



Product Brief 2011

Power Factor Correction

Power Quality Solutions

PQS key components from EPCOS cover the entire range of products needed for successful power factor correction. All parts are carefully matched to each other. With this unique portfolio, EPCOS is more than a supplier of products: Power Quality Solutions is the strategy that has been developed to fulfill the demand of the market to offer solutions rather than single components. This product brief gives an overview of all PQS products for power factor correction and harmonic filtering. For detailed information, please refer to the PFC Product Profile and data sheets, available in the Internet at www.epcos.com/pfc, or contact your local sales office.




PQS key components

- PFC capacitors
 - PhaseCap Premium/Compact/HD
 - PhiCap
 - PoleCap
 - MKV capacitors
- Power factor controllers and measuring devices
 - BR604, BR6000, BR7000
 - MMI6000 and MMI7000
 - Grid analysis tool MC7000-3
- Capacitor contactors
 - J230, N230 series
- Thyristor modules for dynamic PFC
 - TSM-LC, TSM-HV series
- Reactors
 - Antiresonance harmonic filter
 - Discharge reactor
- Accessories

PQS






Power Factor Correction: Capacitors




Technical data			
			
Series	PhaseCap Premium	PhaseCap Compact	PhaseCap HD
	Premium power capacitors for low-voltage power factor correction	Compact power capacitors for low-voltage power factor correction	High-density power capacitors for low-voltage power factor correction
Features			
Technology	MKK	MKK	MKK
Inrush current	High pulse current withstand capability up to $300 \cdot I_R$	High pulse current withstand capability up to $400 \cdot I_R$	High pulse current withstand capability up to $300 \cdot I_R$
Discharge resistor/module	Ceramic discharge resistor pre-mounted up to 690 V AC; external discharge module for 765 and 800 V AC	Ceramic discharge resistor pre-mounted; external discharge module for types ≥ 690 V	External discharge module pre-mounted
Safety system	Triple: <ul style="list-style-type: none"> • Self healing • Overpressure disconnecter • Dry technology 	Dual: <ul style="list-style-type: none"> • Self healing • Overpressure disconnecter 	Triple: <ul style="list-style-type: none"> • Self healing • Overpressure disconnecter • Dry technology
Impregnation	Inert gas, dry, non-PCB	Triple (semi-dry), non-PCB	Inert gas, dry, non-PCB
Rated voltage V_R	230 ... 800 V AC	230 ... 1 000 V AC	400 ... 525 V AC
Power Q_R	5 ... 33 kvar	5 ... 33 kvar	40 ... 60 kvar
Rated frequency f_R	50/60 Hz	50/60 Hz	50/60 Hz
Winding	Concentric	Concentric	Stacked
Mounting position	Upright/horizontal	Upright/horizontal ¹⁾	Upright
Ordering code	B25667C*	B25673A* B25673S*	B25669*
Applications			
	<ul style="list-style-type: none"> • Automatic PFC equipment • Individual fixed PFC • Fixed PFC • Tuned and detuned capacitor banks • 690 and 800 V AC series for usage in harsh application conditions such as wind turbine and industrial applications with heavy harmonic loads 	<ul style="list-style-type: none"> • Automatic PFC equipment • Individual fixed PFC • Fixed PFC • Tuned and detuned capacitor banks • 690 to 1 000 V AC series for usage in harsh application conditions such as wind turbine and industrial applications with heavy harmonic loads 	<ul style="list-style-type: none"> • Automatic PFC equipment • Individual fixed PFC • Fixed PFC • Detuned capacitor banks

¹⁾ S-types: when mounting in horizontal position, additional mechanical support is recommended to prevent breaking of mounting bolt in case of mechanical shock or vibrations. This support should be placed at short distance below the bead at the top end of the capacitor.




