Automatic Voltage Regulator User's Manual

Type designation: EA63-5
Application: AMG Synchronous Generator Industrial Application Series

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1. GENERAL INFORMATION

1.1 DESCRIPTION

EA63-5 is an automatic voltage regulator (AVR) for AMG synchronous generator industrial application series. The AVR is typically supplied by a single-phase auxiliary winding wound into the stator slots. It also can be supplied by permanent magnet generator （PMG）or phase voltage of main terminal.

1.2 SPECIFICATION

Table 1: Specifications.

Sensing input

Voltage: 220/440 VAC (SW1 selectable).
185-290 VAC at 220 VAC.
330-515 VAC at 440 VAC.
Frequency: 50/60 Hz (SW3 selectable).
49-60 Hz at 60 Hz, preset 57Hz.
40-50 Hz at 50 Hz, preset 47Hz.

Power input

Voltage: 30-260 VAC.
Frequency: 40-500 Hz.

Output

Voltage: 85 VDC at 110 VAC input.
170 VDC at 220 VAC input.
Current: continuous 5 ADC.
maximum 40 ADC.

Voltage built-up

Residual voltage >5 VAC at 25 Hz.

Voltage adjustment

<1.0 % (engine speed variation within 4 %).

Excitation resistance

>9 Ω.

Current compensation

1 or 5 A>0.2 VA (SW2 selectable).

Voltage built-up

Residual voltage >5 VAC at 25 Hz.
Max ±7% at p.f. ±0.7.

Analogue voltage input

Un 0-15% at 0-10 VDC.

External voltage adjustment VR

±10 % with 1 kΩ resistance (0.5 W).

C+, C-

External filter capacitor terminal.

Respond time

<1 cycle.

Temperature drift

<0.45 % at -35 to +65℃.

Dissipation

12 W.

Dimensions

140 mm x 125 mm x 43 mm.

1.3 DIMENSIONS

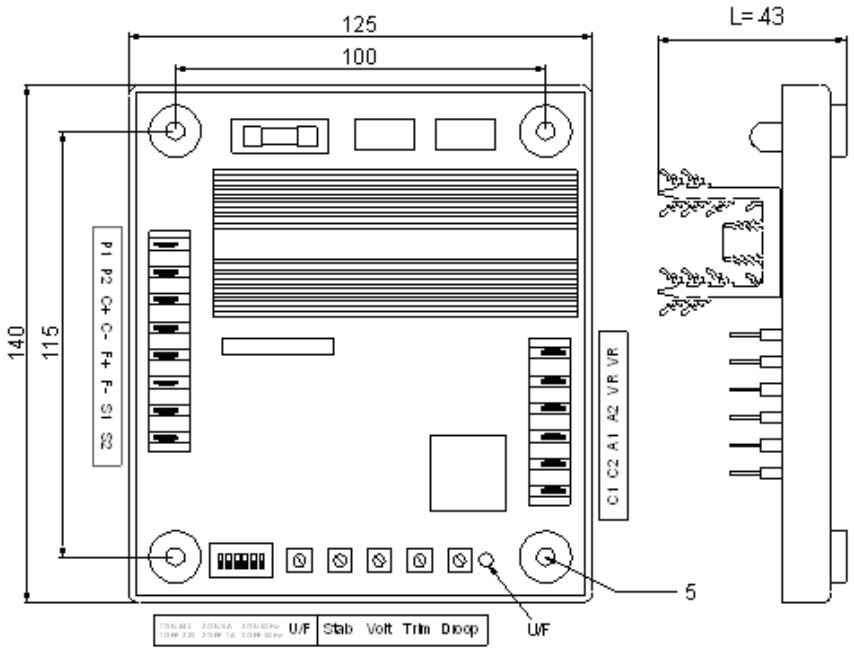

Figure 1: AVR outline drawing.

For enclosure dimensions and mounting holes refer to Figure 1. The protection fuse capacity is 5 A/250 V (slow blow type).

Attention!

