

# PF Controllers BR6000 Series

Intelligent • User-friendly • Cost-effective • Version 5.0



## General

Controllers for PFC are of major importance in the PFC system. They measure the actual power factor and connect or disconnect capacitor stages to achieve a specific desired value ( $\cos \varphi$ ).

The PF controller series and BR6000 (six and twelve stages) offer highly intelligent control behavior and are very user-friendly thanks to menu-driven handling (plain language). Their multifunctional display greatly simplifies installation, handling and maintenance.

Different versions of the BR6000 series provide solutions to various applications:

- BR6000-R6 and BR6000-R12 for conventional applications with slowly changing loads (optionally with RS485 interface)
- BR6000-T6 and BR6000-T12 for dynamic PFC in applications with fast-changing loads



## Features

- Display
  - Large and multifunctional LCD (2 x 16 characters)
  - Graphic and alphanumeric LCD illumination
- Intelligent control
- Menu-driven handling (plain language)
- Self-optimizing control capability
- Recall function of recorded values
- Four-quadrant operation (e.g. stand-by generator)
- Large measuring voltage range
- Powerful alarm output
- Display of numerous of system parameters
  - System voltage (V AC)
  - Reactive power (KVA<sub>r</sub>)
  - Active power (kW)
  - Frequency
  - THD-V, THD-I
  - Individual harmonics up to 19th\*
  - Monitoring of individual capacitor currents
  - Apparent power (KVA)
  - Apparent current (A)
  - Temperature (°C)
  - Real-time  $\cos \varphi$
  - Target  $\cos \varphi$
  - KVA<sub>r</sub> value to target  $\cos \varphi$
- Alarm output
  - Insufficient compensation
  - Overcompensation
  - Undercurrent
  - Overcurrent
  - Overtemperature
  - Harmonics exceeded
  - Threshold value programmable
  - Internal error storage
  - Programming of 2nd signal relay random
  - Undervoltage and overvoltage
- Recall recorded values
  - Number of contactor switching operations
  - Maximum voltage V (V<sub>max</sub>)
  - Maximum reactive power, Q (KVA<sub>r</sub>)
  - Maximum value of harmonic
  - Maximum active power, P (kW)
  - Maximum apparent power, S (KVA)
  - Maximum temperature (°C)
  - Operation time of all capacitors
  - Complete 2nd parameter set available
  - Automatic initialization
  - Dynamic PFC (transistor output)
  - Thyristor switching
- Dual target power factor setting (EB and DG) is available in selected models

## ⚠ Cautions:

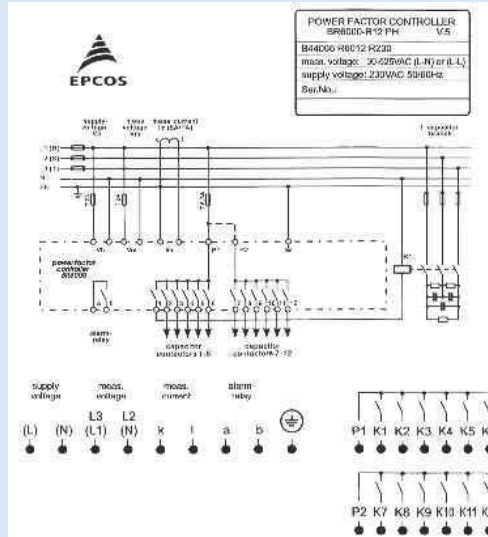
1. Discharge time: Make sure that the discharge time set in controller matches the capacitor discharge time. See page 84
2. Number of switchings: LV PFC capacitors according to standard IEC 60831 are designed for up to 5000 switching operations. Make sure that 5000 switching operations per year are not exceeded.

# PF Controllers BR6000 Series

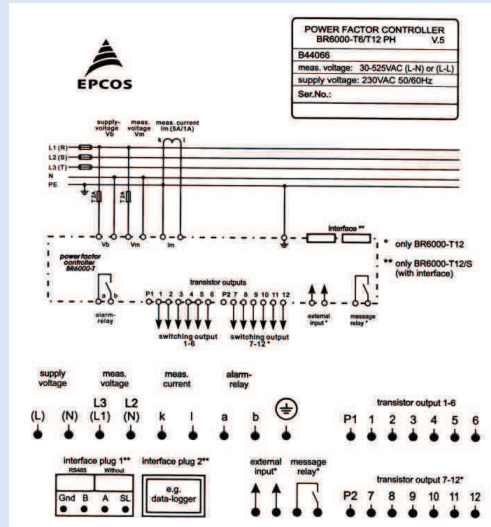
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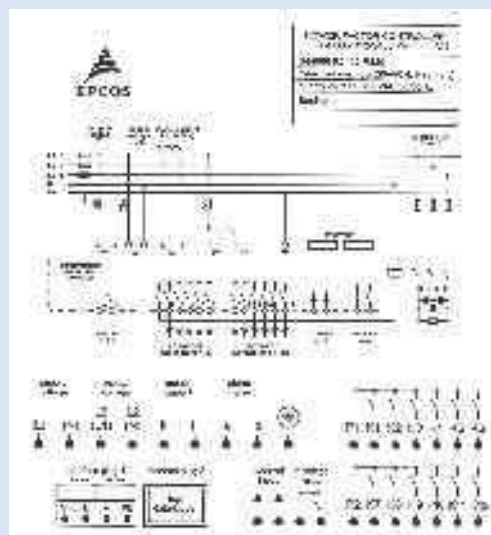
## PF controller BR6000 R-12 : Relay output



