

POWER FACTOR CONTROLLER

RG3-15C / CS / CL / CLS



Before installation and operation, please read this section very carefully. For details, please kindly refer to User Manual CD.

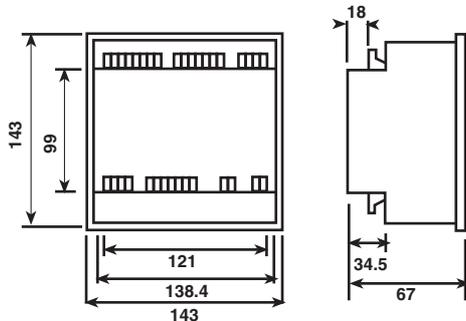
Precautions for Safe Use and Installation

- 1) Maintenance, installation and operation of RG3-15C/CS/CL/CLS must be performed only by the qualified technicians.
- 2) Do not operate undervoltage.
- 3) Do not open the RG3-15C/CS/CL/CLS's housing. There are no user servicable parts inside it.
- 4) RG3-15C/CS/CL/CLS is connected to the network with current transformers. Do not disconnect the current transformer terminals. If you disconnect them, be sure to short-circuit or connect them to another parallel load which have low impedance. In case of failure, dangerously high voltage at the secondary side of current transformer may cause an electric shock.
- 5) Do not use this product for any other purpose than its original task.
- 6) When device is connected to the network, do not remove the front panel.
- 7) Do not clean the device with solvent or similar items. Only clean with a dry cloth.
- 8) Verify terminal connections when wiring.
- 9) Electrical equipment should be serviced only by your competent seller.
- 10) Device is suitable only for panel mounting.



No responsibility is assured by the manufacturer or any of its subsidiaries for any consequences arising out of the use of this material.

DIMENSIONS



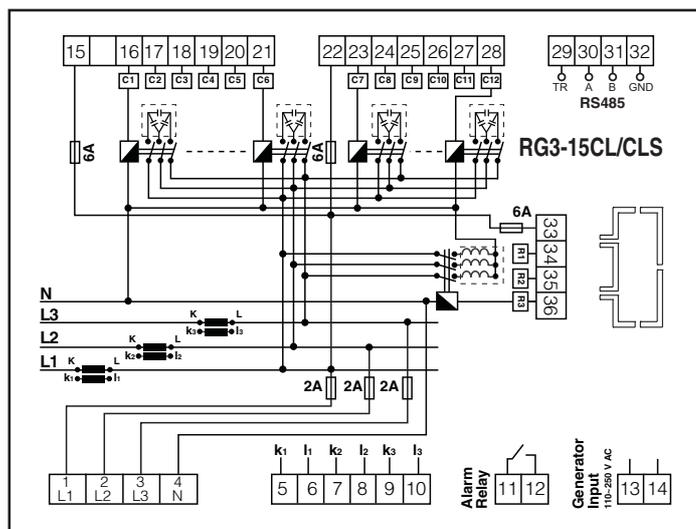
Type PR16
(144x144)

- 1) Panel cut-out dimension must be 139 mm x 139 mm (Type PR16).
- 2) Before installation, remove the mounting brackets.
- 3) Mount the device to front panel.
- 4) Insert the mounting brackets.
- 5) Wire crossection for voltage and current terminals must be 2,5 mm², but also convenient upto 4mm².
- 6) CAT5 cable is recommended for RS-485 input terminal.

Excessive force can damage to the device.

