



LX341 / LX342

Replaces MX341 / MX342

Instruction Manual V1.1

Product version V1.1.0.0

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.

REVISION HISTORY

Version					Change
Product	Hardware	Software	Manual	Date	
V1.0.0.0	1.0	1.0	1.0	May-2019	First release.
V1.1.0.0	1.1	1.1	1.1	Nov-2019	Components moved. Changed time protections, see page 5.

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.

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GENERAL DESCRIPTION

The AVR is designed as a replacement for the MX341 & MX342, providing optimal flexibility and configurability as is reflected by the additional capabilities of the AVR. Nevertheless installation, maintenance and adjustment don't require special application software. The AVR is protected from the environment by a PUR coating.

Mode of control	MX341	MX342	AVR
Constant voltage control	✓	✓	✓
Quadrature voltage droop for parallel operation	✓	✓	✓
Current control (Current limiting)		✓	✓
Protection			
Generator phase loss			✓
AVR over temperature			✓
Generator over voltage			✓
Generator over current			✓
Generator over excitation	✓	✓	✓
User adjustable underspeed knee	✓	✓	✓
User adjustable underspeed slope	✓		✓
User adjustable over excitation current			✓
User adjustable generator current limit		✓	✓
Communication			
AVR Status LED	✓	✓	✓

Options		Terminals
DROOPKIT	Required for parallel operation / current limiting	S1 – S2
DFD7.5	Diode failure detector	Separate unit

ABSOLUTE MAXIMUM RATING

Symbol	Parameter	Condition	Min.	Max.	Unit
2, 3	Voltage sensing input	50 - 60Hz, Intermitted < 30s.	-	270	V _{AC}
X, XX	AVR field current	Continuous ⁽¹⁾	-	2.7	A _{DC}
		Intermittent < 10s.	-	6	A _{DC}
	Field resistance X(+), XX(-)	@ 70V _{AC} supply ^{(3) (4)} @ 170V _{AC} supply	6.6 16	- -	Ω Ω
P2, P3, P4	Supply input (PMG)	DC or 25 - 400Hz.	15	220	V _{AC}
		Supply must be isolated.	15	135	V _{DC}
A1, A2	Accessories input	A1(-), A2(+) Connected device must be isolated. ⁽²⁾	-13	+13	V _{DC}
S1, S2 (W)	Droop, Limit CT	CT > 2VA, Intermitted < 30s. CT must be isolated.	-	1	A _{AC}
T _{AMB}	Operating temperature	95% RHD non condensing ⁽¹⁾	-40	+70	°C
T _{STG}	Storage temperature	95% RHD non condensing	-40	+85	°C
	Static control accuracy			1	%

⁽¹⁾ Always mount with heatsink fins aligned vertically and allow for sufficient airflow.

⁽²⁾ Input resistance is 9.3KΩ.

⁽³⁾ See table below for safe operation area of the AVR.

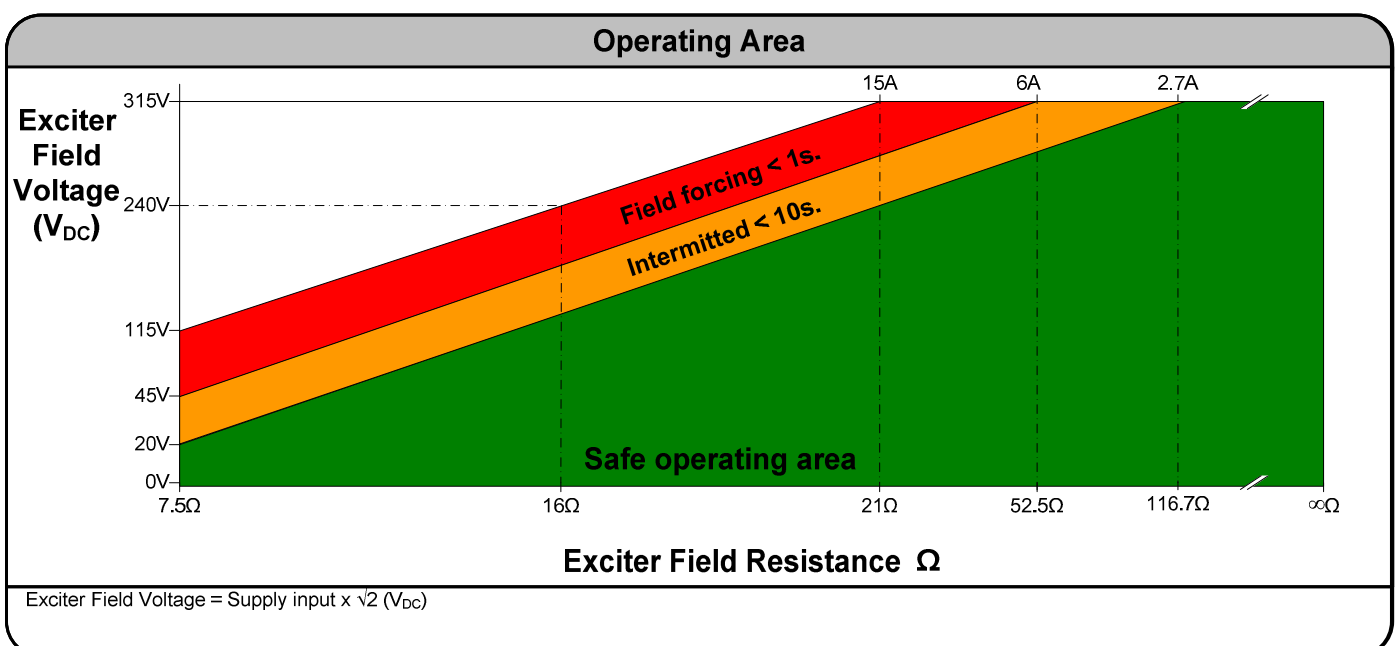
⁽⁴⁾ See formula for calculating minimum field resistance.



