Tescom®

TSVR SERIES STATIC VOLTAGE REGULATOR

10-3200kVA

3 Phase Input-3 Phase Output

USER MANUAL

CONTENTS

1. SAFETY NOTICES

- Contacting with live parts may result in serious wounds and even death.
- Electrical safety precautions should be taken before any set up, maintenance or measurement operation.
- Do not perform connection, measurement and maintenance operations alone. Keep one person with you who can help you in any emergency situation.
- Do not use the device without protective ground connection.
- Electrical connections should only be performed by professional electricians.
- These devices require the neutral connection from mains power system.
- Read this manual carefully before using the device and save it for later reference.
- Ensure that ambient conditions are met with the regulations described in this manual.
- Ensure that cooling fan ventilation holes are open.
- Failure to provide required ambient conditions will result in problems with the device.
- Do not perform any operations which you are unsure about.
- When you encounter a problem in any step throughout this guide, do not skip to next step. Contact our support department for help.

2. FIRST CONTROLS

- Check the device for any damage which may have occurred during shipping processes.
- Check the device nameplate to ensure that the information is consistent with your purchase order.

3. GENERAL WORKING MECHANISM

These devices use tapped transformers and Silicon Controlled Rectifiers (SCRs or thyristors) to regulate voltage. Proper taps are selected on individual transformer of each phase and independent voltage regulation between phases is accomplished. An electronic system controls the whole system with the help of a microcontroller. The electronic system requires initial power to start up. After the electronic system gets power, it starts self-tests and then controls the regulation system against any problems. If electronic system finds no problem it continues with the rest of the steps to start the regulation.

4. TECHNICAL INFORMATION

4.1. Electrical Properties

PARAMETER		MIN	NOMINAL	MAX	UNIT
S3P	Total Power	-	-	75	KVA
S1P	Power per phase	-	-	25	KVA
Vin	Input voltage	173	230	265	V (AC P-N)
Vout	Output voltage	227	230	237	V (AC P-N)
f	Input Frequency	-	50-60	-	Hz

4.2. Ambient Conditions

PARAMETER		MIN	NOMINAL	MAX	UNIT
T	Temperature	-10	20	40	°C
RH	Relative Humidity	-	50	90	%
Alt	Altitude	-	-	2000	m

4.3. Control and Protection Elements Contained in the Device

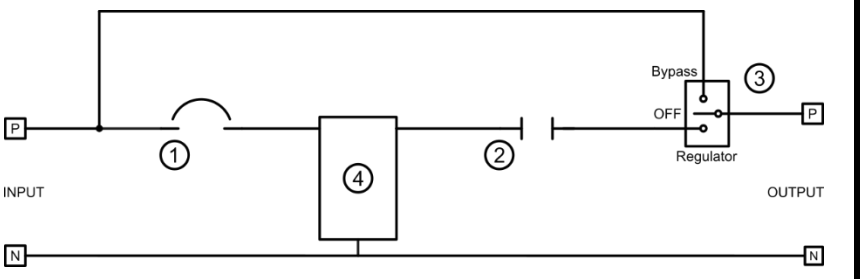
Control and protection elements contained in your device are indicated with (**x**) mark in below table.

Optional Systems List		Switching Elements List	
Manual Bypass System	**x**	Input Breaker	**x**
Automatic Bypass System		Output Breaker	
Isolated Transformers		Input Contactor	
Remote Management Unit		Output Contactor	**x**
		Manual Bypass Switch	**x**
		Surge Protector Device	
		Thyristor Breaker	

5. SINGLE LINE DIAGRAMS

5.1. Simple Single Line Diagram

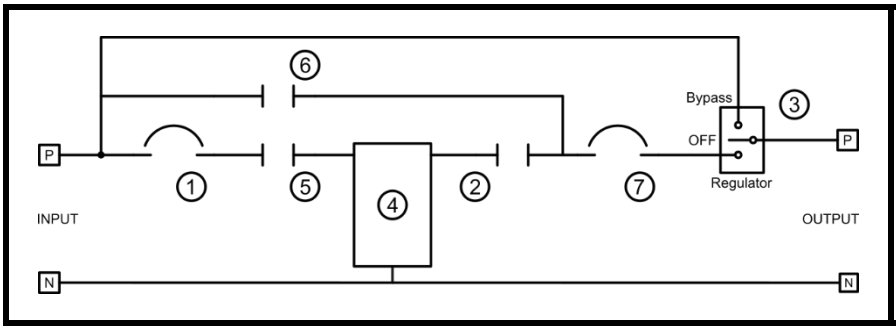
Below single line diagram contains only Input Breaker, Output Breaker and Optional Manual Bypass Switch.



1) Input Breaker.
2) Output Contactor.
3) Manual Bypass Switch.
4) Regulation System Parts.