All voltage readings are to be taken with an average-reading voltmeter Meggers and high-potential test equipment must not be used. Use of such equipment could damage the AVR.

Safely secure all wiring connection. Do not install AVR at place with high vibration to prevent loosen connection. For safety reasons please do not touch the heat sink while operating.

2. ADJUSTMENTS

2.1 DIP SWITCH ADJUSTMENT

2.1.1 SW 1 (see: Figure 2) voltage selection. SW 1 is used to select the suitable genset's sensing input voltage (S1, S2). When sensing input is 440 VAC (380-480 V), switch the SW 1 to 'ON'. If the sensing input is 220 VAC, switch SW 1 to 'OFF' position.

ATTENTION! If system voltage is 220 V but the SW 1 is set to 'ON' position (440V), it will cause over voltage.

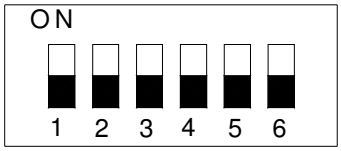

Figure 2: Dip switch (SW).

2.1.2 SW 2 (see: Figure 2) is used to select the suitable current transformer's current input (C1, C2). If current transformer's current is 5 A, switch SW 2 to 'ON' position. If the current is 1 A, switch SW 2 to 'OFF' position.

2.1.3 SW 3 (see: Figure 2) is used for frequency selection. If genset's rated frequency is 60 Hz, switch SW 3 to 'ON' position. If rated frequency is 50 Hz switch SW 3 to 'OFF' position.

ATTENTION! If 60 Hz frequency is selected, while the rated frequency of the generator is 50 Hz, it may result the under voltage fault.

ATTENTION! If a 60 Hz generator is used, but selected frequency is 50 Hz, stop the engine. The over excitation current may damage AVR and generator.

2.1.4 If genset power is less than 90 kW switch SW 4, SW 5 and SW 6 to 'OFF' position (see: Figure 2). If the power is 90-200 kW, switch SW 4 to 'ON' position. SW 5 and SW 6 remain in 'OFF' position. If the power is more than 200 kW, switch SW 4, SW 5 and SW 6 to 'ON' position.

ATTENTION! Each time when SW 4, SW 5 or SW 6 positions are changed, the stability (STAB) must be re-adjusted to achieve the optimum genset performance. The setting of the dip switches (SW) must be conducted while the generator is not in operation.

2.2 TRIMMER ADJUSTMENT

VOLT Voltage setting (see: Figure 3) is used to adjust the genset's rated output voltage. When SW 1 is 'ON' (440 V), the adjustable range is 330-515 VAC. When SW 1 is 'OFF' (220 V), the adjustable range is 180-270 VAC.

ATTENTION! AVR AC voltage readings are all average values.

Ext. potentiometer Connect 0.5 W potentiometer with 500 Ω resistance to the VR terminal (see: Figure 3). The adjustable voltage range is ±5 % of Un. With 1 KΩ resistor the adjustable voltage range is ±10 % of Un. If this function is not required, please short circuit these two terminals.

STAB Stability adjustment (see: Figure 3). It must be conducted while the generator is operating without load. At first, adjust the STAB potentiometer (POT) clockwise until the voltage becomes unstable. Then, adjust to anti-clockwise (approximately 1/5 of rotation) as the voltage just reaches the critical point (knee point) of stabilization. The voltage is now stable, but very close to become unstable.

U/F Under frequency protection adjustment (see: Figure 3). When generator's driving speed falls below the knee point, the under frequency protection circuit will begin to intervene. The voltage and frequency begin to decrease in linear descend. Coordinate with the dip switch SW 3 to make the frequency selection of 50 or 60 Hz. When selecting 50 Hz, the adjustable range is from 40-50 Hz and the factory presets is at 47 Hz. When selecting 60 Hz, the adjustable range is from 49-60 Hz and the factory presets is at 57 Hz.

U/FL When under frequency protection is activated (see: Figure 3), the red LED will light up.

