

## EVC600i

# Generator Automatic Voltage Regulator Operation Manual

## 1. INTRODUCTION

The EVC600i Voltage Regulator is thyristor base to control the DC exciter field power of conventional 50 or 60 Hz brushless generators. The AVR circuitry includes under speed and over load protection features. Excitation power is derived directly from the generator terminals.

## 2. ENVIRONMENTAL

**2.1. Operating temperature:** -30 to 80°C (-22 to 176°F)

**2.2. Storage temperature:** -40 to 80°C (-40 to 176°F)

**2.3. ALTITUDE:** Less than 2600 meter

**2.4. RELATIVE HUMIDITY:** <90%

## 3. TECHNICAL SPECIFICATION

### Sensing Input

Terminal  $V_0$ - $V_{220}$  for 220 Vac

Terminal  $V_0$ - $V_{380}$  for 400 Vac

### Power Input

Voltage: 180 to 250 Vac

Frequency: 50 Hz or 60 Hz

### Voltage Adjust Range

180 - 300 Vac, 300 - 520 Vac

### Field Resistance

Recommend 9 - 24  $\Omega$

### Voltage Regulation

< $\pm$  1%

### Output Voltage

Maximum 90 Vdc @ 220 Vac

### Output Current

Maximum continuous: 8 A @ 220 Vac

10 second forcing: 10 A @ 220 Vac

### Paralleling

Internal burden and adjustment for 0 to 10% droop at 5 A, 0.8 PF, (from external CT)

### Voltage Buildup

4Vac, 30 Hz

### External Volts Adjustment

At least  $\pm$  10% with 100k ohm 1 watt trimmer

### Thermal Drift

0.05% per Degree C change in AVR ambient

### Analog Voltage Input

$\pm$ 5VDC, adjustable output voltage is no less than 2% for 1VDC (i.e. for  $\pm$ 5VDC it come out to be  $\pm$ 10%)

### Current Compensation

In : 5A Input

At least 10 % @ P.F. = 0.8

### Dimensions

175 mm L x 129 mm W x 37.5 mm H

### Weight

530  $\pm$  10g

#### 4. MECHANICAL SPECIFICATION

##### DRAWING

SW1: ON - Increase in Response Time.  
OFF - Response as per STAB pot Set  
SW2: ON - 60 HZ  
OFF -50 HZ

