

**INSTRUCTIONS
FOR
STABILINE®
Automatic Voltage Regulator
19-Inch Rack Mount
Model WHR11SSCX1R**

**Single-Phase
120 Volt**

Superior Electric reserves the right to make engineering changes on all its products. Such refinements may affect information given in the instructions. Therefore, **USE ONLY THE INSTRUCTIONS THAT ARE PACKED WITH THE UNIT.**

WARNING: High voltages are present inside this unit during operation. Do not operate this unit unless all covers are in place. Installation and servicing should be done only by qualified personnel.

Superior
Electric



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INSPECTION

When unpacking the unit, examine it carefully for any shipping damage. The "Damage and Shortage" instructions packed with the unit outline the procedure to follow if any parts are damaged or missing.

SECTION 1: DESCRIPTION

1.1 GENERAL

Model WHR11SSCX1R STABILINE Automatic Voltage Regulator is a single-phase, 120 volt, fast acting electromechanical regulator. The unit is rated for 6.8 or 13.7 kVA, depending on the selected input range. It has an electronic control section and a power section that utilizes a motor-driven POWERSTAT® Variable Transformer combined with a buck-boost transformer.

The WHR11SSCX1R can be rack mounted or may be used without any additional enclosure. It is approximately 19" (483mm) wide, 10.47" (266mm) high, 12.25" (311mm) deep and weighs approximately 88 pounds (40 kg). Two handles are provided on the front of the unit for use when installing or moving the regulator.

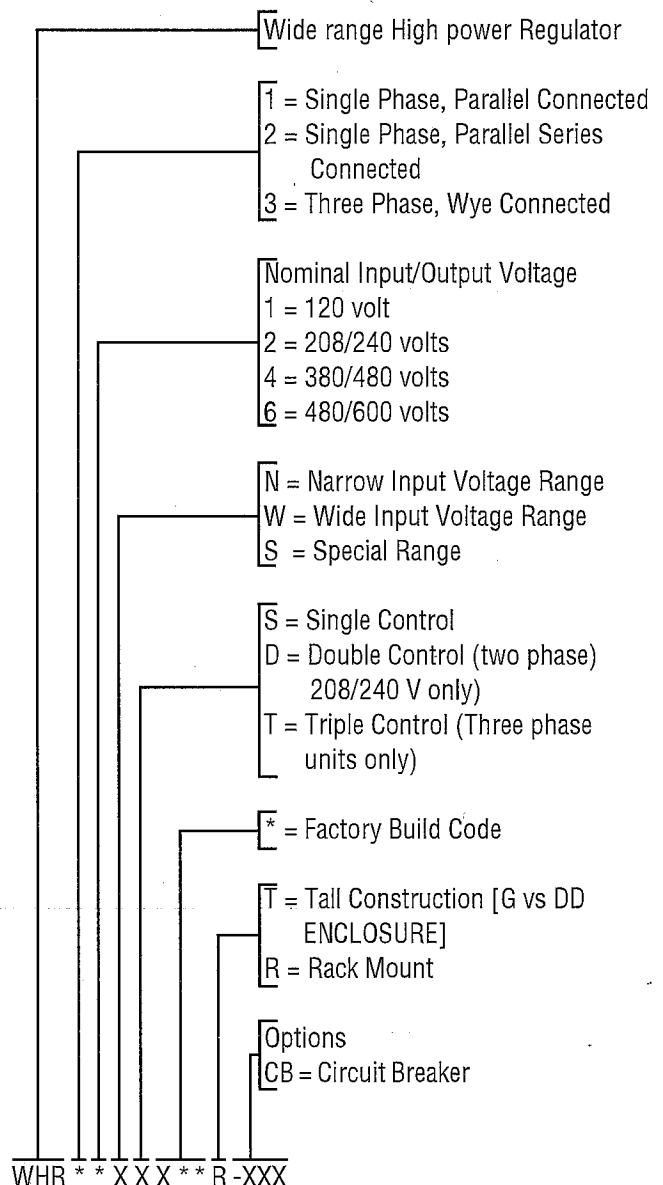
Section 7 of this manual provides complete ratings and specifications for this unit.