## PF Controller BR6000 T- 6/12 : Transistor output



## PF Controller BR6000 R-12 (RS 485) : Relay output



# PF Controllers BR6000 Series

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**Selection table for controllers**

	BR6000 relay output		BR6000 transistor output	
	6 STEP	12 STEP	6 STEP	12 STEP
<b>Switching</b>	Contactar	Contactar	Thyristor	Thyristor
<b>Ordering code</b>	B44066R6006R230N1	B44066R6012R230N1	B44066R6106R230N1	B44066R6112R230N1
<b>Auxiliary supply</b>	1-Phase, 2-Wire, 245 Vac (-20% to +20%)	1-Phase, 2-Wire, 245 Vac (-20% to +20%)	1-Phase, 2-Wire, 245 Vac (-20% to +20%)	1-Phase, 2-Wire, 245 Vac (-20% to +20%)
<b>Measurement voltage</b>	30-525 V AC (L-N) or (L-L)	30-525 V AC (L-N) or (L-L)	1Ph 30-300 V AC (L-N)	1Ph 30-300 V AC (L-N)
<b>Load CT Input current</b>	1 / 5 A	1 / 5 A	1 / 5 A	1 / 5 A
<b>No. of outputs</b>	6	12	6	12
<b>Alarm outputs</b>	1 No.	1 No.	1 No.	1 No.
- Insufficient Compensation	Yes	Yes	Yes	Yes
- Overcompensation	Yes	Yes	Yes	Yes
- Over / under voltage	Yes	Yes	Yes	Yes
- Overcurrent	Yes	Yes	Yes	Yes
<b>Automatic Initialisation</b>		Yes	Yes	Yes/Yes
<b>Communication interface RSXXX</b>	No	No*	No	No
<b>Parameters displayed</b>				
System voltage	Yes	Yes	Yes	Yes
Load current	Yes	Yes	Yes	Yes
Capacitor current	No	No	No	No
Active power	Yes	Yes	Yes	Yes
Reactive power	Yes	Yes	Yes	Yes
Apparent power	Yes	Yes	Yes	Yes
Frequency	Yes	Yes	Yes	Yes
Individual harmonics measurement upto	19	19	19	19
THD - V	Yes	Yes	Yes	Yes
THD - I	Yes	Yes	Yes	Yes
<b>Monitoring of individual capacitor current</b>	Yes - Health check	Yes - Health check	No	No
<b>Apparent current</b>	Yes	Yes	Yes	Yes
<b>Overtemperature</b>	Yes	Yes	Yes	Yes
<b>Real time cos φ</b>	Yes	Yes	Yes	Yes
<b>Target cos φ</b>	Yes	Yes	Yes	Yes
<b>KVAr value to target cos φ</b>	Yes	Yes	Yes	Yes
<b>Switching and discharge time range</b>				
- Correction time	1 sec - 20 min	1 sec - 20 min	20-1000 m sec	20-1000 m sec
- Discharge time	1 sec - 20 min	1 sec - 20 min	20-1000 m sec	20-1000 m sec
<b>Number of control series</b>	20 + E series	20 + E series	20 + E series	20 + E series
<b>Weight (in kG)</b>	1kG	1kG	1kG	1kG
<b>Dimensions (L x D x H in mm)</b>	144 x 55 x 144 mm	144 x 55 x 144 mm	144 x 53 x 144 mm	144 x 53 x 144 mm

\*RS 232-B44066R6312R230N1

\*RS 485-B44066R6412R230N1

# PF Controllers BR5000 Series

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## General

The BR5000 controller series is intended to be used with unbalanced three phase loading conditions and to correct the power factor. The controller needs 3 Load CT inputs and corresponding voltages. The overall compensation is done on averaging basis. The controller is having ultra intelligent processor in built. It covers almost all the electrical parameters to be displayed and monitored .

The three versions of BR5000 Controller are

- BR5000 – 16 for contactor switching logic for slow varying loads
- BR5000 – 16TX for rapidly changing loading conditions (Option for GSM communication available)
- BR5000 – HT for High tension upto 33kV sensing of power factors and correction. Version available in 8/16 steps.



