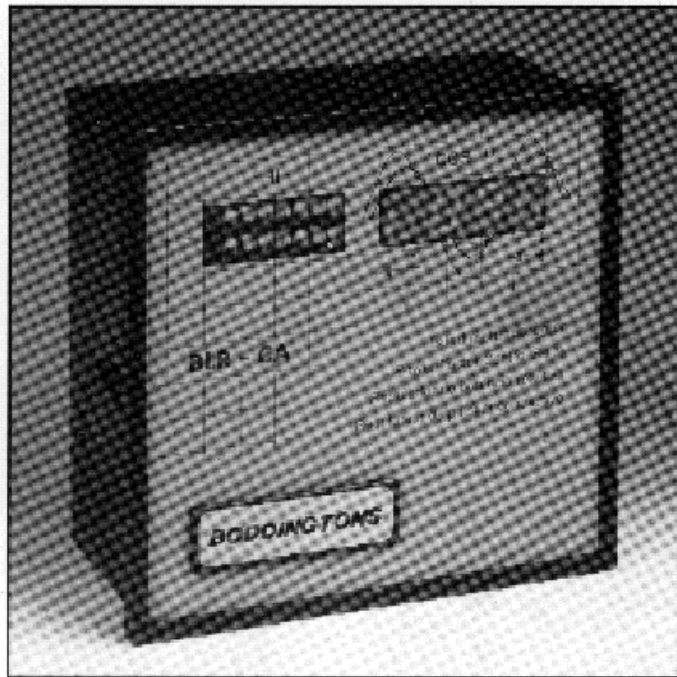


# BLR-CA

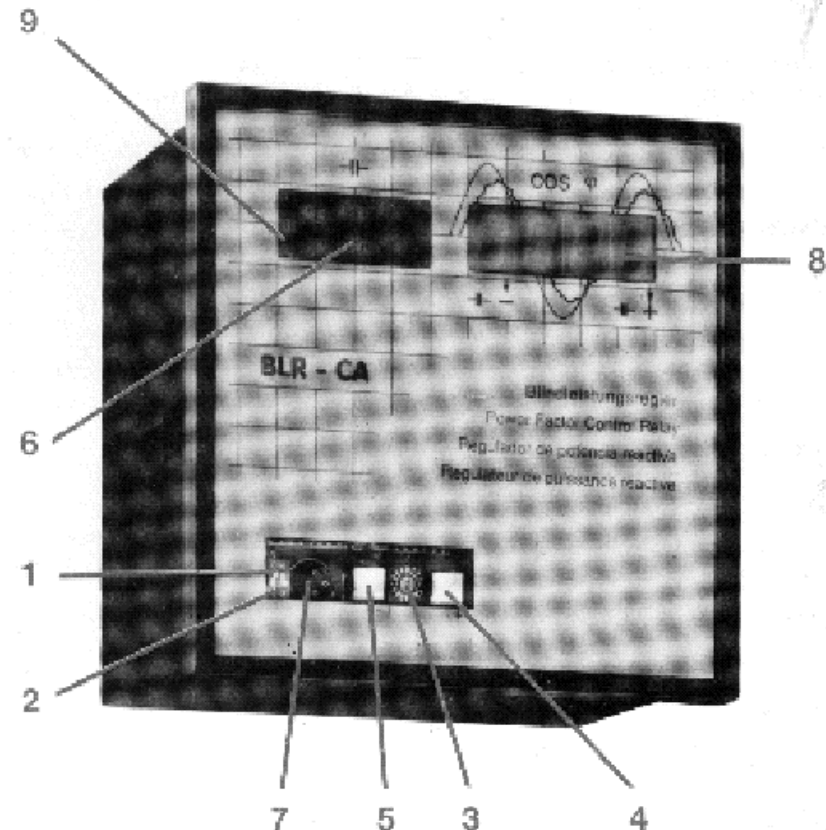
## Power Factor Control Relay

Operating & Commissioning Instructions



As with all electrical equipment, the appropriate specifications governing electrical installation must be followed when Power Factor Correction Equipment is installed. When removing the front nameplate to adjust the function switch and DIP switches, always ensure that your body is not carrying any electrostatic charge. This can be accomplished by simply touching an earthed object, such as the switchboard metal casing to dissipate any electrical charge before removing the name plate.

