INSTRUCTIONS

GEK-36370D

STATOTROL* II

DC DRIVE

Up To 2 Horsepower

3SFW, 3SFWB, 3SFWC AND 3SFWR SERIES

*Registered trademark of General Electric Company, USA

GENERAL ELECTRIC

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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

STATOTROL II DC DRIVE

INTRODUCTION

This manual contains general information on the General Electric Statotrol II DC drive. Additional information and diagrams may be supplied with the equipment when necessary.

DESCRIPTION

The Statotrol II drive is a high performance full wave DC drive. The regulating function is provided by a custom integrated circuit. The electronic components are protected by a rugged NEMA 4 enclosure. The motor is either a shunt wound or permanent magnet field DC motor specially designed for use with a full wave phase controlled SCR power supply.

Standard features of the Statotrol II drive include speed control, protective current limit, undervoltage protection, and potentiometer adjustments for positive and negative IR compensation, maximum speed, minimum speed, and torque taper. Optional features include dynamic braking, controlled torque plug reversing, adjustable torque control, adjustable linear timed acceleration and deceleration, tach feedback, instrument follower, tach follower, speed indication, regenerative braking, and a variety of special functions.

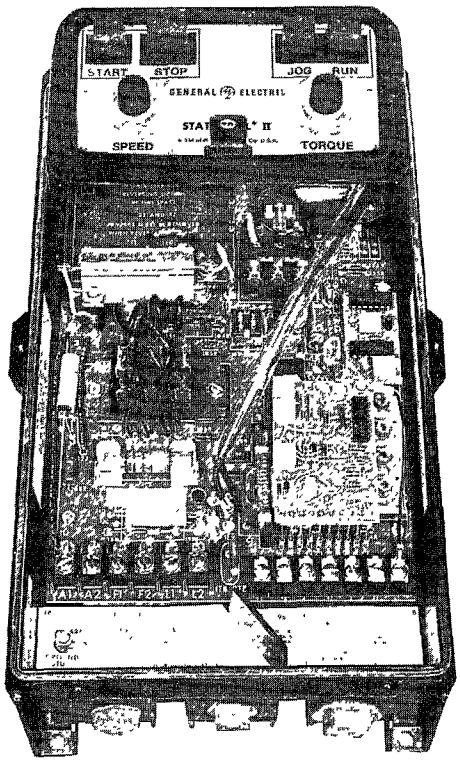


Figure 1. Statotrol II Motor Control

RECEIVING AND STORAGE

As soon as the equipment is received, it should be unpacked and examined for any damage sustained in transit. If damage is evident, a damage claim should be filed immediately with the transportation company, and the local General Electric Co. Sales Office should be promptly notified.

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

INSTALLATION

INSTALL CONTROL STATION AND OPTIONS

Either a local control station or a remote control station adapter unit must be attached to the main component board before operation is possible. Refer to Figure 2 for the mounting location and orientation of the control station. If the reversing option is to be used, it should be plugged in before the control station is mounted. When installing the control station, use care to avoid bending any of the electrical connection pins. Be sure that each pin starts into its receptacle properly. Tighten the four mounting screws snugly to assure proper positioning of the control station.

Specific instructions for the installation, adjustment, and operation of the various options are on instruction sheets packed with the options.

CONTROLLER INSTALLATION

The Controller must be wall mounted in a location which will allow free flow of cooling air over the fins on the heat sink. Maximum ambient temperature around the controller must not exceed 40°C (104°F). Figure 3 gives mounting dimensions and outline dimensions. It is recommended that two or more inches of clearance be provided all around the controller to assure adequate air flow through the heat sink fins of units rated 3/4 HP or more. Air flow over the units rated less than 3/4 HP is also necessary but less air flow is required to cool the lower horsepower units.

Conduit entering the controller enclosure must be properly sealed and the controller cover must be securely seated to maintain the NEMA 4/12 rating of the enclosure.

MOTOR INSTALLATION

The motor must be firmly mounted and properly aligned to prevent vibration. Excessive vibration causes rapid wear and objectionable audio noise. Heat dissipated by the motor will raise the ambient temperature around the motor if the motor is installed in an enclosed space. Since a lower ambient temperature will extend the motor life, it is always desirable to mount the motor in a well ventilated location. The motor should never be used where the ambient temperature exceeds 40°C (104°F) unless an oversized motor has been specially selected.