## Features

- Microcontroller logic for measurements
- Control mode: Binary, unequal, Preset and user defined
- Multifunctional LCD display
- Three CT sensing for unbalanced loads
- Dual target Power Factor setting- useful for utility and DG mode operation
- Automatic synchronization possible
- Separate 3 CT monitoring of healthiness of capacitor within panel
- Data logging
- RS 232 in front and RS 232/485 switchable connection at rear
- Step operation indication on LCD display plus LED which facilitates viewing from a distance
- Unique facility of including 'Fixed Capacitor Bank' for purpose of Transformer compensation. This can be set such that the controller doesn't 'see' this capacitor

- Unique external temperature sensing by PT 100
- Settable alarm facility - undervoltage, overvoltage and so on
- Settable auxiliary outputs - 2 Nos for Alarm, etc.
- Auxiliary input -1 No
- EMI/EMC type tested
- Individual Harmonic measurement Upto 15<sup>th</sup>

## Protection Warning

- Over / under voltage
- Capacitor over / under current
- Over / under frequency
- Load unbalance
- Over temperature
- Out of steps (Indication)
- NV-Ram battery down

## Important display parameters

- Voltage
- Current
- Active power
- Reactive power
- Apparent power
- Capacitor current
- Per phase values of V, I and neutral current
- Power factor
- Frequency
- V<sub>THD</sub>
- I<sub>THD</sub>

## Technical Data

- Auxiliary supply voltage -1Ph, 415V (-40% to + 20%)
- Measurement voltage: 3PH 3 wire 415 VAC (-40% to + 20%)
- Current Input - 1A or 5A
- Steps - 8 and 16 relay outputs
- Supply frequency - 45 Hz to 62 Hz

## Mechanical and Maintenance

- Operating temperature - 0° to 70°C
- Storage temperature - -10°C to +75°C
- Humidity -0 to 98%

**Dynamic Power Factor Controller (Transistorised) available in 16 steps**

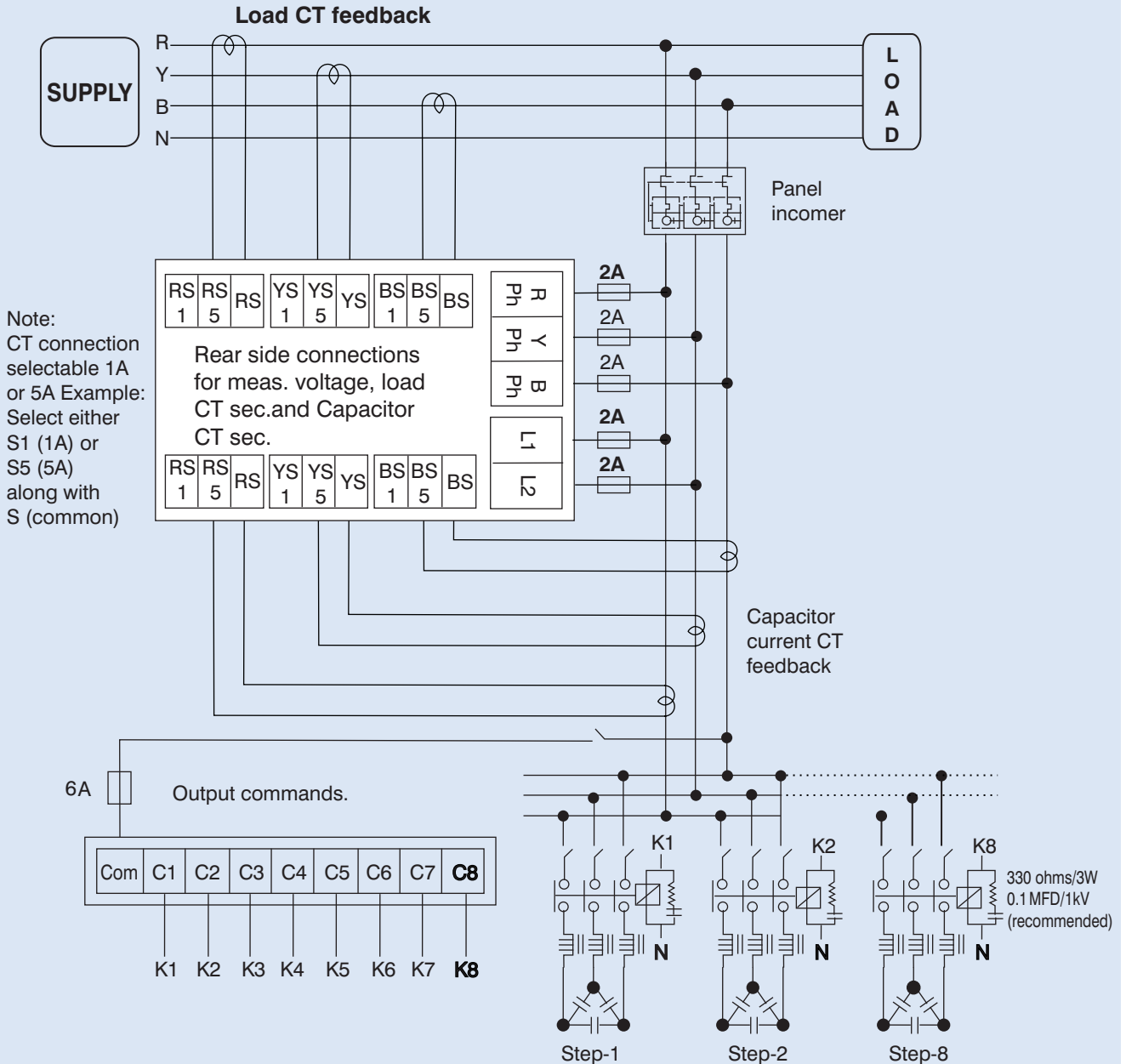
**Special 8/16 step Controller for Medium Voltage application available**

