

THREE-PHASE STATIC VOLTAGE REGULATOR

SET 04-19



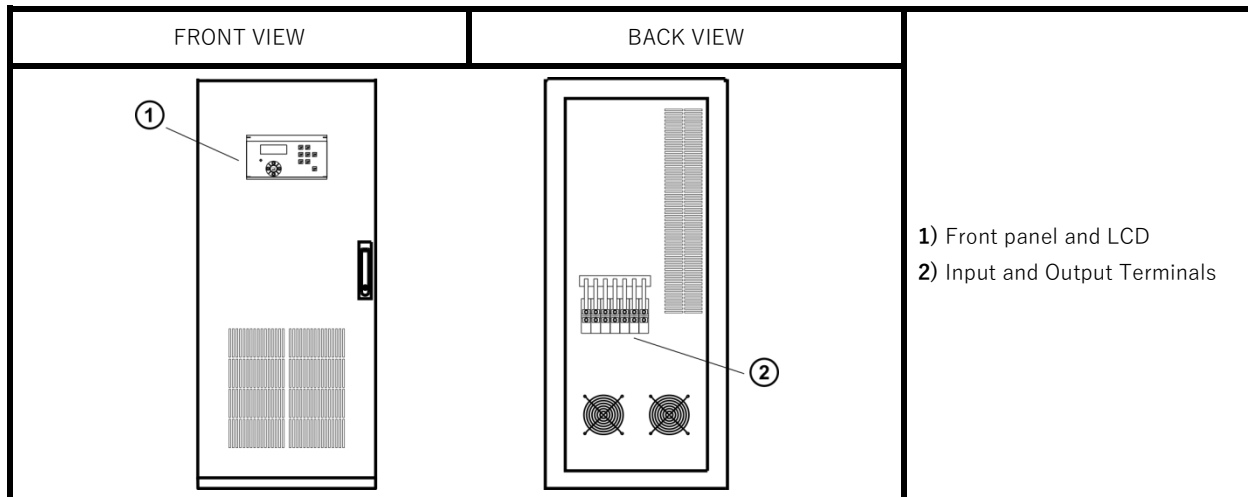
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1. SAFETY NOTICES

- 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. DEVICE OVERVIEW



*Device overview includes optional elements. Your device might not have all of the parts shown in image.

3. 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.

4. 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.

5. TECHNICAL INFORMATION

5.1. Electrical Properties

sample

E.SET					
PARAMETER		MIN	NOMINAL	MAX	UNIT
S3P	Total Power	-	-		KVA
S1P	Power per phase	-	-		KVA
Vin	Input voltage	195	230	265	V (AC P-N)
Vout	Output voltage	227	230	233	V (AC P-N)
f	Input Frequency	45	50	65	Hz

5.2. Ambient Conditions

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

5.3. Control and Protection Elements Contained in the Device

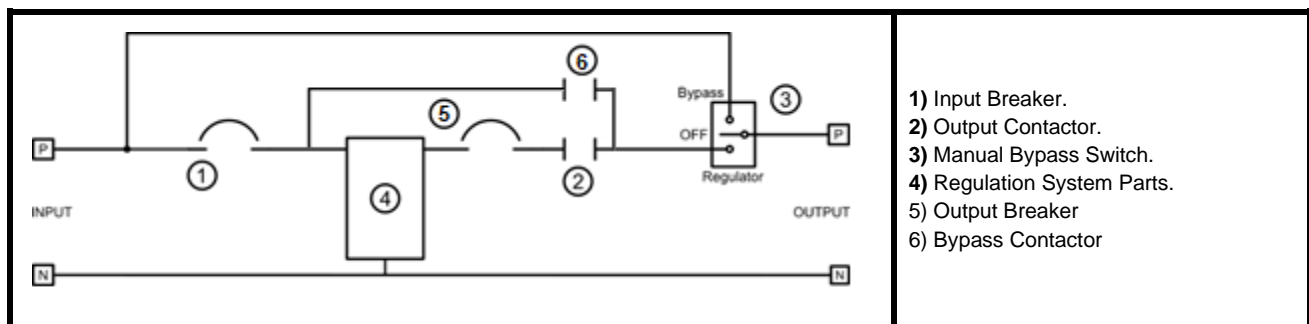
Control and protection elements contained in your device are indicated with (x) mark in below table.

