RKRS / RKRT
User Manual

ADDRESS: Ikitelli OSB Mah. Cevre 14. Blok Sok. Telas Blok Dis Kapi No: 1 Kat: 1-2 Basaksehir/Istanbul

Phone: +90 212 438 80 24
Fax: +90 212 438 80 25

info@gruparge.com

V.25.1

CONTENTS

CONTENTS 2
PROPER USE and SAFETY REQUIREMENTS 8
1. INTRODUCTION 9
1.1. GENERAL FEATURES 9
1.2. MECHANICAL DESIGN FEATURES 9
1.3. ELECTRICAL FEATURES 9
1.4. SETUP AND OPERATION FEATURES 10
1.5. STEPS AND LEARNING FEATURES 10
1.6. SVC STEP FEATURES 11
1.7. COMPENSATION FEATURES 11
1.8. PROTECTION AND RECOVERY FEATURES 12
1.9. SMART DIAGNOSIS AND CORRECTION FEATURES 12
1.10. EVENT / WARNING / FAULT LOGS 13
1.11. ANALYSIS AND HARMONIC MEASUREMENT FEATURES 13
1.12. DISPLAY AND USABILITY FEATURES 13
1.13. ACCESS AND SECURITY FEATURES 14
1.14. COMMUNICATION FEATURES 14
1.15. OTHER FEATURES 14
1.16. MEASURED AND DISPLAYED LINE PARAMETERS 15
1.17. RKRS / RKRT PFC TECHNICAL DRAWING 15
1.18. CONNECTION DIAGRAM 16
1.18.1. RKRS 07/12/18 Power Factor Controller With SVC 16
1.18.2. RKR T18 Power Factor Controller With SVC 16
1.19. SCREEN AND BUTTONS 17
1.19.1. Screen Sections 17
1.19.1.1. Step Information Bar 17
1.19.1.2. Header Information Bar 18
1.19.1.3. Status Information Bar 18
1.19.1.4. Button Information Bar 18
2. QUICK SETUP 19
2.1. DEVICE SETUP 19
3. MAIN SCREENS AND SUB-SCREENS 19
3.1. MAIN SCREEN OVERVIEW 19
3.2. MAIN VALUES 19
3.2.1. Instantaneous Line Values 20
3.2.2. Compensation Status 20
3.2.3. Reactive to Active Ratios 20
3.3. VOLTAGE / CURRENT (RMS) 21
3.3.1. Phase-to-Phase Voltages / Frequency 21
3.3.2. Voltage / Current Angle and Asymmetry 21
3.3.3. Voltage / Current Min-Max (Import) 22
3.3.4. Voltage / Current Min-Max (Export) 22
3.3.5. Voltage / Current Demand (Import) 22
3.3.6. Voltage / Current Demand (Export) 23

3.4. ACTIVE AND REACTIVE POWERS....23
3.4.1. Power Triangle Graph....23
3.4.2. Apparent / Active / Reactive Powers....25
3.4.3. Active / Reactive Min-Max (Import)....25
3.4.4. Active / Reactive Min-Max (Export).. 25
3.4.5. Active / Reactive Demand (Import)....26
3.4.6. Active / Reactive Demand (Export)....26
3.5. PHASOR DIAGRAM AND ANGLES....26
3.5.1. Power Quality....27
3.6. IMPORT ENERGIES....27
3.6.1. Export Energies....27
3.6.2. All Energies....28
3.6.3. Energy Ratios (Import)....28
3.6.4. Energy Ratios (Export)....28
3.7. VOLTAGE / CURRENT (%) HARMONICS....29
3.8. VOLTAGE (RMS) HARMONICS....29
3.9. CURRENT (RMS) HARMONICS....29
3.10. VOLTAGE HARMONIC GRAPH....30
3.11. CURRENT HARMONIC GRAPH....30
3.12. RPP Table (Reactive Power Profile)....31
3.13. WARNING LOG....31
3.13.1. Event Log....31
3.14. SVC POWERS AND USAGES....32
3.15. STEPS (Nominal / kVAr) 32
3.15.1. Step Usage Details....32
4. RKRS PFC MAIN MENU....33
4.1. QUICK MENU....33
4.1.1. Steps 33
4.1.1.1. Step Learning.. 33
4.1.1.2. Control and Clear Details....33
4.1.1.3. Step Common Control....33
4.1.1.4. Clear Notifications 33
4.1.2. Response Times....33
4.1.3. Modbus Address....33
4.1.4. Internet Portal 33
4.1.5. Date & Time....33
4.1.6. Language....33
4.1.7. Start Setup / Assistant.... 34
4.2. STEPS AND SETTINGS.... 34
4.2.1. Step Powers and Manual Entry....34
4.2.2. Step Learning....34
4.2.2.1. All Steps....34
4.2.2.1.1. Smart....34
4.2.2.1.2. Regular....34

4.2.2.1.3. Fast..... 34
4.2.2.2. Single Step Learning..... 34
4.2.2.3. SVC Learning..... 34
4.2.2.4. Group 1 (Steps 1-7)..... 34
4.2.2.5. Group 2 (Steps 8-12)..... 34
4.2.2.6. Group 3 (Steps 13-18)..... 34
4.2.2.7. Steps Waiting for Learning..... 34
4.2.3. Control and Clear Details..... 34
4.2.4. Settings..... 35
4. 2.4.1. Discharge Time..... 35
4.2.4.1.1 Discharge Time for All..... 35
4.2.4.1.2 Discharge Time (Steps 1-7)..... 35
4.2.4.1.3 Discharge Time (Steps 8-12)..... 35
4.2.4.1.4 Discharge Time (Steps 13-18)..... 35
4.2.4.2. Equal Aging..... 35
4.2.4.2.1 Control..... 35
4.2.4.2.2 Equivalent Percentage..... 35
4.2.4.2.3 Operating Time Difference..... 35
4.2.4.3. Auto Control..... 35
4.2.4.4. Delay Time between Steps..... 35
4.2.4.4.1 Delay for All..... 35
4.2.4.4.2 Delay (Steps 1-7)..... 35
4.2.4.4.3 Delay (Steps 8-12)..... 35
4.2.4.4.4 Delay (Steps 13-18)..... 35
4.2.4.5. Advanced Settings..... 35
4.2.4.5.1. Reset All Details..... 35
4.2.4.5.2. Learning Measurement Error..... 35
4.2.4.5.3. Imbalance Percentage..... 35
4.2.4.5.4. Depreciation Percentage..... 35
4.2.5. Step Common Control..... 35
4.2.5.1. Step Common Control..... 35
4.2.5.2. Step Common 1..... 36
4.2.5.3. Step Common 2..... 36
4.2.5.4. Step Common 3..... 36
4.2.6. Clear Notifications..... 36
4.3. COMPENSATION..... 36
4.3.1. Reactive Limits..... 36
4.3.1.1. Inductive Limit..... 36
4.3.1.2. Capacitive Limit..... 36
4.3.2. Response Times..... 36
4.3.2.1. Inductive..... 36
4.3.2.2. Capacitive..... 36
4.3.2.3. Normal..... 36
4.3.3. Unmetered Power..... 36
4.3.3.1. Unmetered Power 3-Phase..... 37
4.3.3.2. Operating Time..... 37
4.3.3.3. Unmetered Power L1..... 37

4.3.3.4. Unmetered Power L2 37
4.3.3.5. Unmetered Power L3 37
4.3.4. Target Cos / Tan 37
4.3.4.1. Target Cos / Tan 37
4.3.4.2. Operating Time 37
4.3.5. Generator 37
4.3.5.1. Compensation with Generator 37
4.3.5.2. Target Cos / Tan (Generator) 37
4.3.6. Export Compensation 37
4.3.7. PROTECTION 37
4.3.7.1. Overvoltage 37
4.3.7.2. Undervoltage 37
4.3.7.3 Excessive Harmonics 37
4.3.7.4 Overtemperature 37
4.3.7.5. Set Values 37
4.3.8. HYSTERESIS 37
4.3.8.1. Inductive 37
4.3.8.2. Capacitive 38
4.3.8.3. Normal 38
4.4. DEVICE SETTINGS 38
4.4.1. Measurement and Transformers 38
4.4.1.1. Current Transformer Ratio 38
4.4.1.2. Current-Voltage Pairs 38
4.4.1.3. Current Transformer Directions 38
4.4.1.4. Voltage Transformers 38
4.4.1.4.1. Line Voltage 38
4.4.1.4.2. Measurement Voltage 38
4.4.2. Modbus Configuration 38
4.4.2.1. Modbus Address 38
4.4.2.2. Modbus Speed (bps) 38
4.4.2.3. Data, Stop Bits and Parity 38
4.4.2.3.1. Data Bits 38
4.4.2.3.2. Parity Setting 38
4.4.2.3.3. Stop Bits 39
4.4.2.4. Silent Interval (xBit) 39
4.4.2.5. Mode 39
4.4.2.6. Modbus Protection 39
4.4.2.6.1. Read Protection 39
4.4.2.6.2. Write Protection 39
4.4.2.6.3. Read Password 39
4.4.2.6.4. Write Password 39
4.4.3. Display Settings 39
4.4.3.1. Average 39
4.4.3.1.1. Sample Count 39
4.4.3.1.2. Refresh Interval 39
4.4.3.1.3. Control Percentage 39
4.4.3.2. Password Protection 39
4.4.3.3. Access Level 39

4.4.3.4. Screen Saver 39
4.4.3.5. Screen Timeout 39
4.4.3.6. Brightness Level 39
4.4.4. SVC Settings 40
4.4.4.1. Active / SVC Power Ratio 40
4.4.4.2. Reactive Usage Percentage 40
4.4.4.3. Normal Usage Percentage 40
4.4.4.4. SVC Thermal Control 40
4.4.5. Advanced Settings 40
4.4.5.1. Power Off / On 40
4.4.5.2. Default Settings 40
4.4.5.3. Device Reset 40
4.4.5.4. Measurement Period 40
4.4.6. Device Information 40
4.4.6.1. Serial Number 40
4.4.6.2. Software Version 40
4.4.6.3. Build Date and Time 40
4.4.6.4. Hardware Version 40
4.4.6.5. Hardware Version 40
4.4.6.6. Language / Dil 40
4.4.6.7. Working Hours 40
4.4.6.8. Periodic Maintenance Time 40
4.5. ANALYZER 41
4.5.1. Energy 41
4.5.2. Peak Values 41
4.5.3. Demands 41
4.5.3.1. Clear / Reset 41
4.5.3.2. Demand Period 41
4.5.4. Harmonics 41
4.5.5. Reactive Power Profile (RPP) 42
4.5.5.1. Clear / Reset 42
4.5.5.2. Power Resolution 42
4.5.5.3. Maximum Difference (%) 42
4.5.5.4. Difference Percentage 42
4.6. WARNING AND EVENT LOGS 42
4.6.1. Clear Event Logs 42
4.6.2. Clear Warning Logs 42
4.6.3. Set Values 42
4.6.3.1. Overvoltage 42
4.6.3.2. Undervoltage 42
4.6.3.3. Excess Harmonics 42
4.6.3.4. Excess Temperature 43
4.6.3.5. Weak Line Percentage 43
4.6.4. Fault Logs 43
4.6.5. Permanent Warning LED 43
4.7. SETUP 43
4.7.1. Start Setup / Assistant 43
4.7.2. Settings 43
4.7.2.1. Setup Mode 43
4.7.2.2. Network Frequency 43

4.7.2.3. C.T. Connection Type....43
4.7.2.4. Current-Voltage Matching....43
4.7.2.5. Auto Control....43
4.7.2.6. Recovery for Measurements....43
4.7.2.7. Advanced Settings....44
4.7.2.7.1. Try Count....44
4.7.2.7.2. Error at Setup....44
4.7.2.7.3. Measurement Factor....44
4.7.2.7.4. Phase-to-Phase Control....44
4.7.2.7.5. C.T. Special Ratio L1....44
4.7.2.7.6. C.T. Special Ratio L2....44
4.7.2.7.7. C.T. Special Ratio L3....44
4.7.3. Ignore the First Setup....44

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 should be done and used by only expert professionals and in accordance with safety regulations and instructions.

The device operates with current transformers. Do not strictly leave current transformer tips unattached. Dangerous high voltage can occur.

1. INTRODUCTION

1.1 GENERAL FEATURES

The RKRS PFC (Power Factor Controller) measures the voltages and currents of three phases, calculates the reactive power drawn by operating loads and provides a effective response through its independently controlled SVC (Static Var Compensator) steps in addition to conventional capacitor and reactor steps it automatically learns. It is a new generation advanced Power Factor Controller (PFC).

Additionally, the RKRS PFC measures and displays parameters such as phase currents, phase-to-neutral and phase-to-phase voltages, frequencies, active and reactive powers, harmonics and phase angle differences between current and voltage. It also offers monitoring capabilities through its communication interface. Furthermore, it measures and records active and reactive energies for both import and export.

The PFC records demand and peak values for these measured line parameters, which can be viewed directly on the device.

Many necessary adjustments related to the device (Current Transformer Ratio, Measurement and Line Voltages, Compensation Parameters, etc.) can be made either through individual menus or collectively via the "Assistant" section.

Thanks to its communication capability, all read parameters can be remotely monitored via standard MODBUS protocols and various adjustments can be performed.

Alarms can be generated through various set values configured in the device menu. The compensation process can enable or disable measurement recovery features for protection against disconnections and connection losses.

1.2 MECHANICAL DESIGN FEATURES

- Slim ergonomic design with a depth of 48 mm, allowing for compact panel design.
- Terminal structure positioned for easy cable mounting.
- Safe C.T. secondary connection with fixed current terminal input, enabling the use of 4 mm² cables to prevent power loss over long distances.
- SVC options with +07, +12, +18 steps.
- Differentiated terminal structures for 7, 5 and 6-step groups to prevent interchangeability.
- Terminal numbers grouped according to the functions of input and output terminals.
- Design suitable for easy field setup.