The screws used for the connection to the terminals must be securely tightened

CONNECTION DIAGRAM

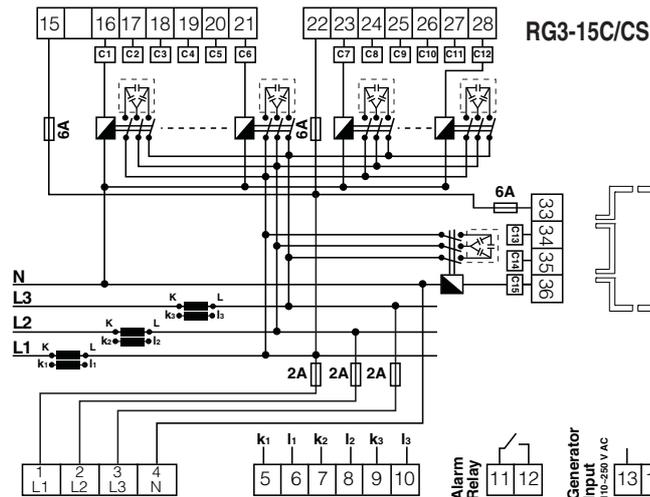


* Current value of 3-Fuses, which are connected to protect the capacitors, must be chosen according to the nominal current value of capacitors.



Do not energize the device before controlling correct connections under any circumstances. It is obligatory to connect a 3-phase capacitor to the 1st step.

Shunt reactors for RG3-15 CL/CLS must be connected to R1,R2 and R3 steps. Inductive load step powers are not calculated on RG3-15 CL/CLS model during automatic capacitor recognition. Power values must be entered manually.



* Current value of 3-Fuses, which are connected to protect the capacitors, must be chosen according to the nominal current value of capacitors.



Do not energize the device before controlling correct connections under any circumstances. It is obligatory to connect a 3-phase capacitor to the 1st step.

Single phase capacitors must be connected to at least 3 steps for RG3-15 C/CS.

1. RG3-15C/CS/CL/CLS Terminal Connections

If the following instructions for the connections are not followed, the device may not function properly. Please refer to the connection diagram for the proper connections. This connection diagram is available on the back cover of the device

a) Connect the 3-Phase-Neutral cables to the voltage measurement terminals. To separate the device from the network, connect an automatic breaker or a circuit breaker between the network and the voltage terminals and mark these to avoid confusion with the other breakers. The fuses used for this connection must be FF type and must have current values of 2A or 3A and 6A (Refer to: Connection Diagram).

b) If the system is going to be compensated according to the target $\cos\phi^2$ when the generator powers up, make sure the generator terminals on the device are connected to the generator. The generator must be connected in a way that the electrical signal must come to the generator input after the generator connection to the network line is made. Otherwise the system will be compensated according to the target $\cos\phi^2$ when the generator is powered up for maintenance even though the system is online.

c) Connect the cables coming from the current transformers of the 3 phases to the current terminals.

d) Make the step connections. It must be noted that a 3-phase capacitor has to be connected to 1st step.

For RG3-15 C/CS, single phase capacitors must be connected to at least 3 steps.

For RG3-15 CL/CLS, shunt reactors must be connected to R1,R2 and R3 steps. For RG3-15 CL/CLS, connected shunt reactors must have equal or smaller power values than capacitors.

e) Make alarm contact output connection of device (Optional).

f) Make communication connection of device (Optional).

g) Do not energize device before confirming correct connections.

Note: (1(L1) and 4(N) labeled measurement terminals are also the terminals of the supply voltage for the device. Voltage drops and power outages on the network which is connected to the device through these terminals will cause the device to shut down.

2. Commissioning RG3-15C/CS/CL/CLS

a) After you made sure that the terminals are connected correctly, energize the device.

b) For the device to show the measured values correctly; you must enter the current transformer ratio and, if one is used, the voltage transformer ratio(See trF Menu)

c) For the device to correct measurement terminal inputs connection errors, if there are any, and to measure the capacitor values which are connected to its steps; automatic capacitor recognition process must be done.

For automatic capacitor recognition, press "SET" for 3 seconds and enter the setup menu. "Auto" is displayed on the screen. Press "SET" and enter this menu. With "UP/DOWN" buttons, find the "Auto SET UP" menu. Press "SET" and enter this menu. With "UP/DOWN" buttons, find the "Auto Set ofF" parameter and change this parameter to "Auto Set on". Confirm this change by pressing the "SET" button. The capacitor recognition process will start before you exit from the setup menu. The device will activate and deactivate the steps one by one. After this process is finished, the device will start the compensation. Inductive load step powers are not calculated for RG3-15 CL/CLS model during automatic capacitor recognition. Power values must be entered manually.

