AC/DC® REGULATOR

www.statikregulator.net

Static Electronic Voltage Regulators

Three Phase : 10.5 kVA - 2000 kVA

TÜV AUSTRIA HELLAS
EN ISO 9001:2008

User's Manuel

Getting started

This operating manual includes all details regarding the introduction, installation, operation, maintenance, malfunction, and repair of AC/DC Static Voltage Regulators ranging between Three-Phase 10,5 kVA and 2000 kVA.

You must read this operating manual before operating Static Voltage Regulator.

You must correspond with the warnings stated in the manual.

Apply all the directions respectively.

ATTENTION..!

1. Please, read this manual carefully in order to enable it to be evaluated under warranty and to avoid vital risks during installation and operation stages.

2. Before accepting Static Voltage Regulator, inspect the cargo packaging and the device itself to ensure if there is any deformation. If there is a deformation, do not accept the product.

3. There is high voltage in Static Voltage Regulator. Interventions made by noncompetent persons carry vital risks.

4. All the necessary connections of Static Voltage Regulator must be made by or within the knowledge of authorized service personnel. Please, do not let any intervention without informing our company. Do not forget that your device will be out of warranty in such situations.

5. Apply all the directions respectively and pay attention to the warnings stated in this manual. Call our authorized service when you come across with a problem regarding the mentioned procedures.

6. Pay attention to neutral error (broken, loose, etc.). Otherwise, your Static Regulator may go wrong.

7. Do not use Static Voltage Regulator without grounding.

8. Load your Static Voltage Regulator with power that is proper to the label value.

9. Do not keep explosive and flammable materials in the same environment with Static Voltage Regulator.

10. The place where Static Voltage Regulator will be placed must not receive direct sunlight. It must not be close to any heat source. Minimum 20 cm distance must be left between Static Voltage Regulator and the materials (things preventing ventilation like wall, cupboard, table, panel, etc.) around.

11. The valuable appropriate of air-conditioner must be used at the location of installation for 200 kVA and above models of 200 kVA Static Voltage Regulator.

12. Use Static Voltage Regulator in a place away from moisture and dust to prevent liquid or foreign object enter into it.

13. The cables to be used in Static Voltage Regulator must be chosen in section that is stated in this manual.

14. Do not apply any procedure, which you are unsure about, without consulting our technical service.

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1- GENERAL INTRODUCTION

1.1 What is Regulator..?

Voltage Regulators are electronic or electromagnetic voltage regulators that are manufactured to protect the devices in places like homes, workplaces, factories, etc. from getting damaged due to voltage drop or voltage rise and to make the best of these devices.

1.2 Why do we need Voltage Regulator..?

Today, because all the electrical/electronic devices have sensitive structures, they are affected badly from the voltage change in the mains. In addition to causing the operations which are done in these devices/machines to be left half finished and damaging the quality of the products obtained from these devices/machines, this situation also causes high cost malfunctions in the mentioned devices/machines. Work and production loss causes high costs as well besides the costs for repairment.

Therefore, it has become compulsory to use at least Voltage Regulator or UPS in order to make all the electrical devices operate safely and uninterrupted. Some device/machine manufacturers even exclude the possible malfunctions from warranty coverage when their products are used without Voltage Regulator or UPS.

AC/DC Static Voltage Regulator is a high technology product which you can safely use wherever the usage of Voltage Regulator is compulsory.

1.3 Why should we use AC/DC Static Voltage Regulator..?

AC/DC Static Voltage Regulator is completely electronic voltage regulator which does not have any moving part inside of it. It has no eroding, perishing, and maintenance requiring parts. Voltage regulation is made with microprocessor controlled digital technology in milliseconds. Regulation process is made with the help of Thyristor-thyristor module and transformer. It brings the voltage to 220 VAC or three-phase 380 VAC level after one period by measuring the change in the voltage in the first period of the mains. Regulation is made at maximum of 20 milliseconds. This means that regulation speed is 5000 V / sec.

AC/DC Static Voltage Regulators are manufactured to operate in the voltage range between 165-250 VAC as standard, and optionally, they are manufactured in wider and narrower ranges.

AC/DC Static Voltage Regulators can be manufactured in 1% to 10% output voltage precision. Our standard manufacture is in 3% precision which would be accepted by many electronic devices/machines.

AC/DC Static Voltage Regulators prevent the load to be damaged by cutting the output voltage with the help of contactor contained in the regulator when the output voltage exceeds 200 – 240 VAC limits. These values can be configured with the help of LCD Panel.

It is possible to follow up the operation data of the device with the help of LCD screen available on the front panel of the regulator.

AC/DC Static Voltage Regulators provide extra protection for sensitive loads thanks to its RFI / EMI filters. It does not produce harmonics because of its operating topology.

AC/DC Static Voltage Regulators respond very quickly to the loads that require high starting current thanks to the semiconductors (Thyristor – Thyristor Module) which are resistant to sudden and high currents and which have been carefully selected during their manufacture. Over-current, over-voltage, low voltage, peak voltage, over temperature and short circuit protections are available and special protections can be added on request.

In the event of possible malfunction in Voltage Regulator, Manual By-Pass switch is included in our product as standard to continue operating via mains.

AC/DC Static Voltage Regulators are manufactured from DKP sheet and can be manufactured as special products in different colors with different IP protection classes and electrostatic powder paint which can be designated on request. AC/DC Static Voltage Regulators are manufactured sensitively to produce vibration and sound as low as possible.

1.4 Usage areas of Voltage Regulator

AC/DC Static Voltage Regulators can be used safely in the following sectors and devices.

- In factories and large industrial enterprises,
- In defense industry facilities,
- In government offices and municipalities,
- In schools, universities, and private teaching institutions,
- In home, villa, and small Office applications,
- In hospitals, health centers, Laboratories, and clinics
- In tourism and rest areas,
- In Land vehicles and Marine vessels.

They can be used to supply all kinds of electrical devices like computers, Telecommunication devices, automation devices, wood working machines, injection machines, radio and television transmitters, textile machines, printing machines, design machines, jewelry machines, marine equipments, telephone switchboards, security systems, illumination units, packaging machines, leather cutting machines, laboratory test and measurement devices, base stations, Welding machines, Heating, cooling and ventilating systems, elevator and moving staircases, deep well divers and motor-pumps, medical devices, air conditioners, CNC benches, and UPS systems.

1.5 Is the Voltage Regulator you purchased going to meet your need..?

Please, review the following technical data to check if AC/DC Static Voltage Regulator that you have purchased meets your need.

a) Detection of Output Voltage Precision of the Voltage Regulator: Output Voltage Precision of the Voltage Regulators may range from 1% to 10%. This value should be selected considering the operating range of your loads which you will connect to the device / machine, etc. Voltage Regulator that is described as sensitive load. These values can be specified by obtaining the necessary information from device/machine manufacturer firm's catalogs or technical service. Detecting the optimum value is important because too low Output Voltage Tolerance would increase the cost of the regulator. Average required tolerance ± 3% means (180 – 240 VAC).

b) Detection of Input Voltage Range of the Voltage Regulator: It consists of the lowest and highest voltage values detected by daily, weekly, and monthly measurement of Electric Source (Mains). Although accepted range for our country is 175 – 245 VAC, local and individual changes are also possible. We recommend utilization of our estimation services, and detection of needs unique to user by obtaining daily / weekly and even monthly data.

Like the Voltage Regulator output voltage precision being small, the wideness of the input voltage range is an important factor in the cost of the regulator to be used. Our manufactures can be made between 175 – 245 VAC range and 90 - 280 VAC range.

c) Power Detection of the Voltage Regulator: It is detected by utilizing labels of Devices and Machines, which are described as Precise Load, and also by using developed measuring devices. Power selection of the Voltage Regulator must be made 20% or 50% more than the detected power value considering the long or short term increase of the enterprise in the machine / device course.

If you think that your Static Voltage Regulator does not meet the above listed criteria, please call our company to return or change the device before making the installation.

