GCR 06, GCR 12

Power factor correction controller

User and service manual

version 2.2

Content

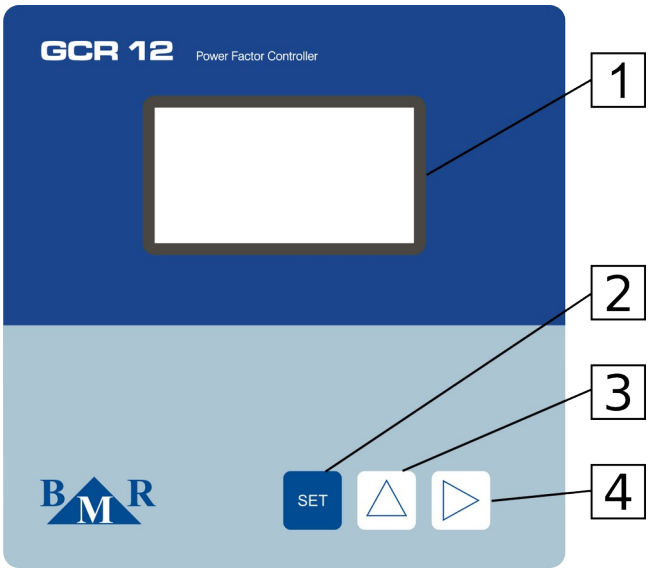
BMR *trading*
Horní lán 17
779 00 Olomouc
Czech Republic

phone: +420 778 066 566
export@bmr-trading.com
www.bmr-trading.com

BMR *trading*
Horní lán 17
779 00 Olomouc
Czech Republic

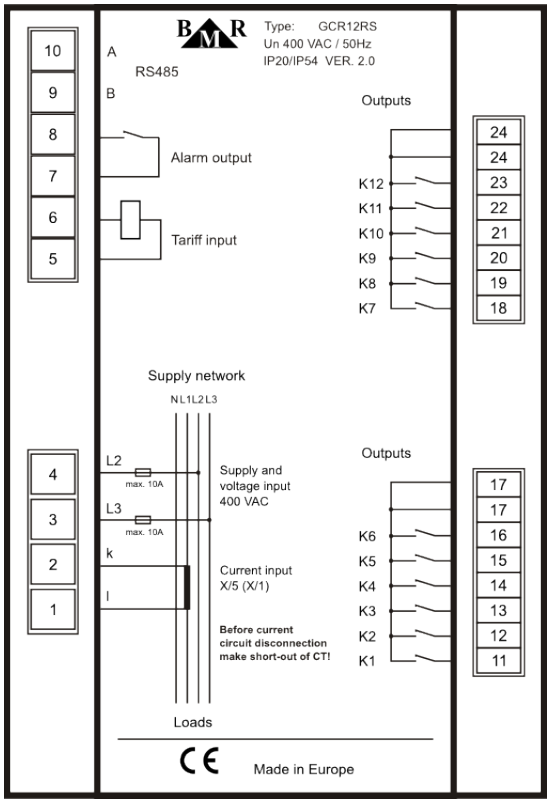
phone: +420 778 066 566
export@bmr-trading.com
www.bmr-trading.com

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: Device 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 steps, 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
Instantaneous cosφ, average cosφ (capacitive, inductive)	•			
Line voltage between measured phases	•	•		
Current in the measured 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	•	•		

Table 1. Measured and displayed parameters

Regulator is available with 6 or 12 controlled outputs variant. Regulator GCR06 has available 1 x 6 outputs and regulator GCR12 has available 2 x 6 outputs. Outputs for mechanical contactors are with relays and outputs for semiconductor switchers are realized by OPTO-MOSFET transistors, which are able to operate under 24 V DC / 100 mA or 230 V AC / 100 mA (maximum) according to regulator variant.

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 or 230 VAC
GCR 12	12	0	230 VAC
GCR 12-01	12	1	230 VAC
GCR 12-02	12	2	230 VAC
GCR 12-03	12	3	230 VAC
GCR 12-06	12	6	24 VDC or 230 VAC
GCR 12-12	12	12	24 VDC or 230 VAC

Table 2. Controller variants for contactor and semiconductor stages

Regulators GCR06 and GCR12 are available in several variants of supplying and measuring voltage. In case that auxiliary power supply is used (measuring voltage is different than supply voltage) the alarm output is not available.

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	Auxiliary 230 VAC	100 ... 690 VAC	no
GCR 12 V100	100 VAC	100 VAC	Yes
GCR 12 V230	Auxiliary 230 VAC	100 ... 690 VAC	no

Table 3. Controller variants according to power supply and measuring voltage

3. Description of the function

Device digitizes measured phase to phase voltage between two phases and current in the measured phase. Then, from those values, parameters like: power factor, effective values of voltage and current, harmonic distortion of voltage and current, are being counted. Calculation of the needed compensation power 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, regulator will switch on or switch off appropriate capacitor steps.

