

Power Factor Controller

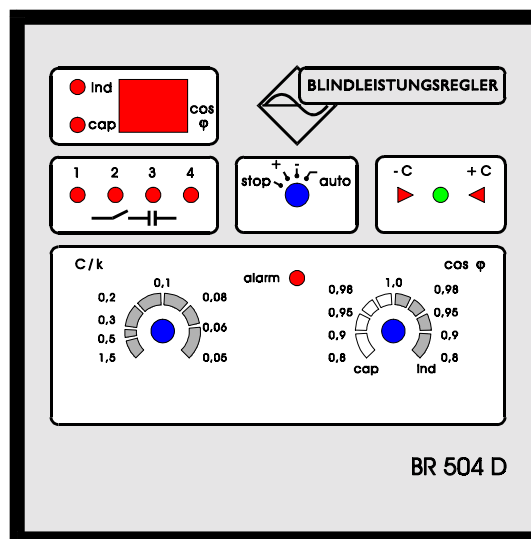
„BR 504 D“

Instruction book

Power factor controller BR 504

1. GENERAL

The BR504 is a power factor regulator for applications with up to 4 capacitor branches. This version has the following characteristic features:



- Stepless variation of the C / k value from 0.05 to 1.5
- Stepless variation of the target cos Phi from 0.80 inductive to 0.80 capacitive
- 16 regulating series
- Connection of up to 4 capacitor branches
- End-stop setting between 1 and 4 capacitor branches in all regulating series
- 4 different switching times (40s, 20s, 2,5s, 40s/2,5s cap)
- Internal and external trouble indication
- Permanent indication of the direction of regulation (" + C" / " - C")
- Indication of readiness for operation
- Permanent indication of the cos Phi
- Connection to current transformers X/5A
- Integrated Manual / Automatic control
- Corrosion resistant plastic housing with protective insulation
- DIN dimensions, small mounting depth (144 x 144 x 55 mm)

The normal version of the regulators is produced with a measure voltage of 400 V / 50Hz and a measure-current of 5 A. The following options are available:

measure voltage: 100 V, 230 V
measure current: X / 1 A
frequency: 60 Hz

separat door for a higher degree of protection

2. REACTIVE POWER ACQUISITION

Reactive power is determined by singlephase measurement. This requires a current transformer in phase L1 (R) as well as connection of phases L2 (S) and L3 (T). Connection of the phases L2 and L3 also provides for internal current supply to the „BR504D“. Special versions for the connection of voltages other than 400 V are available on request. The current transformer may be connected in other phases provided that at $\cos \varphi = 1$ the measuring current is angularly phase-shifted by 90 degrees relative to the measuring voltage.

3. SETTING THE C/k VALUE

The C/k value is calculated from the following formula:

$$C/k = (0,6...0,8) \frac{C}{1,73 \times U \times k}$$

C : Output of the 1 st capacitor branch in var

U : Voltage of the mains

k : Transformation ratio of the transformer

This shows that the C/k value depends on the output of the 1 st capacitor branch (stepped wattage) and the transformation ratio of the transformer. Select these values such that a C/k value between 0.05 and 1.5 is obtained. Set the calculated C/k value on the front panel .

