GCR 06, GCR 12

Power factor correction controller

User and service manual

version 1.6

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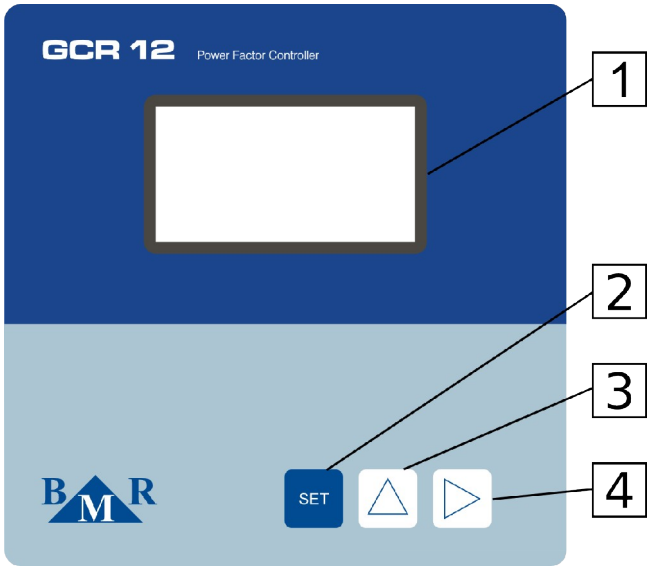
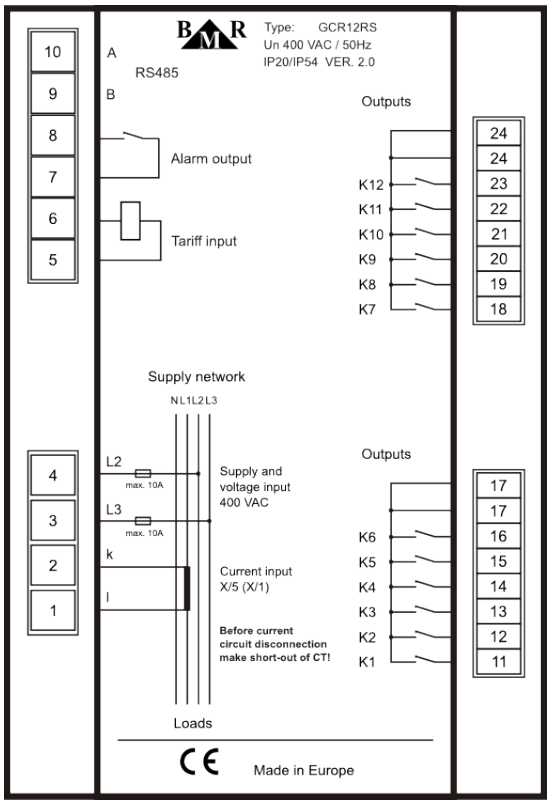
Content

1. Front control panel and back terminal panel



Picture 1: Description of front control panel

1. **Display** – full graphic OLED display
2. Button for menu entrance and saving set parameters
3. Cursor button for moving up in menu and parameter change to higher value
4. Cursor button for moving down in menu and parameter change to lower value



Picture 2: Back panel with terminal connection

2. Device description

Power factor correction regulator GCR06 or GCR12 is designed for power factor control in low voltage system networks 50/60 Hz and also for medium voltage systems up to 35 kV with measuring voltage ratio x/100 V. GCR regulators belong to the group of fast regulators and allow to make regulation up to 25 times per second. This feature allows GCR regulators to control mechanical contactors and also fast semiconductor stages, that make connections in "ZERO" and therefore they don't request delay for capacitor discharging. GCR regulators measure, record and display following parameters:

Parameter	display	maximum	minimum	graph
Phase to phase voltage between measured phases	•	•		
Current in the third phase	•	•		
System frequency	•	•	•	
Apparent three-phase power	•	•		
Active three-phase power	•	•		
Reactive three-phase power	•	•	•	
Allowed reactive power	•	•		
Odd current harmonics (1 ... 19) in %	•	•		•
Total harmonic distortion of current THDI	•	•		
Odd voltage harmonics (1 ... 19) in %	•	•		•
Total harmonic distortion of voltage THDU	•	•		
Number of connections of each stage	•			
Temperature	•	•		

Device is offered with 6 and 12 outputs design. Regulator GCR06 has available 1 x 6 outputs and regulator GCR12 has available 2 x 6 outputs. Outputs for mechanical contactors are with relays for maximum load of 250 V AC, 5A. Outputs for thyristor switching modules are realized by OPTO-MOSFETs, which are able to operate under 230 V AC / 100 mA.

This design brings important advantage. For hybrid compensation where combination of outputs will be according to the table No. 1, thyristor switching modules can be controlled by 230 V AC.

For compensation cabinets with all stages operated by thyristor switching modules or GCR12 with just 6 outputs for thyristor switching modules, controlled voltage 24 V DC is available according to the table No. 2.

Table 1: Controller types for contactor and semiconductor switching modules controlled by 230 V AC

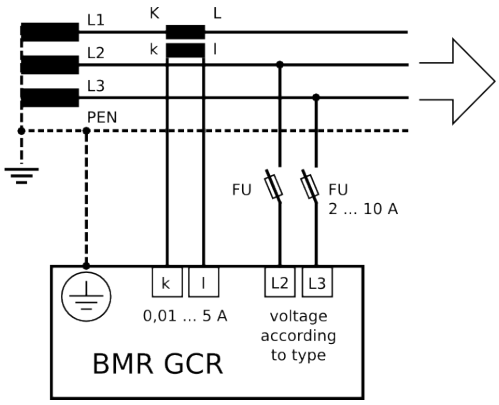
Regulator variant	Total number of all stages	Number of dynamic stages	Control voltage
GCR 06	6	0	230 VAC
GCR 06-01	6	1	230 VAC
GCR 06-02	6	2	230 VAC
GCR 06-03	6	3	230 VAC
GCR 06-06	6	6	24 VDC
GCR 12	12	0	230 VAC
GCR 12-01	12	1	230 VAC
GCR 12-02	12	2	230 VAC

Table 2: Controller types for semiconductor stages controlled by voltage 24 V DC and standard contactors

