



RGT-MT18 USER GUIDE

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About RGT-MT

It is designed to reduce reactive (inductive and capacitive) power that comes from the network and loads do not use. If the inductive reactive power is attracted from the network, it interferes by attracting capacitor at the appropriate step. If capacitive reactive power is attracted from the network, it interferes by attracting shunt reactor at the appropriate step. Thus it endeavors to reduce the inductive/active and capacitive/active rates of the system.

It is designed to make more sensible compensation at the unbalanced inductive and capacitive systems with RGT-MT18 TCR(SVC) step.

Features

- ◆ 5 "Easy to install and use with touch (resistive) display
- ◆ TCR (SVC) Connectable
- ◆ Generator Input and Generator Compensation
- ◆ Remote Communication with RS485 (Computer Communication)
- ◆ Temperature Measurement and Control
- ◆ Compensation for Inductive and Capacitive Systems
- ◆ Manual Step Value Enterable
- ◆ Single, Two, and Three Phase Capacitor and Shunt Reactor can be Connected
- ◆ Turkish and English Language Option
- ◆ Voltage, Harmonic Current/Voltage, Inductive and Capacitive Alarm Output
- ◆ Temperature Alarm Output
- ◆ Intervention, Discharge and Settling Times can be Adjustable
- ◆ Current Harmonics can be Observed Up To 61st Harmonics
- ◆ Voltage Harmonics can be Observed Up To 61st Harmonics
- ◆ Cosine Values of Each Phase Can Be Observed
- ◆ Power Factor Values of Each Phase can be Observed as Graphically
- ◆ Capacitive / Active and Inductive / Active Ratios can be Observed as Grafically.
- ◆ Total Energies (Import/Export) can be Observed.
- ◆ THD-V and THD-I values of Each Phase can be Observed.
- ◆ Creating Power Analysis (20 samples 9999 min.)
- ◆ Demand Registration (Active & Reactive & Apparent Power and Current Demand)
- ◆ Min, Max and Average Values of Current and Voltage of Each Phase can be Observed.
- ◆ Real Date and Time
- ◆ Encrypted Protection
- ◆ Same Aging in Steps

Warnings

- Use the device according to our instructions.
- Avoid direct sun light in order not to harm the LCD screen.
- Leave at least 10 cm of space behind the device after mounting.
- Fix the device with apparatus which comes within the device by avoiding any kind of shake on the front cover of the board.
- Balance the inner and outer heat in the metal boards. Otherwise because of the temperature difference that originates from the dampish surrounding, water droplets occurs on the ceiling of the board and this situation is dangerous for the open connected buses.
- Mark the switch and circuit breaker as the connection tripping element for the device.
- Keep the switch and circuit breaker close to the device and easily accessible by the operator.
- There must be no electricity in the connection cables when assembling.
- Screened and twisted cord cables should be used on the input and output lines without connection to the Mains (network). These cables should not pass near high-Voltage lines and devices.
- Do not touch the touchscreen with a hard, sharp object.

Matters to Be Considered In Compensation

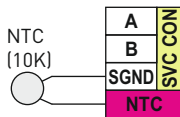
- Compensation starts with the regulations of the load distribution of the Electrical wiring in a balanced way that belongs to the system.
- **Connect three phase capacitor with high value to the first three step (C1, C2, C3) for the current transformer test.**
- Do not define step number and capacitor values randomly where has rapid load changing and where huge amount of load is distributed randomly.
- You can get benefit from the examples which are in the Power Analysis, in order to compensate more effectively to the unbalanced loads in the system.
- It is advisable to add new steps at the same value for the lifespan of the commonly used step's conductor and capacitor.
- While preparing compensation board be careful about that you should easily add new steps for probable changings (load adding or excluding) that can occur subsequently.
- While making current transformer test and measurement of the step, be careful about avoiding rapid load changing on the system as much as possible.
- Choose the automatic fuse current values used in steps according to the power of the capacitor and reactor and point as connection removing member.
- Use different automatic fuse for each feeding inductor of the step conductors.
- Use compensation conductor sand discharge inductors at the steps.
- Unique phase connection at the three phase systems is only appropriate for balanced load attraction. Otherwise desired rates cannot be obtained.

Point to Pay Attention About The Choice And Connection of the Current Transformers

- Be careful about the value of the current transformer to be more than the maximum current which could be/is attracted from the system.
- It is recommended that class of the current transformers (it can be also mentioned class, klas, kl, cl) should be 0,5 which will be used at the compensations.
- Only X5A current transformers can be connected to the RGT-MT18.
- Be careful about the absence of any load before the current transformers. Otherwise there can be differences between reactive and counter.
- Current transformer outputs and phase inputs must be in the same order. Connect the k-l terminals of the current transformer connected to the L1 phase to the k1-l1 terminals, the k-l terminals of the current transformer connected to the L2 phase to the k2-l2 terminals and the k-l terminals of the current transformer connected to the L3 phase to the k3-l3 terminals.
- While connecting output of the current transformer terminals in order to avoid confusion, use different coloured cable for each phase or number the cables.
- Pass the cables which is connected to the output of the current transformer far from the high voltage line.
- It is advised that the cables to be used which are connected to current transformer should be minimum 1.5 mm². It is also recommended that the cables should be thickened as the distance increase.
- In order to avoid shake at the current transformers, fix to the bus, cables or rail.

How to Connect the NTC to Inside of the Panel Temperature?

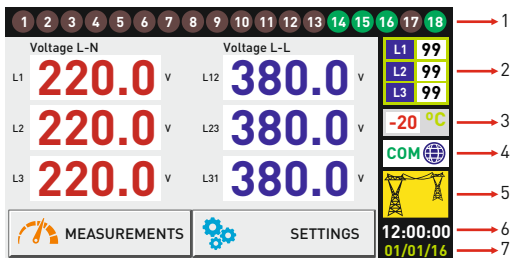
In order to measure the surrounding temperature of the panel, NTC terminal will be attached which comes within the device. NTC's one terminal will be attached to the RS485 connection's GND, the other terminal will be connected to the NTC. When the connection accomplished, panel heat value is seen on the screen. When the connection disconnected or reach to the -40, "NC" sign is seen on the screen.



Maintenance of the Device

Turn off the energy of device and disconnect it from the connections. Clean the body of the device with a slightly damp or dry cloth. Do not use conductive or other chemicals that may damage the device as a cleaning materials. After the device is cleaned, make connections and make sure that the device is working by energizing the device.

Screen Introduction



1- Step LEDs:



It shows the which step?

The display background becomes red when the step is switched on. When the step is switched off, the display background color is gray. It has no touch feature.

2- TCR (SVC) Step Indicator:



It shows separately the driving ratios of the mono-phase shunt reactors connected to the SVC. It has no touch feature.

3- Temperature Indicator:



Indoor temperature is shown in °C. When the NTC connection fails or when the temperature it goes below -40 °C, "NC" is written in the value display. It has no touch feature.

4- Remote Communication Indicator:



It displays for 1 second when remote communication with RGT-MT18. The passive image is displayed when no remote communication is made. It has no touch feature.



5- System Feed (Voltage) Source Indicator:

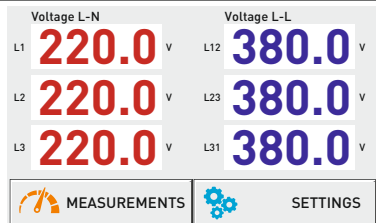


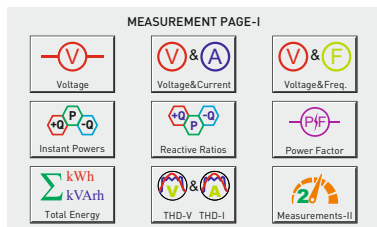
Indicates that the system is fed from the network or generator. When voltage (220V) is applied to the generator input, the system is supplied from the generator. If there is no voltage at the generator input, it means that the system is being fed from the network. It has no touch feature.

