operation of the machines with an increased number of malfunctions in the control system.

As a solution, KBR offer the harmonic filters of the multiwave series. New is the passive version as tuned filter circuit system. multiwave passive has been developed specifically for networks with a high ratio of 5th and 7th harmonics, which are typical for industrial networks. The system is introduced centrally in the low-voltage main distribution and absorbs part of the harmonic current. The degree of network cleaning depends on the design of the passive filter.

The result is a significant improvement of the total harmonic distortion of the voltage (THD-U) and a lesser thermal load on the transformer.

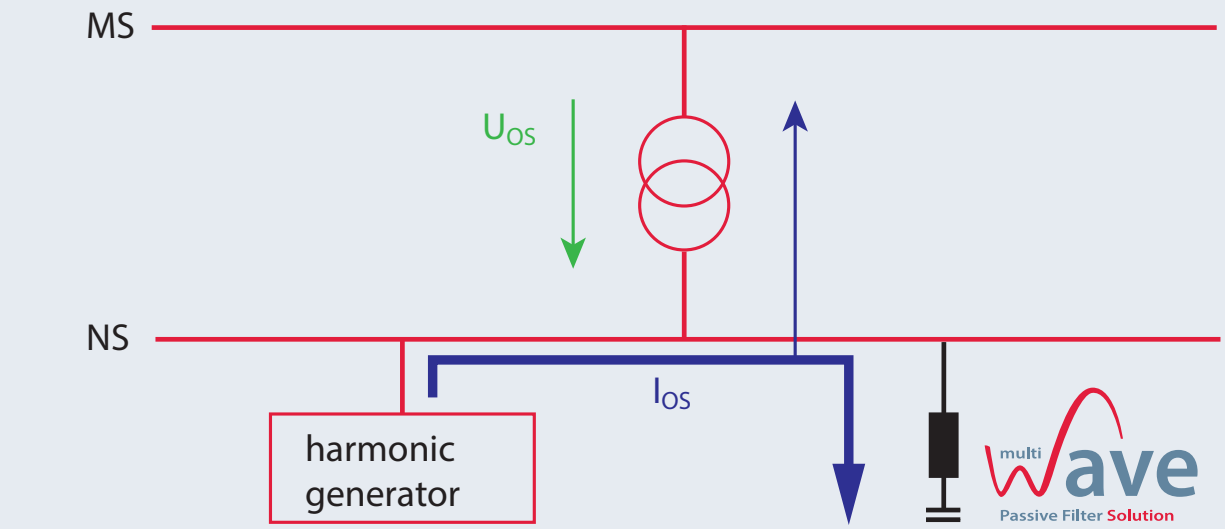
The multiwave passive is controlled and monitored with the tried-and-tested multicomp D6 compensation controller equipped with a special filter circuit system program. The multicomp D6 controls and checks contactors and fans and monitors the system for overcurrent and overtemperature. Various network measuring functions are implemented, as well as an error memory that can be displayed in the plain text display. You can also operate several systems in one network in master/slave operation.

The compensation power of the multiwave passive is considerable. For example, a filter with 250 kvar fundamental reactive power can absorb up to 650 A of harmonic current from the network. The broad-band filter effect yields the following typical degrees of compensation:

5th harmonic 85 %
7th harmonic 43 %
11th harmonic 32 %
13th harmonic 30 %

In order to guarantee this filter capacity in the long term, it is necessary to use components with a high load capacity. Once more, the components from our own production were the most convincing. KBR developed the high-power inductor used specifically for this system type. The tried-and-tested UHPC premium capacitors with an overload capacity of up to twice the rated current complete the package.

Harmonic generator basics



I_{OS} = harmonic current
U_{OS} = harmonic voltage

Overall, this is a consistent concept for the significant improvement of your voltage quality at an unbeatable price/performance ratio.

Each filter system has to be designed for the individual use case. Our Power Quality Service department is specialized in this task and happy to assist you with your project.

multi wave
Passive Filter Solution

multiwave active

multiwave active – the new generation of active harmonic filters

Highlights

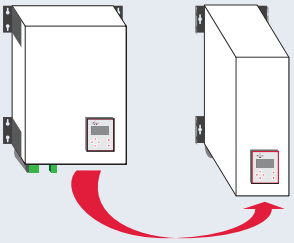
- → Most effective harmonic mitigation up to the 50th order including even harmonics
- → Compact active harmonic filter for 3-phase loads with and without neutral wire (all-in-one)
- → < 5 % THD-I achievable even on most complex mixed loads and at changing load profiles
- → New modular design with intelligent system approach – to offer tailored solutions for different applications and customers
- → 3-level IGBT inverter topology for reduced power losses
- → Extended temperature range up to 50 °C
- → Ultra-fast and dynamic reactive power compensation (inductive and capacitive)
- → Load balancing and unloading of neutral wires

multiwave active modular system approach

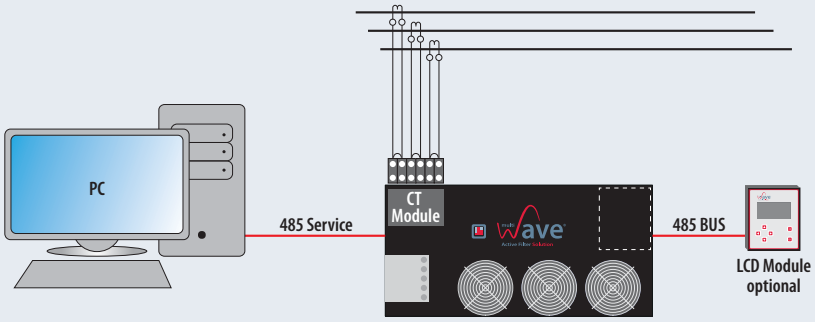
The intelligent modular system approach of the new multiwave active ensures that you always get the most efficient solution tailored to your requirements

multiwave active offers an intelligent solution for many applications

- Plastics processing
- Air conditioning technology
- Office buildings
- Hospitals
- Light systems
- Elevators
- Data centers
- Public buildings
- Department stores
- Pharmacies

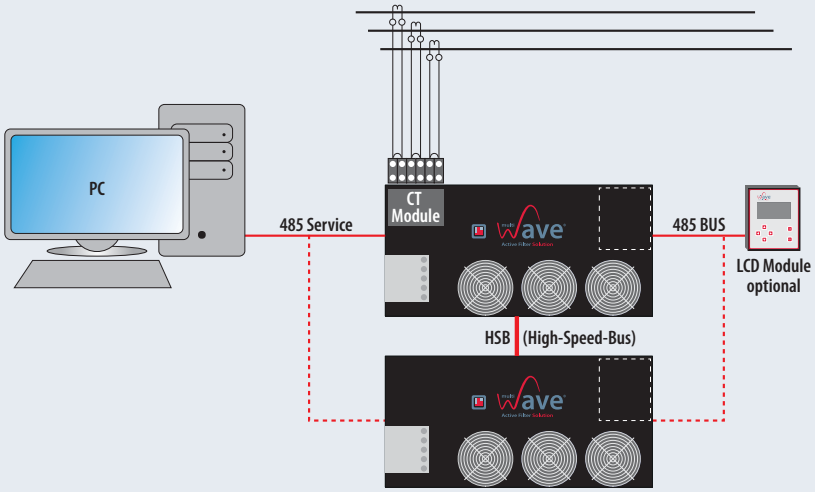


- Wall mounting
- Expandable with a second module
- Book or flat mounting possible



multiwave active – 60 A wall mounting module

- 1 multiwave active power module
- 1 LCD module
- Book or flat mounting possible



multiwave active – 120 A wall mounting module

- 2 multiwave active power modules
- 1 LCD module
- Book or flat mounting possible

Rack mounting

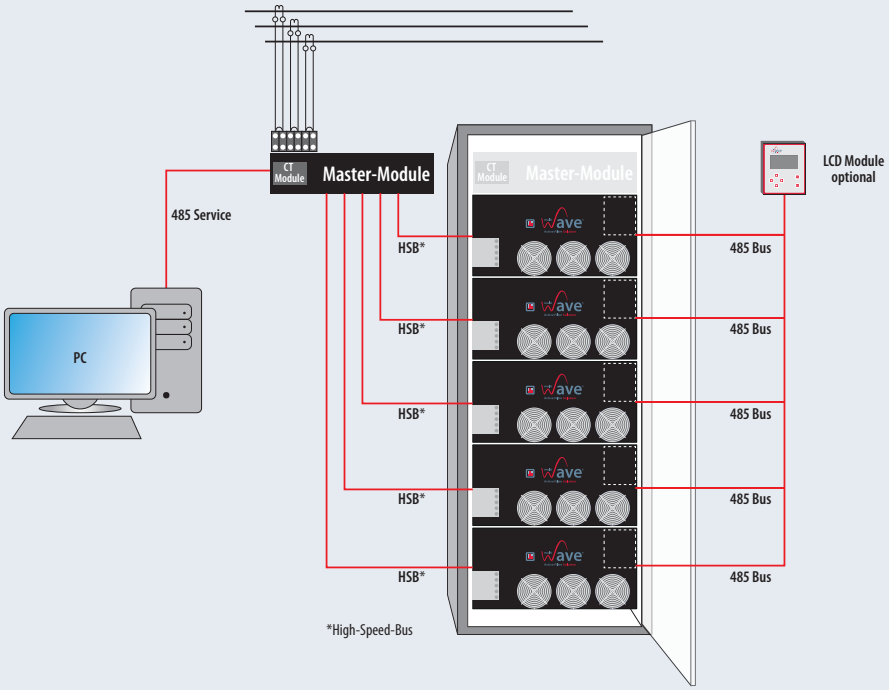
multiwave active – 60 A
- 1 multiwave active power module
- 1 LCD module

multiwave active – 120 A
- 2 multiwave active power modules
- 1 LCD module

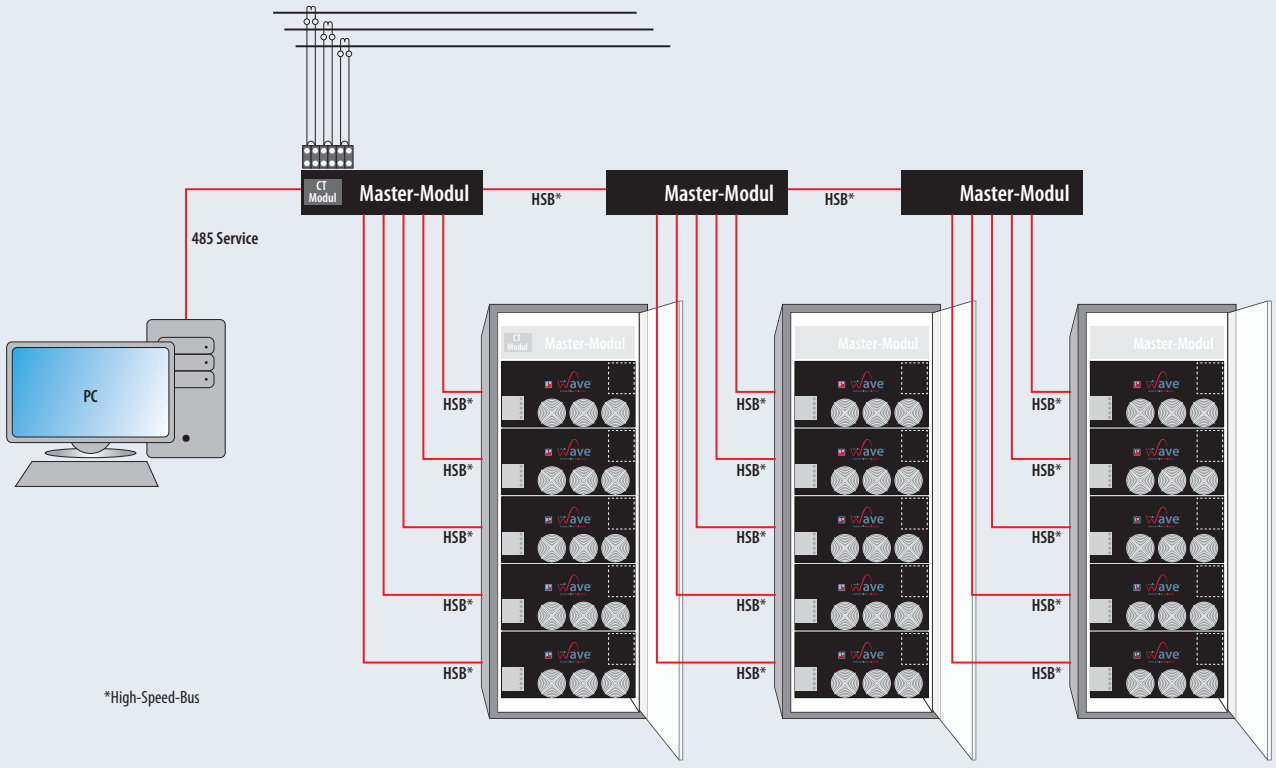
multiwave active – 180 A
- 3 multiwave active power modules
- 1 LCD module
- 1 master module (optional)

multiwave active – 240 A
- 4 multiwave active power modules
- 1 LCD module
- 1 master module (optional)

multiwave active – 300 A
- 5 multiwave active power modules
- 1 LCD module
- 1 master module (optional)



