



AUTOMATIC VOLTAGE REGULATORS

Three Phase AVR

10,5- 3000kVA

3 Phase Input- 3 Phase Output

AUTOMATIC VOLTAGE REGULATORS

USER'S MANUEL

IMPORTANT NOTICES!

Dear User;

This manual contains information about features of Voltage Regulator (AVR), installation, operation and the loads connected to the AVR, safety information, use of the AVR, operation principles, settings and measurements (calibrations), detection and troubleshooting.



Read the instructions carefully before the installation.



Keep manual in case you need as an Application Source!



COMPANY reserves the right to change the contents and information in this document without notice.

This Voltage Regulator is designed to meet the requirements specified CE/ISO9001 Standards.

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Safety Instructions



Information relating to safety of TESCOM Servo Regulator and devices connected thereto as well as the safety of user has been detailed as follows. However, installation shall not start before reading the entire manual.

When device is switched from cold to hot, air humidity may concentrate inside. In such a case wait for at least two hours because operation will be highly dangerous.

- When device is switched from cold to hot, air humidity may concentrate inside. In such a case wait for at least two hours because operation will be highly dangerous.
- Device must be operated in an environment equipped with all specifications mentioned in “installation” section of manual.
- Make sure the spaces left around the device for ventilation are not blocked.
- Be careful not to allow any foreign substances (liquid or solid) penetrate into device.
- Device must be connected by authorized service technician.
- Earthing connections must be made.
- Connections against fire danger must be made with proper section of cables. All cables must be insulated and laid in a manner to prevent stumbling.
- No loads must be connected to output of device that exceed its power.
- Device may only be repaired by authorized service technician.
- In case of emergency, (damage to cabin, front panel or connections, penetration of foreign substances into device etc.) device must be shut down immediately and input voltage must be disconnected and authorized service must be informed.
- Device must be properly packaged for transport

1.General Instructions

1.1 Handling and Shipping

Be careful when handling loads. Do not carry heavy loads without help. Move wheeled devices on smooth and unobstructed surfaces.



- Devices weighing more than 20 kg are not manpower; It can be transported by forklift with the blades entering from the bottom.
- Regulators should not be dropped or hit while being transported.
- Transport the regulator as packaged until it reaches the place where it will be installed.
- After the package is opened, it should be examined whether the device has been damaged during transportation. For this, the package switch, compact switch and W-automatic on the device are examined, and attention is paid to the broken or disassembled parts. It is checked whether the monitor on the front panel is damaged.
- Before using the product with damaged packaging or without packaging, call the technical service.

1.2 Location

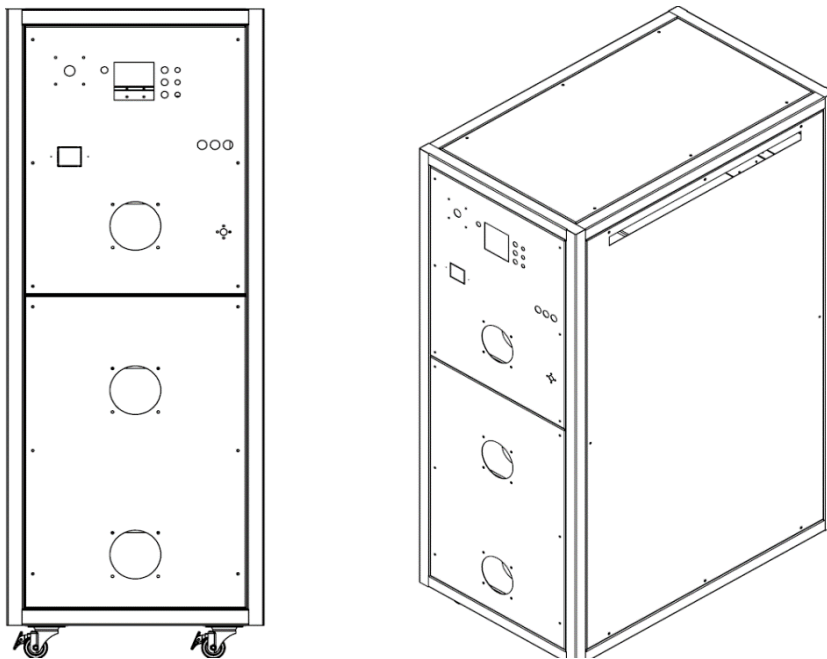


Fig.-1 3-phase servo regulator

Non-Suitable Operating Enviroments for AVR;



- Harmful smoke, dust, abrasive dust.
- Moisture, steam, rainy/bad weather conditions
- Excessive temperature changes
- Lack of ventilation
- Direct/ indirect exposure to radiation heating thru any other sources
- Severe electromagnetic field
- Harmful radioactive level
- Insects, fungus
- The AVR can operate at ambient temperatures between -10 °C/ + 50°C.
- The relative humidity at ambient must be between 20%-95%.
- Make sure the floor is strong enough to carry the system weight.,
- There must be at least 20 cm distance between device surfaces containing ventilation.

1.3 Storage

- AVR can be stored at a temperature of -25 ° C to +60 ° C, far away from heaters and in a dry environment.
- The relative humidity at ambient must be between 20%-95%.
- Check the AVR power compliance of total load to be connected to AVR and line.
- The AVR must be stored in a dry and moisture-proof environment before commissioning.

2. Introduction the Automatic Voltage Regulator (AVR)

2.1 Introduction

Tescom TVR 33 Series Servo Voltage Regulators provide safe energy for your loads in areas where your network is irregular or where the power supply voltage is unstable, such as a generator. By keeping the voltage within certain tolerances, it offers full protection against the risk of damage caused by excessive fluctuations in voltage.

Voltage Regulators Microcontrollers are electromechanical type smart devices with processors. For this reason, it can be used safely and smoothly in sensitive electronic devices that require constant voltage. Usage areas; Voltage Regulators work with measurement technique based on true RMS value. Thus, it always produces a stable output voltage with very fast correction, without being affected by sudden changes in input mains voltage and waveform distortions. With their perfect regulation, they provide the necessary protection in environments where irregular voltage is used, such as generators or industrial electricity, without being affected by the power factor of the load and the harmonic disturbances of the mains voltage.

Device advantages; It consists of quality and long-lasting materials, safe and tried system, silent operation and high efficiency, distortion-free output, stable and uninterrupted feeding, wide correction range and high sensitivity.

The working principle is that the necessary signals for the desired regulation are transmitted to the dc motor with the microprocessor control for each phase. The DC motor provides movement in the direction of adding or subtracting voltage for regulation on the variac to which it is mechanically connected. This supplied voltage is transferred to the differential auxiliary transformer (booster transformer). As a result, electronically controlled stable voltage is provided in the output voltage against voltage changes.



Fig.-2 3-phase servo regulator

It has a clear LCD display. Input-output voltages, frequency and load percentage information can be seen instantly on the screen. It can show warning information and store it in its memory.

The product you have chosen is under warranty for two years within the specified conditions. Keep your warranty card approved by the Authorized Dealer to show it to our service in case of malfunction. This is in the interest of the consumer for the convenience of the transactions to be made.

In this manual, the introduction, use, maintenance and rules to be followed of Three-phase Fully Automatic Servo Model regulators purchased from our company are introduced.

2.2 Structure and Working Principle

Variac (thyroidal transformer) for adjusting the voltage,

- Power (boost) transformer,
- Variac engine,
- Control card
- Display panel,
- Input fuse (optional)
- Current transformer, (optional)
- Mains-Regulator Selector Switch
- Contactor (optional)

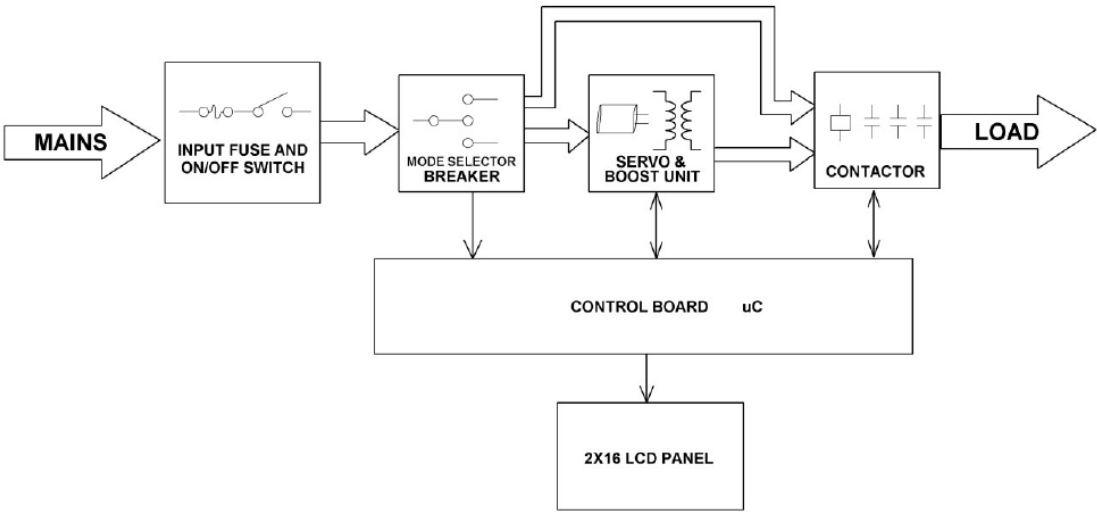


Fig.-3 Regulator block diagram

The Servo Regulator consists of the variable Transformer (Varyac), which provides voltage regulation, the Servo Motor that controls the auxiliary transformer, and the Electronic Board that controls this motor according to the output voltage.

If the normal mains input voltage drops or rises, the electronic control circuit detects it precisely and quickly starts the servo motor. The motor moves the tuned transformer (Varyac) to the right or left according to this signal it receives and moves the primary winding of the

Booster transformer by giving voltage to the network or in the opposite direction. The voltage produced in the secondary winding is reflected as an addition or subtraction to the input voltage of the grid. Thus, it tries to keep the output voltage that may occur in input voltage fluctuations at the desired sensitivity at the output with a tolerance of $\pm 1\%$, and the safe operation of the device is ensured with other auxiliary equipment. The control system with DC motor array with fast response time and high starting torque quickly corrects even small voltage changes at the input. When the Servo Motor input voltage goes out of the operating limits, the output voltage is automatically adjusted to the desired value by the limit switches and deactivated by the control circuit.

2.3 Technical Specifications

2.3.1 Device Features and Basic Information

Servo-Controlled voltage regulators; It consists of toroidal transformer (variac), auxiliary transformer, servo-motor controlling variable transformer and electronic circuits that control this motor according to output voltage.

With its fast response time control system, the DC motor array with high starting torque quickly corrects even small voltage variations at the input. Servo-Motor is deactivated by the control circuit by automatically adjusting the output voltage to the desired value by the limit-control system when the input voltage goes out of the operating limits. When the regulation is completed, the energy of the motor is cut off with the help of the electronic braking circuit and it works silently.

1. Wide Power Range: Three-phase generation from 10,5 kVA to 150 KVA.

2. Input voltage correction range: 160- 260 VAC (Optional: 90- 285 VAC) monophas
285- 440 VAC (Optional: 190-415 VAC) three-phase

3. Regulation Rate: 90V/sec

4. Output Deviation: As long as the regulator is not used over its power, there is no deviation from the output.

5. Efficiency: Efficiency is better than 97% since TESCOM regulators and transformers consist of high-quality silicon sheet and B-ef class conductive materials.

6. Operating Temperature: Regulators shall be used up to 50°C unless there is acidic and humid environment. Extra cooling system also applied for the hot environments over this temperature.

7. Overvoltage and Phase Protection Unit (Optional): Cuts off the output in case where any of phases is gone during over voltage deviations (low-high) and allows output again upon finding the desired voltage. User may deactivate protection unit with its respective on device.

8.By-Pass system: By-pass operation is realized thru high quality pako switches. In case of any fault, the regulator can be transferred to the Line with the 2x and 6x pole changeover switches without any operation.