$$\text{Field resistance } (\Omega) \geq \frac{\text{Supply input} \times \sqrt{2} \text{ (V}_{\text{DC}}\text{)}}{15}$$

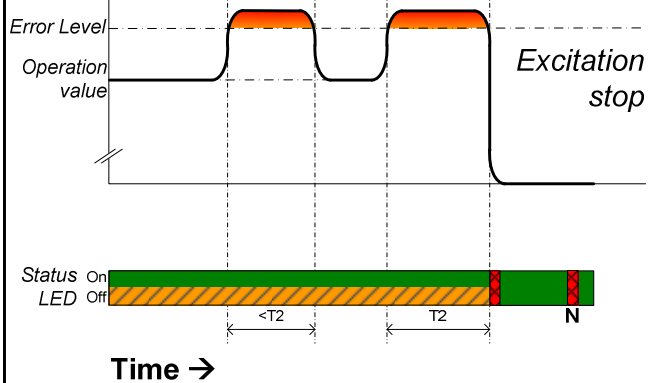


Stresses above “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only, the functional operation of the device or any other conditions indicated in the “operation area” of this specification is not implied. Exposure to maximum rating conditions for extended periods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



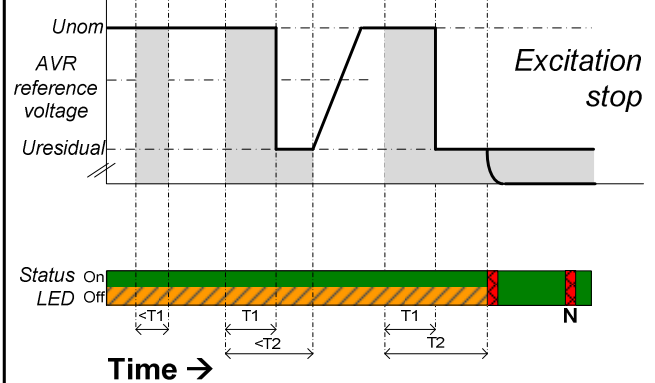
PROTECTIONS

Fault condition : 1, 2, 3, 4, 6



Excitation stop at fault condition.

Fault condition : 5



To recover from "loss of sensing", $Uresidual$ needs to be more than 5% of $Unom$.