6- Dynamic Display:

Touch-screen is active on this area.

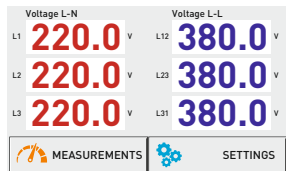
By pressing the buttons in the area, the measured values can be seen and the settings can be changed.





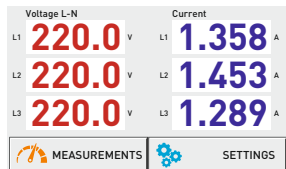
When the Measurements button is pressed, the measurements page-1 comes to the dynamic area. From this page you can switch between Voltage, Voltage & Current, Voltage & Frequency, Instantaneous Power, Ratios, Power Factor, Total Energy, THD-V THD-I and Measurements-2 page.

- 1.1 **Voltage:** Phase-Neutral and Phase-Phase voltage values are displayed.
 - 1.2 **Voltage&Current:** Voltage and current values are displayed.
 - 1.3 **Voltage&Frequency:** Voltage and Frequency values are displayed.
 - 1.4 **Instant Powers:** Instant active and reactive power are displayed.
 - 1.5 **Reactive Ratios:** Capacitive / Active and Inductive / Active ratios are shown.
 - 1.6 **Power Factor:** The power factor values are shown in figures and graphs.
 - 1.7 **Total Energy:** Total Active, Inductive and Capacitive energies are shown.
 - 1.8 **THD-V/THD-I:** Total Harmonic Voltage and Current values are displayed.
2. **Measurements-II:** goes to Measurements Page 2.



In this page, the phase-neutral and phase-to-phase voltage values are displayed for each phase.

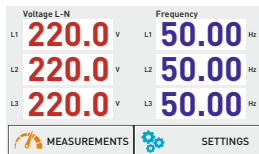
On this page, the "Measurements 1" page is displayed when the "Measurements" button is pressed, and the "Settings" page is displayed when the "Settings" button is pressed.



In this page, the phase-neutral voltage values of each phase and the current values of each phase are displayed.

On this page, the "Measurements 1" page is displayed when the "Measurements" button is pressed, and the "Settings" page is displayed when the "Settings" button is pressed.

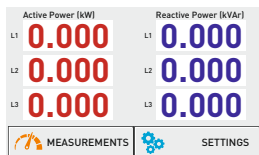
Measurements Page 1 1.3 Voltage & Frequency Page



In this page, the phase-neutral voltage values of each phase and the frequency values of each phase are displayed.

On this page, the "Measurements 1" page is displayed when the "Measurements" button is pressed, and the "Settings" page is displayed when the "Settings" button is pressed.

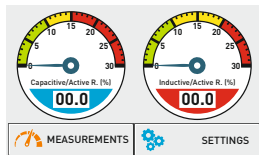
Measurements Page 1 1.4 Instant Powers Page



In this page, the active power and reactive power values are displayed.

On this page, the "Measurements 1" page is displayed when the "Measurements" button is pressed, and the "Settings" page is displayed when the "Settings" button is pressed.

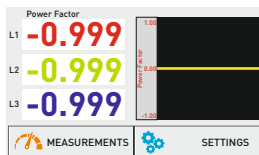
Measurements Page 1 1.5 Reactive Ratios Page



In this page Capacitive / Active and Inductive / Active ratios are displayed as "%" in figures and graphs.

On this page, the "Measurements 1" page is displayed when the "Measurements" button is pressed, and the "Settings" page is displayed when the "Settings" button is pressed.

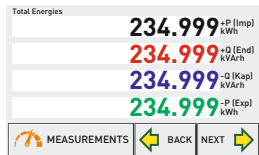
Measurements Page 1 1.6 Power Factor Page



In this page, the Power Factor values are displayed in figures and graphs.

On this page, the "Measurements 1" page is displayed when the "Measurements" button is pressed, and the "Settings" page is displayed when the "Settings" button is pressed.

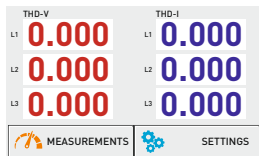
Measurements Page 1 1.7 Total Energies Pages



In this page, total energy values (import active, inductive, capacitive and export active) are displayed.

On this page, the "Measurements 1" page is displayed when the "Measurements" button is pressed. When you press the "BACK" and "NEXT" buttons, you can see the Energy for each phase, Energies of tariffs and Energy values of Generators.

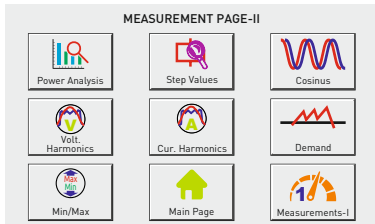
Measurements Measurements Page 1 1.8 THD-V THD-I Page



In this page, THD-V (Voltage total harmonic distortion) and THD-I (Current total harmonic distortion) values of each phase are displayed.

On this page, the "Measurements 1" page is displayed when the "Measurements" button is pressed, and the "Settings" page is displayed when the "Settings" button is pressed.

Measurements 2. Measurements Page 2



When the Measurements-II button is pressed, the measurements page-2 comes to the screen on the dynamic area.

From this page, it is possible to switch to Power Analysis, Step Range, Cosine, Harmonic Voltage, Harmonic Current, Demand, Min / Max, Home and Measurements-1 page.

2.1 Power Analysis: The reactive (inductive and capacitive) records of the system are displayed.

2.2 Step Value: Each phase of step values are shown.

2.3 Cosine: The cosine value is shown in figures and graphs.

2.4 Harmonic Voltage: Values up to the 61st harmonic of each phase are displayed.

2.5 Harmonic Current: Values up to the 61st harmonic of each phase are displayed.

2.6 Demand: Active / Reactive / Apparent power and Current demand values are displayed.

2.7 Min/Max: Current and Voltage Min / Max / Average values are displayed.

Main Page: Go to Main Page.

Measurements-I: Go to Measurements Page 1.

Measurements Measurements Page 2 2.1 Power Analysis Page

	Power Analysis Samples			
	L1	L2	L3	Time (min)
1.	0.00	0.00	0.00	0
2.	0.00	0.00	0.00	0
3.	0.00	0.00	0.00	0
4.	0.00	0.00	0.00	0
5.	0.00	0.00	0.00	0




In this page each reactive (capacitive) is marked as (-) power of the phase are recorded with their time.

If expenditure of power is fixed in a stated time, it is recorded as sample. If latter sample is %15 higher than the former, it is recorded as different. If it is %15 less than the former, it is added to the sample. It includes 20 samples in total. It can take samples up to 9999 minutes most.

In this page when you press the Measurements button "Measurements 1" page comes. When you press "BACK" and "NEXT" button, you can pass among the samples.

Measurements Page 2 2.2 Step Values Page

Step Values					
	L1	L2	L3	Connection	Counter
1.	-0.33	-0.33	-0.33	L1-2-3	10
2.	-0,25	0.00	0.00	L1	30
3.	0.00	-0,25	0.00	L2	45
4.	0.00	0.00	-0,25	L3	1
5.	0.00	0.00	0.00	Cancel	0

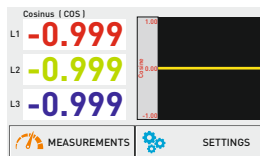
  

In this page, the values of capacitor (sign (-) or shunt reactor value (each phase separately), connection type and number of steps usage are displayed.

It is 18+1 step in total. The 19th step is TCR. Three monophasi (one for each phase) shunt reactor are connected to this step. Shunt reactors are connected to driver. Shunt reactors are triggered via the SVC CON connection.

