- Power Factor Control Relays
- Thyristor Switching Modules
- Power Analyser and Mini SCADA
- MV Capacitor Protection Relays
- Active Harmonic Filters

BELUK

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BELUK

making energy matter

accurate POWER FACTOR control

The 'Power-Factor' of BELUK in reactive power compensation !

BELUK, APFC-relays operating in over 30,000 installations Country-wide

- **Fully automatic setup and operation : no programming !**
- **Advanced sensing and detection to any capacitor step size**
- **Measurement of all 4 quadrant of voltage and current**
- **Multi-voltage facility, enables relays to operate from 90V to 550V !**
- **Unique 'tamper proof' facility in CXD range of relays**
- **Dual target PF control, facility for operation even under DG**
- **High sensitivity commencing from, 15mA, even on a 5A path**
- **Host of configurations including 3xCT, phase-wise compensation**

PTL

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Energy Efficiency by Power Factor Correction

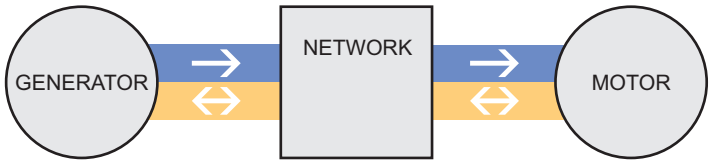
In times of shortage of resources and climate change, conservation of resources is a fundamental objective, and increasing energy efficiency a core aim of policy.

With the systematic use of power factor correction,

- energy losses in the electrical transmission and distribution networks can be significantly reduced, with a corresponding reduction in the CO_2 emissions involved in generating that lost energy;
- energy transmission and distribution networks can be used more efficiently, for instance for the transmission of regenerative energy;
- the reliability of planning for future energy networks can be increased.

Origin and effects of reactive power

Many electrical devices, e.g motors, need active power and reactive power. Active power is converted into mechanical power or heatlosses, reactive power is needed to maintain the magnetic fields of the devices. This reactive power is transferred periodically in both directions between the generator and the load.

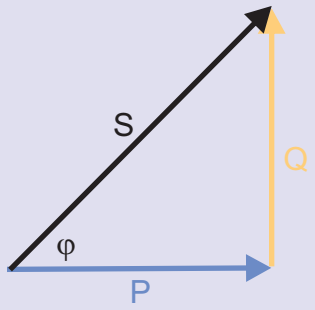


Vector addition of active power P and reactive power Q gives the apparent power S. Power generation utilities and network operators must make this apparent power available and transmit it. This means, that generators, transformers, power lines, switchgear, etc. must be sized for greater power ratings than if load only drew active power. Power supply companies are therefore faced with extra expenditure on equipment and additional power losses. They therefore make additional charges for reactive power if this exceeds a certain threshold. Usually a certain target power factor cos of between 1.0 and 0.9 (lagging) is specified.

Apparent power
$S^2 = P^2 + Q^2$

Active power
$P = S \cdot \cos\varphi$

Reactive power
$Q = S \cdot \sin\varphi$



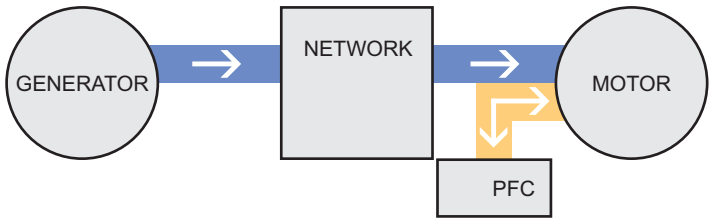
Example: 3-phase motor

Active power	500kW
Reactive Power:	510kvar (ind)
Resulting apparent power:	714kVA
cosφ	ind. 0,70

Transmission in is 714kVA, although only 500kW can be used. Power losses in network are two times of the power losses with cosφ=1.00

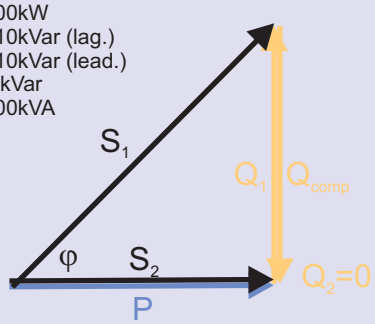
Power factor correction

If the lagging power factor is corrected, for example by installing a capacitor at the load, this totally or partially eliminates the reactive power draw at the power supply company. Power factor correction is at its most effective when it is physically near to the load and uses state-of-the-art technology.



The inductive reactive power Q_1 is compensated for totally or partially by the capacitive reactive power Q_{comp}, the apparent power thus being reduced from S_1 to S_2.

Active power	500kW
Reactive power	510kVar (lag.)
Power-factor-correction	510kVar (lead.)
Resultant reactive power	0 kVar
giving apparent power	500kVA

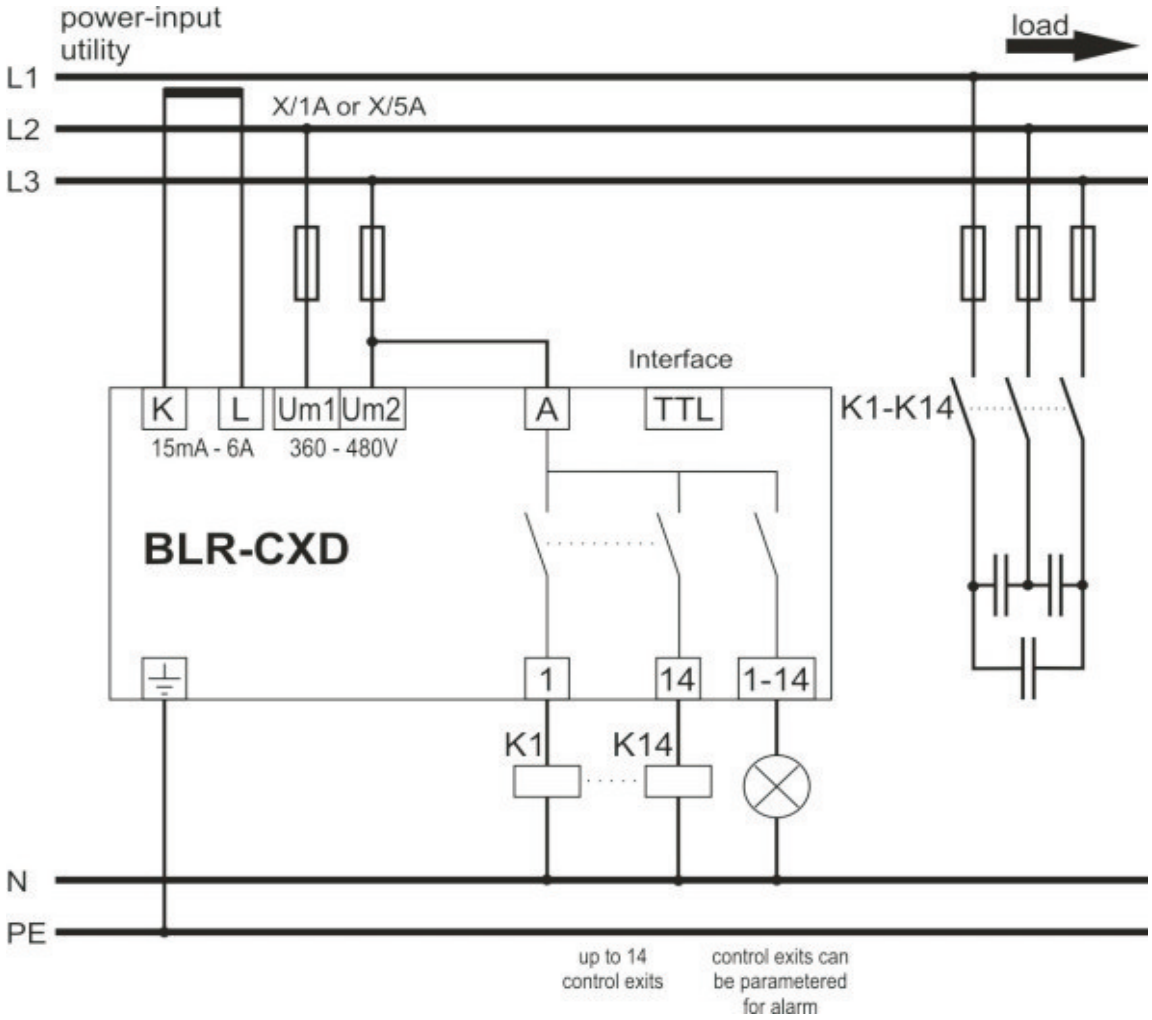


The motor draws an active power of 500kW as before, but ist reactive power is fully compensated.The supply network needs to transmit an apparent power of 500kVA. Power factor correction reduces the transmission load by 43% of nominal active power. The transmission losses are reduced by factor 2.
In India, due to power-factor correction it's possible to save energy losses of around 1 nuclear power plant (compared with no power-factor correction).

Microprocessor controlled “TAMPER PROOF” power factor control relay

- Start menu for easy commissioning with no programming or set up needed
- Automatic detection and correction of the phase of current and voltage connection under ‘Ai” mode
- Fully-automatic c/k-value setting, self adapting, connection of different capacitor step sizes possible, with usage of the optimum capacitor step
- Switching program operates in best fit, with even wear and tear or equal rated steps
- Capable for 4-quadrant operation
- Supply voltage is taken from voltage measurement, input of 360V to 480V, AC, 45Hz to 65 Hz
- Connection with pluggable screw terminals
- LCD display with backlight, and auto-scrolling of Voltage L-L, Displacement PF, Cos-Phi and THD-V
- Instrument casing 144x144mm for cutout 138 x 138mm, depth 49mm
- Protection class IP20 (casing), IP50 (front)
- THD monitoring and facility to trip based on defined threshold
- Three decimal power factor display makes for accurate monitoring

Measuring and supply voltage:	360V – 480V AC, 45-65HZ, 5VA, max. fuse 6A
Current measuring:	15mA – 6A, single phase, burden 20mOhm,
Control Outputs:	Up to 14 relays, n/o, with common point, max. fuse 6A breaking capacity: 250V AC / 5A (or) 400V AC / 2A
Interface:	TTL, rear
Ambient temperature:	Operation: -20°C … +70°C, storage: -40°C … +85°C
Humidity:	0% - 95%, without moisture condensation
Voltage class:	II, dirt class 3 (DIN VDE 0110, part 1 / IEC60664-1)
Standards:	DIN VDE 0110 part 1 (IEC 60664-1:1992) VDE 0411 part 1 (DIN EN 61010-1 / IEC 61010-1:2001) VDE 0843 part 20 (DIN EN 61326 / IEC 61326: 1997 + A1:1998 +A2: 2000)
Conformity and listing:	CE, c UL us, PG
Connection	Pluggable terminal block, screw type max. 4sq.mm
Case:	Front: instrument case PC/ABS (UL94-VO), Rear: metal
Protection class:	Front: IP50 Rear: IP20
Weight:	ca. 0,6kg
Dimension:	144x144x58mm h x w x d, cut out 138 (+0,5) x 138 (+0,5)mm

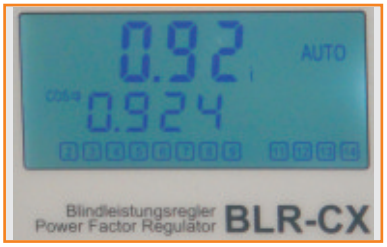


Description	Type
Power Factor Controller BLR-CXD 04 relay outputs	CXD 04R
Power Factor Controller BLR-CXD 06 relay outputs	CXD 06R
Power Factor Controller BLR-CXD 08 relay outputs	CXD 08R
Power Factor Controller BLR-CXD 10 relay outputs	CXD 10R
Power Factor Controller BLR-CXD 12 relay outputs	CXD 12R
Power Factor Controller BLR-CXD 14 relay outputs	CXD 14R

Options and accessories	
Communication module TTL-RS485/USB (internal)	-MB
Communication module TTL-RS485/USB (separate)	3USB

Microprocessor controlled power factor control relay

- Start menu for easy commissioning
- Automatic detection and correction of the phase of current and voltage connection
- Fully-automatic c/k-value setting, self-adapting, connection of different capacitor step sizes possible
- Automatic detection and usage of the optimum capacitor step
- Switching programs, best fit, LIFO, combi-filter, progressive
- Capable for 4-quadrant operation
- 1-phase measurement system also suitable for non-sinusoidal currents & voltages
- Connection with pluggable screw terminals
- LCD display with backlight
- Display of harmonics from 3rd till the 19th order of voltage
- Input for temperature sensor. This input can be used also to switch over to second target cos phi by using a volt-free contact. Fan control possible with designation of any exit relay.
- Input voltage range of 90V to 550V, AC, 45Hz-65Hz
- Current measuring 15mA - 5A, suitable for CT x/1A and x/5A
- Integrated over and under voltage release with auto reset
- Special function to avoid leading Power Factor conditions, suitable for generator APFC
- Displays various power, energy, voltage, current, average PF and missing reactive power readings
- Indication of displacement and true power factor, as well with 3-decimal readings
- Alarm relay (volt-free n/o contact, closed under normal condition)
- TTL-interface on rear
- Instrument casing 144x144mm for cut-out 138 x 138mm, depth 49mm
- Protection class IP20 (casing), IP50 (front)



