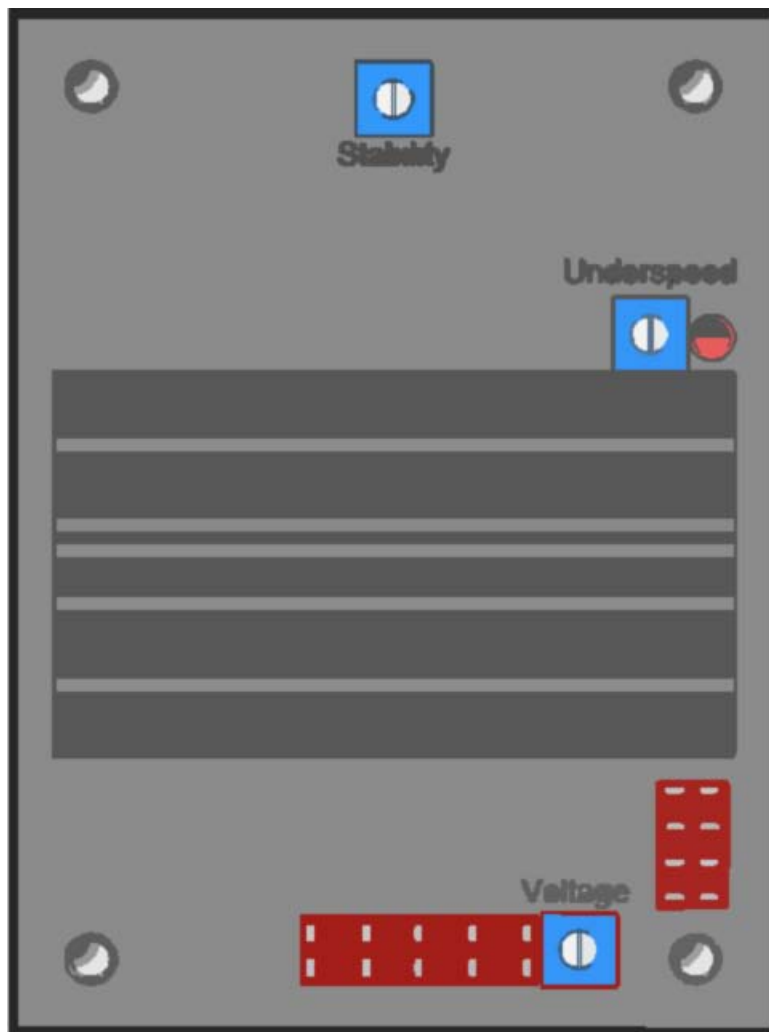


KASR10 v1.0

Voltage regulator for generators



March 2009 v2.3

Instruction Manual



WARNINGS



WARNING

The system should not be installed, operated, serviced or modified except by qualified personnel who understand the danger of electric shock hazards and have read and understood the user instructions



WARNING

Never work on a LIVE generator. Unless there is another person present who can switch off the power supply or stop the engine

WARNING

Dangerous voltages are present at the voltage regulator board. Accidental contact with live conductors could result in serious electrical shock or electrocution. Disconnect the power source before making repairs, connecting test instruments, or removing or making connections to the voltage regulator or generator.

**ELECTRICAL HAZARDOUS VOLTAGES
DANGEROUS DO NOT OPERATE WHEN
NOT FAMILIAR WITH GENERATORS**



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The manual does not cover all technical details of the product. Specifications may be modified by the manufacturer without notice. For further information, the manufacturer should be contacted.

Table of contents

Part 1/1

	1. INTRODUCTION	4
1.1	General description	4
1.2	AVR Layout	5
1.3	Electrical characteristics	6
1.4	Absolute maximum ratings	6
1.5	Commissioning information	7
	2. INSTALLATION	8
2.1	Interfaces overview	8
2.2	Adjustments overview	9
2.3	Terminals overview	10
	3. Operation and maintenance	11
3.1	Modes of control	11
3.1.0	Underspeed	11
	4. Settings and adjustments	11
4.1	Generator Voltage	11
4.3	Underspeed	11
4.4	Factory settings	12
	5. Wiring Diagrams	13
5.1	Wiring diagram	13
	Appendix	14
A.1	General installation information	16
A.2	Contact	18

1. INTRODUCTION

1.1 General description

This manual contains instructions for installing, operating and maintaining the KASR10 automatic voltage regulator (AVR).

The **KASR10** is an easy to use automatic voltage regulator, suitable for single and three phase synchronous generators up to approximately 200 kVA power rating.

The KASR10 AVR is not suitable for parallel operation of generators. When parallel operation must be controlled, the **KASR20** with reactive current sharing is available.

When the system tends to instability, the KASR20 with adjustable Proportional and Integral regulator function is available.

Maximum stability can be obtained by using a three phase sensing AVR with IGBT technology such as the EMRI **LX10.1**.

Visit the EMRI Electronics website www.emri.nl for more avr's.

Ask EMRI Services engineers if you need specialists to solve your power generation problems.

CHECK the INSULATION
of the generator windings before installation.
Poor isolation will cause **damage** to the AVR and
dangerous situations for **persons**.

1.2 AVR Layout

The AVR is protected from the environment by a PUR coating.

