INSTRUCTIONS

GEK-36366B

ELECTRONIC REVERSING STATOTROL* DRIVES

3SSR30B1, 40B1, 70B1, 80,90B1

*Registered trademark of General Electric Company, USA

GENERAL ELECTRIC

TABLE OF CONTENTS

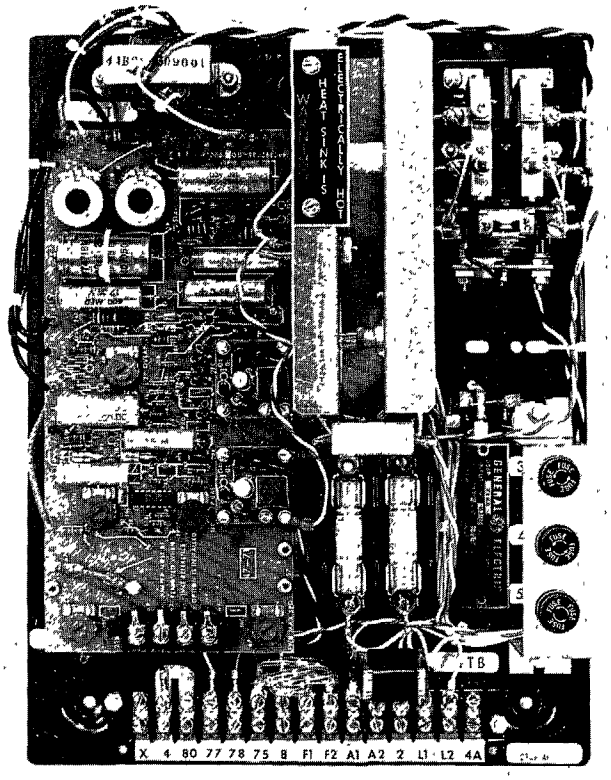
	PAGE
INTRODUCTION	3
RECEIVING, HANDLING AND STORAGE	3
INSTALLATION	3
Mount the Controller	3
Mount the Motor	3
Electrical Connections	3
INPUT REFERENCE MODIFICATIONS	3
Instrument or Tachometer Follower Voltage Source	3
Instrument Follower Modification Current Source	6
POTENTIOMETER ADJUSTMENTS	8
Current Limit Adjustments	8
Overlap Setting	9
Gain Adjustment	9
Balance Adjustment	9
Maximum Speed Adjustments	9
Timed Reference Option Adjustments	9
MAINTENANCE	9
Motor Inspection	9
Controller Inspection	10
TROUBLESHOOTING AND REPAIR	10
RENEWAL PARTS	11
PRINCIPAL RENEWAL AND SPARE PARTS LIST	11

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser s purposes, the matter should be referred to General Electric Company.

ELECTRONIC REVERSING STATOTROL DRIVES
3SSR30B1, 40B1, 70B1, 80,90B1

INTRODUCTION

These instructions together with the elementary diagram supplied with the drive provide the information needed to install, adjust, operate, and maintain the 3SSR series Electronic Reversing Statotrol. This drive has been designed to provide positioning control, high speed reversing, regenerative braking, and many other high performance features not offered in the more common industrial drive products. Special application assistance is available from the General Electric Company when needed.



3SSR Electronic Reversing Statotrol
Figure 1

RECEIVING, HANDLING AND STORAGE

Immediately after receipt, the equipment should be carefully unpacked and examined for any damage that might have occurred in transit. If injury or rough handling is evident, a damage claim should be filed immediately with the transportation company and the nearest sales office of the General Electric Company should be notified promptly.

If the control is not to be used as soon as it is unpacked, it should be stored in a clean, dry place and protected from accidental damage. Avoid storing the equipment in locations where construction work is in progress.

INSTALLATION

Damage to the equipment can be avoided by reading these instructions thoroughly and by wirechecking all connections before power is applied.

The equipment should be installed in a suitable, dry location where it will not be subjected to excessive vibration and where the ambient temperature will not exceed 40 degrees C (104°F).

MOUNT THE CONTROLLER

Figures 2 and 3 give mounting dimensions for the controller and the remote control station. Mount the controller so as not to block the airflow through the louvers in the case. The controller should be wall-mounted to assure adequate flow of cooling air through the case and across the heat sinks. Do not mount the controller where water or other fluids will drip or splash onto the circuitry.

MOUNT THE MOTOR

The coupling between the motor shaft and the motor load must be solid. A coupling which slips, or a slack belt or chain, can cause the motor to run rough and overheat . The motor must also be firmly mounted and properly aligned to prevent damage by vibration.