# PF Controller BR5000 Relay Output

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## Typical wiring diagram for PF correction : Contactor switching

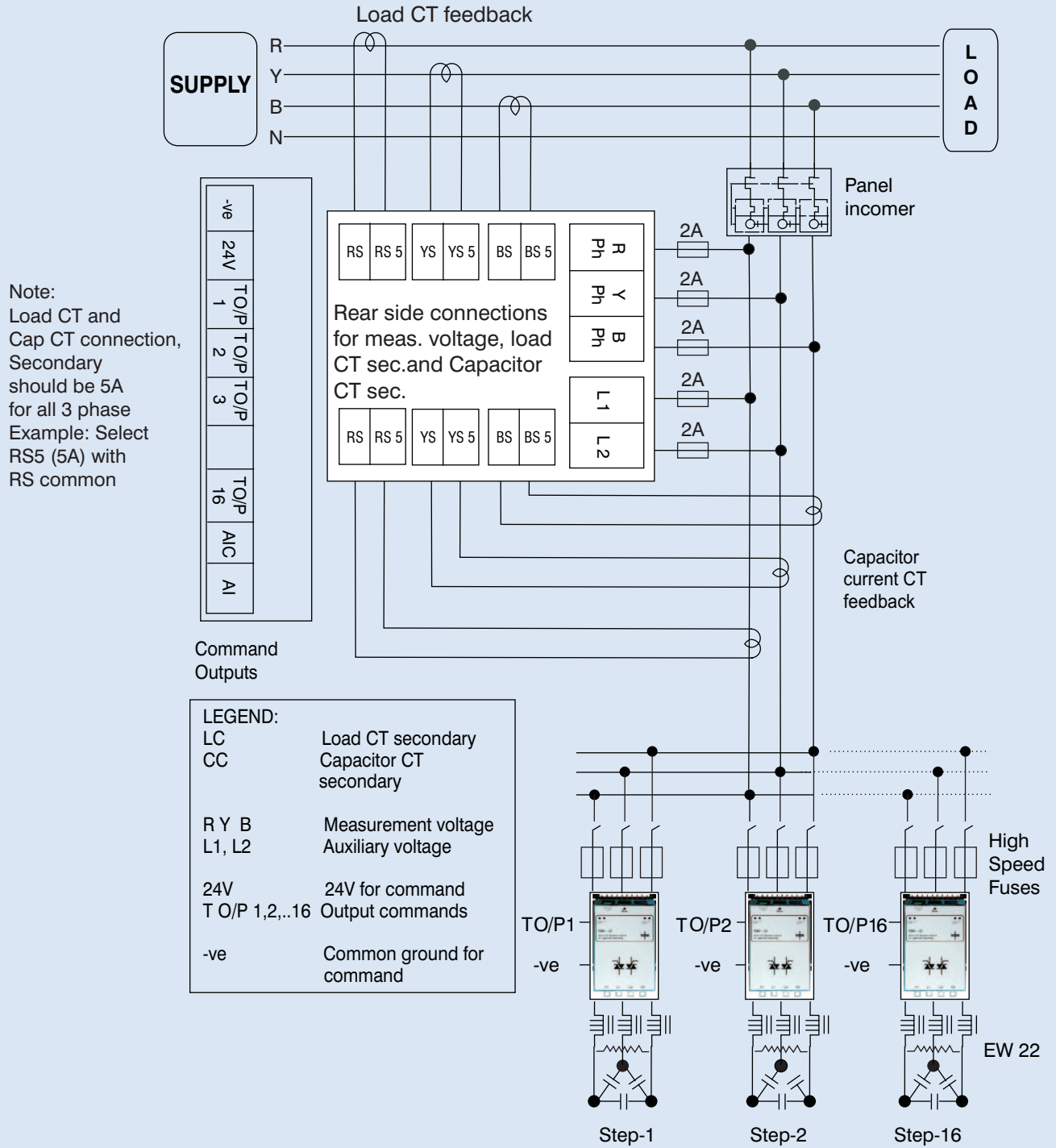


# PF Controller BR5000 Transistor Output

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## Typical wiring diagram for PF correction : TSM switching