Description	Type
Power Factor Controller BLR-CX 04 relay outputs	CX 04R
Power Factor Controller BLR-CX 06 relay outputs	CX 06R
Power Factor Controller BLR-CX 08 relay outputs	CX 08R
Power Factor Controller BLR-CX 10 relay outputs	CX 10R
Power Factor Controller BLR-CX 12 relay outputs	CX 12R
Power Factor Controller BLR-CX 14 relay outputs	CX 14R
Power Factor Controller BLR-CX 06 transistor outputs	CX 06T
Power Factor Controller BLR-CX 12 transistor outputs	CX 12T
Options and accessories	
Pluggable temperature sensor	-L
Separate connection of supply voltage	-V
Communication module TTL-RS485/USB (internal)	-MB
Communication module TTL-RS485/USB (separate)	3USB
Software	In process
Data cable TTL/USB	UMS9
Transparent cover with lock IP54	- VT
Wall mounting bracket	3ZWC

FUNCTION

The intelligent regulation algorithm of BELUK switches the steps optimized and by this it guarantees short compensation times combined with the smallest amount of operations. The operating cycles are shared equally to all steps.
All relevant parameters for the regulation are set ex works in the way that in nearly all cases for BLR-CX no further adjustments are necessary to start the regulation. An optimation of the control mode of the compensation panel to the local conditions is still possible. Parameters can easily be changed, also during operation.
These settings can be done in two separate user menues. The "Start" menu contains only the settings, which can be necessary for commissioning, like nominal voltage, CT and VT ratio and the automatic correction of current and voltage connection.
These settings and furthers settings of the "Expert" menu are:

Measuring: nominal voltage, CT ratio, VT ratio,
tolerance of voltage, connection Ph-Ph/Ph-N,
phase-correction, autom. correction of connection,
synchronisation, reset operating hours,
reset average PF, reset max. temperature

Regulation: sensitivity, target-cosphi 1 and 2,
switch interval, delay step exchange,
step-exchange, autom. capacitorsize detection,
blocking of defective steps,
Regul.progr.: Best-Fit, LIFO, combi, progressive,
Offset reactive power, asymmetric switch interval

Steps: discharging time, step size in kvar,
step type (e.g. fix-steps)

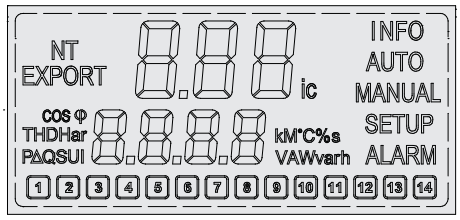
Alarming: regulation alarm, defective step alarm,
power loss of capacitors, THD U Alarm,
over-temperature, limit switching operations,
limit operating hours of panel, limit temp1/temp2
I=0 freeze regulation, etc.

For starting regulation, only the correct setting of nominal voltage is necessary. Otherwise the regulation is blocked for protecting the capacitors. If CT ratio is not set, then all the measurement readings which are dependent on this setting are blanked. A wrong connection can be corrected by starting the automatic phase correction. For maintenance work, each individual step can be switched manually.

MEASURING

BLR-CX is calculating by the measurings of current and voltage the power conditions in electrical network. Generally, it's not important, in which phases voltage and current are connected, because the connection is corrected by BLR-CX after starting the automatical phase correction. The min. sensing current is 15mAmp, which ensures a reliable and exact regulation. For the current measuring 1Amp CTs can be used as well as 5Amp CTs . For this, there is no manual changing of any settings necessary.
The wide range SMPS allows to realize voltage measuring in a range between 90V and 550V.

By using the temperature sensor, BLR-CX can measure the internal temperature of the compensation panel and switch by using one of the exit relays, a fan. The switch-off of the capacitor steps due to overtemperature can be triggered by reaching the second overtemperature level or can be triggered by N/O contacts of external thermostates, which are connected in parallel to the temperature sensor.



High-contrast LCD with backlight
and temperature range from -20°C to +70°C.
(Original size)

DISPLAY

BLR-CX is equipped with LCD with back-lighting. It shows informations about the panel and about the mains parameters. It's also necessary for setting the paramters of BLR-CX:

Mains paramters: voltage, current, kW, kvar, kVA, kvar to target, THD U, 3rd to 19th harmonic of voltage, cos phi, powerfactor, frequency, temperature

Panel informations: power-on hours of panel, operating cycles per step, max. temperature of panel, average power factor, rating per step in kvar, percentage of the rating per step compared with the nominal rating.

Cos phi and status of the exits are shown permanently.

MONITORING

The monitoring features of BLR-CX guarantee a reliable operation and a long life of the compensation panel:

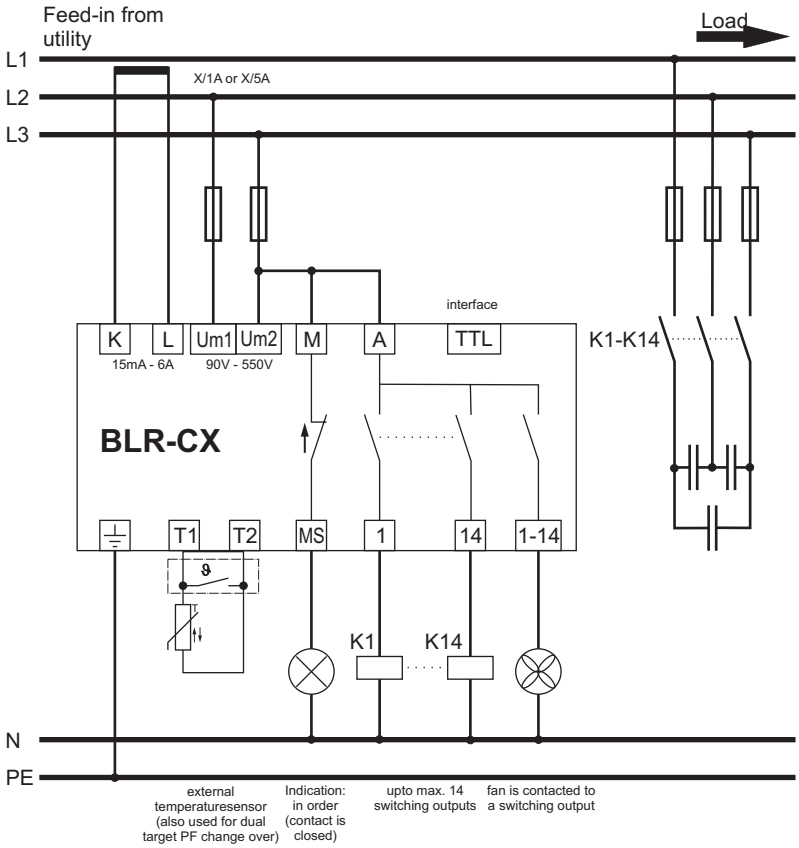
- Low voltage switch-off against chattering of contactors
- Over voltage switch-off for protecting the capacitors
- Overtemperature switch-off
- Monitoring of THD U
- Recognition of defective capacitors
- Alarming, when target of regulation cannot be reached
- Signalling of the need for maintenance
- Fan control

Failures and announcements of the panel are shown in LCD. Failures can also be forwarded by the voltfree alarm-contact (sign-of-life signal)
For switching the fan, one of the step-exits has to be used.

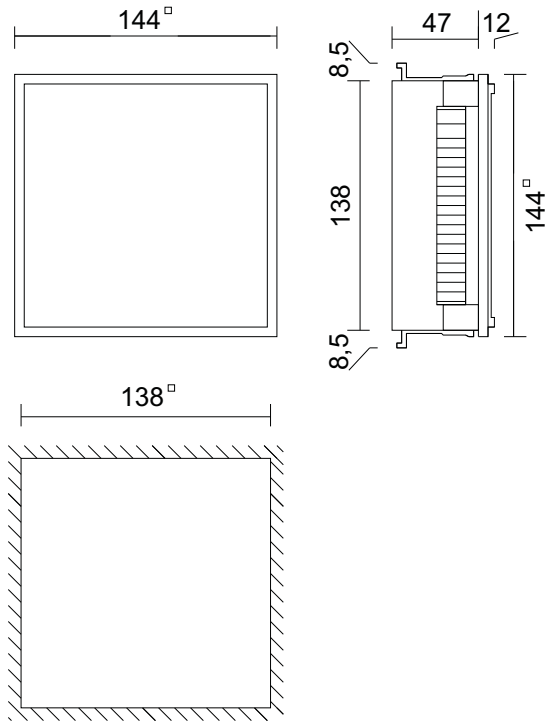
FEATURES

Standard features:
Auxiliary voltage is taken from voltage measuring path
Measuring-auxiliary voltage: 90-550V, 45-65Hz
Current path: 1 x 15mAmp - 6Amp
Alarm relay: 1 x n/o contact (sign-of-life)
Number of control exits: 4, 6, 8, 10, 12, 14
Terminal for connecting a temperature-sensor
TTL-interface
Accessories:
Temperature-sensorInterface converter TTL-USB
Software WinBSTO2

CONNECTION DIAGRAM



DIMENSIONS



TECHNICAL DATA

Type of Device:	Power Factor Control Relay (automatic reactive power management)
Control Variable:	Electrical displacement reactive power
Principle of Regulation:	Stepped regulation with the following modes:: - Best-Fit: starting with the biggest exits - LIFO: last in-first out - Combifilter: Best-Fit, with more connected power of odd exits - Progressive: all required exits are switched in quasi one operation
Special Features:	- Automatic detection and correction of the phase of current and voltage connection - Automatic detection of the used exits - Automatic detection and adaption of the capacitor ratings - Over- and undervoltage monitoring - Monitoring of THD U - Overtemperature switch-off
Measuring Display:	V, A, kVA, kW, kvar, cosphi, PF, Δkvar, THD U, 3rd to 19th harmonic of voltage
Information Display:	Switch cycles per step, capacitor rating, status of the exits, operating hours of the panel, max.temperature, average PF
Measuring- and Auxiliary Voltage:	90- 550V AC, single phase, 45-65HZ, 5VA, max. fuse 6A, VT ratio from 1.0 to 350.0
Current Measuring:	15mA -6A, single phase, burden 20mOhm, CT ratio from 1 to 4000
Control Exits:	Upto 14 relay, N/O, voltfree with common point, max. fuse 6A, breaking capacity: 250V AC / 5A (or) 400V AC / 2A
Temperature measuring:	By NTC
Sign-Of-Life contact:	Relay, voltfree, N/O, max. fuse 4A, breaking capacity: 250V AC / 5A
Fan Control:	By using a control exit
Interface:	Serial interface, TTL located on rearside
Ambient Temperature:	Operation: -20°C...+70°C, storage: -20°C...+80°C
Humidity:	0% - 95%, without moisture condensation
Overvoltage class:	II, pollution degree 3 (DIN VDE 0110, Teil 1 / IEC60664-1)
Standards:	DIN VDE 0110 Teil 1 (IEC 60664-1:1992) VDE 0411 Teil 1 (DIN EN 61010-1 / IEC 61010-1:2001) VDE 0843 Teil 20 (DIN EN 61326 / IEC 61326: 1997 + A1:1998 +A2: 2000)
Conformity and Listing:	CE, UL, cUL
Terminals:	Plugable terminal blocks, screw type, max. 4qmm
Casing:	Front: instrument casing plastic (UL94-VO), Rear: metal
Protection Class:	Front: IP50, (IP54 by using a gasket), Rear: IP20
Weight:	approx. 0.6kg
Dimensions:	144x144x58mm hxwxd, cutout 138 (+0.5) x 138 (+0.5)mm

Microprocessor controlled power factor control relay with 1-phase measurement system and display of measurement values

- Full-automatic c/k-value setting, self adapting, connection of different capacitor step sizes possible
- Automatic detection and usage of the optimum capacitor step
- Manual mode possible
- Multiple connection types possible through adjustable phase compensation angle
- Capable for 4-quadrant operation
- Individually configurable discharging time allows quicker switching time
- 1-phase measurement system also suitable for non-sinusoidal currents and voltages
- Graphical LCD for display of step status, measurement values and system data
- Measurement display for U, I, P, Q, S, THD U, THD I, ΔQ, F, T
- Harmonics measurement for voltage and current up to the 30th order
- Counter for active and reactive work
- Flexible alarm system with up to 15 alarms
- Programmable digital input and digital output
- Programmable alarm relay with volt-free c/o contact
- Step database with storage of origin step size, actual step size and amount of switching cycles for each step
- Real time clock (available in Option –DM)
- Storage of min., max., average value and operating parameters in adjustable time intervals and
- possibility to synchronize via 2. digital input (24VDC),
- Storage of changing from any system parameter with date and time
- Storage of events, e.g. alarm with date and time
- Download of data via TTL/USB (with optional cable) or partly via Modbus or LCD of the controller (use option –DM)
- Supply voltage 115/230V, 45-65Hz, other voltages on request
- Voltage measuring 50 – 530V, 45 – 65Hz
- Current measuring 15mA – 5A, suitable for CT x/1A and x/5A
- Connection with pluggable screw terminals
- Instrument casing for cutout 144 x 144mm, depth 49mm
- Protection class IP20 (casing), IP50 (front)

Description	Type
Power Factor Controller BLR-CM with 06 relay outputs	CM 06R
Power Factor Controller BLR-CM with 12 relay outputs	CM 12R
Power Factor Controller BLR-CM with 6 relay outputs and 6 transistor outputs	CM 12RT
Options	
Interface RS485 protocol Modbus RTU	- MB
Version for HV and MV Capacitor banks	- HV
Data storage, Real time clock, 2. digital input + Interface RS485 protocol Modbus RTU	-DM
Accessories	
Data cable TTL/USB	UMS9
Transparent cover with lock IP54	- VT
Wall mounting bracket	3ZWC

REGULATION

The intelligent regulation algorithm of BLR-CM switches the “normal“ steps optimized. This guarantees short compensation times combined with smallest amount of operations. The operating cycles are shared equally to all steps.

The fast regulation algorithm is using the fast steps to get best results for real time compensation in one period.

Both modes can work parallel in hybride compensation panels. The normal mode is preparing the working point for real time compensation.

All relevant parameters for the regulation are set ex works in the way that in nearly all cases no further adjustments are necessary to start the regulation.
But this does not mean that the power factor controller cannot be adapted to the compensation system by the means of further adjustments.