ELECTRICAL CONNECTIONS

Connect the controller to the power line, the motor, and the control station as shown on the connection diagram in Figure 4. Wires which connect to the four-point terminal strip on the component board (the reference signal wires) must be kept separate from all other wires. Do not run the reference signal wires in harnesses or conduits with any other wires.

For proper operation it is necessary that the power line RMS voltage stay within ±10% of the nameplate rating of the control (either 115 or 230 volts).

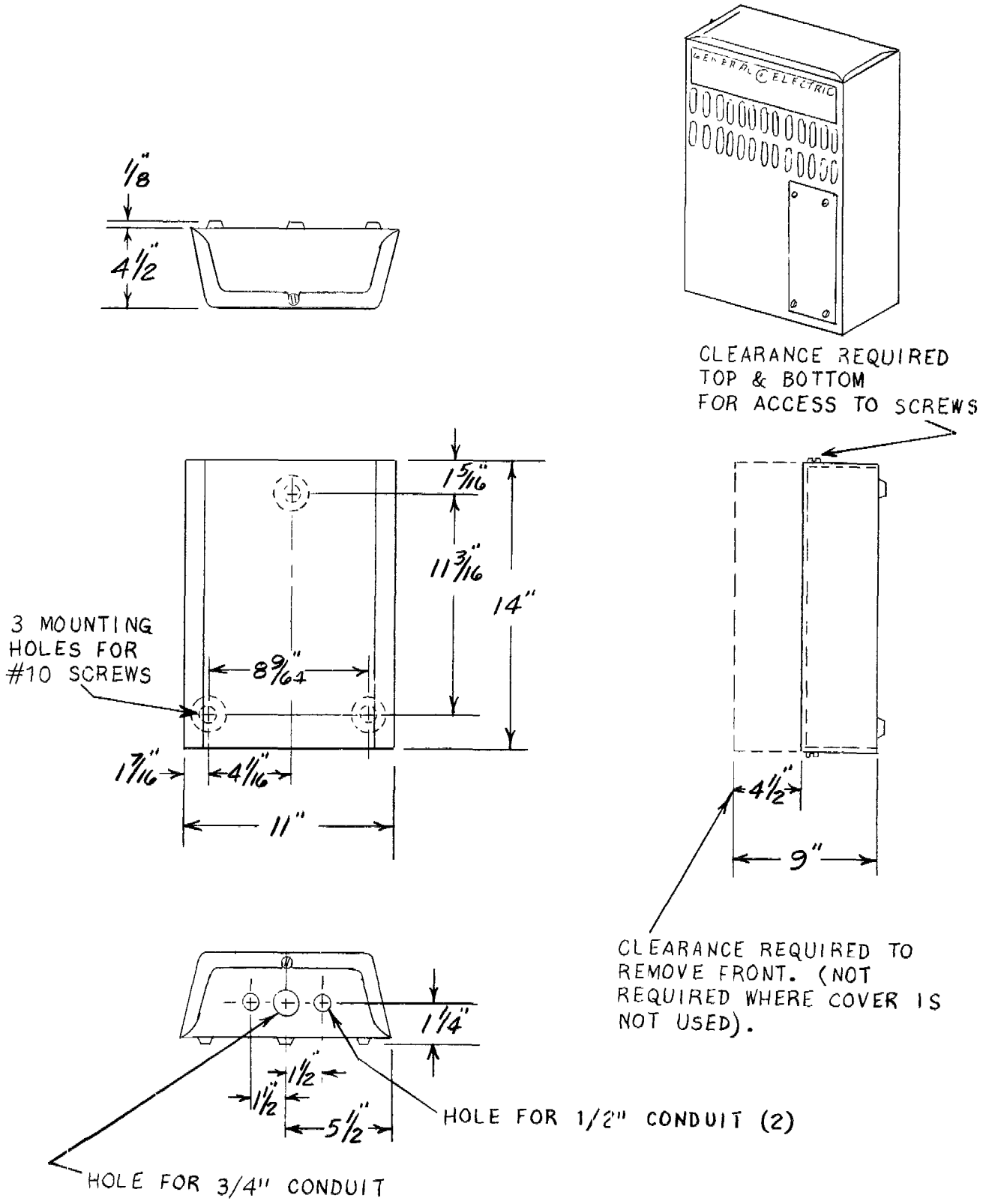
A "ground stud" connection point is provided on the controller panel near the main terminal board. This stud should be connected to building ground to reduce the hazard of electrical shock.