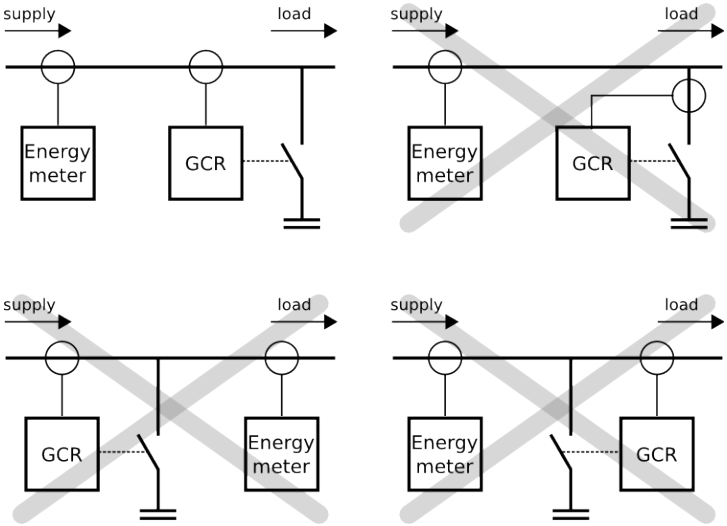
Regulator variant	Power supply voltage	Measuring voltage	Alarm output
GCR 06	400 VAC	400 VAC	yes
GCR 12	400 VAC	400 VAC	yes
GCR 06 V100	100 VAC	100 VAC	yes
GCR 06 V230	230 VAC	100 ... 690 VAC	no
GCR 12 V100	100 VAC	100 VAC	yes

3. Device connection

Default parameters are set to the device in production, according to the table 3. Supply voltage has to be taken from regulated network, because it is used also for voltage measuring circuit. Value of this supply voltage is indicated on the product label. Current for current measuring circuit is taken from the remaining phase and has to cover current of load and compensation cabinet too according the picture 3 and picture 4.

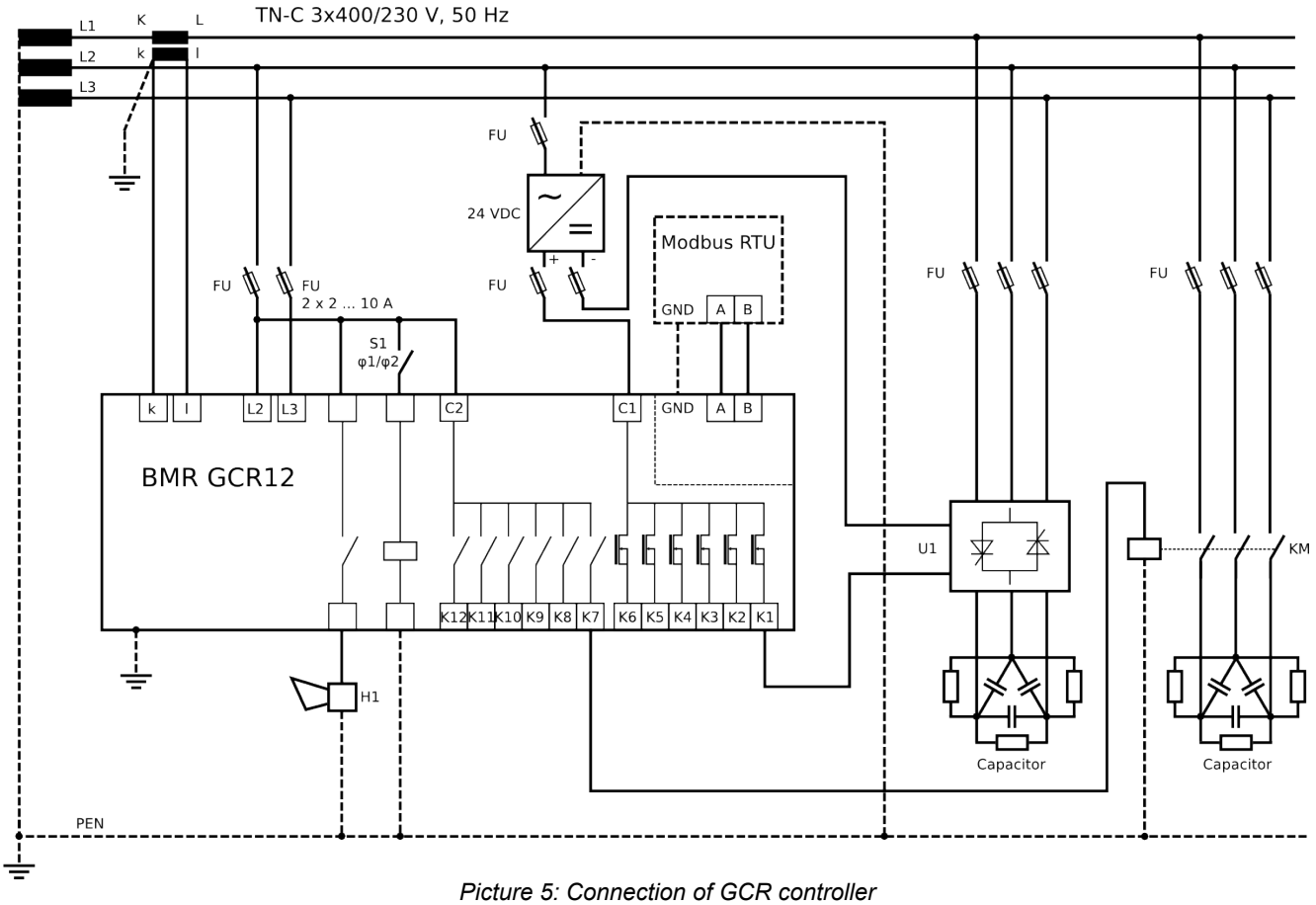


Picture 3: Connection of measuring circuits



Picture 4: Position of GCR controller in the compensation system

By default, in the case of 3 x 400 V AC system, voltage is being measured between phases L2 and L3, and the current is being measured in the phase L1. The connection of device is shown at back side of GCR controller and picture 2.



Picture 5: Connection of GCR controller

4. Setting in operation – fast start

For fast setting of the GCR controller in to the operation follow following instructions.

