

Power Factor Correction Equipment for High Voltage



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HIGH VOLTAGE POWER CAPACITORS

Type KLV

General

Advanced technology of KLV capacitors is based on construction of all-film capacitor sections, folding foil edge design, improved electrical and mechanical connections between sections and impregnation with environmentally compatible insulating oil. KLV capacitors have very low dielectric losses and are designed for long service life.



**Single phase capacitors
– single bushing**



**Single phase capacitors
– double bushing**



**Three phase capacitors
and single phase
capacitors with two
outputs (twin)**

- ▶ **KLV3XXX** – internally fused capacitors. Each capacitor element has a separate internal fuse.
- ▶ **KLV1XXX** – capacitors without internal fuses.
- ▶ **KLVXXX4** – single phase capacitors with two outputs (twin). Capacitors are supplied in sets of three to provide an economical unbalance detection scheme. This is particularly advantageous in low output capacitor banks.

Technical Data

Rated power (max.)	700 kVar
Rated voltage	1.0 - 25 kV
Rated frequency	50 or 60 Hz
BIL	60, 75, 95, 125, 170 kV
Losses total	max. 0.2 W / kVar (0.08 ... 0.15 average)
Dielectric	All-film (hazy polypropylene)
Impregnating fluid	Environmentally compatible impregnating oil based on M/DBT (non-PCB)
Discharge resistor	Built-in discharge resistor reduces the voltage on a de-energised capacitor from the crest of rated voltage to 75 V in 10 minutes or less (discharge to 50 V in 5 minutes on demand).
Permissible overloads	Maximum permissible current $1,3 \times I_n$ continuously Maximum permissible voltage $1,1 \times U_n$ continuously, 12 h per day
Quality	Iskra is certified according to ISO 9001 (quality) and ISO 14001 (environment)
Standards	IEC 60871-1, IEEE Std 18

Routine Tests

Sealing test	Minimum of 6 hours at 75 °C
Voltage test between terminals	2.0 x rated voltage AC, 10 s or 4.0 x rated voltage DC, 10 s
AC voltage test between terminals and container	According to IEC 60871-1, table 3, 10 s
Discharge resistor test	
Measurement of losses (Tan δ)	

Service Conditions

Temperature categories up to -40 / D

Upper Temperature category limit	C	D
Maximum	50 °C	55 °C
Highest mean over 24 h	40 °C	45 °C
Highest mean over 1 year	30 °C	35 °C
Low temperature limit during operation	-25 °C or -40 °C	
Installation	Outdoor or indoor	
Installation Altitude (above sea level)	1000 m standard, up to 4000 m on demand	
Case Material	Stainless steel plate 1.5 mm thick	
Finish / Color	Two-component durable painting RAL 7032 (light grey) on treated surfaces	
Fixing	Depending on the height of capacitor, container is equipped with one or two mounting brackets on the narrower sides. Brackets have mounting slots 11 x 20 mm.	

Terminal & Connections

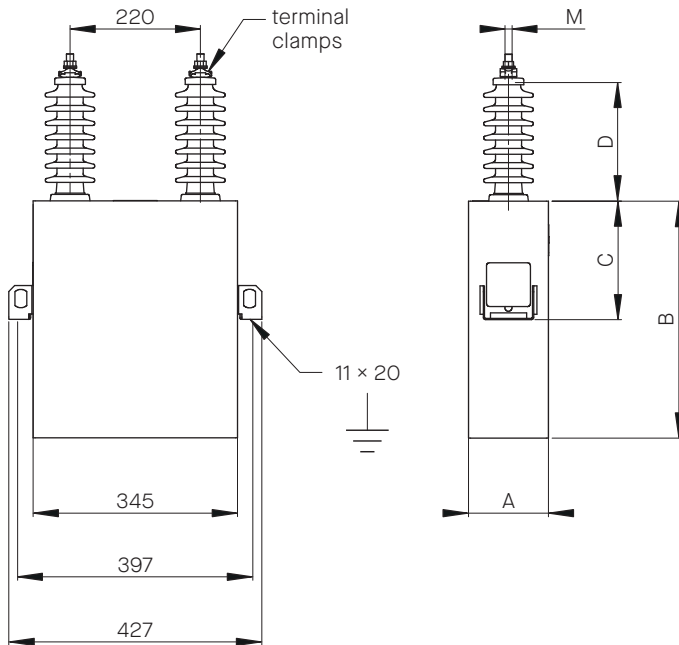
Bushings	Brown or grey porcelain bushings, welded to the container.
Thread of terminal stud	M14 or M16
Current	180 A max.
Connections	Terminal clamps with provision to accommodate any combination of 2 conductors from 4 mm ² solid to 50 mm ² stranded wire are available on demand*. The capacitor unit grounding is provided by unpainted surface of mounting brackets.
Pressure switch	With terminal cap supplied on demand.
Name Plate	Durable plastic label with permanent printing.

