

Power-Factor-Control-Relay BLR-CM



STANDARD FEATURES

- Automatic Self Adjustment to any Capacitor Step Value of up to 12 Capacitors
- Automatic Recognition of Voltage of Current Path Reversed Connection
- Variable Switching Programmes: Fully Automatic, Conventional and Manual Operation
- Digital Display of System Parameters: e.g. Active, Reactive and Apparent Power, Power Factor, Voltage, Current, Thermal Current Load, Harmonics, Load Flow Direction
- Digital Display of Compensation Parameters: e.g. Capacitor Step Sizes, Number of Switching Operations per Step, Defective Capacitor Steps
- Monitoring of Out-of-Limit Conditions with Visual Alarm: e.g. Over- and Undercompensation, Power Loss of Capacitors, Current Overload, Harmonic Overload
- Rs232- Interface for Remote Data Transmission and Compensation Analysis
- Fault Signalling Contact for Control Alarm

OPTIONAL FEATURES

- Fault Signalling Contact for Harmonic and Current Overload Alarm
- Analog Output for Remote Transmission of Power Factor \cos
- RS485-Interface for Data Transmission
- Integrated Data Logger for Data Recording

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Technology of the BLR-CM

The BLR-CM combines the functions of a power factor control relay with an electrical power measurement and control device. In addition to providing the standard requirements of a p.f.c. relay the BLR-CM also measures and supervises the total electrical load on the system.

Reactive Power Compensation

The amount of reactive compensation required is constantly calculated from the analogue values of voltage and current in all four quadrants. These values are continuously digitised and multiplied to calculate active and reactive load, from which the digital $\cos \phi$ indication is continually up-dated.

New installations have a "getting to know" sequence as each capacitor step is switched in, without any unnecessary test switching. As soon as the relay calls for capacitors to meet the target $\cos \phi$, the relay switches in capacitor steps of unknown value for the first time on a "test and measure" sequence. In this way the relay stores the value of each capacitor step in its memory. It is no longer necessary to calculate the starting current setting (C/k value). The size of each step is permanently stored in the memory of the relay even in the event of power failure. The measured value of each step can be recalled at any time.

The BLR-CM eradicates one of the most common connection faults of voltage (L2/L3) or current path (k/l) reversed connections. If the relay senses a negative reactive load on switching a capacitor step, the incorrect polarity will be automatically rectified by the relay itself.

The measured and stored capacitance values are checked each time a step is switched. Any changes in the measured values are corrected and reductions in capacitance values are therefore constantly monitored and indicated. Disconnected steps or defect capacitor steps (e.g. fuse failure) will be excluded from the compensation process. In order to check whether the fuse has been replaced, the BLR-CM will make a maximum of three attempts at weekly intervals, or each time the relay is switched in, to reconnect the failed capacitor step.

In normal operation, the reactive load requirement will be satisfied by switching the stored capacitance values. The preselected switching programmes formerly used are no longer applicable, except for special switching applications with harmonic blocking reactors (see below). The optimal capacitance step value is selected for each reactive load situation.

In those cases where harmonic current blocking reactors are fitted, the common standard (S-) switching programmes are available. The capacitor steps will be switched in from the first to the highest step value and switched out from the highest to the first value.

The BLR-CM is available in three switching step values: BLR-CM 06/08 and 12 with 6, 8 and 12 switching steps. If the installation does not require all the steps available the number of switching steps can be limited on site.

Measurement Functions

The measurement functions cover all important data required in a system network. The BLR-CM measures current and voltage on one phase only, so all the measurements are single phase. The indicated power assumes a three phase balanced load, from which the total power is calculated. Each measurement function is called up from the foil tab key board (10). The appropriate values of current and voltage transformer ratios must be entered in order to obtain the correct readings in the display.

Settings

The input of each relay parameter and threshold setting is given by rotating the function switch (1) which is hidden from direct access underneath the nameplate cover. Each required setting is made using the SET and +/- keys on the foil tab keyboard (10). All the stored settings will be retained in the event of power failure, and using the code switches (3 and 4) each threshold point can be independently adjusted.

Data Transmission

Each BLR-CM relay is fitted with an RS232 output as standard. Connection is made via the 9 pole SUB-D socket (2). Output is fed via an interface into the PC or data logger. Every function of the relay switching operations will be data logged as well as all the measured system power data.