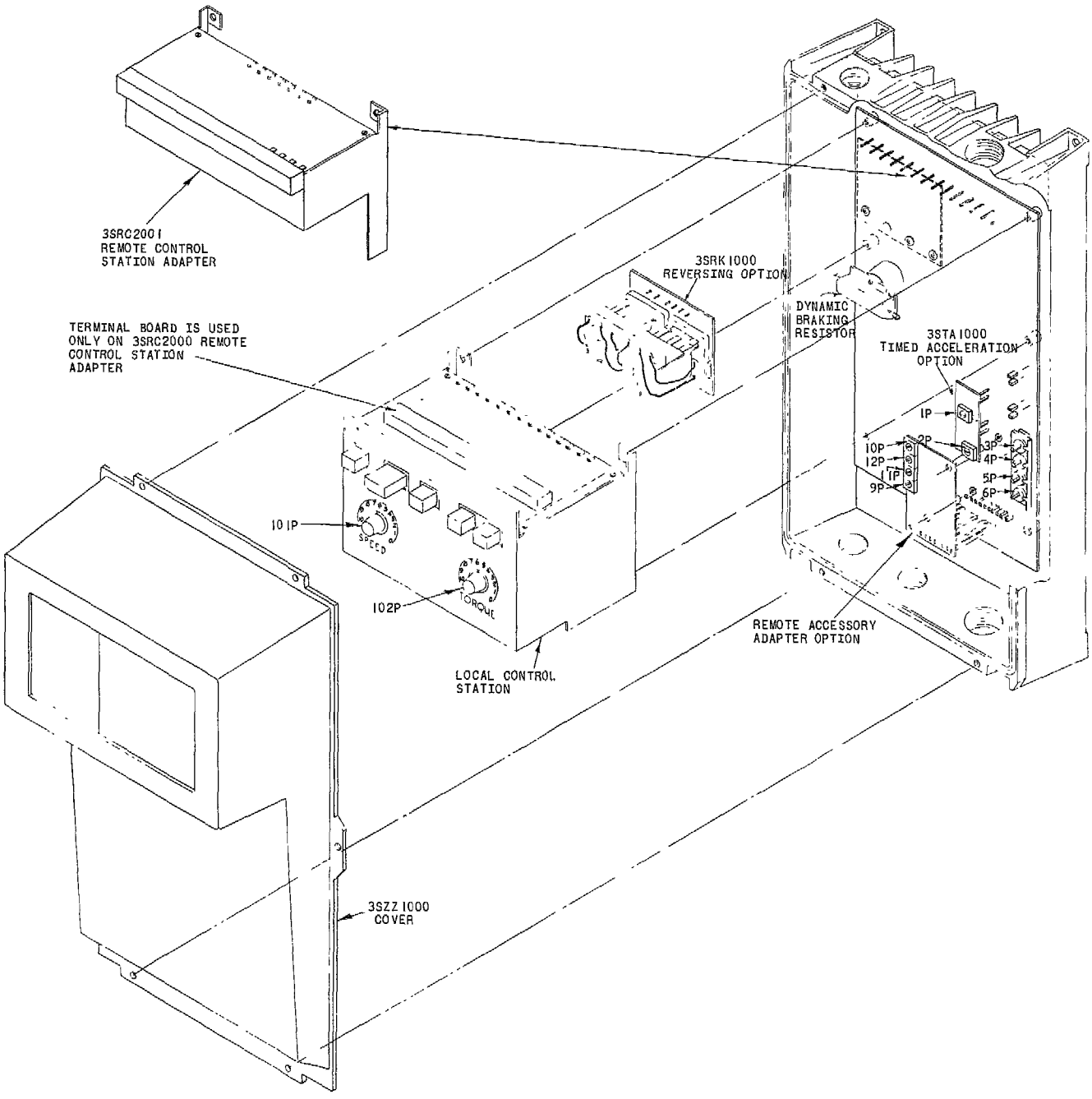


Figure 2. Exploded View Of Statotrol II Controller

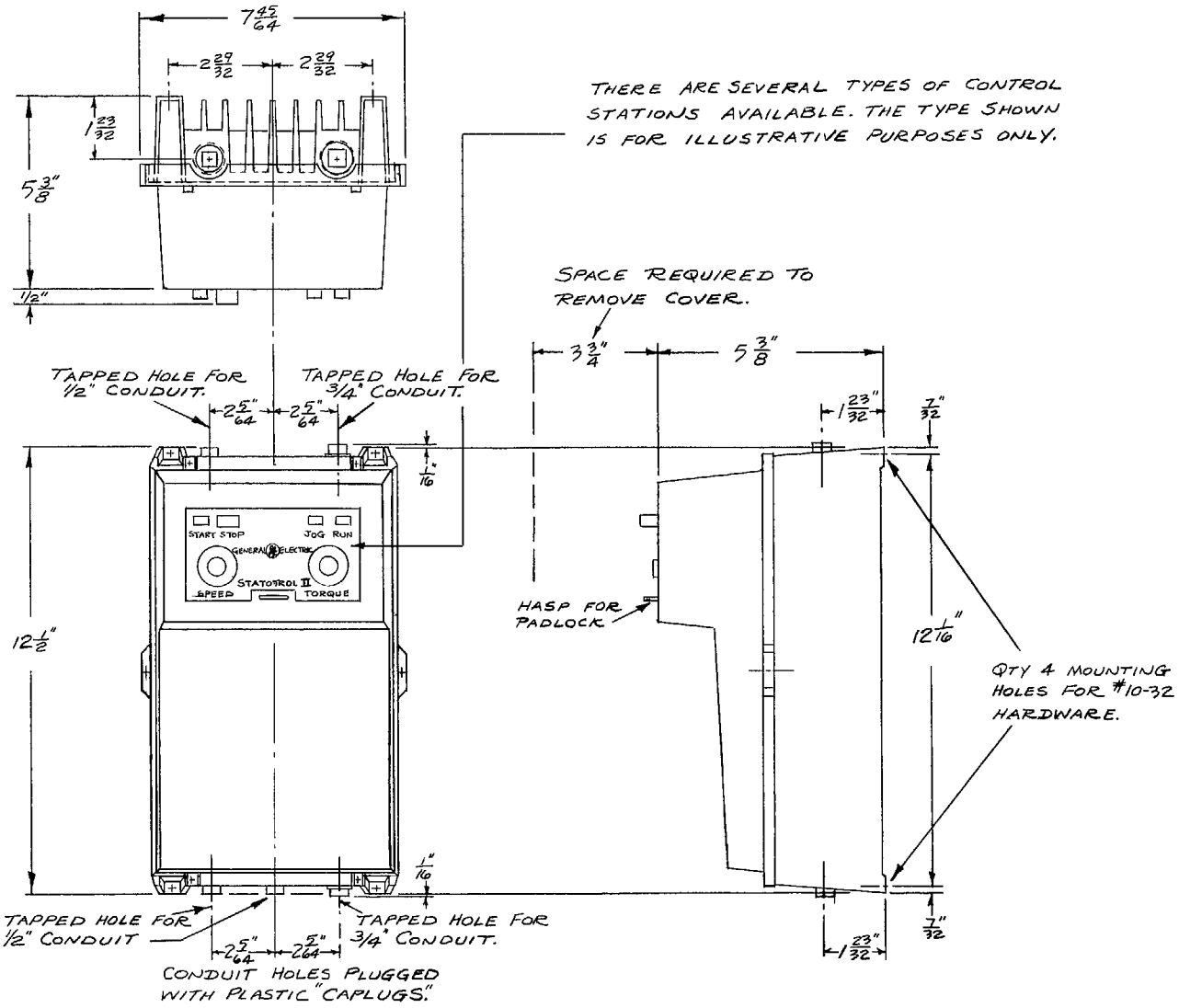


Figure 3. Statotrol II Controller Outline and Mounting Dimensions

WARNING

If the motor is accessable while it is running, a protective guard should be installed around all exposed rotating parts.

ELECTRICAL CONNECTIONS

PROPER LINE VOLTAGE CONNECTION

This controller operates on 50/60 Hz AC. Input voltage is either 115 volts or 230 volts, not both. Check nameplate to determine proper input voltage. A transformer is required where supply voltage deviates more than 10% from the controller rating.

A calibration resistor 140R must be removed from the main component board if 50 Hz power is to be used. Refer to Figure 7.

WARNING

Personnel safety considerations and the National Electric code require that electrical apparatus enclosures be solidly connected to building ground.

GROUNDING

The necessary wire gauge of the ground wire is determined by the rating of the branch circuit breaker.

Connect a suitably grounded lead to the ground connection terminal provided in the wire well below 1TB in the Statotrol II enclosure.

WARNING

Proper motor grounding is also essential for personnel safety. Do not depend upon motor mounting bolts to ground the motor frame.

The ground connection provided in the motor depends upon the type, size, and enclosure of the motor. Each Statotrol motor has one of the following provisions for connecting a ground lead.

1. A 4 inch green wire inside the wire well.
2. A 1/4-20 bolt in a tapped hole in the motor end shield.
3. A brass screw which serves as a ground terminal and also mounts the conduit box found on the side of TEFC motors.
4. A drilled hole in the motor end shield (inside the wire well near the electrical terminals) suitable for a self tapping screw.

POWER WIRING

A six point terminal strip, 1TB, is provided for connection to the AC power lines and the motor leads. Figure 4 is a wiring diagram for the power connections. When the motor is connected as shown in Figure 4, the motor will rotate CCW as viewed from the opposite shaft end. Reverse leads A1 and A2 for clockwise rotation. All power wires should be run through the conduit openings neareast 1TB.

CAUTION

Any connection error in the power wiring can damage the control. Recheck each connection before power is applied.

If there is any doubt about motor lead identification, the problem can be resolved with a simple resistance check. The motor armature resistance will be about 1 to 15 ohms, while field resistance will be about 75 to 1000 ohms. There must be no continuity between armature and field. Permanent magnet DC motors have armature leads, but no field leads.

1 1/2 and 2 HP motors may have leads labled C1 and C2. These leads should be well insulated and left unconnected. 1 1/2 and 2 HP motors may have four field leads marked F1, F2, F3 and F4. In this case, connect motor leads F2 and F3 together and connect motor leads F1 and F4 to controller terminals F1 and F2.

WARNING

Since the controller stop button does not remove voltage from the controller or the motor field, a branch circuit breaker or a fused disconnect must be used to disconnect the controller whenever work is to be performed on the drive.

