INSTRUCTIONS

GEK-36391B

STATOTROL* II

3 HP AND 5 HP

DC DRIVES

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 motor is a shunt wound 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, 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.

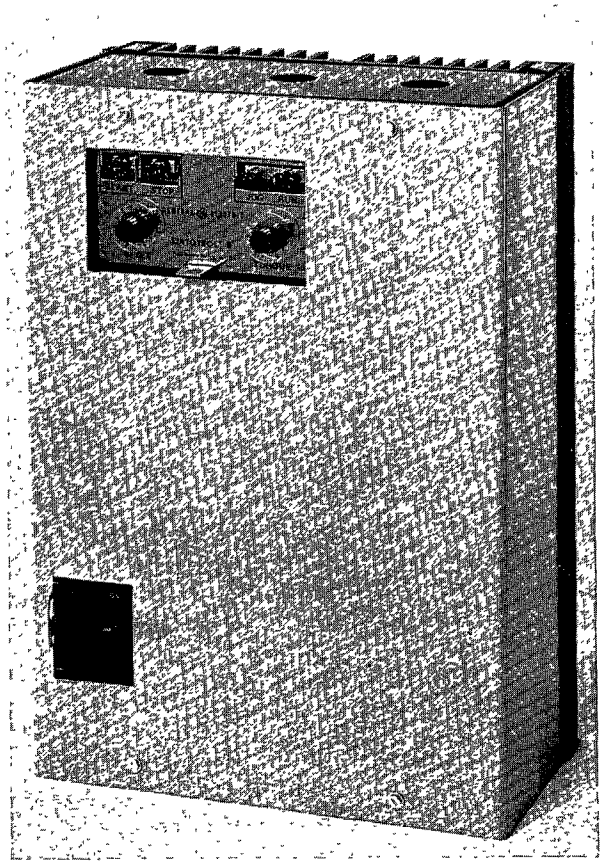


Figure 1. Statotrol II Motor Control 3 HP and 5 HP

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 a motor thermostat is to be used, and the controller has a local control station, the motor thermostat should be connected to the terminals on the control station component board before the control station is plugged into the controller.

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 and adjustment of the various options are on instruction sheets packed with the options.

CONTROLLER INSTALLATION

The Statotrol II 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.

