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BELUK GMBH · SABA KHAZEN · 2011

# BLR-CX OPERATION MANUAL

Installation, commissioning, menus, alarms and factory settings

Source pages **16 pages**

Document language **English**

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**90-550 V**

measuring / supply voltage, 1-phase

**15<sub>mA</sub> - 6 A**

current input, X/1 A or X/5 A CT

**14**

relay outputs, common root

**144<sub>mm</sub>**

panel instrument, 138 × 138 cut-out

## 1 BEFORE YOU START



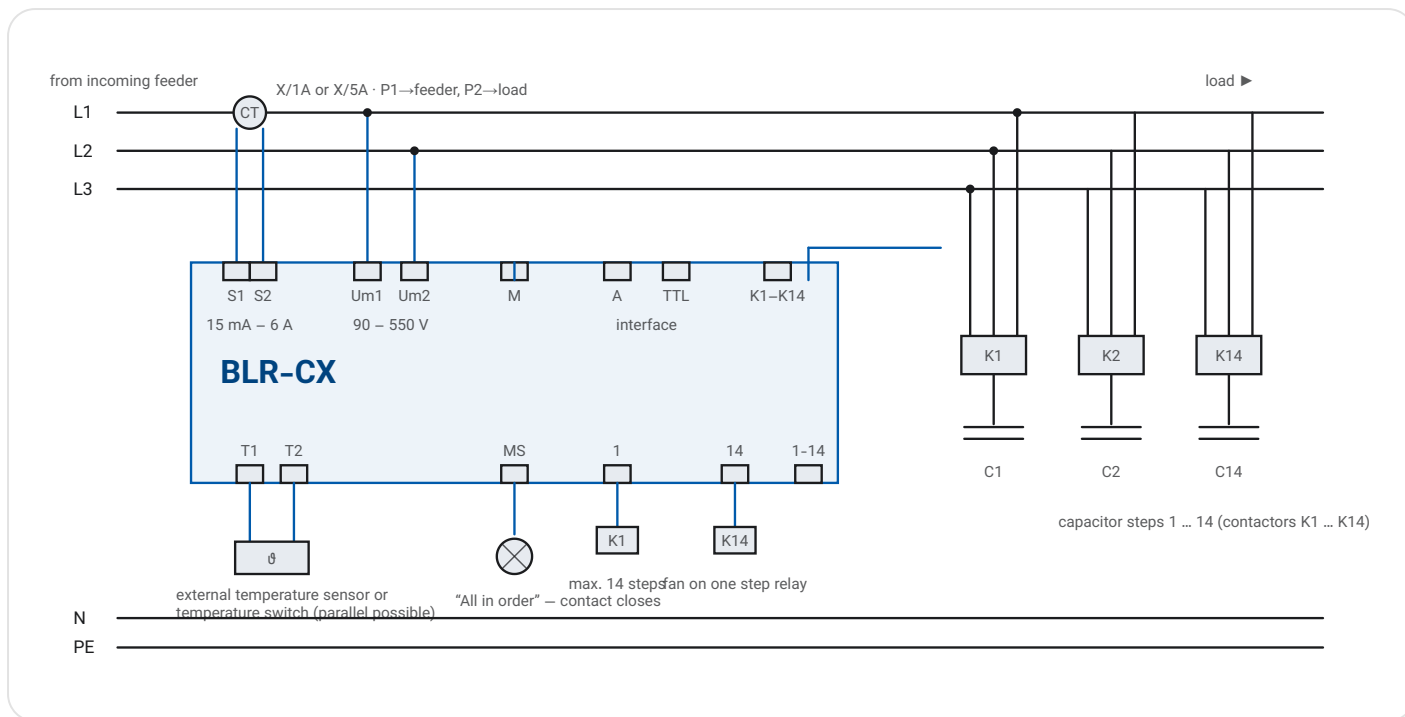
### Attention

Installation of the BLR-CX must only be undertaken by technically qualified persons, since live terminals can cause electric shock. The appropriate safety regulations in the country of installation must be strictly adhered to. Equipment with damaged casing or terminals must not be used and must be disconnected from the mains supply immediately.

The BLR-CX is a reactive power control relay: it measures one voltage and one current, works out the reactive power the network is drawing, and switches up to 14 capacitor steps through contactors K1 ... K14 so that the displacement power factor reaches the target  $\cos \phi$ . This page follows the operation manual supplied by Saba Khazen with the relay.