- 1 – CT 5A - 1A ... 1A = Down 5A = Up
- 2 – P.F. Alarm On/Off
- 3 – Function Select Switch
- 4 – Increase Button
- 5 – Decrease Button
- 6 – Active Stage Indication
- 7 – Printer/PC Connection Socket
- 8 – Power Factor Indication
- 9 – Alternative Target P.F. Selected Indicator.



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## Technical Data:

<b>Measurement System:</b>	Single phase electronic measurement system for connection to phase-phase voltage, 380-415V. Operating frequency 50 or 60 Hz to be stated on order. Voltage supply burden 7 VA max. - according to number of steps switched in (facility for connecting to wide range of other voltages available). Current transformer output 5 A or 1 A. Class 1 to 3 (burden 1.4 VA). Measurement system operates in all four quadrants and analyses non-sinusoidal voltage and current waveforms.
<b>Switch Rating:</b>	3000 VA per contact. 250 V AC (energizing). 1500 VA/250 V(hold); 415 V available on request.
<b>1. Target Power Factor Range: (Normal Tariff)</b>	0.70 lag...1.0...0.90 lead. shown on digital display (function switch position 1)
<b>Step Switching Time:</b>	Adjustable from 5...1200 sec. (function switch position 2)
<b>No-Volt Release:</b>	Automatic disconnection of all capacitors following voltage failure after only 35 msec. Automatic switching will recommence 90 seconds after restoration of supply.
<b>Hand Operation:</b>	By means of +/- push buttons (function switch position 4 - see details above in catalogue).
<b>Ambient Temperature:</b>	-10°C...+70°C.
<b>Manufacturing Specifications:</b>	Insulation protection in accordance with VDE 0110, group C, type tested. EMV guidelines 89/336/EEC; CE identification mark 93/68/EEC.
<b>Casing:</b>	Instrument casing 144x144 mm. Total depth including plug 95 mm, flame retardant to 94 V-O.
<b>Mounting Position:</b>	As required, in 138 x 138 mm cut out in panel.
<b>Protection:</b>	IP 30.
<b>Weight:</b>	1.3 kg.
<b>Connections:</b>	Plug-in terminal block

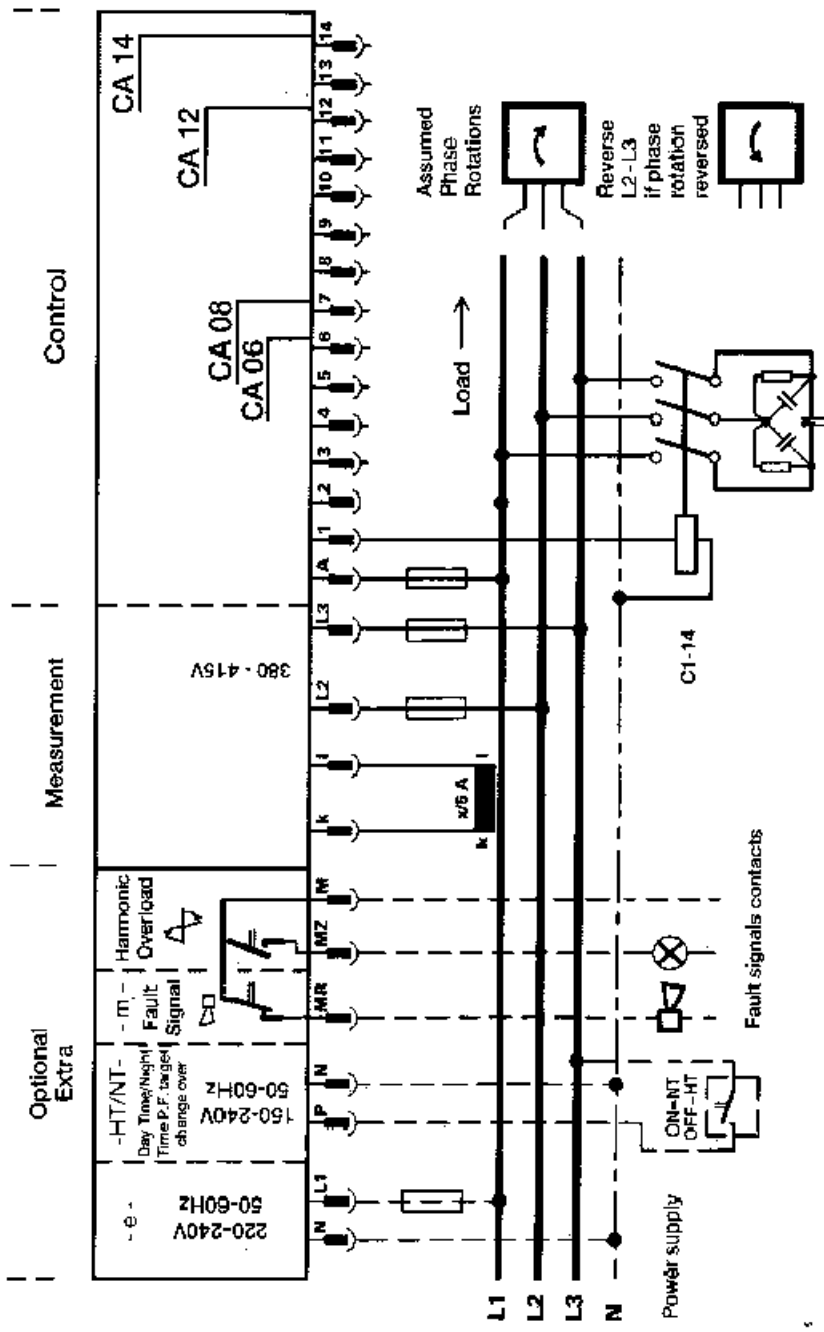
## Technical Data: (continued)

