Power Factor Controller (RKR)
User Manual

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PROPER USE AND SAFETY REQUIREMENTS

Cut all the power when connecting and disconnecting the device to a panel.

Do not clean the device with a solvent or similar material. Only use a dry cloth.

Please do not intervene to the device when a technical problem is encountered and get in contact with a technical service within the shortest time.

If the warnings are not taken into account, our company or the authorized dealer shall not be held responsible for the negative consequences.

Do not dispose in the trash, the device must be delivered to the collection centers (electronic device recycling centers). It should be recycled or disposed of without harming human health and environment.

The installation, assembly, activation and operation of the device hould be done and used by only expert professionals and in accordance with safety regulations and instructions.

1. INTRODUCTION

Preliminary Information

Enter the main menu by pressing the SET Button. (SET)
The user can change the flashing selections using the Up (UP) and Down (DOWN) Buttons.
You can enter a desired sub-menu with the SET (SET) button.
The ESC (ESC) button is used to return to the next menu.
In order to follow the sub-menus, the numbering at the top of the screen is used.

For example, when the SET (SET) button is pressed immediately after the device is turned on, the number 1.--- will appear at the top of the screen.
When Up (UP) button is pressed, it will changed top row as 2.---
When the SET (SET) button is pressed, the 2.1-- expression will appear on the top row and a submenu will be reported.
By pressing the ESC (ESC) button, it can return to the previous menu as 2.---
The manual can be easier to understand by following the numbers at the top of the screen.
As an example: If you want to learn all steps sequentially using the submenu in 4.2.1.2, it will be enough to follow the 4.2.1.2.

NOTE: Each title number in the manual also corresponds to the menu number in the device.

Recommendations for Installation with Capacitors:

In order to get results in a shorter time during installation with capacitors, it is recommended to connect capacitors to the first steps starting with three-phase large power capacitors and reactors to the last steps.

If compensators (capacitor or reactor) are placed in steps in a complex way, without taking into account their characteristics, it is recommended to switch off the supply fuses of the reactors before installation with capacitors.

Recommendations for Installation with Reactors:

During installation with reactors, it is recommended to connect the reactors to the first steps, starting with the three-phase high power reactors, and the capacitors to the last steps, in order to obtain results in a shorter time.

If compensators (capacitor or reactor) are placed in a complex way in steps, without taking into account their characteristics, it is recommended to switch off the supply fuses of the capacitors before the installation with reactors.

The factory default installation setting is set as installation with capacitors.

SETUP / INSTALLATION

- After the device connections are made in accordance with the connection diagram, the device is energized.
- When the device is energized, "Serial Number" screen appears in **Figure 1**. Pressing the SET Key or after 5 seconds automatically switches to the next screen. Then, "Secondary Current Value of CT" screen appears as shown in **Figure 2**.
- Pressing the Enter key or waiting 60 seconds without performing any action will automatically proceed to the next stage. The 'Current Reference' screen will appear as shown in **Figure 3.** In this section, depending on the operating principle of the PFC, it is defined whether the system is single-current transformer or three-current transformer. After the reference selection, the device proceeds to the 'Current Transformer Ratio' screen shown in **Figure 4.** The current transformer value is selected using the Up/Down buttons and the Enter button is pressed.
- Then the device starts to install automatically, the flashing red "setup" LED located on the left side of the device lights up steadily after the installation has started. During the installation; as seen in **Figure 5** and **Figure 6**, it controls parameters such as current control, voltage control, voltage - current mapping and current directions, if no error is encountered, " SEt SuCCES " is displayed and the relay automatically switches to step learning.

Figure 1. The first opening screen showing the "Serial Number" of the device

Figure 2. Display screen where the "Secondary Current Value" of the current transformer is set. (Can be set to 1A or 5A.)

Şekil 3. The screen showing the "Current Reference"

Figure 4. The screen showing the "Current Transformer Ratio"

Figure 5. Screenshot of current transformer secondary directions detected by the device during setup.

Figure 6. The screen showing matched voltage-current pair values during the setup.

- When the device automatically switches the step learning after the installation is completed, the "Setup" LED turns off and the red "Learn Step" LED lights up as seen in **Figure 7**.

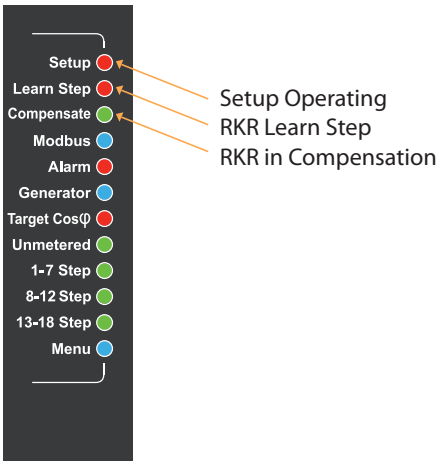


Figure 7. The "Learn Step" led from the states LEDs on the left side of the device lights up continuously during step learning

- Step learning process continues by displaying each learn step value on the screen as seen in **Figure 8**, in the meantime the information of which step is taken on can be followed from the green-colored Step LEDs bar on the upper part of the device as shown in **Figure 9**, and after the last step learn process is completed, the "Learn Step" LED turns off and the green "Compensate" LED lights up. Device started to compensate with defined steps.

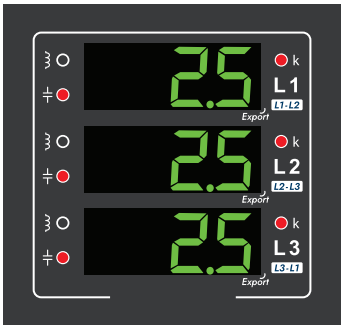


Figure 8. Screen display showing a step value with a capacitive characteristic load

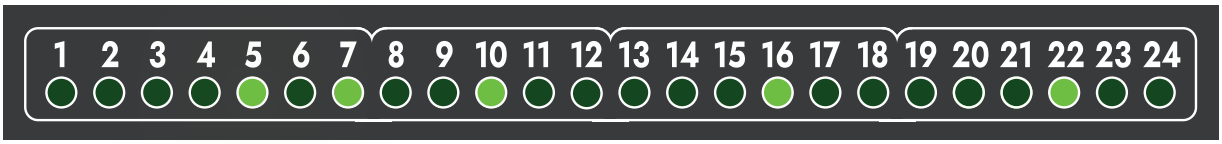


Figure 9. Step LEDs showing the states of the steps on the upper part of the device

- If the compensator connected to the defined step is a capacitor, the capacitive red LED (as in **Figure 8**) lights up on the left side of the device, if it is a shunt reactor, the inductive blue LED seen on the left side of the device lights up.

NOTE: If the ESC key is pressed for 4 seconds during setup and step learn, the ongoing process will be canceled.

- **If a faulty situation is encountered during installation;** the device corrects errors automatically (eg voltage-current mismatch). If device cannot fix the error, it reports one or more messages as in **Example Error 1** and stops the installation before it is completed.

Example Error 1.
Screenshot showing that the current of the third phase is high
(Check the third phase current input and current transformer value).

Example Error 2.
Screenshot showing that the currents of the second and third phases are high
(Check the current inputs of the second and third phases and the current transformer value).

Example Error 3.
Screenshot showing that the currents of all phases are high
(Check the current inputs of all phases and all current transformer values).

Example Error 4.
Screenshot showing that the voltage input of the first phase is empty
(Check the voltage connection of the first phase.)

Example Error 5.
Screenshot showing that the voltage inputs of the second and third phases are empty
(Check the voltage connections of the second and third phases).

Example Error 6.
Screenshot showing that the voltage inputs of the first and third phases are empty
(Check the voltage connections of the first and third phases.)

Example Error 7.
Screenshot showing that the voltage of the first phase is low
(Check the voltage of the first phase.)

Example Error 8.
Screenshot showing that the voltages of the second and third phases are low
(Check the voltages of the second and third phases).