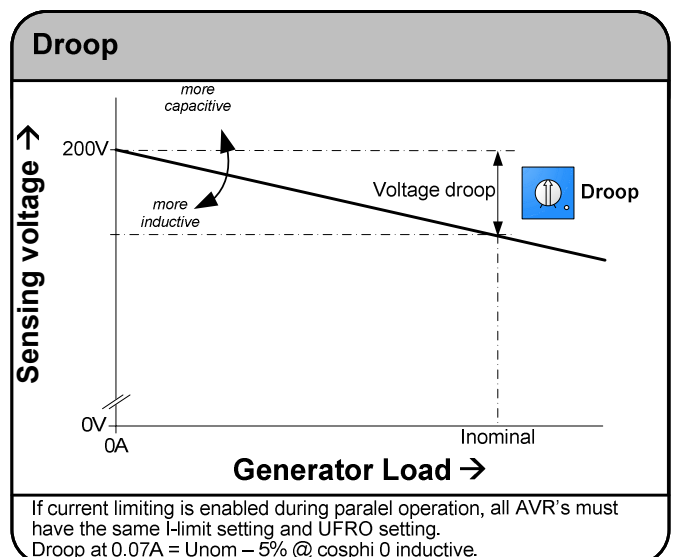
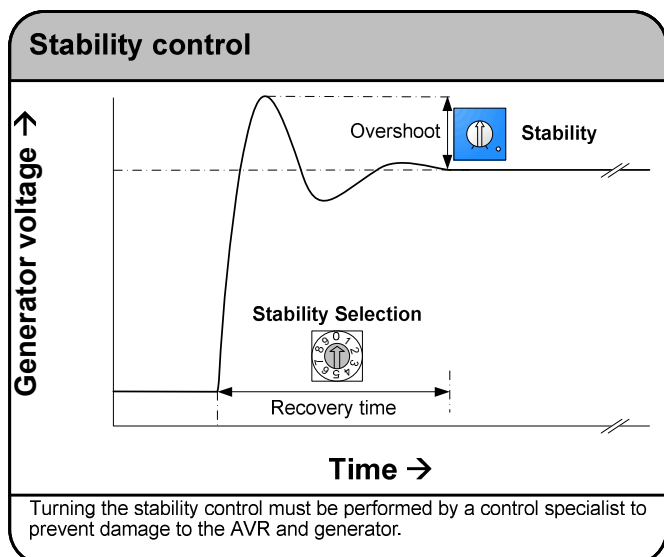
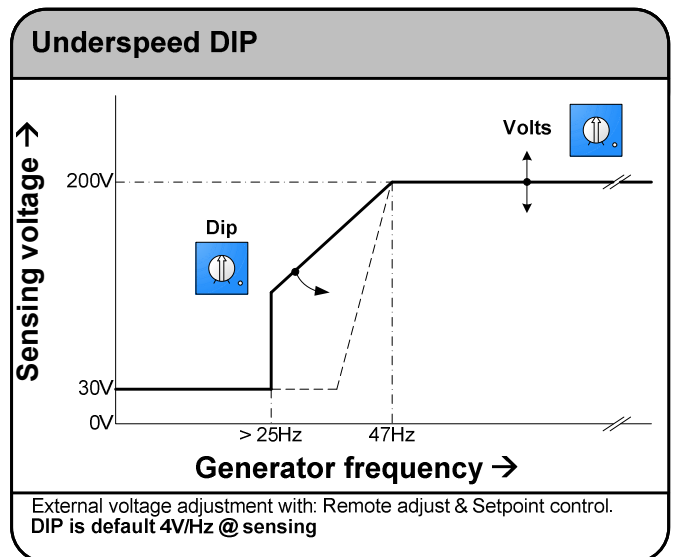
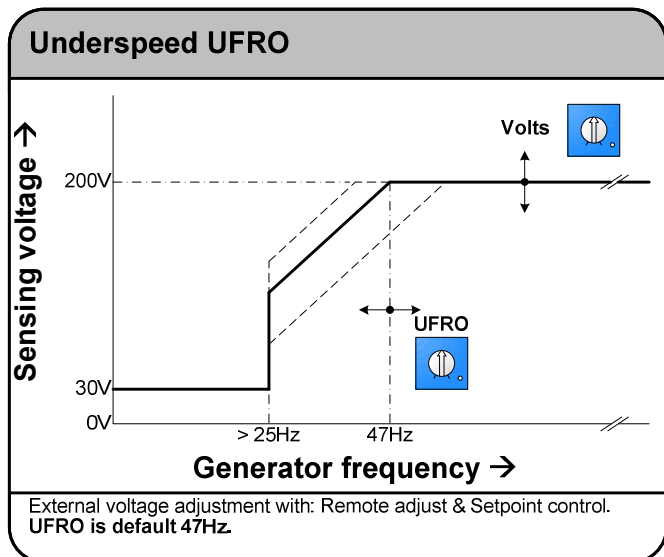
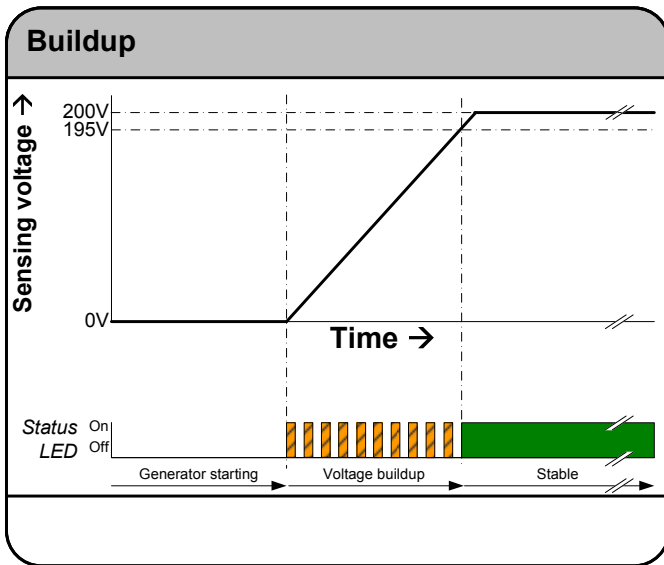
Protection	n	Fault Condition	T1	T2
Over voltage	1	275V at voltage sensing input 2-3	n.a.	2 s.
Over current	2	1A at current sensing input S1-S2	n.a.	15 s.
Over excitation	3	7A	n.a.	10 s.
Over temperature AVR	4	95 °C	n.a.	40 s.
Loss of sensing	5	Loss of sensing	2.5 s.	20 s.
100% excitation	6	Output excitation voltage 100%	n.a.	10 s.