## 2 WIRING DIAGRAM

### Connection of the BLR-CX in a compensation panel



Current transformer P1 towards the incoming feeder, P2 towards the load. The alarm contact (M–MS) is closed while everything is in order. Fan operation can be assigned to one of the step-switching relays.

| TERMINALS              | FUNCTION                            | RANGE / NOTES                                                                                                                                                                 |
|------------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>S1 · S2</b>         | Current measuring                   | 15 mA – 6 A; any X/1 A or X/5 A CT                                                                                                                                            |
| <b>UM1 · UM2</b>       | Measuring and supply voltage        | 90 – 550 V AC, single-phase                                                                                                                                                   |
| <b>M · MS</b>          | "All in order" alarm contact        | Volt-free relay, closed in order, opens on alarm; 250 V AC / 5 A                                                                                                              |
| <b>T1 · T2</b>         | Temperature sensor or digital input | Plug-in thermistor; an external temperature or temperature sensor switch can be operated in parallel. Also usable for switching to the 2nd target cos φ (SETUP / 510 and 511) |
| <b>A</b>               | Interface                           | TTL on the rear (standard); optional RS485 Modbus, USB                                                                                                                        |
| <b>1 ... 14 · 1-14</b> | Control exits                       | Up to 14 relays, N/C, common root; 250 V AC / 5 A, 400 V AC / 2 A                                                                                                             |
| <b>PE</b>              | Earth                               | Connect the earth protection cable to PE on the metal case                                                                                                                    |



#### N/C or N/O – the two BELUK sources disagree

This manual prints the control exits as “relay, N/C, common root” (Technical data, p. 16), and that is what is reproduced above and in §10. The BELUK product catalogue gives “Up to 14 relay, N/O, voltfree with common point” for the same BLR-CX (p. 5). The manual is reproduced as printed; check the device before wiring.

## 3 INSTALLATION AND COMMISSIONING

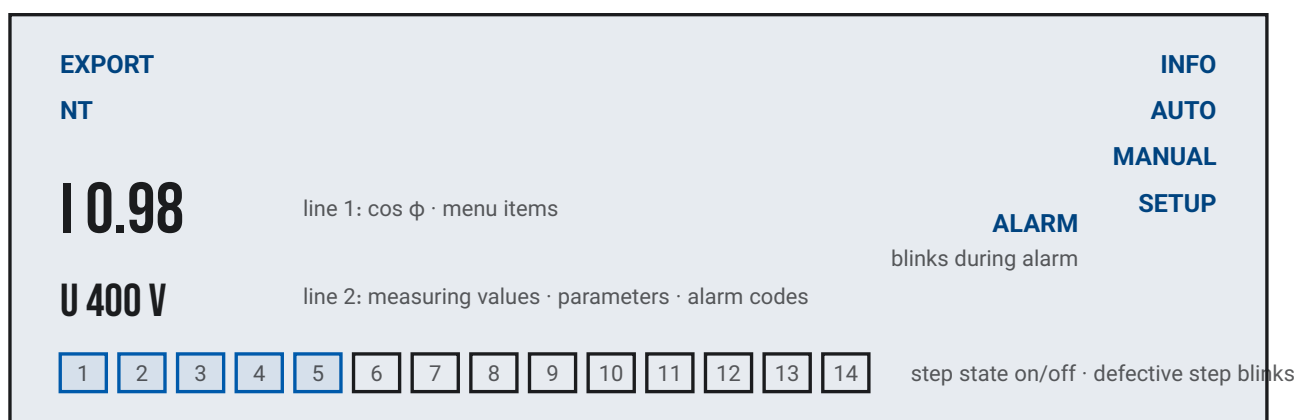
- 1 Check that the mains voltage and CT current input are suitable for the relay.
- 2 Disconnect the panel from mains voltage and check that the voltage is off.
- 3 Ensure the CT is short-circuited or not in operation. **An open-circuit CT produces a high voltage which endangers people and equipment.** It will also damage the CT and affect its accuracy.
- 4 Disconnect and remove any previous PFC relay.
- 5 Mount the BLR-CX in the control panel with the two mounting clips (cut-out 138 × 138 mm).
- 6 Connect the earth protection cable to PE on the BLR-CX metal case.
- 7 Connect the BLR-CX according to the wiring diagram (CT/P1 towards the incoming feeder, CT/P2 towards the load).
- 8 Remove the short-circuit from the CT.
- 9 Connect mains voltage to the panel.
- 10 If the relay has been correctly connected and the mains voltage and CT output comply with the ratings and settings of the BLR-CX, the LCD shows `AUTO` and the control function starts automatically.