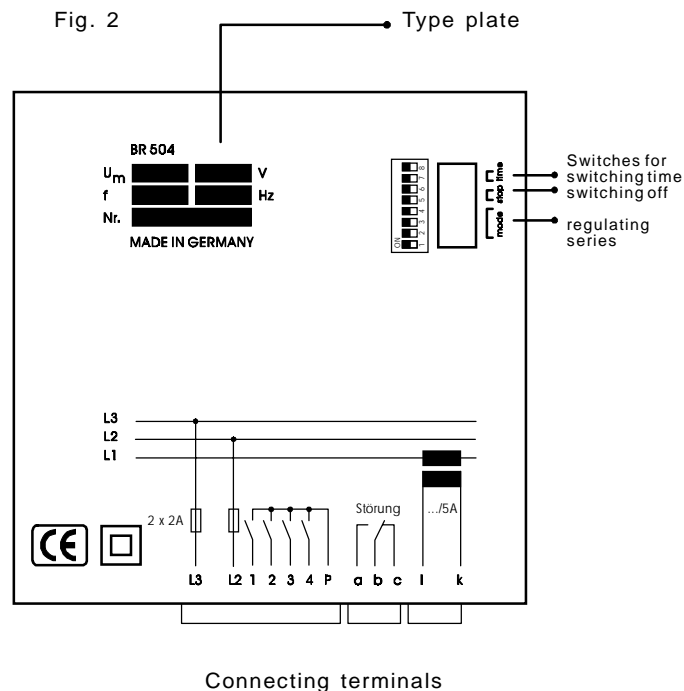
C/k value (voltage of the mains 3 x 380 V, 50 Hz)													
1st capacitor branch in kvar													
Circ. transform	5	10	15	20	25	30	40	45	50	60	75	90	100
50 A / 5 A	0,5	1,00											
75 A / 5 A	0,33	0,67	1,00										
100 A / 5 A	0,25	0,50	0,67	1,00									
150 A / 5 A	0,17	0,33	0,50	0,67	0,80	1,00							
200 A / 5 A	0,12	0,25	0,33	0,50	0,67	0,67	1,00						
300 A / 5 A	0,10	0,17	0,25	0,33	0,40	0,50	0,67	0,80	0,80	1,00			
400 A / 5 A		0,13	0,17	0,25	0,33	0,40	0,50	0,50	0,67	0,80	1,00		
500 A / 5 A		0,10	0,17	0,20	0,25	0,33	0,40	0,50	0,50	0,67	0,80	1,00	1,00
600 A / 5 A			0,13	0,17	0,20	0,25	0,33	0,40	0,40	0,50	0,67	0,80	0,80
800 A / 5 A				0,13	0,13	0,17	0,25	0,25	0,33	0,40	0,50	0,50	0,67
1000 A / 5 A				0,10	0,13	0,13	0,20	0,25	0,25	0,33	0,40	0,40	0,50
1200 A / 5 A					0,10	0,13	0,17	0,17	0,20	0,25	0,33	0,40	0,40
1500 A / 5 A						0,10	0,13	0,17	0,20	0,20	0,25	0,33	0,33
2000 A / 5 A								0,10	0,13	0,17	0,17	0,25	0,25
2500 A / 5 A									0,10	0,13	0,17	0,17	0,20
3000 A / 5 A										0,10	0,13	0,17	0,17

4. SETTING THE TARGET COS φ

The target $\cos \varphi$ is the power factor to be attained by reactive power compensation. The „BR504D“ allows setting the target $\cos \varphi$ within the range of 0.80 ind to 0.80 cap on a scale on the front panel.

5. SETTING THE REGULATING SERIES (Table below)

The regulating series is determined by the ratios of the capacitor branch powers, the power of the 1st capacitor branch representing valency 1. The switches "mode 1-4" on the back of the appliance (Fig. 2) are provided for setting the regulating series.



Regulating series:

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Tabelle 1

Aufstellung der Regelreihen

Nr.	Wertigkeit am Kondensatorabzweig				max. Stufenzahl	Schalter
	1	2	3	4		
0	1	1	1	1	4	
1	1	1	1	2	5	
2	1	1	2	2	6	
3	1	2	2	2	7	
4	1	2	2	3	8	
5	1	2	3	3	9	
6	1	2	3	4	10	
7	1	2	3	6	12	

Tabelle 1

Aufstellung der Regelreihen

Nr.	Wertigkeit am Kondensatorabzweig				max. Stufenzahl	Schalter
	1	2	3	4		
8	1	1	2	4	8	
9	1	2	2	4	9	
10	1	2	4	4	11	
11	1	2	4	8	15	
12	1	1	1	4	7	
13	1	1	2	3	7	
14	1	1	3	6	11	
15	1	2	4	6	13	

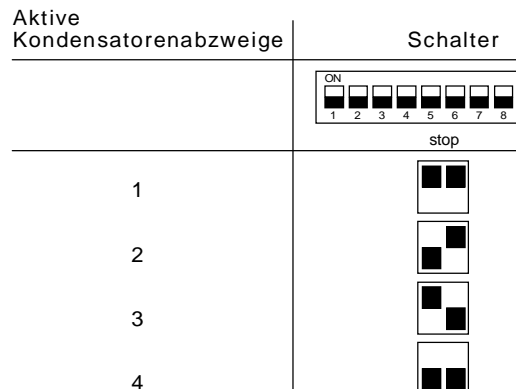
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6. SETTING OF SWITCHING OFF

Switching off setting allows the number of active capacitor branches to be adapted to the capacitor system used. The „BR504D“ permits setting between 1 and 4 active capacitor branches.

The „BR504D“ is delivered with the switching off point set to the maximum possible number of capacitor branches.

Use the switches 5 and 6 on the back of the appliance.



7. SETTING THE SWITCHING TIME

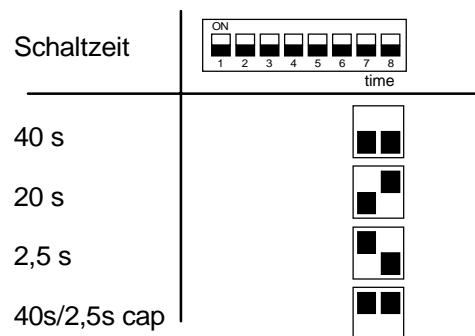
The „BR504D“ allows the following switching times to be set.

These are independent of the reactive load.