Optional Systems List		Switching Elements List	
Manual Bypass System	x	Input Breaker	x
Automatic Bypass System	x	Output Breaker	x
Isolated Transformers		Input Contactor	x
Remote Management Unit		Output Contactor	x
Energy Analyzer		Manual Bypass Switch	x
Data Logger		Bypass Contactor	
Low Save Rate (LSR)		Thyristor Breaker	

6. SINGLE LINE DIAGRAMS

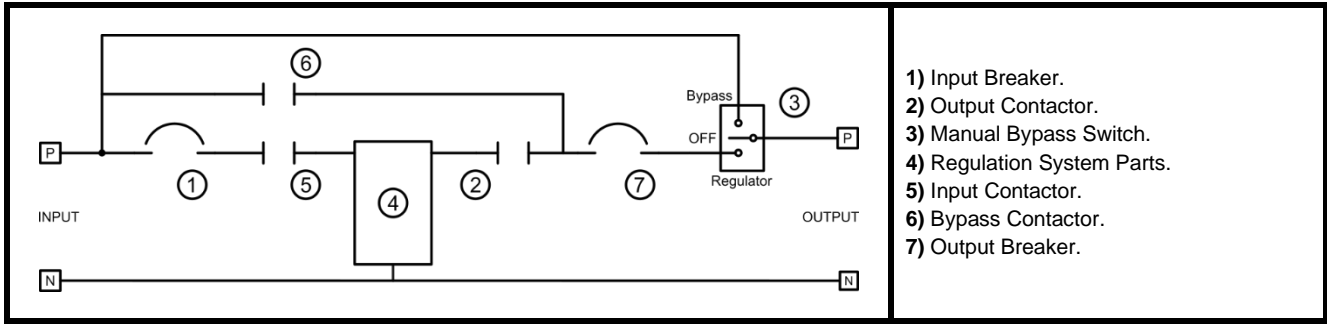
6.1. Simple Single Line Diagram

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



6.2. 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.



7. 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.

7.1. 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.

7.2. Output Breaker - Optional

Optional Output Breaker provides manual control of the output power of the regulation system. This breaker also provides protection against overloads or short circuits.

7.3. Manual Bypass Switch - Optional

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

7.4. Input Contactor - Optional

Input Contactor is controlled by the electronic control system. This contactor is required for some of the optional systems to work properly.

7.5. 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.

7.6. Bypass Contactor - Optional

Bypass Contactor is controlled by the electronic control system. This contactor is required for automatic bypass system to work properly.

7.7. Thyristor Breaker

Check Technical Information part to determine if your device has Thyristor Breaker. This breaker is located behind the front cover of the device. Used to protect thyristors in certain type of device designs. User intervention is not required unless tripped itself to protect thyristors.

8. OPTIONAL SYSTEMS

8.1. 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.

8.1.1. 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.

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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.

8.1.2. 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.

8.1.3. 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.

8.2. AUTOMATIC BYPASS SYSTEM

- Automatic Bypass System is optionally included in the device. See technical information part to determine if your device has this system.
- Electronic control system switches the Automatic Bypass System to bypass mode whenever a fault or overload situation occurs.
- In bypass mode unregulated mains power is directed to output terminals.
- Automatic bypass system switches back to regulator mode when the fault or overload situation ends.
- There will not be interruption of output power when Automatic Bypass System changes modes.
- In this table you can find additional settings menus of optional Automatic Bypass System

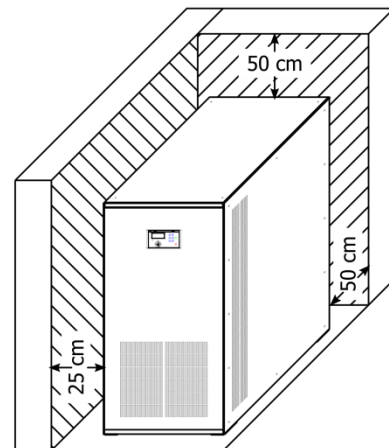
AutoByPass Featured Device Firmware Setting Screen Menu Explanations	Setting Menu	Enter-Up-Up	Ask to EDIT Support
		USER	Admin
Selection of Device Output Working Mode	Set Mode		x
Selection of Device Label	Label Type		x
Adjustment of necessary Load level for ByPass Condition	LSR Min Load		x
Adjustment of necessary Set output-input voltage levels for Bypass Condition	LSR input Dif		x

8.3. Low Save Rate (LSR) System

- This is an optional system. Check "Control and Protection Elements Contained in the Device" part to determine if your device has this system.
- This system provides extra energy savings by shutting down the regulation and cooling system when certain conditions are met and regulation is not needed.
- Condition 1: There is no or very little load.
- Condition 2: Input voltage is already very close to desired target output voltage.
- When device shuts down the regulation system because of any LSR condition, it will switch to automatic bypass mode without output power interruption.
- LSR system can be configured to shut down the regulation system when any of the condition 1 or condition 2 are met, or when only one of them is met.
- All the LSR settings are set by service personnel while device is being installed.

9. 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.