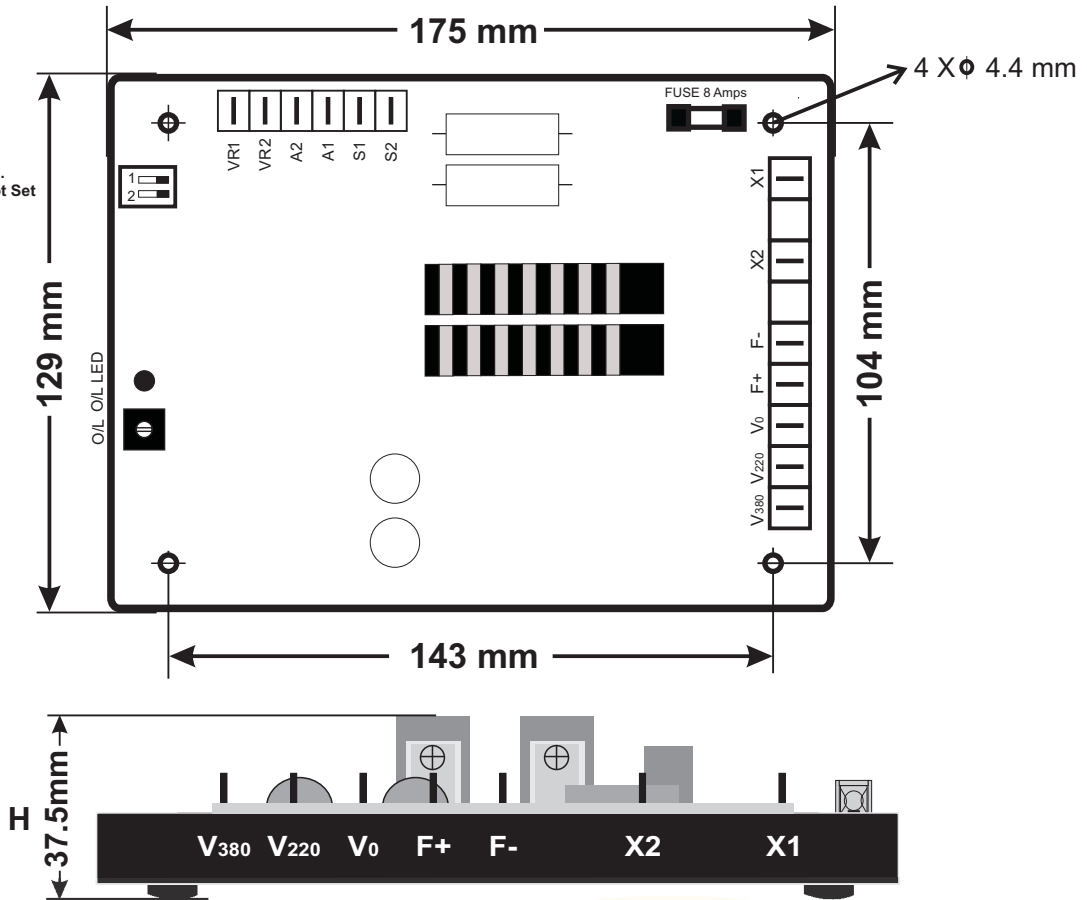


Figure 1. Outline Drawing

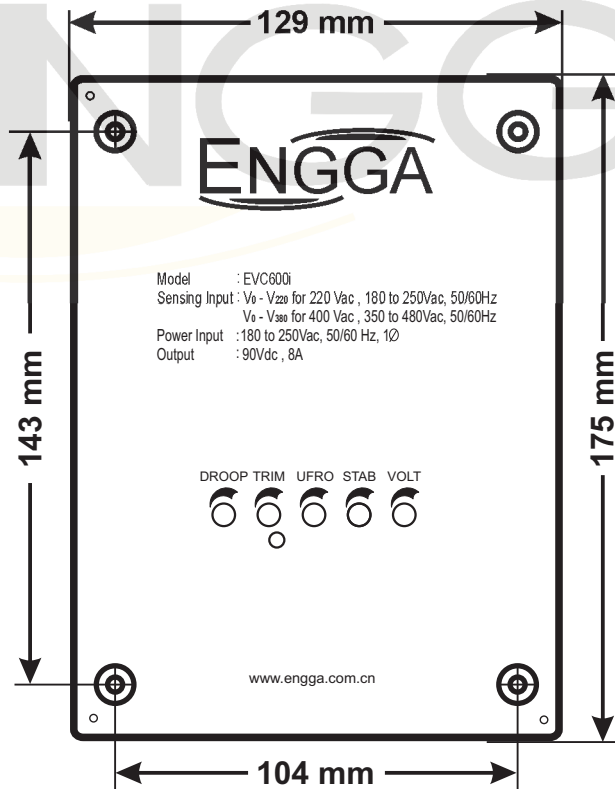


Figure 2. The Drawing For Trimmer

AVR can be mounted directly on the generator, switchgear or control panel that conforms to the mounting specification.

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

## 5. WIRING

### 1. $V_0$ - $V_{220}$ - $V_{380}$ : Sensing Input Voltage.

Sensing Input is between  $V_0$  &  $V_{220}$  (220Vac) or  $V_{380}$  (400VAC). For 2 Phase sensing one phase is connected to  $V_0$  terminal of AVR and second phase is connected to  $V_{220}$  or  $V_{380}$  as explained below:-

- For generator **output voltage 220Vac**, connect sensing phase to terminal  $V_{220}$ .

- For generator **output voltage 400Vac**, connect sensing phase to terminal  $V_{380}$ .

The sensing should be connected "Line to Line" from generator output. Refer Figure 3 & 4.

### 2. F+ , F- : Excitation Output.

Connect the brushless exciter field to terminals F+ and F-. Be sure to observe polarity.

**3. Power Input:** AVR power input is between X1 &  $V_0$ . For **400 Vac system** X1 is connected to Neutral of generator &  $V_0$  to V Phase of generator. For **220 Vac system**, X1 is connected to U Phase &  $V_0$  to V Phase of generator. Refer to Figure 3 & 4.

### 4. S1 - S2: Current compensation input.

Current Transformer(CT) secondary current = 5A, 0.8 PF.