While the device is in measuring mode, enter the "W" parameter. The light in the lower right segment of the 3rd display must not be blinking. If that's not the case, the connection couldn't be found correctly.

If there are sudden changes to the load and there exist many non-linear loads (Thyristor, Triac controlled loads, Frequency converters, UPS etc.), the device may not be able to recognize the capacitors automatically. If this happens, disconnect the before mentioned loads and repeat the automatic capacitor recognition process.

d) Check the capacitor step values which the device calculated. In order to see these step values correctly; you must enter the current and voltage transformer ratios, if one is used.

e) The device will start the compensation according to the factory values of target $\cos\phi$, step switch on/off time and step discharge time. You must enter the appropriate values for your system to the device.

f) Check the factory default values from the factory default value section.

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Auto

SETTINGS

Automatic Capacitor Recognition Mode (Auto Set UP)

When device starts to operate, device checks connections and if there is a connection error, device corrects it internally. For this correction to be made, 3-phase voltage, 3-phase current and 3-phase capacitor connections must be made. After the connection is corrected, capacitor recognition starts.

NOTE: If there are some loads except compensation in the system, device may find connection errors after several times, not at first time. If device can not complete automatic connection process, step measuring must not be made. In order to have correct power values for capacitor steps during capacitor recognition, current and voltage transformer ratios must be entered correctly. If current and voltage transformer ratios are not entered, these ratios are accepted to be "1" and capacitor powers are calculated according to these values (Refer to VT and CT ratio settings).

For automatic capacitor recognition, press "SET" for 3 seconds and enter the setup menu. "Auto" is displayed on the screen. Press "SET" and enter this menu. With "UP/DOWN" buttons, find the "Auto Set UP" parameter. Press "SET" and enter this menu. With "UP/DOWN" buttons, find the "Auto Set of" parameter and change this parameter to "Auto Set on". Confirm this change by pressing the "SET" button and the capacitor recognition process will start. If 10th program(PS-10) is selected, all of the step values will be measured. If any other program is selected, only the first step value will be measured and other steps will be saved according to the power sequence of the selected program.

NOTE: If automatic setup is selected as "on", automatic capacitor recognition starts immediately without waiting to exit from the menu. The step values which are calculated after this process must always be controlled. Inductive load step powers are not calculated during automatic capacitor recognition for RG3-15 CL/CLS model. Power values must be entered manually.

-  Press SET button 3 s and enter the menu.
-  Press SET button and select "Auto oPE rAti" parameter.
-  Select "Auto Setup" parameter by using the UP/DOWN buttons.
-  Press SET button and enter on / oF option.
-  Select "on" or "of" option by scrolling with UP/DOWN buttons. **(Must be selected "ON" for Automatic Capacitor Recognition)**
-  Press SET button in order to activate your selection.

Setting Manual Operating Mode (Auto oPE rAti)

Device has two operating modes which are automatic mode and manual mode. Operating mode can be selected by selecting "on" (automatic) or "of" (manual) option. Manual mode is used for test purpose. In this mode, capacitor steps are switched on&off and so relay outputs of the device are tested. In the manual mode, capacitor steps are switched on by pressing "SET" button and also capacitor steps are switched off by pressing "ESC" button. Factory set values for switch on (t-on) and switch off (t-of) time is 10 sec. These time values can be programmed in the "Delay" menu (Refer to delay time setting). Even if manual mode is selected, after 5 minutes, device starts to work in automatic mode and continues to operate in automatic mode. In the manual mode, step numbers, which will be switched on&off, can be programmed in "Step" menu (Refer to step number setting).

When automatic mode is selected, AUTO/MAN LED lights on continuously. When manual mode is selected, AUTO/MAN LED blinks.

Warning: Device warns user by blinking (short ON, long OFF) the capacitor steps which will be switched on. Also device warns user by blinking (long ON, short OFF) the capacitor steps which will be switched off.

-  Press SET button 3 s and enter the menu.
-  Press SET button and select "Auto oPE rAti" parameter.
-  Press SET button and enter on / oF option.
-  Select "on" or "of" option by using the UP/DOWN buttons.
-  Press SET button in order to activate your selection.