2.3.2 Technical Specifications Table

MODEL	TVR 33010	TVR 33015	TVR 33022	TVR 33030	TVR 33045	TVR 33060	TVR 33075	TVR 33100	TVR 33120	TVR 33150	
Power (kVA)	10,5	15	22,5	30	45	60	75	100	120	150	
INPUT											
In. vol. correct. interval	275- 460 VAC (Optional: 200-460 VAC)										
Operation frequency	47...65 Hz										
Line input protection	Overcurrent, Low and High voltage protection										
Current at input	16,8	24	36	48	72	96	120	161	192	240	
OUTPUT											
Output voltage	380 VAC RMS \pm 1%										
Overloading	10 Sec. 200% Load										
Correction speed	~ 90 Volt / Sec.										
Upturn period	~ 90 Volt / Sec. (275 - 460VAC)										
Output protection	Protects load by opening the circuit when overburden, short circuit occurs. (optional)										
Current at output	12	18	27	36	54	72	90	121	144	180	
GENERAL											
Working principle	Servo Motor, Microprocessor Controlled, Full Automatic										
Cooling	Smart Fan System										
Measured Value Monitor.	TESCOM TRUE RMS Panel Voltmeter (74x74mm) output voltage and line voltage monitorization										
Total efficiency	> 97 %										
Mechanic By-pass	Available										
Protection level*	IP 20										
ENVIRONMENTAL											
Operating temperature	-10°C / 50°C										
Storage temperature	-25°C / 60°C										
Relative humidity	< %90, DIN (40040)										
Altitude	< 2000 m.										
Acoustic level	< 50 dB (1m ²)										
Standards	CE / ISO 9001										
DIMENSIONS											
HxWxD (cm)	61x38x60			129x51x68			159x60x99			171x60x93	
Weight (kg)	105	125	160	180	200	222	280	310	400	425	
Optional 0.8 output power factor (PF) option											
(*) Optional different protection class option											

MODEL	TVR 33200	TVR 33250	TVR 33300	TVR 33400	TVR 33500	TVR 33600	TVR 33800	TVR 33100	TVR 331250	TVR 331500	TVR 331600	TVR 332000	TVR 332500	TVR 333000
Power (kVA)	200	250	300	400	500	600	800	1000	1250	1500	1600	2000	2500	3000
INPUT														
Input voltage correction range	275-460 VAC (Optional: 200-460 VAC)													
Operation frequency	47...65 Hz													
Line input protection	Overcurrent, Low and High voltage protection													
OUTPUT														
Output voltage	380 VAC RMS \pm %1													
Overloading	10 Sn. %200 Load													
Correction speed	~ 90 Volt / Sec.													
Upturn period	~ 90 Volt / Sec. (275VAC - 460VAC)													
Output protection	Protects load by opening the circuit when overburden, short circuit occurs. (optional)													
GENERAL														
Working principle	Servo Motor, Microprocessor Controlled, Full Automatic													
Cooling	Smart Fan System													
Measured Value Monitor.	TESCOM TRUE RMS input and output voltage indicators													
Total efficiency	> %97													
Mechanic By-pass	Available													
Protection level*	IP 20													
ENVIRONMENTAL														
Operating temperature	-10°C / 50°C													
Storage temperature	-25°C / 60°C													
Relative humidity	< %90, DIN (40040)													
Altitude	< 3000 m.													
Acoustic level	< 50 dB (1m ²)													
Standards	CE / ISO 9001													
DIMENSIONS														
WxDxH (cm)	139x66x177			211x100x176			210x144x208	210x214x185	240x214x208	240x264x188	240x264x208	240x260x195	Please ask	
Weight (kg)	1050	1100	1200	1650	2000	2100	2900	3450	3900	4300	4750	6000	Plase ask	

Optional 0.8 output power factor (PF) option
 (*) Optional different protection class option

*The data given in the chart is for information only. It can be changed without prior notice.

2.4 Scope

It covers power regulators from 10,5 KVA to 3000 KVA. Unless otherwise stated in the test report; ISO90001/CE is applied. It covers current local official specifications.

2.5 Liability

The user or the responsible person can safely use the regulators we manufacture by following this instruction. Please read this instruction for the validity of the warranty conditions and for your life and property safety.

Malfunctions that may occur due to misuse, damages that may occur during transportation, short circuit, lightning strike and failure to comply with this instruction are out of the Warranty Coverage. Maintenance and repairs of regulators are carried out in our Authorized Service.

2.6 Service and Spare Parts

Domestic repair service is only provided by our Authorized Service. Please inform our Factory's Technical Service for fault notification. Our Customer Complaints department will guide you and the authorized personnel of our factory will determine for the necessary expertise on-site, in our Service or in our Factory. You can obtain spare parts or additional equipment from our Service or Factory. Regulators will last longer as long as they are protected from short circuit and overvoltage pulses without exceeding their rated power and under suitable ambient conditions.

2.7 Impacts on Human and Environmental Health

Like all power tools, regulators can cause a severe fire if they fail. Their location should be isolated from human habitats. Since it is an electrical device, its covers should not be opened by unqualified persons. There is a risk of electric shock and danger to life when the covers are open. Before opening the covers, the power of the device must be cut off. This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety. In addition, children should be supervised to ensure that they do not play with the appliance.

2.Installing the Automatic Voltage Regulator (AVR)

2.1 10,5 KVA -150 KVA Front Panel View and Rear Panel View



1	Cam Switch (Line-Regulator)
2	Monitoring
3	Fuses
4	Fan
5	Thermostat Adjust
6	Input / Output / Neutral Connection

2.2 Electrical Connection

Connections can only be made by authorized service technicians. Any attempt by the user to establish a connection can be life threatening. Before connecting the input cables, make sure the Automatic fuse in the distribution panel at “OFF” position.

The device monitors from cold to heat, air humidity can condense from its temperature. In such a case, wait at least two hours before connecting because it will be very dangerous.

Connection terminals of the AVR located at rear side. Remove the terminal cover to access the input and output connection terminals of the Three Phase receiver devices. After removing the

cover, route the earth, input and output cables through holes located below cable connection points.

Earth Connection:

For safety, the ground connection of the device must be done. Perform PE ground connections before connecting any other cable.

AVR's PE (Earth) must be connected to high quality Earth line (low resistance)The connection of the load must be done through the output Earthing screw.

Input-Output and Neutral Connections:

The modifications on the panel must be carried out by the authorized technical personnel. Before connecting the input cables, make sure the Automatic fuse in the distribution panel at "OFF" position.

Input Connection:

A bipolar automatic fuse connected on phase and neutral lines must be added to main switchboard to connect Servo Regulator and a residual current relay must be installed. To install an automatic fuse at equivalent values with input fuse of device on switchboard will be appropriate.

Protection threshold value of residual current relay in the input of Servo Regulator must be the total of 30 mA and residual currents of loads connected to Servo Regulator output.

Current values recommended as above are given only considering Servo Regulator on the automatic fuse in question. Otherwise, both values must be recalculated considering all devices on the same fuse. Any modifications on switchboard must be performed by an authorized service technician on electrical installations.

After necessary modifications, switch automatic fuse on switchboard to "0" position and connect phase to INPUT terminal through fuse on switchboard and neutral to NEUTRAL terminal.

Make sure to switch automatic fuse on switchboard to "0" before starting to connect input cables.

Minimum section of cables between switchboard and Servo Regulator must be selected according to the power of device. In case of selecting small sections, there may be a risk of fire.

Output Connection:

In case Servo Regulators are to supply more than a few independent loads, it is recommended to use different fuses and residual current relays for each load. When each load is connected to Servo Regulator through each and every fuse according to its respective current, in case of a short circuit on any of the loads, short circuited fuse blows and other loads do not get affected by this case thanks to short circuit protection property of device.

Make sure input, output automations and automatic fuses on switchboards are in "0" position before starting to make output connections.

Loads are connected to Output, Neutral and output earthing terminals on switchboard of Servo Regulator.

Sections of cables between Servo Regulator and loads must be selected according to its respective current.

Maximum power contracted by loads connected to Servo Regulator must not exceed nominal power of Servo Regulator.

Be sure to cut off the mains electricity while making the connection. Make sure to connect the mains phases to the input terminals of the regulator.

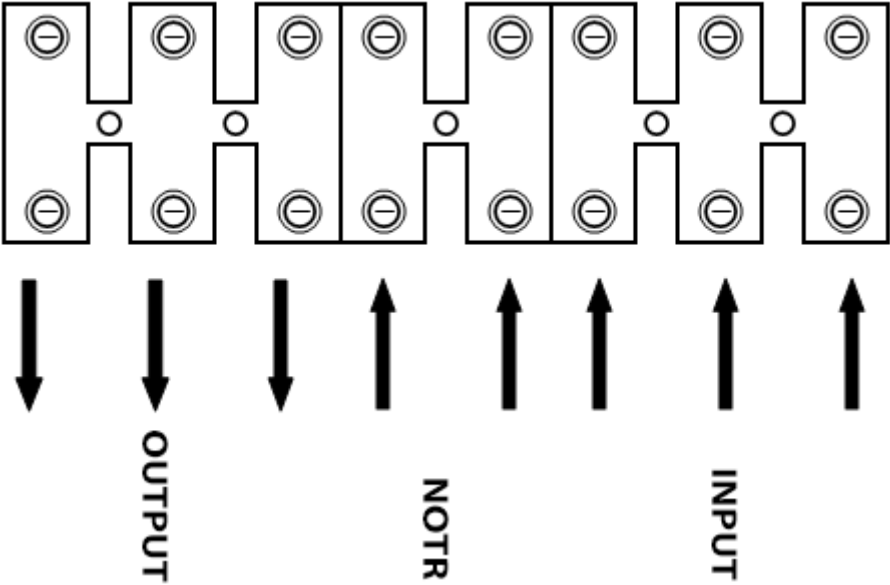


Figure 2.4-1 Example Three-phase connection diagram model 1

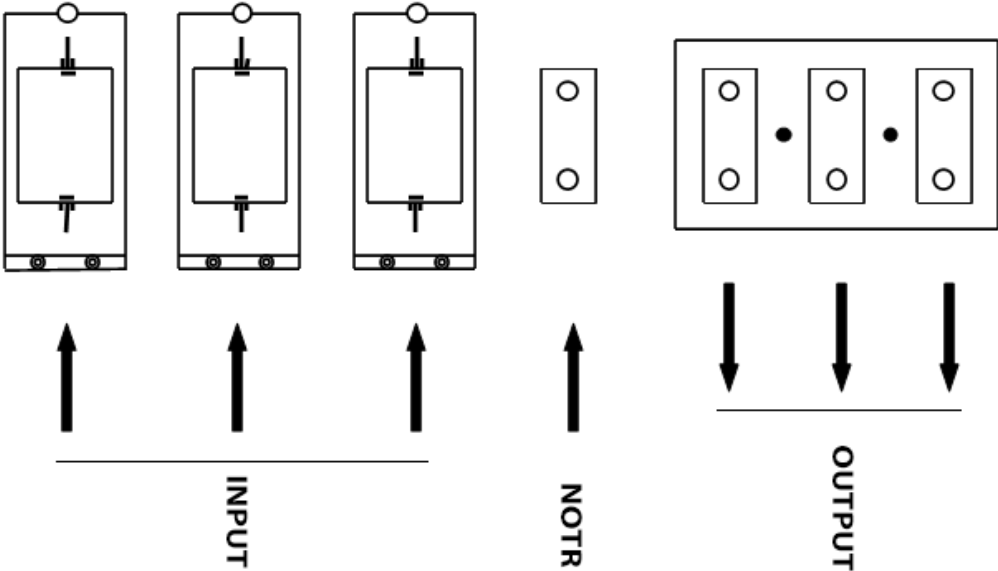


Fig.-4 Example Three-phase connection diagram model 2

Connection diagrams of voltage regulators between 10.5 and 3000 KVA mounted in a single body are shown in Figure 2.4-1 and 2.4-2. Be sure to cut off the mains electricity while making the connection. Make sure to connect the mains phases to the input terminals of the regulator.

2.3 Important Points in Regulator Use

Automatic Servo Voltage Regulators are used to prevent precise devices from failing under bad electrical network conditions. Users with such bad network conditions use Regulator to transfer to devices a regular electrical network.

An electrical network professionally installed within a building is installed by selecting proper quality and thickness of conductive and in accordance with necessary earthing and distribution principles. Any users willing to create regular electrical network with the use of a regulator must pay attention to certain points in making the connections between devices to be supplied by the Regulator. Otherwise, user's health and device's integrity may not be guaranteed.

- Regulator must be connected to electrical network by an authorized service technician using proper sections of cables and as described in installation section.
- Regulator must be connected to an "earthed" switchboard providing the current capacity written on the label on back panel.
- Any device supplied by a socket/switchboard, which is not or poorly earthed, pose a danger of electrical shock to user and the risk of failure of electronic circuits is high.
- Some building electrical installations may show earthed sockets but may contain two-lined (phase and neutral) sockets. Either earth terminals of such sockets may not have been connected to protection earth or connected to neutral terminal instead. In case where no current flows through neutral line, protection may be on earth level. Since neutral voltage will be more different than protection earth level as such sockets or any parallel sockets are loaded, human health and safety of supplied equipment are in danger.

2.4 Commissioning the Regulator

- Device connections must be made by qualified persons in line with their technical information.
- There must be a ground line against electrical leakages in the environment where the regulator operates.
- After the regulator is connected to the installation, set the Pako Switches on the regulator to the 0 (zero) position. Keep the W automaton in the off position. (It is closed when the lever is down) Use an upper section of the cables you have determined while choosing the connection cables, in this way, you can minimize the line losses.
- When putting the regulator into operation, first raise the arm of the W Automaton. In the second step, turn the Pako Switch of your regulator to the Regulator position. The regulator will activate and start working.

- When you want to deactivate the regulator and use the mains network, set the Paco Switch of your regulator to the "Line" position.
- If the regulator does not work properly, you can turn the Pako Switch to the "Line" position and see the incoming mains voltage from the Voltmeter. If the regulator produces an irregular voltage while the mains voltage is within the voltage capacity of the regulator, turn the Paco Switch of the regulator to the " Line " position and disconnect the regulator from the energy by lowering the W automaton arm to check the fuses on it.
- The power specified on the label of the three-phase regulator consists of the sum of 3 phases. For this reason, divide the total load in the installation to be connected as equal to the phases as possible. In unbalanced loads, the regulator will work inefficiently and the regulator may be damaged.