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

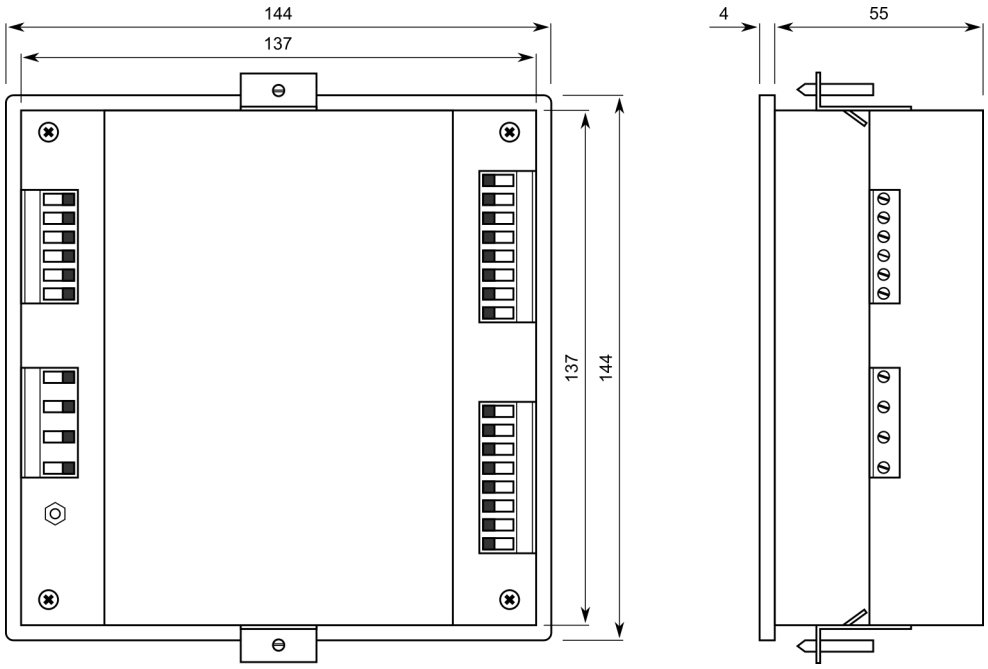
Within the scope of each power level, regulator uses method of circle switching. All the time connects this stage at appropriate power level which was switched off for longest time. Everything is made so that regulator will reach optimal compensation in one regulation cycle with minimum number of switched stages.

The regulator makes harmonics analysis of current and voltage up to 19th harmonics and counts THD factor of voltage and current.

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. If the automatic detection of the powers is not possible, these values could be also set manually. For more details, follow the manual in chapter 7.

4. Installation

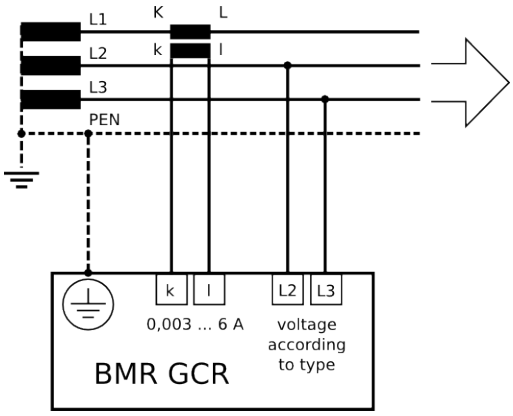
Regulator GCR is designed in metal box, which provides perfect EMC shielding. Regulator's design also provides panel mounting, into the hole 138 x 138 mm. The connection of the wires is from the back side of regulator, to the terminals box.



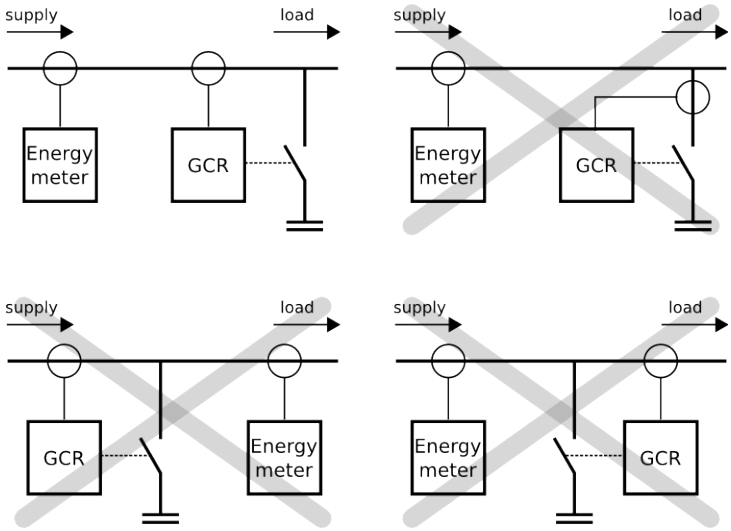
In order to assure well ventilation, instrument has to be installed vertically. There has to be empty space at least 50 mm at the top and bottom and 20 mm at the sides.

