508 AS
SERVICE BULLETIN

Class 8660 — AC Solid State Reduced Voltage Starters and Controllers Types MG, MH, MJ, MK and MM, Series A

GENERAL

Service Bulletin 508AS provides the installation and maintenance instructions. Available accessories are described. The "exploded" view details part locations for ease of identification. Recommended factory tightening torques are listed to assure proper reassembly and functioning of the device. Keep this bulletin with Starter or Controller.

DANGER: Hazard of electrical shock or burn. Turn off power supplying this equipment before working on it.

GENERAL OPERATION

The Class 8660 Solid State Reduced Voltage Starter will provide a smooth, stepless acceleration of an induction motor. This is accomplished by gradually turning on or firing six power SCRs. Two SCRs per phase are connected in a back-to-back or reverse parallel arrangement. Each pair of SCRs is mounted on a heat sink to make up a power pole. The heat sinks are required to cool the SCRs which produce heat when current is passed through them.

The firing circuitry on each power pole is controlled by the modules on the logic rack. This circuitry checks for correct start up and running conditions. If these conditions are not met, the starter checks to determine the cause of the problem and turns off. Light emitting diodes (LEDs) indicate the reason for stopping or not starting.

Different types of starting methods require a special module in the logic rack. Check the specific method of starting for the description of each module.

A solid state overload relay provides the necessary motor starting and running protection.

INSTALLATION

Mounting — Mount on vertical surface, with line terminals L1, L2 and L3 up. For open devices, use four ½ inch bolts tightened to 450-540 lbs.-in./51-61 Newton-meters(N-m).

Terminals — Power terminals on standard devices are suitable for use with copper wire. Refer to table for maximum wire size for power connections. Copper only power lugs are available. Consult your local Square D field office. Control terminals will accept #16 thru #12 AWG copper only wires.

Power Connections — Incoming power lines must be connected to L1, L2 and L3 on the Starter or shunt trip circuit breaker. Outgoing power lines to the motor must be connected to the load side terminals marked T1, T2 and T3 on the Starter. REVERSE FEEDING OF THE STARTER IS NOT PERMITTED.

Starter Type	Wire Size Range
MG	#6 thru 1-350 MCM
MH	#6 thru 1-350 MCM
MJ	#6 thru 2-600 MCM
MK	#6 thru 2-600 MCM
MM	3/0 thru 3-750 MCM

Assembly Instructions — Factory recommended torques for mechanical and electrical connections are listed in the Recommended Driving Torque Table (see page 5) . These must be followed to insure proper functioning of the device.

NOTE: DO NOT USE MEG® OR MEGGER® TYPE TEST EQUIPMENT ON THIS DEVICE ABOVE 1000 VOLTS. DO NOT HIGH POT OR PERFORM HIGH POTENTIAL TESTS ON THIS DEVICE.

Before startup or returning the Starter or Controller to service, checks must be made for tightness of electrical connections and for the absence of short circuits, grounds and leakage. There are control transformers and other circuitry connected between L1, L2 and L3 internally in the starter. If any checks are performed on the distribution system feeding the starter, remove L1, L2 and L3 from the starter. When checks are performed on the motor or lines feeding the motor, the power poles must be removed. (See MAINTENANCE SECTION Page 5).

MEG is a Registered Trademark of the SQUARE D COMPANY.
MEGGER is a Registered Trademark of the James G. Biddle Company.

BRANCH SHORT CIRCUIT COORDINATION

Provide branch circuit overcurrent protection in accordance with the applicable electrical codes, except do not exceed the following maximum protective device ampere ratings:

Starter Type	Class K5 or RK5 Fuse (Amps)	Class J, T or L Fuse (Amps)	Inverse Time⊖ Circuit Breaker (Amps)
MG	150	200	175
MH	250	400	250
MJ	400	600	400
MK	600	600/800*	700
MM	600	600/800*/1000**	1000

Control circuit fusing is covered in the wiring diagram supplied with the device.
* Class T
** Class L
⊖ A shunt trip circuit breaker is recommended. See page 2 "Shorted SCR Protection".

CONTROL CIRCUIT

Distant Control of Contactors and Starters — As with all types of electrical equipment, control circuit wires must be limited in length because of the effect of series impedance and shunt capacitance. A typical wire size and maximum conduit wire run is 120 feet for #14 or #16 AWG wire. The control voltage is required to be at 120V, 60 HZ or 110 V, 50 HZ nominally, therefore only this control distance is given. For other wire sizes, consult your local Square D field office.

Control Circuit Transformer for Type MG, MH, MJ and MK Starters — The Starter requires 300 VA at 120 V 60 HZ or 110 V 50 HZ to power the electronics and the cooling fans. Operation at any other voltage requires the use of a control transformer as illustrated on the wiring diagram supplied with the device.

Control Circuit Transformer for Type MM Starter — The Starter requires 700 VA at 120 V 60 HZ or 110 V 50 HZ to power the electronics and the cooling fans. Operation at any other voltage requires use of a control transformer as illustrated on the wiring diagram supplied with the device.