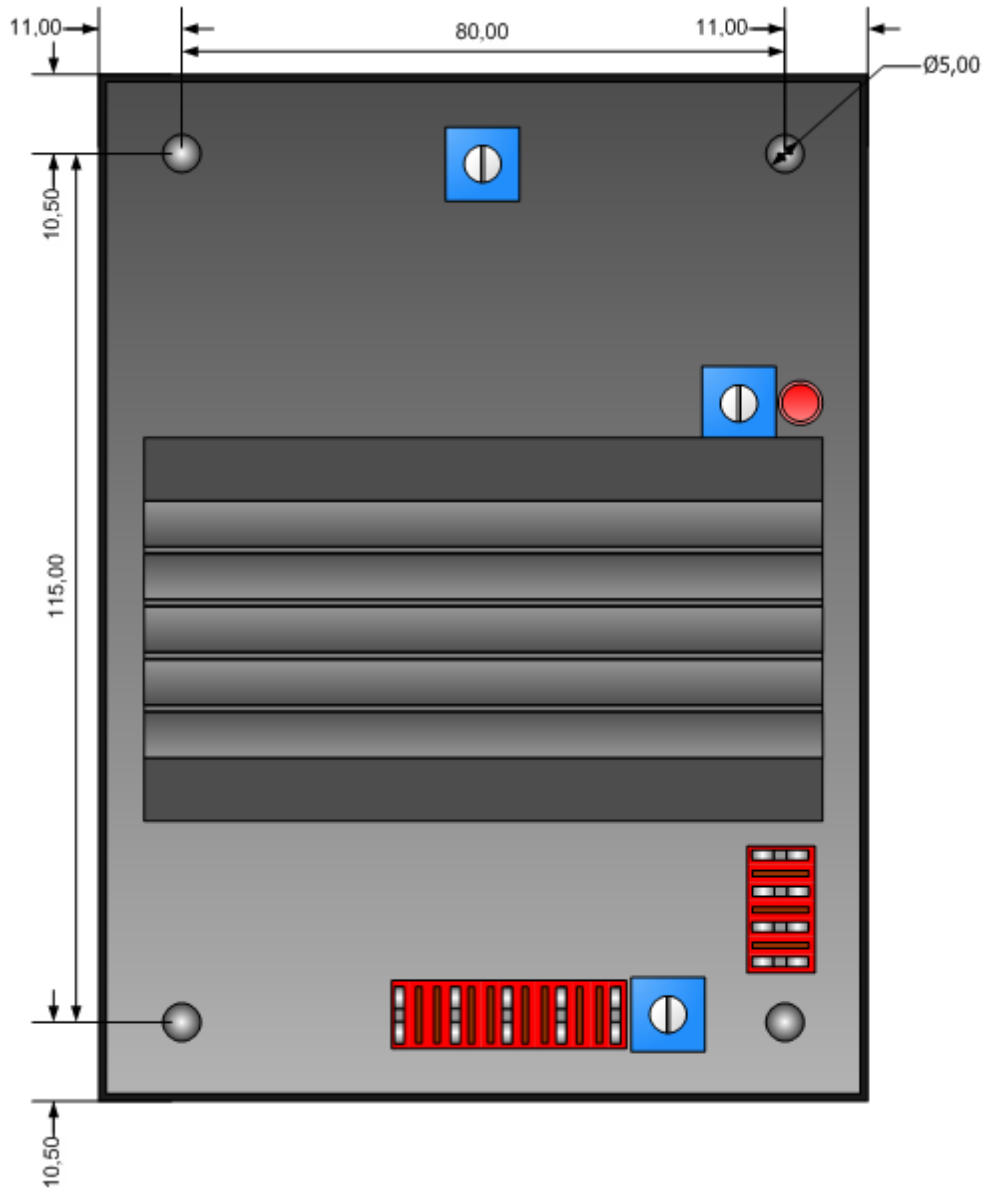


Fig 1. AVR layout

- Measurements in mm
- Height ± 43 mm

1.3 Electrical characteristics

Symbol	Parameter	Condition	Min	Max.	Unit
0-230	Voltage sensing input	50-60 Hz	-	250	V _{AC}
	Self excitation voltage		4.5	-	V _{AC}
+/-	AVR field current		-	5	A _{DC}
T _{AMB}	Operating temperature	95 % RHD non condensing	0	+70	°C
T _{STG}	Storage temperature	95 % RHD non condensing	-20	+85	°C
S-T	External Volt adjust	10kΩ potentiometer	-	10	kΩ

Table 1. Electrical characteristics

1.4 Absolute maximum ratings

Symbol	Parameter	Condition	Min.	Max.	Unit
0-230	Voltage sensing input	Continuous	-	310	V _{AC}
			40	65	Hz
+/-	AVR field current	Continuous	-	5	A _{DC}
	AVR field voltage	< 1 Sec DC % of supply voltage (RMS)		10 35	A _{DC} % _{DC}
R _{field}	Field resistance	@ 110 V _{LH1/LH2} (rms) @ 230 V _{LH1/LH2} (rms)	7,5 15	-	Ω Ω
T _{AMB}	Operating temperature	95 % RHD non condensing	0	+70	°C
T _{STG}	Storage temperature	95 % RHD non condensing	-20	+85	°C
S-T	External Volt adjust		-	10	kΩ

Table 2. Absolute maximum ratings

Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operation listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability and lifetime.

