



CAPACITORS, REACTORS AND AUXILIARY COMPONENTS FOR POWER FACTOR CORRECTION

MKPC™



FACTORY MATCHED TO OPERATE IN PERFECT HARMONY

ELECTRONICON®
always in charge

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WE KNOW FACTORY MATCHED TO WORK IN PERFECT HARMONY. ALL KEY COMPONENTS FROM ONE SOURCE.

WHAT WORKS BEST

The construction of reliable equipment for power factor correction requires not only your excellent experience, but also top-class components. No compromise in quality and safety should be permitted when it comes to the key parts of your PFC equipment. Because we do care, we are offering you the full set of essential components for your capacitor bank:

- The heart: Capacitors. Without them, PFC is impossible. They are the most sensitive and most important component.
- The protection: Most PFC nowadays cannot do without detuning reactors for harmonic protection anymore.
- The brain: The controller shall know what to do, and when.
- The muscle: Switching is one of the key functions in your PFC, and switching capacitors means maximum stress.

FIRST CLASS POWER MKPc™ COMPACT RANGE CAPACITORS FOR YOUR PFC



Apart from your excellent experience, the construction of reliable and competitive equipment for power factor correction requires top-class components at reasonable cost. No compromise in quality and safety should be permitted when it comes to the key part of your PFC equipment.

Germany's largest manufacturer of power capacitors manufactures all components with highest care and expertise and is your best choice for power capacitors and detuning reactors.

Being filled with the same neutral, inert gas as the capacitors of our renowned MKPg™ range, the phase shifters of our low-cost MKPc™-series are environmentally friendly, very compact, and easy to handle. Our capacitors may be mounted in any desired position. Should leakage occur, the leaking gas would escape into the atmosphere causing no undesirable effects to the adjacent equipment, e.g. damage, pollution, or staining. When disposing of the capacitors, no liquids or toxic gasses need to be considered.

Three-phase MKPc™ capacitors contain three separate capacitor elements connected in delta. By using the market's best low-loss, self-healing polypropylene films and sophisticated manufacturing

techniques such as high-vacuum drying and special coating patterns, MKPc™ provide long service life with constant capacitance and high switching stability. As a matter of course, all our power capacitors are provided with BAM™ (overpressure break-action mechanism) as standard, for safe mode of failure.

Our original **CAPAGRIP™** terminals with their options K and L guarantee optimum sealing of the capacitors, and offer convenient connection of cables up to 25mm². A special spring system guarantees reliable and durable operation of the clamp. They are rated IP20, i.e. protected against accidental finger contact with live parts. **CAPAGRIP™** K includes bleeding resistors for a discharge below 50V within less than 60 seconds; **CAPAGRIP™** L permits the direct connection of discharge reactors and discharge resistor modules, as well as convenient parallel connection of additional capacitors within the permitted current limits.

For more detailed information, instructions on mounting and proper calculation, please consult our comprehensive catalogue "Capacitors and Reactors for Power Factor Correction" or check www.electronicon.com

SHIELD YOUR CAPACITORS FK-Dr™ THREE PHASE DETUNING REACTORS FROM RESONANCES



Contemporary practice of power factor correction has become unthinkable without the use of series reactors for blocking overloads and resonances with mains inductances. As a side effect, the overall level of harmonic distortion is also reduced to a considerable extent.

We manufacture our three phase filter reactors of specially selected transformer sheets and aluminium band or copper windings. Unlike many low-end products, our aluminium reactors are connected through copper terminals for long-term reliable connection.

The FK-Dr™ reactors are dried and impregnated in a vacuum with environmentally-friendly, low-styrole resin which ensures they can

withstand high voltages, have low noise levels, and offer a long operating life. High-class iron cores with multiple air gaps as well as a staid designing approach guarantee stable current linearity and low heat dissipation losses, at the same time allowing for compact dimensions and competitive cost. Compared with low-end reactors, our FK-Dr may save up to 100 Watts of heat dissipation losses per piece, a very important factor for the long-term operational cost (and amortisation) of your equipment.

The operating temperature of the reactor can be monitored externally by an integrated thermal switch (125°C).

Along with the common standard-rated reactors (for the usual range of capacitors) we offer a range of special reactors which, combined with properly-rated capacitors, produce exactly the required kvar output at mains voltage, allowing for reduced size and cost of your installation.

The kvar output of a capacitor depends on the voltage it is charged with. At higher voltage, equal capacitance delivers more kvar. A "non-adjusted reactor" (D) is matched to a power capacitor with standard rating at system voltage. This allows for use of capacitors "off the shelf", however with the increased output of kvar due to voltage rise inside the LC circuit, more power output is installed than actually required by the customer.

A reactor with **adjusted rating** (D1a) is considering this internal voltage rise inside the series circuit of capacitor/reactor, and is matched to a specially dimensioned capacitor with reduced capacitance. **Advantage:** The exact power is installed as required by the customer, and switching devices are stressed less. Both capacitor and reactor are smaller than the non-adjusted solution. Note that exact sizing of the capacitor is necessary.

For more detailed information, please order our comprehensive catalogue "Capacitors and Reactors for Power Factor Correction".

GOOD CAPACITORS PFR-X POWER FACTOR CONTROLLER ALONE WON'T DO



The PFR-X power factor controller calculates the active and reactive power in the mains from the measured current and voltage. The intelligent control algorithm optimizes the switching sequences and guarantees for short regulation times with minimum number of switchings. At the same time, switching operations are equally shared among the available capacitor branches where possible. The integrated connection control immediately detects in which phases voltage and current are measured, and adapts the entire system automatically. The very low current threshold of 10mA allows for very reliable and exact PF control. 1A as well as 5A current transformers can be used without additional manual adjustments. The power supply covers a voltage range of 90...550V.

The rated mains voltage is the only value to be entered before commencing operation of the PFR-X. Without this entry, the controller blocks operation to protect the capacitors. All other relevant parameters have been preset by the manufacturer for immediate start of operation in nearly any common configuration. Individual adjustment and optimization of the control parameters is possible at any time, even during operation of the equipment.

The controller will operate correctly even if the value of the current transformer ratio has not been entered. It monitors the temperature inside the capacitor cabinet by means of an integrated sensor.

For more detailed information, please order our comprehensive catalogue "Capacitors and Reactors for Power Factor Correction".

MAKE SURE SPECIAL CAPACITOR CONTACTORS IT WORKS



The contactors of the 17237.004 series have been optimized for switching low-inductive and low loss capacitors in capacitor banks (IEC70 and 831, VDE 0560) without and with detuning reactors. They are fitted with pre-load contacts and damping resistors, in order to drastically reduce the inrush current, thus protecting the capacitors from destructive current surges, and the main contacts from premature deterioration or welding.

butes to the high reliability and long operational life of our contactors.

Unlike most capacitor contactors which are using a mechanical principle for switching the pre-load contacts, the 17237.004 series switches them by separate magnetic controls. As soon as the main switch has been closed, the pre-load contacts are released again and its resistor wires taken out of circuit after no more than 5...10ms of operation. This avoids additional heat losses in the resistor wires during the operation of the connected capacitor branch, and contri-

Since the disconnection of inductive loads is usually accompanied by switch arcs, the pre-load contacts of mechanical capacitor contactors are often facing trouble when used with reactor-capacitor combinations (detuned capacitors) as they are lagging behind the main contact during the switch-off process. The contactors of our 17237.004 series are not affected by this problem as their pre-load contacts are already out of circuit. Hence they can be used for both detuned and non-detuned capacitor installations. **ELECTRONICON strongly recommends the usage of contactors with pre-load contacts even for detuned capacitors** in order to prevent ferro-resonances of the reactor during the start-up period.