1. Make connection according to connection diagram at picture 5.
2. Connect supply voltage. In the case that the value of current on the secondary side of current transformer is lower than 10 mA, the display will show "- - - -". If not, the display will show instantaneous value of power factor, effective value of voltage, effective current value measured on secondary side of current transformer (current transformer ratio is set on "1") and average value of cos φ.
3. Press button **SET** for the time at least 5 seconds. After that, device will switch to the **Main menu**.
4. Cursor stays at the parameter **Target CosΦ**. By pressing the button **SET** once again, device will enter to setting of targeted value of cosφ. Setting the desired value of cosφ is done via buttons ▲ (+) and ► (-).
5. Confirmation of the set value **Target CosΦ** is done by pressing the button **SET**. Regulator will also return back to the **Main menu**.
6. By using cursors move to parameter **Ratio I_TR**. This parameter represents transformer ratio of current transformer.
7. Press the button **SET** and on the display will appear set value of transformer ratio (default value is 1).
8. Using the buttons ▲, ► set known value of transformer ratio. For example, in the case that current transformer 1000/5 A are being used, set the value of transformer ratio 200.
9. By pressing the button **SET** confirm set value. On the display will appear again the **Main menu**.
10. In the case that measuring / supplying voltage is taken from voltage transformer, move to the Advance manu parameter and press button **SET**. Move cursor to parameter **MTU voltage ratio** by using buttons ▲, ► and press button **SET** for entering the voltage transformer ratio setting. For example, if the ratio is 22000/100, then it should be set like 220. Set value confirm by pressing the button **SET**. Another pressing of button **SET** will turn device back to the **Main menu**.
11. Now, by using the buttons ▲, ► move to the parameter **Autodetect** and by pressing button **SET** confirm it. Change the value to **ON** and via button **SET** confirm set value. On the display will appear text Autodetect and device automatically perform phasing of measured voltage, current and detection of connected compensation stages. All parameters will be saved to the internal memory. When the detection is finished, parameter **Autodetect** will be automatically changed back to the value **OFF**.
12. If detected parameters are valid, device will start regulation after detection is finished. In the case that detection fails, information **ERR1** will appear on the display and it is necessary to make manual setting of correction angle and powers of appropriate capacitor stages in the **Advanced menu**.

It is recommended to verify if automatic detection of correction angle and power of all stages was done correctly. Press the button **SET** for more than 5 seconds. On display will appear **Main menu,** via buttons ▲, ► move to the parameter **Advanced menu**. Press again button **SET** to enter that menu and move to the parameter **Stage powers**. Pressing the button **SET** the list of stages will appear on the display. Checking one by one get sure that detected powers are equal with values written on particular capacitors. If the value is not correct, it should be changed by pressing buttons ▲, ► until the correct value. If the power is correct press again button **SET** and on the display will appear again list of stages. Repeat the same procedure the same way like for the first stage. Following the same control or setting of all stages should be done. At the end press button **SET** until the list of **Advanced menu** is shown on the display.

Move to the parameter **Configuration** and press button **SET**. Shown angle should be equal to the configuration of voltage and current measurement according to table 5 in chapter 7.2.11. If detected value is correct confirm it by pressing button **SET**, otherwise change it by using buttons ▲, ► and confirm new value by pressing the button **SET**.

Other parameters may remain on having the default values, that were made by the manufacturer. In the case that further changes are necessary, the user should follow detailed manual given in chapter 7.

5. Description of the function

Device digitizes measured phase to phase voltage between two phases and current in the third phase. Using the FFT (Fast Fourier Transformation) and unique algorithm makes calculation of all parameters like: power factor, effective values of voltage and current, harmonic distortion of voltage and current. Calculation of the compensation power that is needed is done by using the value of allowed reactive power, which is set in the device in the form of requested power factor. According to its size and configuration settings, regulator will switch on or switch off appropriate capacitor stages.

In preference, regulator compensates via semiconductor stages. When it gets to the point when it's not possible anymore, the regulator will use contactor stages.

Within the scope of each power level, regulator uses method of circle switching. At appropriate power level it connects the stage, which was switched off for longest time. Everything is made to manage regulator reaching optimal compensation in one regulation cycle with minimum number of switched stages.

During regulation, controller keeps monitoring of measured parameters and usage of compensation stages in order to assure equal usage of all available compensation stages and perform longer working life of contactor operated stages. If contactor stage goes over set allowed maximum of operation it is noticed as an alarm an regulator points the particular stage on the display.

The regulator makes harmonics analysis of current and voltage up to 19th harmonics, saves maximal values to the internal memory and counts THD factor of voltage and current. If the limit value of TDHI (current) is set, in the case that this value has been over-passed, the regulator will disconnect all capacitor stages and switch on the alarm relay.

The regulator can operate not just with compensation capacitor stages, but also with de-compensation reactor stages as well, at the same time. The power of these reactor stages will be registered with the negative numerical sign. De compensation reactors has to be connected after last capacitor stage.

6. Installation of the device

Regulator GCR is designed in metal box, which provides perfect EMC shielding. Regulator's design also provides panel mounting, into the hole 138 x 138 mm. The connection of the wires is from the back side of regulator, to the terminal box. Measuring and auxiliary voltages are being taken from supply voltage, which must be protected by fuse 6 A.

Location of the current transformer has to allow both, current of the load and the current of the capacitor, to be measured together like it is shown on the picture 4. The complete connection is shown at the picture 5. There is only one rule that should be considered. Stages with the same power have to be connected side by side. For example: 1st stage = 6,25 kvar, 2nd stage = 6,25 kvar, 3rd stage = 30 kvar, 4th stage = 25 kvar, 5th stage = 25 kvar. However, ranging the powers in accordance is not necessary. There could be even gaps between particular power levels. For example, stages 1 and 2 could be connected, then stage 3 disconnected, stages 4 and 5 connected and so on.

Important

Thyristor fast stages have to be placed from the first stage of regulator outputs. De-compensation reactors is useful to connect behind the capacitors.

7. Parameter setting

Considering various usage of regulators GCR, there is a number of programmable parameters. For easy start, regulator is set to default parameters, made by manufacturer. Set main parameters available in the **Main menu** are stated in the following table.

Parameter	Description	Factory setting	Setting range
Target CosΦ1	Targeted cosφ for first tariff	ind 0,98	0,80 cap. ... 0,80 ind. in steps of 0,01
Ratio I_TR	Current transformer ratio	1	1 ... 6000 in steps of 1
Autodetect	Automatic detection of connection and capacitor stages	Off	On/Off
Advanced menu	Submenu with additional settings	►	►

Table 3. Main menu

For fast start, the parameters that should necessary be set are **Target CosΦ1** and transformer ratio of current

transformer **Ratio I_TR**. Eventually, transformer ratio of voltage transformer could also be set.

Further more, there are also other parameters that could be set, in accordance to the customer request. Those parameters are available in the **Advanced menu** and are listed in following table. All configurable parameters are described at chapter 7.