Power Factor Correction: Capacitors

Technical data			
			
Series	PhiCap	PoleCap	MKV
	Power capacitors for low-voltage power factor correction	Power capacitors for outdoor applications or harsh environmental conditions	Power capacitors for high ambient temperatures and especially demanding loads
Features			
Technology	MKP	MKP/MKK	MKV
Inrush current	High pulse current withstand capability up to $200 \cdot I_R$	High pulse current withstand capability up to $200 \cdot I_R$	High pulse current withstand capability up to $500 \cdot I_R$
Discharge resistor/module	Ceramic discharge resistor pre-mounted for B32344E series; discharge resistors included in delivery for other series	Integrated discharge resistor	Ceramic discharge resistor pre-mounted
Safety system	Dual: <ul style="list-style-type: none"> • Self healing • Overpressure disconnecter 	Triple: <ul style="list-style-type: none"> • Self healing • Overpressure disconnecter • Dry technology 	Dual: <ul style="list-style-type: none"> • Self healing • Overpressure disconnecter
Impregnation	Semi-dry biodegradable soft resin, non-PCB	MKP: resin, non-PCB MKK: inert gas, non-PCB	Oil, non-PCB
Rated voltage V_R	230 ... 525 V AC	400 ... 525 V AC	400 ... 800 V AC
Power Q_R	0.5 ... 30 kvar	0.5 ... 30 kvar	4.2 ... 30 kvar
Rated frequency f_R	50/60 Hz	50/60 Hz	50/60 Hz
Winding	Stacked	MKP: stacked MKK: concentric	Stacked
Mounting position	Upright	Upright/horizontal	Upright/horizontal
Ordering code	B32340C* series: single-phase, fast-on terminals B32343C* series: three-phase, fast-on terminals B32344E* series: three-phase, optimized capacitor safety terminals	B25671A*	B25836B*
Applications			
	<ul style="list-style-type: none"> • Automatic capacitor banks • Fixed PFC • Detuned PFC systems 	<ul style="list-style-type: none"> • Pole mounted PFC, i.e. outdoor applications • Fixed PFC inside or outside a cabinet in surroundings with high dust or moisture concentrations • Automatic PFC systems to reduce labor costs 	<ul style="list-style-type: none"> • Applications with high thermal loading • AC applications in industrial electronics, e.g. high dv/dt • Tuned harmonic filters • Industrial applications with heavy harmonic loads



Power Factor Correction: Key Components

Technical data		
	 	
Series	Power Factor Controllers BR604 and BR6000 V5.0	Power Factor Controller BR7000
Features		
	<p>Large and multifunctional display (2 x 16 characters, backlight for BR6000 series) BR6000-HD with OLED display</p> <p>Menu driven handling (plain language)</p> <p>Self-optimizing control capability</p> <p>Recall function of recorded values</p> <p>Automatic initialization possible for BR6000</p> <p>Option: interface RS485 for BR6000</p>	<p>Illuminated graphic display, 128 x 64 dots, 8 lines OLED display optional</p> <p>Menu driven handling (plain language)</p> <p>Three-phase display of numerous parameters as real value and in %</p> <p>Three-phase measuring</p> <p>Controlling three-phase, single-phase, mixed mode</p> <p>HELP-button for interactive help text</p> <p>2 isolated interfaces</p>
Technical data		
	<ul style="list-style-type: none"> Supply voltage BR604: 230 V AC, 50/60 Hz BR6000: 110 ... 230 V AC, 50/60 Hz Measuring voltage: BR604: = supply voltage 230 V AC BR6000: 30 ... 525 V AC (L-N) or (L-L) Sensitivity: 50 mA/10 mA Measuring current BR6000: X:5 A / X:1 A 	<ul style="list-style-type: none"> Supply voltage: 110 ... 230 V AC, 50/60 Hz Measuring voltage: 3 · 30 ... 440 V AC (L-N); 3 · 50 ... 760 V AC (L-L) Power consumption: < 3 VA Operating ambient temperature: -20 ... +60 °C 15 switching outputs 3 additional alarm/message relays
Versions and ordering codes		
	<p>BR604 (4 steps) B44066R6004E230</p> <p>BR6000-R6 (6 steps) B44066R6006E230</p> <p>BR6000-R12 (12 steps) B44066R6012E230</p> <p>BR6000-HD6 B44066R6506E230</p> <p>BR6000-HD12 B44066R6512E230</p> <p>BR6000-R12/S485 (12 steps with RS485 interface) B44066R6412E230</p> <p>BR6000-T6 (6 steps for dynamic PFC) B44066R6106E230</p> <p>BR6000-T12 (12 steps for dynamic PFC) B44066R6112E230</p> <p>BR6000-T12/S485 (12 steps for dynamic PFC, interface RS485) B44066R6412E231</p> <p>BR6000-T6R6 6 transistor outputs, 6 relay outputs for mixed compensation (standard/dynamic) B44066R6066E230</p> <p>BR6000-T6R6/S485 6 transistor outputs, 6 relay outputs for mixed compensation (standard/dynamic) with interface RS485 B44066R6466E230</p>	<p>BR7000 B44066R7415E230</p> <p>BR7000 with OLED display B44066R7515E230</p> <p>PC software BR7000-SOFT</p> <p>Connection to RS485 of BR6000-R12/S485 and BR7000</p> <p>Administration of several PF controllers possible</p> <p>Comfortable analysis of recorded values</p> <p>Direct connection to USB port of a PC via USB-adapter</p> <p>Included in the delivery of BR6000-R12/S485 and BR7000</p>