An abridgement of the possible settings are:

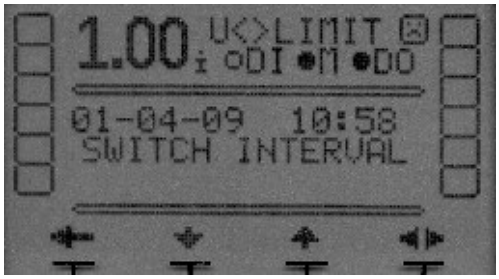
Measurement: CT- ratio, VT- ratio, nominal voltage

CT- and VT- ratio are only necessary to display the correct measurement values. The setting for nominal voltage is needed for over- and undervoltage protection.

Regulation: target-cosphi 1, target-cosphi 2, switching time delay
Switchover from user defined target-cosphi 1 to target-cosphi 2 is done by programmable events. This can either be the digital input or exceeding of threshold levels.

Settings per step:
capacitor size (optional) , discharge time, fix-on, fix-off, fast or normal.

The optional data logger is logging changings of settings. This shows if parameters were changed later, to detect unauthorised settings in case of failfunction.



FEATURES

All relays are fitted with these features as standard:
Auxiliary voltage separate from voltage measuring

Auxiliary voltage:	115/230V, 45-65Hz
Voltage measuring:	1 x 50 - 530V
Current measuring:	1 x 15mA - 5A
Relay output alarm:	1 x C/O contact
Digital input:	1 x 50 - 250V AC
Digital output:	1 x N/O contact

Sensor for temperature measuring

Types of different switching outputs:
BLR-CM 06R: 6 relays (one common point)
BLR-CM 12R: 12 relays (one common point)
BLR-CM 06T: 6 static outputs (one common point)
BLR-CM 12T: 12 static outputs (one common point)
BLR-CM 12RT: 6 static outputs, 6 relays (two seperate common points)

Optional features:
-MB: RS485 with Modbus RTU protocol
-DM: Data logger + RS485 with Modbus RTU protocol

Different auxiliary voltage on request

MEASURING

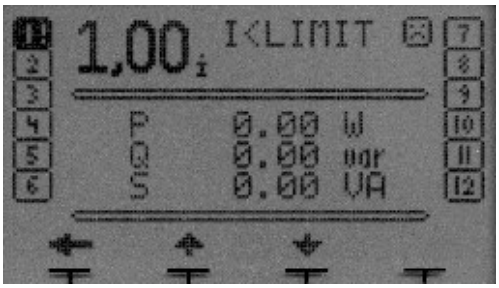
The DSP (digital signal processing) microcontroller of BLR-CM is permanently generating all conditions in the network. As standard, the voltage L1-N and current in L1 are used for this. The separation of auxiliary voltage and voltage measuring allows a voltage measuring range between 50 - 530V. Additionally, there is the possibility to change the phase shift between voltage and current in steps of 15 degrees. The result is the maximum possible flexibility of the relay for applications with voltage measuring phase/neutral, phase/phase and for mixed measuring with different transformer types.

The BLR-CM is measuring the temperature in the panel by using the integrated temperature sensor. This measurement value can be handled flexible, e.g. it can be used for an alarm message, switching-off the steps or activating a fan by using the digital output.

At BLR-CM the following measurement values can be displayed:

- voltage (phase/phase and phase/neutral)
- current
- active power
- reactive power
- apparent power
- THD voltage
- THD current
- harmonics for voltage (order 2 - 30)
- harmonics for current (order 2 - 30)
- counter active work import / export
- counter reactive work induktive / capacitive
- missing reactive power for target-cosphi
- frequency
- temperature

The optional data logger logs measuring values in intervals with minimum, maximum, average and time.

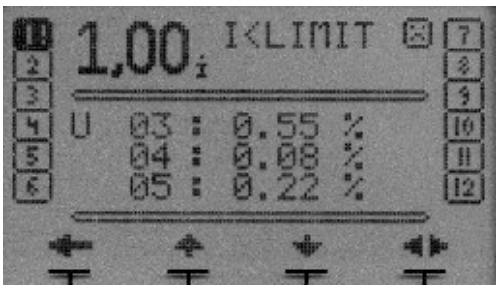


PROTECTION AND ALARMS

The BLR-CM includes a lot of different supervision functions to guarantee a durable safe operation of the compensation system and to ensure a long life cycle of the used components. Some of these supervising functions are:

- under- and overvoltage
- harmonics
- defective steps
- maintenance (loss of power and amount of operations)
- alarm by not reaching the target cosphi
- temperature measuring with fan control and switching off steps
- digital input

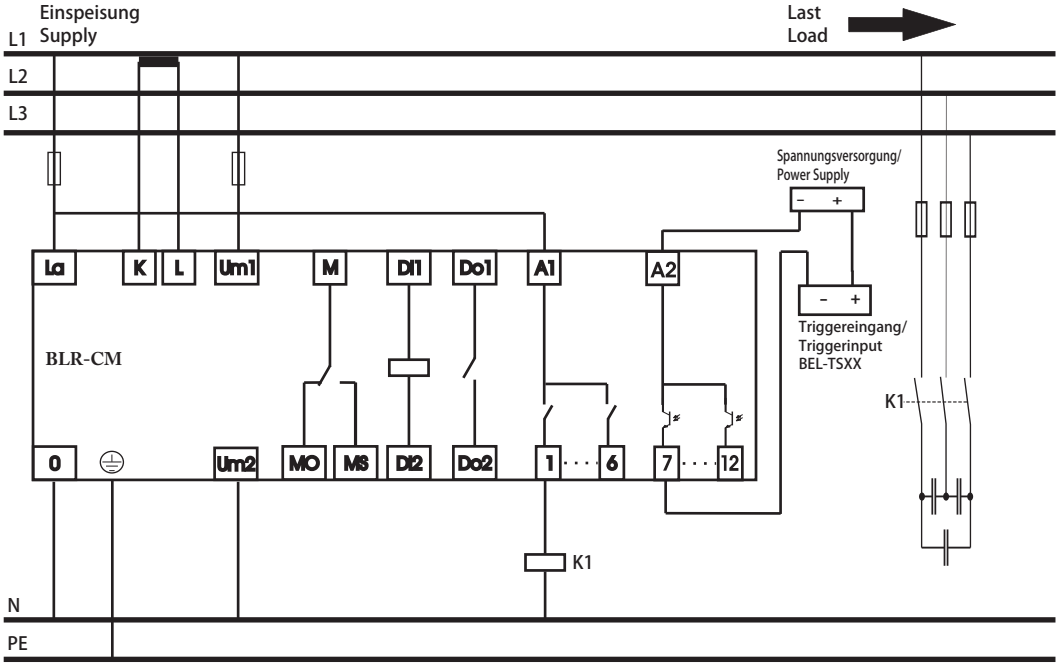
The optional data logger logs all events with time and date.

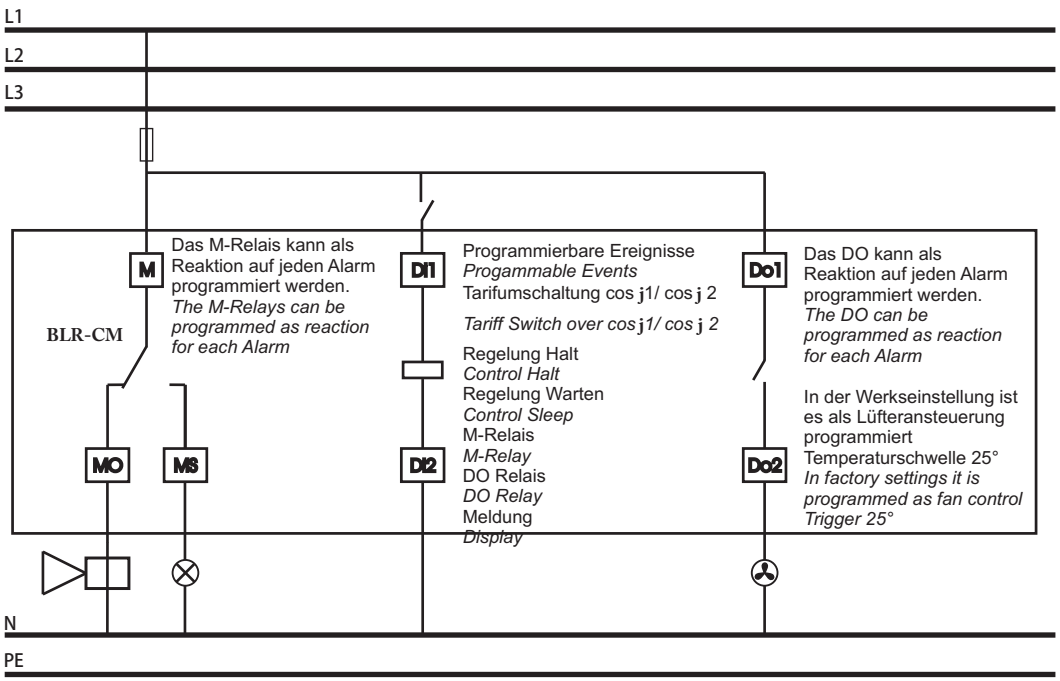


TECHNICAL DATA

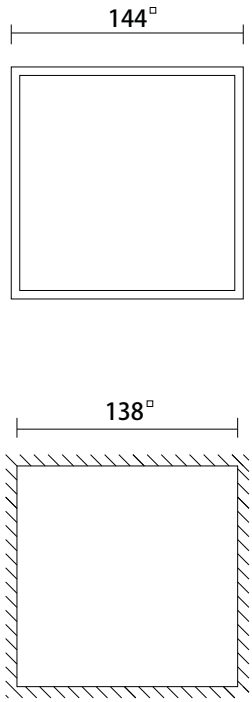
Auxiliary voltage:	100-132V / 207-253V, 45-65Hz, max. fuse 6A
Voltage measuring:	50- 530V, 45-65Hz, PT-ratio 1 - 350
Current measuring:	0-5A, sensitivity 15mA, burden 15mOhm, overload 20% continuous, CT-ratio 1-4000
Regulation outputs:	6R, 12R, 6T, 12T, 12RT relays: N/O, one common point, max. fuse 6A breaking capacity: 250V AC / 5A static outputs: open-collector, breaking capacity: 8-48V DC / 100mA
Alarm contact:	C/O, voltfree, programmable max. fuse 6A, breaking capacity 250V AC / 3A
Digital input:	50 - 250V AC, programmable
Digital output:	N/O, voltfree, programmable max. fuse 6A, breaking capacity 250V AC / 5A
Interface:	RS485 (optional) Modbus RTU protocol (Slave)
Ambient temperature:	operation: 0°C ... +70°C, storage: -20°C ... +85°C
Humidity:	0% - 95%, without moisture condensation
Overvoltage class:	II, pollution degree 3(DIN VDE 0110, Teil 1 / IEC 60664-1)
Standards:	DIN VDE 0110 Teil1(IEC 60664-1:1992) VDE 0411 Teil1 (DIN EN 61010-1 / IEC 61010-1:2001) VDE 0843 Teil 20 (DIN EN 61326 / IEC 61326: 1997 + A1: 1998 +A2:2000)
Conformity and listing:	CE, UL, cUL
Terminals:	screw-type, plugable, max. 2,5qmm
Casing:	front: instrument casing plastic (UL94-VO), rear: metal
Protection class:	front: IP54, rear: IP20
Weight:	ca. 0,8 kg
Dimensions:	144 x 144 x 58mm h x w x d, cutout $138^{+0,5}$ x $138^{+0,5}$mm

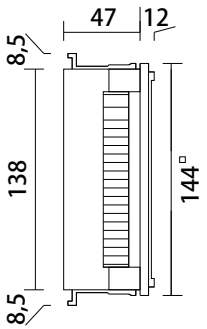
CONNECTION DIAGRAM





DIMENSIONS





Disturbances of mains voltage which are caused by fast fluctuating inductive load, can only be reduced by fast power factor correction.
Compensation panels which are switching capacitors by contactors are not fullfilling these challenges. Suitable solutions from Process Technique for real time power factor correction are thyristor switches of series BEL-TS and power factor controller BLR-CM-T. This system is working fast and free of attrition and free of distortion.

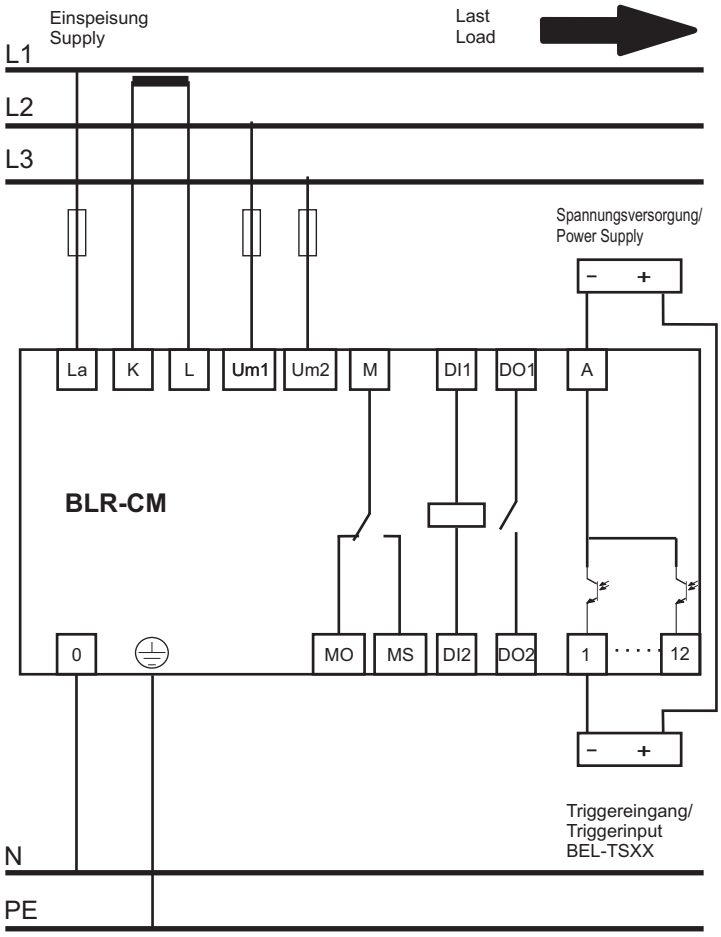
For fast applications, which do not require compensation in real-time, Process Technique is offering with power factor controller BLR-CX-T a suitable solution.
BLR-CM-T-3A allows in combination with single-phase thyristor-switches an exact power factor correction individually per phase. Process Technique also offers thyristor-switches for single phase applications, different voltage levels and different power ratings, as mentioned in this catalogue. Please send us your inqiry with all details.

