

INSTRUCTION MANUAL

FOR

PMG VOLTAGE REGULATOR

Model: XR2002/XR2002F

Part Number: 9 1394 00 100/9 1394 00 101



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WARNING

To prevent personal injury or equipment damage, only qualified technicians/operators should install, operate, or service this device.

CAUTION

Meggers and high potential test equipment should be used with extreme care. Incorrect use of such equipment could damage components contained in the device.

CONFIDENTIAL INFORMATION

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It is not the intention of this manual to cover all details and variations in equipment, nor does it provide data for every possible contingency regarding installation or operation. The availability and design of all features and options are subject to change without notice. Should further information be required, call Basler Electric Company, Highland, IL.

SECTION 1

GENERAL INFORMATION

1-1. GENERAL DESCRIPTION

a. The Basler XR2002 and XR2002F PMG Voltage Regulators provide the dc exciter field regulation to PMG (Permanent Magnet Generator) equipped 50 or 60 Hz brushless generators. The Regulator is available in two models:

- XR2002:** Standard (without a Voltage Limited Volts-per-Hertz characteristic).
- XR2002F:** With a Voltage Limited Volts-per-Hertz characteristic.

b. Input power may be provided by either a single-phase or a three-phase PMG, or optionally, it may be supplied by the generator output.

NOTE

When the input power is to be supplied from the generator output instead of a PMG, please note the difference data highlighted throughout this manual.

1-2. SPECIFICATIONS

Refer to Table 1-1 for the electrical specifications and to Table 1-2 for the physical specifications of the XR2002/XR2002F Voltage Regulators.

Table 1-1. Electrical Specifications.

Dc Output Power:	7 Adc at 63 Vdc (440 W) maximum continuous; 10 Adc at 90 Vdc (900 W) forcing for one minute (at nominal ac input power).
Exciter Field Dc Resistance:	Minimum: 9 Ω Maximum: 100 Ω
Ac Input Power (from PMG):	Single-phase input power: 100 Vac (full-load) to 180 Vac (no-load), 120 Vac nominal. Three-phase input power: 70 Vac (full-load) to 140 Vac (no-load), 80 Vac nominal.
Ac Input Power (from Generator Output):	Single-phase input power: 90 Vac (full-load) to 153 Vac (no-load), 120 Vac nominal. Three-phase input power: 70 Vac (full-load) to 110 Vac (no-load), 80 Vac nominal.
Input Power Frequency Range (from PMG):	48 to 480 Hertz
Ac Sensing Voltage (Single-Phase, 50/60 Hz) and Voltage Adjust Range:	120 Vac Nominal: 100 to 139 Vac $\pm 10\%$. 208/240 Vac Nominal: 190 to 240 Vac, $\pm 10\%$. 416/480 Vac Nominal: 380 to 480 Vac, $\pm 10\%$. 600 Vac Nominal: 500 to 600 Vac, $\pm 10\%$.

Table 1-1. Electrical Specifications - Continued.

Sensing Burden:	Less than 5 VA (PMG input power). Less than 12 VA (BE 18372-001 sensing transformer).
Regulation Accuracy:	Less than $\pm 0.5\%$ no-load to full-load.
Voltage Drift:	Less than 2% voltage variation for a 50°C (90°F) temperature change.
Stability:	Adjustable (refer to Section 3).
Response Time:	Less than 10 msec for a $\pm 10\%$ change in sensing voltage.
EMI Suppression:	Internal electromagnetic interference (EMI) filter.
Power Dissipation:	75 Watts maximum.

Table 1-2. Physical Specifications.

Operating Temperature Range:	-40°C (-40°F) to +60°C (+140°F).
Storage Temperature Range:	-65°C (-85°F) to +85°C (+185°F).
Vibration:	Withstands: 5 to 27 Hz at 1.3 G's, 27 to 52 Hz at 0.036" double amplitude, 52 to 500 Hz at 5 G's.
Shock:	Withstands up to 15 G's in each of three mutually perpendicular axes.
Weight:	2.4 lbs. (1.1 kg) net, 3.4 lbs. (1.4 kg) shipping.

1-3. FREQUENCY COMPENSATION

The XR2002F (only) provides the following types of frequency compensation:

a. Volts-per-Hertz (V/Hz). This is a linear relationship between voltage and frequency and is shown in Figure 1-1. This characteristic is generally used to improve system block load pick-up performance by restraining the voltage recovery until the frequency has also started to recover. A front panel **UF ADJ** control is used in conjunction with a **VOLT** control to provide adjustment of the V/Hz characteristic along both the frequency axis (45 to 65 Hz) and the generator axis of Figure 1-1. This characteristic factory preset at 55 Hz (60 Hz nominal).

b. Voltage Limited Volts-per-Hertz (VLV/Hz). This characteristic provides the advantage of the Volts-per-Hertz characteristic during load application as well as allowing precise voltage regulation during minor variations in generator speed. The "60 Hz" and "50 Hz" curves of Figure 1-1 represent the 60 Hz and 50 Hz VLV/Hz characteristic. The front panel **UF ADJ** control provides adjustment of the corner frequency of both VLV/Hz characteristics along the frequency axis of Figure 1-1.