Configuration: > 5 modules



- Up to 4 master modules can be cascaded

Technical specifications

Number of phases (system input)	3-phase 3-wire / 3-phase 4-wire (all-in-one)				
Mains frequency	50/60Hz ± 3 Hz				
Mains voltage	3-wire: 380 VAC ± 15% – 480 VAC ± 10% 4-wire: 380 VAC ± 15% – 415 VAC ± 10%				
Inverter topology	3-level NPC topology, IGBT				
Switching frequency	16 kHz				
Response time	300 µs				
Harmonic mitigation performance	Up to the 50th harmonic				
Total harmonic distortion current THD-I	< 5%				
Power factor correction	cosφ = -0.7 … 1 … 0.7 (inductive and capacitive compensation)				
Dimensions of a single unit	440 mm × 420 mm × 220 mm (w × d × h)				
Dimensions with cabinet	600 mm × 805 mm × 2095 mm (w × d × h)				
Rated phase mitigation current	60 A	120 A	180 A	240 A	300 A
Rated neutral conductor mitigation current	180 A	360 A	540 A	720 A	960 A
Overload capability (Amp for 10 ms)	150 A	300 A	450 A	600 A	750 A
Current transformer placement	Mains side or load side				
Current transformer ratio	xx:5A or xx:1A				
Mounting	Wall-mounting (book or flat mounting)				
Weight of a single unit	49 kg				
Cooling type	Air cooling				
Communication interface	Ethernet TCP/IP, Modbus RTU RS485				
Digital I/O	3 DI				
Ambient temperature	0 … 50 °C at full power, up to 55 °C with derating				
Protection class	IP 20 / IP 21 on module level IP 23 / IP 54 on cabinet level				
Noise level	< 56 to 63 dB A (depending on load situation)				
Self-protection	Yes				
Overheat protection	Yes				
Overvoltage and undervoltage protection	Yes				
Earthing system	T T, TN-C, TN-S, TN-C-S, IT, corner mounting				
Altitude	<1000m without derating; up to 4000 m with derating				
Ambient conditions	- Pollution degree 2 - Relative humidity < 95 % non-condensing, 3K3 - Temperature: Storage at 55 °C, 1K3, 1K4, Transport at –25 °C to 75 °C, 2K3				
Approval	CE, RoHS, UL (pending)				
Design standards	IEC 61000-4-2, 4-4, 4-5, 4- 6 EN 61000-3-11, 3-12 EN 61000- 6-2 EN 55011 EN 62477-1 EN 61800-3				

Energy Measuring Devices

The multimess energy devices capture all important electrical parameters and provide a comprehensive overview of the energy flows. A convenient user guidance makes operation simple.With the web-based visual energy analysis software, you can conveniently monitor, analyze and optimize the instantaneous and long-term values of the bus-capable multimess devices.

Measuring devices

multimess D4-BS

Housing dimensions 4HP (H x W x D in mm)	90 x 72 x 61
Data display	LCD display *
Interface	KBR module bus

* optional F96-DS display

Storage center and expansion modules

Highlights

- → One measuring device – many applications
- → Competitively priced black box measuring point for energy data management
- → No cables to the switchgear cabinet door
- → Up to 10 distribution measurements on one display

A detailed overview of the **technical details** is provided on page 80.

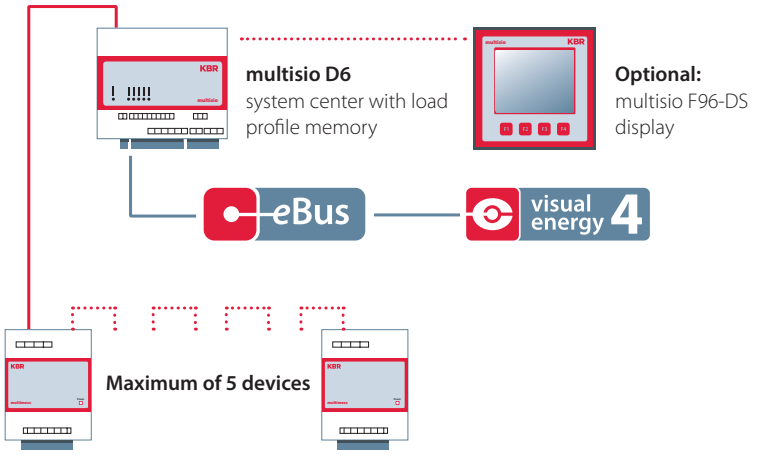
multimess D4 is a multimeter for DIN rail mounting. As a competitively priced output-side measuring device, it can measure all typical alternating and direct current parameters of consumers. You can connect the **optional multimess F96-DS** display with a ready-made RJ12 cable. This way, no complicated wiring of the voltage path and, most importantly, current path from the transformer to the door is necessary. Up to 10 measuring modules can be read out and displayed. Connection between the modules is also established via ready-made RJ12 cables. The measuring device is powered by the measuring voltage. A separate control voltage is not necessary. If the **multimess D4** is connected to the **multisio D6** instead of to the display, the former serves as a load profile memory (P+ -/ Q+ Q-) and an eBus interface. Five measuring modules can be connected to each central storage module.

Combination possibilities

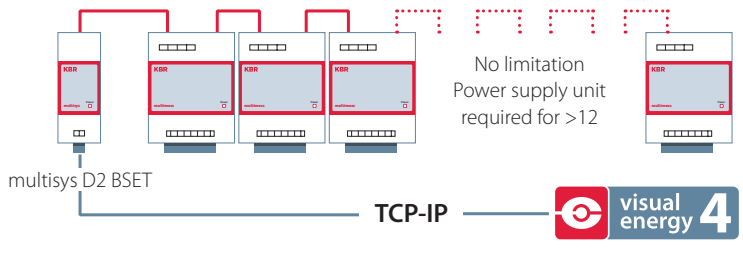
DEVICE TYPES	**multimess** D4-BS with **multimess** F96-DS [1]	**multimess** D4-BS with **multisys** D2-BSES	**multimess** D4-BS with **multisio** D6 and **multisio** F96-DS
LCD display 96 x 96	■	–	■
Number of measuring modules	10 per display	No limitation Power supply unit required from the 12th, 24th, 36th, ...th measuring module. Up to 12 measuring modules can be operated per power supply unit or gateway.	5 per multisio D6
eBUS | eBUS TCP	– | –	■ | ■ [2]	■ | ■ [3]
Instantaneous value display Display | eBUS	■ | –	– | ■	■ | ■
Load profile memory Display | eBUS	– | –	– | –	– | ■
Continuous counter Display | eBUS	■ | –	– | ■ [4]	■ | ■

■ Standard – Not available

[1] To operate the display, you will need an additional power supply unit, e.g. the multisys D2-BSES. [2] For use of the multisys D2-BSET gateway instead of D2-BSES. [3] Additional gateway multisys D2-ESET required. [4] In connection with visual energy 4, daily consumption is automatically recorded. 15-min period values are substitute values (daily consumption/96)



Black box measuring points in energy data management



Up to 10 measuring modules per display

multimess D6

Housing dimensions 6HP (H x W x D in mm)	90 x 108 x 61
Data display	LCD display
Interface	KBR eBus Modbus

* optional F96-DS display

Three-phase network measuring device

Highlights

- → Deployable in 3-wire or 4-wire networks
- → Measurement of many electrical parameters
- → Current transformer connection can be freely configured
- → Pulse output with freely programmable pulse value
- → 4-quadrant load profile memory with a storage duration of up to 160 days
- → Internal and external tariff switching

A detailed overview of the **technical details** is provided on page 80.

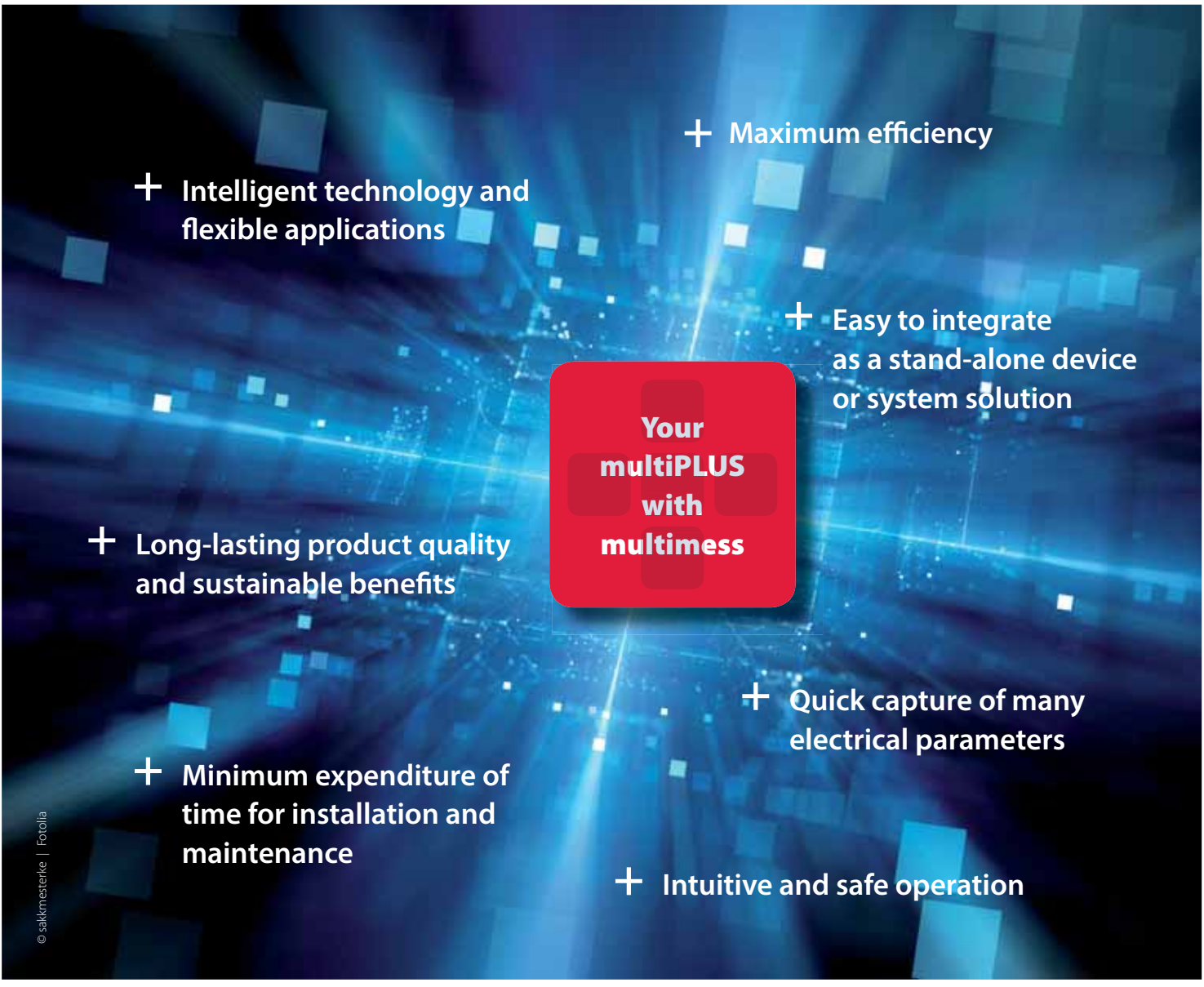
The multimess D6 DIN rail measuring device **is ideal for reliable** use in 3-wire and 4-wire networks. The device is equipped with a bus connection and an internal, non-volatile data memory, in which long-term data is stored. The active and reactive energy is stored separately for energy consumption and recovery (4-quadrant measurement). In addition to the internal and external tariff control for two tariffs, as well as various synchronization possibilities, the device features a pulse output with programmable pulse value. To display measured values, the device has a 6-digit LCD display as well as 6 status LEDs. The KBR eBUS lets you retrieve the energy consumption data of the energy memory along with advanced measurement functions.

This measuring device was designed in accordance with the standards DIN EN 61036 (IEC 1036), DIN EN 61268 (IEC 1268) and requirement specification revision version 2.0 from 12/97 by the German Electricity Association (VDEW).

Active or reactive energy proportional pulses can be output via a programmable output implemented as S0 interface. The pulse output type (proportional to active or reactive energy for consumption or recovery) as well as the pulse value (number of pulses per kWh or per kvarh) and the pulse length can be configured.