Note

*Terminal clamps 70 mm² also available on demand.

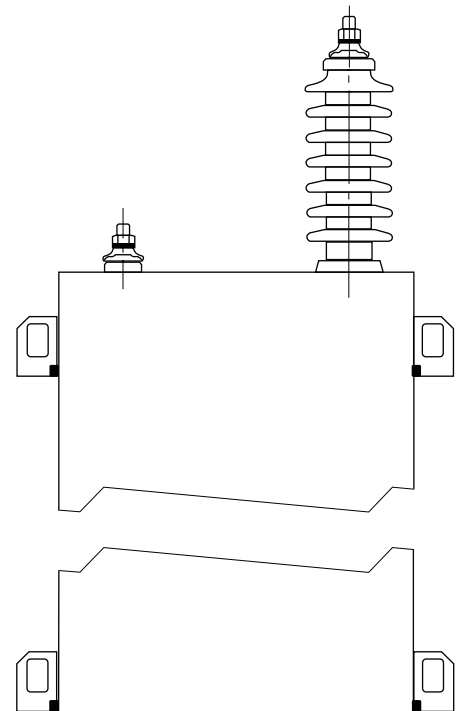
Picture 1

Two - bushing capacitor KLVXXX1
(insulated container)



Picture 2

Single - bushing capacitor KLVXXXO
(voltage on the container)



