

SE350EL

Generator Automatic
Voltage Regulator
Operation Manual



A Regal Brand

REGAL

1. SPECIFICATION

Sensing & Power Input

Voltage 85 ~ 120 VAC / 190 ~ 240 VAC
Frequency 50 / 60 Hz, Jumper selectable

Output

Voltage Max. 73 VDC @ 220 VAC input
Current Continuous 3.5A
Intermittent 7A for 10 sec
(52 / 105VDC)
Resistance Min. 15 ohm Max. 100 ohm

Voltage Regulation

< $\pm 1\%$ (with 4% engine governing)

Voltage Build-up

Residual voltage at AVR terminal > 5 VAC

Operating Temperature

- 40°C to + 60°C

Storage Temperature

- 65°C to + 85°C

Burden

500VA MAX

External Volts Adjustment

$\pm 5\%$ with 1K ohm 1 watt trimmer
 $\pm 10\%$ with 2K ohm 1 watt trimmer

EMI Suppression

Internal electromagnetic interference filtering

Unit Power Dissipation

Max. 8 watt

Under Frequency Protection (Factory Setting)

60 Hz system presets knee point at 54 ~ 61 Hz
50 Hz system presets knee point at 45 ~ 51 Hz

Dimensions

99.5mm L * 67mm W * 47.5mm H

Weight

205g $\pm 2\%$

Fuse

T6.3AH250V Part# A-527066-2

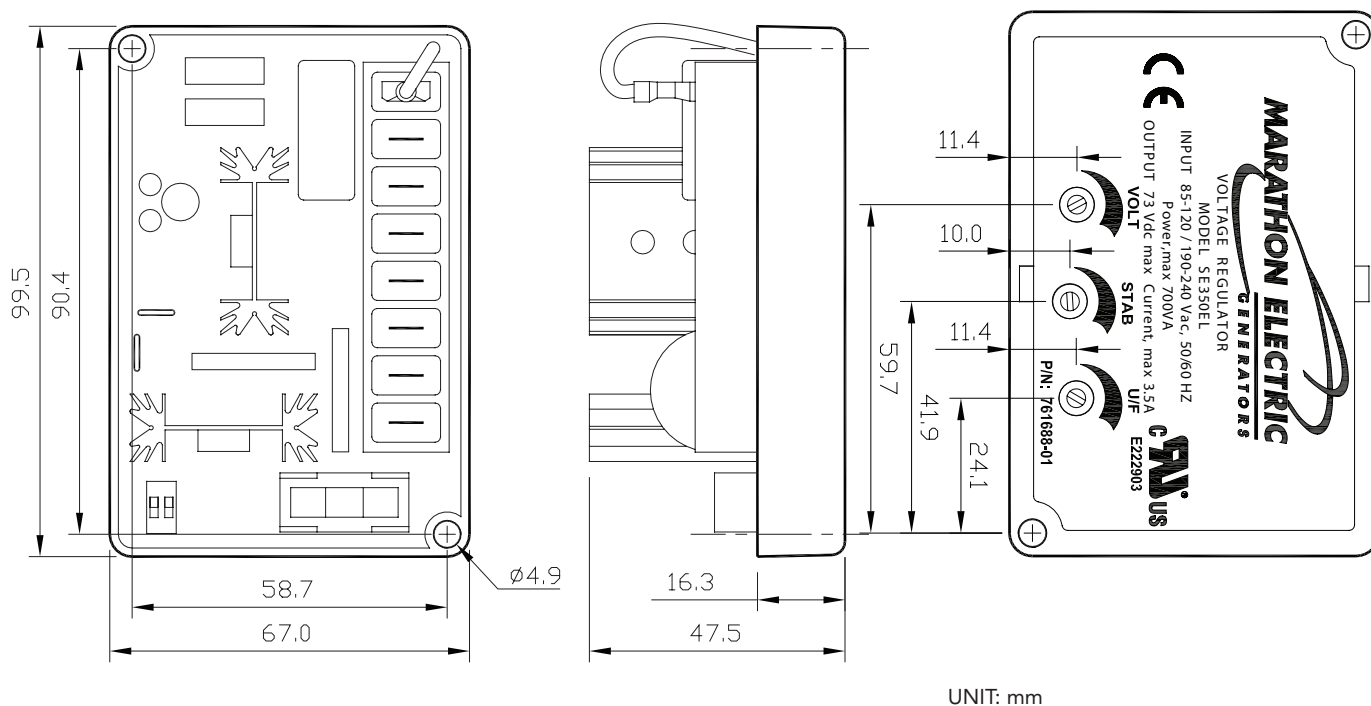


Figure 1 - Outline and Drilling Diagram

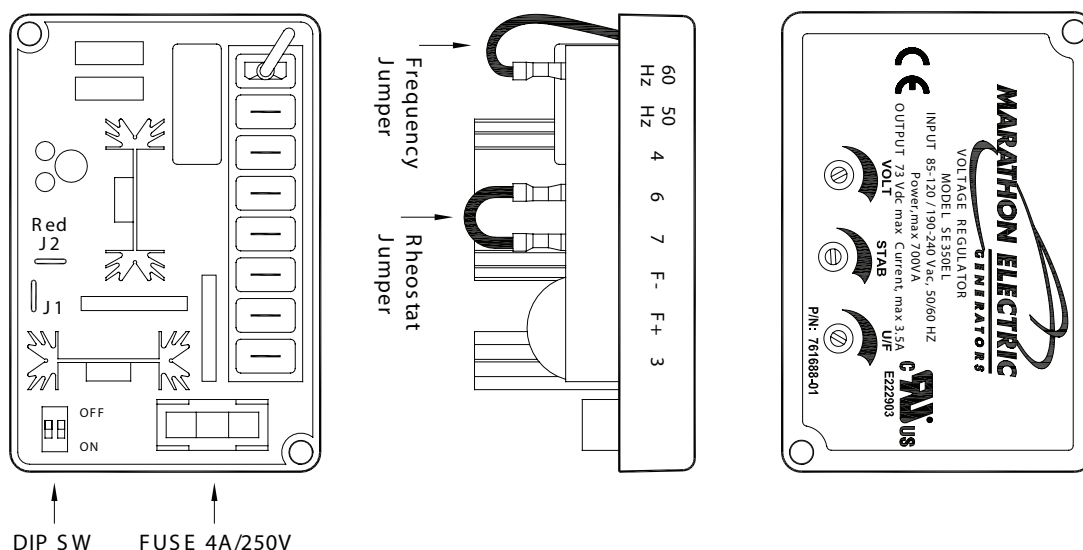


Figure 2 - Jumper and Potentiometer Control Locations

2. WIRING

2.1 Exciter Field Power Circuit

- Connect terminal "F+" and "F-" to field "+" and "-".
- See Figure 6, 7 and 8 for connection diagrams.



The exciter field dc resistance should be between 15 and 100 ohms.

If the exciter field dc resistance is less than 15 ohms and the full load field current does not exceed the maximum continuous current rating of the AVR, add a resistor in series of sufficient wattage to increase the total resistance to 15 ohms.

2.2 Sensing & Power Input Circuit 120/240V

Use terminals 3 and 4 for input power and sensing. The voltage input can be either 120 or 240 VAC selectable via DIP switch.