Automatic Connection Control Function Setting(Auto Connect)

This setting is for enabling or disabling the automatic connection fault detection and correction when the device is energized. It is activated in the factory default settings. In applications with generators depending on the design and the delay of the transfer panel, the device may receive faulty current and voltage signals when a power outage occurs and the generator turns on. In this case, the device may find a connection fault. **That's why this option must be disabled after the device is commissioned.**

trF

CURRENT and VOLTAGE TRANSFORMER RATIO SETTINGS

In order to have correct power values for capacitor steps, current and voltage transformer ratios must be entered correctly. Current and voltage transformer ratios are entered in "trF" menu. If no value is entered in the menu, these ratios are accepted to be "1" and capacitor powers are calculated according to these values.

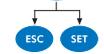
Note: If a voltage transformer is not used in the system, the voltage transformer ratio must be kept as the factory default value "1".

ctr

Current Transformer Ratio

CT ratio can be programmed between 1 and 2000. This value must be the Current Transformer's ratio value.

Example: For 150 A / 5 A current transformer:
150 / 5 = 30 must be the value entered in the menu.

-  Press SET button 3 s and enter the menu.
-  Select "trF" menu by using UP/DOWN buttons.
-  Press SET button. Current transformer ratio (trF Ctr) will be displayed.
-  Press SET button to enter current transformer ratio.
-  Enter CT Ratio between 1-2000 by using UP/DOWN buttons. (Use SET button to move the blinking digit to the right, use ESC button to move the blinking digit to the left)
-  Press SET button to confirm your selection.
-  Press ESC button until SAVE is displayed.
-  Press SET button to save or ESC button to exit without saving.

COS

Target Cosφ and COS2 Target Cosφ2 Values Setting

The device has 2 target Cosφ values as Cosφ and Cosφ2.

Target Cosφ and Cosφ2 can be entered between "0,800 ... -0,800". Negative values represent **Capacitive** region and positive values represent **Inductive** region.

⚠ When a voltage between 110 – 250 VAC exists on the generator input of the device, the target "Cosφ2" which was entered from the device menu becomes active and power factor will be corrected based on this Cosφ2 value. This continues until there is no voltage present on the generator input. Since the capacitor banks will cause voltage increase while the system is supplied from generator, it is strongly advised to set the target "Cosφ2" value equal or smaller to "0.900".

-  Press SET button for 3 s. "Auto" will be displayed on the screen. 
-  When you press DOWN button, "COS" will be displayed on the screen (UP button can also be used). 
-  When you press SET button, first digit of previously set COS value will blink. 
-  Set the blinking digit by using UP - DOWN buttons. Use Set button to go to next digit and ESC button to go to previous digit. After you set the last digit, press SET button and "COS" will be displayed. (Data has been entered but it is not yet activated. Apply following instructions to activate them.) 
-  Press ESC button until "SAUE SET yES" is displayed.
-  When "SAUE SET yES" is displayed, press SET button. (If you press ESC button when "SAUE SET yES" is displayed or you choose "no" option with UP/DOWN buttons instead of "yES" option, new settings will be discarded and previous value will be used.) "COS2" menu is set the same way.

Prog

Program Selection

The device has 10 different program modes which determines the power ratio sequence of the capacitor steps. The sequences are given below: If the power ratio sequence of the capacitor steps is chosen as in 2nd program (PS-02, 1.1.1.1.....), many identical connection elements are needed. If the power ratio sequence of the capacitor steps is chosen as in 3rd program (PS-03) - 8th program (PS-08) less identical connection elements are needed (example: 1.2.2.....). If the power ratio sequence of the capacitor steps is chosen as in 9th program (PS-09), the value of a capacitor step must not exceed the sum of the previous steps and value of the first step value. This way, less capacitors are used. In the 10th program (PS-10), the device calculates the capacitor step values automatically. The switching time of each capacitor step is counted and only the necessary steps are switched on, thus prolonging the service life of the overall system.