  When panel modifications are necessary:
- The existing RKRS PFC mounted on the front panel, along with its voltage, step, SVC, generator and communication terminals, can be detached. However, the current transformer secondary connections remain attached to the PFC to prevent them from being left disconnected.
- The PFC with removed mounting brackets can be taken out by pulling it forward from the metal panel and rotated sideways for removal.
- The new PFC is installed on the panel cover. The current transformer secondary connections are detached from the existing PFC one by one and quickly connected to the fixed current inputs of the newly installed RKRS PFC.
- Once the other terminals are connected to the PFC and power is supplied, the setup process can begin.

1.3 ELECTRICAL FEATURES

- Current measurement precision of 0.5 mA.
- Current measurement range of 0.5 mA to 6.5 A.
- Voltage measurement range of 5 - 300 VAC (Phase-Neutral).

- Safe operation within a supply voltage range of 70 - 300 VAC (Phase-Neutral).
- Compatibility with 50 Hz / 60 Hz networks.
- The presence of any Phase-Neutral voltage is sufficient to supply power and operate the PFC.
- Hardware safety against incorrect Phase-Phase connections to Phase-Neutral inputs.
- Detection and warning for incorrect Phase-Neutral connections.
- 5 A relay in step contactor control outputs.
- Equipped with three independent internal power supplies, each with an isolated 12V DC (250mA) capacity, without the need for an external power supply. (RKR T18 - Thyristor Model)

1.4. SETUP AND OPERATION FEATURES

- Quick Setup with only the Current Transformer Ratio input.
- Easy Configuration through the Setup Assistant.
- Ability to setup with three-phase and single-phase steps.
- Option to configure with capacitor or reactor steps.
- Capability to setup with only SVC steps.
- Automatic pairing for current and voltage inputs.
- Option to disable the automatic current - voltage pairing feature.
- Automatic current direction correction for each phase.
- Detection and warning messages for various incorrect connections and unsuitable conditions, including:
- Voltage inputs, step commons, generator inputs and current transformers.
- Both capacitors and shunt reactors connected to step outputs during setup.
- Secondary outputs of current transformers being connected in series to form a loop.
- The same phase connected to multiple voltage inputs.
- Broken secondary connections of current transformers.
- Option to configure using a single current transformer by specifying any phase.
- Automatic current-voltage pairing capability when three-phase voltage is connected while using a single current transformer.
- If the PFC is reset and forgotten in the panel, it will observe line stability after one hour, automatically complete the setup and step learning and start compensation as a safeguard.
- In case of connection changes to the current transformers after setup, the PFC detects the error of secondary outputs being connected in series to form a loop, automatically switches to single current transformer setup and continues compensation under these conditions.
- Detection and warning for one or all of the three current transformers having different transformation ratios.
- Ability to perform accurate measurement and proper compensation by configuring specific CT Ratio parameters for each current transformer when different transformation ratios are used for any reason.

1.5. STEPS AND LEARNING FEATURES

- Ability to freely connect capacitors or reactors to any step.
- Smart step learning algorithm that monitors line stability before activation/deactivation steps.
- Monitoring line stability to initiate all automatic step learning processes.
- Option to learn all steps from a single menu.
- Option to learn a specific single step.
  Option to learn SVC steps.
- Option to learn Block/Group steps (1-7, 8-12, 13-18).
- Adaptive mode options for smart/regular/fast step learning for all learning modes.
- Ability to automatically initiate learning for unlearned steps by observing operational stability after sensitivity loss due to load changes.
- Step learning performance with 1.5-2 seconds accuracy within a 3% margin of error.
- Capability to learn three-phase, dual-phase and single-phase capacitors and reactors.

- Rapid learning by monitoring common step voltages and learning only appropriate step groups.
- Automatic learning for step groups added later.
- Termination of ongoing learning processes when the generator is activated or voltage/current connections are interrupted, triggering PFC protection.
- Warning messages and rejection of user requests to learn steps under conditions that may cause incorrect values or cancellations.
- Preservation of current step values without canceling them under recovery and protection conditions or in case of current transformer connection failure.
- User-friendly manual step value entry screen.
- Differentiation of capacitors (red) and reactors (blue) with colored numbers in the Step Information Bar.
- Indication of phase allocation for steps in the Step Information Bar.
- Highlighting of manually entered steps in the Step Information Bar with an underline.
- Display of the specific phase with issues for faulty/imbalanced steps in the Step Information Bar.
- Notification of modified, canceled or newly added steps with different background colors after automatic or user-initiated learning.
- Warning records and visual indications of faulty steps with excessive phase imbalance after learning.
- Removal of manually entered steps from manual mode during learning if sensitivity conditions are met.
- Equal aging feature and settings for steps.
- Colored manual control for all steps.
- Grouped step commons with AC and DC type supply control features, parameter settings and warning messages.
- Detailed display of step powers, statuses, activation/deactivation counts and usage durations, grouped by step.
- Measurement of step common voltage levels and display on the related group page with different colors.
- Differentiated discharge times for each step groups.
- Differentiated inter-step delay times for each step groups.

1.6. SVC STEP FEATURES

- Smart SVC steps with 10,000-step resolution.
- Automatic pairing of SVC driver trigger control signals and phases.
- SVC shunt reactor thermal input protected against overvoltage and incorrect connections with connection fault and warning notifications.
- SVC thermal protection.
- Deactivation of SVC steps under conditions exceeding the adjustable "Active Power / SVC Power" ratio.
- Disabling of SVC steps during generator operation.

1.7. COMPENSATION FEATURES

- Advanced intelligent compensation response algorithm.
- Ability to perform hybrid compensation with three-phase capacitors/reactors and single-phase capacitors/shunt reactors.
- Hybrid and effective compensation capability with conventional steps and fast inductive SVC powers.
- Adjustable inductive and capacitive limits.

- Different response times for inductive, capacitive and normal (low reactive) ranges based on the entered limit values.
- Ability to perform bidirectional compensation for both import and export.
- Option to disable compensation during export.
- Ability to perform compensation using a single current transformer by selecting any current phase.
- Adjustable target Cos (φ) setting with optional duration and warning messages.
- Option to disable compensation using the generator control input.
- Safe compensation capability during generator operation with a different target Cos (φ) setting.
- Ability to perform capacitive compensation using only SVC steps.
- SVC response performance within 1.5 seconds of energization.
- High-precision, balanced three-phase unmetered power input (100 VAr sensitivity) which can be set as temporary or permanent to address inductive effects of high-voltage transformers, capacitive effects of long cables, etc.
- Permanent unmetered power input with 1 VAr sensitivity per phase to eliminate imbalances and calibration differences between meter and PFC measurements.
- Warning messages for insufficient capacitors and insufficient shunt reactors during compensation.

1.8. PROTECTION AND RECOVERY FEATURES

- Ability to detect disconnections in voltage and current inputs for phases during compensation and maintain compensation based on the average values of the remaining operational phases.
- Detection of transmission errors in current transformer connections over time and issuance of warning messages.
- Detection of total disconnection of all current transformer secondary outputs, deactivation of steps to avoid capacitive penalty risks and issuance of warning messages.
- Protection settings and options to disable compensation in cases of:
  Overvoltage, High harmonic levels, Excessive panel temperature.

1.9. SMART DIAGNOSIS AND CORRECTION FEATURES

- Automatic step learning initiated by monitoring operational stability to diagnose faulty steps and ensure effective compensation during operation.
- Ability to detect connection errors caused by changes in voltage and current input connections after the initial setup and direct the system to automatic setup, ensuring accurate compensation upon completion.
- Detection of phase sequence changes and redirection to automatic setup.
- During subsequent setups after the initial setup and step learning, the ability to diagnose newly added, modified or canceled steps and redirect to automatic step learning.
- Safe compensation through detection of connection and step errors, redirection to automatic setup and step learning when the PFC is moved to another panel without being reset.
- Detection of step sticking and malfunctions with warning messages.
- Detection of step contactor coil faults and warning messages.
- Detection of missing fuses for step commons and warning messages.
- Safe shutdown by early detection of power outages to prevent data loss.
- Detection of short-term power outages with corresponding warning messages.

1.10. EVENT / WARNING / FAULT LOGS

- Comprehensive event/warning/fault logs with timestamped records and clear messages.
- List of the first and last occurrences of event/warning/fault statuses, along with the number of repetitions in between.
- Ability to delete event, warning or fault logs individually.
- Warning messages and adjustable set values for voltage, harmonics and panel temperature.
- User-configurable warning and fault LEDs.
- Notification through flashing alarm LEDs whenever a warning or fault occurs.
- Display of related text messages in the Status Information Bar whenever a warning or event occurs.

1.11. ANALYSIS AND HARMONIC MEASUREMENT FEATURES

- Reactive Power Profile (RPP) Analysis sorted from largest to smallest based on energy/time/inductive/capacitive/ratio requirements for panel step arrangement.
- Indication of step insufficiency in power samples with different background colors.
- Tracking of the operational instantaneous reactive power sample with a differentiated background color in the RPP list.
- Measurement of harmonics up to the 63rd harmonic for current and voltage.
- Display of harmonics as percentages and RMS values.
- Graphical display of harmonics on both automatic and manual scales.
- THDU and THDI values applicable for each phase.
- Various angle values between voltage and current.
- Minimum and maximum peak values.
- Demand values and their settings.

1.12. DISPLAY AND USABILITY FEATURES

- 3.5-inch TFT color display with 320x480 resolution.
- A rich-content, visually efficient and fast-operating screen and menu design.
- Customizable customer/company/contact information (up to 40 characters) displayed both on the screen saver and the Status Information Bar, editable via remote monitoring.
- Smart Button Information Bar indicating the main or sub-screen transition when the corresponding button is pressed.
- Detailed warning and information messages displayed in pop-up screens.
- Summary information messages displayed in the Status Information Bar for monitoring setup, step learning, warnings, events and operating conditions.
- Status Information Bar background color changes based on exceeding inductive or capacitive limits.
- Easy-to-understand PFC statuses with colors and icons.
- Main values and detailed compensation screens.
- Display of voltage pairing channels and their correct voltage phase positions.
  Phasor Diagram Graph.
- Vector representation with a four-quadrant Power Triangle Graph for power.
- Step and SVC status screens.
- Phase-to-phase representation of the reactive powers drawn by the operation.
- Display of the total power of engaged steps on a phase-to-phase screen.
- Energy indexes compatible with meter codes.
- Separate Energy Indexes for generator operating conditions.
- Easy execution of various parameter adjustments and function calls through menus.

- Information screens showing device details such as serial number, software and hardware version.
- Device runtime display.
- Screen saver feature with adjustable activation timing.
- Adjustable sample count and percentage difference settings for average calculations of displayed values.
- "Setup Assistant" screen providing sequential configuration of parameters required for setup and compensation.

1.13. ACCESS AND SECURITY FEATURES

- Customizable password protection and a unique reset password for each PFC.
- Ability to enable or disable password protection.
- Default operation without password protection when the device is first powered on.
- Automatic lowering of the access level if no buttons are pressed for 5-6 minutes when password protection is active.
- Display of the current access level in the main menu header.
- Intelligent menu system offering three levels of secure and controlled access.
- Practical access to steps, step learning, step control, step information updates, setup, Modbus address, language changes and compensation cycle times via the Quick Menu section.
- Smart menu access feature enabling quick and practical access for setup and step learning when needed.
- Ability to set any "Main Screen" as the default screen by pressing the Menu button for an extended duration.
- Quick switching between the current screen and the Main Screen by pressing the Menu button for a shorter duration.

1.14. COMMUNICATION FEATURES

- Remote monitoring and block read/write capabilities via standard Modbus RTU and Modbus ASCII, with speeds up to 256 kbps.
- High-resolution Modbus data width with 32-bit parameters for line parameters and 64-bit indexes for energy data.
- Modbus protection options for both reading and writing.
- Safe remote shutdown and restart of the PFC via communication.
- Communication status LED.

1.15. OTHER FEATURES

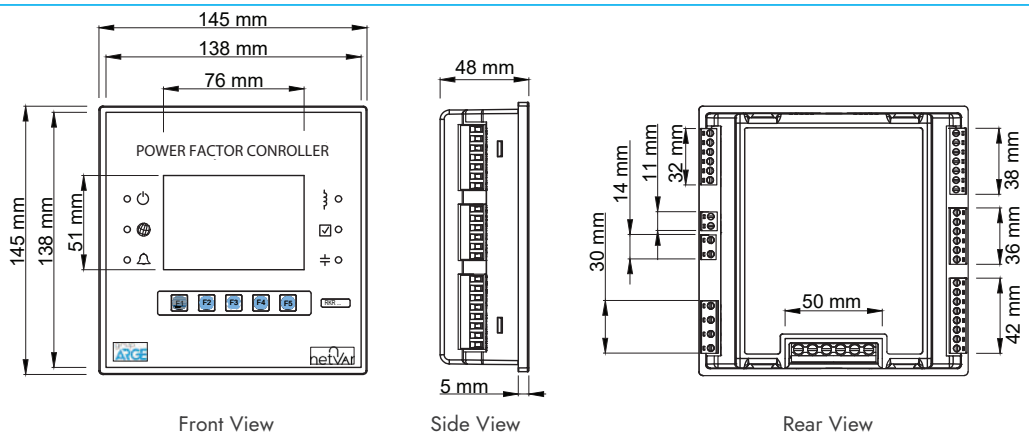
- Real-time clock and calendar.
- Internet link displayed on the screen for the PFC user manual.
- Recording and display of device power-on and power-off times.
- Periodic maintenance time settings and warning messages.
- Approximate panel temperature measurement and warning.
- Measurement of the device’s internal power supply voltage and corresponding warnings.
- Menu function for restoring factory settings collectively for some customized parameters.
- Safe device reset feature that sequentially deactivates engaged steps.