1.5 Commissioning information

The system should not be installed, operated, serviced or modified except by qualified personnel who understand the danger of electric shock hazards and have read and understood the user instructions.

Defects in the generator or AVR may cause consequential loss. Precautions must be taken to prevent this from occurring.

Never work on a LIVE generator. Unless there is another person present who can switch off the power supply or stop the prime mover.

Dangerous voltages are present at the voltage regulator board. Accidental contact with live conductors could result in serious electrical shock or electrocution.

Disconnect the power source before making repairs, connecting test instruments, or removing or making connections to the voltage regulator.

The unit should be installed with respect to the environmental specifications as well as the rules mentioned in the General installation information.

For safety reasons the voltage LEVEL potentiometers are best turned completely counter clockwise in order to start at the lowest possible voltage.

2. INSTALLATION

For a complete wiring diagram see page 15.

2.1 Interfaces overview

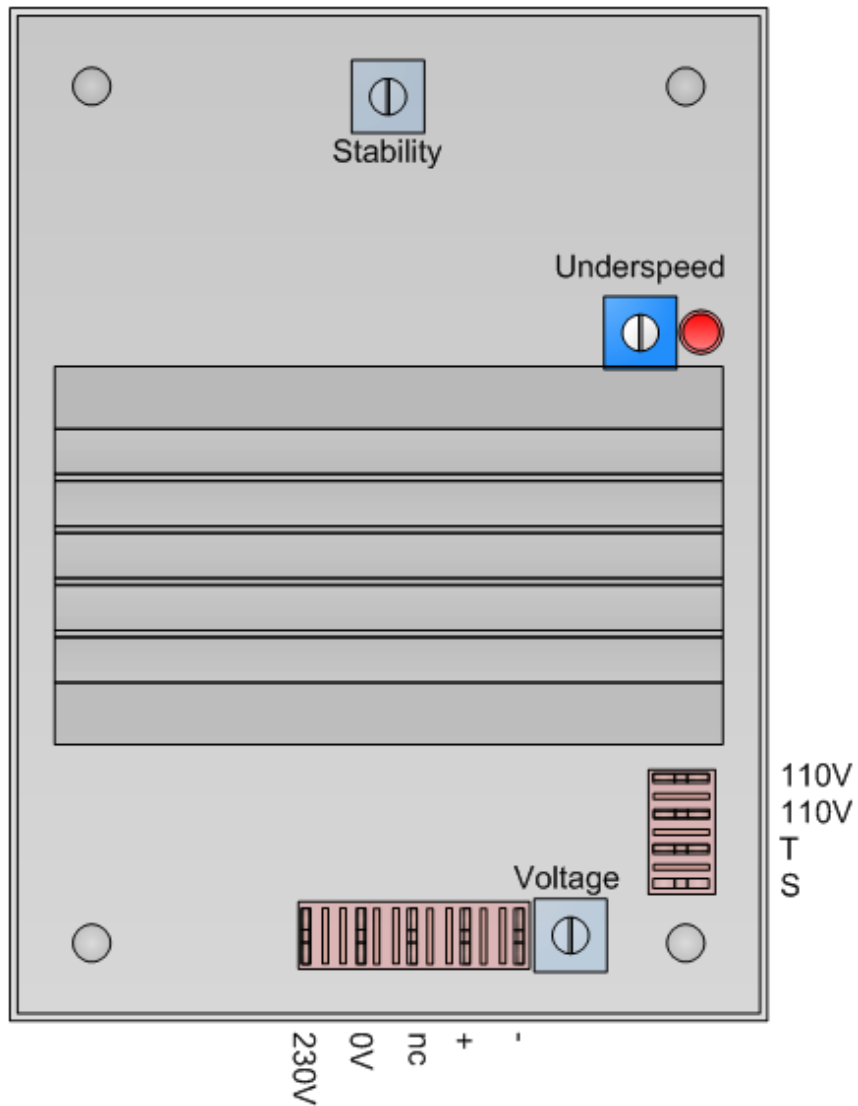


Fig 2. Interfaces overview

Symbol	Description	Notes
Underspeed Led	Underspeed active	ON = underspeed active

Table 3. Interfaces

2.2 Adjustments overview

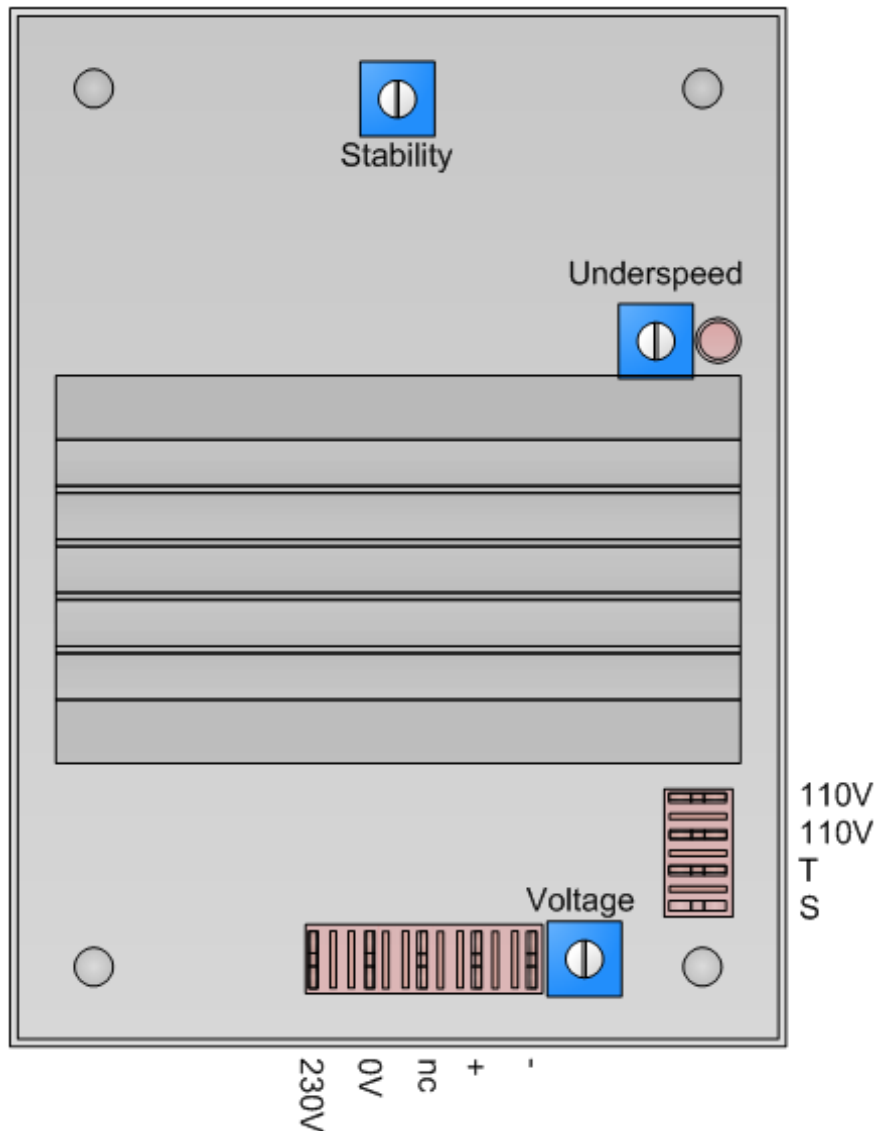


Fig 3. Adjustments overview

Symbol	Description	Notes
Voltage	Generator voltage setpoint	
Stability	Stability setpoint	
Underspeed	Underspeed setpoint	

Table 4. Adjustments

2.3 Terminals overview

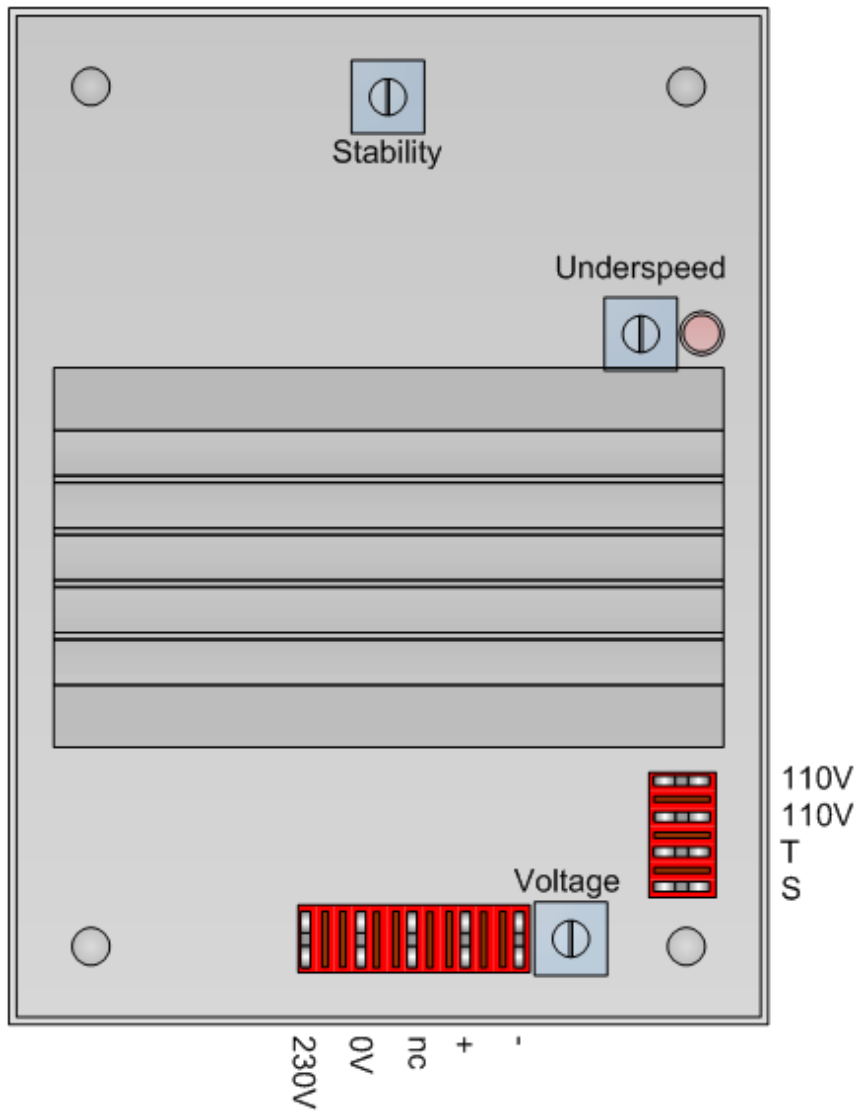


Fig 4. Terminals overview

N.C. pin tussen 0V en + een naam geven en beschrijven dat deze not connected is.