Advantages of all WHR Series regulators include high efficiency (98.5% typical), high overload capacity and low impedance. They are insensitive to the magnitude and power factor. Therefore, these regulators can be used with any type of load.

1.2 MODEL NUMBER

The model number of each WHR Series regulator identifies the various characteristics of that specific unit. The following table explains the meaning of each character in the model number.

WHR TYPE NUMBERING SYSTEM



1.3 THEORY OF OPERATION

The WHR11SSCX1R regulates voltage by automatically adjusting a motor-driven POWERSTAT Variable Transformer which supplies voltage to the primary winding of a buck-boost transformer. The secondary windings of the buck-boost transformer are connected in series with one side of the power line and either add to or subtract from the input voltage, depending on the voltage supplied to the primary winding by the POWERSTAT.

The POWERSTAT Variable Transformer is controlled by the solid-state control unit, which detects the output voltage and continually compares it with the output and accuracy settings selected by the user. If the output is out of specifications, the control unit drives the variable transformer brush, by means of a synchronous motor, to the required new position.

The secondary windings of the buck-boost transformer can be connected either in parallel or in series. This permits either a narrow or a wide range of input correction and a dual rating of 114 amperes, 13.7 kVA, or 57 amperes, 6.8 kVA. The WHR11SSCX1R is connected at the factory for narrow range operation. Refer to Section 2.2.1, Input Voltage Range, for additional information.

SECTION 2: INSTALLATION

2.1 MECHANICAL INSTALLATION

The WHR11SSCX1R is designed for either bench mounting or for standard 19" rack mounting. When installing the regulator in a rack, it is recommended that rear supports be provided.

The WHR Series regulator should be installed in an environment that meets the specifications for temperature and humidity levels as given in Section 7 of this manual.

2.2 ELECTRICAL INSTALLATION

The WHR11SSCX1R is designed to be hard-wired to the input power and the load using copper wire. When an application requires that the regulator increase low input voltage to achieve nominal output voltage, the input current is substantially higher than the output current. Maximum rated input and output current is given in the rating chart in Section 7. Select a wire size that is adequate to carry the maximum rated current as specified by local and national code requirements. The input and output terminals are located behind a removable panel on the rear of the unit.

The ground terminal is a ground stud located on the chassis of the unit. This stud must be connected to a suitable earth ground to reduce the chance of an electrical shock.

The WHR11SSCX1R regulator is intended for control of a 120 volt, 50 or 60 hertz, single-phase power source. It may also be used for the following types of connections:

A. Two units may be used on a 240/120, volt single-phase, three-wire system to regulate both line-to-neutral voltages. This application provides two regulated 120 volt lines and one regulated 240 volt line. The common terminals of the two regulators should be used as the common connection.

B. Three WHR11SSCX1R regulators may be used on a 208Y/120 volt, three-phase, four-wire, wye connected system to provide regulated 120 volts from each line-to-neutral and regulated 208 volts from each line-to-line. The common terminals of the regulators should be connected to the common (neutral).

2.2 INPUT VOLTAGE RANGE

The secondary windings of the buck-boost transformer on the WHR11SSCX1R are connected in parallel at the factory for operation with an input voltage range of 110 to 130 volts and a maximum load of 114 amperes. The unit can also be used for an input range of 100 to 140 volts and a maximum load of 57 amperes by connecting the secondary windings of the auxiliary transformer in series as follows:

1. Remove the X_1 to X_3 and the X_2 to X_4 jumpers on the transformer and jumper X_2 to X_3 .

SECTION 3: START UP

Set the Output Voltage Range toggle switch on the front panel to either 120 volt position. (Both 120 volt positions are the same. Two positions are used to standardize the switch). The Output Voltage potentiometer and the Sensitivity potentiometer are set at the factory for nominal voltage and approximately 2% accuracy, and should not be readjusted until the regulator is initially energized.

After completing and checking all input and output connections, reinstall the terminal cover and tighten its fasteners.

Energize the regulator. The POWER and CONTROL pilot lamps should light, indicating that there is power to the regulator and that the Control Unit is turned on. The Voltmeter should indicate the output voltage (approximately 120 volts).