1.16. MEASURED AND DISPLAYED LINE PARAMETERS

- Phase-to-Phase (VLL) and Phase-to-Neutral (VLN) measurements for Voltage (V), Current (I), Frequency (F), Active Power (P), Reactive Power (Q), Apparent Power (S), Cos (φ), Power Factor (PF), Reactive/Active Power Ratio (Q/P), THDU, THDI and Asymmetry.
- RMS and Percentage values for harmonics up to the 63rd harmonic for both current and voltage (odd/even harmonics).
- Angle and asymmetry values for voltage and current.
- Active, Inductive/Capacitive energy indexes for both import and export.
- Active, Inductive/Capacitive energy indexes for generator operations.
- Accumulated and instantaneous inductive/capacitive (Q/P) percentage ratios for both import and export.
- Demand, minimum/maximum peak values for import and export.
- Total phase-to-phase power of engaged steps.
- Instantaneous phase-to-phase reactive loads drawn by the operation.
- Phase-to-phase powers and percentages used by the SVC.
- SVC thermal status and connection errors.
  Generator statuses.
- Approximate internal temperature of the panel.

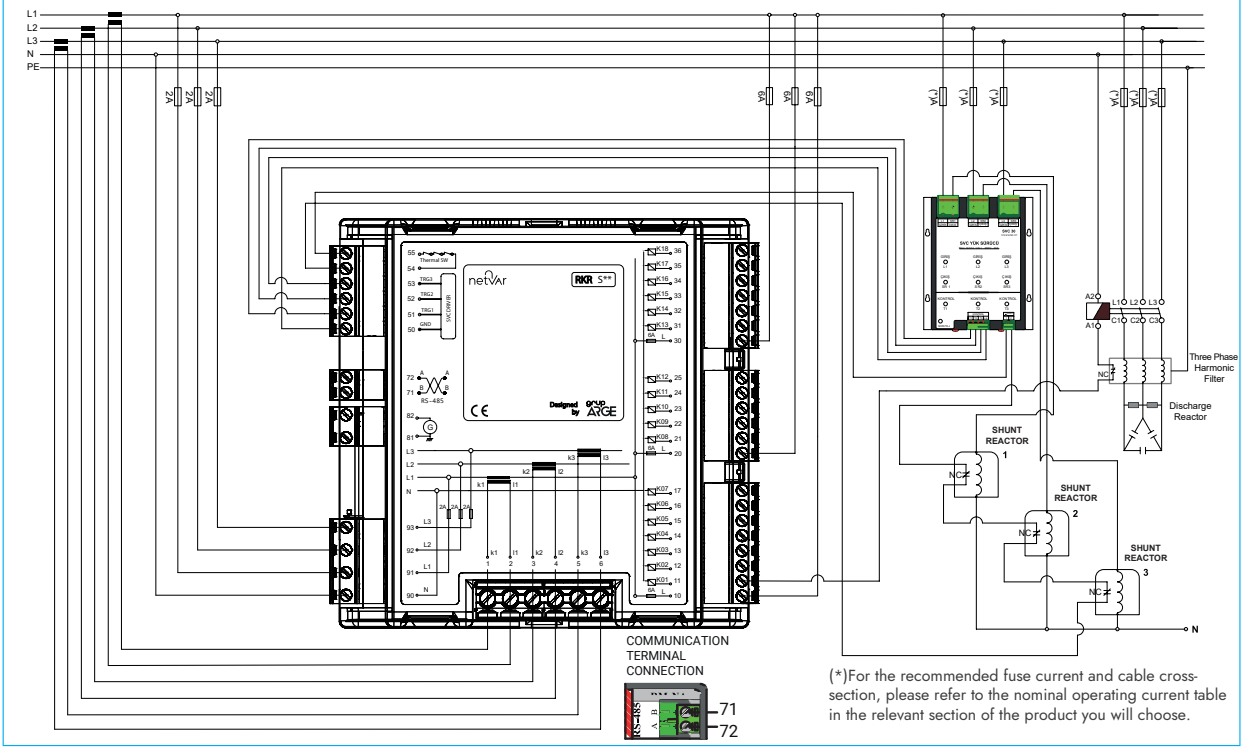
1.17. RKRS / RKRT PFC TECHNICAL DRAWING

RKRS / RKRT Power Factor Controller With SVC



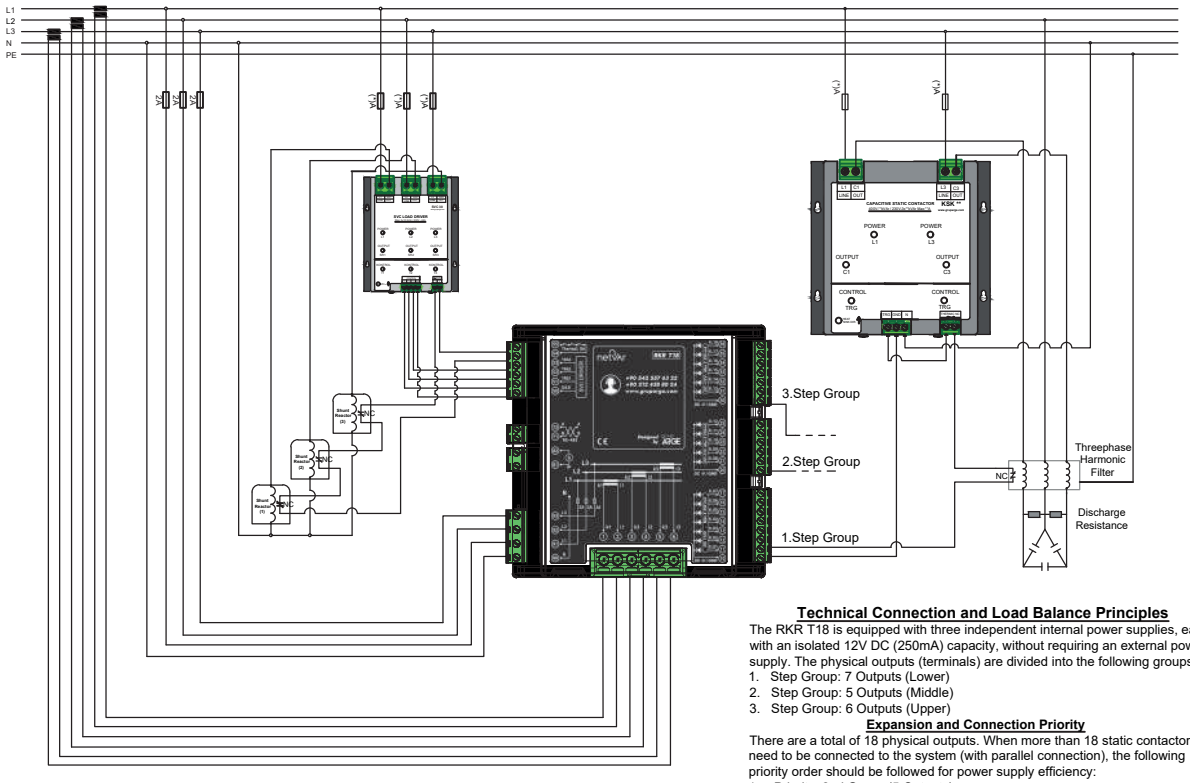
1.18. CONNECTION DIAGRAM

RKRS 07/12/18 Power Factor Controller With SVC



(*)For the recommended fuse current and cable cross-section, please refer to the nominal operating current table in the relevant section of the product you will choose.

RKR T18 Power Factor Controller With SVC



Technical Connection and Load Balance Principles

The RKR T18 is equipped with three independent internal power supplies, each with an isolated 12V DC (250mA) capacity, without requiring an external power supply. The physical outputs (terminals) are divided into the following groups:

1. Step Group: 7 Outputs (Lower)
2. Step Group: 5 Outputs (Middle)
3. Step Group: 6 Outputs (Upper)

Expansion and Connection Priority

There are a total of 18 physical outputs. When more than 18 static contactors need to be connected to the system (with parallel connection), the following priority order should be followed for power supply efficiency:

1. Priority: 2nd Group (5 Outputs)
2. Priority: 3rd Group (6 Outputs)
3. Priority: 1st Group (7 Outputs)

Safety and Efficiency Warnings:

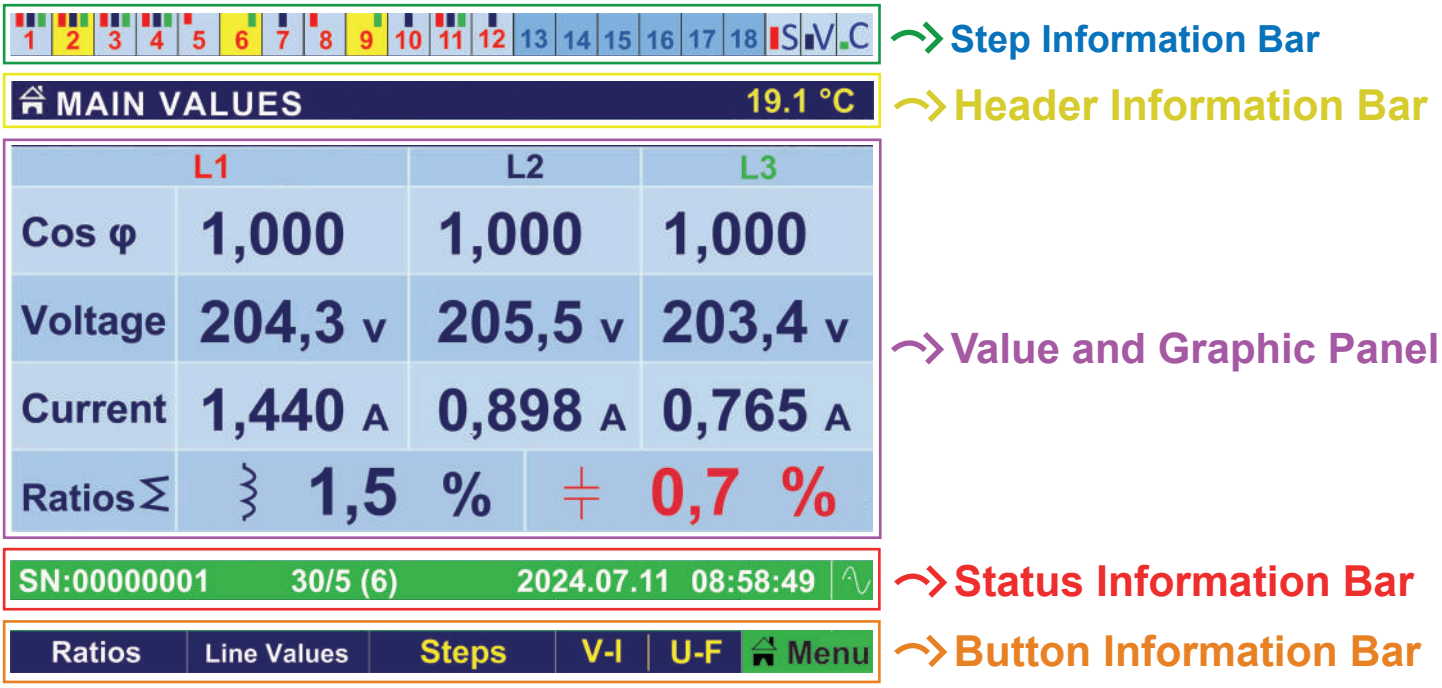
Group Capacity: Each step group can electrically supply up to 10 static contactors in total.

Parallel Connection Limit: A maximum of 2 static contactors should be connected in parallel to a single output terminal.

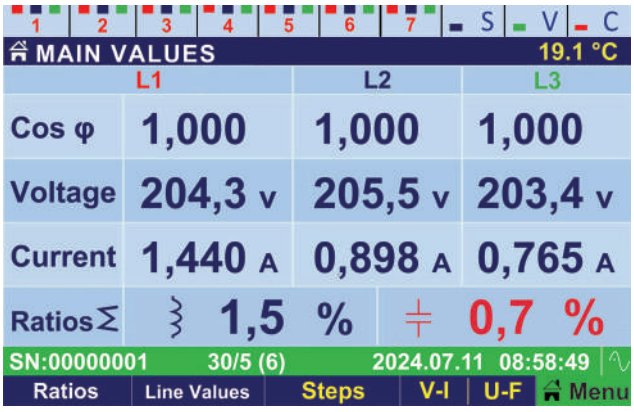
Load Distribution: To ensure the system can continue compensation in the event of a possible failure, high and low power steps should not be grouped together in a single group; they should be distributed homogeneously (equally) across all groups.

1.19. SCREEN AND BUTTONS

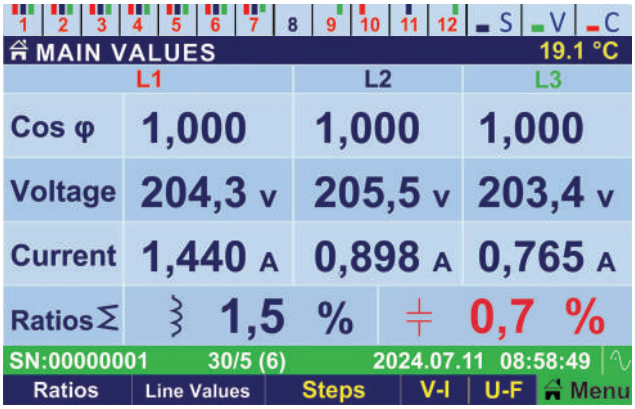
1.19.1. Screen Sections



(RKRS 18)



(RKRS 07)



(RKRS 12)

1.19.1.1 Step Information Bar

This section displays all information and statuses of the compensation steps except for their power and statistical values. It is divided into four sub-sections: Group 1, Group 2, Group 3 and SVC Group. The information and statuses of the steps can be easily understood based on background colors, the colors and numbers of phase bars and other visual indicators. Key details displayed include: Whether the steps are learned or not. Whether they are capacitors or reactors. Whether they are single-phase or three-phase. The phases on which they are positioned. Whether they are balanced or unbalanced. Whether they are active or passive. Whether they are discharging or ready. Whether their values have changed. Whether they are canceled, newly added or manually activated.
Additionally, during single-step learning, manual step entry or step control, the selected step can be tracked in this section.