WARNING: Since the motor is controlled by a solid state switch, hazardous leakage current may be present even when the Starter is off. Disconnect motor and Starter from incoming line and control power before servicing.

OPERATION RATES

Since each Starter type is designed to operate a wide variety of motors and motor loads, the Starter operating rates are dependent on many factors. Standard motor operating rates defined by NEMA motor standard MG-1-12.50 calls for two starts in succession (motor coasting to rest between starts) with the motor initially at the ambient temperature or one start, with the motor initially at a temperature not exceeding its rated load operating temperature are suitable for this control. Consult your local Square D field office for specific applications.

NOTE: POWER FACTOR CORRECTION CAPACITORS — THE ADDITION OF POWER FACTOR CORRECTION CAPACITORS TO THE STARTER CAN BE DONE TO ACHIEVE A BETTER OVERALL SYSTEM POWER UTILIZATION. THESE CAPACITORS MUST BE PLACED AHEAD OF THE STARTER ON THE LINE SIDE. A CONTACTOR IS NECESSARY TO ISOLATE THE CAPACITORS FROM THE LINE WHEN THE STARTER IS NOT ENERGIZED.

New Listing

508 AS
SERVICE BULLETIN

MODULE POSITION

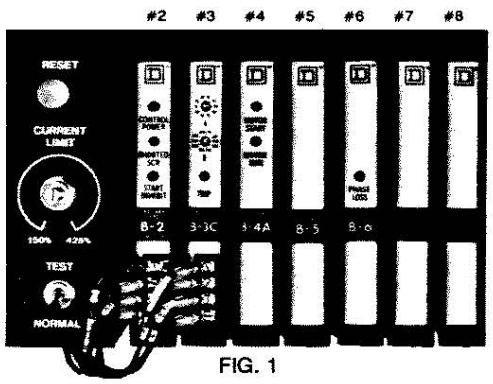


FIG. 1

Logic rack for small or large frame starter or controller with RESET, current limit potentiometer and overload TEST-NORMAL switch. Module type number corresponds to position number (e.g. module Class 8660 Type B2 goes in position #2). The Voltage Monitor and Energy Saving modules are not shown in positions 7 and 8. Socket covers are shown instead.

STATUS INDICATORS

The basic Starter contains a series of red light emitting diodes (LEDs) as standard. These LEDs give a visual indication of the Starter status. Following is a listing with module location, name and function for each of the LEDs on the basic Starter.

Module	Title	Function
B2	CONTROL POWER	ON when 120 VAC control power is present at Terminals 4 and 5 and fuse on starter is in place and not blown.
B2	SHORTED SCR	ON when a shorted SCR is detected and remains ON until RESET. See "Shorted SCR Protection."
B2	START INHIBIT ◑	ON when a fault is present including overload, underload*, phase loss, phase unbalance* or phase out of sequence*. (*Optional).
B3	TRIP	ON when an overload occurs and remains ON until RESET. See "Overload Relay."
B4	MOTOR START	ON when START is initiated and remains ON until motor is "up to speed".
B4	MOTOR RUN	ON when motor is "up to speed" and remains ON until STOP is initiated.
B6	PHASE LOSS ◑	ON when any of the three phases are not present.

◑ If an isolation contactor is used, these LEDs will be ON when the starter is in the STOP mode. Initiating the START circuit closes the isolation contactors and allows the reduced voltage starter to start normally. Connect the isolation and/or shorting contactors per Square D recommended wiring practices pages 13 and 14.

CURRENT LIMIT

This Starter incorporates current limiting circuits that will prevent motor currents from exceeding a preset level. If the motor current demands are greater than this level, the Starter will automatically reduce the motor current to the "current limit" setting. This feature is present during both START and RUN conditions.

If a shorting or a bypass contactor is used, this feature will only be present in the START condition.

The current limit setting is adjustable from 150% to 425% of motor full load current (MFLC). Minimum setting will provide the longest acceleration time. Increasing the current limit setting will result in shorter accelerating times. Because of several variables — type of motor, type of motor load and amount of loading, some motors will not reach full speed at low current limit levels. Increasing the current limit setting will correct this.

The current limit potentiometer is factory set to approximately 300%. To readjust, start the motor. If the motor does not reach full speed and/or stalls, stop the motor and increase the setting by ⅛ turn clockwise (CW). Repeat until the desired motor starting is attained. The current limit potentiometer is supplied with a locking nut to prevent this setting from changing inadvertently.

CAUTION: STARTING AND STOPPING OF THE STARTER SHOULD BE PERFORMED WITH THE ENCLOSURE DOOR CLOSED.

OVERLOAD RELAY

A temperature compensated, solid state overload relay is supplied as standard. It monitors the load current to detect harmful motor overloads. Nominal trip times are listed in the table. An overload condition will automatically deenergize the starter, close the alarm contact at terminals AL1 and AL2 and light the TRIP and the START INHIBIT LED indicators.