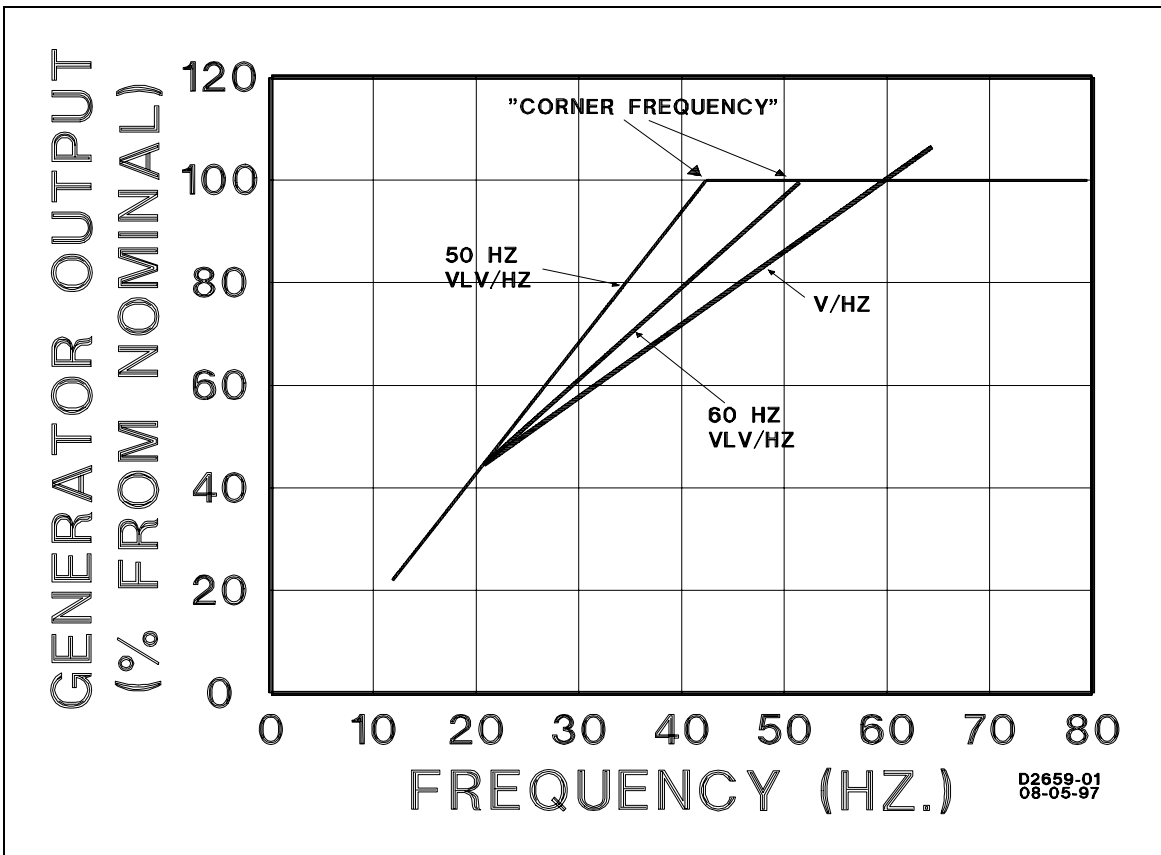


Figure 1-1. Frequency Compensation Curves.

SECTION 2

INSTALLATION

2-1. MOUNTING

For optimum cooling of the regulator, it is recommended that the unit be mounted vertically. Refer to the outline drawing (Figure 2-1). The rugged construction of the XR2002/XR2002F permits mounting directly on the generator set provided the correct hardware is used.

