

# WT-3

## Generator Automatic Voltage Regulator Operation Manual

### 1. INTRODUCTION

The WT-3 Voltage Regulator is based on Pulse-Width Modulation (PWM) to control the DC exciter field power of conventional, 50 or 60 Hz brushless generators. The AVR circuitry includes under-speed and sensing loss protection features. Excitation power is derived directly from the generator terminals or the others (PMG, Harmonic, Full Harmonic, Auxiliary Winding and so on).

### 2. ENVIRONMENTAL

**2.1. Operating temperature:**  $-40$  to  $60^{\circ}\text{C}$  ( $-40$  to  $140^{\circ}\text{F}$ )

**2.2. Storage temperature:**  $-40$  to  $85^{\circ}\text{C}$  ( $-40$  to  $185^{\circ}\text{F}$ )

**2.3. ALTITUDE:** Less than 1000 meter

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

### 3. TECHNOLOGY SPECIFICATION

#### Sensing Input

Transformer isolated, with respect to neutral, 400 Vac or 230 Vac line-to-line nominal, 50/60Hz

Terminal  $V_0$  -  $V_{220}$  for 230 Vac

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

#### Power Input

Voltage: 200 to 250 Vac

Frequency: 50 to 500 Hz

Burden: 1 kVA.

#### Voltage Adjust Range

195 - 265 Vac, 340 - 460 Vac

#### Field Resistance

$9\Omega$  minimum

#### Voltage Regulation

$< \pm 0.5\%$  (with 4% engine governing)

#### Output Voltage

Maximum 90 Vdc @ 220 Vac

#### Output Current

Maximum continuous: 8 A @ 220 Vac

10 second forcing: 15 A @ 220 Vac

#### Paralleling

Internal burden and adjustment for 0 to 10% droop at 1 Aac, 0 PF, (from external CT)

#### Voltage Buildup

8 Vac, 30 Hz

#### External Volts Adjustment

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

#### Thermal Drift

0.05% per  $^{\circ}\text{C}$  change in AVR ambient

#### Analog Voltage Input

0 to 10% generator voltage per 1Vdc turn the TRIM trimmer

#### Current Compensation

In : 1A Input

Maximum 4% @ P.F. = 0.8

#### Dimensions

165 mm L x 135 mm W x 45 mm H

#### Weight

$700 \pm 10\text{g}$

4. MECHANICAL SPECIFICATION

DRAWING

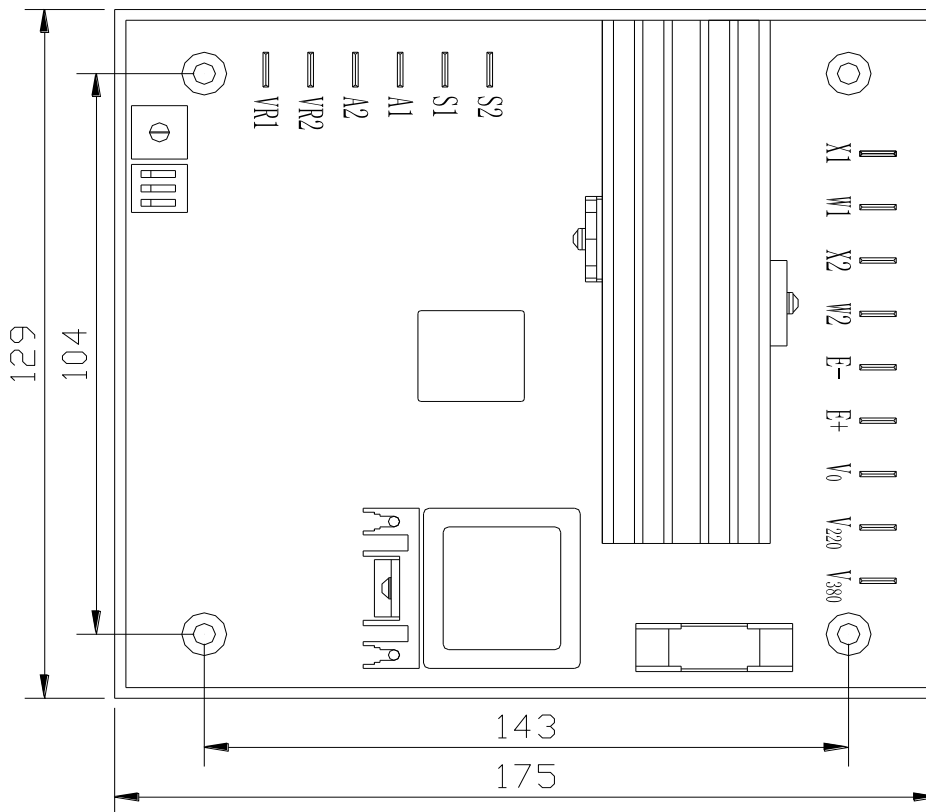


Figure 1 Outline Drawing

AVR can be mounted directly on the engine, genset, 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. Use of such equipment could damage the AVR.