If you are sure that your Static Voltage Regulator you have purchased meets the above criteria and will do your work, you may review to what electrical problems your device will be the solution…

1.6 Voltage Problems in the power source (Mains)

The voltage problems in the power source you may use with Static Voltage Regulator can be summarized as follows;

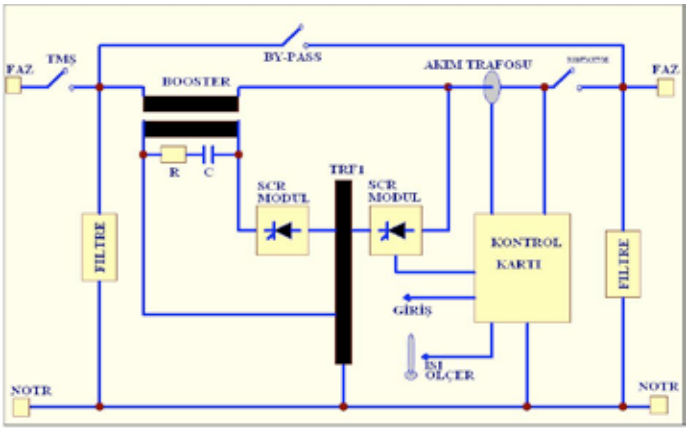
1- SURGE (Rise in RMS value of source voltage): They are over-voltages longer than one period. RMS value of the source voltage may exceed the acceptable limits (10% more than normal mains value) when suddenly deactivating the high capacity loads available on the line. This situation may cause damaging deformations like malfunction, burning, explosion, etc. in the machines that we describe as precise loads. If the things in question are data lines, it can cause serious data loss or errors in these parts.

2- SAG (Drop in source voltage): The deformations that occur on power transmission lines with natural or unnatural causes trigger over-dropping of mains voltage. Activation of major loads on the line and loads that require LRA motor type current causes over-drop of mains voltage. In this situation, problems like resetting, intermittent operation, data loss, software errors, decrease in the level of lighting, and engine drown may occur in microprocessor controlled devices.

3- SPIKE (Instantaneous Over-Voltage Spike): It occurs as a result of stroke of Lightning to a close or distant place and deactivation of extremely powerful loads available on the line. It is the name given to the voltage spikes at the level of thousand volts with very short time (at the level of microseconds). Such instantaneous over-voltage may cause substantial damages and even fires as it exceeds breakdown insulation voltage in electronic or electric circuits and lines.

4- VOLTAGE INSTABILITY: Voltage is the state of rocking of RMS value by getting out of the acceptable lower and upper limits in short periods. It may occur as a result of possible natural and specific effects that may occur in power transmission line or activation and deactivation of a machine in short periods. It is a situation that may cause all the electrical devices to break down.

1.7 Static Voltage Regulator Operating Principle



(Scheme-1)
1 Phase Static Voltage Regulator principle scheme
(In 3 phase systems, same principle is applied repetitively for each phase.)

Booster Transformer: It functions to increase and drop the mains voltage.

SCR MODULE (Thyristor-thyristor module): With the help of this module, output voltage is brought to the suitable value by utilizing TRF-1 and Booster Transformer.

Supply Transformer (Power Supply): It is used for supplying the control card. As it is manufactured using SMPS Technology, it can operate in wide range of voltage.

Thermal Magnetic Switch (TMS): In the event of drawing over-current from the Static Regulator and with the warnings coming from the Microprocessor, system protection is done by TMS blowing.

Manual By-Pass Switch (Stirrup Switch): It is used for supplying the load from the mains in the event of possible breakdown in the Static Regulator or during the maintenance of Static Regulator.

LCD Panel: It is the microprocessor controlled user panel where operating status and information of the Static Regulator can be viewed and modified. Detailed information is given in LCD panel section.

Snubber Filter: It filters the noise that come up during the triggering of thyristors.

Control Card: Output voltage is stabilized to 220 VAC by triggering the suitable thyristors in 20 msec with Direct Access to the Address method by doing the stage calculation with microprocessor which is required for continuous control of the output voltage of the Static Regulator.

NOTE:

All the settings of the Static Regulator are precisely done in our factory during product tests stage. If the need for re-setting occurs by any reason, these settings are done by the authorized personnel under the control of our technical service. Otherwise, your product will be out of warranty and our company is not responsible for the future malfunctions.

AC/DC® REGULATOR

15 - 100 kVA STATIC ELECTRONIC VOLTAGE REGULATOR TECHNICAL SPECIFICATIONS

MODEL	SVR3P-15	SVR3P-22	SVR3P-30	SVR3P-45	SVR3P-60	SVR3P-75	SVR3P-100
Power (kVA)	15	22,5	30	45	60	75	100
INPUT							
Input Voltage	380 VAC, 3 Phase + Notr (Optional 400 VAC, 415 VAC)						
Input Voltage Regulation Range	260 VAC - 440 VAC (L - L)						
Input Voltage Operation Range	220 VAC - 480 VAC (L - L)						
Operation Frequency	50 Hz; ± %5						
Line Input Protection	Over Current thermal fuse and transient over voltage protection						
Max. Input Current	33 A	50 A	66 A	100 A	133 A	166 A	222 A
OUTPUT							
Output Voltage	380 VAC, 3 Phase + Notr (Optional 400 VAC, 415 VAC)						
Output Voltage Tolerance	380 VAC, ± %3						
Output Frequency	50 Hz; ± %5						
Regulation (Control) Speed	~ 5000 V / sec						
Responce Time	~ 20 msec.						
Output Wave form	Sinusoidal						
Output Current	22,5 A	34 A	45 A	68 A	91 A	113 A	151 A
DISPLAY & CONTROL PANEL							
Display Type	2 X 16 character alphanumeric LCD Screen						
Buttons	Menu selection and adjustment button with microprocessor						
Warning Messages	Input Low / Input High, Output Low / Output High, Over Temperature						
LED	Input : Green - Output : Green - System Normal : Green - Fault : Red						
Display Language	English						
Monitoring Measured Values	U, V, W Output Voltages - R, S, T Line Voltages (optional : load percentages)						
Output Max / Min Protection Limit	Adjustable from LCD front panel						
PROTECTIONS							
Output Voltage	Low : 180 VAC, High : 240 VAC (Adjustable from Control Panel)						
Over Load	10 min. at 125 % , 1 min. at 150 %, 1 sec. at 200 %, 10 msec. at 1000 %						
Over Temperature	SCR Temperature > 80 °C						
By-Pass	Manuel By-Pass (Standart), Automatic By-Pass (Optional)						
General Protections	Short Circuit, Over Load, Over Temparature, Over Voltage, Under Voltage, Peak, Surge, Sag, Spike, Thyristor Failure						
GENERAL							
Efficiency	> %97						
Operating Technology	Microprocessing controlled, SCR (Thyristor) Tap Changer, Zero Current Switching, Full Regulation at one Cycle, Static (semiconductor) structure, Isolation Booster Transformer, No Moving Parts						
Protection Level	IP 20 (Standart) - IP 23 & IP 54 (Optional)						
Cooling	Cooling Forced						
Run Duration	Uninterrupted						
Standarts	EN 50091-1 (Safety) / EN 50091-2 EMC						
Dimensions (mm)	300 x 580 x 720				400 x 1000 x 850		
ENVIROMENTAL							
Operating Temperature Range	- 10 °C / 50 °C						
Storage Temperature Range	- 20 °C / 70 °C						
Relative Humidity	< % 90 (Non - Condensing)						
Accoustic Level	< 50 dB (at 1 Meter)						
Operating Heigth	< 2000 Meter						

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AC/DC® REGULATOR

120 - 400 kVA STATIC ELECTRONIC VOLTAGE REGULATOR TECHNICAL SPECIFICATIONS

MODEL	SVR3P-120	SVR3P-150	SVR3P-180	SVR3P-200	SVR3P-250	SVR3P-300	SVR3P-400
Power (kVA)	120	150	180	200	250	300	400
INPUT							
Input Voltage	380 VAC, 3 Phase + Notr (Optional 400 VAC, 415 VAC)						
Input Voltage Regulation Range	260 VAC - 440 VAC (L - L)						
Input Voltage Operation Range	220 VAC - 480 VAC (L - L)						
Operation Frequency	50 Hz; ± %5						
Line Input Protection	Over Current thermal fuse and transient over voltage protection						
Max. Input Current	267 A	333 A	400 A	444 A	556 A	667 A	889 A
OUTPUT							
Output Voltage	380 VAC, 3 Phase + Notr (Optional 400 VAC, 415 VAC)						
Output Voltage Tolerance	380 VAC, ± %3						
Output Frequency	50 Hz; ± %5						
Regulation (Control) Speed	~ 5000 V / sec						
Responce Time	~ 20 msec.						
Output Wave form	Sinusoidal						
Output Current	181 A	227 A	272 A	300 A	378 A	454 A	605 A
DISPLAY & CONTROL PANEL							
Display Type	2 x 16 character alphanumeric LCD Screen			4 x 20 character alphanumeric LCD Screen			
Buttons	Menu selection and adjustment button with microprocessor						
Warning Messages	Input Low / Input High, Output Low / Output High, Over Load, Over Temperature						
LED	Input : Green - Output : Green - System Normal : Green - Fault : Red						
Display Language	English						
Monitoring Measured Values	U, V, W Output Voltages - R, S, T Line Voltages and load percentages						
Output Max / Min Protection Limit	Adjustable from LCD front panel						
PROTECTIONS							
Output Voltage	Low : 180 VAC, High : 240 VAC (Adjustable from Control Panel)						
Over Load	10 min. at 125 %, 1 min. at 150 %, 1 sec. at 200 %, 10 msec. at 1000 %						
Over Temperature	SCR Temperature > 80 °C						
By-Pass	Manuel By-Pass (Standart), Automatic By-Pass (Optional)						
General Protections	Short Circuit, Over Load, Over Temparature, Over Voltage, Under Voltage, Peak, Surge, Sag, Spike, Thyristor Failure						
GENERAL							
Efficiency	> %97						
Operating Technology	Microprocessing controlled, SCR (Thyristor) Tap Changer, Zero Current Switching, Full Regulation at one Cycle, Static (semiconductor) structure, Isolation Booster Transformer, No Moving Parts						
Protection Level	IP 20 (Standart) - IP 23 & IP 54 (Optional)						
Cooling	Cooling Forced						
Run Duration	Uninterrupted						
Standarts	EN 50091-1 (Safety) / EN 50091-2 EMC						
Dimensions (mm)	850 x 600 x 1400			1000 x 700 x 1600		1350 x 850 x 1600	
ENVIROMENTAL							
Operating Temperature Range	- 10 °C / 50 °C						
Storage Temperature Range	- 20 °C / 70 °C						
Relative Humidity	< % 90 (Non - Condensing)						
Accoustic Level	< 50 dB (at 1 Meter)						
Operating Heigth	< 2000 Meter						