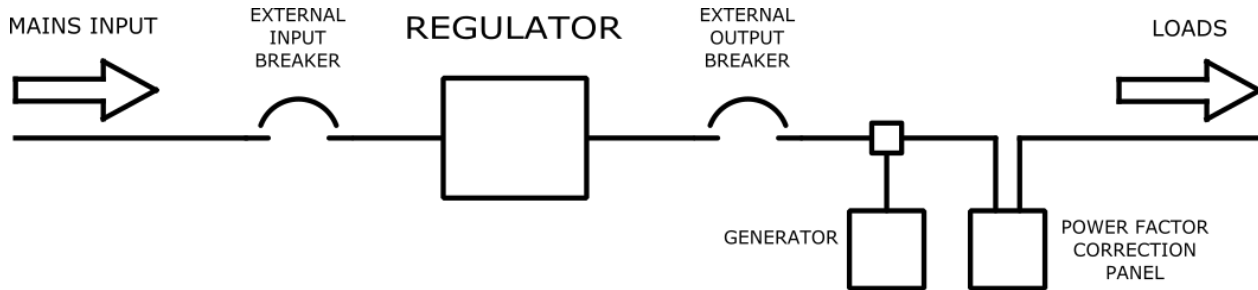


10. MAKING THE CONNECTIONS OF THE DEVICE

- 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.

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- 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.

11. 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.

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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.

12. 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.

13. 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

13.1.1. 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.

13.1.2. M1 - Voltages and Load Screen

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

13.1.3. 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.

13.1.4. 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.

13.1.5. 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.

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Stabilizer Firmware Setting Screen Menu Explanations	Setting Menu	USER	
		Enter-Up-Up	Ask to EDIT 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

13.1.5.1. 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.

14. 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.

15. TROUBLESHOOTING

15.1. 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	Code	Description
y000	No Error	y042	Load Higher than %100
y001	input Voltage very high	y043	Load Higher than %125
y002	input Voltage high	y044	Load Higher than %150
y003	input Voltage very low	y045	Load Higher than %175
y004	input Voltage low	y046	Load Higher than %200
y005	output voltage very high	y047	Wait Other Phase
y006	output voltage high	y048	Paralel Reg - Wait Open RL1 Command
y007	output voltage very low	y049	Paralel Reg -Wait Open RL2 Command
y008	output voltage low	y051	Paralel Reg -Common Output Terminal Voltage synchronization error
y009	user close the main output via remote controller	y052	Paralel Reg- Command Signal Error 1
y010	Current Zero Failure	y053	Paralel Reg -Command Signal Error 2
y011	Thyristor Open Circuit input	y054	Paralel Reg -PMU – MB Communication Error
y012	Thyristor Open Circuit output	y055	Paralel Reg -PMU make reset the control mainboard
y013	Thyristor Fuse Off	y056	Paralel Reg -Command Signal Error 3
y015	Short Circuit Failure	y057	Paralel Reg -PMU Close the RL1 Relay
y016	user switch the by pass via remote controller	y058	Paralel Reg -PMU Close the RL2 Relay
y017	Over Temperature	y059	Paralel Reg -PMU – MB Communcation error bad packet
y018	Current Zero Failure Input Thyristor(SCR)	y060	Communication Error Between Mainboard and Frontpanel
y019	Current Zero Failure Output Thyristor		
y020	Current Zero Failure 1x number Thyristor	y062	Paralel Reg -ManualByPass is active in this device or other devices.
y021	Current Zero Failure 1 number Thyristor	y063	Mainboard have closed output cause of FP Other Phase Com Error (Single Transformer without Contactor)
y022	Current Zero Failure 2 number Thyristor	y064	Frontpanel - RMU(Single) Frontpanel - Gateway(Paralel) Communication problem
y023	Current Zero Failure 3 number Thyristor	y070	The Phase did not pass Energy Saver Mode cause of other phases
y024	Current Zero Failure 4 number Thyristor	y071	The Phase did not pass Energy Saver Mode cause of Load Higher Than %100 in bypass Mode
y025	Current Zero Failure 5 number Thyristor	y072	The Phase is ByPass Mode cause of Other Phase and Phases did not communication with frontpanel
y026	Current Zero Failure 6 number Thyristor	y073	The Phase is ByPass Mode cause of Other Phase and Phases was not same output mode.
y027	Current Zero Failure 7 number Thyristor	y074	MCCB with motor or Contactor does not work with Mainboard Command Short Circuit Command
y028	Current Zero Failure 8 number Thyristor	y075	MCCB with motor or Contactor does not work with Mainboard Command Open Circuit Command
y029	Current Zero Failure 9 number Thyristor	y101	Paralel Reg -PMU does not connect other device