The switching time depends on the discharging devices of the capacitors, so that it is determined by the capacitor system.

In most cases, switching time 40s and 20s are used.

Switching time 2,5s is intended to be used for servicing of the capacitor system. Set the time by means of switches „time 7 and 8“ on the back site.



8. INDICATION OF CAPACITOR BRANCHES

LEDs on the „BR504D“ are signalling permanently which capacitor branches are connected.

9. INDICATION OF THE DIRECTION OF REGULATION

The LEDs "- C" and "+ C" of „BR504D“ are signalling whether at the current reactive power of the mains capacitor stages must be connected or disconnected or whether the capacitor branches connected are compensating the reactive power of the mains as desired.

10. COS φ INDICATION

The cos φ in the mains to be compensated can be indicated by a display unit irrespective of the C/k value and target cos φ settings.

11. TROUBLE SIGNALLING

The „BR504D“ has an internal and external trouble signalling facility. When "- C" or "+ C" are "on" for 10 min. without interruption and no change of the capacitor branches takes place, trouble will be indicated by the LED "Alarm". The trouble message is cancelled as soon as the exciting "- C" or "+ C" signals goes off or the mode of operation switch is operated.

When an internal trouble message is given or the voltage supply breaks down, the trouble signalling relay will drop and close the contact b, c. When connecting the external trouble signalling relay, fuse this circuit with a fuse T 4 A. The maximum switching voltage is 250 V a.c.

12. PROTECTION AGAINST VOLTAGE FAILURE

When the measuring voltage breaks down, the „BR504D“ will disconnect all capacitor branches. They will be connected again according to the selected switching time in the "Automatic" mode, when the voltage comes back. With the "Stop" mode, the desired capacitor branches have to be reclosed through the "+" mode.

13. MODES OF OPERATION

The „BR504D“ can be operated both manually and automatically. The mode of operation is to be selected by means of the respective switch on the front panel. The regulating series, trouble signalling facility and switching time are independently of the operating mode.

"AUTOMATIC" mode of operation

Turn the mode switch to "auto". In this mode, the „BR504D“ operates in dependence on the signals "+ C" and "- C". This means that the mode of operation of the „BR504D“ is determined by the reactive power conditions of the mains to be compensated.

"MANUAL-STOP" mode

The mode switch is to be set to position "stop". In this mode, the indicated position of the capacitor branches will not be changed, no matter what the reactive power conditions in the mains are like.

"MANUAL TURN-ON" mode

The mode switch has to be turned to position "+". In this mode, stages are connected irrespective of the mains conditions, until the set switching off point is reached or the mode of operation changed.

"MANUAL TURN-OFF" mode

The mode switch has to be set to position "-". In this mode, stages are disconnected, irrespective of the mains conditions, until all capacitor branches are disconnected or the mode of operation is changed.

14. MOUNTING THE UNIT

The „BR504D“ is intended for panel mounting. It requires a cut-out of 138 x 138 mm according to DIN 43 700

15. CONNECTION

Before connecting the „BR504D“, make sure that all lines are dead, and short the current transducer. Connect as shown in Fig. 3. A voltage differing from the measuring voltage and not exceeding 230 V may be connected to „P“ for the capacitor contactors.

Mind that for the „BR504D“ within the capacitor system fuses have to be connected in series as shown in Fig 3.

When connecting the measuring voltage and the measuring current, take care to ensure correct phase position.

For connection of the measuring circuit, use a copper lead of 2.5 mm .

When connecting the external trouble signalling unit, fuse the signalling circuit with a T 4 A fuse.

16. PUTTING INTO OPERATION

Having connected the „BR504D“ as shown in Fig. 3 , remove the fuses of the capacitors and short the current transducer.

Set the "stop" mode, the desired regulating series, the switching off point and the switching time 2,5s . As soon as the measuring voltage is connected, the green LED lights up.

Turn the mode switch to " + ". Connect the capacitor branches according to the regulating series till the set switching off point is reached. From this moment on, no further switching cycles must take place. Move the mode switch to " - ", and disconnect the capacitor branches according to the regulating series. When all capacitor branches are disconnected, no further switching cycles must take place.

Subsequently, the measuring voltage is switched off. Set the desired C/k value, target $\cos \varphi$ and switching time for automatic operation. Put in the fuses for the power capacitors and remove the short of the current transducer.

Having connected the measuring voltage, set the mode switch to "auto". The „BR504D“ now operates automatically.

17. INFORMATION REGARDING TROUBLE

If the "- C" LED is alight in spite of an inductive mains load when the „BR504D“ is put into operation, this points to the fact that the measuring voltage or measuring current terminals may have been mixed up, with target $\cos \varphi$ set to 1, or that the phase position was not considered. This also applies in the event that the "+ C" LED remains "on" although compensation is completed. If target $\cos \varphi$ is set to a value other than 1 , "cap", for instance, may be lighting in spite of inductive mains load, without the „BR504D“ being defective, as "+ C" and "- C" indicate the regulating direction, but not the mains conditions.