For continuous rated motors having a service factor of 1.0, set switches "A" and "B" located on module B3 to 100% of full-load current shown on motor nameplate. For continuous-rated motors having service factors of 1.15 to 1.25 set switches "A" and "B" to 108% of full-load current shown on motor nameplate. Trip current rating is 1.15 times the setting of switches "A" and "B."

To functionally test the overload relay, the 120V control voltage must be present. Set the TEST/NORMAL switch to TEST. The TRIP and the START INHIBIT LED indicators should light within 10 seconds. Set TEST/NORMAL switch to NORMAL. Wait a minimum of 5 minutes, then press RESET. TRIP LED should turn-off.

Longer acceleration time for high inertia loads can be provided by the SSRVS. Form Z7-2 provides a Class 30 overload relay **and higher rated power poles on the Types MG, MH** and **MJ** starters. The table below shows the standard Class 10 and special Class 30 overload characteristics.

OVERLOAD TRIP TIME		
Current Limit (% of MFLC)	Standard Class 10	Form Z7-2 Class 30
150%	90 Sec.	250 Sec.
300%	30 Sec.	90 Sec.
425%	5 Sec.	40 Sec.

Trip times assume the starter has been in the STOP mode for **at least** 20 minutes.

The alarm contacts at terminals AL1 and AL2 are rated 3 amp resistive, 120 VAC.

OVERTEMPERATURE PROTECTION

Each power pole contains an integral thermal sensor that will deenergize the Starter if an overtemperature condition develops and will prevent it from restarting until the device cools down. This condition can be caused by excessive duty cyclying, operation above specified maximum ambient temperature of 40°C, inoperative fan(s), restricted air flow or loose power connections.

WARNING: The thermal sensors reset automatically. Do not use a 2-wire pilot device (maintained contact) to control the Starter if unexpected restarting of motor could be hazardous.

MISSING PHASE DETECTION

A standard feature with every Starter is the LOSS OF PHASE circuit. If one or more phases is missing at Line Terminals L1, L2 or L3, the PHASE LOSS and START INHIBIT LED's will light and the Starter cannot be started. Restoring the missing phase will automatically reset the circuits.

SHORTED SCR PROTECTION

A standard feature on every Starter is the Shorted SCR Detector. This circuitry monitors each power pole and will provide a contact closure if a SCR is shorted. This contact should be used to energize the shunt coil of a shunt trip circuit breaker or to deenergize the coil of an isolation contactor. This is required to provide a means of removing power from the motor if a shorted SCR condition exists.

Control and Line power must be present and the Starter must be in the OFF mode for a shorted SCR to be detected. If this condition exits, a contact closure between terminals 14 and 15 takes place, the SHORTED SCR switch will be in the YES position, and the SHORTED SCR LED indicator will come on. (Contacts are rated for 10 amps at 120VAC). After the shorted SCR condition has been corrected, the shorted SCR switch can be reset to the NO position and the RESET button must be depressed.

P.O. Box 9247
Columbia, S.C. 29290
1-803-776-7500
PRINTED IN U.S.A. CPG

508 AS
SERVICE BULLETIN

CONTROL RELAYS

Relays SR1, SR2 and SR3 are used to provide internal and external electrical interlocks. SR1 and SR2 provide the START/STOP holding circuit interlock at Terminals 2 and 3 and two Form C auxiliary electrical interlocks at Terminals 6 thru 11.

CONTROL RELAY CONTACT RATINGS		
120 VAC	1440 VA Make	144 VA Break

SR3 provides a contact closure when the motor is "up to speed" at Terminals A1 and A2. When a shorting contactor is used, an interposing relay must be energized by this contact on the Starter. This interposing relay must be able to handle the VA burden of the shorting contactor.

FCC REGULATIONS

This equipment generates, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communication. As temporarily permitted by regulation, it has not been tested for compliance with the limits for Class A computing devices pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference. Operation of this equipment in a residential area may cause possible interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

AVAILABLE ACCESSORIES

Electrical Interlocks, Instantaneous — All Starters are supplied with a N.O. holding circuit interlock (Terminals 2 and 3) and two Form C contacts (Terminals 6-11) as standard. **The holding circuit interlock is factory wired for this function only.** See Control Relays for contact ratings. **If additional contact capacity is required, auxiliary relays are required.**

Cover Mounted Control Units — NEMA 1, NEMA 4 and NEMA 12 enclosures are supplied with three holes with closing plates for field addition of Class 9001 Type K oiltight control units. The following are the parts needed to add control units in the field:

Pilot Device(s)	Class & Type	Quantity Needed	Description
START-STOP PUSH-BUTTONS	9001 KR-1U	1	START Operator
	9001 KR-1U	1	STOP Operator
	9001 KN-201*	1	START Legend Plate
	9001 KN-202*	1	STOP Legend Plate
	9001 KA-1	2	Contact Block
HAND-OFF-AUTO Selector Switch	9001 KS-43B	1	Selector Switch Operator
	9001 KN-260*	1	HAND-OFF-AUTO Legend Plate
	9001 KA-1	1	Contact Block
Pilot Light	9001 KP-1R9	1	120 VAC With Red Color Cap
	9001 KP-1G9	1	120 VAC With Green Color Cap

* NEMA 4 Enclosures use 9001 KN-8 nameplates plus KU protective caps.