3. Turning The Device “On” And “Off”

- Make sure properly done earth connection before energized the device.
- Make sure the electrical connections are done properly.
- The device should not be operated under load.
- If the device do not work long time change the position of the input and output fuses to “0” position.
- Input and output electric wirings must be suitable for the device power and nominal current.
- Do not prevent air flow of the device.
- Do not place things flammable and liquid materials near the working environment of the device.

3.1 Operating from Regulator

Operating from regulator is possible only if mains voltage is between certain limits. While Servo Regulator is operating in this mode, it processes mains voltage and supplies the loads with a voltage equal to mains nominal value.

Make sure that the regulator is energized by turning the input fuse or switch on the regulator input supply panel to the "ON" position. Set the Pako Switch on the device to the "Regulator" position. Panels open with a beep. Make sure the output voltage is correct. Make sure that the load is fed from the regulator by turning the output supply fuse or the switch on the distribution panel to the "ON" position.

3.2 Operating from Mains (BYPASS)

Transferring voltage on input to output through a mechanical switch on Servo Regulators is called “by-pass”.

Turn all your devices connected to the regulator and the output supply fuse or switch on the distribution panel to the “OFF” position. Set the input fuse or input switch on the regulator to the "OFF" position. Set Pako Switch on the device to “Mains/Bypass” position. Make sure that the load is fed through the mains/bypass by putting the output supply fuse or switch on the distribution panel to the “ON” position.

Bypass feature is generally used to separate Servo Regulator from input and output without deactivating the loads during maintenance.

3.3 Operation under Abnormal Situations

3.3.1 Overloading

Connecting loads exceeding nominal power of device output is called “overloading”. Device keeps powering the loads exceeding nominal power in regulator mode until fuses blow.

Be careful not to overload the device for safe operation.

3.3.2 Short Circuit on Output

Device forces the fuse on device to blow acting as a source of current upon any short circuits on output. Short circuit disappears upon blowing of fuse and other loads are protected against getting affected by this situation..

Each and every load must be connected to circuit through different fuses selected according to nominal current to enable device properly perform short circuit protection function.

3.3 Turning The Device On

After making the connections as described above, all you have to do to start up the device is to switch all fuses and automations on switchboard to “ON” position and then device will automatically start if mains voltage is above a certain value.

3.4 Turning The Device Off

Turn the Switch and Fuses to “0” position to switch off the device.

If maintenance and etc. operations will be performed on Servo regulator without cutting the power of loads connected to the device, turn switch to Mains position

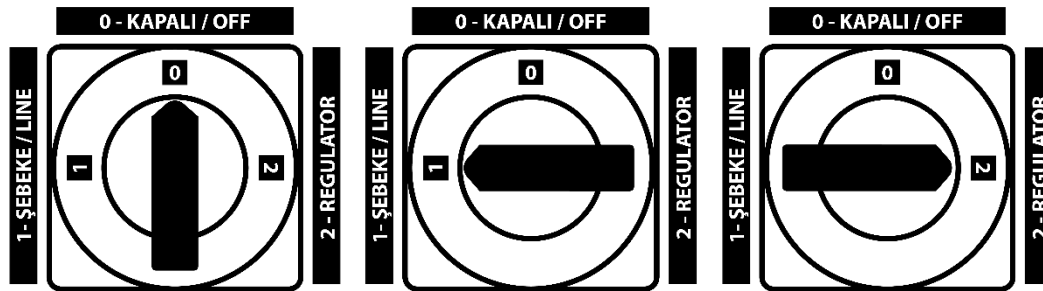


Fig.-5 Regulator Pako Switch Working Positions

3.5 Indicators

3.5.1 Display



It has a simple and clear LCD monitor. Input-output voltages and frequency information can be seen instantaneously on the LCD.

EM-07 Multimeter

EM-07 Multimeter measures the load on the system and voltage, current, apparent power minimum and maximum values, demands related to this load on the system.



Fig.-6 EM-07

- 1- It shows phase number belong to measurement values
- 2- Showing values are minimum of measurement values.
- 3- Showing values are maximum of measurement values.
- 4- Showing values are average of measurement values.
- 5- Showing values are demand of measurement values
- 6- It shows Serial Communications
- 7- It shows that type of measurement values
- 8- It shows number of error
- 9- It shows relay state.  means that relay is close.  means that relay is open.
- 10- It shows phase sequence. "L123" means that phase sequence is correct."L132" means that phase sequence is incorrect.

Definition of Buttons:

Up: It is used to return to the previous menu and increase the value.

Down: Used to go to the next menu and decrease the value

Set: It is used to enter the menu and memorize the set value.

ESC: It is used to exit the menu, exit without saving the adjusted value and turn off the current buzzer.

If you want to see min, max, average and demand values, you can use the down button. If you return to the main screen anywhere, you can use the ESC key.

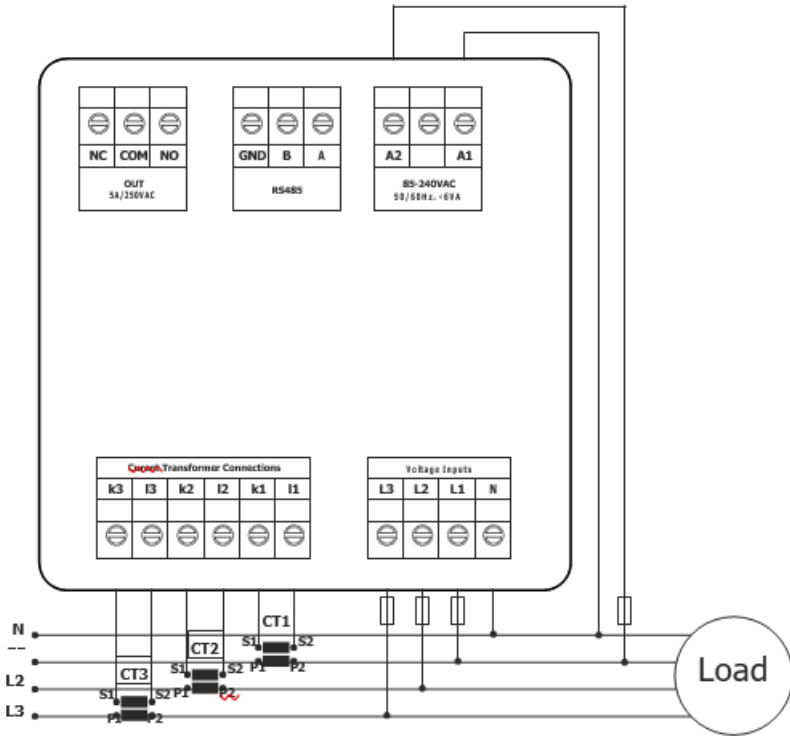


Fig.-7 EM-07 Connection Form

Errors Codes:

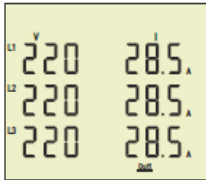
If device in any case of error cut off, Relay will be open, backlight of display will be flashing and bottom right-hand corner of display will display ERR Code.

Error Code	Information
Err0	Phase Sequence ERR
Err1	High Voltage ERR
Err2	Low Voltage ERR
Err3	High Current ERR
Err4	Low Current ERR
Err5	High Frequency ERR
Err6	Low Frequency ERR
Err7	Demurrage ERR
Err8	Voltage Fuses ERR
Err9	Current Fuses ERR
ErrA	Asymmetry Voltage ERR
ErrB	Asymmetry Current ERR

Start-up of the Device:

Read the warnings before the device is energized. Make sure that the device is connected according to the connection diagram. When the device is energized for the first time, the Home Screen is displayed. Enter the current transformer ratio and the voltage transformer ratios*, if installed, on the settings menu at first. *: Only on EM-07.

Display Information:



Home Screen

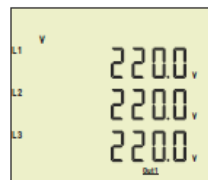


Figure-3

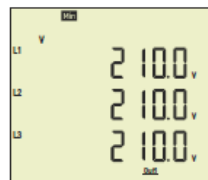


Figure-4

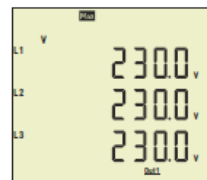


Figure-5

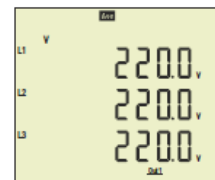


Figure-6

Home Screen: It shows voltage and current values together. If protection type is L-N, it shows phase-neutral voltage else, if protection type is L-L it shows phase-phase voltage. If you use voltage transformer, it is not showed. The figure-3 is displayed when you press the Down button.

Figure-3: It shows the phase-neutral voltage values. The figure-4 is displayed when you press the Down button.

Figure-4: It shows the phase-neutral minimum voltage values. The figure-5 is displayed when you press the Down button.

Figure-5: It shows the phase-neutral maximum voltage values. The figure-6 is displayed when you press the Down button.

Figure-6: It shows the phase-neutral mean voltage values. The figure-7 is displayed when you press the Down button.

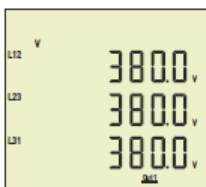


Figure-7

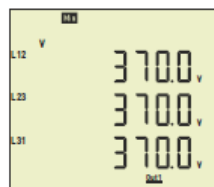


Figure-8

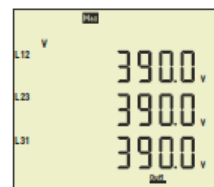


Figure-9

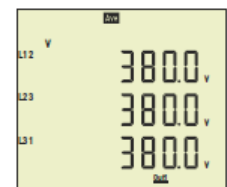


Figure-10

Figure-7: It shows the phase- phase voltage values. The figure-8 is displayed when you press the Down button.

Figure-8: It shows the phase- phase minimum voltage values. The figure-9 is displayed when you press the Down button.

Figure-9: It shows the phase- phase maximum voltage values. The figure-10 is displayed when you press the Down button.

Figure-10: It shows the phase- phase mean voltage values. The figure-11 is displayed when you press the Down button.

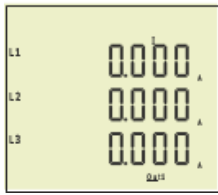


Figure-11

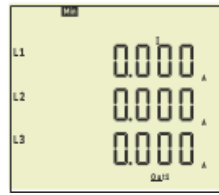


Figure-12

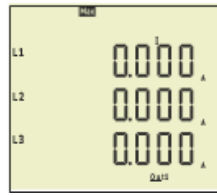


Figure-13

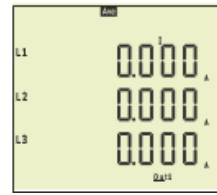


Figure-14

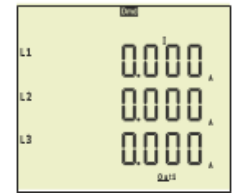


Figure-15

Figure-11: It shows the current values of each phase. The figure-12 is displayed when you press the Down button.

Figure-12: It shows the minimum current values of each phase. The figure-13 is displayed when you press the Down button.

Figure-13: It shows the maximum current values of each phase. The figure-14 is displayed when you press the Down button.

Figure-14: It shows the mean current values of each phase. The figure-15 is displayed when you press the Down button.

Figure-15: It shows the current demand current values of each phase. The figure-16 is displayed when you press the Down button.

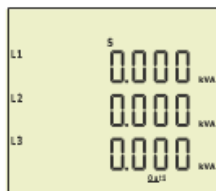


Figure-16

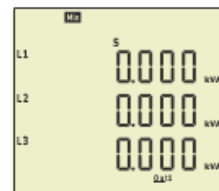


Figure-17

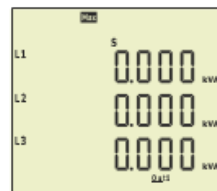


Figure-18

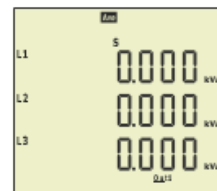


Figure-19

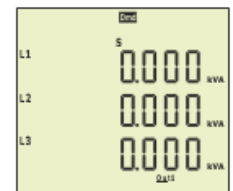


Figure-20

Figure-16: It shows the apparent power values of each phase. The figure-17 is displayed when you press the Down button.

Figure-17: It shows the minimum apparent power values of each phase. The figure-18 is displayed when you press the Down button.

Figure-18: It shows the maximum apparent power values of each phase. The figure-19 is displayed when you press the Down button.

Figure-19: It shows the mean apparent power values of each phase. The figure-20 is displayed when you press the Down button.

Figure-20: It shows the apparent power demand values of each phase. The figure-21 is displayed when you press the Down button.

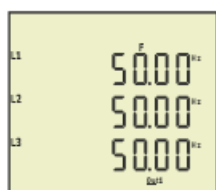


Figure-21



Figure-22



Figure-23



Figure-24

Figure-21: It shows the frequency values of each phase. The figure-22 is displayed when you press the Down button.

Figure-22: It shows the minimum frequency values of each phase. The figure-23 is displayed when you press the Down button.

Figure-23: It shows the maximum frequency values of each phase. The figure-24 is displayed when you press the Down button.

Figure-24: It shows the mean frequency values of each phase. The Home Screen is displayed when you press the Down button.

For other detailed technical information, please review Annex-B.