To recover from "loss of sensing", $Uresidual$ needs to be more than 5% of $Unom$.

When a fault condition is active for more than time **T2**, the AVR stops field excitation. The fault is indicated by the status led with **(N)umbers of red blinks**.

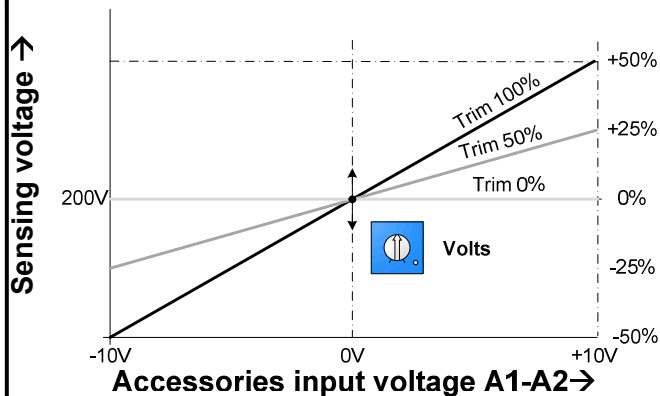
To **reset** the fault, shut down the generator or open contact K1-K2.

MODES OF CONTROL I



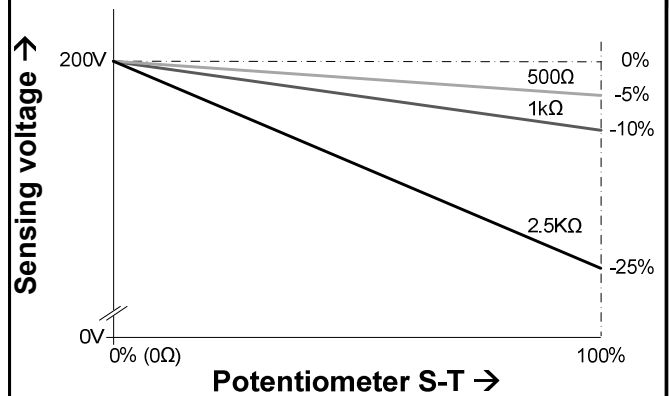
MODES OF CONTROL II

Setpoint control



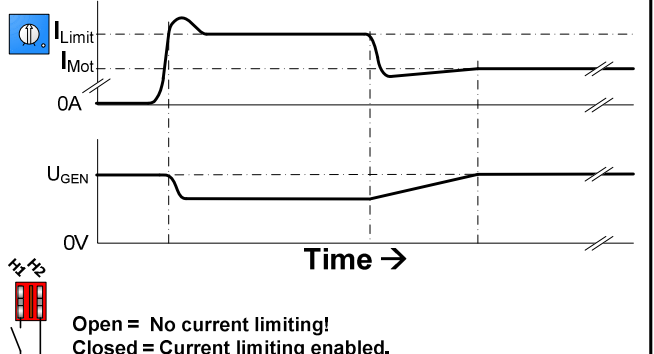
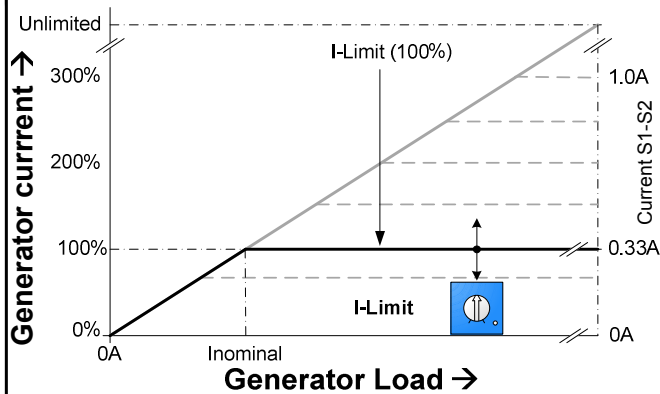
A1 = - (negative) and A2 = + (positive).
Isolated supply must be connected.