5. Connection

Measuring and auxiliary voltages are being taken from supply voltage, which must be protected by fuse of type F2A ... F3,15A.



Picture 3: Connection of measuring circuits



Picture 4: Position of GCR controller in the compensation system

Location of the current transformer has to allow both current of the load and the current of the capacitor to be measured together. Correct location is shown on the picture 4 as well as examples of wrong location.

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:

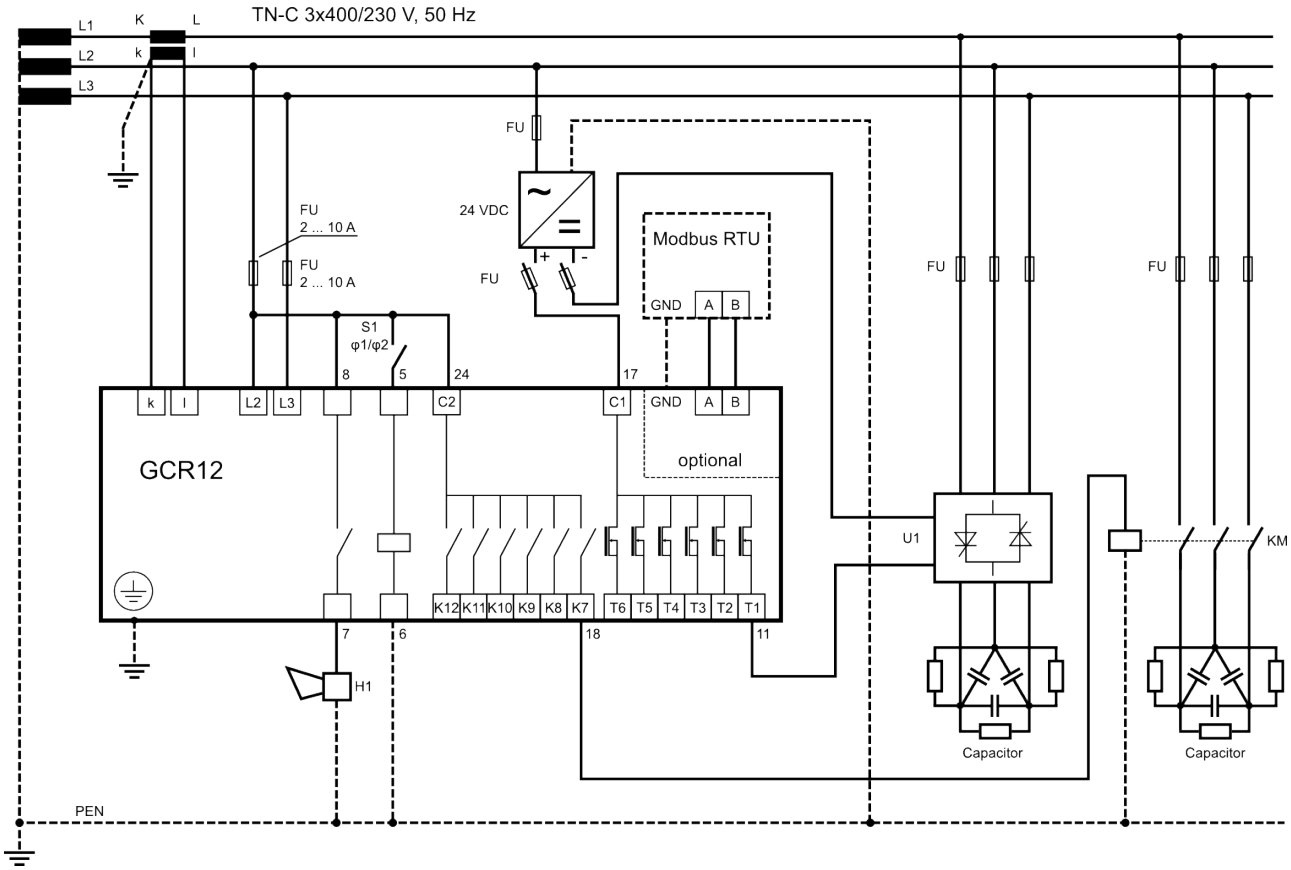
1st step	2nd step	3rd step	4th step	5th step	6th step
6.25 kVAr	6.25 kVAr	12.5 kVAr	-	25 kVAr	25 kVAr

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.