5. WIRING

1. **V<sub>0</sub> – V<sub>220</sub> – V<sub>380</sub>: Sensing Input terminals.**

When the generator output voltage for 230 Vac, connect the sensing input to the terminals **V<sub>0</sub>** and **V<sub>220</sub>**. When the generator output voltage for 400 Vac, connect the sensing input to the terminals **V<sub>0</sub>** - **V<sub>400</sub>**. The sensing should be connected "line-to-line" from generator output.

2. **E+ – E-: Excitation Output.**

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

3. **X1 – W1 – X2 – W2: Power Input terminals.**

When using single phase power input, please connect to terminals **X1** and **X2** or **W1** and **W2**. For 3-phase power input, please connect to **X1**. **X2**. **W2** terminals. The power input can be PMG, Harmonic, Full Harmonic and Auxiliary Winding and so on.

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

Current Transformer(CT) secondary current = 1A.

5. **VR1 – VR2: External Voltage Adjustment.**

If an external voltage adjust control is being used, connect a 1k ohm 1 watt potentiometer to terminals **VR1** and **VR1** as shown. If not, connect a jumper between terminals **VR1** and **VR1**.

6. **A1 – A2: Analog Voltage Input.**

The terminals can accept ± 5Vdc. All wiring please refer to Figure 2 Figure3 and Figure 4.

7. **DIP SWITCH: Function Selection Switch.**

**SW1** Reaction Time Range: ON: for under 550 kW

**SW2** Voltage Compensation : ON: for over 550 kW

**SW3** Rated Frequency 50/60Hz Selection :

ON: 60 Hz, OFF: 50 Hz

## 6. ADJUSTMENTS

All trimmer build in back of the AVR board, except the **TRIM** trimmer. The trimmers include **DROOP**, **DIP**, **UFRO**, **STAB** and **VOLT**.

Please refer to Figure 5

### 1. VOLT: Voltage Adjustment.

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

- The terminals **RV1** and **RV2** must be linked if no hand trimmer.
- Before start the generator, please turn the **VOLT** trimmer on the AVR board fully clockwise. Turn the external trimmer to midway position.
- Turn the stability trimmer on the AVR board to midway position.
- Connect a voltmeter to generator output voltage terminals.
- Start generator set and run on no load at nominal frequency 50 ~ 53Hz or 60~63Hz.
- If the red Led is illuminated, refer to the under frequency roll off adjustment.
- Carefully turn volt trimmer anticlockwise until rated voltage is reached.

### 2. STAB: Stability Adjustment.

If a replacement AVR has been fitted or re-setting of the stability control is required, turn the stability trimmer slowly anticlockwise until the output voltage is steady, on or off load.

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

The WT-3 under frequency adjust is factory preset to cause an average 1 volt drop in the generator's line input voltage to the regulator when the

frequency is between 55 and 57 Hz (for 60 Hz applications). For 50 Hz applications, the frequency roll-off is factory preset to between 45 and 47.5 Hz. To reset the frequency roll-off, proceed as follows:.

- Adjust the prime mover RPM to the desired frequency compensation (corner frequency roll-off) point.
- Adjust the back panel **UFRO** trimmer until the output voltage starts to drop off.
- Bring the prime mover up to rated speed. The output voltage should return to normal

### 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 is connected to **S1** and **S2** on the AVR. The Droop adjustment is normally present in the works to give 5% voltage droop at full load zero power factor. Anticlockwise increases the amount of CT signal injected into the AVR and increases the droop with lagging power factor. With the control fully clockwise there is no droop.

### 5. DIP: To set the frequency related voltage DIP.

When the generator frequency under the knee, the voltage of the generator drop 0 – 5 Vac per 1 Hz turn the **DIP** trimmer. Turn the **DIP** trimmer fully clockwise voltage drop minimum, anticlockwise voltage drop maximum.

### 6. TRIM: Analog Voltage Input Adjustment.

Turn the **TRIM** trimmer fully clockwise has no effect, anticlockwise it has maximum effect.