DYNAMIC AND FAST POWER FACTOR CONTROLLER

BLR-CM-T

DSP-controlled power factor controller with 1-ph. measuring system

- Uses additionally a second "fast" algorithm
- Fast Steps provide compensation in 20 to 30 msec
  Response time < 1ms after one period measuring
  The controller switches all needed steps by one switch cycle
  The nominal step size is free adjustable for every step (connection of different capacitor step sizes possible)
- Normal Steps
  Automatic Stepsize detection and supervision of connected capacitors
  Automatic usage of the optimum capacitor step
  Individually configurable discharging time allows quicker switching time
  Normal steps adjust the operating point for the fast steps
- Full-automatic c/k-value setting
- Manual mode possible
- Multiple connection types possible through adjustable phase compensation angle
- Capable for 4-quadrant operation
- 1-phase measurement system also suitable for non sinusoidal currents and voltages
- Graphical LCD for display of step status, measurement values and system data
- Measurement display for U, I, P, Q, S, THD U, THD I, ΔQ, F, T
- Harmonics measurement for voltage and current up to the 30th order
- Counter for active and reactive work
- Flexible alarm system with up to 15 alarms
- Programmable digital input and digital output
- Programmable alarm relay with voltfree c/o contact
- Step database with storage of origin step size, actual step size and amount of switching cycles for each step
- Real time clock (only option DM)
- Storage of min., max., average value and operating parameters in adjustable time intervals and possibility to synchronize via 2. digital input (24VDC)
  Storage of changing from any system parameter with date and time
  Storage of events, e.g. alarm with date and time
  Download of data via TTL/USB (with optional cable) or partly via Modbus or LCD of the controller
  (only option DM)
- Supply voltage 115/230V, 45-65Hz, other voltages on request
- Voltage measuring 50 - 530V, 45 65Hz
- Current measuring 15mA - 5A, suitable for CT x/1A and x/5A
- Connection with pluggable screw terminals
- Instrument casing for cutout 144 x 144mm, depth 49mm
- Protection class IP20 (casing), IP50 (front)



Power factor controller for real time applications (20msec control time)	Type
Dynamic power factor controller with 06 transistor outputs	BLR-CM06T
Dynamic power factor controller with 12 transistor outputs	BLR-CM12T
Dynamic hybrid power factor controller with 06 transistor and 06 relay outputs	BLR-CM12RT
Fast power factor correction individually per phase (100msec per step)	
Three phase measuring power factor controller with 06 transistor outputs	BLR-CM06T-3A
Three phase measuring power factor controller with 12 transistor outputs	BLR-CM12T-3A
Fast power factor controller in basic version (1sec per step)	
Power factor controller with 06 transistor outputs	BLR-CX06T
Power factor controller with 12 transistor outputs	BLR-CX12T
Optionale Ausstattung	
RS485 with Modbus RTU protocol	-MB
Data-logger, RTC, RS485 with Modbus RTU protocol (only BLR-CM)	-DM
Accessories	
Communication cable TTL/USB	3UMS
Power supply for DIN-rail 85-265VAC / 12VDC; 0,83A; 10W	NG 12DC/Hutsch

Microprocessor controlled power factor control relay with 3-phase measurement system and display of measurement values

- Full-automatic c/k-value setting, self-adapting, connection of different capacitor step sizes possible
- Capacitor capacity is stored as a 3phase value. Thereby 1phase capacitors can be used.
- Automatic detection and usage of the optimum capacitor step for 3 phase power factor control
- Manual mode possible
- Multiple connection types possible through adjustable phase compensation angle
- Capable for 4-quadrant operation
- Individually configurable discharging time allows quicker switching time
- 3-phase measurement system also suitable for non-sinusoidal currents and voltages
- Graphical LCD for display of step status, measurement values and system data
- Measurement display for U, I, P, Q, S, THD U, THD I, ΔQ, F, T
- Harmonics measurement for voltage and current up to the 30th order
- Counter for active and reactive work
- Flexible alarm system with up to 15 alarms
- Programmable digital input and digital output
- Programmable alarm relay with volt-free c/o contact
- 3 dimensional step database with storage of origin step size, actual step size and amount of switching cycles for each step
- Real time clock (available in Option –DM)
- Storage of min., max., average value and operating parameters in adjustable time intervals and possibility to synchronize via 2. digital input (24VDC)
- Storage of changing from any system parameter with date and time
- Storage of events, e.g. alarm with date and time
- Download of data via TTL/USB (with optional cable) or partly via Modbus or LCD of the controller (use option –DM)
- Supply voltage 115/230V, 45-65Hz, other voltages on request
- Voltage measuring 50 – 530V, 45 – 65Hz
- Current measuring 3 x 15mA – 5A, suitable for CT x/1A and x/5A
- Connection with pluggable screw terminals
- Instrument casing for cutout 144 x 144mm, depth 49mm
- Protection class IP20 (casing), IP50 (front)

Description	Type
Power Factor Controller BLR-CM 3phase with 06 relay outputs	CM 06R –3A
Power Factor Controller BLR-CM 3phase with 12 relay outputs	CM 12R –3A
Power Factor Controller BLR-CM 3phase with 06 transistor outputs	CM 06T –3A
Power Factor Controller BLR-CM 3phase with 12 transistor outputs	CM 12T –3A
Power Factor Controller BLR-CM 3phase with 06 relay and 06 transistor outputs	CM 12RT –3A
Options	
Interface RS485 protocol Modbus RTU	-MB
Data storage, Real time clock, 2. digital input + Interface RS485 protocol Modbus RTU	-DM
Accessories	
Data cable TTL/USB	UMS9
Transparent cover with lock IP54	- VT
Wall mounting bracket	3ZWC

REGULATION

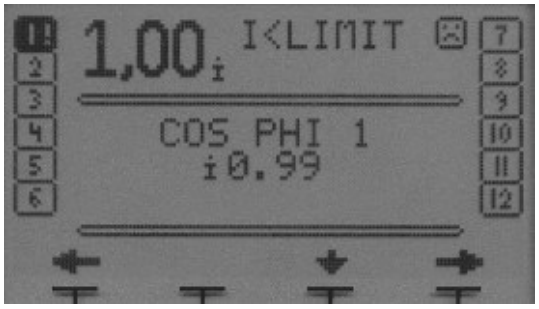
The 3-phase measurement system of the BLR-CM 3phase power factor regulator also detects unsymmetrical loads. Furthermore the regulation algorithm respects unsymmetrical capacitor steps during its work. Thus also in unsymmetrical electricity networks an optimum power factor correction is guaranteed. Short compensation times combined with smallest amount of operations and an equal dispersion of the operating cycles underline the superior intelligence of the BLR-CM 3phase.

All relevant parameters for the regulation are set ex works in the way that in nearly all cases no further adjustments are necessary to start the regulation. But this does not mean that the power factor controller BLR-CM 3phase cannot be adapted to the compensation system by the means of further adjustments.

In the standard setup-menu all basic settings of the BLR-CM 3phase can be done. Among these settings there are e.g. the current- and voltage transformer ratios, which are necessary for the correct display of the measurement values.

Switchover from target-cosphi 1 to target-cosphi 2 can selectively be done by programmable events. These events can be triggered by the digital input as well as by adjustable limits.

In the expert setup-menu there are many further extensive settings available. Entering this sumenu is password protected to avoid access of unauthorized people. By means of these settings the device can be adapted optimally to the pfc system if necessary. Inside this expert menu there are e.g. the alarm settings which can be set very comfortable.



FEATURES

All relays are fitted with these features as standard:

Auxiliary voltage separate from voltage measuring	
Auxiliary voltage:	115/230V, 45-65Hz
Voltage measuring:	1 x 50 - 530V
Current measuring:	3 x 15mA - 5A
Relay output alarm:	1 x C/O contact
Digital input:	1 x 50 - 250V AC
Digital output:	1 x N/O contact
Sensor for temperature measuring	

Types of different switching outputs:
BLR-CM*3phase* 06R: 6 relays (one common point)
BLR-CM*3phase* 12R: 12 relays (one common point)
BLR-CM*3phase* 06T: 6 static outputs (one common point)
BLR-CM*3phase* 12T: 12 static outputs (one common point)
BLR-CM*3phase* 12RT: 6 static outputs, 6 relays
(two seperate common points)

Optional features:
-MB: RS485 with Modbus RTU protocol

Different auxiliary voltage on request

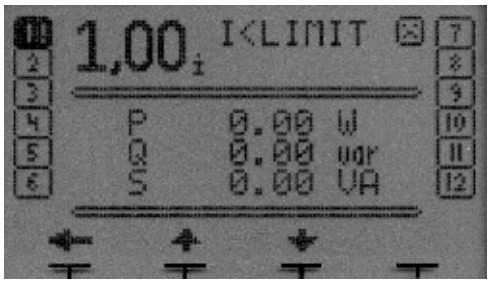
MEASURING

By means of the measurement values of voltage and current BLR-CM calculates the conditions in the network. As standard, the voltage L2-L3 and current in L1, L2 and L3 is used. The separation of auxiliary voltage and voltage measuring allows a voltage measuring range between 50 - 530V. Additionally, there is the possibility to change the phase shift between voltage and current in steps of 15 degrees. The result is the maximum possible flexibility of the relay for applications with voltage measuring phase/neutral, phase/phase and for mixed measuring with different transformer types.

The BLR-CM is measuring the temperature in the panel by using the integrated temperature sensor. This measurement value can be handled flexible, e.g. it can be used for an alarm message. By the means of the digital output an additional fan can be activated.

At BLR-CM the following measurement values can be displayed:

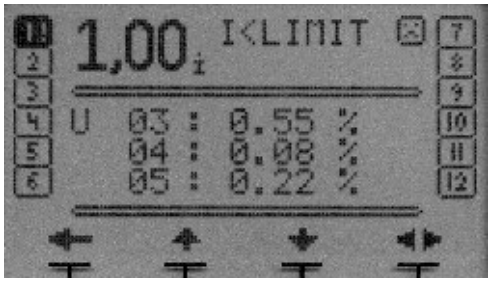
- voltage (phase/phase and phase/neutral)
- current L1, L2, L3
- active power (total)
- reactive power (total)
- apparent power (total)
- THD voltage
- THD current L1, L2, L3
- harmonics for voltage (order 2 - 31)
- harmonics for current L1, L2, L3 (order 2 - 30)
- counter active work import / export
- counter reactive work inductive / capacitive
- missing reactive power for target-cosphi
- frequency
- temperature



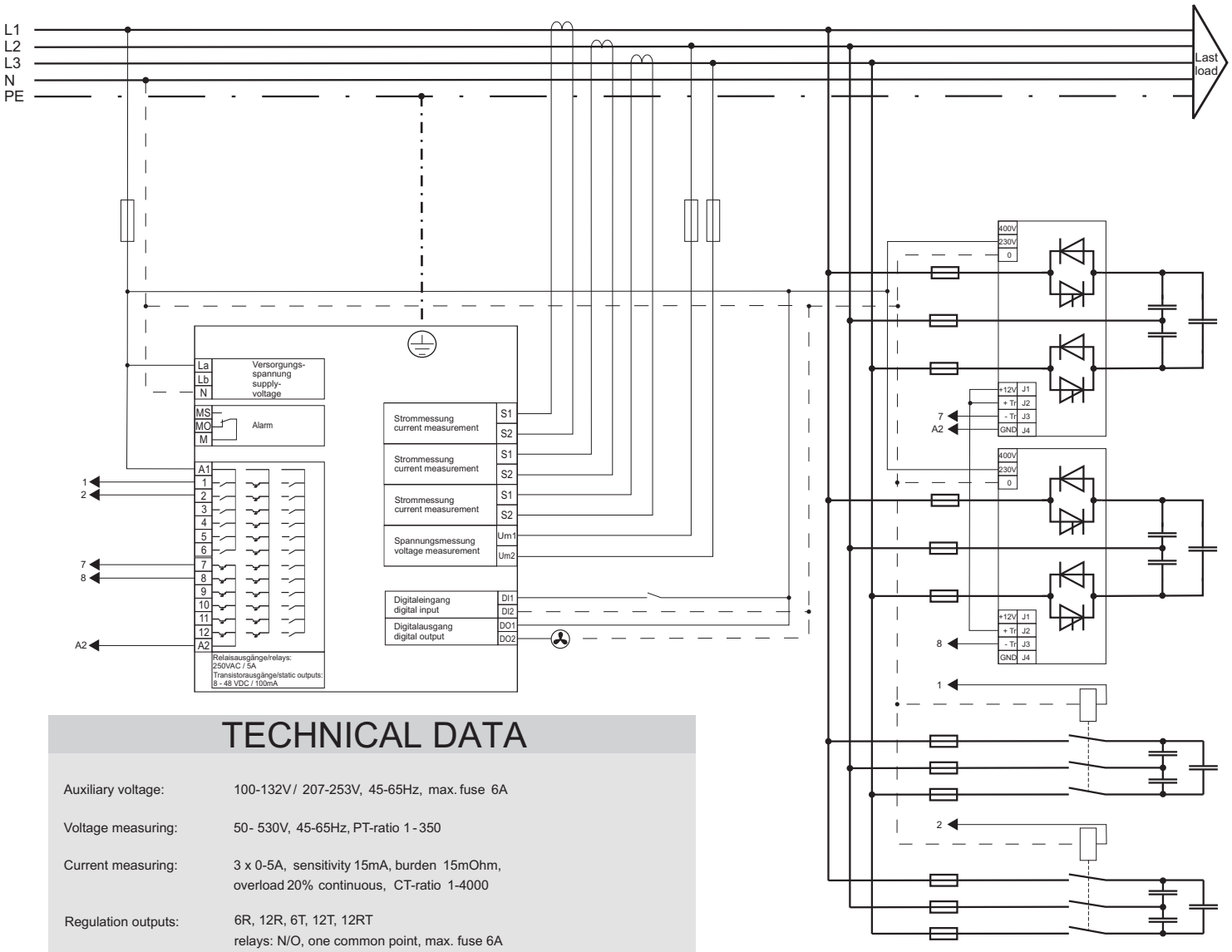
SUPERVISION

The BLR-CM includes a lot of different supervision functions to guarantee a durable safe operation of the compensation system and to ensure a long life cycle of the used components. Some of these supervising functions are:

- under- and overvoltage
- harmonics
- defective steps
- maintenance (loss of power and amount of operations)
- alarm by not reaching the target cosphi
- temperature measuring with fan control and switching off steps
- digital input



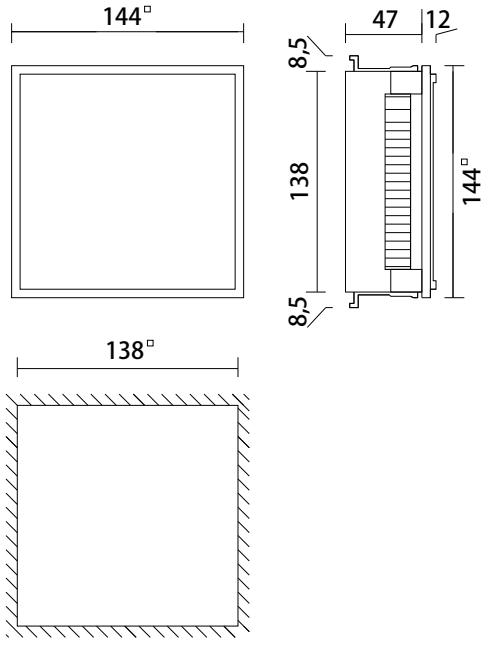
CONNECTION DIAGRAM



TECHNICAL DATA

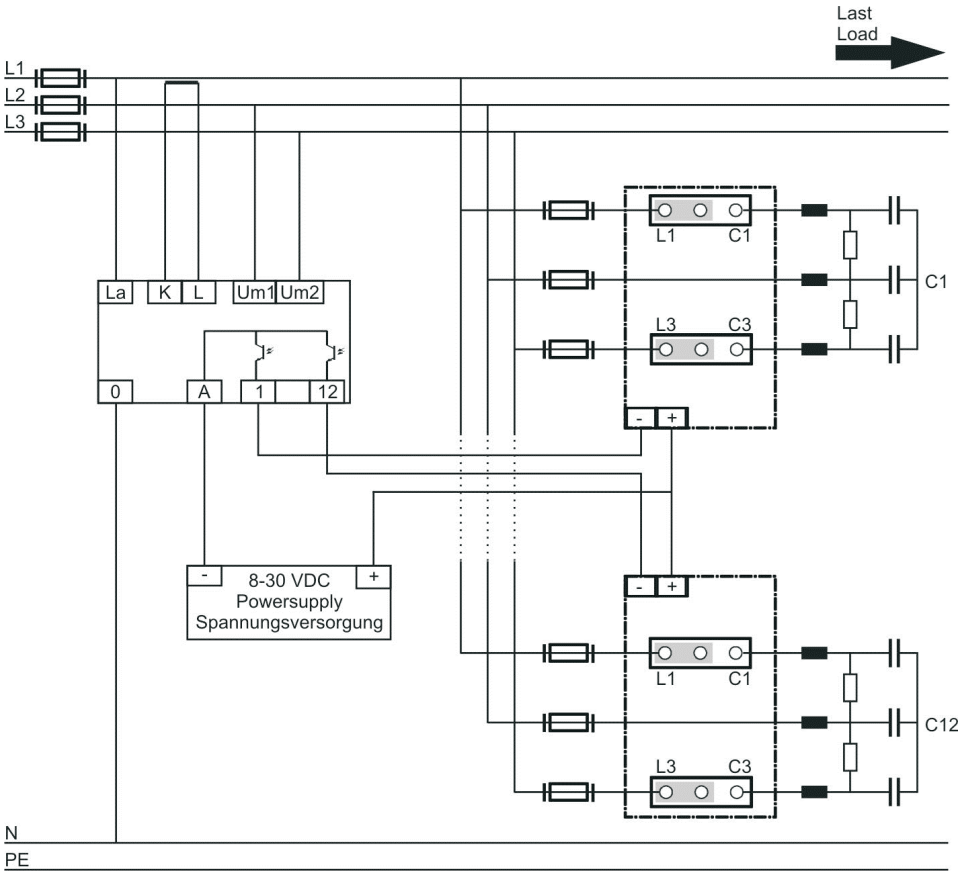
Auxiliary voltage:	100-132V / 207-253V, 45-65Hz, max. fuse 6A
Voltage measuring:	50- 530V, 45-65Hz, PT-ratio 1 - 350
Current measuring:	3 x 0-5A, sensitivity 15mA, burden 15mOhm, overload 20% continuous, CT-ratio 1-4000
Regulation outputs:	6R, 12R, 6T, 12T, 12RT relays: N/O, one common point, max. fuse 6A breaking capacity: 250V AC / 5A static outputs: open-collector, breaking capacity: 8-48V DC / 100mA
Alarm contact:	C/O, voltfree, programmable max. fuse 6A, breaking capacity 250V AC / 3A
Digital input:	50 - 250V AC, programmable
Digital output:	N/O, voltfree, programmable max. fuse 6A, breaking capacity 250V AC / 5A
Interface:	RS485 (optional) Modbus RTU protocol (Slave)
Ambient temperature:	operation: 0°C ... +70°C, storage: -20°C ... +85°C
Humidity:	0% - 95%, without moisture condensation
Overvoltage class:	II, pollution degree 3(DIN VDE 0110, Teil 1 / IEC 60664-1)
Standards:	DIN VDE 0110 Teil1(IEC 60664-1:1992) VDE 0411 Teil1 (DIN EN 61010-1 / IEC 61010-1:2001) VDE 0843 Teil 20 (DIN EN 61326 / IEC 61326: 1997 + A1: 1998 +A2:2000)
Conformity and listing:	CE, UL, cUL
Terminals:	screw-type, plugable, max. 2,5qmm
Casing:	front: instrument casing plastic (UL94-VO), rear: metal
Protection class:	front: IP54, rear: IP20
Weight:	ca. 0,8 kg
Dimensions:	144 x 144 x 58mm h x w x d, cutout $138^{+0.5}$ x $138^{+0.5}$mm

DIMENSIONS



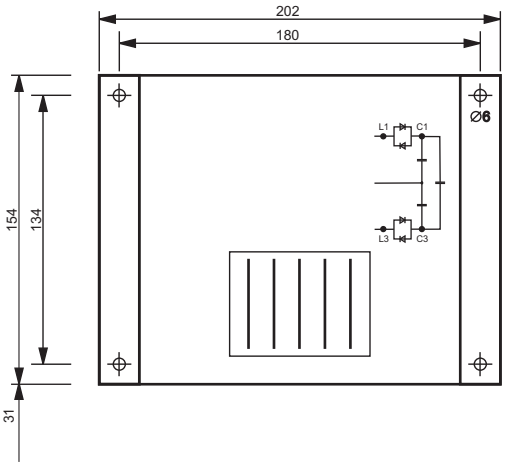
Thyristor switch for rapid switching of capacitors in LV-grid

- Switching without inrush current, smooth disconnecting
- Rapid switching
- Can be used in chocked capacitor banks and unchocked as well
- Depending on the type for max. voltage 525V or 690V
- Recovery time 20ms
- Voltage level trigger signal 8 – 30V DC
- Protection class IP00



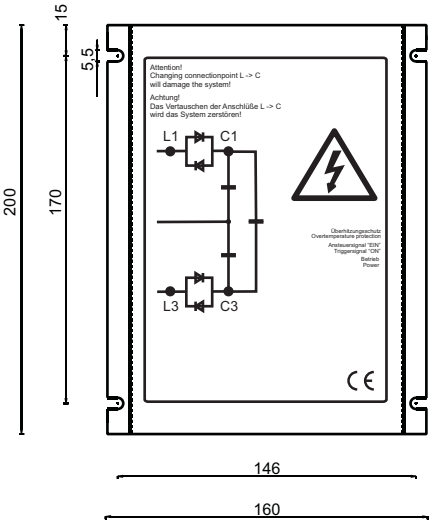
Description	Type
Static contactor without fan, I_N = 22A, $U_{nominal}$ = 400V/440V/480V	BEL-TS 15H2
Static contactor without fan, I_N = 36A, $U_{nominal}$ = 400V/440V/480V	BEL-TS 25H2
Static contactor without fan, I_N = 72A, $U_{nominal}$ = 400V/440V/480V	BEL-TS 50H2
Static contactor without fan, I_N = 42A, $U_{nominal}$ = 690V	BEL-TS 50
Static contactor with fan, I_N = 110A, $U_{nominal}$ = 400V/440V/480V	BEL-TS 75H2
Static contactor with fan, I_N = 145A, $U_{nominal}$ = 400V/440V/480V	BEL-TS100H2
Static contactor with fan, I_N = 84A, $U_{nominal}$ = 690V	BEL-TS100
Static contactor with fan, I_N = 250A, $U_{nominal}$ = 690V/800V	BEL-TS300H2
Static contactor with fan, I_N = 250A, $U_{nominal}$ = 690V	BEL-TS300

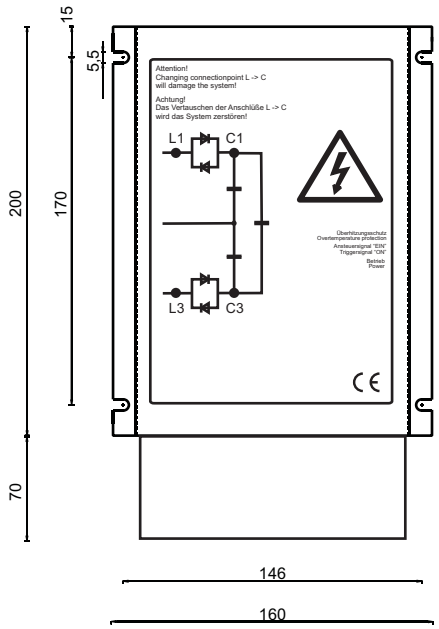
THYRISTOR-SWITCHES FOR SWITCHING CAPACITORS



Nominal power	15kvar		
Nominal voltage / V (+/-10%)	400	440	480
Nominal current / A	22	20	18
Switched phases	2, semi-controlled		
Dimensions H x W x D / mm	188 x 202 x 200		
Weight / kg	2,9		
Thermal losses / W	41	37	33
Cooling	AN, air natural		
Degree of protection	IP20		

Nominal power	25kvar			50kvar		
Nominal voltage / V (+/-10%)	400	440	480	400	440	480
Nominal current / A	36	33	30	72	66	60
Switched phases	2, semi-controlled					
Dimensions H x W x D / mm	200 x 160 x 215					
Weight / kg	4,3					
Thermal losses / W	68	61	52	122	111	104
Cooling	AN, air natural					
Degree of protection	IP10					





