THE POWER OF SYNERGY

ASR150

STATIC EXCITER

Voltage regulator for generators

Instruction Manual V2.1

Product version V2.1.0.0

EMRI ELECTRONICS

POWER IN CONTROL

MANAGEMENTSYSTEEM CERTIFICATIE DNV·GL ISO 9001 = VCA*

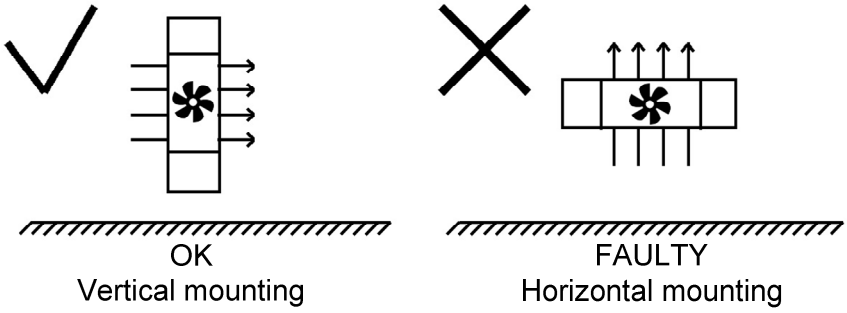
WARNINGS AND COMMISSIONING INFORMATION

HAZARDOUS VOLTAGES. DO NOT OPERATE WHEN NOT FAMILIAR WITH GENERATORS.

- ***Check the isolation of the generator windings before installation.***
  Poor isolation will cause damage to the AVR and dangerous situations for persons.
- 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.
- Never work on a LIVE generator. Unless there is another person present who can switch off the power supply or stop the engine.
- 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.
- Defects in the generator or AVR may cause consequential loss. Precautions must be taken to prevent this from occurring.
- 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.
- Never change the rotary switch or dipswitch settings during operation.
- Never apply supply voltage when generator is not running, unless exciter field is disconnected.

AVR MOUNTING POSITION

Mount the AVR in such a way that the airflow is not vertical (the fan may not be mounted horizontal).
If vertical airflow is required please contact EMRI for available options.



OK
Vertical mounting

FAULTY
Horizontal mounting

REVISION HISTORY

Version					Change
Product	Hardware	PCB	Manual	Date	
For info about older revisions contact your supplier.					
V2.1.0.0	2.1.0.0	1.3	2.1	Feb-2020	*New manual layout.*

The table provides a historical summary of the changes made to the AVR.
Revisions are listed in chronological order.

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

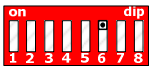
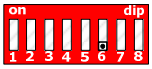
GENERAL DESCRIPTION

The static exciter / voltage regulator type ASR consists of a printed circuit board, which is suitable for working with a separate mounted controlled rectifier.
The AVR can be used with any kind of generator, whatever its exciting power may be.

EMRI also supplies several standard types ASR models, ranging from 35 to 350Adc excitation.
Standard models are: ASR35, ASR100, ASR150, ASR250, ASR350.
If the selected products does not meet your requirements, please contact us.
EMRI can supply custom build static exciters.

Installation, maintenance and adjustment don't require special application software.
The printed circuit board is protected from the environment by a PUR coating.

ABSOLUTE MAXIMUM RATING

Symbol	Parameter	Condition	Min.	Max.	Unit
U, V, W	Voltage sensing input 230Volt	50-60Hz, continuous. (3) 	-	288	V_{AC}
	Voltage sensing input 400Volt	50Hz, continuous. (3) 50Hz, Intermitted < 10s.  60Hz, continuous. 60Hz, Intermitted < 10s.	- - - -	450 480 500 520	V_{AC} V_{AC} V_{AC} V_{AC}
+, -	AVR field current	Continuous. (1) (2) Intermitted < 10s.	- -	150 225	A_{DC} A_{DC}
	AVR field voltage	DC % of supply voltage (RMS)	-	170	V_{DC}
U, 0	Supply input 230V	Minimum supply for self excitation	3	-	V_{AC}
		50-60Hz	90	288	V_{AC}
S1, S2	Droop CT 0.5A	Isolated CT ≥ 15VA. Intermitted < 30s.	-	1	A_{AC}
T_{AMB}	Operating temperature	95% RHD non condensing (1) (2)	0	+50	°C
T_{STG}	Storage temperature	95% RHD non condensing	0	+70	°C
	Static control accuracy			1	%

(1) Mount the AVR in such a way that the airflow is not vertical (the fan may not be mounted horizontal).

