E. INPUT REQUIREMENTS

The VR900 regulator is designed to operate with a wide range of input voltages at either 50 or 60 Hz. This regulator utilizes 1 phase sensing source (line-to-line) and a separate power input 1 phase (line-to-line or line-to-neutral) per Figure 2.

For other voltages than listed in Figure 2, a voltage matching transformer should be used. (See Figure 3)

Voltage Sensing Input—1Ø VAC 50 or 60 Hz		
Voltage	Terminals	Model No.
95-120	TB1-TB2	VR900 VR901
190-240	TB1-TB3	
190-240	TB1-TB2	VR902
380-480	TB1-TB3	
Voltage Power Input—1Ø VAC 50 or 60 Hz		
Voltage	**Terminals**	**Model No.**
95-277	TB13-TB14	VR900 VR901 VR902

Figure 2
Input Requirements

Sensing Input	50 VA Typical with 120-240 VAC Secondary Use or Equivalent
Power Input	Power isolation or matching transformer is determined by the exciter field requirements. Examples: a. F.L. 70V @ 7A - Use 120V sec. × 7A = 840 VA b. F.L. 140V @ 3.5A - Use 240V sec. × 3.5A = 840 VA

Figure 3
Transformer Requirements

Output Power to Exciter Field			
Power Input Voltage	120 VAC	240 VAC	277* VAC
Voltage-Continuous (VDC)	70	140	160
Voltage-Forcing (VDC)	100	200	230
Current-Continuous (A)	0.03-7.0	0.06-7.0	0.06-7.0
Current-1 Min. Forcing (A)	10	10	10
Min. Field Res. (Ohms)	10	20	23
Max. Field Res. (Ohms)	100	100	100

Figure 4
Output Power to Exciter Field

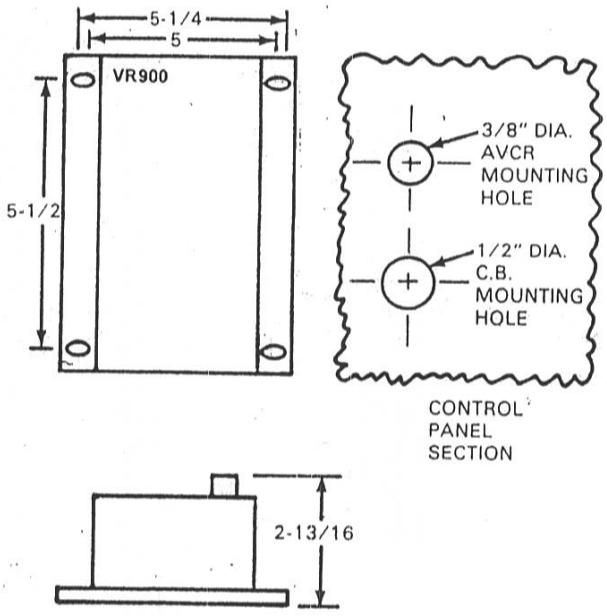


Figure 5
Mounting Hole Configuration

II. INSTALLATION

A. GENERAL

The **VR900** regulator has been designed and built to perform well under normal usage. As with all electrical control equipment, the following installation factors should be considered.

1. Protect from contaminants, such as: coal dust, rock dust, acid, salt and water.
2. Select the most vibration-free surface available for convenient mounting.
3. Protect from falling objects.

B. SAFETY

During installation and connection:

1. Generator set or line circuit breaker must be open.
2. Any external power source must be disconnected.
3. Remote starting circuits, starting battery, and mechanical starting equipment must be disconnected.