Example Error 9.
Screenshot showing that the voltages of the first and third phases are low
(Check the voltages of the first and third phases.)

Example Error 10.
Screen display showing that the current input of the second phase is empty
(Check the current connection of the second phase.)

Example Error 11.
Screenshot showing that the current inputs of the first and third phases are empty
(Check the current connections of the first and third phases.)

Example Error 12.
Screenshot showing that the current inputs of all phases are empty
(Check the current connections of all phases.)

Example additional Error 13.
Screen display showing Phase/ Neutral connection error
(Check phase inputs and neutral connection.)

Example Error 14.
Screenshot showing step connection error
(Check the step connections.)

Example Error 15.
Screen display showing that the current transformer is not connected
(Please connect the current transformer.)

Example Error 16.
Screenshot showing that the current transformer terminals of the first and second phases are connected by mixing them to form a loop
(Check the terminals of the current transformers of the first and second phases).

Example Error 17.
Screenshot showing that the current transformer terminals of all phases are connected by mixing them to form a loop among themselves
(Check the terminals of the current transformers of all phases.)

Example Error 18.
Screenshot indicating that the installation could not be completed with the available steps
(Check the connections and steps and repeat the installation).

Example Error 19.
Screenshot showing that the voltages connected for the first and second phases are in the same phase
(Make the correct voltage connection to the first and second phases.)

Example Error 20.
Screenshot showing that the operating load is not stable
(Perform your test when the operating load is more stable.)

Example Error 21.
Screenshot showing that all step partners are empty
(Check the commonality of the steps to be used.)

Example Error 22.
Screen display showing that the voltage-current terminals of the 1st and 2nd phases are not matched when automatic voltage-current matching is off
(Make sure that the voltage and current terminals of the 1st and 2nd phases are connected in the correct order).

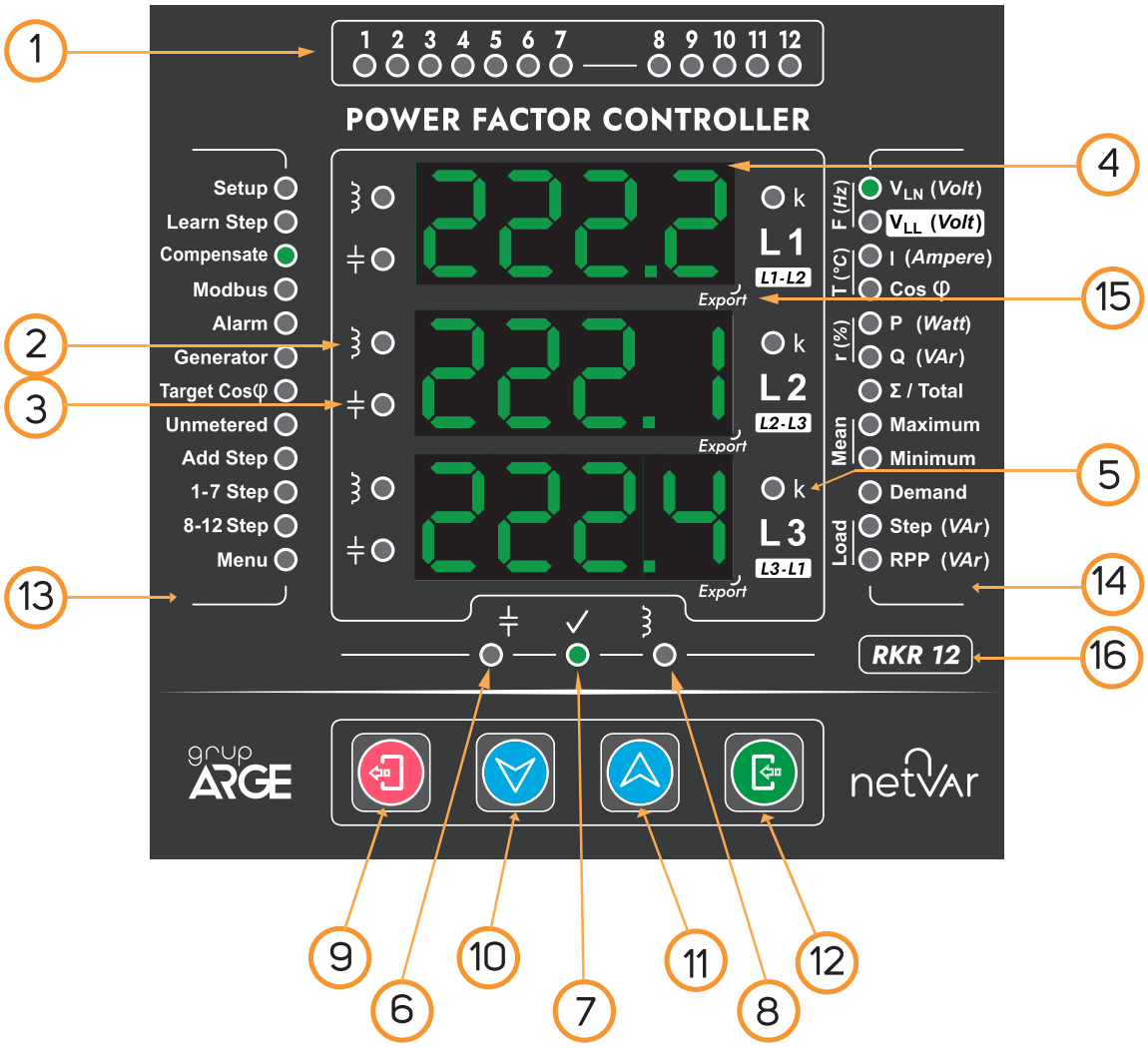
Example Error 23.
When automatic current-voltage matching is off; screenshot showing that the voltage-current terminals of all phases are not matched
(Make sure that the voltage and current terminals of all phases are connected in the correct order).

Example Error 24.
Screenshot indicating that the step has exceeded the pull-up/ release limit
(Check the connections and repeat the process at more stable current).

In cases of faulty connections that the device cannot correct automatically, the operator corrects these errors by taking into account the warnings of the device and when the device is re-energized, the device automatically starts the installation and automatically switches to the step learning step if it does not encounter any errors.

NOTE: During setup and step learning operations, pressing and holding the ESC Key (⎋) for 4 seconds will cancel and terminate the operation.

RKR FRONT PANEL VIEW



1- Step LEDs: LEDs provide monitoring of all step statuses. The activated step LED lights up. The flashing LED indicates that the relevant step is in discharging state. When the LED of the relevant step turns off, the step is ready to be activated.

2- Inductive Load LED: When this LED turns on, it means that the load drawn from the grid is inductive.

3- Capacitive Load LED: When this LED turns on, it means that the load drawn from the grid is capacitive.

4- Seven Segment Display: All powers, ratios, values, warnings and menu parameters are monitored on this screen.

5- K(x1000) LED: When this LED lights up, the values shown on the screen must be multiplied by 1000.

