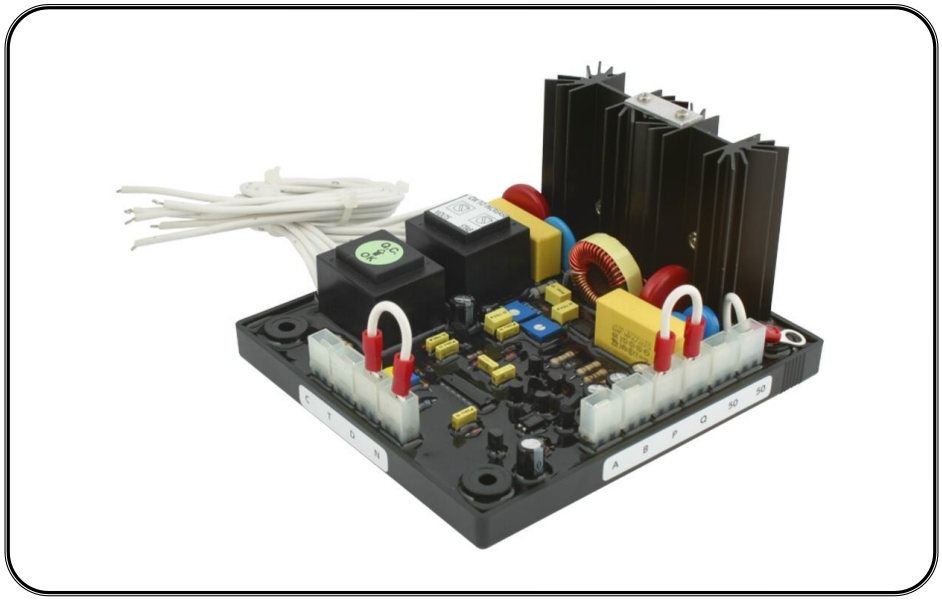
EA42-7

Generator Automatic Voltage Regulator
Operation Manual



Self Excited Automatic Voltage Regulator
Compatible with Basler AEC42-7*
* Use for reference purpose only and not a genuine Basler product.

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ISO 9001
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1. INTRODUCTION

Sensing Input

Voltage 220 ~ 252 VAC ± 10%, 1 phase
Frequency 50 / 60 Hz selectable

Power Input

Voltage 200 ~ 260 VAC ± 10%, 1phase 2wire
Frequency 50 / 60 Hz

Output

Voltage Max. 42 VDC
Current Continuous 7A
Intermittent 15A for 10 sec
Resistance Min. 6 ohm Max. 105 ohm

Voltage Regulation

< ± 1% (with 4% engine governing)

Voltage Build-up

Residual voltage at AVR terminal > 5 VAC

Voltage Adjustable Range

180 ~ 277 VAC

Thermal Drift

0.05% per °C change in AVR ambient

External Volts Adjustment

± 10% with 1K ohm 1 watt trimmer

EMI Suppression

Internal electromagnetic interference filtering

Unit Power Dissipation

Max. 20 watt

Under Frequency Protection (Factory Setting)

60 Hz system presets knee point at 55 Hz
50 Hz system presets knee point at 45 Hz

Over Excitation Shutdown

Field volts shut down after a time delay
If exciter field volts exceed 52 ± 2 VDC

Quadrature Droop

Max. Sensitivity 1 VAC 2%
Max. Input 5 VAC @ 5 ohm Burden

Dimensions

140mm L * 125mm W * 79.4mm H

Weight

680g ± 2%

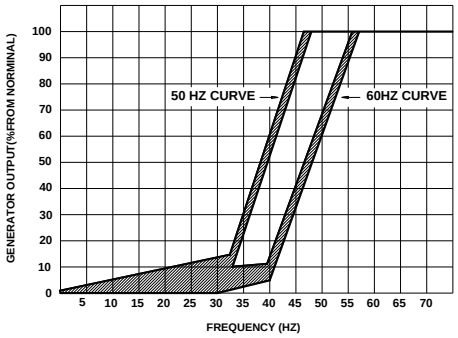


Figure 1 Frequency Compensation Curves

FREQUENCY COMPENATION (See Figure 1)

1. The frequency compensation characteristic of Figure 1 used to improve system load pickup performance by restraining voltage recovery until frequency has also started to recover.