SECTION 4: OPERATION

4.1 OPERATING CONTROLS

4.1.1 OUTPUT VOLTAGE RANGE SWITCH

This is a three-position switch. When the switch is in the center (off) position, the control unit is disconnected and automatic correction of voltage changes will not take place. Any change in input voltage will be reflected in output voltage.

The upper and lower positions select the nominal output voltage. The switch can be placed in either position, since both positions select 120 volts line-to-neutral.

4.1.2 OUTPUT VOLTAGE Potentiometer

This potentiometer sets the output voltage. Its adjustment range is approximately 108 to 132 volts.

4.1.3 SENSITIVITY Potentiometer

This potentiometer adjusts the output accuracy of the regulator. The setting of this potentiometer determines how much the output voltage will change before the unit will correct. Follow the instructions in Section 4.2 to adjust the sensitivity.

4.1.4 ANALOG VOLTMETER

This display shows the output voltage.

4.1.5 POWER Pilot Lamp

The POWER lamp lights when power is present for the motor and indicates that the regulator is energized.

4.1.6 CONTROL Pilot Lamp

This lamp will light whenever the control unit sense voltage is energized. The control sense voltage must be energized for automatic correction of voltage changes to occur.

4.2 SETTING THE OUTPUT VOLTAGE AND SENSITIVITY CONTROLS

Follow the steps below to set the OUTPUT VOLTAGE and SENSITIVITY potentiometers.

1. Energize the power source for the regulator. The pilot lamps should light, indicating that the regulator is energized and that the control unit is on. If necessary, move the OUTPUT VOLTAGE RANGE switch to the upper or lower position. Check the voltmeter. This will indicate the output voltage level.
2. To adjust the output voltage, turn the OUTPUT VOLTAGE potentiometer clockwise to increase the voltage or counterclockwise to decrease it. Adjust the potentiometer until the voltmeter shows the desired voltage level.
3. The sensitivity must be adjusted if the regulator hunts (the motor driven variable transformer section of the regulator cycles back and forth) or if the regulator allows too great a change from the selected voltage before correction occurs.

Turning the SENSITIVITY potentiometer fully clockwise increases the sensitivity to maximum (1/2% to 1% output voltage accuracy). For maximum sensitivity, turn the potentiometer clockwise to the point where the regulator begins to hunt. Then turn the potentiometer counterclockwise until the hunting stops. Turn the potentiometer an additional 1/8 turn counterclockwise.

For most applications, the SENSITIVITY control can be set fully counterclockwise, which will provide accurate control of output voltage and will eliminate operation of the regulator due to small voltage or load changes.

4.3 REMOTE SENSING

Normally, the WHR11SSCX1R regulator will sense and regulate voltage at the regular output terminals. In some cases better control can be obtained by monitoring the voltage at another point, such as at the end of long lines between the regulator and the load. This is known as remote sensing. If remote sensing is desired, remove the jumpers between terminals 6 and 7 and between terminals 8 and 9 on the control module terminal panel. This will disconnect the control module sense terminals from the output terminals of the regulator. Connect the wires for remote sensing to terminals 7 and 9 on the control module terminal panel. These terminals are located on the rear of the front panel and may be accessed by removing the top or the front panel of the regulator.

SECTION 5: MAINTENANCE

To insure maximum life of the equipment, the following should be part of an annual maintenance program.



Warning: Deenergize the unit before performing maintenance. Voltages are present inside this unit which can cause injury. Therefore, only persons qualified to service electrical equipment should perform maintenance on this unit.

To aid servicing, the front panel may be removed and slid into horizontal retaining slots provided in the sides of the chassis.

5.1 Vacuum the regulator inside and out to remove accumulated dirt which could cause overheating or insulation failure.

5.2 Tighten all electrical connections, particularly all power wiring to, and in, the unit.

5.3 Inspect the POWERSTAT brush and commutator for signs of wear or pitting. Replace as required.

Do not attempt to clean a commutator with an abrasive such as sandpaper or a file. This will ruin the soft precious metal plating on the commutator and will shorten the life of the unit. It is normal for commutators to become black due to carbon brush tracking. If a commutator is to be cleaned, use denatured alcohol and a soft cloth.