CAPACITORS AND REACTORS – GENERAL TECHNICAL DATA

MKPc™

design	pressed aluminium can with stud M12 × 16, aluminium lid
internal connection	delta
tolerance of capacitance	- 5 ... + 10%
terminals	three phase terminal, M4 screws (Torx T20)
safety device	BAM™ (overpressure break action mechanism)
dielectric material	low-loss polypropylene, dry
impregnant (filling material)	N ₂
mounting position	any position
permitted overvoltages and test voltages	see data charts for details
maximum permissible current	at least 1.3 I _N , see data charts for details
max. inrush current	300 × I _N
dissipation losses	approx.. 0.25 ... 0.40W/kvar
max. relative humidity	95%
max. altitude	4000m a.s.l.
ambient temperature class	- 40°/D (max. 55°C, average 24h: 45°C)
statistical life expectancy (permitted failure rate ≤ 3%)	> 100 000 h
standards	IEC 60831 (2003), VDE 0560-46/47 UL Standard No. 810, CSA C22.2 No. 190-M1985, GOST 1282-88, ISI 13340/13341
approval marks	 

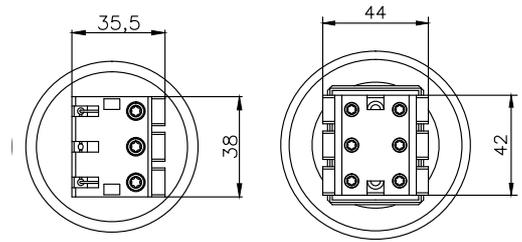
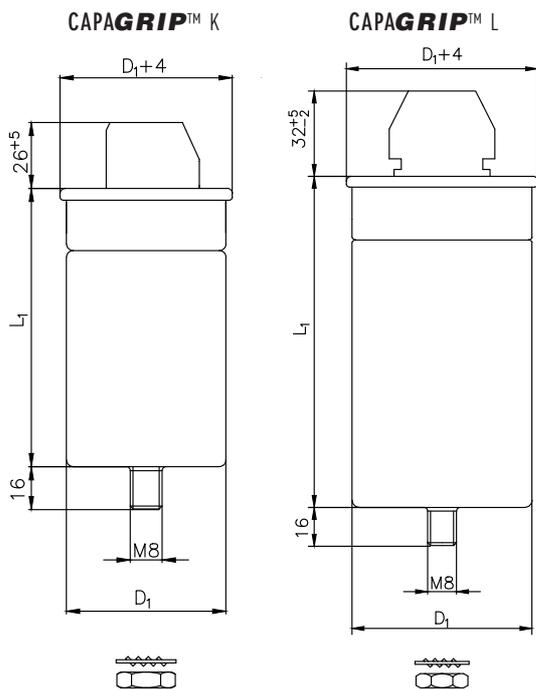


FK-Dr™

design	three phase, iron core with multiple air gaps, IP00
tolerance of inductance	- 3 ... + 3%
terminals	copper lugs; cables available on request
winding material	aluminium band or copper winding
safety device	thermal switch (125°C ± 5K)
impregnant	polyester resin Class F
current linearity	7%: 1.5 × I _N , higher values on request 5.67%: 1.8 × I _N , higher values on request
permitted harmonic load	U ₃ = 0.5% U _N U ₅ = 6.0% U _N U ₇ = 5.0% U _N U ₁₁ = 3.5% U _N U ₁₃ = 3.0% U _N
insulation voltage winding to core	3kV
max. relative humidity	95%
temperature class	T40
statistical life expectancy (permitted failure rate ≤ 3%)	> 200 000 h
standards	EN61558-2-20:2000, VDE 0570-2
approval marks	

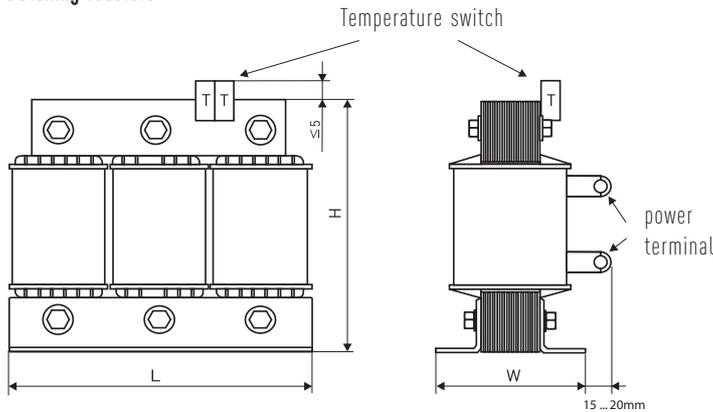


DIMENSION DRAWINGS



terminal design	CAPAGRIP™ K	CAPAGRIP™ L
max.cable \varnothing	1 × 10mm ² /contact	2 × 25mm ² /contact
max.current/ph	39A	56A
fastening torque	1.2 ... 2.0Nm	2.5 ... 3.0Nm
discharge resistors	included	separate module

Detuning reactors



Design shown as listed in this catalogue.

Optional terminations:

- screw terminal block
- temperature-proof flexible cables

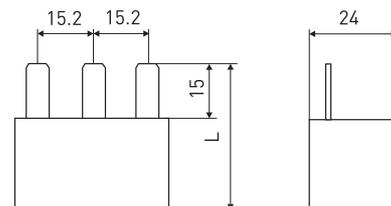
Alternative mounting option:

- threaded bolts for lateral mounting

DISCHARGE DISCHARGE MODULES - THE CONVENIENT MATCH

Capacitors of the **CAPAGRIP™ K** series are fitted with discharge resistors for a discharge < 50V within < 60 seconds. For **CAPAGRIP™ L**, we provide separate resistor modules in a finger-proof housing (IP20) for fast and convenient connection to the terminal.

resistance (k Ω)	U _{max} (V)	L (mm)	order no.
3 × 120	480 V	27	275.100-10120
3 × 180	600 V	27	275.100-10180



HOW TO READ THE SELECTION CHARTS

Capacitors, Reactors, and Contactors

A. You are looking for capacitors and contactors in a non-detuned capacitor bank, e.g. operation at 400V:

1. Select required capacitor power on page 6, e.g. 50kvar; as per chart, you need to use two pcs of item 277.169-516600.
2. See data of 25kvar 400V for details on the individual capacitors.
3. Recommended discharge resistors for each capacitor in the set: Module part no. 275.100-10120.
4. Select matching capacitor contactor type 17237.004-50.0.

MKPC™ Gas-filled Power Capacitors for non-detuned use in mains of 400V, 415V and 440V 50Hz or for detuned systems at 400V 50Hz

capacitor power	U _n (kV)	C _n (µF)	I _n (A)	I _{th} (A)	D = L ₁ (mm)	m (kg)	Design	order no.	pcs /set	res FB	recommended discharge	order code
												U _n 400V 50Hz
2.5kvar 400V	17.5	3 × 17	3 × 6	3 × 9	88 × 164	0.4	K	277.525-01700	10	8	included	...-17.5
5kvar 400V	5	3 × 33	3 × 12	3 × 18	85 × 164	0.5	K	277.529-01300	10	8	included	...-17.5
10kvar 400V	10	3 × 68	3 × 35	3 × 30	85 × 200	1.1	K	277.529-04600	10	10	included	...-17.5
12.5kvar 400V	12.5	3 × 82	3 × 38	3 × 31	75 × 230	1	K	277.544-00800	5	9	included	...-20.0
15kvar 400V	15	3 × 100	3 × 42	3 × 33	75 × 280	1.3	K	277.544-01000	5	10	included	...-20.0
20kvar 400V	20	3 × 130	3 × 49	3 × 30	85 × 280	1.5	K	277.559-01200	5	10	included	...-20.0
25kvar 400V	25	3 × 164	3 × 56	3 × 54	75 × 280	2	L	277.169-516600	2	10	275.100-10120	...-25.0
50kvar 400V	50	3 × 327	3 × 72					(7-) 277.169-516600				...-50.0
75kvar 400V	75	3 × 498	3 × 108					(3-) 277.169-516600				...-50.0
100kvar 400V	100	3 × 664	3 × 144					(6-) 277.169-516600				...-50.0

U_n 400V 50Hz U_n 440V U_{th} 950V AC/2s U_{th} 3600V AC/2s

1 50kvar 400V

2 25kvar 400V

3 275.100-10120

4 ...-50.0

B. You require a matching reactor with detuning factor 5.67% for the above:

1. Go to page 10 and look up the matching reactor in the line which corresponds to the (over-lapped) capacitor line of 50kvar 400V. The resulting power output of the LC-circuit will be 53kvar at 400V.
2. Mind that due to the higher power output, you must now use a bigger contactor (17237.004-50.7).
3. Note that with a capacitor set from the 440V range and matching reactor, you could achieve an exact output of 50kvar into the 400V mains and use the smaller contactor 17237.004-50.0.

Reactors for 5.67% detuning (f_n = 210Hz) in 400V 50Hz mains

capacitor power	LC output @ 400V (kvar @ 40V 50Hz)	order no.	winding material	I _n	I _{th}	L + W × H	order code
2.5kvar 400V							17237.004-...
5kvar 400V							available on request
10kvar 400V	18.6	425.894-0082A0	Cu	3 × 2.89	20	190 × 92 × 165	...-12.5
12.5kvar 400V	12.1	428.894-0082A0	Cu	3 × 2.33	24.8	190 × 92 × 165	...-20.0
15kvar 400V	16.9	433.899-0082A0	Cu	3 × 1.93	30.1	190 × 102 × 165	...-20.0
20kvar 400V	21.2	444.120-0082A0	Cu	3 × 1.44	40	240 × 131 × 215	...-25.0
25kvar 400V	26.5	444.635-0083A0	Al	3 × 1.16	50	240 × 131 × 215	...-31.4
50kvar 400V	53	458.659-0083A0	Al	3 × 0.58	100.2	300 × 192 × 265	...-50.7
75kvar 400V	79.5	458.660-0083A0	Al	3 × 0.38	150.2	300 × 202 × 265	...-48.1
100kvar 400V	106	480.718-0083A0	Al	3 × 0.29	200.4	420 × 180 × 370	available on request
2.5kvar 440V							...-50.0
50kvar 440V	50	440.715-0012A0	Cu	3 × 1.55	38.6	240 × 131 × 215	...-50.0
100kvar 440V	50	488.859-0013A0	Al	3 × 0.58	100.2	300 × 192 × 265	...-50.7

1 53

2 ...-50.7

3 50

3 ...-50.0

C. Your specification prescribes the use of capacitors with a higher voltage rating for a detuned application.

Example: 25kvar 400V 50Hz, 7% reactor, capacitors must have 525V rating.