5.2. Single Line Diagram with All Standard and Optional Elements

Below single line diagram contains all the standard and optional elements. See technical information part to determine which elements are contained in your device.



1) Input Breaker.
2) Output Contactor.
3) Manual Bypass Switch.
4) Regulation System Parts.
5) Input Contactor.
6) Bypass Contactor.
7) Output Breaker.

6. SWITCHING and PROTECTION ELEMENTS

Not all of the elements explained in this part might be present in your device. See technical information part to determine which elements are contained in your device.

6.1. Input Breaker - Standard

Input Breaker controls the input power to regulation system. It also provides protection against overload or short circuit situations. Whenever user turns on this breaker, the regulation system gets power. Turning on the Input Breaker will not immediately supply power to output terminals. Output power will be available after device completes self-tests.

6.2. Manual Bypass Switch - Optional

Manual Bypass Switch controls the manual bypass system. For detailed explanations about this switch see Manual Bypass System part.

6.3. Output Contactor - Optional

Output Contactor is controlled by the electronic control system. This contactor is turned on when the regulation system is ready. This way regulated energy is transferred to the output terminals.

7. BYPASS SYSTEMS

7.1. MANUAL BYPASS SYSTEM

- Manual Bypass System is optionally included in the device. See technical information part to determine if your device has this system.
- Manual Bypass System control is achieved by a rotary transfer switch which has 3 different modes.
- There will be output power interruption when Manual Bypass System mode is changed. Turn off your loads and turn off external output breaker before changing the mode of Manual Bypass System.

7.1.1. Bypass Mode

When Manual Bypass Switch is turned to label **Bypass (or Line)** the manual bypass mode is activated. In this mode regulation system is bypassed and input terminals are directed to output terminals. In case of a fault in regulation system or whenever loads are wanted to be fed with unregulated mains power this mode can be selected. Turning off the Input Breaker or Output Breaker will not affect the operation of the manual bypass mode. These breakers cannot break the output power while in manual bypass mode. See single line diagrams. In manual bypass mode it is possible to turn off the input breaker and shut down the device to save the no load power consumption of the device.
Output voltage values seen on front panel are not the actual output terminal voltage values in manual bypass mode, these voltage values are the output voltage values of regulation system.

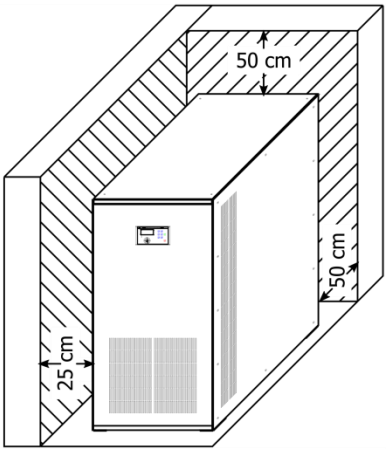
7.1.2. Output Off Mode

When Manual Bypass Switch is turned to label **Output Off (0 or Off),** the output terminals are isolated. In this mode input power to regulation system is not turned off, only output power to loads is turned off. See single line diagrams.

7.1.3.Regulator Mode

When Manual Bypass Switch is turned to label **Regulator,** the regulation system is directed to output terminals. In this mode there will be regulated power at the output terminals. Output voltage values seen on front panel are actual output terminal voltage values in regulator mode.

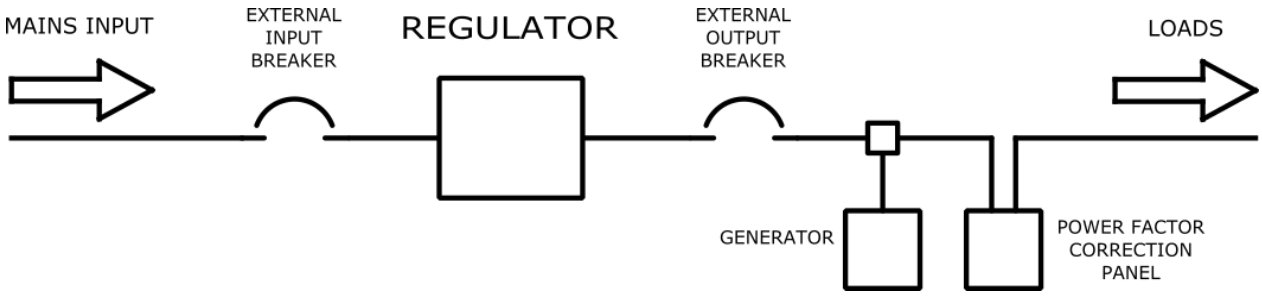
8. INSTALLATION LOCATION



- No liquid or solid objects should enter into the device. Check the enclosure protection of the device and decide a suitable location.
- Ensure that ambient conditions are met in the location. See Technical Information part for ambient conditions.
- Ensure that below conditions are met for the location where you intend to place the device.
- The location should not take direct sun light.
- There will be at least 2 meters between device and any combustible material.
- There will be at least 25 cm between device and any other object or wall.
- There will be at least 50 cm space behind the device to the wall.
- There will be at least 50 cm space in front of any fan airflow outlet of the device.
- There will be no flammable liquid or gas container in the location.
- Generator connection to the system should be after the device.
- Power factor correction device connection to the system should be between device and loads.
- Contact support department if any of the above conditions are not possible to be met.