INPUT REFERENCE MODIFICATIONS

INSTRUMENT OR TACHOMETER FOLLOWER

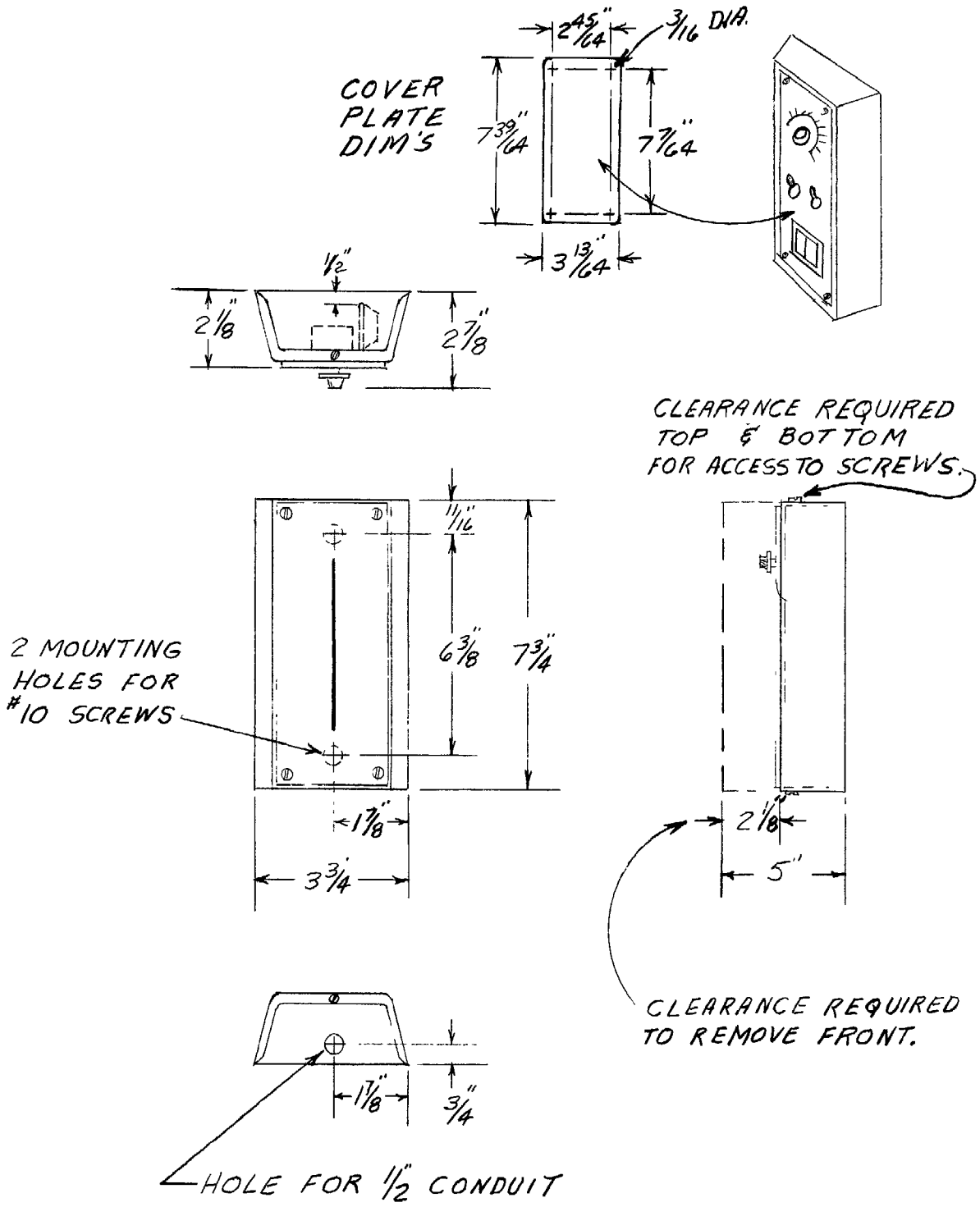
Voltage Source

As isolated voltage source can be used instead of a speed potentiometer for a reference signal source.