6- Capacitive LED: It is the LED shown with ⫩ symbol on lexan. If the ratio of reactive power drawn from any phase to active power exceeds the determined capacitive limit, this red LED lights up.
7- Normal LED: It is the LED shown with ☑ symbol on lexan. If the ratio of reactive power drawn from three phase to active power in between Ind/Cap limit, green normal LED lights up.
8- Inductive LED: It is the LED shown with ⫪ symbol on lexan. If the ratio of reactive power drawn from any phase to active power exceeds the determined inductive limit, this blue LED lights up.
9- Esc Key: It enables to return to the previous process in the menu and exit from the menu. Also pressing long time to ESC key setup and step learning can be canceled.
10- Down Key: It enables to move downward in measurement and menu position.
11- Up Key: It enables to move upward in measurement and menu position.
12- Set Key: The key to enter the menu, switch to a submenu and keep the settings.
13- State LEDs: It is the part where the available status of the device can be observed.
Setup: Indicates that the device is in the setup state. If this LED flashes, it means that the device needs to be set up.
Learn Step: Indicates that the device is in step learning. If this LED flashes, it is understood that the step learning process of the device should be done.
Compensate: This LED indicates that the device is in compensation state and the best response is produced.
Modbus: This LED flashes when communication via Modbus occurs.
Alarm: This is the red LED that informs the user about warnings or problems occurring in the system. This LED turns off when alarms are deleted from the alarm menu.
Generator: This LED indicates that the system is fed from the generator.
Target Cos(φ): This LED lights when the default value of target cos(φ) of 1.00 is changed.
Unmetered: This LED lights up when an unmetered power value is applied to the device.
Add Step: Indicates that the total step power is insufficient for the compensation response of the device and indicates that a step should be added.
1-7 Step: Indicates that steps 1 to 7 are suitable to be used for compensation response. If this LED is not on, the steps in this group cannot be used.
8-12 Step: Indicates that steps 8 to 12 are suitable to be used for compensation response. If this LED is not on, the steps in this group cannot be used.
13-18 Step (for RKR18 and RKR24): Indicates that steps 13 to 18 are suitable to be used for compensation response. If this LED is not on, the steps in this group cannot be used.

19-24 Step (RKR24 only): Indicates that steps 13 to 18 are suitable to be used for compensation response. If this LED is not on, the steps in this group cannot be used.

Menu: This LED is on when you are in a menu. It flashes during editing.

14 - Value LEDs:
VLN: Phase-neutral voltage values of L1, L2 and L3 phases are displayed.
VLL: Phase-phase (L-L) voltage values of L1-L2, L2-L3 and L3-L1 phases are displayed.
VLN and VLL (F): Frequency values for L1, L2 and L3 phases are shown.

I: Current values of L1, L2 and L3 phases are shown.
Cos (φ): Cos (φ) values of L1, L2 and L3 phases are shown.
I and Cos (φ) (T °C): When these two LEDs are lighted together, the approximate temperature of the panel is displayed instantaneously.

P: Active power values of L1, L2 and L3 phases are shown.
Q: Reactive power values of L1, L2 and L3 phases are shown.
P and Q (r %): These LEDs turn on when the capacitive / inductive instantaneous ratios of each phase are shown on the display.

Q and Load: When these LEDs are on at the same time, the total reactive load drawn by the operation is displayed on the screen.
Q, ∑ and Step: It shows the total reactive power of the steps activated by the power factor controller.

VLN, VLL, I, Max and Min: Top to bottom;

Line 1: Average voltage values of L1, L2 and L3 phases are shown.
Line 2: Average current values of L1, L2 and L3 phases are shown.
Line 3: Average frequency values of L1, L2 and L3 phases are shown.

P, Q, Max and Min: Top to bottom;

Line 1: Average active power values of L1, L2 and L3 phases are shown.
Line 2: Average reactive power values of L1, L2 and L3 phases are shown.
Line 3: Average apparent power values of L1, L2 and L3 phases are shown.

P, Q and ∑: Top to bottom;

Line 1: Inductive percentage ratio value is displayed.
Line 2: "%"
Line 3: The capacitive percentage ratio value is displayed.

P and ∑: The first line shows the total active energy

The lines below this line show the total active energy values.

NOTE: Since the lines have 4 characters, the digits after the first 4 digits of the active energy values will be displayed on the bottom line to avoid overflowing the bottom line.

Figure 2.1 Display of total active energy on the device screen

If the active energy value is greater than an 8-digit number, the k (x1000) LEDs on the right side of the display will light up. For example, if a display like the one in Figure 2.1 appears and k LED is not light up, it should be understood that the active energy value is 435,410 W (453.41 kW)

Q and ∑: This index shows the total reactive energies (capacitive and inductive). Firstly, in the first line,

is shown. In the lines below this text, total inductive energies are displayed. To display the total capacitive energies, press the down arrow key. When this is done,

is displayed on the first line. In the lines below this text, total capacitive energy values are read.

NOTE: The display of total reactive energy values on the screen is the same as the display of total active energy values.

VLN and Demand: Voltage demand values of L1, L2 and L3 phases are displayed.

NOTE: If the Export LEDs are blinking, the values shown on the display are Export values.

I and Demand: Demand values of I1, I2 and I3 currents are displayed.

NOTE: If the Export LEDs are blinking, the values shown on the display are Export values.

P and Demand: Demand values for P1, P2 and P3 powers are shown.

NOTE: If the Export LEDs are blinking, the values shown on the display are Export values.

Q and Demand: Demand values for Q1, Q2 and Q3 powers are shown.

NOTE: If the Export LEDs are blinking, the values shown on the display are Export values.

VLN and Max: Maximum voltage (Vmax) values for L1, L2 and L3 phases are displayed.

NOTE: If the Export LEDs are blinking, the values shown on the display are Export values.

VLN and Min: Minimum voltage (Vmin) values for L1, L2 and L3 phases are displayed.

NOTE: If the Export LEDs are blinking, the values shown on the display are Export values.

I and Max: Maximum current (Imax) values for L1, L2 and L3 phases are displayed.

NOTE: If the Export LEDs are blinking, the values shown on the display are Export values.

I and Min: Minimum current (Imin) values for L1, L2 and L3 phases are displayed.

NOTE: If the Export LEDs are blinking, the values shown on the display are Export values.

P and Max: Maximum active power (Pmax) values for L1, L2 and L3 phases are displayed.

NOTE: If the Export LEDs are blinking, the values shown on the display are Export values.

P and Min: Minimum active power (Pmin) values for L1, L2 and L3 phases are displayed.

NOTE: If the Export LEDs are blinking, the values shown on the display are Export values.

Q and Max: Maximum reactive power (Qmax) values for L1, L2 and L3 phases are displayed.

Q and Min: Minimum reactive power (Qmin) values for L1, L2 and L3 phases are displayed.

NOTE: If the Export LEDs are blinking, the values shown on the display are Export values.

Step: This LED lights when the display shows information about the steps.
RPP: This LED lights when power samples are monitored. To access the power samples, the sub-menu must be entered from the menu.

15 – Export LED: When this LED flashes, it indicates that the device's corresponding phase is in export mode.

16 – Product Model Number: Indicates the product model.

Power Factor Controller Front Panel Key Functions

Enters menus and submenus, and also performs confirmation operations.

In the menu, it allows you to go back one step and exit the menu. On the work screen, it allows you to return to the main worksheet.

Allows navigation in the work screen detail pages and menus. It performs the process of increasing the values of the parameters.

Allows to navigate the work screen detail pages and menus. Performs the process of reducing the values of the parameters.

General Features

Power Factor Controller 3 phase current, phase-neutral and phase-phase voltages, frequency, active and reactive powers, angle difference between current and voltage can be measured and displayed on the screen. In addition, it measures and records active and reactive energies.

Demand and peak values for these measured quantities are also recorded by the Power Factor Controller and can be displayed on the device.

Many necessary adjustments related to the device (Current Transformer Value, Measurement and Busbar Voltages etc.) can be made via the menu.

Thanks to the communication feature, all read parameters can be monitored remotely via the standard Modbus protocol and various adjustments can be made.

It can give output in the value range for the quantities (Current, Voltage, Active and Reactive Power, Cos(φ) etc.) set via the device menu.