9. MAKING THE CONNECTIONS OF THE DEVICE

- Below block diagram shows the recommended status of the electrical system and external protection elements after you have installed the regulator.
- The external input breaker can be the main input breaker of the building.
- The external output breaker is recommended for safety of the system.



- The steps starting with the sign (OP) indicates that this step is related to an optional element. Skip to next step if you do not have this optional element.
- Use a reliable true RMS multimeter to perform measurements.

1. Turn off your loads.
2. Turn off the main input breaker of the building.
3. Turn off the external input breaker if you have it in your system.
4. Using a reliable multimeter, ensure that there is no energy on the conductors which will be connected to the input terminals of the device.
5. Turn off the Input Breaker of the device.

6. (OP) Turn off the Optional Output Breaker of the device.
7. (OP) Turn the Optional Manual Bypass Switch to Output Off (0 or Off) position.
8. Turn off the external output breaker if you have it in your system.
9. See Appendix 1 for properties of the conductors to be connected to the device.
10. See Appendix 2 for information about the input output and other terminals of the device.
11. Connect input, output and protective ground conductors to their terminals and tighten their screws with proper amount of torque. See Appendix 3 for tightening torque values.
12. After you have completed connections, check the labels and conductors again.

10. SUPPLYING POWER TO LOADS

- Complete below steps in order to supply power to loads.
- The steps starting with the sign (OP) indicates that this step is related to an optional element. Skip to next step if you do not have this optional element.
- Use a reliable true RMS multimeter to perform measurements.

1. Ensure that the breakers mentioned in the Making the Connections of the Device part are turned off.
2. Ensure that the input, output and protective ground connections are completed properly as described in the Making the Connections of the Device part.
3. Turn on the main input breaker of the building and turn on the external input breaker if you have it in your system. This will supply power to input terminals of the device.
4. Measure phase to neutral voltages at the input terminals of the device. Ensure that phase to neutral voltages at the input terminals are at expected values.
5. Check the phase sequence at the input terminals if you have a load for which the phase sequence is important.
6. Measure phase to neutral voltages at output terminals; ensure that there is no energy at the output terminals.
7. (OP) Continue with following sub steps if your device has a Manual Bypass Switch. Skip to next step if it does not have a Manual Bypass Switch.
    - **7.1.** Turn the manual bypass switch to bypass mode. This will direct the power at input terminals to output terminals.
    - **7.2.** Measure phase to neutral voltages at output terminals. Ensure that phase to neutral voltages at output terminals are same with phase to neutral voltages at input terminals.
    - **7.3.** Turn the Manual Bypass Switch to regulator mode.
8. Turn on the Input Breaker. This will power up the regulation system and the front panel.
9. Electronic system starts self-tests after the regulation system is powered up. These controls last in 10 to 30 seconds. After self-tests are completed, regulated power is automatically directed to output terminals. While optional Manual Bypass Switch is at regulator mode, there will be no power at output terminals until the startup self-tests are completed.
10. (OP) In devices which contain optional Automatic Bypass System, bypass mode is activated whenever the regulation system is not ready. When the regulation system continuing its startup self-tests or deactivated by a fault or an overload, the Automatic Bypass System will switch to bypass mode.
11. (OP) In devices which contain optional Output Breaker, regulated power to output terminals can be controlled manually. After starting up the regulation system, turn on the optional Output Breaker to direct the regulated power to output terminals.
12. Measure phase to neutral voltages at output terminals. Ensure that output phase to neutral voltages are within the limits indicated in the Technical Information part.
13. Turn on the external output breaker if you have it in your system.
14. Turn on your loads.
15. After turning on the loads control the load percentage values shown on the front panel. Ensure that load percentage values are below 100%. See Front Panel and LCD section for information about front panel.
16. If load percentage values are not below 100% you will have to disconnect some of your loads. If this is not possible, contact support department.

17. After turning on the loads and ensuring that there is no problem, enter the input, output voltages and load percentage values to the commissioning form. Sign a copy of commissioning form and send it to support department. This is required for validation of device warranty.