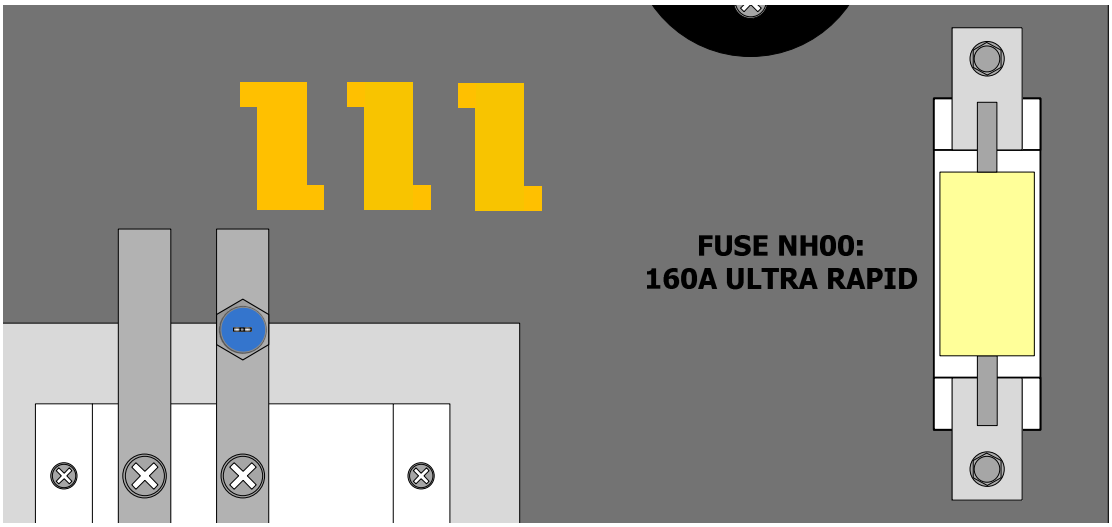
(2) Heatsink may never exceed 80°C.

(3) Depending on voltage selection

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

PROTECTIONS

Fuse protection



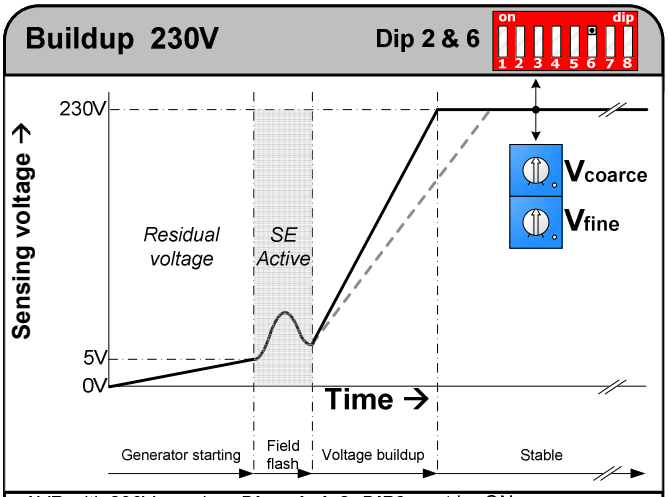
To prevent consequential damage in case of an AVR or generator failure, the AVR supply is fused by a 160A ultra rapid fuse.
Blowing the fuse will interrupt the field excitation output and causes the generator to de-excite.

When replacing the fuse, a 160A ultra rapid NH00 type must be used.

MODES OF CONTROL I

Buildup 230V

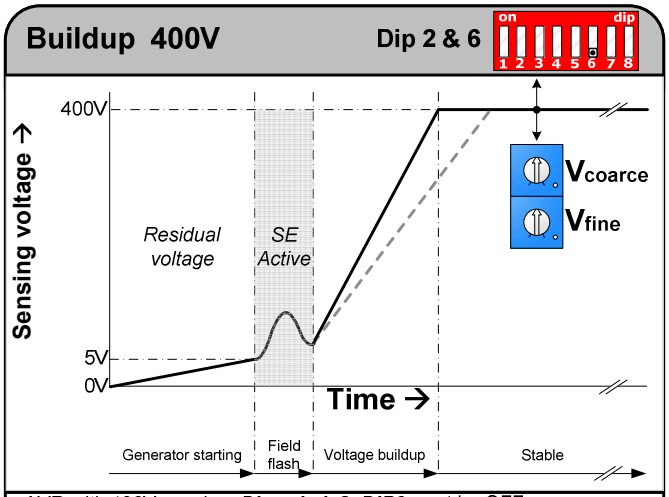
Dip 2 & 6



AVR with 230V sensing, ***Dipswitch 2: DIP6*** must be ON.
Buildup time is adjustable with ***Dipswitch 2: DIP2***.

Buildup 400V

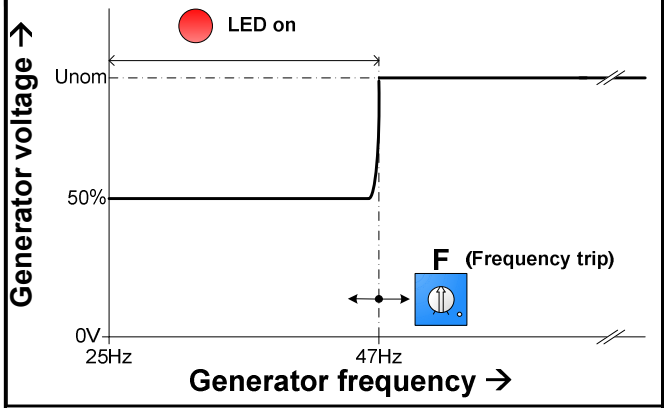
Dip 2 & 6



AVR with 400V sensing, ***Dipswitch 2: DIP6*** must be OFF.
Buildup time is adjustable with ***Dipswitch 2: DIP2***.