C. MOUNTING

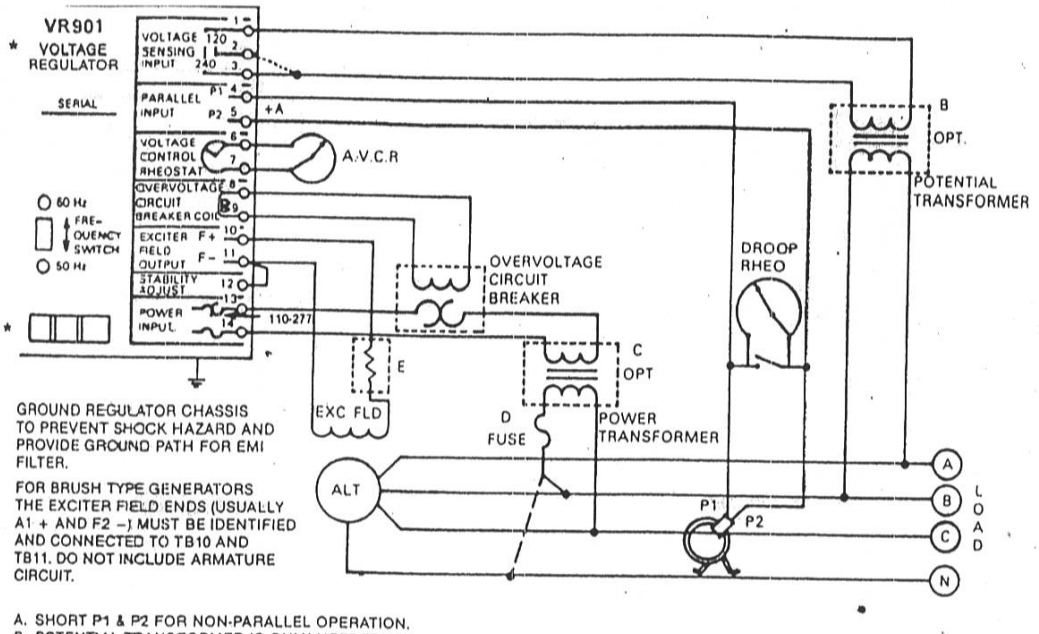
Four #10 bolts in a rectangle 5½ × 5-5¼ in. The regulator function is not affected by mounting position. Choose a mounting position that contributes to the general considerations listed above. Locate the automatic voltage control rheostat (AVCR) and circuit breaker (CB) at some convenient control panel location. See Figure 5.

WARNING

Ground the regulator chassis to prevent shock hazard and provide ground path for EMI filter. The current-carrying capacity of the grounding circuit must be greater than the capacity of the largest lead to the regulator.

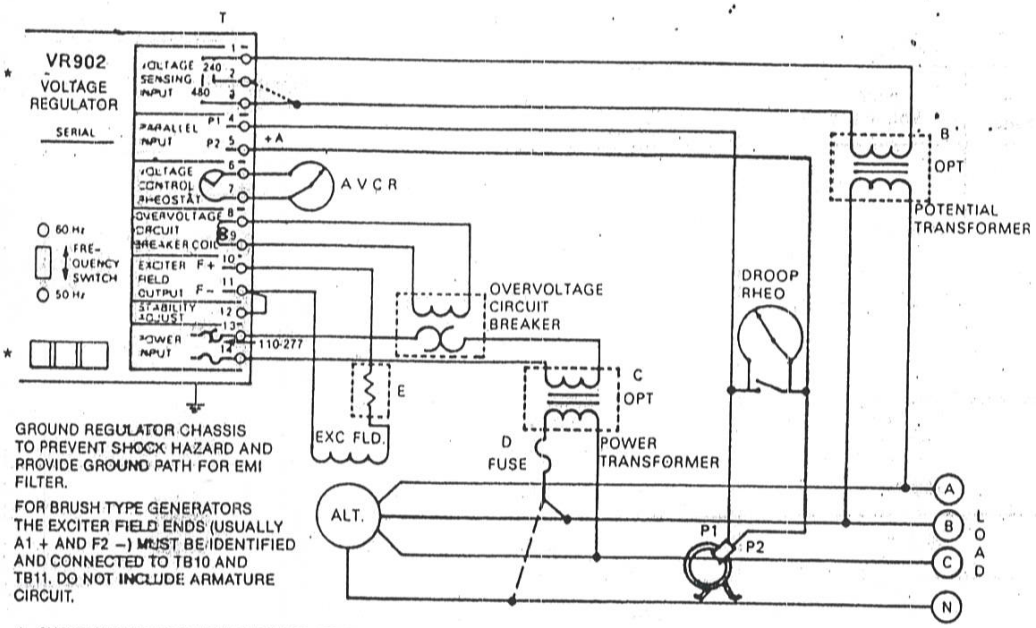
D. WIRE SIZE

Make all connections to the terminal boards of the regulator using AWG #14 or #16 stranded control wire.