1.19.1.2 Header Information Bar

This section displays the titles of the screens being navigated. Depending on the main page being shown, it also displays additional details such as temperature values, step common voltages and SVC status.

1.19.1.3. Status Information Bar

This bar displays key information such as the device serial number, current transformer ratio, Modbus address, date and time. It also provides various notifications and warnings to the user. The background color of this bar changes based on the reactive index ratio: Blue if the inductive limit is exceeded. Red if the capacitive limit is exceeded. Green if the values are within the specified limits.
Additionally, company/customer names entered via Modbus are displayed in this bar at regular intervals.

1.19.1.4. Button Information Bar

The device features 5 buttons and their functions are customized based on the menus and main screens being displayed. Buttons for navigating between main screens are labeled in yellow, while those for switching between sub-screens are labeled in white.
The far-right green button has three distinct functions:
1. Short press: Opens the device menu.
2. Long press (until the blue home icon appears): Provides quick access to the main measurement screen.
3. Very long press (until the red home icon appears): Sets the current main screen as the default custom screen.

If a custom default screen different from the main screen is set, holding the button again (until the blue home icon appears) allows quick switching between the main measurement screen and the custom screen.
When the buttons are pressed, directional arrow icons will appear in the Button Information Bar, assisting the user with navigation. If no buttons are pressed, the abbreviated titles of the screens accessible via the buttons will be displayed in their respective boxes, as shown below.

Short Press on the Menu Button: Opens the device's main menu. In the Menu: The buttons perform the functions shown in the illustration below.

The Exit Button allows the user to directly exit the menu. The Back Button returns the user to the previous main menu from the current menu screen.

2. QUICK SETUP

2.1. DEVICE SETUP

After the device connections are made in accordance with the connection diagram, the device is energized. When the device is energized after the phase and neutral connections are made correctly, it displays the serial number and brings the "Current Transformer Ratio (C.T)" parameter to the screen.

Here, the current transformer ratio is entered using the F3 and F4 buttons and the first setup is automatically started by pressing the F5 OK Confirmation button.

Alternatively, by pressing the "Assistant" (F2) button, all parameters required for setup can be set sequentially from a single menu and the setup can be started.

If the neutral connection is not made or if the cable is disconnected or its other end is left open, the LEDs on the device will repeatedly blink for approximately 100 - 200 ms to notify the user of the connection issue. In this case, the neutral connection must be checked and corrected.

If this setup step is skipped with F5 Cancel button, the device will periodiclly display a warning on the screen and redirect the user to the Setup Option in the quick menu when the menu button is pressed.

If a resetup is required after the initial setup, this option can be selected from the device's Setup Menu to start the setup process again.

3. MAIN SCREENS AND SUB-SCREENS

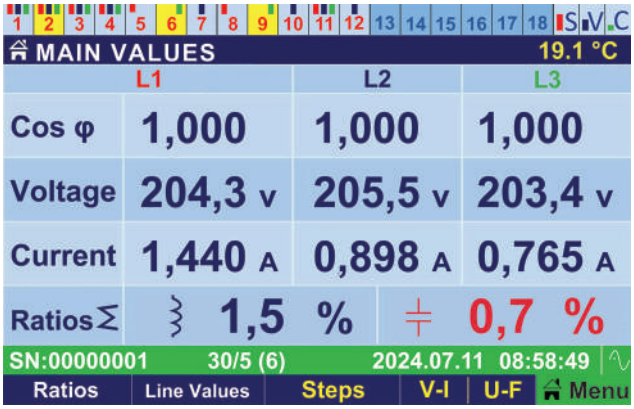
The device includes a total of 14 Main Screen titles. After the setup is completed, the default main screen is displayed as shown below.
NOTE : While navigating between other main and sub-screens, you can return to the Main Screen by pressing and holding the F5 button (labeled "Menu") until the blue home icon appears.

3.1. MAIN SCREEN OVERVIEW

The default main screen of the device is shown on the adjacent display. After completing the setup, the device starts with this screen.
This screen displays the following information in order, from top to bottom, for the three phases:
Cos (φ), Voltage, Current, Total Reactive Energy Ratios (as percentages).
You can access the sub-screens of this main screen using the F1 and F2 buttons located on the left side of the Button Information Bar, which include short descriptions in white text.

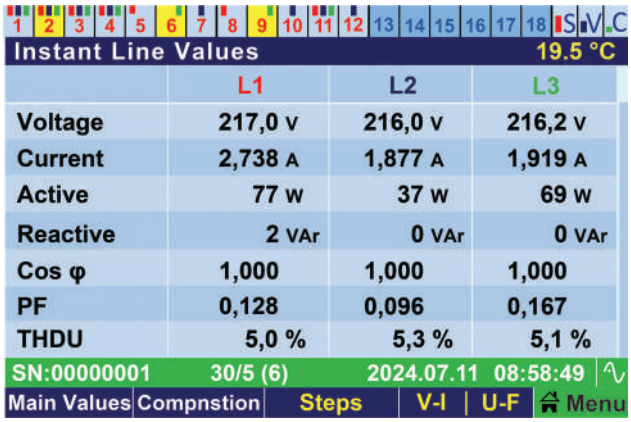
3.2. MAIN VALUES

The screen on the side is the default home screen of the device. After completing the device setup, the device starts with this screen. On this screen, from top to bottom, the Cos φ of three phases, Voltage Current, and the Total Reactive Energy Ratios are displayed as percentages in order. The sub-screens of this main screen can be accessed using the F1 and F2 keys, which are located on the left side of the key information row and have short descriptions written in white.



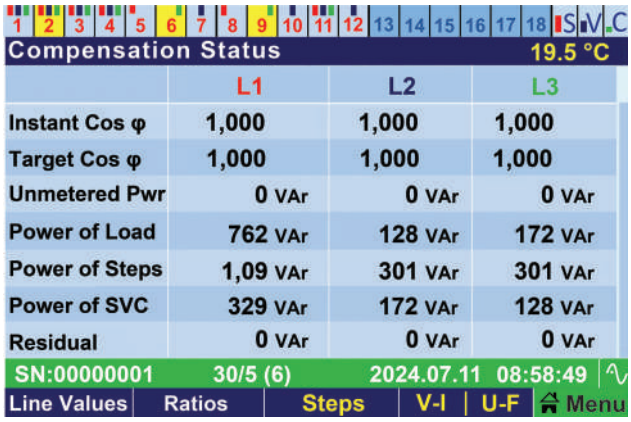
3.2.1. Instantaneous Line Values

This screen displays real-time measured values, including:
Voltage, Current. Active Power, Reactive Power Instantaneous Cos (φ), Power Factor, THDU (%)



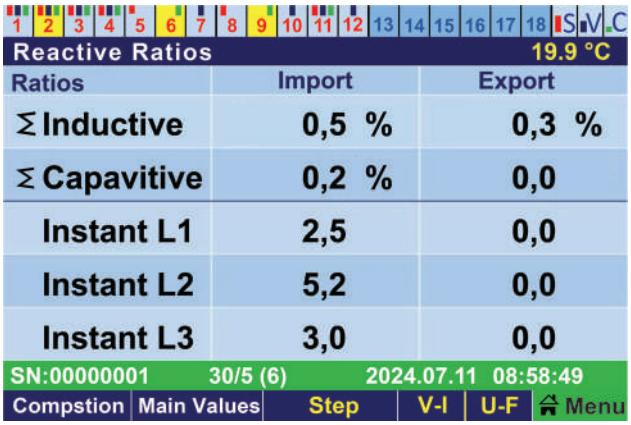
3.2.2. Compensation Status

This screen provides an overview of the main compensation parameters, displaying:
Instantaneous Cos (φ) of the operation, Target Cos (φ), Unmetered Power, Reactive Power of the operation, Total Step Power engaged. Inductive Power delivered to the grid via SVC, Residual Reactive Power drawn from the grid after compensation (for all three phases).

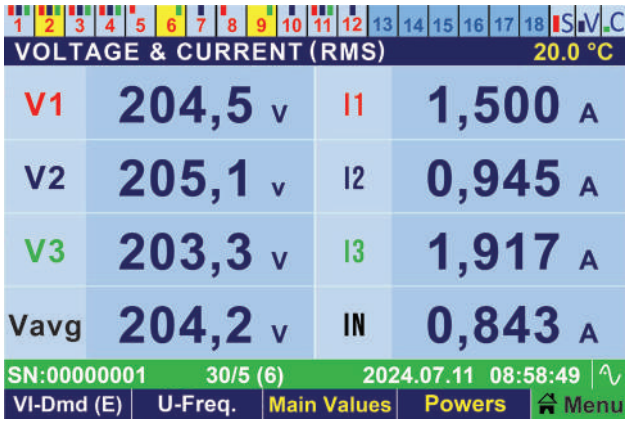


3.2.3. Reactive to Active Ratios

This screen shows:
Total inductive, total capacitive and phase-specific real-time reactive ratios for both import and export, displayed as percentages.
These ratios are color-coded as follows:
Green: Within the limit values.
Blue: Exceeding the inductive limit.
Red: Exceeding the capacitive limit.
Gray: Indicates no import or export in the respective ratio cells.



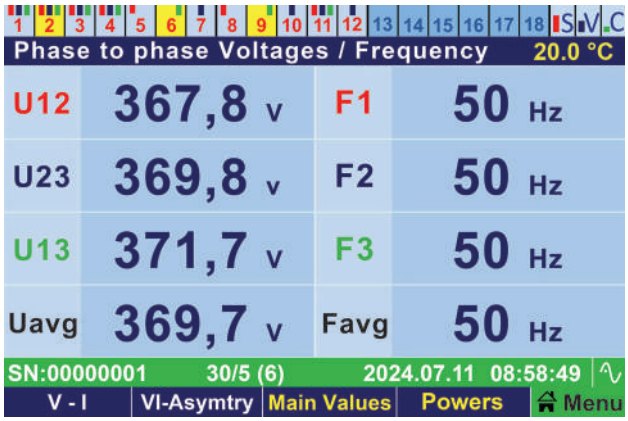
3.3. VOLTAGE / CURRENT (RMS)



The adjacent screen displays:

Phase-to-Neutral voltages and average voltages on the left side. Current values for each phase and neutral current on the right side. This main screen has several sub-screens, accessible using the white buttons on the left side. While on this screen, pressing the "U - Frequency" button navigates to the Phase-to-Phase Voltages/ Frequency sub-screen.

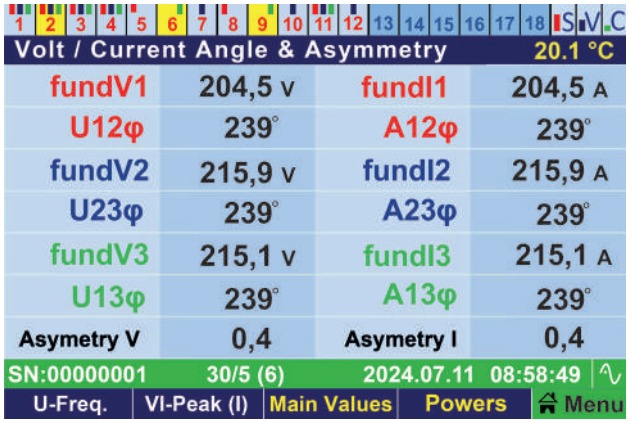
3.3.1. Phase-to-Phase Voltages / Frequency



The adjacent screen displays:

Phase-to-Phase voltage values. Frequency values for each phase. Average voltage and average frequency values for the phases. While on this screen, pressing the VA-Asymmetry button navigates to the Voltage-Current Angle and Asymmetry screen.

3.3.2. Voltage / Current Angle and Asymmetry

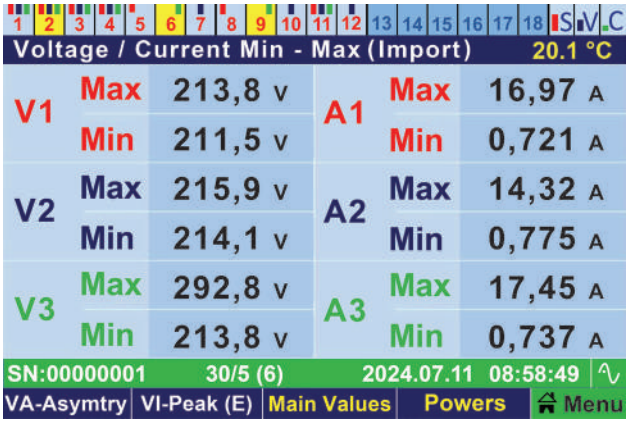


The adjacent screen displays:

Left side:
Fundamental voltage value for each phase. Phase angle differences between voltages. Percentage voltage asymmetry value.
Right side:
Fundamental current value for each phase. Phase angle differences between currents. Percentage current asymmetry value. While on this screen, pressing the VA-Peak(T) button navigates to the Voltage-Current Min-Max (Import) sub-screen.