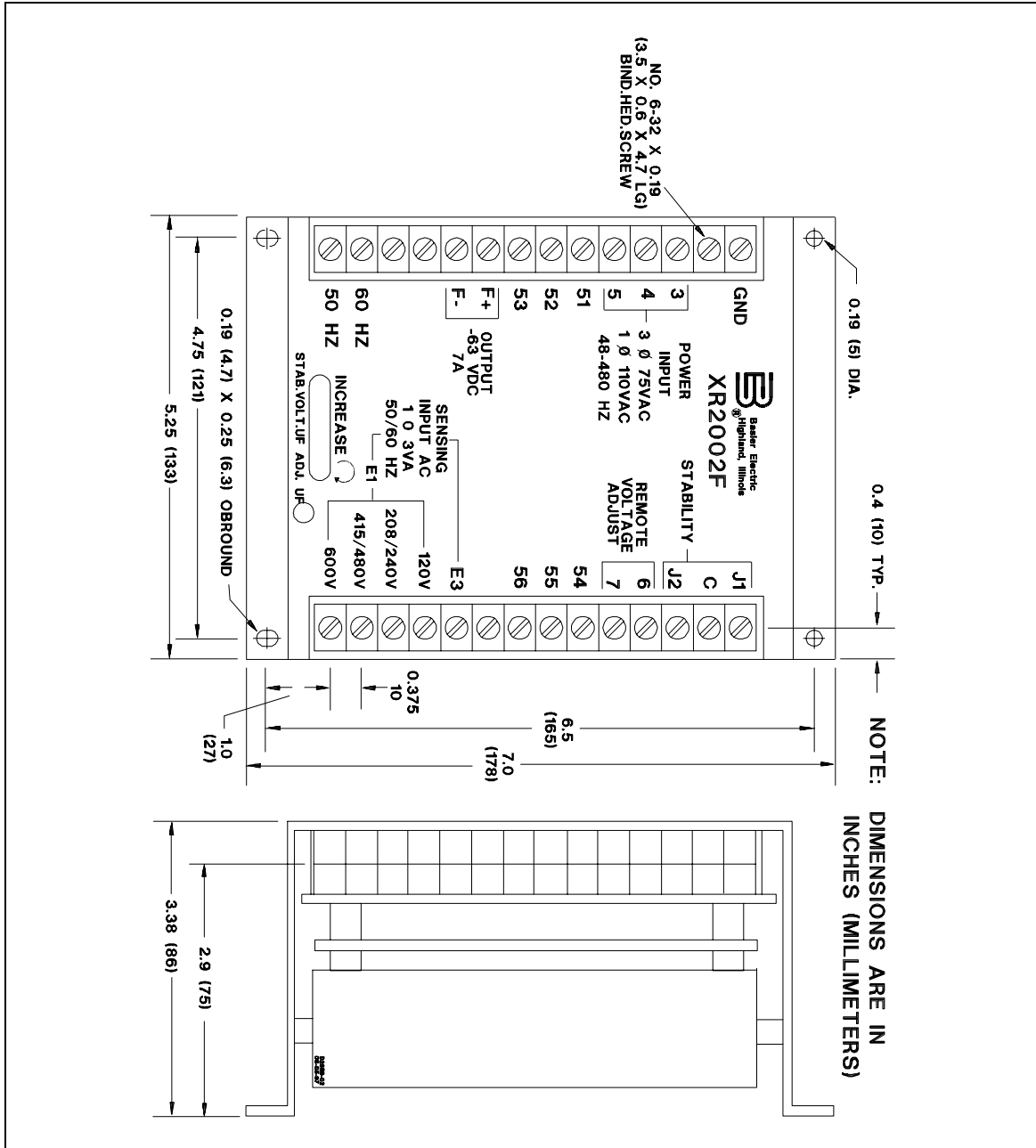


Figure 2-1. XR2002/XR2002F Outline Drawing.

2-2. EXCITER FIELD POWER CIRCUIT (Terminals F+ and F-)

a. Refer to Figure 2-2 and 2-3. Connect the Voltage Regulator output terminals (F+ and F-) to the brushless exciter field terminals while being sure to observe polarity.

CAUTION

The dc resistance of the exciter field must be a minimum of 9 ohms and not greater than 100 ohms.

b. If the exciter field resistance is less than 9 ohms, a current limiting resistor of sufficient wattage must be added in series with the field. If the full-load current does not exceed the maximum continuous current rating of the regulator, a resistor may be added to bring the total of the field plus the series resistor to 9 ohms. For a full-load current greater than the maximum continuous rating, a voltage regulator with a higher output rating is required.

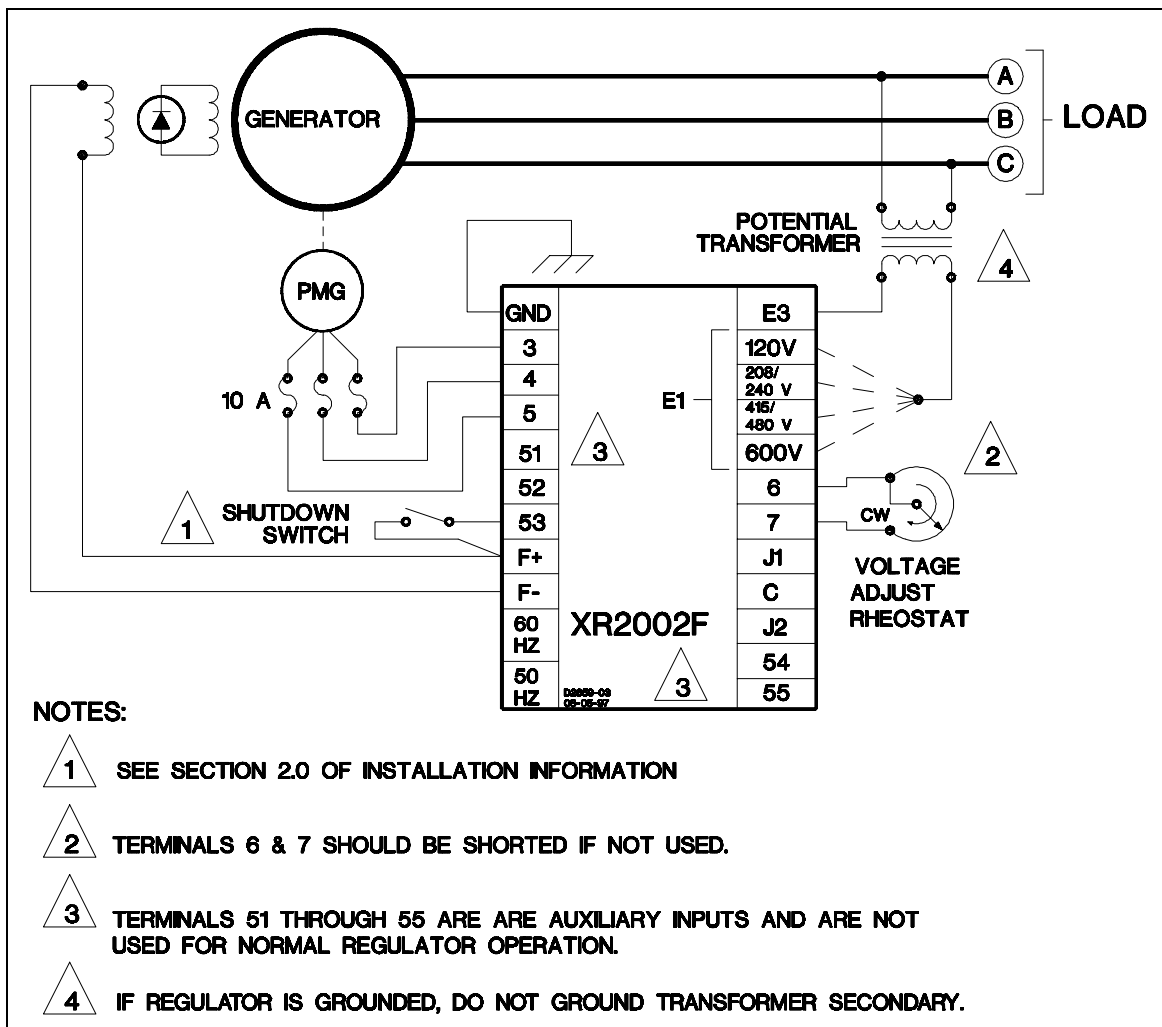


Figure 2-2. XR2002/XR2002F Interconnection Diagram (Input Power from PMG).

c. To prevent damage to the regulator due to grounded PMG output windings or grounded exciter field windings, connect a potential transformer between the generator output and the sensing input of the regulator. Ensure that fuses are connected to all phases of the power input to the regulator.