Control Outline and Mounting Dimensions

Figure 2

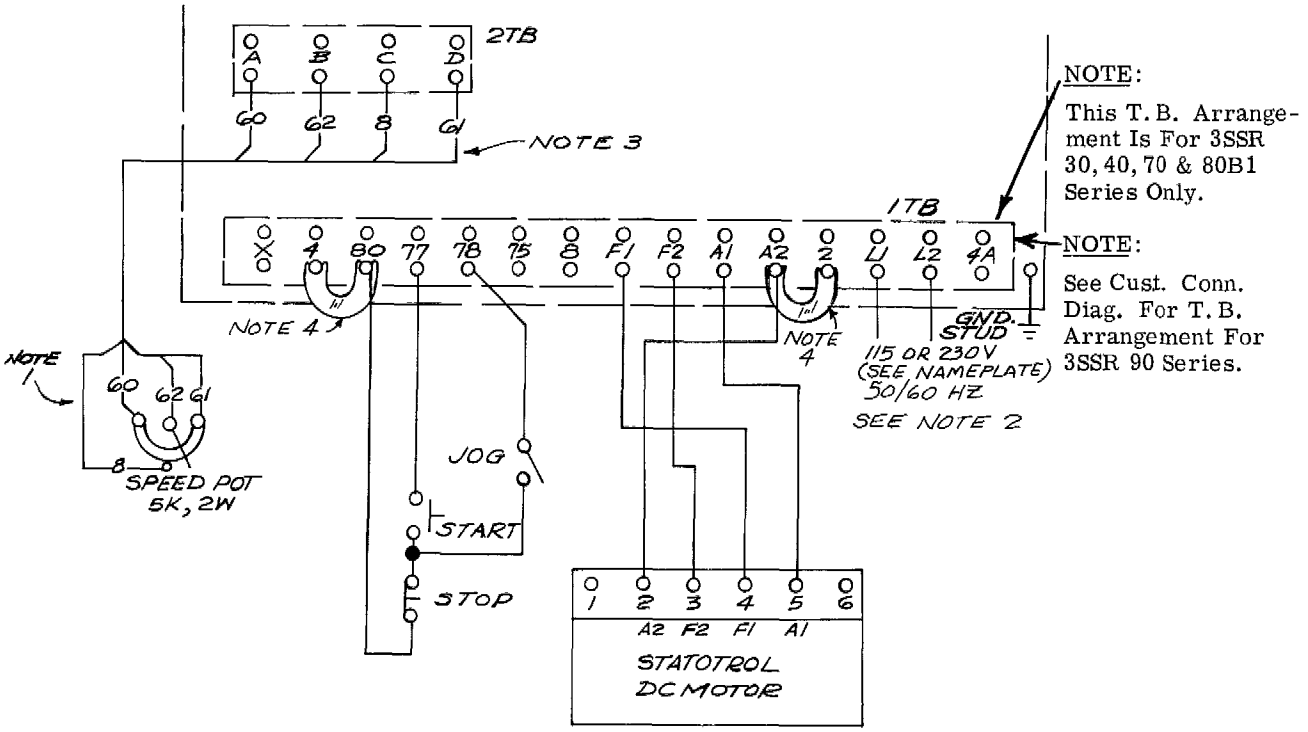


Remote Control Station Outline and Mounting Dimensions

Figure 3

CUSTOMER NOTES:

1. Connection from 2TBC to Mechanical Zero Center Tap on Speed Pot is Optional.
2. If one Power Line Lead is connected to Building Ground, that lead must be connected to Terminal 1TB-L2.
3. Wires connected to 2TB must be kept separate from all other wires. Do not run these wires in harnesses or conduits with any other wires.
4. Metal jumpers are not used when thermal overload option is used.



Customer Connection Diagram

Figure 4

An input signal of 8 volts and 1.6 ma is required to achieve rated motor speed.

(Special low input voltage controls are available from the factory on special orders)

If the voltage source output is greater than 8 volts, select the proper value of dropping resistor, 35R, using the formula given in Figure 5. Connect the voltage source to the control as shown in Figure 5.