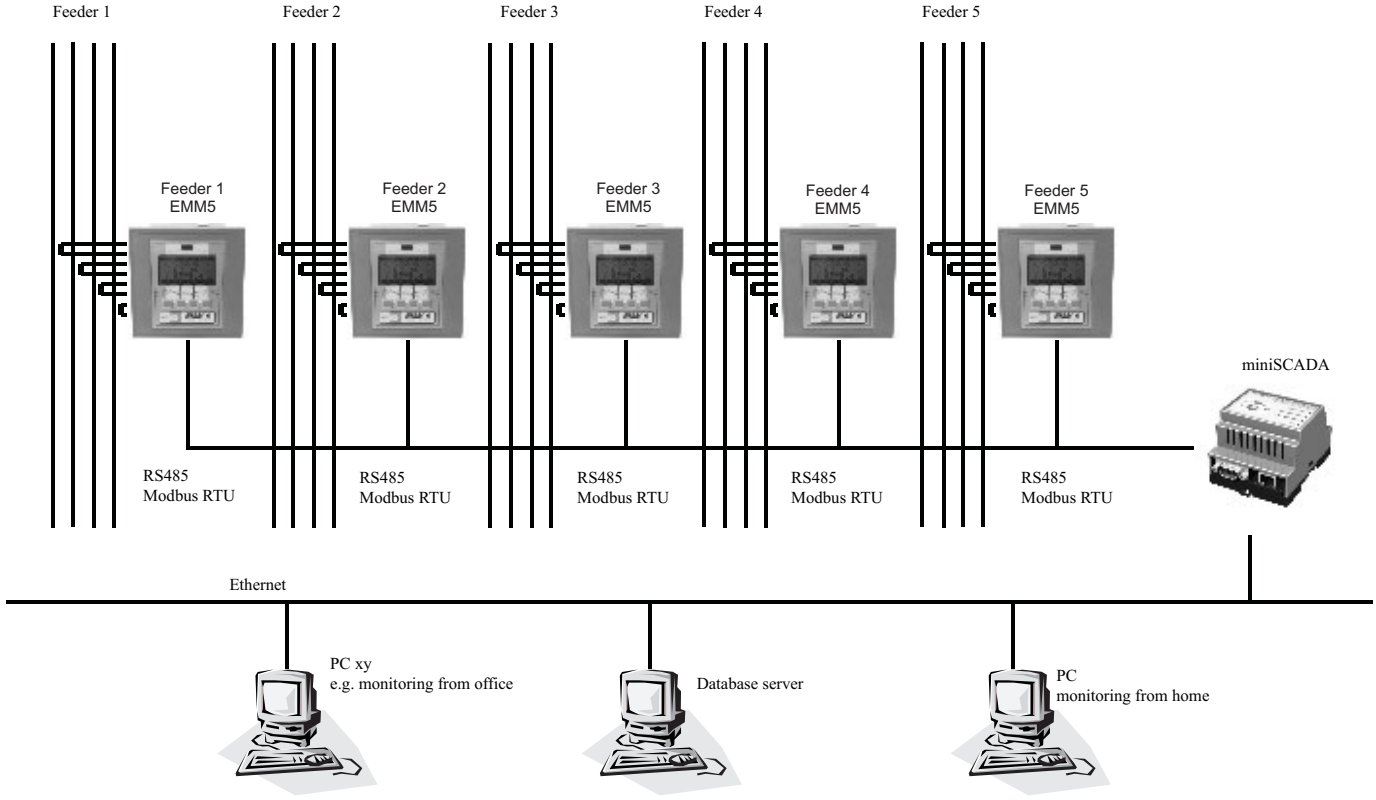
Nominal power	75kvar			100kvar			125kvar
Nominal voltage / V (+/-10%)	400	440	480	400	440	480	480
Nominal current / A	109	99	90	144	131	120	150
Switched phases	2, semi-controlled						
Dimensions H x W x D / mm	270 x 160 x 215						
Weight / kg	5,6						
Thermal losses / W	205	184	172	250	224	244	261
Cooling	AF, air forced (please specify fan voltage in P/O)						
Degree of protection	IP10						

Discharging of capacitors	Fast discharging reactors are not allowed to use! Please consider the high voltage level of capacitors when dimensioning of discharging resisitors!
Recovery time	typically after one periode
Supply voltage	taken directly from power connection (optional is separate supply available)
Consumption of supply	max. 9VA
Voltage level trigger signal	8 - 30V DC
Consumption trigger signal	2mA at 12V DC
Altitude	1000m above sealevel (above this, using with power derating is possible)
Ambient temperature	-10 °C - 45°C (at ambient temp. upto +65°C operation with power derating is possible)
Humidity	10% - 95% (without moisture condensation)

EMM5 - the power and energy monitoring and recording system

- 32 programable thresholds in EMM5
- Selection of 52 different measuring values
- Monitoring of exceeding and shortfall
- Delay of alarming and drop-off in the range of 0-600 sec
- Programmable announcement of alarm:
  2 C/O contacts (option -m)
  4 N/O contacts (option -a)
  Text message in LCD
- Event logging with date and time of alarm and drop and information about threshold and max. values (option -DM)
- Blocking of alarming in special situations (e.g. start of a motor) by signal at digital input (option -DM)
- Alarm conditons can be read out by interface RS485 Modbus (Option -MB, -DM)
- Recording of measuring values in programable intervals. Each interval is recorded with date, time, minimum, maximum and mean value of the measuring values. The data can be downloaded to pc by TTL-USB-Convertor and is saved in a csv-file, which can be used with all spread-sheets.

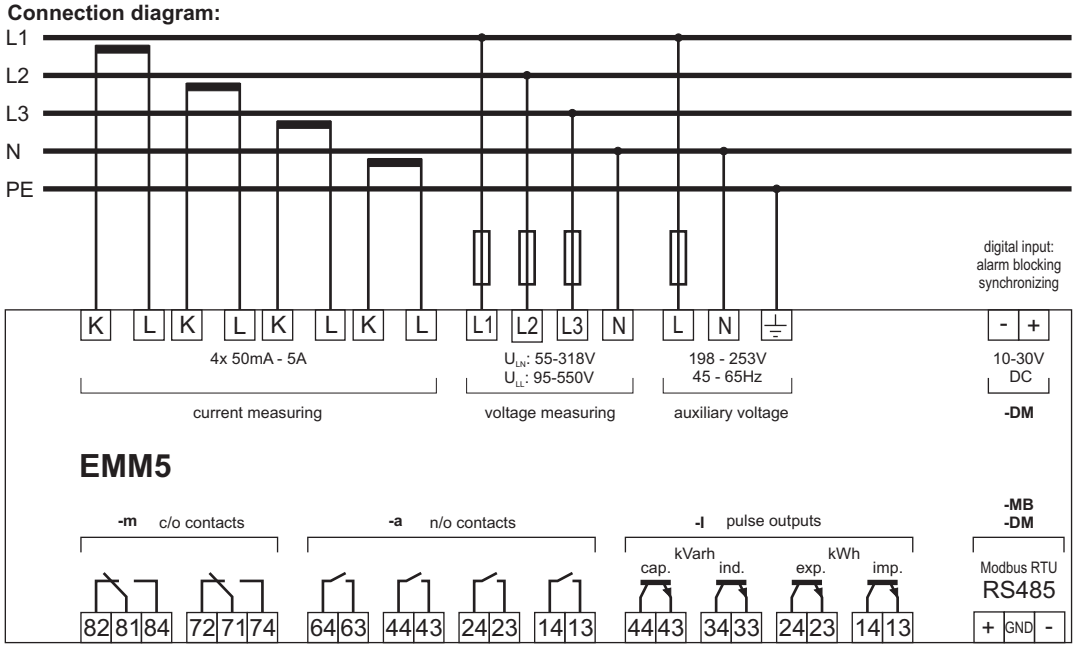
EMM5 and MiniSCADA - the network solution for power applications

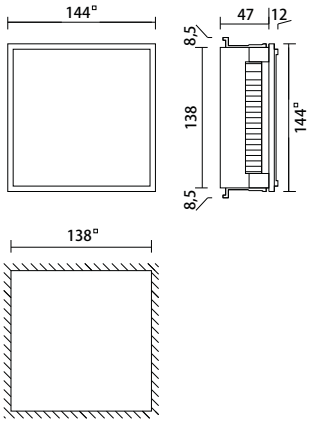


Features EMM5 - MiniSCADA:

- Simple installation
- Complet SCADA System in one device
- DIN-rail mounting of MiniSCADA
- Display and parametering is done by using a web-browser
- No software installation at pc
- Licence fee is included in hardware
- access also by internet
- MiniSCADA is working as Modbus Master
- internal webserver with upto 30 pages
- 64 programable Alarms in MiniSCADA
- Alarming by e-mail
- Alarming by SMS (MiniSCADA2 is necessary)
- Programable command structure for alarm messaging
- Data logging in MiniSCADA with data transmission by e-mail
- MiniSCADA2 is equipped with internal GPRS-modem
- Integration of BLR-CM, BLR-CM3phase and KSR is provided
- Integration of external devices offering a RS485 Modbus RTU slave interface is possible
- 1 MiniSCADA can connect upto 32 devices

Connection diagram:





Measuring Values (display / monitoring / recording)

U_{LN}:	55-318V	+/-0,5%
U_{LL}:	95-550V	+/-0,5%
I L1, L2, L3, N	0,05-5A	+/-0,5%
I_{th} L1, L2, L3, N	0,05-5A	+/-0,5%
I_F L1, L2, L3, N	0,05-5A	+/-0,5%
F:	45-65Hz	+/-0,1Hz
rotation field	right/left	
cosφ L1, L2, L3	c0,00 - i0,00	+/-0,01
Λ L1, L2, L3	0,00 - 1,00	+/-0,01
S L1, L2, L3, tot	0 - 35GVA	+/-0,5%
P L1, L2, L3, tot	0 - 35GW	+/-0,5%
Q L1, L2, L3, tot	0 - 35Gvar	+/-0,5%
THD U	0 - 100%	
THD I	0 - 100%	
Harm. U 2nd - 63rd	0 - 100%	
Harm. I 2nd - 63rd	0 - 100%	
Temperature:	5°C - 80°C	

Metering:

Tariff 1:

active work import	L1, L2, L3, total	0000000.00kWh - 4000000.00GWh
active work export	L1, L2, L3, total	0000000.00kWh - 4000000.00GWh
reactive work ind	L1, L2, L3, total	0000000.00kvarh - 4000000.00Gvarh
reactive work cap	L1, L2, L3, total	0000000.00kvarh - 4000000.00Gvarh

Tariff 2 (only option -DM):

active work import	L1, L2, L3, total	0000000.00kWh - 4000000.00GWh
active work export	L1, L2, L3, total	0000000.00kWh - 4000000.00GWh
reactive work ind	L1, L2, L3, total	0000000.00kvarh - 4000000.00Gvarh
reactive work cap	L1, L2, L3, total	0000000.00kvarh - 4000000.00Gvarh

Due to separate metering of all three phases plus total value, EMM5 provides 32 meters.
With option -DM every day the meters are saved, to get a history of the meters.
Tariff switch-over can be done either by an external signal at digital input or every day at a preset time.

Technische Daten:

Auxiliary voltage:	230V +/- 10%, 45-65Hz, 8VA, max. fuse 6A (also available 110V AC, 110V DC, further ratings on request)
Voltage measuring:	ULL: 95V - 550V, ULN: 55 - 318V, 45-65Hz, VT-ratio 1 - 4000
Current measuring:	50mA - 6A, 50A for 1 sec., burden < 1VA, ext. CT is required, CT-ratio 1 - 10000
Temperature measuring:	+5°C - 80°C, temperature sensor on rear
Switching outputs: (optional available)	-a: 4 n/o contacts, voltfree, 250V AC / 5A, 110V DC / 0,3A (induktiv) -m: 2 c/o contacts, voltfree, 250V AC / 5A, 110V DC / 0,3A (induktiv) -I: 4 pulse outputs, solid state, max. 250V DC / 0,1A
Interfaces:	standard: serial interface with TTL signals optional: RS485 Modbus RTU
Display:	graphical LCD 128x64 pixel with backlit, menues in cleartext
Operating:	membrane keyboard with 4 softkeys
Ambient temperature:	operation: -20°C...+70°C; storage: -30°C...+80°C
Humidity:	0% - 95%, without moisture condensation
Overvoltage category:	II, pollution degree 3 (DIN VDE 0110, Teil 1 / IEC 60664-1)
Standards:	DIN VDE 0110-1 (IEC 60664-1:1992 +A1:2000 +A2:2002) VDE 0411-1 (DIN EN 61010-1 / IEC 61010-1:2001) VDE 0843-20 (DIN EN 61326 / IEC 61326)
Approvals:	CE cULus PG
Connection:	plugable terminals, screw type, max. 4 sqmm rigid wire
Case:	front: instrument case, plastic (UL94-VO) rear: metal
Protection class:	front IP50 (IP54 by mounting with gasket), rear IP20
Weight:	approx. 650gr
Dimensions:	144x144x58mm, cutout 138(+0,5)x138(+0,5)mm

Available types:

EMM5	standard
EMM5 -m	2 c/o contacts
EMM5 -am	2 c/o contacts 4 n/o contacts
EMM5 -Im	2 c/o contacts 4 pulse outputs

Optional features:

-MB	RS485 Modbus RTU
-DM	RS485 Modbus RTU event logger measuring recorder real time clock digital input 2048 kB

Assesories:

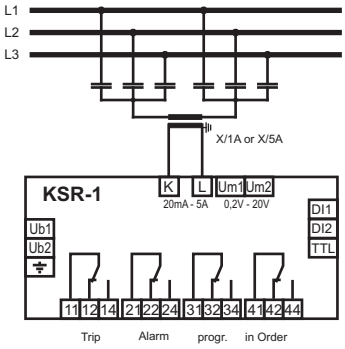
MiniSCADA	web-gateway RS485 Modbus ethernet alarming by e-mail webserver
MiniSCADA2	web-gateway RS485 Modbus ethernet alarming by e-mail alarming by SMS webserver internal GPRS modem
UMS9	TTL-USB converter

High and medium voltage capacitors taken into operation must be monitored all the time. Most of these capacitors are manufactured by using insulating oil for the dielectricum, which could catch fire in any case of fail. To avoid this, the capacitors must be monitored to detect failures. This monitoring can be done either by monitoring the unbalance current or unbalance voltage of capacitor groups.
However, this voltage / current may change in case of any failure of one capacitor, for instance caused by any flash over the inside winded folies.

Applications:

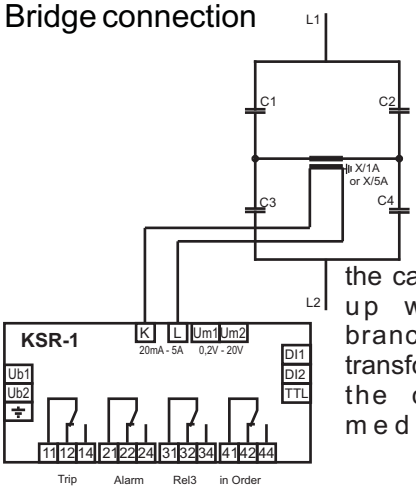
Monitoring Unbalance Current

Double-Star-Connection



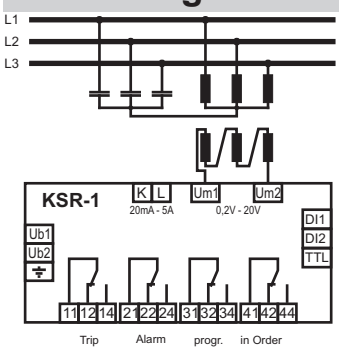
In double-star connection, the star points of two capacitor groups are connected together between each other. This conductor is provided with an own current transformer in order to observe any unbalance current between the two capacitors groups.