Percent Conduction Meter — This meter provides a visual indication of the **approximate** motor speed during START and RUN by showing the percent of conduction of the SCRs. When an Energy Saving Module is used, the meter will show less than 100% conduction when operating at less than full load. This indicates the energy saving feature is reducing the voltage applied to the motor. The meter movement is 0 to 1 milliamps full scale.

Connect meter (+) terminal to Terminal (M+) and meter (common) to Terminal (M/T). Order a Class 8660, Type AM-1 meter for this option.

SHORTING AND ISOLATION CONTACTORS

The Starter can be utilized with shorting and/or isolation contactors. The Elementary Diagrams on pages 13 and 14 show recommended connections for these options. The isolation contactor is used to provide an air gap contact between the motor and the distribution system. The shorting contactor shunts the SCRs when the Starter is "up to speed".

PLUG-IN MODULES

Several features are available as options, including different modes of acceleration, voltage monitoring and energy saving. These options are packaged in convenient plug-in modules for easy field installation. These modules are keyed to prevent incorrect installation. For repair, return or additional information, consult your local Square D field office.

Linear Timed Acceleration (Tachometer Feedback) — This option provides linear timed acceleration, adjustable from 3 to 30 seconds. Current limit override, adjustable from 150 to 425% of MFLC is always present with this option. A tachometer attached to the motor shaft provides the feedback signal. The tachometer output must be 60 to 180 VDC maximum at rated motor speed. Tachometer VA must be less than 100 VA.

This option requires a Class 8660, Type B4B module in module location 4. The tachometer is connected with its (−) negative terminal connected to Terminal (T−) and its (+) positive terminal connected to Terminal (M/T). Note: Since Terminal (M/T) is at chassis ground potential, the tachometer (+) terminal will also be grounded. **The tachometer (−) terminal must not be grounded.**

There are two adjustments located on the front of the module. The CAL potentiometer is used to calibrate the tachometer and motor to the starter. The TIME potentiometer provides the acceleration time adjustment. The following procedure is used for adjusting this option.

DANGER: During calibration, the starter is energized and has hazardous voltage on power and control circuits. Extreme caution should be exercised at all times. Starting and stopping of the starter should always be performed with enclosure doors closed.

1. Set CAL and TIME fully counterclockwise (CCW).
2. Set CURRENT LIMIT midway between 150% and 425%.
3. START motor (minimum loading, or uncoupled, if possible). If motor does not reach full speed and/or stalls, STOP the motor and increase the CURRENT LIMIT setting by ⅛ turn CW. Restart motor and repeat until the motor reaches full speed.
4. With motor "up to speed", slowly turn CAL pot CW until CAL LED on Module #4B turns on. Turn CAL pot CCW until this LED just turns off. The module is now calibrated.
5. STOP the motor and set CURRENT LIMIT to 425%.
6. Adjust TIME for the desired starting time.
7. Restart the motor to verify acceptable starting of the motor.

Do not exceed the maximum operating rates of the Starter or motor during this adjustment procedure.

Voltage Ramp Start — Certain applications may require starting where the applied motor voltage increases linearly to 100% over a presettable time period, with no tachometer feedback. This option provides this feature.

The time period is adjustable from 3 to 30 seconds nominally. When START is initiated, sufficient voltage is applied to the motor to start it turning. The applied voltage will increase linearly from this automatic "breakaway" point until the motor is "up to speed." Current limit override (150% to 425% of MFLC) is also present with this option. Install a Class 8660 Type B4C module in module location #4. The TIME adjustment provides the acceleration time. Rotate potentiometer clockwise to increase acceleration time.

Current Ramp Start — The current ramp module provides smooth acceleration for the motor and load. This optional starting method operates motor without the use of a tachometer. Motor current is ramped from a breakaway current setting to the current limit setting over a period of time. The breakaway current is adjustable from 0 to 150% of motor full load current (MFLC), while the time is adjustable from 0 to 7 seconds. The current limit is adjustable between 150% and 425% of MFLC.

508 AS
SERVICE BULLETIN

Voltage Monitor Module — This module provides three different functions — phase unbalance, phase reversal (out of sequence) and underload. LEDs give a visual indication when any of these fault conditions occurs. Install a Class 8660 Type B7 module in module location #7 for these features.

