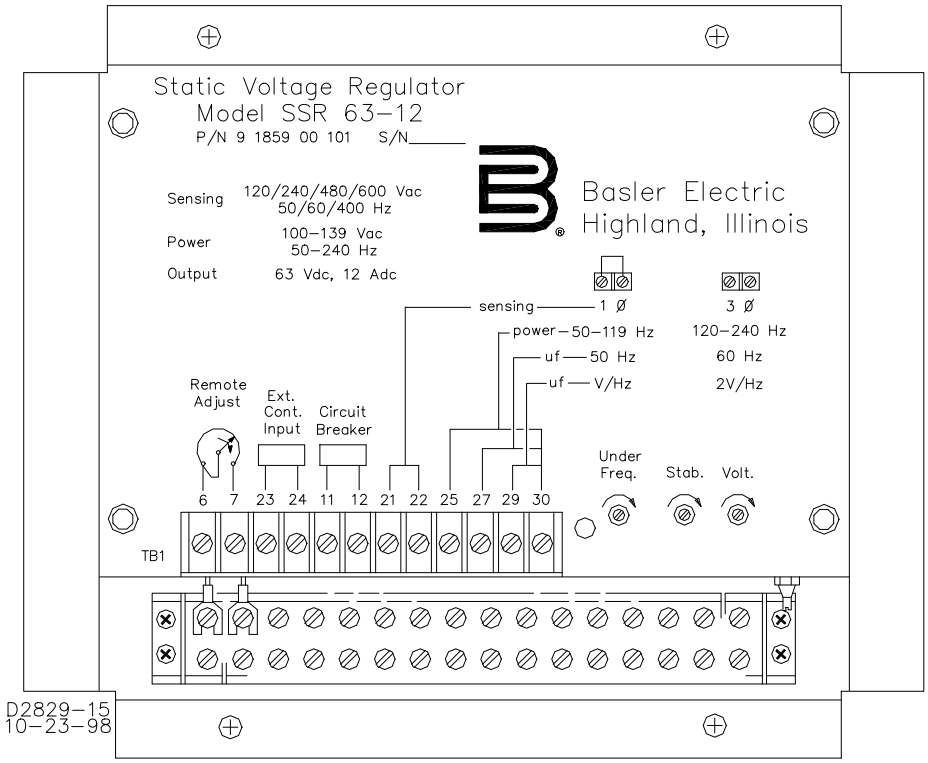
INSTRUCTION MANUAL
FOR
STATIC VOLTAGE REGULATOR

Models	Part Number
SSR 32-12	9185900100
SSR 63-12	9185900101
SSR 125-12	9185900102



Basler Electric

Publication Number: 9185900990
Revision: S 04/12

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INTRODUCTION

This manual provides information concerning the operation and installation of Static Voltage Regulators. To accomplish this, the following is provided.

- Specifications
- Functional Description
- Installation Information
- Operation
- Maintenance

WARNING!
To avoid personal injury or equipment damage, only qualified personnel should perform the procedures presented in this manual.

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.

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

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SECTION 1 • GENERAL INFORMATION

DESCRIPTION

The Basler SSR Series Voltage Regulator precisely controls the output voltage of an ac electric generating system by controlling the amount of current supplied to the exciter (or generator) field. The SSR Series Voltage Regulators are for use on brushless generators that require a high performance regulator and use a wide range of accessory devices.

Compatible with a variety of input voltages and frequencies, the SSR Series Voltage Regulator features a selectable V/Hz or 2-V/Hz frequency characteristic. The 2-V/Hz characteristic is for improved prime mover response during large motor starting and/or large load pick-up. The greater voltage drop means less kW loading will be seen by the prime mover and thus, a faster speed recovery.

Both the SSR 63-12 and SSR 125-12 have full-wave outputs, while the SSR 32-12 has half-wave outputs.

SPECIFICATIONS

Refer to Table 1-1 for the electrical specifications and to Table 1-2 for the physical specifications.

Table 1-1. Electrical Specifications

Input Power Requirements **SSR 32-12:** **SSR 63-12:** **SSR 125-12:**	 90 to 153 Vac, single phase, 50 to 240 Hz, 700 VA 90 to 153 Vac, single phase, 50 to 240 Hz, 1,200 VA 170 to 305 Vac, single phase, 50 to 240 Hz, 2,400 VA
Input Sensing Requirements: **50 Hz:** **60 Hz:**	 90-110/170-242/340-457 Vac, 3 ϕ (selectable 1 ϕ) 90-132/187-264/374-528/540-660 Vac, 3 ϕ (selectable 1 ϕ)
Input Sensing Burden:	3.5 VA per phase.
Paralleling Compensation Input:	5 A from CT at rated load with 10 VA maximum. burden at 0.8 PF
Regulation Accuracy:	±0.25% from no-load to full-rated load.
Thermal Stability:	±0.5% for any 50°C change within operating range.
Power Dissipated:	30 W maximum.
Power Output: **SSR 32-12:** **SSR 62-12:** **SSR 125-12:**	 32 Vdc/12 A Continuous; 50 Vdc/20 A Forcing (115 V input). 63 Vdc/12 A Continuous; 100 Vdc/20 A Forcing (115 V input). 125 Vdc/12 A Continuous; 200 Vdc/20 A Forcing (230 V input).

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Table 1-1. Electrical Specifications - Continued

Minimum Field Resistance: **SSR 32-12:** **SSR 63-12:** **SSR 125-12:**	 2.5 Ω 5.0 Ω 10.0 Ω
Frequency Compensation:	Variable. Frequency roll-off is preset at the factory for 48.5 Hz. (50 Hz. systems) and 58.5 Hz. (60 Hz. systems). Either V/Hz or 2 V/Hz can be selected. Refer to Figures 1-1 and 1-2.
Voltage Buildup:	From 6 volts residual or more (12 V for the SSR 125-12 only).
Internal Voltage Adjust Range (Minimum):	For 120 V Tap: 90 to 132 Vac; For 240 V Tap: 170 to 264 Vac; For 480 V Tap: 340 to 528 Vac; For 600 V Tap: 540 to 660 Vac.
Overexcitation Protection:	Removes excitation if the regulator output is at 95% of rated forcing voltage for more than 60 seconds or instantaneously (<1 second) if output exceeds 130 % of rated forcing voltage. Refer to Figure 1-3.
External Voltage Adjust Range:	±10% of nominal.
Optional Circuit Breaker:	Rated at 20 A, 277 Vac, 50/60 Hz., with a 5,000 A interrupting capacity.

Table 1-2. Mechanical Specifications

Storage Temperature Range:	–40°C (–40°F) to +85°C (+185°F).
Operating Temperature Range:	–40°C (–40°F) to +70°C (+158°F).
Humidity:	The control module is totally protected for humidity and condensation by encapsulation.
Vibration:	Withstands the following: 5 to 26 Hz. at 1.2 G 27 to 52 Hz. at 0.036 inch double amplitude 53 to 1000 Hz. at 5.0 G
Shock:	Withstands 15 G in each of three mutually perpendicular planes.
Weight:	12 lb (5.4 kg) net 15 lb (6.8 kg) shipping.
Overall Dimensions: **Height:** **Width:** **Depth:**	 9.0 in (229 mm) 11.1 in (282 mm) 3.6 in (91 mm)
Optional Circuit Breaker: **Shock:** **Vibration:** **Weight:**	 Withstands 100 G Withstands 10 G 10 oz (283.5 g) net.

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ACCESSORIES

The SSR Series Voltage Regulators is designed to be compatible with any of the Basler accessories and equipment listed below:

a. Remote mounted overexcitation circuit breaker (P/N 9185900014). See Section 2, *Installation* for more information.

b. Var/Power Factor Controller (SCP 250)

c. Series Boost Option (SBO 160)

d. Current Transformers (CT2 through CT50)

e. Exciter Diode Monitor (EDM 200)

f. Minimum/Maximum Excitation Limiter (EL 200)

g. Auto-Synchronizer (BE3-25A or BE1-25A)

h. Line Drop Compensator (LDC 300)

i. Manual Voltage Control (MVC 112)

j. Low and Medium Power Isolation Transformers. See Table 1-3.

Table 1-3. Transformer Selection

Voltage	SSR 32-12	SSR 63-12	SSR 125-12
240/480	BE22207001	BE22209001	BE12819001
600	BE22207001	BE11050001	BE22209001
2,400/4,160	BE22208001	BE13487001	BE12818001
7200	BE22210001	BE22136001	BE22136001
13,800	BE22210001	BE21327001	BE21327001

NOTE: Transformers used with the SSR 32-12 are designed to be compatible with the regulator's half-wave dc output.

SPIKE SUPPRESSION MODULE

Some higher impedance power sources (such as power isolation transformers and PMGs) may have enough inductance to cause potentially damaging voltage spikes in the power output stage of the SSR Voltage Regulator. In these cases, Basler Electric recommends the use of the Spike Suppression Module which was supplied with the Regulator to filter out these potentially damaging voltage spikes. Refer to Section 2 for mounting and interconnection instructions.