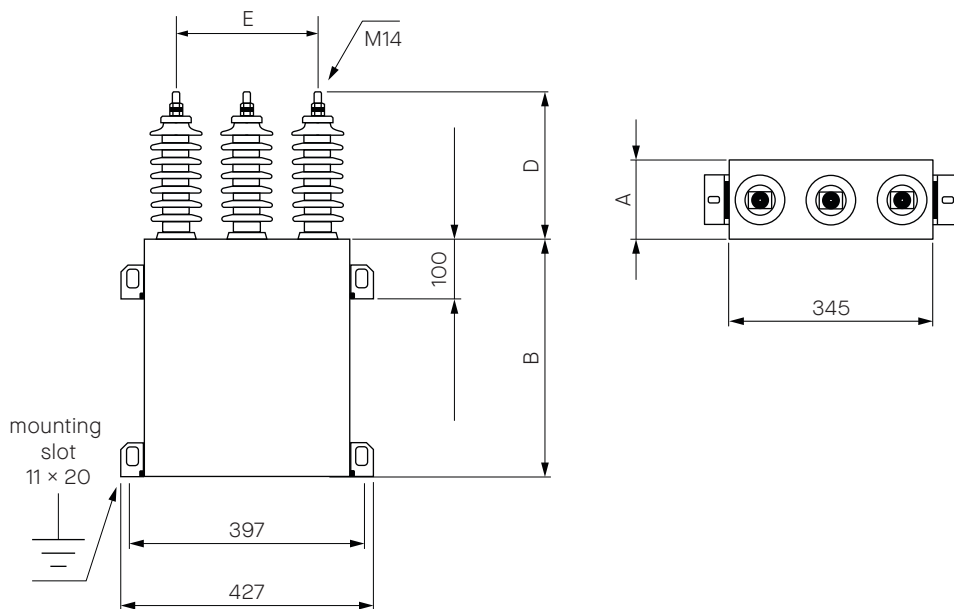
Typical Dimensions

Q _n at 50 Hz (kVar)	U _n KLV 1xxxP (without internal fuses) (kV)	U _n KLV 3xxxP (internally fused) (kV)	Dimensions (mm)						Weight (kg)	Weight* (kg)
			A	B	B*	C	D			
							BIL 75-95 kV	BIL 125 kV		
100	2.0 - 16.5 (20)	2.00 - 2.4	145	240	270	120 ^{2R}	240	315	20	22
150	2.0 - 16.5 (20)	2.00 - 4.8	145	310	340	200 ^{2R}	240	315	26	29
200	2.0 - 16.5 (20)	2.00 - 4.8	145	400	420	200 ^{2R}	240	315	32	36
250	2.27 - 16.5 (20)	2.27 - 7.2	145	470	500	200 ^{2R}	240	315	39	41
300	2.72 - 16.5 (20)	2.72 - 7.2	145	540	580	200 ^{2R}	240	315	44	49
350	3.18 - 16.5 (20)	3.18 - 9.6	145	620	670	200 ^{2R}	240	315	49	53
400	3.64 - 16.5 (20)	3.64 - 9.6	145	700	770	200 ^{2R}	240	315	55	60
450	4.1 - 16.5 (20)	4.10 - 12	145	770	840	100 ^{4R}	240	315	62	66
500	4.56 - 16.5 (20)	4.56 - 14.4	175	720	770	100 ^{4R}	240	315	67	73
550	5.00 - 16.5 (20)	5.00 - 14.4	175	770	825	100 ^{4R}	240	315	75	79
600	5.46 - 16.5 (20)	5.46 - 14.4	175	825	900	100 ^{4R}	240	315	79	84
670	6.09 - 16.5 (20)	5.46 - 14.4	175	920	960	100 ^{4R}	240	315	85	90

Notes

- * Dimensions with an asterisk (*) refer to internally fused capacitors
- 1) Voltage in parenthesis () refer to one-bushing capacitors only
- 2) For output and voltage outside this range, please contact factory
- 3) Case sizes are typical and actual sizes will be confirmed at the time of order
- 4) Capacitor container could have 2 or 4 brackets (1 or 2 brackets on narrower side)
Dimension C – 2R means 1 bracket from each side (capacitor type KLVxx1x); 4R means 2 brackets on each side, one on the top and one on the bottom, except where the height is 310 mm or below, where brackets are on the bottom only (type KLVxx2x)
- 5) Dim A may expand up to 115% due to thermal flexure
- 6) Power at 60 Hz = 1.2 x power at 50 Hz

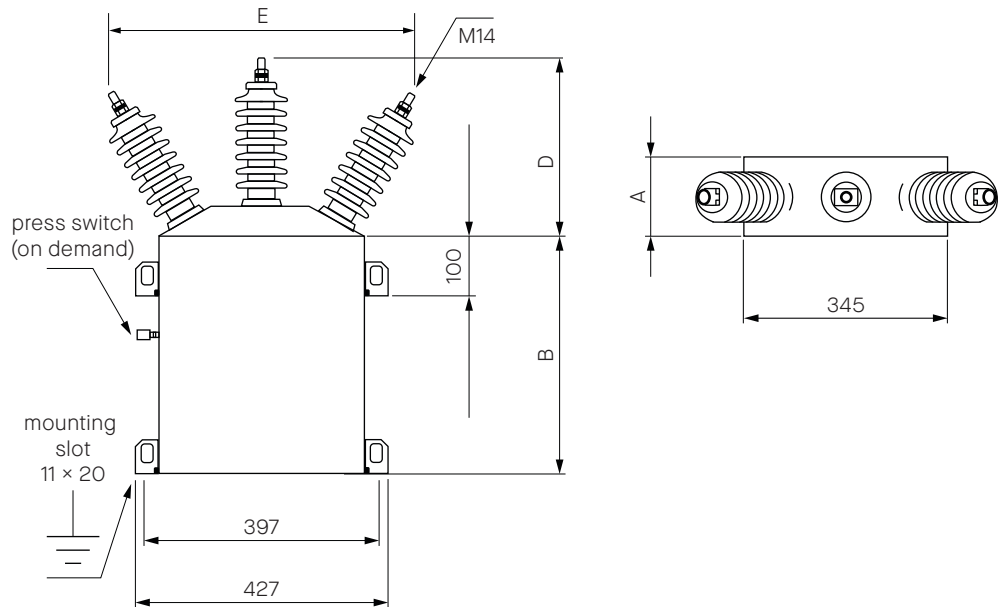
Picture 3



BIL 20/60 kV Typical Dimensions (picture 3)