5.4 Inspect the variable transformer drive chain, sprockets, cams, etc. for signs of slippage or wear and adjust as required.

5.5 Check the POWERSTAT Variable Transformer radiator (the die cast part that holds the brush assembly) for signs of slippage. Be sure that the set screws that hold the radiator to the center tube of the variable transformer are tight.

5.6 Lubrication of the WHR Series regulator is not required since it has been lubricated at the factory for its lifetime.

SECTION 6: TROUBLESHOOTING

WHR Series regulators will provide long, reliable service with little attention. Unless the unit is overloaded, there is little likelihood of component failure.



Warning: Voltages are present inside this unit which can cause injury. Therefore, only persons qualified to service electrical equipment should perform maintenance on this unit.

If the regulator fails to operate properly, the following checks will help locate and correct the problem. Refer to the enclosed schematic diagram, the replacement parts list in Section 8 and the rating chart in Section 7 for further information on the unit.

To aid servicing, the front panel may be removed and slid into horizontal retaining slots provided in the sides of the chassis.

6.1 Check the load connected to the regulator to be sure it does not exceed the rating of the unit for the input range selected.

6.2 See if the POWER pilot lamp is on. If the lamp is not on, there is no power to the regulator, or fuses F1 and F2 (POWER LAMP and MOTOR) are blown, or the lamp has burned out. Check fuses F1 and F2. Check the power input to the unit to be sure the voltage is within the specified range.

6.3 Check the output voltmeter. If the meter shows zero output voltage, check the input line, control unit fuses F3 and F4 (CONTROL fuses), remote sensing wiring, if applicable (see Section 4.3), and input connections.

6.4 Check the CONTROL pilot lamp. If it is not lit, check the OUTPUT VOLTAGE RANGE switch to be sure it is in the upper or the lower position and check for blown CONTROL fuses (F3 and F4). If applicable, check the remote sensing wires (see Section 4.3).

6.5 If the motor hunts (cycles continuously), readjust the SENSITIVITY potentiometer per Section 4.2.

6.6 If the motor drives the POWERSTAT Variable Transformer to one end of its travel, and the voltage increases when it should decrease or decreases when it should increase, check to see if the input and power connections to the regulator are reversed.

If the unit has been reworked or repaired, check to see if the leads driving the motor have been reversed so that the motor runs in the wrong direction. If leads driving the motor are reversed, check to see that the limit switches turn the motor off in the proper direction, i.e., once a limit switch is actuated, the motor should only run in the direction opposite that in which it was running when it actuated the limit switch.

6.7 If the motor continues to hum, buzz or move after the OUTPUT VOLTAGE RANGE switch is placed in the center (off) position, the solid-state switch controlling the motor may be defective. Deenergize the input to the regulator and replace the plug-in control unit.

6.8 To see if the motor is functioning correctly; refer to the schematic diagram for the regulator and; deenergize the input line to the regulator, place the OUTPUT VOLTAGE RANGE switch in the center (off) position and remove fuses F1 and F2 (POWER lamp and motor).

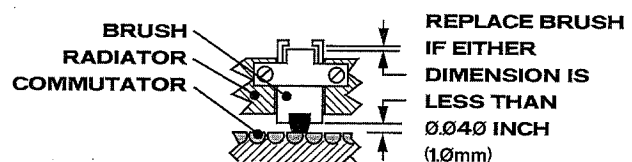
Apply 115 volts between terminals on the motor drive terminal board (TB1) (these terminal boards are connected point-for-point). The motor should turn the variable transformer so as to lower the output voltage (the variable transformer should rotate CCW when viewed from the top) until it reaches the end of its travel, where the limit switch will prevent further rotation in the CCW direction. Applying 115 volts between terminals 1 and 3 should run the motor in the opposite direction until a limit switch stops the motor at the end of travel. If the motor operates successfully in this test, the problem may be within the control unit.

6.9 Inspect the variable transformer brush and commutator for signs of wear or damage. The brush will not need replacement under normal conditions. When excessive brush wear or commutator damage occurs, it is usually the result of an overload. If either condition exists, the POWERSTAT Variable Transformer section or the brush must be replaced or repaired.