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

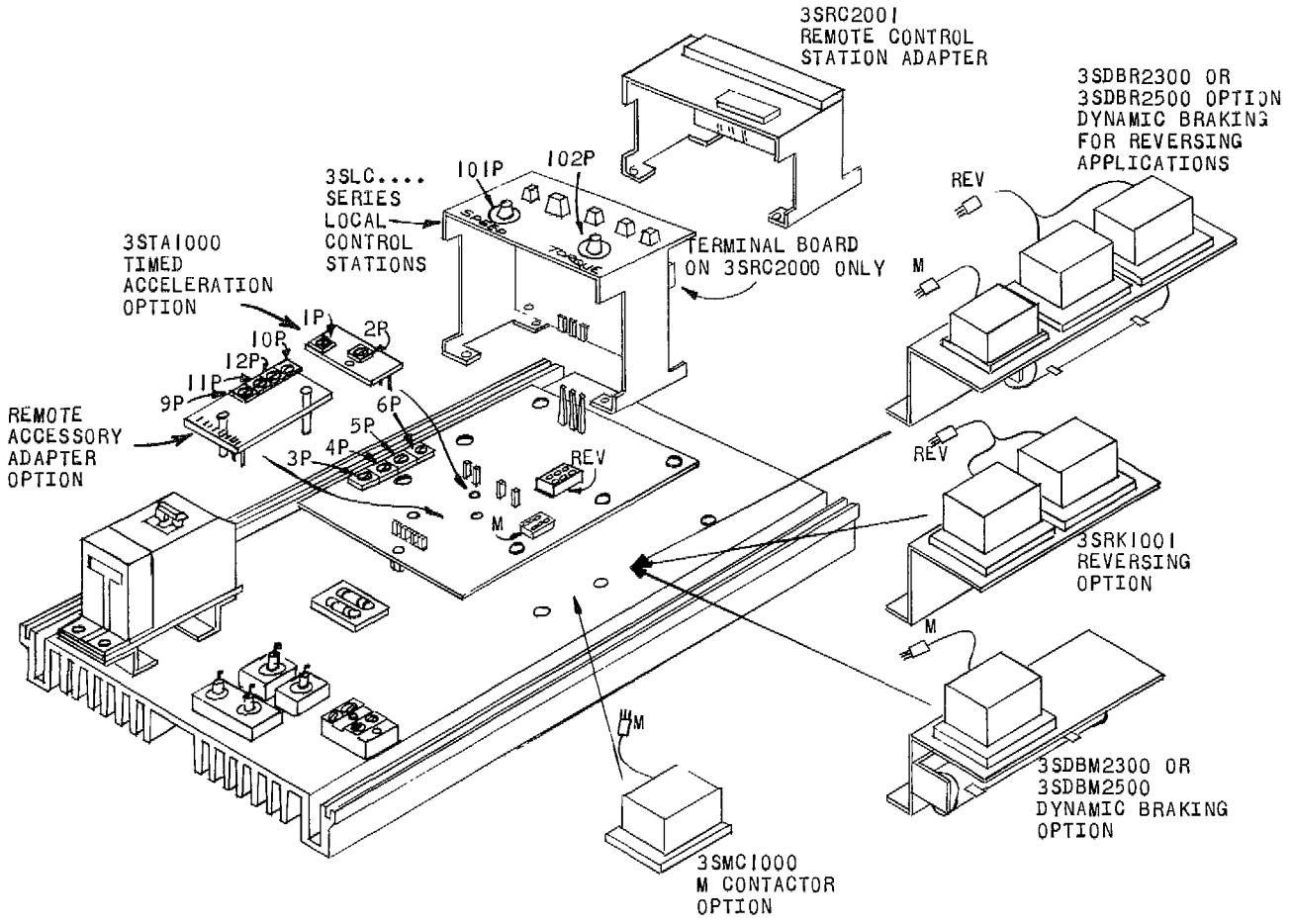


Figure 2. Exploded View of 3 HP and 5 HP Statotrol II Controller

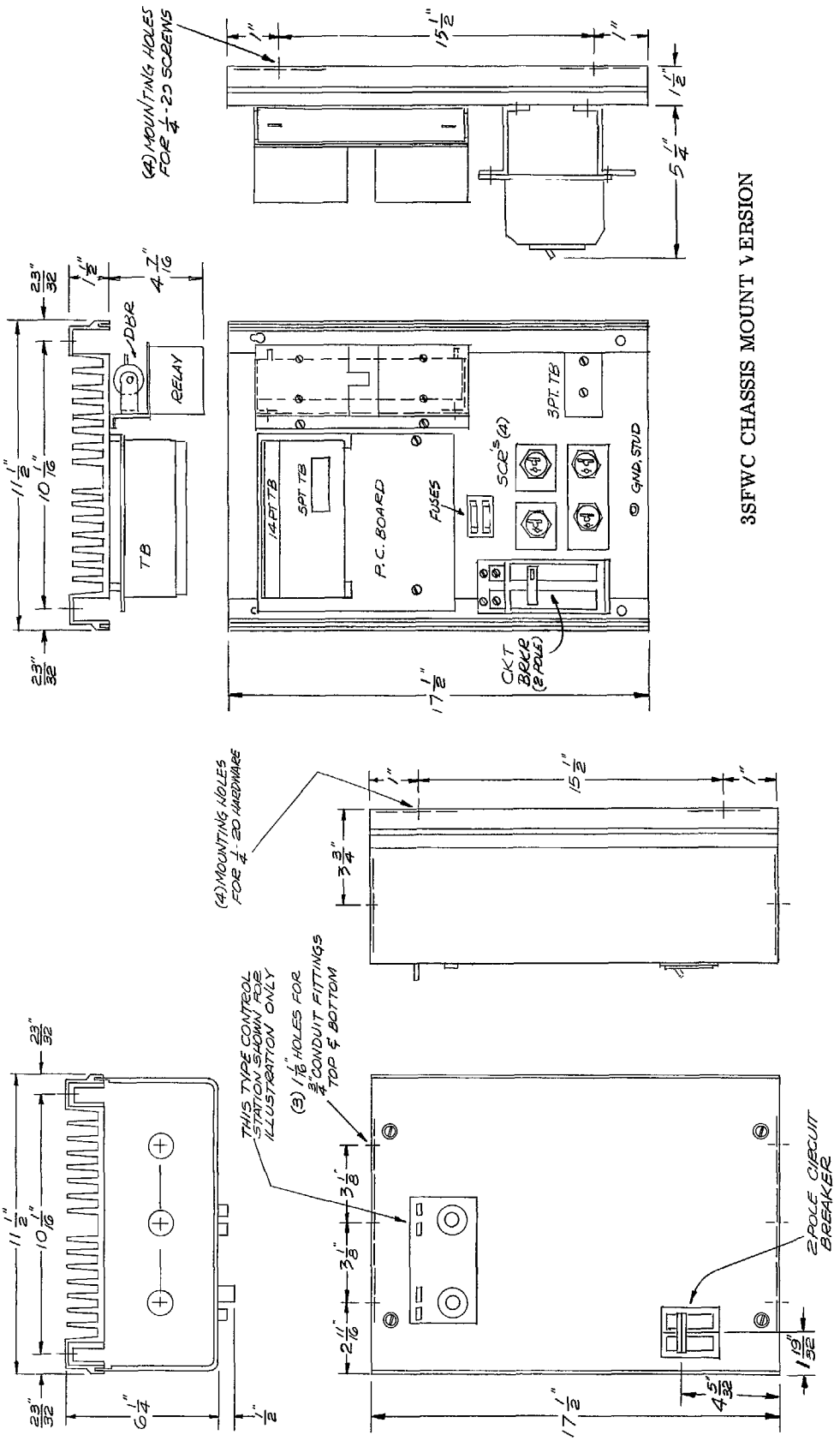


Figure 3. Statotrol II Controller, 3 HP and 5 HP, Outline and Mounting Dimensions

motor has been specially selected. Refer to the instruction book provided with the motor for specific installation instructions.

When 5 HP TENV motors (258ATC or 259ATC frames) are coupled to C face gear reducers it may be necessary to support the motor weight with shims under the motor feet. Check the specifications on the reducer to be used.

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 cycle 230 volt AC. 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 50Hz power is to be used. Refer to Figure 7.

GROUNDING

WARNING

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

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 Statotrol II enclosure near the circuit breaker.

WARNING

Proper motor grounding is also essential for personnel safety. Do not depend upon motor mounting bolts to ground the motor frame. A 1/4 - 20 bolt in a tapped hole in the motor end shield is provided for the ground connection.

POWER WIRING

Connect 230V 50 or 60 Hz lines to the controller circuit breaker. The AC power must not vary from nominal voltage by more than 10%. Resistor 140R (see Figure 7) must be cut out of the circuit before 50 Hz power is connected. Table 1 gives minimum required circuit breaker and wire sizes.

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. Turn off the circuit breaker and reverse leads A1 and A2 for clockwise rotation.