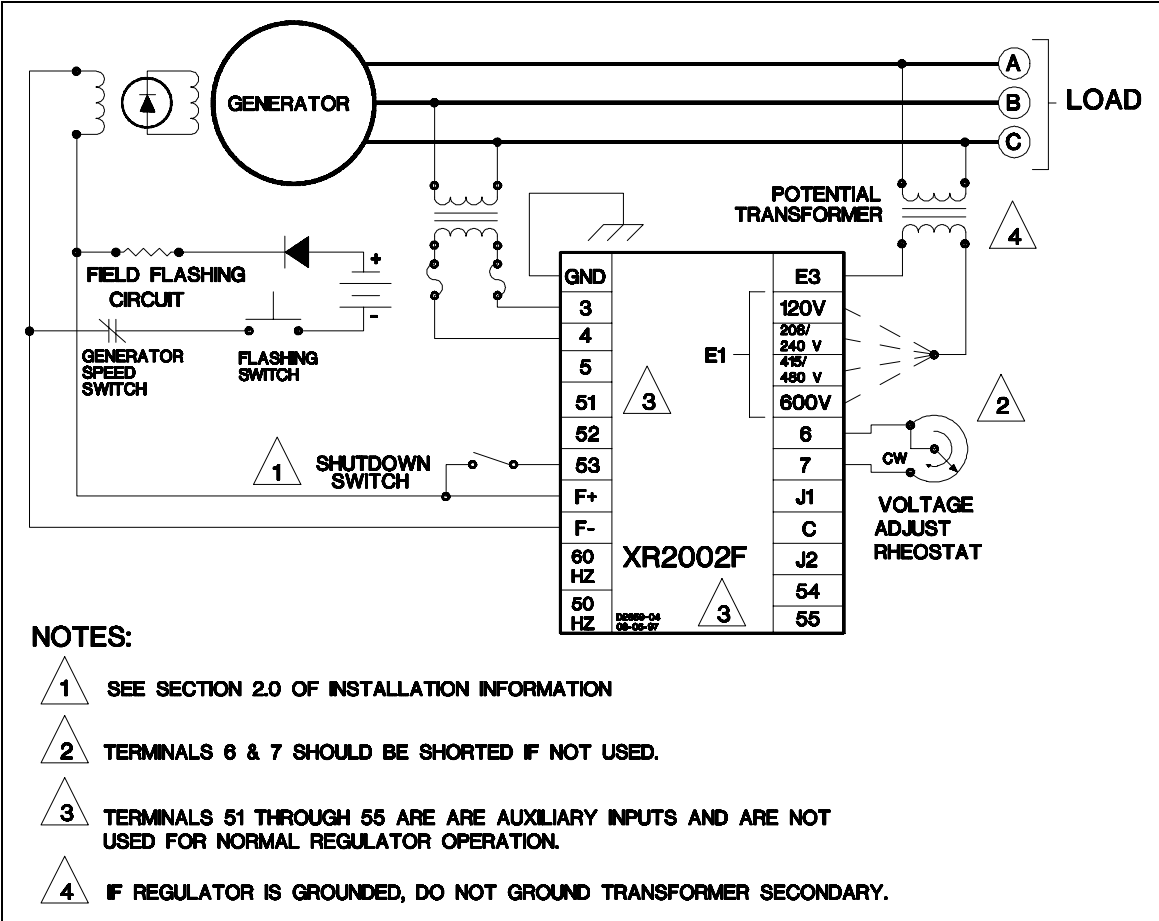


Figure 2-3. XR2002/XR2002F Interconnection Diagram (Input Power from Generator Output).

2-3. POWER INPUT FROM PMG (Terminals 3, 4, and 5)

- a. If input power is to be taken from the PMG, proceed with the following subparagraphs. If input power is to be taken from the generator output, go to paragraph 2-4.
- b. Refer to Figure 2-2. Single-Phase input power from the PMG (within the 48 to 480 Hz frequency range) should not exceed 100 Vac to 180 Vac between terminals 3 and 4.
- c. Refer to Figure 2-2. Three-Phase input power from the PMG (within the 48 to 480 Hz frequency range) should not exceed 70 Vac to 140 Vac between terminals 3, 4, and 5.

2-4. POWER INPUT FROM GENERATOR OUTPUT (Terminals 3, 4, and 5)

- a. If input power is to be taken from the generator output, proceed as follows. If input power is to be taken from a PMG, go to paragraph 2-3.
- b. Refer to Figure 2-3. Single-Phase input power from the generator output, and through an isolation transformer, (within the 48 to 480 Hz frequency range) should not exceed 90 Vac to 153 Vac between terminals 3 and 4.
- c. Refer to Figure 2-3. Three-Phase input power from the generator output, and through an isolation transformer, (within the 48 to 480 Hz frequency range) should not exceed 70 Vac to 110 Vac between terminals 3, 4, and 5.