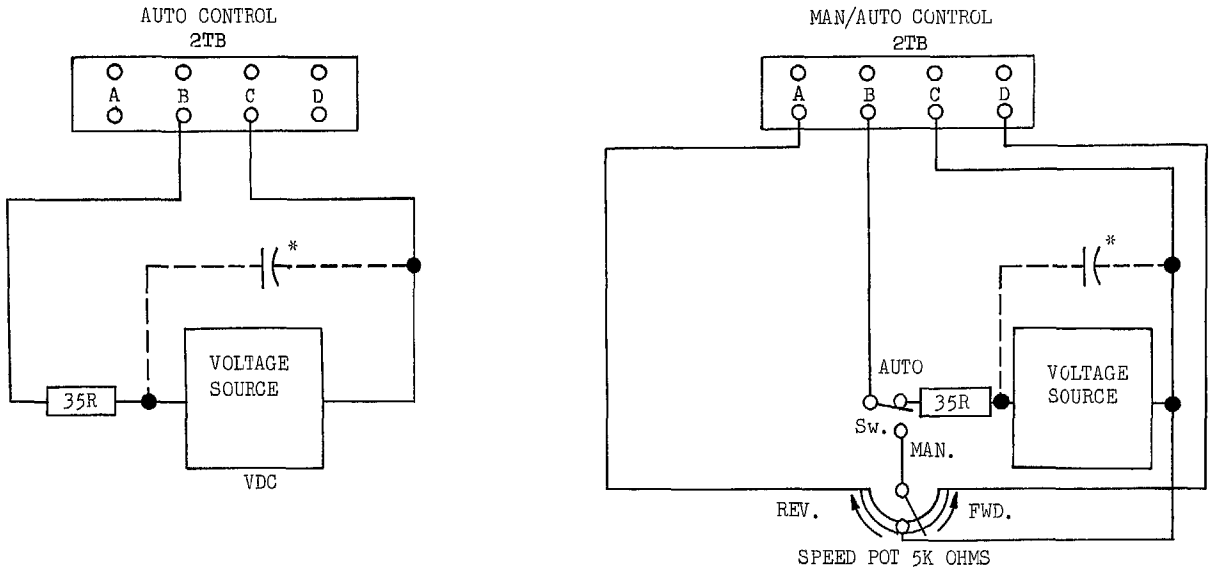
The RMS ripple on the reference voltage must be less than 1%. If necessary, the customer must supply a capacitor across the voltage source to reduce the ripple to a value below 1%. The signal source must be isolated from ground. If an ungrounded signal source is not available, use an isolation transformer to supply AC power to the drive. A negative signal applied to terminal 2TB-B with respect to terminal 2TB-C will run the motor in a clockwise direction when viewed from the commutator end. A positive signal applied to terminal 2TB-B with respect to terminal 2TB-C will run the motor in a counterclockwise direction. Clockwise rotation is considered "forward" and counterclockwise rotation is considered "reverse".

INSTRUMENT FOLLOWER MODIFICATION

Current Source

The minimum required current input signal for rated motor speed is 1.6 milliamps. If the current source output is greater than 1.6 milliamps, select load resistor, 35R, using the formula given in Figure 6.

The RMS ripple should be less than 1%. If necessary, the customer should connect a capacitor across 35R to reduce the ripple to a value below 1%. The signal source must be isolated from ground. If an ungrounded signal source is not available, use an isolation transformer to supply AC power to the drive. A negative signal applied to terminal, 2TB-B with respect to terminal 2TB-C will run the motor