# PF Controllers BR5000 Series

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**Selection table for controllers**

	BR5000 relay output		BR5000 transistor output
<b>Steps</b>	8 STEP	16 STEP	16 STEP
<b>Switching</b>	Contactor	Contactor	Thyristor
<b>Ordering code</b>	B44066R5908A415N1	B44066R5916A415N1	B44066R5716A415N1
<b>Auxiliary supply</b>	1Ph 415V (-40% to +20%)	1Ph 415V (-40% to +20%)	1Ph 415V (-40% to +20%)
<b>Measurement voltage</b>	3Ph 3wire 415V (-40% to +20%)	3Ph 3wire 415V (-40% to +20%)	3Ph 3wire 415V (-40% to +20%)
<b>Load CT Input current</b>	1/5 A-separate connectors for either of the CT connections	1 / 5 A-separate connectors for either of the CT connections	only 5Amp CT secondary
<b>No. of outputs</b>	8 Nos. relay o/p of burden 1000VA by contactor coils	16 Nos. relay o/p of burden 1000VA by contactor coils	16 digital outputs maximum 20 mA loading
<b>Alarm outputs</b>	2 Nos.	2 Nos.	1 No.
-Insufficient Compensation	Yes	Yes	Yes (only display)
-Overcompensation	Yes	Yes	Yes
-Over / under voltage	Yes	Yes	Yes
-Overcurrent	Yes	Yes	Yes
<b>Automatic initialisation</b>		No	NoNo
<b>Communication interface</b>	<b>RSXXX</b> RS232 and RS485	RS232 and RS485	RS232 and RS485
<b>Parameters displayed</b>			--
System voltage	Yes	Yes	Yes
Load current	Yes	Yes	Yes
Capacitor current	No	No	No
Active power	Yes	Yes	Yes
Reactive power	Yes	Yes	Yes
Apparent power	Yes	Yes	Yes
Frequency	Yes	Yes	Yes
Individual harmonics measurement upto	15	15	15
THD - V	Yes	Yes	Yes
THD - I	Yes	Yes	Yes
<b>Monitoring of individual capacitor current</b>	Yes - Health check	Yes - Health check	Yes - total panel capacitor current monitored
<b>Apparent current</b>	Yes	Yes	Yes
<b>Overtemperature</b>	Yes	Yes (only INT temp.)	
<b>Real time cos <math>\phi</math></b>	Yes	Yes	Yes
<b>Target cos <math>\phi</math></b>	Yes (upper and lower target PF- programmable)	Yes (upper and lower target PF- programmable)	Yes- (upper and lower target PF- programmable)
<b>KVAr value to target cos <math>\phi</math></b>	Yes - displayed as System reactive power	Yes - displayed as System reactive power	Yes - displayed as System reactive power
<b>Switching and discharge time range</b>			
-Correction time	1 - 240 sec	1 - 240 sec	20-5000 m sec
-Discharge time	1 - 240 sec	1 - 240 sec	NA
<b>Number of control series</b>	Unequal, C-series (1-15), E-series	Unequal, C-series (1-15), E-series	Binary, unequal C-series (1-15), E-series
<b>Weight (in kG)</b>	2.5 kG	2.5 kG	2.5 kG
<b>Dimensions (L x D x H in mm)</b>	144 x 155 x 144 mm	144 x 155 x 144 mm	144 x 155 x 144 mm



# PF Controllers BR4000 Series

Intelligent • User-friendly • Cost-effective



## General

The BR4000 controller series is the most economical series and intended to serve the basic purpose of power factor corrections... The simplest menu driven version controller with navigational keys. The microcontroller based logic, multifunctional display of electrical parameters, compact size 96 x 96 mm and protections makes this controller extremely user friendly.

BR4000 Controller series is available in 4 stages and 8 stages. Best suited with conventional APFC applications.