2-5. EXCITATION SHUTDOWN SWITCH (Terminals 53 and F+)

CAUTION

Due to the possibility of arcing and subsequent damage to the regulator, the excitation shutdown switch must never be installed into the exciter field circuit (terminals F+ and F-).

(Refer to Figures 2-2 and 2-3.) To allow the removal of the exciter field power, it is strongly recommended that the factory installed jumper be removed from across terminals F+ and 53 and replaced with a switch. A switch (Basler P/N 05407) may be ordered for this purpose. The switch is a single-pole, two position, rotary selector switch that is rated for 10 A at 125 Vac.

2-6. FUSES

It is highly recommended that a fuse with a high interrupting capability be installed in each of the input power lines. Refer to Figures 2-2 and 2-3.

2-7. SENSING CIRCUIT (for Input Power from PMG) (Terminals E1 and E3)

- a. One phase of the generator output voltage is applied between terminal E3 and one of the four E1 terminals as follows:

- (1) For generator output voltages adjustable over the range of 100 to 130 Vac, $\pm 10\%$, use the E1 terminal marked "120V".
- (2) For generator output voltages adjustable over the range of 190 to 240 Vac, $\pm 10\%$, use the E1 terminal marked "208/240V".
- (3) For generator output voltages adjustable over the range of 380 to 480 Vac, $\pm 10\%$, use the E1 terminal marked "414/480V".
- (4) For generator output voltages adjustable over the range of 500 to 600 Vac, $\pm 10\%$, use the E1 terminal marked "600V".

b. To minimize the effect of the third harmonic on voltage regulation, always connect the voltage regulator sensing from phase to phase, never from phase to neutral.

2-8. SENSING CIRCUIT (for Input Power from Generator Output) (Terminals E1 and E3)

a. One phase of the generator output voltage is applied through a potential transformer and applied between terminal E3 and the 208/240V E1 terminal on the voltage regulator. The generator output is applied between transformer terminal H1 (common) and one of the four other transformers as follows:

- (1) For generator output voltages adjustable over the range of 100 to 130 Vac, $\pm 10\%$, use the transformer terminal marked "H2".
- (2) For generator output voltages adjustable over the range of 190 to 240 Vac, $\pm 10\%$, use the transformer terminal marked "H3".
- (3) For generator output voltages adjustable over the range of 380 to 480 Vac, $\pm 10\%$, use the transformer terminal marked "H4".
- (4) For generator output voltages adjustable over the range of 500 to 600 Vac, $\pm 10\%$, use the transformer terminal marked "H5".

b. To minimize the effect of the third harmonic on voltage regulation, always connect the transformer inputs from phase to phase, never from phase to neutral.

2-9. FIELD FLASHING (Power Input from Generator Output ONLY)

When the voltage regulator is operated with the generator for the first time, the polarity of the residual magnetism may not be correct or the magnitude not enough. If the generator does not build-up after start-up, shut down the prime mover and proceed with the following steps:

- a. Connect the field flashing circuit as shown in Figure 2-3. The positive terminal of the dc source voltage must be connected to terminal F+ and the negative terminal of the dc source voltage must be connected to F-.
- b. Ensure that the diode and current limiting resistor are on the positive side of the voltage source. Verify that the SPEED SWITCH closes when the generator frequency (speed) is within its nominal range.

- c. Use the following formula to determine the battery rating:

$$E_b = I_F(R_F + R_{51})$$

- where: E_b = battery rating
 I_F = field flashing current (between 1/2 and full no-load current at rated voltage)
 R_F = exciter field resistance
 R_{51} = current limiting resistor

- d. With the generator frequency within its nominal operating range, and the output voltage low, press and hold the FLASHING SWITCH. Within 15 seconds, the generator output voltage should build-up to a level sufficient to allow the release of the switch.

2-10. VOLTAGE ADJUST CONTROL

- a. An internal **VOLT** screwdriver adjust provides adjustment of the generator output voltage. Clockwise rotation of this control will increase the generator output voltage.
- b. The voltage regulator is shipped from the factory with a jumper connected across terminals 6 and 7. If a remote voltage adjust rheostat (R50) is used (supplied loose), the jumper across these terminals should be removed and the remote voltage adjust rheostat should be connected to these terminals. The wiper of the rheostat must be connected to the rheostat terminal which connects to terminal 6 of the voltage regulator and the other terminals are connected as shown in the interconnection diagram.
- c. When the remote voltage adjust rheostat is adjusted to its maximum resistance (fully counter-clockwise), the minimum generator output voltage will be obtained. Also, when the remote voltage adjust rheostat is used, the front panel **VOLT** control will operate as a voltage range adjust control.

2-11. TERMINALS 51, 52, 53, 54, AND 55 (and 56 on units S/N 1 through 236)

- a. These terminals allow additional external accessories and modules to be combined with the voltage regulator to expand the capabilities of the regulator. An internal jumper must be connected to terminal 54 for normal regulator operation. An external jumper is normally connected between terminals 53 and F+. This jumper may be replaced by an excitation shutdown switch. No connection should be made to terminals 51, 52, 55, or 56 unless so directed by an accessory device instruction manual. Refer to Paragraph 2-5.
- b. Note that on units with serial numbers 001 through 236, terminal 56 is used in lieu of terminal 55. On units with serial numbers 237 and higher, terminal 56 is not present and terminal 55 is used for the external connections.

SECTION 3

SYSTEM OPERATION

3-1. GENERAL

CAUTION

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

The following system operation procedures provide instructions for adjusting the voltage regulator. Symptoms resulting from regulator adjustment, a faulty regulator, and/or certain generator system problems are included together with their suggested remedies.