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 0.3 ohms to 1 ohm, while field resistance will be about 200 ohms to 500 ohms. There must be no continuity between armature and field.

Refer to the instruction book packed with the motor for specific motor connection instructions. If the motor has leads marked C1 and C2, these leads should be insulated and left unconnected.

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 for minimum circuit breaker and wire sizes. 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.

A line power isolation transformer must be used when the Statotrol drive is connected to an instrument signal

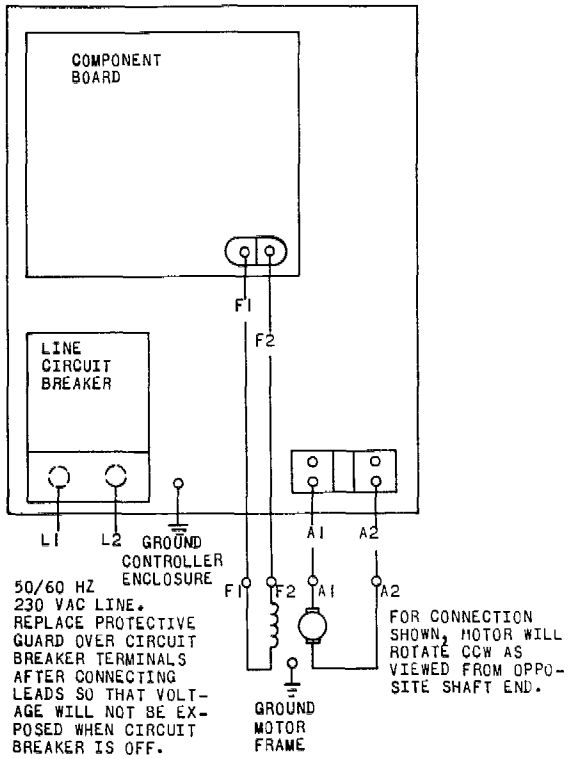


Figure 4. Power Wiring Connection Diagram

source which is not isolated from ground. When a line power transformer is used, any line switch used to disconnect the controller should be on the load side of the transformer.

When connecting a motor which has a reconnectable field (4 field leads), connect motor lead F2 to motor lead F3, and then connect motor leads F1 to controller terminal F1 and connect motor lead F4 to controller terminal F2.

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).

TABLE 1

STANDARD DRIVES HORSEPOWER RATING	MINIMUM WIRE AND CIRCUIT-BREAKER SIZE
3 Horsepower	30 AMP Circuit Breaker 75°C #10 AWG copper wire for line and armature 75°C #14 AWG copper wire for motor field
5 Horsepower	45 AMP Circuit Breaker 75°C #8 AWG copper wire for line and armature 75°C #14 AWG copper wire for motor field

Conductors connected to the speed adjustment potentiometer, the torque adjustment potentiometer, and the auto-manual switch meet 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 various remote control station connection schemes which can be used. 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.