Bridge connection



In bridge connection, the capacitor bank is build up with four bridge branches. The current transformer is provided in the conductor at the medium potential.

Monitoring Unbalance Voltage



To monitor the capacitor bank via the voltage, the voltage of the capacitors of the three phases is connected to three two-pole insulated PT's, which are on secondary side connected in series. KSR1 is measuring the voltage at this open delta.

Features

- Compensation of the natural unbalance (current or voltage) of the capacitor bank
- Display of the actual unbalance current or unbalance voltage
- Self monitoring function with own alarmcontact
- Separatly adjustable thresholds and delay times for Alarm and Trip
- Drop-off-value for Alarm / Trip is adjustable
- Reset behavior for Alarm / Trip can be separately programmed (automatic or manual reset)
- With reset behavior “manual reset”, after a power interruption the switching outputs go back to the origin state and the appropriate indication appears in the display
- Adjustable Transformer ratio (Voltage / Current)
- Thresholds and Readings as current or voltage value or a % value related to the nominal input range of current or voltage channel
- Setup and operatormenu is separately password protected
- Storage of the last five trips and alarms with max. value during delay time
- One free programmable output relay (Rel. 3) can be used to operate when the Alarm/Trip or both Alarm+Trip have operated
- In alarm / trip situation the display flashes as visual indicator

Hardware

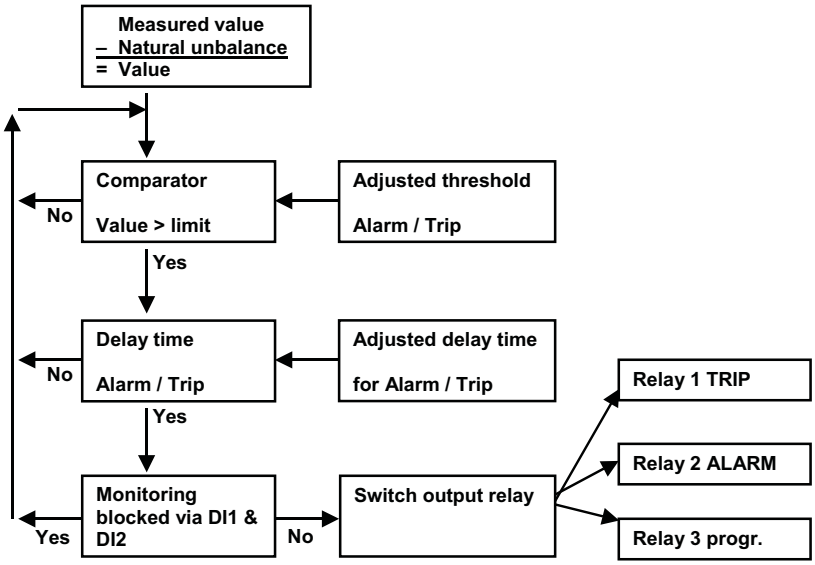
- Wide range power supply suitable for DC / AC voltage
- X/1or X/5; without conversion on the device
- Outputs are mechanical N/O and N/C contacts.
- Measurement signal is passed via low pass filter
- Digital Input to block alarm function
- LCD with backlight
- Sign of Life signal
- Capacitor-Protection-Relay in plastic case
- Rearside is made of metal

Optional features:

Interface RS485, Modbus RTU -MB
Programming via interface

Function

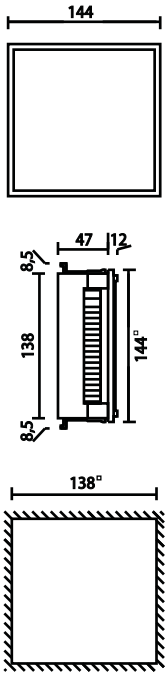
The KSR1 is designed to monitor medium and high voltage capacitors. The KSR1 can be set to monitor current or voltage, selectable from the menu. The device can monitor two threshold levels for Alarm / Trip. All thresholds / readings can be either a current or voltage value or a % setting of the maximum value. Once the Alarm or Trip level is reached the appropriate relay will operate, after the programmed delay time has elapsed. Both relays can be programmed to be held in the Alarm/Trip position until reset by the user if required, alternatively they can be set to automatically reset if the fault is cleared. A further relay can be used to operate when the Alarm/Trip or both Alarm+Trip have operated. The KSR1 can record details of the last 5 Alarm and Trip operations. An natural unbalance (out of balance or asymmetrical value) can be programmed into the device if required. This natural unbalance is subtracted from the measured value and allows a more exactly setting of the thresholds.



Technical Data

Supply voltage:	40 - 250V AC, 45-65HZ / 40 - 300VDC, 5VA; max fuse 6A
Measuring voltage:	0,2 – 20V; burden 284kOhm; vt-ratio from 1 – 350, with low pass filter Continuous overload: 120V; Short term overload: 500V for ten seconds Accuracy: 0.5% from upper range value
Current measuring:	20mA – 5A; burden 20mOhm; ct-ratio from 1-4000, with low pass filter Continuous overload: 25A; Short term overload: 100A for one second Accuracy: 0.5% from upper range value
Relay outputs:	Max. output rating AC: 1250VA, max switching voltage: 440VAC Max. output rating DC (ohmic): 30V / 5A; 60V / 1A; 110V / 0,5A; 220V / 0,3A
Digital input:	Blocking Alarm / Trip via digital input
Interface:	TTL, rear
Ambient temperature:	Operation: -20°C...+70°C, storage: -40°C...+85°C
Humidity:	0% - 95%, without moisture condensation
Overvoltage class:	II, pollution degree 3 (DIN VDE 0110, Teil 1 / IEC 60664-1)
Standards:	DIN VDE 0110 part 1 (IEC 60664-1:1992) VDE 0411 part 1 (DIN EN 61010-1 / IEC 61010-1:2001) VDE 0843 part 20 (DIN EN 61326 / IEC 61326: 1997+ A1:1998 +A2: 2000)
Conformity and listing:	CE
Terminals:	screw-type, max. 4mm2
Casing front:	instrument casing plastic (UL94-VO), rear: metal
Protection class Front:	IP50, (IP54 by using a gasket), Rear: Ip20
Weight:	approx. 0,65 kg

Dimensions:



Function

High voltage capacitors taken into operation must be supervised all the time. Most of these capacitors are manufactured by using insulating oil for the dielectricum, which could catch fire in any case of fail. In general high voltage capacitors will be assembled in so called “Double-Star-Technology”. This means, that two capacitors, e.g. 500 kvar, in star connection are connected in parallel to achieve 1.000 kvar in total. The star points are connected together between each other. This conductor is provided with an own current transformer in order to observe any balance current between the two capacitors. Due to tolerances there will flow a very small balance current. However, this balance current may increase roughly in case of any failure of one capacitor, for instance caused by any flash over inside the winded folies. Further fails may be caused by overvoltages and harmonics with great intensity in the grid and could overheat the capacitor. The Capacitor Protection Relay KSR is as designed as to supervise the balance current via the current transformer (c.t.), fitted on the conductor between the star points. If once the balance current increases a predetermined threshold level, due to any fail in the capacitors, the KSR disconnects the capacitor in order to protect it and triggers alarm. The KSR contents 3 channels for voltage - and 4 channels for current paths. This enables to observe all 3 line voltages with reference to over- or under-voltage and harmonics. The current paths are provided for supervising the 3 line currents and the balance current. If the 3 line current-paths are not in use, it is possible to observe further 3 capacitor banks. It is possible to parameterise up to 32 threshold leves inside the KSR. All of them may be provided with an additional delay time referring either to switch on or off a preselected alarm-relay. Criterions for trigger any relay may be decrease or increase of voltage tolerances in the grid, for instance. All alarm or control relays may be parameterised e.g. with inverting or self holding mode .

Protection Settings

Natural Unbalance compensation

Unbalance alarm / trip

Over-Current alarm / trip

Thermal over-load alarm / trip

Over-voltage alarm / trip

Under-voltage alarm / trip

Voltage asymmetry alarm / trip

Breaker fail protection alarm / trip

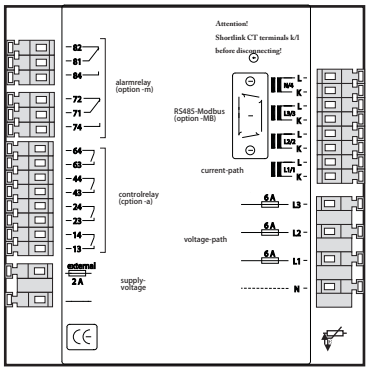
Earth fault alarm / trip

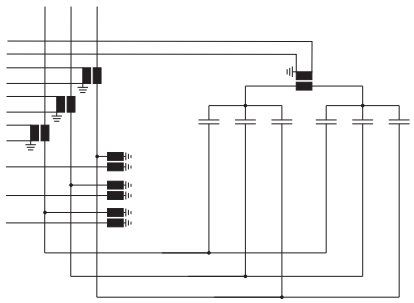
Self-monitoring

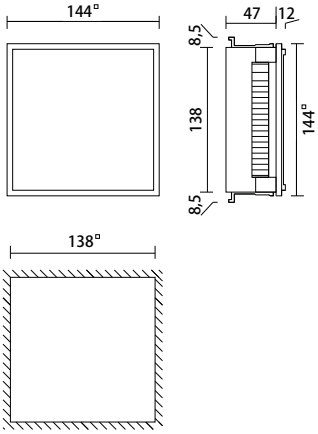
Description	Type
Capacitor Protecting Relay KSR, supply voltage 230V AC	KSR -am
Capacitor Protecting Relay KSR, supply voltage 115V DC	KSR -am
Options	
Galvanically isolated current paths max. load 200A / 1sec	- E
Interface RS485 protocol Modbus RTU	-MB
Fault recorder, Real-time Clock, programmable blocking of the alarm system via digital input, Interface RS485 protocol Modbus RTU	-DM
Accessories	
Transparent cover with lock IP54	- VT
Wall mounting bracket	3ZWC
Data cable TTL/USB	UMS9
Software to adjust device parameter	

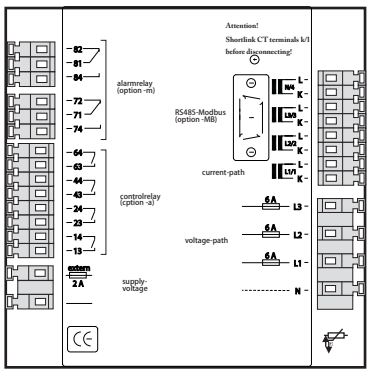
Technical Data

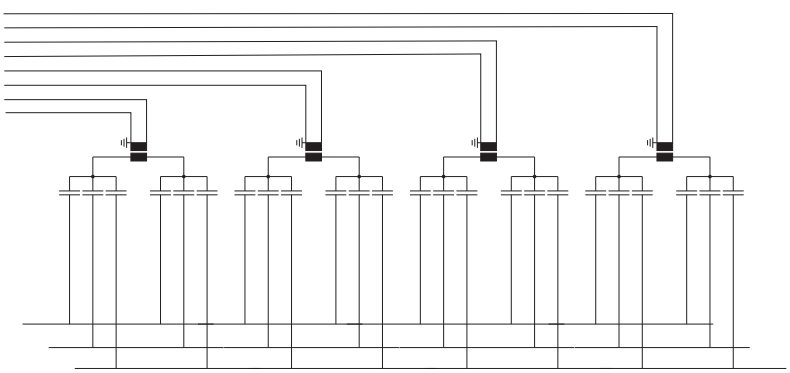
Supply voltage:	207 - 253V, 45-65 Hz, 8VA, max. fuse gL 6A differing voltages on request
Measuring voltage:	55/95V - 318/550V, 45-65Hz, VT-ratio 1 - 4000
Measuring current:	0-5A, minimum sensitivity 50 mA, burden 15 mOhm CT is required, CT-ratio 1-10000 Overload: 20% continuous
Relay outputs:	4 N/O, voltfree, max. fuse gL 6A 2 C/O, voltfree, max. fuse gL 6A Break: 250V AC / 5A, 30VDC / 5A (ohmic) 110V DC / 0,4A (ohmic), 110V DC / 0,3A (inductive)
Fan control:	Sensor in KSR Individual configuration of output-relays possible
Interface:	Standard: none; optional: diverse interfaces on request
Ambient temperature:	Operation: 0°C … +70°C; storage: -20°C … +85°C
Humidity:	0% - 95%, without moisture condensation
Overvoltage category:	II, pollution degree 3 (DIN VDE 0110, Teil 1 / IEC 60664-1)
Specifications:	DIN VDE 0110 Teil 1 (IEC 60664-1:1992) VDE 0411 Teil1 (DIN EN 61010-1 / IEC 61010-1:2001) VDE 0843 Teil 20 (DIN EN 61326 / IEC 61326:1997 +A1:1998 +A2:2000)
Conformity:	CE
Terminals:	Plug-terminals, screw-type, max. 2,5qmm
Housing:	Instument casing
Protection class:	Front: IP50, rear: IP20
Dimensions:	144 x 144 x 59 mm h x w x d, cut out $138^{+0,5}$ x $138^{+0,5}$ mm
Weight:	Ca. 650 gr











Function

High voltage capacitors taken into operation must be supervised all the time. Most of these capacitors are manufactured by using insulating oil for the dielectricum, which could catch fire in any case of fail. To avoid this,the capacitors are monitored for unbalances, to detect failures.