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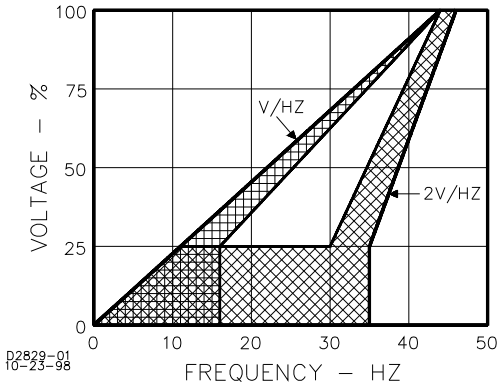


Figure 1-1. 50 Hz Frequency Compensation

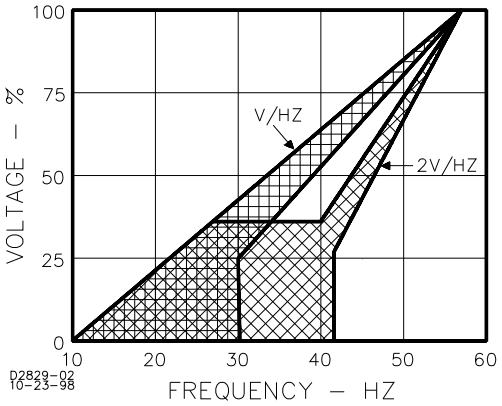


Figure 1-2. 60 Hz Frequency Compensation

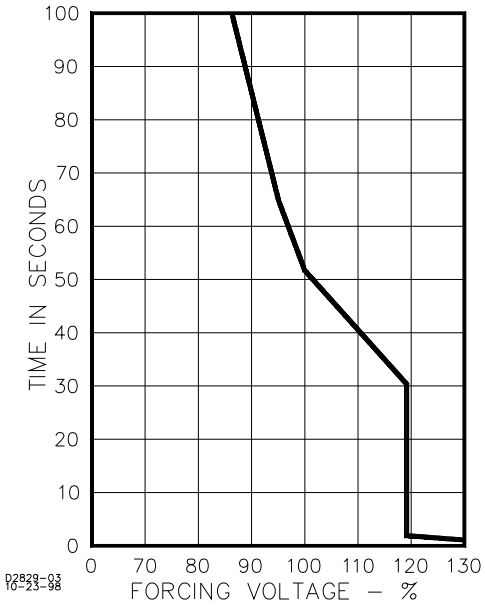


Figure 1-3. Overexcitation Shutdown Curve

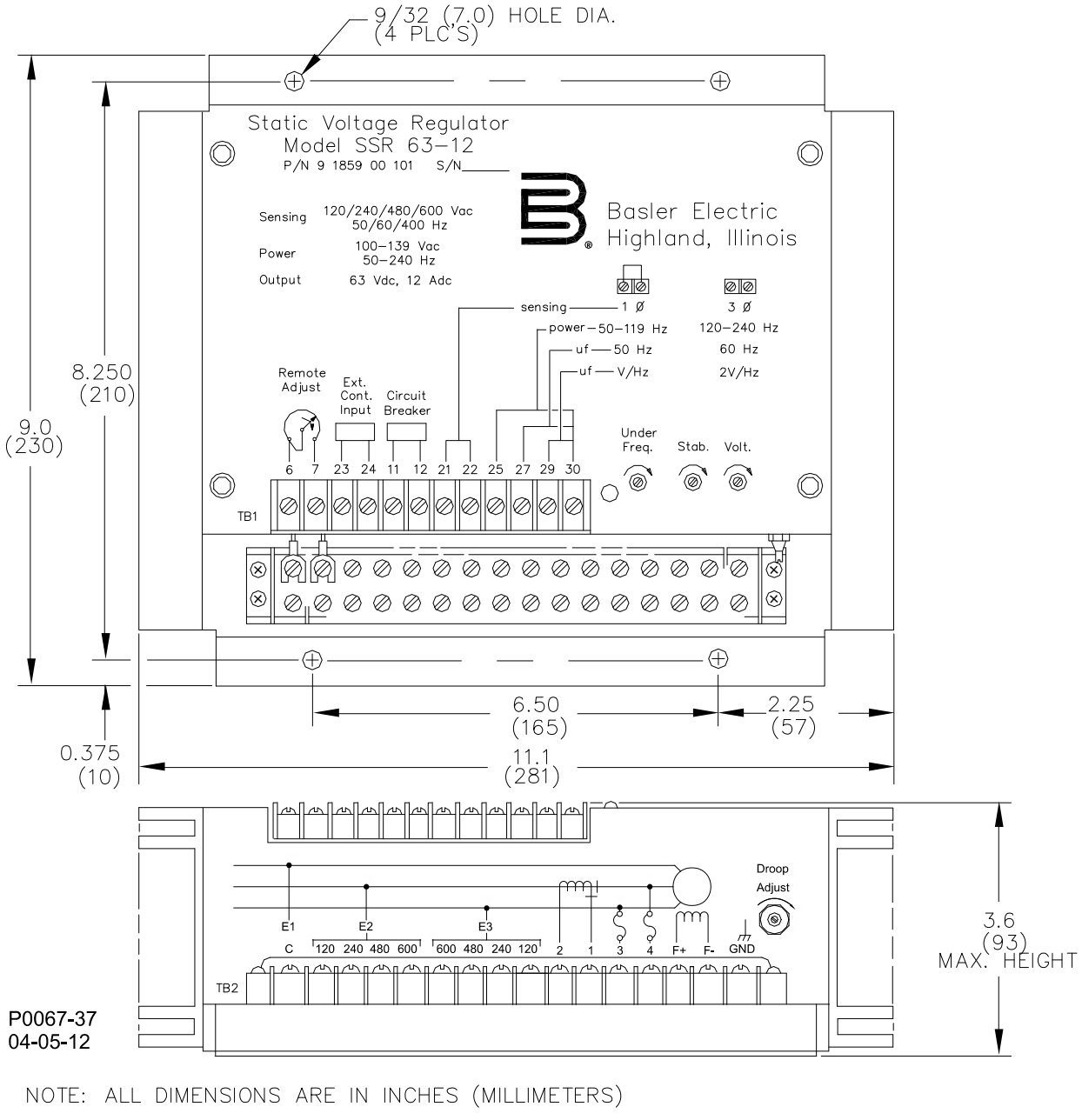
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SECTION 2 • INSTALLATION

MOUNTING

Voltage Regulator Mounting

The Voltage Regulator will operate when mounted in any position, however, it should be vertically mounted to obtain optimum cooling. The Regulator can be mounted in any location where the ambient temperature does not exceed the operational limits. Due to its rugged construction, the Regulator can be mounted directly on the generator. Mounting hardware should be selected based upon the vibration and shock expected to be encountered during shipping/transport and normal operation. Refer to Figure 2-1 for the outline drawing of the unit which provides overall and mounting dimensions.



NOTE: ALL DIMENSIONS ARE IN INCHES (MILLIMETERS)

Figure 2-1. SSR Regulator, Outline Drawing

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Spike Suppression Module Mounting

The Spike Suppression Module will operate when mounted in any position. The Spike Suppression Module can be mounted in any location where the ambient temperature does not exceed the operational limits. Due to its rugged construction, the Spike Suppression Module can be mounted directly on the generator. Mounting hardware should be selected based upon the vibration and shock expected to be encountered during shipping/transport and normal operation. Refer to Figure 2-2 for the outline drawing of the unit which provides overall and mounting dimensions.

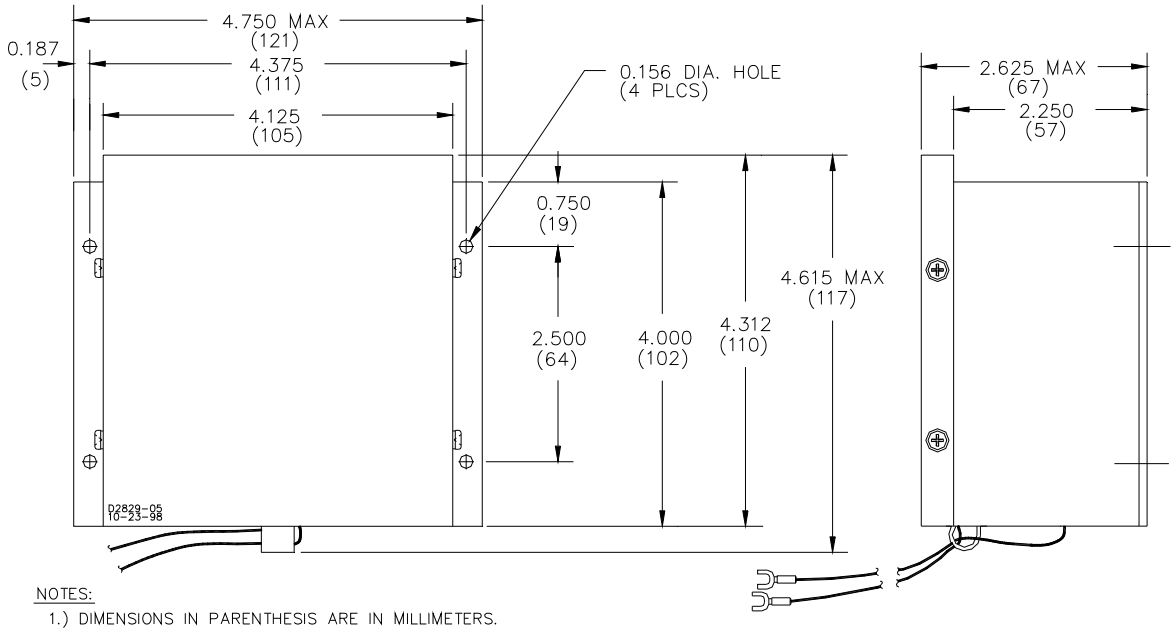


Figure 2-2. Spike Suppression Module, Outline Drawing

INTERCONNECTION

CAUTION

Meggers and high potential test equipment must not be used. Incorrect use of such equipment could damage the semiconductors in the Regulator.