Do not attempt to clean a commutator with an abrasive such as sandpaper or a file. This will ruin the soft precious metal plating on the commutator and will shorten the life of the unit. It is normal for commutators to become black due to carbon brush tracking. If a commutator is to be cleaned, use denatured alcohol and a soft cloth.

Check the radiator (the die cast part that holds the brush assembly) for signs of slippage. If necessary, tighten the set-screws that hold the radiator to the center tube of the variable transformer.

Check the load connected to the regulator to be sure the output current rating of the regulator is not being exceeded.



SECTION 7: RATINGS AND SPECIFICATIONS

7.1 ELECTRICAL SPECIFICATIONS

	NARROW INPUT RANGE, HIGH POWER CONNECTION	WIDE INPUT RANGE, LOW POWER CONNECTION
Input Voltage, Nominal	120 volts	120 volts
Input Correction Range	110 - 130 (-8%, +8%)	100 - 140 V (-17%, +17%)
Output Voltage, Nominal	120 volts	120 volts
Frequency, Nominal	50/60 hertz	50/60 hertz
Rated Output Current (Amperes)	114	57
Rated kVA @ 120 Volts	13.7	6.8
Max. Input Current (Amperes)	1216	70
Selectable Output Accuracy	±1% to ±3%	±1% to ±3%
Recovery Time @ 60 Hertz		
Seconds/%	0.17	0.086
Seconds/Volt (120 V Out)	0.14	0.072
Seconds/Volt (115 V Out)	0.15	0.075
Efficiency, Approximate	97% minimum 98.5% typical @ full load	95% minimum 97% typical @ full load
Distortion	less than 0.25% added total harmonic distortion	
Surge Withstand Capability	6000 volts per IEEE 587-1980, Location Category B	
Jumper Connections (On Rear Terminal Panel)	X1-X3, X2-X4	Both Jumpers X2-X3

Note: Input voltage range shifts proportionally with selected output voltage.

7.2 MECHANICAL SPECIFICATIONS

Approximate Weight.

Net 88 lbs (40kg)
Shipping 110 lbs (50 kg)

Humidity, Operating and Storage ... 10% to 75% relative humidity for any 7 day period and maximum relative humidity not to exceed 95% non condensing.

7.3 ENVIRONMENTAL SPECIFICATIONS

Temperature Range

Operating -20°C to +50°C (-4°F to +122°F)
Average temperature for any 24 hour period not to exceed 30°C (86°F) and maximum temperature not to exceed 40°C (104°F). Average temperature for any 24 hour period may be increased to 50°C (122°F) if load is decreased to 90% of standard rating.

Minimum temperature is -20°C (-40°F).

Storage -40°C to +70°C (-40°F to +158°F)

Altitude

	Max Altitude	Derating
Operating	6,600 ft (2,000 m) 10,000 ft (3,000 m) 15,000 ft (4,500 m)	no derating load to 95%, ambient to 30°C (86°F) load to 90%, ambient to 20°C (68°F)

Storage ... 50,000 ft (15,000 m)

7.4 WARRANTY one year

SECTION 8: REPLACEMENT PARTS

Reference

Symbol

A1
A1-A1
A1-DS1, A1-DS2
A1-F1, A1-F2, A1-F3, A1-F4
A1-M1
A1-R1
A1-R2
A1-S1
A1-TB1
B1
C1
R1
S1, S2
T1
T2
TB1

Description

Control Module, 120 V
Control Unit, CU80
Indicator Light
Fuse, 1 Ampere, 250 Volt
Voltmeter, 0 to 150 Volt
Potentiometer, 150 Ohm
Potentiometer, 100 Ohm
Switch, Rocker
Terminal Strip
Motor, AC, Type SS50
Capacitor, 2.25 mfd, 330 vAC
Resistor, W. W., 400 Ohm, 25 Watt
Switch, Sensitive
POWERSTAT Variable Transformer
Transformer, Power Stepdown
Terminal Strip