2. The regulator is shipped from the factory set at a 45 Hz “corner frequency” for 50 Hz systems. For 60 Hz systems, a 55 Hz corner frequency is achieved by removing the “50-50” external link.

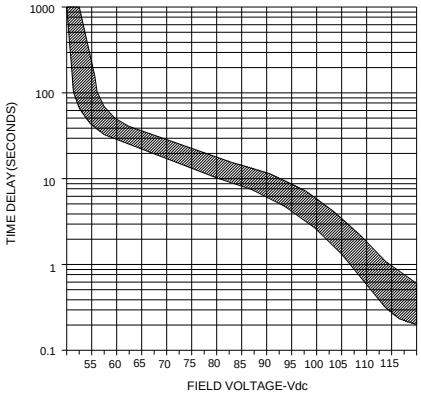
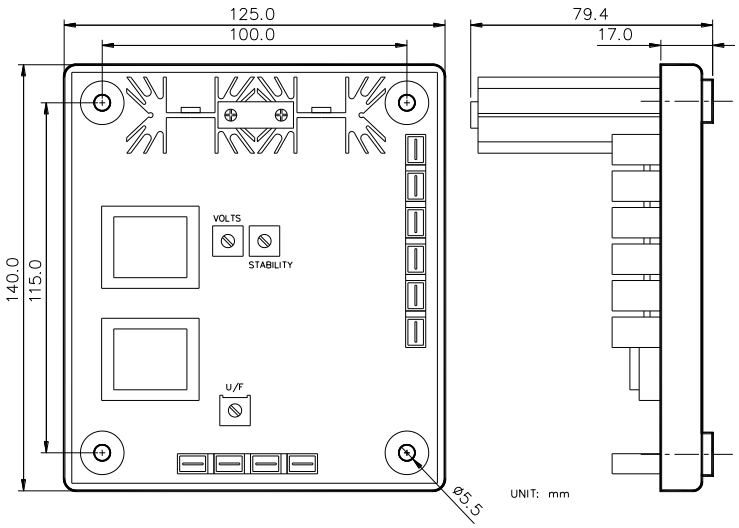


Figure 2 Typical Time Delay Characteristic Curve

OVER-EXCITATION TIME DELAY

If exciter voltage exceeds 52 ± 2 Vdc, the regulator automatically removes the field current, after a time delay. The time delay is inversely proportional to the magnitude of the detected field over voltage condition up to 95 ± 5 Vdc point. Beyond 95 ± 5 Vdc, the field voltage is removed at a much faster rate. This shutdown function may be disabled for parallel operation by linking terminals N and D together.



Outline Drawing
Figure 3

MOUNTING

The regulator may be mounted on the generator in any convenient position. Refer to outline drawing Figure 2-1. Figure 2-2 provides the drilling template.

NOTE !

The ground terminal must be bonded either to a metal ground by the mounting screw or by means of a cable to the most suitable earthing point available close to the requlator.

2. WIRING

2.1 Exciter Fileld Power Circuit

- Connect regulator + wire to the brushless exciter field F+ terminal, and the – wire to the field F- terminal. Refer to Figure 5.
- If the exciter field resistance is less than 6 ohms, and if the full-load field current does not exceed the maximum continuous current rating of the regulator (7 Adc), a resistor of sufficient wattage must be added in series with the field to bring the total resistance to 6 ohms.

CAUTION !

The DC resistance of the exciter field must be equal to or greater than 6 ohms and less than 100 ohms.

2.2 Power Input

Connect wiring as shown in Figure 5. Power for the regulator is derived from the generator auxiliary winding, connected to wires 3 and 4. The operable power input range is 171 ~ 264 VAC.

2.3 Sensing Input

For sensing, wires U and V are connected to the generator phase U and phase V respectively. Wires X and Y are connected to the opposite ends of the U and V phase coils, or commoned together at the Neutral (star) point.

2.4 Quadrature Droop Input

When paralleling is required, a current transformer (C.T.) and variable burden resistor (rheostat) should be connected to terminals A and B. The ratio of the C.T. and the maximum value of the burden must be chosen so that at maximum current the voltage applied to terminals A and B does not exceed 5 VAC rms. A suitable value of burden would be a rheostat adjustable from 0~5 ohms (10 Watts) for a C.T. with a 1 Aac secondary current at full load. These terminals may either be linked or left open when paralleling is not required.