## Features

- Microcontroller logic for measurements
- User friendly operation
- Control mode: binary, unequal, Preset and User defined
- Multifunctional LCD display
- Single CT sensing for unbalanced loads
- Compact 96X96 mm front fascia
- Suitable for auto / manual operation
- Individual harmonic measurement upto 15<sup>th</sup>

## Protection Warning

- Over / under voltage
- Over / under load
- Over temperature
- User friendly operation

## Important display parameters

- Voltage
- Current
- Active power
- Reactive power
- Apparent power
- Frequency
- $V_{THD}$
- $I_{THD}$

## Technical Data

- Measurement voltage: 1PH 230 VAC (-25% to +20%)
- Current input selectable - 1A or 5A for load with class 2 accuracy
- Auxiliary supply - 1Ph, 230V (-25% to +20%)
- Steps - 4 and 8 relay outputs
- Supply frequency -47 Hz to 53 Hz

## Mechanical and Maintenance

- Compact size
- Operating temperature - 0° to 50° C
- Storage temperature - -5°C to 65°C
- Humidity -0 to 98%

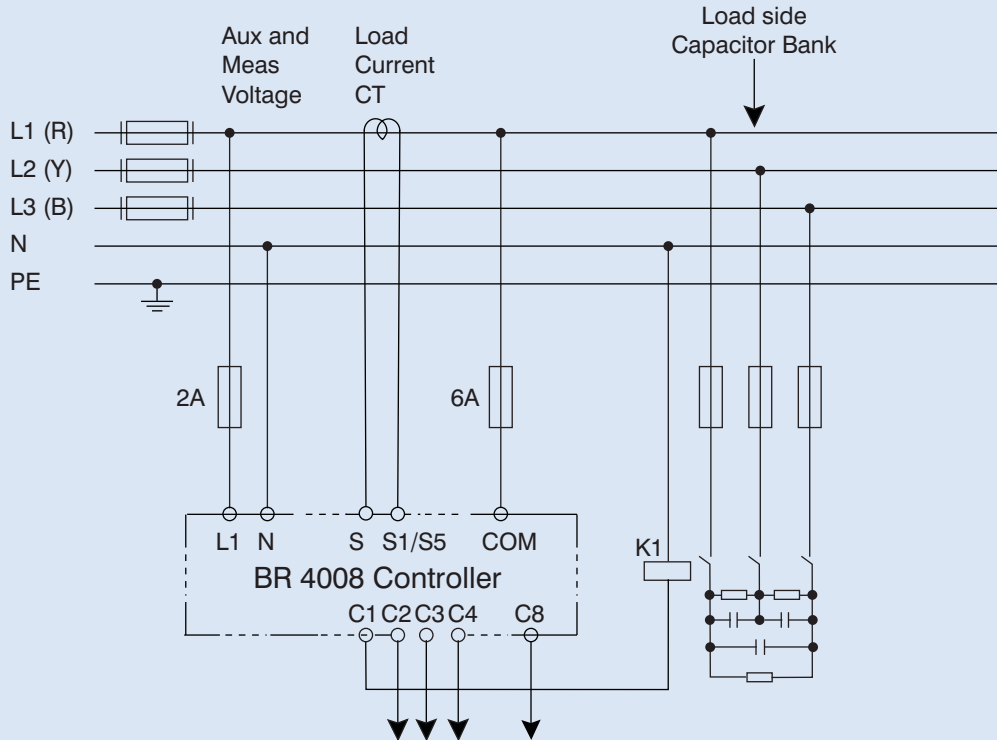


# PF Controllers BR4000 Series

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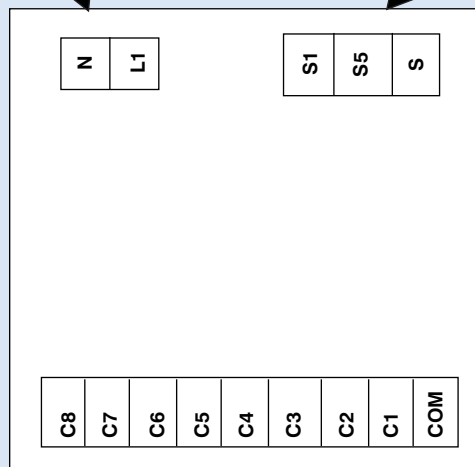
## Typical wiring diagram for PF correction



## Rear side terminals - measurement voltage, measurement current and auxiliary supply

Auxiliary and Measurement  
Voltage Connection  
230 V, 1 Phase, 2 Wire

Load CT Connection  
Selectable 1A or 5A  
Example: Select either  
S1 (1A) or S5 (5A)  
along with S (common)



Output commands to capacitor contactors

# PF Controllers BR4000 Series

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## Selection table for controllers