DROOP Droop adjustment (see: Figure 3). When paralleling, the AVR compensates the input rating and voltage shifting based on load current. This is based on AVR's internal circuit calculation. This way the AVR increases or decreases the voltage. When phase current lags the voltage, AVR decreases original voltage setting, and if the phase current leads the voltage it increases the original voltage setting. The increase and decrease range can be preset by the DROOP adjustment.

TRIM Analogue voltage input sensitivity (see: Figure 3). When terminals A1 and A2 are added with a DC input (0-10 VDC), the TRIM is used to adjust the influence level from the DC input to the rated voltage. If the TRIM potential (POT) is adjusted fully to counter-clockwise, the additional signal will not cause any influence. If the TRIM is adjusted fully clockwise, then the additional signal will produce a maximum effect.

3. CONNECTION

3.1 TERMINALS

P1, P2 Auxiliary winding power input *(see: figure 3)*.

PMG power input *(see: figure 4)*.

The input range is 30-260 VAC at 40-500 Hz.

C+, C- External filter capacitor terminal *(see: figure 3)*. The filter voltage endurance must be greater than 1.7 x voltage between P1 and P2.

F+, F- Excitation output *(see: figure 3)*. Connect to generator excitation winding.

VR External voltage adjustment *(see: figure 3)*. Use 1 W VR (with 1KΩ resistance). Voltage adjustable range is now ± 10 %. If this function is not required, please short circuit these two terminals.

C1, C2 Load current compensation *(see: figure 3)*. Input range is 1 A or 5 A (selected by SW 2) >0.2 VA.

S1, S2 Sensing input *(see: figure* 3). Input range 220 or 440 VAC (selected by SW 1). Input resistance is >2 MΩ.

A1, A2 Analogue voltage input terminal *(see: figure 3).*

3.2 CONNECTION DIAGRAM

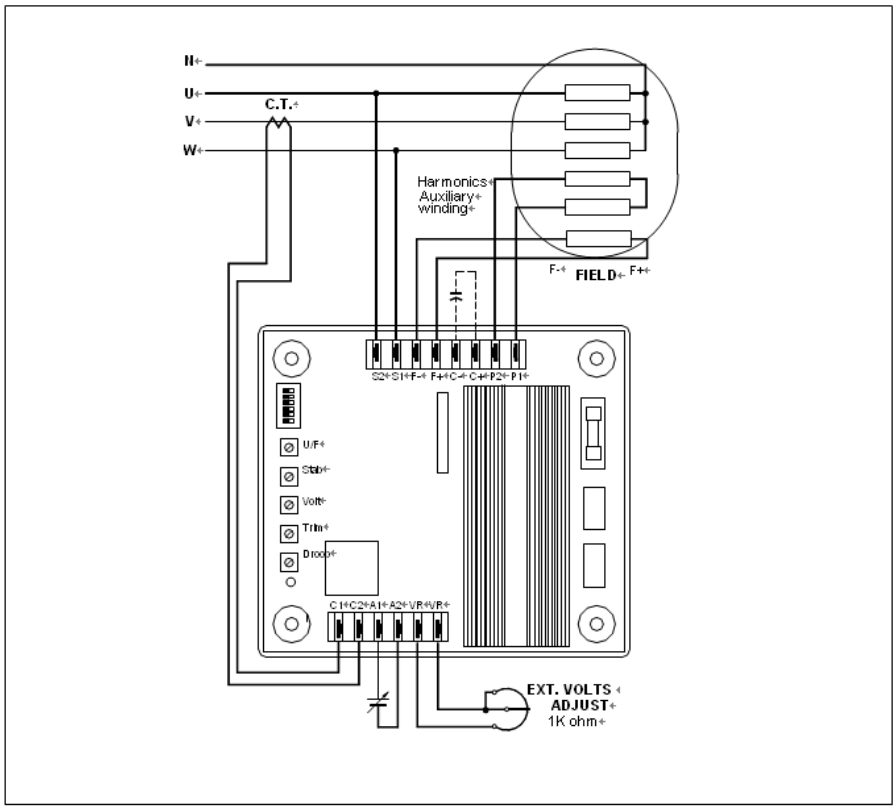

Figure 3: Connection diagram (Power input: Auxiliary winding).

