



# PQC

Power Quality Components

Components for  
Power Factor Correction  
Application

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## Filter reactors DIN VDE 0550/0532 for general applications

### Application

Harmonics generated by non-linear loads such as variable speed drives or other static power conversion equipment have grown rapidly in recent years. Harmonic currents and the voltage distortion, created by these currents have devastating effects on power supply and distribution systems and its connected loads.

This can result in failure of power factor correction capacitors due to overloading, system resonance, overheating of cables and transformers as well as misoperation of PLC's, computer and other sensitive appliances.

A present method to treat harmonic problems is the use of filter reactors combined with power capacitors in detuned and tuned filters.

As well as the improvement of the power factor and the power quality, harmonics are also absorbed from the networks. Furthermore, a critical amplification of the current harmonics caused by a parallel resonance between the power capacitors and the inductances of the power supply system can be avoided.

### Design

Hydra filter reactors are designed as three-phase reactors with an iron core and air gap.

For small filter reactors the winding material is Cu-wire, whereas for bigger filter reactors, an aluminium band is used as winding material.

The filter reactors are completely impregnated under vacuum and over pressure in an impregnating resin of class H and then hardened in a furnace.

### Dimensioning

The dimensioning of the filter reactors is based on the recommendation for allowable limits of voltage harmonics in public and industrial networks according to IEC 1000-2-4.

In the case of higher harmonic loads in networks, special designed filter reactors have to be used. The actual loads can be detected by means of a harmonic analysis. The measured values form the basis for the dimensioning of the filter reactors.

### Losses

The 50 Hz losses are comparatively low but when the filter reactors are installed into the cabinets, they are charged with additional currents, predominately those of the 5th, 7th and 11th harmonics. Then the total heat losses dissipated can be of a level whereby they have to be extracted from the cabinets, e.g. by means of fans.

### Noise level

Filter reactors are nearly silent when operated at 50 Hz or 60 Hz loads. At rated operation with harmonic currents according to the table, the noise level can reach  $\leq 60$  dB measured at a distance of 1 m.

The filter reactors should be installed in an upright position and the assembly arranged in such a way that no vibration will be transferred to other parts of the equipment.

### Terminals

The terminals for filter reactors are either designed as cable terminals ( $d = 8,5$  mm) or copper bus bar terminals,  $20 \times 3$  mm ( $d = 9$  mm) according to DIN 46206.

**DIN VDE 0550/0532 for general applications  
Technical Specification**

**Rated voltage**

See selection list

**Rated output**

See selection list

**Max. allowable operating current**

See selection list

**Max. allowable harmonic voltage**

See selection list

**Linear range**

$L(1,2 \Sigma I) \geq 0,95 LN$

**Adjustment accuracy**

-2% ... +3% from LN

**Insulation level**

$UN \leq 1100 V$ ; 3/- kV (Line-to-line voltage)

**Loss**

See selection list

**Temperature limits**

+35°C annual average

Insulation class T40/H – Filter reactors with Al-winding

Insulation class T40/F – Filter reactors with Cu-winding

**Cooling method**

Natural cooling (AN)

**Installation**

Indoor

**Protection degree**

IP 00

**Operating altitude**

1000 m above sea level at rated operation

Order No. h	50 Hz Mains	60 Hz Mains	Class 1 (%) Public mains	Class 2 (%) Industrial mains
5.	250	300	3	6
7.	350	420	3	5
11.	550	660	3	3,5
13.	650	780	3	3
17.	850	1020	2	2
19.	950	1140	1,5	1,5
23.	1150	1380	1,5	1,5
> 25.	1250	1500	0,2	0,2

**Design specification**

According to IEC 1000-2-4 the following recommended values for voltage harmonics in % related to the agreed operating voltage are valid in low voltage power supply systems. If not stated otherwise the design will be suitable for class 2 industrial mains.

**Note**

When placing an order, the inductance, the rated voltage, as well as the respective harmonic current values and frequencies have to be specified. On request the filter circuit reactors can be delivered or retrofit optionally either with a temperature sensor (PTC resistor) or a thermal switch.

Filter reactors for other mains voltages and mains frequencies are available upon request!