The PHASE UNBALANCE function is activated whenever three phase line voltage is present at Starter Line Terminals L1, L2 and L3. However, it is disabled during starting. The amount of voltage unbalance is adjustable from 5% to 14% as defined by NEMA standards. This condition, when it occurs, will light UNBAL and START INHIBIT LEDs and deenergize the Starter. The Starter cannot be restarted until after the RESET button is pressed. The unbalance has an inverse time relationship. The device will turn-off within 5 seconds at an unbalance approximately equal to the setting and will turn off within 1 second when the unbalance is twice this setting.

The PHASE REVERSAL function is also activated whenever three phase line voltage is present at Starter Terminals L1, L2 and L3. If the three phases are in that sequence the starter will start. If they are not, the OUT OF SEQ and START INHIBIT LEDs will light and the Starter cannot be started. Correcting the sequence by exchanging any two line voltages will automatically reset the circuits. Note: The Starter is designed to be phase insensitive without this module and will operate with any phase sequence on Line Terminals L1, L2 and L3.

The UNDERLOAD function is adjustable from 0% to 90% of the MFLC setting on the Overload Module B3. This circuit only operates after the motor is "up to speed". An Underload condition will cause the Starter to turn-off and light the UNDERLOAD and START INHIBIT LEDs. The Starter cannot be restarted until after the RESET button is pressed. To disable this function, turn pot CCW to the 0% setting.

Energy Saving Module — This module automatically adjusts the applied motor voltage to meet varying load requirements but maintains full motor speed and torque availability. This feature is provided by adding the Class 8660 Type B8 module in module location #8. The circuit is activated only after the motor is "up to speed."

A pair of adjustments is provided on the front of the module. Switch "A" provides a coarse adjustment and potentiometer "B" is for fine tuning. The following procedure is used to adjust this feature.

If the motor full load power factor **(P.F.) is known:**

1. Set switch "A" to the closest lower power factor number. (Example: known P.F. is .80, set switch "A" to .79).
2. Set potentiometer "B" so that the total of setting "A" and "B" equals the known P.F.
3. Start motor with load connected. If motor appears to slow down during load transitions, change switch "A" or potentiometer "B" to next lower P.F. setting until motor runs smoothly.

If the motor full load power factor **(P.F.) is not known:**

1. Set switch "A" to its lowest setting and potentiometer "B" to its highest setting.
2. Start motor with load connected.
3. Slowly increase setting of Switch "A" until motor RPM decreases during load transitions.
4. Decrease potentiometer "B" setting until motor runs smoothly.

CAUTION: STARTING AND STOPPING OF THE STARTER SHOULD BE PERFORMED WITH THE ENCLOSURE DOOR CLOSED.