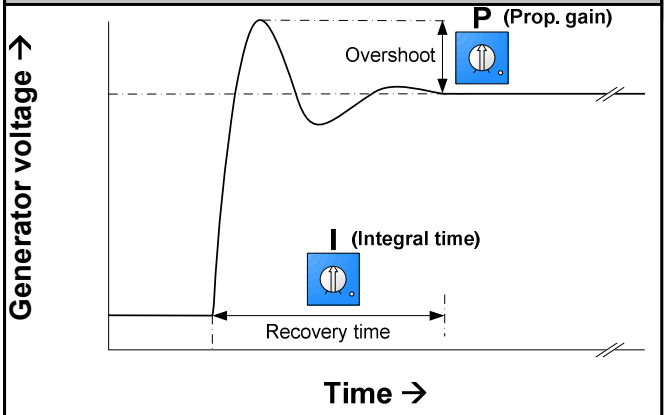
Frequency trip

Dip 3



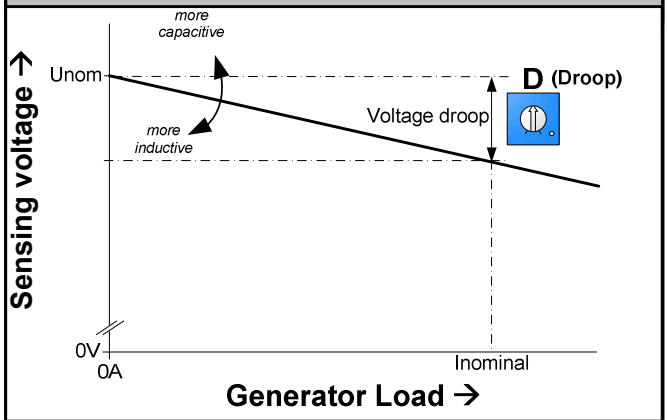
Dipswitch 2: DIP3 **on** to enable Frequency trip.
Too low Freq. trip setpoint or disabling protection may cause damage to the generator or the AVR due to incorrect voltage / frequency ratio.

P/I control



Turning the P/I control must be performed by a control specialist to prevent damage to the AVR and generator.

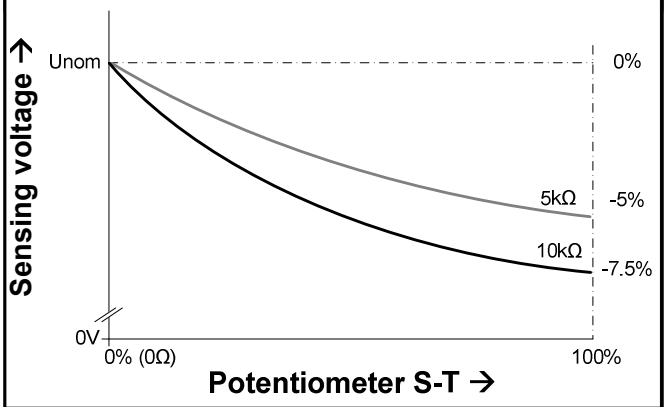
Droop CT: 0.5A



Droop range is Unom – 5% @ cosphi 0,85 inductive.

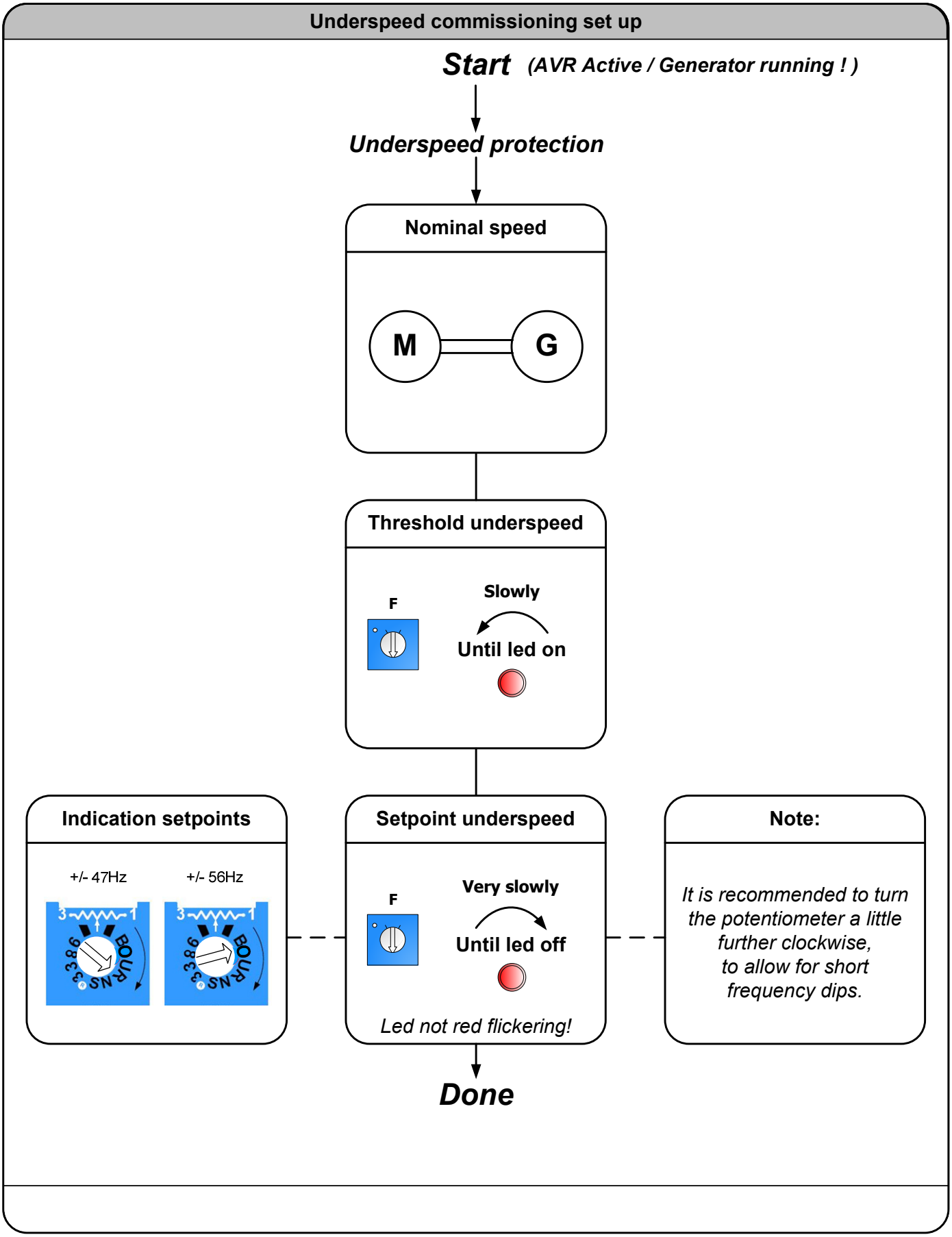
Remote adjust (Ω)