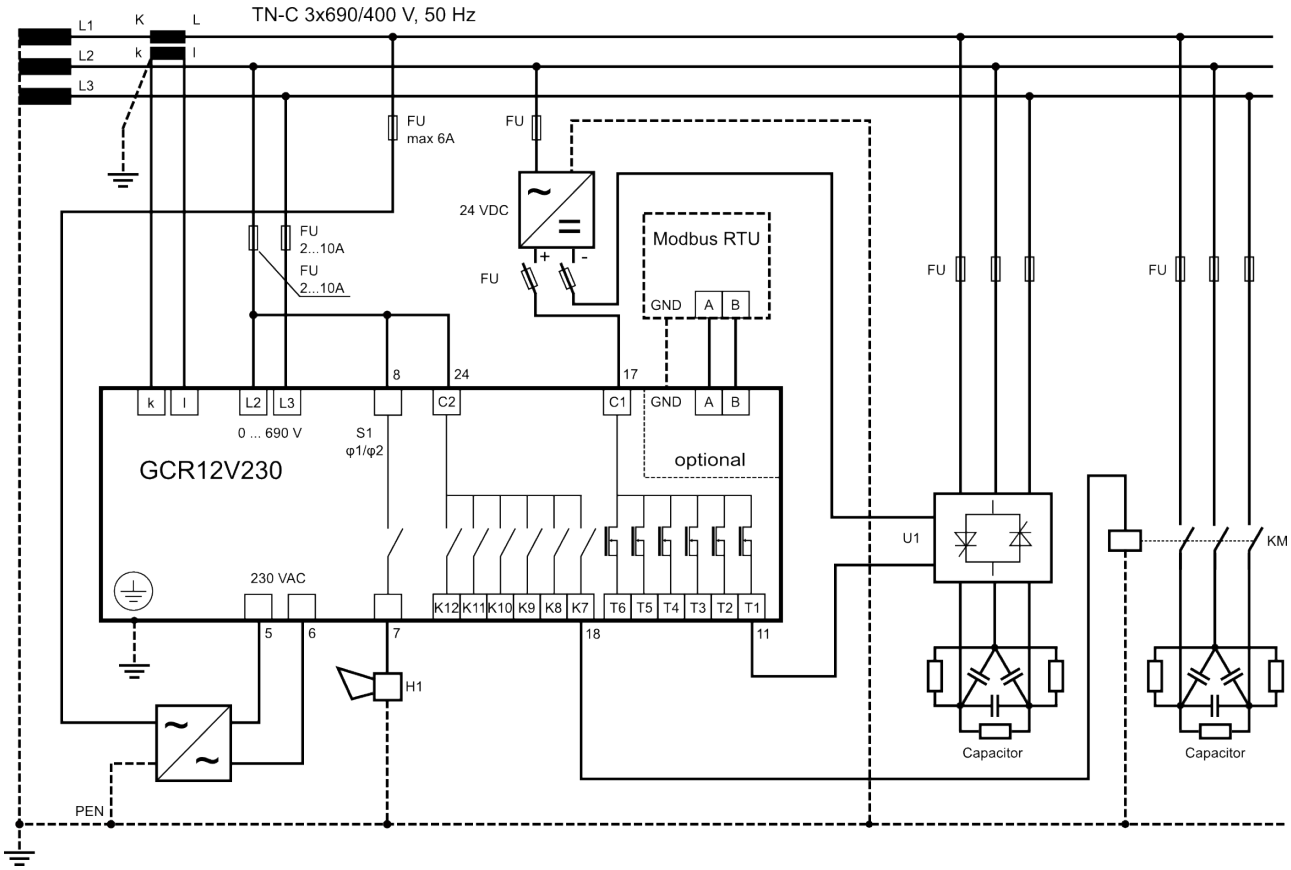
Important

Fast thyristor steps have to be placed from the first step of regulator outputs. De-compensation reactors are recommended to be connected after capacitor steps.

Connection diagrams depend on the fact if the regulator controls only contactor steps, combination of contactor and semiconductor steps in one set of six steps, or it controls only semiconductor steps in the set of 6 steps.



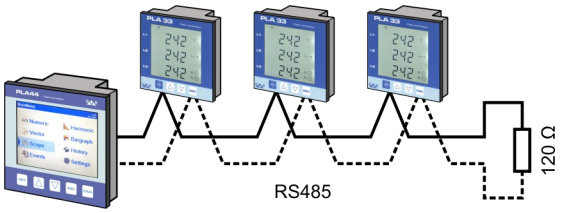
Picture 5a. Connection of the GCR12 controller for contactor and thyristor stages for standard supply voltage 400 VAC



Picture 5b. Connection of the GCR12V230 controller for measuring voltage 0 ... 690 VAC

5.1. RS485 interface

Instrument can be equipped by optically insulated RS485 interface and Modbus RTU protocol. RS485 interface of controller is not supplied, therefore the converter or other instrument used as a gateway has to have supply unit for RS485 bus.



Picture 6: RS485 interface connection

Notice

At each end of the RS485 bus has be installed termination resistor 120Ω.

6. Fast setting in to operation

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

1. Make connection according to connection diagram at pictures 5.
2. Connect supply voltage. In the case that the value of current on the secondary side of current transformer is lower than 3 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 cosφ.
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 menu** 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 in chapter 7.2.10. 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.