Symbol	Description	Notes
0V-230V	Voltage sensing input / supply	
S/T	External voltage adjust input	Short terminals if not used
nc	Not used pin	
+/-	Field excitation output	
110V/110V	Enable ½ phase sensing	Short to enable ½ phase sensing

Table 5. Terminals

3. Operation and maintenance

3.1 Modes of control

3.1.0 Underspeed

The KASR20 has a build in frequency trip function. This function decreases the generator voltage relative to drop of the generator frequency. For further information see chapter 5.3 Underspeed.

4. Settings and adjustments

4.1 Generator Voltage

The generator voltage setpoint is user adjustable by means of a voltage potentiometers. The voltage potentiometer range is $U_{nom} - 30\%$ and $U_{nom} + 10\%$. Turning the potentiometer clockwise increases the generator voltage, turning counter clockwise decreases the generator voltage.

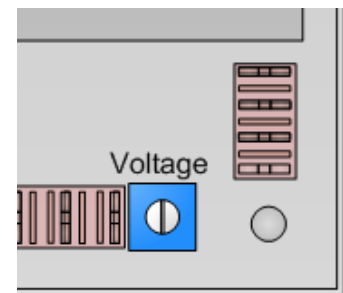


Fig 5. Voltage adjustment

4.2 Stability

The generator stability is adjustable by means of a potentiometer. Turning the potentiometer clockwise makes for a slower response, turning counter clockwise makes for a faster response. Adjusting the stability must be performed by a control specialist to prevent damage to the AVR and generator. If no stability can be obtained, a KASR20 or three phase sensing avr is advised.

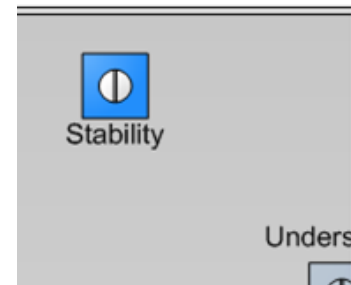


Fig 6. Stability adjustment

4.3 Underspeed

The underspeed trip frequency is adjustable by means of potentiometer F. Turning the potentiometer clockwise decreases the trip frequency to minimum 45 Hz, turning potentiometer F counter clockwise increases the trip frequency to maximum 63 Hz.

Setting the underspeed trip frequency is done by running the generator at normal frequency and turning potentiometer F counter clockwise until the red LED lights, then turning the potentiometer clockwise until the LED is off again(*) and the generator voltage switches back to normal.

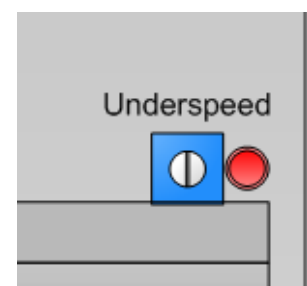


Fig 7. Underspeed adjustment

* NOTE It is recommended to turn the potentiometer a little further counter clockwise to allow for short frequency dips.

4.4 Factory settings

All new or AVR's returned from service are supplied with factory settings as described in table 6. Adjusting the factory settings must only be performed by qualified personnel who understand the danger of electric shock hazards and have read and understood the user instructions