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AC/DC® REGULATOR

500 - 2000 kVA STATIC ELECTRONIC VOLTAGE REGULATOR TECHNICAL SPECIFICATIONS

MODEL	SVR3P-500	SVR3P-600	SVR3P-800	SVR3P-1000	SVR3P-1250	SVR3P-1500	SVR3P-2000
Power (kVA)	500	600	800	1000	1250	1500	2000
INPUT							
Input Voltage	380 VAC, 3 Phase + Notr (Optional 400 VAC, 415 VAC)						
Input Voltage Regulation Range	260 VAC - 440 VAC (L - L)						
Input Voltage Operation Range	220 VAC - 480 VAC (L - L)						
Operation Frequency	50 Hz; ± %5						
Line Input Protection	Over Current thermal fuse and transient over voltage protection						
Max. Input Current	1110 A	1330 A	1777 A	2220 A	2777 A	3330 A	4445 A
OUTPUT							
Output Voltage	380 VAC, 3 Phase + Notr (Optional 400 VAC, 415 VAC)						
Output Voltage Tolerance	380 VAC, ± %3						
Output Frequency	50 Hz; ± %5						
Regulation (Control) Speed	~ 5000 V / sec						
Responce Time	~ 20 msec.						
Output Wave form	Sinusoidal						
Output Current	757 A	910 A	1.212 A	1.515 A	1.894 A	2.273 A	3.030 A
DISPLAY & CONTROL PANEL							
Display Type	4 x 20 character alphanumeric LCD Screen						
Buttons	Menu selection and adjustment button with microprocessor						
Warning Messages	Input Low / Input High, Output Low / Output High, Over Load, Over Temperature						
LED	Input : Green - Output : Green - System Normal : Green - Fault : Red						
Display Language	English						
Monitoring Measured Values	U, V, W Output Voltages - R, S, T Line Voltages and load percentages						
Output Max / Min Protection Limit	Adjustable from LCD front panel						
PROTECTIONS							
Output Voltage	Low : 180 VAC, High : 240 VAC (Adjustable from Control Panel)						
Over Load	10 min. at 125 %, 1 min. at 150 %, 1 sec. at 200 %, 10 msec. at 1000 %						
Over Temperature	SCR Temperature > 80 °C						
By-Pass	Manuel By-Pass (Standart), Automatic By-Pass (Optional)						
General Protections	Short Circuit, Over Load, Over Temparature, Over Voltage, Under Voltage, Peak, Surge, Sag, Spike, Thyristor Failure						
GENERAL							
Efficiency	> %97						
Operating Technology	Microprocessing controlled, SCR (Thyristor) Tap Changer, Zero Current Switching, Full Regulation at one Cycle, Static (semiconductor) structure, Isolation Booster Transformer, No Moving Parts						
Protection Level	IP 20 (Standart) - IP 23 & IP 54 (Optional)						
Cooling	Cooling Forced						
Run Duration	Uninterrupted						
Standarts	EN 50091-1 (Safety) / EN 50091-2 EMC						
Dimensions	1800 x 900 x 1700		2400 x 900 x 1800			2800 x 1000 x 2100	
ENVIROMENTAL							
Operating Temperature Range	- 10 °C / 50 °C						
Storage Temperature Range	- 20 °C / 70 °C						
Relative Humidity	< % 90 (Non - Condensing)						
Accoustic Level	< 50 dB (at 1 Meter)						
Operating Heigth	< 2000 Meter						

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2- INSTALLATION and START-UP

2.1. Unpacking

Carefully check the packaging after the Static Regulator is delivered to you. If you think that there is damage on the packaging of the device, inform our Company before unpacking.
If you think that the packaging is intact, unpack it by being careful not to damage the device. Check if there is scrape, impact, paint defect, etc. problems on the device cabinet… Check if the stirrup switch, compact switch, ventilator, and LCD Panel on the device are damaged.

After all these exterior controls are done, interior controls must be done, too, by opening the covers of the Static Voltage Regulator. During this control, electrical connection points and screws must be checked one by one. If there are any loose connections, they must be fastened. If there are broken, dislocated or deformed parts in the device, our company must definitely be informed.

2.2. Site selection

a) There must be at least 20 cm distance between the device and the closest object to it in order to make the cooling system of the device operate healthfully.
b) Please provide suitable temperature and humidity for the environment of the static regulator. The valuable appropriate of air-conditioner must be used at the location of installation for 200 kVA and above models of 200 kVA Static Voltage Regulator.
c) Be careful about the site, where the device will be installed, to be in the suitable temperature and moisture.
d) Do not use places which are dusty and may cause corrosion.
e) Certainly, do not use the Static Voltage Regulator in the places where inflammable and explosive materials are present.
f) Places where there is a possibility of contact between the device and any liquid are not suitable for installation.
g) Site selection must be made where device covers are opened and the device is in tervened easily considering the subsequent interventions (including the emergency actions).

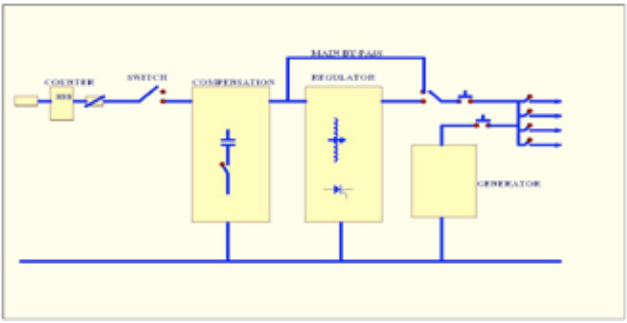
2.3. Electrical Connection

a) Preparing the Wall Box:

Suitable Thermal Magnetic Switches must be available on the wall box where the Static Voltage Regulator will be connected and all the electrical connections must be made after these Thermal Magnetic Switches.
Grounding of the Wall Box must have certainly been done.
Suitable distribution board must be prepared for the distribution of loads which are thought to be connected to the Static Voltage Regulator.
Although Static Voltage Regulator has Manual By-Pass Switch, using central By-Pass switch on the wall box would be proper as an additional precaution.

b) Usage of Static Voltage Regulator Regarding Compensation Box and Generator

Before installing Static Voltage Regulator, other systems (compensation board, generator, etc.) to be used must be detected and in the event of usage of these systems and the regulator together, connection must be made considering the following scheme.



(Figure-1)
Connection scheme of Static Voltage Regulator with Generator and compensation board

- As it is seen in the figure, Static Voltage Regulator must be connected after the counter and the compensation board.

- Generator must be connected after Static Voltage Regulator. (Redundant Connection)

- **Be careful about the neutral error (broken, loose, etc.). Otherwise, Static Voltage Regulator may break down.**

c) Things To Be Conformed While Making the Connection of Static Voltage Regulator

- There is high voltage in the Static Voltage Regulator which may create vital risks. Therefore, it is forbidden for non-experts to interfere with the device.

- Installation, cable, and labors of the device have to be done in accordance with the relevant regulation.

- Ensure that the authorized person who will make the electrical connection do his/her work without wearing any jewelry like necklace, ring, earring, etc.

- Ensure that electrical loads to be connected to the device are distributed equally.

