INSTRUCTIONS

GEK-14786

STATOTROL* DRIVE WITH CURRENT LIMIT

AND

PULSE RATE SPEED CONTROL

3SRA360

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GENERAL ELECTRIC

CONTENTS

STATOTROL* DRIVE WITH CURRENT LIMIT AND PULSE RATE SPEED CONTROL 3SRA360

INTRODUCTION

This manual contains the installation, operation, and servicing instructions for the 3SRA360 Statotrol drive.

The system was designed to control the speed of a 1/2 HP motor in response to the pulse rate output of a digital tachometer.

RECEIVING, HANDLING AND STORAGE

Receiving and Handling

Immediately upon receipt, the equipment should be carefully unpacked. Particular care should be exercised to prevent small parts from being mislaid or thrown away in the packing material.

As soon as the equipment is unpacked, it should be examined for any damage that may have been sustained in transit. If injury or rough handling is evident, a damage claim should be filed immediately with the transportation company and the nearest General Electric Sales Office should be notified promptly.

Storage

If the equipment is not to be used immediately after being unpacked, it should be stored in a clean, dry place and protected from accidental damage. Particular care should be taken to avoid storing the equipment in locations where construction work is in progress.

DESCRIPTION

The Statotrol drive consists of a DC motor, a controller and digital-to-analog converter with stabilizing circuitry suitable for use in this special application. Each of these items is discussed separately below.

Motor

The motor is a DC shunt motor of a design suitable for use with the controller. Motors for this drive are equipped with a thermostatic switch which opens when the motor becomes excessively hot.

Controller (Figure 1)

The controller consists of a basic Statotrol module, a digital-to-analog converter component board, two magnetic relays, a dynamic braking resistor, a step-down transformer, a stop-start switch and a line speed potentiometer. Receptacles for making external connections are provided on the enclosure.

The basic Statotrol module converts the alternating current (AC) from the power lines to direct current (DC) to drive the motor. Silicon rectifiers are used to supply constant field current and a silicon controlled rectifier is used to supply adjustable armature voltage. The control circuitry is encapsulated in an epoxy block, and is equipped with a special current limit circuit to limit surge current in the motor. Standard fuses and a current limit circuit provide rectifier protection. Figure 6 shows the assembly of the basic Statotrol controller while Figure 7 shows the connections on the controller.

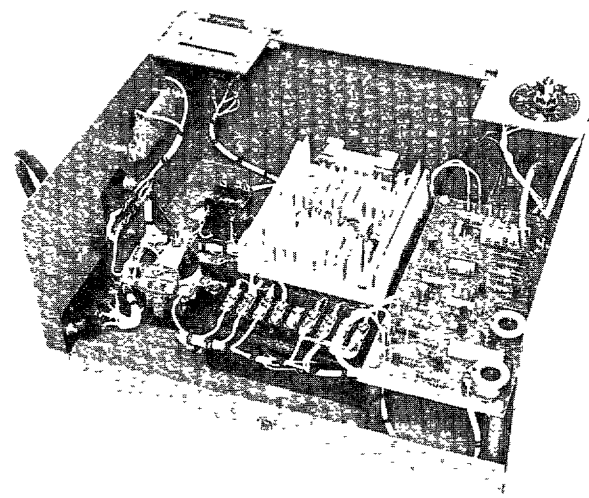

Figure 1

3SRA360 Controller

Auxiliary Control Circuitry

The auxiliary control components are the magnetic relays "M" and "Aux", dynamic braking resistor "DBR", low voltage transformer "1T", a stop-start switch, a special component board, and a speed reference potentiometer.

The function of the relays is to provide contacts for stopping and starting the motor and to provide a connection for dynamic braking through resistor DBR. The low voltage transformer supplies 24 volts to the relays through the thread break switch and the stop-start switch. The transformer also provides voltage to a 22 volt DC power supply on the component board. The primary function of the component board is to convert a pulse train from the customer's tachometer into an analog speed reference signal.

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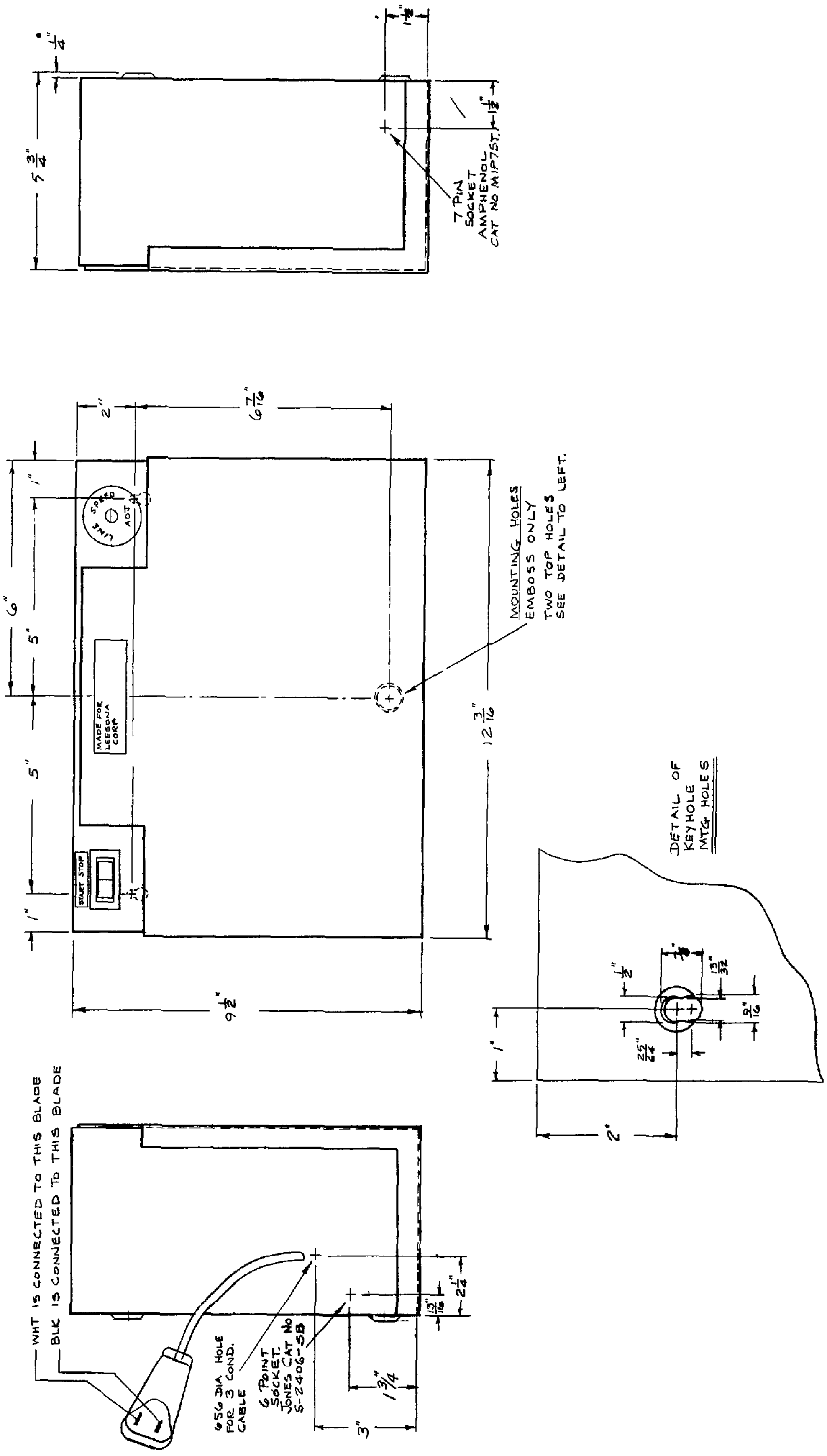


Figure 2
3SRA360 Controller Mounting and Outline Dimensions

INSTALLATION AND ADJUSTMENTS

Mount the Motor

The motor must be properly aligned and firmly mounted to prevent vibration which can lead to excess noise and wear.