On this page, the "Measurements 1" page is displayed when the "Measurements" button is pressed. When you press the "BACK" and "NEXT" buttons, you can pass from one step to another step.

Measurements Page 2 2.3 Cosine Page






In this page, the cosine values of each phase are displayed in figures and graphics.

On this page, the "Measurements 1" page is displayed when the "Measurements" button is pressed, and the "Settings" page is displayed when the "Settings" button is pressed.

Measurements Page 2 2.4 Harmonic Voltage Page

L1 - Voltage Harmonics

3.	0.0	15.0	27.0	39.0	51.0
5.	0.0	17.0	29.0	41.0	53.0
7.	0.0	19.0	31.0	43.0	55.0
9.	0.0	21.0	33.0	45.0	57.0
11.	0.0	23.0	35.0	47.0	59.0
13.	0.0	25.0	37.0	49.0	61.0




In this page, up to the 61st harmonic of each phase voltage is displayed.

On this page, the "Measurements 1" page is displayed when the "Measurements" button is pressed. When you press the "BACK" and "NEXT" buttons, you can see harmonics belong to the other phases.

Measurements Page 2 2.5 Harmonic Current Page

L1 - Current Harmonics

3.	0.0	15.0	27.0	39.0	51.0
5.	0.0	17.0	29.0	41.0	53.0
7.	0.0	19.0	31.0	43.0	55.0
9.	0.0	21.0	33.0	45.0	57.0
11.	0.0	23.0	35.0	47.0	59.0
13.	0.0	25.0	37.0	49.0	61.0

In this page, it is displayed up to the 61st harmonic of each phase current.

On this page, the "Measurements 1" page is displayed when the "Measurements" button is pressed. When you press the "BACK" and "NEXT" buttons, you can see harmonics belong to the other phases.

Measurements Measurements Page 2 2.6 Demand Page

Current Demand (15min.)			
	Current (A)	Date	Time
L1	0.000	00/00/0000	00:00
L2	0.000	00/00/0000	00:00
L3	0.000	00/00/0000	00:00
Total	0.000	00/00/0000	00:00

In this page, the total current, active power, reactive power and apparent power demand values are displayed with the date and Times.

On this page, the "Measurements 1" page is displayed when the "Measurements" button is pressed. When you press the "BACK" and "NEXT" buttons, you can see other demand values.

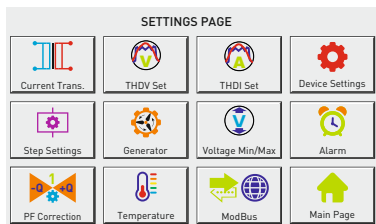
Measurements Measurements Page 2 2.7 Min / Max / Average Page

Current Min-Max-Avg (A) (5min.)			
	Min	Max	Avg
L1	0.000	0.000	0.000
L2	0.000	0.000	0.000
L3	0.000	0.000	0.000

In this page, the minimum (min), maximum (max) and average (avg) values of current and voltage values are displayed. (Values are taken with an average of 5 min.)

On this page, the "Measurements 1" page is displayed when the "Measurements" button is pressed. When you press the "BACK" and "NEXT" buttons, it is toggle between the others.

Settings 3. Settings Screen



When the Settings button is pressed, the Settings page appears on the screen on dynamic area.

From this page, you can switch to Current Transformer, Harmonic Voltage, Harmonic Current, Device Settings, Step, Generator, Voltage Min / Max, Alarm, Compensation, Temperature, Modbus settings and Main Page.

3.1 Current Transformer : The current transformer test / current transformer value change is made.

3.2 Harmonic Voltage: Harmonic Voltage settings are made.

3.3 Harmonic Current: Harmonic Current settings are made.

3.4 Device Settings: Go to Device settings menu.

3.5 Step: Go to the menu of Step settings.

3.6 Generator: Generator settings are made.

3.7 Voltage Min / Max: Voltage settings are made.

3.8 Alarm: Inductive and Capacitive Alarm settings are made.

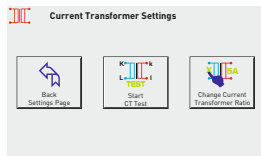
3.9 Compensation: Inductive and Capacitive target settings are made.

3.10 Temperature: Temperature Alarm settings are made.

3.11 ModBus: Modbus (Communication) settings are made.

Main Page: Go to Main Page.

Settings **3.1 Current Transformer Settings**

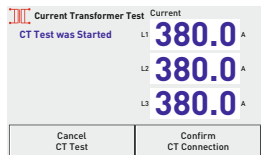


In this page you can start the current transformer test and change the current transformer value.

On this page, when the "Start Current Transformer Test" button is pressed, the current transformer test is started. When the "Change Current Transformer Value" button is pressed, the current transformer value changing page is displayed on the screen.

When the "Back" button is pressed, the "Settings" page appears on the screen.

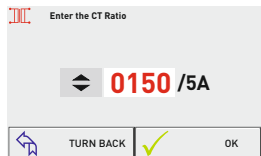
Settings **Current Transformer 3.1.1 Current Transformer Test**



The test starts automatically when the "Start current transformer test" button is pressed. If there are any problems in the connection, the device will give a warning and will not accept the connection.

If the current transformer test is successful and the connection is confirmed, the device starts to measure the step automatically.

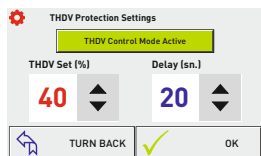
Settings **Current Transformer 3.1.2 Changing the Current Transformer Value**



To set the current transformer value, press the up and down arrow buttons on the screen after pressing the "Change current transformer value" button. The test starts automatically when the "Confirm" button is pressed. If there are any problems in the connection, the device will give a warning and will not accept the connection.

If the current transformer test is successful and the connection is confirmed, the device starts to measure the step automatically.

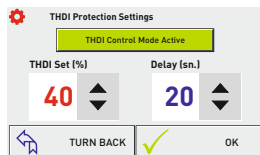
Settings **3.2 Voltage Harmonic Protection**



In this page voltage harmonic control mode can be made active or passive, harmonic of total voltage and delay of it can be set. When the set is active the colour of the button's writing becomes green, and when the set is passive it becomes red. When the control mode is active and the total voltage harmonics get higher than the setted harmonic values, the device waits as much as delay; after the time of the delay comes to an end it makes the compensation stop

and "High Harmonic Voltage" warning comes to the screen. Also "ALR1" is on. When the control mode is passive, the device doesn't make voltage harmonic control. Pressing the "Confirm" button, the saved data is recorded and returns to "Settings" page. When the "Return" button is pressed, without recording any value, turns to "Settings" page.

Settings **3.3 Current Harmonic Protection**

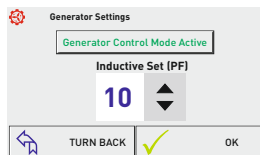


In this page current harmonic control mode can be made active or passive, harmonic of current and delay can be set. When the setting is active color of the button's writing becomes green, when it is passive it becomes red. When the control mode is active and the total voltage harmonics get higher than the setted harmonic values, the device waits as much as delay; after the time of the delay comes to an end

it makes the compensation stop and "High Harmonic Current" warning comes to the screen. Also "ALR1" is on. When the control mode is passive, the device doesn't make voltage harmonic control.

Pressing the "Confirm" button, the saved data is recorded and returns to "Settings" page. When the "Return" button is pressed, without recording any value, turns to "Settings" page.