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y030	Thyristor Open Circuit Failure 1x number Thyristor	y102	Paralel Reg -PMU – MB L1 Phase communication Error
y031	Thyristor Open Circuit Failure 1 number Thyristor	y103	Paralel Reg -PMU – MB L2 Phase communication Error
y032	Thyristor Open Circuit Failure 2 number Thyristor	y104	Paralel Reg -PMU – MB L3 Phase communication Error
y033	Thyristor Open Circuit Failure 3 number Thyristor	y105	Paralel Reg -PMU – MB L1 Phase Command Error
y034	Thyristor Open Circuit Failure 4 number Thyristor	y106	Paralel Reg -PMU – MB L2 Phase Command Error
y035	Thyristor Open Circuit Failure 5 number Thyristor	y107	Paralel Reg -PMU – MB L3 Phase Command Error
y036	Thyristor Open Circuit Failure 6 number Thyristor	y110	Paralel Reg -PMU - Other PMUs closed the device
y037	Thyristor Open Circuit Failure 7 number Thyristor	y2xx	Special Product Error Codes
y038	Thyristor Open Circuit Failure 8 number Thyristor	y3xx	System hardware failures inform us
y039	Thyristor Open Circuit Failure 9 number Thyristor	y4xx	System hardware failures inform us
y040	Input Square Wave Low Failure	y9xx	Device Protect itself. Device will Wait “xx” minute
y041	Input Square Wave High Failure		

15.1.1. 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.

15.1.2. 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.

15.1.3. 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.

15.1.4. 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.

15.1.5. Building lights are flickering.

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

15.1.6. Comm Error string on the front panel.

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

15.1.7. 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.

16. APPENDICES

16.1. 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.

Model	Total Power (kVA)	Power per phase (kVA)	Input Conductor Size (mm ²)	Output Conductor Size (mm ²)
E.SET04	10	3	5	4
E.SET05	15	5	8	6
E.SET06	22.5	8	13	10
E.SET08	30	10	20	15
E.SET09	45	15	30	23
E.SET11	60	20	45	34
E.SET12	75	25	56	42
E.SET13	100	33	81	61
	120	40	97	73
E.SET14	150	50	121	91
	165	55	133	100
	200	67	162	121
	225	75	207	155
	250	83	230	172
	265	88	243	183

Model	Total Power (kVA)	Power per phase (kVA)	Input Conductor Size (mm ²)	Output Conductor Size (mm ²)
E.SET17	300	100	275	207
E.SET18	400	133	367	275
E.SET19	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

16.2. Appendix 2 - Input and Output Terminal Configurations

16.2.1. 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.

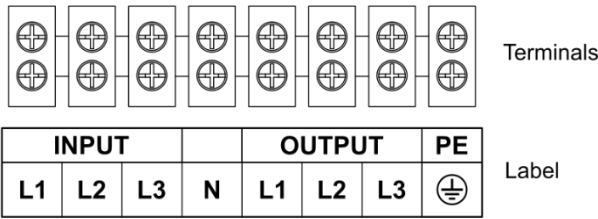
16.2.2. Devices with Non-Isolated Transformer (Autotransformer)

- 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.

16.2.3. Devices with Isolated Transformer

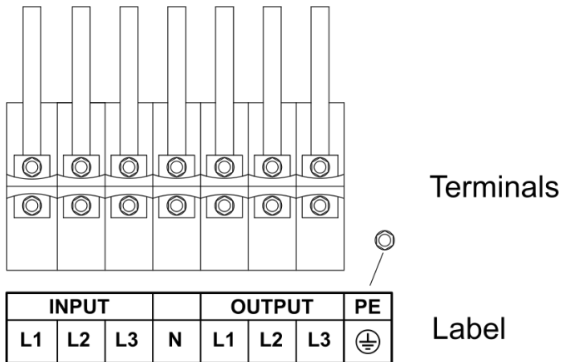
- See Technical Information part to determine if your device has isolated transformers.
- If your device has isolated transformers, input and output neutral conductors will have to be connected separately to their own terminals.
- In devices with screw or bolt terminals there is an additional neutral 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.

16.2.4. Screw Terminals



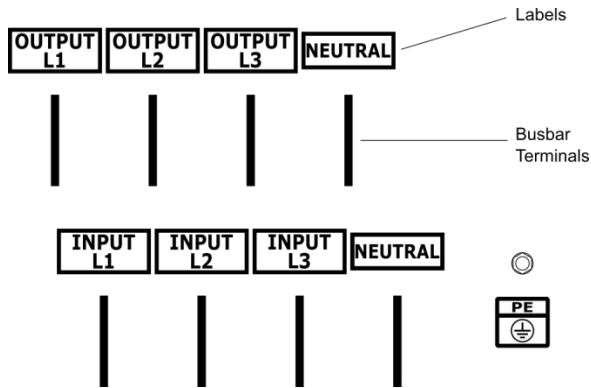
- Above image showing terminals of a standard device. In standard devices there is only one neutral terminal. Connect input and output neutral conductors together to this common neutral terminal.
- Stranded wires must be crimped with cord end terminals before connecting to small screw terminals.

16.2.5. 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.

16.2.6. Busbar Terminals



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

16.3. 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

16.4. Appendix 4 - Enclosure Protection Class

16.4.1. 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.