<b>Cos <math>\phi</math> Indication:</b>	Only when in automatic operation (function switch position 3 - as set on delivery from factory).
<b>Current Path:</b>	5 A (1 A on request).

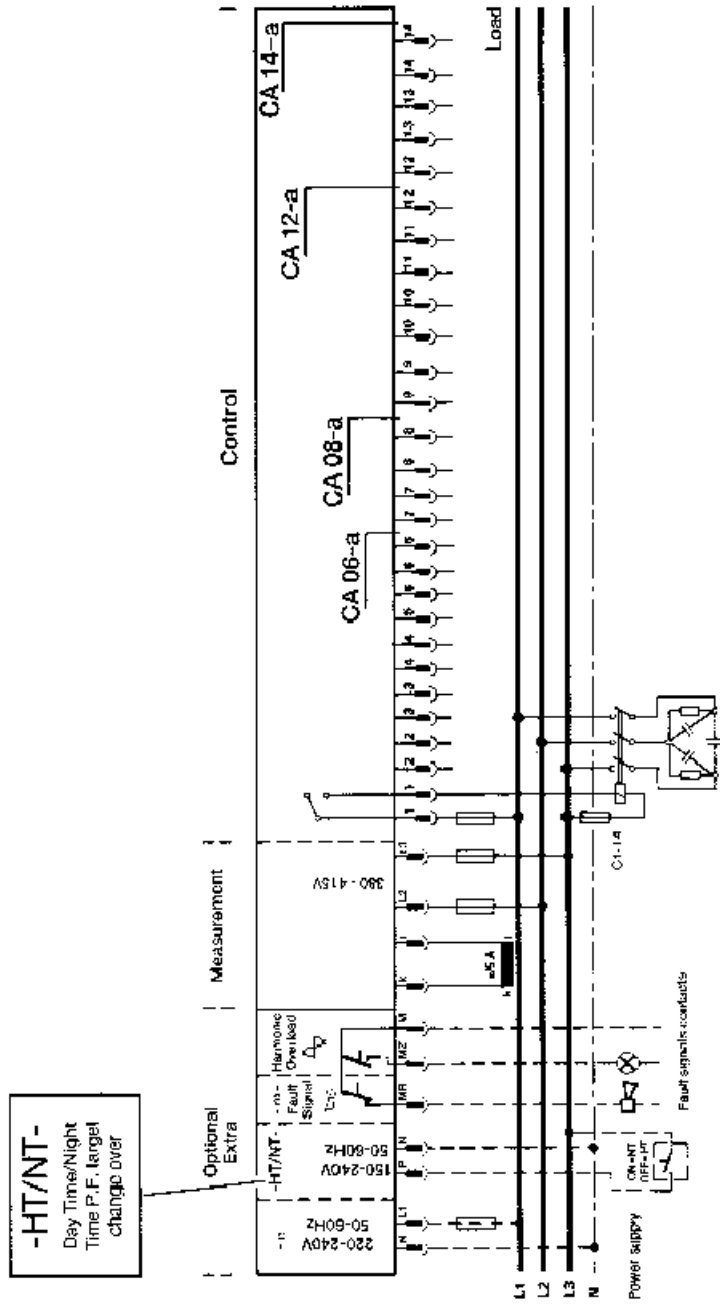
## Optional Features:

<b>Single Phase Measurement (e):</b>	For single phase systems, version "e" is available for measurement between phase and neutral. This relay, e.g. BLR-GA 12e can, of course, also be installed on three phase, four wire, systems.
<b>Fault Signalling Relay (z):</b>	As a complimentary feature to the alarm signal in the digital display "HA" for harmonic overload alarm (du/dt), a switching relay (z) is available for remote indication of this alarm. Volt-free contacts 1500 VA/250 V AC (MZ).
<b>Fault Signalling Relay (m):</b>	Operates when the digital display alarm (AL) is functioning. In the event of a fault in the relay, the contact (MR) will close, e.g. target power factor not obtained! Volt-free contacts 1500 VA/250 V AC.
<b>PC Monitor:</b>	When used with a separately supplied interface, the relay can be connected to a standard PC (VGA graphics standard).
<b>Remote Indication of cos (F):</b>	The instantaneous system power factor can be transmitted for remote indication on receiver instrument DCA-F.
<b>2. Target Power Factor Range: (Low Tariff)</b>	Target power factor setting on low tariff (NT) in position A indicated digitally from 0.70 lag...1...0.90 lead.

## Connection diagram – Common Point Switching Type CA



## Connection diagram – Volt Free Switching Type CA-A



1. Check that the Measurement and Control Voltage, Supply Frequency and Current Transformer rating comply with the ratings given on the back of the relay.
2. Mount the relay in the switch panel. The cut-out size is 138 × 138mm. The relay is secured either with two fixing bolts on the side of the relay, or with two side mounting right angled brackets, for fixing to a flat surface.
3. Connect up in accordance with the wiring diagram. **Pay special attention to the cross section size of the C.T. connections. We recommend for runs up to 10 metres 2.5 sq.mm. cross section.**
4. Adjust DIP Switch (2) to select p.f. Alarm function ON (in circuit) or OFF (out of circuit).
5. Apply the measurement and control voltages. Connect the Current Transformer and remove any short-circuit link.
6. Wait for the 90 sec. lockout time to elapse. During this time the required parameters can be set as listed below, using the +/- buttons (4/5). Each set value is stored in the memory, once the function switch is moved on to the next position.
7. With function switch in position 1, select the required target p.f. using +/- buttons.
8. With function switch in position 2, select the required switching step time delay, using +/- buttons. (5-1200 seconds).
9. With function switch in position 5, select the number of switching steps using the +/- buttons. The relay is delivered with this setting on its maximum number of steps. If the max number of steps is selected, but capacitors are not connected to all the steps, the relay will recognise this and will make three switchings to verify there is not connection. The disconnected step(s) will then be excluded from the switching sequence process. The number of disconnected steps will be shown in the display by putting the function switch in position 6. After 7 days, or following a system power failure the disconnected steps will be automatically reactivated and a renewed switching attempt will be made.
10. Set function switch in position 3, so that the installation is in "Automatic" operation.
11. The Digital indicator will show the system power factor (e.g. 1.0.87).
12. After the lock out time with an inductive load on the system if the relay is correctly connected, the + LED will start to flash.
13. If the installation is correctly connected the relay will now switch successive steps following the selected step time delay until the target power factor is obtained. Each energised step will be indicated on the LED display 6. As each step switches in, so the digital display of power factor will change. If the installation p.f. is above or below the target p.f. the "+" LED (below target) or "-" LED (above target) will flash.
14. The BLR-CA does not require any adjustment of C/k and so this control is not fitted. The relay measures the output of each capacitor step in the form of "Units of Value". This measurement is made during the normal switching function according to reactive load requirement. These "Units of Value" are stored in the relay memory and the appropriate unit is called up in order to meet the changing reactive load demand.
15. A flashing display segment indicates that the relay is searching for a suitable capacitor size (ind or cap) in order to meet the required target power factor. If no suitable size is available, then no switching will take place and the segment will continue to flash until the target p.f. is obtained.
16. It is often necessary to commission an installation when there is no other load on the system. In this case, put the function switch in position 4, and with the aid of +/- buttons switch the steps in manually. In this case, the steps will be switched in without reference to or calculation of the step "units of value". After switching all the steps in manually, a simulated loss of voltage supply to the measurement voltage path is recommended, alternatively the function switch can be put to position 0. All steps will then be switched off together within 5 seconds. Then set the function switch back