**Selection table:**  
**Filter reactors for mains 400 V, 50 Hz**

Power kvar	Reactor	L (mH) 3x ...	Winding Al/Cu	Weight kg	Losses		max. oper. current			Capacitor type
					50 Hz	r. m. s.	50 Hz	250 Hz	350 Hz	
<b>Detuned to p=5,67%</b>										
5	DFR6-5,97/8/5/1	5,97	Cu	7	40	70	8	5	1	PRB DPM 5,8/440
6,25	DFR7-4,99/10/6/2	4,99	Cu	10	40	80	10	6	2	PRB DPM 7/440
11	DFR7-2,8/17/11/3	2,8	Cu	11	50	110	17	11	3	PRB DPM 12,5/440
12,5	DFR8-2,49/20/12/3	2,49	Cu	13	80	130	20	12	3	PRB DPM 14/440
22	DFR9-1,39/34/18/6	1,39	Al	18	90	170	34	18	6	PRB DPM 25/440
24	DFR9-1,26/37/20/7	1,26	Al	18	90	170	37	20	7	PRB DPM 28/440
30	DFR11-1,05/46/29/8	1,05	Al	26	110	240	46	29	8	2 x PRB DPM 16,7/440
33,3	DFR11-0,93/52/32/9	0,93	Al	27	120	240	52	32	9	PRB DPM 12,5/440 + PRB DPM 25/440
50	DFR12-0,63/77/48/13	0,63	Al	35	130	290	77	48	13	2 x PRB DPM 28/440
60	DFR13-0,51/95/58/16	0,51	Al	39	170	350	95	58	16	2 x PRB DPM 20/440 + PRB DPM 28/440
66,7	DFR15-0,47/104/64/18	0,47	Al	45	170	360	104	64	18	3 x PRB DPM 25/440
75	DFR16-0,42/117/72/20	0,42	Al	50	170	380	117	72	20	3 x PRB DPM 28/440
<b>Detuned to p=7%</b>										
5	DFR6-7,38/8/3/1	7,38	Cu	7	50	60	8	3	1	PRB DPM 5,8/440
6,25	DFR7-6,16/10/3/1	6,16	Cu	10	50	60	10	3	1	PRB DPM 7/440
11	DFR7-3,45/18/6/2	3,45	Cu	11	70	90	18	6	2	PRB DPM 12,5/440
12,5	DFR8-3,07/20/7/2	3,07	Cu	13	80	110	20	7	2	PRB DPM 14/440
22	DFR9-1,71/36/12/4	1,71	Al	18	120	160	36	12	4	PRB DPM 25/440
25	DFR9-1,56/39/13/5	1,56	Al	18	120	160	39	13	5	PRB DPM 28/440
30	DFR10-1,29/47/16/6	1,29	Al	19	150	200	47	16	6	2 x PRB DPM 16,7/440
33,3	DFR11-1,15/53/18/6	1,15	Al	26	140	200	53	18	6	PRB DPM 12,5/440 + PRB DPM 25/440
50	DFR11-0,78/75/26/10	0,78	Al	28	180	250	75	26	10	2 x PRB DPM 28/440
60	DFR12-0,63/96/32/12	0,63	Al	34	200	280	96	32	12	2 x PRB DPM 20/440 + PRB DPM 28/440
66,7	DFR13-0,57/106/36/13	0,57	Al	37	220	310	106	36	13	3 x PRB DPM 25/440
75	DFR13-0,52/117/40/14	0,52	Al	41	220	310	117	40	14	3 x PRB DPM 28/440
<b>Detuned to p=12,5%</b>										
8,33	DFR7-9,17/13/1/1	9,17	Cu	11	80	85	13	1	1	PRB DPM 10,5/480
12,5	DFR8-6,17/19/2/1	6,17	Cu	14	110	120	19	2	1	PRB DPM 15/480
16,7	DFR9-4,58/25/3/1	4,58	Cu	20	130	140	25	3	1	PRB DPM 20/480
25	DFR1-3,08/38/4/2	3,08	Al	26	170	180	38	4	2	PRB DPM 30/480
33,3	DFR1-2,29/50/6/3	2,29	Al	27	220	230	50	6	3	2 x PRB DPM 20/480
50	DFR13-1,54/75/8/4	1,54	Al	39	230	250	75	8	4	2 x PRB DPM 30/480
60	DFR15-1,22/95/11/5	1,22	Al	44	310	340	95	11	5	3 x PRB DPM 25/480
75	DFR16-1,02/109/11/6	1,02	Al	49	340	360	109	11	6	3 x PRB DPM 30/480
<b>Detuned to p=14%</b>										
8,33	DFR8-10,27/13/1/1	10,27	Cu	13	90	95	13	1	1	PRB DPM 10,5/480
12,5	DFR8-6,9/19/2/1	6,9	Cu	15	130	140	19	2	1	PRB DPM 15/480
16,7	DFR9-5,13/26/2/1	5,13	Cu	20	140	150	26	2	1	PRB DPM 20/480
25	DFR11-3,46/38/4/2	3,46	Al	27	180	190	38	4	2	PRB DPM 30/480
33,3	DFR12-2,57/51/5/2	2,57	Al	33	240	250	51	5	2	2 x PRB DPM 20/480
50	DFR15-1,73/76/7/4	1,73	Al	44	250	270	76	7	4	2 x PRB DPM 30/480
60	DFR16-1,37/96/9/4	1,37	Al	49	350	370	96	9	4	3 x PRB DPM 25/480
66,7	DFR16-1,28/103/10/5	1,28	Al	50	370	380	103	10	5	2 x PRB DPM 30/480 + PRB DPM 20/480

