

# **Power-Factor-Control-Relays**

## **Comparison of CA, CB, CC & CM Models**

**ILLIMITE IS YOUR HEADQUARTERS  
FOR THE BELUK FAMILY OF  
POWER FACTOR CONTROLLERS !**

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# Beluk-Reactive Power Control Relays

## Convert Reactive Power, Thus Saving Active Power

### - World-wide -

Beluk manufacture reactive power control relays of various types which operate on the following measuring and controlling principle:

Reactive and active power are calculated from voltage and current. The actual  $\cos\phi$  is constantly compared to the target  $\cos\phi$  and the difference between these two values serves as a basis to determine the compensating reactive power required. Capacitors in any size can be used in the automatic mode of operation. No pre-selected switching programme is required, because the controller will always select the optimum switch sequence. When switching capacitors, the reactive kvar output of each step is determined and stored. This enables permanent supervision of the reactive power output of each individual capacitor step. In this way the number of switching operations is considerably reduced. Due to the permanent supervision of capacitor stages, Beluk power-factor-relays BLR-CA, CB, CC and CM do not require a fixed switching sequence when energising capacitor steps for compensation. Beluk power factor control relays are pre-set at the factory for immediate service following installation. However, the customer can also select his own switching parameters such as switching time per step.

#### Features

- 4-quadrant measurement of reactive and constant supervision of inductive/capacitive load.
- measurement and supervision of each step kvar output during switching process.
- adjustment of current transformer ratio for control purposes is not required. (with BLR-CM the input of the transformer ratios is required for the indication of values measured).
- adjustment of target  $\cos\phi$  in the range 0.70 (lag) – 1 – 0.90 (lead)
- adjustable switching time.
- manual switching may be selected
- no-volt release with mains interruption greater than 35 ms.
- 90 sec's lockout time following mains failure and subsequent power restoration.
- optical indication of each individual stage.
- failure alarm if target  $\cos\phi$  is not achieved (after fulfilment of 75 switching cycles).
- failure alarm if relay detects there is a risk of overloading capacitors due to excessive harmonic current.

#### Symbols for Options Available on Your Order

- m: status message 'target  $\cos\phi$  not achieved'
- z: volt free switching contacts operate when capacitors are overloaded due to excessive harmonic currents.
- q: LED indication of power flow direction (import – export)
- NT: Selectable target power factor settings for HT/NT (day/night tariff) including asymmetric switching time and variable re-connection lock-out time.
- s: asymmetric switching time and variable re-connection lock-out time.
- p: sub-D-connection plug for serial interface on rear of case.
- j: status message for 'overload' due to excessive current, adjustable threshold (volt free contacts).
- c: analogue output proportional to  $\cos\phi$  (please state output required 0...20mA, 4...20mA or 0...24mA).
- B: serial interface RS485 on rear of case (Beluk - bus)(BLR-CM).
- B: serial interface RS 422 on rear of case (BLR-CA).
- B: integrated data logger contained within the relay (1024 kB on BLR-CM only).
- e: single phase measurement (L-N)
- t: transistor outputs to select respective thyristor controllers.

#### Other Accessories

- wall mounting brackets, length 102mm or 212mm
- DIN rail fixing accessory
- Lockable cover IP54
- Connection wires (lengths to customer's request)
- External data loggers DS21 (256kB), DS22 (512kB), DS23 (1024kB)
- Data cable
- TTL/RS232 interface
- Software for read-out and indication
- Matching transformers for supply and measuring voltages up to 690V