- When the inverter switch of the Static Voltage Regulator is switched over under load, it may breakdown. Therefore, **WHEN THE INVERTER SWITCH IS UNDER LOAD, IT'S POSITION MUST NOT BE CHANGED.**

- Suitable valued switch installation must certainly be available on the main board in order to break the power of the regulator when needed.

- You can check from the electrical scheme given with the device if the connection is duly made or not.

- Carefully review the labels and warnings on the device.

• Do not install the device to a place which is sticky, dirty, and airless and which cannot be reached by technical personnel in the event of any possible breakdown.

• Covers of the device must only be opened by the authorized personnel.

• The power coming from wall box to Static Voltage Regulator must be cut during activation.

• Static Voltage Regulator must not be operated continuously under overload.

• In the event of any possible breakdown of the regulator, ensure that nobody except for the authorized personnel contacts the regulator.

• Place the power cable in such a way that no object would be put on it. Ensure that no bending and curling exist on the cable.

• Proper connection scheme for enterprises that own compensation board is shown in Figure 1–1.

• Fire extinguishers to be used for Static Voltage Regulators have to be CO2 fire extinguishers.

• If there is any sign of fire (like odor, smoke, etc.), first cut the electricity coming to the device.

d) Making the Electric Connection of Static Voltage Regulator

(Figure-2)
Three-Phase Static Voltage Regulator connection scheme

Electric terminals are used for input – output connection in Static Voltage Regulator models up to 150 kVA. Input output connections will be made by using Buses in 150 kVA and higher models.

Apply the following directions respectively for electrical connection of Static Voltage Regulator.

1. By turning off the Thermal Magnetic Switch, which belongs to the Static Voltage Regulator, from the main board, make sure the power going to the Static Voltage Regulator is cut off by measuring with the help of the measuring instrument.

2. Detect the cable sections, which are necessary for input and output connections, from the table that is stated in the below Table-1. Prepare the tips of the cables, which will be connected to the main board and Static Voltage Regulator, in accordance with the standards.

3. Connect the prepared Input cable to the Static Voltage Regulator from the left in order of L1-**L2-L3-NEUTRA**L in accordance with the above (Figure-2) stated connection scheme.

4. Connect the prepared Output cable to the Static Voltage Regulator from the left in order of **NEUTRAL-L1-L2-L3** in accordance with the above (Figure-2) stated connection scheme.

5. Ground the Static Voltage Regulator in accordance with the above (Figure-2) stated connection scheme by preparing the grounding cable which will be selected from the below table (Table-1).

6. Recheck if all the electrically connected cables are connected according to the standards and if they are connected properly and be sure.

Cable and switch or Thermal Magnetic Switch values to be used in the connection of Static Voltage Regulator must be selected by making use of the below table (Table-1).

Power	Input Breaker Thermal Magnetic Switch	Input Cable section	Output Cable section	Ground Cable section
10,5 kVA	25 A	4x4	4x3	1.5
15 kVA	32 A	4x6	4x4	1.5
22,5 kVA	50 A	4x6	4x4	1.5
30 kVA	63 A	4x10	4x6	1.5
45 kVA	100 A	4x16	4x10	1.5
60 kVA	125 A	4x25	4x16	2.5
75 kVA	150 A	4x35	4x25	2.5
100 kVA	200 A	4x50	4x35	4
150 kVA	300 A	4x50	4x35	6
200 kVA	400 A	4x70	4x50	10
250 kVA	500 A	4x70	4x50	16
300 kVA	600 A	4x95	4x70	25
400 kVA	800 A	4x95	4x70	25
500 kVA	1000 A	4x120	4x95	25
600 kVA	1200 A	4x120	4x95	25
800 kVA	1600 A	4x150	4x120	35
1.000 kVA	2000 A	4x150	4x120	35
1.250 kVA	2500 A	4x185	4x150	35
1.500 kVA	3000 A	4x185	4x150	50
1.600 kVA	3200 A	4x240	4x185	50
2.000 kVA	4000 A	4x240	4x185	50

2.4. Start-up and Running

1 Give power to the Static Voltage Regulator by turning on (bringing to position " 1 ") the Thermal Magnetic Switch, which belongs to the Static Voltage Regulator, from the main board.

2. After all the connections of the Static Voltage Regulator are made, bring the Stirrup Switch of the device to position **"1" (Mains)** to make installation error check.

3. Read the line current with clamp meter. Make sure there is no unnatural current and devices connected to the Static Voltage Regulator operate normally.

4. Controlledly shut down all the electrical loads connected to the Static Voltage Regulator.

5 Bring the Stirrup Switch to position **"0"**. In this position, there will be no power in the output of the regulator.

6. Run the Static Voltage Regulator by bringing the Compact Switch to position **"1" (ON**).

7. Check from the LCD Screen if there is any warning or not. If there is any warning, Compact Switch will trip in 10 sec. In such situation, note down the error information on the LCD Screen. Provide solution to the problem from the malfunction and solutions table (Table-2) in the manual.

8. If there is no error warning, read input and output voltage values from the LCD Panel of the Static Voltage Regulator. Make sure output voltage is within the required limits. (It must be between 214 VAC-226 VAC range for standard devices.)

9. Bring the Stirrup Switch to position **"2" (Regulator)**. Run the loads, which you have connected to the Static Voltage Regulator, respectively. Meanwhile, make the Load Percentage and warning follow-up by continuously checking the LCD Panel.

10. Possible warning in your Static Voltage Regulator in this stage is overload error. When this warning shows up, thermal magnetic switch will trip in between 1 second to 10 minutes according to the load percentage. Detect the cause of the overload and find solution. Or replace your Static Voltage Regulator with a proper power regulator.

11. If the warning you observed is different from the overload warning, improve the solution by reviewing the Malfunction and Solutions Table (Table-2).

12. If there is no error information, check the validity of all the values shown on the LCD Panel with help of measuring device. (Input, Output Voltages and Output Currents)

Important Notes:

After your Static Voltage Regulator is run through activation, an odor (varnish odor) due to the newness of the device is normal for the first few days. This should not be seen as a problem. However, in the event of stronger or longer odor, you must contact with our technical service.

Position of the By-Pass Switch of the Static Voltage Regulator must not be changed while the device is on load. Otherwise, the switch may break down as arc will form in the switch while changing the position.

After the installation of the device is completed, the device is made durable by making its periodical maintenances with the help of the maintenance form in the back of the manual.

3 - LCD PANEL

(Figure-3)
LCD Panel of the Static Voltage Regulator

3.1 Functions of the Buttons on the LCD Panel

ENTER : It is used to select a menu and record the selected values.
If ENTER button is pressed while in the "Last Error" screen, past 10 error logs are accessed. ENTER is pressed again in order to exit the past error logs. If the SETTING MENU is selected, it is used to select the following parameter to be set.

DOWN ARROW : It is used to select the one-down menu in the LCD menu and if the SETTING MENU is selected, it is used to bring down the new value to be entered.

UP ARROW : It is used to select the one-up menu in the LCD menu and if the SETTING MENU is selected, it is used to bring up the new value to be entered.

ENTER–DOWN ARROW : SETTING menu is accessed by pressing both of them together.

ENTER–UP ARROW : Exit from the SETTING menu by recording the setting which is made by pressing both of them together.

3.2 LCD Panel Leds:

INPUT : It shows that input voltage of the Static Voltage Regulator is available. (Green led)

OUTPUT : It shows that output voltage of the Static Voltage Regulator is created. (Green led)

FAULT : This lamp lights up when there is an error in the regulator. (Red Led)

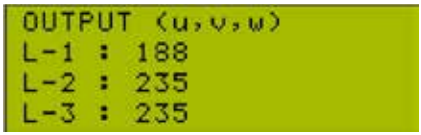
ARROW : If there is no error in the regulator and if the output is created in normal values, this led lights up. (Green Led)

3.3 LCD Main Menu

Below screen will show up in the LCD Panel during the first start-up of the Static Voltage Regulator. In this situation, as all the parameters of the system are being checked, **"WAIT..."** warning will emerge. You must wait without doing any operation until the warning disappears.

After the control operation of the system finishes, below screen will appear if there is no error.

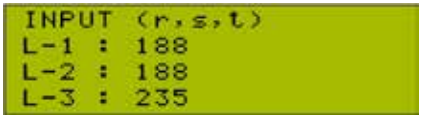
3.3.1 Output Voltage Screen (Main Screen)



If your Mains Voltage is 230 VAC; the output voltage will range between 224 – 236 VAC.
If your Mains Voltage is 220 VAC; the output voltage will range between 214 – 226 VAC.
If your Mains Voltage is 110 VAC; the output voltage will range between 107 – 113 VAC.