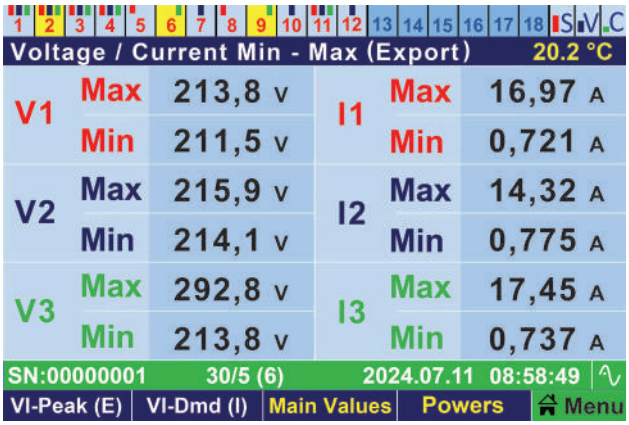
3.3.3. Voltage / Current Min-Max (Import)

This screen displays the minimum and maximum import values for the current and voltage of each phase separately. While on this screen, pressing the VA-Peak(P) button navigates to the Voltage / Current Min-Max (Export) sub-screen.



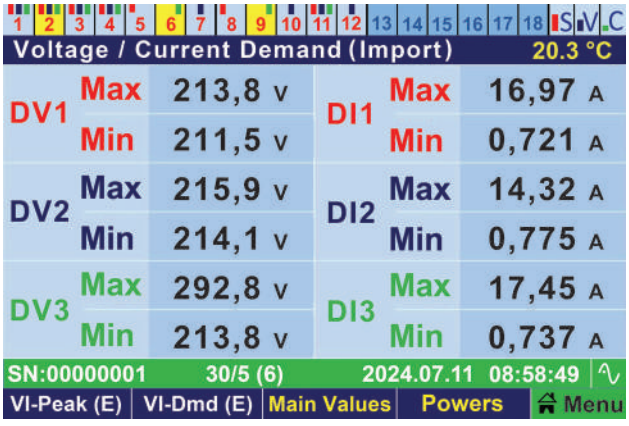
3.3.4. Voltage / Current Min-Max (Export)

This screen displays the minimum and maximum export values for the current and voltage of each phase separately. While on this screen, pressing the VA-Dmd(C) button navigates to the Voltage / Current Demand (Import) sub-screen.



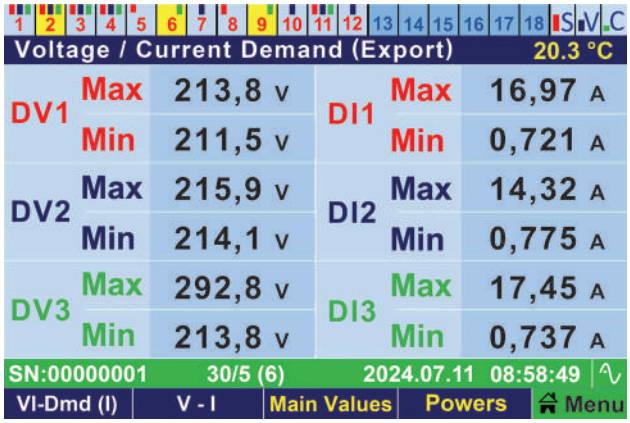
3.3.5. Voltage / Current Demand (Import)

This screen displays the minimum and maximum import demand values for current and voltage for each phase separately. While on this screen, pressing the VA-Dmd(P) button navigates to the Voltage / Current Demand (Export) sub-screen.



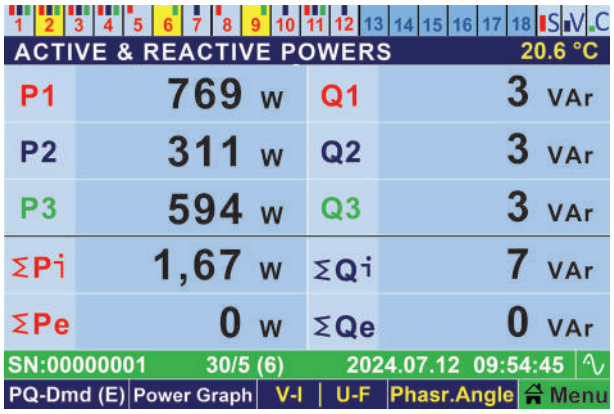
3.3.6. Voltage / Current Demand (Export)

This screen displays the minimum and maximum export demand values for current and voltage for each phase separately.



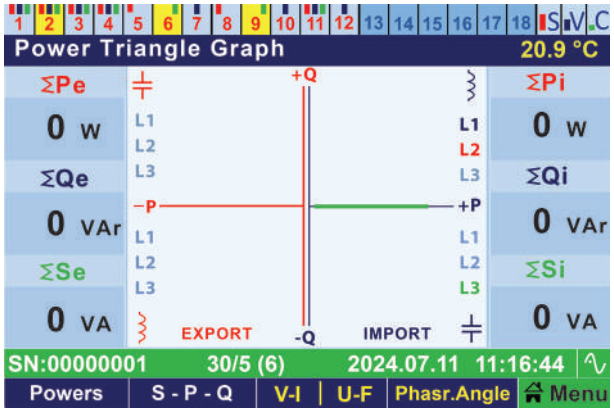
3.4. ACTIVE AND REACTIVE POWERS

The left side of this screen displays the active powers for each phase individually, as well as the total active powers for import and export. The right side displays the reactive powers for each phase individually, along with the total reactive powers for import and export. The inductive or capacitive nature of the powers is indicated by coil and capacitor symbols in front of the values. This main screen has several sub-screens, accessible using the white buttons on the left side. While on this screen, pressing the Power Graph button navigates to the Power Triangle Graph sub-screen.



3.4.1. Power Triangle Graph

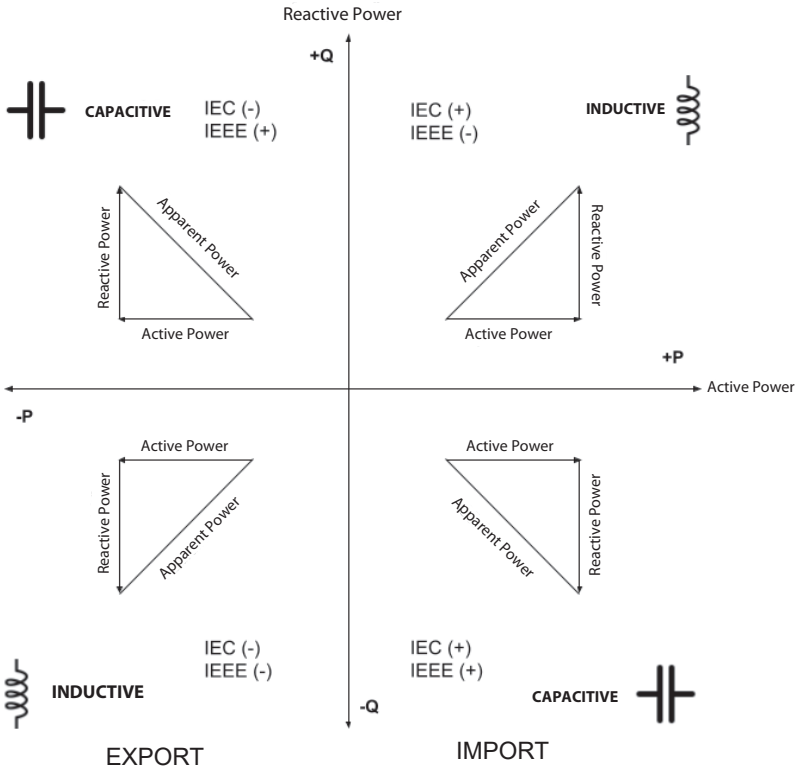
The center of this screen shows a Power Triangle Graph, where:
Red lines represent active power. Blue lines represent reactive power. Green lines represent apparent power. The graph is divided into two sections by import (consumption) and export (generation) axes and consists of four quadrants: The left side of the graph shows export values. The right side shows import values. The red-dashed section represents the inductive and capacitive values for the export power triangle.



The blue-dashed section represents the inductive and capacitive values for the import power triangle. Each of the four quadrants displays the status of the phases (L1, L2, L3), indicating which phase is active in that specific quadrant.
For example:
In the displayed graph, L1 and L2 phases are operating in the inductive import region, while the L3 phase is in the capacitive import region.
On the left side of the screen, the total active, reactive and apparent powers for export are displayed.

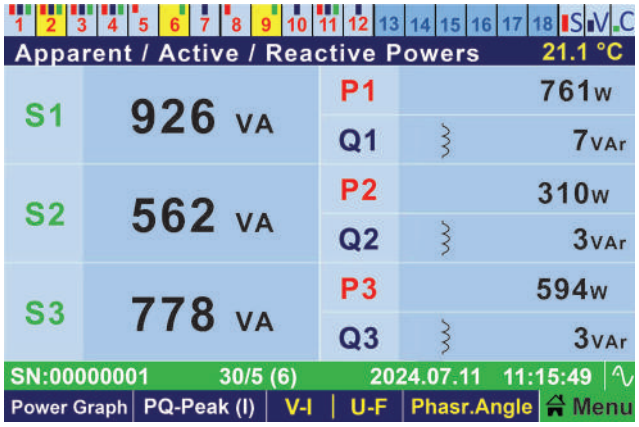
On the right side, the same values for import are shown.
Pressing the S - P - Q button navigates to the Apparent / Active / Reactive Powers sub-screen.

Pressing the S - P - Q button navigates to the **Apparent / Active / Reactive** Powers sub-screen.



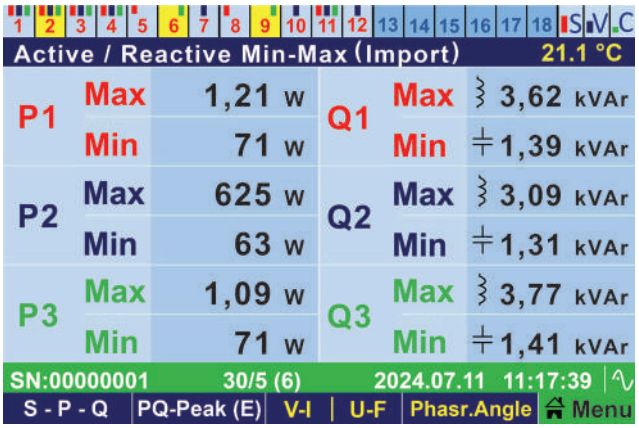
3.4.2. Apparent / Active / Reactive Powers

The left side of this screen displays the apparent power for each phase. The right side shows the active and reactive powers for each phase. While on this screen, pressing the PQ-Peak(T) button navigates to the Active / Reactive Min-Max (Import) sub-screen.



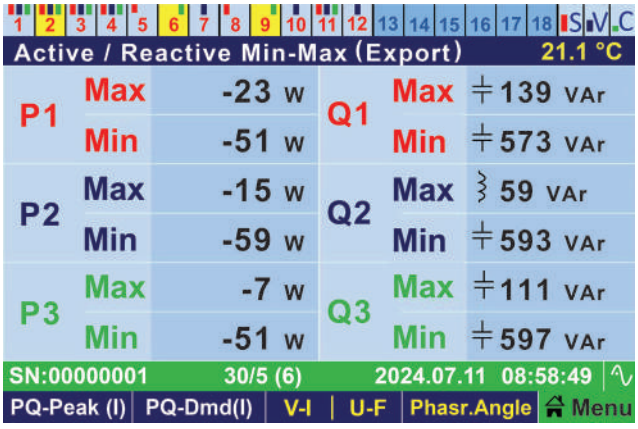
3.4.3. Active / Reactive Min-Max (Import)

The left side of this screen displays the minimum and maximum active powers for each phase in import mode. The right side shows the minimum and maximum reactive powers for each phase in import mode. Reactive power values are annotated with capacitor or coil symbols in front of the values, depending on whether they are capacitive or inductive. While on this screen, pressing the PQ-Peak(P) button navigates to the Active / Reactive Min-Max (Export) sub-screen. The left side of this screen displays the minimum and maximum active powers for each phase in import mode. The right side shows the minimum and maximum reactive powers for each phase in import mode. Reactive power values are annotated with capacitor or coil symbols in front of the values, depending on whether they are capacitive or inductive. While on this screen, pressing the PQ-Peak(P) button navigates to the Active / Reactive Min-Max (Export) sub-screen.



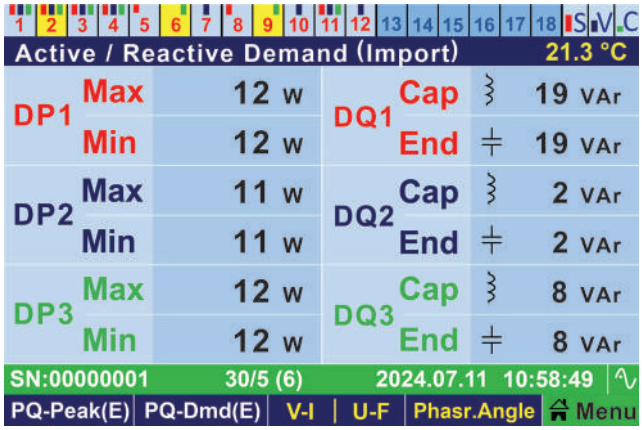
3.4.4. Active / Reactive Min-Max (Export)

The left side of this screen displays the minimum and maximum active powers for each phase in export mode. The right side shows the minimum and maximum reactive powers for each phase in export mode. Reactive power values are annotated with capacitor or coil symbols in front of the values, depending on whether they are capacitive or inductive. While on this screen, pressing the PQ-Dmd(C) button navigates to the Active / Reactive Demand (Import) sub-screen.



3.4.5. Active / Reactive Demand (Import)

The left side of this screen displays the maximum and minimum active demands for each phase in import mode. The right side displays the maximum and minimum reactive demands for each phase in import mode. While on this screen, pressing the PQ-Dmd(P) button navigates to the Active / Reactive Demand (Export) sub-screen.