**Selection table:  
Filter Reactors for mains 525V, 50Hz**

Power kvar	Reactor	L (mH) 3x ...	Winding Al/Cu	Weight kg	Losses (Watt)		max. oper. current			Capacitor type
					50 Hz	r. m. s.	50 Hz	250 Hz	350 Hz	
<b>Detuned to p=5,67%</b>										
13	DFR8-4,0/16/10/3	4	Cu	14	60	120	16	10	3	PRB DPM 15/580
26	DFR9-2,0/31/16/5	2	Al	18	100	190	31	16	5	PRB DPM 30/580
39	DFR11-1,33/48/30/8	1,33	Al	28	130	270	48	30	8	PRB DPM 30/580 + PRB DPM 15/580
52	DFR13-1,0/64/39/11	1	Al	38	140	320	64	39	11	2 x PRB DPM 30/580
<b>Detuned to p=7%</b>										
13,5	DFR7-4,92/16/5/2	4,92	Cu	11	80	100	16	5	2	PRB DPM 15/580
27	DFR9-2,45/31/9/4	2,45	Al	18	110	150	31	9	4	PRB DPM 30/580
40	DFR11-1,63/49/17/6	1,63	Al	27	160	230	49	17	6	PRB DPM 30/580 + PRB DPM 15/580
54	DFR12-1,23/65/22/8	1,23	Al	34	180	260	65	22	8	2 x PRB DPM 30/580
<b>Detuned to p=12,5%</b>										
12,5	DFR8-10,7/14/2/1	10,7	Cu	14	120	130	14	2	1	PRB DPM 18,5/690
25	DFR11-5,35/28/3/2	5,35	Al	27	150	160	28	3	2	PRB DPM 12,5/690 + PRB DPM 25/690
37,5	DFR11-3,5/42/4/2	3,5	Al	28	230	240	42	4	2	3 x PRB DPM 18,5/690
50	DFR13-2,65/57/6/3	2,65	Al	37	280	300	57	6	3	3 x PRB DPM 25/690
<b>Detuned to p=14%</b>										
12,5	DFR9-11,41/15/1/1	11,41	Cu	19	120	130	15	1	1	PRB DPM 18,5/690
25	DFR11-5,66/31/3/1	5,66	Cu	30	190	200	31	3	1	PRB DPM 12,5/690 + PRB DPM 25/690
37,5	DFR14-3,78/46/4/2	3,78	Al	39	250	260	46	4	2	3 x PRB DPM 18,5/690
50	DFR15-2,83/61/6/3	2,83	Al	45	300	310	61	6	3	3 x PRB DPM 25/690

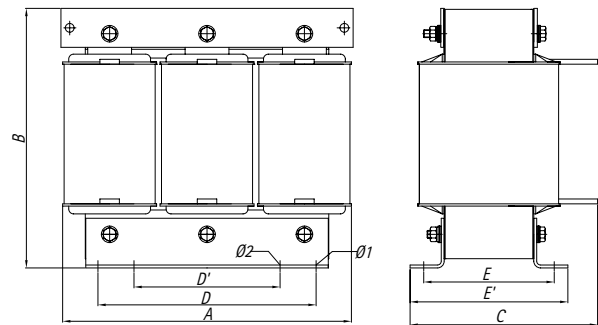
Dimensions

Filter reactor with aluminum windings (Al)

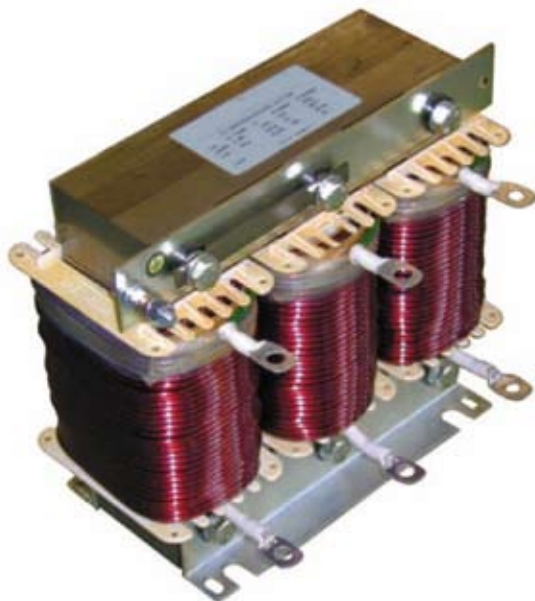


Type	A	B	C	D	D'	E	E*	Ø 1	Ø 2
DFR9 ...	230	205	135	176	150	95	114	7	11
DFR10 ...	260	235	125	200	150	76	106	10	11
DFR11 ...	260	235	150	200	150	102	132	10	11
DFR12 ...	300	235	165	224	150	119	147	10	11
DFR13 ...	300	265	165	224	150	119	147	10	11
DFR14 ...	300	235	180	224	150	134	162	10	11
DFR15 ...	300	265	180	224	150	134	162	10	11
DFR16 ...	300	265	295	224	150	147	175	10	11

All dimensions in mm!