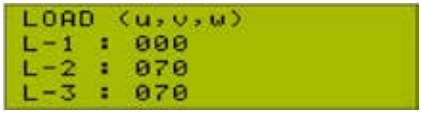
You may access other menus by pressing the **"UP ARROW"** or **"DOWN ARROW"** on the LCD panel.

3.3.2 Input Voltage Screen



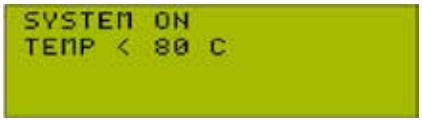
It shows Input voltage values of the Static Voltage Regulator and instantaneous RMS voltage measurement results of R,S,T phases on the screen.

3.3.3 Load Percentage Screen



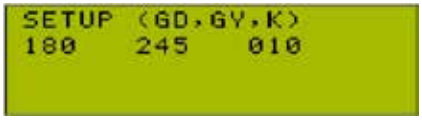
It shows the instantaneous loading percentage for each phase according to the capacity of the device. (This screen is not available in 100 kVA or lower power models.)

3.3.4 Temperature Screen



It gives the information about the temperature of the device. It would write **"TEMP<80 C"** when the temperature is normal. If the temperature is excessive, **"TEMP>80"** would appear. And **"SYSTEM OFF"** data appears on the first line.

3.3.5 Setting Screen



The last values, to which the protection values of the device are set, are seen. Here;
GD (Voltage Low) : low value of the output voltage to be set,
GY (Voltage High) : high value of the output voltage to be set,
K (Break Time) : it shows the required breaking time values in the event of a possible error.

As factory setting is configured as;
GD (Voltage Low) : 180 VAC
GY (Voltage High) : 240 VAC
K (Break Time) : 10 sec
Sub setting menus are accessed by pressing "ENTER" – "DOWN ARROW" buttons together in order to change these values.
Sub setting menus are described below under the title of 3.4 LCD Setting Menus.

3.3.6 Error Log Screen

The last error occurred in the Static Voltage Regulator will be seen in this screen.
If there is no recorded past error, this situation is informed with both **"NO ERROR"** message and **"00"** error number on the right side.

In the above example, the number **"03"** on the right side is the number of previous errors. (It is indicated in the example that there has been 3 error data. The last recorded error type is over load.) If the number is more than **"01"**, other recorded error data can be accessed by pressing

ENTER and **"UP ARROW"** and **"DOWN ARROW"** buttons. If no button is pressed for 30 sec, it will automatically go to the normal menu. However, if you want to exit before waiting for 30 sec, then, again, press the **"ENTER"** button.

3.4 LCD SETTING MENUS (optional)

Setting menu on the LCD panel is accessed by pressing "ENTER" and "UP ARROW" buttons together. The menu of the parameter to be configured is accessed with the help of "ENTER" button. Each time when you press "ENTER" button, it records the value on the screen at that moment. When you want to change the value on the screen, benefit from the "UP ARROW" or "DOWN ARROW" buttons.

3.4.1 GD (Voltage Low) Setting Screen

Low value of the output voltage is configured.
Recommended minimum value is 170 VAC, and maximum value is 200 VAC
(for 220 VAC output).

3.4.2 GY (Voltage High) Setting Screen

It is the place where the high value of the output voltage is configured.
Recommended minimum value is 235 VAC, and maximum value is 255 VAC
(for 220 VAC output).

It is used to set the waiting time required to break the output in case of breakdown. The recommended value is between 5 and 20 sec.
This breaking time used for output high, output low, input low, input high warnings.
Factory settings are valid for over load situations and no setting can be done.

"ENTER" and **"DOWN ARROW"** are pressed together in order to exit from the setting screen by saving. It is informed from the LCD panel that settings are saved.

3.5 LCD ERROR MENUS

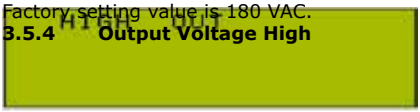
Following screens will show up in case of a possible error in the device. Intermittent alarm will sound at the same time. "UP ARROW" or "DOWN ARROW" is pressed in order to silence the alarm. When the warning screen shows up, again UP ARROW" or "DOWN ARROW" buttons are utilized to access the other operating information. Warning screen would go normal after the error is debugged.

This warning is seen on the screen when over load occurs in the Static Voltage Regulator and when the device is shut down as a result of this. (This screen is not available in 100 kVA and lower power models.)

When the cooling unit is over heated, the device will shut down automatically and this warning shows up on the screen.

This warning is given if the output voltage is under the set value.
Factory setting value is 180 VAC.

3.5.4 Output Voltage High



This warning is given if the output voltage is higher than the set value.
Factory setting value is 240 VAC.

3.5.5 Input Voltage High

This warning is given if the input voltage is higher than 285 VAC value.

4 – MALFUNCTION AND SOLUTIONS

Following table is the possible problems and solutions that are encountered during the operation of Static Voltage Regulator.

!.. Intervention of non-expert persons carries vital risk.

!.. This product would go out of the scope of warranty in the event of intervention done without receiving approval of our authorized technical service.

PROBLEM	CAUSE	SOLUTION
Operating Loudly	Over LoadLoad	The problem is solved by deactivating the devices causing over load or buying a more powerful regulator.
	Thyristor Error	One or more of the Thyristor module groups may have broken down. The defected part must be replaced with the original one.
	Ventilator Error	Some of the ventilators on the regulators and aluminum coolers are defected. The defected ones must be replaced with the new ones.
Smoke or Odor Coming from the Device	Short circuit of Transformer coils	The problem is solved by replacing the Transformer.
	First-use	Odor in the first-use is normal as the transformers used in the regulator are varnished. However, this lasts for 24 hours. If the problem persists after 24 hours, inform the technical service.
Compact Switch Trips	1-Over load 2-Over voltage 3-Low voltage 4-Over heat	The reason of the trip of compact switch is shown on the LCD screen. Note down the warning on the LCD screen and call the technical service for solution.
Output voltage excesses normal limits	Mains excesses normal limits	Your regulator regulates between 150 and 255 VAC range. Its operating range, on the other hand, is 130-280 VAC. If your mains voltage exceeds 150-255 VAC range but in between 130 and 280 VAC, your output voltage ranges between 190 and 240 VAC. If this situation persists, replace your regulator with another regulator which has wider range.
	Breakdown of the control card	The setting is made with voltage setting trimpot on the control card. If it cannot be set, the control card must be replaced.
	Loosing of the connection points	Recheck the connection points of the power cables. And fasten the necessary ones.
	Faulty measurement of the output voltages on the LCD panel	Measure the output voltage of the regulator with the help of a measuring device and compare it with the value seen on the LCD panel. If there is any variation, make the calibration with the trimpots available on the 3FSB6 coded 3 phase sampling card.
	Stirrup Inverter switch left in the position of "**MAINS**"	The By-Pass switch, which is available on the regulator, enables your load to work in the mains in the event of a Regulator error. In normal operating status, this switch must be in the position of "**REGULATOR**". If By-Pass switch is not in the position of "**MAINS**", bring it to the position of "**REGULATOR**".
Load failure, which are connected to the output, although there is electricity in the entrance of the device	Üzengili Enversör Şalter veya Kompakt Şalter arızası.	The point in question is that contacts in the switches do not conduct the power due to loose contact. The relevant switch must be replaced with the new one.

Malfunction and Solutions Table (Table-2)

5 – MAINTENANCE

Periodical inspection and preventive maintenances guarantee to make your Static Voltage Regulator operate safely, properly and make it durable.

The first maintenance must be made 6 months after the first-use of the Static Voltage Regulator. Then, maintenance must be made every 6 months or 12 months period according to the power and operating environment of the device.
If the operating conditions of the device are tough, the maintenances may be made in shorter time periods.

5.1. Maintenance procedures

a) Maintenance procedures to be done when Static Voltage Regulator is without power:

As the cleaning and connection controls will be made in this stage, the power coming to the Static Voltage Regulator must be cut from the Main Board in order to prevent the vital risk. Warning message, saying maintenance is being done, must be written on the board and giving uncontrolled power to the Static Voltage Regulator must be avoided.

1) Surface general cleaning of the Static Voltage Regulator and around it must be made.

2) It must be ensured that air ducts of the device stay open. In the event of the blockage of the air ducts by dust or any other object, the necessary intervention must be made to open the ducts.

3) If there is powdering on the transformer coils, it must be cleaned with a soft fabric.

4) All the electrical and mechanical connection points must be reviewed and loose connections must be fastened.

5) Power cables must be checked if their insulations are deformed or not.

6) Transformer coils are checked. If there is darkening or burning, technical service is informed.

7) Connection sockets of the SMPS Power Supplies, which supply the control cards, must be checked.