A. SHORT P1 & P2 FOR NON-PARALLEL OPERATION.
B. POTENTIAL TRANSFORMER IS ONLY NEEDED IF 120 OR 240 SENSING VOLTAGE IS NOT AVAILABLE FROM ALT. USE A 50 VOLT AMP OR GREATER.
C. A POWER TRANSFORMER MUST BE USED IF 110 - 277 VOLTS A.C. IS NOT AVAILABLE FROM THE ALT. THE V.A. RATING MUST BE SIZED TO THE EXCITER REQUIREMENTS. IF EXCITER FIELD OR FIELD FLASHING CIRCUIT IS GROUNDED, A POWER ISOLATION TRANSFORMER MUST BE USED.
D. THE CIRCUIT BREAKER IS FOR OVERVOLTAGE PROTECTION ONLY. OVERCURRENT PROTECTION MUST BE PROVIDED BASED ON GENERATOR EXCITER FIELD REQUIREMENTS.
E. EXCITER FIELD D.C. RESISTANCE MUST BE AT LEAST 10 OHMS FOR 120V POWER INPUT OR 23 OHMS FOR 277V POWER INPUT. ADD SERIES RESISTOR AS REQUIRED.
F. CAUTION: SENSING INPUT VOLTAGE AND POWER INPUT VOLTAGE SHOULD BE FROM DIFFERENT PHASES OF ALTERNATOR AS SHOWN (*).

Figure 7
General Connection for VR901 Regulator



A. SHORT P1 & P2 FOR NON-PARALLEL OPERATION.
B. POTENTIAL TRANSFORMER IS ONLY NEEDED IF 240 OR 480 SENSING VOLTAGE IS NOT AVAILABLE FROM ALT. USE A 50 VOLT AMP OR GREATER.
C. A POWER TRANSFORMER MUST BE USED IF 110 - 277 VOLTS A.C. IS NOT AVAILABLE FROM THE ALT. THE V.A. RATING MUST BE SIZED TO THE EXCITER REQUIREMENTS. IF EXCITER FIELD OR FIELD FLASHING CIRCUIT IS GROUNDED, A POWER ISOLATION TRANSFORMER MUST BE USED.
D. THE CIRCUIT BREAKER IS FOR OVERVOLTAGE PROTECTION ONLY. OVERCURRENT PROTECTION MUST BE PROVIDED BASED ON GENERATOR EXCITER FIELD REQUIREMENTS.
E. EXCITER FIELD D.C. RESISTANCE MUST BE AT LEAST 10 OHMS FOR 120V POWER INPUT OR 23 OHMS FOR 277V POWER INPUT. ADD SERIES RESISTOR AS REQUIRED.
F. CAUTION: SENSING INPUT VOLTAGE AND POWER INPUT VOLTAGE SHOULD BE FROM DIFFERENT PHASES OF ALTERNATOR AS SHOWN (*).

Figure 8
General Connection for VR902 REGULATOR

NOTE

The effect of decreasing D.C. voltage removes the load from the auto-transformer, which causes the A.C. input voltage to increase several volts past the "cut-off point." ("cut-off point" is the value of A.C. input voltage at which the D.C. output voltage begins to decrease. This must be read quickly, before the unloading effect happens.) The reverse also happens. That is, if the A.C. input voltage is above the cut-off point (D.C. output voltage will be zero) and you decrease the A.C. input voltage, as soon as the D.C. output voltage begins to rise. The loading effect on the auto-transformer will cause a decrease in A.C. input voltage and the D.C. output voltage will increase rapidly until it is several volts below the cut-off point. Unless the auto-transformer is very large, it will be nearly impossible to hold the D.C. output voltage at any intermediate point.

d. As you increase the A.C. voltage input, pause at about 25 volts, 50 volts, and 75 volts and record the D.C. output voltage at each point to determine how close the regulator meets the typical curve of Figure 14. It should not deviate by more than 10% at any point.

e. As you approach 80 volts, go slow so that the A.C. input voltage may be read just as the voltage reaches the "cut-off point".

f. Range of voltage adjustment

Determine the cut-off point for zero ohms in the AVCR and for 3500 ohms. These should be within ±10 volts of the value given in Figure 14.