General

The regulator must be connected to the generator system as instructed in this section and as shown in the basic interconnection diagrams (refer to Figures 2-3 through 2-5).

NOTE

If the input power source is from a power isolation transformer or a PMG, the spike suppression module should be connected to provide transient voltage spike protection for the regulator.

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Regulator Sensing Connections

Three-Phase Sensing

The SSR Voltage Regulators contain internal sensing transformers with taps for the various input sensing voltages. Connect the input sensing (external terminals) as follows (refer to Figure 2-3):

(a) Connect terminal TB2-E1 (C) to phase A.

(b) Connect terminal TB2-E2 (Taps for 120, 240, 480, and 600 Vac are provided) to phase B.

CAUTION

Be sure to use the same value tap for TB2-E3 that was used for TB2-E2.

(c) Connect terminal TB2-E3 (Taps for 120, 240, 480, and 600 Vac are provided) to phase C.

(d) Be sure to remove any jumper installed across terminals TB1-21 and TB1-22.

Single-Phase Sensing

The SSR Voltage Regulators use the same internal sensing transformer for single-phase sensing that it uses for three-phase sensing. Connect the input sensing (external terminals) as follows (refer to Figure 2-4):

(a) Install a jumper between terminals TB1-21 and TB1-22.

(b) Connect terminal TB2-E1 (C) to phase A.

(c) Connect terminal TB2-E3 (Taps for 120, 240, 480, and 600 Vac are provided) to phase C.

Frequency Selection

Match the regulator underfrequency range to the generator frequency as follows:

50 Hz Systems (48 - 53 Hz Underfrequency)

Connect a jumper between terminals TB1-27 and TB1-30.

60 Hz Systems (54 - 63 Hz Underfrequency)

Remove any jumpers connecting terminals TB1-27 and TB1-30.

In either of the above cases, the frequency compensation slope can be selected for either volts/Hertz or twice volts/Hertz as follows:

Volts/Hertz

Connect a jumper between terminals TB1-29 and TB1-30.

Twice Volts/Hertz

Remove any jumpers connecting terminals TB1-29 and TB1-30.

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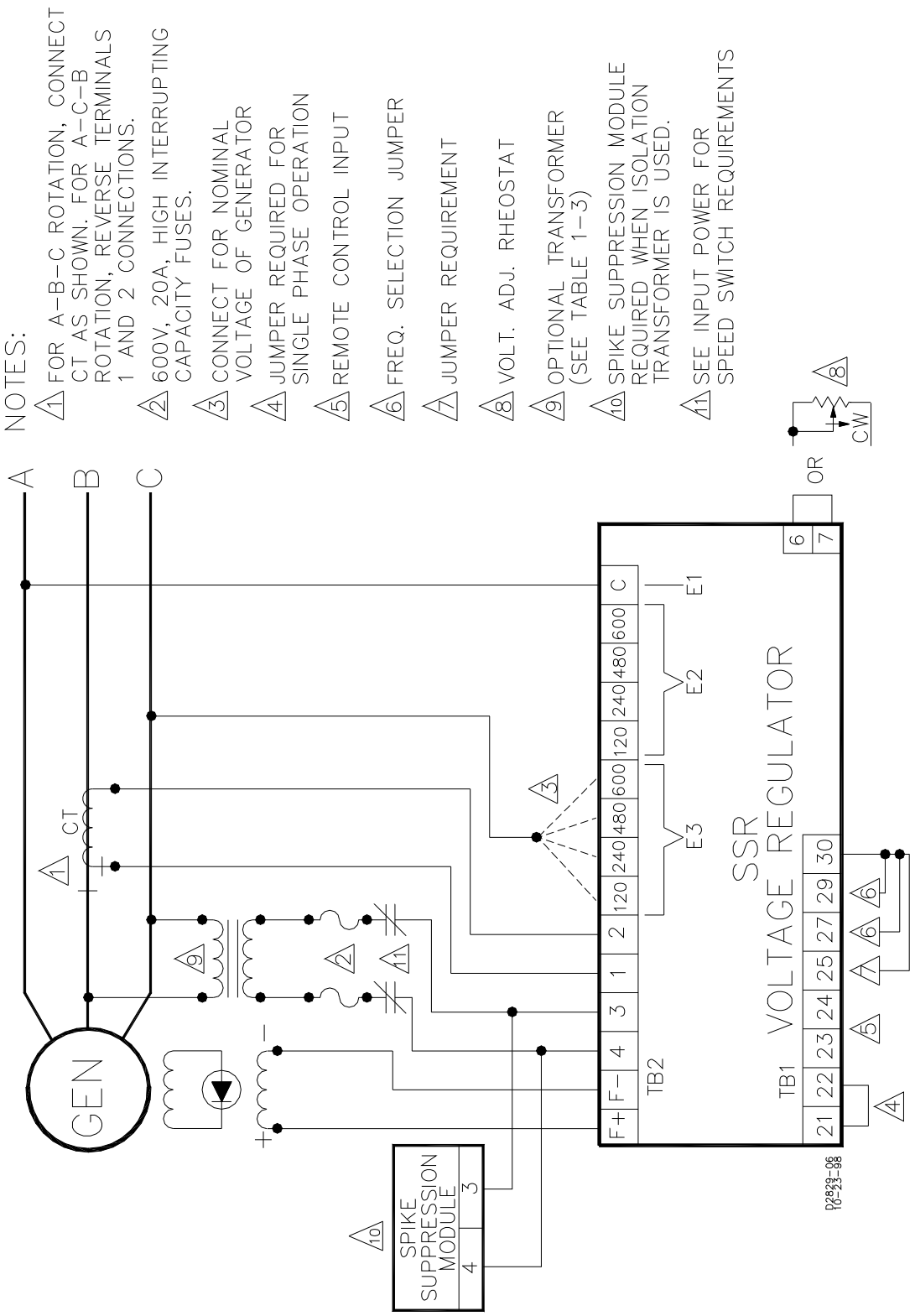


Figure 2-3. Typical SSR Voltage Regulator Interconnection, Single-Phase Sensing

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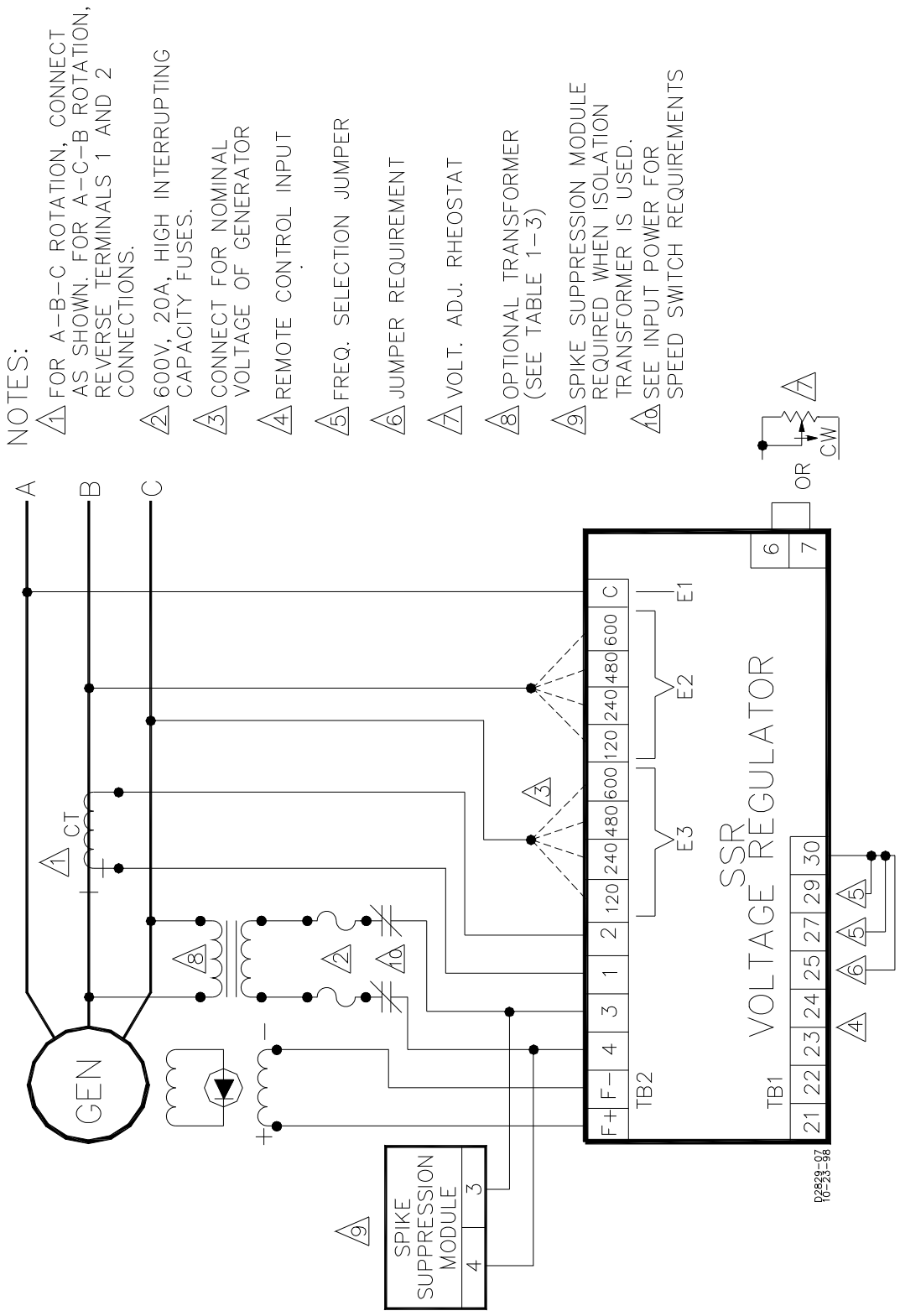