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.

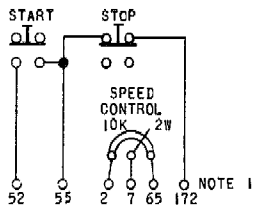
REMOTE ACCESSORY WIRING

A seven point terminal strip, 2TB, is provided for connection of leads from remote accessories. This terminal strip is not 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.

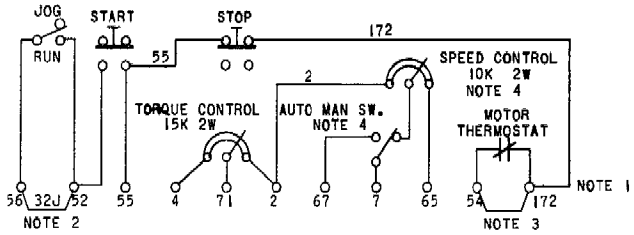
Figure 6 shows the wiring connections for remote accessories. The wiring shown should be considered as Class I signal wiring (National Electric Code, 1971, Article 725), except the instrument signal wiring which may be considered Class II if the instrument output is limited as specified in the referenced code article.

The tachometer feedback function is installed by coupling a 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, 3SFB series, must be installed in the Statotrol II controller (refer to Figure 2) to complete the circuit. Refer to the instruction sheet which is packed with the remote accessory adapter unit for complete instructions on installation, adjustment, and voltage limitations.

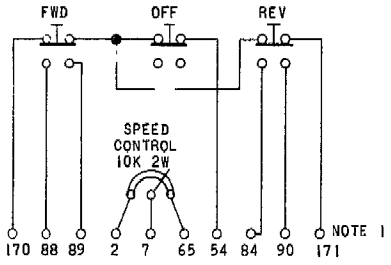
The tachometer follower signal is obtained from a PY59JY DC tachometer by connecting the tachometer leads to points 97 and 2 on terminal strip 2 TB as shown in Figure 6. The positive side of the tachometer must be connected to terminal 97. Terminal number 2 on the PY59JY tachometer (tachometer terminal 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 (refer to the instruction sheet packed with the option for maximum and nominal voltages). One of the optional remote accessory adapter units, 3SFB1000 or 1001 or 3STF1000 or 1001, 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



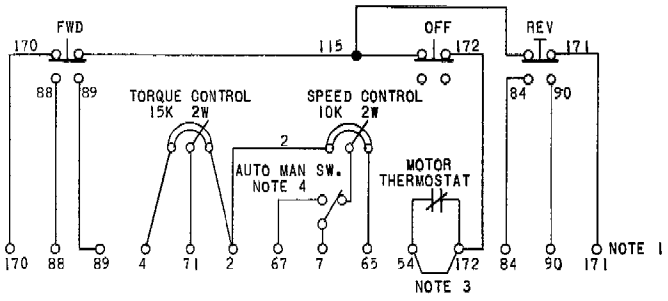
SIMPLEST NON-REVERSING REMOTE CONTROL STATION



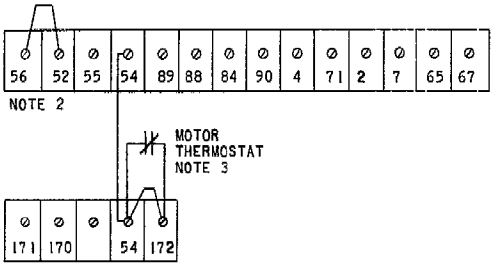
FULL OPTION NON-REVERSING REMOTE CONTROL STATION. ANY SINGLE FEATURE OR ANY COMBINATION OF TORQUE CONTROL, JOG-RUN, AUTO-MANUAL, AND MOTOR THERMOSTAT MAY BE CONNECTED.



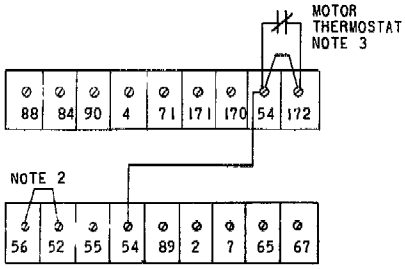
SIMPLEST REVERSING REMOTE CONTROL STATION