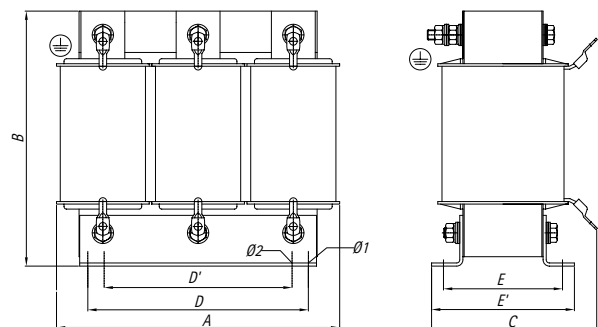


Filter reactor with copper windings (Cu)



Type	A	B	C	D	D'	E	E*	Ø 1	Ø 2
DFR6 ...	180	160	105	136	100	57	76	7	9
DFR7 ...	180	160	125	136	100	77	96	7	9
DFR8 ...	230	205	115	176	150	68	90	7	11
DFR9 ...	230	205	140	176	150	95	114	7	11
DFR11 ...	260	235	150	200	150	102	132	10	11

All dimensions in mm!



## Power Factor Controller BLR-CX Edition2



Reactive power compensation panels are used to reduce load in the electrical grid and to save costs. This is the reason, that there are special requirements for the control units of these compensation panels, the reactive power regulator.

The most important task for the reactive power regulator is to control the reliable termination of reactive power. This is reducing the costs for electrical energy. Cables, transformers, switch components and power distribution are unloaded by reduce reactive power.

Another task of the reactive power regulator is monitoring the compensation panel and giving alarms.

All of these requirements are solved by reactive power regulators with their patented regulation principle. By continuous measuring of the capacitor power, the steps are always used with their exact capacitor ratings. The regulation program is only defined by the

choice of the capacitor sizes. There are no limitations and no settings for step sequence are necessary at BLR-CX. If BLR-CX cannot recognize anymore the function of a step e.g. caused by damaged capacitors, contactors or blown fuses, then it shows alarm. The integrated alarm relay with sign-of-life contact can forward this also to a control room.

Microprocessor controlled power factor controller with 1-phase measurement system

- 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, combifilter. progressive
- Capable for 4-quadrant operation
- 1-phase measurement system also suitable for non sinusoidal currents and voltages
- Supply voltage is taken from voltage measurement
- Voltage measuring 90 - 550V, 45 ~ 651 lz
- CurTenI measuring 15mA – 5A, suitable for CT x/1A and x/5A
- Connection with pluggable screw terminals
- LCD display with backlight
- Display all important grid and system parameter
- Display harmonics from 3. – 19. 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
- Alarm relay (volt-free n/o contact, closed under normal condition)
- TTL-interface on rear
- Instrument casing 144x144 mm for cutout 138x138 mm, depth 49 mm
- Protection class IP20 (casing), IP50 (front)

Description	Type
Power Factor Controller BLR-CX 4 relay outputs	CX 04R
Power Factor Controller BLR -CX 6 relay outputs	CX 06R
Power Factor Controller BLR-CX 8 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 6 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



## Power Factor Controller BLR-CM-R



Microprocessor controlled power factor controller 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, FQ, F, T
- Harmonics measurement for voltage and current up to the 31. 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)

Description	Type
Power Factor Controller BLR-CM with 6 relay outputs	CM 06R
Power Factor Controller BLR-CM with 12 relay outputs	CM 12R

Options	
Interface RS485 protocol Modbus RTU	–MB
Version for HV and MV Capacitor banks	–HV
<b>Data storage, Real time clock, 2. digital input + Interface RS485 protocol Modbus RTU</b>	–DM

Accessories	
Data cable TTL/USB	UMS9
Transparent cover with lock IP54	–VT
Wall mounting bracket	3ZWC

## Power Factor Controller BLR-CM 3-phase



Microprocessor controlled power factor controller 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 3-phase value. Thereby 1-phase 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,  $\Delta Q$ , F, T
- Harmonics measurement for voltage and current up to the 31. 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
- 3 dimensional 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, 45–65 Hz, other voltages on request
- Voltage measuring 50–530V, 45–65 Hz
- Current measuring 3 x 15 mA–5 A, suitable for CT x/1 A and x/5 A
- Connection with pluggable screw terminals
- Instrument casing for cutout 144x144 mm, depth 49 mm
- Protection class IP20 (casing), IP50 (front)

Description	Type
Power Factor Controller BLR-CM 3-phase with 6 relay outputs	CM 06R –3A
Power Factor Controller BLR-CM 3-phase with 12 relay outputs	CM 12R –3A
Power Factor Controller BLR-CM 3-phase with 6 transistor outputs	CM 06T –3A
Power Factor Controller BLR-CM 3-phase with 12 transistor outputs	CM 12T –3A
Power Factor Controller BLR-CM 3-phase with 6 relay and 6 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