Figure 2-4. Typical SSR Voltage Regulator Interconnection, Three-Phase Sensing

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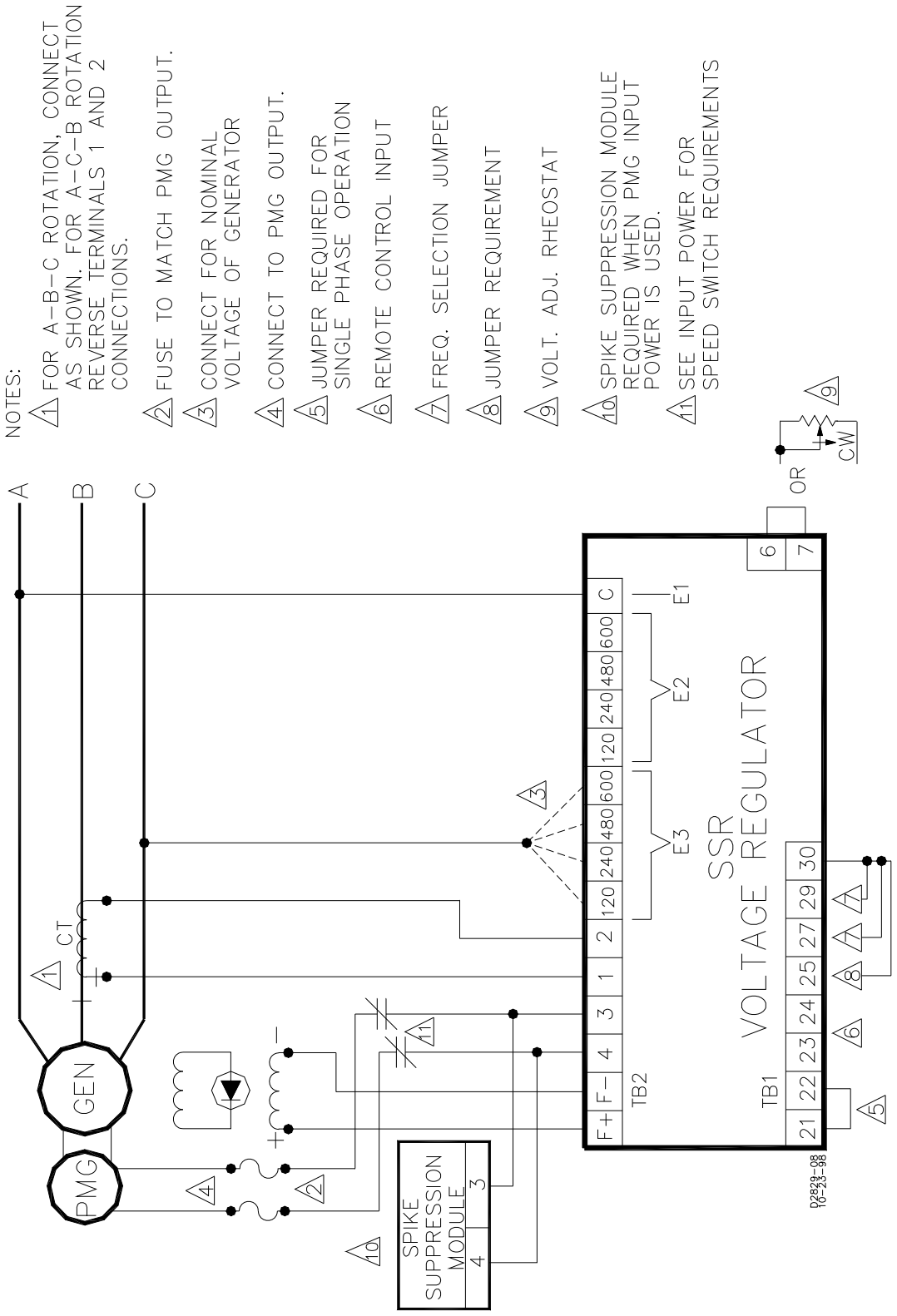


Figure 2-5. SSR Voltage Regulator Interconnection with PMG

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Field Power Connection

(1) Be sure to observe polarity and connect the field leads to terminals TB2-F+ and TB2-F-.

(2) The dc resistance of the field to which the Regulator is connected (terminals TB2-F+ and TB2-F-) must be equal to, or greater than that specified in Table 1-1. If the resistance is less than the specified minimum, a resistor must be added in series with the field. This resistor value plus the field resistance, must be equal to or greater than the minimum field resistance.

Input Power

(1) If the SSR is to be powered directly from a generator output, terminals TB2-3 and TB2-4 must be fused and connected to lines C and B respectively. Please refer to Figures 2-3 and 2-4 for the proper connections.

(2) When the generator output voltage does not match the values given in Table 1-1, a power transformer must be used to match the generator output to the Regulator input (refer to Table 1-3 for proper transformer selection). If excessive voltage is applied to the Regulator, the Regulator will be damaged.

CAUTION

Without the use of a power isolation transformer, any ground in the field circuit and another ground in the generator output could result in Regulator failure.

NOTE

On prime mover applications that require a long time to reach rated RPM, a speed switch setting should be coordinated such that input voltage applied to the SSR is above the SSR minimum residual build-up level. The minimum residual build-up level is 6 Vac for the SSR32-12 and SSR63-12, and 12 Vac for the SSR125-12.

(3) If the field or field flashing circuit is grounded, a power transformer must be used to isolate the Regulator input from ground.

(4) If the SSR is powered directly from a 50 Hz or 60 Hz generator output (as in Figures 2-3 and 2-4), install a jumper between terminals TB1-25 and TB1-30. If the SSR is powered from a special source, such as a PMG (as in Figure 2-5), the frequency of the incoming power must be considered. If this frequency is less than 120 Hz, install a jumper between terminals TB1-25 and TB1-30. If the input power frequency is between 120 Hz and 240 Hz, then remove any jumpers connecting terminals TB1-25 and TB1-30.

External Control Input

When using an external control device such as a VAR/Power Factor Controller (SCP 250), Auto-Synchronizer (BE1-25A or BE3-25A), and/or a Minimum/Maximum Excitation Limiter (EL 200), then connect them in series with terminals TB1-23 and TB1-24. Refer to the accessory item manuals for proper connection.

Remote Voltage Adjust Rheostat

When using an external voltage adjust rheostat, connect the rheostat to terminals TB1-6 and TB1-7. Use the potentiometer supplied with the Regulator (as a loose item) or replace it with any 5 kW, 2 Watt rheostat/potentiometer. If using only the internal voltage adjust, install a jumper across terminals TB1-6 and TB1-7. If shielding of the wiring is required due to its location in a high noise environment, connect the shield to terminal 30 of the SSR. If connected anyplace else, the shielding will not have any effect.

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Parallel Compensation

(1) When it is required to operate the generator in parallel, a 25 VA current transformer (CT) is required. The CT is connected into the generator line and should deliver from 3 to 5 amperes secondary current at rated load to the Regulator terminals, TB2-1 and TB2-2.

(2) The phase relationship of the CT signal to the Regulator sensing input must be correct or the system will not parallel properly. For three-phase sensing, the CT must be installed in the line supplying the sensing voltage to terminal TB2-E2 (phase B). For single-phase sensing, the CT must be installed in the line that does not supply sensing to the Regulator (phase B).

Reactive Droop Compensation

(1) For reactive droop compensation, connect the Regulator to the CT as shown by Figures 2-3 and 2-4.

(2) A unit/parallel switch shorts the parallel CT secondary to prevent any droop signal from being injected into the regulating system during single-unit operation. The switch may not be required on parallel droop compensation applications where a voltage drop is not objectionable.

Reactive Differential (Cross-Current) Compensation

(1) On parallel reactive differential (cross-current) compensation applications, a contact should be used to short out the paralleling CT secondary when that generator is not paralleled to the bus. If the switch is not used, a voltage droop will be introduced into the system. This is due to the unloaded generator parallel CT not supplying a compensated signal, but allowing a voltage drop to occur across it. Lack of this shorting contact will also cause the voltage of the oncoming generator to fluctuate prior to paralleling. Ideally, this contact is an auxiliary of the circuit breaker contractor (52 device) that opens when the breaker is closed.

(2) For reactive differential (cross-current) compensation, refer to Figure 2-6 when only SSRs are being used. If SSR and non-SSR regulators are used, refer to Figure 2-7. First connect each CT to its respective Regulator. Then connect the end of the first CT to the start of the second CT, the end of the second CT to the start of the third, etc. Continue until all of the CT's are connected in series. The final step will be to connect the end of the last CT to the start of the first CT.

(3) Reactive differential compensation should not be used with generators in parallel with the utility or any infinite bus. If the system will be paralleled with a source not in the loop, a switching circuit must be used to convert the system to a reactive droop compensation system by opening the loop at any point.

Overexcitation Circuit Breaker

An optional Overexcitation Circuit Breaker is available which will perform three functions as follows (refer to Figures 2-8 through 2-10):

(1) The Circuit Breaker can be operated manually to perform as an On/Off switch to apply or remove ac power and replaces the input power fuses connected to terminals TB2-3 and TB2-4.