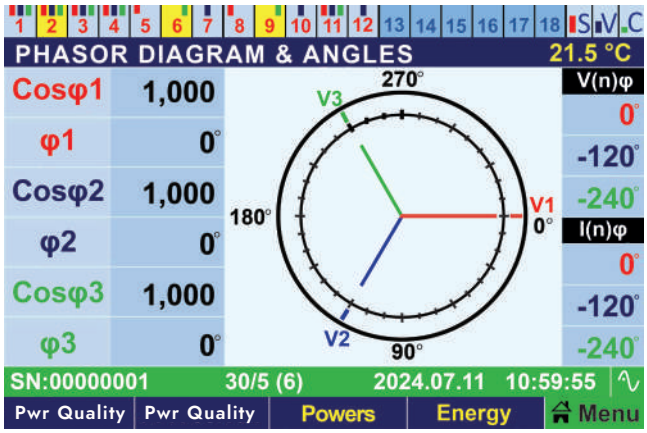


3.4.6. Active / Reactive Demand (Export)

The left side of this screen displays the maximum and minimum active demands for each phase in export mode. The right side displays the maximum and minimum reactive demands for each phase in export mode.

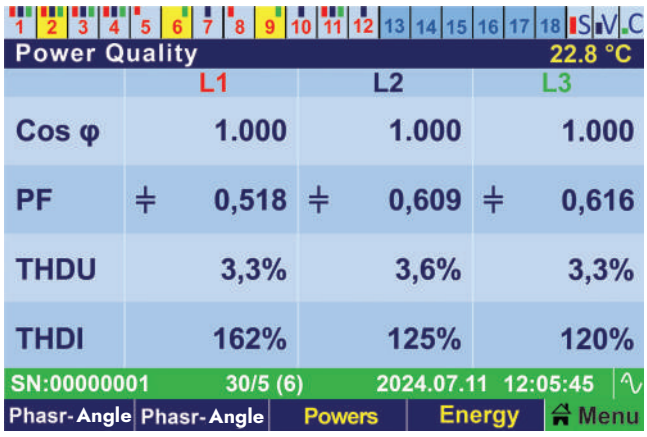
3.5. PHASOR DIAGRAM AND ANGLES

The adjacent screen displays an intelligent phasor diagram, allowing the user to observe the phase angles between current and voltage.
The phasor diagram consists of two concentric circles:
The outer thick circle and the inner thinner circle.
Thick, colored bars between the circles represent the angles of the phase voltages. Colored bars within the inner circle represent the phase currents and their angles. The length of the current bars changes dynamically based on the magnitude of the current, enabling the user to understand:
The phase angles between currents and voltages. The relative magnitude of each phase's current from the length of its corresponding colored bar. To assist with angle readings, the inner circle is marked with:
Thick black lines at 30° intervals. Thin short lines at 10° intervals. These markers help the user observe angles more accurately. While on this screen, pressing the Power Quality button navigates to the Power Quality sub-screen.



3.5.1. Power Quality

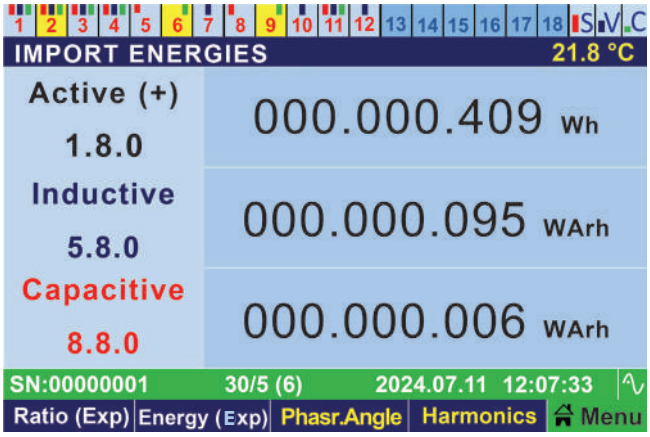
The adjacent screen displays the following parameters for each phase, in order: Cos (φ), PF (Power Factor), THDU (Total Harmonic Distortion for Voltage), THDI (Total Harmonic Distortion for Current)



3.6. IMPORT ENERGIES

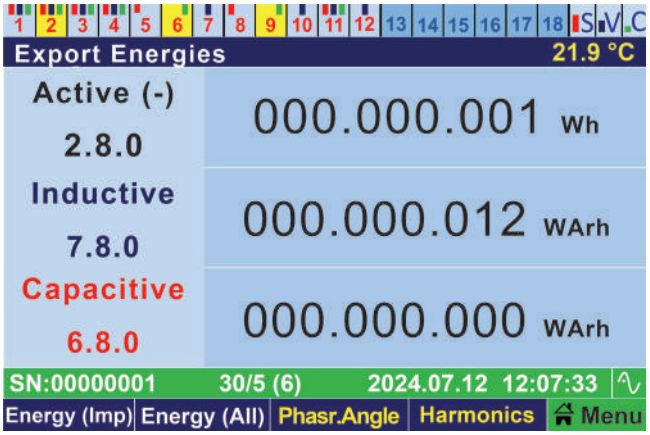
The adjacent screen displays the active, inductive and capacitive energy import values. Additionally, the OBIS codes for the consumed energies are shown on this screen.

While on this screen, pressing the Energ (Exp) button navigates to the Energy Export sub-screen.



3.6.1. Export Energies

The adjacent screen displays the active, inductive and capacitive energy export values. The OBIS codes for the produced energies are also shown. While on this screen, pressing the Energy (All) button navigates to the All Energies sub-screen.



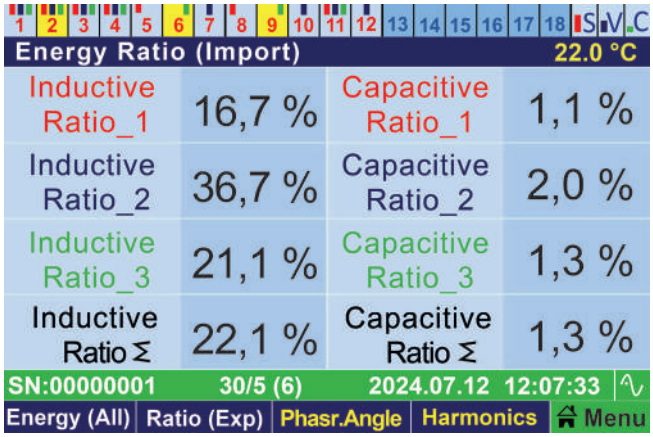
3.6.2. All Energies

The adjacent screen shows the complete indexes for both produced and consumed active, inductive and capacitive energies.

The OBIS codes for all energies (imported and exported) are displayed as well. While on this screen, pressing the Ratio (Imp) button navigates to the Energy Ratios (Import) sub-screen.

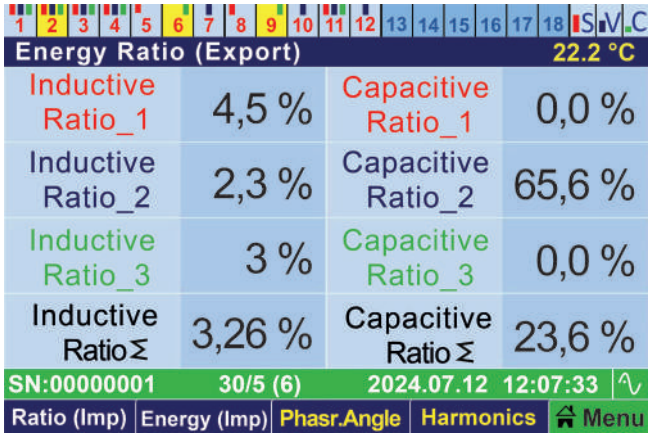
3.6.3. Energy Ratios (Import)

This screen displays the ratios of inductive and capacitive energies to active energy for each phase, separately for import.
While on this screen, pressing the Ratio (Exp) button navigates to the Energy Ratios (Export) sub-screen.



3.6.4. Energy Ratios (Export)

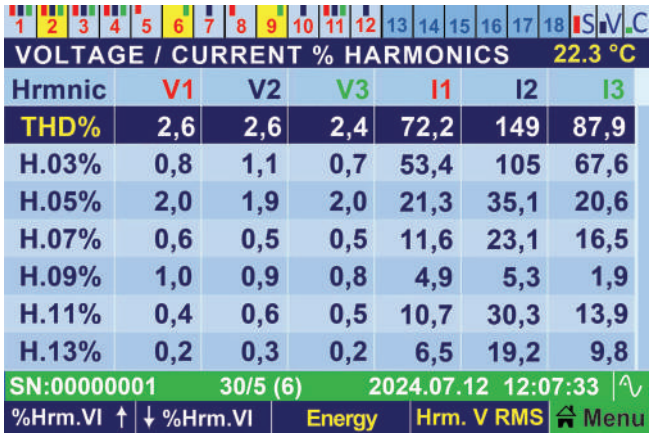
This screen displays the ratios of inductive and capacitive energies to active energy for each phase, separately for export.



3.7. VOLTAGE / CURRENT (%) HARMONICS

The adjacent screen lists the harmonic values for The device can measure harmonics up to the 63rd harmonic. The user can configure which harmonics to list (up to a specific harmonic) via the menu. If all harmonics are selected, they will be displayed on this screen.

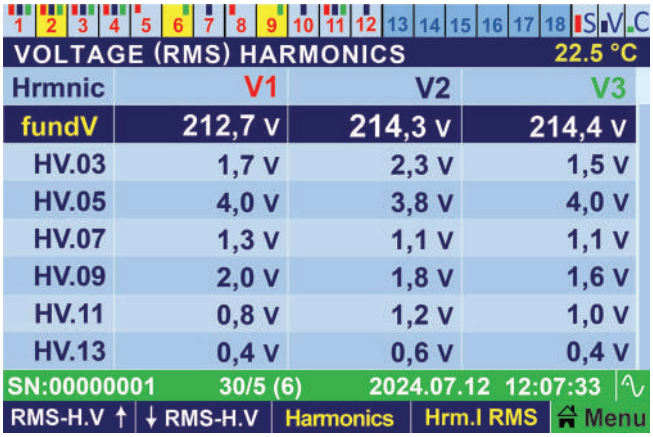
While on this screen, pressing the Hrm.V RMS button navigates to the Voltage (RMS) Harmonics sub-screen.



3.8. VOLTAGE (RMS) HARMONICS

The adjacent screen lists the RMS values of voltage harmonics. The device can measure harmonics up to the 63rd harmonic. The user can configure which harmonics to list via the menu. If all harmonics are selected, they will be displayed on this screen.

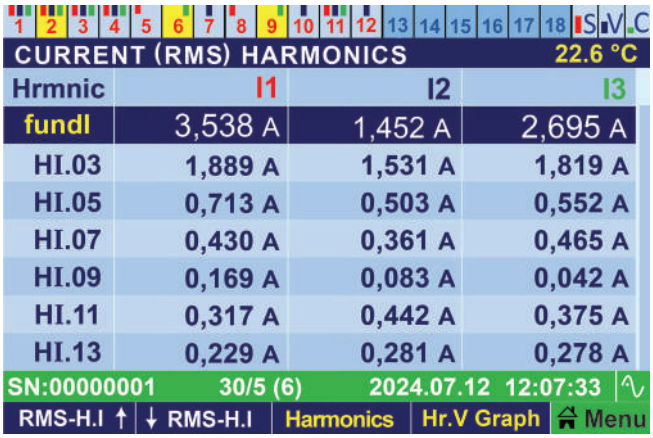
While on this screen, pressing the Hrm.A RMS button navigates to the Current (RMS) Harmonics main screen.



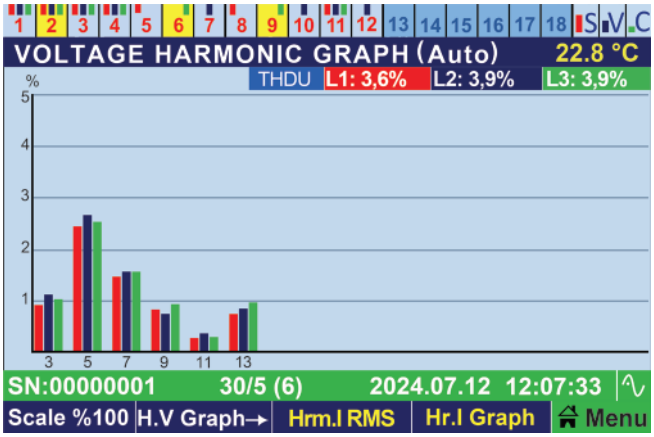
3.9. CURRENT (RMS) HARMONICS

The adjacent and below screens list the RMS values of current harmonics. The device can measure harmonics up to the 63rd harmonic. The user can configure which harmonics to list via the menu. If all harmonics are selected, they will be displayed on this screen.

While on this screen, pressing the Hr.V Graph button navigates to the Voltage Harmonic Graph main screen.