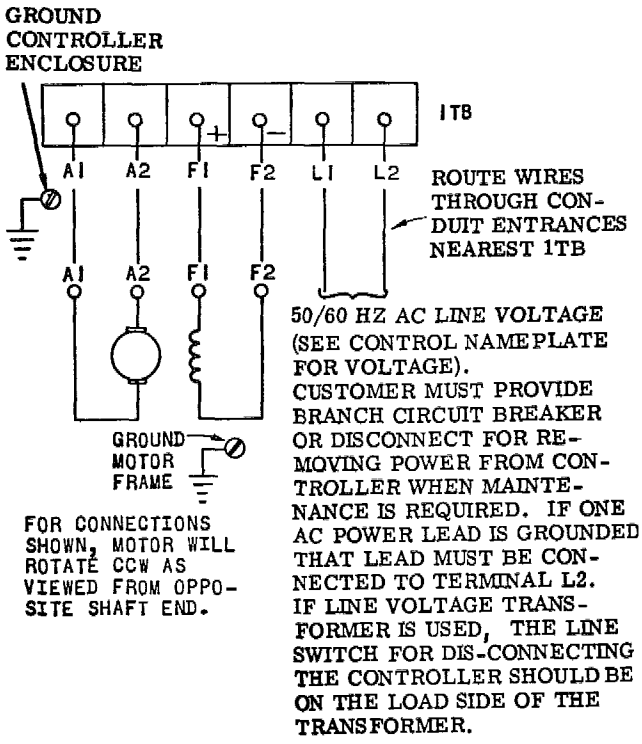


Figure 4. Power Wiring Connection Diagram

The branch circuit breaker must be large enough to eliminate nuisance tripping and small enough to protect the branch circuit and motor connection conductors. Refer to the National Electric Code (1971, section 310-20) and Table 1 on the following page. Wherever local codes are more restrictive, the local codes take precedence over the National Electric Code. Special requirements exist for installations in hazardous locations and other special situations.

When one side of the AC power line is grounded, that side must be connected to terminal L2 on 1TB.

A line power isolation transformer must be used when the Statotrol drive is connected to an instrument signal source which is not isolated from ground. When a line power transformer is used, the line switch used to disconnect the controller should be on the load side of the transformer.

TABLE 1

STANDARD DRIVES HORSEPOWER AND VOLTAGE RATING	MINIMUM WIRE AND CIRCUIT-BREAKER SIZE
up to 1/2 HP 115 V, and up to 1 HP 230 V	15 AMP Circuit Breaker 75°C #14 AWG Copperwire
3/4 HP 115 V, 1 1/2 HP 230 V, and 2 HP 230 V	20 AMP Circuit Breaker 75°C #12 AWG Copper wire

REMOTE CONTROL STATION WIRING

When a remote control station is to be installed, it must be connected to a 3SRC2000 or 3SRC2001 series adapter unit which plugs into the Statotrol II controller main component board. The connections for the forward, reverse, off, start, jog, run, and stop buttons are Class II control circuits as defined in Article 725 of the National Electric Code (1971).

Conductors connected to the speed adjustment potentiometer, the torque adjustment potentiometer, and the auto-manual switch are Class II circuits if the control is connected to 115 volt power. If the input voltage is 230 volts, conductors for these circuits should be installed in accordance with the Class I control and signal circuit requirements of Article 725 of the National Electric Code. Wherever local codes are more restrictive, the local codes take precedence over the National Electric Code.

Figure 5 shows the various remote control station connection schemes which can be used. The control wires should go through the conduit openings at the top of the Statotrol II enclosure.

To avoid electrical noise pickup, it is necessary to keep the torque potentiometer, speed potentiometer, and auto-manual switch wires separate from all other wires. Do not run these wires through conduits with power conductors or relay coil wiring.

If these leads are run in shielded cable, the cable shield should be connected to circuit 2 at the controller only. The cable shield must be insulated and must not come into contact with plant ground at any point.

MOTOR THERMOSTAT CONNECTIONS

When a motor thermostat is used, it should be connected in series with the "off" switch. Refer to Figure 5 for connection diagrams of remote control stations with motor thermostats. Local control stations (those which are inside the controller enclosure) have a jumper across two terminals on the foil side of the control station component board. Remove the jumper and connect the thermostat leads across these two terminals. Use insulated lugs on the thermostat leads.

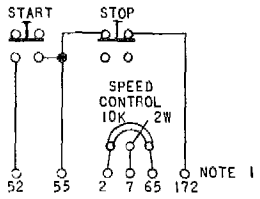
REMOTE ACCESSORY WIRING

A seven point terminal strip, 2TB, is provided for connection of leads from remote accessories. This terminal strip is not to be used unless one of the optional remote accessory adapter units has been installed in the Statotrol controller. (See Figure 2.) Remote accessory functions include tachometer feedback, tachometer follower, instrument follower, and speed indication. Any combination of these functions can be used simultaneously with the exception of the tachometer follower and the instrument follower which are mutually exclusive.

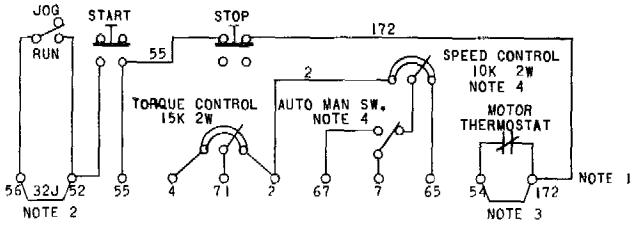
Figure 6 shows the wiring connections for remote accessories. The wiring shown should be considered as Class I signal wiring (National Electric Code, 1971, Article 725), except that the speed indicator wiring may be considered Class II if the AC input power to the control is 115V, and the instrument signal wiring may be considered Class II if the instrument output is limited as specified in the referenced code article.

The tachometer feedback function is installed by coupling a 20 volt per 1000 RPM PY59JY DC tachometer to the motor and connecting the tachometer leads to terminal strip 2TB as shown in figure 6. The polarity of the signal and the direction of rotation do not affect this connection. The recommended PY59JY tachometer has only two terminals. (The identification numbers on the tachometer terminals do not correspond to the controller terminal numbers.) One of the optional remote accessory adapter units, 3SFB1000 or 3SFB1100, must be installed in the Statotrol II controller (refer to Figure 2) to complete the circuit. The adapter units are factory connected for use with motors rated 1725 RPM to 1800 RPM. When used with a 2500 RPM motor, jumper 7J on the adapter unit must be opened by snipping it out with wire cutters. Refer to the instruction sheet which is packed with the remote accessory adapter unit for complete instructions on installation and adjustment, including use of motors with higher speed and tachometers with higher output voltage.

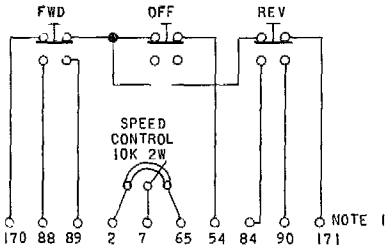
The tachometer follower signal is obtained from a 20 volt per 1000 RPM PY59JY DC tachometer by connecting the tachometer leads to points 97 and 2 on terminal strip 2 TB as shown in Figure 6. The positive side of



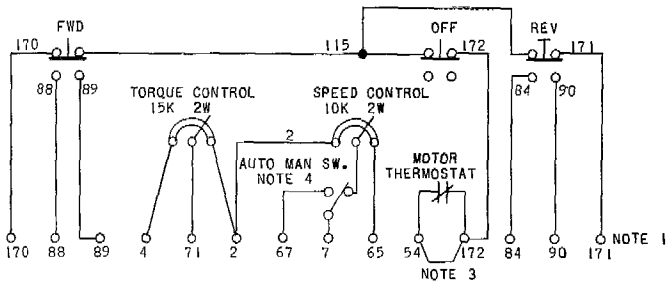
SIMPLEST NON-REVERSING REMOTE CONTROL STATION



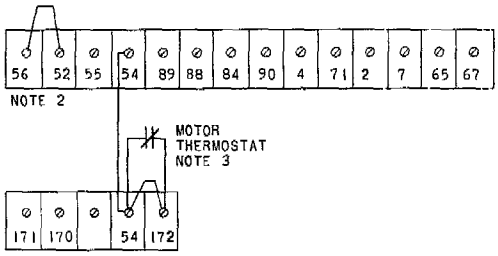
FULL OPTION NON-REVERSING REMOTE CONTROL STATION. ANY SINGLE FEATURE OR ANY COMBINATION OF TORQUE CONTROL, JOG-RUN, AUTO-MANUAL, AND MOTOR THERMOSTAT MAY BE CONNECTED.