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

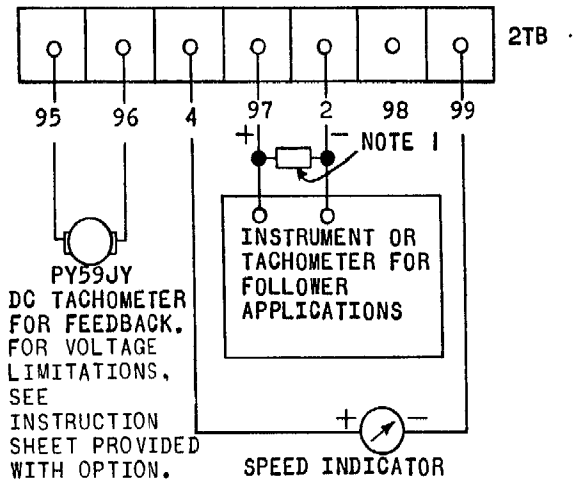


TERMINAL ARRANGEMENT ON 3SRC2000 REMOTE CONTROL STATION ADAPTER

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 overvoltage when a current signal instrument with maximum output of more than 5 milliamps is used. Use a 560 ohm resistor with a 20 ma max. signal, and use a 180 ohm resistor with a 50 ma 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.

NOTE 2:

See instruction sheet provided with option for connection diagram when instrument with voltage signal output is used in follower applications.

Figure 6. Remote Accessory Connection Diagram

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 optional remote accessory adapter units, 3SFB1100, 1101, 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 CYCLE POWER ADJUSTMENT

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

MOTOR CHECKS

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

The "Inspection Before Starting" section of the motor instruction book must be carefully followed.

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

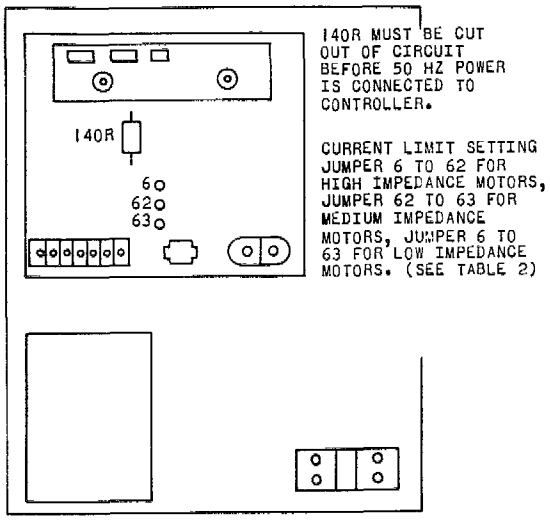


Figure 7. Current Limit Jumper Setting and 50 Hz Adjustment

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 resistor is properly installed. (Refer to Figure 6 and the instruction sheet packed with the option.) 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.

The relay coil circuit is normally grounded at circuit point 51, and is isolated from the other controller circuits.

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 3 HP and 5 HP MOTORS WITH "3SFM....." CATALOG NUMBER ON NAMEPLATE

All motors which do not have "3SFM....." number on nameplate and all 1150 RPM and all 3500 RPM motors.	See special instructions provided with control or consult factory.
3HP and 5HP 2500 RPM dripproof	high impedance motors (jumper 6 to 62)
3HP and 5HP 1750 RPM dripproof and 3HP 2500 RPM TENV	medium impedance motors (jumper 62 to 63)
3HP and 5HP 1750 RPM TENV and 5HP 2500 RPM TENV	low impedance motors (jumper 6 to 63)

TABLE 3

PREPOWER WIRING CHECKS

TERMINALS	APPROPRIATE RESISTANCE
Load side of open circuit breaker	500 to 1000 ohms
F1 to F2	200 to 500 ohms
A1 to A2	0.3 to 1.0 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 paragraphs).

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 "Inspection After Starting" section of the motor instruction book should be carefully followed at this time.

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 controller cover and use a small screwdriver to adjust the potentiometers as described in the following instructions.

WARNING

Line voltage is exposed if the line circuit breaker is on and the cover is removed. Always turn off the circuit breaker before performing any work other than potentiometer adjustments 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 motor should never be operated above its rated speed.

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 factory 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. NOTE: 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, 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 is relatively

insensitive to 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 torque control knob is used.

In applications which require 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

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 continuously.

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. (Proper setting of the torque control knob and the torque taper adjustment can prevent motor overheating by limiting armature current to the nameplate rating of the motor.)

JOG-RUN

To jog, push the "jog" button, and then the motor will run 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. The control must be protected from dripping or sprayed moisture and oil.

MOTOR

Complete instructions for motor maintenance are included in the motor instruction book.

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. Brushes should be inspected after every 1000 hours of operation and replaced when they wear down to 3/8" in length.

TROUBLESHOOTING AND REPAIR

WARNING

Line voltage is exposed if the line circuit breaker is on while the controller cover is removed. Use extreme care to avoid touching exposed conductors. Always turn off the line circuit breaker 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 function properly, 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 between 253 volts AC and 207 volts AC, 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 and the controller circuit breaker to be certain they are closed. Then if the control station has one, turn the torque control knob clockwise. Then turn off the line circuit breaker and check fuses FU5 and FU6 in the controller.