3-2. PRELIMINARY SET-UP INFORMATION

Complete the following steps before proceeding with the system start-up:

- a. Verify that the Voltage Regulator specifications conform with the generator system requirements.
- b. Verify that the following jumpers are in the positions given:
 - (1) *[XR2002F Only]* Connect the frequency compensation jumper to the nominal operating frequency terminal: 50 Hz or 60 Hz.
 - (2) If the remote voltage adjust rheostat is not connected, be sure that a jumper is connected across terminals 6 and 7.
 - (3) If an external accessory is NOT connected to terminal 55 or 56 (see paragraph 2-11), ensure that the internal jumper is connected to terminal 54.
- c. Ensure that the voltage regulator is correctly connected to the generator system.
- d. Install the fuses per paragraph 2-6.
- e. Set the regulator controls, external controls (if used), and stability selection jumpers as follows:
 - (1) Set the front panel **VOLT** control fully counter-clockwise (CCW).
 - (2) Set the remote voltage adjust rheostat to approximately the center of the wiper travel (if used).
 - (3) Leave the front panel **UF ADJ** at the factory preset setting.

- (4) Set the front panel **STAB** control to approximately the center of the wiper travel.
- (5) Close the excitation shutdown switch (if used).
- (6) Connect the stability jumpers to terminal C. If adjustment of the stability is required, refer to Table 3-1 for jumper location and stability response.

Table 3-1. Stability Selection Jumpers Selection

Sequence	Jumper 1 Connected To:	Jumper 2 Connected To:	Response
1	J1	C	Fast
2	C	C	Moderate
3	J1	J2	Moderate
4	C	J2	Slow

3-3. OPERATION AT REDUCED SPEEDS

During periods of prime mover idling, the use of an excitation shutdown switch is highly recommended to remove power from the regulator.

3-4. SYSTEM START-UP

Perform the below system start-up procedures. If the system does not perform as specified, refer to the symptom/corrective action portion of the table and perform the steps contained therein.

- a. Be sure that the preliminary start-up procedures (paragraph 3-2) have been performed.
- b. Start the prime mover and bring up to rated speed.
- c. Close the Excitation Shutdown Switch.
 - (1) If the generator output voltage does not build up, refer to the troubleshooting table contained in Section 4.
 - (2) If the generator output voltage builds up and then decays, and then builds up again, refer to the troubleshooting table contained in Section 4.
- d. Slowly adjust the front panel **VOLT** control until the generator output voltage is at the nominal value. If the remote voltage adjust rheostat is used, adjust the rheostat until the generator voltage is set to the exact value desired.
 - (1) If the generator output voltage does not build up to the rated value, perform the following:
 - (a) Check the generator output for shorts or an excessive load. Correct condition if found.

- (b) Check that the sensing input (terminal E1) correctly matches the generator voltage.
- (2) If the voltage is high and uncontrollable using either the front panel **VOLT** control or the remote voltage adjust rheostat, refer to the troubleshooting table contained in Section 4.
- e. Check for stable operation of the generator in both loaded and unloaded conditions.
 - (1) If the generator is unstable (hunting) in the loaded condition, perform the stability adjustment contained in paragraph 3-5b. If adjusting the stability does not correct the problem, refer to the troubleshooting table contained in Section 4.
 - (2) If the generator is unstable (hunting) in the unloaded condition, rotate the front panel **STAB** control further clockwise (CW) until stable operation occurs.
- f. Check for proper voltage regulation under normal operating and load conditions. If regulation is poor, refer to the troubleshooting table contained in Section 4.
- g. *[XR2002F Only]* Check for proper V/Hz or Voltage Limited V/Hz operation by reducing the generator frequency (speed).
 - (1) In V/Hz mode - if generator voltage does not decrease, adjust in accordance with paragraph 3-5c.
 - (2) In VLV/Hz mode - if generator voltage does not decrease at approximately 57 Hz (60 Hz systems) or 47 Hz (50 Hz systems), adjust in accordance with paragraph 3-5d.

3-5. ADJUSTMENTS

a. Field Flashing. Field flashing is only to be performed when the regulator is receiving input power from the generator output. Do not flash the field when input power is being received from a PMG.

b. Stability Adjustment. To adjust the system stability, proceed as follows:

NOTE

If a stability setting is desired that provides the fastest possible voltage response along with good generator stability, an oscilloscope or other high speed transient voltage recording device should be used.

- (1) Ensure that the front panel stability selection jumpers are both connected to terminal C.
- (2) With the generator operating in a no-load condition, rotate the front panel **STAB** control counter-clockwise (CCW) until hunting occurs.
- (3) Slowly rotate the front panel **STAB** control clockwise (CW) until the hunting stops.
- (4) Alternately apply and remove the load from the generator while observing the output voltage. Hunting should not occur. If the generator voltage is still unstable, perform the following:
 - (a) Further adjust the front panel **STAB** control clockwise and repeat step (4) until the unit is stable.