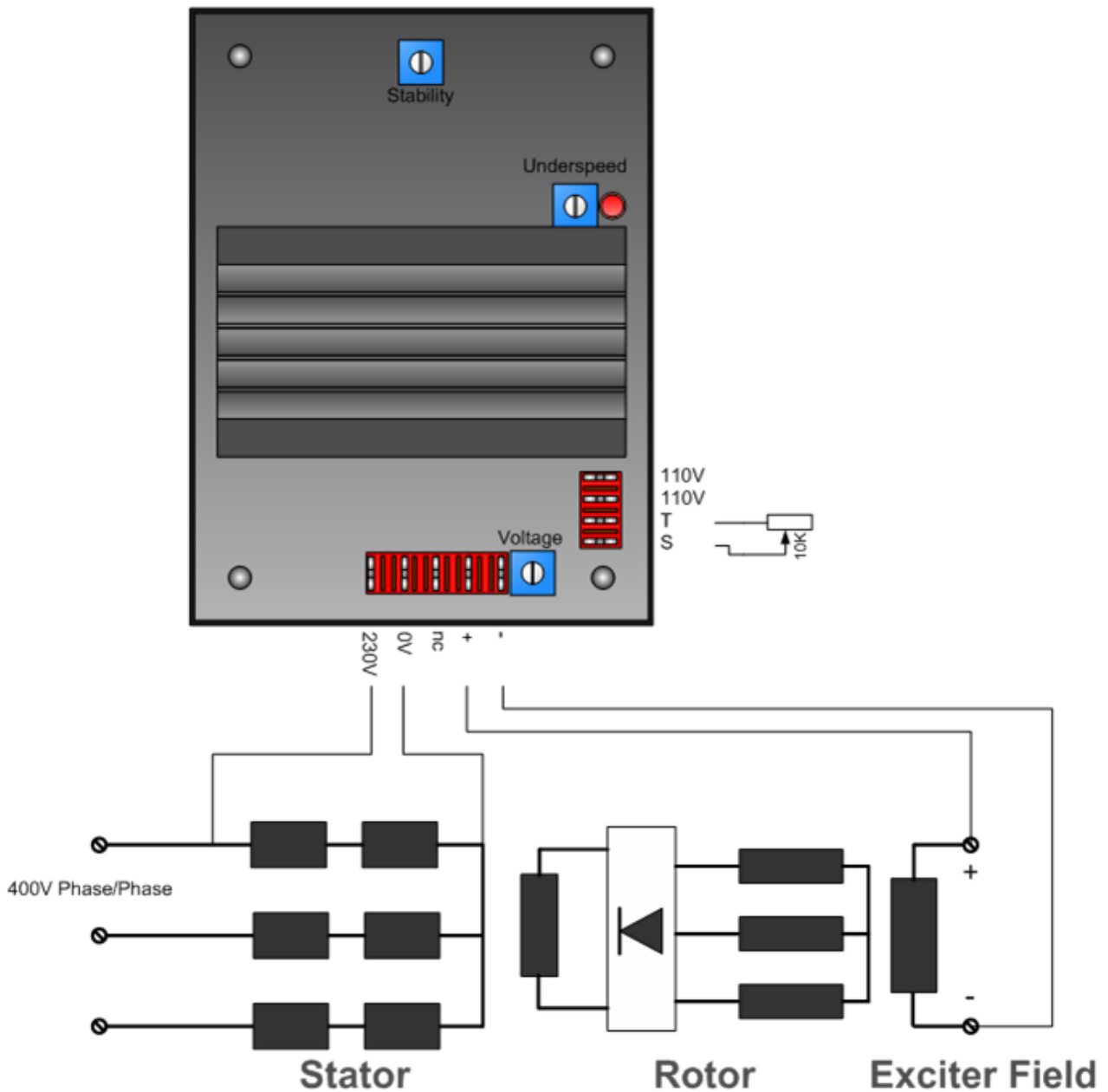
Parameter	Value	Unit
Output Voltage	400	Vac
Stability	Middle	
Underspeed trip	47	Hz
S/T	Shorted	

Table 6. Factory settings

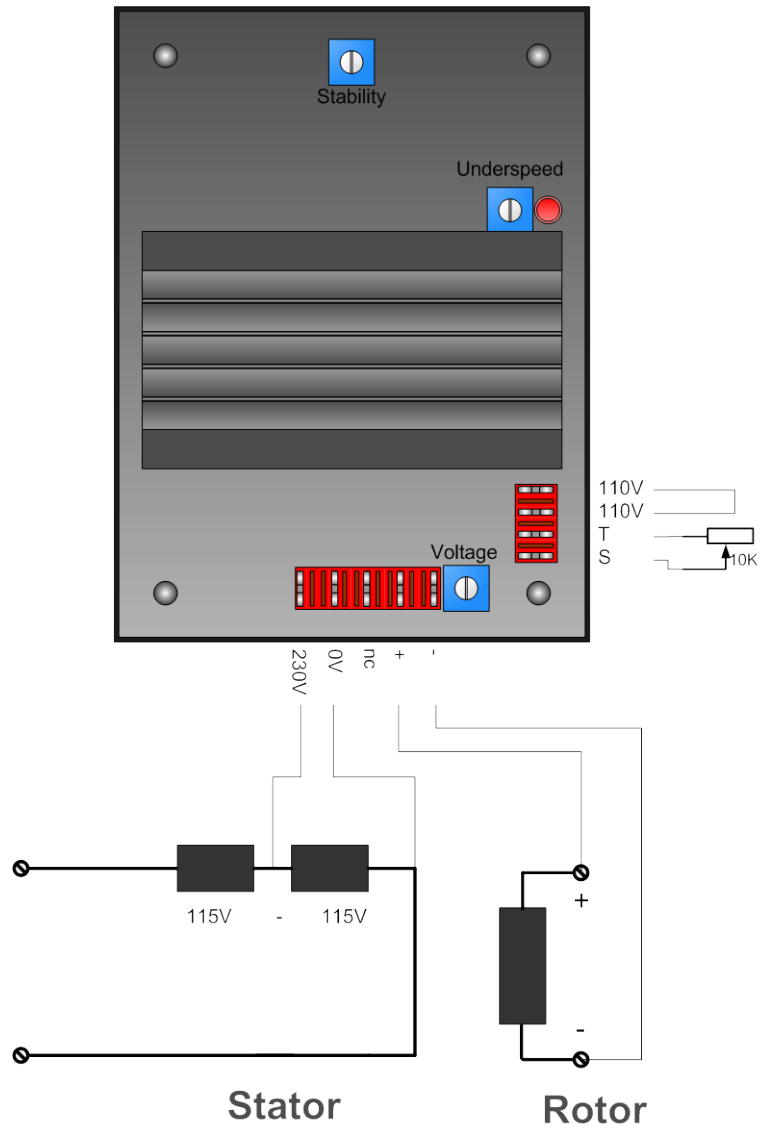
CHECK the INSULATION
of the generator windings before installation.
Poor isolation will cause **damage** to the AVR and
dangerous situations for **persons**.