1. Select required power of LC-circuit on page 7. (25kvar 400V); use the visible part of overlapped capacitor chart (page 11) on the right-hand margin as indicator for proper capacitor voltage.
2. Select matching capacitor contactor type 17237.004-25.0.
3. Go to page 11 for details of the applicable capacitor. You are recommended to use 2 pcs of 20kvar 525V capacitors.

capacitor power	U _n (kV)	C _n (µF)	I _n (A)	I _{th} (A)	D = L ₁ (mm)	m (kg)	Design	order no.	pcs /set	res FB	recommended discharge	order code
20kvar 400V	440	124-0012A0	Cu	3 × 1.93	35.1	240 × 131 × 215						...-25.0
25kvar 400V	444	124-0013A0	Al	3 × 1.54	43.8	240 × 131 × 215						...-25.0
30kvar 400V	458	158-0013A0	Al	3 × 1.77	87.6	300 × 192 × 265						...-50.0
35kvar 400V	440	157-0013A0	Al	3 × 0.51	127.1	300 × 192 × 265						...-50.7
100kvar 400V	480	718-0033A0	Al	3 × 0.38	175	420 × 180 × 370						...-50.1

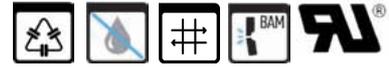
1 25kvar 400V

1 40kvar 525V

2 ...-25.0

15	3 × 87	3 × 14	3 × 27	75 × 280	1.3	K	277.549-00700	5	10	included		10kvar 525V
16	3 × 62	3 × 18	3 × 30	75 × 280	1.3	K	277.549-00700	5	10	included		10kvar 525V
20	3 × 77	3 × 22	3 × 33	85 × 245	1.5	K	277.558-00700	5	12	included		20kvar 525V
25	3 × 98	3 × 28	3 × 45	95 × 245	1.6	L	277.169-00700	3	12	275.100-10100		25kvar 525V
30	3 × 125	3 × 33	3 × 43	95 × 280	2	L	277.169-011500	3	10	275.100-10100		30kvar 525V
32	3 × 123	3 × 35	3 × 45	95 × 280	2	L	277.169-012000	3	10	275.100-10100		32kvar 525V
4 × 20	3 × 154	3 × 44					2 × 277.558-007700					40kvar 525V
4 × 20	3 × 300	3 × 80					4 × 277.558-007700					40kvar 525V
4 × 20	3 × 442	3 × 132					6 × 277.558-007700					120kvar 525V
8 × 20	3 × 616	3 × 176					8 × 277.558-007700					160kvar 525V

3 40kvar 525V



MKPC™ Gas-filled Power Capacitors for non-detuned use in mains of 400V, 415V and 440V 50Hz or for detuned systems at 400V 50Hz

Contactors

capacitor power	U _c (kvar)	C _N (μF)	I _N (A)	I _{max} (A)	D ₁ × L ₁ (mm)	m (kg)	Design	order no.	pcs /box	box FB	recommended discharge	order code	
		U_N 400V 50Hz			U_{max} 440V		U_{BB} 950V AC/2s		U_{BG} 3600V AC/2s			17237.004-...	
2.5kvar	400V	2.5	3 × 17	3 × 6	3 × 9	60 × 164	0.4	K	277.525-401700	10	8	included	...-12.5
5kvar	400V	5	3 × 33	3 × 12	3 × 18	65 × 164	0.5	K	277.535-403300	10	8	included	...-12.5
10kvar	400V	10	3 × 68	3 × 15	3 × 30	65 × 280	1.1	K	277.539-406800	10	10	included	...-12.5
12.5kvar	400V	12.5	3 × 82	3 × 18	3 × 31	75 × 230	1	K	277.546-408200	5	9	included	...-12.5
15kvar	400V	15	3 × 100	3 × 22	3 × 33	75 × 280	1.3	K	277.549-410000	5	10	included	...-20.0
20kvar	400V	20	3 × 133	3 × 29	3 × 38	85 × 280	1.5	K	277.559-413300	5	10	included	...-20.0
25kvar	400V	25	3 × 166	3 × 36	3 × 56	95 × 280	2	L	277.169-516600	3	10	275.100-10120	...-25.0
50kvar	400V	50	3 × 332	3 × 72					(2×) 277.169-516600				...-50.0
75kvar	400V	75	3 × 498	3 × 108					(3×) 277.169-516600				...-50.7
100kvar	400V	100	3 × 664	3 × 144					(4×) 277.169-516600				...-60.1
		U_N 440V 50Hz			U_{max} 440V		U_{BB} 950V AC/2s		U_{BG} 3600V AC/2s				
2.5kvar	440V	2.5	3 × 14	3 × 3.3	3 × 5.6	60 × 164	0.4	K	277.525-401400	10	8	included	...-12.5
5kvar	440V	5	3 × 28	3 × 6.6	3 × 12	60 × 164	0.4	K	277.525-402800	10	8	included	...-12.5
10kvar	440V	10	3 × 55	3 × 14	3 × 25	65 × 230	0.9	K	277.536-405500	10	9	included	...-12.5
11.2kvar	440V	11.2	3 × 62	3 × 14	3 × 27	65 × 245	1	K	277.538-406200	10	12	included	...-12.5
12.5kvar	440V	12.5	3 × 68	3 × 16	3 × 30	65 × 280	1.1	K	277.539-406800	10	10	included	...-20.0
14.1kvar	440V	14.1	3 × 77	3 × 19	3 × 27	75 × 230	1	K	277.546-407700	5	9	included	...-12.5
15kvar	440V	15	3 × 82	3 × 20	3 × 31	75 × 230	1	K	277.546-408200	5	9	included	...-20.0
20kvar	440V	20	3 × 110	3 × 27	3 × 38	75 × 280	1.3	K	277.549-411000	5	10	included	...-20.0
22.4kvar	440V	22.4	3 × 123	3 × 28	3 × 42	85 × 245	1.4	L	277.158-412300	5	12	275.100-10120	...-20.0
25kvar	440V	25	3 × 137	3 × 33	3 × 47	85 × 280	1.5	L	277.159-413700	5	10	275.100-10120	...-25.0
28.2kvar	440V	28.2	3 × 154	3 × 35	3 × 53	95 × 245	1.6	L	277.168-415400	3	12	275.100-10120	...-25.0
30kvar	440V	30	3 × 166	3 × 40	3 × 56	95 × 280	2	L	277.169-516600	3	10	275.100-10120	...-33.4
40kvar	440V	40	3 × 220	3 × 54					(2×) 277.549-411000				...-50.0
50kvar	440V	50	3 × 274	3 × 66					(2×) 277.159-413700				...-50.0
56.4kvar	440V	56.4	3 × 308	3 × 70					(2×) 277.168-415400				...-50.0
60kvar	440V	60	3 × 332	3 × 80					(2×) 277.169-516600				...-50.7
75kvar	440V	75	3 × 411	3 × 99					(3×) 277.159-413700				...-50.7
84.6kvar	440V	84.6	3 × 462	3 × 105					(3×) 277.168-415400				...-50.7
100kvar	440V	100	3 × 548	3 × 132					(4×) 277.159-413700				...-60.1
112.8kvar	440V	112.8	3 × 616	3 × 140					(4×) 277.168-415400				...-60.1

Rated Voltage U_N

Root mean square of the max. permissible value of sinusoidal AC voltage in continuous operation. The rated voltage must not be exceeded even in cases of malfunction. Bear in mind that capacitors in detuned equipment are exposed to a higher voltage than that of the rated mains voltage; this is caused by the connection of detuning reactor and capacitor in series. Consequently, capacitors used with reactors must have a voltage rating higher than that of the regular mains voltage.

Rated Power Q_c

Reactive power resulting from the ratings of capacitance, frequency, and voltage.

Current Rating I_N

RMS value of the current at rated voltage and frequency, excluding harmonic distortion, switching transients, and capacitance tolerance.

Maximum RMS Current Rating I_{max}

Maximum rms value of permissible current in continuous operation. In accordance with EN 60831 all ELECTRONICON capacitors are rated at least 1.3I_N, allowing for the current rise from permissible voltage and capacitance tolerances as well as harmonic distortion. Continuous currents that exceed these values will lead to a build-up of heat in the capacitor and - as a result - reduced lifetime or premature failure. Permanent excess current may even result in failure of the capacitor's safety mechanisms, i.e. bursting or fire.