Mount the Controller

Mount the controller, using hole locations and overall dimensions in Figure 2.

CAUTION

Temperature around the controller while it is operating must not exceed 40°C (104°F). The control module must always be mounted in a vertical position to allow maximum air flow over heat sink.

Install Interconnecting Wiring

Wiring and disconnects should be installed in accordance with good electrical practice and applicable codes. The connection diagram furnished with the controller tells how to make connections and what wire size to use. Make all connections to the controller at suitable plugs. Make all connections to the motor at the terminal studs which are covered by a removable plate.

CAUTION

Motor connections must be made exactly as shown on the customer connection diagram. Incorrect wiring may cause immediate failure of field rectifiers.

If the connections between the motor and controller are made as shown on the customer connection diagram supplied with the controllers, the motor will turn in the counter clockwise direction when viewed from the commutator end. For opposite rotation of the motor, interchange motor connections A1 and A2. DO NOT CHANGE ANY MOTOR CONNECTIONS IN THE CONTROLLER.

Make Proper Line Voltage Connection

The controller is designed to operate on 115 volts, AC, 50/60 Hz.

Set the Current Limit Circuit

The current limit circuit must be adjusted for use with either 50 or 60 Hz power. It should also be adjusted to compensate for high or low line voltage if the system is to be operated continuously from power line voltage other than the nominal 117 volts. The current limit circuit is adjusted by changing jumpers and/or the value of the resistor mounted on terminal board 2TB (see Figure 7) which is located at the rear of the blue potted module. The proper resistor value or jumper connections to be used can be determined from Table I. An incorrect setting will result in either nuisance fuse blowing on starting or in reduced motor output torque.

OPERATION

Initial Operation

When all connections have been made correctly, apply power to the drive by closing the customer's disconnect switch. No warmup time is required. Press the "Start" switch, and motor will start. If the direction of motor rotation is other than the desired one, reverse motor connections A1 and A2 at the motor terminals.

Normal Operation

When operating properly, the drive can be started with the speed potentiometers set at any desired speed. The motor will start properly and come up to the selected speed. The motor can be stopped at any speed by operating the "Stop" switch.

Changes in line voltage and changes in motor and controller temperature will change the motor speed.

PRINCIPLES OF OPERATION

The following brief discussion is intended to provide a general understanding of the circuit operation.

System Functional Diagram (Figure 3)

The setting of the line speed potentiometer provides a reference signal to the controller module. The controller module provides regulated DC voltage to the motor. The motor drives the load. The motor speed and the dimensions of the load determine the

TABLE I

LINE VOLTAGE	FREQUENCY	RECOMMENDED VALUE OF 50R (1/2 WATT)	
		5BCD56RA58 MOTOR	5BCD56EA6 MOTOR
105 VAC	50 Hz.	1100 OHMS	600 OHMS
	60 Hz.	JUMPER 3 TO 4 (NO RESISTOR)	JUMPER 3 TO 4 TO 5 (NO RESISTOR)
117 VAC	-50 Hz.	2400 OHMS	1800 OHMS
	60 Hz.	800 OHMS	330 OHMS
130 VAC	50 Hz.	2500 OHMS	2500 OHMS
	60 Hz.	1700 OHMS	900 OHMS

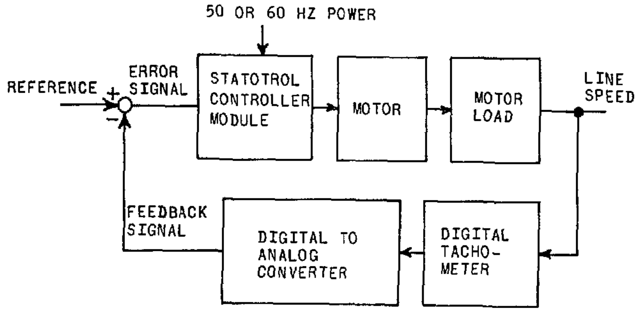


Figure 3

System Functional Diagram

line speed. The digital tachometer generates a pulse train, the pulse rate of which is proportional to line speed. The digital-to-analog converter generates an analog voltage feedback signal proportional to the pulse rate, and compares the analog voltage to the reference signal set by the line speed potentiometer. If the analog feedback signal and the reference signal do not agree an "error" signal is sent to the controller which causes the motor to speed up or slow down in order to eliminate the error. The function of the various parts of the system are described in more detail in the following discussion.

Statotrol Control Module

The controller as shown in Figure 4 consists of rectifiers 2D and 3D connected as the conventional free-wheeling field supply; 1D power rectifier for inverse voltage protection, the silicon controlled rectifier 1SCR and associated firing circuit, and maximum speed potentiometer 2P. Fuse 1FU is selected for short circuit protection only. The current limit circuit in the controller limits motor current and protects the SCR. The overload switch in the motor protects the motor. Thyrector 1BD provides transient voltage protection.

The silicon controlled rectifier (SCR) used in the Statotrol controller is much like an ordinary rectifier which has been modified to block current in the forward direction until a small signal is applied to the gate lead. After the gate signal is applied, the silicon controlled rectifier conducts in the forward direction with a forward characteristic very similar to that of an ordinary rectifier and will continue conduction even after the gate signal is removed.

The circuitry in the potted module compares the input speed signal to the motor back EMF voltage and determines the proper time at which to send a gate signal to the SCR in order to maintain smooth operation of the motor at the desired speed.

Digital-to-Analog Converter (Figure 5)

The magnetic pickup unit generates a voltage pulse each time a geartooth of the associated gear goes by the pickup unit. The gear turns at a rate proportional to line speed so the output of the magnetic pickup is a pulse train whose pulse rate is proportional to line speed. The pulse train is amplified by transistor 8Q. Transistors 1Q and 2Q form a switch which reshapes