In order to avoid any unwanted reprogramming of the device, it is possible to protect unauthorized changes by setting the four digits password. By default, new regulator does not have any password protection activated. It is recommended to activate password protection after setting all parameters. After the protections has been activated, it is possible to see all set parameters, but not to change any of them.

Parameter	Description	Factory setting	Setting range
Target CosΦ2	targeted cosφ for second tariff	ind 0,90	0,80 cap. ... 0,80 ind. in steps of 0,01
COSΦ1 / COSΦ2	switching method between COSΦ1 and COSΦ2	External input	External input / Current direction
MTU voltage ratio	voltage transformer ratio	1	1 ... 300 in steps of 1
Stage powers	manual setting of power of compensation stages	0	999,9 kvar cap. ... 999,9 kvar ind. in steps of 0,1 or overdrive of 1
Delay at Qc	deceleration of regulation at over-compensation	60	0 ... 9999s in steps of 1s
Discharging time	discharging time of thyristor / contactor stage	0 / 30	5 ... 900s in steps of 5s or overdrive of 50s
Min. closing time	delay for disconnection of thyristor / contactor stage	0 / 15	5 ... 900s in steps of 5s or overdrive of 50s
Stage operation No	number of operation of thyristor / contactor stage	0 / 999 999	up to 999 999
Fix stages	behavior of particular capacitor stages	Auto	Auto / Off / On
Configuration	controller connection configuration	90	0° ... 330° in steps of 30°
Max. THDU	maximum level of THDU for cabinet disconnection	0	0 ... 20 %
Max. THDI	maximum level of THDU for cabinet disconnection	0	0 ... 300 %
Alarms	alarm events menu	►	►
Average COSΦ	regulation on average or instantaneous cosφ	On	On / Off
Average COSΦ time	time period for calculation of average cosφ	15	15, 30, 45, 60 minutes
Max. temperature	temperature for disconnection of all stages	55	30 ... 80 °C
Fan temperature	temperature for ventilation start	35	30 ... 80 °C
Maximum saving	saving the maximums of measured values	On	On / Off
Serial port	serial port RS485 configuration menu	►	►
Password	protection password against unauthorized setting	0	any four digits number 0001 ... 9999
Manual mode	manual operation of capacitor stages	Off	On / Off
Reset	reset to default factory configuration	-	-

Table 4. Advanced menu

For checking respective setting parameters of configuration menu, follow those instructions:

1. Press the button **SET** for 5 seconds. Device switches to the **Main menu** and list of parameter will appear on the display. Via buttons ▲, ► move to requested parameter and by pressing button **SET** enter the configuration.
2. It is possible to set the requested value of specified parameter by using the buttons ▲, ►.
3. By pressing the button **SET** again, regulator will save changed value to the internal memory and return back to the **Main menu** or **Advanced menu**. Pressing the buttons ▲, ► makes possible to move to another parameter (table 3 and 4).
4. If the offered parameter is not the one, which is requested to be modified, follow by using the buttons ▲, ► to the requested parameter.
5. Regulator turns back automatically from service mode after 1 minute without any keyboard action, or by repeated pressing of the button **SET** during returning from the parameter value setting.

Important

While service mode is activated, device is not regulating. Regulator will not react to the power factor changes, neither to the changes of other monitored variables. Alarm output will not operate as well.

Note

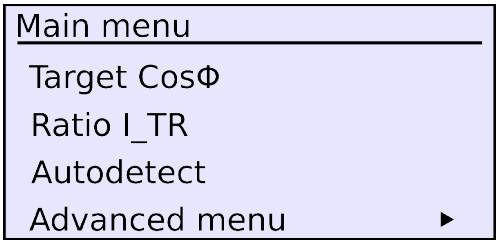
Overdrive is activated by permanent pressing of button ▲ or ►.

7.1. Main menu

Main menu of configuration mode is activated from the normal operation mode by pressing the button **SET** for at least 5 seconds. Moving in the menu is done via buttons, where button ► is for moving down and button ▲ for moving up. Entering the parameter setting or **Advanced menu** is by pressing the button **SET**.

7.1.1. Target CosΦ1 – requested cosφ

The first parameter in the menu is **Target CosΦ1** for setting the requested cosφ. Via buttons ▲, ► set the new requested value in the limits from 0,8 inductive to 0,8 capacitive. Inductive or capacitive character is symbolized by capacitor or inductor icon on the display. Pressing of button **SET** saves new value to the memory and turns back to **Main menu** screen.



7.1.2. Ratio I_TR – setting of current transformer ratio

Current transformer ratio is very essential parameter which has to be set. After entering the setting of **Ratio I_TR** set value of current ratio via buttons ▲, ►. Pressing the button **SET** saves new value to the memory and escape to the **Main menu** list.

It is important to have in mind that the value which is set, is ratio itself. It means that, for example, if primary nominal current of current transformer is 50 A and secondary is 5 A then set parameter value is 10.

Caution

Measurement range of the current inputs is from 10 mA to 5 A. Maximum of the current transformer ratio is 30000/5 A. If the current value is over 5,3 A, alarm will be started, in the case it is enabled.

7.1.3. Autodetect – automatic detection of compensation stages

Another parameter in the menu is function **Autodetect**. After pressing of button **SET**, the display will show **Off**. Via buttons ▲, ► change to the value **on**. By pressing the button **SET** automatic detection will start to detect connection of current transformer and voltage measurement. While automatic detection is in the progress on the display is shown information **Settings** and first capacitor stage will switch On / Off 6 times in the cycle of 20 seconds.

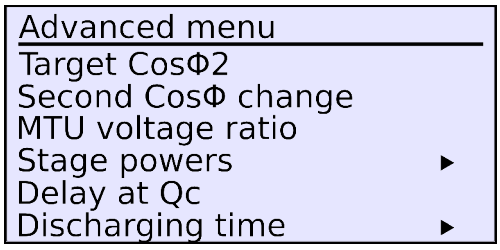
Detection of regulator connection to the network is followed by detection of power of connected capacitor stages. During detection, the measured values of each stage are shown on the display. Measured values are being rounded on 0,5 kvar and saved into the device non-volatile memory. After the detection is finished, the regulator will switch parameter **Autodetect** back to **Off**.

Important

In some cases regulator is not able to make automatic detection and in place of measured power shows zeros. It can happen in places with very fast changes of network parameters, where measured values will not be correct. In this case regulator shows Err1 and it is necessary to set parameters manually, after detailed network measurements.

7.2. Advanced menu – configuration submenu

7.2.1. Advanced menu



Selecting the parameter **Advanced menu** in the list of **Main menu** and pressing the button **SET** will enter the **Advanced menu**. For moving in the menu follow the same procedure as for **Main menu**.