FK-Dr™
400V 50Hz

MKPc™
480...525V
50Hz

Contactors
(for 400V mains)

Reactors for 7% detuning ($f_R = 189\text{Hz}$) in 50Hz mains

LC output @ U_{mains} (kvar, V)	order no.	winding material	L_N (mH)	I_{eff} (A)	L × W × H (mm)	order code 17237.004-...	capacitor power
			available on request				5kvar 480V
			available on request				6.25kvar 480V
			available on request				7.5kvar 480V
			available on request				10kvar 480V
			available on request				12.5kvar 480V
12.5kvar 400V	428.094-4032X0	Cu	3 × 3.07	21.9	290 × 92 × 165	...-12.5	16.7kvar 480V
			available on request				25kvar 480V
25kvar 400V	444.625+4033X0	Al	3 × 1.54	43.8	240 × 131 × 215	...-25.0	33.4kvar 480V
50kvar 400V	458.758+4033X0	Al	3 × 0.77	87.6	300 × 180 × 190	...-50.0	67kvar 480V
75kvar 400V	468.659+4033X0	Al	3 × 0.51	116.8	300 × 192 × 265	...-50.7	100kvar 480V
100kvar 400V	4H0.718+4033X0	Al	3 × 0.38	175	420 × 188 × 370	...-60.1	134kvar 480V
			available on request				5kvar 525V
			available on request				6.25kvar 525V
			available on request				7.5kvar 525V
			available on request				10kvar 525V
			available on request				15kvar 525V
10kvar 400V	425.093-4032X0	Cu	3 × 3.84	17.5	190 × 82 × 165	...-12.5	16kvar 525V
12.5kvar 400V	428.094-4032X0	Cu	3 × 3.07	21.9	290 × 92 × 165	...-12.5	20kvar 525V
			available on request				25kvar 525V
			available on request				30kvar 525V
20kvar 400V	440.124-4032X0	Cu	3 × 1.92	35.1	240 × 121 × 215	...-20.0	32kvar 525V
25kvar 400V	444.625+4033X0	Al	3 × 1.54	43.8	240 × 131 × 215	...-25.0	40kvar 525V
50kvar 400V	458.758+4033X0	Al	3 × 0.77	87.6	300 × 180 × 190	...-50.0	80kvar 525V
75kvar 400V	468.659+4033X0	Al	3 × 0.51	127.1	300 × 192 × 265	...-50.7	120kvar 525V
100kvar 400V	4H0.718+4033X0	Al	3 × 0.38	175	420 × 188 × 370	...-60.1	160kvar 525V

LC output @ U_{mains} :

The series combination of detuning reactor (L) and capacitor (C) causes a voltage rise at the capacitor terminals. The capacitor then produces more kvar than under "normal" circumstances. This value states the kvar output delivered by the LC-set into the mains.

I_{eff} :

Permitted current load on the reactor in permanent operation, caused by the fundamental wave **plus** harmonics in the system. For all data given in this catalogue, we are assuming a 10% increase of the fundamental current, resulting from voltage tolerances as permitted by DIN EN 50160.



Reactors for 7% detuning ($f_R = 189\text{Hz}$) in 400V 50Hz mains

Contactors

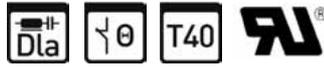
capacitor power	LC output @ U_{mains} (kvar @ 400V 50Hz)	order no.	winding material	L_N	I_{eff}	L × W × H	order code
							17237.004-...
2.5kvar 400V	available on request						
5kvar 400V	available on request						
10kvar 400V	10.8	425.093-40D2X0	Cu	3 × 3.57	18.2	190 × 82 × 165	...-12.5
12.5kvar 400V	13.3	428.094-40D2X0	Cu	3 × 2.88	22.6	190 × 92 × 165	...-20.0
15kvar 400V	16.1	433.095-40D2X0	Cu	3 × 2.38	27.3	190 × 102 × 165	...-20.0
20kvar 400V	21.5	440.124-40D2X0	Cu	3 × 1.76	36.4	240 × 121 × 215	...-25.0
25kvar 400V	26.9	444.625+40D3X0	Al	3 × 1.43	45.5	240 × 131 × 215	...-33.4
50kvar 400V	53.8	458.758+40D3X0	Al	3 × 0.71	91	300 × 180 × 190	...-50.7
75kvar 400V	80.6	468.659+40D3X0	Al	3 × 0.48	136.6	300 × 192 × 265	...-60.1
100kvar 400V	107.5	4H0.660+40D3X0	Al	3 × 0.36	182.1	300 × 203 × 265	available on request
2.5kvar 440V	available on request						
5kvar 440V	available on request						
10kvar 440V	available on request						
11.2kvar 440V	10	425.093-4032X0	Cu	3 × 3.84	17.5	190 × 82 × 165	...-12.5
12.5kvar 440V	10.8	425.093-40D2X0	Cu	3 × 3.57	18.2	190 × 82 × 165	...-20.0
14.1kvar 440V	12.5	428.094-4032X0	Cu	3 × 3.07	21.9	290 × 92 × 165	...-12.5
15kvar 440V	13.3	428.094-40D2X0	Cu	3 × 2.88	22.6	190 × 92 × 165	...-20.0
20kvar 440V	17.8	436.095-4032X8	Cu	3 × 2.15	30.1	190 × 102 × 165	...-20.0
22.4kvar 440V	20	440.124-4032X0	Cu	3 × 1.92	35.1	240 × 121 × 215	...-20.0
25kvar 440V	22.3	442.625+4033X0	Al	3 × 1.76	36.4	240 × 121 × 215	...-25.0
28.2kvar 440V	25	444.625+4033X0	Al	3 × 1.54	43.8	240 × 131 × 215	...-25.0
30kvar 440V	26.7	445.625+4033X0	Al	3 × 1.43	45.5	240 × 131 × 215	...-33.4
40kvar 440V	36	432.626+4033X0	Al	3 × 1.07	60.4	240 × 141 × 215	...-50.0
50kvar 440V	44	495.758+4033X0	Al	3 × 0.86	75.2	300 × 180 × 190	...-50.0
56.4kvar 440V	50	458.758+4033X0	Al	3 × 0.77	87.6	300 × 180 × 190	...-50.0
60kvar 440V	54	460.758+4033X0	Al	3 × 0.71	91	300 × 180 × 190	...-50.7
75kvar 440V	67	471.657+4033X0	Al	3 × 0.58	112.9	300 × 177 × 265	...-50.7
84.6kvar 440V	75	468.659+4033X0	Al	3 × 0.51	116.8	300 × 192 × 265	...-50.7
100kvar 440V	available on request						
112.8kvar 440V	100	4H0.660+4033X0	Al	3 × 0.38	175	300 × 203 × 265	...-60.1

LC output @ U_{mains} :

The series combination of detuning reactor (L) and capacitor (C) causes a voltage rise at the capacitor terminals. The capacitor then produces more kvar than under "normal" circumstances. This value states the kvar output delivered by the LC-set into the mains.

I_{eff} :

Permitted current load on the reactor in permanent operation, caused by the fundamental wave plus harmonics in the system. For all data given in this catalogue, we are assuming a 10% increase of the fundamental current, resulting from voltage tolerances as permitted by DIN EN 50160.



FK-Dr™
400/415V 50Hz

MKPc™
480...525V
50Hz

Contactors
(for 400V mains)

Reactors for 5.67% detuning ($f_R = 210\text{Hz}$) in 50Hz mains

LC output @ U_{mains} (kvar. V)	order no.	winding material	L_N (mH)	I_{off} (A)	L × W × H (mm)	order code 17237.004-...	capacitor power
available on request							5kvar 480V
available on request							6.25kvar 480V
available on request							7.5kvar 480V
available on request							10kvar 480V
available on request							12.5kvar 480V
12.5kvar 400V	428.094-4012A0		3 × 2.49	24.1	190 × 92 × 165	...-12.5	16.7kvar 480V
available on request							25kvar 480V
25kvar 400V	444.625+4013A0		3 × 1.24	48.2	240 × 131 × 215	...-25.0	33.4kvar 480V
50kvar 400V	458.659+4013A0		3 × 0.62	96.6	300 × 192 × 265	...-50.0	67kvar 480V
75kvar 400V	468.660+4013A0		3 × 0.41	144.8	300 × 203 × 265	...-50.7	100kvar 480V
100kvar 400V	4H0.718+4013A0		3 × 0.31	193.1	420 × 188 × 370	...-60.1	134kvar 480V
available on request							5kvar 525V
available on request							6.25kvar 525V
available on request							7.5kvar 525V
available on request							10kvar 525V
available on request							15kvar 525V
10kvar 400V	425.094-4012A0		3 × 3.11	19.3	190 × 92 × 165	...-12.5	16kvar 525V
12.5kvar 400V	428.094-4012A0		3 × 2.49	24.1	190 × 92 × 165	...-12.5	20kvar 525V
available on request							25kvar 525V
available on request							30kvar 525V
20kvar 400V	440.125-4012A0		3 × 1.55	38.6	240 × 131 × 215	...-20.0	32kvar 525V
25kvar 400V	444.625+4013A0		3 × 1.24	48.2	240 × 131 × 215	...-25.0	40kvar 525V
50kvar 400V	458.659+4013A0		3 × 0.62	96.6	300 × 192 × 265	...-50.0	80kvar 525V
75kvar 400V	468.660+4013A0		3 × 0.41	144.8	300 × 203 × 265	...-50.7	120kvar 525V
100kvar 400V	4H0.718+4013A0		3 × 0.31	193.1	420 × 188 × 370	...-60.1	160kvar 525V

LC output @ U_{mains} :

The series combination of detuning reactor (L) and capacitor (C) causes a voltage rise at the capacitor terminals. The capacitor then produces more kvar than under "normal" circumstances. This value states the kvar output delivered by the LC-set into the mains.