g. Gain test

With the cut-off point adjusted for 110 volts, adjust the A.C. input volts for about 115 volts and then reduce the input volts slowly. Record the A.C. input voltage when the D.C. volts have increased to about 5 volts. This value of A.C. input volts should be within 3 volts above the cut-off point (110 volts).

h. Overvoltage

With the cut-off point still at 110 volts, quickly adjust the A.C. input voltage to 125 volts. The overvoltage coil of the circuit breaker should trip the circuit breaker in 3 seconds. As soon as it trips, reduce the A.C. input voltage to below 110 volts. Turn power off. Reset the circuit breaker and adjust the A.C. input voltage to 115 volts. Turn the power on. The circuit breaker should not trip in 15 seconds.

8. If the regulator is within limits in all tests, it is good and may be used on any generator which operates in its range. (See Section IV, F.)

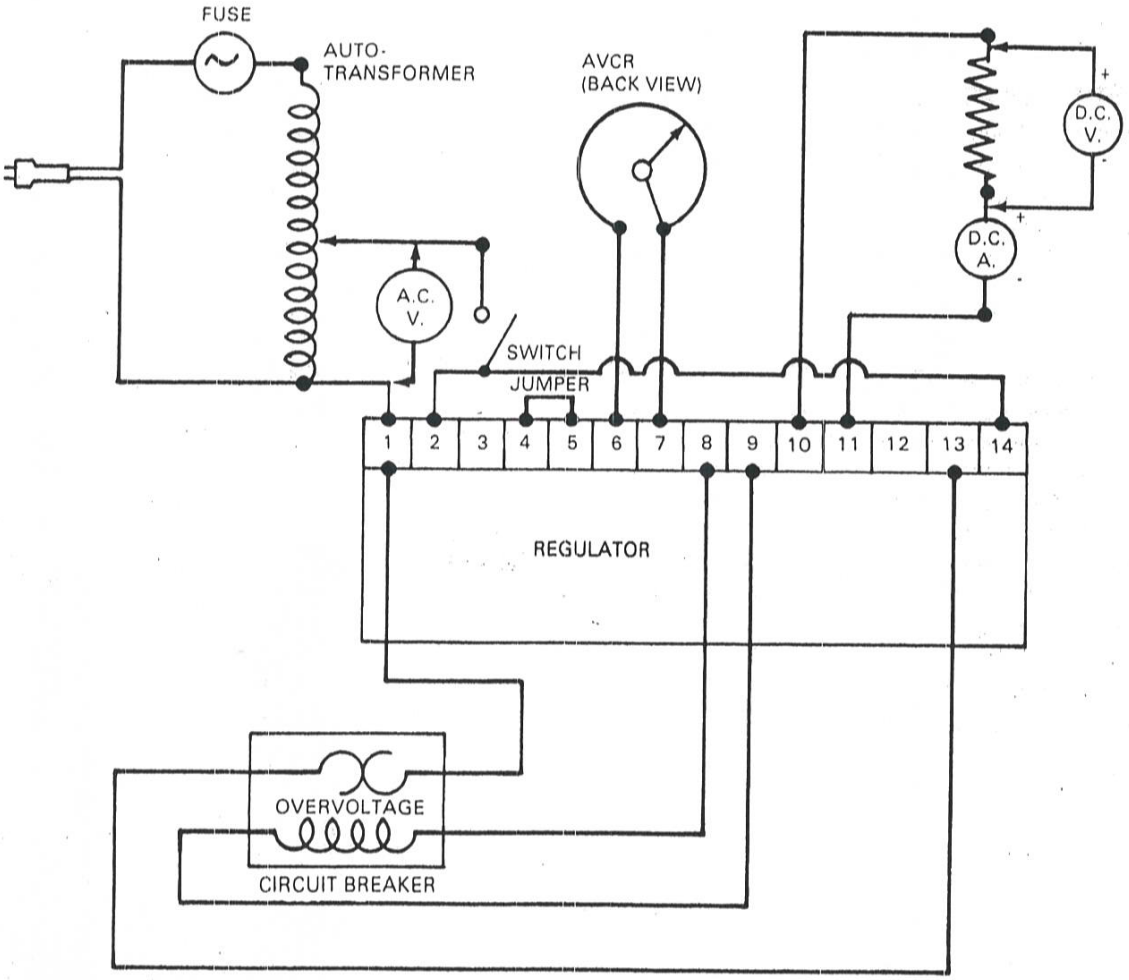
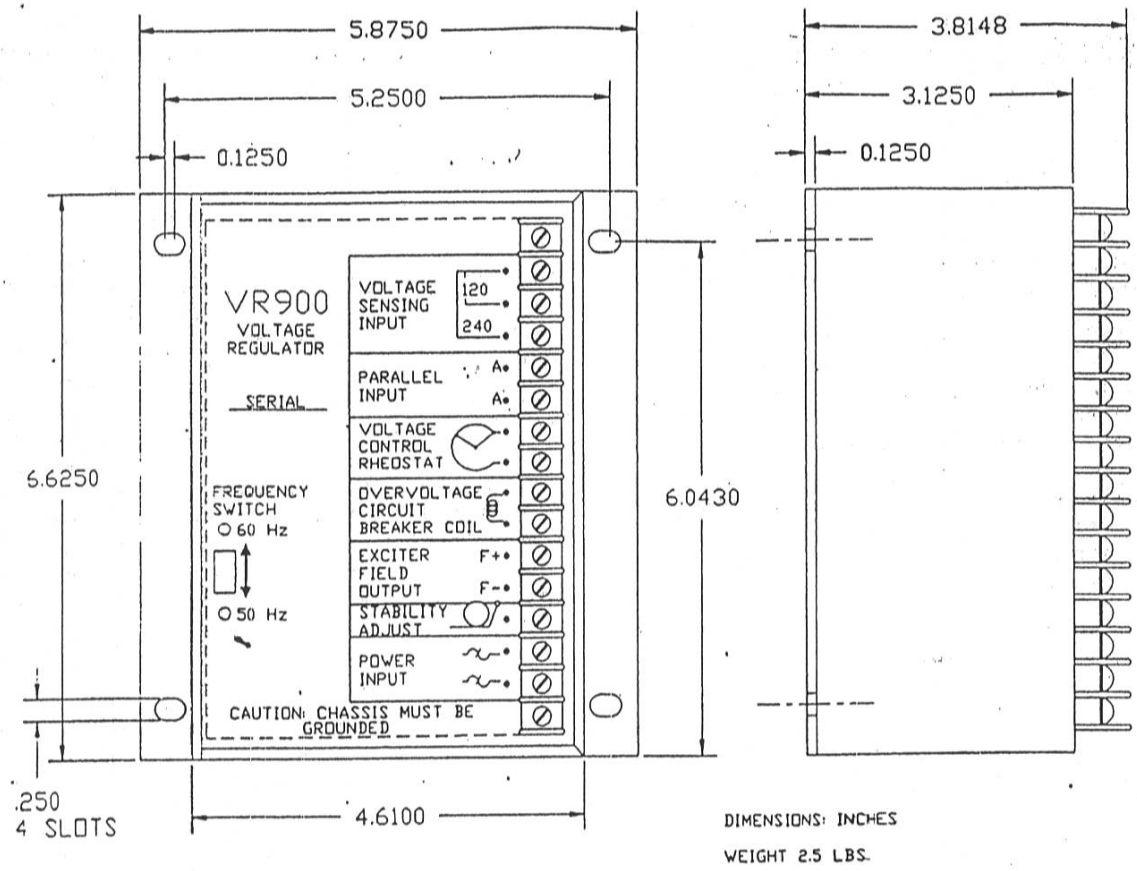
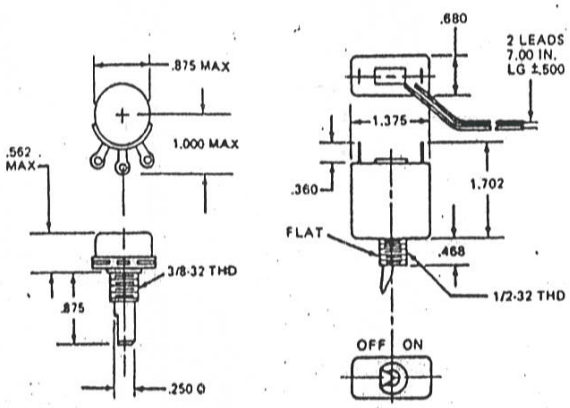