11. TURNING OFF THE DEVICE

1. Turn off your loads before turning off the device.
2. Turn off the external output breaker if you have it in your system.
3. Turn off the optional Output Breaker.
4. Turn off the Input Breaker. This will cut off the power to the regulation system.
5. Turn off the external input breaker if you have it in your system.

- After turning off the Input Breaker it is possible to feed the loads with unregulated mains power by turning the optional Manual Bypass Switch to bypass mode.

12. CONTROLS AFTER INSTALLATION

- After first installation, turn on as much load as possible which will not exceed load percentages shown on front panel over 100%. Wait for a few hours for ambient temperature to stabilize. Ensure that the temperature stays inside the allowed range indicated in the Technical Specifications part.
- Check the environmental conditions once in 6 months.
  Check cooling fan airflow holes once in 6 months to ensure that they are not blocked. Perform this control for both thyristor cooling fans and cabinet cooling fans. The cooling fans might be controlled by a thermic switch which turns on fans at certain temperature level. These fans might not start running when you start up the device.

13. PERIODICAL MAINTENANCE

We are recommending that the general maintenance of the regulator should be made by the end-user to the relevant technicians. In this maintenance, the following step-by-step repairs should be carried out carefully with the life safety of the technician who will perform the maintenance.

- The regulator should be closed completely.
- Internal general cleaning of the regulator should be done.
- The connections inside the regulator should be checked.
- Something blocking vents inside and outside the regulator check if it is available.
- Check if the regulator cooling fans are working properly or not.
- The functions of the regulator electronic boards should be checked.
- The functions and calibration of the regulator monitor should be checked and if necessary, it should be calibrated.
- Regulator input and output voltages should be measured and they must be compared with values on the shown regulator LCD front panel, if necessary they must be calibrated.
- The functions of the regulator power elements should be checked.
- Regulator load control should be done and if excessive loads are removed.
- If there is any existing fault on the regulator, it should be fixed.

14. FRONT PANEL and LCD

1.1. General Information

- Device front panel starts working when the Input Breaker is turned on and regulation system is energized.
- "INPUT" labeled light indicates that input power to the device and its main control board is present.
- "AVR" labeled light indicates that regulation system is receiving power.

- "OUTPUT" labeled light indicates the status of the output power.
- “FAULT” labeled red light turns on when regulation system has a problem. Go to Faults Screen in the front panel LCD and check the fault codes. See fault codes part in this manual for explanations of the fault codes.

1.2. LCD Screen

14.1.1. General Information

- Screen number: The string at the upper right corner indicates the screen number being shown (M1, M2...).
- Switching between screens: Use “Left” and “Right” buttons on the front panel to switch to other screens.
- Selecting an option or entering a submenu: Press “Enter” button to select an option or enter into a submenu.
- Cursor symbol (>) at the beginning of a row indicates that this row has an option which can be changed.
- Edit option symbol (=) at the beginning of a row indicates that the option or value on this row is selected and can be changed by pressing “Up” or “Down” button.
- Press “Enter” again after you have changed a setting to change the edit option symbol to cursor symbol.
- Press “Enter” button on Save & Exit option to save, apply and exit the settings you have made.

14.1.2. M1 - Voltages and Load Screen

- This screen displays the input and output voltages and the percentage of the loads.

14.1.3. M2 - Frequency Screen

- On M2 screen on the first row, measured input line frequency is displayed. This value is displayed for only information purposes. The device cannot change the frequency. The device will work in any frequency value inside the range indicated in the electrical properties table.

14.1.4. M3 - Faults Screen

- Second line displays the latest fault code record. Pressing “Down” or “Up” button will display older fault code records.
- Third and fourth line the ongoing faults of each phase are displayed. If these lines are empty, there are no ongoing faults.
- See Fault Codes part for explanation of fault codes.

14.1.5. M4 - Settings Password Screen

- When you see the “Need Password” string on the screen, press (Enter - Up - Up) buttons in sequence to enter into the submenus of settings.

Stabilizer Firmware Setting Screen Menu Explanations	Setting Menu	USER	Admin
		Enter-Up-Up	Ask to Support
Output Voltage Adjustment	Set Output	x	x
Turning ON/OFF of Audible Alarm System.	Sound Alarm	x	x
Time Adjustment	Set Year	x	x
Time Adjustment	Set Month	x	x
Time Adjustment	Set Day	x	x
Time Adjustment	Set Hour	x	x
Time Adjustment	Set Minute	x	x
Adjustment of Output Voltage Hysteresis	Offset		x
Selection of Regulation Mode	Reg Mode		x
Selection of Modbus Device ID	Modbus Address		x
Selection of Modbus CH1 Baud Rate	MB1 Baud Rate		x
Selection of Modbus CH1 Parity	MB1 Parity		x
Selection of ID for RMU or Parallel Device	RMU(For Single) Device ID(For Parallel)		x
General Commands	Comand		x
Selecting to Booster transformer availability.	Booster Tra(For Single)- None(For Paralel)		x

Note: Modbus Feature is Optional.