Technical Features

- 32-bit based microcontroller
- High efficiency with operating ambient temperature from -10 °C to +55 °C
- Easy access to step learning, setup, C.T value, Modbus address, response time with Quick Menu
- Ability to set the desired value with the target Cos (φ) feature
- Ability to add virtual power to the business with the Unmetered Power addition feature
- Ability to check and display whether the relevant tap block is active or not with the ability to detect step partners
- Intelligent step learning and individual step learning
- Adjustable response time (with inductive, capacitive and normal options)
- RS-485 Standard Modbus RTU protocol for ease of communication
- 247 different Modbus addresses
- Baud rate from 4800 bps up to 256000 bps
- Modbus protection option for writing and reading
- Manual step control for testing capacitor/reactor and related fuses and even related contactors
- Adjustable inductive and capacitive limit
- Adjustable hysteresis limit
- Automatic voltage-current matching
- Three different user modes (User, Chef and Guru modes)
- Ability to create a special PIN for high security needs
- Possibility of installation according to compensator characteristics (capacitive or inductive)
- Possibility of installation according to business profile (production or consumption)
- Adjustable current transformer value, adjustable line and measuring voltage
- Automatic finding and correction of current transformer connection directions
- Possibility to adjust the polarity direction of current transformers with three different modes (automatic, manual and reverse)
- Ability to save energy, demand, export, minimum and maximum values in permanent memory and delete them when desired
- Ability to synthesize steps thanks to the ability to view and analyze the reactive power profile of the enterprise with the Reactive Power Profile feature
- Thinnest ergonomic design with a depth of 48 mm allowing for narrow enclosure design
- Terminal block structure positioned for easy cable assembly
- Secure C.T. secondary installation with constant current terminal input allowing the use of 4 mm2 cables for long distances
- 0.5 mA measurement accuracy with automatic gain
- 0.5 mA - 6.0 A current measuring range

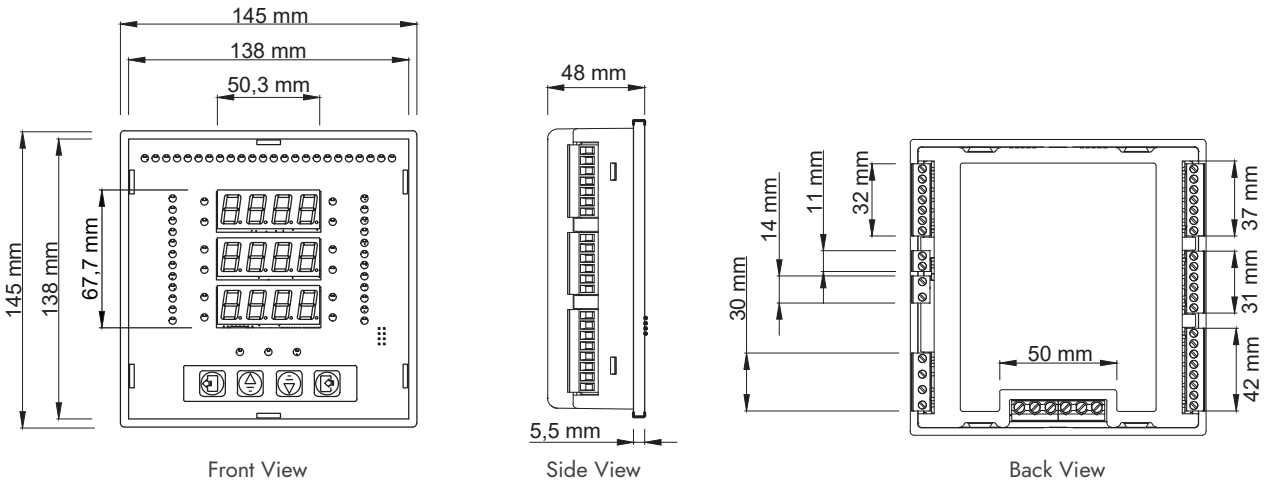
- 80 - 265 VAC voltage measurement range
- Ability to feed from any phase
- Safe operation in 80 - 280 VAC supply voltage range
- Equipment safe against voltage connection failure
- Phase - Neutral faulty connection detection
- 12, 18 and 24 step options
- Easy assembly and easy installation
- Ability to install monophase, diphase, triphase steps
- Installation options with capacitor or reactor steps
- Installation and compensation option with single current transformer
- Detection of various connection errors for current transformers
- Intelligent compensation response algorithm
- Ability to use single-phase reactor/capacitor steps simultaneously with capacitor/reactor steps for compensation solution
- Intelligent/sequential/fast step learning in Adaptive mode
- Single step learning
- Recognize 1 step in under 1 second
- Monophase, diphase, triphase capacitor and reactor learning
- Manual step input
- Non-interchangeable terminal block structure with different pin numbers for step groups
- Feed control of grouped step partners
- Capacitor and reactor can be freely connected to each step
- 7 Segment LED display in bright green color
- Status and value indicators with Blue, Green and Red LEDs
- Determining the target Cos (φ)
- Ability to be fed via generator and different Cos (φ) setting in generator use
- Unmetered Power addition feature for inductive effect of MV power transformers or capacitive effect of long cables, which can be set for an optional period of time
- Reactive Power Profile analysis sorted by energy/time/inductive/capacitance/ratio for step synthesis
- Easy and fast operation
- Various warning/alarm codes
- Smart menu with 3-level access
- Indexed menu heading for technical support
- Turkish, English language options
- Show current access level in the main menu

- PIN protection and different reset pins for each power factor controller
- Various parameter settings and function calls from the menu
- Information menus with identification information such as serial number, software and hardware version, etc.

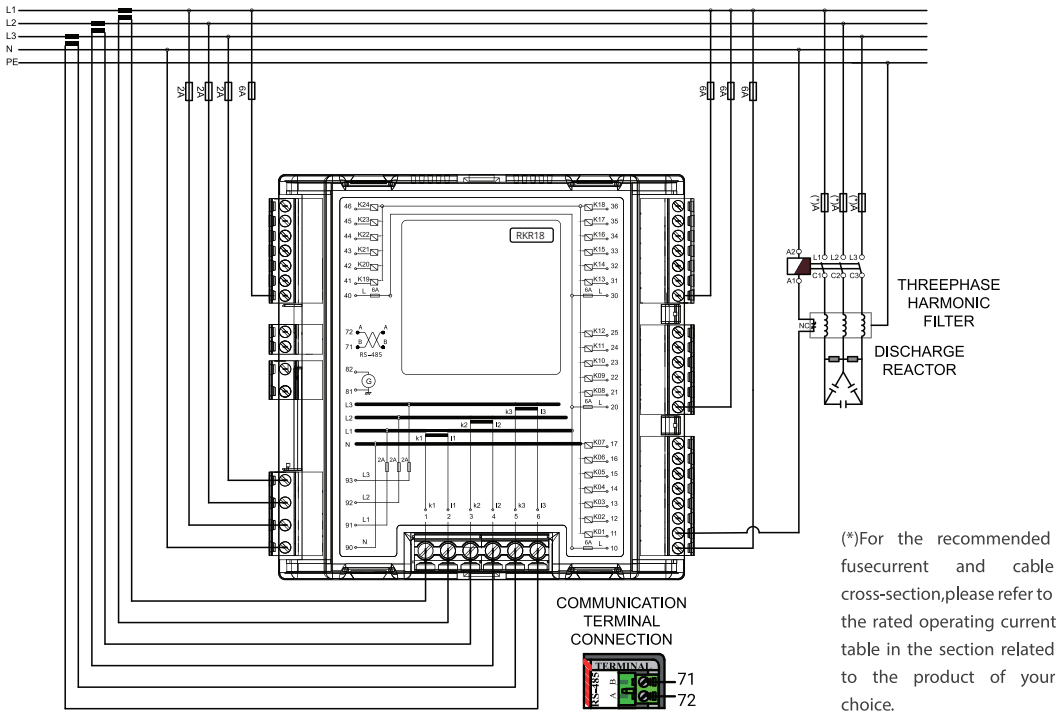
Observable Values:

- VLL, VLN, I, F, P, Q, Cos (φ), Q/P
- Instantaneous and Accumulated Inductive/Capacitive Q/P Ratio (%)
- Demand, Min, Max, Average values
- Active, Inductive/Capacitive energy indexes
- Export indexes, demand, mininum, maximum values
- Total phase-to-phase power of the drawn steps
- Instantaneous reactive loads drawn by the enterprise from each phase
- Approximate temperature of the panel
- Step powers, number of uses
- Examples of Reactive Power Profile

RKR 12/18/24 Power Factor Controller Technical Drawing



RKR 12/18/24 Power Factor Controller Connection Diagram



(*)For the recommended fusecurrent and cable cross-section,please refer to the rated operating current table in the section related to the product of your choice.