U _n (kV)	Q _n at 50 Hz (kVar)	Dimensions (mm)					Weight (kg)	Weight* (kg)
		A	B	B*	D	E		
3.3 - 7.2	50	145	200	200	190	240	16	20
	100	145	290	325	190	240	23	26
	150	145	415	430	190	240	30	33
	200	145	520	550	190	240	37	42
	250	145	620	670	190	240	44	49
	300	145	740	770	190	240	51	55
	350	145	825	900	190	240	60	63
	400	145	940	1000	190	240	66	71
	450	175	870	960	190	240	73	78

Picture 4



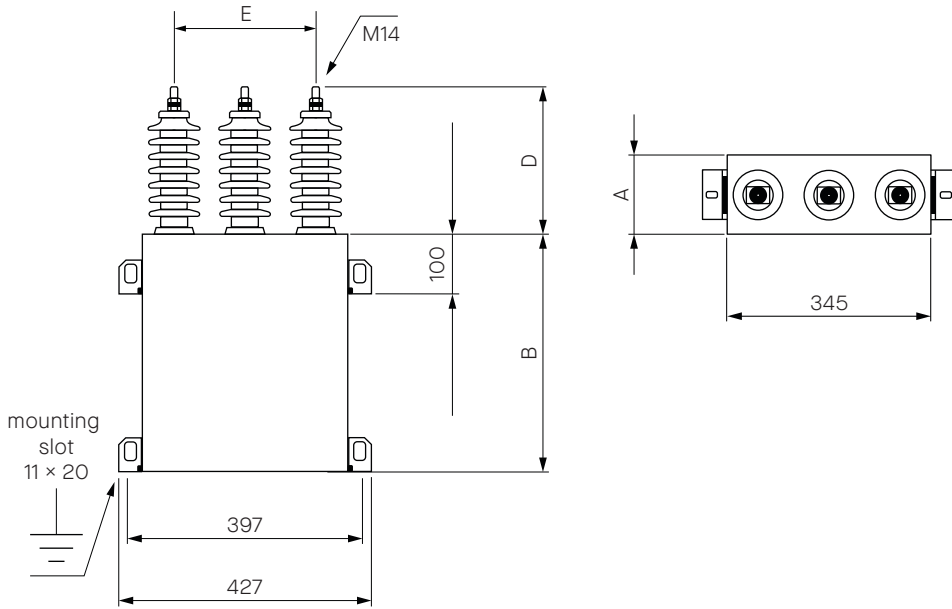
BIL 28/75 kV Typical Dimensions (picture 4)

U _n (kV)	Q _n at 50 Hz (kVar)	Dimensions (mm)					Weight (kg)	Weight* (kg)
		A	B	B*	D	E		
	50	145	200	200	300	510	22	23
	100	145	290	310	300	510	28	29
	150	145	400	430	300	510	35	37
	200	145	500	550	300	510	42	44
up to 12	250	145	600	670	300	510	49	51
	300	145	720	770	300	510	55	60
	350	145	825	870	300	510	63	66
	400	145	940	1000	300	510	69	75
	450	175	840	940	300	510	76	82

Notes

- * Dimensions with an asterisk (*) refer to internally fused capacitors
- 1) For output and voltage outside this range, please contact factory
- 2) Case sizes are typical and actual sizes will be confirmed at the time of order
- 3) Pressure switch on demand
- 4) Either 2 or 4 fixing brackets are used, depending on the height of the unit. Special bracket positions can be provided if required. Please specify at the inquiry stage
- 5) Dim a may expand up to 115 % due to thermal flexure
- 6) Power at 60 Hz = 1.2 x power at 50 Hz