Memory functions:

- 4-quadrant load profile memory to record the cumulated active and reactive power (consumption and recovery)
- Memory to record the daily energy values for 365 days
- Memory for the previous month's maximum measurement period
- Event memory (4096 entries), for logging actions of the meter such as mains failures, tariff switches, delete functions, etc.



multimess D9-PQ

Housing dimensions 9HP (H x W x D in mm)	90 x 162 x 58
Data display	1.7 inch LCD color display
Interface	Modbus Modbus TCP

Power quality network analyzer for low and medium voltage networks

Highlights

- → Class A measuring device
- → Automatic reporting according to EN 50160
- → Free-of-charge analysis software included
- → 4 voltage and current measurement inputs each
- → Oscilloscope and 10 ms report on trigger thresholds
- → Large internal 1 GB memory, expandable to up to 32 GB

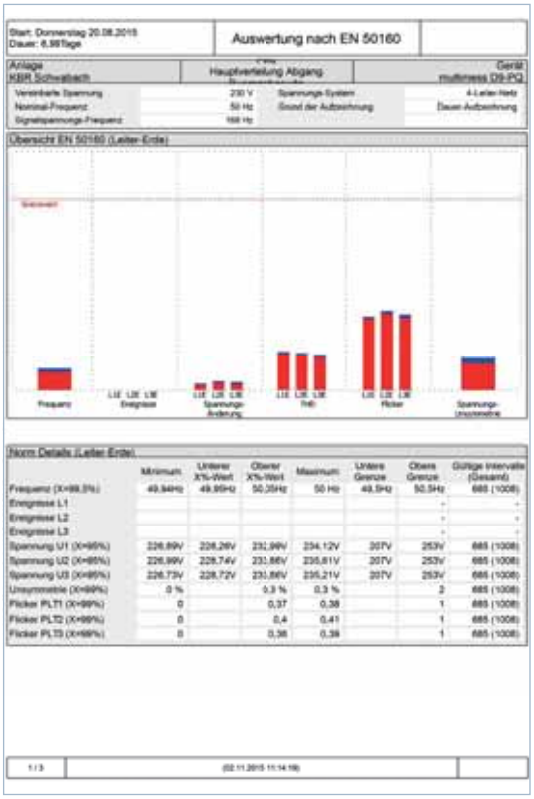
A detailed overview of the **technical details** is provided on page 80.

The **multimess D9-PQ** helps you to analyze the causes of malfunctions in electrical systems and machines. By permanently monitoring and controlling network quality, you can detect possible malfunctions early on.
The innovative **multimess D9-PQ** power quality analyzer and fault recorder for low and medium voltage networks is suitable for any measurement task required in electrical networks. You can use it as a power quality interface in accordance with network quality standard EN 50160 and as a measuring device for all physically defined measured values in alternating current networks. Additionally, it provides all consumption values required for energy data management.
In addition to the standard evaluations, the **multimess D9-PQ** also features a high speed fault recording rate of 40.96 kHz / 10.24 kHz, as well as a 10 ms RMS value recorder.

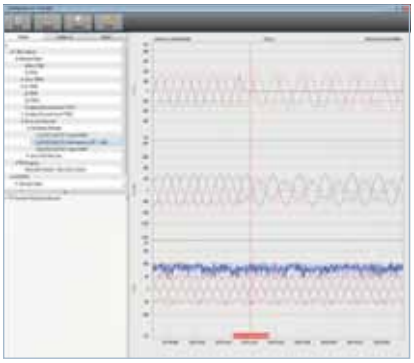
This makes a detailed evaluation of network interferences possible.
This component is especially suitable to monitor individual supply qualities or quality agreements between the energy provider and customer, to register them and make them available for evaluation or storage. Modern voltage quality measuring devices operate according to the IEC 61000-4-30 (2008) standard. This standard defines measurement methods to create a comparable basis for the user. Devices of different manufacturers operating according to this standard necessarily have to obtain the same measuring results.

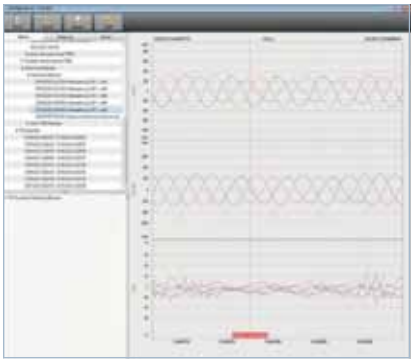
Technical Data:

- 1.7 inch color display
- Class A measured data processing
- EC 61000-4-30
- Recording of power quality events according to DIN EN 50160; IEC61000-2-2; -2-12;-2-4
- Automatic EN 50160 network quality report
- 1 GB internal memory
- Input channel bandwidth 20 kHz
- 4 voltage inputs, measuring range end value: 480 V L-N, accuracy < 0.1%
- 4 current inputs
- Simultaneous processing of scanned and calculated voltages and currents
- Voltage and current oscillograph scanning frequency: 40.96 kHz / 10.24 kHz
- Half-cycle recorder: network frequency, RMS voltage and current, voltage and current pointer, power recording rate: 10 ms (50 Hz) / 8.33 ms (60 Hz)
- Powerful triggering



When used as a power quality interface, the **multimess D9-PQ** provides comprehensive evaluations in accordance with the network quality standard DIN EN 50160





multimess D4, D6 and D9-PQ Technical details

MEASURING PARAMETERS	**Voltage**	U Ph–N (L1 – L3) | U Ph-Ph
	Current	I Ph (L1 – L3)
	Average current value	I Ph (L1 – L3)
	Neutral conductor current	IN | IN average
	Apparent power	S Ph (L1 – L3) | S total
	Active power	P Ph (L1 – L3) | P total
	Q1 = fundamental reactive power	Q 1 (L1 – L3) | Q 1 total
	Q = fundamental and harmonic reactive power	Q (L1 – L3) | Q 1 total
	Frequency	f network L1
	Harmonics	THD (L1 – L3) voltage
		THD (L1 – L3) current
		3rd - 19th harmonic (L1 – L3) voltage
		3rd - 50th harmonic (L1 – L3) voltage
		3rd - 19th harmonic (L1 – L3) current
		3rd - 50th harmonic (L1 – L3) current
	Rotary field control: Rotary field display in deg.	
	Power factors	Fundamental component cosφ (L1 – L3)
		Total power factor λ (L1 – L3) | λ total
	Electrical energy	Continuous counter for active energy P+ | P-
		Continuous counter for reactive energy Q+ | Q-
	HT / LT	
MEMORY	**Load profile memory P total / Q total**	P+ | Q+ (cumulated)
		P- | Q- (cumulated)
	Duration of load profile storage	(for 15-minute measurement period)
	Daily, active and reactive energy	
	Maximum indicator function (min/max)	
	Event memory	
PQ ANALYSIS	**Oscilloscope recorder**	With trigger function
	RMS recorder	With trigger function
	Event recorder	
	Permanent recorder	Recording of 3000 parameters
	Software	Analysis tool with automatic reporting acc. to EN 50160

[1] Only available via interface [2] In multisio D6 ■ Standard □ Optional – Not available



multimess D4 BS *	multimess D6 1-LCD-ESMS-2DI1DO-US1	multimess D9-PQ 3-LCD-MSMT-US8 (-US9)
■ | ■	■ | ■	■ | ■
■	■	■
■	■	■
■ [1] | –	–	■ | ■
■ | ■	■ [1] | –	■ | ■
■ | ■	■ [1] | –	■ | ■
■ | ■	■ [1] | –	■
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■	–	■
–	■	■
■ [1] | ■ [1]	■ | ■	–
■ [1] | ■ [1]	■ | ■	–
–	■	–
■ [2] | ■ [2]	■ | ■	■ | ■
■ [2] | ■ [2]	■ | ■	■ | ■
Ring buffer for 40 days [2]	Ring buffer for 40 days	Memory for at least one year
–	Annual energy memory, daily values for active and reactive energy	Daily values for active and reactive energy
–	–	For all displayed measured values with date and time
–	4096 events to log tariff switching commands, error messages, etc. with date and time	Event recorder
–	–	■
–	–	■
–	–	■
–	–	■
–	–	■

* **Caution:** The measured values are only displayed on the multisio D6 or an external display.

Status: June 2017. Subject to change.

multimess F96 LCD

Housing dimensions (H x W x D in mm)	96 x 96 x 55
Data display	LCD
Interface	KBR eBUS * Modbus * Profibus * KBR eBUS TCP * Modbus TCP *

* depending on the respective device type.

Three-phase network measuring device

Highlights

- → Compact design, standard installation size 96 x 96 mm
- → Optional upgradeable interfaces for any possible application
- → Easy and intuitive operation
- → Comfortable LCD display with graphical representation, e.g. a bar chart of network harmonics
- → Graphical diagnosis of voltage and current levels after a defined EN-61000 event

A detailed overview of the **technical details** is provided on page 84.

The electronic network measuring devices of the **multimess F96** series measure and monitor all important parameters in a three-phase network and are available in different versions. All device versions are equipped with a pulse output. Aside from the F96-0 entry level model, the load profile (P+ P- / Q+ Q-) can be saved with all device versions and later read out via eBus. Network voltage can be monitored in accordance with EN 61000-T4-30. In case of a violation, the voltage and current history is saved and can be analyzed on the LCD display, for example. Different optional interfaces and protocols allow various applications.

Input and output configuration

DEVICE TYPES	multimess F96	multimess F96 TCP	multimess F96 Profibus
	[1] F96-0-LCD-US1 /-US6 [2] F96-0-LCD-ESMS-US1 /-US6 [3] F96-1-LCD-MS-2RO-US1 /-US6 [4] F96-1-LCD-ESMS-2RO-US1 /-US6	[1] F96-1-LCD-ET-2RO-US1/-US6 [2] F96-1-LCD-MT-2RO-US1 /-US6	[1] F96-1-LCD-DP-US1/-US6
DIGITAL INPUTS	–	–	–
PULSE OUTPUT	1 (P+/ Q+)	1 (P+/ Q+)	1 (P+/ Q+)
RELAY OUTPUTS	[1] – [2] – [3] 2 [4] 2	2	–
INTERFACE	[1] – [2] RS485 [3] RS485 [4] RS485	[1] Ethernet TCP/IP [2] Modbus TCP	RS485
KBR eBUS	[1] – [2] ■ [3] – [4] ■	–	–
KBR eBUS TCP	–	[1] ■ [2] –	–
MODBUS RTU/ACSII	[1] – [2] ■ [3] ■ [4] ■	–	–
MODBUS TCP	–	[1] – [2] ■	–
PROFIBUS DP	–	–	■
POWER SUPPLY 85–265 V AC/DC; 15 VA	■	■	■
POWER SUPPLY 20-100 V AC/DC; 15 VA	□	□	□
MEMORY/BATTERY	[1] – [2] – [3] ■ [4] ■	[1] ■ [2] ■	–

■ Standard □ Optional – Not available

Well-arranged bar graph to display harmonics

Graphical display of I and U in case of a voltage dip acc. to EN 61000-T4-30

multimess F96 Technical details

MEASURING PARAMETERS	**Voltage**	U Ph–N (L1 – L3) | U Ph-Ph
	Current	I Ph (L1 – L3)
	Average current value	I Ph (L1 – L3)
	Neutral conductor current	IN | IN average
	Apparent power	S Ph (L1 – L3) | S total
	Active power	P Ph (L1 – L3) | P total
	Q1 = fundamental reactive power	Q 1 (L1 – L3) | Q 1 total
	Q = fundamental and harmonic reactive power	Q (L1 – L3) | Q total
	Frequency	f network L1
	Harmonics	THD (L1 – L3) voltage
		THD (L1 – L3) current
		3rd - 19th harmonic (L1 – L3) voltage
		3rd - 50th harmonic (L1 – L3) voltage
		3rd - 19th harmonic (L1 – L3) current
		3rd - 50th harmonic (L1 – L3) current
	Rotary field control: Rotary field display in deg.	
	Power factors	Fundamental component cosφ (L1 – L3)
		Total power factor λ (L1 – L3) | λ total
	Electrical energy	Continuous counter for active energy P+ | P-
		Continuous counter for reactive energy Q+ | Q-
	HT | LT	HT | LT
MEMORY	**Load profile memory P total / Q total**	P+ | Q+ (cumulated)
		P- | Q- (cumulated)
	Duration of load profile storage	(for 15-minute measurement period)
	Daily, active and reactive energy	
	Maximum indicator function (min/max)	
	Event memory	
PQ ANALYSIS	**Oscilloscope recorder**	With trigger function
	RMS recorder	With trigger function
	Event recorder	
	Permanent recorder	Recording of 3000 parameters
	Software	Analysis tool with automatic reporting acc. to EN 50160

[1] Without storage and timestamp [2] Switching via eBus [3] Cannot be read via Modbus and Profibus ■ Standard – Not available

multimess F96 0-LCD-US1/-US6 0-LCD-ESMS-US1/-US6	multimess F96 1-LCD-ET-2RO-US1/-US6 1-LCD-ESMS-2RO-US1/-US6 1-LCD-MT-2RO-US1/-US6 1-LCD-DP-US1/-US6 1-LCD-MS-2RO-US1/-US6
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■ | ■	■ | ■
■ | ■	■ | ■
■ | ■ [2]	■ | ■
– | –	■ | ■ [3]
– | –	■ | ■ [3]
–	Ring buffer for 40 days
–	Annual energy memory, daily values for active and reactive energy
■ [1]	■
–	4096 events to log tariff switching commands, error messages, etc. with date and time [3]
–	–
–	–
–	–
–	–
–	–

Status: June 2017. Subject to change.

multimess F144 LED

Housing dimensions (H x W x D in mm)	144 x 144 x 60
Data display	LED
Interface	KBR eBUS Modbus Profibus * KBR eBUS TCP * Modbus TCP *

* depending on the respective device type.