Available Programs

PROGRAM	SEQUENCE
01	linear
02	1.1.1.1.....
03	1.1.2.2.....
04	1.2.2.2.....
05	1.2.3.3.....
06	1.2.4.4.....
07	1.1.2.4.....
08	1.2.3.4.....
09	1.2.4.8.....
*10	Any sequence can be selected by user.

* Recommended operating mode.

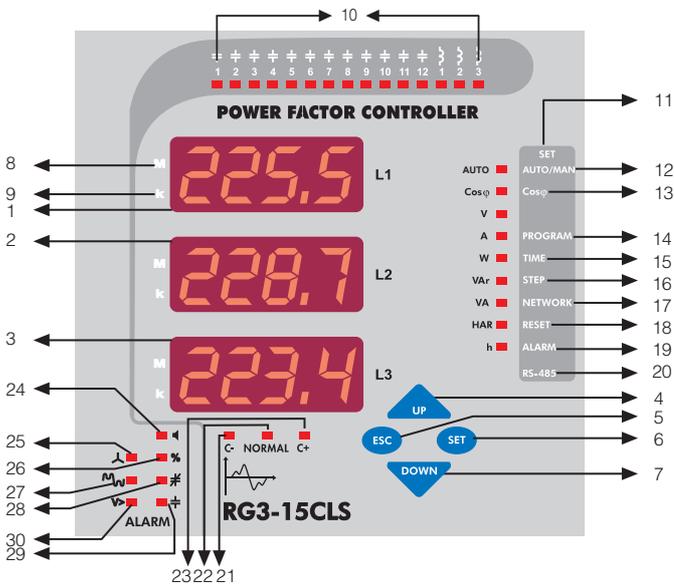
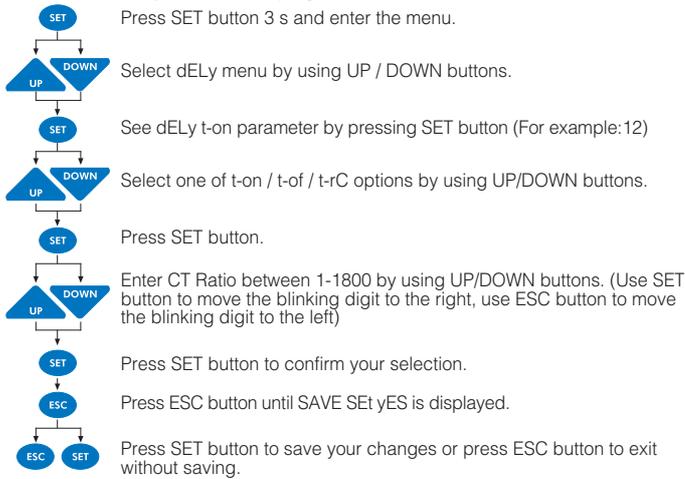
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dELy

Delay Time Setting

Switching "ON" (t-on), Switching "OFF" (t-of) and discharge time (t-rC) for the steps can be programmed to the device.
t-on, t-of, t-rC delay times can be programmed between 1-1800 s.



- L1** : Display for 1st phase.
- L2** : Display for 2nd phase.
- L3** : Display for 3rd phase.
- Up Button** : Used for moving upwards in measurement and menu screens. Used for increasing numerical values in Settings screen.
- Esc Button** : Used for returning to a past operation and for leaving the menu. User for leaving harmonics display mode in measurement mode.
- Set Button** : Used for entering the menu, accessing sub-menus and storing changes. Used for monitoring harmonics values of current, voltage and powers in measurement mode.
- Down Button** : Used for moving downwards in measurement and menu screens. Used for decreasing numerical values in Settings screen.
- M LED** : Indicates that the unit of displayed value is Mega levels which means the displayed value must be multiplied with 10^6 .
- k LED** : Indicates that the unit of displayed value is Kilo levels which means the displayed value must be multiplied with 10^3 .
- 1,2,3,,Step LEDs** : These LEDs belong to steps that will be activated or deactivated. During power factor correction, it indicates the active steps. When a step becomes active, its LED turns on. On RG3-15CL and RG3-15CLS models, reactor LEDs turn on after the 12th capacitor LED.
- SET Menu** : These are menu options on the right that you access when you press the SET button for 3 s.
- OTO/MAN LED** : Indicates automatic or manual operating mode. If Oto/man LED is constantly on, the device operates in automatic mode and if Oto/man LED is blinking, the device operates in manual mode. LED is green colored.
- Cos ϕ LED** : When Cos ϕ is lit up during browsing in the menu, target Cos ϕ value can be entered between - 0,800 and + 0,800. In measurement screen, Cos ϕ values of connected phases are displayed on the screen.