## Power Factor Controller BLR-CM-T/RT for dynamic Power Factor Control



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

- Uses additional to the normal regulation algorithm an second “fast” algorithm
- For every static output the step type can be chosen between “normal” or “fast”
- Fast Steps
- Response time <1 ms after one period measuring
- To get an optimal compensation result in systems with rapid load changes the controller switches all needed steps by one switch cycle
- The normal step size is free adjustable for every step (connection of different capacitor step sizes possible)
- Normal Steps
- Automatic Stepsize detection and supervision of the connected capacitor steps
- 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 31. 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 115/230 V, 45–65 Hz, other voltages on request
- Voltage measuring 50–530 V, 45–65 Hz
- Current measuring 15 mA–5 A, suitable for CT x/1A and x/5 A
- Connection with pluggable screw terminals
- Instrument casing for cutout 144 x 144 mm, depth 49 mm
- Protection class IP20 (casing), IP50 (front)

Description	Type
Power Factor Controller BLR-CM with 6 transistor outputs	CM 06T
Power Factor Controller BLR-CM with 12 transistor outputs	CM 12T
Power Factor Controller BLR-CM with 6 relay and 6 transistor outputs	CM 12RT

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

## Power Analyzer EMM-5



Multi-function power analyzer for acquisition and analysis of all parameters in 3-phase grids

- 3-phase measurement with 3- or 4-wire connection
- Operation and parameter input with 4 keys
- User guidance with plain text menu
- Measurement data displayed on large LCD display with backlight
- Harmonics measurement up to the 63. harmonic for voltage and current
- Connected to voltage transformers also suitable for higher voltages
- Integration in networks possible via interface RS485 Modbus RTU (optional)
- Flexible alarm system enables supervision of up to 32 measurement values
- Output relays (optional) can be programmed for external alarms
- Supply voltage 230 V, 45–65 Hz, other voltages on request
- Voltage measuring 50–530 V, 45–65 Hz
- Current measurement 50 mA–5 A, suitable for CT x/1 A and x/5 A
- Connection with pluggable screw terminals
- Instrument casing for cutout 144 x 144 mm, depth 49 mm
- Protection class IP20 (casing), IP50 (front)

Description	Type
Power Analyzer Emm-5	EMM-5
Power Analyzer Emm-5 with 2 programmable signalling contacts (2 c/o, voltfree)	EMM-5 -m
Power Analyzer Emm-5 with 6 programmable signalling contacts (2 c/o and 4 n/o, voltfree)	EMM-5 -am
Power Analyzer Emm-5 with 4 impulse outputs for active and reactive work and 2 programmable signalling contacts (2 c/o, voltfree)	EMM-5 -lm

Options	
Galvanically isolated current paths max. load 200 A/1 sec	–E
Interface RS485 protocol Modbus RTU	–MB
Data-logger, real-time clock, RS485 Modbus RTU	–DM

Accessories	
Transparent cover with lock IP54	–VT
Wall mounting bracket	3ZWC

## Voltage Control Relay VxR



Multi-function device for voltage supervision of 3-phase systems

- User guidance with plain text menu
- Measurement data displayed on large LCD display with backlight
- Harmonics measurement up to the 63. harmonic for voltage
- Connected to voltage transformers also suitable for higher voltages
- Integration in networks possible via interface RS485 Modbus RTU (optional)
- Flexible alarm system enables supervision of up to 32 measurement values
- Supply voltage 230 V, 45–65 Hz, other voltages on request
- Voltage measuring 50–530 V, 45–65 Hz
- Connection with pluggable screw terminals
- Instrument casing for cutout 144 x 144 mm, depth 49 mm
- Protection class IP20 (casing), IP50 (front)

Description	Type
Voltage Control Relay VCR, 1-phase	VCR
Voltage Control Relay VSR, 3-phase	VSR

Options	
Interface RS485 protocol Modbus RTU	–MB

Accessories	
Transparent cover with lock IP54	–VT
Wall mounting bracket	3ZWC

## Web Gateway miniSCADA



Configurable web gateway with integrated web server for direct Ethernet connection of devices with Modbus RTU interface

- Monitor and control Modbus devices with standard web browser
- Configuration and design of web interface without special tools or HTML editors
- Send alarm messages via e-mail or SMS (external modem necessary)
- Data logging of selectable data points
- Can also be used as gateway for protocol Modbus RTU/TCP
- Supply voltage 9–32 V AC/DC
- Casing plastic grey 90 x 70 x 58 mm, DIN rail mounting, IP20

Description	Type
miniScada 1	
miniScada 2 with integrated GSM/GPRS modem	

## Static Contactor BEL-TS



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 525 V or 690 V
- Recovery time 20 ms
- Voltage level trigger signal 8–30 V DC
- Protection class IP00