	BR4000 relay output	
<b>Steps</b>	4 STEP	8 STEP
<b>Switching</b>	Contactor	Contactor
<b>Ordering code</b>	B44066R4904A230N1	B44066R4808A230N1
<b>Auxiliary supply / Measurement voltage</b>	1-Phase, 2-Wire, 230 Vac (-25% to +20%) (common for both measurement and auxiliary)	1-Phase, 2-Wire, 230 Vac (-25% to +20%) (common for both measurement and auxiliary)
<b>Load CT input current</b>	1 / 5 A - separate connectors for either of the CT connections	1 / 5 A - separate connectors for either of the CT connections
<b>No. of outputs</b>	4 Nos. Relay o/ps of 5A @230V AC Resistive	8 Nos. Relay o/ps of 5A @230V AC Resistive
<b>Alarm outputs</b>	No	No
-Insufficient compensation	Yes (only display)	Yes (only display)
-Overcompensation	No	No
-Over / under voltage	Yes (not editable) (Factory set UV@170V (P-N) resume@178V, OV@276V (P-N) resume@264V)	Yes, programmable
-Overcurrent	No	Yes, programmable
<b>Automatic initialisation</b>	No	No
<b>Communication interface RSXXX</b>	No	No
<b>Parameters displayed</b>		
System voltage	Yes	Yes
Load current	Yes	Yes
Capacitor current	No	No
Active power	Yes	Yes
Reactive power	Yes	Yes
Apparent power	Yes	Yes
Frequency	Yes	Yes
Individual harmonics measurement upto	15	15
THD - V	Yes	Yes
THD - I	Yes	Yes
<b>Monitoring of individual Capacitor current</b>	No	No
<b>Apparent current</b>	Yes	Yes
<b>Overtemperature</b>	Yes (only INT temp.)	Yes (only INT temp.)
<b>Real time cos <math>\varphi</math></b>	Yes	Yes
<b>Target cos <math>\varphi</math></b>	Yes (single target PF - programmable)	Yes (upper and lower target PF programmable)
<b>KVAr value to target cos <math>\varphi</math></b>	Yes (as system reactive power)	Yes (as system reactive power)
<b>Switching and discharge time range</b>		
- Correction time	1 - 1200 sec	1 - 65530 sec
- Discharge time	1 - 1200 sec	1 - 65530 sec
<b>Number of control series</b>	Only unequal	Binary, unequal, C-series, E-series
<b>Weight (in kG)</b>	1 kG	1 kG
<b>Dimensions (L x D x H in mm)</b>	96 x 90 x 96 mm	96 x 90 x 96 mm

# PF Controller BR7000

15 relay outputs • Three-phase measuring and controlling



## General

The PF controller BR7000\* is a follow-up development of the PF controller BR6000-series, featuring two devices in one: it can be used as a controller as well as a grid measuring tool.

The BR7000 offers 15 relay outputs for the steps and three message/ alarm relays. Due to the possibility of programming, the 15 outputs can be used for a broad range of applications, for example:

- 15 conventional steps, each for one three-phase capacitor
- 15 steps for single-phase capacitors, where each output will switch

a single-phase capacitor to N (usually 5 per phase, balancing of grid is possible)

- Mixed operation: 6 single-phase capacitors (2 per phase) for balancing plus 9 steps for conventional compensation (three-phase capacitors)

The controller can be connected to a PC via an RS485 interface. The Windows-based software BR7000-SOFT allows the readout of acquired data. The possibility of graphical display of all values offers a comfortable visualization.



## Features

- LCD full graphic display  
128 x 64 dots, 8 lines
- Self explanatory menu navigation in five languages
- Three-phase measuring and controlling; display of following grid parameters:
  - Voltage
  - Current
  - Frequency
  - Real power
  - Reactive power
  - Apparent power
  - Power factor
  - Missing reactive power
  - Harmonic of voltage and current (up to 31<sup>st</sup>)
  - THD-V
  - THD-I
  - Temperature
- HELP-button for interactive help text
- 15 switching outputs
- 3 additional alarm/message relays
- 2 isolated interfaces
- Detailed error messages with time stamp
- Automatic initialization/test run
- Automatic and manual operation, service operation, expert mode
- Three-phase and single-phase controlling; mixed mode possible
- Display and storage of maximum values, switching operations and operating time
- Display of date and time
- Time-controlled functions possible by internal timer
- Oscilloscope mode for graphical display
- Quick programming

\*BR7000 is imported and sold in India.