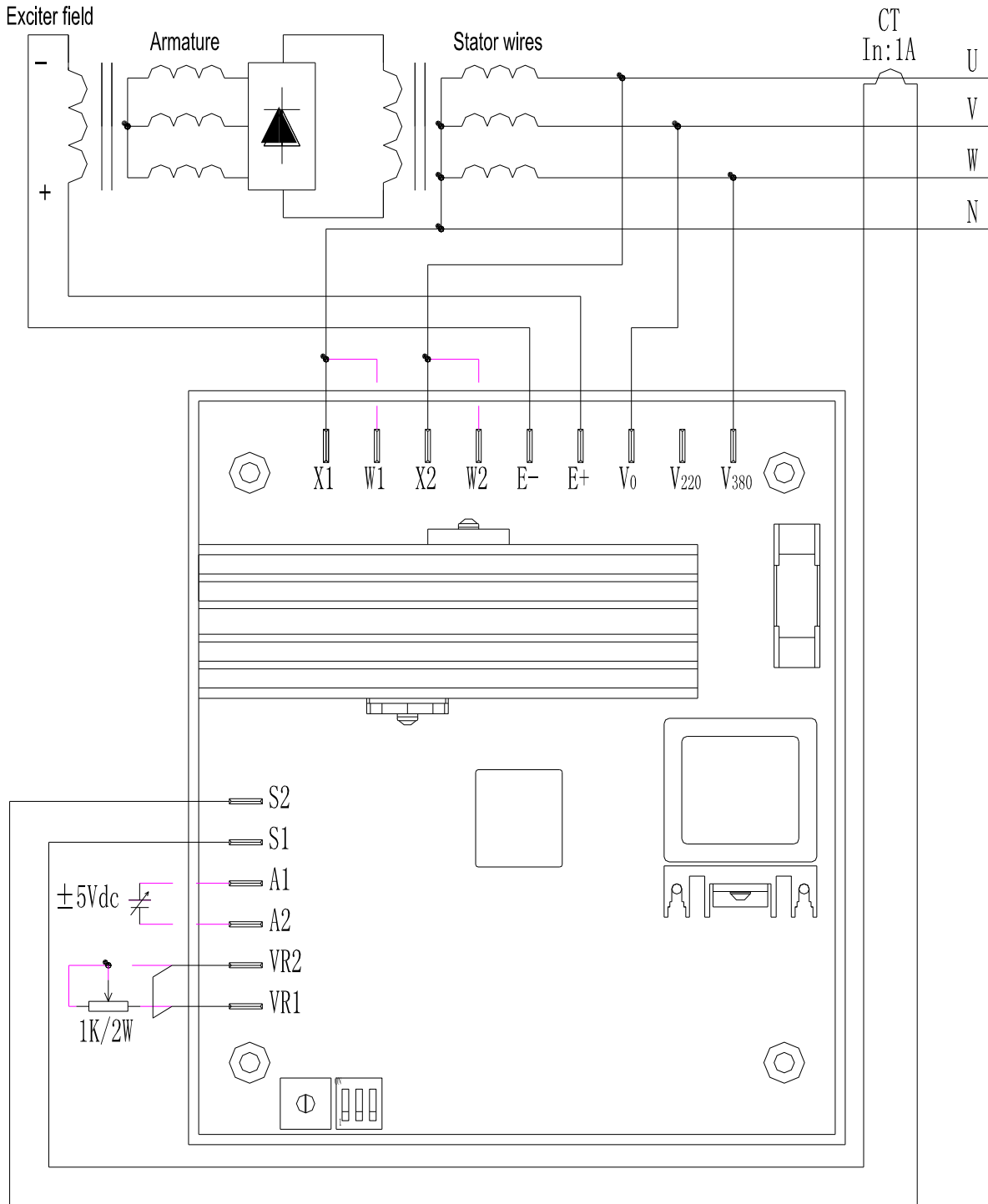


Figure 2 Typical Interconnection, self Excitation for 