Description	Type
Static contactor without fan, $I_N = 22 \text{ A}$ , $U_{\text{nominal}} = 400 \text{ V}/440 \text{ V}/480 \text{ V}$	BEL-TS 15H2
Static contactor without fan, $I_N = 36 \text{ A}$ , $U_{\text{nominal}} = 400 \text{ V}/440 \text{ V}/480 \text{ V}$	BEL-TS 25H2
Static contactor without fan, $I_N = 72 \text{ A}$ , $U_{\text{nominal}} = 400 \text{ V}/440 \text{ V}/480 \text{ V}$	BEL-TS 50H2
Static contactor without fan, $I_N = 42 \text{ A}$ , $U_{\text{nominal}} = 690 \text{ V}$	BEL-TS 50
Static contactor without fan, $I_N = 110 \text{ A}$ , $U_{\text{nominal}} = 400 \text{ V}/440 \text{ V}/480 \text{ V}$	BEL-TS 75H2
Static contactor without fan, $I_N = 145 \text{ A}$ , $U_{\text{nominal}} = 400 \text{ V}/440 \text{ V}/480 \text{ V}$	BEL-TS 100H2
Static contactor without fan, $I_N = 84 \text{ A}$ , $U_{\text{nominal}} = 690 \text{ V}$	BEL-TS 100
Static contactor without fan, $I_N = 250 \text{ A}$ , $U_{\text{nominal}} = 690 \text{ V}/800 \text{ V}$	BEL-TS 300H2
Static contactor without fan, $I_N = 250 \text{ A}$ , $U_{\text{nominal}} = 690 \text{ V}$	BEL-TS 300

## Fuses with blade contacts

### Fuse-links PHN


PHN fuse-links with blade contacts and utilization category gG are suitable for applications with rated voltage 690 V a.c. They feature high breaking capacity, high current limiting capacity, low power losses and low values of overvoltage during fuse-link action.

- The fuse-links do not contain harmful substances according to the RoHS Regulation (cadmium, lead and other).
- In particular, for use in fuse switch-disconnectors, fuse-rails and fuse-bases.
- Utilization category gG for protection of lines, cables and other equipment against overload and short-circuit.

### Fuse-links with blade contacts PHN

Size	I <sub>N</sub> [A]	Type	Product code	Power losses [W]	Weight [kg]	Package [ks]
1	32	PHN1 32A gG	09400	3.42	0.22	3
	35	PHN1 35A gG	34400	3.64	0.22	3
	40	PHN1 40A gG	09401	4.28	0.22	3
	50	PHN1 50A gG	09402	4.55	0.22	3
	63	PHN1 63A gG	09403	6.38	0.22	3
	80	PHN1 80A gG	09404	6.71	0.22	3
	100	PHN1 100A gG	09405	8.35	0.22	3
	125	PHN1 125A gG	06944	10.71	0.43	3
	160	PHN1 160A gG	06946	12.3	0.43	3
	200	PHN1 200A gG	06952	14.4	0.43	3
	224	PHN1 224A gG	17120	16.1	0.43	3
250	PHN1 250A gG	06961	17.8	0.43	3	
2	100	PHN2 100A gG	10534	8.21	0.44	3
	125	PHN2 125A gG	06965	10.63	0.44	3
	160	PHN2 160A gG	06967	12.1	0.44	3
	200	PHN2 200A gG	06971	14.14	0.44	3
	224	PHN2 224A gG	06973	15.81	0.44	3
	250	PHN2 250A gG	06975	17.35	0.44	3
	315	PHN2 315A gG	06979	23.2	0.59	3
	350	PHN2 350A gG	06983	26.8	0.59	3
3	250	PHN3 250A gG	18619	18.8	0.61	3
	315	PHN3 315A gG	06991	22.5	0.61	3
	350	PHN3 350A gG	06993	26.5	0.61	3



Description	Type
Rated voltage	690 V a.c. 250 V d.c.
Breaking capacity (rms)	120 kA/690 V a.c. 50 kA/250 V d.c.
Utilization category	gG
Discrimination	1 : 1.6
Standards	IEC 60269 DIN 43620, EN 60269
Approval marks	



## Fuse switch-disconnectors

### Fuse Switch-Disconnectors Size 1 Up To 250 A

Fuse switch-disconnector FH1 is intended for fuse-links with blade contacts size 1. It enables safe disconnection not only of rated current, but also overcurrent up to octuple rated current.

- It is equipped with a label for description of the protected circuit.
- Measuring holes in the cover.
- Basic design with terminal screws M10/20 Nm for cable lugs max.  $\varnothing$  34 mm and busbars of width max. 25 mm.
- Connecting sets with terminal inbus screws.
- Variability of connecting sets including rear connection.
- It is possible to lock the switch-disconnector cover.

A version of this switch-disconnector enables remote signalling of fuse-state, in each pole separately. For signalling of fuse state is used standard visual status indicators of the fuse-links with blade contacts.