5. Wiring Diagrams

5.1 Wiring diagram

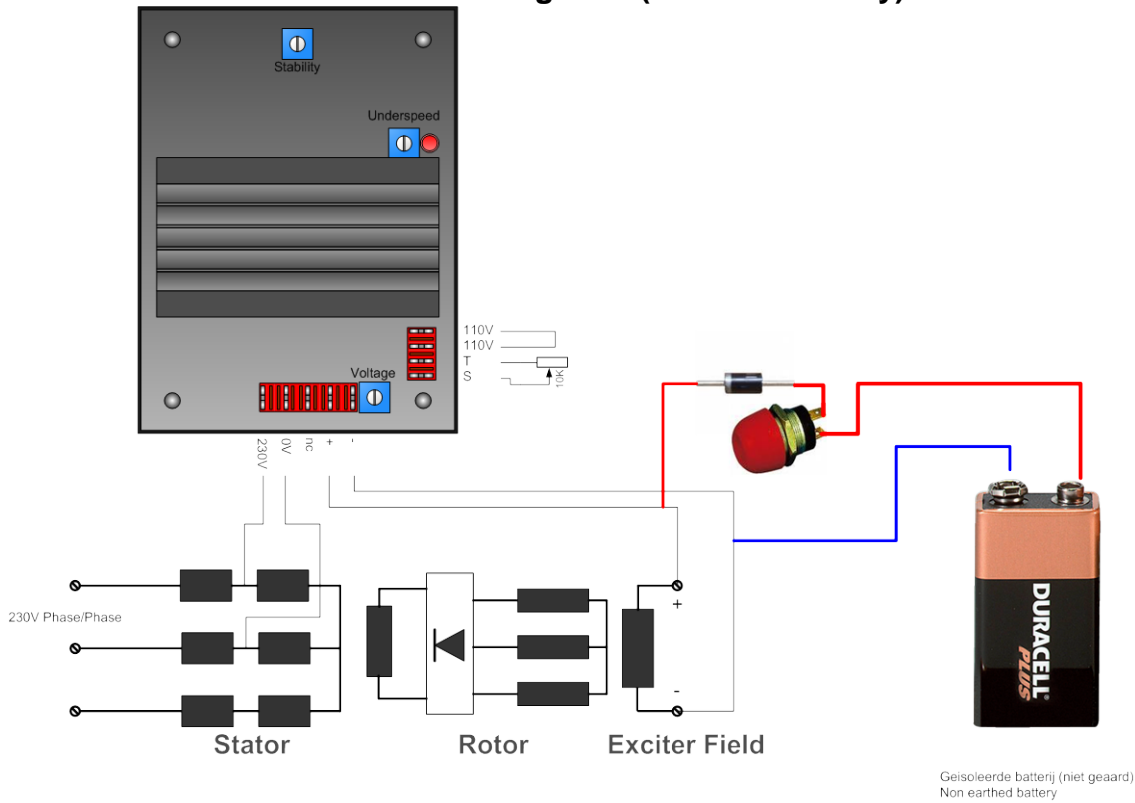


Single phase generator

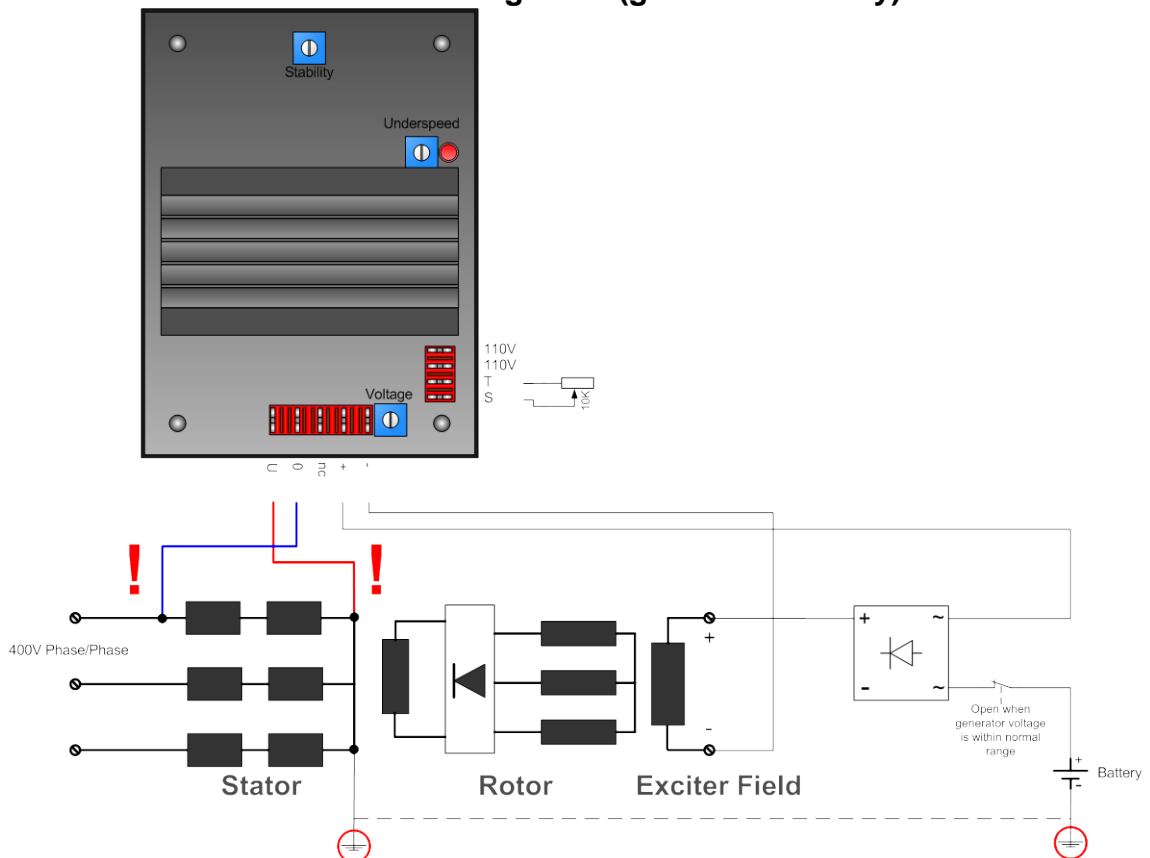


When the generator does not self excite due to lack of residual magnetism, one of the below diagrams can be used to overcome this problem.

FIELD FORCE Diagram 1(isolated battery)



FIELD FORCE Diagram 2 (grounded battery)



Appendix

A.1 General installation information

Absolute Maximum Ratings

- The Absolute Maximum Ratings are those limits for the device that, if exceeded, will likely damage the device. Exceeding the absolute maximum ratings voids any warranty and/or guarantee.

Mounting

- Mounting of the product should be done in such a way that the absolute maximum ambient temperature rating of the product will never be exceeded.
- Mounting of the product should be done in such a way that maximum cooling (direction of cooling ribs and direction of airflow) is achieved.
- Mounting of the product should be done in such a way that no humid air can flow through the product or condensation occurs.
- Mounting of the product should be done in such a way that dust or other materials or residue will not remain in or on the product.
- Mounting of the product should be done in such a way that the maximum vibration is not exceeded.
- Mounting of the product should be done in such a way that personal contact with persons is impossible.

Wiring

- Diameter size of the wiring should be enough to carry the expected current. Wire insulation should be enough to withstand the expected operating voltages and temperatures.
- To improve EMC emission and immunity, care should be taken for the lay out of the wiring. This in respect to all wiring in the installation.
- Keep current carrying wires as short as possible.
- Keep wires carrying a total sum of zero Ampere close to each other, or in one single cable. E.g Phase and neutral or + and -.
- Avoid current carrying conductors next to sensing or control wiring. Especially current controlled by SCR's or PWM controlled transistors.
- If sensitive sensing signal cables need to be laid across distance along other cabling, shielded cable is preferred. Keep the shield as long as possible and the wiring outside the shield as short as possible. Do not solder or shrink the shield to a regular wire. Connect the original shield to ground at one side with an as large as possible contact surface.

Additional installation information

- When the product is supplied by means of a transformer, it should never be an auto-transformer. Auto-transformers react as voltage sweep up coil and may cause high voltage peaks.