# PF Controller BR7000

15 relay outputs • Three-phase measuring and controlling



Technical data : BR7000 controller	
<b>BR7000</b>	
<b>Supply voltage</b>	110 ... 230 V AC 50/60 Hz
<b>Measurement voltage range</b>	3 · 30 ... 440 V AC (L-N); 50 ... 760 V AC (L-L)
<b>Power consumption</b>	< 3 VA
<b>Operating ambient temperature</b>	-20 ... 60 °C
<b>Display</b>	illuminated graphic display, 128 x 64 dots, 8 lines
<b>Large display of 3 grid parameters</b>	selection in display editor
<b>Plain language</b>	E / ES / GER / RU / TR
<b>In- and outputs</b>	
<b>Number of relay outputs</b>	15 switching outputs, freely programmable for switching of 1- or 3-phase capacitors
<b>Number of transistor outputs</b>	–
<b>Alarm/message relay</b>	1/1
<b>Additional separate fan relay</b>	yes
<b>Interface</b>	2 independent isolated RS485-interfaces
<b>Input 2nd parameter-set switchover target PF</b>	yes
<b>Special functions</b>	
<b>Measuring</b>	three-phase
<b>Controlling</b>	single-phase, three-phase, mixed mode
<b>Automatic initialization</b>	yes
<b>Test-run of complete PFC-system</b>	yes
<b>Quick-program</b>	yes
<b>Internal timers</b>	yes
<b>Oscilloscope (graphical display) mode</b>	yes
<b>Display editor</b>	yes
<b>Backwards navigation ESCAPE button</b>	yes
<b>HELP button for interactive help text</b>	yes
<b>Number of control series</b>	20 series pre-set
<b>Control series editor for free programming</b>	yes

# PF Controller BR7000

15 relay outputs • Three-phase measuring and controlling



Technical data : BR7000 controller	
<b>Parameters displayed (three-phase display)</b>	
Apparent current (A)	real value / large display / in %
Reactive power (KVAr)	real value / large display / in %
Active power (kW)	real value / large display / in %
Apparent power (kVA)	real value / large display / in %
KVAr value to target $\cos \varphi$	real value / large display / in %
Energy	real value / large display
Frequency	real value / large display
Temperature	real value / large display
Real-time $\cos \varphi$	real value / large display
Target $\cos \varphi$	real value / large display
Individual harmonics up to	up to 31st, real value / in % / bar graph
THD-V, THD-I	real value / in % / bar graph
Time/date	yes
<b>Recall recorded values</b>	
Min. and maximum voltage	yes, with time stamp
Maximum current	yes, with time stamp
Maximum active power	yes, with time stamp
Maximum reactive power	yes, with time stamp
Maximum apparent power	yes, with time stamp
Maximum value THD-V, THD-I	yes, with time stamp
Maximum temperature (°C)	yes, with time stamp
Operation time of all capacitors	yes
Number of contactor switching operations	yes
<b>Others</b>	
Weight	1 kg
Dimensions (h x w x d)	144 x 144 x 60 mm
PC-software included	yes
Suitable for dynamic PFC	no
Ordering code	B44066R7415E230



# Grid Analysis Tool MC7000-3

Three-phase measuring • Easy evaluation of data • 1GB memory card included



## General

The measuring device MC7000-3\* has been developed for three-phase measuring, display and storage of electric parameters in low-voltage grids. The Windows-based software (included in the delivery) allows a fast and comfortable evaluation of the measured data. Based on the findings of this evaluation the optimum design for a tailored PFC solution or the inspection of an existing one is easily performed. The collected data is available in Excel-format giving the user further processing options. As an additional feature the MC7000-3 is equipped with an

SD memory card slot. A memory card (1 GB) for data storage and easy passing on to a PC is already included in the delivery. Featuring an illuminated 128 x 64 graphic display and a large number of configuration options for data collection, display and storage the new standard measuring tool is flexible and easy to use in the field. Additionally its compact design and the light weight suitcase make it easy to transport. A further benefit for very user is the availability of not only English, but also German, Spanish, Russian and Turkish as menu languages.



## Features

- Measuring, display and storage of numerous parameters
  - Voltage (3-phase)
  - Current (3-phase)
  - Frequency (3-phase)
  - Active power (3-phase)
  - Reactive power (3-phase)
  - Apparent power (3-phase)
  - Power factor (3-phase)
  - Active, reactive and apparent energy
  - Voltage harmonics (up to 51<sup>st</sup>)
  - Harmonics of current (up to 51<sup>st</sup>)
  - TDH-V (3-phase)
  - THD-I (3-phase)
  - Temperature
- Comfortable programming of recording interval and duration via timers
- Display and internal storage of maximum values with time stamp
- Display of date and time
- Display of harmonics, bar diagram available
- Large number of display options e.g. rotating display and adjustment of font size

## PC software included

- Software for evaluation of grid parameters for Windows operating system
- Administration of several projects possible
- Graphical display
  - Several pre-configured graphical display of standard values
  - Graphical display of selected grid values, large number of configuration options
  - Comfortable editing of parameters and time interval
  - Display as line graph or bar diagram
  - Copy into clipboard and print function available
- Mathematical evaluation of measured values
  - Automatic calculation of required KVA<sub>r</sub> (target-cos-φ to be set by user)
  - Evaluation of measured harmonics and recommendation of detuning factor of a PFC system of calculated size
  - Influence of detuning on the harmonics for the calculated detuning factor and system size is provided

\*MC7000-3 is imported and sold in India