Three-phase network measuring device

Highlights

- → Several performance classes for all fields of application
- → Extensive displays, functions and storage possibilities
- → Optimum readability thanks to bright LED displays
- → Wide range of inputs and outputs (digital/analog)
- → Narrow mounting depth of only 60 mm

A detailed overview of the **technical details** is provided on page 88.

The electronic network measuring devices of the **multimess F144 LED** series measure and monitor all important parameters in the three-phase network and are available in a wide range of performance classes.

The load profile of the system measured for a 15-minute measurement period can be saved for up to 365 days, depending on the model. The integrated event memory can log up to 4096 events, such as limit violations, power failures, voltage dips, etc.

Input and output configuration

DEVICE TYPES	multimess F144 LED F144-1-LED-ESMS-US1/-US5 F144-1-LED-ESMSET-US1/-US5 F144-1-LED-ESMSMT-US1/-US5 F144-1-LED-ESMSDP-US1/-US5	multimess F144 LED F144-2-LED-ESMS-US1/-US5 F144-2-LED-ESMSET-US1/-US5 F144-2-LED-ESMSMT-US1/-US5 F144-2-LED-ESMSDP-US1/-US5
DIGITAL INPUTS	1 synchronization, 1 HT/LT tariff	2 configurable
PULSE OUTPUT	1 (P+/ Q+)	1 (P+/ P-/Q+/ Q-)
RELAY OUTPUTS	2 [1]	2 [2]
ANALOG OUTPUTS	–	3
INTERFACE	RS485	RS485
KBR eBUS	■ | ■	■ | ■
KBR eBUS TCP	□	□
MODBUS RTU/ACSII	■	■
MODBUS TCP	□	□
PROFIBUS DP	□	□
POWER SUPPLY 85–265 V AC/DC; 15 VA	■	■
POWER SUPPLY 20-100 V AC/DC; 15 VA	□	□

[1] Limit function [2] Additional switch relay function via bus ■ Standard □ Optional – Not available

multimess F144 Technical details

MEASURING PARAMETERS	**Voltage**	U Ph–N (L1 – L3) | U Ph-Ph
	Current	I Ph (L1 – L3)
	Average current value	I Ph (L1 – L3)
	Neutral conductor current	IN | IN average
	Apparent power	S Ph (L1 – L3) | S total
	Active power	P Ph (L1 – L3) | P total
	Q1 = fundamental reactive power	Q 1 (L1 – L3) | Q 1 total
	Q = fundamental and harmonic reactive power	Q (L1 – L3) | Q 1 total
	Frequency	f network L1
	Harmonics	THD (L1 – L3) voltage
		THD (L1 – L3) current
		3rd - 19th harmonic (L1 – L3) voltage
		3rd - 50th harmonic (L1 – L3) voltage
		3rd - 19th harmonic (L1 – L3) current
		3rd - 50th harmonic (L1 – L3) current
	Rotary field control: Rotary field display in deg.	
	Power factors	Fundamental component cosφ (L1 – L3)
		Total power factor λ (L1 – L3) | λ total
	Electrical energy	Continuous counter for active energy P+ | P-
		Continuous counter for reactive energy Q+ | Q-
	HT / LT	
MEMORY	**Load profile memory P total / Q total**	P+ | Q+ (cumulated)
		P- | Q- (cumulated)
	Duration of load profile storage	(for 15-minute measurement period)
	Daily, active and reactive energy	
	Maximum indicator function (min/max)	
	Event memory	
PQ ANALYSIS	**Oscilloscope recorder**	With trigger function
	RMS recorder	With trigger function
	Event recorder	
	Permanent recorder	Recording of 3000 parameters
	Software	Analysis tool with automatic reporting acc. to EN 50160

[1] Only available via interface [2] In multisio D6 ■ Standard □ Optional – Not available

multimess F144 1-LED-ESMS-US1/-US5 1-LED-ESMSMT-US1/-US5 1-LED-ESMSET-US1/-US5 1-LED-ESMSDP-US1/-US5	multimess F144 2-LED-ESMS-US1/-US5 2-LED-ESMSMT-US1/-US5 2-LED-ESMSET-US1/-US5 2-LED-ESMSDP-US1/-US5
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Ring buffer for 40 days	Ring buffer for 365 days
Annual energy memory, daily values for active and reactive energy [1]	Annual energy memory, daily values for active and reactive energy
For all displayed measured values, active and reactive power periods with date and time	For all displayed measured values, active and reactive power periods with date and time
4096 events with date, time and duration, e.g. limit violations, power failures and overvoltage ≥ 20 ms at 100% measuring circuit voltage dip [1]	4096 events with date, time and duration, e.g. limit violations, power failures and overvoltage ≥ 20 ms at 100% measuring circuit voltage dip [1]
–	–
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Status: June 2017. All changes reserved.

multimess device matrix

		DIN rail installation		
		multimess D4 BS	multimess D6 1-LCD-ESMS-2DI1DO-US1	multimess D9-PQ 3-LCD-MSMT-US8 (-US9)
DISPLAY	LCD	–	■	■
	LED	–	–	–
	External display (optional)	□	–	–
POWER SUPPLY	by measuring voltage, 3.2 VA	■	–	–
	US1: 85 – 265 V AC/DC, 50/60 Hz, 15 VA	–	■	–
	US5: 20 – 70 V AC/DC, 50/60 Hz, 15 VA	–	–	–
	US6: 20 – 100 V AC/DC, 50/60 Hz, 15 VA	–	–	–
	US8: AC: 90 V … 264 V / DC: 100 V…300 V, 50/60 Hz, 20 VA	–	–	■
	US9: DC 18 V … 60 V … 72 V, 20 VA	–	–	■
MEASURING INPUTS	Voltage path 3 x 87 … 400 … 460 V AC	■	–	–
	Voltage path 3 x 30… 400 … 480 V AC	–	■	–
	Voltage path 3 x 20… 500 … 600 V AC	–	–	■
	Current path 3 x 0.02 … 5 … 6 A	■	■	–
	Current path 3 x 0.01 … 1 … 1.2 A	■	■	–
	Current path 4 x 0.02 … 5 … 6 A	–	–	■
INTERFACES	RS 485 eBus configuration interface	–	–	–
	RS 485 KBR module bus	■	–	–
	RS 485 Modbus	–	■	■
	RS 485 eBus	–	■	–
	Profibus DP	–	–	–
	TCP/IP Modbus	–	–	■
	TCP/IP eBus	–	–	–
MEASUREMENT ACCURACY	U,I: 0.5 % P,Q,S: 1 %	■	■	–
	U,I: 0.1 % P,Q,S: 0.2 %	–	–	■
	Class A, EN 50160, IEC 61000-4-30	–	–	■
OUTPUTS	2 relay outputs for notification of limit violations	–	–	–
	1 digital output, energy pulse, active or reactive energy	–	■	–
	2 x digital output, configurable	–	–	–
	3 x analog output 0 (4) – 20 mA, 0 (2) – 10 V	–	–	–
INPUTS	1 x digital input for HT/LT switching	–	■	–
	1 x digital input for energy supplier synchronization	–	–	–

■ Standard □ Optional – Not available

Switchboard installation 96 x 96 mm							Switchboard installation 144 x 144 mm								
multimess F96 0-LCD-US1 (-US6)	multimess F96 0-LCD-ESMS-US1 (-US6)	multimess F96 1-LCD-DP-US1 (-US6)	multimess F96 1-LCD-ESMS-2RO-US1 (-US6)	multimess F96 1-LCD-ET-2RO-US1 (-US6)	multimess F96 1-LCD-MS-2RO-US1 (-US6)	multimess F96 1-LCD-MT-2RO-US1 (-US6)	multimess F144 0-LED-EP-US1 (-US5)	multimess F144 1-LED-ESMSDP-US1 (-US5)	multimess F144 1-LED-ESMSET-US1 (-US5)	multimess F144 1-LED-ESMSMT-US1 (-US5)	multimess F144 1-LED-ESMS-US1 (-US5)	multimess F144 2-LED-ESMSDP-US1 (-US5)	multimess F144 2-LED-ESMSET-US1 (-US5)	multimess F144 2-LED-ESMSMT-US1 (-US5)	multimess F144 2-LED-ESMS-US1 (-US5)
■	■	■	■	■	■	■	–	–	–	–	–	–	–	–	–
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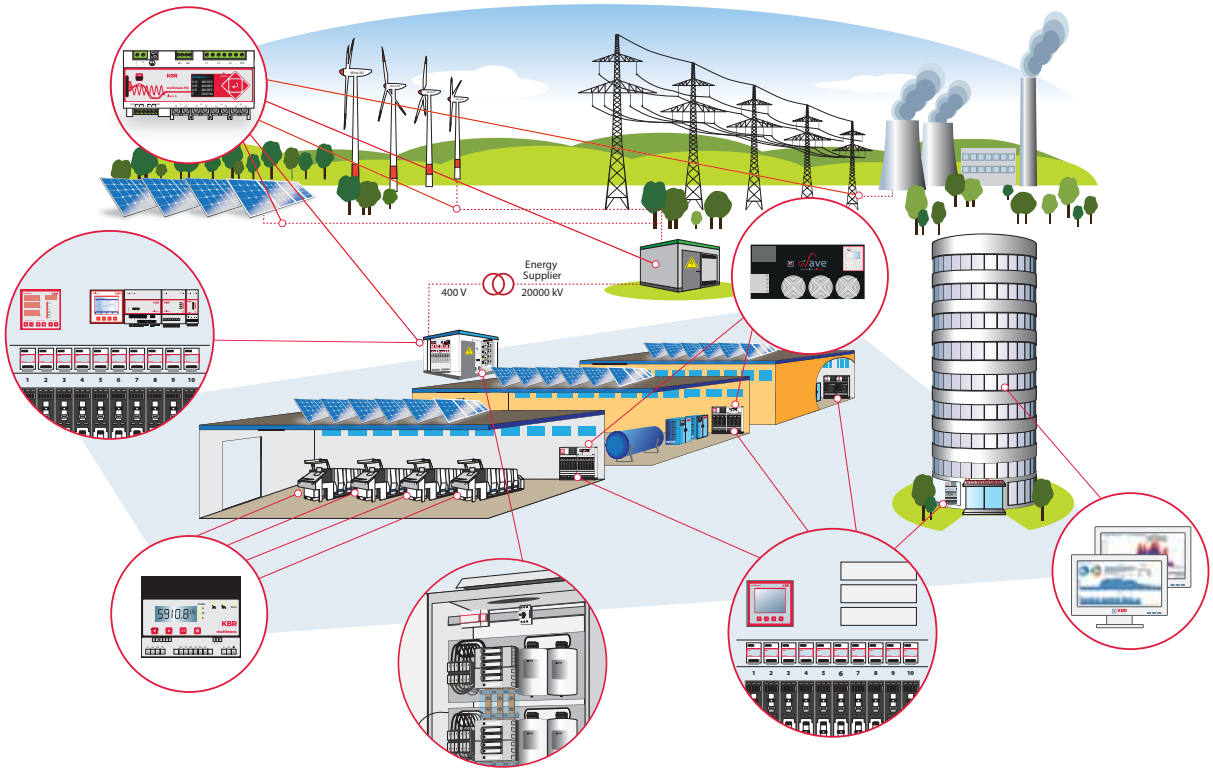
Status: June 2017. Subject to change.

The KBR system

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

Energy efficiency solutions by KBR

Signal recording | **Energy measurement technology** | **Visualization** | **Power Quality**



www.kbr.de

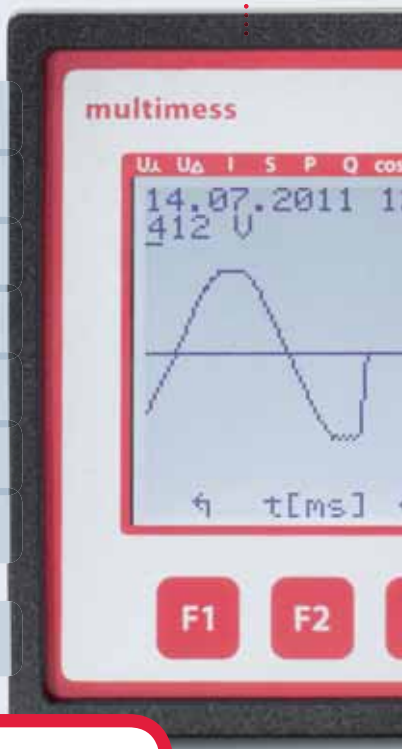
KBR Energy Management

THE MULTIMESS EXCELLENCE:

MEASURE, MEASURE, MEASURE AND MORE ...

Comprehensive range of applications
Be it as a stand-alone device or in a system – multimess is a superior multimeter available in several performance classes.