- Program / A LED** : Power sequence selection can be made by entering the menu and selecting **PROGRAM//** LED. While **PROGRAM/A** LED is lit up in measurement mode, current values of phase(s) that is(are) connected to the device is displayed.
- Time / W LED** : Switch on, switch off and discharge times can be adjusted by entering the menu and selecting **TIME/W** LED. While **TIME/W** LED is lit up in measurement mode, active power and total active power (imp. / exp.) values of phase(s) that is(are) connected to the device is displayed.
- Step / VAR LED** : Step power values and step connection types (R, S, T, RST) can be adjusted by entering the menu and selecting **STEP/VAR** LED. While **STEP/VAR** LED is lit up in measurement mode, reactive power and total reactive power (imp. / exp.) values of phase(s) that is(are) connected to the device is displayed.
- Network / VA LED** : Current transformer ratio (Ctr), voltage transformer ratio (Vtr) and calculation (Calc) adjustments can be done by entering the menu and selecting **NETWORK/VAR** LED. While **NETWORK/VAR** LED is lit up in measurement mode, apparent power and total apparent power (imp. / exp.) values of phase(s) that is(are) connected to the device is displayed.
- Reset / HAR LED** : Energy values can be deleted and reactive energy ratios and alarms can be reset by entering the menu and selecting **RESET/HAR** LED.
- Alarm / h LED** : Limit values for alarm-creating events (such as overvoltage, reactive/active ratio, temperature and harmonics) can be entered by entering the menu and selecting **ALARM/h** LED.
- RS-485** : Address, Baudrate and Parity settings about RS-485 communication protocol is done in this menu option.
- C- LED** : When this LED is turned on, it indicates that RG3-15C/CS/CL/CLS is waiting to deactivate a capacitor step.
- Normal LED** : When this LED is turned on, it indicates that the device will not activate or deactivate any steps.
- C+ LED** : When this LED is turned on, it indicates that RG3-15C/CS/CL/CLS is waiting to activate a capacitor step.
- ▲** : In case of any failure, alarm relay is switched on and alarm LED turns on.
- ▲** : In case of a connection failure, connection fault LED turns on.
- %** : If reactive energy ratios exceed adjusted limit values, ratio fault LED turns on.
- M_n : If voltage harmonic ratios exceed adjusted limit values, harmonics LED turns on.
- \neq : When there isn't enough step power for power factor correction which means when target power factor value is not reached although all the capacitor steps are switched on, insufficient step power LED turns on.
- \neq : When there isn't a connected capacitor on the step, step fault LED turns on.
- ∇ : When voltage value exceeds adjusted limit value, overvoltage LED turns on.