As additional options the output can be made via a SUB-D socket on the rear of the relay (option -p), and RS485 output (option -B) is available if required.

Evaluation of the stored data is obtained by using the SW software (option -SW).

Data Logging

Each switching function of the capacitor installation can be data logged on site giving the time of each operation using an integrated data logger (option -D).

Threshold Values

No-Volt Release Function

In the event of a power failure of > 35 ms, all capacitors are automatically disconnected.

Voltage Failure

If the voltage falls to below 70% of its nominal value, all capacitors will be switched off. Resumption of the power factor regulation will be restarted 90 sec. after resumption of supply – as with the no-volt release function.

Current Transformer Input Failure (I--0)

If the measured current falls to less than 10 mA the display will show "I--0". After a 10 min. delay all energised capacitors will be switched off.

Power Factor Alarm (ALLo/ALHi)

If the required target power factor cannot be obtained (e.g. fixed capacitors or insufficient capacitance installed) overcompensation will be indicated with "ALHi" and undercompensation with "ALLo".

Loss in Capacitor Step kVAr Output Alarm (ALnn)

If the capacitor step output falls to below 60% of its originally stored value, an alarm showing the step number (nn) will be indicated.

Defective Capacitor Step Alarm (ALCd)

If a capacitor step fails to operate, this will be reported. Also, if there is a connection fault (e.g. C.T. not on the incoming main cable) or if there is no connection to a step output, then this alarm signal will be reported.

Harmonic Overload Alarm (ALHA)

The BLR-CM relay is fitted with a special device to evaluate the dynamic voltage supply, so the forecast current in the power capacitor bank is evaluated. If this forecast current exceeds 120% of the capacitor nominal value, then the harmonic overload alarm will be actuated.

Fault Signalling Contacts

Remote signalling of the relay alarms, power failure or defective capacitor step alarm can be transmitted using the alarm contact relays MO and MS (voltage-free switching). If an independently powered supply is available, a signal can be given for power supply to the p.f.c. relay.

Optional Features

(Thermal) Overcurrent (AL I) (-s)

The BLR-CM can be fitted with an additional overcurrent or thermal overcurrent alarm device. This will oversee the momentary as well as the thermal current value. The threshold value can be adjusted between 1 and 9.999 A. The fault signalling relay (-j) will close in case of thermal overload.

Peak Setting of Capacitors Power Reduction (-s)

The threshold setting can be adjusted between 0 (total power failure) and 60% of the nominal power per each capacitor. Any alarm will be triggered in case of decreasing the preset threshold level; alarm contact M-MS will close.

Harmonic Overload Alarm Contact (-z)

Contact MZ will close in alarm conditions ($I_c > 1,2 I_n$).

Displayed Functions

Number of Steps in Circuit

The LED display (6) shows the switch condition of each individual capacitor step.

Export / Import of Power

The LED displays (7) and (9) show the direction of flow of energy.

Active Power (P)

Indicates total active power.

Apparent Power (S)

Indicates total apparent power.

Reactive Power (Q)

Indicates total reactive power.

Power Factor (cos φ)

Indicates system power factor cos φ.

Voltage (U)

Indicates system three phase voltage.

Current (I)

Indicates apparent current and thermal current load.

Fourier Analysis

Indicates the harmonic percent content of each harmonic voltage from the 3rd to the 13th harmonic, as a percentage of the mains waveform.

Capacitor Step Output

Indicates the present as well as the original kVAr output of each individual capacitor step.

Step Switching Counter

Indicates the number of switching operations per step.

Defect Capacitor Indicator

Indicates which capacitor step is not functioning or not connected.

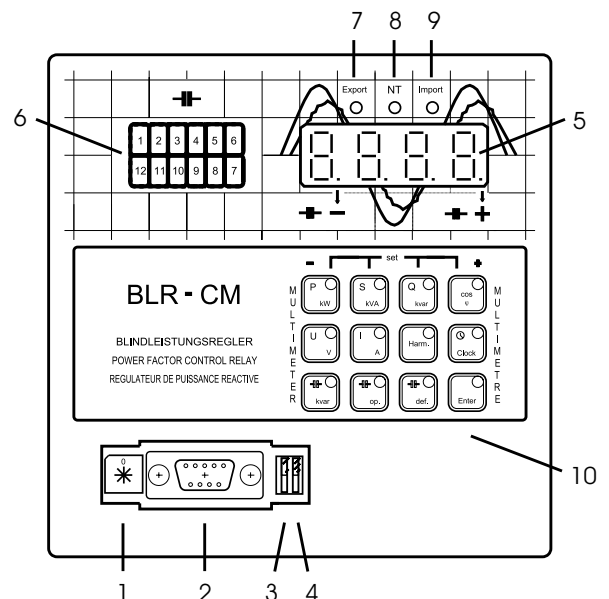
Additional Options

Tariff Change-over Indicator (-TN)