Return from **Advanced menu** to **Main menu** is possible after pressing button **SET** where the first press enters the parameter, second press confirms the set value and turn back to **Advanced menu** and third press escapes to the **Main menu**.

7.2.2. Target CosΦ2 – requested cosφ for second tariff

First parameter in the Advanced menu is **Target CosΦ2** for setting the requested cosφ for second tariff. Via buttons ▲, ► set new requested value in the limits from 0,8 inductive to 0,8 capacitive. Inductive or capacitive character is symbolized by capacitor or inductor icon on the display. Pressing of button **SET** saves new value to the memory and turns back to **Advanced menu** screen.

7.2.3. Second CosΦ change – second tariff trigger

This parameter defines event for switching to the second tariff of cosφ. Tariff can be controlled by external input (option **Ext. input**) or by current direction (option **Current dir.**) for systems which are being changed from consumption to distribution and distribution has different request for cosφ. Via buttons ▲, ► correct the option and confirm by pressing the button **SET** which saves option to the memory and returns back to **Advanced menu**.

7.2.4. MTU voltage ratio – setting of voltage transformer ratio

In the case of using the voltage transformer, mostly only at medium voltage application, enter this parameter **MTU voltage ratio** for setting the voltage transformer ratio value via buttons ▲, ►. Pressing the button **SET** saves new value to the memory and escapes to the **Advanced menu**.

It is important to have in mind that the value which is set, is ratio itself. It means that, for example, if primary nominal current of current transformer is 6000 V and secondary is 100 V then set parameter value is 60. **MTU voltage ratio** value can be set in range from 0 to 600.

7.2.5. Stage powers – particular stage power setting

Power of every controlled stage of GCR controller can be set independently within the range of values from 999,9 kVAr inductive to 999,9 kVAr capacitive. Inductive or capacitive character is symbolized by capacitor or inductor icon on the display. Pressing of button **SET** saves new value to the memory and turns back to **Advanced menu** screen.

After entering the the submenu **Stage powers**, select requested stage represented by parameters **ST1** ... **ST12** (for GCR06 up to **ST6**) and confirm by pressing the button **SET**. By usage of buttons ▲, ► define the stage power and confirm by pressing the button **SET**. Follow the same procedure for another stages.

7.2.6. Delay at Qc – deceleration of regulation at over compensation

This parameter defines initial time for slowing down the regulation during over-compensation. Default value set by the manufacturer is 60 seconds and it is suitable for most applications. Deceleration is calculated at every second, while there is over-compensation, from initial time and deviation square of real cosφ from targeted cosφ. In the case of need of faster or slower reaction at over-compensation change the value down or up.

By buttons ▲, ► it is possible to change value and button **SET** saves this into the memory.

Important

This function doesn't affect semiconductor stages. Semiconductor stages react immediately. Changes of this parameter should be done only by authorized and experienced person.

7.2.7. Discharging time

For setting the absorption of stages, parameter **Discharging time** is available in the **Advanced menu.** By this parameter, it is possible to set, for each stage separately, suitable time for capacitor discharge. This time can be set from 5 to 900 seconds. Default factory setting value is 60 seconds.

After entering the the submenu **Discharging time**, select requested stage represented by parameters **ST1** ... **ST12** (for GCR 06 up to **ST6**) and confirm by pressing the button **SET**. By usage of buttons ▲, ► define the stage discharging time and confirm by pressing the button **SET**. Follow the same procedure for another stages.

Important

For semiconductor stages the time is set on 0 seconds and it is not possible to change it. Changes of this parameter should be done only by authorized and experienced person.

7.2.8. Min. closing time – delay for disconnection

This parameter is represented on the display by symbol **Min. closing time**. It is the minimum time for contactor stage circuit closing. It is possible to be set from 5 to 900 seconds.

After entering the the submenu **Min. closing time**, select requested stage represented by parameters **ST1** ... **ST12** (for GCR06 up to **ST6**) and confirm by pressing the button **SET**. By usage of buttons ▲, ► define the stage minimum connection time and confirm by pressing the button **SET**. Follow the same procedure for another stages.

Important

For semiconductor stages the time is set on 0 seconds and it is not possible to change it. Changes of this parameter should be done only by authorized and experienced person.

7.2.9. Stage operation No – number of stage circuit closing

This parameters defines number of contactor stage operation until alarm information will appear on the display. On the display. Every stage can be set independently in range from 0 ... 999.999 operations in step of 1000 operation.

After entering the the submenu **Stage operation No** select requested stage represented by parameters **ST1** – **ST12** (for GCR06 up to **ST6**). By usage of buttons ▲, ► define maximum number of contactor stage operations and confirm by pressing the button **SET**. Follow the same procedure for another stages.

7.2.10. Fix stages – behaviour of particular stages

This parameter allows to define behaviour of every stage. This parameter allows to set stages as a fixed ones. Te regulator is not counting those stages for regulation cycle. Each stage can stay in three working regimes.

- Auto – normally regulated stage
- Off – permanently off (stage number indication blinks and it is less bright)
- On – permanently on (stage number indication blinks and it is bright)

Setting procedure is according the same rules as another parameters explained before. After entering the submenu **Fix stages** select requested stage represented by parameters **ST1** – **ST12** (for GCR 06 up to **ST6**). By usage of buttons ▲, ► define status (Auto / Off / On) of the stage and confirm it by pressing the button **SET**. Follow the same procedure for another stages.

7.2.11. Configuration – connection configuration

If the regulator is connected according the connection diagram on the picture no. 3, correction angle is 90°. That is default value set by the manufacturer. If the regulator is not connected according to this connection diagram, then it is necessary to make angle correction by displacement of measuring current and voltage. Parameter **Configuration** allows to set angle movement from 0° to 330° in steps of 30°. After pressing the button **SET**, the display will show set value. Via buttons ▲, ► it is possible to change the value. Another press of button **SET** will save new value into the memory.