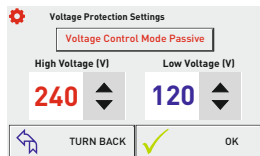
Settings **3.4 Generator Compensation Setting**



In this page generator control mode can be made passive or active and inductive/active can be set. When the setting is active color of the button's writing becomes green, when it is passive it becomes red. When the generator mode is activated, the device compensates according to the set "inductive set value" while the generator is on. When the generator mode is passive, compensation is stopped while the generator is on.

Pressing the "Confirm" button, the saved data is recorded and returns to "Settings" page. When the "Return" button is pressed, without recording any value, turns to "Settings" page.

Settings **3.5 Voltage Protection**



In this page Voltage control mode can be made passive or active, High voltage and low voltage values can be set. When the setting is active color of the button's writing becomes green, when it is passive it becomes red. When the voltage control mode is active, it stops the compensation if set voltage get out of upper and lower limits. Then the display will show "High Voltage" or "Low Voltage" warning.

Also "ALR1" is on. When the Voltage Protection mode is passive, the device doesn't make voltage control.

Pressing the "Confirm" button, the saved data is recorded and returns to "Settings" page. When the "Return" button is pressed, without recording any value, turns to "Settings" page.

Settings 3.6 Inductive and Capacitive Alarm

Select the Alarm You Want to Set!

Ind. Alarm Active	Cap. Alarm Passive
Inductive Alarm %	Capacitive Alarm %
05	10
TURN BACK	OK

In this page inductive/active and capacitive/active Alarm mode can be made passive or active and inductive/active and capacitive/active ratio can be set. When the setting is active color of the button's writing becomes green, when it is passive it becomes red. When the ratios rise above the activated set value, the display shows "High Inductive" or "High Capacitive" warning. Also "ALR1" is on. When the Alarm mode is passive, the display doesn't show warning.

Pressing the "Confirm" button, the saved data is recorded and returns to "Settings" page. When the "Return" button is pressed, without recording any value, turns to "Settings" page.

Settings 3.7 Compensation Target Setting

Enter the Target Ratios!

Inductive Set %	Capacitive Set %
05	10
TURN BACK	OK

In this page, the inductive/active and capacitive/active ratio that the device is aiming at compensation can be set.

Pressing the "Confirm" button, the saved data is recorded and returns to "Settings" page. When the "Return" button is pressed, without recording any value, turns to "Settings" page.

Settings 3.8 Temperature Control

Temperature Protection Settings

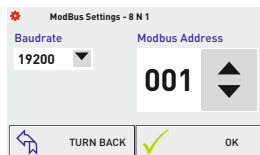
Temperature Control Mode Active

High Temperature	Low Temperature
30	-10
TURN BACK	OK

In this page Temperature control mode can be made passive or active, High Temperature and low Temperature values can be set. When the setting is active color of the button's writing becomes green, when it is passive it becomes red. When the Temperature control mode is active if Set Temperature get out of upper and lower limits, the display will show "High Temperature" or "Low Temperature" warning. Also "ALR2" is on.

Pressing the "Confirm" button, the saved data is recorded and returns to "Settings" page. When the "Return" button is pressed, without recording any value, turns to "Settings" page.

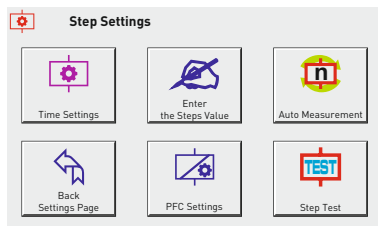
Settings 3.9 Modbus Settings



In this page remote communication settings can be done to the device. Addresses of Baudrate and Modbus can be changed. Databits=8, Stopbits=1 and Parity=none values are fixed.

Pressing the "Confirm" button, the saved data is recorded and returns to "Settings" page. When the "Return" button is pressed, without recording any value, turns to "Settings" page.

Settings 3.10 Step Settings Page



When the Stage Button is pressed, Stage Settings page comes to the screen in the dynamic area. Times related to steps, Enter Stage Value, Automatical Measurement, PFC Settings, Stage Test and Settings Page can be passed from this page.

3.10.1 Times: Drive, Discharge and Settling Times are set.

3.10.2 Enter Step Value: Value of step is entered manually

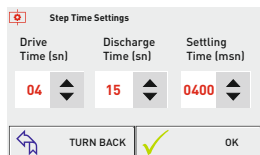
3.10.3 Automatical Measurement: The selected steps are measured.

Back Settings Page: Returns to the Settings page.

3.10.4 PFC Settings: Compensation can be active or passive mode.

3.10.5 Stage Test: The selected steps are checked.

Settings Step Settings 3.10.1 Step Times



In this page, the intervention time, the capacitor discharge time and the capacitor settling time can be set.

Drive time: it is the Intervention (Step taking-drop) time of the device to the power change in the system.

Discharge time: It is the delay time of re-commissioning the same step after dropping the capacitor in the step.

Step settling time: When a few steps are needed is the delay time between steps.

Pressing the "Confirm" button, the saved data is recorded and returns to "Settings" page. When the "Return" button is pressed, without recording any value, turns to "Settings" page.

Settings ⚙️ Step Settings ⚙️ 3.10.2 Entering the Manual Step Value

Step	Phase	Value (kVar)
01	L1	-01.00

1. Step L1 Value was Saved!

TURN BACK OK

In this page, manual step value can be entered. Mono and three phase capacitor or shunt reactor values can be entered.

Step, Phase and Values are set to help with the up and down arrow buttons. The values entered by pressing the "Confirm" button are saved and the writing comes to the related screen as "1. Stage L1 Value Registered!".

If the value to be entered is mono phase, select "L1, L2 or L3" from the phase section according to the phase to which it is connected. "L123" should be selected for the three phases.

Example: The value entered in the display is 1kvar capacitor in L1 phase and Step 1.

When the "Return" button is pressed, without recording any value, turns to "Settings" page.

Settings ⚙️ Step Settings ⚙️ 3.10.3 Automatic Level Measurement

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	TCR	All Pass	All Active

TURN BACK START

In this page, step is measured automatically.

Measurement could be done automatically only at chosen step. If you press the button of the step you desired, logo of the step will change. According to the Page 8th and 10th steps are chosen for the automatic measurement. After choosing the steps, automatic measurement starts when the "start" button is pressed.

Step Measurement	1. Step [kVAr]
L1	-01.50
L2	-01.50
L3	-01.50

Step Test Was Started

CANCEL OK

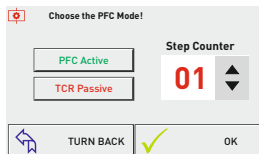
When the "Return" button is pressed, without recording any value, turns to "Settings" page.

When the automatic step measurement is started, a page comes to the screen like on the side. In the page it could be seen which measurement of the step is done and phases of

the measured value is shown separately. If the condenser is connected to the step, (-) sign is seen on the left. If the shunt reactor is connected to the step, the value does not have a sign. The chosen steps will be measured subsequently and when the measurement is finished press "confirm" button in order to record values.

When the "cancel" button is pressed, measurement of the step is canceled and measured values returns to the automatic step measurement screen without recording.

Settings → Step Settings → 3.10.4 PFC Setting

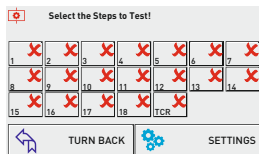


In this page PFC(compensation) and TCR(SVC) are made active or passive ,from the Step Counter part,the setting of the device on how many steps can be included is done. The device can disable PFC (compensation) in necessary (like manuel usage) situations. When the PFC is passive, the device gives up intervening to the system. In this situation the device only makes measurement.

When the TCR(SVC) is deactivated, the device starts to make compensation as normal reactive relay. Intervention can not be done with shunt reactor driver.

When the "cancel" button is pressed, measurement of the step is canceled and measured values returns to the automatic step measurement screen without recording.