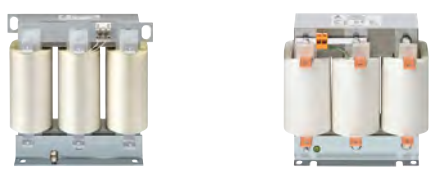

Power Factor Correction: Key Components

Technical data			
			
Series	Multi Measuring Interface MMI6000	Multi Measuring Device MMI7000	Grid Analysis Tool MC7000-3
Features			
	Coupling with PF controller BR6000 via interface for determination of real capacitor current	Display of harmonics as bar chart: harmonic of voltage up to 51 st and harmonic of current up to 51 st	Measuring, display and storage of numerous parameters
	Capacitor protection by step switch-off at current limit	Oscilloscope mode: for graphic display of a complete oscillation incl. harmonics	Illuminated full graphic display, current limit 128 x 64 dots
	Fast trigger for dynamic PFC	Display editor: for free programming of display for measured values	Comfortable programming of recording interval
	Independent switching of a single capacitor step	Scan mode: for rotating display of selected values	Display and internal storage of max. values with time stamp
	Stand-alone measuring device with interface for read-out	Display and recording of minimum and maximum values with time stamp	Display of date and time
	Single-phase measurement of V, I, P, Q, S, cos φ, f, W, T (read out via RS485)	Three-phase measuring and display of numerous parameters: V, I, P, Q, S, cos-φ, f, W, T, THD-V, THD-I	Large number of display options
	Panel mounting instrument	Panel mounting instrument	Fast and easy evaluation of measured values, with PC software included in the delivery
	Recording of maximum values	Graphical menu (E/DE/RU/ES/TR)	
	Graphical menu (E/DE)	Integrated help function	
		Display of date and time	
Technical data			
	<ul style="list-style-type: none"> Operating voltage: 230 V AC Measuring voltage (3-phase): 230 V AC ±15% Measuring current: X:5 A / X:1 A Rated frequency f_R: 50 and 60 Hz Power consumption: < 4 VA Sensitivity: 40 mA LCD display 2 · 16 characters; alphanumeric 	<ul style="list-style-type: none"> Operating voltage: 110 ... 230 V AC ±15% Measuring voltage (3-phase): 3 · 30 ... 440 V AC (L-N) 3 · 50 ... 760 V AC (L-L) Measuring current: X:5 A / X:1 A Rated frequency f_R: 50 and 60 Hz Power consumption: < 5 VA Sensitivity: 50 mA/10 mA Illuminated full graphic LCD display, 128 x 64 dots 	<ul style="list-style-type: none"> Operating voltage (auxiliary voltage): 110 ... 230 V AC Measuring voltage (3-phase): 3 · 30 ... 440 V AC (L-N) 3 · 50 ... 760 V AC (L-L) Power consumption: < 5 A Large number of accessories included: 3 safety measuring cables 1 safety measuring line 4 safety dolphin clips Windows-based software on CD-ROM 1 memory SD-Card (1 GB) 1 power lead
Versions and ordering codes			
	MMI6000-R (standard version with relay output) B44066M6000E230 MMI6000-T (dynamic version with transistor output) B44066M6100E230	MMI7000-B (basic version) B44066M7100E230 MMI7000-S (incl. 2 interfaces RS485) B44066M7200E230 MMI7000-E (extended version with additional interface, memory card and additional in- and outputs) B44066M7300E230	B44066M7777E230 Ordering code for flexible current clamps (not included in the delivery, but mandatory for operation): please refer to page 8.