to position 3 "Automatic".

17. With the function switch in position 9 two types of Low Power Factor Alarm can be selected:-
- a: With "0" in the display the alarm indication can only be cancelled by moving DIP switch (2) briefly into the off position (down).
  - b: With "1" in the display the alarm will extinguish itself automatically once the correct target power factor has been obtained again.
  - c: If the target power factor is not obtained, on account of insufficient capacitors, after a time delay of 75 times step switching time, the symbols "AL" will appear at 5 sec. intervals in the display.
  - d: If the capacitors are being subjected to a distorted waveform which is producing dangerous harmonic over currents then this will be shown as an alarm in the display: "HA" will flash at 5 second intervals.
  - e: If both alarms are signalling together then the symbols "AH" will flash in the display.
  - f: If external fault signalling contacts for power factor (m) are fitted the alarm contact is given between terminals M-MR.
  - g: If external fault signalling contacts for harmonic current overload (Z) are fitted the alarm contact is given between terminals M-MZ.
18. A small event printer type KA 01 or KA 02, or an interface for a PC can be connected to the exit port (7). This enables events with date and time to be recorded, such as power factor, date and time or each switching step, record of alarm functions etc. for subsequent analysis.

Once the required settings or alterations have been made, set the function switch to position 3 "Automatic" and replace the front cover plate, so as to inhibit unauthorised interference with the relay settings.

## DIP Switch Settings

DIP switch 1. On standard feature relays this has no function. On optional feature relays it will adjust the relay C.T. settings from 5A input to 1A input.

DIP switch 2. Alarm functions ON/OFF. Switch to OFF to cancel alarms.

## Function Switch (3)

- 0 = Relay is de-activated. All steps will be switched off after 5 secs. The digital display will show "OFF".
- 1 = Adjustment of pre-set target power factor within the range 0-70 lag,...1.0...0.90 lead by means of the +/- buttons. Target level is shown in the display.
- 2 = Adjustment of the step switching time, 5-1200 secs., by means of the +/- buttons. For rapid digit change, hold the button down continuously. The display will show for example "50".
- 3 = Relay in automatic mode, with indication of system power factor in the digital display, i-ind, c=cap. If the +/- segments are flashing this indicates that the target power factor has not been achieved. A suitable capacitor size will be selected.
- 4 = Manual operation. The display will show alternately "H" (1 sec) and Power Factor. (5 secs). Capacitor steps can be switched in rotation after the selected step switch time using the +/- buttons.
- 5 = The number of switching steps can be limited using +/- buttons. The display will indicate the number of steps - e.g. for 10 steps "S10". Do not exceed the number of steps on the relay.
- 6 = Automatic indication in the display of the number of steps which are not connected or are not working. The indication will rotate through the non-functioning steps. Display "CDO" means that all steps are functioning.
- 7 = The number of switchings each Contractor has made, is shown in the display e.g. "OC 1" for 2 secs, then "248". Other Contactors can be selected using the +/- buttons. The relay will store up to 9999 contactor operations on each step. The

stored data of all steps can be cancelled by depressing the + or - buttons for a period of greater than 20 secs. Automatic regulation is active during this time.