Remote adjust



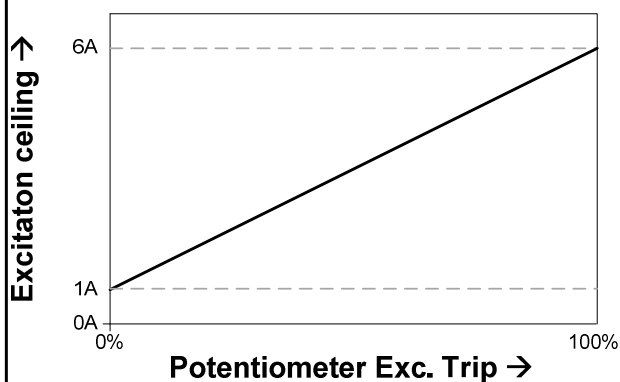
Maximum value at terminal S-T is 2.5kΩ.

I-Limit



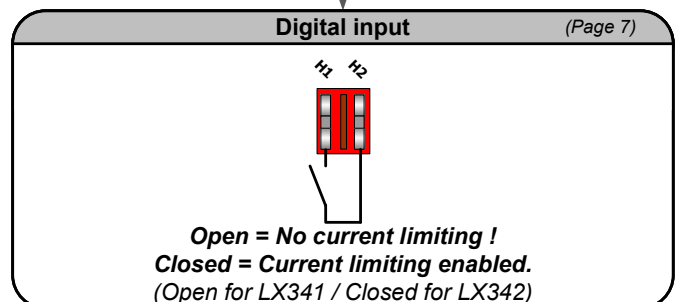
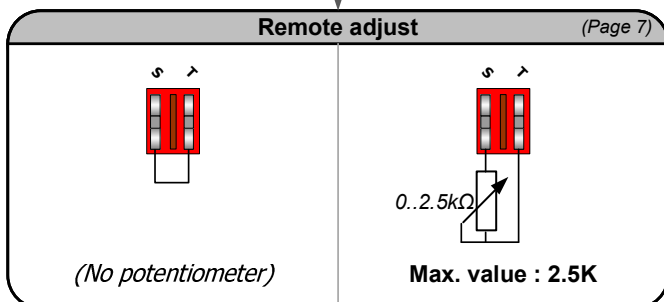
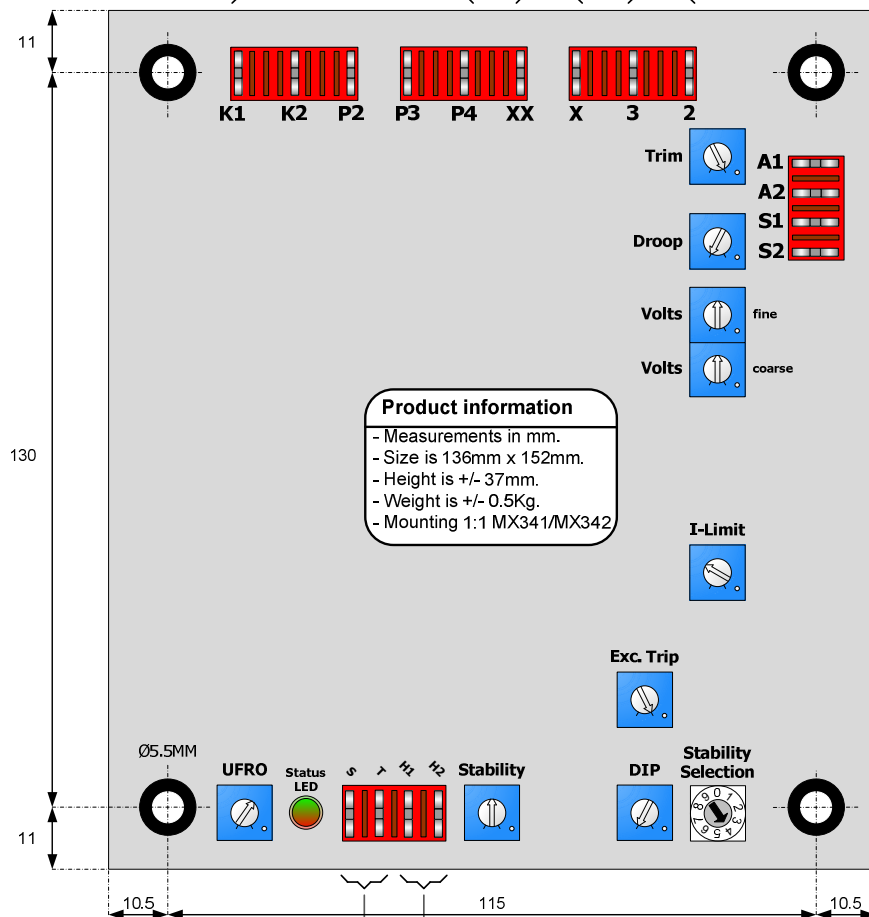
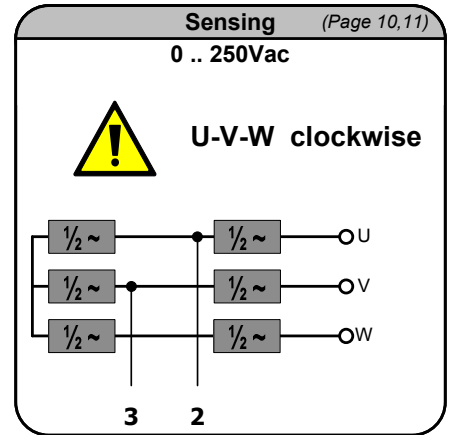
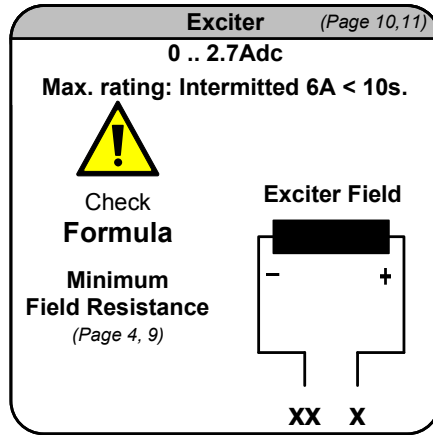
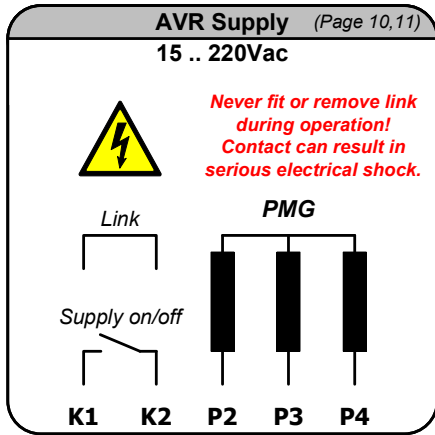
Enable current limiting with input H1-H2.
Changing I-Limit settings above Inominal, must be done by qualified personal and within the limits set by the generator thermal damage curve.