Dip 4

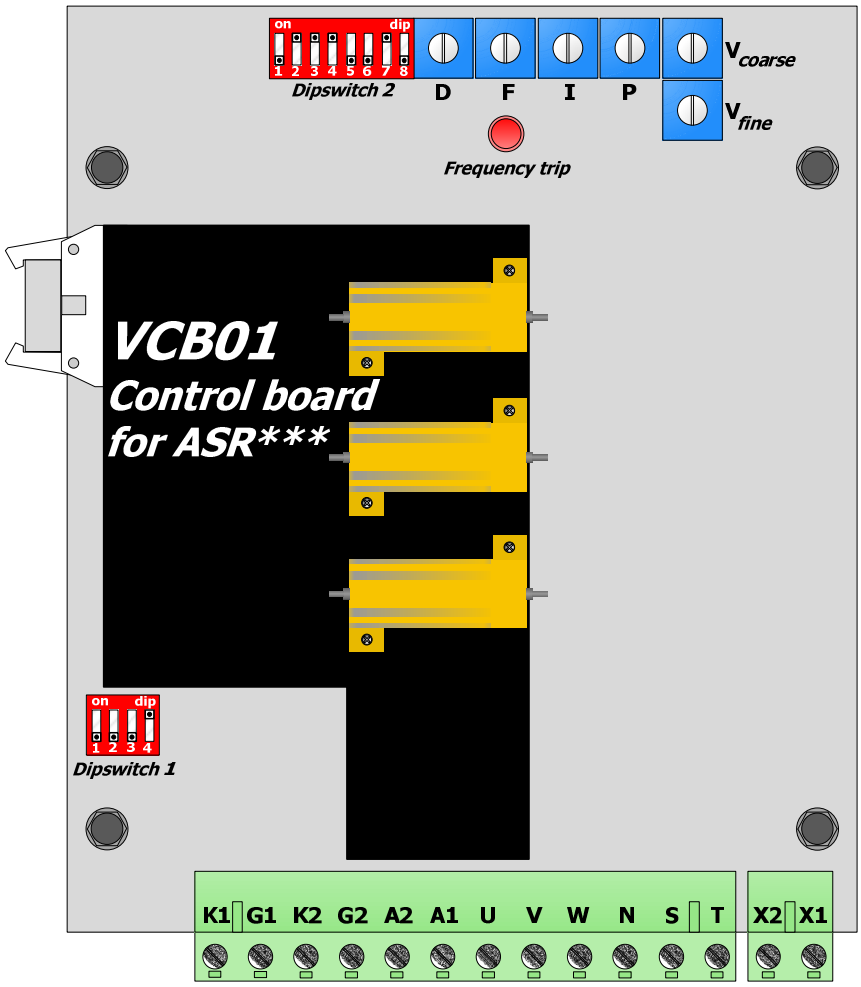


Dipswitch 2: DIP4 **off** to enable Remote adjust.
Maximum value at terminal S-T is 15kΩ.

