

THREE-PHASE SYNCHRONOUS GENERATOR

AVR: WT-2

INTRODUCTION

The WT-2 Voltage Regulator is an encapsulated unit contained in a plastic case.

The regulator controls the dc exciter field power of conventional, 50 or 60 Hz brushless generators that have a max 63 Vdc exciter field to regulate the generator output voltage.

Regulation is provided by sensing the generator output voltage, converting it to a dc signal and comparing the signal to a reference voltage signal. An error signal is developed and used to control the dc field power in order to maintain a constant generator output.

ELECTRICAL SPECIFICATIONS

Output Power(DC)

6 A at 63 Vdc maximum continuous with a 240 Vac input.

Max Output Current(DC)

15 A maximum, 1 minute

Exciter Field DC Resistance

6.0 ohms minimum.

Input(AC)

180 to 300 Vac, single-phase, 50/60 Hertz.

Burden: 1000 VA maximum at 240 Vac power.

Sensing Voltage(AC)

180 to 277 Vac at 220 Vac single-phase system; 312 to 480 at 400 Vac three phase system, 50/60 Hertz.

Burden: 5 VA.

Voltage Adjust Range

180 to 277 Vac using the internal voltage adjust.

The external voltage adjust provides a $\pm 10\%$

Regulation Accuracy

Plus/minus 0.5%.

Voltage Drift

$< \pm 1\%$ voltage variation for a 50°C (90°F) change.

Response Time

< 1 cycle

Voltage Build-Up

Internal provisions for automatic build-up from generator residual voltages as low as 9 Vac at 35 hertz.

Power Dissipation

40 W maximum.

Paralleling Provisions

CT input for customer supplied 1 Amp nominal CT.

Adjustable droop from 0 to 5% with 5 Amps input at 0.8 power factor.

SPECIFICATIONS

Operating Temperature

$-25^{\circ}\text{C} \sim +60^{\circ}\text{C}$.

Vibration

Withstands 1.2 Gs at 5 to 26 Hz; 0.036" double amplitude at 27 to 53 Hz; 5 Gs at 53 to 1000 Hz.

Shock

Withstands up to 15 Gs in each of three mutually perpendicular axes.

Weight

0.4 kg net.

INSTALLATION

Mounting

The regulator mounted in terminals box using M4 hardware. Refer to the outline drawing (Figure 1).

Interconnection

Refer to Figures 2 and 3.

a. Change the frequency to 50 Hz or 60 Hz in the filed by push-on link selection.

b. If an external voltage adjust control is being used, connect the potentiometer (minimum 1W, resistance 2000 Ω) to terminals Rv1 and Rv2. If not, connect a jumper between terminals Rv1 and Rv2.

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

d. Connect the input power to the generator stator to provide power to terminals P1 and P4

The input should be connected 200~277Vac.

e. Connect the sensing input P2 and P4 for 400Vac operation or P3 and P4 for 200 Vac operation. The sensing should be connected "line to line".

Parallel

When it is required to operate the regulator in parallel with an isolated or utility bus, in addition to the regulator provisions, a 5 VA current transformer (CT) is required (See Figures 2 and 3.)

This CT is connected in a generator U line and should deliver from TP1 to TP2 amperes secondary current at rated load.

The phase relationship of CT signal to the regulator sensing voltage must be correct or the system will not parallel properly. The CT must be installed in the U line of the three-phase generator

That does not supply sensing to the regulator.

Figures 2 and 3 show the correct CT polarity for A B C phase rotation sequence. If the phase rotation sequence is A-C-B, the CT's secondary leads must be interchanged.

ADJUSTMENTS


VOLT - potentiometer for adjusting the output voltage of the generator:

to adjust the output voltage of the generator: the voltage adjust possibility depends on the characteristics of the generator. Normally the internal potentiometer **RP1** allows possibility of adjusting the voltage in a wide range (i.e. between 350 and 480 V, or between 170 and 277 V); to obtain setting or to adjust the voltage from the control panel, or in order to limit

THREE-PHASE SYNCHRONOUS GENERATOR


AVR: WT-2

the voltage range, an external potentiometer can be connected to provide a finer possibility of voltage to the terminal "RV1" and "RV2" (resistance about 2000 Ohm, 1W, to obtain +/- 5% voltage regulation).