- V Voltage
- A Current
- T Active power
- Q Reactive power
- S Apparent power
- P(t) Supply power
- cosφ
- λ tot Consumption
- Harm. U Harmonics
- Load profiles
- Hz Frequency
- Limits
- Maximum values
- \+ … and many more parameters



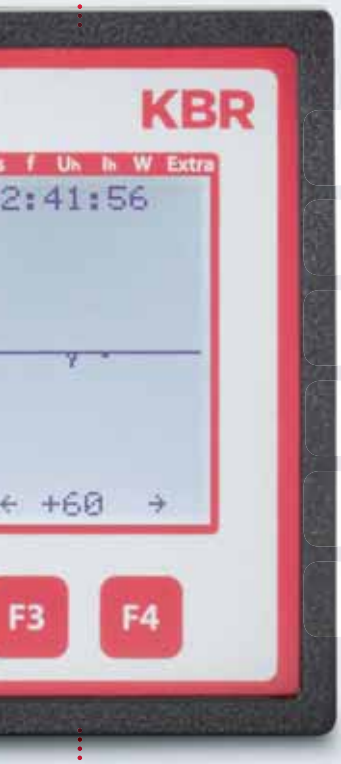
Future-proof technology
High precision and performance in "made in Germany" quality offer the best conditions for modern energy management.

With our energy measuring devices, efficient energy management is very easy. We will be happy to advise you personally.

Product consulting:
+49 (0) 9122 6373-0
info@kbr.de

Capturing and documenting energy data has never been easier.
Whether it be standard and consumption values, load profiles or network quality according to applicable standards: multimess energy measuring devices meet the most diverse requirements with the highest level of safety and precision.

Flexible interfaces
The bus compatibility and load profile memory create the basis for efficient energy monitoring and safe power networks.



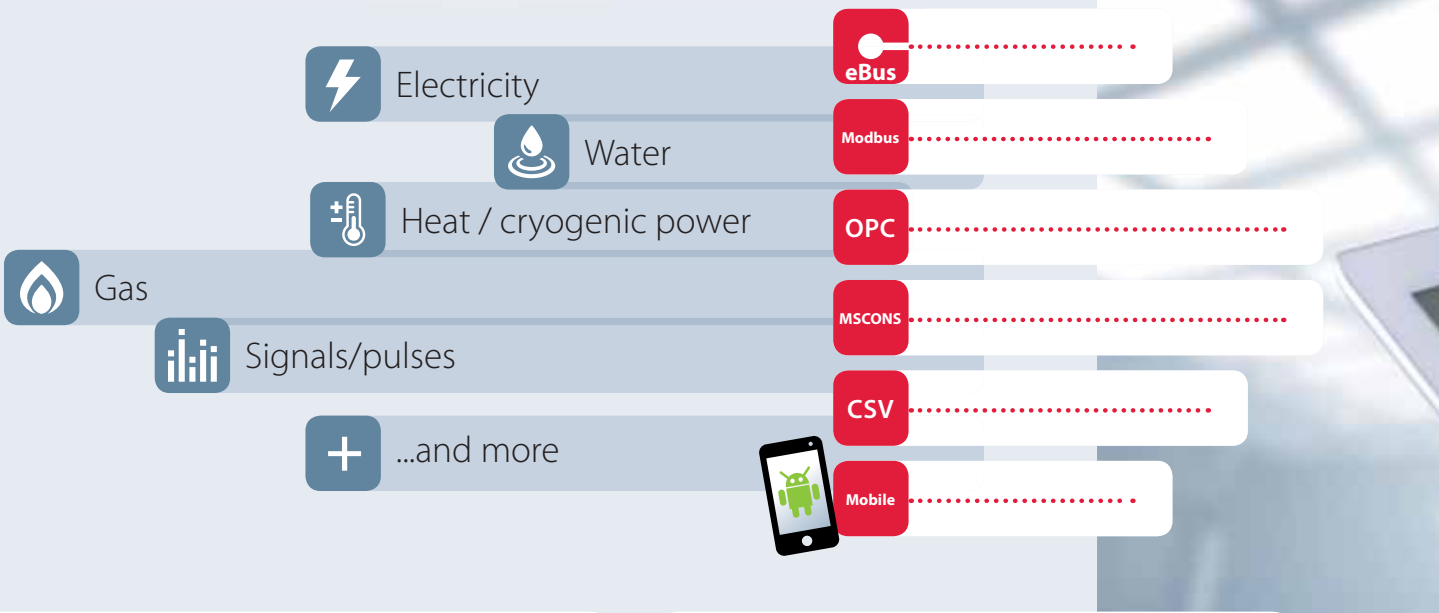
eBus
Ethernet eBus
TCP eBus
Modbus
Modbus TCP
Profibus DP

Comfortable monitoring
Easy monitoring, evaluation and control of all captured energy data with the web-based **visual energy analysis software**

Intuitive operation
Clear, functional user interface design and LED or LCD displays provide a good overview and easy operation.

VISUAL ENERGY:

EASY AND SAFE ENERGY DATA CONTROL.



Measurement and capture

- Current
- Gas
- Water
- Heat / cryogenic power
- Temperature
- Operating hours
- and much more

Transmission and import

- Automatic meter reading (current, water, gas, heat, etc.) with commercially available Modbus devices or via OPC
- Continuous capture of load profiles and long-term storage for comparative analyses
- Manual recording of meter data or mobile capture with Android smartphones
- Data import from the energy provider via MSCONS

For detailed information and technical specifications, please refer to our **visual energy brochure**.
You can **download it as a PDF online at www.kbr.de** or request the printed version.

visual energy – energy data management

With its impressive functionality, the web-based visual energy software allows for transparent and efficient energy management. You can easily capture, monitor, analyze and process the most diverse energy information from networks or systems. This helps you keep track of the network quality, supply structure and energy costs.

Analysis and optimization

- Comprehensive consumption, billing, measuring point and cost center management
- Graphical representation and automatic plausibility check of the supply structure
- Load profile evaluation
- Automatic monitoring of the network quality, consumption values, projected energy volumes and device parameters

Processing and export

- Data output in different formats: PDF, CSV or OPC
- Convenient data transfer via MSCONS
- Excel interface for individual tables

KBR online service
For up-to-date product information, downloads and more, visit our website:
www.kbr.de

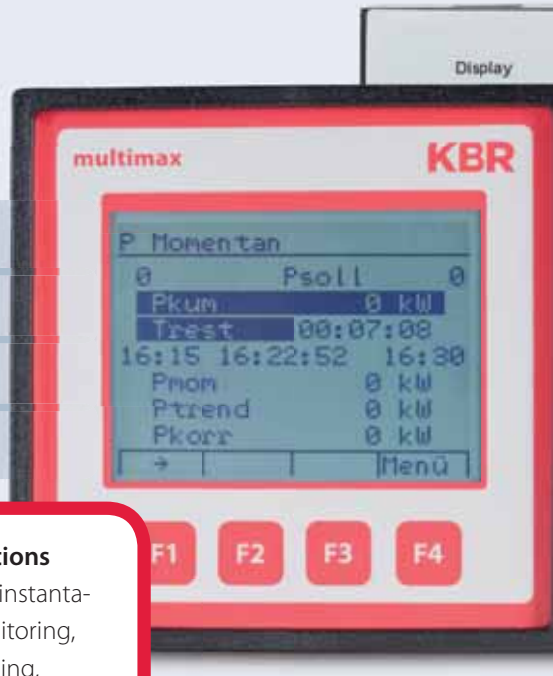
THE MULTIMAX FACTOR:

HIGHLY FLEXIBLE AND EXTREMELY EFFICIENT.

multisio relay modules

multimess measuring module

Modular system
With the **multimess** and **multisio modules,** you can expand the load management system to control up to 80 consumers.



multimax D6 base device
with multimax F96-DS display

Electricity

State detection

Gas

Electrical power

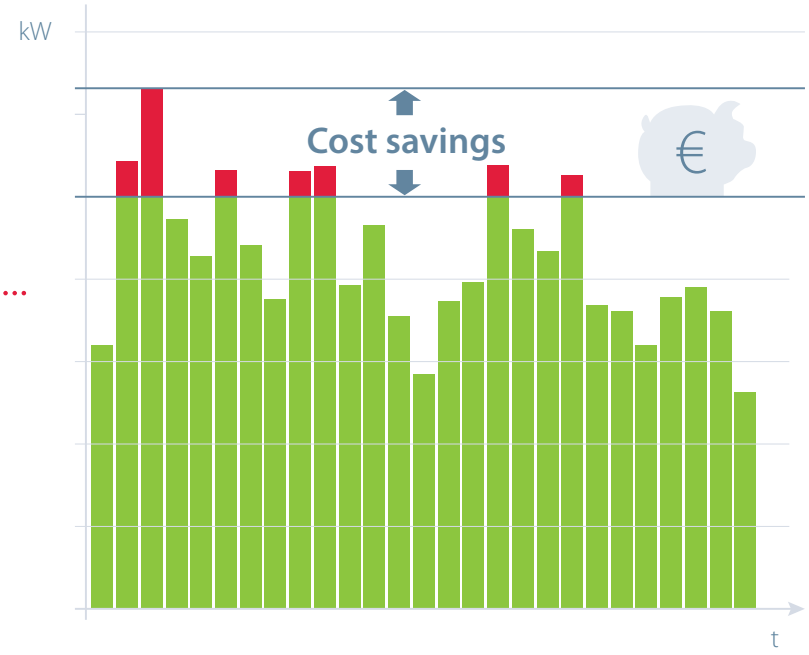
Intelligent functions
Target value and instantaneous value monitoring, target value tracking, prewarning contact (alarm), timer programs, emergency shut-down, etc.

Energy optimization is an important aspect of modern energy management.
We will be happy to advise you personally.

Product consulting:
+49 (0) 9122 6373-0
info@kbr.de

The key to successful energy optimization is the perfect coordination of reliable product technology and flexible load control.
With its modular system architecture and comprehensive functionality, the multimax energy optimization system is easy to expand and highly efficient for the most diverse applications.

Analog outputs
For consumers that are controlled continuously, the **multisio D2-2AO** module is the right choice. Inputs and outputs can be linked.



Use the enormous savings potential wisely with our energy flow and consumption optimization measures.

Meter inputs with pulse totalizer function
multimax D6 can capture the values of up to 5 meters. You can connect additional meters with the **multisio D2-4DI** module.

THE MULTISIO SPECIALTY:

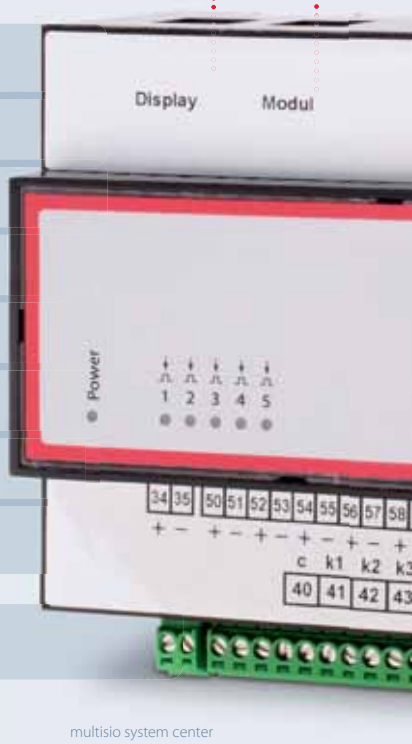
RECORD WHATEVER YOU CAN MEASURE.

multisio expansion module

Flexible expansion

With the **multisio expansion modules**, you can easily adapt the system's functionality to your company-specific requirements.

- Energy consumption
- State detection
- Analog values
- Current
- Heat, cryogenic power
- Operating hours
- Gas, water
- Compressed air
- And more ...



multisio system center

Unlimited measurement
You can easily record and process different states, media and energy types such as water, gas, current, heat or compressed air.

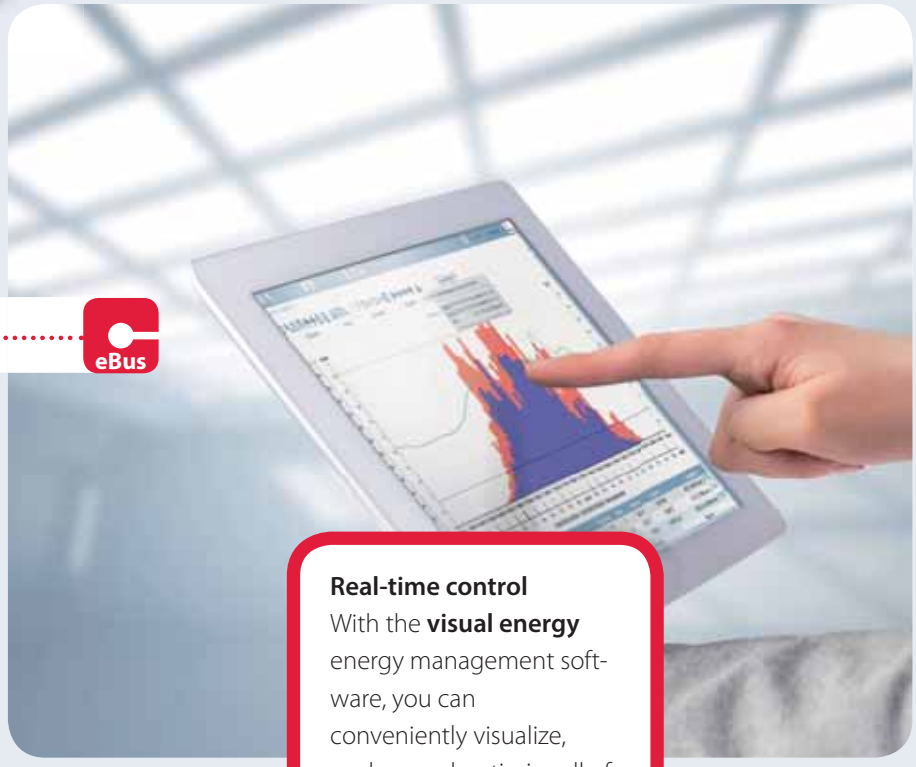
Any questions on multisio? From product consulting to startup – our technical advisors are always at your service.