WARNING

Always turn the circuit breaker off before replacing fuses.

Replace any open fuse with one of the same type and amperage rating as the original fuse. Next, connect an AC voltmeter across the controller circuit breaker terminals and verify that the line voltage is between 207V and 253V AC. Next connect a DC voltmeter between field terminals F1 and F2 on the two point terminal strip on the component board and verify that the voltage is between 180 volts DC and 220 volts DC. If the field voltage is less than 150 volts DC, one of the diodes in the field power supply may have failed. These diodes are 16D, 17D, 18D and 19D and are located on the main component board just above the field connection terminals. If the voltage is zero, two or more diodes may have failed, or a fuse may be open. If the field voltage is correct, press the start button, verify that the control relay on the component board and the M contactor (if used) pick up, turn the speed control knob to full speed, and read the DC voltage across terminals A1 and A2. If this voltage is 10 to 20 volts or more, the motor is stalled due to an overload, or there is an open in the motor leads, windings, or brushes. If the voltage from A1 to A2 is zero, turn the minimum speed adjustment (3P) clockwise. 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, locate the two small connectors which are used to plug the SCR gate leads onto the main component board. Partially extract and then reseat each connector to restore electrical contact which may have been lost due to corrosion. If the motor still will not start, the main component board 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 options removed.) Reconnect the power and retest.

If the motor speed now responds to the "minimum speed" or "maximum speed" adjustments, there is a short circuit in the control station. If the motor still runs at top speed only, replace the main component board.

Motor Runs Very Fast for Speed Setting, but Very Little Torque is Produced:

Just above 2TB on the main component board there is a row of receptacles which accept the pins of the Remote Accessory Adapter Option. If the option is not used, a jumper must be used to connect receptacles 20 and 22. The proper jumper location is marked by a yellow line on the component board. Verify that this jumper is in place if the option board

is not being used. Next, check the AC line voltage at the controller circuit breaker terminals. Verify that this voltage is within ±10% of the nominal 230V AC. Check the DC voltage from F1 to F2 on 1TB. If this voltage is less than 150V DC, one or more of the field power supply diodes has probably failed. These diodes are labeled 16D, 17D, 18D, and 19D, and are located on the main component board just above the field connection terminals.

Motor Operates Normally at No Load, but Will Not Deliver Adequate Torque to Drive Load

If the drive has operated properly in the past and suddenly develops this symptom, locate the two small connectors which are used to plug the SCR gate leads onto the main component board. Partially extract and then reseat each connector to restore electrical contact which may have been lost due to corrosion. Then, if an oscilloscope is available, connect it across terminals A1 and A2, and if full wave rectified power (a voltage pulse every 8 1/3 milliseconds) is being applied to the armature, reset the current limit as explained in the next paragraph. If no oscilloscope is available, or if the oscilloscope shows that half wave rectified power (a voltage pulse every 16 2/3 milliseconds) is being applied to the armature, replace the main component board and if the problem still persists, replace the SCR's.

If a newly installed drive will not deliver adequate torque to drive the load, first verify that the torque control knob (if used) is turned clockwise, and also verify that the motor is not running faster than its rated speed. Then turn off the line circuit breaker and connect ammeters in series with the motor armature and run the motor under load. If the DC armature current exceeds the motor nameplate rating or if the AC armature current is more than 1.5 times the nameplate rating, the motor is overloaded. If the measured DC current is less than the motor nameplate rating, and if the AC current is less than 1.5 times nameplate rating turn off the line circuit breaker and reset the current limit adjustment to the setting appropriate to the next higher impedance group of motors in Table 2 and retest.

Circuit Breaker Trips

If the circuit breaker trips within a few seconds after power is applied, there is probably a short circuit or a wiring problem. Refer to the "Prepower Checks and Adjustments" section of this book for the appropriate wiring and impedance checks. If the input impedance is low, set the ohmmeter to the X1000 scale and measure the resistance between the cathode and anode (i.e., power terminal and heatsink) of each SCR. The meter should show open circuit for either polarity of the probes. If the reading on any SCR is not open circuit, that SCR should be replaced.

If the circuit breaker trips when the motor starts, turn off the line circuit breaker, refer to Table 2 and Figure 7, and reset the current limit adjustment to the setting appropriate to the next lower impedance group of motors. (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 before resetting the current limit.)

If the circuit breaker trips after a few minutes or a few hours of steady running, the motor is probably overloaded. Measure the DC armature current in the motor, and if it exceeds the motor nameplate rating, the motor is overloaded.