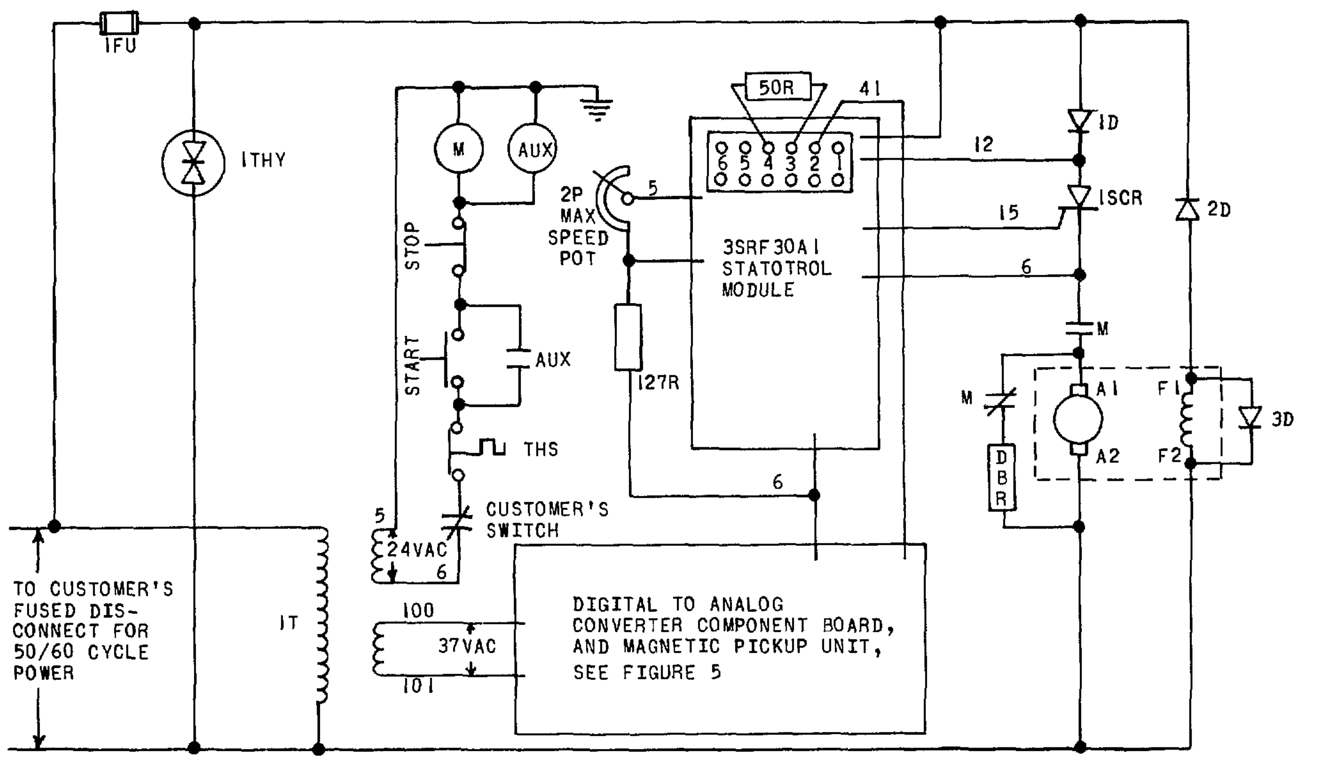


Figure 4

System Elementary Diagram

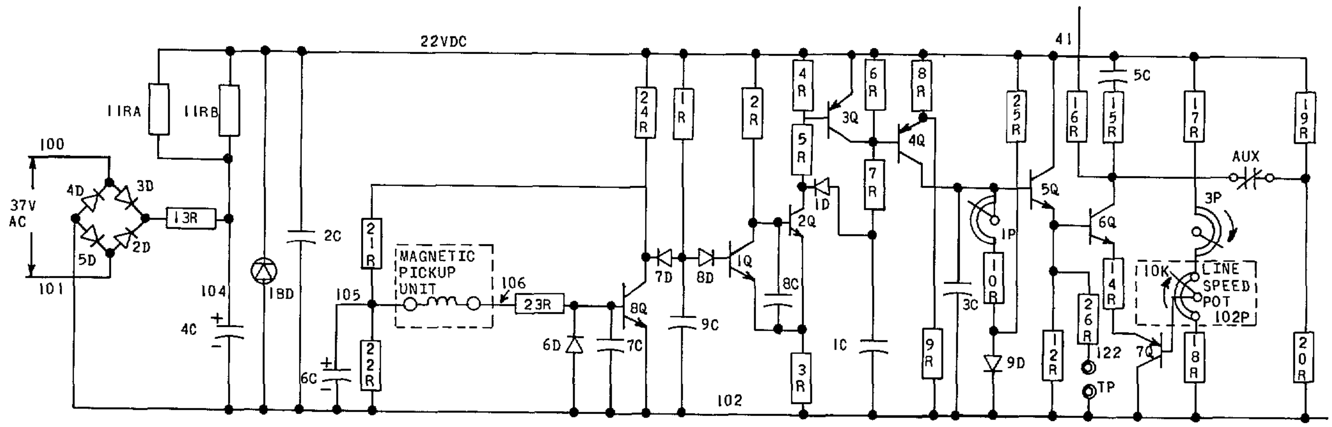


Figure 5

Digital-to-Analog Converter

the amplified pulse train into square cornered pulses with an amplitude of about 20 volts. Each time the collector of transistor 2Q is positive, it blocks diode 1D and current flowing through resistors 6R and 7R charges capacitor 1C. While capacitor 1C is charging, transistor 4Q conducts until the voltage across 1C gets high enough to turn 4Q off. When the voltage at the collector of 2Q goes low, it turns on 3Q which holds 4Q off while capacitor 1C discharges through diode 1D, transistor 2Q, and resistor 3R. As soon as capacitor 1C is fully discharged, the system is ready for th next pulse. Transistor 4Q pumps a precisely metered charge (measured in ampere seconds) into capacitor 3C each time a geartooth goes by the magnetic pickup unit, and the charge on 3C is drained away at a predetermined rate by potentiometer 1P, resistor 10R, and diode 9D. If the pulse rate increases, the voltage across capacitor 3C will rise. If the pulse rate decreases, the voltage across 3C will decrease. This establishes an analog voltage proportional to line speed. Transistor 5Q provides isolation for capacitor 3C while placing the analog signal on the base of transistor 6Q.

When the voltage on the base of 6Q goes above a certain level, 6Q conducts more and thereby causes the Statotrol control module to slow the motor down. When the voltage on the base of 6Q goes below a certain level, 6Q will conduct less which causes the motor to go faster. The level at which the motor speed stays constant is determined by the setting of the line speed potentiometer which acts through transistor 7Q to control the biasing of the emitter of 6Q.

Capacitor 5C and resistor 15R act to slow the rate of change of voltage at the collector of 6Q. This provides a "soft start" function when the motor starts and slows the motor response to changes in the pulse rate.

MAINTENANCE

Motor

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

Inspect the commutator, the brushes, the brush contact surfaces, and the brush springs. A rough commutator may often be detected by the sound of the motor. Inspect the commutator for color and condition. It should be clean, smooth, and polished brown color where the brushes ride. A blue color indicates overheating.

Roughness of the commutator should be removed by sandpapering or stoning (never use emory cloth or emory stone).

If the communtator is found to be dirty when the motor is inspected, it should be wiped clean with a piece of canvas or other cloth that is free from lint.

Check the brushes to make sure that they will not wear down too far before the next inspection. When new brushes are installed, they should be permitted to run without load long enough to assure a good fit.

Make sure that each brush surface in contact with the commutator has the polished finish that indicates good contact, and that the polish covers essentially all the brush surface. Check the freedom of motion of each brush in its holder. Check the springs that hold the brushes against the commutator. Lack of spring pressure will lead to arcing and rapid wear.