8) All the semiconductor elements (thyristor – thyristor module group) must be checked one by one to see if there is any deformation or not. If there is deformation, semiconductor material must be replaced with the original one.

9) Control cards and filters are inspected. If there is deformed component, technical service is informed.

10) Mechanical connection and parallel resistances of the current transformers are checked.

11) Ventilators are checked. Broken ventilators are replaced with the new ones.

12) Stirrup Inverter and Thermal Magnetic Switch connections are checked. Broken Switch is replaced with the original one.

b Maintenance procedures to be done when Static Voltage Regulator is with power:

As the tests from now on will be the functional tests of the Static Voltage Regulator, the device will be powered. Therefore, as the test to be made from now on will carry vital risk, necessary precautions must be taken.
Main Switch is turned on from the main board to give power to the Static Voltage Regulator.

1) Supplies of the control cards of each 3 phase are measured. Output voltages are measured with a True RMS multimeter. Calibration of the phase, which is out of 214 VAC – 226 VAC, is made with the trimpot on that card.

2) Validity of the values on the LCD Panel is checked while the device is in operating status. To do this, input and output parameters must be measured with a True RMS multimeter and LCD Panel calibration must be made.

3) If it is possible, functionality of the regulator must be tested with an adjustable AC supply (Variac). If it is not possible, it must be detected if the output voltage is in normal limits by making at least 5 measurements in the same day.

4) Loads connected to the Static Voltage Regulator are calculated. It is detected if there is any increasing load. If there is load increase, it is detected if the power of the Static Voltage Regulator is efficient for the total power of the loads. The drawn current is measured with the clamp meter after all the devices connected to the Static Voltage Regulator are run. Measurement made with load calculation and clamp meter are compared.

5) Temperature measurement is made on many points (power connection points, coolers, thyristors, transformers, supply units) with the help of remote thermometer after the device is operated at least a day.

5.2. Maintenance Form

	1st Maintenance	2nd Maintenance	3rd Maintenance	4th Maintenance
Date	..... /...../ 201..	..... /...../ 201..	..... /...../ 201..	..... /...../ 201..
General Cleaning				
Air ducts				
Connection control				
Control of the Power Cables				
Control of the Power Transformers				
Supply Units and Cables				
Thyristors				
Control Cards and Filters				
Current Transformers				
Control of the Ventilators				
Control of the Switches				
Breakers				
LCD panel				
Operating with power				
Calibration				
Control of the Regulation				
Load analysis				
Thermal analysis				

Table-3

6 – WARRANTY

6.1 Terms of Warranty

Below terms must be paid attention to get your device evaluated within the scope of the warranty.

1. Our company is not responsible for any problems that may occur as a result of any kind of intervention to Static Voltage Regulator by the user without informing our technical service. In addition, such interventions will cause your Static Voltage Regulator to be out of warranty.

2. If you think that the packages you receive are damaged during the transportation, unpack and check them in front of the authorized personnel of the transport company. If there is any damage on the product, do not accept the product by writing a minute to the courier company. Do not forget that by signing the document, you accept that you have received the product free of damage and in complete state.

3. Warranty of the Static Voltage Regulator is void in the event of any change on the Warranty Certificate and removing or changing the original serial number on the device.

4. Damages and defects caused by freezing, fire or lightning are excluded from the scope of warranty. We recommend you to insure your device in order not to suffer from such situations.

5. Defects which take place during the cargo handling and transport after the delivery of the product are evaluated out of the scope of Warranty.

6. Static Voltage Regulators which are used without grounding are out of warranty.

7. Static Voltage Regulators which are used out of the operating voltage range values that are stated on the label are evaluated out of the scope of warranty.

8. AC/DC technical service must be informed when the installment place of the Static Voltage Regulator is to be changed. In the event of displacement without informing, the device is kept out of the scope of warranty.

9. As the Static Voltage Regulator is not an outdoor type, it must not be used in the places which may receive direct sunlight, excessive moisture, excessive dust, etc. and which receive rains like snow, rainfall, dew, etc. The device is kept out of warranty in such situations.

10. Warranty includes only part replacement warranty in export sales. The defective part will be replaced with the new one after it is sent to our company.

11. AC/DC Static Voltage Regulators which are not used according to the directions stated in the operating manual are kept out of the scope of warranty.

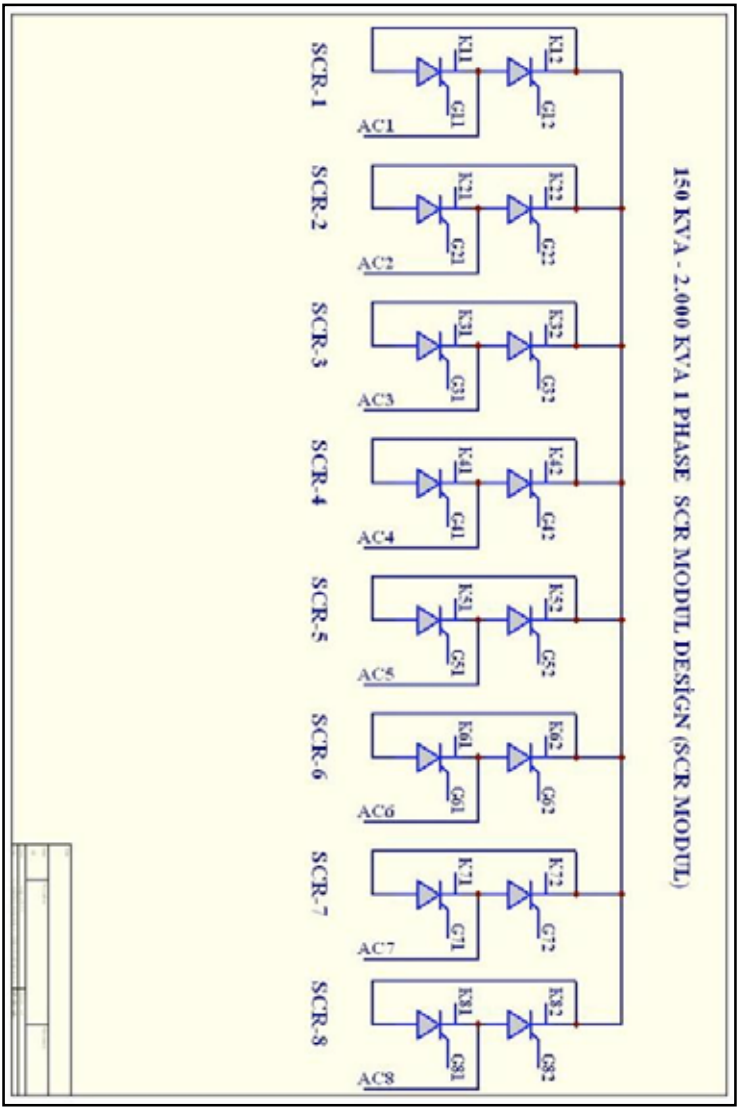
12. If no problem is found in the Static Voltage Regulator as a result of the technical service given in accordance with the failure notice, the given service is evaluated out of the scope of warranty.

6.2 Product Warranty Card

PRODUCT WARRANTY CARD	
Product	**:** Static Voltage Regulator
Model	**:** . . . . .
Serial Number	**:** . . . . .
Power	**:** . . . . . kVA
Warranty Start Date	**:** . . . / . . . / 201. .
Warranty Expiration Date	**:** . . . / . . . / 201. .

7 – SCHEMES

7.1 Thyristor – thyristor module group electrical connection scheme



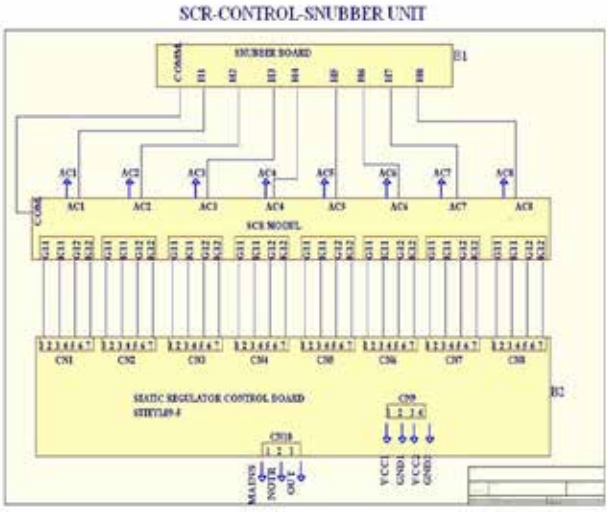
(Figure-4)
Thyristor – thyristor module group electrical connection scheme

7.2 Thyristor – mechanical assembly scheme of the thyristor module group onto aluminum cooler

(Figure-5)