#### Mounting:

- Directly on the panel by means of screws.
- On busbars with spacing 60 mm by means of adapter.
- More switch-disconnectors "side-by-side" or "H at" can be installed without limitation of electrical parameters.
- Bottom connection is possible without limitation of electric parameters ( the device should be marked „ATTENTION, BOTTOM CONNECTION“).



### Fuse switch-disconnectors up to 250 A

Type	Product code	Power losses [W]	Weight [kg]	Package [ks]
FH1-1A/F	14362	1-pole, design with terminal screws	1.100	1
FH1-1S/F	14363	1-pole, with fuse state signalling, connector with a 1 m cable, design with terminal screws M10, switch-disconnector cover with signalling can be ordered as a spare part	1.112	1
FH1-3A/F	14364	3-pole, design with terminal screws M10	2.660	1
FH1-3S/F	14365	3-pole, with fuse state signalling, connector with 1 m cable, design with terminal screws M10, switch-disconnector cover with signalling can be ordered as a spare part	2.675	1
FH1-3SB/F	14367	3-pole, with fuse state signalling, connector without cable, this version enables any connection according to the user needs, design with terminal screws M10	2.670	1
FH1-3L/F	20769	3-pole, design with terminal screws M10, with light indication of fuse state, fuse blowing is signalled by H ashing red LED, if the fuse is not blown, the red LED does not light	2.700	1

Fuse switch disconnectors for group FH2 and FH3 (250 A) on request.







## Capacitor Switching Contactors for use with reactive or non-reactive capacitor banks

When a capacitor is switched to an AC voltage, the result is a resonant circuit damped to a greater or lesser degree. In addition to the rated current, the capacitor accepts a transient current that is a multiple of (as many as 200 times) its rated current. Fast switching, low-bounce contactors should be used.

Because of the leading contacts, the inrush current spikes (reverse charging operations) are limited or damped by resistance wires. These current spikes would lead to welding of the contactor's main

contacts and they are also harmful for the capacitors. Reduction of the inrush currents also avoids transients and voltage sags. Leading contacts with a wiper function are used in these capacitor contactors, i.e. each leading contact is linked to the contactor yoke by a permanent magnet. The leading contacts close before the main contacts are with certainty closed. This feature of the capacitor contactors guarantees effective, stable operation throughout useful life. The single controlled leading contacts also enhance resistance to soiling during operation.

	Rated Operational Power at 50/60Hz Ambient Temperature						Aux. con- tacts Cuilt-in Add.			Type	Coil voltage <sup>1)</sup> 220–240 V 50 Hz	Pack pcs.	Weight kg/pc.
	50°C			60°C			NO	NC	pcs.				
	380 V 400 V kVAr	415 V 440 V kVAr	660 V 690 V kVAr	380 V 400 V kVAr	415 V 440 V kVAr	660 V 690 V kVAr				230			
	0–12,5 0–12,5	0–13 0–13	0–20 0–20	0–12,5 0–12,5	0–13 0–13	0–20 0–20	1 –	– 1	1 <sup>2)</sup> 1 <sup>2)</sup>	K3-18K10 K3-18K01	1 1	0,34 0,34	
	10–20 10–25	10,5–22 10,5–27	17–33 17–41	10–20 10–25	10,5–22 10,5–27	17–33 17–41	– –	– –	3 <sup>3)</sup> 3 <sup>3)</sup>	K3-24K00 K3-32K00	1 1	0,62 0,62	
	20–33,3 20–50 20–75 <sup>4)</sup>	23–36 23–53 23–75 <sup>4)</sup>	36–55 36–82 36–120 <sup>4)</sup>	10–33,3 20–50 20–60	23–36 23–53 23–64	36–55 36–82 36–100	– – –	– – –	3 <sup>3)</sup> 3 <sup>3)</sup> 3 <sup>3)</sup>	K3-50K00 K3-62K00 K3-74K00	1 1 1	1,0 1,0 1,0	
	33–80 33–100 <sup>6)</sup>	36–82 36–103 <sup>6)</sup>	57–120 57–148 <sup>6)</sup>	33–75 33–90 <sup>6)</sup>	36–77 36–93 <sup>6)</sup>	57–120 57–148 <sup>6)</sup>	– –	– –	6 <sup>5)</sup> 6 <sup>5)</sup>	K3-90K00 K3-115K00	1 1	2,3 2,3	

**Specification:** Contactors K3-..K are suitable for switching low-inductive and low loss capacitors in capacitor banks (IEC70 and 831, VDE 0560) without and with reactors.

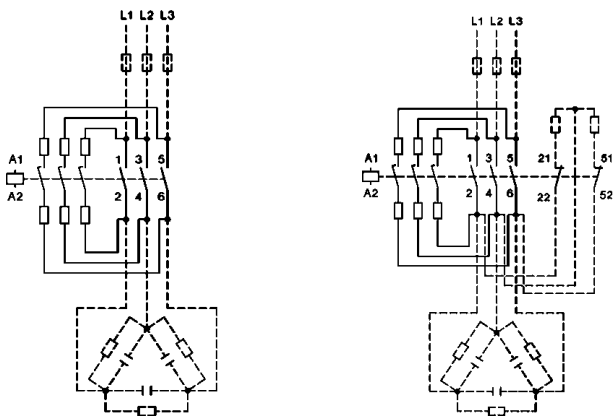
Capacitor switching contactors are fitted with early make contacts and damping resistors, to reduce the value of make current <70 x Ie.