Annex-B contains the following information about the EM07 Multimeter;

- Connection Diagrams
- Points to take into consideration in the selection and connection of Current Transformer
- Warnings
- Maintenance of the Device
- General
- Introduction of Home Screen
- Definition of Buttons
- Error Codes
- Start-up of the Device
- Display Information
- To advance in Display Inventory
- Settings
- Voltage Settings
- Current Settings
- Frequency Settings
- RS485 RS485 Settings
- General Settings
- About
- Enter Menu with Password
- Changing Password
- Password Enable/Disable
- High Voltage Protection Value Change
- Low Voltage Protection Value Change
- High Current Protection Value Change
- Low Current Protection Value Change
- Voltage Asymmetry Protection Value Change
- Phase Sequence Protection Enable/Disable
- Demand Time Set
- Quick Setup
- Parameters Table
- Dimensions
- Technical Specifications
- Index

4.Maintenance

4.1 Rules for Maintenance, Repair and Use

1. There should be no flammable or heat-affected materials around the device (bottom, top, front, back and sides).
2. The environment where the device is located should be at normal room temperature values, it should not be exposed to direct sunlight if possible, it should not be left or used in damp and humid environments.
3. Water and similar liquid substances should not enter the device.
4. The working environment should be free from rodents and insects.
5. The covers of the device should not be opened except at the Authorized Service station.
6. The device should not be exposed to impacts or high temperatures that cause deformation in the outer box.
7. Modifications made later in the electrical installation of the device must be in accordance with the power of the device.
8. The external appearance of the device should be checked once a month.
9. The paint of the device should be checked once a year.
10. The switches and cables of the device should be checked once a month.

4.2 Errors That May Occur in Use

1. In case of any electrical leakage, the ground line should be checked.
2. If the device is loaded more than the usage capacity; overheating and odor are seen, check whether the usage capacity and the incoming load are suitable.
3. If odor and heat are observed, the device should not be used and the service should be contacted.
4. In case of water and similar liquid substances entering the device, the device input energy should be cut off for safety reasons.
5. If the device connection cables are damaged by rodents or other factors, the device should not be used and the cables should be replaced by qualified persons.
6. If the device does not give energy by signaling frequently, the service should be contacted for the capacity.

4.3 Possible Problems And Solutions

Problem	Possible Cause	Solution
Voltmeter does not show right	Voltmeter is defective	If voltmeter is digital, check socket; if it is analog, replace.
	Electronic card is defective	Check neutral connection, if problem persists please inform Technical Service
Smell emanates from device	Overloading is available	Check loads on phase, switch device to Mains position and inform Technical Service.
Device does not indicate voltage	If device is protected	Check fuse switch. Phase may be cut off, may not be neutral or voltage is not within operating range.
	If device is not protected	Fuse switch may be burned off or defective, voltmeter may be defective. Report technical service
Device turns on and off sometimes	If device is protected	Make sure neutral and phases are correct.
	If device is not protected	It must be drawing excessive ampere.
		Voltage may be outside current limits.
Sounds coming from device	Aşırı yüklenme vardır, Motor bağlantısı gevşek olabilir.	Turn device to mains positions, please contact your dealer or Service Center. Provide Service Center with following information: -Device Serial Nr. and KVA, -Date of occurrence of problem.
IMPORTANT NOTICE:		
Any interventions to device must only be made by qualified individuals		

4.4 Matters Not Covered by the Warranty

1. After the delivery of the goods to the consumer, malfunctions caused by transportation, shipment, dropping and impact, breaking and scratching of the outer surfaces,
2. Incorrect use and application of incorrect voltage, or interventions by unauthorized persons and natural disasters are not covered by the warranty.

APPENDICES

ANNEX-A

Warranty Conditions

1. The warranty period starts from the delivery date of the goods and is 2 (two) years.
2. All parts of the product, including all parts, are under the guarantee of our company.
3. If the product fails within the warranty period, the repair period is added to the warranty period. The repair time of the goods is a maximum of 20 working days. This period starts from the date when the product is notified to one of the seller, dealer, agency, representative, importer or manufacturer-manufacturer if there is no service station for the product. If the defect of the goods is corrected within 15 days, the importer or the manufacturer-manufacturer has to allocate another good with similar characteristics to the use of the consumer until the repair of the good is completed.
4. In the event that the product malfunctions due to material, workmanship or assembly faults within the warranty period, it will be repaired free of charge under the labor cost, spare part cost or another name.
5. Despite the consumer's right to repair, the goods;
 - Within one year, provided that it remains within the warranty period determined from the date of delivery to the consumer; More than two repetitions or different failures occurring more than four times within the specified warranty period, or the total of different failures being more than six, and these failures rendering the inability to use the product permanent.
 - Exceeding the maximum time required for repair,
 - In case the company's service station is not a service station, it is determined by a report to be drawn up by the seller, dealer, agency, representative, importer or manufacturer-manufacturer of the product that the product cannot be repaired. defect, where it is possible to replace the consumer goods free of charge, a refund or discount on the defect rate may be requested.
6. Defects arising from the use of the product contrary to the terms in the user manual are not covered by the warranty.
7. For problems that may arise regarding the Warranty Certificate, the Ministry of Industry and Trade, General Directorate of Protection of Consumer and Competition can be applied to.

ANNEX-B



EM-07 and EM-07D USER MANUAL



- * RS485 Modbus RTU (1200 - 38400bps)
- * 71.5 x 61.5 Custom Design Glass LCD
- * 3-phase voltage and 3-phase current transformer.
- * It shows that V1, V2, V3, V12, V23, V31, I1, I2, I3, S1, S2, S3, F1, F2, F3
- * It shows the minimum, maximum and average values of V1, V2, V3, V12, V23, V31, F1, F2, F3
- * It shows the minimum, maximum, average and demand values of I1, I2, I3, S1, S2, S3
- * High/Low voltage, current, frequency (adjustable)
- * Phase-Neutral or Phase-Phase protection (adjustable)
- * 1x relay output
- * Protect Voltage, Current and Frequency
- * Shows phase sequence
- * You can delete the demands
- * Menu is password-protected.

1 - Connection Diagrams:

Figure-1

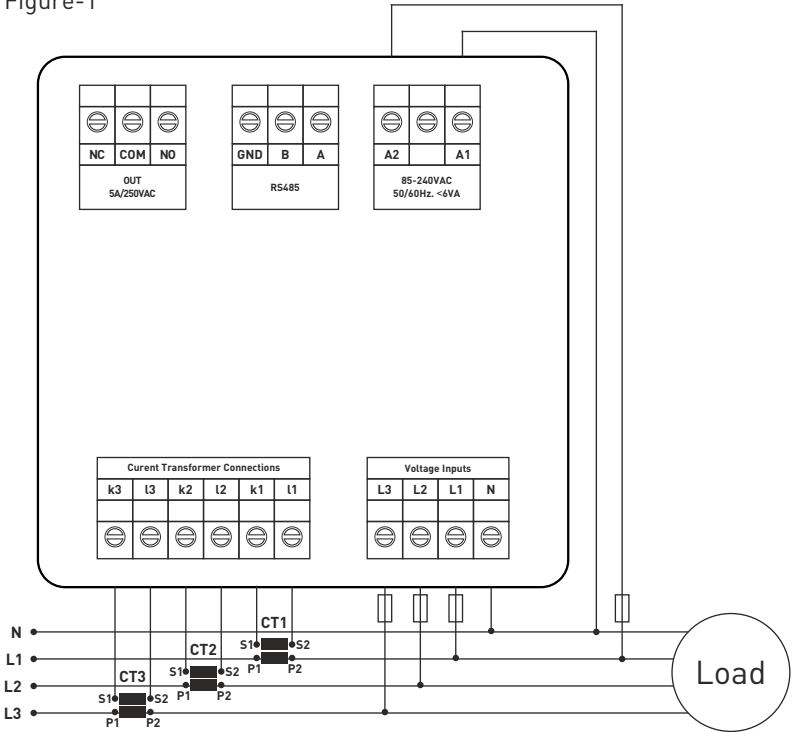


Figure-1: 3P4W connection type: 3 phase current and 3 phase voltage and neutral.

2 - Points to take into consideration in the selection and connection of Current Transformer: _____

- Be sure that the current transformer value is higher than the maximum current drawn from the system.
- In order to prevent any mistake while connecting the output terminals of the current transformer, use cables in different colors for each phase or designate a number for each cable.
- Keep the cables connected to the output terminals of the current transformer away from the high-voltage line.
- In order to prevent any shake on the current transformer, fix it on the bus-bar, cable or rail.

3 - Warnings: _____

- Use the device according to the instructions specified by us.
- Do not expose the LCD display directly to sunlight in order to avoid any harm on it.
- Note that the temperature level on the panel to which the device is mounted is at the range of operating temperature of the device (-20°C.....55°C)
- There must be a space of 5cm behind the device after its installation.
- Fix the device securely to the front-cover of the panel with the apparatus delivered together with the device.
- Be sure that the panel to which the device is mounted does not operate in a humid environment.
- Place the switch or circuit breaker close to the device or in a location that is easily accessible for the operator.
- Place a switch or circuit breaker on the system during installation of the device.
- Please note that the cables must not be energized during installation.
- Flexible monitored and twisted cables must be used for the input and output lines which are not connected to the mains.
- The technical personnel according with the instructions specified in the user's manual must perform installation of the device and electrical connections.
- The feeder cables must be compatible with the requirements of IEC 60227 or IEC 60245

4 - Maintenance of the Device: _____

De-energize and disconnect the device. Clean the body of the device with a dry or damp-dry cloth. Do not use conductive or other chemical substances as a cleaning agent that can damage the device. After cleaning the device, make its connections and check whether it is working by energizing it.



5 - General: _____

EM-07 Multimeter measures the load on the system and voltage, current, apparent power minimum and maximum values, demands related to this load on the system.





6- Introduction of Home Screen:



Figure-2

- 1 - It shows phase number belong to measurement values
- 2 - Showing values are minimum of measurement values
- 3 - Showing values are maximum of measurement values
- 4 - Showing values are average of measurement values
- 5 - Showing values are demand of measurement values
- 6 - It shows Serial Communications
- 7 - It shows that type of measurement values
- 8 - It shows number of error
- 9 - It shows relay state.  means that relay is close,  means that relay is open.
- 10 - It shows phase sequence. "L123" means that phase sequence is correct. "L132" means that phase sequence is incorrect.

7- Definition of Buttons:

-  **ESC:** State of Measurement; Back to home screen. State of Menu; Exit menu.
State of changing parameter; Not save chance and back to menu state.
State of Error; Manual reset
-  **SET:** State of Measurement; Entry Menu. State of Menu; Entry state of changing parameter.
State of changing parameter; save chance and back to menu state
-  **UP:** State of Measurement; To navigate from a main measurement values to another.
State of Menu; To navigate from menu parameters to another.
State of changing parameter; Increase value of parameter
-  **DOWN:** State of Measurement; To navigate from a deep measurement values to another (min,max,avg, dmd). State of Menu; To navigate from menu parameters to another.
State of changing parameter; Decrease value of parameter

8- Error Codes:

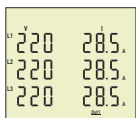
If device in any case of error cut off, Relay will be open, backlight of display will be flashing and bottom right-hand corner of display will display ERR Code.

Error Code	Information
Err0	Phase Sequence ERR
Err1	High Voltage ERR
Err2	Low Voltage ERR
Err3	High Current ERR
Err4	Low Current ERR
Err5	High Frequency ERR
Err6	Low Frequency ERR
Err7	Demurrage ERR
Err8	Voltage Fuses ERR
Err9	Current Fuses ERR
ErrA	Asymmetry Voltage ERR
Errb	Asymmetry Current ERR

9 - Start-up of the Device:

Read the warnings before the device is energized. Make sure that the device is connected according to the connection diagram. When the device energized for the first time, the Home Screen is displayed. Enter the current transformer ratio and the voltage transformer ratios*, if installed, on the settings menu at first.
*: Only on EM-07.

10 - Display Information:



Home Screen

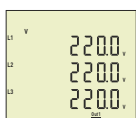


Figure-3

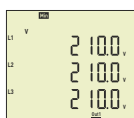


Figure-4

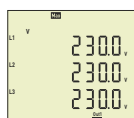


Figure-5

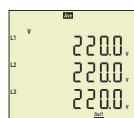


Figure-6

Home Screen: It shows voltage and current values together. If protection type is L-N, it shows phase-neutral voltage else, if protection type is L-L it shows phase-phase voltage. If you use voltage transformer, it is not showed. The figure-3 is displayed when you press the Down button.

Figure-3: It shows the phase-neutral voltage values. The figure-4 is displayed when you press the Down button.

Figure-4: It shows the phase-neutral minimum voltage values. The figure-5 is displayed when you press the Down button.

Figure-5: It shows the phase-neutral maximum voltage values. The figure-6 is displayed when you press the Down button.

Figure-6: It shows the phase-neutral mean voltage values. The figure-7 is displayed when you press the Down button.

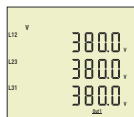


Figure-7

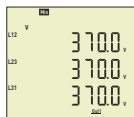


Figure-8

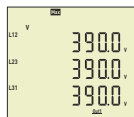


Figure-9

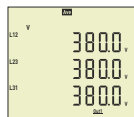


Figure-10

Figure-7: It shows the phase- phase voltage values. The figure-8 is displayed when you press the Down button.