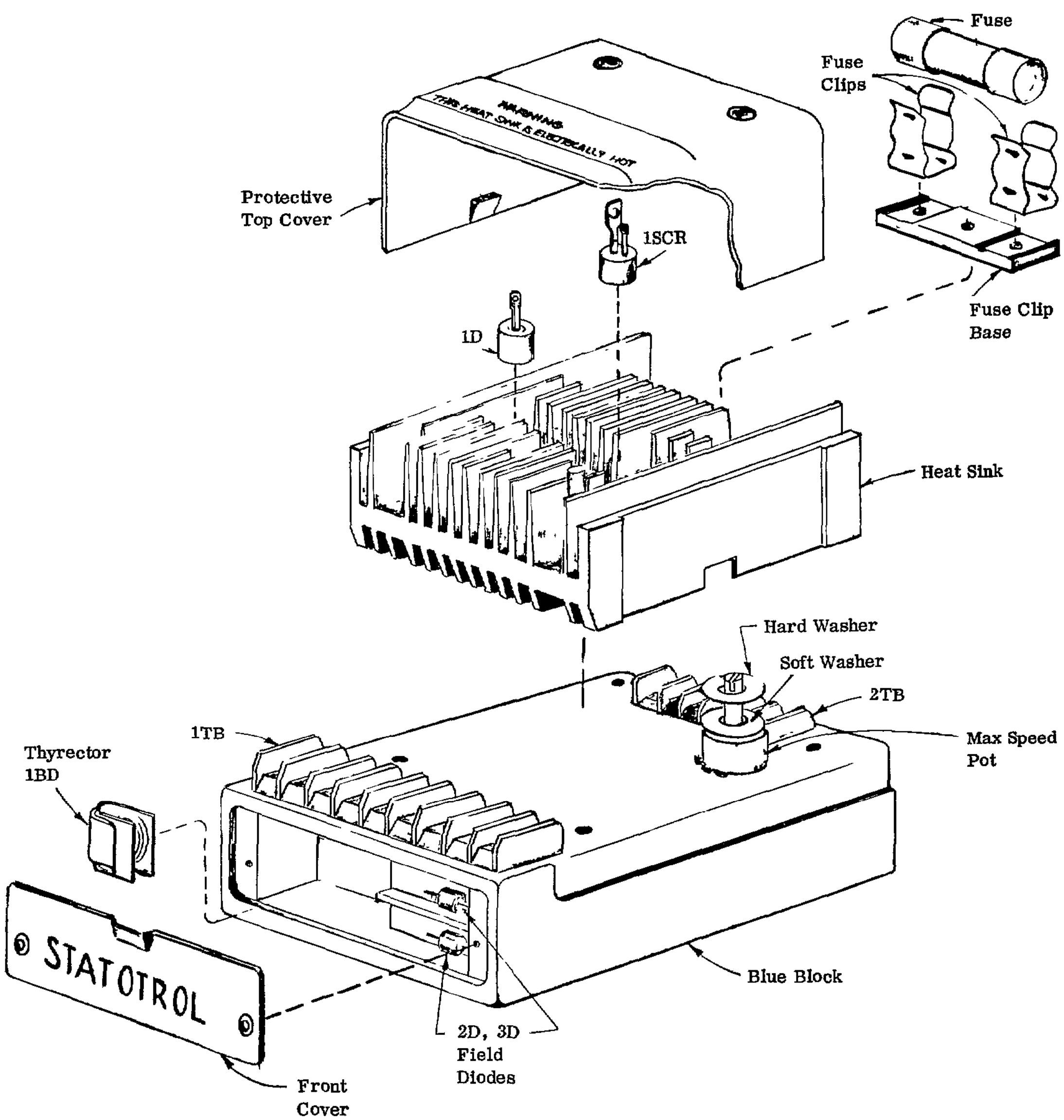


Figure 6

Control Module Showing Heat Sink and Component Mounting

The motor has ball bearings which are lubricated at the factory with grease sufficient for 5 years of normal operation or 2 years of continuous running. At the end of that time, the bearings should be thoroughly cleaned of the old grease and repacked about 1/3 full with General Electric ball bearing grease.

Controller

Look inside the panel and be sure it is free of dust, chips, oil, or other foreign matter. Be sure to remove the cover of the control module and examine the heat sink. It must be clean to provide maximum heat dissipation.

REPAIR

Motor

The motor can be repaired like standard DC motors by any competent motor repairman. If the overload thermostat trips repeatedly, fuses blow often or the motor shows signs of overheating, check the motor for possible overload.

Controller

The controller is designed so that occasional fuse replacement will usually be the only repairs necessary. The basic controller consists of the control module and the motor contactor.

Encapsulation helps protect control circuitry from dust, dirt, moisture, and the effects of shock and vibration. The silicon controlled rectifier (SCR) and silicon diodes should seldom, if ever, need replacing under normal operating conditions. A drive malfunction resulting from controller component failure can be quickly corrected by simply replacing the control module. Before replacement is made, check all connections and components used with the control module. The following check list should help:

Check List To Localize Trouble

If Motor Will Not Run:

1. Be sure all connections are made and tight.

2. Be sure power switch is closed and relays "M" and "AUX" make contact. Examine the relay contacts for contamination and freedom of movement. See if thermal overload switch in the motor is closed.

3. Check the fuse. If it is blown, replace it. If it blows again, look for an overload on the motor or a short circuit. Do not use any fuse other than the one listed in the renewal parts list.

4. Check for proper field voltage on motor. It should be 50 volts DC, and can be measured between terminals D+ and C on terminal board 1TB of the potted control module. Refer to Figure 7 for the location.

5. Replace the potted control module. (See instructions below.)

If Your Motor Runs Faster or Slower Than Normal For a Given Setting of Speed Control:

1. Check line voltage to be sure it is normal.

2. Check for motor overload.

3. Check the speed control potentiometer for possible open or short circuit.

4. Check the maximum speed potentiometer for possible open or short circuits.

5. Replace the control module.

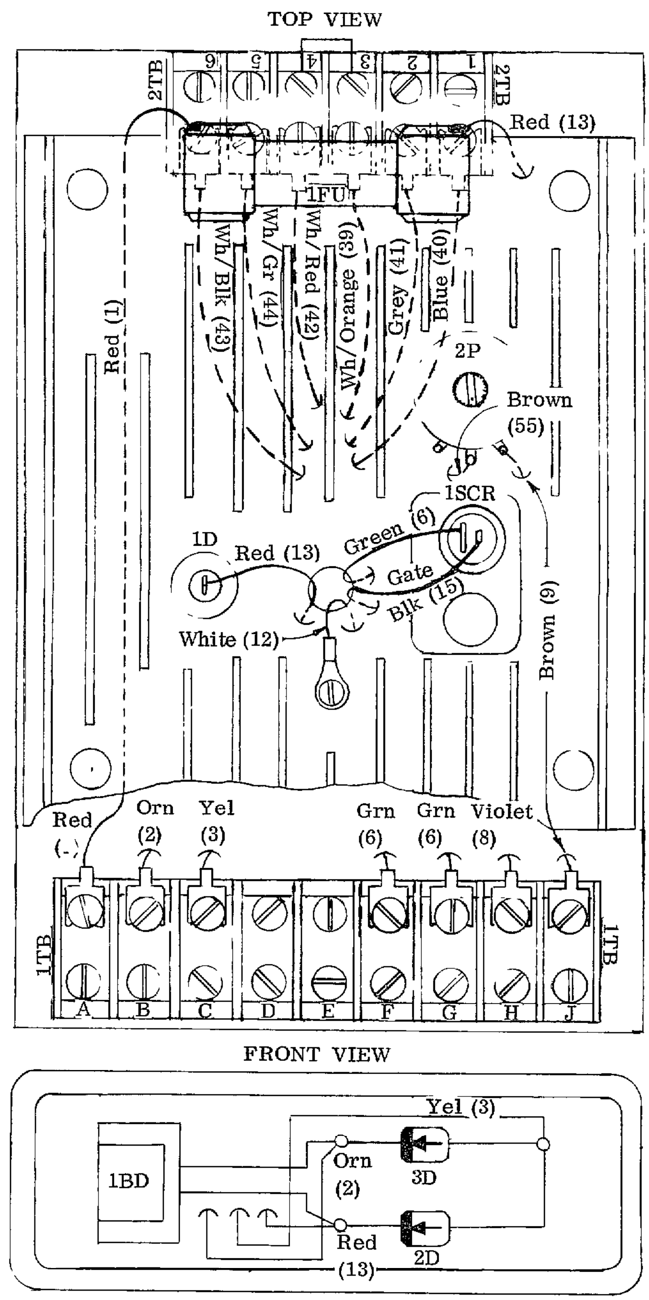
If The Motor Runs at Full Speed and Cannot Be Controlled by the Speed Control:

1. Check all connections for poor connection or short circuit.

2. Check the speed control potentiometers for possible open or short circuits.

3. Check the voltage at the test points between circuits 102 and 122+ while the motor is running. If the voltage exceeds 4 to 6 volts DC, skip Step "A" and go to Step "B" on the following page.

Step A. If the voltage is less than 4 to 6 volts DC, check the position of the magnetic pickup unit. It must be about 0.005 inches from the teeth of the associated gear. If the position of the magnetic pickup unit is proper, replace the component board. The calibration potentiometers on the new component board will probably require adjustment. Refer to the adjustment instructions provided with the winder.



NOTE: THE ARC SYMBOL (LIKE THIS ——)) AT THE END OF A WIRE DENOTES THE POINT WHERE THE WIRE EMERGES FROM THE BLUE PLASTIC BLOCK.

Figure 7

Connection Diagram for Components on Control Module

Step B. If the voltage across the test points between circuits 102 and 122+ exceeds 4 to 6 volts, check connections on the wire between the component board and terminal 2 on terminal board 2TB of the potted module. Then, locate the maximum speed potentiometer which is mounted on the potted module (see Figure 6). Rotate the maximum speed potentiometer. If this controls the speed of the motor, replace the component board. If rotation of the maximum speed potentiometer does not control the speed of the motor, replace the potted module (see instructions below).

Replacing Control Module

1. Disconnect AC power from drive.

2. Remove cover from control module.

3. Remove the interconnecting wires from the control module terminal board. Tag the wires so you will be able to replace them on the proper points.

4. Remove the mounting screws of the control module by inserting a screwdriver in the holes located on two corners of the heat sink.

5. Mount the new control module and replace the wires on the terminal board.

In most cases, it will not be necessary to discard the complete control module. The blue block may have to be replaced, or one or more of the components mounted on the block. The control module can probably be repaired by a trained technician. Return the unit to the factory for repair after calling your GE Sales Office for return instructions. If facilities and technicians are available to locate and replace components which have failed, order the parts by their individual catalog numbers. Specific instructions are given below for repairing the control module.

Repairing Control Module

When you are sure the control module is defective, there are two courses of action that can be taken:

(1) Replace the components mounted on the blue block or

(2) Replace the blue plastic block (encapsulated circuitry).

A simple check for the blue block and external components is given below. This should help to determine if component failure is inside the blue block or any of the components mounted on the block. There is a possibility that the defective component will not be discovered with the simple tests given below. In this case, a trial and error solution will have to be used. As a first trial, replace the SCR (see instructions). If this does not correct the trouble, replace the blue block (see instructions).

The following list of drive malfunctions and components to check should help to isolate the trouble. (Blue block will be considered as one component.)

Motor Will Not Run (Controller Fuse Not Blown)

1. Check series rectifier (1D) for open circuit.

2. Check maximum speed potentiometer (2P) for open circuit.

3. Check controlled rectifier, (1SCR).

4. Check blue block.

Controller Fuse Blows When Power is Applied

1. Check field diodes, 2D and 3D.

2. Check thyrector, 1BD.

Motor Runs At Full Speed And Cannot Be Controlled

1. Check blue block.

2. Check SCR.

Motor Runs Slower Than Normal For Given Setting Of Speed Control

1. Check maximum speed potentiometer (2P) for possible open circuit.

2. Check current limit setting.

3. Check blue block (voltage check).

Checking External Components

The components mounted on the blue block should be checked first since they can be replaced. These components consist of field rectifiers (2D, 3D), silicon controlled rectifier 1SCR, series rectifier (1D), Thyrector (1BD), and maximum speed potentiometer (2P). (See Figure 6 for location.)

NOTE

> Before checking control module components, disconnect AC power from drive and remove all interconnecting leads and jumpers from the control module terminal board (1TB).

Silicon Diodes

The characteristic of a silicon diode to block current in one direction and pass current freely in the other direction is used in a simple ohmmeter check.

1. Connect ohmmeter leads across silicon diode to be checked. (High resistance scale should be used, at least "times 1,000.") When the meter leads are reversed, the indicated resistance should change from infinite to some very low value. (Low value will vary with different instruments.)

NOTE

> Silicon diodes will usually fail either to a short or an open which will be quickly discovered with the above check.

Silicon Controlled Rectifier (1SCR)

The SCR is the heart of the control module and is provided with special current and voltage protection. A malfunction of either protective device under the right conditions could result in an SCR failure. This failure could either be to a short, an open or simply a change in characteristics. For the latter two cases, a skilled technician and special test equipment would be required to determine if the SCR has failed. However, if the SCR had failed to a short, this could be discovered with an ohmmeter. Do not overlook this one simple SCR check.

Thyrector

The Thyrector is used as transient voltage protection for the rectifiers in the control circuit. It should last for years under normal conditions. If for some reason, the rating of the Thyrector is exceeded, it will always fail to a short. This can be easily checked with an ohmmeter.

Maximum Speed Potentiometer

A maximum speed potentiometer failure would normally be an open circuit. Disconnect brown lead from terminal J on module terminal board and check potentiometer with an ohmmeter. Check for continuity over the full range of potentiometer rotation.

Checking Blue Block

The blue block which encloses most of the control circuit components can be checked by making the simple measurements listed below. It should be understood that this check is not conclusive but will be sufficient in most cases. A good quality analyzer with a known accuracy must be used. All readings should be within the tolerances set for normal operation.

NOTE

Before checking the blue block, disconnect AC power from drive and remove all interconnecting leads and jumpers from terminal board 1TB. Be sure that module fuse is in place and not defective.

Resistance Check

Measure between the following points on the control module terminal boards (1TB and 2TB).

NOTE

The + sign next to a letter indicates that the positive lead of the ohmmeter (or voltmeter) should be connected to that point.