### 5. VR1 - VR2: External Voltage Adjustment.

If an external voltage adjust control is being used, connect a 100 K / 1 watt potentiometer to terminals **VR1** and **VR2** as shown in Figure 3 & 4. If not in use then let VR1 & VR2 left open.

### 6. A1 - A2: Analog Voltage Input.

Fully isolated analog voltage from PF controller or any other type of Digital (PLC) controller can be injected into AVR for variation of generator output voltage. Analog voltage range is  $\pm 5VDC$  maximum and can be connected to A1 & A2 terminals for at least 10 % variation in terminal voltage.

### 7. DIP SWITCH:

**a) SW1 - ON:** When 60Hz operation, AVR response time needs to be reduced. For that turn ON Switch1 so that extra fixed response time is now added with STAB POT setting such that no over or under shoot of voltage occurs during loading-unloading of generator at 60Hz.

**SW1 - OFF :** When 50Hz operation, no need to decrease response time as STAB POT setting is proper for optimum stability of generator with minimum over-under shoot of Voltage during loading - unloading of generator.

**b) SW2 - ON:** For 60 Hz operation of UFRO  
**SW2 - OFF:** For 50 Hz operation of UFRO

## 6. ADJUSTMENT

All trimmer build in back of the AVR board, except the **O/L** Trimmer. The trimmers include **DROOP**, **TRIM**, **UFRO**, **STAB** and **VOLT** as shown in Figure 2. For **O/L** Trimmer refer to Figure 1.

### 1. VOLT: Voltage Adjustment.

The generator output can be altered by adjustment of the **VOLT** trimmer on the AVR board, or by the external trimmer (100K ohm 1W) if fitted.

**Vset is factory set for 400 Vac , If Vset is disturbed and set value is not known then proceed as below :**

a) The terminals **VR1** and **VR2** must be left unconnected if no hand trimmer is required.

b) Before starting the generator, please turn the **VOLT** trimmer on the AVR board fully anti-clockwise.

c) Connect a voltmeter to generator output voltage terminals.

d) Start the generator set and run on no load at nominal frequency 50 - 53 Hz or 60 - 63 Hz.

e) If the red Led is illuminated, refer to the under frequency roll off adjustment.

f) Carefully turn volt trimmer clockwise until required voltage is reached.

### 2. STAB: Stability Adjustment.

Stability Pot is factory set for optimum performance & is advisable not to disturb. But if required then with the generator in ON Condition, rotate STAB POT clockwise direction till voltage start oscillating fast.

From this position, rotate STAB POT anti-clockwise direction till voltage is stable. Load the generator and check for stable voltage and if not then rotate more towards anticlockwise till voltage is stable.

### **3. UFRO: Frequency Roll-Off Adjustment.**

The EVC600i under frequency adjust is factory preset to cause voltage drop in the generator line voltage when the frequency is between 56.8 and 57.2 Hz for 60 Hz applications. For 50 Hz applications, the frequency roll-off is factory preset to between 46.8 and 47.2 Hz.

To reset the frequency roll-off, proceed as follows:

- a. Adjust the prime mover RPM to the desired frequency compensation (corner frequency roll-off) point.
- b. If UFRO LED is ON adjust the back panel **UFRO** trimmer anticlockwise to just OFF the LED. If UFRO LED is OFF then adjust UFRO trimmer clockwise to turn ON LED and then anticlockwise to just turn it OFF.
- c. Bring the prime mover up to rated speed. The output voltage should return to set level.

### **4. DROOP: Droop Adjustment.**

Generator intended for parallel are fitted with a quadrature droop CT which provides a power factor dependent signal for the AVR. The CT connected to **S1** and **S2** of AVR. CT with secondary N:5A is required to provide at least 10% droop at 0.8 PF. Percentage of droop required can be adjusted using DROOP POT in the range of 0 to 10%. Fully anticlockwise is 0% and fully clockwise is maximum as per CT current and load power factory. Factory set is 0% so that mostly during solo operation there is no droop in terminal voltage.

### **5. TRIM: Analog Voltage Input Adjustment.**

Trim Pot is used to decrease the effect of analog input voltage on generator output voltage. When set fully anticlockwise, there is no variation in generator voltage on application of DC voltage On A1-A2 Fully clockwise has maximum effect. Thus using this POT we can get intermediate percentage variation of the full scale i.e 0 to 10% at  $\pm 5VDC$ .