Exc. Trip (Excitation limit)



Exc. Trip is default 6A.


QUICK REFERENCE I




QUICK REFERENCE I I

Volts (Page 6)


fine

-1.5%  +1.5%

coarse


150V  250V

Stability selection (Page 6)




0 < 10kW	5 < 1000kW
1 < 45kW	6 < 1500kW
2 < 90kW	7 < 2000kW
3 < 250kW	8 < 3000kW
4 < 550kW	9 < 5000kW


Stability (Page 6)


Decrease stability  Increase stability

UFRO (Page 6)

Underspeed knee


60Hz  40Hz

 +/- 57Hz

 +/- 47Hz

DIP (Page 6)



Underspeed slope


4V/Hz  16V/Hz

(Slope @ sensing)



Accessories input (Page 7)


Max. rating: -13V .. +13V

A1  A2  Isolated supply (-10V .. +10V)

Trim  0% 100%


Current sensing (Page 7,10,11)

S1  S2  W phase (Original Newage CT) 0.33A 0.33A = 100% I_{gen}

I-Limit  60% 300%

See H1-H2 input

I-Limit (Page 7)

60%  300%

CT:0.33A






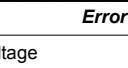
See H1-H2 input

Factory settings

Control mode	: Constant voltage
Sensing	: 200V
UFRO	: 47Hz.
DIP	: 4V/Hz @ sensing
Droop	: 0V
I-Limit	: 0.41A (I-limit Off)
H1-H2	: No link (I-limit Off)
Exc. Trip	: 6A
Stability	: 50 %
Stability selection	: Pos. 4
Trim	: 100 % (1V/5%)


Link: K1-K2, S-T

Status Led


Orange Blink		Buildup
Green Continuous		Voltage control
Orange Continuous		Current control
Green with Orange blink		Underspeed (>25Hz.)
Red Continuous		Underspeed (<25Hz.)
Green with Red blink		Error: (n) number of red blinks

n	Error
1	Over voltage
2	Over current
3	Over excitation
4	Over temperature AVR
5	Loss of sensing
6	100% excitation

Droop (Page 6)

0%  100%

Exc. Trip (Page 7)

1A  6A

Minimum Rfield


Formula

Minimum field resistance

Supply input x $\sqrt{2}$ (V_{DC})