16.4.2. Example:

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

16.5 Modbus Table For Optional Modbus Featured Devices

Holding Register Map										
Addresses	without Autobypass	single stabilizer without Autobypass	Parallel stabilizer with Autobypass	Single Stabilizer or Single Energy Saver with Autobypass	Data Name	Data Types	Reading / Writing	Descriptions	Range	Default
SECTION 1 : STABILIZER DATA										
0	x	x			Device Status	unsigned 16 bit	R	0:Off, 1:On		
1	x	x	x		L1 - input Voltage (V)	unsigned 16 bit	R			
2	x	x	x		L2 - input Voltage (V)	unsigned 16 bit	R			
3	x	x	x		L3 - input Voltage (V)	unsigned 16 bit	R			
4	x	x	x		L1 - Output Voltage (V)	unsigned 16 bit	R			
5	x	x	x		L2 - Output Voltage (V)	unsigned 16 bit	R			
6	x	x	x		L3 - Output Voltage (V)	unsigned 16 bit	R			
7	x	x	x		L1 - input Load (%)	unsigned 16 bit	R			
8	x	x	x		L2 - input Load(%)	unsigned 16 bit	R			
9	x	x	x		L3 - input Load(%)	unsigned 16 bit	R			
10	x	x	x		L1 - Frequency (Hz)	unsigned 16 bit	R	Divide 10		
11	x	x	x		L2 - Frequency (Hz)	unsigned 16 bit	R	Divide 10		
12	x	x	x		L3 - Frequency (Hz)	unsigned 16 bit	R	Divide 10		
13		x			L1 - Common Output Voltage (V)	unsigned 16 bit	R			
14		x			L2 - Common Output Voltage (V)	unsigned 16 bit	R			
15		x			L3 - Common Output Voltage (V)	unsigned 16 bit	R			
16	x	x	x		L1-Actual Error	unsigned 16 bit	R			
17	x	x	x		L2-Actual Error	unsigned 16 bit	R			
18	x	x	x		L3-Actual Error	unsigned 16 bit	R			
19	x	x	x		GF-Actual Error	Unsigned 16 bit	R			
21	x	x	x		FrontPanel Firmware Version	IEEE754	R	MS: First , LS:Second		
22	x	x	x				R			