7. Regulator parameter setting

Considering various usage of regulators GCR06 or GCR12, there is a number of programmable parameters. For easy start, regulator is set to default parameters, made by manufacturer. Set parameters 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 4. 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
Delay at Qc	deceleration of regulation at over-compensation	60	0 ... 9999 seconds in steps of 1second
Stage powers	manual setting of power of compensation stages	0	999.9 kvar cap. ... 999.9 kvar ind.
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	behaviour of particular capacitor stages	Auto	Auto / Off / On
Configuration	controller connection configuration	90	0° ... 330° in steps of 30°
Q offset	reactive power offset for regulation	0	0 ... 999.9 kVAr
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
Maximum saving	saving the step oper. and maxim to memory	Off	On / Off
Inductive steps	activates inductive steps for de-compensation	Off	On / Off
Alarms	alarm events menu	►	►
Ventilator temp.	temperature for ventilation start	35	30 ... 80 °C
Cascade operation	ID number of parallel controller in cascade connection	0	0 ... 32
Frequency	grid system frequency	50	50 / 60 Hz
Delay at reg.	delay of regulation for fast thyristor steps	10	10 … 1000 ms in step of 10 ms
Serial port	serial port RS485 configuration menu	►	►
Password	protection password against unauthorized setting	0	any four digits number 0001 ... 9999
Menu lock		►	►
Manual ON	manual operation of capacitor stages	Off	On / Off
Reset	reset to default factory configuration	-	-

Table 5. 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.

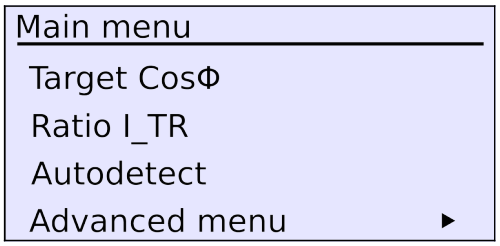
Important

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

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 reactor 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

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.

Notice

Measurement range of the current inputs is from 3 mA to 6 A. Maximum of the current transformer ratio is 30000/5 A.

7.1.3. Automatic detection

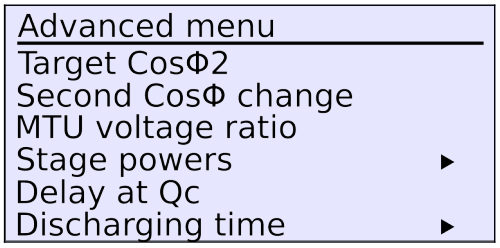
Another parameter in the menu is function **Autodetect**. After pressing of button **SET**, the display will show **Off**. Via buttons ▲, ► change to the value **on**. By pressing the button **SET** automatic detection will start to detect connection of current transformer and voltage measurement. While 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



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**.

7.2.1. Target CosΦ2 for 2nd 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 reactor icon on the display. Pressing of button **SET** saves new value to the memory and turns back to **Advanced menu** screen.

7.2.2. Second CosΦ change

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**.

7.2.3. MTU voltage 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.

7.2.4. Stage powers

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.

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

This parameter defines initial time for slowing down the regulation at over-compensation. When instantaneous cosφ rises over the defined target cosφ (parameter Target CosΦ1), timer delay at Qc starts to count down time from initial time until the counter reaches 0 and controller makes an action on regulation. At each moment when instantaneous cosφ goes under the defined target counter is stopped. When instantaneous cosφ increases over the target cosφ again, counter continue counting down at time it finished.

Default value suits most of the application. When reaction of controller is too often you can extend the initial time. Speed of count down depends on difference of over-compensation and target cosφ.

Notice

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

7.2.6. 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.

7.2.7. Min. closing time – delay for disconnection

Minimum closing time defines the shortest time of step operation. It is the time for which the capacitor will be connected after regulation action no matter if it is needed or not. This time prevents capacitor and mechanical contactor against the rapid number operation. This minimum closing time 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.

7.2.8. Stage operation number

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 step operations and confirm by pressing the button **SET**. Follow the same procedure for another steps.

7.2.9. Fix 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 step
- Off – permanently off (step number indication blinks and it is less bright)
- On – permanently on (step 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 step 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.

7.2.10. 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.

CT location and direction of measuring terminals		Line voltage					
		L1 (4) - L2 (3)	L2 (4) - L1 (3)	L2 (4) - L3 (3)	L3 (4) - L2 (3)	L3 (4) - L1 (3)	L1 (4) - L3 (3)
L1	k (2) - l (1)	210°	30°	90°	270°	330°	150°
	l (1) - k (2)	30°	210°	270°	90°	150°	330°
L2	k (2) - l (1)	330°	150°	210°	30°	90°	270°
	l (1) - k (2)	150°	330°	30°	210°	270°	90°
L3	k (2) - l (1)	90°	270°	330°	150°	210°	30°
	l (1) - k (2)	270°	90°	150°	330°	30°	210°