400Vac operation

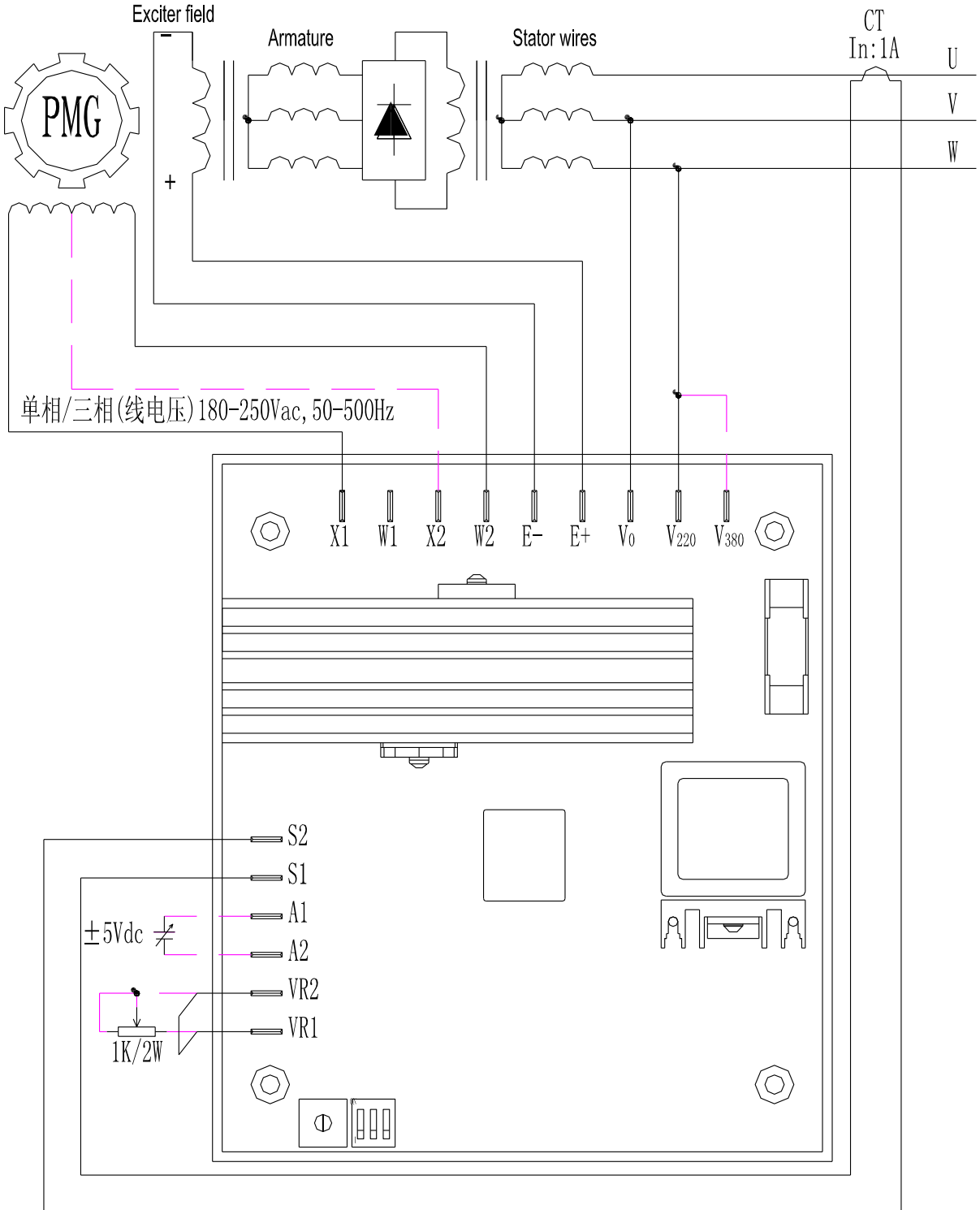
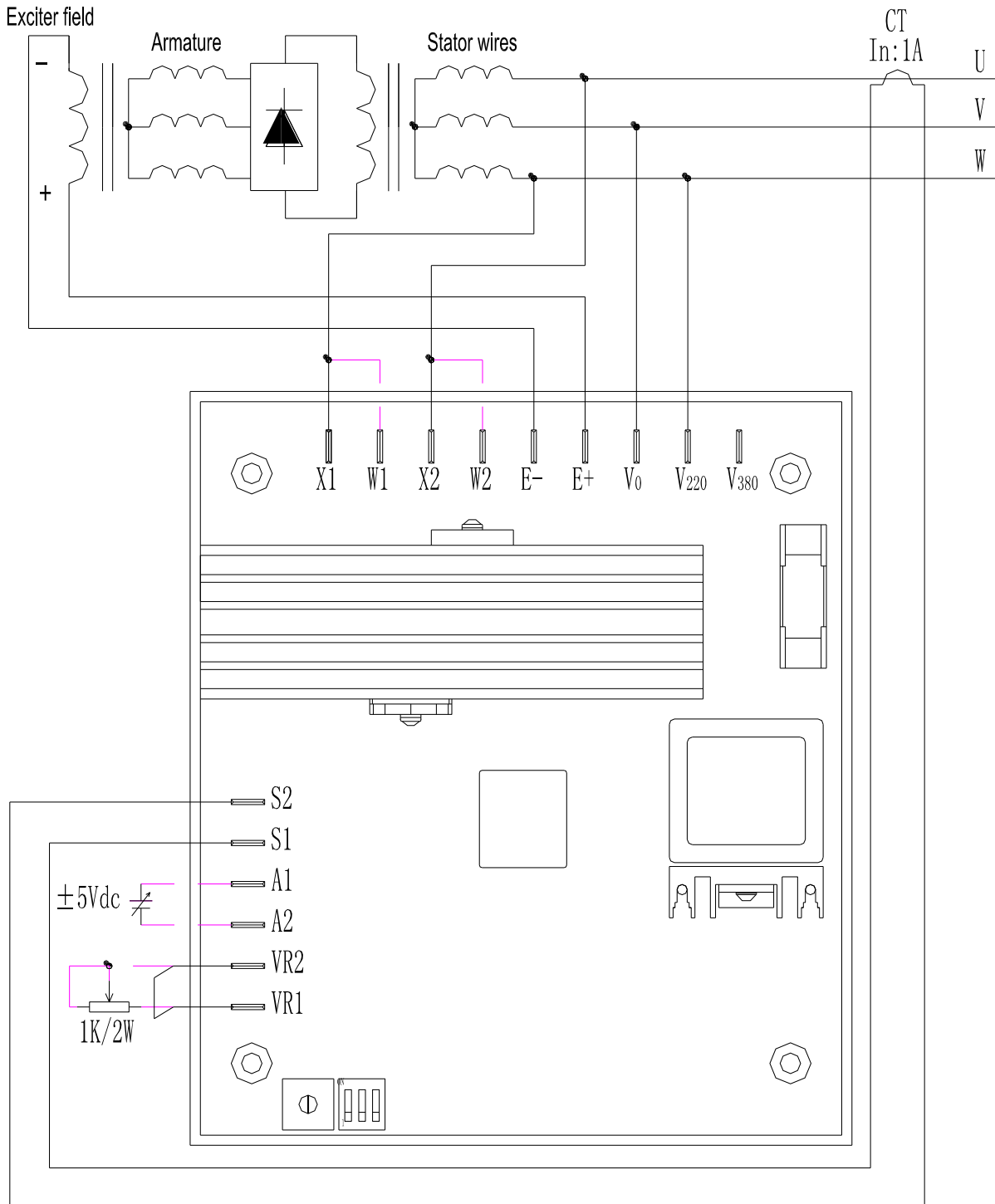