Because battery polarity is not the same in all ohmmeters, it may be necessary to reverse the leads to obtain the specified resistance reading.

F^+ to B	17,000 ohm ± 20%
H to B^+	125,000 ohm ± 20%
J to 1 (2TB) 2P Max. CW	150 ohm ± 20%
H to 2 (2TB)	18,000 ohm ± 20%
F to 1^+ (2TB)	Not less than 1,000 ohm

Voltage Check

1. Connect AC power leads to terminals A and B on terminal board 1 TB.

2. Close the AC power switch.

WARNING

Be careful not to touch heat sink. It is a live part of the circuit.

3. Measure between the following points on the terminal boards.

J^+ to G (1TB)	12 volts DC ±10% (2P max. CW)
1^+ (2TB) to G (1TB)	15 volts DC ±5%

Replacing the Blue Block

CAUTION

In removing or replacing the SCR or any rectifier, use a small pencil type soldering iron of not more than 35 watts. Do not apply soldering iron heat to rectifier terminals any longer than necessary.

1. Remove leads from rectifier 1D and controlled rectifier 1SCR (see Figure 7).

2. Remove leads from fuse clips (see Figure 7).

3. Remove screw from ring terminal of white lead 12 (see Figure 7).

4. Loosen heat sink mounting screws and remove heat sink (see Figure 6).

5. Replace defective blue block with a new one. (All wires coming out of the replacement block are cut to the correct length.)

6. Position heat sink as shown in Figure 6 and replace heat sink mounting screws.

7. Connect red leads 1 and 13 to fuse clips as shown in Figure 7.

8. Solder black lead 15 and green lead 6 to 1SCR per connection diagram, Figure 7. Don't forget to push spaghetti down over the terminal of 1SCR after soldering black lead.

9. Solder red lead 13 to rectifier 1D per connection diagram, Figure 7.

10. Connect white lead 12 to heat sink with ring terminal and screw.

Replacing Field Diodes

1. Remove front cover (see Figure 6).

2. Observe polarity of diodes so they can be replaced with the same polarity.

3. Remove defective diode by applying a soldering iron lightly to the soldered terminal.

4. Replace with a new diode by soldering terminals to proper points. (See Figure 7.)

Replacing Thyrectors

1. Remove front cover (see Figure 6).

2. Remove defective thyrector by applying soldering iron lightly to the soldered terminals.

3. Insulate leads of new thyrector and connect to proper points. (See Figure 7.)

Replacing Maximum Speed Potentiometer

1. Remove heat sink. (See instructions above.)

2. Disconnect potentiometer leads.

3. Remove clamping washers and lift potentiometer out of locating holes.

4. Set replacement potentiometer into locating holes and reconnect leads.

5. Reposition insulating washers on the shaft with the Textolite (hard) washer on top.

6. Return heat sink to its proper position and check to make sure potentiometer terminals are clear of the heat sink. Reconnect all leads.

Replacing Rectifiers Mounted On Heat Sink

Rectifiers 1D and 1SCR will be of either the stud mounted or press fit type depending on module rating.

The aluminum heat sink used on Statotrol control modules has been specifically designed to accommodate press fit devices. These heat sinks provide hole accommodation for one press fit SCR and rectifier. Note that an additional mounting hole is also provided for stud mounted SCR's. If an SCR should fail and facilities are not available for replacing press fit units, replacement can be made with a stud mounted SCR of equivalent rating.

The heat sink should be completely removed from the module to simplify rectifier replacement. Instructions for removing the heat sink are given in the section above. It will not be necessary to disconnect leads from the fuse clips since the fuse block can be easily removed. (See Figure 6.)

It is important that rectifiers be mounted correctly to assure maximum heat sink efficiency.

Stud Mounted Rectifers

1. Remove defective rectifier from heat sink and thoroughly clean the area around the mounting hole.

2. Apply silicone grease (General Electric Insulgrease #G640 or G641, or Dow-Corning #3) to rectifier stud before mounting on heat sink.

3. Add star washer and rectifier mounting nut.

4. Tighten the rectifier mounting nut to assure a firm contact between rectifier and heat sink but don't overdo it. Excessive stress on the stud may damage the rectifier. If a torque wrench is available, tighten the rectifier mounting nut to 20 inch pounds. (Torque to 30 inch pounds if silicon grease is not used.)

Press Fit Rectifiers

When replacing press fit rectifiers, it is important that care be exercised in removing and mounting to prevent damage to the heat sink hole and rectifiers.

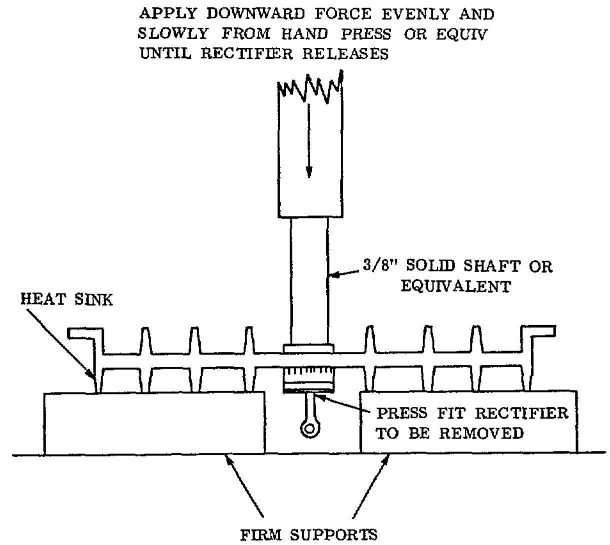


Figure 8

Diagram Showing Removal of Press Fit Rectifiers

Reference is made to Figures 8, 9, and 10 for removing and mounting the rectifiers and for a recommended tool to be used in this operation

RENEWAL PARTS

Should a component fail, a replacement part can be ordered from the nearest sales office of the General Electric Company. When ordering renewal parts, specify the quantity required, give the catalogue numbers and describe the required parts in detail. In addition, give the 3S model number and the complete nameplate rating of the equipment. A principal parts list is shown on page 14.