Table 6. Phase shift setting for all possible configurations

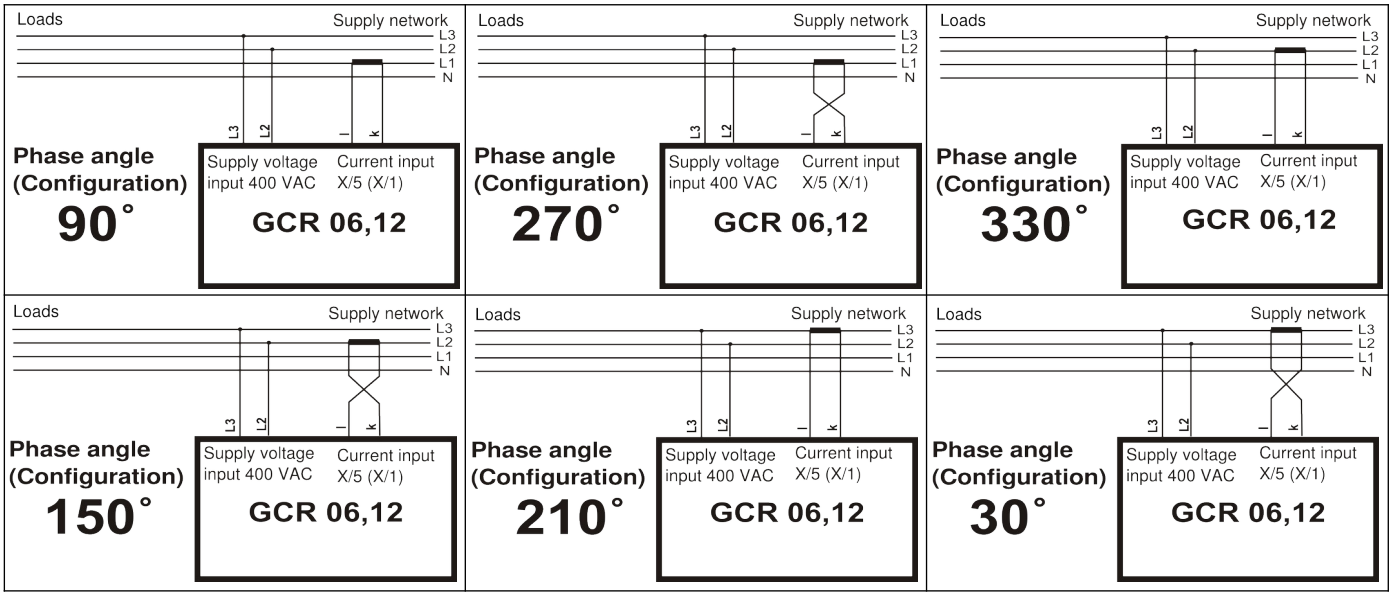


Table 7: Phase shift setting for supply and measuring voltage 400V, 100V and measuring voltage 100 … 690V

7.2.11. Q offset (reactive power offset)

Q offset parameter is useful for such type of systems where there is permanent presence of inductive or capacitive reactive power. Typical example of this can be long grid line which generates permanent and constant capacitive reactive power.

Parameter **Q offset** is set as a real power offset present in the system. This value is then assigned to measured reactive power.

7.2.12. Max. THDU level

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

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

During normal operation alarm output is opened. If there is activated an alarm by an event the alarm output will switch on.

Notice

Alarm output is switched on for 1 minute. After that it is switched off.

Individual events, which activate alarm event can be defined in setting mode by four particular settings.

Parameter	Description
Undervoltage	Under-voltage alarm
Overvoltage	Over-voltage alarm
Undercurrent	Low-current alarm
Overcurrent	Over-current alarm
Powerfactor	Under compensation alarm
THDU	THDU alarm
THDI	THDI alarm
Temperature	Temperature alarm
Step operation	Alarm from maximum allowed step connection

Table 8. Available alarm events

Each alarm event that is requested has to be enabled at first. After that the value of trigger that activated alarm has to be set and also duration of event presence. Last setting option is an alarm event influence on disconnection of compensation outputs.

Parameter	Description	Factory setting	Setting range
Activation	enable or disable alarm	Off	On / Off
Value	threshold for an alarm value level	0	according to alarm type
Delay time	minimum event duration for an alarm activation	0	0 ... 3600 s
Outputs	alarm event disconnects compensation steps	Off	On / Off

Table 9. Alarm event settings menu

Temperature alarm is a special alarm which behaves in two levels. 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 goes over level set in parameter **Ventilator temp.** In this case, all alarm events are only shown on the display without output contact action. Second level which disconnects all compensation stages and gives alarm event on display is defined by parameter **Temperature**.

Important

*If the **Ventilator temp.** is enabled then alarm output is used for ventilator control. All other alarms are then only informative without feedback on the alarm output.*

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.

7.2.15. Average COSΦ regulation method

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

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. Temperature

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 **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.

