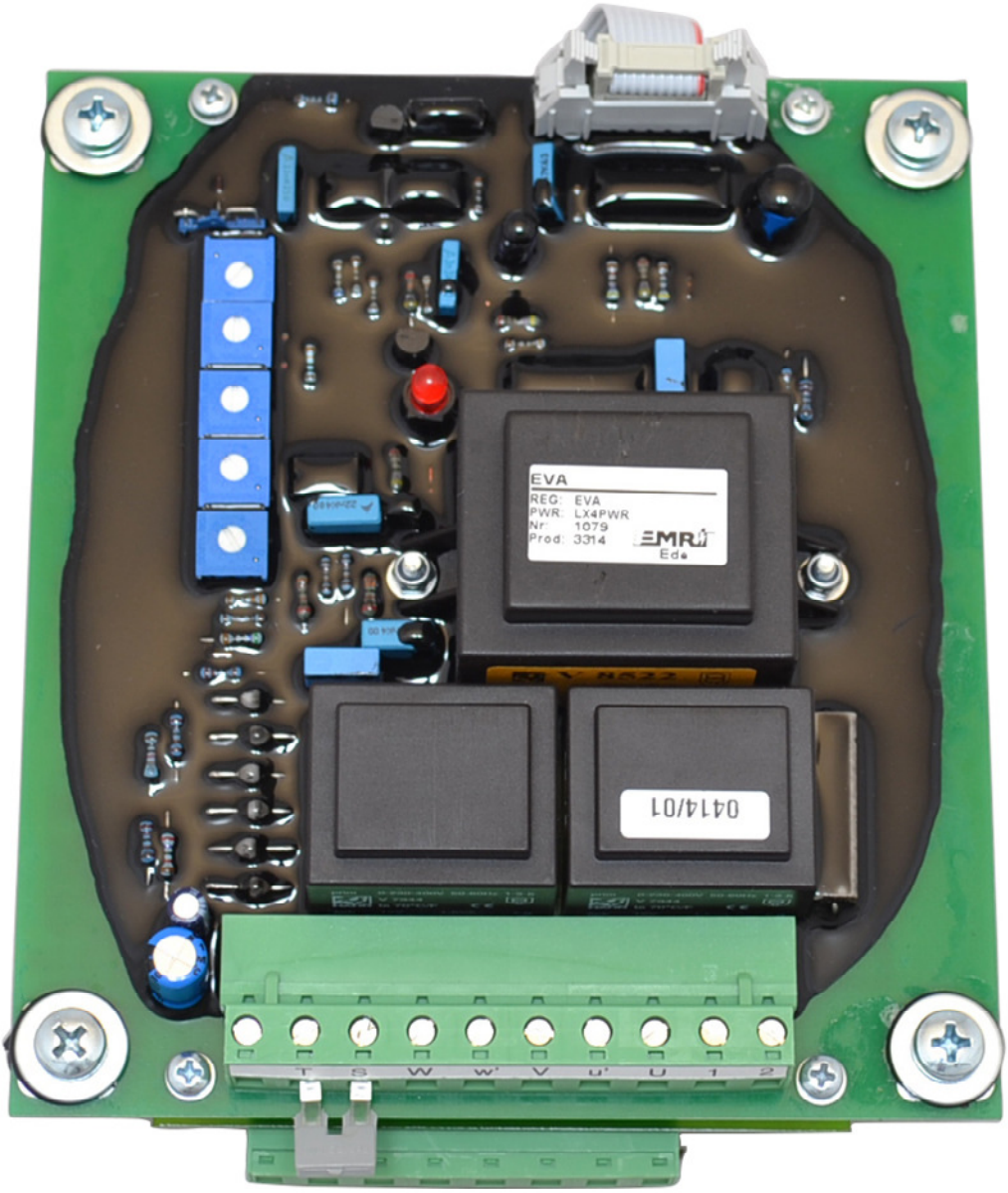
THE POWER OF SYNERGY

EVA

Voltage regulator for generators

Instruction Manual V1.3.1

Product version V1.1.1


EVA
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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 dipswitch settings during operation.

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.

EVA
EME / Van Kaick Alternative

CONDITIONS FOR INSTALLATION and COMMISSIONING

Mounting and commissioning of this product may only be done by qualified people with knowledge of electrical machines !
This product is meant to be build in, in a closed cabinet or machine, so that any contact with persons is excluded.
Do not touch the printed cardboard during operation. High Voltage !
Only use isolated measuring instruments.
EMRI bv points out that this product is meant to be assembled as a component in a system or installation on which the following standards take effect :

89/336 EEG (EMC guidelines)
72/23 EEG (Low voltage guidelines)

General:

The EVA voltage regulator is a replacement for AVR's : R280/290, Ti7.5D, R260/274, R260/261.
The AVR is also applicable in any generator where the excitation current is within the AVR's limits, and there is an auxiliary winding (with voltage within specifications).
The EVA is a constant voltage voltage regulator. An AVR with Volt per Hertz characteristic is available under type LX4. The LX4 has also PTC -winding temperature input as well as excitation current limitation.