On the fourth line EXIT option can be selected. After you have made changes on a setting, bring the cursor to this option and press enter. Option for saving or exiting without saving is asked. Choose proper option and exit the menu

14.1.5.1. M5.1 – System Information Screen

- Here is shown firmware versions and EEPROM options of the microcontrollers utilized in the device
- This is an informative menu only. There are no user changeable settings inside.

15. CONTROLS AFTER INSTALLATION

- After first installation, turn on as much load as possible which will not exceed load percentages shown on front panel over 100%. Wait for a few hours for ambient temperature to stabilize. Ensure that the temperature stays inside the allowed range indicated in the Technical Specifications part.
- Check the environmental conditions once in 6 months.
- Check cooling fan airflow holes once in 6 months to ensure that they are not blocked. Perform this control for both thyristor cooling fans and cabinet cooling fans. The cooling fans might be controlled by a thermic switch which turns on fans at certain temperature level. These fans might not start running when you start up the device.

16. TROUBLESHOOTING

16.1. Fault Codes

- Following table explains the fault codes and recommended actions. See next section for information about other situations.
-

Error Format ; yaaa

y : for 1 means L1 Phase

y : for 2 means L2 Phase

y : for 3 means L3 Phase

y : for 4 means General Failure

aaa: means specific error code

EXAMPLE: 2010 means L2 Phase current zero failure

Code	Description	Level
y000	No Error	
y001	input Voltage very high	High
y002	input Voltage high	Medium
y003	input Voltage very low	Low
y004	input Voltage low	Low
y005	output voltage very high	High
y006	output voltage high	Medium
y007	output voltage very low	Low
y008	output voltage low	Low
y009	Main output is closed from Webserver or modbus	Low
y010	Fire Detector (Opsionel System)	High
y011	Open Circuit input Thyristor/IGBT Group	High
y012	Open Circuit output Thyristor/IGBT Group	High
y013	Thyristor/IGBT Fuse Off	High

y015	Output Short Circuit Failure	High
y016	Main output is by pass from Webserver or modbus	Low
y017	Over Temperature	Medium
y018	Short Circuit Failure Input Thyristor/IGBT	High
y019	Short Circuit Failure Output Thyristor/IGBT	High
y020	Short Circuit Failure 1x number Thyristor/IGBT	High
y021	Short Circuit Failure 1 number Thyristor/IGBT	High
y022	Short Circuit Failure 2 number Thyristor/IGBT	High
y023	Short Circuit Failure 3 number Thyristor/IGBT	High
y024	Short Circuit Failure 4 number Thyristor/IGBT	High
y025	Short Circuit Failure 5 number Thyristor/IGBT	High
y026	Short Circuit Failure 6 number Thyristor/IGBT	High
y027	Short Circuit Failure 7 number Thyristor/IGBT	High
y028	Short Circuit Failure 8 number Thyristor/IGBT	High
y029	Short Circuit Failure 9 number Thyristor/IGBT	High
y030	Open Circuit Failure 1x number Thyristor/IGBT	High
y031	Open Circuit Failure 1 number Thyristor/IGBT	High
y032	Open Circuit Failure 2 number Thyristor/IGBT	High
y033	Open Circuit Failure 3 number Thyristor/IGBT	High
y034	Open Circuit Failure 4 number Thyristor/IGBT	High
y035	Open Circuit Failure 5 number Thyristor/IGBT	High
y036	Open Circuit Failure 6 number Thyristor/IGBT	High
y037	Open Circuit Failure 7 number Thyristor/IGBT	High
y038	Open Circuit Failure 8 number Thyristor/IGBT	High
y039	Open Circuit Failure 9 number Thyristor/IGBT	High
y040	İnput Square Wave Low Failure	Low
y041	input Square Wave High Failure	Low
y042	Load Higher than %100	Medium
y043	Load Higher than %125	High
y044	Load Higher than %150	High
y045	Load Higher than %175	High
y046	Load Higher than %200	High
y047	Wait Other Phase	Low
y048	VOR; Wait "Close Circuit - Main Input" Command	Low
y049	VOR; Wait "Close Circuit - Main Output" Command	Low
y050	Mcu reset (emc or thd) or Power cut off for one phase	High
y051	VOR; Common Output Terminal Voltage synchronization error	High
y052	VOR; Command Signal Error 1	Medium
y053	VOR; Command Signal Error 2	Medium
Y055	(opt) ByPass switch cabinet door is opened	Medium
y059	VOR ; Mainboard - Frontpanel Communication Error (bad packet)	Medium
y060	Mainboard - Frontpanel Communication Error or Phase Cut Off	Medium
y062	VOR ; ManualByPass is active in this device or other devices.	High
y063	Close output signal cause of FP Other Phase Com Error (Optional)	Medium
y067	VOR; The device input breaker is off.	Medium