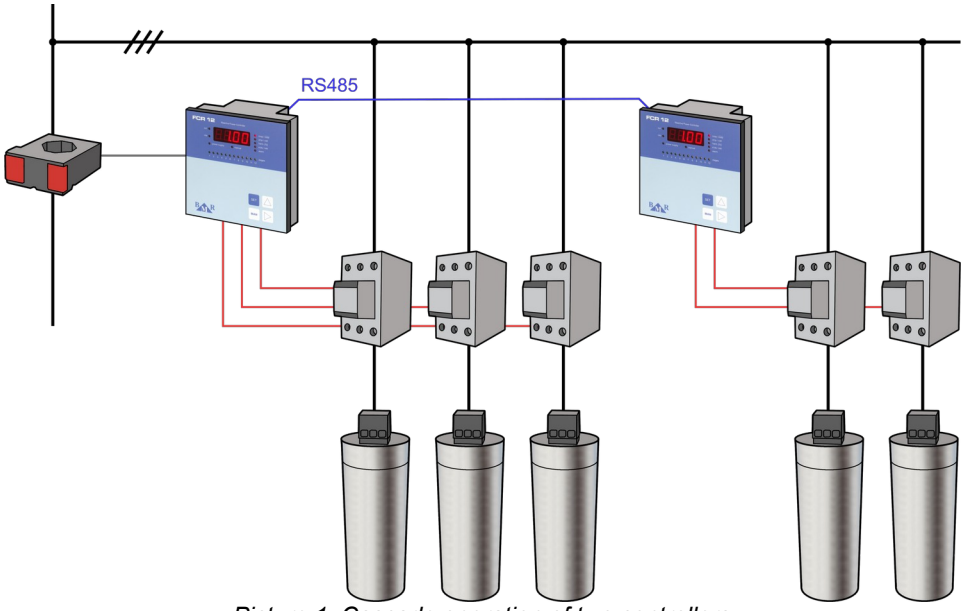
7.2.18. Ventilator temperature

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 **Ventilator temp.** 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. Cascade operation

Controllers GCR06RSC and GCR12RSC can work in cascade mode of two controllers. Controllers are connected via RS485 interface which is managing the communication in between.



Picture 1. Cascade operation of two controllers

Each controller has to have unique **Id** of serial interface. In parameter **CASC** is then set the Id of opposite controller. For example: there are two controller with Id=1 and Id=2. Then for correct parallel work of both controllers in cascade mode the controller with Id=1 will have set the parameter CASC=2 and controller with Id=2 will have the parameter CASC=1.

Cascade connection of two controllers

Parallel work of controller cascade does not have defined master and slave. Both controllers can work as a master or slave or even independently. Everything depends on measured conditions of network. In case that one of controllers does not measure any power and if the second controller does not have enough compensation power it offers to second controller its compensation power.

One of the application can be also enlarging the number of outputs in case that there is demand for more than 12 steps.

Controller which will be expanding number of outputs only will not have connected the current measuring circuit and will work permanently as a slave.

Important

For correct work it is necessary that first step power size of controller working as a slave is lower or equal to the maximum step size of controller working as a master.

7.2.20. Frequency

Defines the grid system frequency for measurement. Controllers are designed for 50Hz or 60Hz networks while factory set value is 50Hz.

7.2.21. Delay at reg.

Time for slowing the regulation speed for dynamic and hybrid APFC with fast switching thyristor module. This parameter setting affects only transistor outputs for thyristor switching modules.

7.2.22. Maximum saving

This parameters enables/disables recording of maximum values (the minimum value of frequency is being recorded as well) of measured parameters into internal memory. Max/min values are recorded absolutely without time stamp.

Max and Min values are stored in non volatile memory where there are saved once per 60 minutes period. Before recording the maximum (minimum) into the non volatile memory, this value is kept in RAM. Therefore in the case power supply is lost before the moment of recording to non volatile memory these values might 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.

7.2.23. Serial port configuration

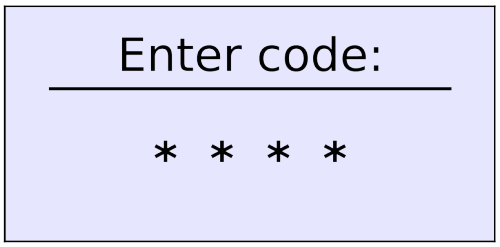
This parameters contains sub-menu with specification of serial communication for RS485 port (MODBUS communication protocol). Sub-menu, with parameters according to table no. 7, is available under the parameter **Serial port**.

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 10. Serial interface 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).

7.2.24. Password of service mode



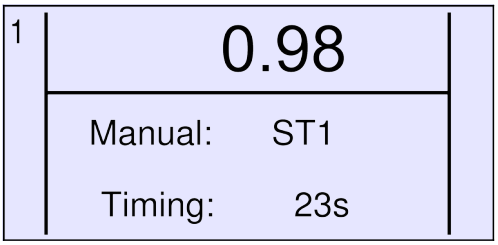
Due to the password, it is possible to protect regulator against unauthorized configuration. Without knowing an adequate password it is only possible to see set parameters, but not to change them. Password is set as four digit number.

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.

7.2.25. 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 steps cannot be controlled in the manual mode.