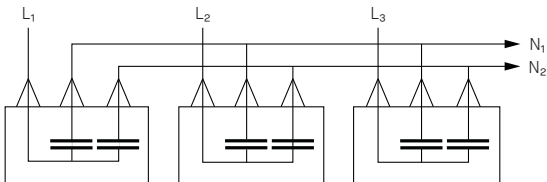
Picture 5



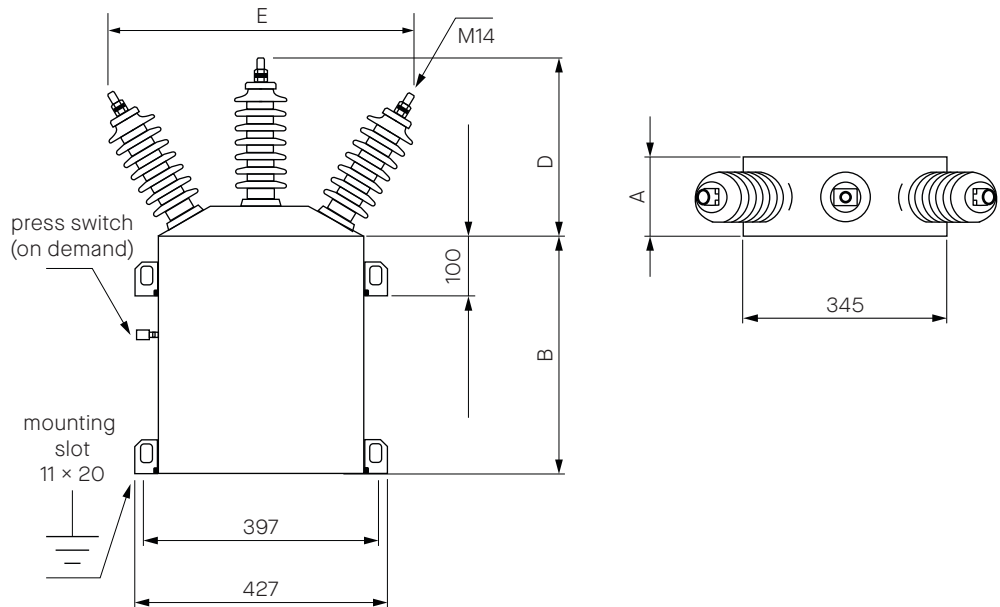
BIL 20/60 kV Typical Dimensions (picture 5)

U _n (kV)	Q _n at 50 Hz (kVar)	Dimensions (mm)					Weight (kg)	Weight* (kg)
		A	B	B*	D	E		
2.0 - 4.16	50 (2x25)	135	200	220	250	240	22	23
	100 (2x50)	145	290	310	250	240	28	29
	150 (2x75)	145	400	430	250	240	35	37
	200 (2x100)	145	500	550	250	240	42	44
	250 (2x125)	145	620	640	250	240	49	51
	300 (2x150)	145	720	770	250	240	51	55
	400 (2x200)	145	940	1000	250	240	66	71

Connection



Picture 6



BIL 28/75 kV Typical Dimensions (picture 6)

U _n (kV)	Q _n at 50 Hz (kVar)	Dimensions (mm)					Weight (kg)	Weight* (kg)
		A	B	B*	D	E		
up to 7.2	50 (2×25)	145	180	200	300	510	22	23
	100 (2×50)	145	290	330	300	510	28	29
	150 (2×75)	145	400	440	300	510	35	37
	200 (2×100)	145	500	550	300	510	42	44
	250 (2×125)	145	590	670	300	510	49	51
	300 (2×150)	145	690	770	300	510	55	60
	400 (2×200)	145	900	1000	300	510	69	75