Thyristor – mechanical assembly scheme of the thyristor module group onto aluminum cooler

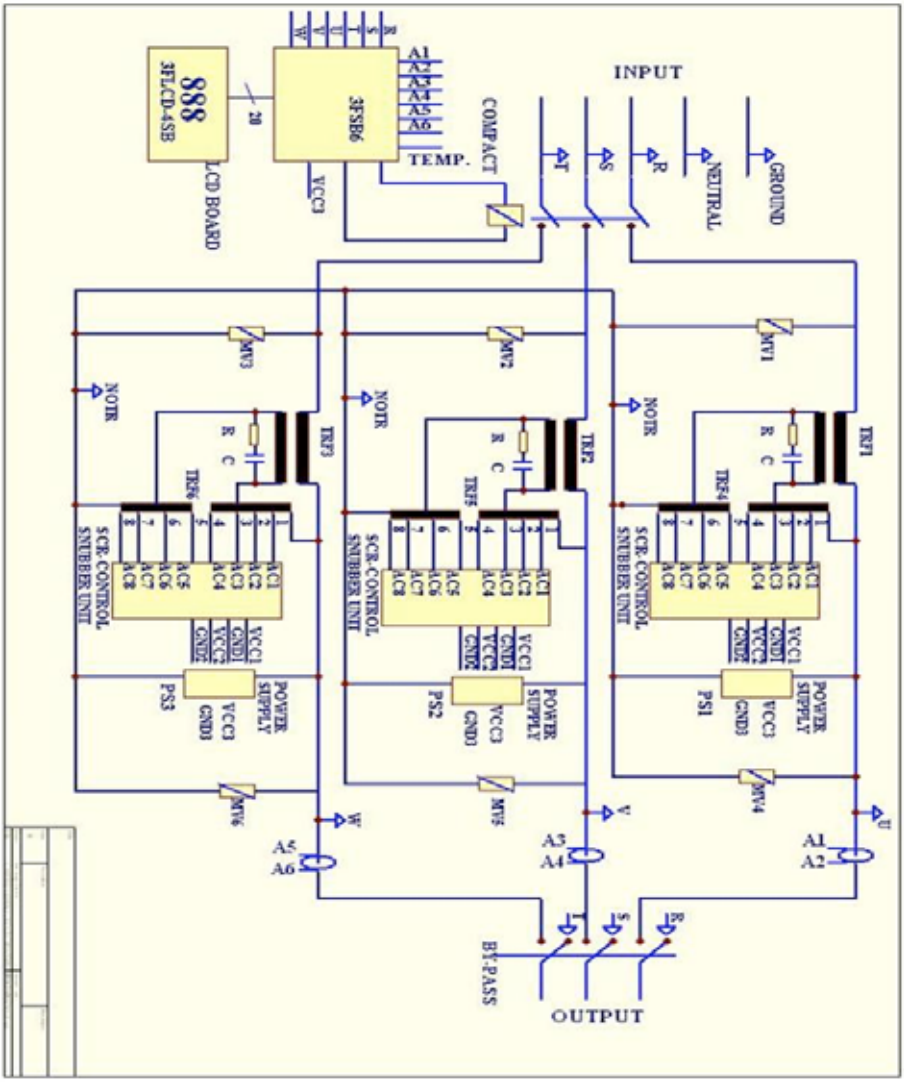
7.3 Thyristor – thyristor module group – control card – snubber electrical connection (SCSU module)



(Figure-6)

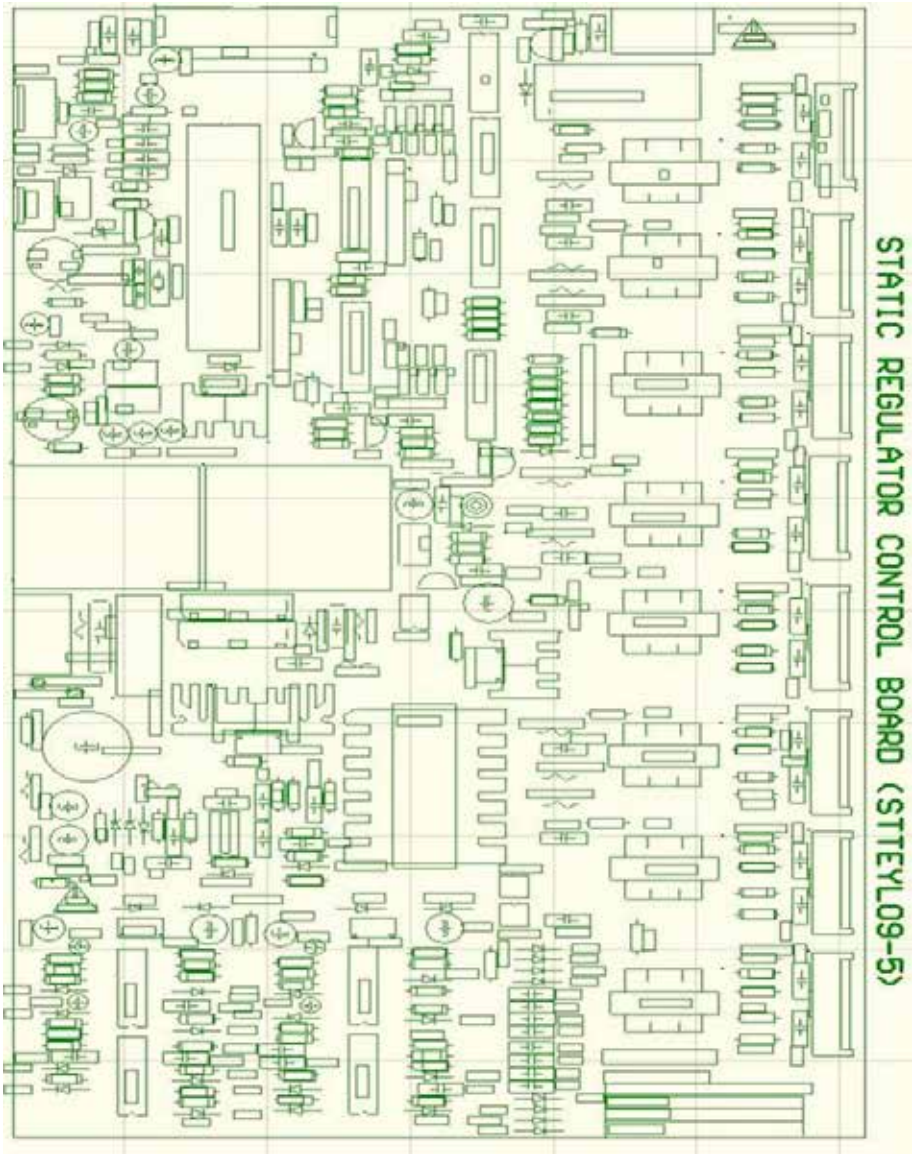
Thyristor – thyristor module group – control card – snubber electrical connection (SCSU module)

7.4 Static Voltage Regulator electrical connection scheme



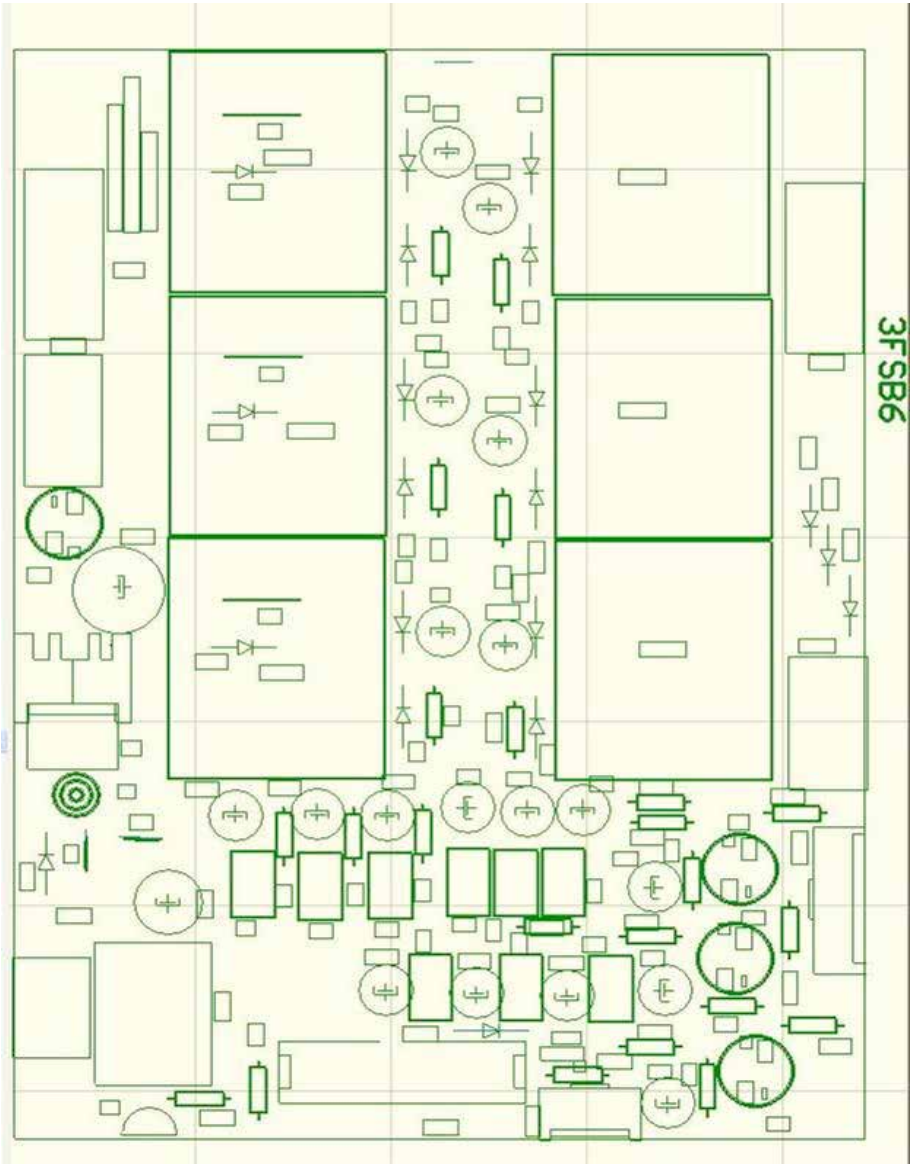
(Figure-7)
Static Voltage Regulator electrical connection scheme