**Operating Conditions:** Capacitor switching contactors are protected against contact welding for a prospective making current of 200 x Ie.

**Technical Data acc. to IEC 947-4-1, IEC 947-5-1, EN 60947-4-1, EN 60947-5-1, VDE 0660**

Type		K3-18K	K3-24K	K3-32K	K3-50K	K3-62K	K3-74K	K3-90K	K3-115K
Max. frequency of operations z	1/h	120	120	120	120	120	80	80	80
Contact life non reactive capacitor banks	S x 103	250	150	150	150	150	120	120	120
	reactive capacitor banks	S x 103	400	300	300	300	200	200	200
Rated operational current Ie 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 operational current Ith 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 acc. to EN 61921: 30% min.	at 50°C %	78	60	67	108	53	11	35	32
	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

**Typical Circuit Diagram**



**Wiring Diagram for Quick Discharge Resistors**

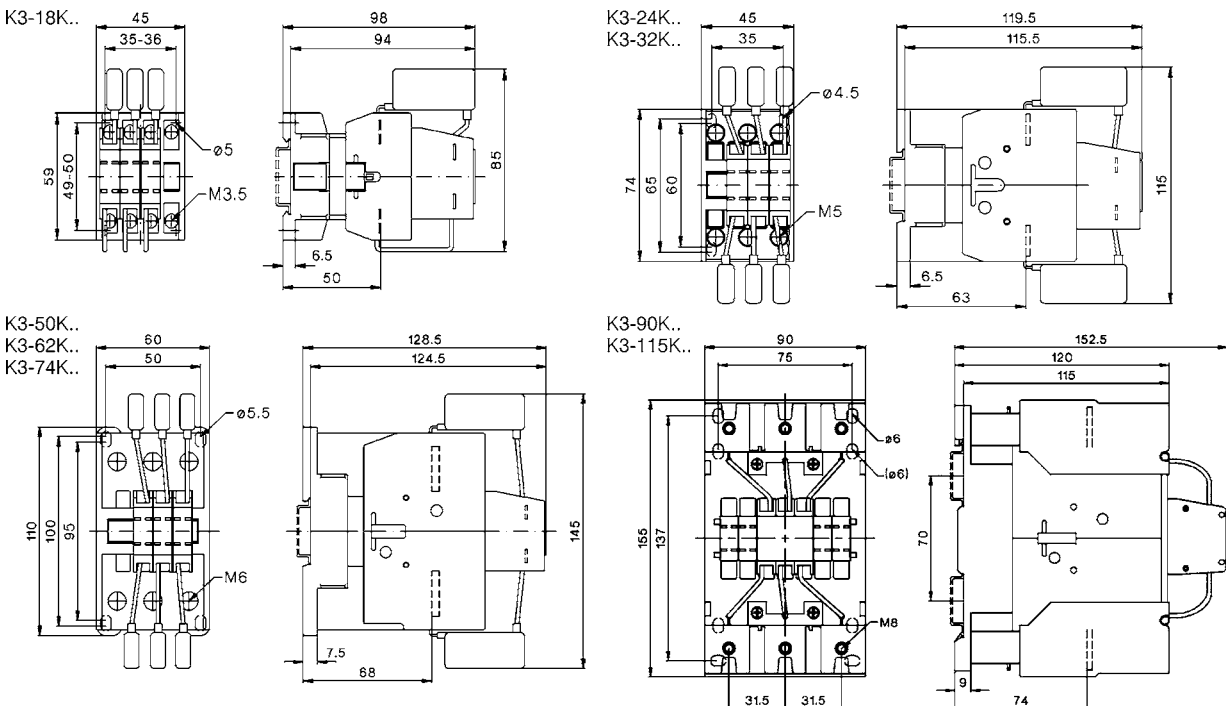
Make sure that the current of the discharge resistors is not higher than the rated current (AC1) of the auxiliary contacts

**Mounting instructions:**

In the area of capacitor switching contactors, difficulty inflammable and self-extinguishing materials shall be used only, because abnormal temperatures within the area of the resistor spirals cannot be excluded.

- 2) 1 HN.. or HA.. snap-on
- 3) 2 HB.. for side mounting and 1 HN.. or HA.. snap-on
- 4) Consider the max. thermal current of the contactor K3-74A:  $I_{th}$  130A
- 5) 2 HB.. on the left or right side and 4 HN.. or HA.. snap-on
- 6) Consider the min. cross-section of conductor at max. load

**Capacitor switching contactors, AC operated**



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