Field resistance (Ω) \geq 15

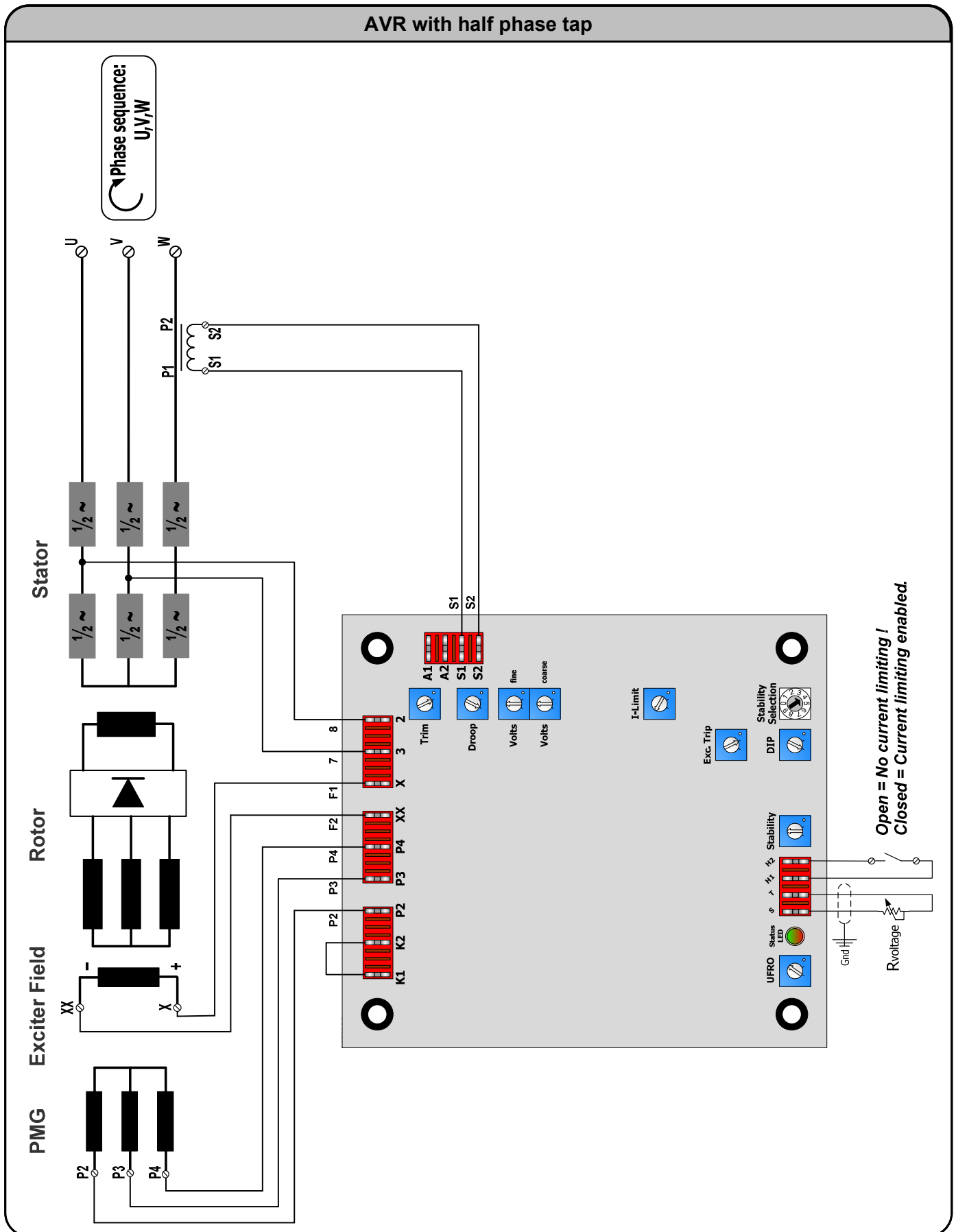
Trim (Page 7)