THREE-PHASE STATIC VOLTAGE REGULATOR

SET 04-19

Holding Register Map									
Addresses	single stabilizer without AutobyPass	Parallel stabilizer without AutobyPass	Single Stabilizer or Single Energy Saver with AutobyPass	Data Name	Data Types	Reading / Writing	Descriptions	Range	Default
SECTION 1 : STABILIZER DATA									
25		x		Working Mode - Paralel Devices	unsigned 16 bit	R	0:Unknown,1:Master,2:Slave,3:Standalone		
26		x		Number of Common Connections	unsigned 16 bit	R			
27		x		PMU-Actual Error Code	unsigned 16 bit	R			
28			x	Working Mode - AutobyPass	unsigned 16 bit	R	0:Invalid, 1:ByPass , 2:Regulator / Energy Saver		
50	x	x	x	Total Recorded Error	unsigned 16 bit	R			
51	x	x	x	Error-1 Error Code	unsigned 16 bit	R	Recorded Faults: First In First Out		
52	x	x	x	Error-1 Recorded Year -Month	unsigned 16 bit	R	MSB:Year LSB:Month		
53	x	x	x	Error-1 Recorded Day - Hours	unsigned 16 bit	R	MSB:Day LSB:Hours		
54	x	x	x	Error-1 Recorded Minutes- Seconds	unsigned 16 bit	R	MSB:Minutes LSB:Seconds		
55	x	x	x	Error-2 Error Code	unsigned 16 bit	R			
56	x	x	x	Error-2 Recorded Year -Month	unsigned 16 bit	R	MSB:Year LSB:Month		
57	x	x	x	Error-2 Recorded Day - Hours	unsigned 16 bit	R	MSB:Day LSB:Hours		
58	x	x	x	Error-2 Recorded Minutes- Seconds	unsigned 16 bit	R	MSB:Minutes LSB:Seconds		
59	x	x	x	Error-3 Error Code	unsigned 16 bit	R			
60	x	x	x	Error-3 Recorded Year -Month	unsigned 16 bit	R	MSB:Year LSB:Month		
61	x	x	x	Error-3 Recorded Day - Hours	unsigned 16 bit	R	MSB:Day LSB:Hours		
62	x	x	x	Error-3 Recorded Minutes- Seconds	unsigned 16 bit	R	MSB:Minutes LSB:Seconds		
63	x	x	x	Error-4 Error Code	unsigned 16 bit	R			
64	x	x	x	Error-4 Recorded Year -Month	unsigned 16 bit	R	MSB:Year LSB:Month		
65	x	x	x	Error-4 Recorded Day - Hours	unsigned 16 bit	R	MSB:Day LSB:Hours		
66	x	x	x	Error-4 Recorded Minutes- Seconds	unsigned 16 bit	R	MSB:Minutes LSB:Seconds		
67	x	x	x	Error-5 Error Code	unsigned 16 bit	R			
68	x	x	x	Error-5 Recorded Year -Month	unsigned 16 bit	R	MSB:Year LSB:Month		
69	x	x	x	Error-5 Recorded Day - Hours	unsigned 16 bit	R	MSB:Day LSB:Hours		
70	x	x	x	Error-5 Recorded Minutes- Seconds	unsigned 16 bit	R	MSB:Minutes LSB:Seconds		
71	x	x	x	Error-6 Error Code	unsigned 16 bit	R			
72	x	x	x	Error-6 Recorded Year -Month	unsigned 16 bit	R	MSB:Year LSB:Month		
73	x	x	x	Error-6 Recorded Day - Hours	unsigned 16 bit	R	MSB:Day LSB:Hours		
74	x	x	x	Error-6 Recorded Minutes- Seconds	unsigned 16 bit	R	MSB:Minutes LSB:Seconds		
75	x	x	x	Error-7 Error Code	unsigned 16 bit	R			
76	x	x	x	Error-7 Recorded Year -Month	unsigned 16 bit	R	MSB:Year LSB:Month		
77	x	x	x	Error-7 Recorded Day - Hours	unsigned 16 bit	R	MSB:Day LSB:Hours		
78	x	x	x	Error-7 Recorded Minutes- Seconds	unsigned 16 bit	R	MSB:Minutes LSB:Seconds		
79	x	x	x	Error-8 Error Code	unsigned 16 bit	R			
80	x	x	x	Error-8 Recorded Year -Month	unsigned 16 bit	R	MSB:Year LSB:Month		
81	x	x	x	Error-8 Recorded Day - Hours	unsigned 16 bit	R	MSB:Day LSB:Hours		
82	x	x	x	Error-8 Recorded Minutes- Seconds	unsigned 16 bit	R	MSB:Minutes LSB:Seconds		
83	x	x	x	Error-9 Error Code	unsigned 16 bit	R			
84	x	x	x	Error-9 Recorded Year -Month	unsigned 16 bit	R	MSB:Year LSB:Month		
85	x	x	x	Error-9 Recorded Day - Hours	unsigned 16 bit	R	MSB:Day LSB:Hours		
86	x	x	x	Error-9 Recorded Minutes- Seconds	unsigned 16 bit	R	MSB:Minutes LSB:Seconds		
87	x	x	x	Error-10 Error Code	unsigned 16 bit	R			
88	x	x	x	Error-10 Recorded Year -Month	unsigned 16 bit	R	MSB:Year LSB:Month		
89	x	x	x	Error-10 Recorded Day - Hours	unsigned 16 bit	R	MSB:Day LSB:Hours		
90	x	x	x	Error-10 Recorded Minutes- Second	unsigned 16 bit	R	MSB:Minutes LSB:Seconds		
100	x	x	x	Commands	unsigned 16 bit	W	1:Clear Errors 678: Device will reset all settings and errors		
101	x	x	x	Set Output Voltage	unsigned 16 bit	R/W		210-240	230
102	x	x	x	Set Histeresiz	unsigned 16 bit	R/W		2-12	7
103	x	x	x	Set Regulation Type	unsigned 16 bit	R/W	1:Standart, 2:Fast, 3:Stable 4:Slow	1-3	1
				Modbus - Slave Configuration	unsigned 16 bit	R/W	1:9600 8None, 2:19200 8None, 3:38400 8None, 4:57600 8None, 5:115200 8None, 6:9600 8Even, 7:19200 8Even, 8:38400 8Even, 9:57600 8Even, 10:115200 8Even, 11:9600 8Odd, 12:19200 8Odd, 13:38400 8Odd, 14:57600 8Odd, 15:115200 8Odd	1-15	3
104	x	x	x						
105	x	x	x	Modbus - Slave Address	unsigned 16 bit	R/W		1-252	1