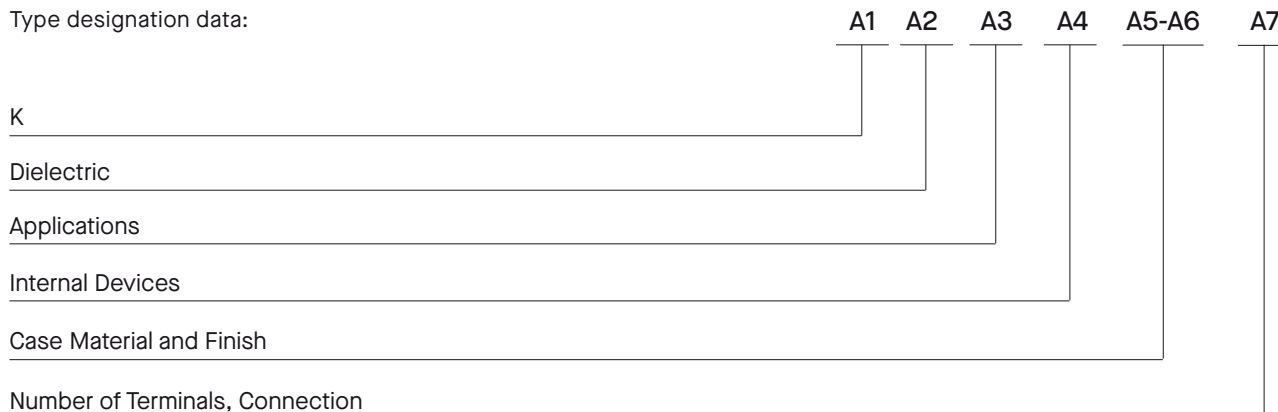
Notes

* Dimensions with an asterisk (*) refer to internally fused capacitors

- 1) For output and voltage outside this range, please contact factory
- 2) Case sizes are typical and actual sizes will be confirmed at the time of order
- 3) Pressure switch on demand
- 4) Either 2 or 4 fixing brackets are used, depending on the height of the unit. Special bracket positions can be provided if required. Please specify at the inquiry stage
- 5) Dim a may expand up to 115 % due to thermal flexure
- 6) Power at 60 Hz = 1.2 x power at 50 Hz

Ordering data

Type designation data:



A1	K	Capacitor
A2	L	Dielectric Polypropylene (all-film)
A3	V	High voltage capacitor for power factor correction
A4	1	Discharge resistor built-in
	2	Without discharge resistors
	3	Internal fuses and discharge resistors built-in
	4	Internal fuses built-in
A5	0	Ordinary steel case coated with primer and top coat (intended for indoor installation)
	2	Stainless steel case coated with primer and top coat (intended for outdoor and aggressive atmosphere installation)
A6	1	Case side mounting (2 brackets)
	2	Case side mounting (2 brackets on the top and / or 2 brackets on the bottom)
A7	0	Single-phase, one brushing capacitor
	1	Single-phase, two brushing capacitors
	3	Three-phase capacitor
	4	Single-phase capacitor with two outputs

When ordering, please state:

Rated output	kVar
Rated voltage	V
Rated frequency	Hz
Tolerance of capacitance	- ... % / + ... %
Number of bushings	single bushing, two bushings
Installation	indoor / outdoor
Insulation level	.../...kV, if higher than required by U
Internal fuses	yes / no
Pressure switch	yes / no
Terminal clamps	yes / no

POWER FACTOR REGULATOR PFC-CX

General

The PFC-CX is a modern single-phase unbalance protection relay. Capacitors in MV or HV compensations use oil as dielectric, which could catch fire in case of a damage. A permanent supervision of the state of the capacitors is therefore essential. The PFC-CX offers many ways to protect the capacitors against internal faults, and can warn and switch off if required (alarm/trip).



Key features

Measuring Inputs

The imbalance can be monitored either by using a separate current or voltage measuring input. Permissible currents range from 15 mA to 5 A, permissible voltages from 0.1 to 20 V AC. A wide range of typical monitoring scenarios is covered with the KSR1.

Wide Range Power Supply

The PFC-CX can be connected to any power supply from 40 to 250 V AC as well as 40 to 300 V DC. It is therefore capable to work with normal mains connection or with battery power. There is no need to make a selection.

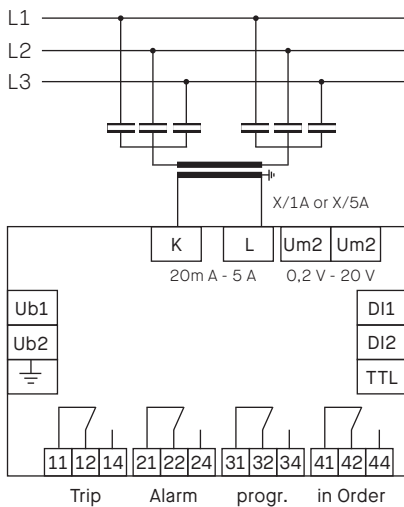
Programmable Outputs

Each of the 3 output relays has its own parameters. After expiration of the programmed delay time, the corresponding relay will be triggered. After the alarm causing situation is over, the respective relay will be reset automatically or must be reset manually.