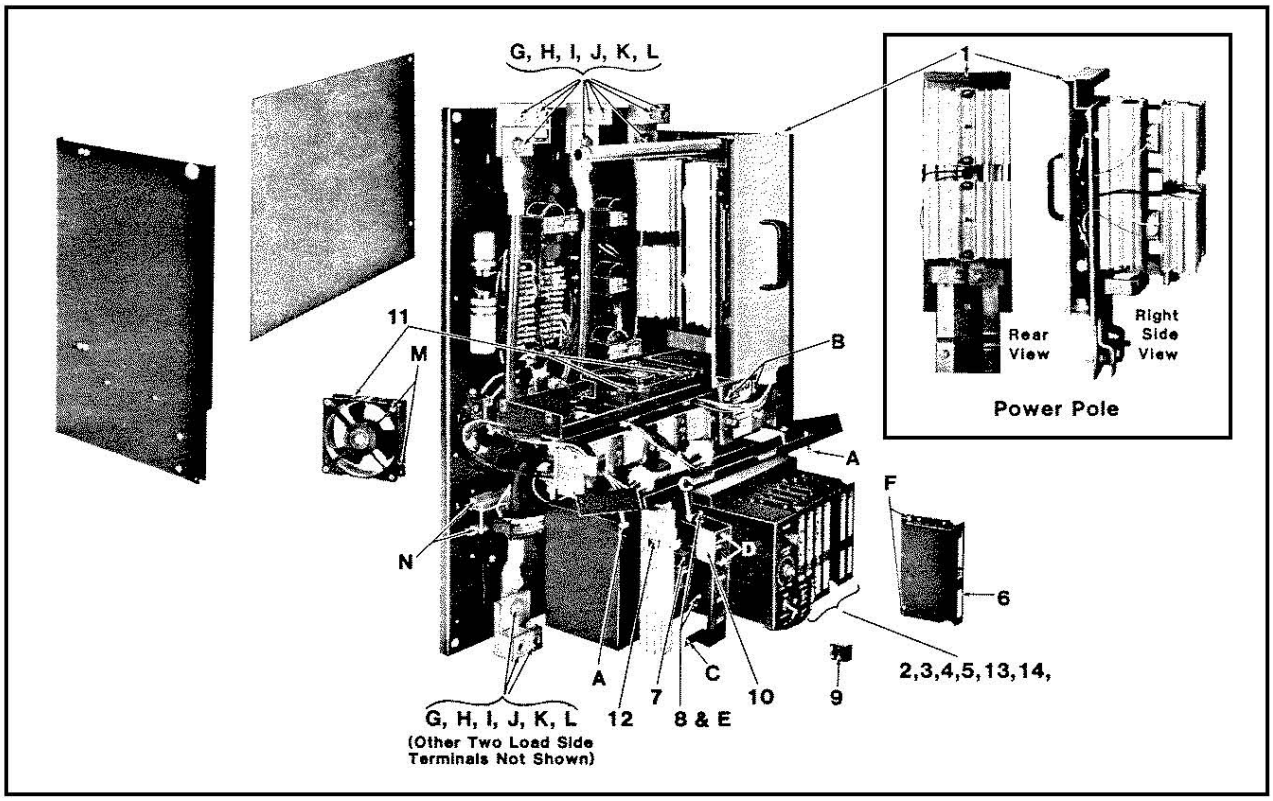


FIG. 2 Exploded View of Small Frame Size. Large Frame Similar.

SQUARE D COMPANY
P.O. Box 9247
Columbia, S.C. 29290
1-803-776-7500
PRINTED IN U.S.A. CPG

508 AS
SERVICE BULLETIN

DANGER: Hazard of electrical shock or burn. Turn off power supplying this equipment before working on it.

MAINTENANCE

This solid state Starter will provide long life when it is operated within its ratings. However, periodic maintenance will help insure reliable operation. This maintenance should include keeping the device and enclosure interior clean and dustfree and checking that all bolted connections are at their recommended tightening torques.

Power Pole Assembly — Dust and dirt on the power pole heat sinks will cut down on the efficiency of the Starter. Removal of power poles will ease cleaning. Removal is accomplished by opening service door, removing plug connection, loosening the two bolted connections, and lifting the power pole up and out.

Tightening Torques — The factory recommended tightening torques are listed in the table. These tightening torques must be used when reassembling after **any** maintenance or assembly operation.

FACTORY RECOMMENDED DRIVING TORQUES
TIGHTENING TORQUE TABLE

Item	Description	Driving Torque Lb-In	Driving Torque N-m
A	Service Door Screw (2)	12-16	14-1.8
B	Power Pole Bolts (2 per pole)		
	For Class 8660, Types MG, MH, MJ and MK	225-270	25-30
	For Class 8660, Type MM	450-540	51-61
C	Relay Retainer Bracket Screw (2)	17-21	1.9-2.4
D	Shorted SCR Switch Retainer Screws (2)	9-11	1.0-1.2
E	Switch Bracket Screws (2)	17-21	1.9-2.4
F	Control Module Screws (14)	9-11	1.0-1.2
G	Copper/Aluminum Lug Screws (standard)		
	For Class 8660, Types MG and MH (6)	225-275	25-30
	For Class 8660, Types MJ and MK (12)	270-330	30-37
	For Class 8660, Type MM (18)	270-330	30-37
	Copper Only Lug Screws (optional)		
	For Class 8660, Types MG and MH (6)	225-275	25-30
	For Class 8660, Types MJ and MK (12)	270-330	30-37
	For Class 8660, Type MM (18)	270-330	30-37
H	Aluminum Lug Retaining Screws (standard) (6)	300-350	34-40
	Copper Lug Retaining Screws (optional)		
	For Class 8660, Types MG and MH (6)	225-275	25-30
	For Class 8660, Types MJ, MK and MM (6)	450-540	51-61
I	Line/Load Connector to Power Block Nuts (6)		
	For Class 8660, Types MG, MH, MJ and MK	225-275	25-30
J	Line/Load Connector to Power Block Assembly Screws (6)		
	For Class 8660, Type MMO	450-540	51-61
K	Line/Load Connector to Support Assembly Screws (6)		
	For Class 8660, Types MG, MH, MJ and MK	450-540	51-61
L	Line/Load Connector to "Z" Bus Screws (6)		
	For Class 8660, Types MMO	450-540	51-61
M	Fan Retaining Screws (4)		
	For Class 8660, Types MG, MH, MJ and MK	9-11	1.0-1.2
	For Class 8660, Type MM	23-29	2.6-3.3
N	Current Transformer Retaining Screws (12)		
	For Class 8660, Types MG, MH and MJ	17-21	1.9-2.4
	For Class 8660, Types MK and MM	60-72	6.8-8.1

PRINTED IN U.S.A. CPG
SQUARE D COMPANY
P.O. Box 9247
Columbia, S.C. 29290
1-803-776-7500

508 AS
SERVICE BULLETIN

ORDERING INSTRUCTIONS

Specify quantity, part number and description of part, giving nameplate data of device. For example, one Class 8660, Type B3C, Overload Relay Module for Class 8660, Type MJ-22 Starter.