0%  100%

% of input A1-A2

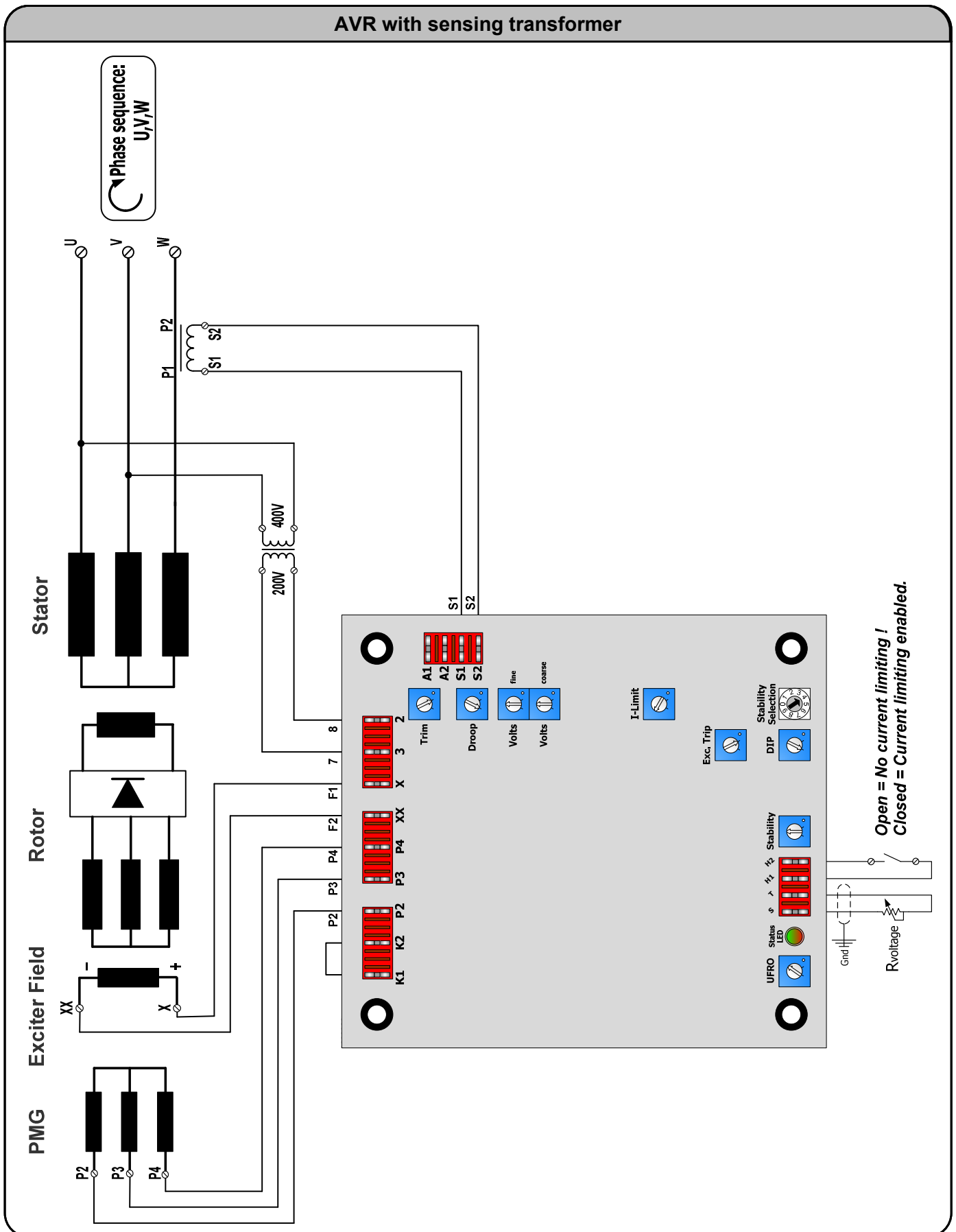
WIRING DIAGRAM I

AVR with half phase tap



WIRING DIAGRAM II

AVR with sensing transformer



COMMISSIONING

Commissioning : Underspeed protection

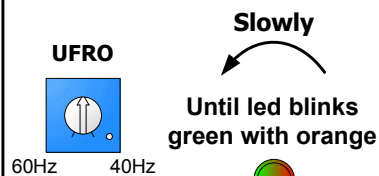
Start (AVR Active / Generator running !)

Underspeed protection

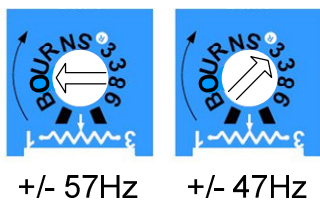
Set speed

Set nominal speed.

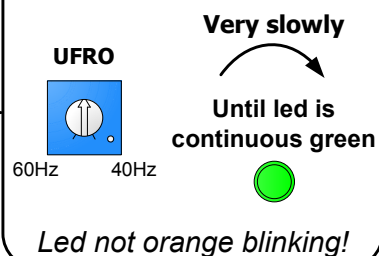
Threshold UFRO



Indication setpoints



Setpoint UFRO



Note:

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

Done

Empty page

Empty page

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.

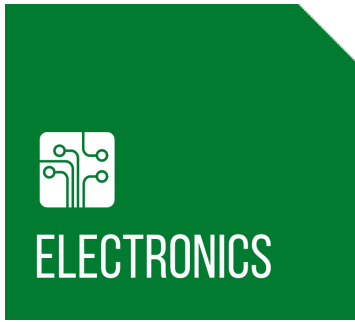
Wiring

- 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 X (+) and XX (-), 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 X (+) and XX (-), 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.

CONTACT



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