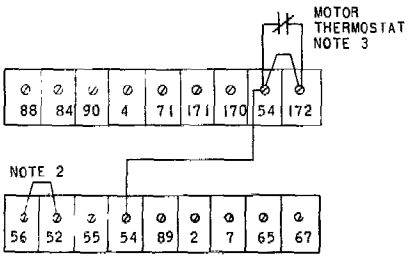
SIMPLEST REVERSING REMOTE CONTROL STATION



FULL OPTION REVERSING CONTROL STATION. ANY SINGLE FEATURE, OR ANY COMBINATION OF TORQUE CONTROL, AUTO-MANUAL, AND MOTOR THERMOSTAT MAY BE CONNECTED. FOR JOG-RUN SEE NOTE 8.



TERMINAL ARRANGEMENT ON 3SRC2001 REMOTE CONTROL STATION ADAPTER

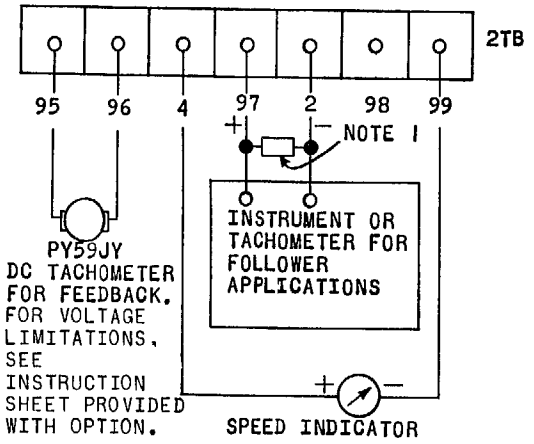


TERMINAL ARRANGEMENT ON 3SRC2000 REMOTE CONTROL STATION ADAPTER

NOTES:

1. TERMINAL ARRANGEMENTS ON SCHEMATIC DIAGRAMS DO NOT REPRESENT ACTUAL TERMINAL LOCATION. SEE SKETCHES AT LEFT FOR ACTUAL TERMINAL ARRANGEMENT ON REMOTE CONTROL STATION ADAPTERS.
2. FACTORY INSTALLED METAL JUMPER FROM TERMINAL 56 TO TERMINAL 52 MUST BE REMOVED BY CUSTOMER WHEN JOG-RUN SWITCH IS CONNECTED.
3. FACTORY INSTALLED METAL JUMPER FROM TERMINAL 54 TO TERMINAL 172 MUST BE REMOVED WHEN MOTOR THERMOSTAT IS CONNECTED.
4. GOLD PLATED CONTACTS ARE REQUIRED ON SWITCHES OR RELAYS USED FOR SWITCHING SPEED CONTROL POTENTIOMETER OR TORQUE CONTROL POTENTIOMETER.
5. FORWARD, OFF, REVERSE, STOP AND START SWITCHES ARE MOMENTARY. AUTO-MANUAL AND JOG-RUN SWITCHES ARE MAINTAINED.
6. CONTROL STATION WIRING MUST ENTER CONTROLLER ENCLOSURE THROUGH CONDUIT HOLES AT TOP OF CASTING.
7. WHEN FORWARD, REVERSE, OR START SWITCHES WITH MAINTAINED CONTACTS ARE TO BE USED, A 3SRC2002 OR 3SRC2003 REMOTE CONTROL STATION ADAPTER MUST BE USED. WIRE PER INSTRUCTION SHEET GEK-36405 PROVIDED WITH 3SRC2002 AND 3SRC2003.
8. A MAINTAINED CONTACT ADAPTER, 3SRC2002 OR A 3SRC2003, IS REQUIRED WHEN JOG-RUN IS TO BE USED WITH REVERSING.

Figure 5. Remote Control Station Connections



NOTE 1:

PROTECTIVE SHUNT RESISTOR IS REQUIRED TO PREVENT OVER-VOLTAGE WHEN A CURRENT SIGNAL INSTRUMENT WITH MAXIMUM OUTPUT OF MORE THAN 5 MILLIAMPS IS USED. USE A 560 OHM RESISTOR WITH A 20MA MAX. SIGNAL, AND USE A 180 OHM RESISTOR WITH A 50MA MAX. SIGNAL. THE PROPER VALUE OF THE PROTECTIVE SHUNT RESISTOR CAN BE FOUND BY THE FOLLOWING FORMULA WHEN INSTRUMENTS WITH OTHER MAXIMUM OUTPUTS ARE USED.

$$R = \left(\frac{8500}{I - 5}\right) \text{ OHMS } \pm 10\%$$

R IS THE RESISTANCE OF THE PROTECTIVE SHUNT RESISTOR AND I IS THE MAXIMUM OUTPUT OF THE SIGNAL GENERATOR IN MILLIAMPS.

Figure 6. Remote Accessory Connection Diagram

the tachometer must be connected to terminal 97. Terminal number 2 on the PY59JY tachometer (tachometer terminals numbers do not correspond to the controller terminal numbers) is positive when the tachometer rotates counterclockwise as viewed from the opposite shaft end. The polarity reverses when the direction of rotation reverses. The output voltage of the tachometer must be limited to 50 volts during overspeed conditions. Nominal output voltage should be 36 volts or less. One of two optional remote accessory adapter units, 3SFB1000 or 3STF1000, must be installed in the Statotrol controller (refer to Figure 2) to complete the circuit. When a local control station is used, it must be one of the following four: 3SLC1003, 3SLC1005, 3SLC1009, or 3SLC1011. Refer to Figure 5 for connections for remote control stations. Refer to the instruction sheet which is packed with the remote accessory adapter unit for complete instructions on installation and adjustment.

The instrument follower function is installed by connecting the instrument signal to points 97 and 2 on terminal strip 2TB as shown in Figure 6. The positive terminal of the signal generator must be connected to terminal 97. One of the two optional remote accessory adaptor units, 3SFB1100, or 3SMA 1000, must be installed in the Statotrol II controller (refer to Figure 2) to complete the circuit. When a local control station is used, it must be one of the following four: 3SLC1003, 3SLC1005, 3SLC1009, or 3SLC1011. Refer to Figure 5 for connections for remote control stations.

CAUTION

When the instrument signal is not completely isolated from ground, it is necessary to use a line power isolation transformer to supply the Statotrol drive.

In non-reversing applications, it is possible to avoid use of an isolation transformer by removing fuses 2FU and 3FU from the component board and using tach feedback with a special remote accessory adapter unit. Contact the factory for assistance and detailed instructions.

CAUTION

When the maximum current output of the instrument signal generator may exceed 5 ma, it is necessary to connect a protective shunt resistor from terminal 97 to terminal 2 on 2TB. Failure to do so may result in damage to the Statotrol II control circuitry. See Figure 6, Note 1, for proper resistance value.

PREPOWER CHECKS AND ADJUSTMENTS

WARNING

This section contains important warnings and cautions which must be observed during installation of the Control and motor. Failure to observe these cautions may cause safety hazards or equipment damage. Read this section carefully and make all necessary adjustments before power is applied to the control.

CURRENT LIMIT SETTING

The current limit circuit is factory adjusted for low impedance motors. If a medium or high impedance motor is to be used, the current limit must be adjusted at the time of installation. To set the current limit, first refer to Table 2 and locate the motor which is to be used.