- Standard fit capacitors or over-voltage suppressers across + and - or exciter field terminals inside the generator should be removed.
- When the product is supplied by means of a transformer, it should be able to carry at least the maximum expected current. Advisable is, to have a transformer which can carry twice the maximum expected current. Inductive loads make voltage sags and peaks into the secondary voltage of a transformer, from which the device may malfunction.
- It is not recommended to apply switches in dc outputs. It is preferred to use switches in the ac supply inputs of devices. In case it is unavoidable to have switches in the dc output of a device, action must be taken to avoid over voltage damage to the device due to contact arcing. Use a voltage suppressor across the output.
- It is not recommended to apply switches or fuses in the sensing lines. Defects can cause high voltage situations due to over-excitation.
- When using a step down transformer in medium or high voltage generators, the transformer should be three phase (if three phase sensing), and the transformer should be suitable for acting as a sensing transformer. If the transformer is unloaded, connect a resistor to avoid voltage waveform distortion.
- The phase relation from the generator to the AVR is important. Also when voltage transformers and/ or current transformers are installed.
- When using a step down or insulation transformer in the droop circuit, phase relation from the generator to the AVR is important.
- CT's wiring, connected to the AVR should never be grounded.
- Always disconnect electronic products, circuits and people before checking the insulation resistance (Megger check).
- Due to differences in generators impedance's, EMC behavior is not predictable. Therefore the commissioner / installer should be aware of proper and correct installation.
- Large, highly inductive, exciter stator windings can cause destructive high voltage peaks. Adding a resistor from 10 to 20 times the exciter stator field resistance reduces voltage spikes. If necessary filter can be fitted additionally. (e.g. snubber, RC-network)
- Upon problems during commissioning, faulty behavior or defects in the generator, consult the fault finding manual at our web site
- Some advises may be overdone or seem extraordinary, but since the electrical rules are the same everywhere, these advises are given.

A.2 Contact

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See our website www.emri.nl for local suppliers