See Figure 4 .

2.3 Voltage Adjustment (VOLT)

The screwdriver adjustable potentiometer adjusts the generator output voltage. Adjustment clockwise increases the generator voltage.

Remove the jumper wire across terminals 6 and 7 when installing the remote voltage adjust rheostat, and install a 2000 ohm 1/2 watt rheostat. This gives $\pm 10\%$ voltage adjustment from the nominal. (For a

$\pm 5\%$ voltage range, use a 1000 ohm 1/2 watt rheostat). See Figure 6, 7 and 8.

2.4 Stability Adjustment (STAB)

- Stability is the ability of the generator to respond to load changes. Decreasing the stability makes the generator less sluggish and faster to respond to load changes. If the stability is decreased too much, the generator will tend to hunt under steady state conditions.

2.5 V/HZ Roll-Off Frequency Selection (U/F)

- The roll off point is the frequency where the generator voltage starts to decrease. This reduces the load to the engine, which allows the engine to recover. Use jumper to select 50 HZ or 60 Hz. The screwdriver adjustable potentiometer sets the roll-off frequency from 54~61 Hz in the 60 Hz setting or from 45~51 Hz in the 50 Hz setting. We also use the Roll-Off to disconnect the regulator when you shut off the engine.
- The SE350EL has the roll-off point preset to 58 Hz at 60 Hz and 48 Hz at 50 Hz. To change the roll-off point, adjust engine speed to the preferred Hz (50 or 60 Hz).
- Set the voltage to the preferred setting at rated Hz. Adjust engine speed to the new roll-off point. Turn the potentiometer counterclockwise until the voltage starts to drop off. Then adjust the potentiometer clockwise until the voltage returns to rated voltage. Re-adjust engine speed to rated speed.