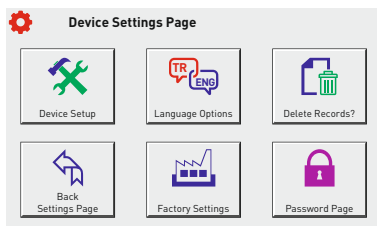
Settings → Step Settings → 3.10.5 Step Test



In this page step test is made manually. Control of the step's output(like connection etc.) can be done. Chosen steps are made active and the steps are on.

When the "Return" button is pressed, "step setting" page comes to the screen; when the Setting button is pressed "setting page comes.

Ayarlar → 3.11 Device Settings



When the Device Setting button is pressed, Device Setting page comes to the dynamic screen. You can pass Device Setup, Language Choice, Deleting the Recordings, Factory Settings, Password Menu and Settings from this page.

3.11.1 Device Setup: Current Transformer Test and Automatic Step Measurement Operation

3.11.2 Language Options : Language settings of the device are changed.

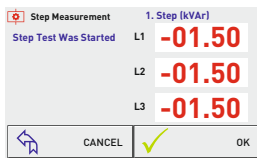
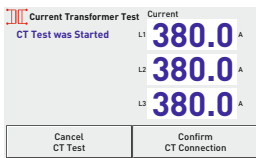
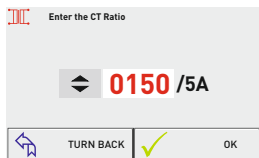
3.11.3 Delete the Recordings : Data which are taken automatically by the device are deleted

Back Setting Page : Returns to the settings page

3.11.4 Factory Settings: Factory or Menu settings, assumed values are returned.

3.11.5 Password Page: Password protection is assigned to the device.

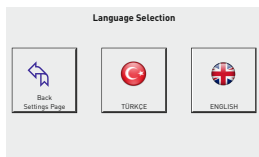
Settings ⚙️ Step Settings ⚙️ 3.11.1 Device Setup



In order to set the device press the "up" and "down" buttons, enter the current transformer value. When you press "confirm" button the device starts current transformer test automatically; after completing the test if any matter is available; the device gives warning with connections.

If there is no matter in the connections, after completing the current transformer test; the device start the step measurement automatically. When the device measured all of the steps, if the "confirm" button is pressed, all of the steps are recorded. When the "cancel" button is pressed; the device cancels the step measurements and returns to "Automatic Measurement" screen without recording the step measurements. After completing the step measurement; the device starts to compensation according to the recorded values.

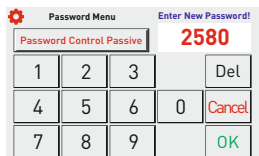
Settings ⚙️ Step Settings ⚙️ 3.11.2 Language Options



In this menu, The language settings of the device are changed as Turkish or English. When you click to the language you desired, the language of the device changes and turns to device setup page.

When the "Back" button is pressed, "Device Setup" page comes to the screen.

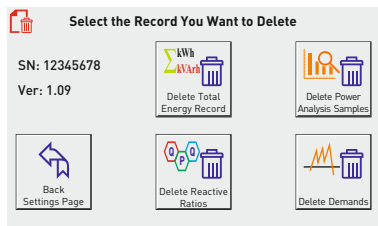
Settings ⚙️ Step Settings ⚙️ 3.11.3 Password Settings



In this page control of the password becomes active, the device can be protected against the unauthorized intervention. After the control of the password is made active ;entered password value is recorded. the password consist of 4 letters. You can enter the password pressing the numbers. When the password is entered, press "confirm" button to record password. When you quit from the setting menu; the device is protected anymore.

When the "Return" button is pressed, it turns to the "Setting" page without doing operation.

Settings ⚙️ Step Settings ⚙️ 3.11.4 Delete The Recording



When the "Delete Registration" button is pressed, the dynamic area screen displays the Register Delete page. In this page, the total energy values, power analysis examples, Ratio and Demand values that the device automatically receives are deleted. The device serial number and software version are included.

Delete Total Energy Values:Deletes total energy values (Active, Inductive, Capacitive).

Delete Power Analysis Samples: Deletes the sample records of the power analysis.

Back Settings Page: Returns to the Settings page without performing any operation.

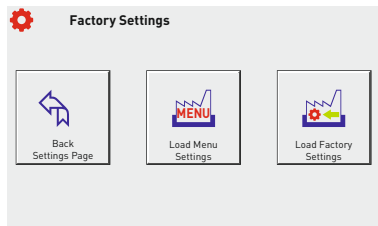
Delete Ratios: Deletes Capacitive/Active and Inductive / Active ratios.

Delete Demands: Deletes Active Power, Reactive Power, Apparent Power and Current Demand.

Press the record button you want to delete. Then the confirmation message box will come up again. If you press the "confirm" button here, the record will be deleted. If you press the "cancel" button. It returns without deleting the records.

When you press the "Back Settings Page" button, the main page of the device setup is displayed.

Settings ⚙️ Step Settings ⚙️ 3.11.5 Factory Settings



When the Factory Setting button is pressed, factory settings main page comes to the dynamic screen. In this page all values of the device are expected to return factory settings or only menu values can be provided to return factory values.

Note: Returning to the factory settings necessitates the device to be set up again.

(Current transformer value, step value, menu settings etc. All values and records will be reset.)

Note: Returning to the menu settings does not require the device to be reinstalled.

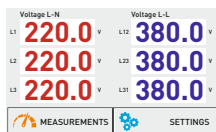
(Harmonic Voltage, Harmonic Current, Step Times, Generator, Voltage Min / Max, Alarm, Compensation Target Values, Temperature and Modbus Settings will be reset.)

Press the button you want to return to the old settings. Then the confirmation message box will come up again. If you press the "confirm" button on this page, the relevant settings will return to the old factory values. If you press the "cancel" button, it exits without doing anything.

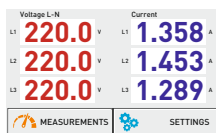
When you press the "Back Settings Page" button, the main page of the device setup is displayed.

How to Choose a Main Page?

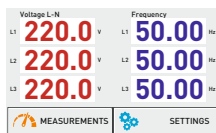
The home page is the page that will appear on the dynamic display when the device is energized and will remain visible without pushing the buttons. You can define the main page you want to see continuously from the following measurement pages.



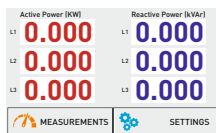
To select the voltage page as the home page, after the “measurements” button is pushed, the dynamic screen displays **measurement page1**. From this page, press the **1.1 Voltage** button. Voltage page comes to the Dynamic page. If it does not switch to another page for 15 minutes, it is defined as the main page.



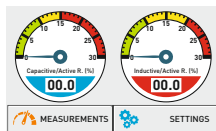
To select the voltage and current pages as the home page, after the “measurements” button are pushed, the dynamic screen displays **measurement page1**. From this page, press the **1.2 Voltage& Current** button. Voltage- current page comes to the Dynamic page. If it does not switch to another page for 15 minutes, it is defined as the main page.



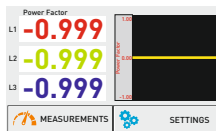
To select the voltage and frequency pages as the home page, after the “measurements” button are pushed, the dynamic screen displays **measurement page1**. From this page, press the **1.3 Voltage& Frequency** button. Voltage- Frequency page comes to the Dynamic page. If it does not switch to another page for 15 minutes, it is defined as the main page.



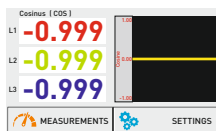
To select the Instant powers pages as the home page, after the “measurements” button are pushed, the dynamic screen displays **measurement page1**. From this page, press the **1.4 Instant powers** button. Instant powers page comes to the Dynamic page. If it does not switch to another page for 15 minutes, it is defined as the main page.