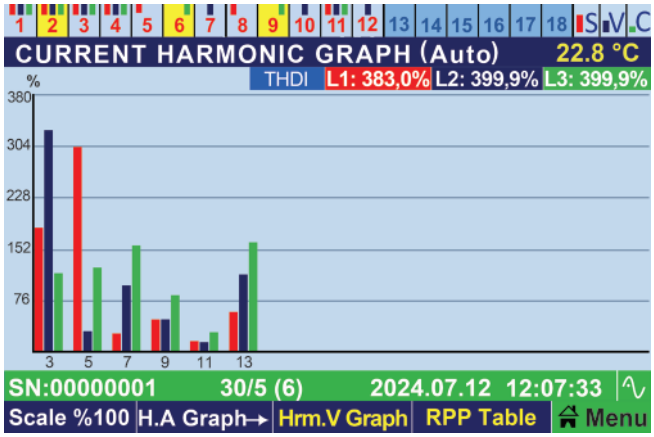
3.10. VOLTAGE HARMONIC GRAPH



The adjacent screen displays the voltage harmonic values for each phase as a bar chart (%). Additionally, the total harmonic distortion percentages (THDU) for each phase's voltage are shown on the screen.
The default scale is set to automatic and the voltage harmonic graphs for each phase are displayed as percentages. If closer observation of smaller harmonics is required, pressing the F1 button allows the percentage scale to be adjusted to a different value, providing a more detailed view. The number of harmonics to be displayed on the graph can be configured via the menu. If the configured number exceeds the screen limit, an additional sub-screen will be automatically created. Pressing the HV. Graph button navigates to the next sub-screen.

While on this screen, pressing the Hr.A Graph button navigates to the Current Harmonic Graph main screen.

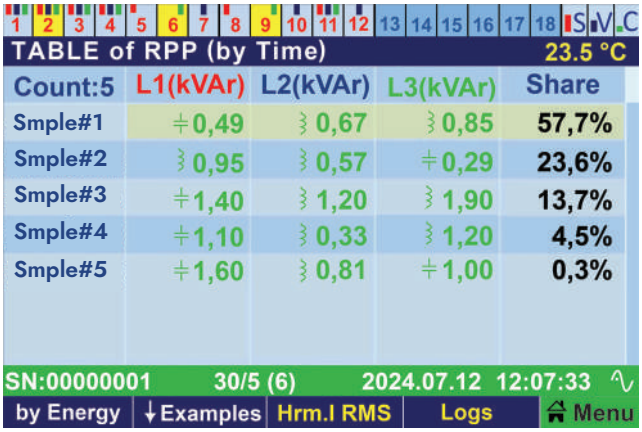
3.11. CURRENT HARMONIC GRAPH



The adjacent screen displays the current harmonics for each phase as a bar chart (%).
Additionally, the total harmonic distortion percentages (THDI) for each phase's current are shown on the screen.
The default scale is set to automatic and the harmonic graphs for each phase are displayed in percentages.
If closer observation of smaller harmonics is required, the percentage scale can be adjusted by pressing the appropriate button. This allows for a more detailed view of smaller harmonics.
The number of harmonics to be displayed on the graph can be configured via the menu. If the number exceeds the screen's capacity, an additional sub-screen will be automatically created.

While on this screen, pressing the H.A Graph button navigates to the next sub-screen.

3.12. RPP Table (Reactive Power Profile)

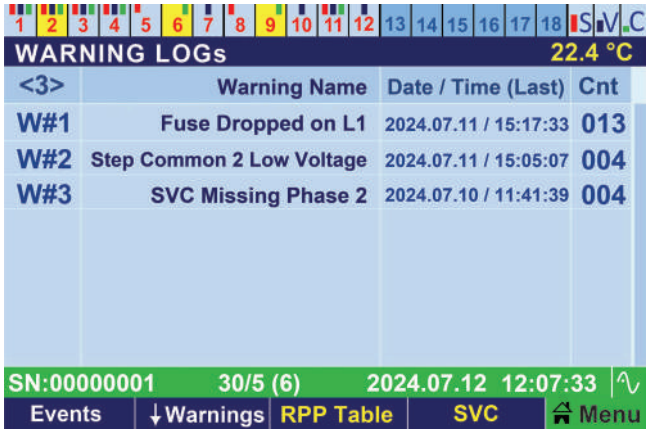


This screen lists the reactive powers drawn by the operation, recorded as reactive power samples. By pressing the white button in the lower-left corner, you can access sorted lists of power profiles based on:

Energy, Time, Inductive power, Capacitive power, Q/P ratio. The color of the listed reactive powers indicates the status of compensation:
Green: The steps fully compensate for the drawn reactive power.

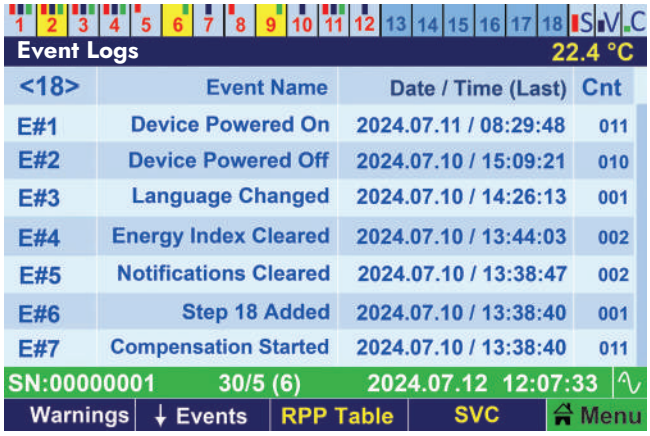
Blue: The capacitors are insufficient.
Red: The shunt reactors are insufficient.
Yellow background: Indicates the current reactive power sample drawn by the operation.

3.13. WARNING LOG



This screen displays the descriptions of warnings, the number of occurrences and the timestamps of the first and last occurrences.

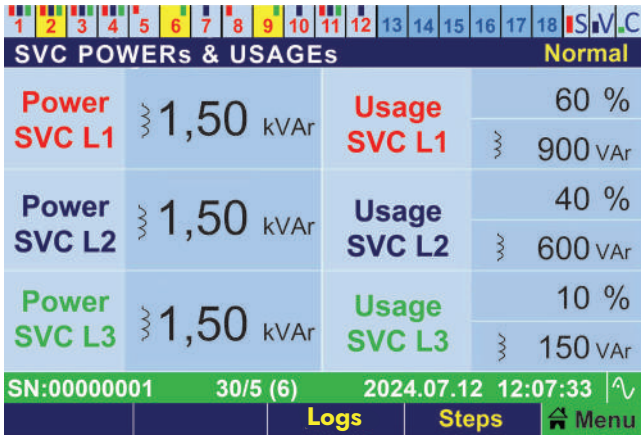
3.13.1 Event Log



This screen provides the descriptions of events, the number of occurrences and the timestamps of the first and last occurrences.

3.14. SVC Powers and Usages

This page shows the SVC step powers learned by the RKRS, the percentage of each phase currently engaged and the corresponding kVAr values for these percentages. Unlike the nominal power display on the step page, these powers are calculated based on the real-time voltages of the network. The top-right corner of the page displays the status of the SVC and information about the shunt reactor thermal conditions.

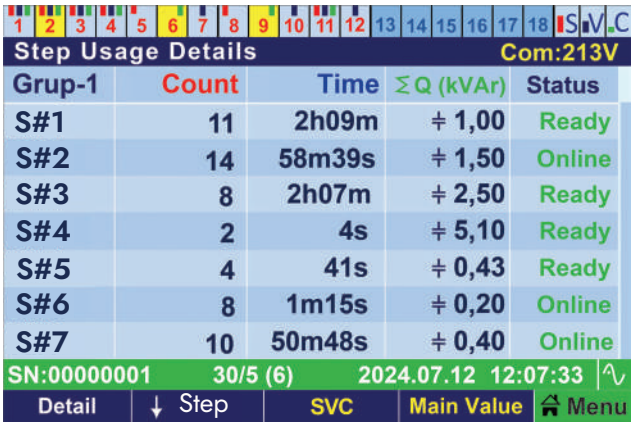


3.15. Steps (Nominal / kVAr)

As previously described, the Step Information Bar at the top of the screen provides a summarized view of step information for each step. On this main screen, the nominal power of each step for every phase, their total power and their status are listed in groups. The top-right corner of the screen shows the voltage level and status of the step group commons.

3.15.1 Step Usage Details

This screen displays how long and how many times each step has been used and its total power. The current status of the step is also shown in the rightmost column, both as text and in color for easy identification.



4. RKRS PFC MAIN MENU

4.1. QUICK MENU

Menu → Quick Menu

The Quick Menu allows for fast configuration of the device's steps, response times, Modbus address, date and time and language. Additionally, documents such as the user manual can be accessed via the internet portal by scanning the QR code visible in this section.

4.1.1 Steps

Menu → Quick Menu → Steps

4.1.1.1 Step Learning: Starts step learning in smart mode.
4.1.1.2 Control and Clear Details: Enables viewing the status of steps and SVC individually and manually activating/deactivating them.
4.1.1.3 Step Common Control: Activates voltage monitoring for step commons.
4.1.1.4 Clear Notifications: Clears notifications in the Step Information Bar, removing warning colors from the step's background.

4.1.2. Response Times

Menu → Quick Menu → Response Time

Allows adjustment of inductive and capacitive response times to desired values.

4.1.3. Modbus Address

Menu → Quick Menu → Modbus Address

Configures the communication settings for Modbus, allowing the device's Modbus address to be set within the range 1-247.
After entering the desired value, press the OK button to update the parameter.
NOTE: Default Modbus address: 1 (factory setting).

4.1.4. Internet Portal

Menu → Quick Menu → Internet Portal

Provides access to a QR code that redirects to a website containing resources such as the device's user manual.

4.1.5. Date & Time

Menu → Quick Menu → Date & Time

Allows modification of the device's date and time settings if needed. This menu is removed after initial setup.

4.1.6. Language

Menu → Quick Menu → Language

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

4.1.7. Start Setup / Assistan

Menu → Quick Ment → Start Setup / Assistant

Setup begins by selecting and confirming the Current Transformer Ratio (C.T). Alternatively, pressing the "Assistant" button provides sequential access to general parameters of the PFC through a single menu.

4.2. Steps and Settings

Menu → Steps and Settings

his section includes the Steps Menu, where all settings related to steps can be configured. Users can view step powers, manually set values and perform actions such as step learning and control.

4.2.1. Step Powers and Manual Entry

Menu → Steps and Settings → Step Powers and Manual Entry

Allows viewing step powers and entering values manually. Select the desired step, press OK and input the required values for each phase. Once values are confirmed, the step is set and the step number in the Step Information Bar is underlined to indicate manual entry.

4.2.2. Step Learning

Menu → Steps and Settings → Step Learning

4.2.2.1 All Steps

Starts the learning process for all steps in one of three modes: Smart, Regular or Fast.

4.2.2.1.1 Smart

Sequentially learns all steps except those currently in use. Temporarily active steps are disengaged at the most suitable time and the learning process completes with discharging steps being learned last.

4.2.2.1.2. Regular

Starts from the 1st step and learns all steps by engaging and disengaging them in sequence. Active steps are disengaged first, allowed to complete their discharge times and then engaged and disengaged for learning.

4.2.2.1.3. Fast

Quickly disengages all active steps and starts learning from the 1st step. Skips discharging steps initially, learning them last.

4.2.2.2 Single Step Learning

Allows learning of a single, user-selected step.

4.2.2.3 SVC Learning

Allows learning of only the SVC steps.

4.2.2.4 Group 1 (Steps 1-7)

Starts learning for steps in Group 1 (1-7) using Smart, Regular or Fast modes.

4.2.2.5 Group 2 (Steps 8-12)

Starts learning for steps in Group 2 (8-12) using Smart, Regular or Fast modes.

4.2.2.6 Group 3 (Steps 13-18)

Starts learning for steps in Group 3 (13-18) using Smart, Regular or Fast modes.

4.2.2.7 Steps Waiting for Learning

If the reactive load movement in the operation continues during step learning, sensitivity decreases and ongoing learning processes are delayed until line stability is achieved. Once the line becomes stable, the PFC automatically resumes pending learning processes. This menu allows users to manually initiate learning for such steps.

NOTE: If no steps are waiting for learning, this menu remains hidden.

4.2.3. Control and Clear Details

Menu → Steps and Settings → Control and Clear Details

Enables manual control of the selected step. Use the OK button to engage or disengage the desired step. If a step is being discharged, press and hold the OK button to engage it during discharge.

4.2.4. Settings

Menu → Steps and Settings → Settings

4.2.4.1 Discharge Time: Defines the discharge time for steps.
4.2.4.1.1 Discharge Time for All: Sets the discharge time for all steps in one step.
4.2.4.1.2 Discharge Time (Steps 1-7): Sets the discharge time for steps 1-7.
4.2.4.1.3 Discharge Time (Steps 8-12): Sets the discharge time for steps 8-12.
4.2.4.1.4 Discharge Time (Steps 13-18): Sets the discharge time for steps 13-18.

4.2.4.2 Equal Aging:
Manages parameters related to the equal aging method, ensuring effective and long-lasting use of similar compensation steps.
4.2.4.2.1 Control: Enables or disables the equal aging feature, which balances the usage of compensators to enhance overall system performance.
4.2.4.2.2 Equivalent Percentage: Sets the acceptable power difference percentage among compensators to be considered equivalent. Example: If set to 5%, a 25 kVAr capacitor will accept equivalents with power values between 23.75 kVAr and 26.25 kVAr. Capacitors outside this range will not be considered equivalent.
4.2.4.2.3 Operating Time Difference: Sets the maximum time difference between the operating durations of equivalent compensators. Example: If set to 3 hours, the PFC will prioritize compensators with shorter operating times when the difference reaches 3 hours.

4.2.4.3 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 enabled.

4.2.4.4 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 500 ms.
4.2.4.4.1 Delay for All: Sets the delay time for all steps in one step.
4.2.4.4.2 Delay (Steps 1-7): Sets the delay time for steps 1-7.
4.2.4.4.3 Delay (Steps 8-12): Sets the delay time for steps 8-12.
4.2.4.4.4 Delay (Steps 13-18): Sets the delay time for steps 13-18.

4.2.4.5 Advanced Settings:
4.2.4.5.1 Reset All Details: Resets operating durations, pull/release counts and previous values for all steps.
4.2.4.5.2 Learning Measurement Error: Sets the maximum allowable error percentage between pull and release values during step learning.
4.2.4.5.3 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.
4.2.4.5.4 Depreciation Percentage: Sets the percentage of observed power loss or increase in phase values during re-learning of a step. If the change exceeds this value, the step is flagged for value loss/change and its background color turns orange.