2.5 Fuses

It is recommended that a fuse or fuses with high interruption capability be installed per ther interconnection diagram. A suitable fuse type would be LittlefuseTM type 3AG, rated 250 VAC, 6,3 A, “SLOBLO”. Dimensions are 6.3 mm × 32 mm ($1_{1/4}^{M}$ × $_{1/4}^{M}$).

NOTE :

Fuse(s) MUST be installed per interconnection diagram to avoid interrupting field current directly.

2.6 Voltage Adjust Rheostat (V)

- An internal screw-driver pre-set (V) provides coarse adjustment of generator output voltage. Adjustment of V clockwise increases voltage.

- The voltage regulator is shipped from the factory with a link across terminals P and Q. If a remote voltage adjust rheostat is used, the link should be removed and the Rheostat connected to P and Q. A 1 ohm, 1W. Potentiometer will provide a “fine” voltage range adjustment of approximately ± 10% over most of the coarse range of adjustment.

  See Figure 4 interconnection diagram.

2.7 V/Hz “Corner Frequency” Selection

For 50 Hz systems, the regulator is pre-set at the factory for a 45 Hz “ corner frequency ”, and a link fitted across terminals “50”. If operation at 60 Hz is required, this link should be removed; the “ corner frequency ” is now set to 55 Hz. Do not operate the system at 60 Hz with the 50 Hz link still in place.

2.8 Over-Excitation Shutdown

- Over-excitation shutdown is provided to remove output excitation should the regulator’s output voltage exceeds 52 ± 2 Vdc for a sufficient time. The inverse-time delay curve is shown in Figure 1-2. For voltage above 95 ± 5 Vdc, there is a second and much shorter inverse time curve.
- After output power is removed, the regulator can be reset by decreasing the input voltage to less than 5 Vac for a minimum of 2 seconds; this may be .accomplished by stopping the prime mover or interrupting the regulator input by means of a reset switch.
- In cases where the generator is operating in a parallel mode, it is sometimes considered undesirable to allow the regulator to shut down, which may cause the generator to be “ motored”. The regulator is provided with terminals N and D, which may be linked together to prevent over-excitation shutdown. Note however that continuous running at output levels greater than the continuous rating may result in eventual regulator failure, and that other means should be employed to protect the system.

3. OPERATION PROCEDURE

3.1 General

- The following system operation procedures provide instructions for adjusting the EA42-7 voltage regulator. Symptoms resulting form a faulty regulator and certain generator system problems are included, together with suggested remedies.
- Complete the following steps before proceeding with system start-up.

CAUTION !

Meggers and high-potential test equipment must not be used. Incorrect use of such equipment could damage the semiconductors used in the regulator.

3.2 Preliminary Set-Up

- Verity that the voltage regulator specifications conform with the generator system requirements.
- Ensure that the regulator links are fitted correctly where required, as follows:

1. If the remote voltage adjust rheostat is not required, ensure terminals P and Q are linked together.
2. If a 55 Hz corner frequency for 60 Hz systems desired, ensure the “ 50~50 ” link is removed. If a 45 Hz corner frequency for 50 Hz systems is desired, ensure the “ 50~50 ” link is connected.
3. If the system is to be run in parallel, consider whether shutdown of the generator’s excitation is acceptable. If not, ensure that the link between terminals N and D is in place.

- Ensure the voltage regulator is correctly connected to the generator system; F+ to field positive, F- to field negative, and terminals 3 and 4 to the auxiliary winding supply. It is vital that the sensing connections are correctly made to all 4 wires U, V, X, and Y. Ensure the metal ring tag at one mounting hole is bonded to ground via either a metal screw or shout length of cable.
- Install the fuses as per paragraph 2-5.
- Set the regulator and external voltage adjust, if used, as follows :

Regulator Volts Adjust “ V ”	Fully CCW
Remote Volts Adjust	Centered
Stability Adjust “ S ”	Centered

3.3 System Start-Up

- Perform preliminary set-up, per paragraph 3.2, checking wiring carefully.

NOTE :

All AC voltage readings are to be taken with an “ average ” reading voltmeter.