To select the Ratios pages as the home page, after the “measurements” button are pushed, the dynamic screen displays **measurement page1**. From this page, press the **1.5 Ratios** button. Ratios page comes to the Dynamic page. If it does not switch to another page for 15 minutes, it is defined as the main page.

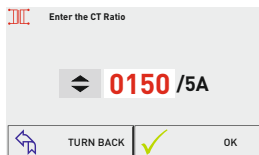


To select the Power Factor pages as the home page, after the “measurements” button are pushed, the dynamic screen displays **measurement page1**. From this page, press the **1.6 Power Factor** button. Power factor page comes to the Dynamic page. If it does not switch to another page for 15 minutes, it is defined as the main page.



To select the Cosine pages as the home page, after the “measurements” button are pushed, the dynamic screen displays **measurement page2**. From this page, press the **2.3 Cosine** button. Cosine page comes to the Dynamic page. If it does not switch to another page for 15 minutes, it is defined as the main page.

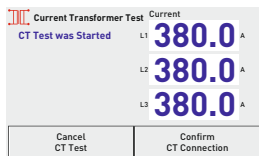
How to Install the Device?



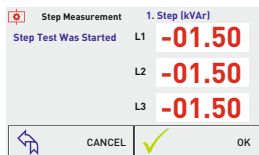
To access the device setup page, enter the following menus, respectively;

Ayarlar → **Device Settings** → **Device Setup**

After reaching the device setup page, press the up or down buttons to enter the current transformer value. When the "Confirm" button is pressed, the device automatically starts the current transformer test. If there is any trouble in the connections after the current transformer test is finished, the device will give a warning and will not accept the connection. After correcting the connection errors according to the warning, you can start the device installation again.



If there is no problem with the connections, the device will automatically start to measure the Step after the current transformer test is confirmed. After the device has measured all the steps, pressing the "Confirm" button saves all measured steps and the device starts to intervene.



When the "Cancel" button is pressed, it will cancel and returns to the "Automatic measurement" screen without saving the step measurements.

How to Change the Current Transformer Value?

To reach the current transformer value change page, enter the following commands respectively;

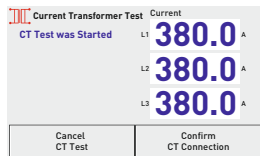
Settings → **Current Transformer** → **Change Current Transformer Ratio**

After reaching the Change current transformer page (Figure 1), press the up and down buttons to enter the current transformer value. When the "Confirm" button is pressed, the device automatically starts the current transformer test (figure 2) if there is any trouble in the connections after the current transformer test is finished, the device will show the warning and will not accept the connection. After correcting the connection errors according to the warning, you can start the current transformer test again.

If there is no problem with the connections, the device will automatically start to measure the Step after the current transformer test is confirmed (figure 3). After the device has measured all the steps, pressing the "Confirm" button saves all measured steps and the device starts to intervene.

When the "Cancel" button is pressed, it will cancel and returns to the "Automatic measurement" screen without saving the step measurements.

How is the Current Transformer Test Done ?



In order to reach current transformer test page, enter these menus subsequently;

Settings → **Current Transformer** → **Start CT Test**

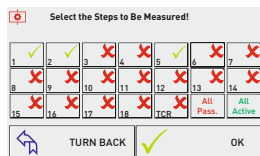
After reaching the current transformer page, when the "Start Current Transformer Test" button is pressed, the test starts automatically. If any kind of error happens in the connections, the device gives warning and does not accept the connection. After canceling the test, you can start current transformer test, just after correcting the connection error according to the warnings.

If there is no error in the connections, the device starts step measurement automatically after the current transformer test is confirmed. After the device measured all steps, when

the "confirm" button is pressed all of the measured steps are recorded and the device starts intervention.

When the "Cancel" button is pressed, it will cancel and returns to the "Automatic measurement" screen without saving the step measurements.

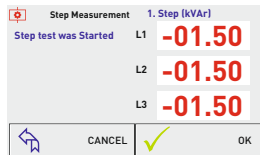
How is the Step Measurement Done?



In order to reach step measurement (automatic measurement) page, enter these menus subsequently;

Settings → **Step Settings** → **Auto Measurement**

In order to choose the steps which is to be measured in the automatic measurement page; press the button of the step. When the button is pressed; logo of the step is changed. After choosing the steps, when the "Start" button is pressed; automatic measurement starts.



When the step measurement starts, step measurement page comes to the screen. The page shows which measurement of the step is done and the value that is measured at each phase. If the capacitor is connected, (-) sign appears on the left. If the shunt reactor is connected, there is no sign of the value. After the measurement of the

step is completed, subsequent step measurement starts if there is chosen steps. When the measurements completed "step test is completed" sign comes to the screen. Press the "confirm" button in order to record values. When you press the "confirm" button; "step measurement is confirmed" sign comes to the screen and turns to the main page and the device start to interfere.

If you press the "return" button, main page of the step comes to the screen without doing any operation.

How is the Step Value Entered Manually?

Enter the Step Value!

Step	Phase	Value (kVar)
01	L1	-1.00

1. Step L1 Value was Saved!

TURN BACK OK

In order to reach "Enter Step Value" page, enter these menus subsequently;

Settings → **Step Settings** → **Enter the Steps Value**

After reaching the Enter Step Value page; Step, Phase, and Values are set pressing "up" and "down" buttons. Then the values are recorded pressing the "Confirm" button and "1. Step L1 Value was Saved!" sign comes to the screen.

Ex: Capacitor value is entered to the 1st step at the L1 phase

If the value to be entered is mono phase, from the phases section "L1,L2 or L3" should be chosen according to the phase which is connected to; if it is three phase "L123" should be chosen.

Note: If the condenser will be added to the system, the value to be entered should be "-" (picture6); if the shunt reactor is to be added ,the value to be entered should be "+" (picture7).

Capacitor

Enter the Step Value!

Step	Phase	Value (kVar)
02	L123	-10.00

TURN BACK OK

3 phase 10kVar capacitor value entered to the 2nd step.

Shunt Reactor

Enter the Step Value!

Step	Phase	Value (kVar)
03	L3	+1.50

TURN BACK OK

1.5kVar shunt reactor value entered to the 3rd step at the L3 phase.

How is The Step Test Done?

Select the Steps to Test!

1 ✓	2 ✗	3 ✓	4 ✓	5 ✗	6 ✗	7 ✗
8 ✗	9 ✓	10 ✗	11 ✗	12 ✗	13 ✓	14 ✗
15 ✗	16 ✗	17 ✗	18 ✓	TCR ✓		

TURN BACK SETTINGS

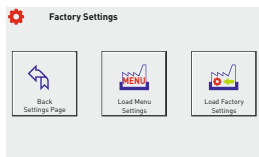
In order to reach the step test page ,enter these menus subsequently;

Settings → **Step Settings** → **Step Test**

All of the steps will be apparent on the screen; after reaching Step Test Page. Touching the step; it is pulled and left back. If the logo of the step is ✗ "red x"; when Quit the Step button is pressed, logo of the step becomes ✓ green thick and gives Quit. When we press the same step button again, the logo changes and the steps don't give quit.

If "the Return" button is pressed; step main page comes to the screen by abandoning steps one by one.

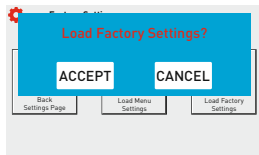
How to Return to Factory Settings?



In order to return Factory Settings page, enter these menus subsequently;

Settings → **Device Settings** → **Factory Settings**

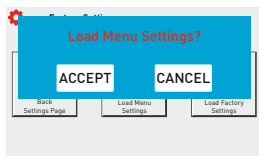
After reaching the Factory Settings page when "Load Factory Settings" button is pressed; "Load Factory Settings?" message box come to the screen and when the "Accept" button is pressed; the device returns to Factory Settings.