y068	VOR; The device output breaker is off.	Medium
y070	Auto bypass Devices: The Phase did not pass Energy Saver Mode cause of other phases	Low
y071	Auto bypass Devices: The Phase did not pass Energy Saver Mode ;Load Higher Than %100 in bypass Mode	Medium
y073	Auto bypass Devices: The Phase will stay ByPass Mode; Because of Communication error between mainboards	Medium
y074	MCCB with motor or Contactor does not close contacts with Mainboard Command	Medium
y075	MCCB with motor or Contactor does not open contacts with Mainboard Command	Medium
y076	RTC hardware problem	Low
y078	Reserved.	Low
y079	Energy Saver Group: Load is higher than %90 - The device stay bypass operation.	Medium
y080	TCC Board Special Error: Analog Feedback Error.	Medium
y081	(Opt)Last Error Have Output Volt. Err or Load Higher than %125. Device cannot give energy .	Medium
y082	(3IN1Out Device) Line Board -Input Voltages are not inappropriate	Medium
y083	(3IN1Out Device) Line Board -Frequencies are not inappropriate	Medium
y084	(3IN1Out Device) Line Board -Phase choose will not apply; All Phases have not good input VAC	Medium
y085	(3IN1Out Device) Line Board -Input Voltages are not inappropriate. Device will wait 30 minutes	Medium
y086	Load Higher than %300	
y087	Load Higher than %400	
y200	IGBT/SCR A Group general Error	High
y201	IGBT/SCR A Group -1 Error	High
y202	IGBT/SCR A Group -2 Error	High
y203	IGBT/SCR A Group -3 Error	High
y204	IGBT/SCR A Group -4 Error	High
y205	IGBT/SCR A Group -5 Error	High
y206	IGBT/SCR A Group -6 Error	High
y207	IGBT/SCR A Group -7 Error	High
y208	IGBT/SCR A Group -8 Error	High
y210	IGBT/SCR B Group general Error	High
y211	IGBT/SCR B Group -1 Error	High
y212	IGBT/SCR B Group -2 Error	High
y213	IGBT/SCR B Group -3 Error	High
y214	IGBT/SCR B Group -4 Error	High
y215	IGBT/SCR B Group -5 Error	High
y216	IGBT/SCR B Group -6 Error	High
y217	IGBT/SCR B Group -7 Error	High
y218	IGBT/SCR B Group -8 Error	High
y219	Freq Signal Not stable for Very Fast Regulation (Sag Compensator)	Medium
y8xx	Auto bypass Devices: Can not pass Energy Saver/Regulator Mode cause of other phases device will re try after “xx” Seconds	Low
y9xx	Device Protect itself. Device will Wait “xx” minute	Low
Code	**Description**	
y064	Frontpanel - RMU Communication problem	Low
y065	Frontpanel - Circutor RGU10-C Communication Error	Low

Y077	Phase Rotate Error	Low
y101	Paralel Reg The device lost its master device.	Medium
y102	L1 PMU - MB Serial Communication Error	Medium
y103	L2 PMU - MB Serial Communication Error	Medium
y104	L3 PMU - MB Serial Communication Error	Medium
y105	L1 PMU - MB Proc State Communication Error	Medium
y106	L2 PMU - MB Proc State Communication Error	Medium
y107	L3 PMU - MB Proc State Communication Error	Medium
y108	The Asistant Memory is return to default because of New upgrade firmware	Low
y109	PMU have closed output of device from webserver	Low
y111	L1 PMU - MB System not ready	Medium
y112	L2 PMU - MB System not ready	Medium
y113	L3 PMU - MB System not ready	Medium
y114	Record Operation is Resuming	Medium
y115	External / Internal Memory is damaged or Not found	High
y120	3 Volt Battery Error.	Medium
y121	Power Analyzer L1 Phase Load Lower Than 3 Amp, measurements can show wrong values	Low
y122	Power Analyzer L2 Phase Load Lower Than 3 Amp, measurements can show wrong values	Low
y123	Power Analyzer L3 Phase Load Lower Than 3 Amp, measurements can show wrong values	Low
y133	Active Energy Measurement Fault - Measurement higher than Maximum Expected value	Low
y134	Active Energy Measurement Fault - Measurement less than Minimum Expected value	Low
y140	L1 Communication Error (Addresses)	Medium
y141	L2 Communication Error (Addresses)	Medium
y142	L3 Communication Error (Addresses)	Medium
y152	PMU Device ID is Changed by user	Medium
Y153	Mcu reset (emc or thd) or Power cut off for one phase	High
y154	PMU Device ID is Changed by system.	Medium
y156	PMU Slave Device Waiting Command.	Medium
y157	PMU Master ID Conflict.	High
y160	Power Analyzer L1 Phase Wrong Connection.Please change Polarity as soon as possible	High
y161	Power Analyzer L2 Phase Wrong Connection. Please change Polarity as soon as possible	High
y162	Power Analyzer L3 Phase Wrong Connection. Please change Polarity as soon as possible	High
y163	Communication Error between Front panel and Energy Analyzer (Entes)	Medium
y164	Communication Error between Front panel and Energy Analyzer (Qeed)	Medium
y165	Power Analyzer Total Load is lower than 10Amper, Energy Saving Calculates does not work	Low
y166	Energy Saver devices ; Contactor positions are wrong. Possible contactor error.	Medium
y3xx	System hardware failures inform us	High
y4xx	System hardware failures inform us	High
y5xx	System Logs - This is for Producer	High