Figure-8: It shows the phase- phase minimum voltage values. The figure-9 is displayed when you press the Down button.

Figure-9: It shows the phase- phase maximum voltage values. The figure-10 is displayed when you press the Down button.

Figure-10: It shows the phase- phase mean voltage values. The figure-11 is displayed when you press the Down button.

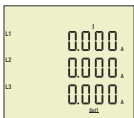


Figure-11



Figure-12



Figure-13

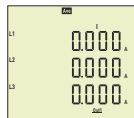


Figure-14

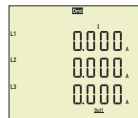


Figure-15

Figure-11: It shows the current values of each phase. The figure-12 is displayed when you press the Down button.

Figure-12: It shows the minimum current values of each phase. The figure-13 is displayed when you press the Down button.

Figure-13: It shows the maximum current values of each phase. The figure-14 is displayed when you press the Down button.

Figure-14: It shows the mean current values of each phase. The figure-15 is displayed when you press the Down button.

Figure-15: It shows the current demand current values of each phase. The figure-16 is displayed when you press the Down button.

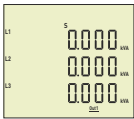


Figure-16

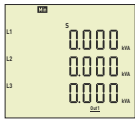


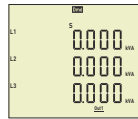
Figure-17



Figure-18



Figure-19



Şekil-20

Figure-16: It shows the apparent power values of each phase. The figure-17 is displayed when you press the Down button.

Figure-17: It shows the minimum apparent power values of each phase. The figure-18 is displayed when you press the Down button.

Figure-18: It shows the maximum apparent power values of each phase. The figure-19 is displayed when you press the Down button.

Figure-19: It shows the mean apparent power values of each phase. The figure-20 is displayed when you press the Down button.

Figure-20: It shows the apparent power demand values of each phase. The figure-21 is displayed when you press the Down button.



Figure-21



Figure-22



Figure-23



Figure-24

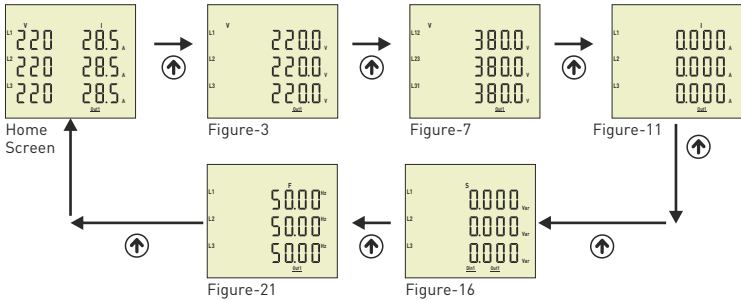
Figure-21: It shows the frequency values of each phase. The figure-22 is displayed when you press the Down button.

Figure-22: It shows the minimum frequency values of each phase. The figure-23 is displayed when you press the Down button.

Figure-23: It shows the maximum frequency values of each phase. The figure-24 is displayed when you press the Down button.

Figure-24: It shows the mean frequency values of each phase. The Home Screen is displayed when you press the Down button.

11 - To advance in Display Inventory:



The Home screen is displayed, when the device is energized. When you press the up button to see the other data on the display, the next data is displayed (Figure-3). The figure-7 is displayed when you press the Up button. The figure-11 is displayed when you press the Up button. The figure-16 is displayed when you press the Up button. The figure-21 is displayed when you press the Up button. The screen back to Home Screen when you press the Up button.

If you want to see values of min,max,mean and demand you can use down button. If you back to home screen in anywhere, you can use ESC button.

12 - Settings:

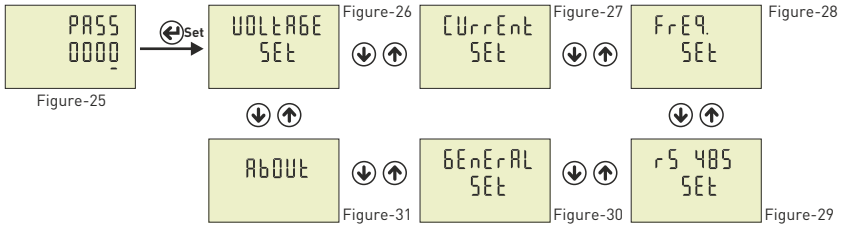


Figure-25: Press Menu button to enter password section. The figure-26 is displayed when you enter password and press the Menu button.

Figure-26: It uses for voltage settings. The figure-27 is displayed when you press the UP button.

Figure-27: It uses for current settings. The figure-28 is displayed when you press the UP button.

Figure-28: It uses for frequency settings. The figure-29 is displayed when you press the UP button.

Figure-29: It uses for RS-485 settings. The figure-30 is displayed when you press the UP button.

Figure-30: It uses for general settings. The figure-31 is displayed when you press the UP button.

Figure-31: It uses for about the device. This section give a information about device serial number and version number. You can use ESC button for exit menu.

13.1 - Voltage Settings:

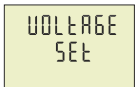


Figure-26

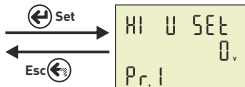


Figure-32

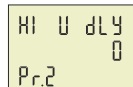


Figure-33

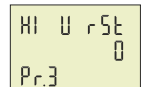


Figure-34

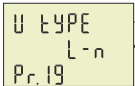


Figure-50



Figure-32

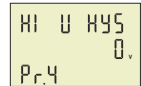


Figure-35

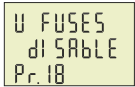


Figure-49

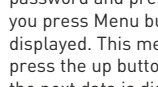


Figure-32

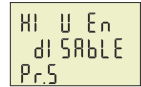


Figure-36

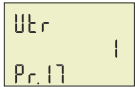


Figure-48

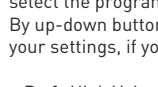


Figure-32

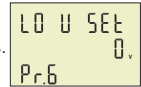


Figure-37

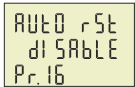


Figure-47

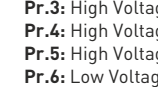


Figure-32

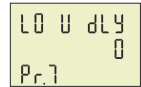


Figure-38

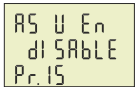


Figure-46

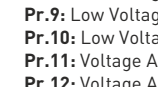


Figure-32

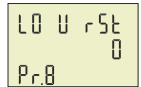


Figure-39

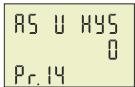


Figure-45

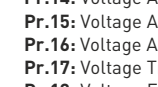


Figure-32

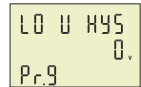


Figure-40

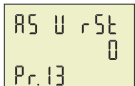


Figure-44

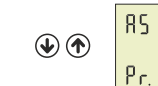


Figure-32

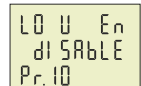


Figure-41

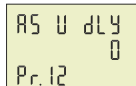


Figure-43

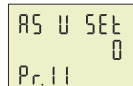


Figure-42

Press Menu button and enter password (Default Password =0000) to enter program list. The figure-26 is displayed when you enter password and press the Menu button. You enter Voltage set when you press Menu button. If you enter voltage set menu, the figure-32 is displayed. This menu have 19 different voltage set value. When you press the up button to see the other voltage set values on the display, the next data is displayed. The figure-32 is displayed when you press the up button after the Pr.19 is displayed. By using up-down buttons select the program. Press Menu to enter required program. By up-down buttons, you can set the program. Press Menu to record your settings, if you press ESC button, you cannot record your settings.

- Pr.1:** High Voltage Protection Value
- Pr.2:** High Voltage Protection Delay time
- Pr.3:** High Voltage Protection Reset time
- Pr.4:** High Voltage Protection Hysteresis
- Pr.5:** High Voltage Protection Enable/Disable
- Pr.6:** Low Voltage Protection Value
- Pr.7:** Low Voltage Protection Delay time
- Pr.8:** Low Voltage Protection Reset time
- Pr.9:** Low Voltage Protection Hysteresis
- Pr.10:** Low Voltage Protection Enable/Disable
- Pr.11:** Voltage Asymmetry Protection Value
- Pr.12:** Voltage Asymmetry Protection Delay Time
- Pr.13:** Voltage Asymmetry Protection Reset Time
- Pr.14:** Voltage Asymmetry Protection Hysteresis
- Pr.15:** Voltage Asymmetry Protection Enable/Disable
- Pr.16:** Voltage Auto Reset Enable/Disable
- Pr.17:** Voltage Transformer Ratio
- Pr.18:** Voltage Fuses Enable/Disable
- Pr.19:** Voltage Protection Type

HI U SEt
Pr.1
0.

Figure-32

Pr.1 : High Voltage Protection Value: Determines the maximum operating voltage value of load.

Default: 250V, **Min:** 1V, **Max:** 300V

HI U dLY
Pr.2
0

Figure-33

Pr.2: High Voltage Protection Delay Time: Determines delay open time. Delay time for activating the output. If any voltage exceeds high voltage protect value, Relay output switches open at the end of delay time.

Default: 3sec, **Min:** 1sec, **Max:** 10000sec.

HI U rSt
Pr.3
0

Figure-34

Pr.3: High Voltage Protection Reset Time: Determines delay close time. If all voltage below the high voltage protect value as a hysteresis voltage , relay output switches close at the end of the reset time.

Default: 3sec, **Min:** 1sec, **Max:** 10000sec.

HI U HYS
Pr.4
0.

Figure-35

Pr.4: High Voltage Protection Hysteresis: Required hysteresis voltage for high voltage warning is programmed.

Default: 5V, **Min:** 1V, **Max:** 200V

HI U En
dI SAbLE
Pr.5

Figure-36

Pr.5: High Voltage Protection Enable/Disable: Determines Enable or Disable the high voltage protection.

Default: Enable, **Min:** Disable, **Max:** Enable

LO U SEt
Pr.6
0.

Figure-37

Pr.6: Low Voltage Protection Value: Determines the minimum operating voltage value of load.

Default: 170V, **Min:** 1V, **Max:** 300V

LO U dLY
Pr.7
0

Figure-38

Pr.7: Low Voltage Protection Delay Time : Determines delay open time. Delay time for activating the output. If any voltage over the low voltage protect value, Relay output switches open at the end of delay time.

Default: 3sec, **Min:** 1sec, **Max:** 10000sec.

LO U rSt
Pr.8
0

Figure-39

Pr.8: Low Voltage Protection Reset Time: Determines delay close time.If all voltage below the low voltage protect value as a hysteresis voltage , relay output switches close at the end of the reset time.

Default: 3sec, **Min:** 1sec, **Max:** 10000sec.

LO U HYS
Pr.9
0.

Figure-40

Pr.9: Low Voltage Protection Hysteresis: Required hysteresis voltage for low voltage warning is programmed.

Default: 5V, **Min:** 1V, **Max:** 200V

LO U En
dI SAbLE
Pr.10

Figure-41

Pr.10: Low Voltage Protection Enable/Disable: Determines Enable or Disable the low voltage protection.

Default: Enable, **Min:** Disable, **Max:** Enable

```
RS U SEt
Pr.11 0
```

Figure-42

Pr.11: Voltage Asymmetry Protection Value : Determines the controlled voltage asymmetry. **Asymmetry Ratio Adjustment:** Device calculates a value by dividing difference between highest and lowest phase value to highest phase value.

Asymmetry Ratio = [(Highest Voltage – Lowest Voltage) / Highest Voltage] x 100

Default: %20, **Min:** %5, **Max:** %30

```
RS U dLY
Pr.12 0
```

Figure-43

Pr.12: Voltage Asymmetry Protection Delay time: Determines delay open time. Delay time for activating the output. If calculated asymmetry value below the voltage asymmetry protect value, Relay output switches open at the end of delay time.

Default: 3sec, **Min:** 1sec, **Max:** 10000sec.

```
RS U rSt
Pr.13 0
```

Figure-44

Pr.13: Voltage Asymmetry Protection Reset Time: Determines delay close time.

If calculated asymmetry value over the voltage asymmetry protect value as a hysteresis voltage , relay output switches close at the end of the reset time.

Default: 3sec, **Min:** 1sec, **Max:** 10000sec.

```
RS U HYS
Pr.14 0
```

Figure-45

Pr.14: Voltage Asymmetry Protection Hysteresis: Required hysteresis voltage for voltage asymmetry warning is programmed.

Default: %2, **Min:** %1, **Max:** %10

```
RS U En
dI SAbLE
Pr.15
```

Figure-46

Pr.15: Voltage Asymmetry Protection Enable/Disable: Determines Enable or Disable the voltage asymmetry protection.

Default: Enable, **Min:** Disable, **Max:** Enable

```
AutO rSt
dI SAbLE
Pr.16
```

Figure-47

Pr.16: Voltage Auto Reset Enable/Disable: If auto reset enable and system into error, if all voltage are over/below the protect value as hysteresis value ,relay output switches on at the end of the Reset time. If Auto reset is disable, after all voltage are over/below hysteresis value, relay output switches manually. (Using ESC button).