**COMPARISON OF FEATURES ON EACH TYPE OF BELUK RELAY**

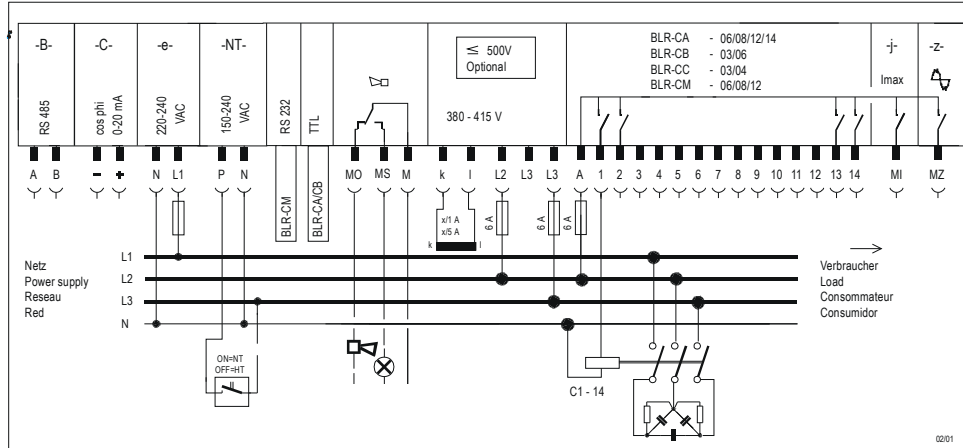
Type of PF control relay	CA	CB	CC	CM
Number of switching steps available	06/08/12/14	03 / 06	03 / 04	06 / 08 / 12
Fully automatic control	x	x	x	x
Selectable pre-determined switching sequence	-	-	-	x
Manual switching	x	x	x	x
Terminal connection strip	x	x	x	x
Measuring voltage 400 V, 50/60 Hz	x	x	x	x
Measuring voltage of your choice 100 V – 500 V, 50Hz/60Hz	o	o	o	o
Current path 5A/1A	x	x	o	x
Automatic matching of capacitors	x	x	x	x
Adjustable values of target $\cos\phi$	i0,7 -1- c0,9	i0,7 -1- c0,9	i0,7 -1- c0,9	i0,7 -1- c0,9
Adjustable values of step switching time	5 - 1200 s	5 – 1200 s	5 - 1200 s	3 - 9999 s
Rapid switching time (200ms) + transistor outputs	-	-	-	o
Adjustment of max. number of steps switched	x	x	x	x
Disconnection in case of mains failure (>35ms)	x	x	x	x
Disconnection in case of loss of current input (I=0 > 10 min)	x	x	x	x
Visual alarm of low power factor	x	x	x	x
Low power factor alarm contacts (volt free)	o	o	o	x
Visual indication of harmonics overload (du/dt)	x	x	-	x
Switching contacts for harmonic overload (du/dt) (volt free)	o	-	-	o
Each capacitor step kvar output	x	x	x	x
Alarm reset feature                      selectable automatically/manually	x	x	-	x
Alarm reset feature                      automatically available only	-	-	x	-
Serial interface behind DIP switch cover                      TTL	x	x	-	-
Serial interface behind DIP switch cover                      RS 232	-	-	-	x
Visual indication of number of switching each step in circuit	x	x	-	x
Visual indication of defective capacitor switching steps	x	x	-	x
Visual indication of voltage, current and mean average	-	-	-	x
Visual indication of kW, kvar, kVA	-	-	-	x
Visual indication of power factor $\cos\phi$	x	x	x	x
Visual indication of voltage harmonics 3 <sup>rd</sup> /5 <sup>th</sup> /7 <sup>th</sup> /9 <sup>th</sup> /11 <sup>th</sup> /13 <sup>th</sup>	-	-	-	x
Visual indication of load direction (import/export)	o	-	-	x
Indication of kvar output of each capacitor step	-	-	-	x
Single phase measurement (L1/N)	o	o	-	o
Two selectable settings of target $\cos\phi$ (day and night tariffs)	o	-	-	o
Change of target $\cos\phi$ when export of kW	-	-	-	o
Asymmetric switching time	o	-	-	o
Variable load reversal lock-out time	o	-	-	o
Visual display of I <sub>max</sub> target setting	-	-	-	o
External volt free contacts for I <sub>max</sub> target setting	-	-	-	o
Analogue current output proportional to $\cos\phi$ (0-20, 4-20, 0-24mA)	-	-	-	o
Sub-D-connecting plug for serial interface on rear of relay	o	o	-	o
Serial interface RS485 (Beluk bus) included in the relay	-	-	-	o
Serial interface RS422 included in the relay	o	-	-	-
Data logger integrated in the relay	-	-	-	o

- x       standard equipment
- o       optional equipment
- equipment not available on this relay

## Technical Data

Voltage measurement:	Connection to L2/L3, 380 V- 415 V. Deviating voltages up 500 V on request. Tolerance $\pm 10\%$ . Power consumption according to the number of stages 10 VA (max.). Factor of voltage transformer programmable between 1..99 (on CM-relay only). 6amp external fuse protection required on all relays.
Current measurement:	By current transformer mounted on phase L1 x/5 A or x/1 A, class 1 to 3. Power consumption 1.4 VA. Impedance $< 0.1\Omega$ . Current transformer multiplication factors for CT ratios (on CM relay only) programmable between 1..9999.
Power frequency:	50 ... 60 Hz.
Making/breaking capacity:	250 V~/5A per contact on closing. Contacts are also available to a maximum switching voltage of 440 V~/2A.
Construction:	Insulation in accordance with VDE 0160. Type tested. Creepage distances to VDE 0110, Group C, heavy inflammable 94 V-0 (UL (USA), cUL (Canada)).
Operating temperature:	-10 ... +70 °C.
Degree of protection:	Front side IP 50, case IP 30. lockable transparent plastics door IP 54 available.
Dimensions:	Meter case 144 x 144 mm. Total installation depth including terminals: CA, CM 95 mm; CB, CC 62 mm
Installation:	For mounting in switchboard panels (cut-out 137 x 137 mm). May be mounted in any position. Screw terminal connection plugs.
Target $\cos\phi$ setting:	0,7 lag...1,0...0,9 lead
Starting current:	Matching any capacitor value automatically. Limit of sensitivity 1% of nominal secondary current of CT
Switching time:	Adjustable 5 s...20 min (CA, CB, CC); 3 s – 9999 s (CM)
Weight:	CA, CM 1,3 kg; CB, CC 0,85 kg

## Wiring Diagram



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