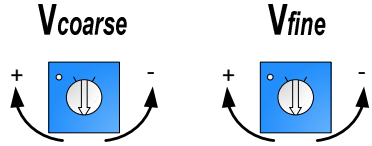
COMMISSIONING SET UP



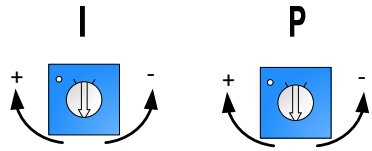
QUICK REFERENCE I



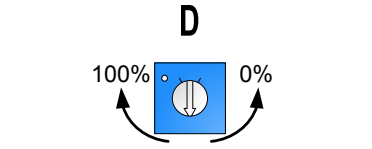
Voltage (Page 6)



Stability (Page 6)

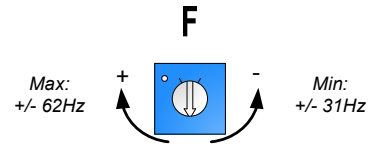


Droop (Page 6)



Range : Unom – 5% @ cosphi 0,85 inductive.

Frequency trip (Page 6,7)



LED (Page 6,7)

Led is on when:

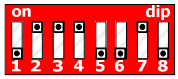
1: Generator frequency drops below the frequency trip setpoint.

2: One of the three phases is missing.

Dipswitch 1

DIP	Off	On
1	Only for OEM use	Only for OEM use
2	Dip2 off & Dip3 off for 50Hz supply	Dip2 on & Dip3 off for 150Hz supply
3		Dip2 off & Dip3 on for 400Hz supply
4	One SCR disabled	Two SCR activated

Dipswitch 2 (Page 5,6)



DIP	Off	On
1	100 % output	Only for OEM use
2	Slow voltage ramp up	Fast voltage ramp up
3	Frequency trip disabled	Frequency trip enabled
4	Remote adjust enabled	Remote adjust disabled
5	-	Extra smoothening on sensing voltage
6	400V sensing voltage	230V sensing voltage
7	Phase loss protection enabled	Phase loss protection disabled
8	No function	No function

Factory settings

Sensing voltage	: 400V
Frequency Trip	: 47Hz
Droop	: 50%
Stability P-action	: 50%
Stability I-action	: 50%