## 4 FAQ DURING COMMISSIONING

| SYMPTOM                                              | CAUSE / WHAT TO CHECK                                                                                                                                       |
|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>No indication AUTO – relay does not switch</b>    | Relay set to manual operation; in SETUP/100 the selection for PFC is OFF or HOLD; temperature too high; current < 15 mA; voltage or THD U out of tolerance. |
| <b>Indication U ALARM – voltage out of tolerance</b> | Check the settings for nominal voltage (SETUP/Un) and voltage transformer (SETUP/Pt).                                                                       |
| <b>Indication I Lo ALARM – CT current &lt; 15 mA</b> | Connection error of the CT; the CT short-link has not been removed; the CT ratio is too high compared with the real current; no current.                    |
| <b>Indication EXPORT – kW export</b>                 | If there is no real kW export, check the voltage and current connection to the BLR-CX (see Wrong connections / AI).                                         |
| <b>Wrong cos <math>\phi</math> indication</b>        | Wrong connection: check the voltage and current connection (see Wrong connection / AI).                                                                     |
| <b>Steps switch in and quickly switch out again</b>  | See Step size detection / Defective capacitors.                                                                                                             |
| <b>Frequent switching of steps</b>                   | The size of the capacitors has not been completely detected.                                                                                                |

## 5 DISPLAY AND KEYS

### Display



#### INFO

step database information



#### AUTO

relay is working in AUTO mode



## MANUAL

relay is working in manual mode



## SETUP

setup of parameters



## EXPORT

kW export



## NT

2nd target cos  $\phi$  is working



## ALARM

blinking during alarm

## ≡ Handling – four keys



exit

exit menu · cursor left  
reset alarm (hold 5 s)



increase

raise values  
select menu items



enter

open menu · cursor right  
confirm input



decrease

lower values  
select menu items

## Entering a parameter

- ▲ ▼ set the digit; ► selects the next digit.
- After the last digit, ▲ ▼ select the multiplier k (kilo) or M (mega) and the leading sign I (inductive) or C (capacitive) – the letter blinks.
- ► stores the setting; ◀ **esc** aborts the input.

## 6 MENUS

Select menu items with ▲ ▼ and enter a submenu with ►.

## **Measuring values**

- U L-L, U L-N, A (I), kW (P), kvar (Q),  $\Delta$ kvar ( $\Delta$ Q), kVA (S)
- THD U, 3rd – 19th harmonic of U
- $\cos \phi$ , PF ( $\lambda$ ), APF (average PF),  $\tan \phi$  (tAn)
- Hz (F), °C (t), °C max (thi), operating hours (OPh)

## **INFO – step database**

Attention: the actual state of the control outputs is not shown here. Choose a step with ▲ ▼ and enter with ►; the selected step blinks. ▲ ▼ then show for the step:

- actual size of the capacitor (rated to nominal voltage)
- derating: present kvar / original kvar in %
- switch cycles of the contactor
- step setting: AUTO automatically switched · F<sub>on</sub> permanently on · F<sub>off</sub> permanently off · AL used for fan control · FL<sub>ty</sub> defective

## **MANUAL operation**

Hold ► for 3 seconds. Select a step with ▲ ▼ (its number is shown in line 2); ► switches the selected step on or off; ◀ leaves manual operation.



### **Important**

Manual operation cannot be opened in the LIFO and Combi-Filter modes. The discharge lock-out time is also active in manual mode. If the voltage is out of tolerance all steps are disconnected. THD U and over-temperature alarms prevent steps switching in. Only steps of type AUTO can be switched. On leaving the menu the relay switches to the actual load.

## **SETUP parameters (menu 100)**

Choosing SETUP shows submenu 100; ► opens it. ▲ ▼ reach menus 200 – 600, which are protected by a PIN (see the reference book).

| PARAMETER | MEANING                                                                                                   |
|-----------|-----------------------------------------------------------------------------------------------------------|
| UN        | Nominal voltage (very important!) – over/under-voltage monitoring and the reference for the step database |
| CT        | CT ratio – enables the current-dependent measuring values                                                 |
| PT        | VT ratio – base for the nominal voltage                                                                   |
| AI        | Automatic initialising (see Wrong connection / AI)                                                        |
| PFC       | PFC ON / OFF / HOLD – on, off, or freezing of the automatic correction                                    |
| CP1       | Target cos $\phi$ 1 – base for the compensation target                                                    |
| ST        | Switch time delay of each step – speed of regulation                                                      |
| OUT       | Step type: AUTO, Fon, Foff, AL; reset of defective steps (FLty)                                           |

## 7 WRONG CONNECTION, AUTOMATIC INITIALISING AND STEP DETECTION

A PFC relay demands the correct connection of voltage and current (polarity and phase). If the connection is wrong it must be corrected; as this is not always possible, the BLR-CX offers a manual correction (SETUP/200, reference book) and **automatic initialising** (SETUP/100/AI).