Specifications:

Sensing Voltage		
Sensing U,V,W	**:**	**3 x 400 Volt 50/60Hz, max. 500 Volt (sine wave)**
Sensing U=,V,W=	**:**	**3 x 230 Volt 50/60Hz, max. 350 Volt (sine wave)**
Supply LH1,LH2,,LH3 and LH4	**:**	**1x 22 Volt up to 1x 100Volt or 3x15Volt up to 3x100Volt DC or AC untill 400Hz.**
Output voltage	**:**	**Supply voltage**
Output current	**:**	**4 Amp. continuously 10, Amp. max. (1 Second)**
Minimum field resistance	**:**	**ca. 10 Ohm at 120 Volt supply voltage proportional less on decreasing supply voltage**
Adjustment range	**:**	
3 x 400 Volt	**:**	**print potentiometer (S and T shortened) 275-480 Volt**
3 x 230 Volt	**:**	**print potentiometer (S and T shortened) 165-280 Volt**
Accuracy	**:**	**< 1%**
Self excitation	**:**	**from 3 Volt remanent magnetism voltage**
Connectors	**:**	**not mutually exchangeable**
Droop input	**:**	**0.5 A > 1 VA**
Sizes	**:**	**L x W x H : 130 x 150 x 77mm**
Weight	**:**	**890 gram**
Max. temp	**:**	**40 °C**

Protections:

Under speed trip (Ftrip)	**:**	**Adjustable between 40 en 60 Hz and jumper to enable - disable Ftrip**
Fuse	**:**	**6.2 x 32 mm 10 A Ultra Rapid**

Monting and connection

The AVR is preferably mounted on vibration studs. When placed inside a closed cabinet, sufficient cooling masu be obtained. The connection is according the circuit diagram, where as some generators may differ a little, but the inputs LH1 - LH4 are not sensitive for which winding on which terminal.
The terminal LH1, LH2, LH3 and LH4 are the supply voltage terminals. These terminals are electrically connected to the terminals S, T, +_and -. The terminals 1 and 2 are only used for connecting a droop transformer when parallel operation is necessary. If not used these terminal can be shortened. The supply LH1 - LH4 may also be sourced by any auxiliary voltage, as long as this voltage is disconnected when the generator is not running.

Frequency (underspeed) trip

The regulator has a built-in Frequency trip function. This function drops the Generator voltage to approximately 50% of the nominal value, when the generator frequency comes below the adjusted value.
The factory adjustment is 45 Hz. Adjustment is made at nominal frequency by turning the potentiometer counter clock wise until the voltage decreases. Then turn it the other direction until the red LED just goes out.
The frequency of the generator is determined by its rotating speed.
The voltage regulator can not adjust the actual frequency. Do not run the generator on lower speed for longer periods, since this may cause damage to generator and AVR.
The frequency trip may be disabled with the jumper switch.

Self excitation circuit

The EVA voltage regulator has a build in self excitation circuit, which operates from 3 Vac up. This circuit is connected to the terminal LH4.

When only one auxiliary winding is present in the generator to supply the avr, do parallel the supply inputs LH1 and LH3, LH2 and LH4 to divide the current over more input rectifiers.

Parallel operation

If the generator operates in parallel operation with one or more generators, reactive load sharing can be accomplished by means of Quadrature Droop Compensation (QDC). Parallel operation requires an EMRI droopkit. The droopkit must be rated to match the generator nominal current.
In order to obtain a proper load distribution the no-load voltages and the amount of voltage droop during load must be set equal for all generators. The adjustments must be made very precise and under equal conditions for each generator (frequency, current, power factor)

The influence of the voltage droop on the generator voltage is depicted in diagram 2.