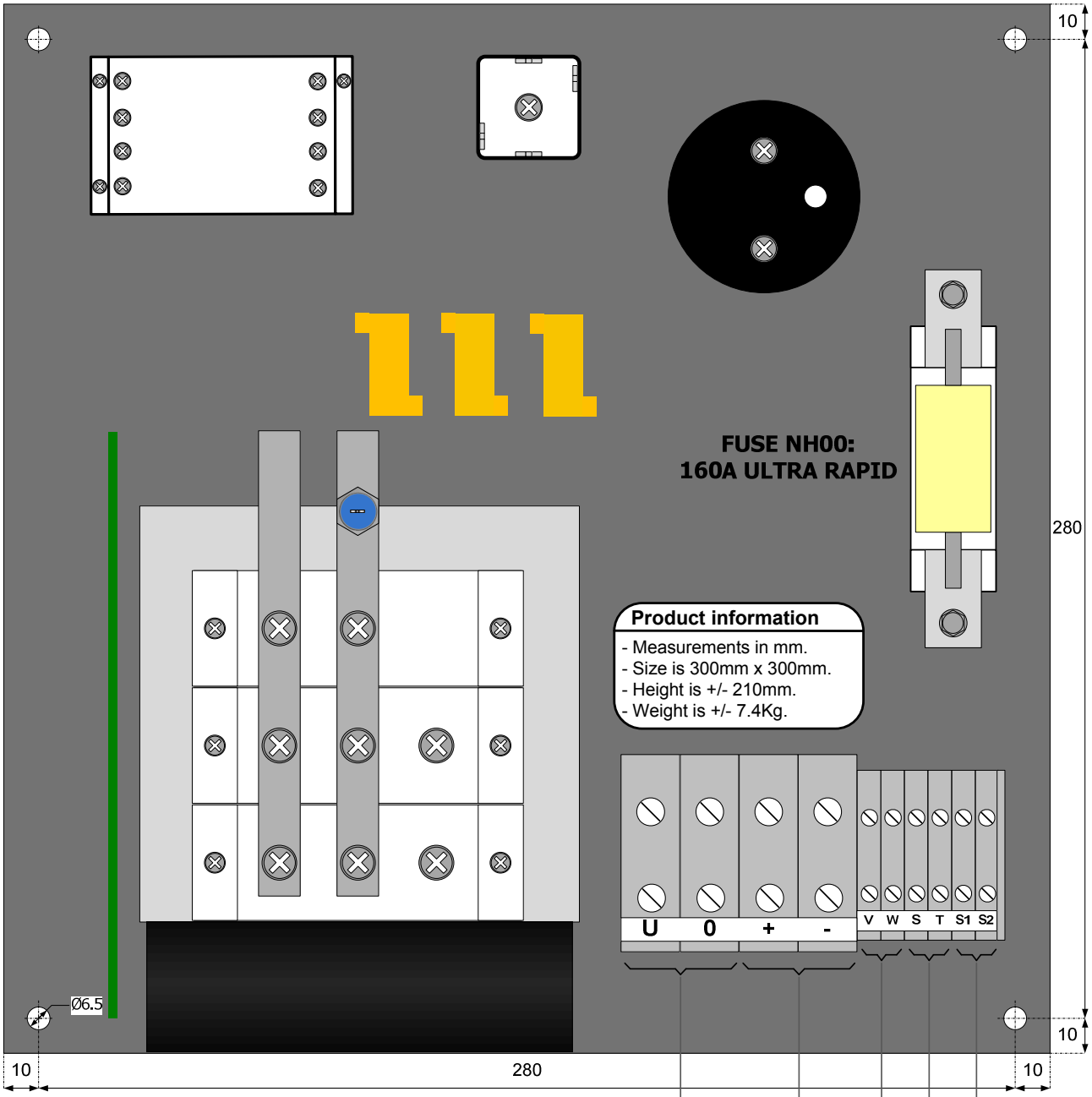
Dipswitch 1

DIP1	: Off
DIP2	: Off
DIP3	: Off
DIP4	: On

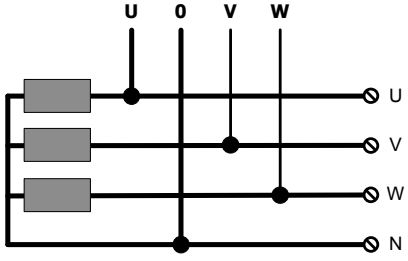
Dipswitch 2

DIP1	: Off
DIP2	: On
DIP3	: On
DIP4	: On
DIP5	: Off
DIP6	: Off
DIP7	: On
DIP8	: Off

QUICK REFERENCE II

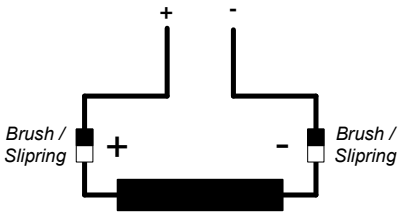


Supply & Sensing



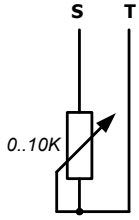
Supply voltage : 230V (U,0)
Sensing voltage : 400V (U,V,W)

Exciter



0..150Adc
Max. rating: Intermitted 225A < 10s.