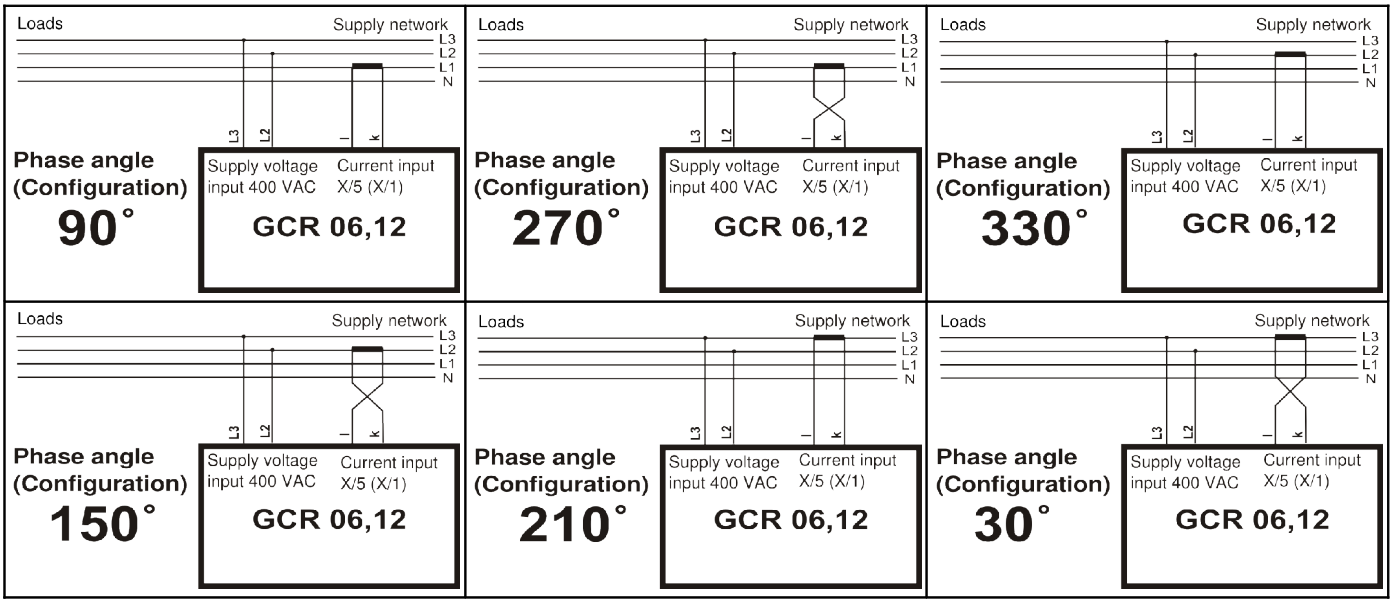


Table 5: Phase shift setting for supply and measuring voltage 400V

7.2.12. Max. THDU – level of maximum total voltage harmonic distortion

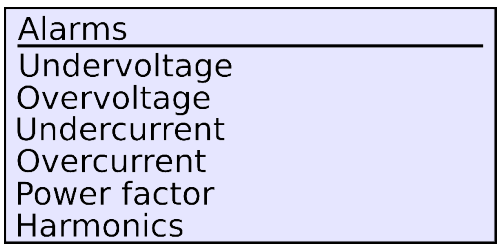
Controller GCR makes harmonic analysis of voltage up to 19th harmonic. From measured values it counts total harmonic distortion of voltage THDU. Parameter **Max. THDU** represents the maximum allowed voltage harmonic distortion at which exceeding controller disconnects all capacitor stages. If the parameter **Max. THDU** is set to 0, THDU control is disabled.

7.2.13. Max. THD I – level of maximum total current harmonic distortion

Regulator makes harmonic analysis of currents and voltages, up to 19th harmonic. From measured values it counts total harmonic distortion of current THDI. Parameter **Max. THDI** represents the maximum allowed current distortion at which exceeding controller disconnects all capacitor stages. If the parameter **Max. THDI** is set to 0, THDI control is disabled.

7.2.14. Alarms – setting of alarm event activation

During normal operation alarm output contact is opened. In the case of any alarm event the alarm output contact will close for 1 minute time. There are lot of events, that can be enabled to activate alarm.



After entering the **Alarm** parameter, list of available alarm events will appear on the display. Selecting the requested event and confirming by pressing the button **SET** will open window for alarm event activation. Via buttons ▲, ► it is possible to enable or disable alarm event (**on / off**). By pressing button **SET** new value is saved into the regulator memory. Following the same procedure sets other alarm events.

For alarm **Power factor** (**COAL**) it is also possible to set the event when the alarm should be activated at power factor failure, during: consumption and distribution (**on**), only during consumption (**on_o**) or only during distribution (**on_d**).

Parameter	(shorter)	Description	Factory setting	Setting range
Undervoltage	ULAL	measuring voltage < 0,8 U_N	Off	On / Off
Overvoltage	UHAL	measuring voltage > 1,14 U_N	Off	On / Off
Undercurrent	ILAL	measuring current on regulator terminals < 10 mA	Off	On / Off
Overcurrent	IHAL	measuring current on regulator terminals > 5,3 A	Off	On / Off
Power factor	COAL	permanently not possible to reach set power factor for 1 hour	Off	On / On_d / On_o / Off
Harmonics	HTAL	threshold value of set THDI or THDU overpassed set level	Off	On / Off
Temperature	OTAL	ambient temperature for regulator location > 80°C	Off	On / Off
Stage operation	RSAL	contactor stage overpasses maximum allowed switching operation	Off	On / Off

Table 6: Table of available alarms events

The alarm event **Temperature** has a special significance. If this alarm is activated, alarm output contact is used for ventilator control and cannot be used for any other alarm event indication. Output contact closes when temperature measured by controller GCR goes over level set in parameter **Fan temperature**. In this case, all alarm events are only shown on the display without output contact action.

If there is more alarm events at the same time, the last one is shown on the display together with the value which caused alarm event. After pressing the button **SET**, alarm is erased and another alarm event will appear. Follow the same procedure till the last alarm is erased.

Caution

In the case that high harmonic distortion THDU or THDI goes over the set level, regulator disconnects all compensation stages, even if corresponding alarm is not enabled.

7.2.15. Average COSΦ – regulation to average or instantaneous cosφ

This setting defines if regulator will regulate contactor stages to average or instantaneous power factor. If the set value is **On** then usage of contactor stages is affected by average power factor. If the set value is **Off** then regulation is performed only according to instantaneous power factor. After entering the parameter **Average COSΦ** by pressing the button **SET**, display will show set value **On** / **Off**. Via buttons ▲, ► it is possible to change this value. Another pressing of button **SET** saves new value into the regulator memory.

7.2.16. Average COSΦ time – time period for calculation of average power factor

This setting defines half-period of average cosφ calculation. There are available four half-periods for average cosφ calculation (15, 30 45 and 60 minutes). Default value of period for average cosφ calculation is 30 minutes which refers to half-period set from factory on 15 minutes. It is suitable for most of applications.