Technical Features

- Please look at the rear label of the device.**
- Operating Voltage (Un) : (0,9-1,1)xUn
 - Operating Voltage Range ΔU : 50mA-5,5A
 - Operating Current Range ΔI : 50 Hz / 60 Hz
 - Frequency : 1% \pm 1 digit (V, I, Cos ϕ), 2% \pm 1 digit (W, VAR, VA, Wh) (100mA-5,5A)
 - Measurement Class
 - Power Consumption : <2 VA (Current) 3 VA - 10 VA (Voltage)
 - Output Contact : 5 A, 250 V AC, 1250 VA
 - Generator Input : 110 V AC ~ 250 V AC
 - No-Volt Feature : In case of power failure (for phase 1) longer than 20 ms, all capacitor steps are disconnected automatically
 - Setting Range : - 0,800 ... +0,800
 - Cos ϕ Setting : - 0,800 ... +0,800
 - CT Ratio : 1 - 2000
 - VT Ratio : 1 - 2000
 - Switch on&off and Discharge Time Setting : Switching on&off and discharge times can be set between 1-1800 s.
 - Step Number : 15
 - Over Voltage Setting : Selectable
 - Ambient Temperature Range : -5° C - 55° C
 - Display : Red LED Display with 4 Digits
 - Equipment Protection Class : Double Insulation (□)
 - Wire Cross section (for terminals) : 2,5 mm²
 - Box Protection Class : IP 00
 - Connection Type : Terminal Connection
 - Dimension : Type PR16
 - Panel Cut-out : 139x139 mm
 - Weight : 0,85 kg.
 - RS-485 Communication * : Address : 1-247 Baud Rate : 1.200 bps, 2.400 bps, 4.800 bps, 9.600 bps, 19.200 bps, 38.400 bps Parity : no, odd, even
 - Default Factory Settings** : Auto Connection Correction : On Target Cos ϕ : 1,000 (inductive) Target Cos ϕ 2 : 0,900 (inductive) Program : PS-10 t-on (Switching on delay) : 10 sec. t-off (Switching off delay) : 10 sec. Discharge time : 14 sec. Over Voltage : 260,0 V AC Delay : 3,0 sec. Step protection : Off Over Harmonic : 7,0 % Delay : 1,0 sec. Step protection : Off Inductive Ratio Limit : 25 Capacitive Ratio Limit : 15 Energy Ratio Read Time : 96 hours CT Ratio : 1 VT Ratio : 1 RS-485 Communication : Address : 1 Baud Rate : 9,600 bps Parity : no

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EnEr
99

Deleting the Energy Counters and Entering Index

The device has 2 energy counters. While the "Energy Counter 1" can be monitored on the display of the device, "Energy Counter 2" can only be read from the register of the device.

"Enerji sayacı 1" için; cihaz menüsünde Aktif İmport (A-I), Aktif Export (A-E), Reaktif İndüktif (r-L) ve Reaktif Kapasitif (r-C) enerji değerleri için 0,1 kWh/kVAh hassasiyeti ile indeks girilebilir.

For "Energy Counter 1"; index for the Active Import(A-I), Active Export(A-E), Reactive Inductive(r-L) and Reactive Capacitive(r-C) energy values can be entered from the device menu with an accuracy of 0,1kWh/kVAh. Deleting the energy values can also be done from this menu. Energy counters can be conditioned to the generator input.

En99|SEt|R-I

In this menu, index value of the active import energy is entered.

En99|SEt|R-E

In this menu, index value of the active export energy is entered.

En99|SEt|r-L

In this menu, index value of the reactive inductive energy is entered.

En99|SEt|r-C

In this menu, index value of the reactive capacitive energy is entered.

En99|CLr|En-1

In this menu, values of the "Energy Counter 1" is deleted.

En99|CLr|En-2

In this menu, values of the "Energy Counter 2" is deleted.

En99|SEt|9En

In this menu, the conditioning of the energy counters is done. There are 2 parameters. If the "gEn Act no" parameter is selected, "Energy Counter 1" and "Energy Counter 2" will count simultaneously. If the "gEn Act yES" is selected; in the presence of a signal on the generator input, "Energy Counter 1" will stop counting and "Energy Counter 2" will start counting. In the absence of a signal on the generator input, "Energy Counter 2" will stop counting and "Energy Counter 1" will start counting. This way, "Energy Counter 2" can be set as generator energy counter.

ALr

Adjustable Alarm Protections of the Device

These parameters can be set by the user to protect the capacitors.

UoLt Overvoltage Protection Setting

It is used to protect the capacitors from overvoltage. There are 3 parameters. "SP-U" : It can be entered between 0-500 V. If "0" is entered, this alarm will be disabled.

"dELy" : Delay time can be set between 0-999.9 s.

"StEP" : It determines the state of the steps in an alarm condition. If "on" is selected, the steps will not be affected in an alarm condition. If "oF" is selected, all of the steps will be switched off.

THd Over THDV Protection Setting

If the THDV value exceeds the user-defined value, an alarm is created. There are 3 parameters.