Default: Enable, **Min:** Disable, **Max:** Enable

```
UTr
Pr.17 1
```

Figure-48

Pr.17: Voltage Transformer Ratio: If you use medium voltage , you can use VTR

Default: 1, **Min:** 1, **Max:** 999

```
U FUSES
dI SAbLE
Pr.18
```

Figure-49

Pr.18: Voltage Fuses Enable/Disable: If any phase voltage exceeds 1.5 times of high voltage protect values, or ,if any phase voltage decrease 0.5 times of low voltage protect value, the relay switches off instantly. At position disable, voltage fuses function is cancelled.

Default: Disable, **Min:** Disable, **Max:** Enable

```
U tYPE
L-n
Pr.19
```

Figure-50

Pr.19: Voltage Protection Type: Voltage Protection can be selected as L-N or L-L in this menu. Phase-Neutral voltage protection can be implemented if the "L-N" protection is selected. Phase-Phase voltage protection can be implemented if the "L-L" protection is selected.

Default: L-n, **Min:** L-n, **Max:** L-L

13.2 - Current Settings:

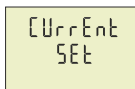


Figure-27

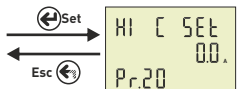


Figure-51

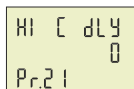


Figure-52

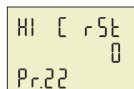


Figure-53

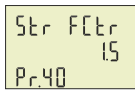


Figure-71

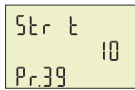


Figure-70

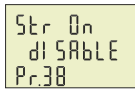


Figure-69

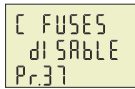


Figure-68

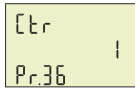


Figure-67

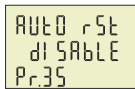


Figure-66

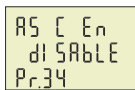


Figure-65

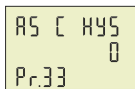


Figure-64

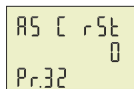


Figure-63

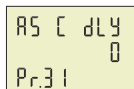


Figure-62

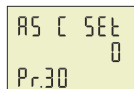


Figure-61

Press Menu button and enter password (Default Password =0000) to enter program list. The figure-26(Voltage SET) is displayed when you enter password and press the Menu button. The figure-27 (Current SET) is displayed when you press the up button. You enter Current set when you press Menu button. If you enter Current set menu, the figure-51(Pr.20) displayed. This menu have 21 different current set value. When you press the up button to see the other current set values on the display, the next data is displayed. The figure-51 is displayed when you press the up button after the Pr.40 is displayed. By using up-down buttons select the program. Press Menu to enter required program. By up-down buttons, you can set the program. Press Menu to record your settings, if you press ESC button, you cannot record your settings.

Pr.20: High Current Protection Value

Pr.21: High Current Protection Delay Time

Pr.22: High Current Protection Reset Time

Pr.23: High Current Protection Hysteresis

Pr.24: High Current Protection Enable/Disable

Pr.25: Low Current Protection Value

Pr.26: Low Current Protection Delay Time

Pr.27: Low Current Protection Reset Time

Pr.28: Low Current Protection Hysteresis

Pr.29: Low Current Protection Enable/Disable

Pr.30: Current Asymmetry Protection Value

Pr.31: Current Asymmetry Protection Delay Time

Pr.32: Current Asymmetry Protection Reset Time

Pr.33: Current Asymmetry Protection Hysteresis

Pr.34: Current Asymmetry Protection Enable/Disable

Pr.35: Current Auto Reset Enable/Disable

Pr.36: Current Transformer Ratio *

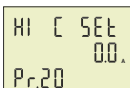
Pr.37: Current Fuses Enable/Disable

Pr.38: Demurrage Protection Enable/Disable

Pr.39: Demurrage Protection Time

Pr.40: Demurrage Protection Factor

*: Only on EM-07.

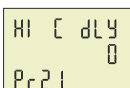


HI C SEt
00.
Pr.20

Figure-51

Pr.20: High Current Protection Value: Determines the maximum operating current value of load.

Default: 3.0A, **Min:** 0.1A, **Max:** 5.0A

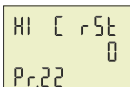


HI C dLY
0
Pr.21

Figure-52

Pr.21: High Current Protection Delay Time: Determines delay open time. Delay time for activating the output. If any current exceeds high current protect value, Relay output switches open at the end of delay time.

Default: 3sec, **Min:** 1sec, **Max:** 10000sec.

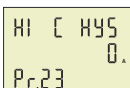


HI C rSt
0
Pr.22

Figure-53

Pr.22: High Current Protection Reset Time: Determines delay close time. If all current below the high current protect value as a hysteresis current, relay output switches close at the end of the reset time.

Default: 10sec, **Min:** 1sec, **Max:** 10000sec.

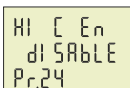


HI C HYS
0.
Pr.23

Figure-54

Pr.23: High Current Protection Hysteresis: Required hysteresis current for high current warning is programmed.

Default: 0.5A, **Min:** 0.1A, **Max:** 3.0A

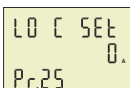


HI C En
dI SAbLE
Pr.24

Figure-55

Pr.24: High Current Protection Enable/Disable: Determines Enable or Disable the high current protection.lir.

Default: Enable, **Min:** Disable, **Max:** Enable

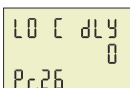


LO C SEt
0.
Pr.25

Figure-56

Pr.25: Low Current Protection Value: Determines the minimum operating current value of load.

Default: 0.1A, **Min:** 0.1A, **Max:** 5.0A

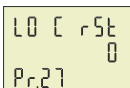


LO C dLY
0
Pr.26

Figure-57

Pr.26: Low Current Protection Delay Time: Determines delay open time. Delay time for activating the output. If any current over the low current protect value, Relay output switches open at the end of delay time.

Default: 3sec, **Min:** 1sec, **Max:** 10000sec.

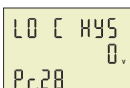


LO C rSt
0
Pr.27

Figure-58

Pr.27: Low Current Protection Reset Time: Determines delay close time. If all current below the low current protect value as a hysteresis current, relay output switches close at the end of the reset time.

Default: 10sec, **Min:** 1sec, **Max:** 10000sec.

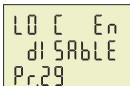


LO C HYS
0.
Pr.28

Figure-59

Pr.28: Low Current Protection Hysteresis: Required hysteresis current for low voltage warning is programmed.

Default: 0.5A, **Min:** 0.1A, **Max:** 3.0A



LO C En
dI SAbLE
Pr.29

Figure-60

Pr.29: Low Current Protection Enable/Disable: Determines Enable or Disable the low current protection.

Default: Enable, **Min:** Disable, **Max:** Enable


```
AS [ SEt
Pr30 0
```

Figure-61

Pr.30: Current Asymmetry Protection Value: Determines the controlled current asymmetry. **Asymmetry Ratio Adjustment:** Device calculates a value by dividing difference between highest and lowest phase value to highest phase value.

Default: %30, **Min:** %5, **Max:** %50

```
AS [ dLY
Pr31 0
```

Figure-62

Pr.31: Current Asymmetry Protection Delay Time : Determines delay open time. Delay time for activating the output. If calculated asymmetry value below the current asymmetry protect value, Relay output switches open at the end of delay time.

Default: 3sec, **Min:** 1sec, **Max:** 10000sec.

```
AS [ rSt
Pr32 0
```

Figure-63

Pr.32: Current Asymmetry Protection Reset Time: Determines delay close time. If calculated asymmetry value over the current asymmetry protect value as a hysteresis current, relay output switches close at the end of the reset time.

Default: 10sec, **Min:** 1sec, **Max:** 10000sec.

```
AS [ HYS
Pr33 0
```

Figure-64

Pr.33: Current Asymmetry Protection Hysteresis: Required hysteresis current for current asymmetry warning is programmed.

Default: %3, **Min:** %1, **Max:** %20

```
AS [ En
dI SAbLE
Pr34
```

Figure-65

Pr.34: Current Asymmetry Protection Enable/Disable: Determines Enable or Disable the current asymmetry protection.

Default: Disable, **Min:** Disable, **Max:** Enable

```
AutO rSt
dI SAbLE
Pr35
```

Figure-66

Pr.35: Current Auto Reset Enable/Disable : If auto reset enable and system into error, if all current are over/below the protect value as hysteresis value ,relay output switches on at the end of the Reset time. If Auto reset is disable, after all current are over/below hysteresis value, relay output switches manually. (Using ESC button).

Default: Enable, **Min:** Disable, **Max:** Enable

```
CTr
Pr36 1
```

Figure-67

Pr.36: Current Transformer Ratio: If a current transformer which has a ratio of 100/5A is used between the system and device; Current transformer ratio is entered as = $100/5 = 20$. *

Default: 1, **Min:** 1, **Max:** 2000

*: Only on EM-07.

```
[ FUSES
dI SAbLE
Pr37
```

Figure-68

Pr.37: Current Fuses Enable/Disable: If any phase current exceeds 1.5 times of high current protect value, or ,if any phase current decrease 0.5 times of low voltage protect value, the relay switches off instantly. At position disable, current fuses function is cancelled.

Default: Disable, **Min:** Disable, **Max:** Enable

```
St r On
dI SAbLE
Pr38
```

Figure-69

Pr.38: Demurrage Protection Enable/Disable: Determines Enable or Disable the demurrage protection.

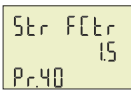
Default: Enable, **Min:** Disable, **Max:** Enable

```
St r t
Pr39 10
```

Figure-72

Pr.39: Demurrage Protection Time: Demurrage time is used to prevent from faulty switching caused by motor Demurrage current. In this period, demurrage is controlled by device.

Default: 10, **Min:** 1, **Max:** 100



Sekil-71

Pr.40: Demurrage Protection Factor: Demurrage current is 3-5 times more than normal operation current consumption.

Ex: High current set value is :5A, demurrage protection factor is :1.5.

Max Demurrage current is $5 \times 1.5 = 7.5$ A so device will let motor use 35A for start up.

Default: 3.0, **Min:** 1.0, **Max:** 10.0.

13.3 - Frequency Settings:

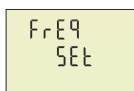


Figure-28

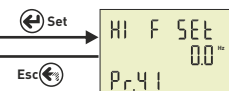


Figure-72

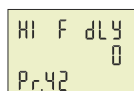


Figure-73

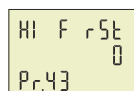


Figure-74

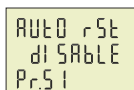


Figure-82

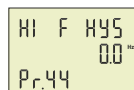


Figure-75

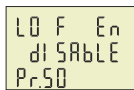


Figure-81

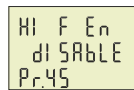


Figure-76

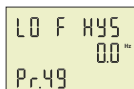


Figure-80

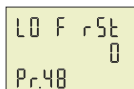


Figure-79

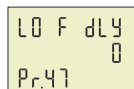


Figure-78

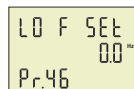


Figure-77

Press Menu button and enter password to enter program list. The figure-26(Voltage SET) is displayed when you enter password and press the Menu button. The figure-27(Current SET) is displayed when you press the up button. The figure-28(Frequency SET) is displayed when you press the up button. You enter Frequency set when you press Menu button. If you enter Frequency set menu, the figure-72(Pr.41) displayed. This menu have 11 different current set value. When you press the up button to see the other Frequency set values on the display, the next data is displayed. The figure-Figure 78 is displayed when you press the up button after the Pr.51 is displayed. By using up-down buttons select the program. Press Menu to enter required program. By up-down buttons, you can set the program. Press Menu to record your settings, if you press ESC button, you cannot record your settings.

Pr.41: High Frequency Protection Value

Pr.42: High Frequency Protection Delay Time

Pr.43: High Frequency Protection Reset Time

Pr.44: High Frequency Protection Hysteresis

Pr.45: High Frequency Protection Enable/Disable

Pr.46: Low Frequency Protection Value

Pr.47: Low Frequency Protection Delay Time

Pr.48: Low Frequency Protection Reset Time

Pr.49: Low Frequency Protection Hysteresis

Pr.50: Low Frequency Protection Enable/Disable

Pr.51: Frequency Auto Reset Enable/Disable

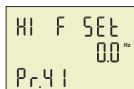


Figure-72

Pr.41: High Frequency Protection Value : Determines the maximum operating frequency value of load.

Default: 51Hz, **Min:** 45.0Hz, **Max:** 70.0Hz

```
HI F dLY
      0
Pr.42
```

Figure-73

Pr.42: High Frequency Protection Delay Time: Determines delay open time. Delay time for activating the output. If any frequency exceeds high frequency protect value, Relay output switches open at the end of delay time.

Default: 3sec, **Min:** 1sec, **Max:** 10000sec.

```
HI F rSt
      0
Pr.43
```

Figure-74

Pr.43: High Frequency Protection Reset Time: Determines delay close time. If all frequency below the high frequency protect value as a hysteresis frequency, relay output switches close at the end of the reset time.

Default: 3sec, **Min:** 1sec, **Max:** 10000sec.

```
HI F HYS
      0.0
Pr.44
```

Figure-75

Pr.44: High Frequency Protection Hysteresis: Required hysteresis frequency for high frequency warning is programmed.