I_{off} :

Permitted current load on the reactor in permanent operation, caused by the fundamental wave **plus** harmonics in the system. For all data given in this catalogue, we are assuming a 10% increase of the fundamental current, resulting from voltage tolerances as permitted by DIN EN 50160.



Reactors for 5.67% detuning ($f_R = 210\text{Hz}$) in 400V 50Hz mains

Contactors

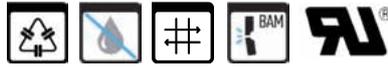
capacitor power	LC output @ U_{mains} (kvar @ 400V 50Hz)	order no.	winding material	L_N	I_{eff}	L × W × H	order code
							17237.004-...
2.5kvar 400V	available on request						
5kvar 400V	available on request						
10kvar 400V	10.6	425.094-40B2A0	Cu	3 × 2.89	20	190 × 92 × 165	...-12.5
12.5kvar 400V	13.1	428.094-40B2A0	Cu	3 × 2.33	24.8	190 × 92 × 165	...-20.0
15kvar 400V	15.9	433.095-40B2A0	Cu	3 × 1.93	30.1	190 × 102 × 165	...-20.0
20kvar 400V	21.2	444.125-40B2A0	Cu	3 × 1.44	40	240 × 131 × 215	...-25.0
25kvar 400V	26.5	444.625+40B3A0	Al	3 × 1.16	50	240 × 131 × 215	...-33.4
50kvar 400V	53	458.659+40B3A0	Al	3 × 0.58	100.2	300 × 192 × 265	...-50.7
75kvar 400V	79.5	468.660+40B3A0	Al	3 × 0.39	150.3	300 × 203 × 265	...-60.1
100kvar 400V	106	4H0.718+40B3A0	Al	3 × 0.29	200.4	420 × 188 × 370	available on request
2.5kvar 440V	available on request						
5kvar 440V	available on request						
10kvar 440V	available on request						
11.2kvar 440V	10	425.094-4012A0	Cu	3 × 3.11	19.3	190 × 92 × 165	...-12.5
12.5kvar 440V	10.6	425.094-40B2A0	Cu	3 × 2.89	20	190 × 92 × 165	...-20.0
14.1kvar 440V	12.5	428.094-4012A0	Cu	3 × 2.49	24.1	290 × 92 × 165	...-12.5
15kvar 440V	13.1	428.094-40B2A0	Cu	3 × 2.33	24.8	190 × 92 × 165	...-20.0
20kvar 440V	17.6	436.095-4012A6	Cu	3 × 1.74	33.3	190 × 102 × 165	...-20.0
22.4kvar 440V	20	440.125-4012A0	Cu	3 × 1.55	38.6	240 × 131 × 215	...-20.0
25kvar 440V	22	442.625+4013A0	Al	3 × 1.44	40	240 × 131 × 215	...-25.0
28.2kvar 440V	25	444.625+4013A0	Al	3 × 1.24	48.2	240 × 131 × 215	...-25.0
30kvar 440V	26.4	445.626+4013A0	Al	3 × 1.16	50	240 × 131 × 215	...-33.4
40kvar 440V	35	488.627+4013A0	Al	3 × 0.87	66.5	240 × 151 × 215	...-50.0
50kvar 440V	44	495.758+4013A0	Al	3 × 0.70	82.8	300 × 180 × 190	...-50.0
56.4kvar 440V	50	458.659+4013A0	Al	3 × 0.62	96.6	300 × 192 × 265	...-50.0
60kvar 440V	53	460.659+4013A0	Al	3 × 0.58	100.2	300 × 192 × 265	...-50.7
75kvar 440V	66	465.659+4013A0	Al	3 × 0.47	124.2	300 × 192 × 265	...-50.7
84.6kvar 440V	75	468.660+4013A0	Al	3 × 0.41	144.8	300 × 203 × 265	...-50.7
100kvar 440V	available on request						
112.8kvar 440V	100	4H0.718+4013A0	Al	3 × 0.31	193.1	420 × 188 × 370	...-60.1

LC output @ U_{mains} :

The series combination of detuning reactor (L) and capacitor (C) causes a voltage rise at the capacitor terminals. The capacitor then produces more kvar than under "normal" circumstances. This value states the kvar output delivered by the LC-set into the mains.

I_{eff} :

Permitted current load on the reactor in permanent operation, caused by the fundamental wave plus harmonics in the system. For all data given in this catalogue, we are assuming a 10% increase of the fundamental current, resulting from voltage tolerances as permitted by DIN EN 50160.



MKPc™ Gas-filled Power Capacitors for non-detuned use in mains of 400V...525V 50Hz or for detuned systems at 400...440V 50Hz

Q _C (kvar)	C _N (µF)	I _N (A)	I _{max} (A)	D ₁ × L ₁ (mm)	m (kg)	Design	order no.	pcs /box	box FB	recommended discharge	capacitor power	
U _N 480V 50Hz		U _{max} 480V		U _{BB} 1030V AC/2s			U _{BG} 3600V AC/2s					
5	3 × 23	3 × 6	3 × 10	60 × 164	0.4	K	277.525-502300	10	8	included	5kvar	480V
6.25	3 × 28	3 × 8	3 × 12	60 × 196	0.7	K	277.523-502800	10	8	included	6.25kvar	480V
7.5	3 × 34.6	3 × 9	3 × 14	65 × 196	0.8	K	277.533-503500	10	9	included	7.5kvar	480V
10	3 × 46.1	3 × 12	3 × 18	65 × 230	0.9	K	277.536-504600	10	9	included	10kvar	480V
12.5	3 × 58	3 × 15	3 × 23	65 × 280	1.1	K	277.539-505800	10	10	included	12.5kvar	480V
16.7	3 × 77	3 × 20	3 × 30	75 × 280	1	K	277.549-507700	5	10	included	16.7kvar	480V
25	3 × 115	3 × 30	3 × 39	85 × 280	1.5	K	277.559-511500	5	10	included	25kvar	480V
2 × 16.7	3 × 154	3 × 40					2 × 277.549-507700				33.4kvar	480V
4 × 16.7	3 × 308	3 × 81					4 × 277.549-507700				67kvar	480V
6 × 16.7	3 × 462	3 × 121					6 × 277.549-507700				100kvar	480V
8 × 16.7	3 × 616	3 × 161					8 × 277.549-507700				134kvar	480V
U _N 525V 50Hz		U _{max} 525V 50Hz		U _{BB} 1130V AC/2s			U _{BG} 4500V AC/2s					
5	3 × 19	3 × 5.5	3 × 9.0	65 × 164	0.5	K	277.535-601900	10	8	included	5kvar	525V
6.25	3 × 24	3 × 6.9	3 × 11	60 × 230	0.7	K	277.526-602400	10	9	included	6.25kvar	525V
7.5	3 × 29	3 × 8.2	3 × 12	60 × 230	0.7	K	277.526-602900	10	9	included	7.5kvar	525V
10	3 × 38	3 × 11	3 × 15	60 × 280	0.9	K	277.529-603800	10	10	included	10kvar	525V
15	3 × 57	3 × 16	3 × 22	75 × 280	1.3	K	277.549-605700	5	10	included	15kvar	525V
16	3 × 62	3 × 18	3 × 30	75 × 280	1.3	K	277.549-606200	5	10	included	16kvar	525V
20	3 × 77	3 × 22	3 × 33	85 × 245	1.5	K	277.558-607700	5	12	included	20kvar	525V
25	3 × 96	3 × 28	3 × 45	95 × 245	1.6	L	277.168-609600	3	12	275.100-10180	25kvar	525V
30	3 × 115	3 × 33	3 × 43	95 × 280	2	L	277.169-611500	3	10	275.100-10180	30kvar	525V
32	3 × 123	3 × 35	3 × 46	95 × 280	2	L	277.169-612300	3	10	275.100-10180	32kvar	525V
2 × 20	3 × 154	3 × 44					2 × 277.558-607700				40kvar	525V
4 × 20	3 × 308	3 × 88					4 × 277.558-607700				80kvar	525V
6 × 20	3 × 462	3 × 132					6 × 277.558-607700				120kvar	525V
8 × 20	3 × 616	3 × 176					8 × 277.558-607700				160kvar	525V

Rated Voltage U_N

Root mean square of the max. permissible value of sinusoidal AC voltage in continuous operation. The rated voltage must not be exceeded even in cases of malfunction. Bear in mind that capacitors in detuned equipment are exposed to a higher voltage than that of the rated mains voltage; this is caused by the connection of detuning reactor and capacitor in series. Consequently, capacitors used with reactors must have a voltage rating higher than that of the regular mains voltage.