Power Factor Correction: Key Components

Technical data			
			
Series	Capacitor Contactors J230/N230		Thyristor Modules for Dynamic PFC
Features			
	<p>Excellent damping of inrush current</p> <p>Soft switching of capacitors to increase the life expectancy of PFC systems, contactors and capacitors</p> <p>Reduced ohmic losses</p> <p>High safety standards</p> <p>Reduction of voltage sags and transients</p> <p>Series J230: with pre-charge resistors for conventional PFC systems without reactors</p> <p>Series N230: without pre-charge resistors for detuned PFC systems</p>	<p>Easy installation: usage similar to a contactor</p> <p>Ultra-short reaction time, almost no inrush current</p> <p>Permanent self controlling of various parameters:</p> <ul style="list-style-type: none"> • Voltage • Phase sequence • Capacitor output <p>Display of</p> <ul style="list-style-type: none"> • Operation • Faults • Activation <ul style="list-style-type: none"> • Maintenance-free • Long service life • No switching noise 	
Technical data			
	<ul style="list-style-type: none"> • Voltage: 400 ... 690 V • Output: 12.5 ... 100 kvar • Auxiliary contacts: included (normally open) • Mounting: integrated DIN-rail • Approval: cUL, CCC (up to 75 kvar) 	<ul style="list-style-type: none"> • Output at 400 V: 10, 25, 50, 100, 200 kvar • Output at 690 V: 50 and 200 kvar • Switching time: approx. 5 ms 	
Versions and ordering codes			
	J230 series	B44066S****J230	TSM-LC (400 V): B44066T0***E402
	N230 series	B44066S****N230	TSM-HV (690 V): B44066T0050E690 B44066T0200E690

Power Factor Correction: Key Components

Technical data		
		
Series	Reactors – Antiresonance Harmonic Filter	Reactors – Discharge Reactor
Features		
	High harmonic loading capability, very low losses	Fast discharge for fast reconnection of capacitors
	High linearity to avoid choke tilt, low noise emission	Reduced losses
		Shockproof case for DIN-rail mounting
Technical data		
	<ul style="list-style-type: none"> • Voltage: 400 V, 440 V, 690 V • Frequency: 50 or 60 Hz • Output: 10 ... 100 kvar • Harmonics (duty cycle = 100%): $V_3 = 0.5\% V_R$ $V_5 = 6.0\% V_R$ $V_7 = 5.0\% V_R$ $V_{11} = 3.5\% V_R$ $V_{13} = 3.0\% V_R$ • Effective current: $I_{rms} = \sqrt{I_1^2 + I_3^2 + \dots + I_{13}^2}$ • Fundamental current: $I_1 = 1.06 \cdot I_R$ (50 Hz or 60 Hz current of capacitor) • Temperature protection: microswitch (NC) • Detuning factor: 5.67%, 7%, 14% 	<ul style="list-style-type: none"> • Voltage: 230 ... 525 V • Frequency: 50/60 Hz • Discharge time (t): 230 V: up to 25 kvar < 10 s / up to 50 kvar < 20 s / up to 100 kvar < 40 s 400 ... 525 V: up to 25 kvar < 5 s / up to 50 kvar < 10 s / up to 100 kvar < 20 s
Ordering codes		
	B44066D*	B44066E9900S100
General information		
	<p>We constantly strive to improve our products. Consequently, the products described in this publication may change from time to time. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order.</p> <p>We also reserve the right to discontinue production and delivery of products. Consequently, we cannot guarantee that all products named in this publication will always be available.</p>	