After entering selected parameter currently set value of time period will appear. Via buttons ▲, ► it is possible to change this value. Another pressing of button **SET** saves new value into the regulator memory.

7.2.17. Max. temperature – temperature for capacitor stages disconnection

This parameters defines the maximum level of ambient temperature at which regulator will disconnect all capacitor stages and will signalize temperature alarm event in case it is activated. Default temperature is set on 55°C by the manufacturer and can be set in the range from 30°C to 80°C.

After entering the **Max. temperature** parameter by pressing the button **SET**, the set value will appear. Via buttons ▲, ► it is possible to change this value. Another pressing of button **SET** saves new value into the regulator memory.

7.2.18. Fan temperature – temperature level for ventilator start

This parameters defines the level of ambient temperature at which regulator will close alarm output contact in order to start ventilator. Default temperature is set by the manufacturer on 35°C and can be set in the range from 30°C to 80°C.

After entering the **Fan temperature** parameter by pressing button **SET**, the set value will appear. Via buttons ▲, ► it is possible to change this value. Another pressing of button **SET** saves new value into the regulator memory.

7.2.19. Maximum saving – recording of measured values maximum

Activation of this parameters allows the controller to save maximums (the minimum value of frequency is being recorded as well) of measured values into to internal EEPROM memory.

Monitoring of measured parameters is being done in real time but recording to non violative memory is done in one hour period. Before recording the maximum (minimum) into the memory, this value is kept in standard operating memory. In the case that power supply is lost before one hour recording the maximum (minimum) value will be lost.

After entering the **Maximum saving** parameter by pressing the button **SET**, the set value will appear. Via buttons ▲, ► it is possible to change this value. Another pressing of button **SET** saves new value into the regulator memory.

7.2.20. Serial port – configuration of RS485 communication port

This parameters contains submenu with specification of serial communication for RS485 port (MODBUS communication protocol). Submenu, with parameters according to table no. 7, is available under the parameter **Serial port**.

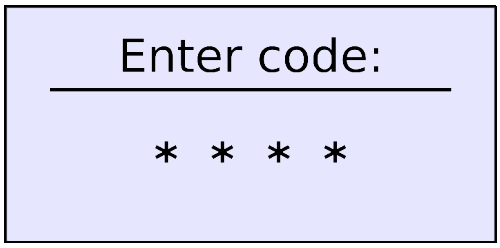
Parameter	Description	Factory setting	Setting range
ID NUMBER	device id number in RS485 network	1	1 ... 255
BAUD RATE	communication speed for data transmission	0	0 / 2400 / 4800 / 9600 Bd
PARITY	communication control by parity checking	Off	On _O / On_E / Off

Table 7: Serial port menu

ID NUMBER defines the number of device in the RS485 network and can be set from 1 – 255. BAUD RATE is by default set to 0 and it defines communication speed between the GCR controller and PC. PARITY is by default set to Off and it can be changed to even (On_E) or odd (On_O).

7.2.21. Password – for entering service mode (CODE)

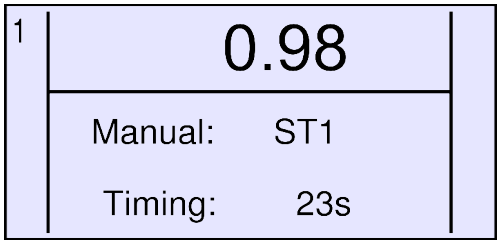
Due to the password, it is possible to protect regulator against unauthorized configuration. Without knowing an adequate password it is only possible to see set parameters, but not to change them. Password is set as four digit number.



After entering the **Password** parameter, display will show screen with text “Enter code” and symbols “ * * * * ”. First dash from left side is blinking. Via button ▲ set number from 0 – 9 and move to another number by button ►. Now second dash is blinking and first set number lights on the display. Keep the same procedure until last number is set. By pressing the button **SET**, password will be saved into the memory. From this moment it is necessary, for each change, to type the password when entering configuration. Otherwise, none of the changes will be accepted.

7.2.22. Manual ON

Parameter **Manual ON** allows to turn controller into the mode where it is possible to operate all stages manually. After entering this mode on the display will appear following screen.



Via buttons ▲, ► particular stages are getting selected and by pressing the button **SET**, the stage turns On or Off. Change of stage status is possible only with respecting the set discharging time and delay for stage disconnection. Information about remaining time is shown on the display.

Returning from the **Manual ON** mode is possible by pressing the button **SET** for at least 5 seconds to enter the **Main menu.** Moving to the **Advanced menu** and choosing the parameter **Manual OFF** will turn the controller to the normal operation.

Important

Fix stages cannot be controlled in the manual mode.

7.2.23. Reset – return back to factory setting

This function restores default configuration. It is the last parameter in **Advanced menu** and it is represented by parameter **Reset**. By pressing the button **SET** enter the **Reset** parameter. New screen will ask for confirmation of reset. If yes, move the cursor to option OK via buttons ▲, ► and confirm by pressing the button **SET**. Controller will turn to the factory setting and switch to the normal operating mode.

Important

After reset, it is necessary to set device again as well as to make auto detection.

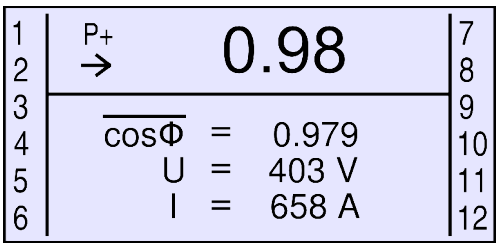
8. Measured and displayed values

Power factor controller GCR is displaying many information on the front display at the same moment. In order to provide as much information as possible in the logical way, there are 7 main screens available at the normal operating mode. For movement between single screens use button ►. Screens can be opened and seen just in one direction according to the order described below.

8.1. First screen – voltage and current

First screen provides information about instantaneous power factor, direction of active power, average cosφ, phase-to-phase voltage, phase current and stage statuses.

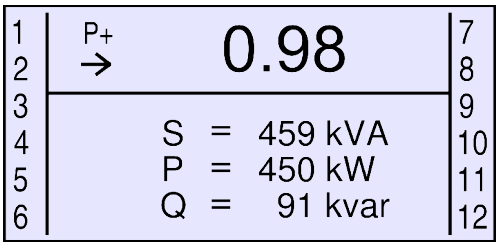
By pressing the button ► move to the second screen.