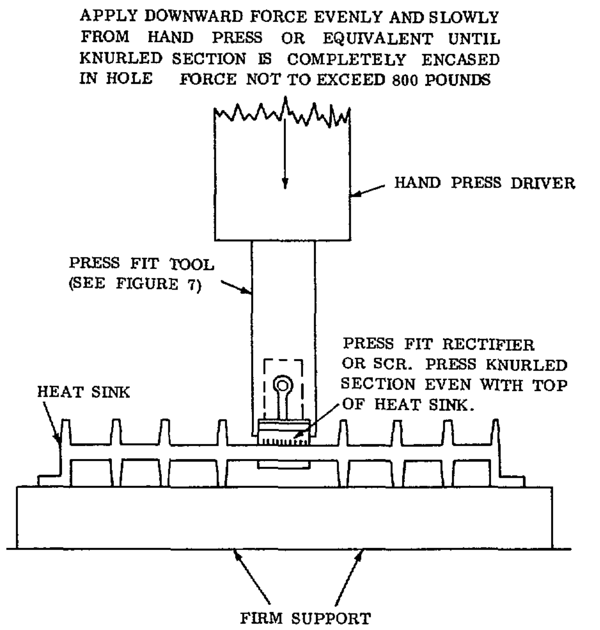


Figure 9

Diagram Showing Mounting of Press Fit Rectifiers

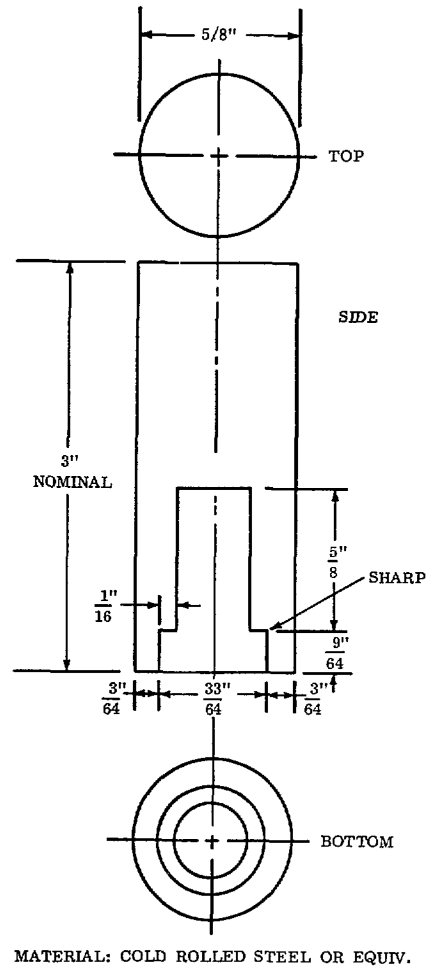


Figure 10

Typical Tool for Press Fit Rectifiers

PRINCIPAL RENEWAL PARTS LIST FOR 3SRA360 A1 AND B1

DIAGRAM SYMBOL	QUANTITY		ORDERING NUMBER	DESCRIPTION
	1		3SRF30A1	Module consisting of:
		1	44B315619-G01	Potted Block Assembly
1SCR		1	44B212741-005	Rectifier (C35B)
1D		1	44B216186-005	Rectifier (A44D)
1FU		1	K9774700P5	Fuse 15A
		1	44A216882-001	Fuse Block
		2	44A212159-002	Fuse Clip
2D & 3D		2	44B232019-005	Rectifier
1THY		1	6RS20SC4D4AB	Thyrector
2P		1	44A315928-G10	Maximum Speed Potentiometer
M	1		44A318502-001	Relay
Aux	1		44B218524-006	Relay
1T	1		44B333019-001	Transformer
102P	1		L8205216G10	Line Speed Potentiometer
DBR	1		275A377C75	Dynamic Braking Resistor
1CO	1		P9357469P51	Square 6 Pin Receptacle
2CO	1		K9397086P4	Round 7 Pin Receptacle
1SW	1		44A315572-001	Stop-Start Switch
	1		44C238489-G05	Component Board
	1		44A318524-001	Line Cord with Plug

NOTES

GENERAL ELECTRIC SALES OFFICES

READY TO ASSIST YOU When You Have Electrical Problems Need Further Information Require Ordering Instructions

KEY TO SALES OPERATIONS

- A - Agency & Distributor
- C - Components Sales
- I - Industrial Sales
- M - Marine & Defense Facilities Sales
- S - Installation and Service Engineering
- U - Electric Utility Sales

ALABAMA
A C I S U Birmingham 35205 2151 Highland Ave
I Huntsville 35801 3322 Memorial Pkwy S
A I S Mobile 36606 1111 S Beltline Hwy

ARIZONA
A C I S U Phoenix 84012 3550 N Central Ave
A I S U Tucson 85711 40 No Swan Rd

ARKANSAS
A C I S N Little Rock 72119 120 Main St
U Pine Bluff 71602 P O Box 1033

CALIFORNIA
A Burlingame 94010 770 Airport Blvd
C Burlingame 94010 1675 Rollins Rd
A I Emeryville 94608 5000 Shellmound St
A I Fresno 93728 1532 N West Ave
C Los Angeles 90015 1543 W Olympic Blvd
A I M S U Los Angeles 90054 212 N Vignes St
A Oakland 94621 8105 Edgewater Dr
A Ontario 91764 214 West E St
S Palo Alto 94303 960 San Antonio Rd
A S U Sacramento 95808 2407 'J St
A M S U San Diego 92103 2560 First Ave
A I M S U San Francisco 94106 235 Montgomery St
A Santa Clara 95050 1400 Coleman Ave

COLORADO
A C I S U Denver 80206 201 University Blvd

CONNECTICUT
I U Hamden 06518 2905 Dixwell Ave
A Hartford 06105 764 Asylum Ave
C I S U Meriden 06450 1 Prestige Dr

DISTRICT OF COLUMBIA
I M U Washington 20005 777-14th St , N W

FLORIDA
A I S U Jacksonville 32207 4040 Woodcock Dr
A S U Miami 33134 4100 W Flagler St
A Orlando 32803 601 N Fern Creek Ave
U Pensacola 32502 P O Box 1027
A C I S U Tampa 33609 2106 S Lois Ave

GEORGIA
A C I S U Atlanta 30309 1860 Peachtree Rd N W
A Macon 31204 2720 Riverside Dr
A I S U Savannah 31405 5002 Paulsen St

IDAHO
A U Boise 83701 1524 Idaho St

ILLINOIS
A I M S U Chicago 60680 840 S Canal St
C Oakbrook 60521 1200 Harger Rd
A I U Peoria 61603 2008 N E Perry Ave
A I Rockford 61108 4223 E State St
U Springfield 62701 607 E Adams St
A Springfield 62701 425 1/2 So Fifth St

INDIANA
A C S U Evansville 47714 2709 Washington Ave
C Fort Wayne 46804 1635 Broadway
S Fort Wayne 46807 3606 S Calhoun St
A U Fort Wayne 46806 6001 S Anthony Blvd
A I S U Indianapolis 46207 3750 N Meridian St
C Indianapolis 46240 1010 E 86th St
A C South Bend 46601 430 N Michigan St

IOWA
U Cedar Rapids 52401 210 Second St , S E
C Davenport 52722 P O Box 748
A I S Davenport (1039 State St , Bettendorf 52722)
A U Des Moines 50310 3839 Merle Hay Rd
U Sioux City 51101 520 Pierce St

KANSAS
C Overland Park 66204 7219 Metcalf St
A Wichita 67211 820 E Indianapolis Ave
U Wichita 67202 104 S Broadway Suite 1408

KENTUCKY
A U Lexington 40502 443 S Ashland Ave
A C I S U Louisville 40218 2300 Meadow Dr

LOUISIANA
A U Alexandria 71301 2001 MacArthur Dr
I S Baton Rouge 70806 8312 Florida Blvd
I Lake Charles 70604 1424 Ryan St
I S Monroe 71201 1028 N Sixth St
A I S New Orleans 70125 4747 Earhart Blvd
U New Orleans 70112 225 Baronne St
M New Orleans 70130 930 Inter Trade Mart
A S U Shreveport 71104 2620 Centenary Blvd

MAINE
U Augusta 04330 152 State St
I Bangor 04402 77 Central St
A Portland 04102 Thompson's Point

MARYLAND
I S U Baltimore 21201 1 N Charles St
A U Columbia 21403 10221 Wincopin Circle
U Hagerstown 21740 P O Box 477
A Salisbury 21801 P O Box 424