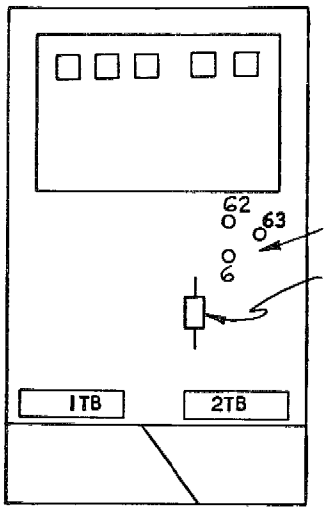
After finding the relative impedance of the motor to be used, refer to Figure 7 for instructions on how to position the current limit setting jumper.

50 HZ POWER ADJUSTMENT

The controller is factory adjusted for use with 60 Hz AC power. If 50 Hz power is to be used, resistor 140 R must be cut out of the circuit before 50 Hz power is applied. See Figure 7 for the location of 140R.

MOTOR GUARDS

If the motor is accessable while it is running, a protective guard should be installed around all exposed rotating parts.



CURRENT LIMIT SETTING JUMPER 6 TO 62 FOR HIGH IMPEDANCE MOTORS, JUMPER 62 TO 63 FOR MEDIUM IMPEDANCE MOTORS, JUMPER 6 TO 63 FOR LOW IMPEDANCE MOTORS. (SEE TABLE 2)

140R MUST BE CUT OUT OF CIRCUIT BEFORE 50 HZ POWER IS CONNECTED TO CONTROLLER.

Figure 7. Current Limit Jumper Setting and 50 Hz Adjustment

WIRING CHECK

Any connection error in the power wiring can damage the control as soon as power is applied. Any short to building ground in the signal wiring can cause damage as soon as power is applied, unless the Statotrol II drive is connected to a line power isolation transformer. If the controller is connected to any instruments or equipment which may be grounded, a line isolation transformer must be used. In no case should the circuit be grounded at more than one point. If the drive is to be operated as an instrument follower, verify that the correct protective shunt resistor is properly installed. (Refer to Figure 6.) It is advisable to recheck all wiring before power is applied. Make certain that all screw terminals are tight. If an ohmmeter is available, the simple resistance checks shown in Table 3 should be performed to verify that the power wiring is correct.

GROUNDING

Safety considerations and the National Electric Code require the motor frame and the controller enclosure to be connected solidly to building ground. Do not rely on mounting bolts for grounding. Refer to the "Electrical Connections" section of this instruction book for ground lead connections.

TABLE 2
CURRENT LIMIT SETTINGS FOR STATOTROL MOTORS WITH "3SFM----" CATALOG NUMBER ON NAMEPLATE

1140 RPM Drip Proof and totally enclosed 1725 RPM Drip Proof* (Except 1 1/2 & 2 HP. See below)	High Impedance Motors (jumper 6 to 62)
1725 RPM totally enclosed non ventilated & totally enclosed fan cooled 2500 RPM Drip Proof	Medium Impedance Motors (jumper 62 to 63)
2500 RPM totally enclosed non ventilated & totally enclosed fan cooled 3450 RPM motors Drip Proof & totally enclosed	Low Impedance Motors (jumper 6 to 63)
Any motor which does not have 3SFM---- catalog number on nameplate	Refer to Factory for Instructions

*CAUTION: 1 1/2 & 2 HP 1750 RPM Drip Proof Motors require jumper from 6 to 63.

TABLE 3
PREPOWER WIRING CHECKS

TERMINALS	APPROPRIATE RESISTANCE
L1 to L2	150 ohms or more
F1 to F2	75 to 1000 ohms
A1 to A2	1 to 15 ohms
F1 to A1 or F2 to A2	500, 000 ohms or more
Control Circuit to Ground	500, 000 ohms or more (see exceptions in preceding paragraph).

POWER LINE CONNECTIONS

If one AC power lead is grounded, that lead must be connected to terminal L2 since the controller fuse is connected to terminal L1.

The switch in the Statotrol II controller does not remove power from the controller or the motor field, so a branch circuit breaker or a fused disconnect must be used to disconnect the AC line wherever it is necessary to perform work on the motor or the controller.

Line voltage is exposed when the controller cover is removed. Use extreme care to avoid touching conductors. Always disconnect AC power before doing anything other than adjusting potentiometers.

INITIAL OPERATION AND ADJUSTMENT

When the control has been mounted and connected, and the prepower checks and adjustments are complete, apply power to the control, turn the speed control knob to zero, and press the "Start" button on the control station. Slowly turn the speed control knob until the motor starts to turn. Check the direction of motor rotation to be sure it is correct. If the motor turns the wrong way, disconnect power from the control and reverse the motor armature leads.

The control is now ready for normal operation. Some applications may require special settings for maximum speed, minimum speed, IR compensation, and torque taper. Potentiometers for adjusting these functions are in a line along one edge of the main component board inside the controller. Remove the Statotrol II cover and use a small screwdriver to adjust the potentiometers as described in the following instructions.

WARNING

AC power line voltage is exposed when the protective cover is removed. Use extreme care to avoid touching any exposed conductors inside the controller. Internal adjustments should be made by qualified electricians, and not by machine operators.

MINIMUM SPEED ADJUSTMENT (4P)

The minimum speed adjustment is factory set so that the motor will start to run when the speed control knob is turned just slightly off zero. To change this setting, first turn the speed control knob to zero and then rotate the minimum speed potentiometer until the motor runs at the desired minimum speed.

The minimum speed adjustment is also used to match proper motor speed to specific signal levels when the reference signal comes from a signal generating instrument. This function is explained on the instruction sheets packed with the remote accessory adapter option boards.

Adjusting the minimum speed changes the maximum speed also, so the minimum speed should be set before the maximum speed potentiometer is adjusted.

MAXIMUM SPEED ADJUSTMENT (3P)

CAUTION

Do not change the factory setting of the maximum speed potentiometer if tachometer feedback is to be used. If the maximum speed potentiometer is inadvertently disturbed, it should be returned to approximately 80% of its possible CW rotation.

The maximum speed adjustment does not limit motor speed when the control is in the "automatic" mode of operation (tachometer follower and instrument follower applications).

The maximum speed adjustment is factory set to a speed slightly higher than rated motor speed. To change the maximum speed, first turn the speed control knob to its highest speed setting. Then adjust the maximum speed potentiometer until the motor runs at the highest speed needed for the particular application.

The Statotrol II drive may not meet its performance specifications when the motor is run above its rated speed. It is, therefore, recommended that the maximum speed be set for rated motor speed or less.

IR COMPENSATION ADJUSTMENT (6P)

Conventional IR compensation boosts the motor speed at high load. The Statotrol II IR compensation circuit provides this feature and can also be adjusted to provide "droop" for applications which require motor speed to drop off linearly as load is added. The IR compensation adjustment is factory set so that for a given speed setting, the full load speed is different from the no load speed by about ±1% of rated motor speed. This setting is adequate for most applications. When necessary, the IR compensation can be adjusted by the following procedure.

Start the drive and set the speed control knob to the speed at which regulation is most critical in your particular application. Adjust the motor load to minimum and then measure the motor speed precisely with a hand tachometer or a strobe light. The speed of integral hp motors may be conveniently read by removing the dust cap on the commutator-end motor bearing and using a hand tachometer. On fractional hp motors, motor speed can be read with a strobe light at any convenient point where the rotating shaft can be seen.

Now adjust the motor load to maximum (not exceeding 100 percent rated torque) and again read motor speed.