7.2.26. Reset 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.

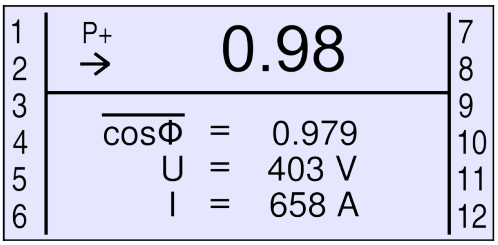
8. Measured and displayed values

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. Screen of 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.

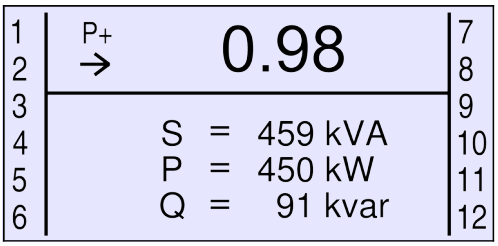
By pressing the button ► move to next screen.



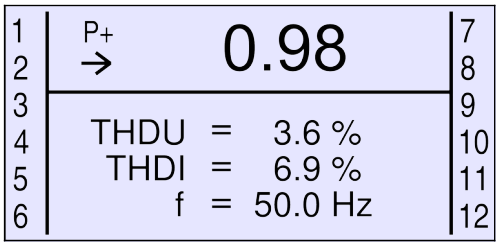
8.2. Screen of powers

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 next screen.



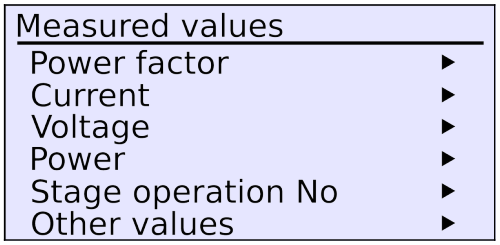
8.3. Screen of THD



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 next screen.

8.4. Screen of 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.

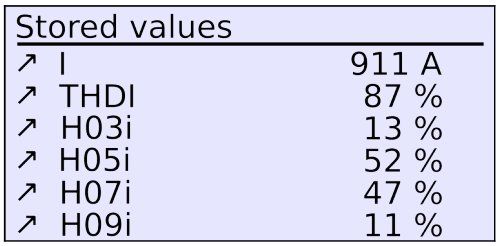
By pressing the button ► move to next screen.

Note

Explanation of some shortcuts used in the Measured values menu:

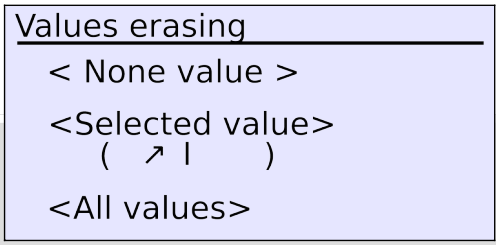
iCosO – inductive power factor of consumption	*iCosD – inductive power factor of distribution*
cCosO – capacitive power factor of consumption	*cCosD – capacitive power factor of distribution*
IA_P – phase current	*U_EF – effective phase-to-phase voltage*

8.5. Screen of 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.

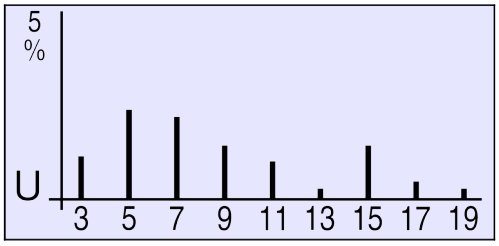


By pressing the button ► move to next screen.

Note

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

8.6. Screen of harmonics 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.

BMR *trading*
Horní lán 17
779 00 Olomouc
Czech Republic

phone: +420 778 066 566
export@bmr-trading.com
www.bmr-trading.com

9. Technical features

Parameter	Value
Supply voltage / measuring voltage (according the type)	400 V AC (+10%,-15%) 230 V AC (+10%,-15%) / 100 ... 690 VAC 100 V AC (+10%,-15%)
Frequency	50/60 Hz
Current range	0.003 ... 6 A
Measurement accuracy of current input	± 0.2%
Measurement accuracy of voltage input	± 0.5%
THDU and THDI accuracy	(U>10%Un) ±5% / (I>10%In) ±5%
Phase error for I < 3% In	± 3° (otherwise ±1°)
Power consumption	< 6 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 steps	25 operations per second
Range of requested power factor	0.8 ind. ... 0.8 cap.
Reconnection delay: semiconductor / contactor steps	0s / 5 ... 900 s
Switching off delay: semiconductor / contactor steps	0s / 5 ... 900 s
Compensation stages value setting	manually / automatically
Communication port	RS485 (optional)
Communication protocol	MODBUS RTU
Communication speed	1200 ... 38400 Bd
Over-voltage class	300 V CAT III
Pollution degree	2
Temperature limit	-25°C ... +70°C
Front panel	144 mm x 144 mm
Panel cut-out	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