- Start Prime-mover and bring up to rated speed.

RESULT :

Voltage should build up to less than nominal value. If not, proceed to paragraph 3.4.

- Slowly adjust the regulator voltage adjust V until the generator output voltage reaches the nominal value. Should a low frequency oscillation or hunting be present on the generator output voltage, adjust stability control S to cause this to be damped out. In general, " Clockwise " increases the stability but in some cases, too far CW may start to reduce stability again, and will invariably slow the response of the generator to load changes. An optimum method of setting is to adjust S slowly CCW until the generator voltage just starts to become unstable, then up to 1/4 turn CW from that position.
- If used, adjust the external voltage adjust rheostat to fine trim the voltage to the exact value desired.

RESULT :

Voltage should now have built up and be stable at the desired value. If voltage does not build to rated value, check that there is no short circuit or excessive load present on the generator lines. If a minimum residual of 5 Vac is not present, perform " field flashing " per paragraph 3.4.

- Check regulator under normal operating and loading conditions.

RESULT :

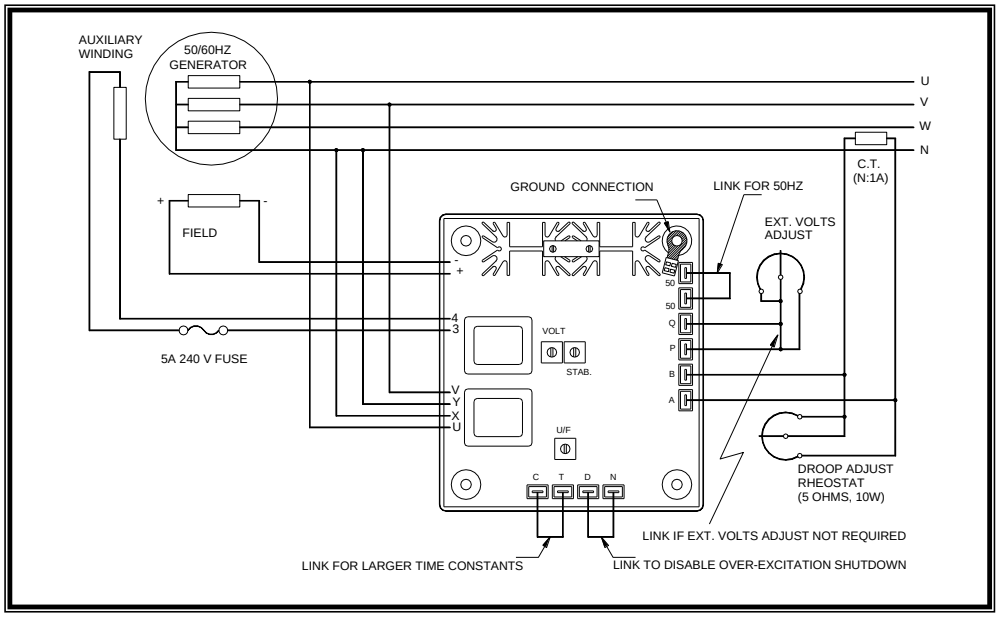
Voltage regulation should be better than $\pm$ 1.0% no-load to full-load. If regulation is not within this range, check the following :