PARTS LIST

Item	Description	Part Number	Recommended Spares
1	Power Pole Assembly (Complete with SCRs, Gate Amplifier Module and Overtemperature Switch) (3 Required per Starter)	Class 8660	1
	For Type MG-XX Starter	Type PG-XX*	
	For Type MH-XX Starter	Type PH-XX*	
	For Type MJ-XX Starter	Type PJ-XX*	
	For Type MK-XX Starter	Type PK-XX*	
	For Type MM-XX Starter	Type PM-XX*	
2	Regulator Module	Class 8660 Type B2	1
3	Overload Relay Module	Class 8660	1
	Type MG Starter	Type B3A	
	Type MH Starter	Type B3B	
	Type MJ Starter	Type B3C	
	Type MK Starter	Type B3D	
	Type MM Starter	Type B3E	
4	Current Limit Module	Class 8660 Type B4A	1
5	Control Module (Location 5)	Class 8660 Type B5	1
6	Control Module (Location 6)	Class 8660 Type B6	1
7	SR1 Control Relay	Class 8501, Type RS-4 120 VAC	1
8	SR2 Control Relay	Class 8501, Type RS-14 120 VAC	1
9	SR3 Control Relay	Class 8501, Type RSD-14 24 VDC	1
10	Shorted SCR Switch	26499-32700	—
11	Fan (3 Required per Starter)		1
	For Types MG, MH, MJ and MK Starter	26016-30610	
	For Type MM Starter	26016-31100	
12	Control Circuit Fuse (TB4)		1
	For Types MG, MH, MJ and MK Starter Bussman KTK-3 or equivalent	25419-10091	
	For Type MM Starter Bussman KTK-6 or equivalent	25419-10121	
13	Accessory Modules		
	Linear Timed Acceleration Module	Class 8660,** Type B4B	1
	Voltage Ramp Start Module	Class 8660,** Type B4C	1
	Current Ramp Start Module	Class 8660,** Type B4D	1
	Voltage Monitor Module	Class 8660, Type B7	1
	Energy Saving Module	Class 8660, Type B8	1
14	Socket Cover Module (required when special feature modules, Types B7 or B8, not used.)	31131-046-59	—
15	Percent Conduction Meter (For NEMA 1 enclosure only. For NEMA 4 or 12 consult local Square D field office.)	Class 8660 Type AM-1	—

* Power Pole Assemblies are voltage rated. To complete Type number add -11 for 200 V, -22 for 230/460 V, and -33 for 575 V Systems. Example, Type PG-22 is the power pole for a 230/460V, Type MGO-11 starter.