Product consulting:
+49 (0) 9122 6373-0
info@kbr.de

The strength of multisio: recording, documenting and evaluating many different energy types, consumption values and states. With numerous functions and interfaces, the highly flexible system consisting of a storage center and expansion modules makes any measurement task easier.

multisio display

eBus



Real-time control
With the **visual energy** energy management software, you can conveniently visualize, analyze and optimize all of your measured data.

Decentralized system
The bus-compatible **multisio central unit** is the core of the multisio system. In a decentralized setting, you can connect up to five expansion modules to it.

Current transformers

There are current transformers for any application. Split core current transformers are especially well-suited for the subsequent setup of measurements in the context of an energy data management system.

Supercapacitors

Supercapacitors, also called ultracapacitors, are electrochemical capacitors. Compared to regular rechargeable batteries, supercapacitors can be charged and discharged much faster and endure significantly more switching cycles.
One area of application is for example the recovery of braking energy (recuperation) in vehicles (buses) and fairground rides (roller coasters).

Current transformers and Supercapacitors

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 or 5 A	5 A
Rated frequency	50 ... 60 Hz	50 ... 60 Hz	50 ... 60 Hz
Overcurrent class	F5	F5	F5
Operating voltage	up to 700 V | class 1 | $I_{th} = 60 \times I_N$	up to 720 V | class 1 | $I_{th} = 20 \times I_N$	up 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 opposite page		

The **multict-TA** bushing type current transformer is designed for assembly on busbars or circular conductors and records the current for reactive power controllers, energy control systems and measuring devices.
The **multict-SW** totalizing current transformer is used for summation of two or more main current transformers, for example with parallel feed-in with two or more transformers. It is attached to a mounting plate. The **multict-TP** split core current transformer is designed for subsequent assembly, without having to separate the busbars or circular conductors.

multict-TA specifications

BUSHING TYPE CURRENT TRANSFORMER

TYPE	multict-TA 30 Rail: 30 x 10 mm Cable: ø 28 mm		multict-TA 40 Rail: 40 x 10 mm Cable: ø 28 mm		multict-TA 60 Rail: 60 x 10 mm Cable: ø 45 mm	
RATED CURRENT in A	**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

multict-SW specifications

TOTALIZING CURRENT TRANSFORMER

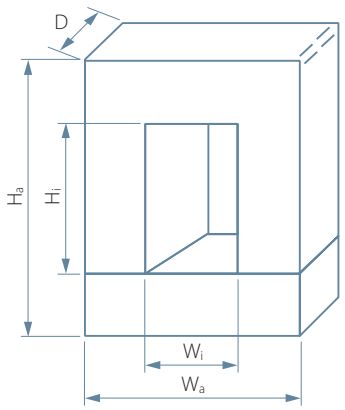
TYPE	POWER in VA	DIMENSIONS H x W x D in mm
multict-SW 2-1A	10	1 + 1 | 1 A
multict-SW 3-1A	10	1 + 1 + 1 | 1 A
multict-SW 2-5A	10	5 + 5 | 5 A
multict-SW 3-5A	10	5 + 5 + 5 | 5 A

Important note:
Please use main current transformers of the same type.If the transmission ratios of the main current transformers are unequal, a special construction is possible.

multict-TP specifications

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



multict-TQ30 Split core current transformer

The very compact multict-TQ30 split core current transformer by KBR is especially suited for digital measurement systems. The multict-TQ30 by default has 3-meter-long color-coded cables. The maximum load on the current transformer is 0.2 VA at the end of the cable.

The correct assembly of the current transformer is ensured by its design. It locks with a clearly audible clicking sound. Two UV-resistant cable ties that are easy to install and included in the delivery secure the transformer additionally.

Technical specifications

Ith:	60 x In/1s
Insulation class:	E (max 120°)
Protection type:	IP20
Ambient temperature:	–5…+40 °C
Location:	Indoor use
Relative humidity:	5%... 85%, non-condensing
Primary conductor:	max. Ø18 mm
Connection:	L=3 m cable 0.5 mm²

May only be extended after prior calculation!
Calculation tool available online: http://www.kbr.de/en/multict-current-transformer#calculation-tool

Comment:	Only for insulated primary conductors
Thermal rated continuous current (Icth):	100%
Rated frequency:	50/60 Hz
In accordance with:	IEC 61869-2

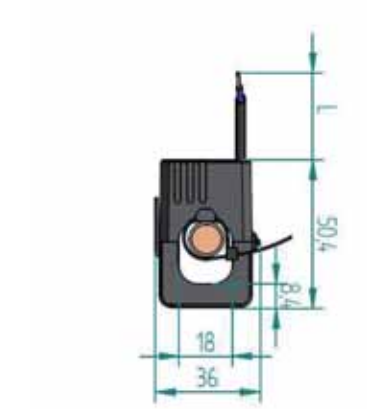
Order information

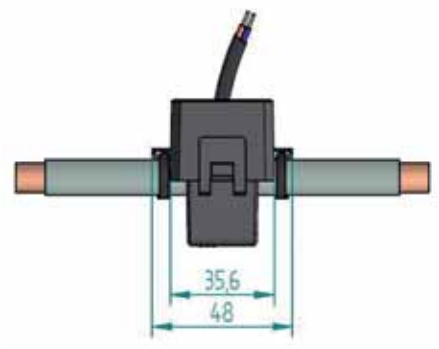
Current transformer	Class[1)]	Load	Item no.
60/1 A	3	0.2 VA	12312
75/1 A	3	0.2 VA	12313
100/1 A	3	0.2 VA	12314
250/1 A	1	0.2 VA	19785

1) Accuracy in accordance with IEC 61869-2, between 5-120% In

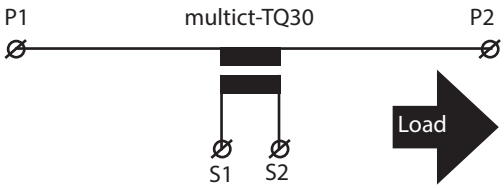
Additional types on request.

Dimensions





Connection diagram



multict-TQ40-B and -TQ40-C Split core current transformers

The compact multict-TQ40 split core transformer by KBR is especially suited for digital measurement systems. The transformer by default has color-coded cables. With accuracy class 1, this transformer is suitable for exact kWh measurements. The maximum load on the current transformer is 0.2 VA at the end of the cable.

The correct assembly of the current transformer is ensured by its design. It locks with a clearly audible clicking sound. Two UV-resistant cable ties that are easy to install and included in the delivery secure the transformer additionally.

Technical specifications

multict-	TQ40-B	TQ40-C
Ith:	60 x In/1s	
Insulation class:	E (max 120°)	
Protection type:	IP20	
Ambient temperature:	-10…+55 °C	
Location:	Indoor use	
Relative humidity:	5%... 85%, non-condensing	
Primary conductor:	max. Ø18 mm	max. Ø28 mm
Connection:	1A: L=3 m cable 0.5 mm²	
	5A: L=0.5m cable 1.5 mm²	

May only be extended after prior calculation!
Calculation tool available online: http://www.kbr.de/en/multict-current-transformer#calculation-tool

Comment:	Only for insulated primary conductors
Thermal rated continuous current (Icth):	100%
Rated frequency:	50/60 Hz
In accordance with:	IEC 61869-2

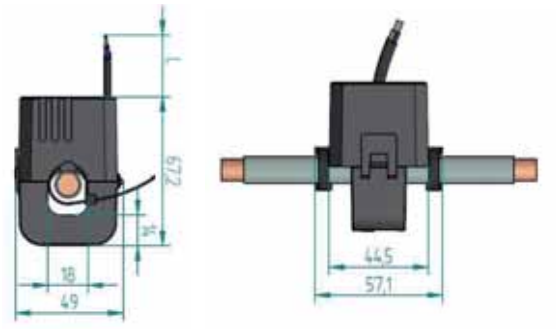
Order information

Type	Current transformer	Class[1)]	Load	Item no.
multict-TQ40-B	100/1 A	1	0.2 VA	12318
	150/1 A	1	0.2 VA	12320
multict-TQ40-C	200/1 A	1	0.2 VA	12326
	250/1 A	1	0.2 VA	12327
	300/1 A	1	0.2 VA	12328
	400/1 A	1	0.2 VA	12329

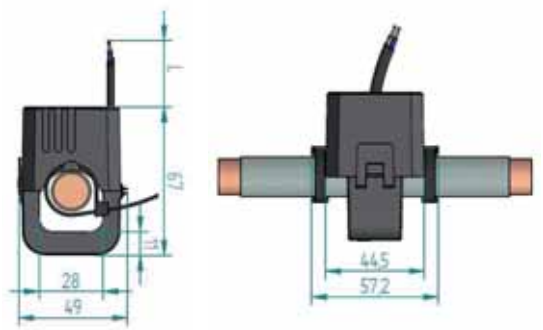
1) Accuracy in accordance with IEC 61869-2, between 5-120% In

Additional types on request.

Dimensions

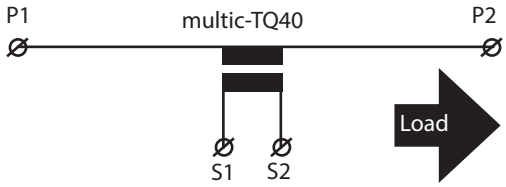


Dimensions
multict-TQ40-B



Dimensions
multict-TQ 40-C

Connection diagram



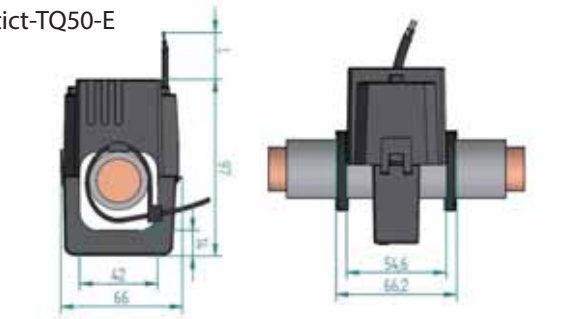
multict-TQ50-E and -TQ50-L Split core transformers

The compact multict-TQ50 split core transformer by KBR is especially suited for digital measurement systems. The transformer by default has color-coded cables. With accuracy class 1 or 0.5 respectively, this transformer is suitable for exact kWh measurements. The maximum load on the current transformer is 0.5 VA at the end of the cable.

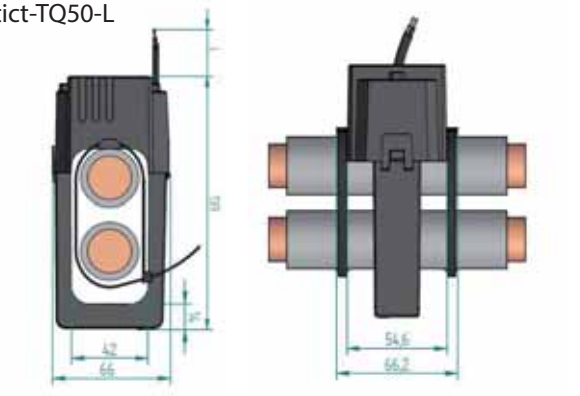
The correct assembly of the current transformer is ensured by its design. It locks with a clearly audible clicking sound. Two UV-resistant cable ties that are easy to install and included in the delivery secure the transformer additionally.