MASSACHUSETTS
I U Boston 02117 31 St James Ave
I Springfield 01103 120 Maple St
A C I M S Wellesley 02181 1 Washington St

MICHIGAN
A C I S U Detroit 48202 700 Antoinette St
I Flint 48502 801 S Saginaw St
A C I Grand Rapids 49508 2821 Madison Ave , S E
S U Jackson 49201 210 W Franklin St
S Kalamazoo 49003 P O Box 2085
A I S Saginaw 48601 1230 S Washington Ave

MINNESOTA
I S U Duluth 55802 300 W Superior St
U Fergus Falls 56537 201 1/2 Lincoln Ave , W
C Minneapolis 55424 4018 W 65th St
A I S U Minneapolis 55416 1500 Lilac Dr , S

MISSISSIPPI
U Gulfport 39502 P O Box 33
A S Jackson 39206 333 No Mart Plaza
U Jackson 39201 Rm 717 Electric Bldg

MISSOURI
A Joplin 64802 310 Wall St
A I S U Kansas City 64105 911 Main St
A C I S U St Louis 63101 1015 Locust St

MONTANA
A Billings 59101 312 Transwestern Life Bldg
A I S U Butte 59701 103 N Wyoming St

NEBRASKA
A I S U Omaha 68102 409 S 17th St

NEVADA
U Las Vegas 89106 1711 S 8th St

NEW HAMPSHIRE
U Manchester 03104 46 Bay St

NEW JERSEY
C East Orange 07017 56 Melmore Gardens
A I S U Millburn 07041 25 E Willow St

NEW MEXICO
A I M S U Albuquerque 87108 120 Madeira Dr , N E

NEW YORK
A I M S U Albany 12201 11 Computer Dr West
U Binghamton 13902 40 Front St
A I S U Buffalo 14202 625 Delaware Ave
A Elmsford 10523 44 N Central Ave
A Harrison 10528 600 Mamaroneck Ave
C Mattydale 13211 P O Box 5858 E Molloy Rd
I M S U New York 10022 641 Lexington Ave
C Rochester 14618 3380 Monroe Ave
A I S U Rochester 14604 339 East Ave
A I S U Syracuse 13201 3532 James St
A Vestal 13805 P O Box 407

NORTH CAROLINA
A C I S U Charlotte 28207 141 Providence Rd
A I Greensboro 27405 801 Summit Ave
A U Raleigh 27603 120 N Boylan Ave

NORTH DAKOTA
U Bismarck 58501 418 Rosser Ave
A Fargo 58102 112 University Dr

OHIO
A I Akron 44320 341 White Pond Dr
I U Canton 44703 515 Third St , N W
A C I S U Cincinnati 45206 2621 Victory Pkwy
C Cleveland 44116 20950 Center Ridge Rd
A I M S U Cleveland 44114 1000 Lakeside Ave
C Columbus 43212 937 Burrell Ave
A I S U Columbus 43216 1110 Morse Rd
A C I U Dayton 45439 3430 S Dixie Hwy
C Mansfield 44902 166 Park Ave , W
U North Canton 44720 7900 Whipple Ave N W
U Toledo 43604 420 Madison Ave
A I S Youngstown 44507 272 E Indianola Ave

OKLAHOMA
A S U Oklahoma City 73106 2000 Classen Blvd
A I Tulsa 74105 5138 S Peoria Ave
U Tulsa 74103 420 Main St
S Tulsa 74105 P O Box 7646 Southside Station
C Tulsa 74135 3315 E 47th Place

OREGON
A I S U Eugene 97409 1170 Pearl St
A U Medford 97501 107 E Main St
A C I S U Portland 97210 2929 N W 29th Ave

PENNSYLVANIA
A I U Allentown 18102 1444 Hamilton St
A Camp Hill 17011 1521 Cedar Cliff Dr
A Erie 16501 3001 E Lake Rd
I Erie 16501 1001 State St
I U Johnstown 15902 841 Oak St
C Philadelphia 19114 2417 Welsh Rd
A I M S U Philadelphia 19102 3 Penn Center Plaza
C Pittsburgh 15234 300 Mt Lebanon Blvd
A I S U Pittsburgh 15222 300 6th Ave Bldg
A Williamsport 17701 2209 Fink Ave
C York 17403 1617 E Market St

RHODE ISLAND
A Providence 02904 1006 Charles St , N

SOUTH CAROLINA
A I U Columbia 29205 2728 Devine St
S Columbia 29204 Middleburgh Office Mall
A I Greenville 29606 1403 Laurens Rd

SOUTH DAKOTA
A Sioux Falls 57105 513 Main Ave

TENNESSEE
U Chattanooga 37402 832 Georgia Ave
A C I M S Chattanooga 37411 5800 Bldg Eastgate Center
I Kingsport 37664 1170 E. Eastman Rd
A U Knoxville 37921 1301 Hannah Ave , N W
A I S U Memphis 38116 3385 Airways Blvd
A Murfreesboro 37130 117 N W Broad St
A U Nashville 37203 1717 West End Bldg
C Nashville 37204 2930 Sidco Drive
M Oak Ridge 37830 253 Main St , East

TEXAS
S U Abilene 79601 442 Cedar St
S U Amarillo 79101 303 Polk St
A I S U Beaumont 77704 1385 Calder Ave
S U Corpus Christi 78401 205 N Chaparral St
A C I S U Dallas 75247 8101 Stemmons Freeway
I S U El Paso 79902 215 N Stanton St
A El Paso 79902 2800 N Stanton St.
A Fort Worth 76107 100 N Univ Dr
S U Fort Worth 76102 408 W 7th St.
A C I S U Houston 77027 4219 Richmond Ave
A I Lubbock 79408 500 E 50th St
A S Midland 79704 122 N "N" St
A S U San Antonio 78204 419 S Main Ave

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U Rutland 05702 38 1/2 Center St.

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A I S U Richmond 23230 1508 Willow Lawn Dr
A I S U Roanoke 24015 2018 Colonial Ave , SW

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A I S U Spokane 99220 E 1805 Trent Ave

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A I S Charleston 25328 306 MacCorkle Ave , SE
I U Fairmont 26555 310 Jacobs Bldg
A Huntington 25701 Sixth Ave & Ninth St
I Wheeling 26002 40 14th St

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U Madison 53704 2038 Pennsylvania Ave
C Milwaukee 53226 Mayfair Plaza, 2421 N Mayfair Rd
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• Baton Rouge 70814 10955 North Dual St
•* New Orleans 70114 1115 DeArmas St

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•* Baltimore 21230 920 E Fort Ave

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• Flint 48505 1506 E Carpenter Rd

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•* St Louis 63110 1115 East Road

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• (Long Island) Old Bethpage 11804 183 Bethpage-Sweet Hollow Rd
• (New York City) North Bergen, N J 07012 6001 Tonnelle Ave
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*Δ Schenectady 12305 1 River Road
• Syracuse 13208 1015 E Hiawatha Blvd

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•*Δ Cleveland 44125 4477 East 49th St
• Columbus 43229 6660 Huntley Rd
•* Toledo 43605 405 Dearborn Ave
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•* (Pittsburgh) West Mifflin 15122 4930 Buttermilk Hollow Rd
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