RKR 12/18/24 Current Transformer Connection Diagram

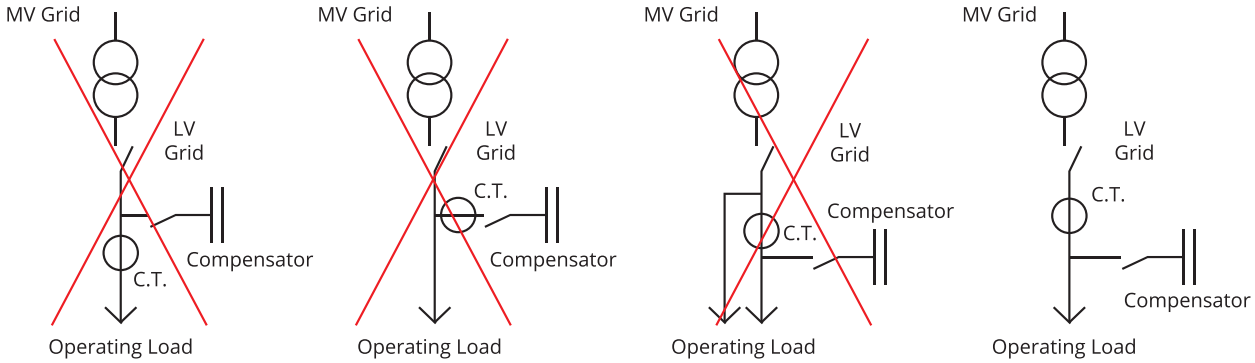


Figure 1. Wrong Connection **Figure 2. Wrong Connection** **Figure 3. Wrong Connection** **Figure 4. Correct Connection**

If the feeds of the compensator steps in the panel are taken before the current transformer connection nodes, naturally the device will not be able to read the current of the steps, since the currents of the compensators (capacitors or reactors) do not pass through the primary of the current transformers. In this case, installation will not be possible. Current transformers must be connected as shown in Figure 4.

Current transformers must be placed at the immediate output of the main switch of the plant.

User Access Levels

The device offers the user three different access levels. These access levels are shown by entering the menu on the second line. In addition, the user can easily determine the selection that is flashing periodically on the 3rd row. There are three different user access levels in total.

User Level: It is the simplest user mode. After the first installation, the device starts operating in this mode. If "**CHEF**" or "**GURU**" access level PINs are entered, the device will exit this mode. In this mode, the user's authority to monitor and change settings is restricted. The user can only observe the read electrical parameters, step powers, alarms.

Figure 2.1. "User" access level seen in the first line when entering the menu

Figure 2.2. "Chef" access level seen on the first line when entering the menu

Chef Level: In addition to the user mode, it is the mode in which a number of settings can be made on the device. From the "**USER**" mode, you can switch to "**CHEF**" mode by entering a 4-digit "**CHEF**" PIN. If requested, this PIN can be changed in the PIN settings menu. The default PIN is defined as "0000".

Guru Level: It is the most advanced user mode. It is the mode in which all settings related to the device can be made. From "**USER**" and "**CHEF**" mode, you can switch to "Guru Access Level" by entering a 4-digit "Guru" PIN. If requested, this PIN can be changed in the PIN settings menu. When the device is in "Chef Level" or "Guru Level" mode, it automatically switches to "User Level" 5 minutes after exiting the menu. The default PIN is defined as "1000".

Figure 2.3. "Guru" access level seen on the first line when entering the menu

1. QUICK MENU

This menu is a main menu where the most commonly used submenus are grouped together for quick access. It includes step powers, step menu with step learning and control, response time, setup and Modbus address menus.

1.1. Step Menu

It is the menu where operations such as displaying the power values related to the steps, starting the step learning processes, manually activating and deactivating the steps can be easily performed.

1.1.1. Step Powers

Step Powers menu is the menu that shows which steps are in the system and their step powers. All steps can be displayed in order by using the Up and Down arrow keys.

1.1.2. Step Learning

With step learning, the capacitor and reactor groups connected to the system are learned. It is possible to recognize all or a selected one of the steps in the menu.

1.1.2.1. All Steps

With step learning, all capacitor and reactor groups connected to the system are learned. It works with automatic learning method.

1.1.2.2. Single Step Learning

With this submenu, the desired step is selected and the learning of this selected step is performed.

1.1.3. Manual Step Control

By activating the selected step, compensator in the step (capacitor or reactor), the fuse and contactor connected to that step are also used to check whether they are working or not.

1.2. Response Time

With the response time menu, the number of seconds in which the device will respond to the system in the inductive and capacitive region is set. As the response time increases, the response speed of the device decreases, as it decreases, the speed increases. For example; response time is kept low in places with fast load changes. The default response time is 2 seconds.

1.3. Modbus Address

Modbus Address menu is the menu where the Modbus Address required for the device to communicate with Modbus protocol is displayed and set.

NOTE: Modbus Address can be set in the range of 1-247. User access level must be "Guru" to make changes in this menu. The default Modbus Address is "1".

1.4. Language

Enables changing the device's language to either English or Turkish.

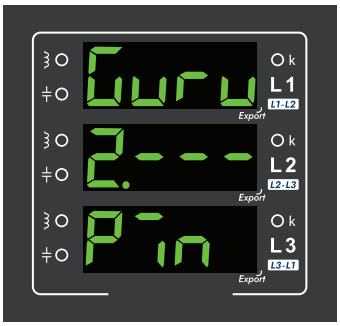
1.5. Setup

With the installation, voltage, current and tap connections are checked, and if there is a situation that may prevent the system from working properly, the user is informed about this situation. Installation is performed with this menu.

2. PIN

The PIN menu is used to switch between different user types or to set a new PIN.

NOTE: This menu is hidden by default. You can activate it from the **"5.4.5. Password Protection"** menu.



2.1. Enter PIN

This is the menu where you enter your PIN to switch between different user types.

2.2. New PIN

This is the menu where PINs can be changed. When changing the PIN, the new PIN is set by using the directional keys to change the digits from 0 to 9, starting with the first digit, and the selected digit is confirmed by pressing the Enter key. This process is repeated for all 4 digits, and the PIN is confirmed by pressing the Enter key again at the end.

3. EVENT, WARNING AND FAULT LOGS

The device generates alarms and warnings to inform the user about certain situations. Details of the generated alarms are given in the sub-menus.

3.1. Event Logs

Recorded event alarms can be viewed and deleted from this section.

3.1.1. List

This menu lists which event (alarm or warning) occurred and how many times it occurred. When you enter this submenu with the Enter Key, the error codes of the events that have occurred can be displayed. The screen in this menu changes at certain intervals.

The second line of the first screen displays the sequence number of the event (this number is not the alarm error code, do not confuse it), and the third line displays the error code of the event.

The second screen shows the number of times this error is repeated. The meaning of the error codes can be found in the "Warning - Alarm Codes Table" (p. 49).

3.1.2. Delete

This menu deletes event records saved in the device.

3.2. Warning Logs

Recorded warning alarms can be viewed and deleted from this section.

3.3. Fault Logs

Recorded fault alarms can be viewed and deleted from this section.

3.4. Set Values

In this menu, the alarm generation values of some alarm conditions (High Voltage, Low Voltage, High Temperature) can be seen and changed.

NOTE: You must be in "Guru" mode to make changes in this menu.

3.4.1. High Voltage Limit

This is the menu where the necessary settings are made for the device to alarm above the specified voltage value. As factory default, this value is set to 253 V.

3.4.2. Low Voltage Limit

This is the menu where the necessary settings are made for the device to alarm below the specified voltage value. As factory output, this value is set to 184 V.

3.4.3. High Temperature Limit

This is the menu where the necessary setting is made for the device to alarm above the set temperature value. As factory default, this value is set to 70 °C.