Dimensions

Dimensions multict-TQ50-E



Dimensions multict-TQ50-L



Technical specifications

Ith:	60 x In/1s
Insulation class:	E (max 120°)
Protection type:	IP20
Ambient temperature:	-10…+55 °C
Location:	Indoor use
Relative humidity:	5%... 85%, non-condensing
Insulation test voltage:	0.72/3/-kv
Primary conductor:	TQ50-E Ø max. 42 mm TQ50-L Ø max. 2x 42 mm
Connection:	1A: L=5m cable 0.5mm², flexible 5A: L=3m cable 1.5mm², flexible

May only be extended after prior calculation!
Calculation tool available online: http://www.kbr.de/en/multict-current-transformer#calculation-tool

Comment:	Only for insulated primary conductors
Thermal rated short-time current	60 x In/1s
Thermal rated continuous current (Icth):	100%
Rated frequency:	50/60 Hz
In accordance with:	IEC 61869-2

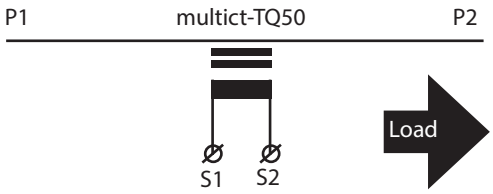
Order information

Current transformer	Class[1)]	Load	Item no. multict-TQ50-E	Item no. multict-TQ50-L
400/1 A	0.5	0.5 VA	12337	12352
500/1 A	0.5	0.5 VA	-	12353
600/1 A	0.5	0.5 VA	12339	12354
800/1 A	0.5	0.5 VA	-	12356
1000/1 A	0.5	0.5 VA	-	12357[2)] *

1) Accuracy in accordance with IEC 61869-2, between 5-120% In
2) 1000/1 A: Ambient temperature -10...+40 °C

* Non-stock items. Delivery time is approx. 6 weeks.
Additional types on request

Connection diagram



multict-RM27 Plug-on current transformer

The very compact multict-RM27 current transformer was especially designed for the connection to digital measurement systems. The most important benefit of the multict-RM27 is that it was specifically dimensioned for use in a 3-phase safety circuit breaker with a phase distance of 17.5 mm. The multict-RM27 has a terminal block for easy installation of the secondary lines. Optional: Mounting with screws or on a DIN rail

Technical specifications

Ith:	60 x In/1s
Insulation class:	E (max 120 °)
Protection type:	IP20
Ambient temperature:	-10…+55 °C
Location:	Indoor use
Relative humidity:	5%... 85%, non-condensing
Insulation test voltage:	0.72/3/-kv
Cable opening:	Ø 7.5 mm plug-in connector (female, spring terminal)
Connection:	L=3 m cable 1.5mm², rigid
Comment:	Only for insulated primary conductors
Thermal rated short-time current	60 x In/1s
Thermal rated continuous current (Icth):	100%
Rated frequency:	50/60 Hz
In accordance with:	IEC 61869-2

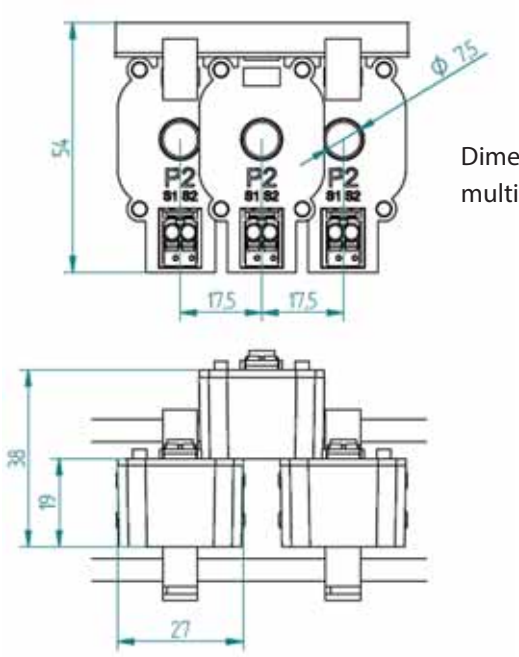
Order information

Current transformer	Class[1)]	Load	Item no. multict-RM27
35/1 A	1	0.2 VA	12365*
64/1 A	1	0.2 VA	12366*
Terminal mounting		Item no.	12367*

1) Accuracy in accordance with IEC 61869-2, between 5-120% In

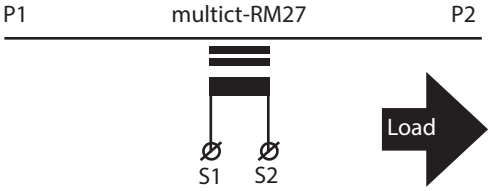
* Non-stock items. Delivery time is approx. 6 weeks.

Dimensions



Dimensions multict-RM27

Connection diagram



KBR-SCAP-3000F-2P70V-M12

Typical application

- Hybrid vehicles
- Braking energy recovery systems
- Wind turbine pitch control
- Engine starting
- Heavy industrial equipment
- UPS power and dynamic voltage compensation systems
- Power grid / power quality application

KBR-SCAP-3000F-2P70V-M12

Supercapacitors

Highlights

- → High power capability
- → Low internal losses and stable performance are the result of the state-of-the-art design and advanced manufacturing processes
- → Long operating life of >1 million cycles, depending on the application and environmental conditions
- → Easy to install (M12 bolt system), with a large contact surface
- → „Double sealing system“ (KBR patent) for high reliability over the entire operating life
- → Integrated safety valve
- → Developed and manufactured by KBR

KBR-SCAP-3000F-2P70V-M12 Product specifications

Type	**KBR-SCAP-3000F-2P70V-M12**		
Electrical	**Rated capacitance**		3000 F
	Rated voltage		2.7 V
	Rated ESR		0.28 mΩ
	Leakage current at 25 °C, maximum		5.0 mA
	Absolute maximum voltage		2.85 V
	Absolute maximum current		1950 A
Physical	**Mass, typical**		510 g
	Terminals		M12
Power and energy	**Impedance match specific power, P_{max}**		12.8 kW/kg
	Specific energy, E_{max}		6Wh/kg
	Stored energy, E_{stored}		3Wh
Thermal characteristics	**Maximum continuous current 132 A** (ΔT = 15 °C)		132A
	Maximum continuous current 215 A (ΔT = 40 °C)		215 A
Temperature	**Operating temperature (cell case temperature)**		Minimum: -40 °C
			Maximum: 65 °C
	Storage temperature (stored uncharged)		Minimum: -40 °C
			Maximum: 65 °C
Performance characteristics at low / high temperature	**40 to 65 °C**	**Capacitance change** (% change from initial value at 25 °C)	5%
		ESR change (% change from initial value at 25 °C)	60%
Operating life	**Operating life at high temperature condition: 1500 hrs** (continuous operation at rated voltage and maximum operating temperature)	**Capacitance change** (% decrease from minimum initial value)	20%
		ESR change (% increase from maximum initial value)	100%
	Designed operating life at 25 °C: 10 years (continuous operation at rated voltage)	Capacitance change 20% (% decrease from minimum initial value)	20%
		ESR change 100% (% increase from maximum initial value)	100%
	Designed cycle operating life at 25 °C (test current: 100 A): >1,000,000 cycles	**Capacitance change** (% decrease from minimum initial value)	20%
		ESR change (% increase from maximum initial value)	100%

KBR-SMOD…

Typical application

- Hybrid vehicles
- Braking energy recovery systems
- Wind turbine pitch control
- Engine starting
- Heavy industrial equipment
- UPS power and dynamic voltage compensation systems
- Power grid / power quality application

KBR-SMOD-0165F-48V-C01

KBR-SMOD-0165F-48V-B01

Supercapacitors

Highlights

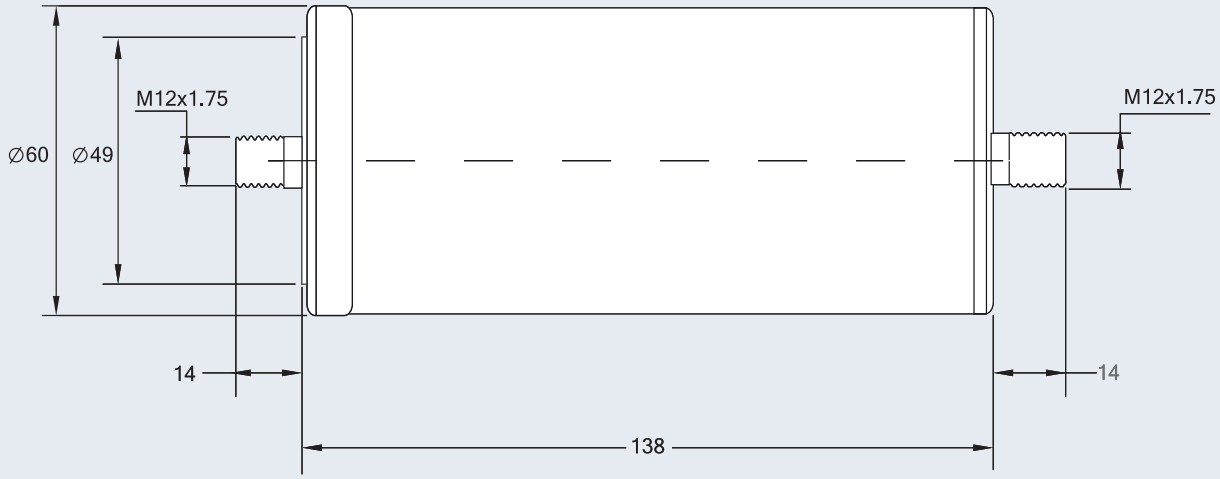
- → High power capability
- → Choice of two versions for standard or „heavy duty“ applications
- → Thanks to its improved heat dissipation, the „heat sink version“ (for heavy duty or high ambient temperature applications) has a normal operating life and performance even under very critical conditions
- → The internal control and measuring electronics (balancing) are easy to connect with a standard connector (part of the delivery)
- → Long operating life of 1 million cycles, depending on the application and environmental conditions
- → Easy mechanical and electrical installation
- → Developed and manufactured by KBR

KBR-SMOD... Product specifications

Type	**KBR-SMOD-0165F-48V-C01 | KBR-SMOD-0165F-48V-B01**		
Electrical	**Rated capacitance**		165 F
	Rated voltage		248 V
	Rated ESR		5.8 mΩ
	Leakage current at 25 °C, maximum		5.0 mA
	Storage energy, E_{stored}		54 Wh
	Absolute maximum voltage		51 V
	Absolute maximum current		1950 A
	Capacitance of individual cells		3000 F
	Stored energy per individual cell		3 Wh
	Number of cells		18
Temperature	**Operating temperature** (cell case temperature)		Minimum: -40 °C
			Maximum: 65 °C
	Storage temperature (uncharged storage)		Minimum: -40 °C
			Maximum: 70 °C
Physical	**40 to 65 °C**		M8/M10
	Degree of protection		IP65
	Cooling		Natural convection
	Mass, typical	KBR 0165F-48V-C01	16.5 kg
		KBR 0165F-48V-B01	13.5 kg
Operating life	**Operating life at high temperature condition: 1500 hrs** (continuous operation at rated voltage and maximum operating temperature)	**Capacitance change** (% decrease from minimum initial value)	20%
		ESR change (% increase from maximum initial value)	100%
	Designed operating life at 25°C: 10 years (continuous operation at rated voltage)	Capacitance change 20% (% decrease from minimum initial value)	20%
		ESR change 100% (% increase from maximum initial value)	100%
	Designed cycle operating life at 25 °C (test current: 100 A): >1,000,000 cycles	**Capacitance change** (% decrease from minimum initial value)	20%
		ESR change (% increase from maximum initial value)	100%

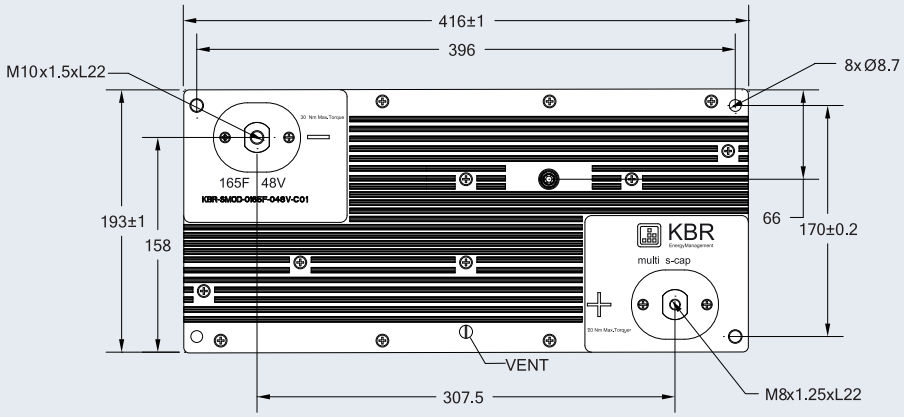
KBR-SCAP-3000F-2P70V-M12 Dimensions

KBR-SCAP-3000F-2P70V-M12

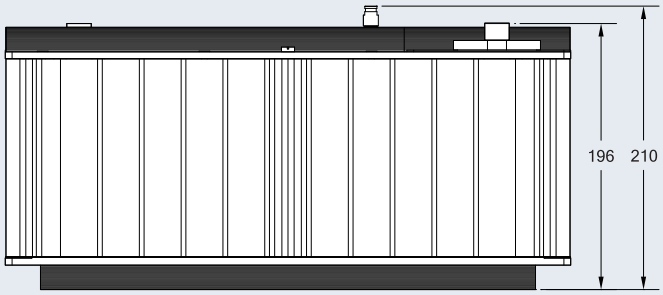


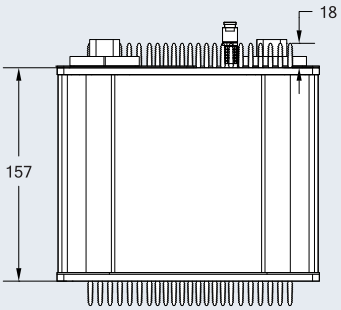
All dimensions are in mm. Not suitable for measurement purposes.