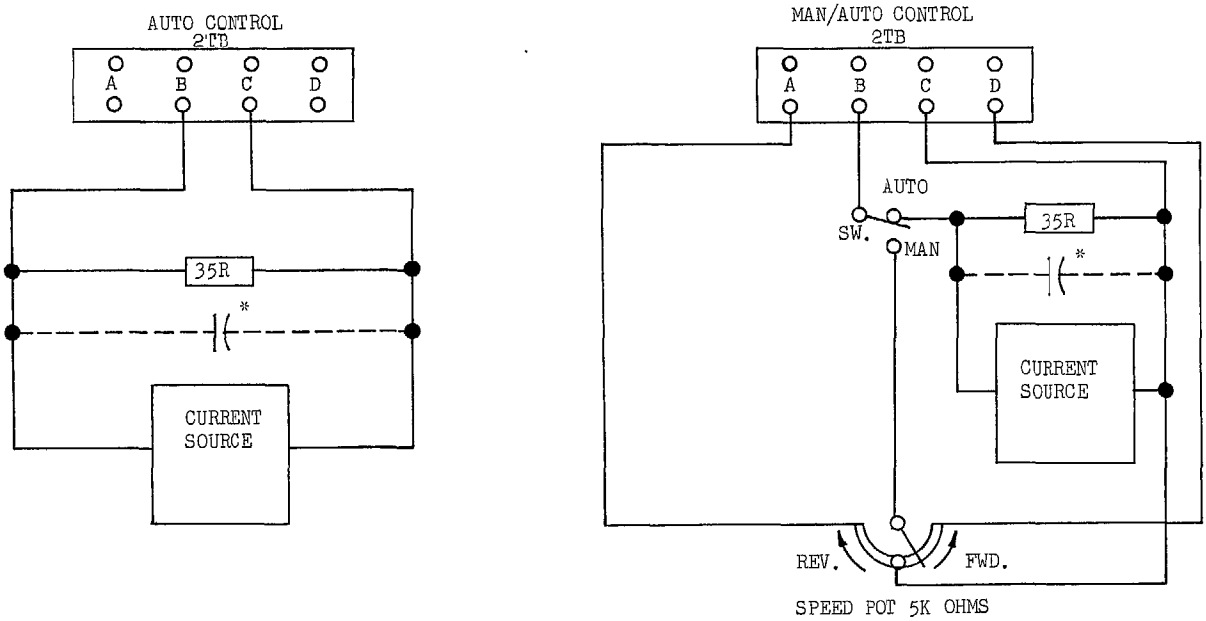


*Capacitor supplied by customer to reduce voltage ripple to under 1%.

$$35R\ (K\ \Omega) = \frac{VDC-8V}{1.6ma}$$

Reference Circuit Connections for Isolated Voltage Source

Figure 5



*Capacitor supplied by customer to reduce voltage ripple to under 1%.

$$35R\ (ohms) = \frac{8Vx10^3}{IMAX.\ (ma)-1.6}$$

Reference Circuit Connections for Isolated Current Source

Figure 6

in a clockwise direction when viewed from the commutator end. A positive signal applied to terminal 2TB-B, with respect to terminal 2TB-C, will run the motor in a counterclockwise direction. Clockwise rotation is considered " forward" and counterclockwise rotation is considered "reverse".

POTENTIOMETER ADJUSTMENTS

CURRENT LIMIT ADJUSTMENTS

The Statotrol current limit circuitry works by limiting the turn-on time of the SCR's. This limits the effective voltage across the motor armature, and the armature impedance then limits the current. The Statotrol controller is factory-set to limit the current in a low impedance motor. If a high impedance motor is to be used, it may be necessary to adjust potentiometers 3P and 4P to get the desired motor torque output.

Set Potentiometer 3P

Turning potentiometer 3P clockwise will increase the current which will flow in the armature when the rotor is locked. Since motor output torque is proportional to armature current, 3P effectively adjusts the starting torque of the motor.

How to Set 3P by Measuring Armature Current

Connect a DC ammeter in series with the motor armature, lock the rotor, turn the reference potentiometer in either direction, and energize the M relay. Turn potentiometer 3P until the desired armature current is achieved. Do not stall the motor for more than one (1) minute or the motor may be damaged.

CAUTION

Do not set DC stall current to exceed 200% of motor nameplated-rated current or damage may result. Consult the factory if higher torque is required.

How to Set 3P Without an Ammeter

An approximate setting for stall current can be achieved by aligning the correct ink spots on potentiometer 3P. Read the instructions carefully since turning 3P too far clockwise may result in damage to the motor or the controller. Consult the factory if the settings given below do not give adequate torque for the application

To set 3P, find the proper motor in the left hand column of Table 1 and set 3P to the mark indicated in the right hand column.

TABLE 1
STARTING CURRENT LIMIT

STATOTROL MOTORS THROUGH 1 HP	3P SETTING AND 4P SETTING
All 2500 RPM, TENV, TEFC	Counterclockwise dot
All 1725 RPM, TENV, TEFC and all 2500 RPM, D. P.	Center dot
All 1725 RPM, D. P.	Clockwise dot
TEFC = Totally enclosed, fan cooled TENV = Totally enclosed, non-ventilated D. P. = Drip-proof, open construction	

Set 4P

Turning 4P clockwise will increase the available motor output torque at rated motor speed.

How to Set 4P by Measuring Armature Current

With a DC ammeter in the armature circuit, lock the rotor, turn the reference potentiometer in either direction, and energize the M relay. Read the current in the armature, release the rotor, and observe the ammeter as the motor accelerates. Potentiometer 4P must be set so that the armature current holds steady or gradually decreases as the motor accelerates to top speed. Turning 4P clockwise will increase the armature current available at higher speeds. For smooth acceleration and long motor life, it is recommended that 4P be turned to the farthest counterclockwise setting which will allow desired motor performance.

How to Set 4P Without an Ammeter

An approximate setting for current limit can be achieved by aligning the correct ink spots on potentiometer 4P. Find the proper motor in the left hand column of Table 1 and set 4P to the mark indicated in the right hand column of Table 1.

OVERLAP SETTING

Potentiometer 2P is the overlap adjustment. Turning 2P clockwise gives faster "breakaway" response and decreases the "deadband" as the reference signal goes from forward to reverse. Turning 2P clockwise also increases motor heating at low speed and may contribute to stability problems in certain applications. Therefore, 2P is set fully counterclockwise as a factory adjustment, and it is recommended that 2P be kept fully counterclockwise except in those applications which specifically require a narrow reference deadband between forward and reverse.