THREE-PHASE STATIC VOLTAGE REGULATOR

SET 04-19

Holding Register Map										
Addresses	single stabilizer without Autobypass	single stabilizer without Autobypass	Parallel stabilizer with Autobypass	Single Stabilizer or Single Energy Saver with Autobypass	Data Name	Data Types	Reading / Writing	Descriptions	Range	Default
SECTION 1 : STABILIZER DATA										
106			x		Set Working Mode	unsigned 16 bit	R/W	0:ByPass Operator 1:LSR Load, 2:LSR Volt 3:E.Saver / Regulator	0-3	3
107	x	x	x		Set Time - Date : Year	unsigned 16 bit	R/W		0-99	No Default
108	x	x	x		Set Time - Date : Month	unsigned 16 bit	R/W		1-12	No Default
109	x	x	x		Set Time - Date : Day	unsigned 16 bit	R/W		1-31	No Default
110	x	x	x		Set Time - Date : Hour	unsigned 16 bit	R/W		0-23	No Default
111	x	x	x		Set Time - Date : Minutes	unsigned 16 bit	R/W		0-59	No Default
112		x			Device ID Set	unsigned 16 bit	R/W		1-16	No Default
113			x		LSR Total Load Limit	unsigned 16 bit	R/W	If Set working mode is LSR Load and three phase total load voltage lower than lsr load limit, Device will go to the bypass mode(Standby)	2-60	3
114			x		LSR Voltage Limit	unsigned 16 bit	R/W	If Set working mode is LSR Volt and each phase (input voltage - set output voltage) lower than lsr voltage limit, Device will go to the bypass mode(Standby)	2-10	3

17. TECHNICAL SPECIFICATIONS

MODEL SET	04	05	06	08	09	11	12	13	14	15	16	17	18	19	
Power (KVA/KW)	10	15	22	30	45	60	75	100	150	200	250	300	400	500	
INPUT															
Voltage	400Vac 3ph.+N														
Voltage range	-25% +15% @ 300Vac ~ 460Vac (optional ±15%, -35%+15%, -50%+15%)														
Frequency	50/60Hz ±5%														
Connection type	Terminal block										Bars				
OUTPUT															
Voltage	400Vac														
Voltage precision	± 2%														
Current (A)	14	22	32	43	65	87	108	143	217	289	362	434	579	724	
Overload (microprocessor controlled)	101% - 125% load 3" 126% - 150% load 10" 150% load disabling output in 0.2"														
Frequency	50/60Hz ±5%														
Power factor	1														
Adjustment speed	ca. 500V / sec														
Efficiency	min. 97%														
Connection type	Terminal block										Bars				
LCD Display	LCD display 4 x 16 characters input voltage - output voltage - % load - output frequency - Stabilizer status and fault Info - overload - overtemperature - no input alarm														
Communication	RS-232 and SNMP Monitoring Port + software (optional)														
PROTECTIONS															
Output	with input outside the range -40%+25% output disabled via contactor														
Current	electronic protection with microprocessor and output disabling input thermal magnetic switch														
By-Pass	Yes														
Isolation transformer	available on request														
ENVIRONMENT															
Max temperature	-10 °C ~ +40 °C														
Altitude	2000 m														
Humidity	95% (without condensation)														
Noise level	< 50dB														
PHISICAL															
Color	RAL7035														
Dim. (WxDxH) cm	35x79x80					60x70x170			70x90x150	80x90x170	80x100x170		90x120x190		
Weight (Kg)	100	105	115	130	170	220	270	300	550	750	820	900	1050	1200	

Technical data and images are indicative only and may be changed at any time without notice

WARRANTY

Dear Customer,

Thank you for purchasing a NAICON product. We hope that you be satisfied.

If the product fails in warranty period, please contact your dealer or call +39 02 950031 or go to www.naicon.com/elsist. Before contacting your dealer or authorized service network, we recommend that you read the operating and maintenance manual carefully.

With this warranty, NAICON warrants the product to be free from defective in materials or workmanship for 2 years, as of the original delivery date.

If there are material or manufacturing defects during the warranty period, NAICON affiliates, Authorized Service Centers or authorized resellers located in the UE region will repair or (at NAICON discretion) replace the defective product or components under the terms and conditions below, without any charge for labor or spare parts costs. NAICON reserves the right (in its sole discretion) to replace the components of defective products or low cost products with assembled parts or new or refurbished products.

Conditions.

1. This warranty will be valid only if the defective product is returned together with the sales invoice.

NAICON reserves the right to refuse warranty service in the absence of such documents or if the information contained therein is incomplete or illegible.