### **6. O/L : Over Load Protection.**

Over load protection provides protection to generator against overloading. It is based on field current when field current increase above set value (which is set using O/L POT), internal timer starts and if overloading condition continues for 20 seconds

then after 20 seconds AVR cuts off field voltage and generator voltage is shut off. O/L LED continues to light indicating O/L Trip. Adjustable from 0.1Amp to 8Amp DC. When O/L POT is fully anticlockwise is minimum setting and fully clockwise is maximum. Internal delay timer is fixed and delay time is 20 seconds  $\pm 1\%$ . Factory set is 8 Amps DC.

## **OPERATIONAL TEST**

To operationally test any EVC600i, refer to Figure 5 and perform the following steps:

- a. Connect the voltage regulator as shown in Figure 5 and apply 230 Vac 50 Hz.
- b. Adjust the rear panel **VOLT** trimmer fully clockwise (CW).  
RESULT: Observe that the lamp lights up full.
- c. Adjust the rear panel **VOLT** trimmer fully counter-clockwise (CCW).  
RESULT: Observe that the lamp is not lit.
- d. Adjust the rear panel **VOLT** trimmer until the lamp just goes out.

Regulator operation is satisfactory if the above results are obtained. Stability, however must be tested with the generator and regulator operating.

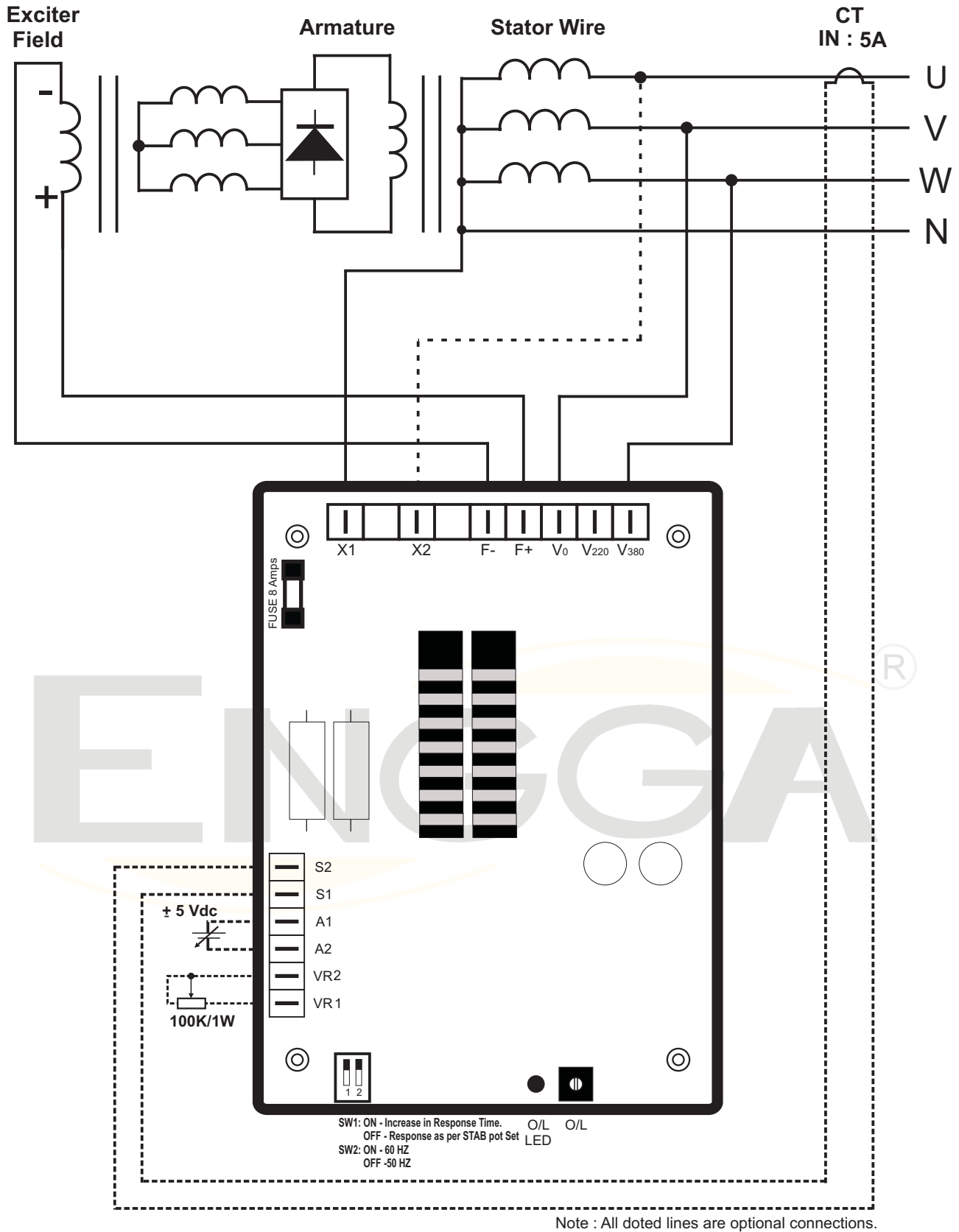


Figure 3. Connection Diagram for 400 Vac Operation

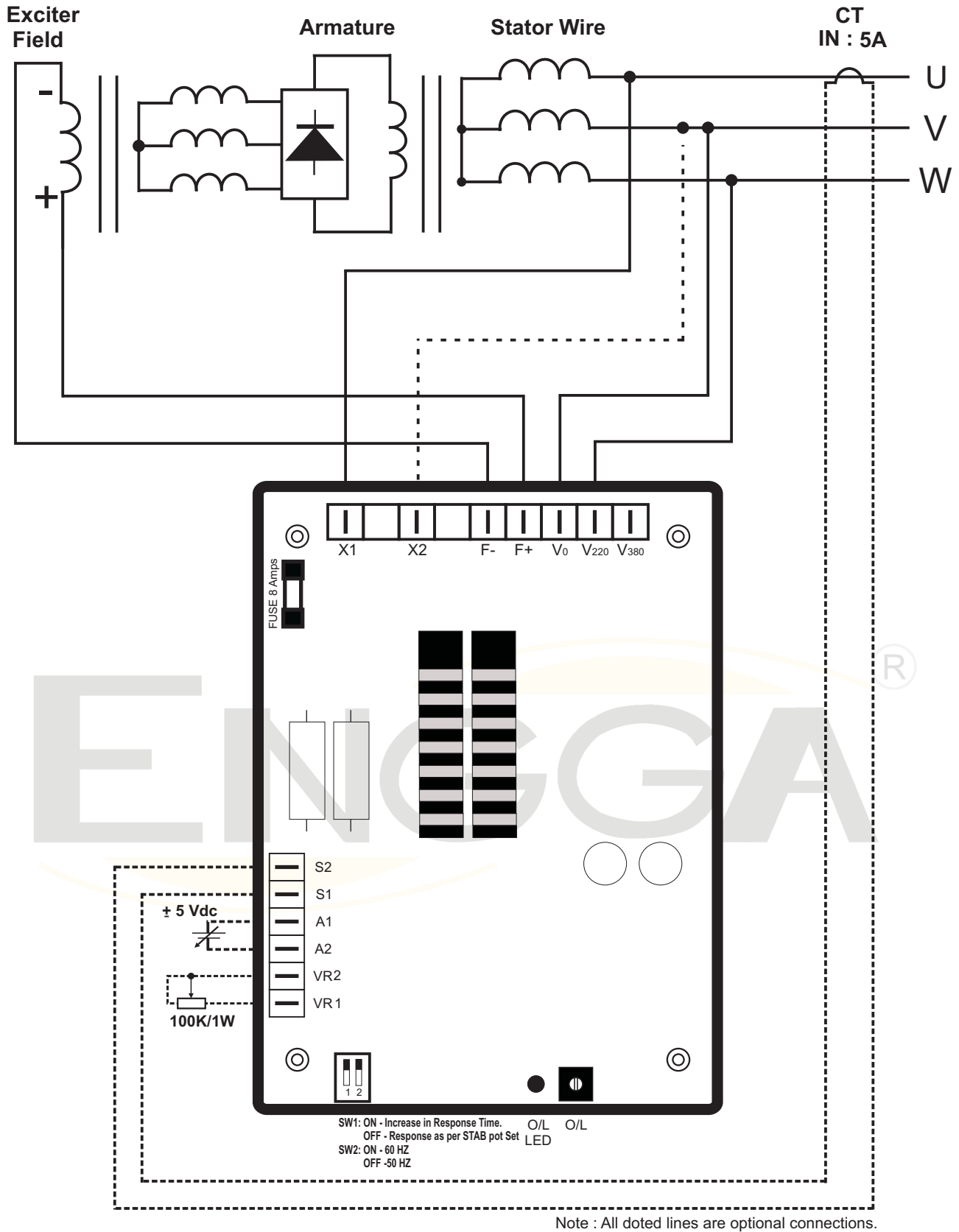
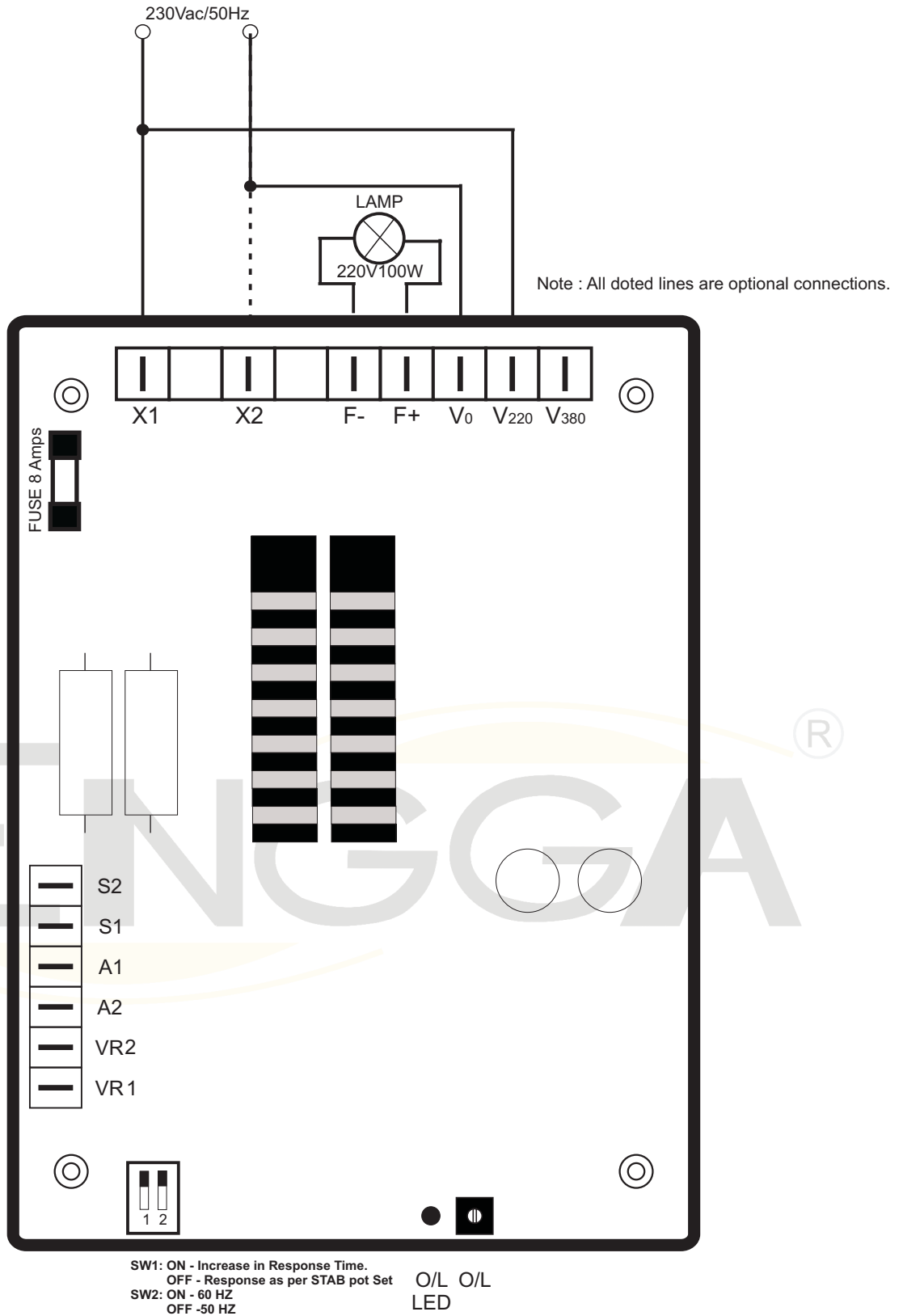


Figure 4. Connection Diagram for 200 Vac Operation



**Figure 5. Operational Test**