Rated Power Q_C

Reactive power resulting from the ratings of capacitance, frequency, and voltage.

Current Rating I_N

RMS value of the current at rated voltage and frequency, excluding harmonic distortion, switching transients, and capacitance tolerance.

Maximum RMS Current Rating I_{max}

Maximum rms value of permissible current in continuous operation. In accordance with EN 60831 all ELECTRONICON capacitors are rated at least 1.3xI_N, allowing for the current rise from permissible voltage and capacitance tolerances as well as harmonic distortion. Continuous currents that exceed these values will lead to a build-up of heat in the capacitor and - as a result - reduced lifetime or premature failure. Permanent excess current may even result in failure of the capacitor's safety mechanisms, i.e. bursting or fire.

CAPACITOR CONTACTORS

General Technical Data

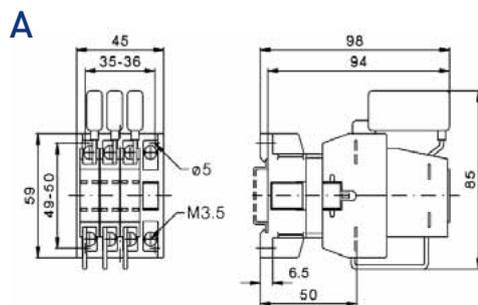


design	magnetic, three phase, with pre-load contacts for inrush protection
voltage range	U _{mains} = 400...440V (other voltages available on request)
control voltage	220...240V (other voltages available on request)
mounting	DIN hat rail W × H = 35 × 7.5mm or base mounting lugs for ø5mm screws
snap-on auxiliary contacts	available on request
standards	IEC947-4-1, EN60947-4-1, VDE0660

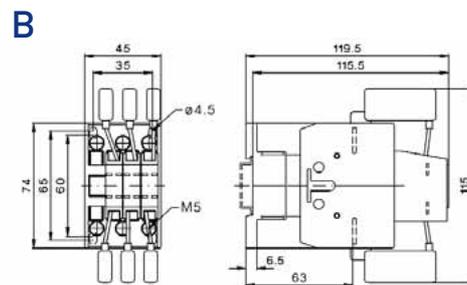
Contactors with Pre-load Contacts for Capacitor Switching in 400...440V Mains

	17237.004-...						
	...12.5	...20.0	...25.0	...33.4	...50.0	...50.7	...60.1
rated current @50°C	≤18A	14...28A	14...36A	30...48A	30...72A	30...108A	50...144A
permitted operating temperature	-40...+60°C	-40...+60°C	-40...+60°C	-40...+60°C	-40...+60°C	-40...+50°C	-40...+50°C
kvar 400V	≤12.5	10...20	10...25	20...33.3	20...50	20...75	33...100
kvar 415/440V	≤13	10.5...22	10.5...27	23...36	23...53	23...75	36...103
permitted switchings per hour	up to 120	up to 120	up to 120	up to 120	up to 120	up to 80	up to 80
contact life (switchings, non-detuned)	250000	150000	150000	150000	150000	120000	75000
contact life (switchings, detuned)	400000	300000	300000	300000	300000	200000	200000
dimension drawing	A	B	B	C	C	C	D

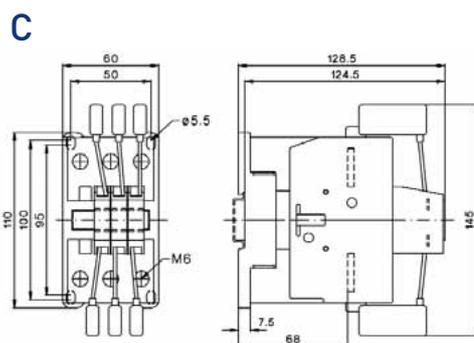
Dimension Drawings



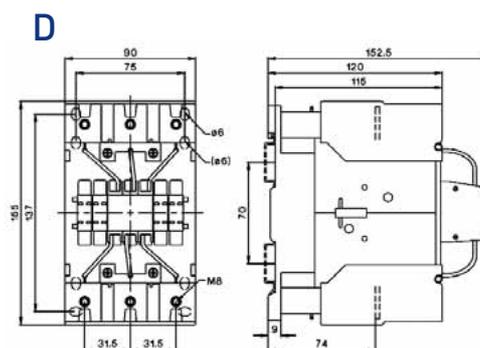
cable cross section with ferrule: 0.75...4mm²



cable cross section with ferrule: 1.5...16mm²



cable cross section with ferrule: 6...35mm²



cable cross section with ferrule: 10...95mm²

POWER FACTOR CONTROLLERS

Technical Data

Operation/Control voltage adjustable transformer ratio	90- 550V AC, 45 ... 65HZ, 5VA, 1ph 1 ... 350
No of output relays	6.12
Output rating	250V AC / 5A
Switching delay	1s ... 1200s
Display elements	LCD
Operating elements	Foil keyboard
Measuring current adjustable transformer ratio	10mA ... 6A, 20m Ω , 1ph 1..4000
External Alarm contact	isolated relay, closed contact
Terminals	4mm ² multiple contact plug
Fuses	to be installed externally (see manual)
Ambient temperature	-20°C ... 70°C
Humidity	0% ... 98% (no condensation)
Temperature measurement	NTC
Fan control	through branch output
Interface	TTL (back)
Protection class Front Back	IP50 (IP54 with special gasket) IP20
Pollution degree	3 (DIN VDE 0110, Pt 1 / IEC60664-1)
Mounting position	no restrictions
Case Front Back	plastic (UL94: V0) metal
Dimensions H × W × D	144 × 144 × 58mm (window size 138 × 138mm)
Weight	ca. 0.6 kg
Standards	DIN VDE 0110 1 (IEC 60664-1:1992) VDE 0411 1 (DIN EN 61010-1 / IEC 61010-1:2001) VDE 0843 20 (DIN EN 61326 / IEC 61326: 1997 + A1:1998 +A2: 2000) GOST R 52319-2005, GOST R 51522-99 UL 508 – Industrial Control Equipment CSA C22.2 No. 14-M95 - Industrial Control Equipment
Approval marks	 



CE Conformity

The controller is declared to conform with the following European Directives:

73/23/EWG	Low-Voltage Directive
2004/108/EG	EMC directive
93/68/EWG	Directive for amendment of directive 73/23/EWG (CE- Mark of Conformity)



IMPORTANT REMARKS

12 Months Limited Warranty

All our products are designed, manufactured, and tested with the highest care and workmanship. The satisfaction of our customers is our highest goal. We therefore warrant remedying any defect in the goods resulting from faulty design, materials or workmanship, which appears within 12 months from the date of sale.

This warranty does not cover defects due to improper use of the goods or operation at conditions exceeding the rated values stated in the catalogue or special data sheet. Nor does it cover defects due to faulty maintenance or incorrect installation, alterations or faulty repairs undertaken by the Buyer. Finally the warranty does not cover normal wear and tear or deterioration.

Protection Against Overvoltages and Short Circuits: Self-Healing Dielectric

All dielectric structures used in our power capacitors are "self-healing": In the event of a voltage breakdown the metal layers around the breakdown channel are evaporated by the temperature of the electric arc that forms between the electrodes. They are removed within a few microseconds and pushed apart by the pressure generated in the centre of the breakdown spot. An insulation area is formed which is reliably resistive and voltage proof for all operating requirements of the capacitor. The capacitor remains fully functional during and after the breakdown.

For voltages within the permitted testing and operating limits the capacitors are short-circuit- and overvoltage-proof.

They are also proof against external short circuits as far as the resulting surge discharges do not exceed the specified surge current limits.

Mounting and Cooling

The useful life of a capacitor may be reduced dramatically if exposed to excessive heat. Typically an increase in the ambient temperature of 7°C will halve the expected life of the capacitor. Make sure to obey the permitted operating temperatures of ambient temperature class D (max. temperature 55°C, max. average over 24hrs. 45°C, max. average over 365 days 35°C).