(2) The Circuit Breaker will respond to a special signal from the overexcitation circuit in the Regulator. This signal will open the Circuit Breaker if the field voltage remains after the internal overexcitation circuit has tripped and thus provide a back-up to the Regulator circuitry. This condition could arise as a result of component failure within the regulator.

(3) In 50/60 Hz applications, the Circuit Breaker provides overcurrent protection. For higher frequency power sources such as a PMG, fuses must be used to provide proper overcurrent protection.

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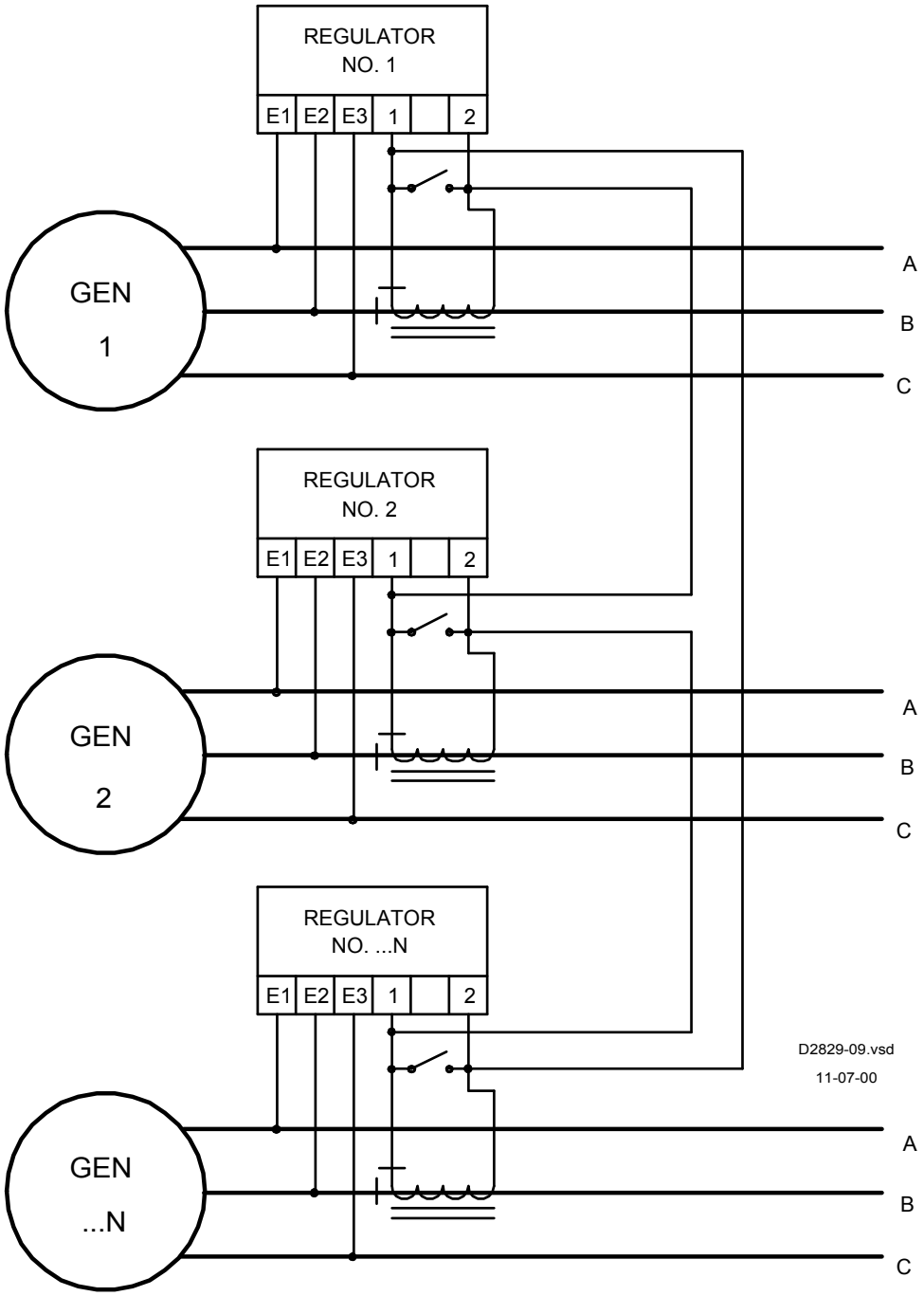


Figure 2-6. Reactive Differential (Cross Current) Compensation CT's Interconnection

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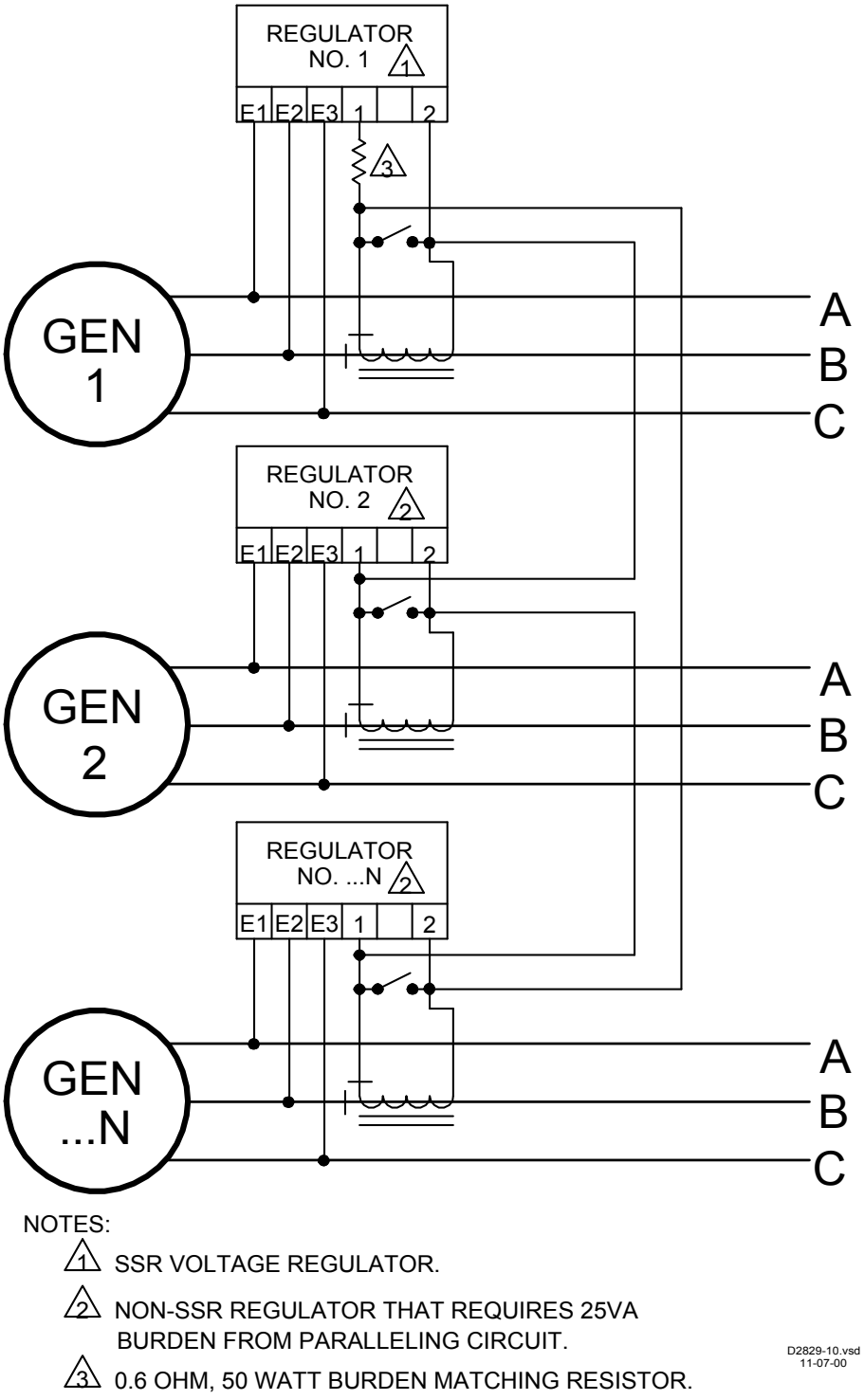


Figure 2-7. Reactive Differential (Cross Current) Compensation CT's Interconnection with Non-SSR Regulators

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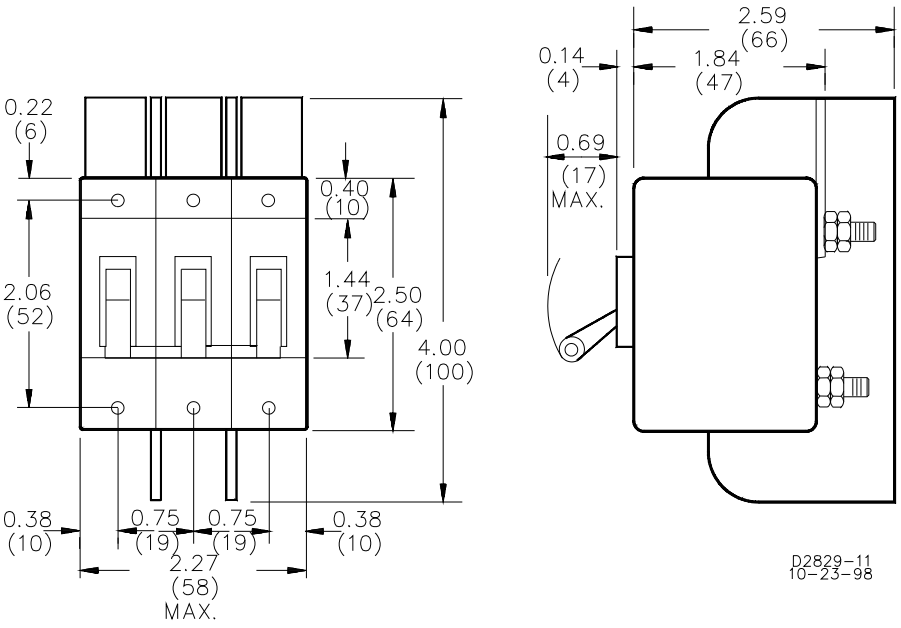