If the "maximum-load" speed is less than the "Minimum-load" speed, turn the IR compensation potentiometer clockwise (CW) until they are equal. There is no need to wait for the motor to warm up since the Statotrol II IR compensation works equally well at any motor temperature. Some loads may "hunt" if the IR compensation is set too high. Turning the IR compensation potentiometer CCW should eliminate this hunting.

TORQUE TAPER ADJUSTMENT (5P)

CAUTION

The torque taper adjustment is factory set full CCW. The torque taper adjustment must be kept full CCW when a control station with a manual torque control knob is used.

In applications requiring a fixed program of torque control, the torque taper adjustment may be turned clockwise to increase the output torque which the motor will deliver at low speeds.

OPTION ADJUSTMENT

The optional features should not be adjusted until after any necessary adjustments of the maximum speed, minimum speed, IR compensation, and torque taper have been completed. Detailed instructions are on the instruction sheets which come with the options.

OPERATOR CONTROLS, NORMAL OPERATION

The operator controls have been made as simple and foolproof as possible. However, in certain applications, it may be necessary to caution the machine operator against operation sequences which may damage the machinery or process driven by the Statotrol motor. The following instructions apply only when the customer's load requires no special operating sequences.

STARTING

Press the "start", "forward", or "reverse" button. The speed control knob may be at any desired setting. The motor will accelerate smoothly to the speed set by the speed control knob.

Motor current is automatically limited to a safe value. No warmup is required, and motor response is immediate.

CHANGING SPEED

The speed control knob may be turned to any desired setting at any time, and the motor will respond smoothly. Turning the speed control knob clockwise will increase the motor speed.

STOPPING

Press the "stop" button. Motor will stop smoothly regardless of setting of knobs and other switches.

TORQUE CONTROL

The torque control knob adjusts the maximum output torque the motor will deliver. To operate in the torque control mode, first set the speed control knob to the highest desired speed and then turn the torque control knob to any desired setting.

Torque knob settings above 5 on the dial are for intermittent duty only, since settings above 5 may cause the motor to deliver more than rated torque (except with limited torque loads) and the motor will consequently overheat. The numbers on the torque control knob are for indication only, and should not be relied upon for motor overload protection. When the motor load is such that it will not overload the motor except during acceleration, the torque control knob may be left at any setting if the motor is not stopped and restarted too frequently.

REVERSING

The rotation of the motor may be reversed at any time by pressing the "forward" or "reverse" button. The motor will smoothly reverse its direction of rotation. Operators should be cautioned to avoid rapidly cycling the motor from forward to reverse enough times to overheat the motor.

JOG-RUN

To jog, push the "jog" button, and then the motor will turn only while the operator holds the "start", "reverse", or "forward" button. When jogging is complete, push the "run" button and the drive will return to normal operation.

AUTO-MANUAL

When the "manual" button is set, the motor will respond to the speed control knob. When the "auto" button is set, the motor will respond to a speed reference signal from a remote signal source.

MAINTENANCE

CONTROLLER

The controller enclosure should be periodically inspected to prevent an accumulation of materials which might block the flow of cooling air through the heat sink fins. If the control is subjected to dripping or sprayed water, the gasket over the pushbutton switches should be periodically inspected for wear or damage.

MOTOR

Bearings

In general, opening Statotrol motors for bearing maintenance will create more problems than it will prevent. However, if for some reason it is felt that bearing maintenance is necessary, the bearings should be relubricated or replaced after 5 years of normal service or 2 years of severe duty.

Brushes

Brushes should be inspected after every 1000 hours of operation. Replacement brushes should be installed before old brushes wear down to 3/8 of an inch in length. Replacement brushes must be preshaped to approximately conform to the curved commutator surface. The motor should be run near rated speed for about 12 hours with no load to seat the new brushes before the motor is returned to normal duty. Failure to seat the new brushes may cause commutator damage and rapid wear. Replacement brushes must be of the type recommended by the motor manufacturer. Refer to the renewal parts section of this book.

Mounting

The motor should be inspected periodically to assure that the mounting bolts are tight. Loose mounting bolts can cause vibration, rapid wear, and misalignment. Proper alignment of motor couplings must be maintained.

Ventilation

Do not allow an accumulation of materials to block cooling air from flowing through open motors or over totally enclosed motors.

GEAR BOX

Periodic oil changes and bearing lubrication are necessary to prolong the life of most gear boxes. Refer to the instructions provided with the unit for recommended maintenance schedule and lubricants.

TACHOMETER

After 5 years of normal service or 2 years of severe duty, the bearings should be inspected. If they appear to be loose or worn, they should be replaced. Brush inspection and replacement requirements are the same as for motors.

TROUBLESHOOTING AND REPAIR

WARNING

Line voltage is exposed when the controller cover is removed. Use extreme care to avoid touching exposed conductors. Always disconnect the AC power before doing anything other than adjusting potentiometers. The control station stop button does not remove power from the control or the motor field.

If a newly installed drive will not run, it is most likely that a terminal is loose, or a problem exists with a connection, line voltage, or an adjustment. Line voltage must be within ±10% of the nameplate rating of the controller, and the adjustments must be set as described in the "Initial Operation and Adjustments" section of this book. If the drive operates normally for a while and then malfunctions, the problem may be line voltage, motor overload, motor failure, a loose terminal, an open fuse, or a component failure. In the following discussions, each step of troubleshooting is based on the assumption that all preceding steps have been completed and nothing abnormal has been found.

SYMPTOMS AND THEIR PROBABLE CAUSES

Motor Will Not Run

First check the branch circuit breaker to be certain it is closed. Then turn off the branch circuit breaker and check the fuse in the controller.

WARNING

Always disconnect the AC line voltage from the control before replacing fuse.

Replace the fuse with one of the same type and amperage rating as the original fuse. Next, connect an AC voltmeter across terminals L1 and L2 on 1TB and verify that the voltage is within ±10% of the nameplate rating of the control. Next connect a DC voltmeter between terminals F1 and F2 on 1TB and verify that the voltage is within ±10% of the field voltage stated on the nameplate. If the field voltage is 1/2 of the rated value, one of the diodes in the field power supply has probably failed. These diodes are mounted between 1TB and the fuse on the controller main

component board. If the field voltage is zero, 2 or more diodes may have failed, or the fuse may be open. If the field voltage is correct, press the start button, verify that the M relay (on the main component board) picks up, turn the speed control knob to full speed, and read the DC voltage across terminals A1 and A2 on 1TB. If this voltage is about 10 or 20 volts the motor is stalled due to an overload or there is an open in the motor leads, windings, or brushes. If this voltage is zero, turn the minimum speed adjustment slowly from one extreme to the other. If the motor now starts the problem is in the control station and its plug-in contacts should be checked and then the control station should be replaced. If the motor does not start, the main component board along with the power semiconductor package should be replaced.

Motor Runs At High Speed And Cannot Be Controlled

If the drive system is used as a tachometer follower or an instrument follower, try to operate the control in the manual mode. If it works OK in manual, the problem is probably in the tachometer or instrument, or the "Remote Accessory Adapter" option (see Figure 2).

If the drive has tachometer feedback, remove the remote accessory adapter board (see Figure 2), jumper between the two option connection receptacles 22 and 20 as indicated by the yellow line on the main component board, and retest.

If the control has the "timed acceleration and deceleration" option (see Figure 2), disconnect the option. Jumper between the two receptacles 7 and 10 as shown on the main component board. (An explanatory note on the main component board is exposed when the option is removed.) Reconnect the power and retest.