To avoid overheating the capacitors must be allowed to cool unhindered and should be shielded from external heat sources. We recommend forced ventilation for all applications with detuning reactors. Give at least 20mm clearance between the capacitors for natural or forced ventilation, and do not place them directly above or next to heat sources such as detuning or tuning reactors, bus bars, etc.

Functioning of the BAM™ (Break Action Mechanism)

In the event of overvoltage or thermal overload or ageing at the end of the capacitor's useful service life, an increasing number of self-healing breakdowns may cause rising pressure inside the capacitor. To prevent it from bursting, the capacitor is fitted with an obligatory "break action mechanism" (BAM). The BAM™ is based on an attenuated spot at one of the connecting wires inside the capacitor. With rising pressure the case begins to expand, mainly by opening the folded crimp and pushing the lid upwards. As a result, the prepared connecting wire is separated at the attenuated spot, and the current path is interrupted irreversibly.

Warning:

It has to be noted that this safety system can act properly only within the permitted limits of loads and overloads. The simple presence of a safety mechanism does not mean that catastrophic failures are completely impossible. Strong overvoltages, permanent external heat, and heavy current overload, e.g. during harmonic resonances may cause sudden, uncontrollable rise of temperature and pressure inside the can which may not leave sufficient time for the BAM™ to act properly, and result in explosion and fire.

Safety

ELECTRONICON will not indemnify or be responsible for any kind of damages to persons or property due to the improper application of any capacitors or reactors purchased from ELECTRONICON or its distributors. The capacitors and reactors should only be used for the application intended.

Mind that electrical or mechanical misapplication of capacitors and reactors can become hazardous. Misapplied capacitors can explode or catch fire and cause bodily injury or property damage due to the expulsion of material or metal fragments.

Please consult the detailed instructions for mounting and application stated in our Catalogue brochure "Capacitors and Reactors For Power Factor Correction", and on the ELECTRONICON website. If in doubt about how to connect, operate, or discharge a capacitor, consult ELECTRONICON engineering.

For more detailed information, please order our comprehensive catalogue "Capacitors and Reactors for Power Factor Correction", and the "General Safety Advice for Power Capacitors" issued by the German Electrical and Electronic Manufacturer's Association (ZVEI).

See our "General Conditions" for details on Warranty and Product liability.



APPROVED QUALITY AND PERFORMANCE

Regular investments in advanced and environmentally sound technologies guarantee the highest standards in manufacture and quality to standards which are approved worldwide. The ELECTRONICON system of quality assurance has been approved by the TUV organisation to ISO 9001. VDE is monitoring our production facilities on a regular base.

Überwachte Fertigungsstätte
Approved Place of Manufacture

ELECTRONICON Kondensatoren GmbH
 Keplerstraße 2
 07549 Gera

Fertigungsstättennummer: 30003593

Die Überwachung der Fertigungsstätte erfolgte nach dem europäischen Werksinspektions-Verfahren auf Basis der folgenden Schriftstücke: / This surveillance of the factory was performed according to the European Factory Inspection Procedure based on the following documents:

EC5/CIG 021 - 024
 Mai/May 2009

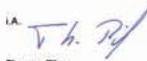
**Werksinspektionsverfahren, Harmonisierte Anforderungen/
 Factory Inspection Procedure - Harmonized Requirements**

Die Anforderungen wurden erfüllt. / The requirements have been fulfilled.

Datum der letzten Inspektion / Date of last inspection:
 2012-05-30

Produkt-Kategorie: Siehe Anhang /
 Product Category: See Appendix

VDE Prüf- und Zertifizierungsinstitut GmbH
 Werksinspektion und Konformitätsüberwachung
VDE Testing and Certification Institute
 Factory Inspection and Conformity Control

i.A. 
 Thomas Bliz
 Datum / Date: 2012-06-04

Marianstrasse 28, 63069 Offenbach, Deutschland / Germany
 Telefon / Phone: + 49 69 83 06-0, Telefax / Fax: + 49 69 83 06-555
 E-Mail / e-mail: vde.institut@vde.com, http://www.vde-institut.com

Dieses Zertifikat ist nicht übertragbar auf andere Fertigungsstätten und bewirkt nicht zum Führen eines VDE-Zeichens. /
 This Certificate is not transferable to other places of manufacture and does not authorize to use any VDE Mark.
 Attention: **Rechtlich verbindlich / Legally Binding**

VDE
 INSTITUT

CERTIFICATE 

**for the management system
 according to ISO 9001:2008**

The proof of the conforming application with the regulation was furnished and in accordance with certification procedure it is certified for the company

ELECTRONICON®

ELECTRONICON Kondensatoren GmbH
 Keplerstraße 2
 07549 Gera / Germany

Scope
Development, production and sale of DC/AC capacitors for high, medium and low voltage, reactors, controllers, capacitor modules, accessories and banks, metal coating of film

Certificate Registration No.: TIC 15 100 9534 Valid until: 2015-06-31
 Audit Report No.: 3330 208V M0 Valid from: 2012-06-28
 Initial certification: 1999

This certification was conducted in accordance with the TIC auditing and certification procedures and is subject to regular surveillance audits.

  Jena, 2012-06-28
 TÜV Thüringen e.V.
 Certification body for systems and personnel

 
 DGA 1435-08-05

 Original certificate
 is available with a signature.

The present validity can be downloaded at our homepage: www.tuv-thueringen.de
 Zustellungsadresse: 15244 Thüringen e.V. • Internat. Auslieferung: 15244PT1, Jena • Tel. 03641 20211 • Fax 03641 20211 • E-Mail: cert@tuv-thueringen.de

Certificate of Compliance

Certificate Number: 20110111-E211978 Page 1 of 1
 Report Reference: E211978, 2011 January 11
 Issue Date: 2011 January 11

 **Underwriters Laboratories**

Issued to: **ELECTRONICON KONDENSATOREN GMBH**
 KEPLERSTRASSE 2
 07549 GERA GERMANY

This is to certify that representative samples of **CAPACITORS**
 MKP, MKPg, MKPc

Have been investigated by Underwriters Laboratories Inc.® (UL) or any authorized licensee of UL in accordance with the Standard(s) indicated on this Certificate.

Standard(s) for Safety: Standard for Capacitors, UL 810, Fifth Edition
 CSA C22.2 No. 190-M1985, The Standard for Capacitor for Power Factor Correction, 1st Edition

Additional Information: See UL On-Line Certification Directory at www.ul.com for additional information.

Only those products bearing the UL Recognized Component Mark for the U.S. and Canada should be considered as being covered by UL's Recognition and Follow-Up Service and meeting the appropriate U.S. and Canadian requirements.

The UL Recognized Component Mark for the U.S. generally consists of the manufacturer's identification and catalog number, model number or other product designation as specified under "Marking" for the particular Recognition as published in the appropriate UL Directory. As a supplementary means of identifying products that have been produced under UL's Component Recognition Program, UL's Recognized Component Mark may be used in conjunction with the required Recognized Mark. The Recognized Component Mark is required when specified in the UL Directory preceding the recognition or under "Marking" for the individual recognition. The UL Recognized Component Mark for Canada consists of the UL Recognized Mark for Canada and the manufacturer's identification and catalog number, model number or other product designation as specified under "Marking" for the particular Recognition as published in the appropriate UL Directory.

Look for the UL Recognized Component Mark on the product

William R. Carney
 Director, North American Certification Programs
 Underwriters Laboratories Inc.
UL's Recognition and Follow-Up Service (RFS) service is provided as part of Underwriters Laboratories Inc. (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at <http://www.ul.com> or ul@ul.com.

Certificate of Compliance

Certificate Number: 20111107-E-337535A Page 1 of 2
 Report Reference: E237535-20111105
 Issue Date: 2011-NOVEMBER-07

 **Underwriters Laboratories**

Issued to: **ELECTRONICON KONDENSATOREN GMBH**
 KEPLERSTRASSE 2
 07549 GERA GERMANY

This is to certify that representative samples of **COMPONENT - POWER CIRCUIT AND MOTOR-MOUNTED APPARATUS**
 See Addendum Page

Have been investigated by Underwriters Laboratories in accordance with the Standard(s) indicated on this Certificate.

Standard(s) for Safety: UL508
 CAN/CSA C22.2 No. 14-2010.

Additional Information: See UL On-line Certification Directory at www.ul.com for additional information.

Only those products bearing the UL Recognized Component Mark for the U.S. and Canada should be considered as being covered by UL's Recognition and Follow-Up Service and meeting the appropriate U.S. and Canadian requirements.