Figure 2-8. Overexcitation Circuit Breaker Outline Drawing

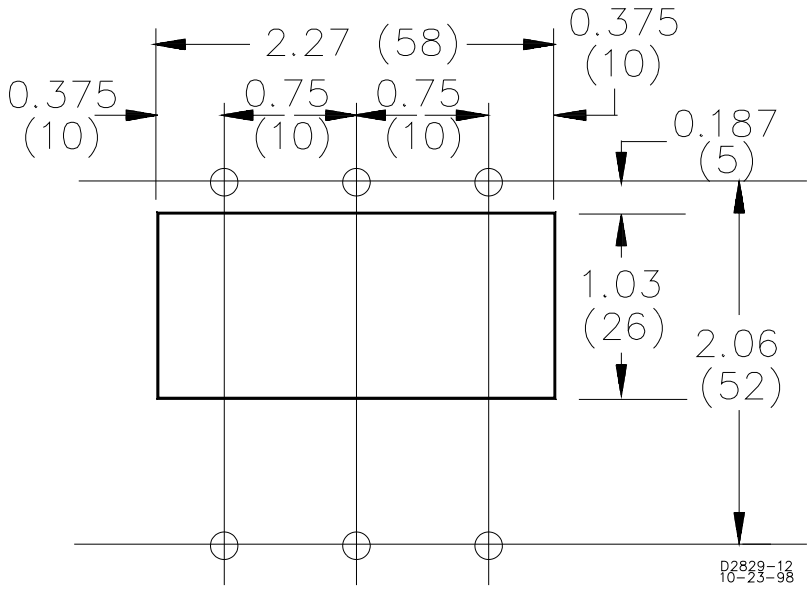


Figure 2-9. Overexcitation Circuit Breaker Panel Cutout Drawing

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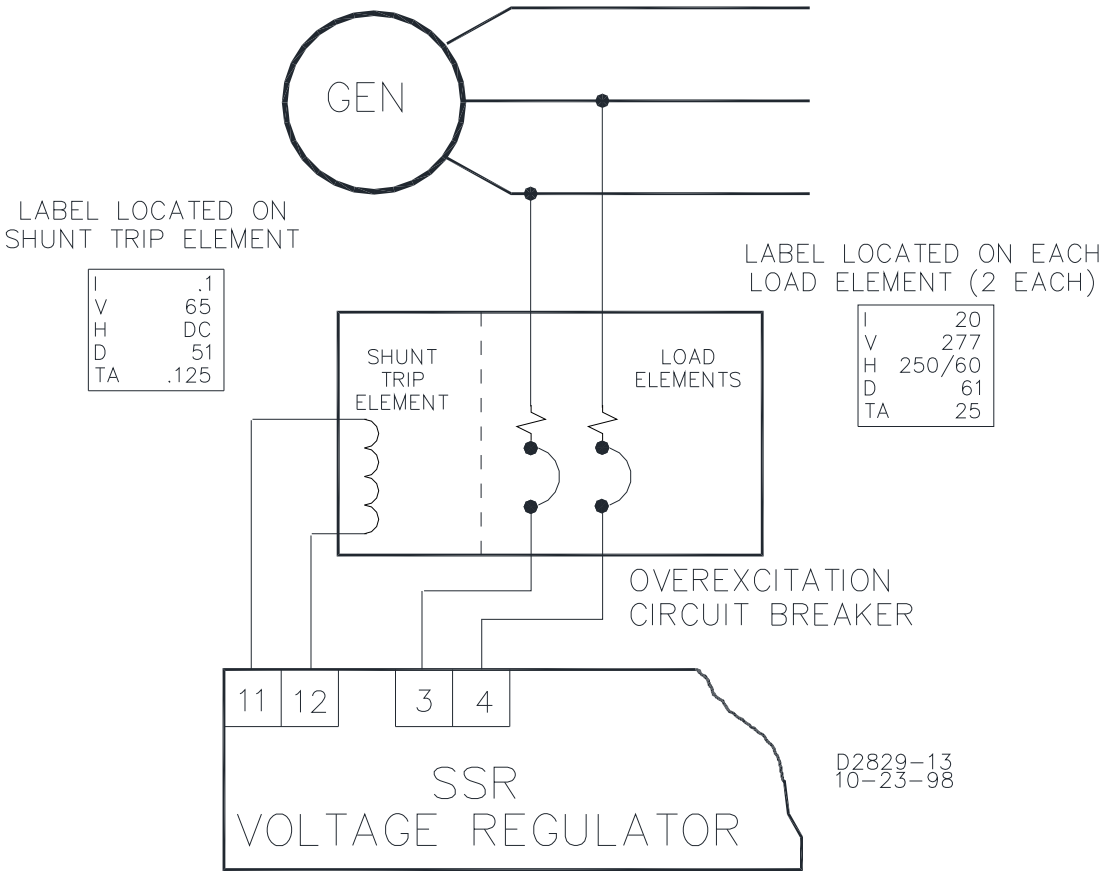


Figure 2-10. Overexcitation Circuit Breaker Interconnection Drawing

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SECTION 3 • OPERATION

FRONT PANEL CONTROLS AND INDICATORS

VOLT Adjustment

This adjustment is used to control the generator output voltage. When adjusted fully counterclockwise (CCW), minimum generator voltage is obtained. Maximum generator voltage is obtained with full clockwise (CW) rotation. This adjustment also allows for centering the external (remote) voltage adjust rheostat if it is used.

STAB Adjustment

This adjustment is used to provide stable regulator operation. Normally, this adjustment is factory set in the (CW) position. While this setting assures good stability, it does tend to slow the generator response time. If rotated CCW, the generator response time will decrease. However, if rotated too far CCW, the generator voltage may oscillate (hunt). It should then be rotated CW to a point well above the point where oscillation occurred. The system voltage instability is most likely to occur at no-load.

FREQ Adjustment

This adjustment is used to set the underfrequency roll-off point. By rotating the control CW, the roll-off point is increased. The roll-off point is adjustable between 48 and 63 Hz. For Volts-per-Hertz operation, rotate the **FREQ** control to maximum CW.

UNDER FREQ Indicator

This indicator (an LED) will light any time the generator frequency is below the roll-off point set by the **FREQ** adjustment. If operating in Volts-per-Hertz mode, this indicator will be illuminated at all times when the generator system is operating.

DROOP ADJUST Control

This adjustment sets the level of the reactive droop compensation.

OPTIONAL VOLTAGE SHUTDOWN SWITCH

CAUTION

When a voltage shutdown switch is used, it must always be installed in the input power circuit (Terminals TB2-3 and TB2-4). A high flyback could develop and damage the Regulator and/or Exciter field if this switch were installed in the dc field circuit (Terminals TB2-F+ and TB2-F-).

To avoid high voltage arcing, the field circuit must never be opened during operation. Also, a shutdown circuit using a field discharge resistor in the exciter field circuit must not be used. Safe shutdown can be accomplished only by interrupting the Regulator input ac power.

The Voltage Regulator and generator system may be equipped with a switch in the input power circuit to allow removal of the excitation from the field in an emergency or when the prime mover must be operated at an extremely reduced speed. If this switch is not used, it is recommended that a switch be temporarily be installed for the initial start-up.

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INITIAL OPERATION

Preliminary Instructions

Verify that all wiring is properly and securely connected. Refer to Section 2.

System Check-out

Perform the following steps to ensure the proper operation of the Regulator during initial operation:

(1) Start the prime mover and bring up to rated speed. If a voltage shutdown switch is used, close the switch to apply excitation. When this switch is not used, generator voltage will build up automatically.

(2) Verify generator voltage. Note that any of the following conditions may occur:

Overvoltage

If this condition occurs, open the shutdown switch and stop the prime mover. Determine the cause of the overvoltage. If necessary, refer to the troubleshooting chart in Section 4.

No Voltage Buildup

If this condition occurs, field flashing may be required. Refer to the following sub-section *Flashing.*

Undervoltage

If this condition occurs, adjust the **VOLT** control. If not corrected, refer to the troubleshooting chart in Section 4.

Voltage Builds Up and Then Collapses

If this condition occurs, stop the prime mover and determine the cause by referring to the troubleshooting chart in Section 4.

Oscillating Voltage

If this condition occurs, rotate the front panel **STAB** adjustment to correct. If the voltage continues to oscillate and the **STAB** control has no effect, refer to the troubleshooting chart in Section 4.

(3) Adjust the front panel **VOLT** control for nominal generator output.

(4) Apply load to the generator.

(5) Verify that the voltage regulation is within ±0.25%. If not, refer to the troubleshooting chart in Section 4.

(6) Alternately remove and apply the load to determine if the generator voltage is stable.

(7) If an underfrequency setting other than the factory pre-set is desired, proceed as follows:

  (a) Lower the generator frequency (speed) to the desired underfrequency value.