GAIN ADJUSTMENT

Turning 5P clockwise increases the gain of the drive system. High gain makes the system very responsive to transient charges in the motor load or the reference signal. As in any closed loop feedback system, high gain can contribute to system instability as well as transient response overshoot and ringing. Therefore, 5P is factory-set to minimum gain (full CCW) and it is recommended that 5P be kept in the minimum gain position except in those applications which specifically require high gain.

BALANCE ADJUSTMENT

Balance Potentiometer 7P is used to establish the reference voltage which will stop the motor. 7P is factory-adjusted by setting the reference signal to zero (jumpering 2TB-B to 2TB-C) and adjusting 7P until the motor stops. This is the proper setting for most applications.

In some applications it may be desirable to have the motor stop at some reference voltage other than zero. For these applications, set the reference signal to the voltage at which it is desired that the motor stop, and then turn 7P until the motor does stop.

MAXIMUM SPEED ADJUSTMENTS

Turning 1P clockwise will increase the maximum reverse speed at which the motor will run. Turning 6P clockwise will increase the maximum forward speed at which the motor will run. Electrically, these potentiometers accomplish their function by limiting the range of the speed reference potentiomenter in the control station.

Potentiometers 1P and 6P are factory-set to limit the motor speed to a value about 10% above the motor nameplate rating. The customer can adjust these potentiometers by turning the reference signal potentiomenter in the control station to one extreme and adjusting the maximum speed, and then repeating the operation for the other extreme. It is recommended that motors never be operated at speeds above their nameplate rating.

TIMED REFERENCE OPTION ADJUSTMENTS

The timed reference circuit is a factory-installed option. It consists of a small component board which is attached to the main component board by five screws. An auxiliary contact on the M relay is used to bypass the time delay and reset the reference to zero when the M relay is de-energized.

Turning timed reference option potentiometer 101P clockwise will increase the time the motor takes to accelerate from one speed to another when the reference signal is changed from stop to any reverse speed, or is changed from any high forward speed to a lower forward speed or a reverse speed.

Similarly, turning 102P clockwise will increase the time the motor takes to accelerate from one speed to another when the reference signal is changed from stop to any forward speed or is changed from any high reverse speed to a lower reverse speed or any forward speed.

MAINTENANCE

MOTOR INSPECTION

Limited life items in the motor include the brushes, the commutator, the bearings, and the winding insulation. If the motor is not overloaded, the bearings and insulation should provide years of troublefree operation. However, the brushes and the commutator will wear with use. Factors which shorten brush life include high speed operation, high armature current, high armature voltage, extremely low humidity, and scratches or pits on the commutator surface. In severe duty applications the

brushes should be inspected after every 1000 hours of operation. The brushes should be replaced anytime it is found that less than 1/2 inch of brush material remains. The bearings are packed with a special grease during assembly and should not be relubricated.

Make sure that the motor mounting bolts are all tight. A loose mounting bolt can cause considerable noise and may result in excessive wear.

If the motor requires maintenance, please refer to the General Electric Motor Maintenance Manual for the particular motor used on the application.

CONTROLLER INSPECTION

Inspect the contacts of the M relay, and replace the relay if the contacts are worn. Keep the heat sinks clean, and do not allow anything to block the flow of air across the heat sinks and through the enclosure.

TROUBLESHOOTING AND REPAIR

Most minor operational problems can be traced to improper adjustment of the various potentiometers on the component board. Proper adjustments are described in the "Potentiometer Adjustments" section of this book. Other possible problems are discussed below:

CAUTION

The M relay does not remove power from the controller. Turn off the branch circuit breaker of the customer's disconnect switch before working on the Control.

If the motor will not run:

1. Be sure all connections are correct and tight. Check fuses 3FU, 4FU, and 5FU.

2. Be sure there is AC power available at the controller terminal. Check power switch closure.

3. Check the power fuses 1FU and 2FU. If a fuse is blown, replace it. If it blows again look for short circuit or motor overload.

CAUTION

Use only OT or NON type power fuses, and do not use a fuse larger than the original equipment fuse.

If new fuses also blow, refer to Table 1 and check the settings of 3P and 4P. With an analyzer set on the X1000 ohms scale, verify that the reading from the cathode to the anode of the SCR's is open circuit. If the reading is not open circuit, one or both of the SCR's may have failed short.