Default: 0.5Hz, **Min:** 0.1Hz, **Max:** 20.0Hz

```
HI F En
dI SAbLE
Pr.45
```

Figure-76

Pr.45: High Frequency Protection Enable/Disable: Determines Enable or Disable the high frequency protection.

Default: Disable, **Min:** Disable, **Max:** Enable

```
LO F SEt
      0.0
Pr.46
```

Figure-77

Pr.46: Low Frequency Protection Value: Determines the minimum operating frequency value of load.

Default: 49Hz, **Min:** 45.0Hz, **Max:** 70.0Hz

```
LO F dLY
      0
Pr.47
```

Figure-78

Pr.47: Low Frequency Protection Delay Time: Determines delay open time. Delay time for activating the output. If any frequency over the low frequency protect value, Relay output switches open at the end of delay time.

Default: 3sec, **Min:** 1sec, **Max:** 10000sec.

```
LO F rSt
      0
Pr.48
```

Figure-79

Pr.48: Low Frequency Protection Reset Time: Determines delay close time. If all frequency below the low frequency protect value as a hysteresis frequency, relay output switches close at the end of the reset time.

Default: 3sec, **Min:** 1sec, **Max:** 10000sec.

```
LO F HYS
      0.0
Pr.49
```

Figure-80

Pr.49: Low Frequency Protection Hysteresis: Required hysteresis frequency for low voltage warning is programmed.

Default: 0.5Hz, **Min:** 0.1Hz, **Max:** 20.0Hz

```
LO F En
dI SAbLE
Pr.50
```

Figure-81

Pr.50: Low Frequency Protection Enable/Disable : Determines Enable or Disable the low frequency protection.

Default: Disable, **Min:** Disable, **Max:** Enable

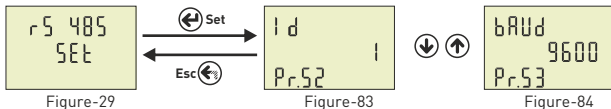
```
AUTO rSt
dI SAbLE
Pr.51
```

Figure-82

Pr.51: Frequency Auto Reset Enable/Disable: If auto reset enable and system into error, if all frequency are over/below the protect value as hysteresis value ,relay output switches on at the end of the Reset time. If Auto reset is disable, after all frequency are over/below hysteresis value, relay output switches manually. (Using ESC button).

Default: Disable, **Min:** Disable, **Max:** Enable

13.4 - RS485 RS485 Settings:



Press Menu button and enter password to enter program list. The figure-26(Voltage SET) is displayed when you enter password and press the Menu button. The figure-27(Current SET) is displayed when you press the up button. The figure-28(Frequency SET) is displayed when you press the up button. The figure-29 (RS485 SET) is displayed when you press the up button. You enter Rs-485 set when you press Menu button. If you enter Rs-485 set menu, the figure-83(Pr.52) displayed. This menu have 2 different current set value. When you press the up button to see the other Frequency set values on the display, the next data is displayed. By using up-down buttons select the program. Press Menu to enter required program. By up-down buttons, you can set the program. Press Menu to record your settings, if you press ESC button, you cannot record your settings.

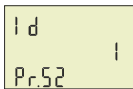


Figure-83

Pr.52: Modbus ID: Determines Modbus device ID.
Default: 1, Min: 1, Max: 247

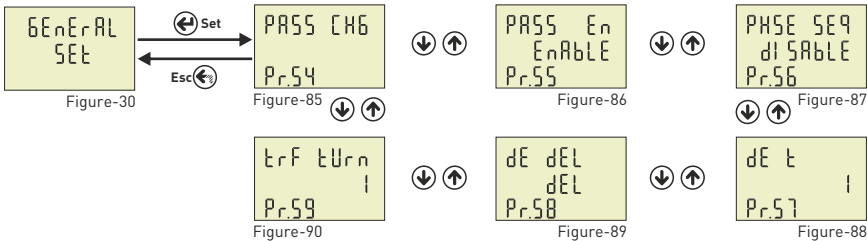


Figure-84

Pr.53: Baudrate Selection: Determines Modbus communication speed.
Default: 9600bps, Min: 1200bps, Max: 38400bps

Note: **Stopbits: 1, Parity: none and Databits: 8**

13.5 - General Settings:



Press Menu button and enter password to enter program list. The figure-26(Voltage SET) is displayed when you enter password and press the Menu button. The figure-27(Current SET) is displayed when you press the up button. The figure-28(Frequency SET) is displayed when you press the up button. The figure-29 (RS485 SET) is displayed when you press the up button. The figure-30(General SET) is displayed when you press the up button. You enter General set when you press Menu button. If you enter General set menu, the figure-85(Pr.54) displayed. This menu have 6 different current set value. When you press the up button to see the other General set values on the display, the next data is displayed. By using up-down buttons select the program. Press Menu to enter required program. By up-down buttons, you can set the program. Press Menu to record your settings, if you press ESC button, you cannot record your settings.

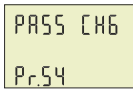


Figure-85

Pr.54: Password Change: This menu is used for changing the user password.
Default: 0000, Min: 0000, Max: 9999

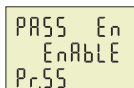


Figure-86

Pr.55: Password Protection Enable/Disable: This menu is used for activating the user password. After the user password is activated for entering to the menus; if the Menu button is pressed, while the instant values are observed, user password is required.

Default: Disable, **Min:** Disable, **Max:** Enable

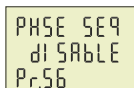


Figure-87

Pr.56: Phase Sequence Protection Enable/Disable: You can use device with phase sequence or without phase sequence function. If you set device for phase sequence, when running, it will be check phase sequence and it will display sequence error on screen. If you set "Disable" You can see phase sequence error but device not give error.

Default: Disable, **Min:** Disable, **Max:** Enable

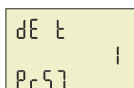


Figure-88

Pr.57: Demand Time: Determines demand calculate time. Demand is calculated using average value. Device take sample for demand time and calculate average value. Demand is maximum average value.

Default: 15min, **Min:** 1min, **Max:** 120min.

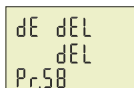


Figure-89

Pr.58: Demand Record Delete: You can delete demand and average records.

If cut off device energy min,max, average and demand values are deleted.

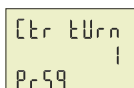


Figure-90

Pr.59: Current Transformer Cable Turn Number: User defines the turn number, which is the number of how much tour the current cable has rounded into the current transformer. Numbers can be selected between 1-20. Greater the number of turn means greater the sensitivity

Default: 1, **Min:** 1, **Max:** 20.

13.6 - About:



Figure-31

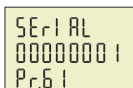


Figure-91

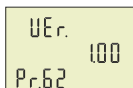


Figure-92

Press Menu button and enter password to enter program list. The figure-26(Voltage SET) is displayed when you enter password and press the Menu button.

The figure-27(Current SET) is displayed when you press the up button.

The figure-28(Frequency SET) is displayed when you press the up button.

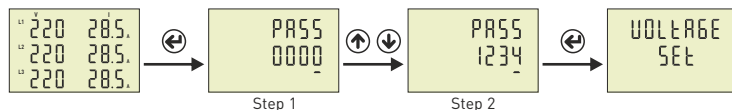
The figure-29(RS485 SET) is displayed when you press the up button.

The figure-30(General SET) is displayed when you press the up button.

The figure-31(About) is displayed when you press the up button.

You enter "About" when you press Menu button. If you enter "About" menu, the figure-91(Pr.61) displayed. When you press the up button to see the other parameter on the display, the next data is displayed.

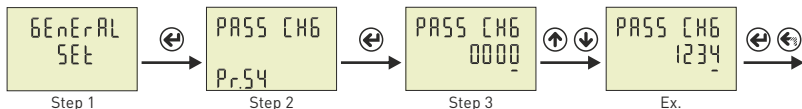
14- Enter Menu with Password:



Step 1: Press "SET" button for entering menu.

Step 2: If Password is activated ,you can see "PASS" screen, you have to enter user password. There are four digit and press "Down" button ,selected digit is change. You can increase digit value using "Up" button. Press "Set" button after enter the user password. If you back to home screen you press "ESC"button. Default password is "0000".

15- Changing Password:

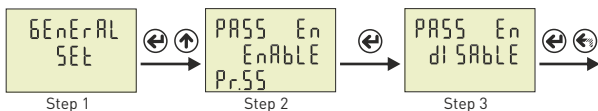


Step 1: Press Menu button and enter password to enter program list. The Voltage SET is displayed when you enter password and press the Menu button. Press "Up" button until you see the General SET

Step 2: Pr.54 is displayed when you press the "SET" button. Pr.54 is using for changing password. Pr.54 is deleted from screen when you press the "SET" button.

Step 3: You can change selected digit (underline) using "Down" button. "Up" button is used to increase its value. You can use "SET" button to save new password. If you press "ESC" button, you cannot record your settings.

16- Password Enable/Disable:

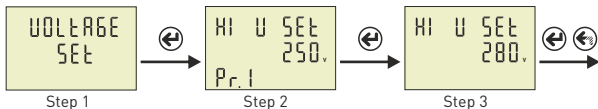


Step 1: Press Menu button and enter password to enter program list. The Voltage SET is displayed when you enter password and press the Menu button. Press "Up" button until you see the General SET

Step 2: Pr.54 is displayed when you press the "SET" button and press "Up" button. You will see Pr.55. It is used for enable/disable password protection. It is deleted from screen when you press the "SET" button.

Step 3: You can select Disable/Enable to use Up/Down Button. You can use "SET" button to save. If you press "ESC" button, you cannot record your settings.

17- High Voltage Protection Value Change:

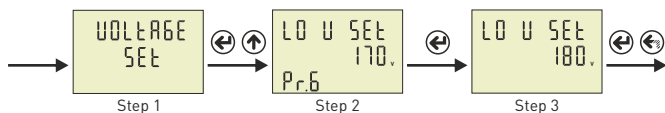


Step 1: Press Menu button and enter password to enter program list. The Voltage SET is displayed when you enter password and press the Menu button.

Step 2: Pr.1 is displayed when you press the "SET" button. It is used for setting high voltage protection value. It is deleted from screen when you press the "SET" button.

Step 3: You can increase/decrease value to use Up/Down Button. You can use "SET" button to save. If you press "ESC" button, you cannot record your settings.

18- Low Voltage Protection Value Change:

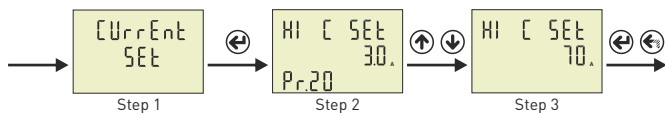


Step 1: Press Menu button and enter password to enter program list. The Voltage SET is displayed when you enter password and press the Menu button.

Step 2: Pr.1 is displayed when you press the "SET" button. and press "Up" button. You will see Pr.6. It is using for setting low voltage protection value. It is deleted from screen when you press the "SET" button.

Step 3: You can increase/decrease value to use Up/Down Button. You can use "SET" button to save. if you press "ESC" button, you cannot record your settings.

19- High Current Protection Value Change:

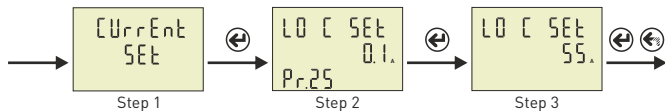


Step 1: Press Menu button and enter password to enter program list. The Voltage SET is displayed when you enter password and press the Menu button. Press "Up" button until you see the Current SET

Step 2: Pr.20 is displayed when you press the "SET" button. It is using for setting high current protection value. It is deleted from screen when you press the "SET" button.

Step 3: You can increase/decrease value to use Up/Down Button. You can use "SET" button to save. if you press "ESC" button, you cannot record your settings.

20- Low Current Protection Value Change:

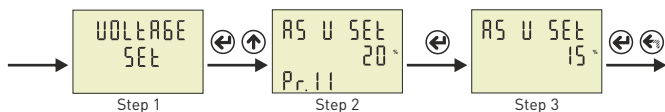


Step 1: Press Menu button and enter password to enter program list. The Voltage SET is displayed when you enter password and press the Menu button. Press "Up" button until you see the Current SET

Step 2: Pr.20 is displayed when you press the "SET" button. and press "Up" button. You will see Pr.25. It is using for setting low current protection value. It is deleted from screen when you press the "SET" button.

Step 3: You can increase/decrease value to use Up/Down Button. You can use "SET" button to save. if you press "ESC" button, you cannot record your settings.

21- Voltage Asymmetry Protection Value Change:



Step 1: Press Menu button and enter password to enter program list. The Voltage SET is displayed when you enter password and press the Menu button.

Step 2: Pr.1 (HI V SET) is displayed when you press the "SET" button and press "Up" button. You will see Pr.11. It is using for setting voltage asymmetry protection value. It is deleted from screen when you press the "SET" button.

Step 3: You can increase/decrease value to use Up/Down Button. You can use "SET" button to save. if you press "ESC" button, you cannot record your settings.