### ✓ Automatic initialising (AI)

AI connects and disconnects all control exits several times – this lasts several minutes. Exits that are not connected are set to **FOFF**. Step sizes are not detected by this function. After AI the relay must be checked for correct operation.

- Requirements: voltage within tolerance; CT connected (no simulation); capacitor banks installed and fuses inserted.
- Possible problems: load variations; small current signals (big CT ratio, small steps).
- Failure AI / Abt: AI aborted because no clear result could be achieved; PFC = OFF.

### Step size detection

At each switching operation the step size is measured (unless disabled in SETUP/300). No c/k setting is needed: the switching sequence selects the steps whose kvar best matches

the load. The values are stored in the step database, where the loss of output of each step can be seen. If a step fails during the first 3 operations after a database reset, it is set to Foff automatically.

## Defective steps

A step switched 3 times in series without a measured size is detected as defective and blocked for 24 h (step state flashing, status `FLty`). Check fuses, contactors and capacitors of that step, then reset in `SETUP/100/OUt` or by restarting the relay.



### After commissioning all steps show Foff?

Is the short link of the CT secondary removed? Is the position of the CT correct?  
Are all fuses present and in order?

## 8 ALARMS

Alarm settings are in `SETUP/500` (reference book). Hold ◀ esc for 5 seconds to reset an alarm.

| CODE                     | ALARM        | MEANING / ACTION                                                                                                              |
|--------------------------|--------------|-------------------------------------------------------------------------------------------------------------------------------|
| <code>U</code>           | Voltage      | Voltage out of tolerance                                                                                                      |
| <code>I LO</code>        | Current low  | Current < 15 mA – check the current path                                                                                      |
| <code>I HI</code>        | Current high | Current > 6 A – CT rating is too small                                                                                        |
| <code>PFC</code>         | Control      | Target cannot be reached – check the panel                                                                                    |
| <code>HAR</code>         | Harmonics    | Limit of THD U is exceeded                                                                                                    |
| <code>STEP / FLTY</code> | Step         | Defective steps                                                                                                               |
| <code>SPL / NR</code>    | Derating     | Step size < 70 % of original – step number and code flash in rotation                                                         |
| <code>THI</code>         | Temperature  | Over-temperature – disconnection of steps                                                                                     |
| <code>OPH</code>         | Maintenance  | Max. operation hours reached                                                                                                  |
| <code>OPC / NR</code>    | Maintenance  | Max. switch cycles per step – step number and code flash in rotation                                                          |
| <code>AI / ABRT</code>   | Initialising | Abort of automatic initialising – start AI again at quieter load, or set the phase offset manually ( <code>SETUP/200</code> ) |

## 9 FACTORY DEFAULT SETTINGS (AS DELIVERED BY BELUK)

### SETUP / 100 – for the user (open access)

| PARAMETER | DEFAULT      |
|-----------|--------------|
| Un        | 400 V        |
| Ct        | 1            |
| Pt        | 1            |
| Ai        | (no setting) |
| PFC       | ON           |
| CP1       | 1            |
| St        | 10 s         |
| OUt       | Auto         |

### SETUP / 200 – measuring (password)

| NO. | PARAMETER          | DEFAULT      |
|-----|--------------------|--------------|
| 201 | nominal voltage    | 400 V        |
| 202 | CT ratio           | 1            |
| 203 | VT ratio           | 1            |
| 204 | tolerance voltage  | 10 %         |
| 205 | Ph-Ph / Ph-N       | (automatic)  |
| 206 | phase offset       | 0°           |
| 207 | Ai                 | (no setting) |
| 208 | countdown with Ai  | NO           |
| 209 | synchronising      | AUTO         |
| 210 | temperature offset | 0 °C         |