 ⇒ **increase voltage**

FREQ -potentiometer for changing the low speed protection:

usually it is set at the factory in order to reduce the excitation when speed becomes lower than 90% of rated speed at 50 Hz. By removing the bridge which normally shorts the terminals "Hz" and "60", the speed protection acts properly for 60 Hz operation. By acting on potentiometer RP3 it is possible to adjust further (in case should it be necessary) the frequency at which the low speed protection is effective.

 ⇒ **decrease frequency of intervention**

STABILITY SETTING


The voltage regulator is provided with internal adjustable stability circuits in order to allow operation in a wide range of applications. The operation of the regulator can be set on field to adapt it to the characteristics of the plant and of the driving engine (i.e. diesel engine, water turbine, gas turbine) in order to obtain the best voltage response. To change the stability characteristics of the regulator, it is necessary to act on the potentiometer "RP2" for fine setting of stability

 ⇒ **increase response time, increase stability**

DROOP

The device is included in the voltage, to allow parallel operation between similar generators: the device permits to share correctly the total reactive power required by the load among all generators operating in parallel. The device is composed by an external current transformer (which is sensing the current in phase U) and by a "droop" circuit internal in the regulator.

The voltage regulator is provided with input terminals (terminals "TP1" and "TP2") for easy connection to current transformer. Such terminal are normally short-circuited by a connection, when the generator is used in single operation. If the voltage is increasing as the load increases, it is necessary to reverse the leads of the current transformer at the terminals "TP1-TP2". Adjust the potentiometer "RP4" until the desired amount of droop is achieved

 ⇒ **the droop increase**

OPERATIONAL TEST

To operationally test any WT-2, refer to Figure 4 and perform the following steps.

- a. Connect the voltage regulator as shown in Figure 4 and apply 230 Vac.
- b. Adjust the RP1 control fully counter-clockwise (CCW).

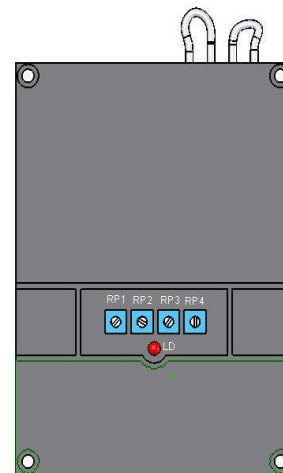
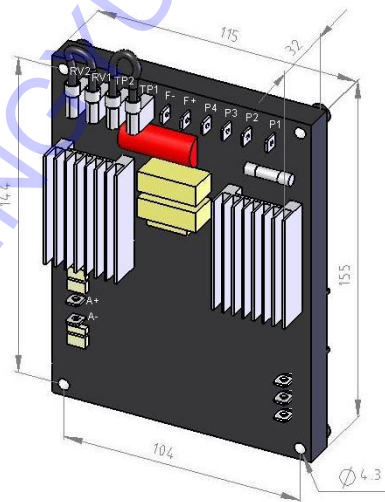
RESULT: Observe that the lamp does not light.

- c. Adjust RP1 control fully clockwise (CW).

RESULT: Observe that the lamp is now lit.

- d. Adjust RP1 control 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.