If the fuse is not blown, but the motor still will not run, check the field voltage from 1TB-F1 to 1TB-F2. The field voltage should be 100 volts DC and 200 volts DC for input power voltages of 115 volts or 230 volts respectively. If there is no field voltage, check the field power supply diodes which are mounted on the main terminal board.

4. Check the motor for internal shorts. An ohmmeter should read one to five ohms from A1 to A2, and should read from 100 to several hundred ohms from F1 to F2.

Rotating the armature slowly while reading the resistance helps check for intermittent shorts in the motor.

If the motor runs faster or slower than normal for a given setting of the speed control:

1. Check the line voltage to be sure that it is normal, and check fuse 4FU.

2. Check the reference voltage to be sure that it is normal. If it is low, check the setting of the max speed potentiometers 1P and 6P.

3. Check the current limit adjustment. (See Table 2.)

4. Check for an overload on the motor. The motor is overloaded if the armature current exceeds the motor nameplate rating.

If the motor runs at full speed and cannot be controlled by speed control:

1. Check all connections for poor connection or short circuits. Check fuse 4FU.

2. Disconnect line power and check the SCR's with an ohmmeter set to the X1000 scale. The SCR's should read open circuit from the cathode to the heat sink.

3. With the motor running, check the voltage from component board terminal 13A to 2TB-C. This is the feedback signal and must be equal to armature voltage. If this voltage is not equal to armature voltage, disconnect the power and check continuity from point 13A to 1TB-A1.

If the motor will run in only one direction:

1. Verify that the reference voltage measured from 2TB-B to 2TB-C is correct. 2TB-B must be positive with respect to 2TB-C for reverse rotation and negative with respect to 2TB-C for forward rotation.

2. Firing circuit 2FC triggers 2 SCR to make the motor go forward. 1FC triggers 1SCR to make the motor go in the reverse direction. If the motor will

not run in one direction, replace the corresponding firing circuit component board. If this does not solve the problem, replace the corresponding SCR.

If all previous troubleshooting steps have been unsuccessful:

1. Check the voltages on the transformer leads where the leads connect to the component board. The voltages should be as shown in Table 2. If any voltages are wrong disconnect the control from the power line and disconnect the questionable transformer leads from the component board. Isolate the loose leads from all conductors, open circuit the M relay, connect the control to the power line and check the voltage again. If the voltage is now correct, the main component board should be replaced.
2. Replace the main component board.

TABLE 2

CIRCUIT NUMBERS	NOMINAL VOLTAGE
8 to 46	16 volts RMS ±20%
8 to 48	16 volts RMS ±20%
38 to 34	4 volts RMS ±20%
38 to 53	4 volts RMS ±20%

RENEWAL PARTS

When ordering renewal parts, contact the nearest General Electric Sales Office, giving the quantity required and catalog numbers. In addition, give the 3SSR number and the complete nameplate rating of the control.

PRINCIPAL RENEWAL AND SPARE PARTS LIST

DESCRIPTION OF ASSEMBLY OR PARTS	ORDERING NUMBER	3SSR SERIES MODEL NUMBERS				
		30	40	70	80	90
1, 2 SCR	44B310090-007					2
1, 2 SCR	44B212741-008	2				
1, 2 SCR	44B310090-005		2			
1, 2 SCR	44B212741-010			2	2	
Rectifier 13, 14, 15 & 16D	44B232019-005	4	4			
Rectifier 13, 14, 15 & 16D	44B232019-008			4	4	
Thyrector 1THY	6RS20SC4D4AB	1	1			
Thyrector 1THY	6RS20SP8B8			1	1	
Relay M	44A335805-001	1	1			
Relay M	44A332169-001			1	1	1
Fuse 3FU, 4FU, 5FU	K9774740P4	3	3	3	3	3
Fuse 1FU (2FU)	K9774700P5	1		2		
Fuse 1FU (2FU)	K9774700P6		1		2	
Transformer 1T	44B333188-001	1	1			
Transformer 1T	44B334509-001			1	1	
Main P.C.B.	44C392735-G04	1	1			
Main P.C.B.	44C392735-G03			1	1	
Timed accel &decel	3SSM01B1	1		1	1	
TOL*	CR124C028	1		1	1	
Rectifier 13, 14, 15 & 16D	44B232032-006					4
Fuse (1 & 2 FU)	K9774700P8					2

*Overload relay less heater. Order heater by either catalog number stamped on heater in use or by motor the heater is to protect.

Control Devices Operation and Speed Variator Products Department,
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