### SETUP / 300 – control (password)

| NO. | PARAMETER           | DEFAULT |
|-----|---------------------|---------|
| 301 | sensitivity         | 60 %    |
| 302 | target cos $\phi$ 1 | 1.00    |
| 303 | target cos $\phi$ 2 | i 0.95  |
| 304 | EXPORT cos $\phi$ 2 | NO      |
| 305 | switch time delay   | 10 s    |
| 306 | St step exchange    | 2 s     |
| 307 | step exchange       | YES     |

| NO. | PARAMETER            | DEFAULT   |
|-----|----------------------|-----------|
| 308 | step recognition off | NO        |
| 309 | lock defective steps | YES       |
| 310 | PFC                  | ON        |
| 311 | algorithm            | Automatic |
| 312 | kvar offset          | 0 kvar    |
| 313 | asymmetric St        | 1         |
| 314 | Qcap steps off       | NO        |

#### SETUP / 400 – step database (password)

| NO. | PARAMETER                 | DEFAULT |
|-----|---------------------------|---------|
| 401 | discharge lock time       | 75 s    |
| 402 | nominal step size, CT = 1 | 5 var   |
| 403 | step type                 | Auto    |
| 404 | switch cycles             | 0       |

#### SETUP / 500 – alarm settings (password)

| NO. | PARAMETER                     | DEFAULT |
|-----|-------------------------------|---------|
| 501 | reset manual                  | NO      |
| 502 | THD U alarm                   | NO      |
| 503 | THD U limit                   | 20 %    |
| 504 | THD steps off                 | NO      |
| 505 | delay time THD, temp2         | 60 s    |
| 506 | I = 0 freeze PFC              | NO      |
| 507 | maintenance alarm             | NO      |
| 508 | limit switch cycles           | 262 k   |
| 509 | limit operation hours         | 65.5 k  |
| 510 | target cos $\phi$ 2 by DI = 1 | NO      |
| 511 | DI = 1 when T1/T2 closed      | NO      |
| 512 | temperature alarm             | NO      |
| 513 | temp1 limit                   | 30 °C   |
| 514 | temp2 limit                   | 55 °C   |
| 515 | control alarm                 | NO      |
| 516 | defective steps alarm         | NO      |
| 517 | derating alarm                | NO      |

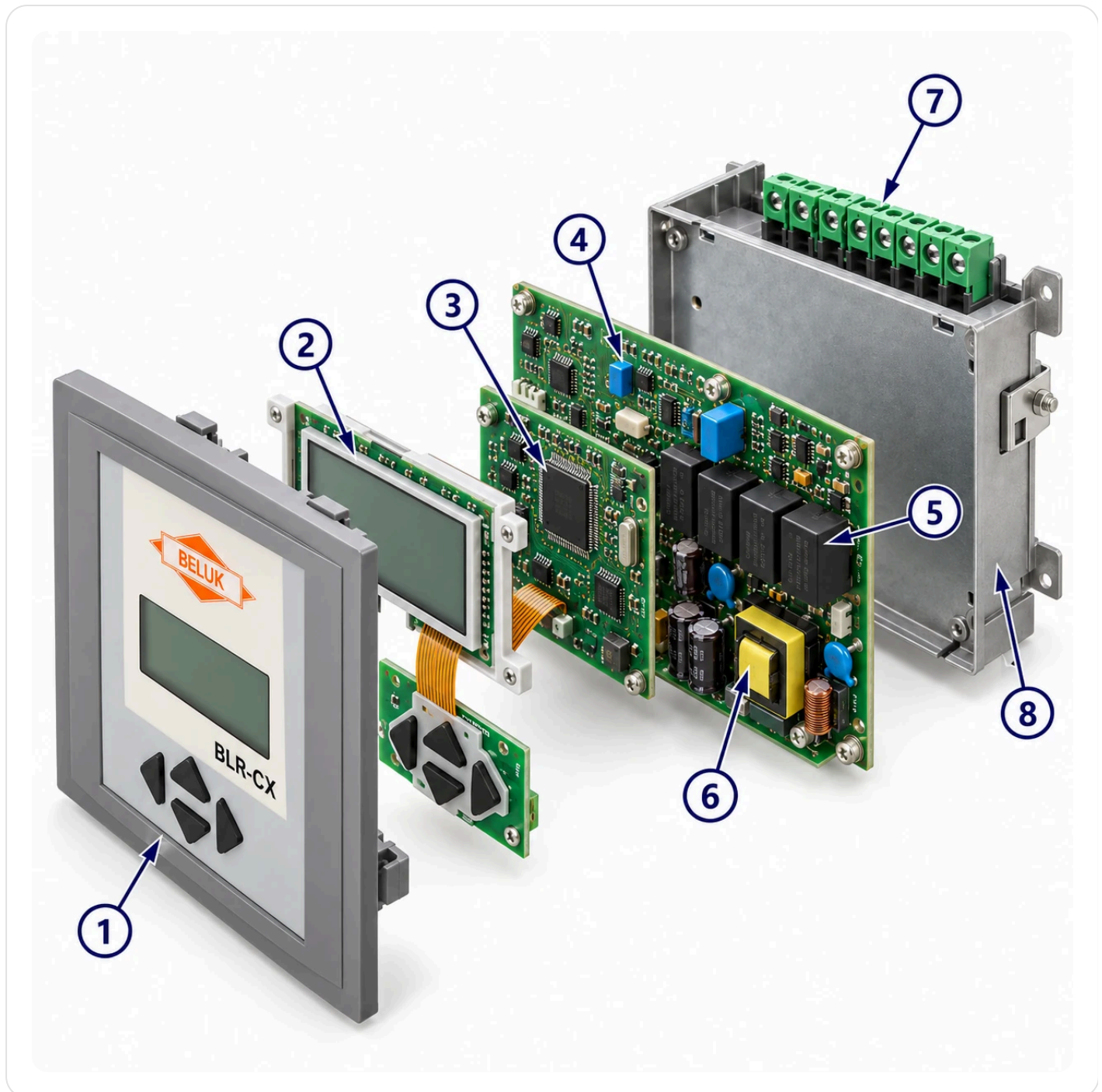
## SETUP / 600 – reset (password)