Back view

Figure 1 WT-2 AVR dimension drawing

THREE-PHASE SYNCHRONOUS GENERATOR AVR: WT-2

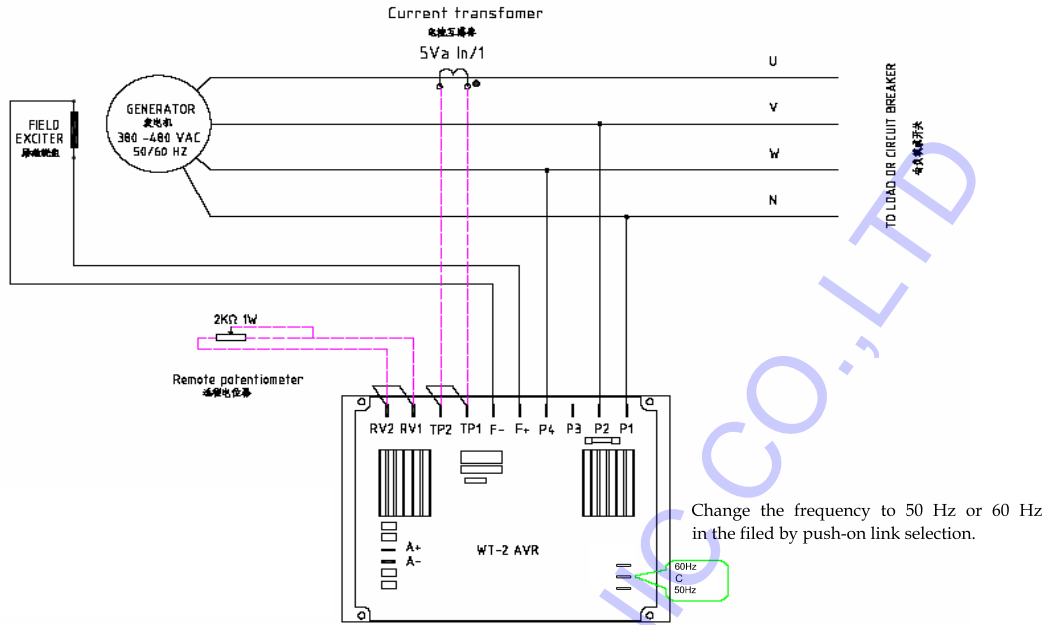


Figure 2 connection diagram for 400Vac operation

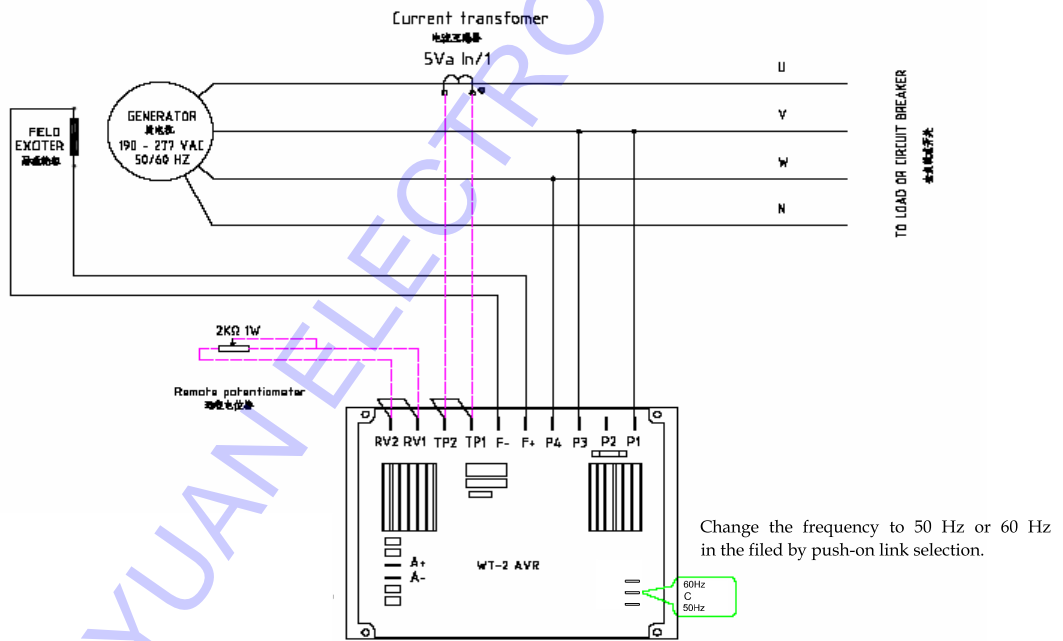


Figure 3 connection diagram for 200Vac operation

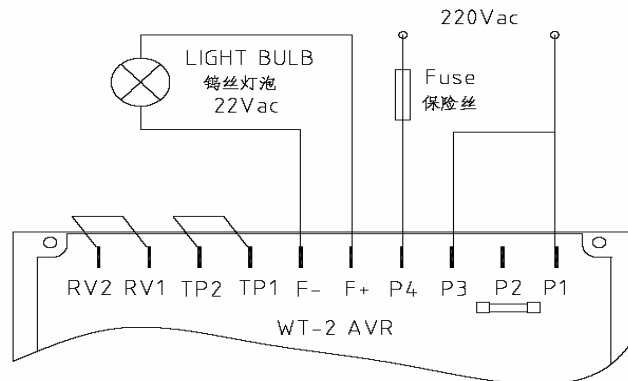


Figure 6. Operational Test