Remote adjust



Max. value : 15K

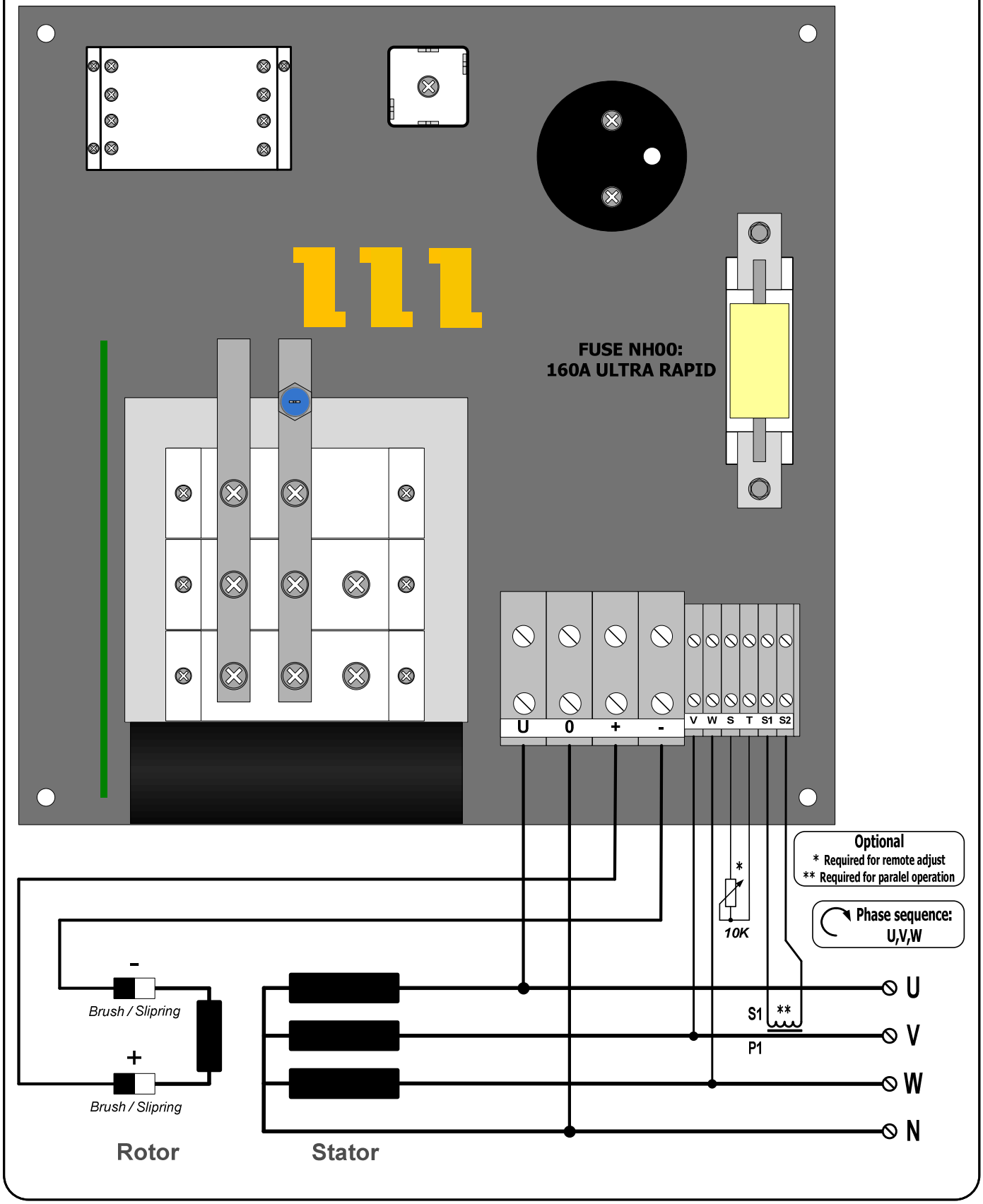
Current sensing

V phase
0.5A

Droopkit or CT

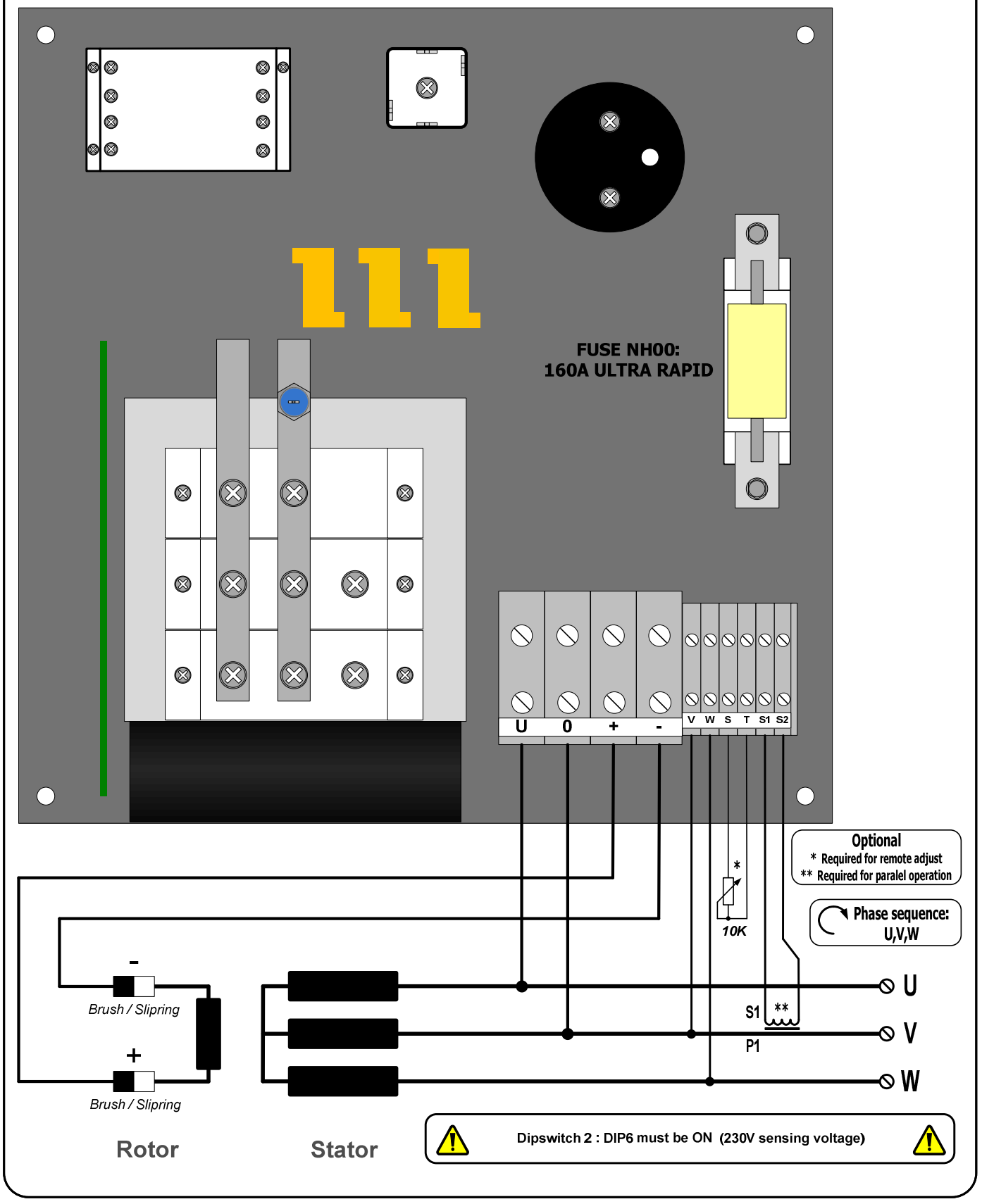
WIRING DIAGRAM I

Sensing voltage 3x400V / supply voltage 230V



WIRING DIAGRAM II

Sensing voltage 3x230V / supply voltage 230V



TIPS AND SUGGESTIONS I

Generator insulation- / polarization index test

As a rule of thumb the testing voltage used during an insulation test is two times the nominal voltage of the winding under test. This exceeds the AVR ratings and may cause permanent damage to the AVR. Therefore the AVR must be disconnected completely from the generator. When performing an insulation test on the generator rotor disconnect the rotating rectifiers and any other components from the windings under test. This will prevent damage should the testing voltage exceed the rectifiers blocking voltage.