7.5 Static Voltage Regulator control card PCB (STTEYL09-5)



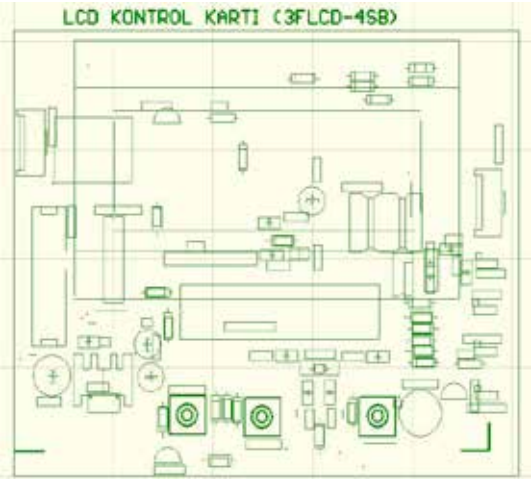
(Figure-8)
Static Voltage Regulator control card PCB (STTEYL09-5)

7.6 3 Phase sampling card (3FSB6)



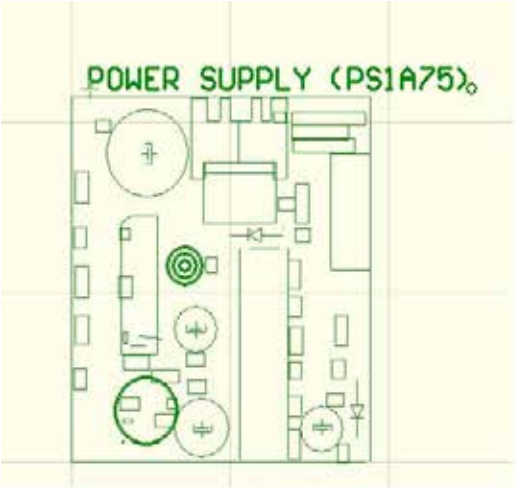
(Figure-9)
3 Phase sampling card (3FSB6)

7.7 LCD Control card (3FLCD-4SB)



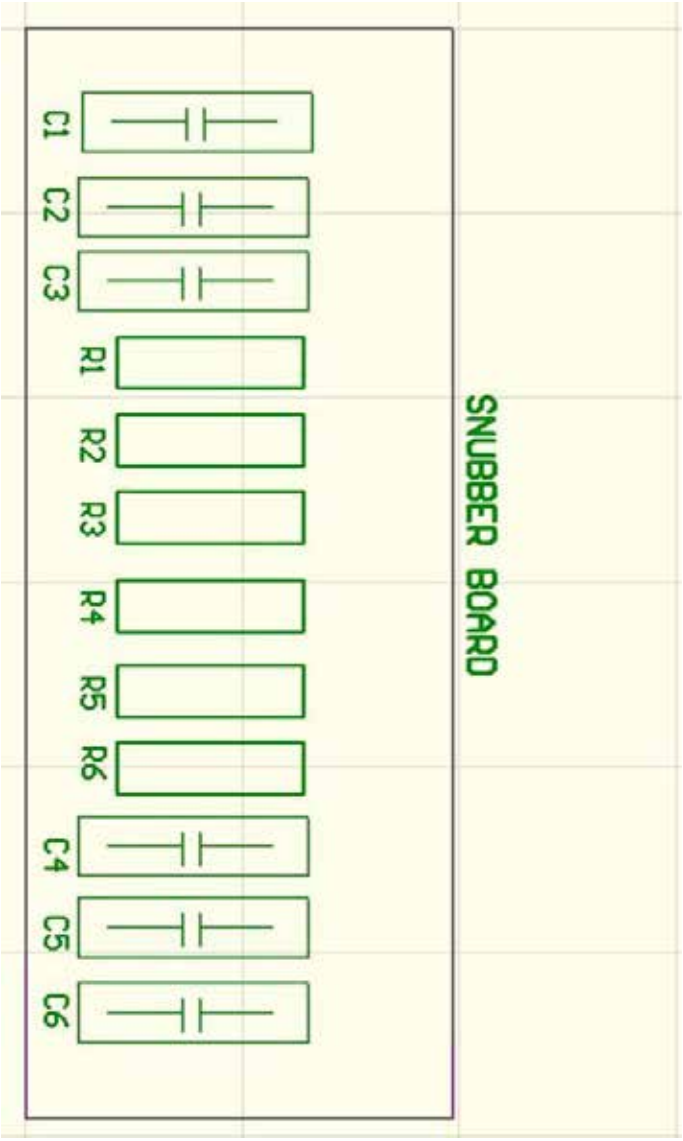
(Figure-10)
LCD Control card (3FLCD-4SB)

7.8 Supply card (PS1A75)



(Figure-11)
Supply card (PS1A75)

7.9 Snubber Card



(Figure-12)
Snubber Card

8 - Spare Parts List of Static Voltage Regulator

Item No	Stock Code	Material code	Material Name	Pcs
	1125024151	2400G160Y	Box	1
	1206021723	75KVA-6K2	Stage transformer	1
	1206023524	140KVA-B2	Booster transformer	1
	1126020120	PIC16F877A-PLCD	LCD card microprocessor	1
	1126020121	PIC16F877A-PSRR	Control card Microprocessor	3
	1138020117	STTEYL09-5	Static regulator control card	3
	1138020325	SNUBBER-3X3	Snubber card	3
	1138020432	STRFI-3	RFI card	2
	1138020534	3FSB-MAY11	3 phase sampling card	1
	1138020636	LCD-3F4S	LCD card with micro	1
	1138020734	1A-STBB	Supply card	3
	1206020345	15W-4IO	Supply transformer	3
	1206020441	1-5000A-TRD	Current transformer	3
	1206020254	ART-1044	1:1 pulse transformer	18
	1206020465	2W-2X12	2 w sampling transformer	12
	1125004562	E3N3200	Compact switch	1
	1125004468	4000AES	4.000 A Stirrup inverter Switch	1
	1125000469	150x50x8	Neutral Bus	2
	1125000472	150x50x10	Input-Output Connection Bus	6
	1126004275	SKKT270-12	Thyristor	18
	1125000442	TMP80C	Thermostat	3
	1125006226	G12038AH	12X12 220V AC VENTILATOR	9
	1125006227	G170O45AS	17X17 220V AC PHASE	3
	1126006724	VRS250	Varistor	12
	1126006725	VRS270	Varistor	12
	1143008517	M6x15	Screws	62
	1143008518	M8x25	Screws	36
	1143008519	M12x35	Screws	24
	1143006232	T80P	Roller	6
	1126003442	PNRCBB60-30	30 uf-400v condenser	6
	1126003448	PNRCBB60-40	40 uf-400v condenser	6
	1143008482	99AS40	199 as 40 cm cooler	3
	1143008502	180x50x10	Thyristor Bus Aluminum	6
	1135002681	DNM15-500	500 R-1500W resistance	3

(**Table-4**)
Spare parts list of Static Voltage Regulator

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