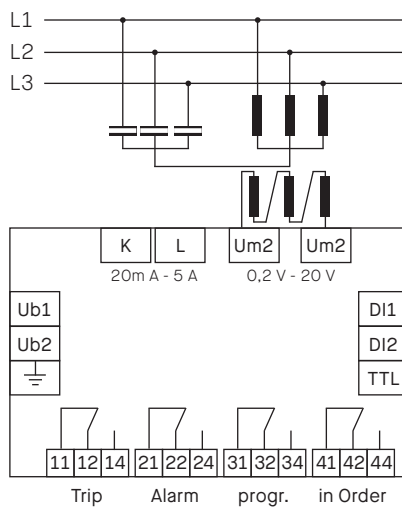
Option Modbus

Retrofitting the PFC-CX with Modbus communication is very simple. A Modbus module can be attached to the back of the relay casing and connected by cable. There is no need to exchange the entire relay if there is a requirement to integrate the PFC-CX to a Modbus communication.

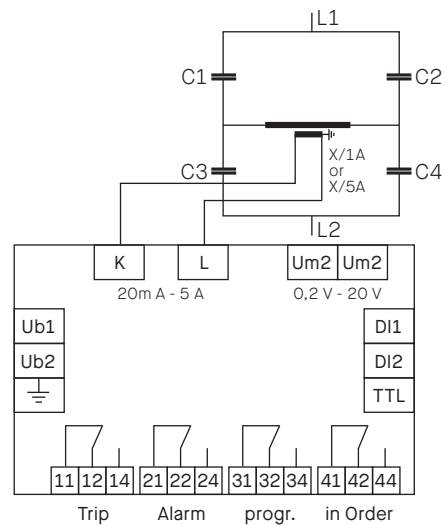
Double-Star Connection



Voltage Monitoring



H-Bridge Connection



Technical Data

Supply voltage	40 – 250 V AC, 45 - 65 HZ / 40 – 300 V DC, 5 VA; max. fuse 6 A
Measuring voltage	0.1 – 20 V; burden 240 kOhm, with low-pass filter, Vt- ratio adjustable 1 - 350, Short term overload: 500 V for 10 seconds
Accuracy	0.5 % of upper range value.
Current measurement	15 mA – 5 A; burden 20 mOhm; Ct ratio adjustable 1 - 4000, Continuous overload: 25 A; short term: 100 A / 1 sec
Relay outputs	4 relays, c/o, voltagefree, max. fuse 6 A
Functions	Relay 1: Trip, Relay 2: Alarm, Relay 3: Programmable (Alarm / Trip / both), Relay 4: Device working OK
Max. output rating AC	1250 VA, max. switching voltage: 440 V AC
Max. output rating DC (ohmic)	30 V / 5 A; 60 V / 1 A; 110 V / 0.5 A; 220 V / 0.3 A

FILTER REACTORS



Technical data

Type	Symbol	Unit	
Rated voltage	U_n	V	
Rated frequency	f_n	Hz	50 / 60
Rated inductance	L_n	mH	
Rated capacitor output	Q_{cN}	kVar	
Rated capacitor voltage	U_{cN}	V	
Filtering factor		%	5.67 / 6 / 7 / 12.5 / 14 / other
Ambient temperature		°C	40 / other
Altitude M.S.L.		m	≤ 1000 m / other
System of protection			IP00 / other
Inrush current			$200 \times I_n$
Forced ventilation		m/s	none /
Temperature class			B / F / other
Rated lightning impulse withstand voltage and separate source AC withstand voltage	LI / AC	kV	
Rated short-time current	I_{KN} (s)	kA_{eff}	
Way of mounting			with rubber-metal / without rubber-metal
Harmonic content	HvM-standard		U1=106%; U3=0.5%, U5=5%, U7=5%
	Linearity		$L(1.2 \Sigma I) \geq 0.95 L_N$ or per customer's specification

Description

Filter reactors protect reactive power compensation equipment from overload caused by excessive harmonic levels in medium and low voltage distribution systems. They are also used in a variety of configurations of harmonic filters to remove unwanted harmonics from electric power systems.