| NO. | FUNCTION               |
|-----|------------------------|
| 601 | factory settings       |
| 602 | reset step database    |
| 603 | reset operation hours  |
| 604 | reset APF              |
| 605 | reset max. temperature |
| 606 | reset alarm            |
| 607 | info software version  |
| 608 | change password        |

## 10 TECHNICAL DATA

|                       |                                                                   |
|-----------------------|-------------------------------------------------------------------|
| Voltage               | 90 – 550 V, 1-phase, 50/60 Hz, 6 VA                               |
| Current               | 15 mA – 6 A, 1-phase, < 1 VA                                      |
| Control exits         | relay, N/C, common root; 250 V AC / 5 A, 400 V AC / 2 A           |
| Temperature measuring | by plug-in thermistor                                             |
| Alarm contact         | relay, volt-free, N/C operated; 250 V AC / 5 A, 400 V AC / 2 A    |
| Fan control           | using a control exit                                              |
| Interface             | TTL, rear (standard); optional RS485 Modbus, USB                  |
| Ambient temperature   | operation –20 ... 70 °C; storage –40 ... 85 °C                    |
| Humidity              | 0 – 95 %, without condensation                                    |
| Overvoltage           | class II, pollution degree 3                                      |
| Connection            | screw type, pluggable                                             |
| Case                  | front: instrument case, plastic; rear: metal                      |
| Protection            | front IP50 (IP54 with gasket); rear IP20                          |
| Weight                | approx. 0.6 kg                                                    |
| Size                  | 144 × 144 × 58 mm (h × w × d); cut-out 138 (+0.5) × 138 (+0.5) mm |

## Inside the relay – case, boards and terminals



The exploded view above is an illustration prepared for this edition, not a manufacturer's service drawing; the numbers belong to the illustration and are not manufacturer part numbers. 1 Front bezel and control fascia · 2 Display and indicator assembly · 3 Processor and control section (illustrative) · 4 Voltage and current measurement section (illustrative) · 5 Step-output section (variant dependent) · 6 Power-supply section (illustrative) · 7 Connection terminals · 8 Rear housing and panel mounts. The exterior is taken from a photograph of a BLR-CX with the LCD display and the four keys, the 144 × 144 × 58 mm case of the table above; the output suffix is not visible on it, so the step-output section is drawn as the variant-dependent block it is. Illustrative exploded view; not to scale. Catalog dimensions and identity limitations are listed separately. Internal geometry and OEM subcomponent part numbers are unverified.

① This page is a re-typeset edition of the original document; where they differ, the manufacturer's file prevails. For technical questions,



## SABA KHAZEN MANUFACTURING & INDUSTRIAL CO.

Saba Khazen Industrial Company, established in 1994, is the first and only manufacturer of gas capacitors MKK and resin capacitors MKP under Siemens Germany license in Iran. With the slogan of superior quality and customer satisfaction, the company provides regular after-sales services. It is also the official representative of EPCOS and BELUK Germany, offering a wide range of power factor correction equipment and harmonic elimination solutions to industries.

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