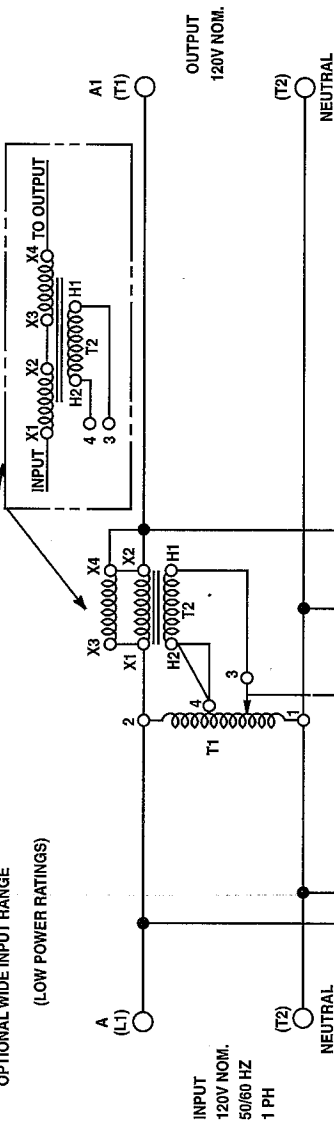
Part Number

219452-001
209066-001
052095-002
104364-003
212917-001
103159-012
103159-024
219740-002
007120-006
130803-001
207419-010
000262-025
051214-000
093072-001
005647-002
007120-016

056135-001

Rep. brush

NOTE: CONNECT "T2" TERMINALS AS SHOWN HERE FOR OPTIONAL WIDE INPUT RANGE (LOW POWER RATINGS)



RATINGS		
NARROW RANGE HIGH POWER CONNECTION	WIRE RANGE LOW POWER CONNECTION	
X1-X3, X2-X4	BOTH JUMPERS X2-X3	
T2 TRANSFORMER JUMPERS		
INPUT RANGE (% OF OUTPUT VOLTAGE)	±9%	±17%
OUTPUT AMPS	114	57
LOAD KVA	13.7	6.8

NOTE: INPUT VOLTAGE RANGE SHIFTS PROPORTIONALLY WITH SELECTED OUTPUT VOLTAGE.

REF SYM.

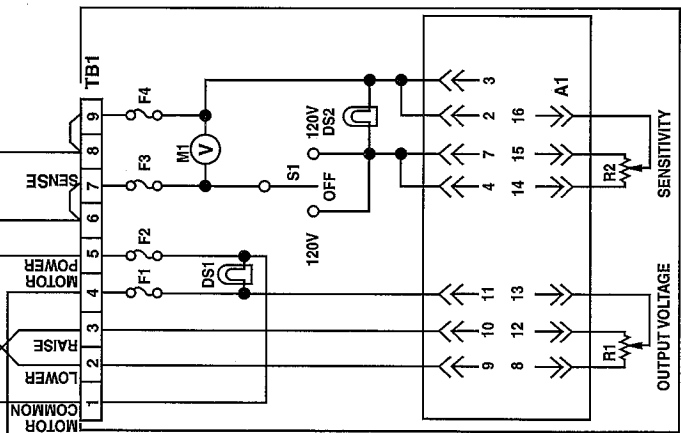
- A1
- A1-A1
- A1-DS1, A1-DS2
- A1-F1, F2, F3, F4
- A1-M1
- A1-R1
- A1-R2
- A1-S1
- A1-TB1
- B1
- C1
- R1
- S1, S2
- T1
- T2
- TB1