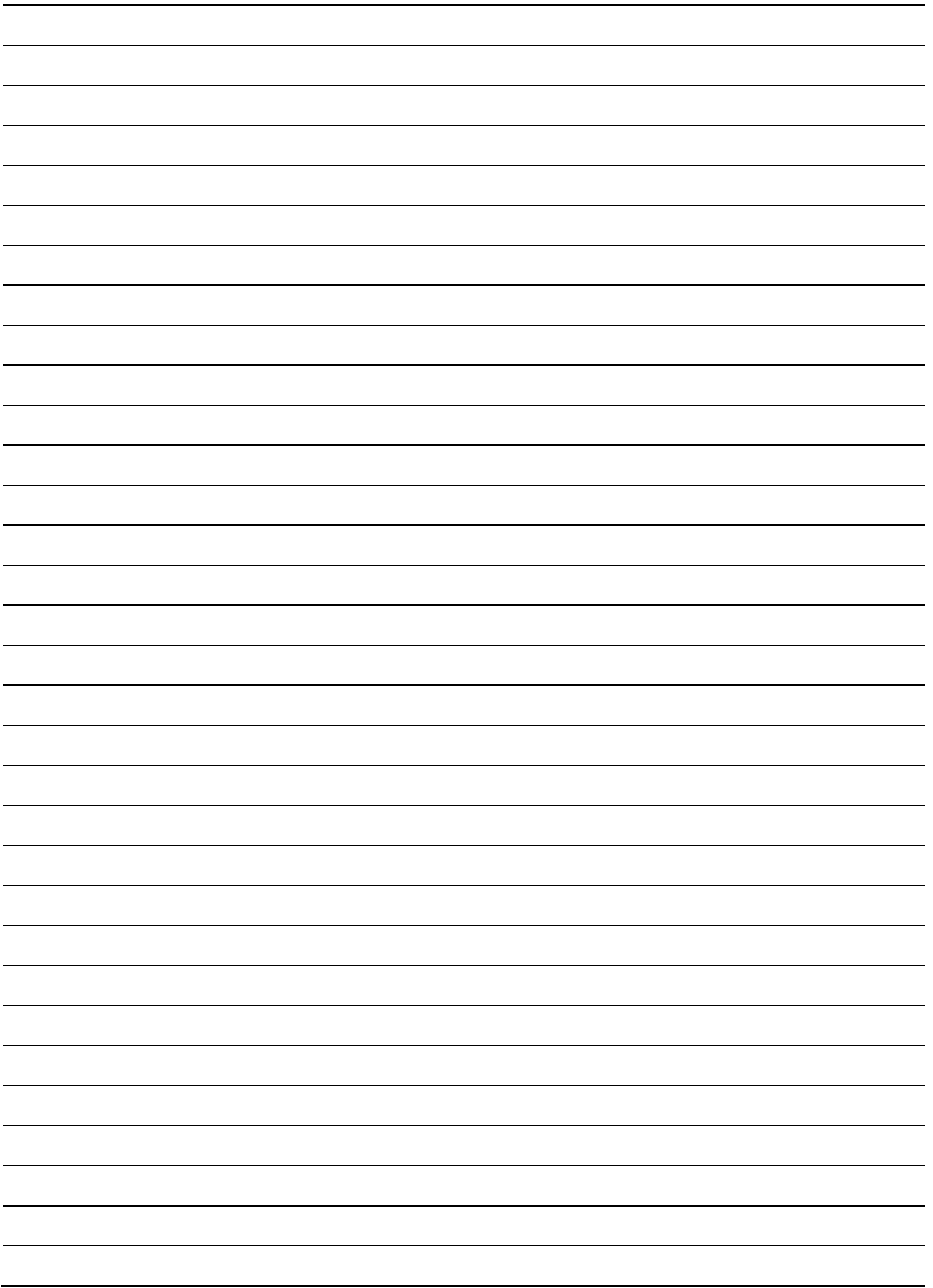
2. This warranty does not cover the costs and / or any damages and / or defects resulting from any modifications or adjustments made to the product, without prior written permission from NAICON, in order to adapt the product to local technical or safety standards in countries other than those for which the product was originally designed and manufactured.
3. This warranty will be void if the model or serial number indicated on the product has been modified, deleted, removed or otherwise illegible.
4. Are excluded from the warranty:
 - Periodic maintenance and repair or replacement of parts subject to normal wear and tear.
 - Any modification or modification to the product, without prior written permission from NAICON to enhance performance than those described in the User and Maintenance Manual
 - All costs of technical staff support and any transport from the customer's address to Assistance Center and vice versa as well as all the risks involved.
 - Damages due to:
 - a) Improper use, including but not limited to: (a) the use of the product for any purpose other than the intended use or failure to observe the NAICON instructions for correct use and maintenance of the product, (b) installation or use of the product not complying with the Technical or Safety standards in the country in which it is used.
 - b) Repairs by unauthorized personnel or by the Customer himself.
 - c) Accidental events, lightning, floods, fires, incorrect ventilation or other causes not attributable to NAICON.
 - d) Defects of the equipment or equipment to which the product was connected.
5. This warranty does not affect the buyer's rights established by applicable national laws nor the Customer's rights to the reseller arising out of the sales contract.

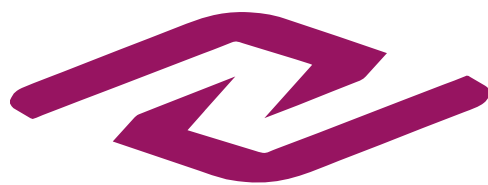
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In case of failure:

Contact our Customer Service Center at +39 02 95 0031, and verify the AVR malfunction.

If the products returned to NAICON were OPERATING or if they were delivered without our permission or for out-of-warranty products, they will be returned to the customer by charging a cost that will depend on the country where will be shipped.





Naicon

UNIT



Diloc



Elsist



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