16.1.1. Output voltages are not at desired levels.

- Control the SETOUT setting in settings menu.
- Input voltage levels might be out of range of allowed limits. If input voltage levels are not within the limits desired output voltage cannot be generated.
- There can be a voltage measurement calibration problem. This can happen after a long period of device working time. See below explanation.

16.1.2. Front panel displaying wrong voltage values.

- Ensure that neutral connections are performed correctly.
- Measure input and output voltages from the input and output terminals with a multimeter. Compare measured values with the front panel displayed values. A voltage measurement calibration on the mainboards might be required if there are more than 2 volts difference between multimeter measurement and front panel displayed values.
- Voltage calibration operation will require opening the covers of the device. Contact support department for detailed instructions.

16.1.3. Front panel displaying wrong load percentage values.

- Load percentage values shown on front panel are only for the electronic system to detect overloads. There can be up to 10% deviations from actual values.
- If the deviations are more than 10%, load calibration on mainboards is required. Contact support department for detailed instructions.

16.1.4. Input and output voltages are fluctuating too much.

- This problem occurs when mains neutral is not connected to device neutral terminal correctly.
- Ensure that mains neutral is coming to the device neutral terminal properly.

16.1.5. Building lights are flickering.

- This problem occurs when device settings are not set properly.
- Contact support department to solve this problem.

16.1.6. Comm Error string on the front panel.

- Front panel cannot communicate with one or more of the mainboards.
- See fault codes table.

16.1.7. Front panel is not displaying one or more of the voltage values.

- One or more of the regulation system components might be damaged.

Contact support department.

17. APPENDICES

17.1. Appendix 1 - Input and Output Conductor Properties

- Below table contains information about the cross sectional area of the conductors to be connected to device terminals.
- Cross sectional area values indicated in this table are recommended minimum values.
- Find the conductor cross sectional area corresponding to your device power rating.
- Neutral and protective earth cable sizes are same with input phase cable sizes.
- Input and output conductor sizes are different because input and output voltage and currents are different.

Total Power (kVA)	Power per phase (kVA)	Input Conductor Size (mm^2)	Output Conductor Size (mm^2)
10	3	5	4
15	5	8	6

Total Power (kVA)	Power per phase (kVA)	Input Conductor Size (mm^2)	Output Conductor Size (mm^2)
300	100	275	207
400	133	367	275

22.5	8	13	10
30	10	20	15
45	15	30	23
60	20	45	34
75	25	56	42
100	33	81	61
120	40	97	73
150	50	121	91
165	55	133	100
200	67	162	121
225	75	207	155
250	83	230	172
265	88	243	183

500	167	459	344
600	200	606	455
700	233	707	530
800	267	808	606
900	300	909	682
1000	333	1010	758
1250	417	1263	947
1600	533	1616	1212
2000	667	2020	1515
2500	833	2525	1894
3000	1000	3030	2273
3200	1067	3232	2424

17.2. Appendix 2 - Input and Output Terminal Configurations

17.2.1. General Rules

- These devices require the mains neutral connection to be connected properly to their correct terminals. Starting up the device without neutral conductor connected might damage the device or your loads.
- Input conductors will be connected to terminals with label INPUT. Output conductors will be connected to terminals with label OUTPUT.
- Phase connection terminals are labeled as L1, L2 and L3.
- Neutral connection terminals are labeled as N or Neutral.
- Protective Earth connection terminal is labeled as PE.
- Measure terminal screw diameters and determine the tightening torque value from Appendix 3.