22- Phase Sequence Protection Enable/Disable:

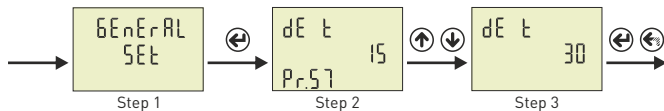


Step 1: Press Menu button and enter password to enter program list. The Voltage SET is displayed when you enter password and press the Menu button. Press "Up" button until you see the General SET

Step 2: Pr.54 is displayed when you press the "SET" button and press "Up" button. You will see Pr.56. It is using for enable/disable phase sequence protection. It is deleted from screen when you press the "SET" button.

Step 3: You can select Disable/Enable to use Up/Down Button. You can use "SET" button to save. If you press "ESC" button, you cannot record your settings.

23- Demand Time Set:

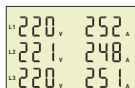


Step 1: Press Menu button and enter password to enter program list. The Voltage SET is displayed when you enter password and press the Menu button. Press "Up" button until you see the General SET

Step 2: Pr.54 is displayed when you press the "SET" button and press "Up" button. You will see Pr.57. It is using for setting demand time. It is deleted from screen when you press the "SET" button.

Step 3: You can increase/decrease value to use Up/Down Button. You can use "SET" button to save. If you press "ESC" button, you cannot record your settings.

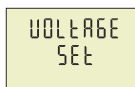
24- Quick Setup :



220, 252
221, 248
220, 251
220, 251



This section describes some of the most commonly used parameters. You can adjust your system by apply them. These parameters are High/Low Voltage Protection value and hysteresis, Voltage Asymmetry protection value, High/Low Current Protection value and hysteresis, Current transformer ratio, demurrage factor and time.

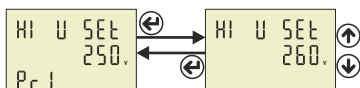


VOLTAGE
SET

Figure-26



Press Menu button and enter password to enter program list. The Voltage SET is displayed when you enter password and press the Menu button. Voltage SET menu is include set of high/low voltage protection and asymmetry settings. Pr.1 is displayed when you press the "SET" button.



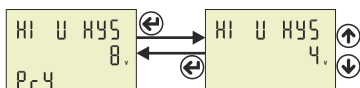
HI U SET 250.
Pr.1

HI U SET 260.

Figure-32



Pr.1 is using for setting high voltage protection. It is deleted from screen when you press the "SET" button. You can increase/decrease value to use Up/Down Button. You can use "SET" button to save. The figure-32 is displayed when you press the SET button. Press "Up" button until you see the Pr.4 (figure-35)



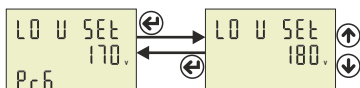
HI U HYS 8.
Pr.4

HI U HYS 4.

Figure-35



Pr.4 is using for setting high voltage protection hysteresis. It is deleted from screen when you press the "SET" button. You can increase/decrease value to use Up/Down Button. You can use "SET" button to save. The figure-35 is displayed when you press the SET button. Press "Up" button until you see the Pr.6 (figure-37)



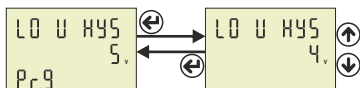
LO U SET 170.
Pr.6

LO U SET 180.

Figure-37



Pr.6 is using for setting low voltage protection. It is deleted from screen when you press the "SET" button. You can increase/decrease value to use Up/Down Button. You can use "SET" button to save. The figure-37 is displayed when you press the SET button. Press "Up" button until you see the Pr.9 (figure-40)



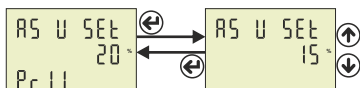
LO U HYS 5.
Pr.9

LO U HYS 4.

Figure-40



Pr.9 is using for setting low voltage protection hysteresis. It is deleted from screen when you press the "SET" button. You can increase/decrease value to use Up/Down Button. You can use "SET" button to save. The figure-40 is displayed when you press the SET button. Press "Up" button until you see the Pr.11 (figure-42)



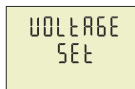
AS U SET 20.
Pr.11

AS U SET 15.

Figure-42



Pr.11 is using for setting voltage asymmetry protection. It is deleted from screen when you press the "SET" button. You can increase/decrease value to use Up/Down Button. You can use "SET" button to save. The figure-42 is displayed when you press the SET button. Press "ESC" button for back to main menu.

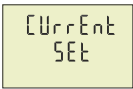


VOLTAGE
SET

Figure-26



"Voltage SET" is displayed when you pressed the "ESC" button. (Figure-26)
"Current SET" is displayed when you press the "Up" button (Figure-27).



Current SET menu is include set of high/low current protection, current transformer ratio and demurrage settings.

Figure-27

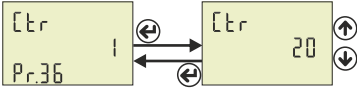


Figure-67

Pr.36 It is using for setting current transformer ratio*. You can increase/decrease value to use Up/Down Button. You can use "SET" button to save. The figure-67 is displayed when you press the SET button. Press "Up" button until you see the Pr.25 (figure-56).

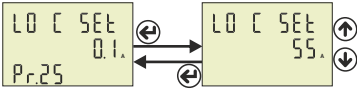


Figure-56

Pr.25 is using for setting low current protection. It is deleted from screen when you press the "SET" button. You can increase/decrease value to use Up/Down Button. You can use "SET" button to save. The figure-56 is displayed when you press the SET button. Press "Up" button until you see the Pr.20 (figure-51)

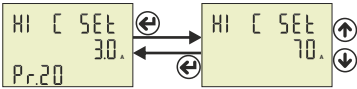


Figure-51

Pr.20 is displayed when you press the "SET" button and press "Up" button. You will see Pr.36 (Figure-67).It is using for setting current transformer ratio. You can increase/decrease value to use Up/Down Button. You can use "SET" button to save. The figure-67 is displayed when you press the SET button. Press "Up" button until you see the Pr.25 (figure-56).

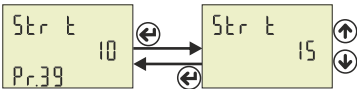


Figure-70

Pr.39 is using for setting demurrage time. It is deleted from screen when you press the "SET" button. You can increase/decrease value to use Up/Down Button. You can use "SET" button to save. The figure-70 is displayed when you press the SET button. Press "Up" button until you see the Pr.40 (figure-71).

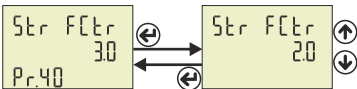
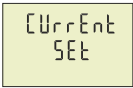


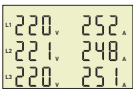
Figure-71

Pr.40 is using for setting demurrage time. It is deleted from screen when you press the "SET" button. You can increase/decrease value to use Up/Down Button. You can use "SET" button to save. The figure-71 is displayed when you press the SET button. Press twice "ESC" button for back to home screen.



All settings are made. Press ESC to exit. The figure-27 is displayed on screen. Press the ESC key again.

Figure-27



Home Screen

You have exited the menu. The "Home Screen" is displayed on screen. The device will control according to the set values.

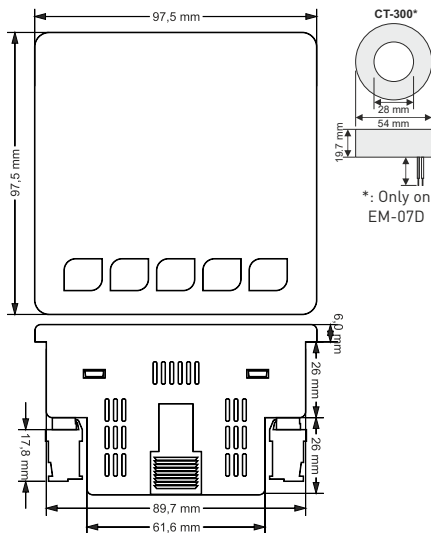
*: Only on EM-07

25 - Parameters Table:

Menu	Parameter Number	Parameter	Unit	Default Value	Minimum Value	Maximum Value
VOLTAGE SET	Pr.1	High Voltage Value	Volt	250	1	300
	Pr.2	High Voltage Delay Time	Second	3	1	10000
	Pr.3	High Voltage Reset Time	Second	3	1	10000
	Pr.4	High Voltage Hysteresis	Volt	5	1	200
	Pr.5	High Voltage Protection	-	Disable	Disable	Enable
	Pr.6	Low Voltage Value	Volt	170	1	300
	Pr.7	Low Voltage Delay Time	Second	3	1	10000
	Pr.8	Low Voltage Reset Time	Second	3	1	10000
	Pr.9	Low Voltage Hysteresis	Volt	5	1	200
	Pr.10	Low Voltage Protection	-	Disable	Disable	Enable
	Pr.11	Voltage Asymmetry Value	-	%20	%5	%30
	Pr.12	Voltage Asymmetry Delay Time	Second	3	1	10000
	Pr.13	Voltage Asymmetry Reset Time	Second	3	1	10000
	Pr.14	Voltage Asymmetry Hysteresis	-	%2	%1	%10
	Pr.15	Voltage Asymmetry Protection	-	Disable	Disable	Enable
	Pr.16	Voltage Auto Reset	-	Disable	Disable	Enable
	Pr.17	Voltage Transformer Ratio	-	1	1	999
	Pr.18	Voltage Fuse	-	Disable	Disable	Enable
	Pr.19	Voltage Protection Type	-	L-n	L-n	L-L
CURRENT SET	Pr.20	High Current Value	Amper	3.0	0.1	5.0
	Pr.21	High Current Delay Time	Sanıye	3	1	10000
	Pr.22	High Current Reset Time	Second	10	1	10000
	Pr.23	High Current Hysteresis	Amper	0.5	0.1	3.0
	Pr.24	High Current Protection	-	Disable	Disable	Enable
	Pr.25	Low Current Value	Amper	0.1	0.1	5.0
	Pr.26	Low Current Delay Time	Second	3	1	10000
	Pr.27	Low Current Reset Time	Second	10	1	10000
	Pr.28	Low Current Hysteresis	Amper	0.5	0.1	3.0
	Pr.29	Low Current Protection	-	Disable	Disable	Enable
	Pr.30	Current Asymmetry Value	-	%30	%5	%50
	Pr.31	Current Asymmetry Delay Time	Second	3	1	10000
	Pr.32	Current Asymmetry Reset Time	Second	10	1	10000
	Pr.33	Current Asymmetry Hysteresis	-	%3	%1	%20
	Pr.34	Current Asymmetry Protection	-	Disable	Disable	Enable
	Pr.35	Current Auto Reset	-	Disable	Disable	Enable
	Pr.36	Current Transformer Ratio*	-	1	1	2000
	Pr.37	Current Fuse	-	Disable	Disable	Enable
	Pr.38	Demurrage Protection	-	Disable	Disable	Enable
Pr.39	Demurrage Time	Second	10	1	100	
Pr.40	Demurrage Protection Factor	-	3.0	1.0	10.0	
FR EQ. SET	Pr.41	High Frequency Value	Hertz	51.0	45.0	70.0
	Pr.42	High Frequency Delay Time	Second	3	1	10000
	Pr.43	High Frequency Reset Time	Second	3	1	10000
	Pr.44	High Frequency Hysteresis	Hertz	0.5	0.1	20.0
	Pr.45	High Frequency Protection	-	Disable	Disable	Enable
	Pr.46	Low Frequency Value	Hertz	49.0	45.0	70.0
	Pr.47	Low Frequency Delay Time	Second	3	1	10000
	Pr.48	Low Frequency Reset Time	Second	3	1	10000
	Pr.49	Low Frequency Hysteresis	Hertz	0.5	0.1	20.0
	Pr.50	Low Frequency Protection	-	Disable	Disable	Enable
	Pr.51	Frequency Auto Reset	-	Disable	Disable	Enable
RS 485	Pr.52	ModBus ID	-	1	1	247
	Pr.53	ModBus BaudRate	bps	9600	1200	38400
GENERAL SET	Pr.54	Password Change	-	0000	0000	9999
	Pr.55	Password Protection	-	Disable	Disable	Enable
	Pr.56	Phase Sequence	-	Disable	Disable	Enable
	Pr.57	Demand Time	Minute	15	1	120
ABOUT	Pr.58	Demand Delete	-	-	-	-
	Pr.59	C.T. Cable Turn Number	Round	1	1	20
	Pr.60	Serial Number	-	-	-	-
	Pr.61	Version	-	-	-	-

*: Only on EM-07

26- Dimensions:



27 - Technical Specifications:

Operating Voltage	85V - 240V AC
Operating Frequency	50 / 60 Hz
Operating Power	<10VA
Operating Temperature	-20°C.....55°C
Voltage Input	5V -300V AC
Voltage Measurement Range	5V - 300kV
Current Input	50mA-5,5A,1A-300A(EM-07D)
Current Measurement Range	50mA-10.000A,1A-300A(EM-07D)
Voltage, Current Accuracy	%±1
Supported Connection	3P4W
Current Transformer Ratio	1.....2000(Only on EM-07)
Voltage Transformer Ratio	1....999
Communication	RS485 MODBUS RTU
Display	71.5 x 61.5mm Glass LCD
Output	2A / 250V AC (Resistive Load)
Weight	<300Gr.
Protection Class	IP41(Panel), IP20(Body)
Panel Hole Size	91mm x 91mm
Connection Type	Plug-in Connection
Cable Diameter	1.5mm ²
Installation	Front panel mounted
Operating Altitude	<2000meters

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