The UL Recognized Component Mark for the U.S. generally consists of the manufacturer's identification and catalog number, model number or other product designation as specified under "Marking" for the particular Recognition as published in the appropriate UL Directory. As a supplementary means of identifying products that have been produced under UL's Component Recognition Program, UL's Recognized Component Mark may be used in conjunction with the required Recognized Mark. The Recognized Component Mark is required when specified in the UL Directory preceding the recognition or under "Marking" for the individual recognition. The UL Recognized Component Mark for Canada consists of the UL Recognized Mark for Canada and the manufacturer's identification and catalog number, model number or other product designation as specified under "Marking" for the particular Recognition as published in the appropriate UL Directory.

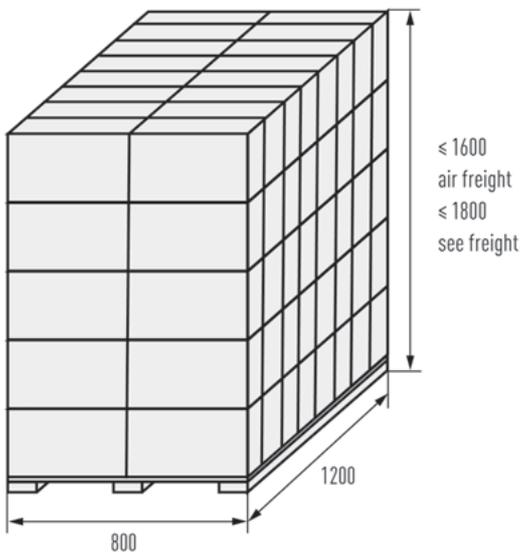
Look for the UL Recognized Component Mark on the product

William R. Carney
 Director, North American Certification Programs
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UL's Recognition and Follow-Up Service (RFS) service is provided as part of Underwriters Laboratories Inc. (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at <http://www.ul.com> or ul@ul.com.

PACKING DETAILS

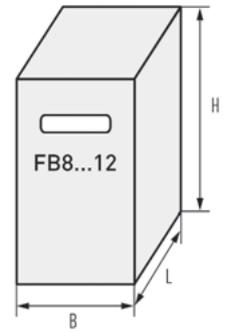
Capacitors

Type Box	L × B × H mm	Box/pallet
FB 8	393 × 153 × 270	80
FB 9	393 × 153 × 320	70
FB 10	393 × 153 × 370	56
FB 12	393 × 153 × 330	70



Box

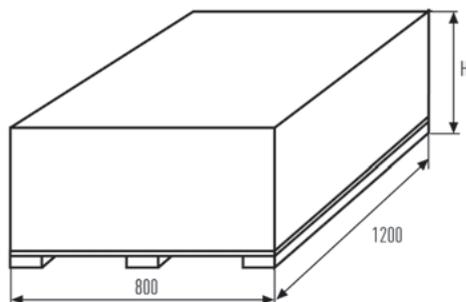
Carton, sealed with adhesive paper tape



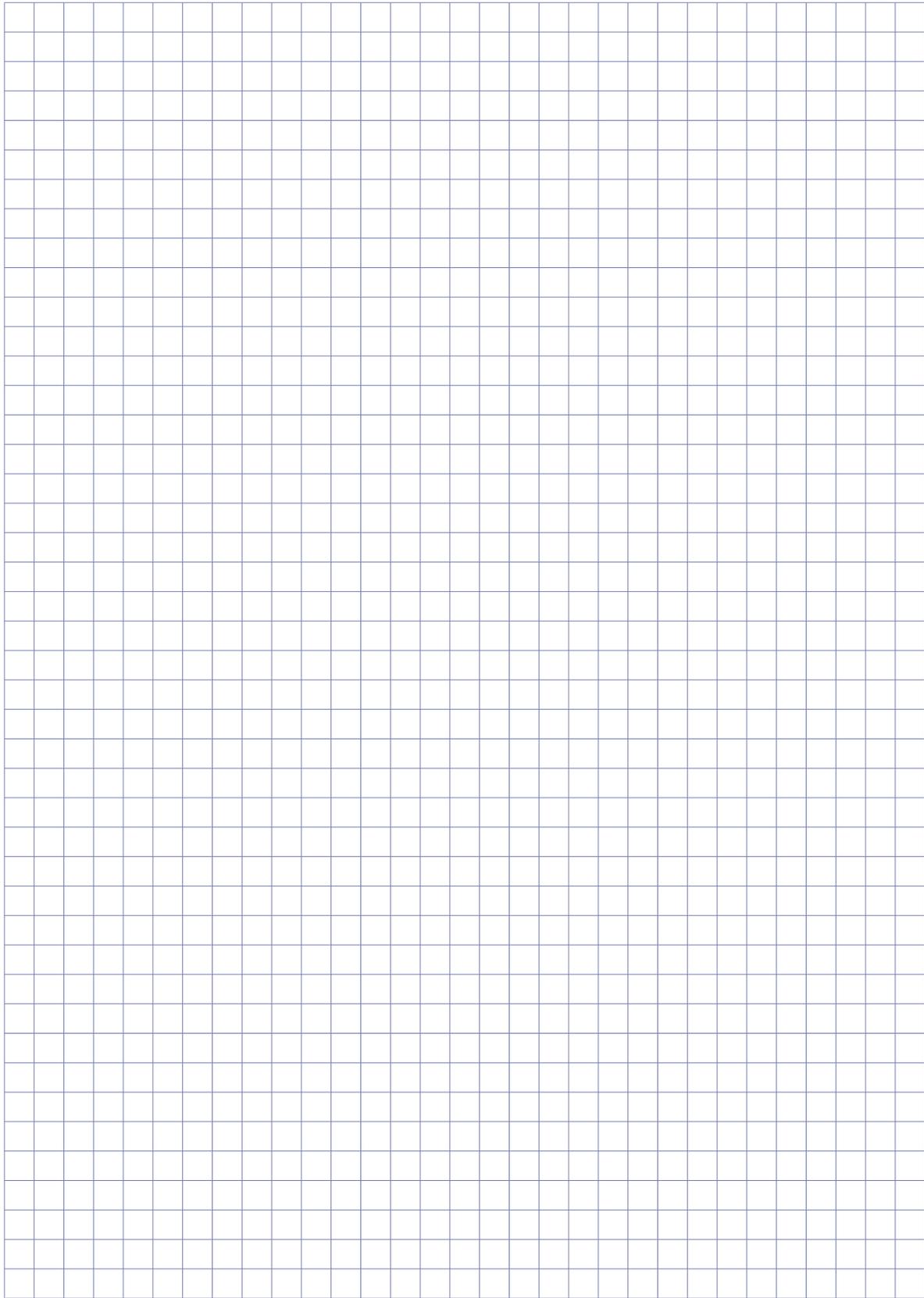
Pallet

Standard Euro-pallet (fumigated if required), wrapped in PP-foil

Reactors

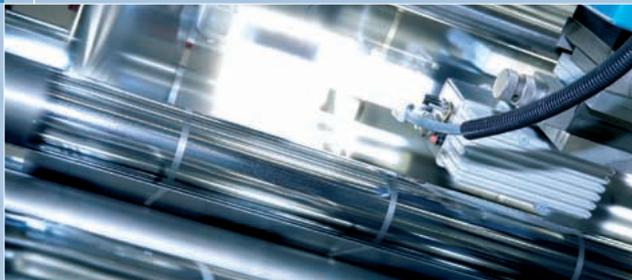


Wooden frame on standard Euro-pallet (fumigated if required)



EXCELLENT EXPERIENCE IN CAPACITOR MAKING FOR 75 YEARS

Gera has been a centre of capacitor making since 1938. ELECTRONICON Kondensatoren GmbH which emerged from previous RFT/VEB ELEKTRONIK Gera in 1992, has become one of Europe's leading capacitor manufacturers supplying customers worldwide and being an open and competent partner for manufacturers and users of power factor correction equipment, for many manufacturers of drives, power electronics, home appliances, and for the lighting industry. Regular investments in advanced and environmentally sound technologies guarantee the highest levels in manufacture and quality to modern standards which are approved and monitored by leading certification authorities.



- In today's globalised competition, we distinguish ourselves by
- Absolute reliability and safety of our products
 - Close co-operation between manufacturer and client to meet both technical and commercial requirements
 - Improvement and development of our technical expertise in capacitor design and manufacture, as well as film coating, with special attention paid to the MKPg-technology
 - Early identification and incorporation of new trends and methods in the manufacturing of capacitors
 - Flexibility and punctual fulfilment of our commercial obligations

Our experienced development engineers are competent and responsible for both implementing the latest technical trends applicable to our products and ensuring that our products adapt to the challenges of traditional and new markets.

The close and intense co-operation between the departments of Marketing & Sales, Research & Development, and Production has become the keystone of our success. ELECTRONICON is continually striving to establish a similarly close and interactive relationship with its distributors and direct clients both in home and overseas markets, to become not just one out of many suppliers, but your preferred partner for ideas and solutions.

ELECTRONICON®

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E-Mail: sales@electronicon.com, www.electronicon.com