DESCRIPTION

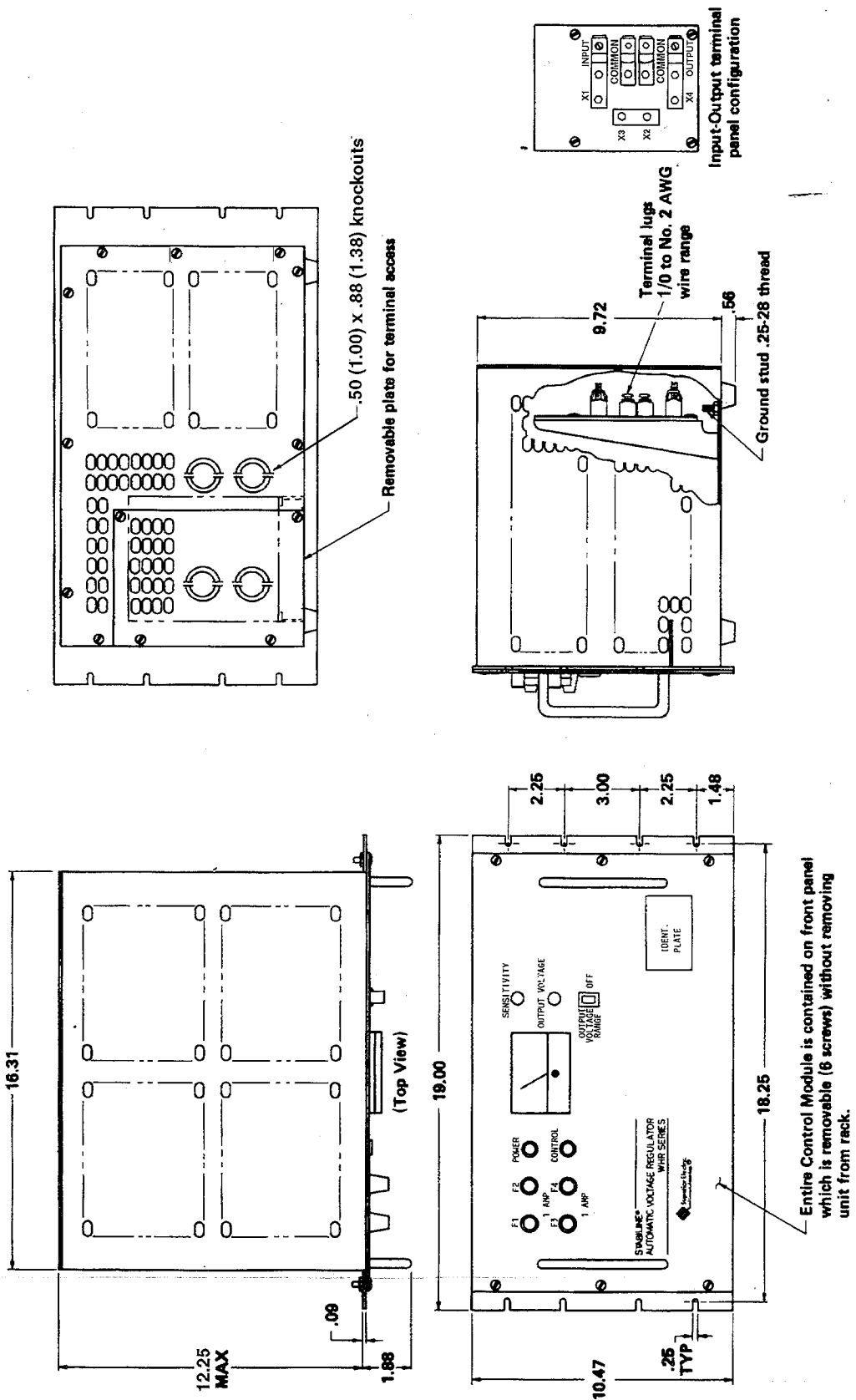
- Control Module, 120V
- Control Unit, CU80
- Indicator Light
- Fuse, 1 Ampere, 250 V
- Voltmeter, 0 to 150 V
- Potentiometer, 150 Ohm
- Potentiometer, 100 Ohm
- Switch, Rocker
- Terminal Strip
- Motor, AC, Type SS50
- Capacitor, 2.25 mfd, 330 vAC
- Resistor, W. W., 400 Ohm, 25 W
- Switch, Sensitive
- POWERSTAT Variable Transformer
- Transformer, Power Stepdown
- Terminal Strip

S.E. PT. NO.

- 219452-001
- 209066-001
- 052095-002
- 104364-003
- 212917-001
- 103159-012
- 103159-024
- 219740-002
- 007120-006
- 130803-001
- 207419-010
- 000262-025
- 051214-000
- 093072-001
- 005647-002
- 007120-016



SECTION 9: SCHEMATIC DIAGRAM



Entire Control Module is contained on front panel which is removable (6 screws) without removing unit from rack.