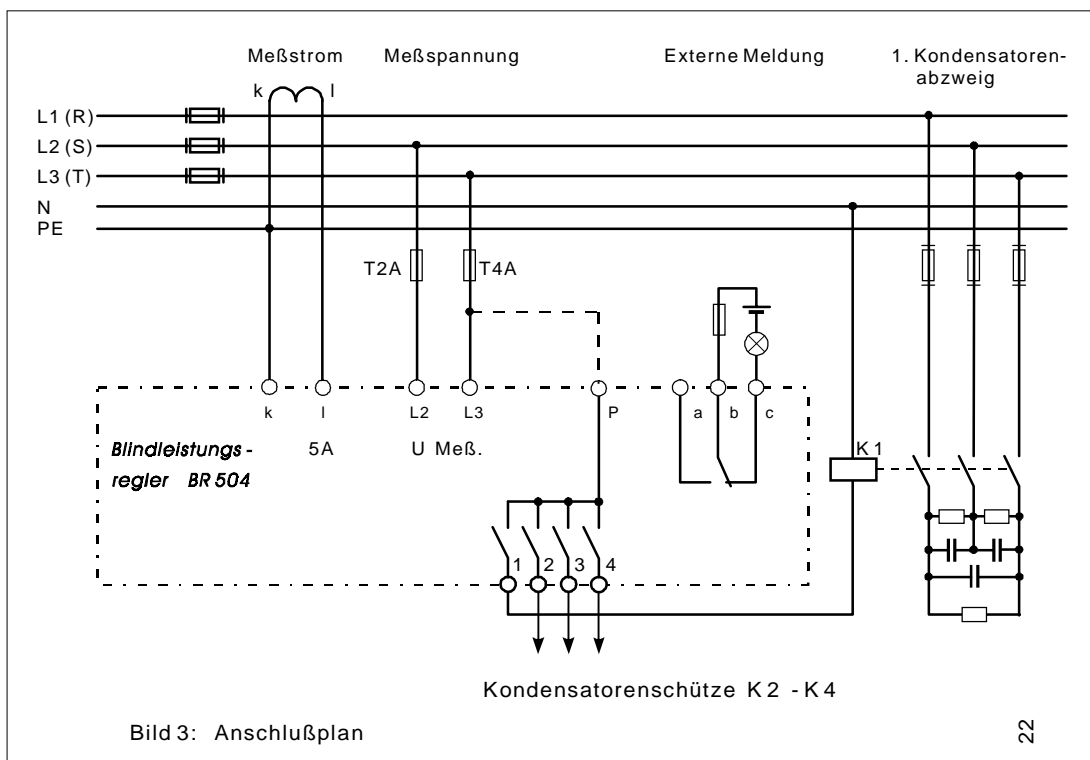
A capacitor branch being alternately connected and disconnected in regular intervals without any changes in the reactive power conditions of the mains calls for an increase in the C/k value until the alternate connecting and disconnecting is stopped.

The „BR504D“ is designed for reactive power compensation in mains loaded symmetrically. Irregular phase loading, therefore, may cause shifting of the measurement results. Use the phase in which the current measurement is taken as reference value for reactive power determination.

18. MAINTENANCE AND GUARANTEE

The „BR504D“ is maintenance-free, provided that the operating conditions are observed. It is advisable, however, to test the functions of the regulator when carrying out the regular inspection of the capacitor system. No guarantee claims will be accepted if repairs are carried out on the regulator within the guarantee period.

Fig.3 Connecting plan „BR504D“



TECHNICAL DATA

Type:	BR504D
Outputs:	4
No. of regulating series:	16
Max. No. of stages:	15
Measuring voltage:	400V , Option: 100V, 230V
Measuring current:	X / 5A, Option: X / 1A
Switching capacity of outputs:	2200VA, 230Va.c.
Frequency:	50 Hz Option: 60 Hz
Switching time:	40s, 20s, 2,5s, 40s/2,5s cap
Sensitivity:	C/k value of 0,05 to 1,5
Target cos Phi:	0,8 ind. to 0,8 cap.
Trouble signalling facility:	10 min. responding time
Zero-voltage-trigger:	available
External trouble signalling device:	zero-potential changeover contact 250V a.c., 4A

Dimensions: 144 x 144 x 55 mm
 Weight: 0,85 kg

Transportation and storage temperature: -55 ...+70 °C
 Degree of protection (DIN 40 050): Front IP 40
 Back IP 20
 Immunity: Class 4 at IEC 1000-4-4

Other data may be agreed upon with the manufacturer. We reserve the right of modifications.