Figure 3 Typical Interconnection, single-phase or 3-phase PMG Excitation



**Figure 4 Typical Interconnection, self Excitation for 200Vac operation**

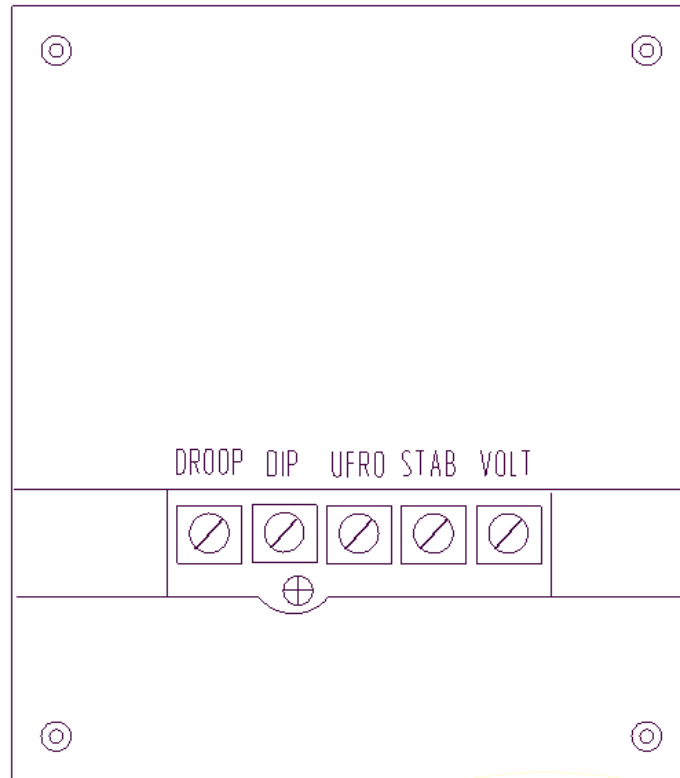


Figure 5 The Drawing For Trimmer