SECTION 10: DIMENSIONAL DRAWING

NOTES:



WARRANTY

Superior Electric, Bristol, Connecticut, warrants to the first end user purchaser (the "purchaser") of equipment manufactured by Superior Electric that such equipment, if new, unused and in original unopened cartons at the time of purchase, will be free from defects in material and workmanship under normal use and service for a period of one year from date of shipment from Superior Electric's factory or a warehouse of Superior Electric in the event that the equipment is purchased from Superior Electric or for a period of one year from the date of shipment from the business establishment of an authorized distributor of Superior Electric in the event that the equipment is purchased from an authorized distributor.

SUPERIOR ELECTRIC'S OBLIGATION UNDER THIS WARRANTY SHALL BE STRICTLY AND EXCLUSIVELY LIMITED TO REPAIRING OR REPLACING, AT THE FACTORY OR A SERVICE CENTER OF SUPERIOR ELECTRIC, ANY SUCH EQUIPMENT OR PARTS THEREOF WHICH AN AUTHORIZED REPRESENTATIVE OF THE COMPANY FINDS TO BE DEFECTIVE IN MATERIAL OR WORKMANSHIP UNDER NORMAL USE AND SERVICE WITHIN SUCH PERIOD OF ONE YEAR. SUPERIOR ELECTRIC RESERVES THE RIGHT TO SATISFY SUCH OBLIGATION IN FULL BY REFUNDING THE FULL PURCHASE PRICE OF ANY SUCH DEFECTIVE EQUIPMENT. This warranty does not apply to any equipment which has been tampered with or altered in any way, which has been improperly installed or which has been subject to misuse, neglect or accident.

THE FOREGOING WARRANTY IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, and of any other obligations or liabilities on the part of Superior Electric; and no person is authorized to assume for Superior Electric any other liability with respect to equipment manufactured by Superior Electric. Superior Electric shall have no liability with respect to equipment not of its manufacture. SUPERIOR ELECTRIC SHALL HAVE NO LIABILITY WHATSOEVER IN ANY EVENT FOR PAYMENT OF ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING, WITHOUT LIMITATION, DAMAGES FOR INJURY TO ANY PERSON OR PROPERTY.

Written authorization to return any equipment or parts thereof must be obtained from Superior Electric. Superior Electric shall not be responsible for any transportation charges.

IF FOR ANY REASON ANY OF THE FOREGOING PROVISIONS SHALL BE INEFFECTIVE, SUPERIOR ELECTRIC'S LIABILITY FOR DAMAGES ARISING OUT OF ITS MANUFACTURE OR SALE OF EQUIPMENT, OR USE THEREOF, WHETHER SUCH LIABILITY IS BASED ON WARRANTY, CONTRACT, NEGLIGENCE, STRICT LIABILITY IN TORT OR OTHERWISE, SHALL NOT IN ANY EVENT EXCEED THE FULL PURCHASE PRICE OF SUCH EQUIPMENT.

Any action against Superior Electric based upon any liability or obligation arising hereunder or under any law applicable to the sale of equipment, or the use thereof, must be commenced within one year after the cause of such action arises.

The right to make engineering refinements on all products is reserved. Dimensions and other details are subject to change.

Distribution Coast-To-Coast and International

WHR Series STABILINE® Voltage Regulators are obtainable worldwide through an extensive authorized distributor network. These distributors offer literature, technical assistance and a wide range of models off the shelf for fastest possible delivery and service.

In addition, Superior Electric sales engineers are available to provide prompt attention to customer needs. Call or fax for ordering and application information or for the address of the closest authorized distributor.

Superior Electric

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Fax: 860-582-3784

Customer Service: 860-585-4500 - Ext. 4750

Product Application: 860-585-4500 - Ext. 4755

In U.S.A. and Canada

Tel: 1-800-787-3532

Fax: 1-800-821-1369

Customer Service: 1-800-787-3532 - Ext. 4750

Product Application: 1-800-787-3532 - Ext. 4755

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