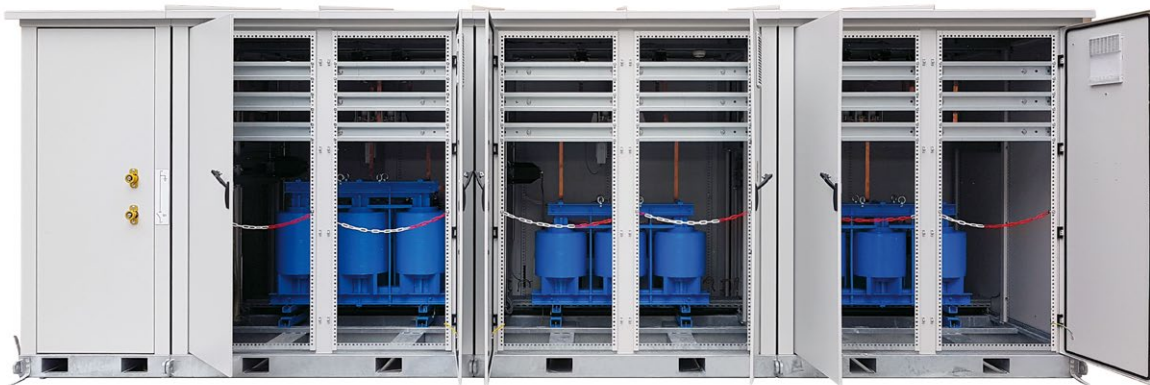
Iskra produces iron core filter reactors for low and medium voltages, in single- or three-phase construction, for tuned and detuned filter applications.

Our filter reactors are built with unique PolyGap® core construction to minimize stray flux and audible noise as well as to achieve a maximum lifetime in rigorous applications. Our standard practice is to use vacuum pressure impregnation for secure bonding of the core laminations and gaps as well as to minimize noise emissions.

Ordering

Designs will be customized to meet customer needs from winding of the coils, various termination options, to temperature monitoring.

Upon request, we can perform a type test complete with temperature rise test under specific operating conditions including harmonics currents.



Filter Reactor, UKC, Ljubljana, Slovenia

INRUSH REACTORS



Technical data

Type	Symbol	Unit	
Rated voltage	U_n	V	
Rated frequency	f_n	Hz	50 / 60
Rated inductance	L_n	mH	
Rated continuous current	I_n	A	
Rated inrush current	I_n	A_{peak}	
Inrush current resonant frequency	f_{in}	Hz	
Ambient temperature		°C	40 / other
Altitude M.S.L.		m	≤ 1000 m / other
System of protection			IP00
Inrush current			$200 \times I_n$
Forced ventilation		m/s	none /
Temperature class			B / F / other
Rated lightning impulse withstand voltage and separate source AC withstand voltage	LI / AC	kV	

Description

Effective against switching peaks and inrush currents in reactive compensation and other capacitor systems and in limiting short-circuit currents in downstream industrial equipment.

Inrush reactors have a core of air or non-ferrous or non-conductive material. This makes them highly suitable for high frequencies and current limiting applications. Free of ferromagnetic materials, they avoid saturation, eddy current loss and hysteresis loss.

Inrush reactors by Iskra effectively limit switching peak inrush currents in reactive compensation and other capacitor based equipment. Optimally designed for the capacitor rated current, these reactors serve to dampen the incoming currents so as to safely protect the capacitors and their wiring.

Iskra Inrush reactors serve as current limiting reactors mostly to limit short-circuit currents in downstream equipment. As a result, the switchgear, cables and other elements used can be designed for a much lower short-circuit power.



11kV 5MVAR project

Ordering

Designs will be customized to meet customer needs from winding of the coils, various termination options, to temperature monitoring.

Upon request, we can perform a type test complete with temperature rise test under specific operating conditions including harmonics currents.

Disclaimer

While every care has been taken to ensure that the information contained in this document is correct, no responsibility can be accepted for any inaccuracy. We reserve the right to alter or modify the information contained herein at any time in the light of technical or other developments.

Technical specifications are valid under normal operating conditions only. We do not accept any responsibility for any misuse of the product and cannot be held liable for indirect or consequential damages. Technical data and design can be subject to change and should be confirmed prior to ordering.