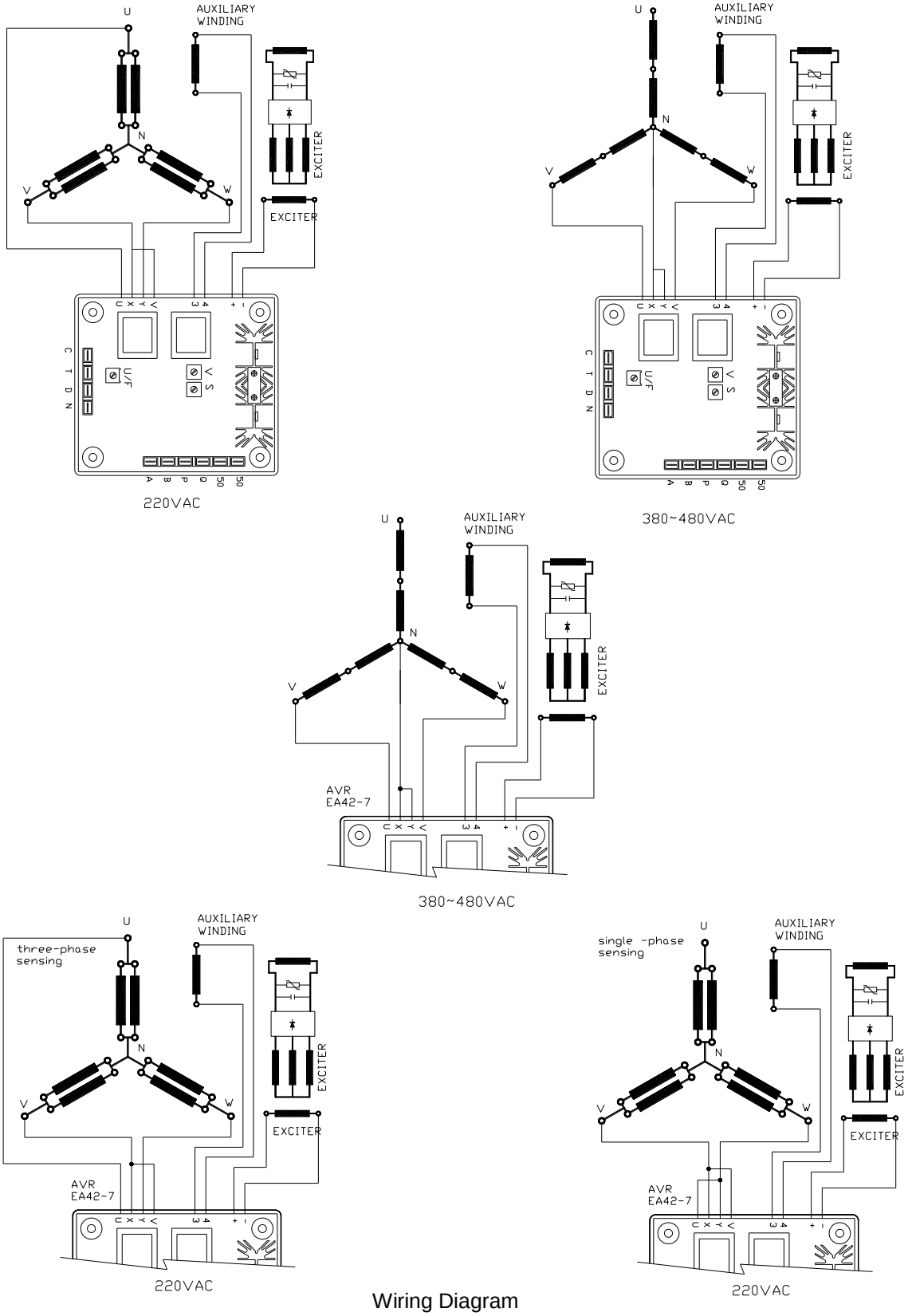
1. Voltage reduction under loads of $\cos\theta > 0.0$ may be due to speed reduction due to loading of the prime mover. This may be causing the frequency compensation (V/Hz) circuit to reduce voltage at a speed which is less than the " corner frequency ".
2. Replace voltage regulator.

3.4 Field Flashing

When the regulator is operated with the generator for the first time, the polarity of residual magnetism may be reversed or too small to achieve the necessary build-up voltage for the regulator. If reversing the field connections does not induce build-up, and the residual voltage is less than the specified value of 5 Vac, shut down the Prime-mover and proceed with the following steps :

- With the Prime-mover at rest and the regulator's field output wires disconnected, apply a DC source (NOT grounded) of not more than 3~12 Vdc with Positive to F+ and Negative to F-, in series with a current-limiting resistor of 3~5 ohms 20 watt. (The set battery is a suitable source.)
- Allow approximately 3 seconds before removing the DC source.
- With the voltage regulator disconnected (wires 3 and 4), start the prime mover and measure the " residual " voltage available at the auxiliary winding. If this voltage is greater than 5 Vac, reconnect voltage regulator, and voltage build-up should be successful. If less than 5 Vac is measured, repeat field flashing procedure.
- If repeating steps a. and b. does not result in generator voltage build-up, and residual is greater than 5 Vac, replace voltage regulator.





Wiring Diagram
Figure 5