3.4.4. Line Percentage

This is the menu where the necessary setting is made for the device to alarm above the set the percentage threshold for voltage changes at the inputs. As factory output, this value is set to % 5.

NOTE: If this warning appears, check the line and neutral connections.

3.5. Permanent Warning LED

If an alarm occurs during operation and you want the alarm icon to be permanently displayed in red, set this option to "Enable".

4. STEP

It is the menu where operations such as displaying the power values related to the steps, manually changing the power values, performing step learning operations, and manually activating the steps can be easily performed.

4.1. Step Power

Step Powers menu is the menu where the steps in the system and the step powers are displayed. All steps can be displayed in order by using the Up and Down Arrow keys. The power of the relevant step can be changed manually with the Enter Key. For manual step input, the access level of the device must be "Guru".

4.2. Step Learning

Step Learning Menu consists of 6 submenus.

4.2.1. All Steps

This submenu starts the learning process for all steps.

4.2.2. Single Step Learning

This submenu allows learning of a single, user-selected step.

4.2.3. Group 1 (Steps 1-7)

This submenu starts the learning process for steps in Group 1 (Steps 1-7).

4.2.4. Group 2 (Steps 8-12)

This submenu starts the learning process for steps in Group 2 (Steps 8-12).

4.2.5. Group 3 (Steps 13-18)

This submenu starts the learning process for steps in Group 3 (Steps 13-18).

4.2.6. Group 4 (Steps 19-24)

This submenu starts the learning process for steps in Group 4 (Steps 19-24).

4.3. Step Control

It is used to check whether the relevant fuse and contactors in the selected step are working by activating the selected step.

4.4. Step Settings

This is the menu where certain adjustments related to steps are made.

4.4.1. Discharge Time

This menu sets the discharge waiting time required for capacitive-type steps to be re-energized after being de-energized.

4.4.2. Equal Aging

Manages parameters related to the equal aging method, ensuring effective and long-lasting use of similar compensation steps.

4.4.3. Auto Control

This parameter enables or disables dynamic monitoring of steps during compensation. When active, the PFC dynamically observes the steps, automatically measures and verifies their values during stable operating conditions and issues warnings if differences or issues are detected. The PFC uses these updated measurements to ensure stable and effective compensation.

Factory Default: Continuous monitoring is disabled.

4.4.4. Delay Time between Steps

Determines the waiting time between pulling or releasing two steps in the set applied by the PFC.

Adjustable with a resolution of 5 ms; the default value is 400 ms.

4.4.5. Advanced Settings

This menu allows you to configure advanced settings related to steps.

4.4.5.1. Reset All Details

Resets operating durations, pull/release counts and previous values for all steps.

4.4.5.2. Learning Measurement Error

Sets the maximum allowable error percentage between pull and release values during step learning.

4.4.5.3. Imbalance Percentage

Defines the maximum acceptable power difference percentage between phases for three-phase capacitors. If the imbalance exceeds this percentage, the step is flagged as faulty. Faulty steps are activated only when total compensation is insufficient.

4.4.5.4. Depreciation Percentage

Sets the percentage of observed power loss or increase in phase values during re-learning of a step.

4.5. Step Common Control

4.5.1. Step Common Control

Manages the voltage type (AC/DC), contactor coil voltage and percentage deviation parameters for step commons. If the measured voltage deviates from the specified contactor coil voltage by the set percentage, the device issues a warning and disables all steps in the corresponding group.

4.5.2. Step Common 1

Configures parameters for Common 1 input: Voltage type (AC/DC), contactor coil voltage and percentage deviation. If the measured voltage deviates from the specified contactor coil voltage by the set percentage, the device: Issues a warning for Common 1 input. Disables all steps in Group 1 (Steps 1-7).

4.5.3. Step Common 2

Configures parameters for Common 2 input: Voltage type (AC/DC), contactor coil voltage and percentage deviation. If the measured voltage deviates from the specified contactor coil voltage by the set percentage, the device: Issues a warning for Common 2 input. Disables all steps in Group 2 (Steps 8-12).

4.5.4. Step Common 3

Configures parameters for Common 3 input: Voltage type (AC/DC), contactor coil voltage and percentage deviation. If the measured voltage deviates from the specified contactor coil voltage by the set percentage, the device: Issues a warning for Common 3 input. Disables all steps in Group 3 (Steps 13-18).

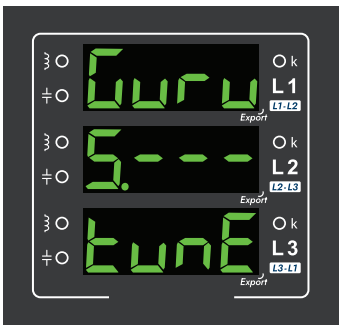
4.5.5. Step Common 4

Configures parameters for Common 4 input: Voltage type (AC/DC), contactor coil voltage and percentage deviation. If the measured voltage deviates from the specified contactor coil voltage by the set percentage, the device: Issues a warning for Common 4 input. Disables all steps in Group 4 (Steps 19-24).

4.6. Clear Notifications

If the "Yes" option is confirmed, all notifications for the steps are cleared.

5. DEVICE SETTINGS



This menu allows configuration of various device parameters.

5.1. Measurement and Transformers

5.1.1. Current Transformer Ratio

Set the current transformer (CT) ratio between 5/5 and 10000/5. (The secondary current can be set to 1A.) The current CT ratio blinks in the menu. Use the UP ( ) and DOWN ( ) buttons to select the desired value, then press SET ( ) to update it.

5.1.2. Secondary Current Value

Determines the secondary current value of the current transformer. The secondary current value of CT blinks in the menu. Use the UP ( ) and DOWN ( ) buttons to select the desired value, then press SET ( ) to update it.

5.1.3. Current-Voltage Pairs

Displays which voltage inputs correspond to the measured currents.

5.1.4. Current Transformer Directions

Displays the direction of the current connections

5.1.5. Voltage Transformers

Allows setting line voltage and measurement voltage.

5.1.5.1. Line Voltage

Set the line voltage within a range of 90 V to 46000 V. The current line voltage blinks in the menu. Use the UP ( ) and DOWN ( ) buttons to select the desired value, then press SET ( ) to save it.

5.1.5.2. Measurement Voltage

Set the measurement voltage within a range of 22 V to 1000 V. The current measurement voltage blinks in the menu. Use the UP ( ) and DOWN ( ) buttons to select the desired value, then press SET ( ) to save it.

5.2. Compensation

This menu allows configuration of all parameters related to compensation.

5.2.1. Reactive Limits
5.2.1.1. Inductive Limit

It is the limit value that initiates the inductive response time of the PFC and will generate a solution in the inductive side. (Default Value: %15)

5.2.1.2. Capacitive Limit

It is the limit value that initiates the capacitive response time of the PFC and will generate a solution in the capacitive side. (Default Value: %12)

5.2.2. Response Times
5.2.2.1. Inductive

Time the device waits before responding to an inductive limit excess.

5.2.2.2. Capacitive

Time the device waits before responding to a capacitive limit excess.

5.2.2.3. Normal

Time the device waits to provide an optimal response when no limit excess occurs.

5.2.3. Unmetered Power

This menu configures additional reactive loads (e.g., inductive transformer effects or capacitive effects of long cables) that are not metered by the PFC but could lead to penalties. These unmetered loads are factored into compensation and can be set as either timed or continuous.

5.2.3.1. Unmetered Power 3-Phase

Total Unmetered Power evenly distributed across all three phases, with a 100 VAr resolution. A value of “0” disables Unmetered Power compensation.

5.2.3.2. Operating Time

When timed, Unmetered power compensation ends after the specified duration and the value of Unmetered Power resets to 0. A value of “0” for Operating Time means the setting is considered continuous.

5.2.3.3. Unmetered Power L1

Independent settings for Unmetered power for L1 phase, with a 1 VAr resolution, used to address discrepancies between meter and PFC measurements.