- 8 = Indicates the measured "Unit of Value" of each step, which is proportional to the capacitor output in kVAR. For example, the display will show "CC 12" for 2 secs., to indicate step No. 12 and will then alternate to "125" units of value. The "unit of value" for other steps is obtained by depressing the + and - buttons simultaneously for a period of greater than 20 secs. Automatic regulation is active during this time.

The stored data of all steps can be cancelled by depressing +/- buttons together for a period of greater than 20 seconds.

- 9 = Select the mode of alarm signal required. If the display shows A "0" the alarm is stored in the memory and can only be cancelled by briefly switching DIP switch 2 off. If the display shows A"1" the alarm will be cancelled when automatically the target power factor level is restored.

### Optional Setting Features

- A = Input of alternative target power factor level for low tariff operation. Setting range 0.70 lag...1.0...0.90. The required target level is adjusted in the display using the +/- buttons. In order to activate this feature a supply voltage of 150-240V must be applied across L1-N. This could be accomplished using a time switch, or impulse relay etc. LED (9) will illuminate if this feature is active. This is a useful feature to reduce capacitor watt losses at those times when the utility gives no benefit for p.f.c. improvement.
- B = Input for asymmetrical switching times. Using the +/- buttons this can be adjusted between 0...50. For example if the display show "y 10" for factor displayed will multiply the switching time in the capacitive direction (Rapid switch on - slow switch off). The standard setting with equal switch on/off times is "Y 0".
- C = Rapid contactor switching rate limiter. By using the +/- buttons a time delay can be set in seconds so as to prevent

the rapid on/off switching of a contactor on a constantly changing load. The standard setting would be 30 secs. and the display would show "L 30". The delay time can be set up to 255 secs.

- D = Input of a BUS address within the limits 0 - 225, selected by using the +/- buttons and shown in display. e.g. "b 25". Using this function relay data can be transferred through the RS 485 interface over a distance of 1.2km. (with separate BLK software and Bus Channel) to transmit data such as Power Factor, number of Steps on/off, Date and time of switching and time and date the alarm(s) operated.

E = OFF

F = OFF

### Functions Summary

#### FUNCTION

- 0 - Off
- 1 - Target Power Factor
- 2 - Stage Timer 5- 1200 Seconds
- 3 - Automatic Mode - Instantaneous P.F. Display
- 4 - Manual Stage Switching
- 5 - Set Number of Active Stages
- 6 - Number Of Disconnected Stages
- 7 - Contactor Switching Counter
- 8 - Capacitor Stage Unit of Value
- 9 - P.F. Alarm 0 = Store Until Cancel  
1 = Until Target P.F. Achieved

#### OPTIONAL FUNCTIONS

- A - Alternative Target Power Factor
- B - Asymmetric Switching
- C - Switching Rate Limiter
- D - RS485 Bus Address
- E - OFF
- F - OFF

## Fault Finding Guide

### FAULT

Relay does not operate at all  
(no LEDs illuminated)

Relay does not work automatically  
but functions in manual mode.

Relay appears to be working in  
reverse. (ie: when capacitors  
switch in the PF becomes worse).

P.F. shown on relay is incorrect.

Relay switches capacitors in but  
will not switch them out.

Relay does not switch in sufficient  
capacitance.

There is no load on the system but  
we need to check the relay is  
working correctly.

### POSSIBLE REMEDY

Check Power Supply to L2-L3.  
Ensure connection plug is fully  
pushed in to back of relay.

CT output is incorrect. Check for  
loose connections. If summation  
CT is being used, check that CT  
has correct polarity (see fig 1).

Check the CT is on correct  
phase, and correctly connected  
(see fig 1) It is easier to rectify the  
problem by swapping L2-L3  
connections, rather than touching  
the CT.

C.T. has been fitted on wrong  
phase (see fig 1).

C.T. is not measuring the  
capacitor current. It must measure  
the total load plus the capacitor  
current.

C.T. is not measuring the total  
load.

Switch capacitors in manually using  
manual mode (function 4). Select  
function 3 (auto-mode) and test if  
capacitors are switched out automatically.