Disconnect the AC power. If the drive has a remote control station, disconnect the wire from terminal 7 on the "Remote control station adapter" (see Figure 2) and tape the lug to prevent accidental short circuits. If the drive has a local control station, look in the control station and locate the wire (from the speed control potentiometer) which is plugged into either point 7 or 7A (make a note of which it is) and pull this wire loose. Tape the loose end to prevent accidental short circuits. Reconnect AC power and retest. If the motor speed now responds to the "minimum speed" adjustment, there is a short circuit in the control station. If the motor still runs at top speed only, replace the main component board, including the power semiconductor package.

Motor Runs Very Fast For Speed Setting, But Very Little Torque is Produced

Check the AC line voltage from L1 to L2 on 1TB. Verify that this voltage is within ±10% of the value stated on the nameplate. Check the DC voltage from F1 to F2 on 1TB. If this voltage is less than 3/4 of the value stated on the nameplate, one or more of the field power supply diodes on the main component board has failed. These diodes are between 1TB and the fuse on the main component board.

Motor Operates Normally At No Load, But Will Not Deliver Adequate Torque To Drive A Load

If the motor has operated properly in the past and suddenly develops this symptom, the main component board and/or the power semiconductor package should be replaced.

If this problem is evident immediately upon installation, refer to the section of this book titled "Prepower Checks and Adjustments", and check the current limit setting of the control. If it is wrong, disconnect the AC power and correct it. If it was set per the table, then disconnect the AC power, connect a DC ammeter in series with the motor armature, and run the motor with the load connected. If the observed DC current is more than the nameplate rating on the motor, either the motor has failed or the motor is overloaded. If the observed DC current is less than the nameplate rating of the motor, check the setting of the torque control knob, if the drive has one, and then disconnect the AC power and reset the current limit adjustment to the setting appropriate to the next higher impedance group of motors in Table 2 and retest.

Motor Hunts

Too much IR compensation may cause some motor-load combinations to hunt. Turn the IR compensation adjustment CCW until the hunting stops.

If adjustment of the IR compensation does not correct the problem, verify that the motor is not being run at higher than rated speed. Then refer to the section of this book titled "Prepower Checks and Adjustments", and check the current limit setting of the control. If it was not set per Table 2, disconnect the AC power and correct it. If it was set per the table, then disconnect the AC power and change the current limit adjustment to the setting appropriate to the next lower impedance group of motors in Table 2, and retest.

Fuse Blowing

If the control is being used with 50 Hz power, verify that resistor 140R has been cut out of the circuit as shown on Figure 7.

If the fuse blows within a few seconds after power is applied, there is probably a short circuit or a wiring problem. If the fuse blows after a few minutes or a few hours of steady running, the motor is probably overloaded. To check for an overload condition, measure the DC current in the motor armature. This current should not exceed the rated armature current which is stamped on the motor nameplate.

The fuses have been selected to provide the maximum possible protection for the drive. However, if the application requires the motor to start and stop or

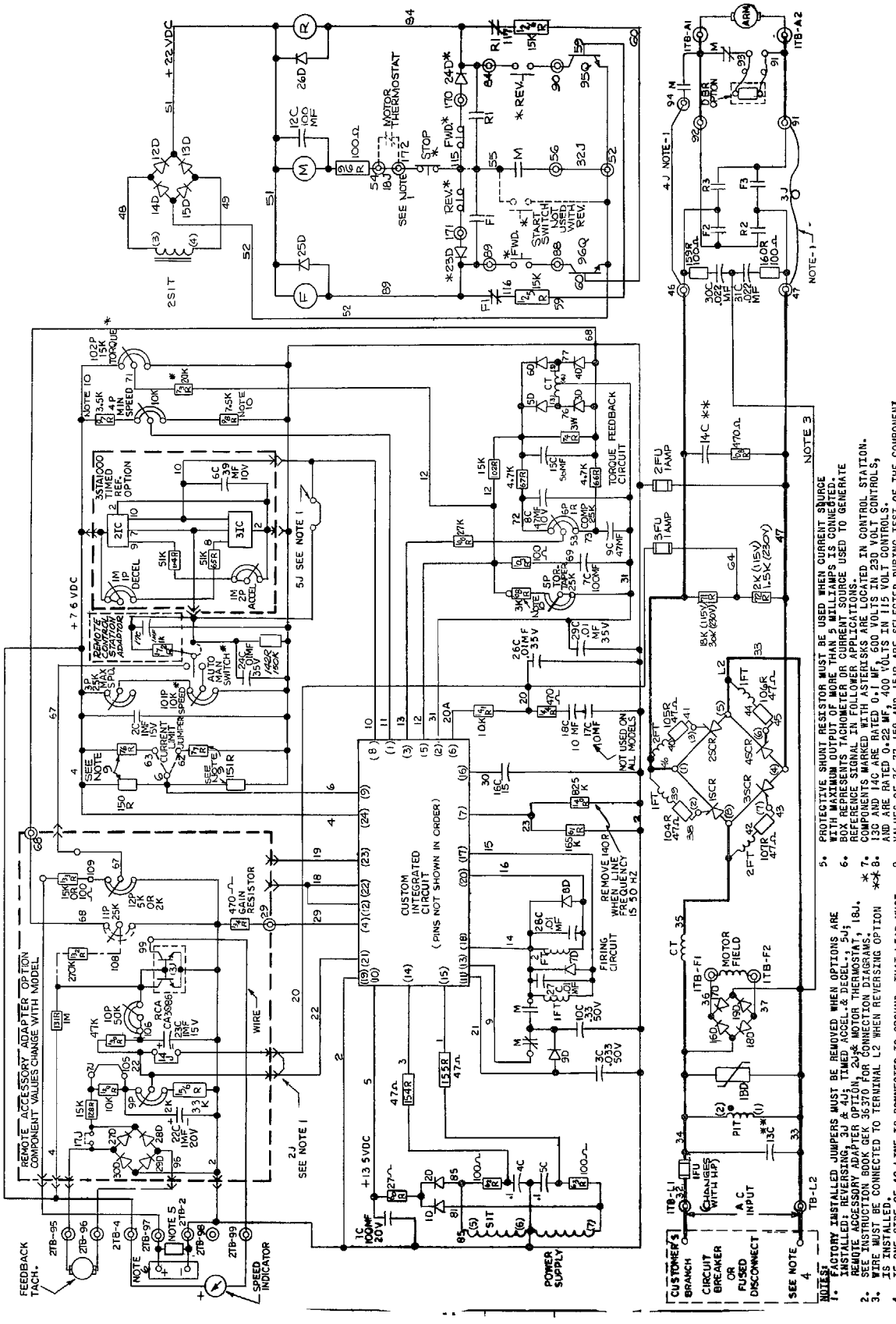


Figure 8. Statotrol II DC Drive Elementary Diagram

reverse repetitively, the starting current may eventually cause the fuse to blow since starting current is higher than running current. The most desirable remedy for this situation is to reset the current limit. Refer to Table 2 and Figure 7, disconnect AC power from the control, and change the current limit adjustment to the setting appropriate to the next lower impedance group of motors. If resetting the current limit prevents the motor from delivering adequate output torque, return the current limit to its original setting and select a new fuse rating from the following table. When a larger fuse is required, the drive is being overloaded, and while intermittent overload duty is acceptable, the drive must not be operated continuously in this manner.

FUSE TABLE

Drive horsepower and line voltage rating		Standard fuse- Buss BAF or Littlefuse 5AB	Oversize fuse for intermittent duty - Buss BAF or Littlefuse 5AB
1/6 HP	115V	4 amp	6 amp
1/4 HP	115V	5 amp	7 amp
1/3 HP	115V	7 amp	10 amp
1/2 HP	115V	10 amp	15 amp
3/4 HP	115V	15 amp	20 amp*
1/2 HP	230V	5 amp	7 amp
3/4 HP	230V	7 amp	10 amp
1 HP	230V	10 amp	15 amp
1 1/2 HP	230V	15 amp	20 amp*
2 HP	230V	15 amp	20 amp*

* The 20 amp fuse is not listed by Underwriters' Laboratories.