Fuse Blows

The instrument fuses 5FU and 6FU provide overcurrent protection for the component board, including the motor field DC power supply. If a fuse blows it should be replaced with a new fuse of the same type and rating. If the fuse blows again, turn off the line circuit breaker and measure the line to line resistance on the load side of the fuse block. This resistance should be 500 to 1000 ohms. A short circuit here indicates a failure of filter capacitor 13C, power supply transformer 1T, transient suppressor 1BD, or one or more of the field power supply diodes 15D, 16D, and 17D or 18D. (Failure of a field diode indicates a short in the motor field circuit.) Next, inspect the wiring for bare wires, loose terminals, and stray wire strands at wire terminations, and verify that the field circuit and regulating circuit are isolated from building ground (refer to the wiring checks in the "Prepower Checks and Adjustments" section for grounding exceptions). Finally, disconnect one motor field lead and measure the motor field resistance while very slowly rotating the motor shaft through a full 360°. The field resistance should be between 200 and 500 ohms and should be the same regardless of the shaft position.

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 adjustments of the IR compensation do not correct the problem, verify that the motor is not running faster than rated speed, and if the control is being used on 50 Hz line voltage, verify that resistor 140R has been cut out of the circuit as shown in Figure 7. Then refer to the section of this book entitled "Prepower Checks and Adjustments" and check the current limit setting. If it was not set per Table 2, turn off the line circuit breaker and correct the setting. If it was set per Table 2, turn off the power circuit breaker and change the current limit adjustment to the setting appropriate to the next lower impedance group of motors in Table 2.

REPAIR

Motor Repair

WARNING

The controller stop switch does not remove voltage from the motor field. Always turn off the line circuit breaker 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, options, fuses, circuit breakers, and the SCR's. 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 turn off the line circuit breaker before performing any work on any part of the circuit. The controller stop switch does 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 semiconductor 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 conductors. 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.

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

When replacing SCR's, it is recommended that a Molybdenum Disulfide compound be applied to the replacement SCR mounting threads before installing. This improves heat transfer and prevents the galling action which makes SCR removal very difficult.

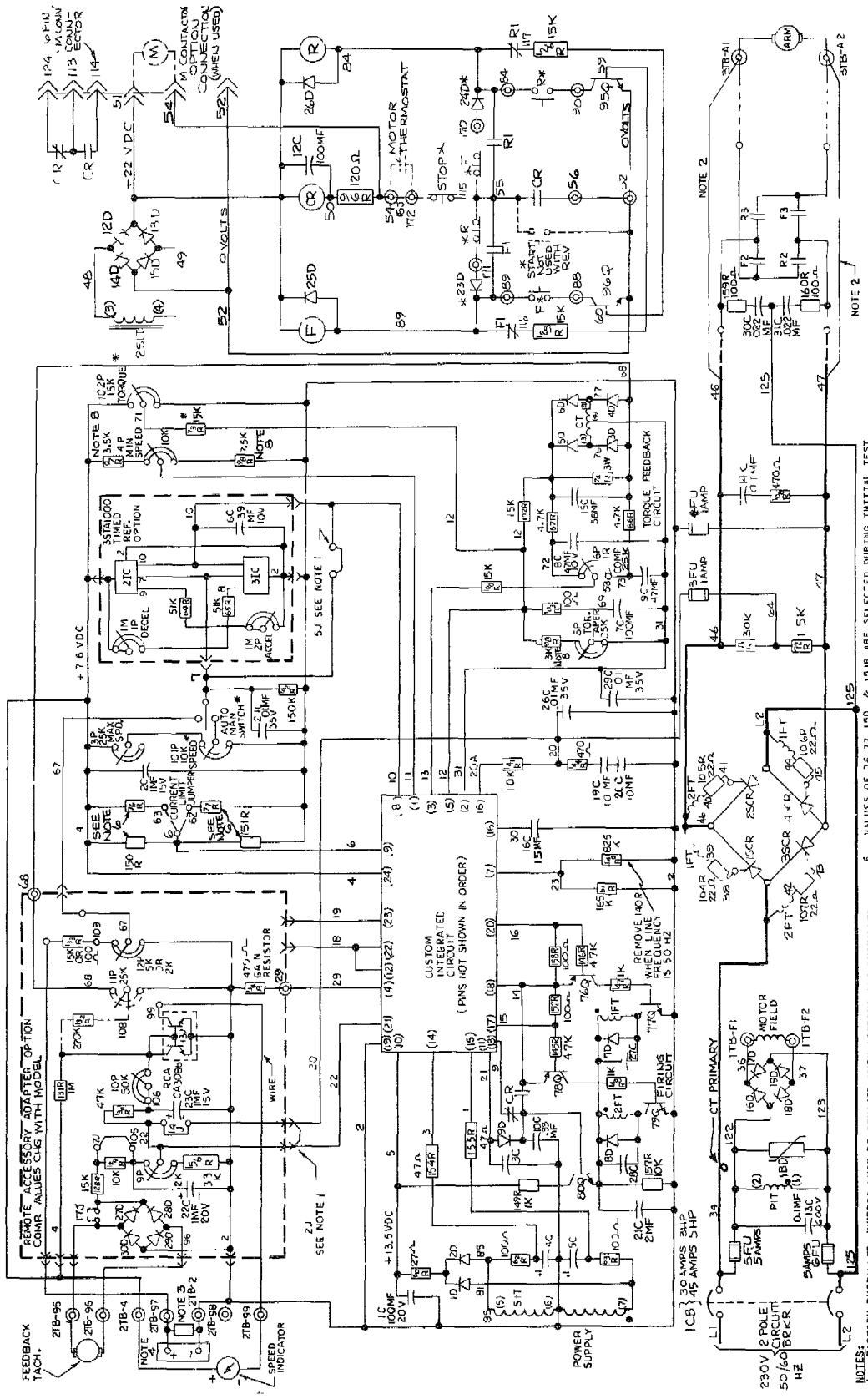
A good recommended compound is "Molykote M-77", available from the Dow Corning Corporation, Midland, Michigan.