4.2.5 Step Common Control

Menu → Steps and Settings → Step Common Control

4.2.5.1 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.

4.2.5.2. Step Common 1: Configures parameters for Common 1 input: Voltage type (AC/DC) Contactor coil voltage 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).

4.2.5.3. Step Common 2: Configures parameters for Common 2 input: Voltage type (AC/DC) Contactor coil voltage 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).

4.2.5.4. Step Common 3: Configures parameters for Common 3 input: Voltage type (AC/DC) Contactor coil voltage 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).

4.2.6. Clear Notifications

Menu → Steps and Settings → Clear Notifications

If the "Yes" option is confirmed, all notifications for the steps are cleared. When notifications are cleared, the background colors used for different warnings in the Step Information Bar are removed.

4.3. COMPENSATION

Menu → Compensation

This menu allows configuration of all parameters related to compensation.

4.3.1. Reactive Limits

Menu → Compensation → Reactive Limits

4.3.1.1. Inductive Limit: Sets the inductive penalty limits.
4.3.1.2. Capacitive Limit: Sets the capacitive penalty limits.

4.3.2. Response Times

Menu → Compensation → Response Times

4.3.2.1. Inductive: Time the device waits before responding to an inductive limit excess.
4.3.2.2. Capacitive: Time the device waits before responding to a capacitive limit excess.
4.3.2.3. Normal: Time the device waits to provide an optimal response when no limit excess occurs.

4.3.3. Unmetered Power

Menu → Compensation → 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.

4.3.3.1. 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.
4.3.3.2. 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.
4.3.3.3. 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.
4.3.3.4. 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.
4.3.3.5. 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.

4.3.4. Target Cos / Tan

Menu → Compensation → Target Cos / Tan

4.3.4.1. Target Cos / Tan: Sets the desired target Cos (φ) and Tan (φ) values. Default values are Cos (φ) = 1 and Tan (φ) = 0.
4.3.4.2. 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.

4.3.5.Generator

Menu → Compensation → Generator

4.3.5.1. Compensation with Generator: Enables or disables compensation when the generator is active.
4.3.5.2. Target Cos / Tan (Generator): Sets the target Cos (φ) and Tan (φ) values for compensation during generator operation.

4.3.6. Export Compensation

Menu → Compensation → Export Compensation

Allows enabling or disabling compensation during export.

4.3.7. Protection

Menu → Compensation → Protection

4.3.7.1. Overvoltage: Eables overvoltage prontection.
4.3.7.2. Undervoltage: Enables undervoltage protection.
4.3.7.3. Excessive Harmonics: Enables excessive voltage harmonic protection.
4.3.7.4. Overtemperature: Enables overtemperature protection.
4.3.7.5. Set Values: Sets the limit values for protection parameters.

4.3.8. Hysteresis

Menu → Compensation → Hysteresis

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

4.3.8.1. Inductive: Sets the hysteresis percentage for applying new solutions when operating in the inductive region.

4.3.8.2. Capacitive: Sets the hysteresis percentage for applying new solutions when operating in the capacitive region.
4.3.8.3. Normal: Sets the hysteresis percentage for applying new solutions when operating in the normal (reactive within limits) region.

4.4. Device Settings

Menu → Device Settings

This menu allows configuration of various device parameters.

4.4.1. Measurement and Transformers

Menu → Device Settings → Measurement and Transformers

4.4.1.1. Current Transformer Ratio: Set the current transformer (CT) ratio between 5/5 and 10000/5. The current CT ratio blinks in the menu. Use the up and down buttons to select the desired value, then press OK to update it.
4.4.1.2. Current-Voltage Pairs: Displays which voltage inputs correspond to the measured currents.
4.4.1.3. Current Transformer Directions: Displays the direction of the current connections.
4.4.1.4. Voltage Transformers: Allows setting line voltage and measurement voltage.
4.4.1.4.1. 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 OK to save it.
4.4.1.4.2. 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 OK to save it.

4.4.2. Modbus Configuration

Menü → Device Settings → Modbus Configuration

Configure parameters for Modbus communication.

4.4.2.1. Modbus Address: Assign a unique Modbus address (1–247) to the PFC, distinct from other connected devices. se the up and down buttons to select the desired address, then press OK to update it.
4.4.2.2. 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 OK to save it.
4.4.2.3. Data, Stop Bits and Parity:
4.4.2.3.1. Data Bits: Displays the number of data bits used in Modbus communication. This parameter depends on other settings and cannot be manually changed.
4.4.2.3.2. Parity Setting: Set the parity bit to None, Odd or Even, matching the application or device.

4.4.2.3.3. Stop Bits: Set the stop bits used in communication to 1 or 2.
4.4.2.4. Silent Interval (xBit): Configures the silent interval (xBit) after the stop bit to determine how long the device waits before resuming communication.
4.4.2.5. Mode: Select the Modbus communication mode: RTU or ASCII.
4.4.2.6. 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.
4.4.2.6.1. Read Protection: Activates or deactivates read protection.
4.4.2.6.2. Write Protection: Activates or deactivates write protection.
4.4.2.6.3. Read Password: Sets a four-digit password for active read protection.
4.4.2.6.4. Write Password: Sets a four-digit password for active write protection.

4.4.3. Display Settings

Menu → Device Setting → Display Settings

Average Values: Configures the number of samples used for averaging display values, how frequently samples are taken and the percentage difference required for display updates.

4.4.3.1. 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.
4.4.3.1.1. Sample Count: Number of samples to calculate average values (1–16).
4.4.3.1.2. Refresh Interval: Time interval for sample collection (100 ms – 1.0 s).
4.4.3.1.3. Control Percentage: Percentage difference required for value updates (5%–50%).
4.4.3.2. Password Protection: Activates or deactivates menu access restrictions requiring a password.
4.4.3.3. Access Level: Enables password-protected access levels.
4.4.3.4. Screen Saver: Toggles the screen saver on or off.
4.4.3.5. Screen Timeout: Configures the delay (2–240 minutes) before the screen saver activates.
4.4.3.6. Brightness Level: Adjusts screen brightness (5%–100%).

4.4.4. SVC Settings

Menu → Device Settings → SVC Settings

4.4.4.1. Active / SVC Power Ratio: Defines the ratio of active power to SVC power for a phase. If exceeded, the associated SVC step is disabled. Default value: 35.

4.4.4.2. Reactive Usage Percentage: Determines the minimum percentage of SVC usage for providing a solution when reactive ratios exceed limits. Default value: 65%.

4.4.4.3. Normal Usage Percentage: Sets the SVC usage percentage threshold under normal operating conditions. Solutions are adjusted to reduce SVC usage when the usage exceeds this value. Default value: 25%.

4.4.4.4. SVC Thermal Control: Enables thermal control for SVC cooling fans and drivers. SVC steps are disabled during overheating and re-enabled after cooling. Frequent warnings indicate inadequate panel ventilation.

4.4.5. Advanced Settings

Menu → Device Settings → Advanced Settings

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

4.4.5.1. Power Off / On: Safely powers the device on or off via the screen.

4.4.5.2. Default Settings: Resets all customized settings and data to factory defaults.

4.4.5.3. Device Reset: Clears stored information and restarts the device for reconfiguration.

4.4.5.4. Measurement Period: Configures data collection and measurement interval (20 – 500 ms).

4.4.6. Device Information

Menu → Device Settings → Device Information

4.4.6.1. Serial Number: Displays the device's serial number.
4.4.6.2. Software Version: Shows the device's software version.
4.4.6.3. Build Date and Time: Displays when the device's software was compiled.
4.4.6.4. Hardware Version: Displays the hardware version of the device.
4.4.6.5. Date and Time: Configures the device's date and time settings.
4.4.6.6. Language / Dil: Sets the device's language (English or Turkish).
4.4.6.7. Working Hours: Displays the total time the device has been powered on.
4.4.6.8. Periodic Maintenance Time: Configures the periodic maintenance interval (in hours).
NOTE : Default: Disabled.

4.5. Analyzer

Menu → Analyzer

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

4.5.1. Energies

Menu → Analyzer → Energies

To Clear / Reset energy values, navigate to the "Yes" option using the arrow buttons and confirm with the OK button. All energy values will be cleared.

4.5.2. Peak Values

Menu → Analyzer → Peak Values

To Clear / Reset minimum and maximum electrical peak values: Navigate to the "Yes" option using the arrow buttons and confirm with the OK button. All peak values will be cleared.

4.5.3. Demands

Menu → Analyzer → Demands Values

This is the menu where the periods of the demand values are set and the values are reset.

4.5.3.1. Clear / Reset: To clear demand values, navigate to the "Yes" option and confirm with the OK button. All demand values will be Clear / Reset.
4.5.3.2. Demand Period: Set the demand period between 1 and 60 minutes. Adjust using the arrow buttons and confirm with the OK button.

NOTE: The factory default demand period is 15 minutes.

4.5.4. Harmonics

Menu → Analyzer → Harmonics

Profil

View specific harmonic ranges for current and voltage:

- **1–13 Odd, 1–13 Even or 1–13 All**
- **1–31 Odd, 1–31 Even or 1–31 All**
- **1–63 Odd, 1–63 Even or 1–63 All**

Custom Profile

Select a custom harmonic profile with specific limit and analysis settings:
Limit: Adjust the harmonic limits to be monitored.
Analysis: Specify whether to monitor odd, even or all harmonics.

4.5.5. Reactive Power Profile (RPP)

Menu → Analyzer → Reactive Power Profile

Reactive Power Profile (RPP) parameters are set in this section.

4.5.5.1. Clear / Reset: Clear recorded reactive power profiles by navigating to the "Yes" option and confirming.
4.5.5.2. Power Resolution: Set the resolution for reactive power sampling. Adjust using the arrow buttons and confirm with the OK button.
4.5.5.3. Maximum Difference (%): Set the maximum percentage change in load required to record a new reactive power profile. Adjust using the arrow buttons and confirm with the OK button.
4.5.5.4. Difference Percentage: If the difference between the reactive power profiles exceeds the set percentage, a new sample is recorded. If the profile is full, the percentage automatically increases and existing samples are compressed to make room for new entries.

4.6. WARNING AND EVENT LOGS

Menu → Warning and Event Log

This menu allows configuration of alarm settings, clearing logs and enabling alarm LEDs.

4.6.1. Clear Event Logs

Menu → Warning and Event Log → Clear Event Log

Clear recorded event alarms in the Event Log. Navigate to "Yes" and confirm to clear the log.

4.6.2. Clear Warning Logs

Menu → Warning and Event Log → Clear Warning Log

Clear recorded warning alarms in the Warning Log. Navigate to "Yes" and confirm to clear the log.

4.6.3. Set Values

Menu → Warning and Event Log → Set Values

The PFC uses the following thresholds for alarm and protection functions:
4.6.3.1. Overvoltage: Set the threshold for triggering an overvoltage alarm.
Selectable range: 230 V – 920 V.
4.6.3.2. Undervoltage: Set the threshold for triggering an undervoltage alarm.
Selectable range: 5 V – 230 V.
4.6.3.3. Excess Harmonics: Set the percentage value for triggering a voltage harmonics alarm.
Selectable range: 2% – 50%.

4.6.3.4. Excess Temperature: Set the minimum temperature value for triggering a high-temperature alarm. Selectable range: 40°C – 90°C.
4.6.3.5. Weak Line Percentage: Set the percentage threshold for voltage changes on the inputs during step learning or setup. If the voltage change exceeds this value, the PFC will issue a warning. Selectable range: 1% – 10%.
NOTE: Check the line and neutral connections if this warning appears.

4.6.4. Fault Logs

Menu → Warning and Event Log → Fault Log

Enables or disables the log that records faults occurring during the device's operation.

4.6.5. Permanent Warning LED

Menu → Warning and Event Log → Permanent Warning

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

4.7. SETUP

Menu → Setup

This menu handles all the settings related to the Device's Setup.

4.7.1. Start Setup / Assistant

Menu → Setup → Start Setup / Assistant

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

4.7.2. Settings

Menu → Setup → Settings

4.7.2.1. Setup Mode: Define whether the setup will use capacitors, SVC or reactors.
4.7.2.2. Network Frequency: Set the device to operate at 50 Hz or 60 Hz.
4.7.2.3. C.T. Connection Type: Configure power measurement to use either three current transformers for all three phases or only one selected phase.
4.7.2.4. Current-Voltage Matching: Enable or disable current-voltage matching during setup. Default: Enabled.
4.7.2.5. Auto Control: Dynamically detects changes in current transformer and voltage inputs, redirecting to automatic setup if necessary. Default: Enabled.
4.7.2.6. Recovery for Measurements: Allows recovery of measurements by averaging available phase values if there are disconnections in voltage or current inputs. Default: Enabled.

4.7.2.7. Advanced Settings

4.7.2.7.1. Try Count: Defines the number of successful measurement repeats required for completing setup.

4.7.2.7.2. Error at Setup: Adjust the maximum percentage difference allowed between measurements during capacitor step engagement and release.

4.7.2.7.3. Measurement Factor: Recommended to set this value to 1 when using very small steps in the panel.

4.7.2.7.4. Phase-to-Phase Control: Disables the control preventing the same phase from being connected to multiple voltage inputs. Designed for expert users.

4.7.2.7.5. 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.

4.7.2.7.6. C.T. Special Ratio L2: Similar to L1 but for phase L2.

4.7.2.7.7. C.T. Special Ratio L3: Similar to L1 but for phase L3.

4.7.3. Ignore the First Setup

Menu → Ignore the First Setup

Select "Yes" in this menu to ignore/skip the first setup process if not required.