- (b) If the generator remains unstable, shutdown the generator and reconnect the Stability Selection Jumpers in accordance with Table 3-1 for a more stable operation and repeat steps (1) through (4) of this sub-paragraph.

c. V/Hz Characteristic Adjustment. To adjust the V/Hz characteristic, perform the following steps:

- (1) Ensure that the frequency compensation jumper is connected to the proper nominal operating frequency terminal (either 50 Hz or 60 Hz).
- (2) Adjust the generator output voltage to nominal.
- (3) Adjust the front panel **UF ADJ** control clockwise (CW) until the front panel **UF** indicator just illuminates.
- (4) Continue adjusting the front panel **UF ADJ** control until the generator output voltage decreases to approximately 90% of nominal. The front panel **UF** indicator should be illuminated.
- (5) Slowly adjust the front panel **VOLT** control clockwise (CW) until the generator output voltage is restored to the nominal level. The generator output voltage should now increase above nominal when the frequency exceeds the nominal frequency and decrease when the frequency falls below the nominal frequency.

d. Voltage Limited V/Hz Characteristic Adjustment. To adjust the Voltage Limited V/Hz characteristic, perform the following steps:

- (1) Ensure that the frequency compensation jumper is connected to the proper nominal operating frequency terminal (either 50 Hz or 60 Hz).
- (2) Adjust the prime mover speed (frequency) to the desired frequency compensation point (corner frequency).
- (3) Adjust the front panel **UF ADJ** control until the front panel **UF** indicator just illuminates. This establishes the underfrequency point (the control will increase the compensation point (corner frequency) when rotated clockwise).
- (4) Bring the prime mover speed (frequency) back to nominal. The front panel **UF** indicator should be extinguished.

SECTION 4
MAINTENANCE AND TROUBLESHOOTING

4-1. PREVENTIVE MAINTENANCE

A periodic inspection should be made on the unit to insure it is kept clean and free from accumulations of dust and moisture. Insure that all the terminal connections to the voltage regulator are kept tightened.

4-2. TROUBLESHOOTING

The following troubleshooting procedures contained in Table 4-1 will determine if the voltage regulator is performing properly. If troubleshooting does not isolate the problem to the voltage regulator, refer to the generator instruction manual and accessories instruction manuals.

WARNING

The following procedures are performed with operating power and sensing voltage applied to the regulator. Ensure proper precautions are exercised when taking voltage measurements during the following procedures.

Table 4-1. Troubleshooting.

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

1. VOLTAGE DOES NOT BUILD UP.

NOTE

This procedure should be used only if a PMG-equipped generator is being used for input power to the regulator. If the regulator is instead connected to accept input power from the generator output instead of from the PMG, proceed to MALFUNCTION 1A.

With the excitation shutdown switch closed and the prime mover up to rated operating speed, apply a voltmeter across regulator terminals 3 and 4 (single-phase input) or across terminals 3, 4, and 5 (three-phase input), then across terminals F+ and F-, each time recording the readings.

RESULT: The voltage across terminals 3 and 4 (single-phase input) should be within the limits of 100 Vac to 180 Vac - or across terminals 3, 4, and 5 (three-phase input) should be within the limits of 70 Vac to 140 Vac, and across terminals F+ and F- should be approximately 63 Vdc.

Table 4-1. Troubleshooting - Continued.

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

1. VOLTAGE DOES NOT BUILD UP - Continued.

If the voltages are correct, the regulator is good.

If the voltage across terminals 3 and 4 or 3, 4, and 5 is not within the given limits, check interconnecting wiring, fuses, switches, transformers, and generator connections for open circuits.

If the voltage across terminals 3 and 4 or 3, 4, and 5, are correct, but the voltage across F+ and F- is less than approximately 63 Vdc, the regulator is faulty. Replace the regulator.

1A. VOLTAGE DOES NOT BUILD UP.

NOTE

This procedure should be used only if input power is being supplied from the generator output voltage. If the regulator is instead connected to accept input power from a PMG instead of from the generator output, see MALFUNCTION 1.

With the excitation shutdown switch closed and the prime mover up to rated operating speed, apply a voltmeter across regulator terminals 3 and 4 (single-phase input) or across terminals 3, 4, and 5 (three-phase input), then across terminals F+ and F-, each time recording the readings.

RESULT: The voltage across terminals 3 and 4 (single-phase input) should be within the limits of 90 Vac to 153 Vac - or across terminals 3, 4, and 5 (three-phase input) should be within the limits of 70 Vac to 110 Vac, and across terminals F+ and F- should be approximately 63 Vdc.

If the voltages are correct, the regulator is good.

If the voltage across terminals 3 and 4 or 3, 4, and 5 is not within the given limits, check interconnecting wiring, fuses, switches, transformers, and generator connections for open circuits.

If the voltage across terminals 3 and 4 or 3, 4, and 5 is below lower limit, flash the field in accordance with paragraph 2-9.

If the voltage across terminals 3 and 4 or 3, 4, and 5, are correct, but the voltage across F+ and F- is less than approximately 63 Vdc, the regulator is faulty. Replace the regulator.

Table 4-1. Troubleshooting - Continued.

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

2. VOLTAGE BUILDS UP, THEN DECAYS, THEN BUILDS UP AGAIN

If the voltage is below normal and not controllable by the front panel **VOLT** control perform the following:

If the remote voltage adjust rheostat is installed: short a jumper wire across the regulator terminals 6 and 7; if the voltage then stabilizes, install the jumper wire permanently. If the voltage does not stabilize, substitute a replacement regulator; if the problem still exists, contact Basler Electric Company Application Engineers for assistance.

If the remote voltage adjust rheostat is not installed, substitute a replacement regulator; if the problem still exists, contact Basler Electric Company Application Engineers for assistance.

3. VOLTAGE HIGH, UNCONTROLLABLE WITH FRONT PANEL VOLT CONTROL

CAUTION

Open the excitation shutdown switch to prevent overexcitation of generator and possible system damage. Keep the switch open during this procedure until directed otherwise.

- a. Check that regulator sensing input (EI) voltage terminal correctly matches generator voltage.
- b. Bring prime mover up to rated speed.
- c. Apply voltmeter across sensing terminals "EI" and "E3".