Indicates the change-over from day (HT) to night (NT) power cost by means of LED (8), second target power factor adjustable for off-peak loads/low tariff (NT).

Date / Time (-D)

If the BLR-CM is supplied with an integrated data logger the recorded date and time can be displayed.



Technical Data

Measuring Device:	Single phase electronic measurement system for connection to three-phase systems. The measuring system operates in all four quadrants and analyses non-sinusoidal voltage and current waveforms and rectifies automatically any voltage or current path reversed connection.
Measuring Voltage:	Connection to delta voltage L2/L3, 380 - 415 V. Other voltages up to 500 V on request. Tolerance +/- 10%. Voltage supply burden 10 VA (max) according to number of steps connected. Voltage transformer ratio kU adjustable from 1 ... 99. External protection with 6A required.
Measuring Current:	Connection to current transformer in phase L1, x/5 A or x/1A, class 1 to 3. Consumption 1,4 VA. Impedance < 0,1 Ω . Current transformer ratio kI adjustable from 1 ... 9999.
System Frequency:	50 ... 60 Hz.
Switch Rating:	3000 VA, 250 V~ per contact (energizing). 1500 VA, 250 V~ per contact (hold).
Specifications:	Insulation protection in accordance with VDE 0160, creepage air paths in accordance with VDE 0110, group C, type tested. Flame retardant to 94 V-O.
Ambient Temperature:	-10 ... +70 °C.
Protection:	Facia IP 50, Casing IP 30. Lockable transparent cover available for IP 54.
Casing:	Instrument casing 144 x 144 mm. Total depth including plug 95 mm. weight 1,3 kg.
Installation:	Panel mounting (cutout 137 x 137 mm). Mounting position as required. Plug-in terminal connection.
Target Power Factor:	Adjustable from 0,7 lag ... 1,0 ... 0,9 lead.
Starting Current:	Automatic self adjustment to any capacitor step value. Response value 10 mA.
Switching Time Delay:	5 s ... 20 min.
Switching Programmes:	Fully automatic or fixed: 1:1:1:1 / 1:1:2:2 / 1:2:2:2 / 1:2:3:3 / 1:2:4:4 (S-Programmes)
Control Exits:	BLR-CM 12: 1 to 12 steps adjustable. BLR-CM 08: 1 to 8 steps adjustable. BLR-CM 06: 1 to 6 steps adjustable.
Alarm Mode:	Fault Signalling OFF. Fault Signalling ON with automatic or manual alarm reset.

Optional Features

Single Phase System (-e):	For connection to single phase alternating systems or to three-phase systems between phase and neutral (L/N).
Asymmetric Switching	
Time Delay (-s):	For fast connection and slow disconnection of steps.
Variable Load Reversal	
Switching Time Delay (-s):	For a fast switching in one direction.
Tariff Change-Over (-TN):	Second target power factor adjustable from 0,7 lag ... 1,0 ... 0,9 lead. Target power factor setting for off-peak periods (low tariff). Change over by applying a signal voltage via time clock or ripple-control receiver.
Harmonic Surveillance (-HA):	Automatic disconnection of capacitors in case of harmonic overcharge ($I_c > 1,2 I_n$ within 8 min.).
Harmonic Alarm Contact (-z):	Volt-free fault signalling contact for harmonic alarm ($I_c > 1,2 I_n$ within 8 min.), switch rating 1250 VA / 250 V ~.
Analog Exit (-C):	Current exit for remote transmission of power factor cos φ (0 - 20, 4 - 20 oder 0 - 24 mA DC).
Overload Alarm Contact (j):	Volt-free fault signalling contact when exceeding a preset thermal current threshold value, switch rating 1250 VA / 250 V ~.

Connection Diagram