When the "Cancel" button is pressed on the message box, it returns to Factory Setting page without doing operation.

Note: Restoring the factory settings requires reinstallation! (Current transformer value, step values, menu settings, etc. all values and records will be reset.)

How to Return to Menu Settings?



In order to return Factory Settings page, enter these menus subsequently;

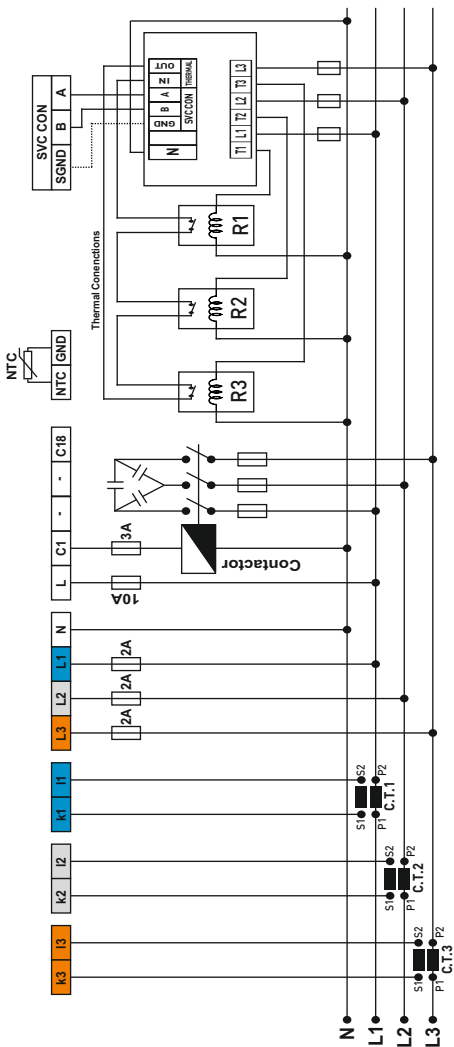
Settings → **Device Settings** → **Factory Settings**

After reaching the Factory Settings page when "Load Menu Settings" button is pressed; "Load Menu Settings?" message box come to the screen and when the "Accept" button is pressed; the device returns to Menu Settings.

When the "Cancel" button is pressed on the message box, it returns to Factory Setting page without doing operation.

Note: Return to the Menu settings requires reinstallation! (Harmonic Voltage, Harmonic Current, Step Times, Generator, Voltage Min / Max, Alarm, Compensation Target Values, Temperature and Modbus Settings will be reset.)

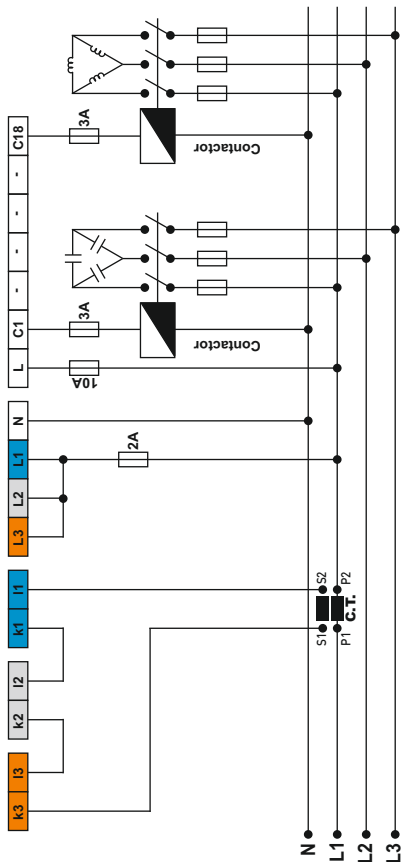
Three Phase (3P4W) Connection Scheme



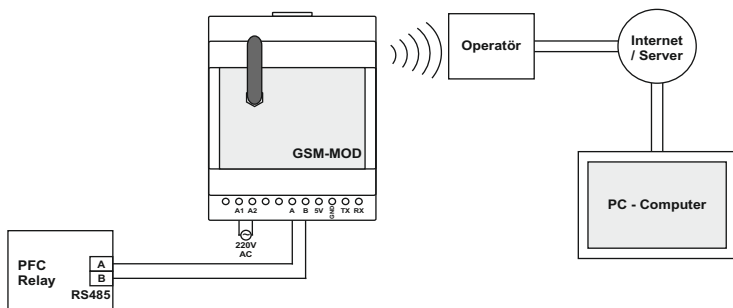
Single Phase Connection Scheme in Three Phase Systems

It is not recommended to use single-phase compensation for three-phase systems. The device intervenes only with single phase. It is not known how this intervention will result in the other two phase

This connection should be preferred after ensuring that the three-phase system is balanced. Check the index values in the counter more frequently.

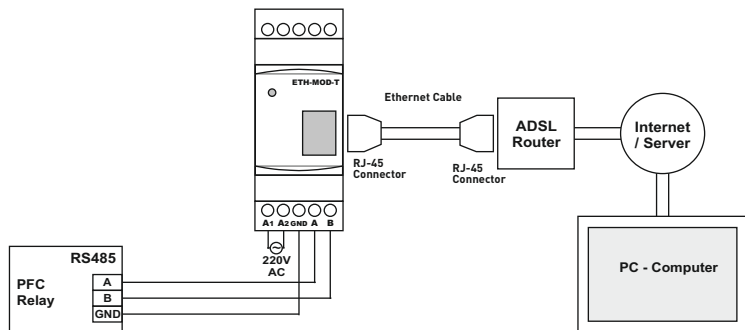


Remote Communication with RS485 (GSM-MOD)



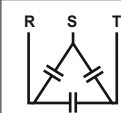
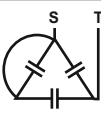
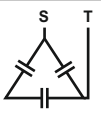
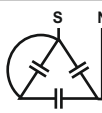
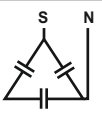
Only reactive relay or together with counter and energy analyzer can be connected with GSM-MOD on remote communication. Using a 100MB (recommended) data line from GSM operators, remote communication is made with reactive relay via www.tenseenerji.com (server).

Remote Communication with RS485 (ETH-MOD)



Only reactive relay or together with counter and energy analyzer can be connected with GSM-MOD on remote communication. Remote connection is made with reactive relay via www.tenseenerji.com (server) by connecting modem.

Capacitor Account Table according to Connection Type

					
Capacitor Power	3 Phase Connection (Q/3)	2 Phase Connection Bridge (Q/3)	2 Phase Connection (Q/4)	Phase-Neutral Bridging Connection (2xQ/9)	Phase-Neutral Connection (Q/6)
0,5 KVAR	0,16 KVAR	0,16 KVAR	0,12 KVAR	0,11 KVAR	0,08 KVAR
1 KVAR	0,33 KVAR	0,33 KVAR	0,25 KVAR	0,22 KVAR	0,16 KVAR
1,5 KVAR	0,5 KVAR	0,5 KVAR	0,37 KVAR	0,33 KVAR	0,25 KVAR
2,5 KVAR	0,83 KVAR	0,83 KVAR	0,62 KVAR	0,55 KVAR	0,41 KVAR
5 KVAR	1,66 KVAR	1,66 KVAR	1,25 KVAR	1,11 KVAR	0,83 KVAR
7,5 KVAR	2,5 KVAR	2,5 KVAR	1,87 KVAR	1,66 KVAR	1,25 KVAR
10 KVAR	3,33 KVAR	3,33 KVAR	2,5 KVAR	2,22 KVAR	1,66 KVAR
15 KVAR	5 KVAR	5 KVAR	3,75 KVAR	3,33 KVAR	2,5 KVAR
20 KVAR	6,66 KVAR	6,66 KVAR	5 KVAR	4,44 KVAR	3,33 KVAR
25 KVAR	8,33 KVAR	8,33 KVAR	6,25 KVAR	5,55 KVAR	4,16 KVAR
30 KVAR	10 KVAR	10 KVAR	7,5 KVAR	6,66 KVAR	5 KVAR

Step Creation According to Power Analysis Examples?