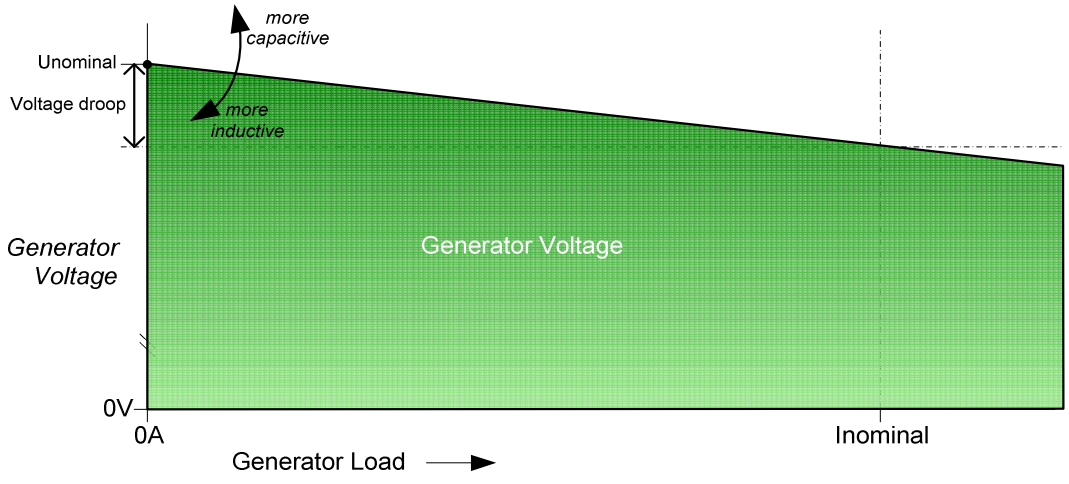
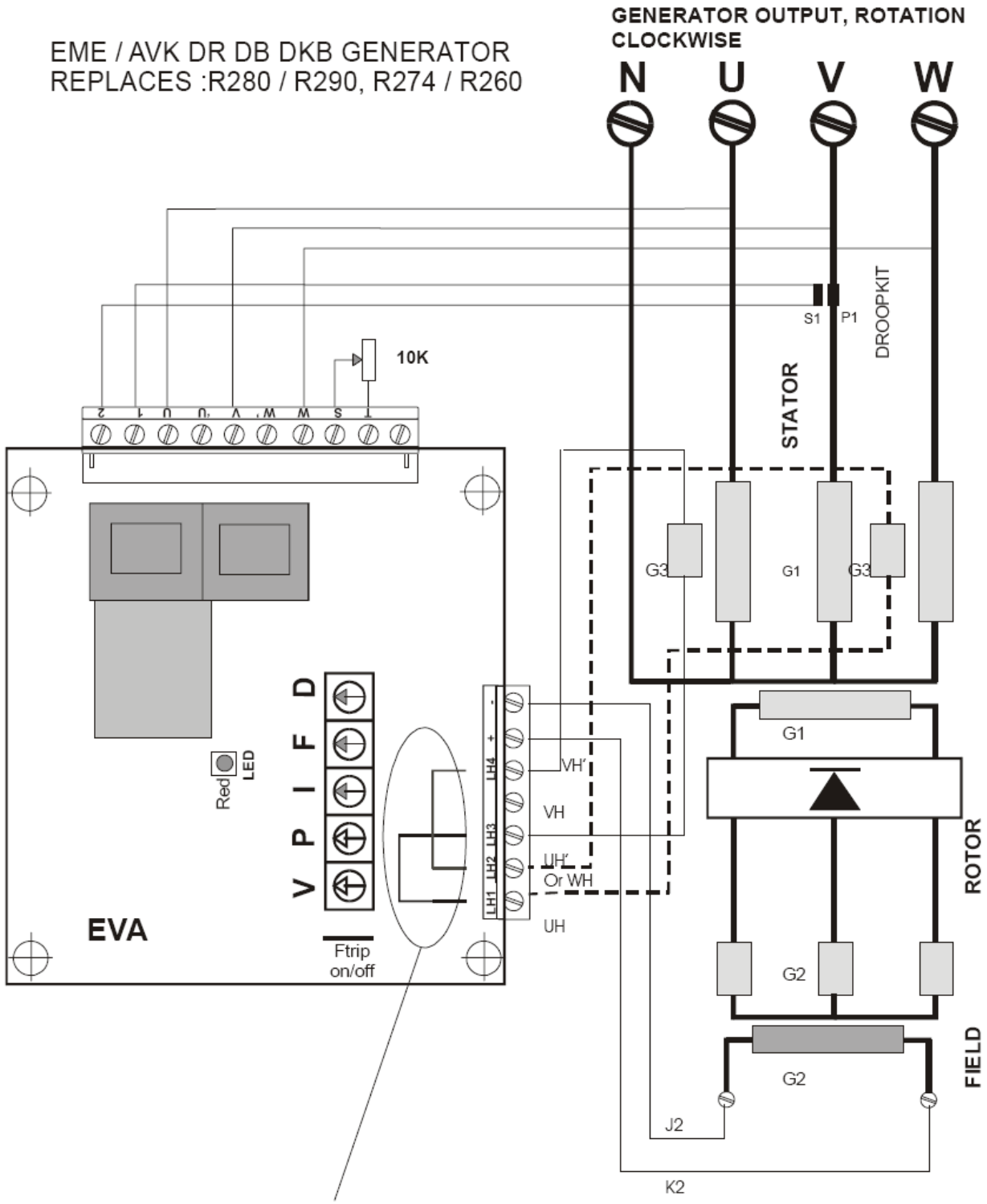


Diagram 2. Voltage droop

WIRING DIAGRAM



When only one auxiliary winding is present, parallel the inputs LH1-LH3 and LH2-LH4 to divide the current.
Machines may be equipped with two exciter fields
(one is compound excited)
The two auxiliary windings may also be
one auxiliary and a tap from the main winding.
These are differences in the AVK types, but can all be handled by the EVA
Use U' - V - W ', when the generator is 230 Volt between the phases at the main terminals

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 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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