Figure 13
Connection Diagram for Bench Test

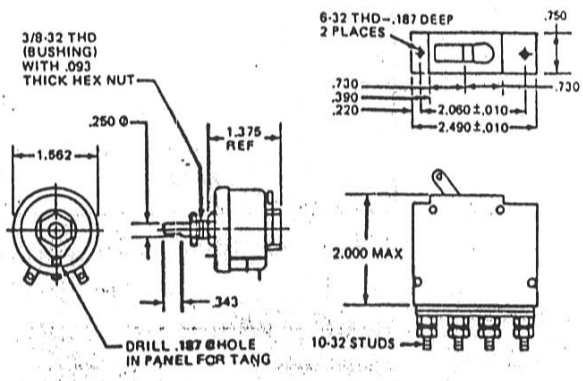
VR900 Series Dimensions

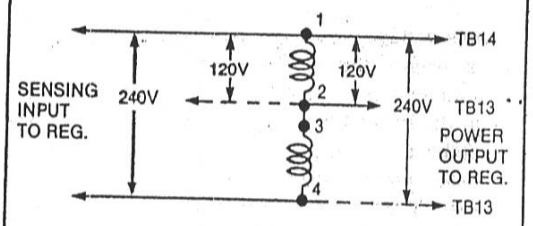


VR900 and VR902



VR901



Generator					
Description			Nameplate Voltage Within:	Gen. Voltage Conn.	Connection Options
Ph	Type	Leads			
1	—	4	60 Hz: 115/230-120/240 50 Hz: 110/220	RECONNECT-ABLE, HIGH OR LOW	

Hertz	Sensing Input—VAC	Power Input—VAC	Voltage Regulator Selection
60	115-240	115-240	VR900 VR901
50	110-220	110-220	
60	230-240	115-240	VR900 VR901 VR902
50	220	110-220	

Figure 13 (2 of 2)
Available Regulator-Generator Connections

III. START-UP PROCEDURE ("START-UP TESTS")

When a regulator is first applied to a generator or at any later time if the quality of the generator is questioned, the following tests should be conducted to be certain that there is no defect in the generator, even if it is new, and that the generator is in the proper operating range for the regulator.

If the tests, compared with known data, show that the generator is good, they should be kept so that later tests can be compared with them. These tests require the engine to be running at rated speed and that the meters are accurate.

The exciter field current or voltage across the exciter field are **very** important. Record these readings and compare with values listed on generator nameplate and capability of the **VR900** regulator.

1. Turn AVCR fully CCW (Max. resistance) so that the line voltage will be at a minimum after the engine is started. **Note:** See Figure 1 for proper AVCR wiring.
2. Start the driving engine and adjust to **rated speed** of the generator.
3. With each of the following conditions, read and record exciter field amps. **Record** the D.C. voltage across the exciter field if a DC ammeter with the proper range is not available. The exciter field amps (or volts) is **very important,** especially under **load. DO NOT** exceed 7 amps continuous or 10.0 amps for **1 minute** (field forcing).
   a. At no load—with AVCR fully CCW.
   b. At no load—with AVCR fully CW—not longer than 30 sec. (If the A.C. voltage at this point exceeds 120% of rated voltage, take the reading at 120% of rated voltage.)
   c. At no load—with AVCR adjusted to rated voltage.
   d. At no load—with speed reduced from 10% to 50% of rated speed—output voltage should drop and exciter field current should not exceed generator nameplate rating.
   e. Under any normal, relatively constant load, cold—when load is first applied.
   f. Under same load as (e) above, after two hours running. (May be eliminated on new generator.)
4. If voltage fails to build-up, is too low or too high and is not adjustable to rated voltage, exhibits other undesirable characteristics, or exciter field current exceeds 7.0 amps, check Section VI on "Troubleshooting."
5. If voltage is hunting or oscillating, change the setting of the stability adjust control. This control requires a screwdriver adjustment and is accessible through a hole in the top plate of the regulator. CW rotation decreases regulator response time. CCW rotation increases regulator response time, and assures output voltage stability. Find the point at no load where the voltage stops oscillating and advance slightly beyond in the CCW direction. Should you be unable to control hunting in this manner, remove the jumper between TB11 - TB12 and readjust the stability control.