  (b) Rotate the front panel **FREQ** adjustment until the front panel **UNDER FREQ** indicator (LED) is illuminated.

  (c) Return the generator frequency (speed) to its nominal value.

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FIELD FLASHING

CAUTION

Do not attempt to flash the machine when it is rotating.

When the voltage regulator is operated with the generator for the first time, the polarity of residual magnetism may not be correct or of sufficient magnitude. If the generator does not build up after start-up, check for 6 volts or more residual at the Regulator terminals TB2-3 and TB2-4. If the voltage is below 6 volts, shut down the prime mover and proceed as follows:

a. With the prime mover at rest, apply a dc source (non-grounded) of not more than 12 Vdc, to terminals "F+" (positive) and "F-" (negative) while observing polarity, in series with a limiting resistor of 25 to 30 ohms.

b. Allow approximately 3 seconds before removing the dc source.

c. With the Voltage Regulator power input disconnected (terminals TB2-3 and TB2-4), start the prime mover and measure the voltage at the generator terminals. If the generator output is less than 6 volts, repeat steps a. and b. If the voltage is greater than 6 volts, voltage buildup should occur. Stop the prime mover and reconnect the regulator input power.

PARALLEL OPERATION

The following paragraphs describe the procedures to be followed when operating two or more generators in parallel. In order to ensure proper operation, the following requirements must be met:

(1) The voltage regulating systems must cause the generators to share the total kvar load,

and

(2) The speed governing system must make the generators share the total kW load.

Preliminary Instructions

It is essential that the paralleling signal at terminals TB2-1 and TB2-2 of the regulator have the proper phase relationship with that of the sensing voltages at terminals TB2-E1, TB2-E2, and TB2-E3. Verify that these connections are made as shown by Figure 2-2. If reactive differential (cross-current) compensation is desired, the paralleling CT's must be connected as described in Section 2. A CT must be selected which will furnish 3 to 5 amperes at the rated generator load current.

Preliminary Operation

Before attempting to parallel two or more generators, it is recommended that the individual generators be tested to verify that the paralleling features function properly. Test as follows:

(1) Place each generator in operation in accordance with initial operation instructions.

(2) Verify that the paralleling CT secondary is not shorted. (Unit/Parallel switch in Parallel position.)

(3) Verify that the front panel **DROOP ADJUST** control is adjusted for maximum droop.

(4) Apply 25% to 100% unity power factor load to the generator under test. The generator voltage should not change more than 1%.

(5) Apply 25% to 100% 0.8 PF inductive load to the generator under test. The generator voltage should droop from 2% to 6% with the reactive load. If the voltage rises instead of drooping, reverse the CT sensing leads.

(6) Verify that the voltage and speed do not drift or jump erratically.

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Conditions Necessary for Paralleling

In order to prevent damage to the generator and/or prime mover, paralleling should be attempted only when the generator speeds (frequencies) are equal and at the instant when the generator voltages are equal. That is, they have the same phase sequence of voltage and the voltages are in phase.

Paralleling Operation

The following instructions describe the procedures for paralleling two or more generators. If using an auto-synchronizer (such as the Basler BE1-25A or BE3-25A) than all adjustments and the breaker closure are automatically performed by the auto-synchronizer.

(1) Start generator No. 1 and verify that the bus is dead.

(2) Close the breaker connecting generator No. 1 to the bus.

(3) Adjust the generator voltage and frequency to nominal.

(4) Apply the load. (If possible, the load should be at least 10% or more of the generator kW rating.)

(5) Start generator No. 2 and adjust the output to nominal.

(6) Adjust generator No. 2's speed slightly higher than that of No. 1's. Speeds must be within 0.1 Hz (10 second rotation of synchroscope through 360°).

(7) At zero phase angle between the generator and bus, close the breaker for the No. 2 generator and immediately read the ammeter for No. 2. The reading should be well within the generator rating and the operation stable. If not, shut down the system and troubleshoot.

(8) Adjust the speed of No. 2 to the point where each set is carrying the desired share of the load.

(9) Adjust the voltage of No. 2 until the ammeter reading (of both generators) are near minimum.

(10) If kvar meters are available, adjust the front panel DROOP ADJUST on Regulator No. 2 for an equal kvar reading.

(11) If the generators are equipped with power factor meters instead of kW meters, alternately adjust the speed and droop of No. 2 until the ammeter readings are proportional and the power factor readings are equal.

NOTE

For best results, final adjustments should be made with a full load on the bus.

(12) With a full load applied, readjust the speed and voltage on No. 2 until the desired load division is obtained.

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SECTION 4 • MAINTENANCE

PREVENTIVE MAINTENANCE

The only preventive maintenance required on the SSR Series voltage regulators is to periodically check that the connections between the regulator and system are clean and tight and that the regulator cooling fins and housing are free from accumulations of dirt and dust.

CORRECTIVE MAINTENANCE

The SSR Series voltage regulators are designed for ease of repair by the replacement of major parts, such as the transformers, power module, or electronics module.

WARRANTY AND REPAIR SERVICE

The Basler SSR Series voltage regulators are warranted against defective material and workmanship for 18 months from the date of shipment from our factory. Units submitted for warranty repair should be returned to the factory in Highland, Illinois, freight prepaid, with a complete description of the installation and the reported problem. Pre-arrangement with either the nearest Basler Sales Office or with the factory will assure the fastest possible turn around time.

TROUBLESHOOTING

The more common generator system malfunctions and the appropriate repair procedures are listed in Table 4-1.

OPERATIONAL TESTING

To test the SSR Voltage Regulator, refer to Figure 4-1 and proceed as follows:

a. Adjust the front panel **STAB** control fully counterclockwise (CCW).

b. Connect the circuit as shown in Figure 4-1. The light bulb should be a 120 V type of not more than 300 W).

c. Adjust the Voltage Adjust Rheostat for maximum resistance.

d. Connect the regulator to a power source. Note that the light bulbs may flash momentarily.

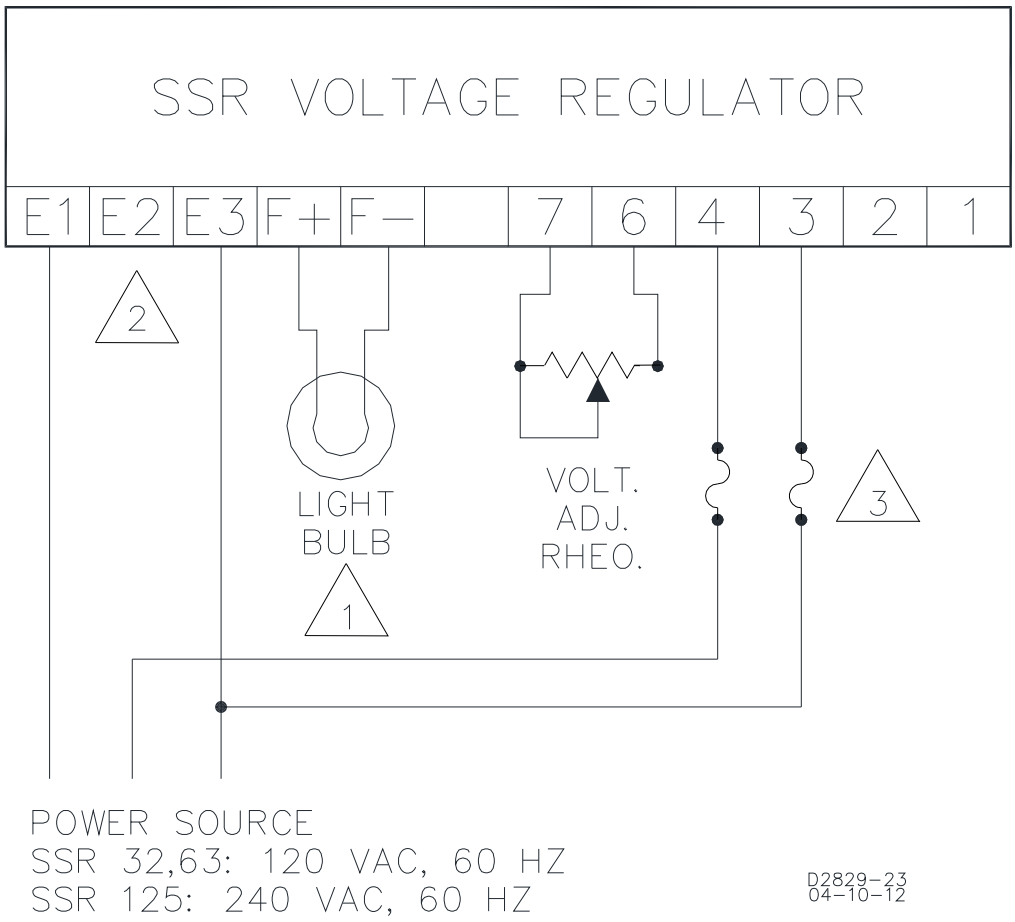
e. Slowly rotate the Voltage Adjust Rheostat toward minimum resistance. The light should reach full brilliance before minimum resistance is attained. (If the light does not illuminate, adjust the front panel **VOLT** control.)

f. At the regulating point, a small change in the Voltage Adjust Rheostat should turn the light on or off.

NOTE
If the light bulb(s) do not illuminate, the regulator is defective.

g. This test may not reveal a stability problem. However, rotating the front panel **STAB** adjustment should affect the bulb's turn on/turn off time.