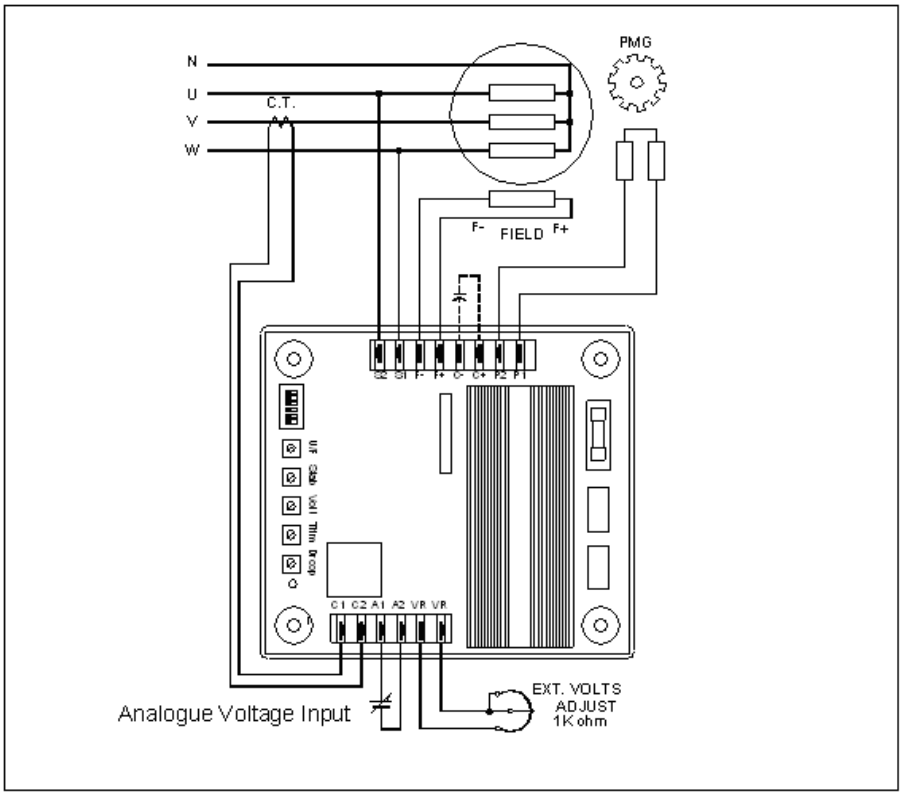

Figure 4: Connection diagram (Power input: PMG).

4. TROUBLE SHOOTING

The following instructions are intended to assist in localizing a fault within the excitation system as a whole. However, it is not possible to deal with all eventualities in full.

Table 2: Trouble shooting.

FAILURE	POSSIBLE CAUSE	ACTION
Voltage not built up.	Low remanence. AVR wires disconnected. Problem with rectifier bridge. Defective AVR. Defective generator	Make separate excitation running, then make self-excitation running. Check AVR connections. Check the diode. Change AVR. Refer generator manual.
Low voltage.	AVR wires disconnected Defective generator. Problem with rectifier bridge. Generator below allowed frequency.	Check AVR connections. Refer to generator manual. Change the diode. Correct engine speed.
High voltage.	Original AVR settings incorrect. AVR wires disconnected. Defective AVR.	Adjust VOLT-trimmer. Check AVR connections. Change AVR.
Voltage unstable.	Original AVR settings incorrect. Variable running speed. AVR connections wrong. Defective AVR.	Adjust STAB-trimmer. Correct engine speed. Check AVR terminals. Change AVR.
Voltage lost during running.	Defective generator. Defective rectifier. Defective AVR.	Refer to generator manual. Change invalid parts. Change AVR.