"SP-t" : A THD value between 0-99.9% can be entered. If "0" is entered, this alarm will be disabled.

"dELy" : Delay time can be set between 0-999.9 s.

"StEP" : It determines the state of the steps in an alarm condition. If "on" is selected, the steps will not be affected in an alarm condition. If "oF" is selected, all of the steps will be switched off.

rAtE Ratio Protection Setting

If the capacitive and inductive ratios go out of the defined range, an alarm is created at the end of the user-defined time. There are 3 parameters. "ind" : Inductive ratio can be entered between 0-99.9%. If "0" is entered, this alarm will be disabled.

"CAP" : Capacitive ratio can be entered between 0-99.9%. If "0" is entered, this alarm will be disabled.

"HoUr" : A value between 1-240 hours can be entered.

NOT : If the defined time is "xxx" hours, the "ind" and "CAP" ratios are displayed according to the last "xxx" hours.

Generator Input

When a voltage between 110 and 250 V AC is applied to the generator input; target "Cosφ", which is programmed in the menu, is deactivated, "Cosφ2" is activated and the device will start to compensate the system according to Cosφ2. This setting will be active as long as there is voltage on the generator input of the device.

Erro r-08 Displaying the Alarm Codes which are given by the device

Related Alarm LED is on if any failure is occurred for any reason. Monitoring of the errors by a user is done by pressing UP/DOWN buttons until Error-xx is displayed. This will not be displayed if there is no error. All the error codes are displayed in sequence by pressing the SET button.

ALARM CODES

NO	DESCRIPTION	LED ☼	REASON
00	Angle between phase voltages doesn't equal to 120°	⊥	Neutral and Voltage terminal connections may be wrong
01	Reverse phase sequence	⊥	Voltage terminal connections may be in counter clockwise direction
02	One or more phase voltages don't exist	⊥	Voltage terminal connections may be wrong
03	Phase 1 Current	⊥	Current transformer connections for phase 1 may be wrong or first capacitor step may be defected
04	Phase 2 Current	⊥	Current transformer connections for phase 2 may be wrong or first capacitor step may be defected
05	Phase 3 Current	⊥	Current transformer connections for phase 3 may be wrong or first capacitor step may be defected
06	THD for voltage exceeds the preset value	⌚	Excessive harmonic may be exist in the system
07	Voltage value of any phase exceeds the preset value	V>	Voltage value of the system may be increased
08	Reactive compensation ratio exceeds the preset value	%	Compensation Error
09	Reactive inductive ratio exceeds the preset value	%	Compensation Error
10			
11	Automatic connection could not be found	⊥	Defected capacitor step or variable loads
12	Over compensation	≠	Target Cosφ is capacitive even if all capacitor steps are switched off
13	Insufficient compensation	≠	Capacitor powers are not sufficient for target Cosφ
14	Phase sequence is not correct	≠	3-phase capacitor powers were not selected properly
15	Capacitor power for phase 1 is not appropriate	≠	Capacitor powers for phase 1 were not selected properly
16	Capacitor power for phase 2 is not appropriate	≠	Capacitor powers for phase 2 were not selected properly
17	Capacitor power for phase 3 is not appropriate	≠	Capacitor powers for phase 3 were not selected properly
18	Capacitor step 1 is defected	⊥	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
19	Capacitor step 2 is defected	⊥	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
20	Capacitor step 3 is defected	⊥	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
21	Capacitor step 4 is defected	⊥	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
22	Capacitor step 5 is defected	⊥	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
23	Capacitor step 6 is defected	⊥	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
24	Capacitor step 7 is defected	⊥	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
25	Capacitor step 8 is defected	⊥	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
26	Capacitor step 9 is defected	⊥	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
27	Capacitor step 10 is defected	⊥	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
28	Capacitor step 11 is defected	⊥	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
29	Capacitor step 12 is defected	⊥	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
30	Capacitor step 13 is defected	⊥	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown
31	Capacitor step 14 is defected	⊥	In the capacitor step measurement, 3-phase capacitor step is unbalanced or the fuse of any phase is blown