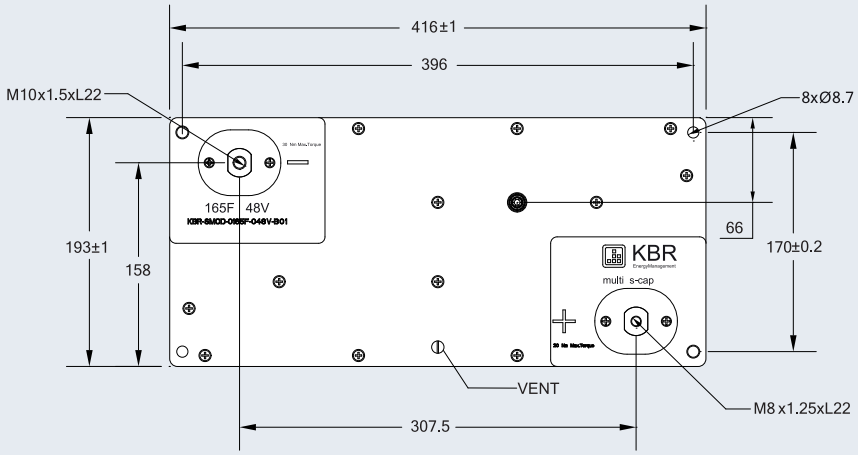
KBR-SMOD... Dimensions



KBR-SMOD-0165F-48V-C01







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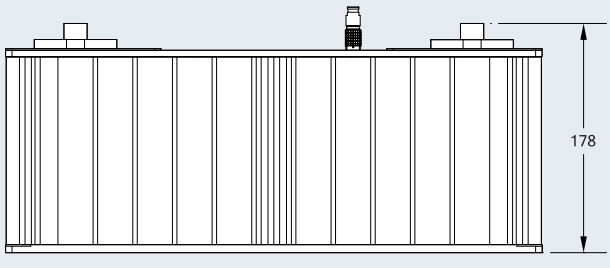

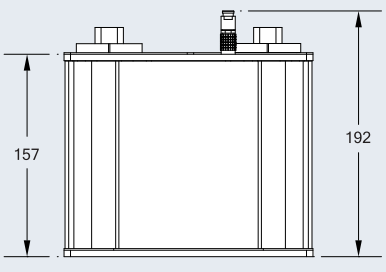

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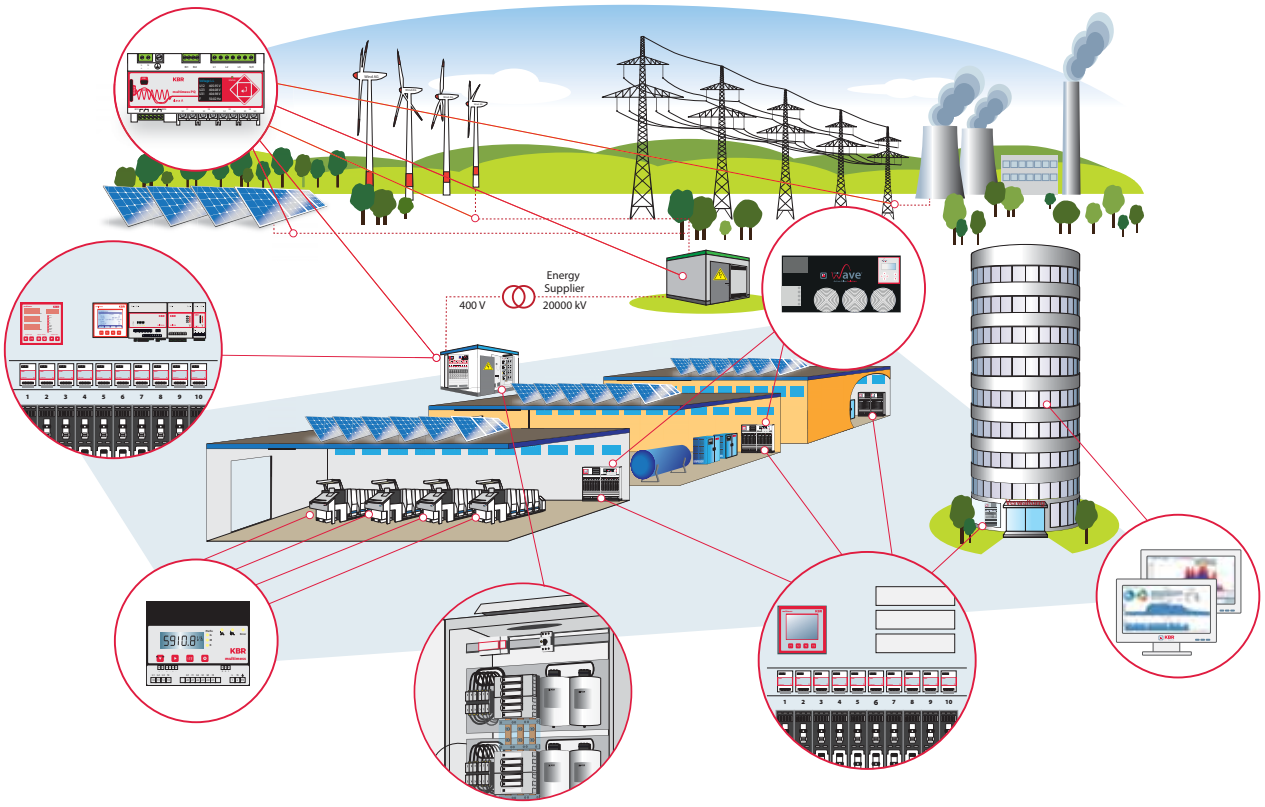
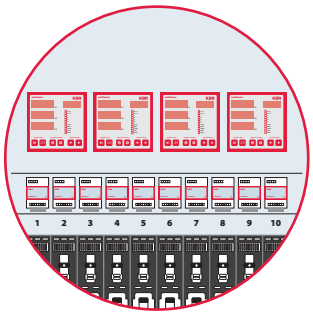


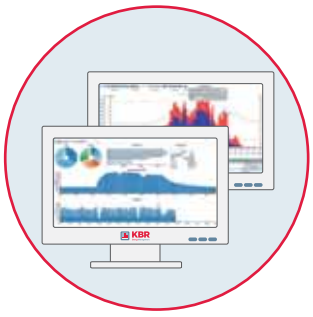
Cost savings through increased efficiency

Our solutions for contemporary energy management.



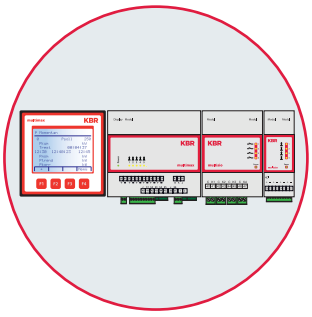
When measurement alone is not enough.

Capturing and documenting energy data has never been easier. Standard and consumption values, load profiles or easily recording countless forms of energy, media, and states – our measuring devices meet the most diverse requirements with the highest level of safety and precision.



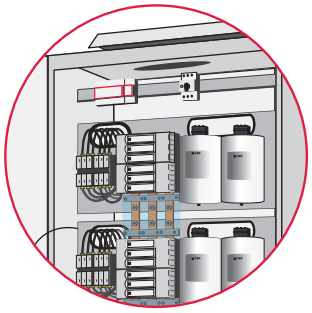
We make energy visible

With its impressive functionality, visual energy allows for transparent and efficient energy management. You can easily capture, monitor, analyze and process the most diverse energy information from networks or systems. This helps you track your energy costs.



Intelligent load distribution that pays off in several ways

The key to successful energy optimization is the perfect coordination of reliable product technology and intelligent load control. With its system architecture and comprehensive functionality, the system is highly efficient for the most diverse applications.



Spot-on network quality

The use of compensation systems does not only reduce the reactive current costs but also the load on a company's lines and distributions. Intelligent controllers, innovative components, as well as the perfectly matched construction considerably increase the operating life as well as your profit.

Measuring | **Visualization** | **Optimizing** | **Control**

Our offers...

- lowering energy costs
- increasing operational safety
- from planning to realization - all from one source
- top quality "Made in Germany"
- high production depth
- factory service center hotline
- innovative system solution
- in-house engineering
- TÜV certified energy data management software
- contribution to protect the environment

KBR provides impulses and smoothes the way…

PRODUCTS AND SOLUTIONS
FOR CONTEMPORARY
ENERGY MANAGEMENT

MADE IN
GERMANY

Product consulting:
+49 (0) 9122 6373-0
info@kbr.de

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We will be happy to advise you personally.

FOR YOU. ON SITE WORLDWIDE.

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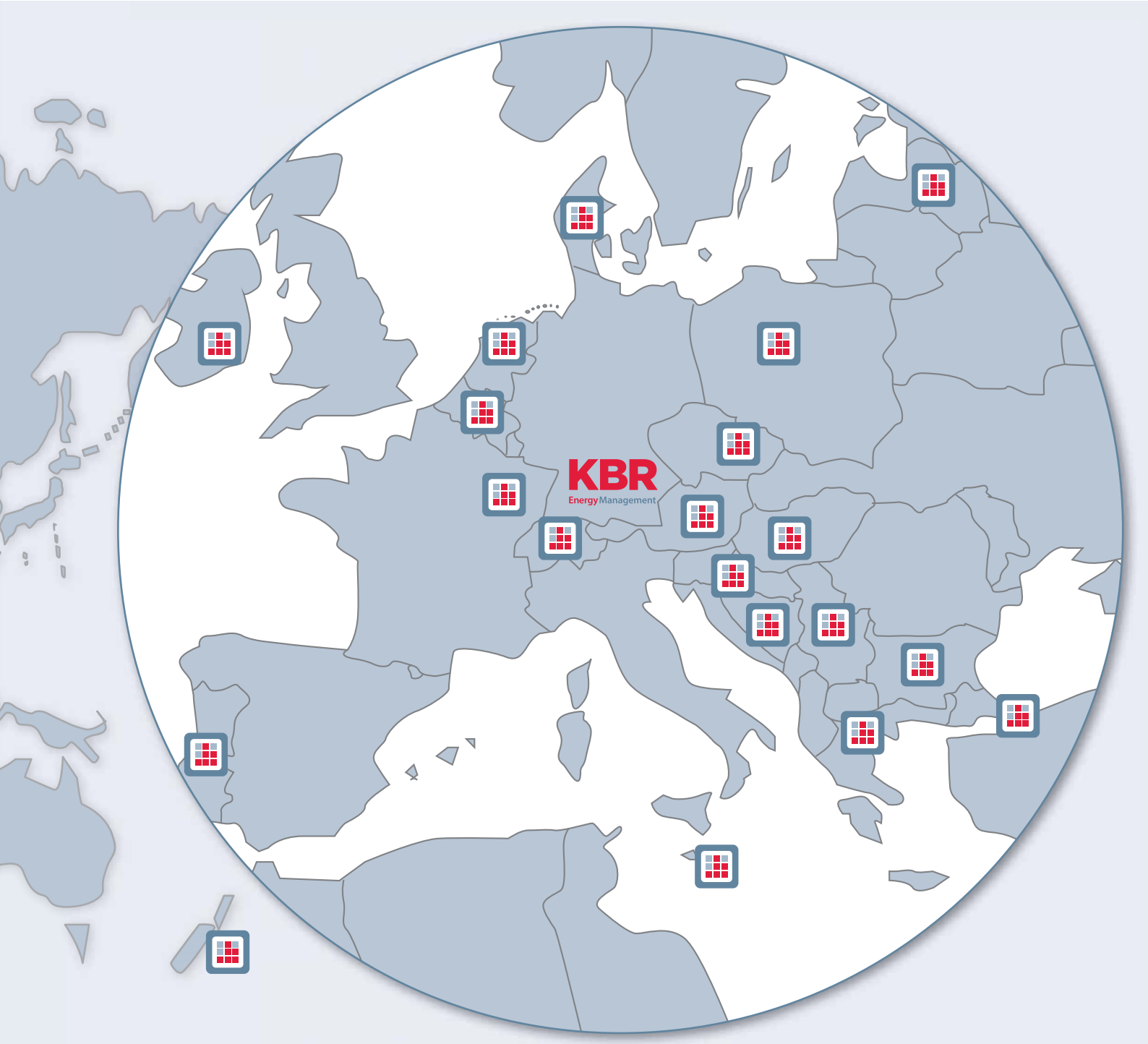
Czech Republic	Greece	Kenya	Netherlands	Serbia



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KBR provides you a dense network of quality and experienced business partners.

KBR is your reliable energy management partner.
With precision technology, efficient solutions and a comprehensive range of services, the KBR system helps companies from the plant engineering, industry or craft sector maintain their technical edge.
For a sustainable and future-proof energy supply.
Our services:

- **Planning and consulting**
- **Energy measuring devices**
- **Analysis software**
- **System integration**
- **Seminars & workshops**
- **First-class services from one source**

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