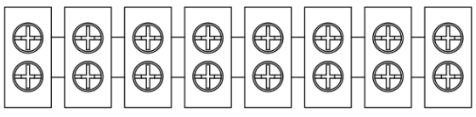
17.2.2. Devices with Non-Isolated Transformer (Autotransformer)

- Standard devices has non-isolated transformers.
- In devices with non-isolated transformers input and output neutral conductors are common.
- In devices with screw or bolt terminals this common neutral connection is performed by connecting input and output neutral conductors together to common neutral terminal of the device.
- In devices with busbar terminals connect input neutral to input side neutral busbar terminal and output neutral to output side busbar neutral terminal. These separate terminals are connected to each other inside the device to provide the common neutral connection.

17.2.3. Devices with Isolated Transformer

- See Technical Information part to determine if your device has isolated transformers.
- If your device has isolated transformers, input and output neutral conductors will have to be connected separately to their own terminals.
- In devices with screw or bolt terminals there is an additional neutral connection terminal at the right side of the output terminals. Connect output neutral conductor to this terminal.
- In devices with busbar terminals connect input and output neutral conductors to their own separate terminals.

17.2.4. Screw Terminals



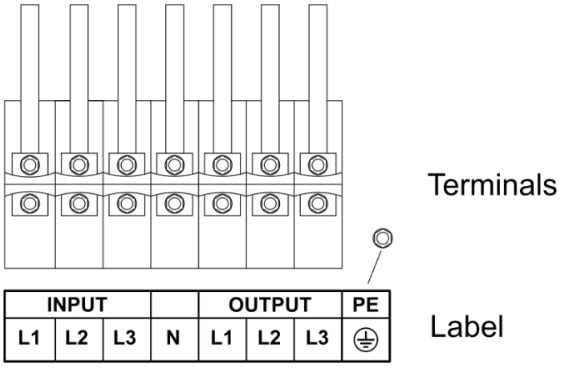
Terminals

INPUT				OUTPUT			PE
L1	L2	L3	N	L1	L2	L3	⏚

Label

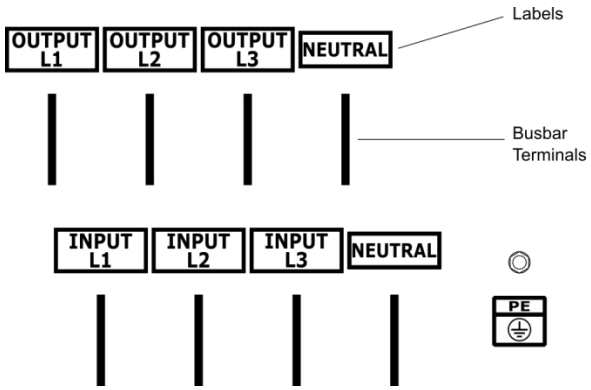
- Above image showing terminals of a standard device. In standard devices there is only one neutral terminal. Connect input and output neutral conductors together to this common neutral terminal.
- Stranded wires must be crimped with cord end terminals before connecting to small screw terminals.

17.2.5. Bolt Terminals



- Above image showing terminals of a standard device. In standard devices there is only one neutral terminal. Connect input and output neutral conductors together to this common neutral terminal.
- Crimped cable lugs must be used for connecting the cables to bolt terminals.

17.2.6. Busbar Terminals



- Compression cable lugs must be used for connecting the conductors to busbar terminals.

17.3. Appendix 3 - Tightening Torque Values

- Diameter row on the below table indicates the diameter of the bolt or screw in millimeter.

Diameter	Tightening Torque (N.m)
M3	1.14
M3.5	1.8
M4	2.7
M4.5	3.9
M5	5.4
M6	9.2

Diameter	Tightening Torque (N.m)
M7	15
M8	22
M10	44
M12	76
M14	122
M16	190

17.4. Appendix 4 - Enclosure Protection Class

17.4.1. IP Protection Class

Level	First digit identifies the protection level against solid objects.	Second digit identifies the protection level against liquids
0	No protection	No protection

1	Protection against objects larger than 50 mm.	Protection against liquid dripping from above.
2	Protection against objects larger than 12.5 mm.	Protection against liquid dripping from above when device is inclined towards any side at 15° or more.
3	Protection against objects larger than 2.5 mm.	Protection against spray of liquid from above when device is inclined towards any side at 60° or more.
4	Protection against objects larger than 1 mm.	Protection against liquid that sprayed or poured from any angle to the device.
5	Limited protection against objects as small as dust particles.	Protection against liquid that sprayed with a 6.3 mm radius nozzle to the device from any angle.
6	Full protection against objects as small as dust particles.	Protection against liquid that sprayed with a 12.5 mm radius nozzle with pressure to the device from any angle.

17.4.2. Example:

IP20 protection class indicates that device has protection against only solid objects larger than 12.5 mm. There is no protection against liquids.

AGKK15150