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NOTES:

1. TWO IDENTICAL BULBS CONNECTED IN SERIES ARE REQUIRED FOR THE SSR 63 AND SSR 125.
2. FOR 3-PHASE SENSING, 3-PHASE VOLTAGE AND FUSING ARE REQUIRED
3. 5A, 120 V OR 5 A, 240 V GLASS ENCLOSED FUSES ARE REQUIRED

Figure 4-1. Operational Test

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SYMPTOM
CORRECTIVE ACTION

1. VOLTAGE DOES NOT BUILD UP TO RATED VALUE.

Step 1. Check for low residual voltage (less than 6 volts).

If low residual voltage exists, flash the field in accordance with Section 3.

If residual voltage is normal, proceed to step 2.

Step 2. Check Shutdown Switch and fuses.

Check that Shutdown Switch is closed.

Check that fuses are intact.

If Shutdown Switch is closed and fuses are intact, proceed to step 3.

Step 3. Check that prime mover is up to speed.

If prime mover is operating at rated speed, proceed to step 4.

Step 4. Verify that generator output is not shorted or heavily loaded.

If output is not shorted, proceed to step 5.

Step 5. Verify that the wiring between the external Voltage Adjust Rheostat and terminals TB1-6 and TB1-7 is not defective.

If wiring is defective, repair or replace wiring.

If wiring is not defective, proceed to step 6.

Step 6. Replace the external Voltage Adjust Rheostat and wiring with a jumper across terminals TB1-6 and TB1-7. Check for proper operation by adjusting the front panel VOLTS control.

If voltage buildup occurs, replace the external rheostat.

If voltage buildup does not occur, replace the regulator.

2. VOLTAGE BUILDS UP AND THEN DECAYS.

Check for open circuit from external Voltage Adjust Rheostat (if used), or lack of jumper across TB1-6 and TB1-7 (if an external Voltage Adjust Rheostat is not used).

If connections to TB1-6 and TB1-7 are not defective, replace the electronics module.

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SYMPTOM
CORRECTIVE ACTION

3. VOLTAGE HIGH AND UNCONTROLLABLE WITH VOLTAGE ADJUST RHEOSTAT.

CAUTION

The generator and exciter may be damaged by operation this condition for more than 5 to 10 seconds. Use the shutdown switch to minimize operating time.

Step 1. Adjust the front panel **VOLT** control fully CCW.

If this reduces the voltage below nominal value, adjust for nominal voltage and discontinue troubleshooting. If not, proceed to step 2.

Step 2. Verify that sensing voltage is available at terminals TB2-E1, TB2-E2, and TB2-E3 and that the proper taps are used.

If sensing voltage is not available, correct wiring.

If sensing voltage is proper, proceed to step 3.

Step 3. Replace the internal sensing transformers (BE21755001).

Step 4. Replace the electronics module.

4. VOLTAGE HIGH AND CONTROLLABLE WITH VOLTAGE ADJUST RHEOSTAT.

Step 1. Adjust the front panel **VOLT** control fully CCW.

If this action reduces the voltage below nominal, adjust for nominal voltage and discontinue troubleshooting. If not, proceed to step 2.

Step 2. Verify that the sensing voltage is available at terminals TB2-E1, TB2-E2, and TB2-E3 and that the proper taps are used.

If the sensing voltage is not available, repair wiring.

If the sensing voltage is proper, proceed to step 3.

Step 3. If using single-phase sensing, verify that the jumper across terminals TB1-21 and TB1-22 has been installed.

If jumper is not present, install jumper.

If jumper has been installed, proceed to step 4.

Step 4. Check for defective voltmeter.

If voltmeter is defective, replace voltmeter.

If voltmeter is not defective, proceed to step 5.

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SYMPTOM
CORRECTIVE ACTION

4. VOLTAGE HIGH AND CONTROLLABLE WITH VOLTAGE ADJUST RHEOSTAT - Continued.

Step 5. Replace the internal sensing transformers (BE21755001).

Step 6. Replace the electronics module.

5. VOLTAGE LOW AND CONTROLLABLE WITH VOLTAGE ADJUST RHEOSTAT.

Step 1. Verify that prime mover is up to rated speed.

If prime mover is not operating at rated speed, increase speed.

If prime mover is operating at rated speed, proceed to step 2.

Step 2. Verify that the sensing voltage is available at terminals TB2-E1, TB2-E2, and TB2-E3 and that the proper taps are used.

If the sensing voltage is not available, repair wiring.

If the sensing voltage is proper, proceed to step 3.

Step 3. If using three-phase sensing, verify that the jumper across terminals TB1-21 and TB1-22 has been removed.

If jumper is present and three-phase sensing is used, remove jumper.

If jumper has been removed or three-phase sensing is not used, proceed to step 4.

Step 4. Check for defective voltmeter.

If voltmeter is defective, replace voltmeter.

If voltmeter is not defective, proceed to step 5.

Step 5. Check the front panel **UNDER FREQ** indicator.

If the indicator is lit, and frequency (speed) is correct, adjust the front panel **FREQ** control CCW until the indicator is out. Then adjust for normal voltage.

If the above fails, proceed to step 6.

Step 6. Replace the electronics module.

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SYMPTOM
CORRECTIVE ACTION

6. POOR REGULATION

Step 1. Verify that the field voltage/current requirements at full load are not in excess of the maximum Regulator output capability.

If regulator limits are being exceeded (per Table 1-1), consult with factory for suitable model.

If regulator limits are not exceeded, proceed to step 2.

Step 2. Verify that the input power to terminals TB2-3 and TB2-4 is correct (see Table 1-1).

If input power is incorrect, connect proper power input.

If input power is correct, proceed to step 3.

Step 3. Verify that generator output voltmeter is connected at the same location as sensing inputs.

If voltmeter location is different, reconnect.

If voltmeter location is the same, proceed to step 4.

Step 4. Check for waveform distortion due to harmonic content in generator output voltage. (Regulator senses average voltage, meter may be indicating RMS value.)

If waveform distortion is present, use an average sensing (rectifier type) voltmeter to verify regulation accuracy.

If waveform distortion is not present, proceed to step 5.

Step 5. Verify that Unit/Parallel switch is in Unit position except during parallel operation.

If Unit/Parallel is in incorrect position, place switch into proper position.

If Unit/Parallel switch is in proper position, proceed to step 6.

Step 6. Verify that load is balanced (three-phase sensing only).

If load is unbalanced, measure three phase-to-phase voltages at no-load and full-load. Calculate the average of these voltages to verify regulation accuracy.

If load is balanced, proceed to step 7.

Step 7. Verify that Regulator frequency compensation circuit is not causing load change by observing the front panel **UNDER FREQ** indicator at no-load and full-load. If LED lights, adjust the front panel **FREQ** control CW or increase prime mover speed until the LED does not light.

Step 8. Replace the electronics module.

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SYMPTOM
CORRECTIVE ACTION

7. POOR STABILITY

Step 1. Check the adjustment of the front panel **STAB** control (Section 3).

If the front panel **STAB** control is out of adjustment, readjust.

If the front panel **STAB** control is in adjustment, proceed to step 2.

Step 2. Check for unstable frequency.

If the frequency is unstable, consult governor manual.

If the frequency is stable, proceed to step 3.

Step 3. Replace the electronics module.

8. VOLTAGE RECOVERY SLOW WITH LOAD CHANGE.

Step 1. Check the adjustment of the front panel **STAB** control (Section 3).

If the front panel **STAB** control is out of adjustment, readjust.

If the front panel **STAB** control is in adjustment, proceed to step 2.

Step 2. Verify that the field voltage/current requirements at full load are not in excess of the maximum Regulator output capability.

If regulator limits are being exceeded (per Table 1-1), consult with factory for suitable model.

If regulator limits are not exceeded, proceed to step 3.

Step 3. Replace the electronics module.

9. PARALLEL GENERATORS DO NOT DIVIDE REAL kW LOAD EQUALLY.

Consult governor manual.

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SYMPTOM
CORRECTIVE ACTION

10. PARALLEL GENERATORS DO NOT DIVIDE REACTIVE LOAD EQUALLY.

Step 1. Verify that sensing CT is rated to produce 3 to 5 amperes at rated load.

If CT is of improper size, replace CT.

If CT is of proper size, proceed to step 2.

Step 2. Verify that terminals TB2-1 and TB2-2 are not shorted.

If terminals are shorted, open terminals.

If terminals are not shorted, proceed to step 3.

Step 3. Refer to Section 3 to verify proper connections and to test parallel compensation circuit.

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SECTION 5 • MANUAL CHANGE INFORMATION

CHANGES

Substantive changes in this manual to date are summarized in Table 5-1.

Table 5-1. Summary of Changes

Revision	Summary of Changes	Date
N	Corrected Voltage Build-Up in Specifications from “From 6 volts residual or less” to “From 6 volts residual or more.” Changed the format of the manual. Added Section 6 “Manual Change Information.”	10/98
O	Added polarity markings to CTs in Figures 2-6 and 2-7. In Table 5-1, corrected the Description for part numbers 19781 and 02682	11/00
P	Replaced obsolete part number for SCR Power Module in Table 5-1, *Replacement Parts*.	08/02
R	Removed Section 5, *Replacement Parts* and moved *Manual Change Information* from Section 6 to Section 5. Added publication number and revision level to page footers.	07/08
S	Updated *Input Power* (page 2-7) to state that when using generator output as input power, terminal TB2-3 must be connected to phase C and TB2-4 must be connected to phase B. Changed Figures 2-1, 2-10, and 4-1 to show new input power connections.	04/12

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