FREQUENCY COMPENSATION (See Figure 3)

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.

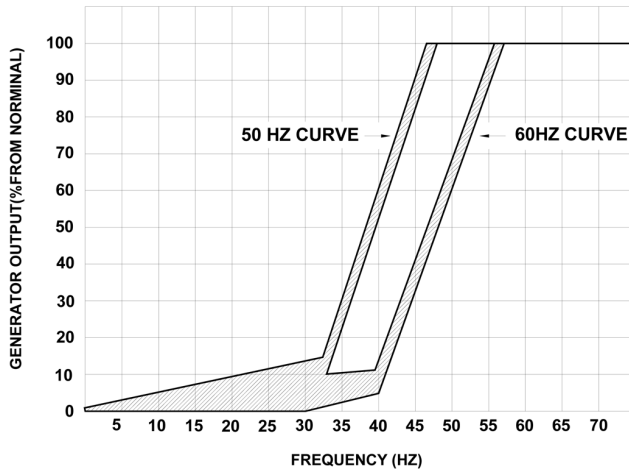


Figure 3 - Frequency Compensation Curves

2.6 120 / 240 VAC Input Power Selection

Switch DIP select ON for 120VAC and OFF for 240 VAC according to the generator system voltage.

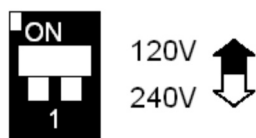


Figure 4 - Sensing & Power Input Voltage Selection

2.7 Stability Selection

When excitation under voltage, it can result in insufficient adjustment range for stability adjustment and when excitation over voltage, the response from the AVR becomes sluggish. The AVR is equipped with 2 bridging wires J1 and J2 to help improve this problem. See Figure 2.

- If the unloaded excitation voltage is less than 7 VDC, please cut open the J2 red bridging wires.
- If the unloaded excitation voltage is greater than 25 VDC, please cut open the J1 white bridging wires.

3. OPERATION PROCEDURE

3.1 Static AVR bench test

Complete before starting test.

1. Connect the AVR as shown in Figure 5 Operational Test Diagram. Do not apply power. Ensure that the light bulbs are rated for 120 volts and less than 100 watts.
2. Adjust the voltage potentiometer / external voltage adjustment rheostat (if used) fully counterclockwise.
3. Connect 240 VAC, 60 Hz power to the controller. The light bulbs should flash momentarily.
4. Slow adjust the AVR voltage potentiometer clockwise.

RESULT :

1. Before minimum luminance is reached, the light bulbs should attain maximum luminance to signify the regulation point.
2. At the regulation point, a small change in the voltage adjustment potentiometer or rheostat position should turn the light bulbs on or off.

3.2 Preliminary Setup

- Confirm the regulator matches the requirements of the generator.
- Ensure all connection and leads from voltage regulator to generator are correctly connected.
- Ensure all jumpers and DIP SW are correctly installed and positioned.
- Ensure terminal 6 & 7 is bridged if external voltage adjustment rheostat is not in use.
- Set VOLT voltage control potentiometer fully counter-clockwise and the external voltage adjustment rheostat (if used) to the center position.
- Set STAB stability control potentiometer fully clockwise (Maximum stability level with sluggish response).
- If adjustment of the under frequency control potentiometer is required, start with the potentiometer adjusted fully counterclockwise, then, slowly adjust the potentiometer clockwise to set.

3.3 System Start-Up

NOTE : All AC voltage readings are to be taken with an "average" reading voltmeter.

- Start prime-mover and bring up to rated speed.
- If generator voltage does not build up, perform field flashing. Please reference from 4. Field Flashing.
- Slowly adjust the regulator voltage control potentiometer (or remote voltage adjust rheostat) until the generator voltage reaches the nominal level. If the voltage does not build up to the rated level:
 1. Check the generator output for excessive load or possible short circuit.
 2. Residual voltage under 5 volts. Perform field flashing.
- Apply and remove the generator load to verify stability. If the generator responds too slowly or hunts (oscillates):
 1. Check the generator output for excessive load or a short circuit. Adjust the Regulator stability control with no load applied.