RESULT: A small residual voltage should be measured. If voltage is not present, shut down the generator and check the sensing connection to the generator.

- d. Shut down generator and check for correct generator connections.
- e. If all connections are good, remove the regulator from the system and perform the operational test per paragraph 4-3.

RESULT: If the regulator fails the operational test, replace the regulator.

- f. If the regulator is good, further troubleshooting of the system is required.

Table 4-1. Troubleshooting - Continued.

**MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION**

4. VOLTAGE UNSTABLE, HUNTING

- a. Check prime mover speed controls for possible speed variation.
- b. Substitute a replacement regulator; if the problem still exists, contact Basler Electric Company Application Engineers for assistance.

5. POOR VOLTAGE REGULATION

- a. *[XR2002F Only]* Voltage reduction under load is due to speed change from no load to full load and frequency compensation is reducing voltage.
- b. Ensure that voltmeter is connected at same point as regulator sensing.
- c. The presence of waveform distortion can cause an rms voltmeter indication to differ from the averaged voltage sensed by the regulator. Use rectifier type meter and check voltage regulation.
- d. Replace voltage regulator.
- e. Contact Basler Electric Company Application Engineers for assistance.

6. FUSE FAILURE

If fuses in the sensing circuit fail, a ground loop may be the cause. Check that a double ground is not present.

4-3. OPERATIONAL TEST

NOTE

This test may not reveal a voltage stability or hunting problem.

- a. Connect the test setup as shown in Figure 4-1. Do not apply power. Ensure the light bulb is 120 V and less than 200 watts.

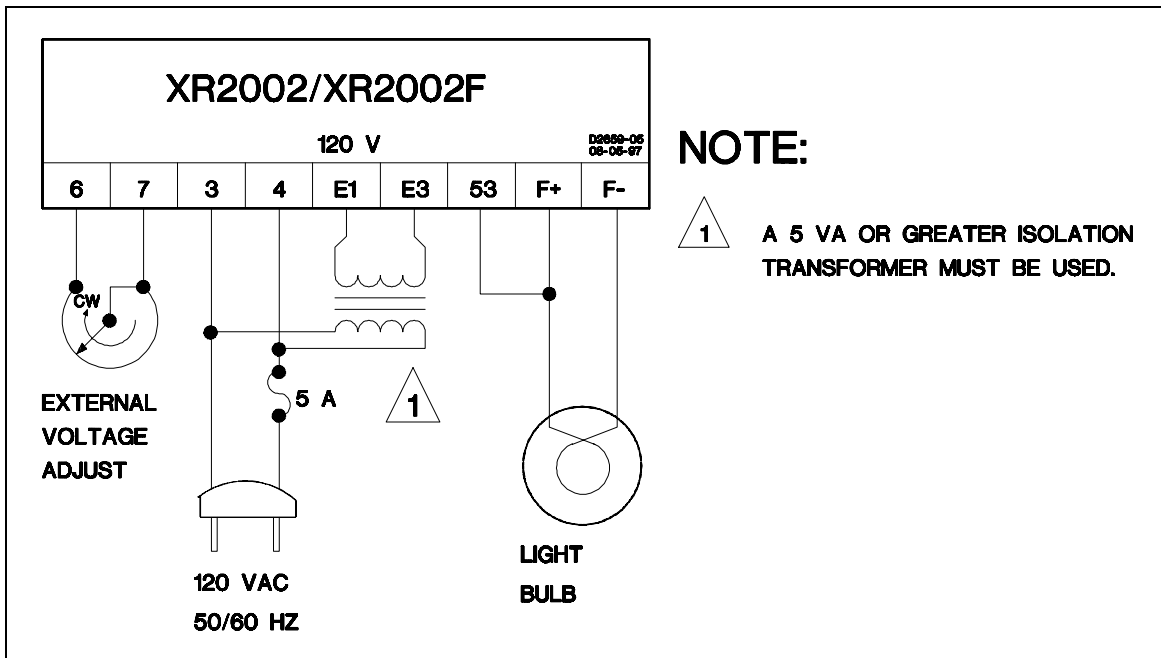


Figure 4-1. Operational Test.

- b. Adjust external voltage adjust rheostat for maximum resistance.
- c. Apply 120V 50/60 Hz power to regulator.

RESULT: Light bulb flashes momentarily.

- d. Slowly adjust the external voltage adjust rheostat toward minimum resistance.

RESULTS:

- (1) Before minimum resistance is reached, the light bulb reaches full brilliance to signify the regulating point.
- (2) At the regulating point, a small change in the external voltage adjust rheostat should turn the light bulb on or off.
- (3) Speed of turn-on or turn-off of bulb should be faster at CCW "STAB" control setting than at CW setting.

SECTION 5

REPLACEMENT PARTS

5-1. GENERAL

The following list (Table 5-1) describes the components and assemblies of the voltage regulator that have maintenance significance. When ordering parts from Basler Electric Company, be sure to specify the regulator part number (9 1394 00 100 or 9 1394 00 101, as applicable), reference, Basler part number, quantity, and description.

Table 5-1. Replacement Parts

Reference	Basler Part Number	Qty	Description
-----	9 1394 01 100	1	Circuit Board Assembly (XR2002 Only)
-----	9 1394 01 101	1	Circuit Board Assembly (XR2002F Only)
CR4, CR8, CR9, CR10	02677	4	Diode
CR5, CR6, CR7	06721	3	Diode
Q3	09791	1	Transistor
Q4, Q5	14936	2	Transistor
Q6	14928	1	Transistor
R50	06874	1	Resistor, 500 Ω , 25 W