5.2.3.4. Unmetered Power L2

Independent settings for Unmetered power for L2 phase, with a 1 VAr resolution, used to address discrepancies between meter and PFC measurements.

5.2.3.5. Unmetered Power L3

Independent settings for Unmetered power for L3 phase, with a 1 VAr resolution, used to address discrepancies between meter and PFC measurements.

5.2.4. Target Cos / Tan
5.2.4.1. Target Cos / Tan

Sets the desired target Cos (φ) and Tan (φ) values. Default values are Cos (φ) = 1 and Tan (φ) = 0.

5.2.4.2. Operating Time

Specifies how long the target Cos (φ) and Tan (φ) values remain active. When the duration ends, the target Cos (φ) resets to 1.0. A value of 0 makes the setting continuous.

5.2.5. Generator
5.2.5.1. Compensation with Generator

Enables or disables compensation when the generator is active.

5.2.5.2. Target Cos / Tan (Generator)

Sets the target Cos (φ) and Tan (φ) values for compensation during generator operation.

5.2.6. Export Compensation

Allows enabling or disabling compensation during export.

5.2.7. Protection
5.2.7.1. High Voltage

Enables overvoltage protection.

5.2.7.2. Low Voltage

Enables undervoltage protection.

5.2.7.3. High Temperature

Enables overtemperature protection.

5.2.7.4. Set Values

Sets the limit values for protection parameters.

5.2.8. Hysteresis

Defines the percentage thresholds for applying new compensation settings based on current operating conditions.

5.3. Modbus Configuration

Configure parameters for Modbus communication.

5.3.1. Modbus Address

Assign a unique Modbus address (1–247) to the PFC, distinct from other connected devices. Use the UP ( ) and DOWN ( ) buttons to select the desired address, then press SET ( ) to update it.

5.3.2. Modbus Speed (bps)

Set the Modbus communication speed (baud rate) in bits per second (bps). Select the desired speed using the UP ( ) and DOWN ( ) buttons, then press SET ( ) to save it.

5.3.3. Data, Stop Bits and Parity
5.3.3.1. Data Bits

Displays the number of data bits used in Modbus communication. This parameter depends on other settings and cannot be manually changed.

5.3.3.2. Parity Bits

Set the parity bit to None, Odd or Even, matching the application or device.

5.3.3.3. Stop Bits

Set the stop bits used in communication to 1 or 2.

5.3.4. Silent Interval (xBit)

Configures the silent interval (xBit) after the stop bit to determine how long the device waits before resuming communication.

5.3.5. Mode

Select the Modbus communication mode: RTU or ASCII.

5.3.6. Modbus Protection

Configures password protection for read/write Modbus requests. If enabled, passwords must be set in the password menu. After three incorrect attempts, no new password entry will be possible until the PFC is restarted.

5.3.6.1. Read Protection

Activates or deactivates read protection

5.3.6.2. Write Protection

Activates or deactivates write protection.

5.3.6.3. Read Password

Sets a four-digit password for active read protection.

5.3.6.4. Write Password

Sets a four-digit password for active write protection.

5.4. Display Settings

5.4.1. Auto

It is determined whether to switch between the default screen (displaying Cos (φ) values) and the screen where the operator adjust the user specific custom screen.

5.4.2. Type

This menu is used to adjust the level of details for line values and energy indexes.
There are two modes in this menu, Full (Professional) and Bare (Simple).

Values shown on the work screen in Simple Mode:

- Phase-neutral voltage, Phase-phase voltage, Phase current and Frequency
- Active power (P), Reactive power (Q) (Inductive-Capacitive)
- Cos(φ), Phase phase instantaneous reactive ratios, Total reactive energy ratio, Display of activated step Powers
- Inductive/Capacitive ratio, Total active energy, Total reactive energy (Inductive-Capacitive)

NOTE: The factory default operating screen of the device is simple mode.

Values added to the work screen in Full Mode:

- Total Active Energy Export Values, Total Reactive Energy Export Values (Inductive-Capacitive)

5.4.3. Average

Here, it is determined how many samples will be taken for the values shown on the screen and the maximum percentage difference between the samples to be included in the average calculation.

5.4.3.1. Sample Count

Number of samples to calculate average values (1–16).

5.4.3.2. Control Percentage

Percentage difference required for value updates (5%–50%).

5.4.4. Hide

This menu is used to hide warning messages which are related to line values.

5.4.5. Password Protection

Activates or deactivates menu access restrictions requiring a password.

5.4.6. Access Levels

Enables password-protected access levels.

5.5. Advanced Settings

This is the settings menu where the device can be turned off and on, reset and returned to factory settings can be changed.

5.5.1. Power Off / On

Safely powers the device on or off via the screen.

5.5.2. Default Settings

Resets all customized settings and data to factory defaults.

5.5.3. Device Reset

This menu allows the power factor controller to be reset while preserving its basic structural parameters. This process supports the safe and fast operation of the device; it only clears/resets some temporary auxiliary data stored in memory due to user interaction, step values, and energy indexes. Basic configuration information is preserved, and the power factor controller returns to its normal operating mode with setup and step learning, without the reconfiguration of system through its parameters.

5.5.4. Full Reset

This menu resets the device to factory settings by deleting all user settings, including step values and energy indexes, as well as all stored data and system configurations of the power factor controller. After this process, the device restarts with default parameters. All user-defined information, historical records and custom configurations are permanently deleted. This feature is used when the system needs to be configured from scratch or when a clean start is desired after a major structural change.

5.5.5. Shipment

This section is the final step in preparing the system for shipment, where panel manufacturers complete all necessary settings, tests, installation, and step learning processes before delivering the system to the end user. All necessary connections and structural adjustments are made for this process. Finally, the current transformer ratio is entered, all controls are verified, and the installation is completed. The steps are automatically recognized, and all configurations are permanently saved. After completing the above steps, the panel manufacturer can use this menu to deliver the device prepared for final on-site installation. This allows the end user to quickly and safely commission the system in the field with a single click.

5.6. Device Information

5.6.1. Serial Number

Displays the device's serial number.

5.6.2. Language

Enables changing the device's language to either English or Turkish.

5.6.3. Software Version

Shows the device's software version.

5.6.4. Access Level

This menu provides three different access levels to ensure the safe, efficient, and long-lasting operation of the power factor controller: User, Chef, and Guru. Each level grants specific permissions aligned with the user's role and responsibilities.

5.6.6. Periodic Maintenance Time

Configures the periodic maintenance interval (in hours).

NOTE: Default: Disabled.

5.6.7. Reset Status

This menu shows the reason why the device is powered on.

6. ANALYZER

The analyzer section contains settings for electrical measurement parameters such as energy, peak values and demands.

7. REACTIVE POWER PROFILE (RPP)

7.1. Instance (Case)

You can see the reactive power profiles in this section.

7.2. Clear

Clear recorded reactive power profiles by navigating to the "Yes" option and confirming.

8. Setup

8.1. Start Setup

Selecting "Yes" in this menu will start the device setup process.

8.2. Settings

8.2.1. Setup Mode

Define whether the setup will use capacitors or reactors.

8.2.2. Grid Frequency

Set the device to operate at 50 Hz or 60 Hz.

8.2.3. Secondary Current Value

Determines the secondary current value of the current transformer. The secondary current value of CT blinks in the menu. Use the UP ( ) and DOWN ( ) buttons to select the desired value, then press SET ( ) to update it.

8.2.4. C.T. Connection Type

Configure power measurement to use either three current transformers for all three phases or only one selected phase.

8.2.5. Current-Voltage Matching

Enable or disable current-voltage matching during setup.

Default: Enabled.

8.2.6. Auto Control

Dynamically detects changes in current transformer and voltage inputs, redirecting to automatic setup if necessary.

Default: Enabled.

8.2.7. Recovery for Measurements

Allows recovery of measurements by averaging available phase values if there are disconnections in voltage or current inputs.

Default: Enabled.