REPAIR

Motor Repair

WARNING

The controller switch does not remove voltage from the motor field. Always disconnect the AC power from the controller before attempting to service motor.

The motor can be repaired just as a standard DC motor by any competent motor repairman. For replacement parts or motor service, take the motor model number from the motor nameplate and contact the nearest service shop authorized by the motor manufacturer.

Controller Repairs

Normal field repair should be limited to replacing component boards, fuses, options, and the SCR power module. The complexity of the test sequence required to verify proper operation of a component board after repair makes it highly advisable to return failed component boards to General Electric Company for repair and retest by the trained personnel and automatic test equipment at the factory.

When emergency repairs are required in the field, the following cautions should be observed. Always disconnect AC power from the control before performing any work on any part of the circuit. The controller switches do not remove voltage from the circuitry. When soldering components to a printed circuit board, always use the smallest possible amount of solder. Do not overheat the leads of semi-conductor components such as SCR's, diodes, transistors, and integrated circuits. After soldering, inspect carefully to be certain that solder has not bridged between foil paths or reduced the electrical clearance between foil paths. Solder flux is conductive so flux accumulations must be cleaned from the component board when soldering is complete. Solder icicles and component leads must be trimmed from the bottom of the board to prevent short circuits to the heat sink. Many components on the board are very fragile and must be protected from damage while the component board is being handled.

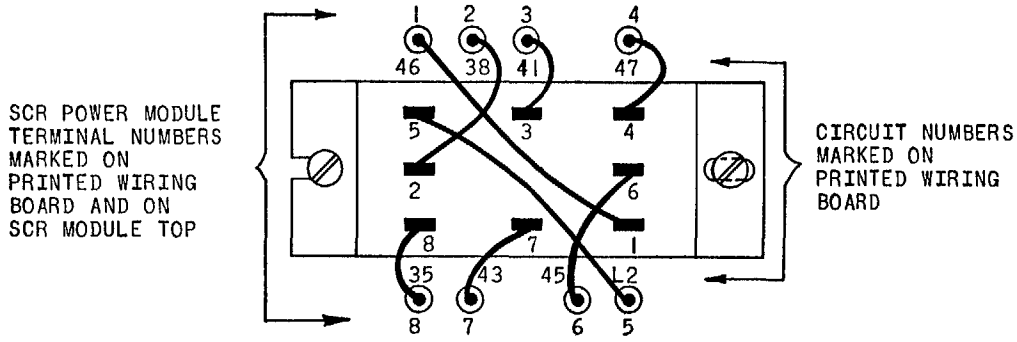
To remove the component board, first remove the four control station mounting screws and remove the control station. Now remove the dynamic braking resistor (DBR) and the reversing option, if they are present. Next, remove two screws from the Transformer (1T) mounting feet, two screws from the SCR power module, and two component board mounting screws, one in each corner near the terminal boards. The component board is now free to be removed.

When replacing the SCR power module, be sure that the module mounting surface (on the heat sink) is clean and free of foreign material which would prevent a good thermal contact between the module mounting strap and the module mounting surface on the heat sink. Before installing the module, apply a thin coating of silicone grease to the surface of the module mounting pedestal. A recommended silicone grease is Dow Corning 3 Compound, available from the Dow Corning Corporation, Midland, Michigan.

The SCR power module you receive as a replacement unit may have a different terminal arrangement than the original.

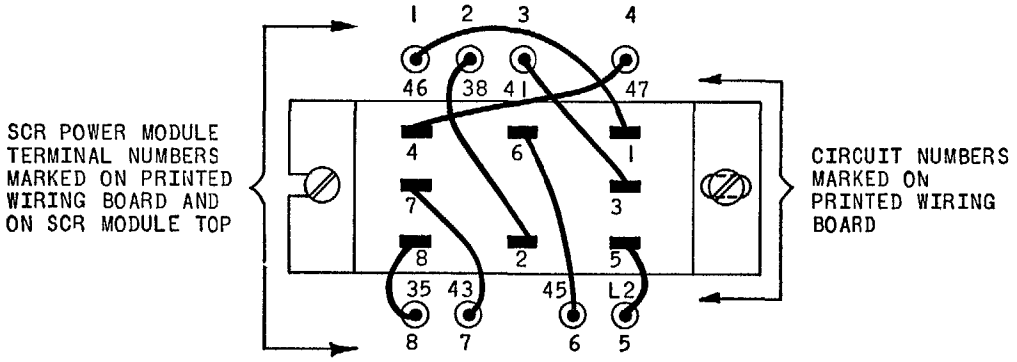
Refer to Figures 9 and 10. Compare terminal location on the replacement SCR module with the two figures. Connect the wires to the SCR terminals as shown in the appropriate figure.

The SCR terminal numbers are identified on the top of the module and also are marked on the printed wiring board, except that some early boards may not have the terminal numbers marked on them.



TOP VIEW - I. R. SCR MODULE
WIRE CONNECTIONS

Figure 9



TOP VIEW - GENERAL ELECTRIC SCR
MODULE WIRE CONNECTIONS

Figure 10

When returning component boards for repair, pack them carefully to prevent additional damage from occurring in transit.

RENEWAL AND SPARE PARTS

Replacement parts can be ordered from the nearest sales office of General Electric Company. Replacements for control stations and options should be ordered by the "3S" catalog number which appears on the control station or option originally purchased with the control.

Motor parts can be obtained from the nearest service shop authorized by the motor manufacturer.

RENEWAL PARTS LIST
FOR 3SFW, 3SFWB, 3SFWC AND 3SFWR SERIES
1/6 HP THROUGH 2 HP STATOTROL II CONTROLLERS

DESCRIPTION OF PART OR ASSEMBLY	CATALOG NUMBER	MODEL NUMBER AND HORSEPOWER									
		3SFW 1016 (1/6 HP 115V)	3SFW 1025 (1/4 HP 115V)	3SFW 1033 (1/3 HP 115V)	3SFW 1050 (1/2 HP 115V)	3SFW 1075 (3/4 HP 115V)	3SFW 2050 (1/2 HP 230V)	3SFW 2075 (3/4 HP 230V)	3SFW 2100 (1 HP 230V)	3SFW 2150 (1 1/2 HP 230V)	3SFW 2200 (2 HP 230V)
Main Component Board	44B331753-G110	1									
Main Component Board	44B331753-G111		1								
Main Component Board	44B331753-G112			1							
Main Component Board	44B331753-G113				1						
Main Component Board	44B331753-G114					1					
Main Component Board	44B331753-G220						1				
Main Component Board	44B331753-G221							1			
Main Component Board	44B331753-G222								1		
Main Component Board	44B331753-G223									1	
Main Component Board	44B331753-G224										1
Power Semiconductor	44A370660-G01	1	1	1	1						
Power Semiconductor	44A370660-G02						1	1	1		
Power Semiconductor	44A370660-G03					1				1	1
Fuse 4 Amp	44A334256-011	1									
Fuse 5 Amp	44A334256-004		1				1				
Fuse 7 Amp	44A334256-006			1				1			
Fuse 10 Amp	44A334256-008				1				1		
Fuse 15 Amp	44A334256-009					1				1	1

FOR FACTORY SERVICE AND APPLICATION ASSISTANCE CALL WAYNESBORO, VA.

703-942-7811

Before calling, list catalog numbers of the Controller, Motor, Operator's Station and any plug-in options.

Control Devices Operation and Speed Variator Products Department,
General Electric Company, Waynesboro, Virginia 22980

10-73 (1M)

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