For this, the voltage of the capacitors of the three phases is connected to three two-pole insulated PTs, which are on secondary side connected in series. KSR-V is measuring and monitoring the voltage at this open delta. In case of an failure, this voltage increases and KSR-V can give a signal to switch off the capacitor. Further fails may be caused by overvoltages and harmonics with great intensity in the grid and could overheat the capacitor. The KSR-V contents 3 channels for mains-voltage. This enables to observe all 3 line voltages with reference to over- or under-voltage and harmonics.

It is possible to parameterise up to 32 threshold leves inside the KSR-V. All of them may be provided with an additional delay time referring either to switch on or off a preselected alarm-relay. Criterions for trigger any relay may be decrease or increase of voltage tolerances in the grid, for instance. All alarm or control relays may be parameterised e.g. with inverting or self holding mode.

Supervised measurements

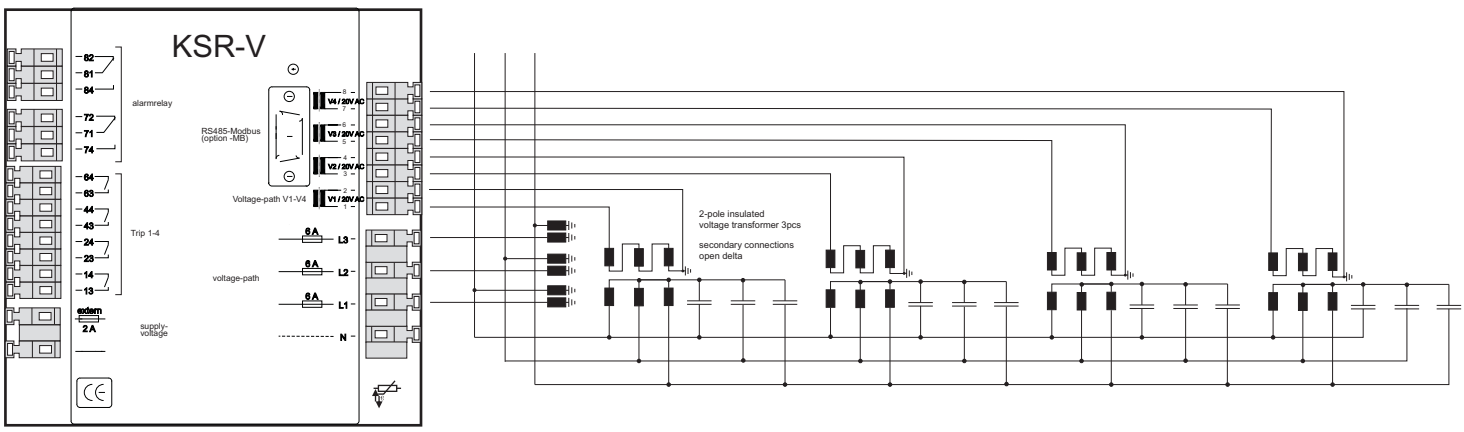
Voltage (RMS)
Overvoltage damages capacitors
Undervoltage causes switching off the capacitors

Voltage (THD)
Harmonics overload capacitors

Voltage (out-of-balance detection)
failure of capacitor
measuring at open delta

Technical Data

Supply voltage:	207 - 253V, 45-65 Hz, 8VA, max. fuse gL 6A
	differing voltages on request
Measuring voltage:	55/95V - 318/550V, 45-65Hz, VT-ratio 1 - 4000
Voltagemeasuring for out-of-balance detection:	0-20V, minimum sensitivity 0.5V, max. 60V continuous
Relay outputs:	4 N/O, voltfree, max. fuse gL 6A
	2 C/O, voltfree, max. fuse gL 6A
	Break: 250V AC / 5A, 30VDC / 5A (ohmic) 110V DC / 0,4A (ohmic), 110V DC / 0,3A (inductive)
Fan control:	Sensor in KSR
	Individual configuration of output-relays possible
Interface:	Standard: none; optional: RS485 Modbus RTU
Ambient temperature:	Operation: 0°C … +70°C; storage: -20°C … +85°C
Humidity:	0% - 95%, without moisture condensation
Overvoltage category:	II, pollution degree 3 (DIN VDE 0110, Teil 1 / IEC 60664-1)
Specifications:	DIN VDE 0110 Teil 1 (IEC 60664-1:1992)
	VDE 0411 Teil1 (DIN EN 61010-1 / IEC 61010-1:2001)
	VDE 0843 Teil 20 (DIN EN 61326 / IEC 61326:1997 +A1:1998 +A2:2000)
Conformity:	CE
Terminals:	Plug-terminals, screw-type, max. 2,5qmm
Housing:	Instument casing
Protection class:	Front: IP50, rear: IP20
Dimensions:	144 x 144 x 59 mm h x w x d, cut out $138^{+0,5}$ x $138^{+0,5}$ mm
Weight:	Ca. 650 gr



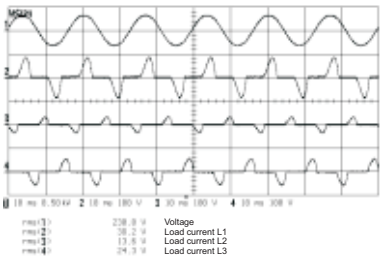
A reliable electric power supply is in companies the basic requirement for all operational sequences. Many electrical devices are polluting electrical grid by non-linear load current. Effect is, that electrical devices are disturbing each other and correct function is not possible. Also load in electrical grid is much more as necessary. In extreme situations, this can cause shortage in electrical power-supply. An indication for such situation are harmonics, unbalanced load, neutral current and bad power-factor.
Function of active filter BEL-AF is improvement of voltage quality by filtering the current. BEL-AF is compensationg harmonics upto 51st order, balancing phase current and improvement of power-factor. By this neutral current will be reduced.

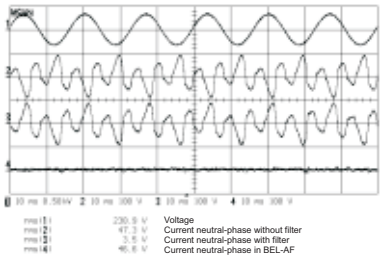
EXAMPLE OF FUNCTION

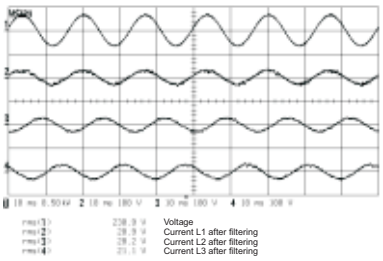
Unbalanced load current with high harmonic content can be the reason that required quality of mains-voltage cannot be met. Examples for electrical load which creates these problems are power supplies of electronic devices, inverter and energy saving lamps.

Current of harmonics divisible by three and unbalanced current create neutral current. This is often larger than phase current.
BEL-AF is compensating harmonic current and unbalanced load. By this way neutral current is reduced.

Filtering of current by BEL-AF causes symmetrical sinusoidal phase current. Condition for this is, that BEL-AF is sized with sufficient capacity. With enough power reserve real-time compensation of phase-shift is also possible.

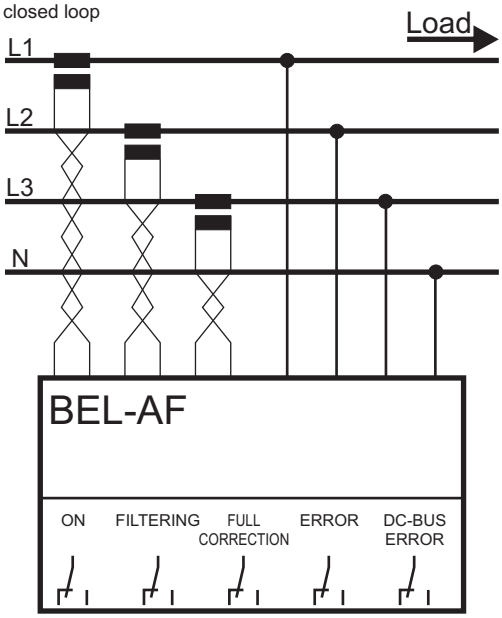




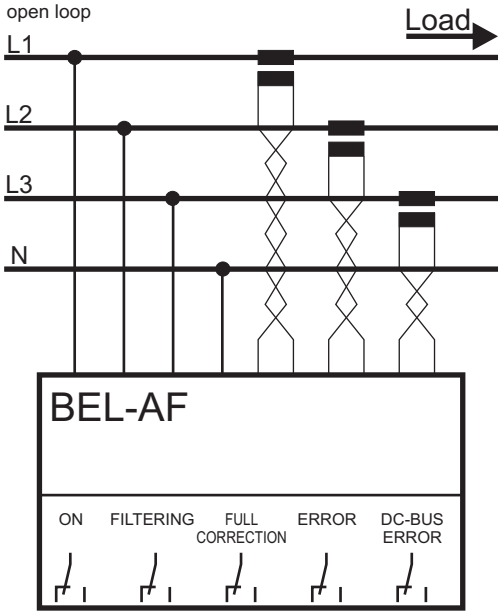


CONNECTION DIAGRAM

closed loop



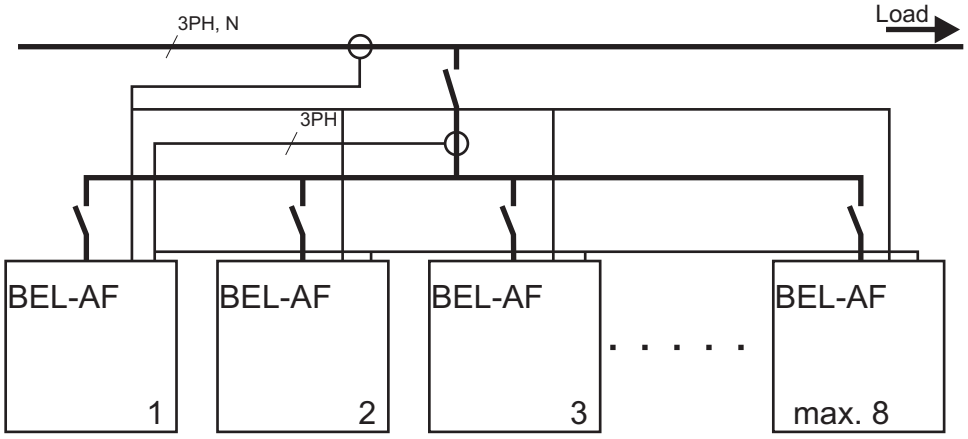
open loop



TECHNICAL DATA

		BEL-AFW435@400C	BEL-AFW460@400C	BEL-AFW490@400C	BEL-AFW4120@400C
Compensation current	3 phase / 3 wires	35A	60A	90A	120A
	3 phase / 4 wires	35A / 105A	60A / 180A	90A / 270A	120A / 360A
Current limit		at full correction			
Inrush current		less than rated current			
Compensated harmonic orders		2nd to 51st order			
Response time		< 20ms			
Power factor correction		ind. 0,70 - cap. 0,70			
Input voltage		400V +15% -20%			
Frequency		47 - 63 Hz			
Current transformer	standard	100A:1A - 10000A:1A			
	optional	100A:5A - 10000A:5A			
CT location	source side	close loop control			
	load side	open loop control			
Max. heat losses		< 700W	< 1350W	< 2000W	< 2650W
Cooling		AF, air forced			
Altitude		< 1000m above sea-level			
Ambient temperature	Operation	0°C...+ 40°C			
	Storage	-20°C...+ 70°C			
Display		LCD			
Status indication		4 LED - POWER ON, FILTERING, FULL CORRECTION, ERROR			
Handling		2 keys: ON/OFF, RESET; 6 keys: menue			
Indication in LCD	meter	paramter, wave form and spectrum			
	event log	upto 300 records (FIFO)			
	configuration	all necessary settings and modes			
	language setting	upto 10 different languages			
Interfaces	standard	RS232 / USB			
	optional	RS485 / RS422 / Ethernet			
I/O s	standard	5 output dry contacts			
	standard	1 input dry contact			
	standard	1 EPO			

PARALLEL OPERATION



Current inputs of the filters are connected in series!

NOTES

…cutting-edge technology backed with specialized expertise, ensure PTL BELUK products are the preferred choice with leading systems integrators!

Process Technique Electronics Pvt. Limited (PTL) is an Organization that has over 3 decades of specialized experience in the field of electrical energy conservation and reactive power management. Set up in 1981, in technical association with a British Company, PTL was one of the only Companies that is approved by the Govt. of India to manufacture a wide range of electronic power factor control relay systems.

These installations are in operation in varied applications like, petro chemicals, automobile plants, wind generation mills, commercial buildings, cement plants, iron & steel mills, and software development centers, PTL has gained enormous expertise in providing accurate and reliable solutions in automatic PF control and energy management.

Process Technique, has high quality technical trained manpower for its production facility, development and integrated quality control systems. The Company, today, has a nation-wide presence with reseller and authorized representation network in all major cities and towns covering and supporting all its clients closely.

There are newer products being introduced for 'real time power factor control' along with static switching of power capacitors, to meet the growing demand for these applications.

At PTL, it is a continued march towards our goal of providing the latest in automatic reactive power compensation technology and quality services to support its client base Country-wide.

Its vision is to provide variety of customized solutions to installations that require special engineering and design skills, with quality products. The Company strives to live up to its slogan ... ***making energy matter,*** this has been the case for over 30,000 of our clients, who have saved with better and reliable power factor management for their operations, with our products.

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BELUK

Since 1956

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Process Technique Electronics Pvt. Ltd.,

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Process Technique Electronics,

in the products you buy, which represent authentic & exclusive range of
BELUK products manufactured in INDIA

Power Factor & Power Quality Products

Managing Director
BELUK Gmbh
Schongau, Germany

March 2007