Table1					Table2			
	L1	L2	L3	Time (min.)	Threephase Capacitor (kvar)	Monophase (L1) Capacitor (kvar)	Monophase (L2) Capacitor (kvar)	Monophase (L3) Capacitor (kvar)
1.Sample	0.00	0.00	1.50	571	-	-	-	1.50
2.Sample	0.00	1.00	1.50	525	-	-	1.00	1.50
3.Sample	2.00	1.50	0.50	490	1.50	1.50	1.00	-
4.Sample	0.75	1.00	1.50	470	2.50	-	0.20	0.70
5.Sample	1.50	1.80	1.00	453	3.00	0.50	0.80	-
6.Sample	0.50	2.00	2.50	400	1.50	-	1.50	2.00
7.Sample	0.20	1.50	1.90	385	0.50	-	1.30	1.70
8.Sample	0.80	0.00	0.50	350	-	0.80	-	0.50
9.Sample	0.30	0.40	0.35	300	1.00	-	0.05	-
10.Sample	2.40	3.50	4.50	295	7.50	-	1.00	2.00
11.Sample	3.20	4.00	1.50	280	5.00	1.60	2.30	-
12.Sample	2.50	4.50	1.90	257	6.00	0.50	2.5	-
13.Sample	2.70	2.90	3.20	236	8.00	-	0.20	0.40
14.Sample	0.50	1.00	1.50	205	1.50	-	0.50	1.00
15.Sample	0.00	-0.10	0.50	192	-	-	-	0.50
16.Sample	0.35	1.00	1.70	180	1.00	-	0.65	1.35
17.Sample	2.50	0.50	1.50	120	1.50	2.00	-	1.00
18.Sample	3.20	4.70	5.50	100	10.0	-	1.30	2.10
19.Sample	3.00	4.20	2.50	70	7.50	0.50	1.70	-
20.Sample	2.70	0.50	1.50	45	1.50	2.20	-	1.00

In the Table 1; artificial samples are created. In Table 2 ; three phase and one phase samples which can be used through these samples are created. While step structures are being created; the interval values should be interfered. Replace highest three phase capacitor values to the first steps.

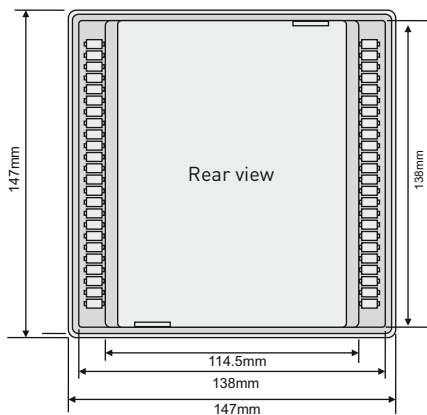
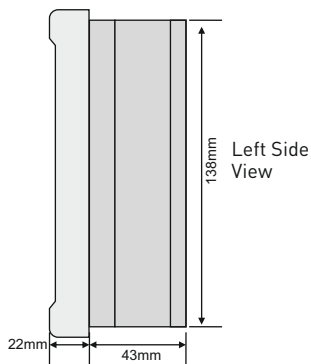
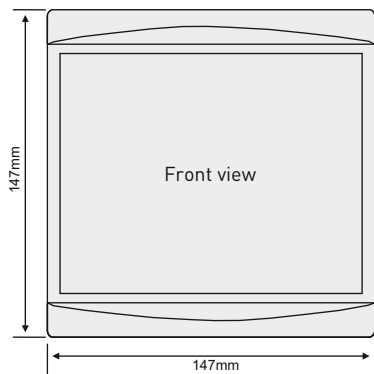
Lowest 0.5 kvar and highest 10 kvar are available in three phase capacitors. 0.5kvar, 1kvar, 2.5kvar, 5kvar, 7.5kvar three phase capacitor can be used.

Lowest 0.5kvar and highest 2.2kvar are available at one phase capacitors to be used at L1 phase. 0.5kvar, 1kvar and 1.5kvar one phase capacitor can be used.

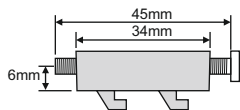
Lowest 0.20kvar and highest 2.3 kvar are available at one phase capacitors to be used at L2 phase. 0.25kvar, 0.5kvar, 1kvar and 1.5kvar one phase capacitor can be used.

Lowest 0.40kvar and highest 2.1 kvar are available at one phase capacitors to be used at L3 phase. 0.25kvar, 0.5kvar, 1kvar, and 1.5kvar one phase capacitor can be used.

Dimensions



Screwed side ear (apparatus)



Side ear (apparatus)



Factory Defaults

Setting Name	Factory Value	Minimum Value	Maximum Value	Unit
Current Transformer Ratio	5/5	5/5	5000/5	A
Harmonic Voltage (A/P) <i>Passive</i>	10	5	99	%
Harmonic Voltage Delay	30	1	60	sn.
Harmonic Current (A/P) <i>Passive</i>	50	5	99	%
Harmonic Current Delay	50	1	60	sn.
High Voltage (A/P) <i>Passive</i>	250	240	285	V
Low Voltage (A/P) <i>Passive</i>	180	120	200	V
Inductive Alarm (A/P) <i>Passive</i>	20	5	50	%
Capacitive Alarm (A/P) <i>Passive</i>	15	5	50	%
Generator (A/P) <i>Passive</i>	45	1	50	%
Inductive Set	5	1	50	%
Capacitive Set	10	1	50	%
High Temperature (A/P) <i>Passive</i>	50	30	70	°C
Low Temperature (A/P) <i>Passive</i>	-10	-20	10	°C
Drive Time	2	1	15	sn.
Discharge Time	15	1	30	sn.
Settling Time	400	100	2000	msn.
Baudrate	9600	2400	115200	bps.
Modbus Address	1	1	247	
Step Counter	16	1	18	

Fixed Values: Parity: none, Stopbits:1, Demand Time: 15min.

(A/P): Can be active or passive.

Technical Features

Operating Voltage	100V - 300V AC
Operating Frequency	50 / 60 Hz
Operating Power	<12VA
Operating Temperature	-20°C.....+55°C
Voltage Measuring Range	5V -280V AC
Current Measurement Range	5mA - 5,5A
Current Transformer Ratio	5/5A.....5000/5A
Voltage, Current Accuracy	%±0,5
Active Accuracy	%±1
Reactive Accuracy	%±2
Real Time Clock	>5 years
Harmonic Voltage	2 - 61
Harmonic Current	2 - 61
Remote Connection Speed	2400, 4800, 9600, 19200, 38400, 57600, 115200bps
Remote Connection Features	Databits.:8, Stopbits.:1, Parity:None
Remote Link Interface	RS485 MODBUS RTU
Indicator	5" resistive touch color LCD
Connection Type	Plug-in terminal connection
Contact	3A / 250V AC Resistive Load
Number of Steps	18 + TCR
Cable Diameter	1.5mm ² , 2.5mm ² (voltage inputs)
Weight	<900Gr.
Mounting	Mounting on the front of the panel
Operation Altitude	<2000meters
Protection Class	IP41 (Front Panel), IP00 (Body)
Panel Hole Dimensions	140mm x 140mm

Contact Informations

Web: www.tense.com.tr

Mail: info@tense.com.tr

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