Power Factor Correction: Accessories

Technical data		
Plastic protective case for PhaseCap capacitors		Ordering code
	Protection class IP54, up to 16 mm ² cable cross section	
	Capacitor d x h: 116 x 164 mm	B44066X9122
	Capacitor d x h: 116 x 200 mm	B44066X9142
	Capacitor d x h: 136 x 200 mm	
Plastic protective terminal cover, protection class IP54		
	PhaseCap Premium, PhaseCap Compact (n/a for Ø 100 mm), MKV	
	Capacitor d x h: 116 x 164 mm	B44066K0135A000
	Capacitor d x h: 116 x 200 mm	B44066K0160A000
	Capacitor d x h: 136 x 200 mm	B44066K0210A000
	PhiCap	
	Capacitor Ø: 53 mm	B44066K0530A000
	Capacitor Ø: 63.5 mm	B44066K0635A000
Capacitor Ø: 75 mm	B44066K0795A000	
Capacitor Ø: 85 mm	B44066K0895A000	
Discharge resistors / discharge modules		
		Available on request for PhaseCap Premium, PhaseCap Compact, PhaseCap HD, PhiCap B32344 series and MKV capacitors.
For PF controller series BR6000/BR7000 and MMI6000/MMI7000		
	USB to RS485 converter	
	For connection of BR6000 or BR7000 with interface RS485 to PC with USB-interface. Connection of several devices at RS485 possible.	B44066R3333E230
	RJ45 adapter connectors	
	3 versions available:	
	• Connection to the interface terminals of BR6000, BR7000 or MMI6000 via LAN cable	
	• Simple connection of several devices via the RS485 bus, for example:	
	– Connection of several BR6000 or BR7000 controllers to a PC with BR7000-SOFT software	
	– Interconnection of several BR6000 controllers	
	– Connection of BR6000 with MMI6000/MMI7000	
	Suitable for: 1xRJ45 for BR6000/BR7000	B44066R1611E230
	Suitable for: 2xRJ45 for BR6000/BR7000	B44066R1711E230
	Suitable for: 2xRJ45 for MMI6000/MMI7000	B44066R1811E230
For Thyristor modules TSM series		
		Discharge resistor block EW-22
		Discharge resistor for all types of TSM-LC to achieve fast discharging. At least one piece per step required.
		B44066T0022E400
		Current limitation reactor BD-xxx (not suitable for TSM-HV)
		Protection of thyristor modules in PFC systems without reactor TSM-LC10, TSM-LC25, TSM-LC50: BD-100. TSM-LC100: BD-200.
		B44066T0***E400
For Grid analyzing tool MC7000-3		
	1x Flexible current clamp "Mini-Flex MMI7000-3"	B44066M1301E230
	3x Flexible current clamps "Mini-Flex MMI7000-3"	B44066M1303E230

Important information: Some parts of this publication contain statements about the suitability of our products for certain areas of application. These statements are based on our knowledge of typical requirements that are often placed on our products. We expressly point out that these statements cannot be regarded as binding statements about the suitability of our products for a particular customer application. It is incumbent on the customer to check and decide whether a product is suitable for use in a particular application. This publication is only a brief product survey which may be changed from time to time. Our products are described in detail in our data sheets. The *Important notes* (www.epcos.com/ImportantNotes) and the product-specific *Cautions and warnings* must be observed. All relevant information is available through our sales offices.