The recommended maximum torque for the SCR's is 20 inch-pounds for the 3 hp and 100 inch-pounds for the 5 hp. Torqueing the SCR's beyond these limits may damage the SCR's or the mounting threads.

RENEWAL AND SPARE PARTS

Replacement parts can be ordered from the nearest sales office of the 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.



NOTES:
1. FACTORY INSTALLED JUMPERS MUST BE REMOVED WHEN OPTIONS ARE INSTALLED: TIMED ACCEL.& DECEL., 2J; REMOTE ACCESSORY ADAPTER OPTION, 2J; & MOTOR THERMOSTAT, 18J.
2. WHEN REVERSING OPTION IS USED, IT IS CONNECTED BETWEEN POINT 46 & 3TB-A1 AND BETWEEN POINT 47 & 3TB-A2. SEE ELEMENTARY DIAGRAM OF ARMATURE CIRCUIT ON THE INSTRUCTION SHEET PROVIDED WITH THE OPTION WHEN DYNAMIC BRAKING OR LINE CONTACTOR OPTIONS ARE USED.
3. PROTECTIVE SHUNT RESISTOR MUST BE USED WHEN CURRENT SOURCE WITH MAXIMUM OUTPUT OF MORE THAN 5 MILLIAMPS IS CONNECTED.
4. BOX REPRESENTS TACHOMETER OR CURRENT SOURCE USED TO GENERATE REFERENCE SIGNAL IN FOLLOWER APPLICATIONS.
5. COMPONENTS MARKED WITH ASTERISKS ARE LOCATED IN CONTROL STATION.
6. VALUES OF 76,77,150 & 151R ARE SELECTED DURING INITIAL TEST OF THE COMPONENT BOARD AND WILL VARY FROM BOARD TO BOARD.
7. IF ONE SIDE OF THE AC LINE IS CONNECTED TO GROUND, THAT LEAD MUST BE CONNECTED TO L2. FOR SPECIAL GROUNDING INSTRUCTIONS FOR INDIVIDUAL OPTIONS, SEE THE INSTR.BK. GEK 36391A AND THE INSTRUCTION SHEETS PACKED WITH EACH OPTION.
8. RESISTORS 68,97 & 98R ARE LOCATED ON THE 4-POT ASSEMBLY.

Figure 8. Statotrol II DC Drives, 3 HP and 5 HP, Elementary Diagram

RENEWAL PARTS LIST
FOR 3SFW, 3SFWB, 3SFWC, AND 3SFWR SERIES
3 HP AND 5 HP STATOTROL II CONTROLLERS

DESCRIPTION OF PART OR ASSEMBLY	CATALOG NUMBER	MODEL NUMBER AND HORSEPOWER	
		3SFW2300 3 HP	3SFW2500 5 HP
		QTY. PER UNIT	QTY. PER UNIT
Main Component Board	44B337316-G01	1	
Main Component Board	44B337316-G10		1
Circuit Breaker	TQC2130WL	1	
Circuit Breaker	TQC2145WL		1
SCR's	44B212741-109	4	
SCR's	44B310090-206		4
Fuse 5FU and 6FU 5 amps	K9774717-7 (Bussman Type ABC-5) (Littlefuse Type 314005)	2	2

FOR FACTORY SERVICE AND APPLICATION

ASSISTANCE CALL WAYNESBORO, VA.

703-942-7811

Before calling, list the 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

3-73 (1M)

GENERAL ELECTRIC