2. Check the stability of the governor system.

- Check regulation under normal operating conditions. If the regulation is poor:
 1. Ensure the prime mover is operating at rated speed.
 2. Verify that the voltmeter is connected to the same lead as the Regulator sensing.
 3. Use an average-sensing voltmeter (not an RMS sensing voltmeter).
- If under frequency adjustment is required. Slowly reduce the generator frequency until the generator output voltage begins to drop:
 1. Rotate the under frequency potentiometer fully counterclockwise.
 2. Reduce the generator frequency from nominal (either 50Hz or 60Hz) to the desired corner frequency.
 3. Slowly adjust the under frequency control clockwise until the generator output voltage just starts to decrease.

CAUTION

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

4. FIELD FLASHING

When 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 :

- A. With the Prime-mover at rest and the regulator's field output wires disconnected, apply a DC source (Not grounded) of not more than 6~12 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.)
- B. Allow approximately 3 seconds before removing the DC source.

3. With the 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 regulator and restart prime mover. If less than 5 VAC is measured, repeat field flashing procedure.
4. If repeating step A. and B. does not result in generator voltage build-up, and residual is greater than 5 VAC, replace with a new regulator.

⚠ WARNING

This Automatic Voltage Regulator is not equipped with loss-Sensing Protection function / Over Excitation Protection. An additional Over-Voltage Protection device for load may be required to avoid possible damage to the equipment or severe personal injury or death.

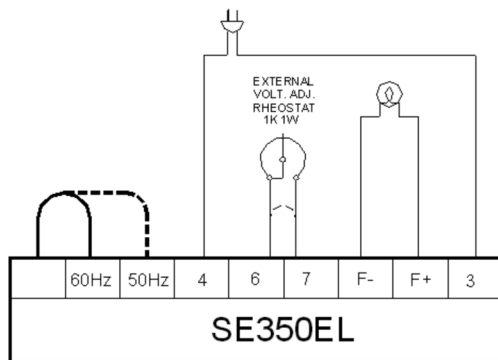


Figure 5 - Operational Test Diagram

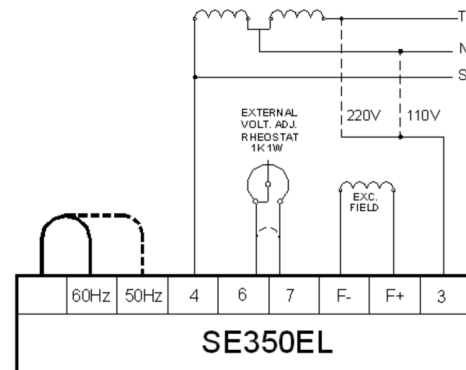


Figure 6 - 1Ø 110 / 220VAC Diagram

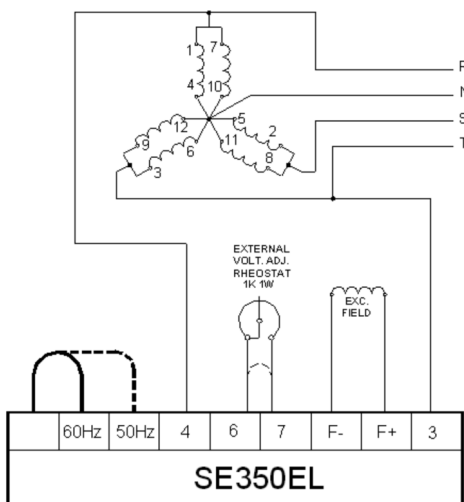


Figure 7 - 3Ø 220VAC Diagram

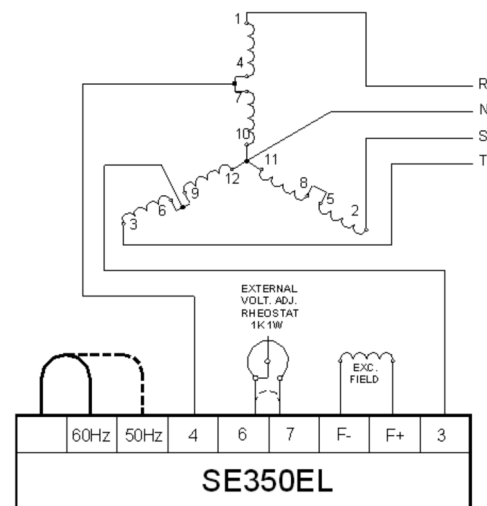


Figure 8 - 3Ø 380VAC Diagram

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