Field flashing

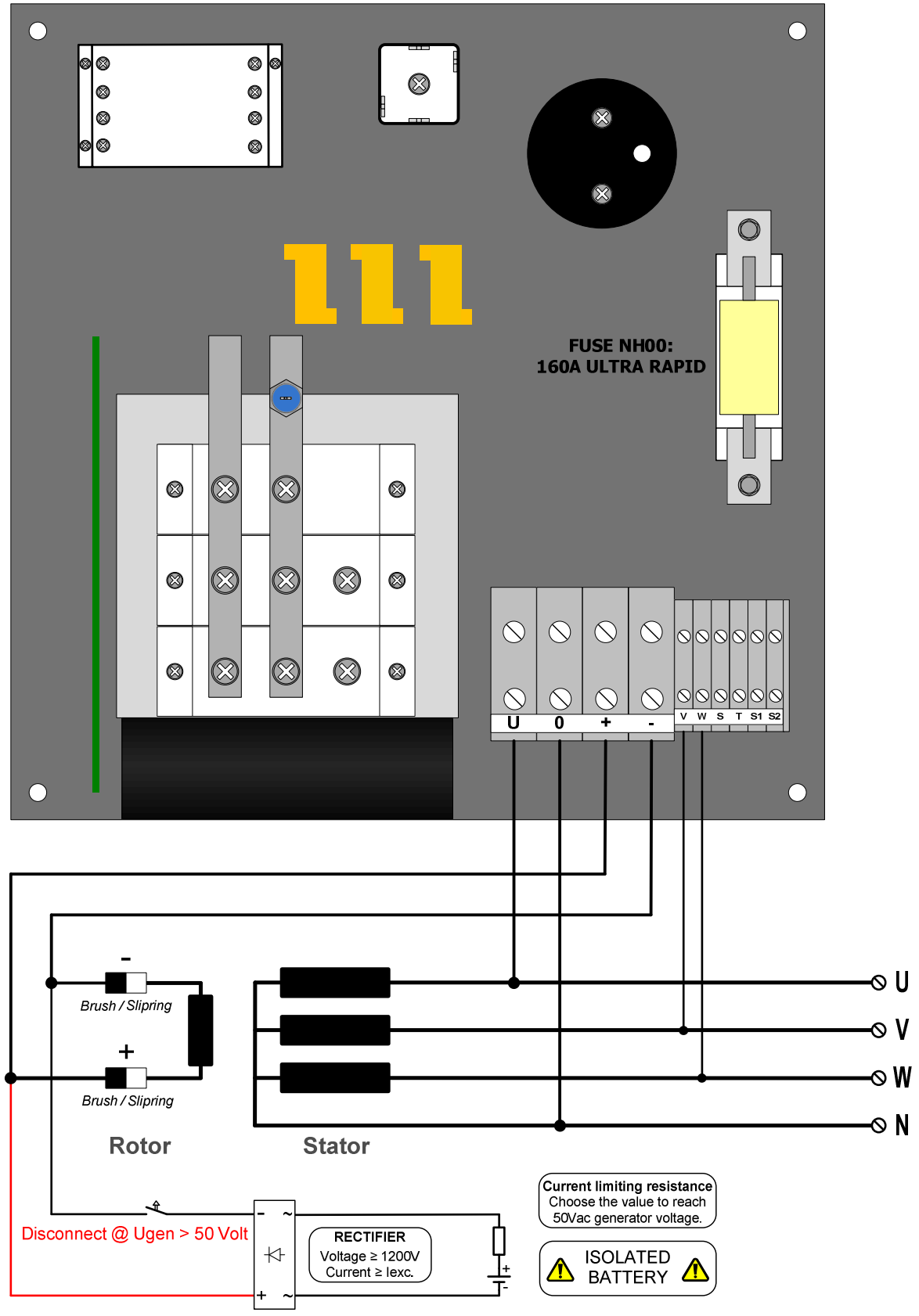
In case of a self excited generator it could be that the residual voltage level is too low to build up. Causes for a low residual voltage can be a prolonged period of stand still, excessive heating or mechanical shock and vibration.

To restore the residual voltage the generator can be manual field flashed. In order to perform this safely the AVR must be completely disconnected from the generator. Next a potential free voltage (e.g. a 9V battery block) source is connected to the exciter field of the generator, while it's rotating. This will cause the generator voltage to rise and restore the residual voltage level.

If the residual voltage of the generator is permanently low, an automatic field flash unit can be used or a potential free voltage source which is automatically switched off when the generator voltage is within normal range. The generator voltage should not exceed nominal voltage when field flash is active, to prevent damage to the AVR. When using "Automatic field flash" there should always be a rectifier bridge in the output of the source/unit.

TIPS AND SUGGESTIONS II

Field Flash with isolated battery



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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.
- maximum cooling (direction of cooling ribs and direction of airflow) is achieved.
- Mounting no humid air can flow through the product or condensation occurs.
- dust or other materials or residue will not remain in or on the product.
- the maximum vibration is not exceeded.
- 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. U, V, W, or F1 (+) and F2 (-), or Phase and neutral, or S and T.
- 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 F1 (+) and F2 (-), 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 sacks and peeks 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.

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