8.2. Second screen – powers

On the second screen are available information about instantaneous power factor, direction of active power, value of three-phase apparent power, value of three-phase active power, value of three-phase reactive power and stage statuses.

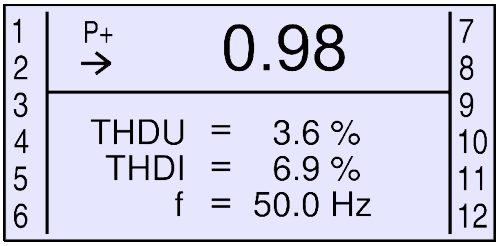
By pressing the button ► move to the third screen.



8.3. Third screen – harmonics

On the third screen are available information about instantaneous power factor, direction of active power, value of total harmonic distortion of voltage THDU, total harmonic distortion of current THDI. system frequency and stage statuses.

By pressing the button ► move to the fourth screen.

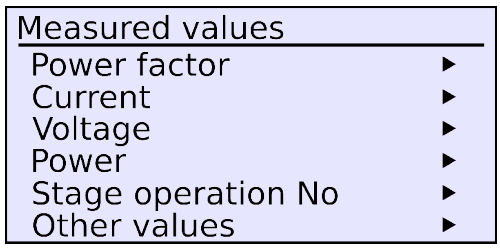


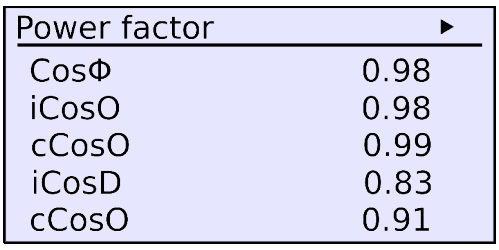
8.4. Fourth screen – measured values

Fourth screen brings list of measured values grouped into logical groups and available in the menu called **Measured values**. For moving in the rotary menu use the button ▲ which moves you to the next parameter. For entering the submenu with measured values press button **SET** and screen with available measured values will appear.

If the list of measured parameters is longer than screen, use button ▲ to reach all measured parameters.

Another pressing of button **SET** will turn you back to screen of **Measured values**. Follow the same procedure to see other measured parameters.





By pressing the button ► move to the fourth screen.

Note

Explanation of some shortcuts used in the Measured values menu:

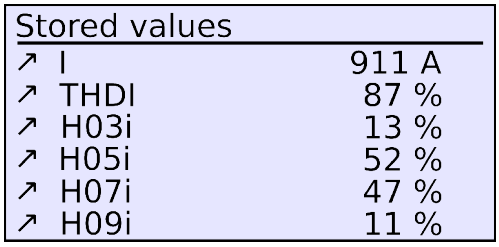
iCosO – inductive power factor of consumption	*iCosD – inductive power factor of distribution*
cCosO – capacitive power factor of consumption	*cCosD – capacitive power factor of distribution*
IA_P – phase current	*U_EF – effective phase-to-phase voltage*

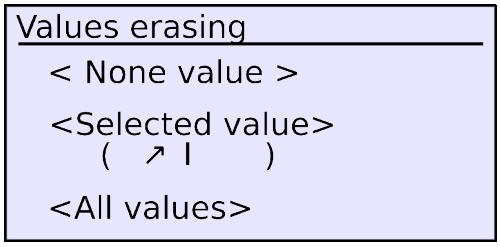
8.5. Fifth screen – stored values

Fifth screen is called **Stored values** screen. This list shows maximum (minimum) values of all measured parameters and it is related to the parameter **Maximum saving** in **Advanced menu**. If maximum saving is not activated, values displayed in the list of stored data will not be saved into the internal memory and in case of voltage disconnection these data will be lost.

Moving through the list is possible by usage of button ▲. Pressing the button **SET** on selected parameter will open new screen **Values erasing** which allows to erase selected value or all values from **Stored values** screen.

By pressing the button ► move to the sixth screen.





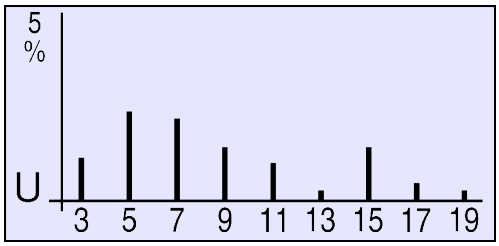
Note

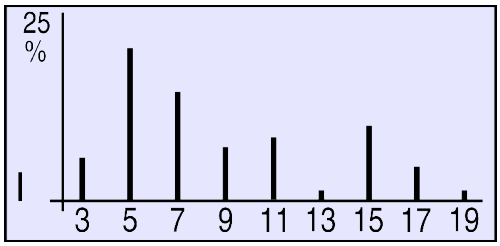
*Symbols **arrow up / arrow down** in front of the stored value parameter symbolize **maximum** / **minimum** value.*

8.6. Sixth and seventh screen – graphs

Sixth and seventh screens are displaying the graphs of harmonic content for voltage and current of odd harmonics up to 19th. By pressing the button ▲ it is possible to change the scale of graph in scales of 5%, 10%, 25%, 50%, 100% and 200%.

Pressing the button ► will switch from voltage to current. Another pressing of button ► will turn display back to the first screen.





9. Technical features

Parameter	Value
Supply voltage = measuring voltage	400 V AC 50 Hz (+10%,-15%)
Frequency	50/60 Hz
Current range	0,01 ... 5,3 A
Measurement accuracy of 1st current harmonic (I > 200mA)	±1 mA (class 2)
Power consumption	10 VA
Output channels number	6 or 12
Switching power of alarm output	250 VAC / 5 A
Switching power of relay contacts	250 VAC / 5 A
Switching power of semiconductor contacts	24 VDC / 100 mA or 230 VAC / 100 mA
Switching speed of semiconductor stages	25 operations per second
Range of requested power factor	0,8 ind. ... 0,8 cap.
Reconnection delay: semiconductor / contactor stages	0s / 5 ... 900 s
Switching off delay: semiconductor / contactor stages	0s / 5 ... 900 s
Compensation stages value setting	manually / automatically
Communication port	RS485 (optional)
Communication protocol / speed	MODBUS RTU / up to 9600 Bd
Temperature limit	-25°C ... +70°C
Front panel	144 mm x 144 mm
Panel cutout	138 mm x 138 mm
Site depth	55 mm
Weight	1 kg (including packaging)
Protection degree	IP20 rear cover / IP54 front panel
Standards	EN 61010-1, EN50081-1, EN50082-1

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