8.2.8. Advanced Settings
8.2.8.1. Try Count

Defines the number of successful measurement repeats required for completing setup.

8.2.8.2. Error at Setup

Adjust the maximum percentage difference allowed between measurements during capacitor step engagement and release.

8.2.8.3. Phase-to-Phase Control

Disables the control preventing the same phase from being connected to multiple voltage inputs. Designed for expert users.

8.2.8.4. C.T. Special Ratio L1

Assign a temporary special ratio for the current transformer connected to phase L1 in case of mismatched ratios due to errors or requirements.

8.2.8.5. C.T. Special Ratio L2

Assign a temporary special ratio for the current transformer connected to phase L2 in case of mismatched ratios due to errors or requirements.

8.2.8.6. C.T. Special Ratio L3

Assign a temporary special ratio for the current transformer connected to phase L3 in case of mismatched ratios due to errors or requirements.

EVENT (WARNING, ALARM) CODES and DESCRIPTIONS

	Event Code	Event Names
WARNING	U.011	1. Line Weak
	U.012	2. Line Weak
	U.013	3. Line Weak
	U.021	1. Line Voltage Zero
	U.022	2. Line Voltage Zero
	U.023	3. Line Voltage Zero
	U.041	Installation Started
	U.042	Step Learning Initiated
	U.050	All Steps Deleted
	U.051	Energy Indices Deleted
	U.052	Min-Max. Values Deleted
	U.053	Demands Deleted
	U.054	Rates Deleted
	U.055	RPP Values Deleted
	U.061	RPP Compressed
	U.071	Manual Step Entered
	U.072	Learning Stopped
	U.073	Installation Stopped
	U.074	Default Values Set
	U.081	Incorrect PIN Entered
	U.082	PIN Changed
	U.083	Private PIN Entered
	U.101	Step 1 Added
	U.102	Step 2 Added
	U.103	Step 3 Added
	...	...
ALARMS	A.201	Step 1 Changed
	A.202	Step 2 Changed
	...	...
	A.301	Step 1 Broken
	A.302	Step 2 Broken
	...	...
	A.401	Step 1 Imbalance
	A.402	Step 2 Imbalance
	...	...
	A.501	Step Common 1 Error
	A.502	Step Common 2 Error
	A.503	Step Common 3 Error
	A.504	Step Common 4 Error
	...	...
	A.507	No Step
	A.508	Step Connection Error

	Event Code	Event Names
ALARMS	A.510	1. Step Block Error
	A.511	1. Step Block Phase 1 Error
	A.512	1. Step Block Phase 2 Error
	A.513	1. Step Block Phase 3 Error
	A.520	2. Step Block Error
	A.521	2. Step Block Phase 1 Error
	A.522	2. Step Block Phase 2 Error
	A.523	2. Step Block Phase 3 Error
	A.530	3. Step Block Error
	A.531	3. Step Block Phase 1 Error
	A.532	3. Step Block Phase 2 Error
	A.533	3. Step Block Phase 3 Error
	A.540	4. Step Block Error
	A.541	4. Step Block Phase 1 Error
	A.542	4. Step Block Phase 2 Error
	A.543	4. Step Block Phase 3 Error
	...	...
	A.600	Over Current
	A.601	1. Line High Current
	A.602	2. Line High Current
	A.603	3. Line High Current
	A.611	1. Line Low Voltage
	A.612	2. Line Low Voltage
	A.613	3. Line Low Voltage
	A.621	1. Line High Voltage
	A.622	2. Line High Voltage
	A.623	3. Line High Voltage
	A.630	Over Inductive
	A.631	Over Capacitive
	A.632	Add Capacitor
	A.633	Add Reactor
	A.634	Current Transformer Value Error
	A.635	Current Transformer Direction Changed.
	A.636	Current Transformer Connection Error
	A.637	Voltage - Current Unmatched
	A.638	Initial Setup Stopped.
	A.639	First Installation Canceled
	A.700	Excess Harmonics
	A.701	Extreme Temperature
	A.710	Modbus Access Denied
	A.720	RPP Table Full
	S.Err	System Error

Communication Parameters

BAUDRATE : 19200 BPS (default)
DATA BITS : 8
PARITY : NONE
STOP BITS : 1

Parameters that can be read, written and deleted via Modbus in remote access are shown in the Modbus Maps table. In the table, in the R/W/E column;

R → Parameter values can be read,

W → Parameter can be written to,

E → Indicates that the parameter value can be deleted.

Note: The parameter can have more than one feature at the same time. For example, if R/W is written in the column, it indicates that the parameter can be both read and written.

To access the Modbus Map:

http://www.gruparge.com/wp-content/uploads/2025/11/RKR_Modbus_Table.pdf

TABLES
CURRENT TRANSFORMER PRIMARY VALUE (X/5 A) TABLE

Index	Other	Index	Other	Index	Other
0	5 A	23	240 A	47	1500 A
1	10 A	24	250 A	48	1600 A
2	15 A	25	300 A	49	1800 A
3	20 A	26	330 A	50	2000 A
4	25 A	27	350 A	51	2200 A
5	30 A	28	360 A	52	2400 A
6	40 A	29	400 A	53	2500 A
7	50 A	30	450 A	54	2600 A
8	60 A	31	500 A	55	3000 A
9	70 A	32	520 A	56	3200 A
10	75 A	33	550 A	57	3500 A
11	80 A	34	600 A	58	3600 A
12	90 A	35	630 A	59	4000 A
13	100 A	36	650 A	60	4500 A
14	120 A	37	700 A	61	5000 A
15	125 A	38	730 A	62	5500 A
16	130 A	39	750 A	63	6000 A
17	150 A	40	800 A	64	6500 A
18	160 A	41	900 A	65	7000 A
19	175 A	42	1000 A	66	7500 A
20	180 A	43	1100 A	67	8000 A
21	200 A	44	1200 A	68	8500 A
22	225 A	45	1250 A	69	10000 A
		46	1400 A		

Current Transformer Table: The values indicated by the indices in this table used for Menu and Modbus are divided by 5, the nominal value of the secondary current, to calculate the current transformer value. Ex: Current transformer value with index 12 is 90/5=18,
The 35th index current transformer value is 630/5=126.

LINE VOLTAGE VALUE TABLE

Index	Other	Index	Other	Index	Other
0	173 V	17	850 V	33	28500 V
1	190 V	18	900 V	34	29250 V
2	200 V	19	1000 V	35	30000 V
3	208 V	20	3600 V	36	30750 V
4	220 V	21	6300 V	37	30800 V
5	380 V	22	7200 V	38	31500 V
6	400 V	23	10500 V	39	32000 V
7	415 V	24	11000 V	40	32800 V
8	440 V	25	12000 V	41	33000 V
9	480 V	26	13800 V	42	33600 V
10	500 V	27	14000 V	43	34500 V
11	525 V	28	15000 V	44	35000 V
12	550 V	29	15800 V	45	35400 V
13	650 V	30	17000 V	46	36000 V
14	690 V	31	17500 V	47	36200 V
15	725 V	32	24000 V	48	38500 V
16	800 V			49	46000 V

Line Voltage Table: This table is used for Menu and Modbus and the values indicated by the indices in this table can be selected for line voltage.

For example: 17th index line voltage is 850 V, 23rd index line voltage is 10500 V.

MEASUREMENT VOLTAGE VALUE TABLE

Index	Other	Index	Other	Index	Other
0	22 V	8	110 V	16	400 V
1	25 V	9	120 V	17	415 V
2	30 V	10	173 V	18	440 V
3	33 V	11	190 V	19	480 V
4	36 V	12	200 V	20	525 V
5	40 V	13	208 V	21	600 V
6	50 V	14	220 V	22	690 V
7	100 V	15	380 V	23	725 V

Measuring Voltage Table: This table is used for Menu and Modbus and the values indicated by the indices in this table can be selected for the measurement voltage.

For example: Measuring voltage with index 9 is 120 V, measuring voltage with index 16 is 400 V.