** If one of these modules is used, Item 4 is not needed.

P.O. Box 9247
Columbia, S.C. 29290
1-803-776-7500

PRINTED IN U.S.A. CPG

508 AS
SERVICE
BULLETIN

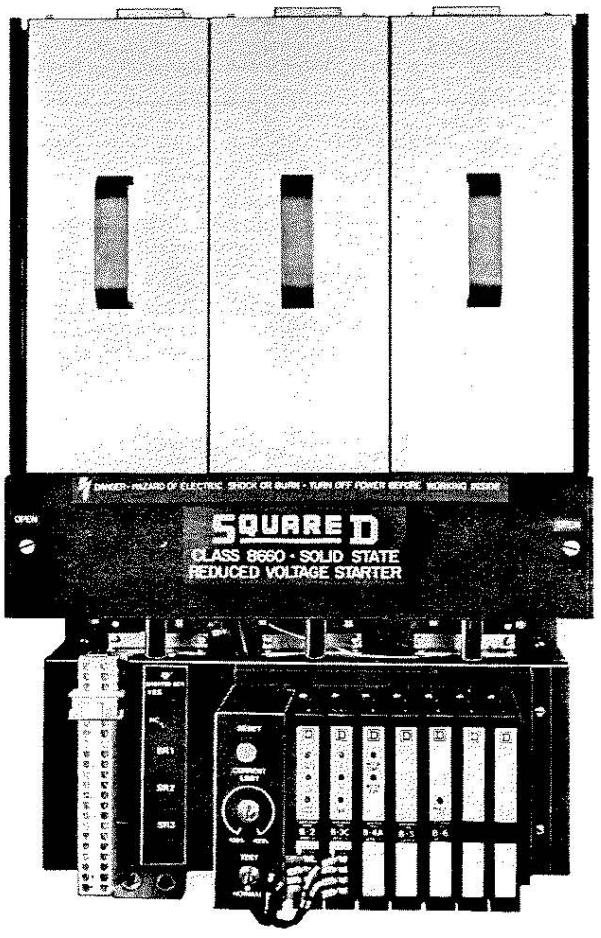


FIG. 3
Small Frame Starter
Type MG, MH, MJ and MK

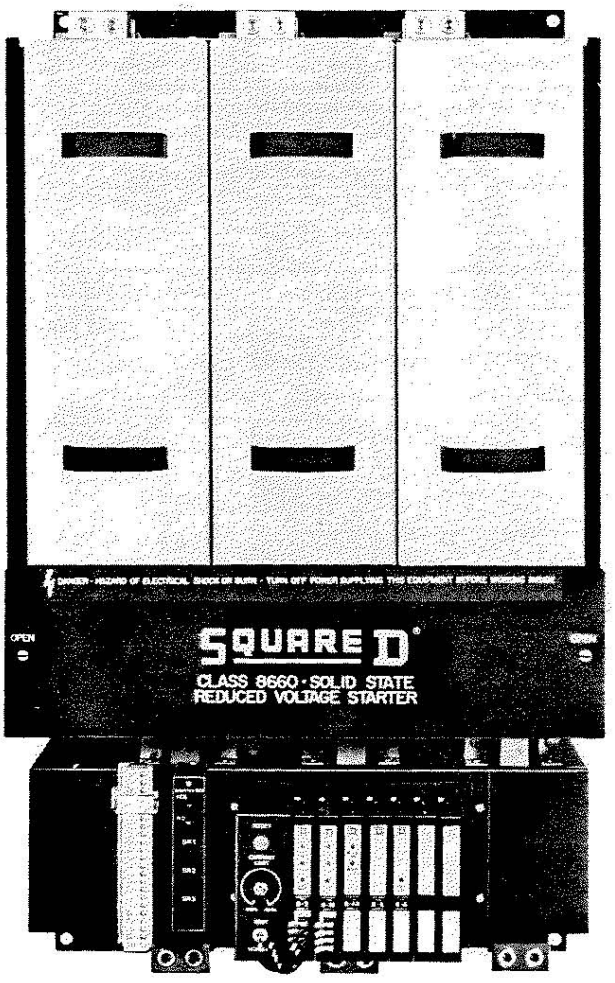


FIG. 4
Large Frame Starter
Type MM

508 AS
SERVICE
BULLETIN

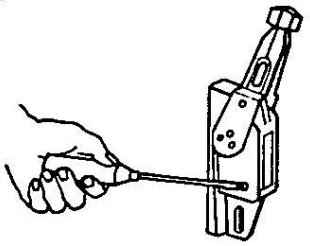
TROUBLESHOOTING PROCEDURE FOR STANDARD STARTER OR CONTROLLER

WARNING: SERVICING SHOULD BE PERFORMED BY ONLY *QUALIFIED* PERSONNEL. TROUBLESHOOTING WITH THE POWER TURNED-ON IS DANGEROUS BECAUSE OF POSSIBLE ELECTRIC ARCING, BURN OR SHOCK. — REMAIN ALERT!

Troubleshooting of the Starter is best done in an efficient and systematic manner. Experience has shown that reported symptoms may not be accurate. Therefore, first check with the operator. Then, if the Starter can be operated, personally observe the problem. Use the LED Troubleshooting Guide to assist in locating operational problems. When a LED indicates a problem, refer to the suggested list of Problems and Possible Causes for corrective action.

DANGER

Because of possible shock or burn, always close enclosure door before operating disconnect. If energized circuit must be checked, close and latch door, move disconnect handle to "ON". Gain entry to enclosure by defeating disconnect operating handle door interlock. Do not leave controller unattended with enclosure door open and circuit energized. Close and latch door when circuit check is completed.



To defeat interlock when handle is "ON" insert screwdriver and turn.

Refer to sections indicated below for problem and possible causes.

LED TROUBLESHOOTING GUIDE

(LED is on when circle has an X thru it e.g.⊗)

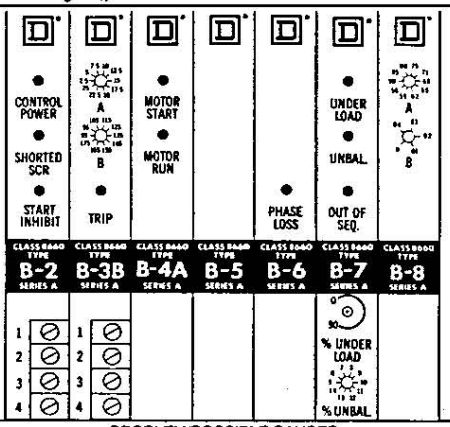


FIG. 5

CONTROL POWER	SHORTED SCR	START INHIBIT	TRIP	MOTOR START	MOTOR RUN	PHASE LOSS	UNDERLOAD	UNBALANCE	OUT OF SEQ	PROBLEM/POSSIBLE CAUSES (See Following Pages)
O	O	O	O	O	O	O	O	O	O	1A, 1C, 1E, 1H, 2 (ALL), 8 (ALL), 9 (ALL)
⊗	O	O	O	O	O	O	O	O	O	1A, 1E, 1F, 1G, 1H, 1I, 4A, 7C, 17 (ALL), 21 (ALL)
●	⊗	O	O	O	O	O	O	O	O	8 (ALL), 9 (ALL)
●	O	⊗	O	O	O	O	O	O	O	1H
●	O	●	⊗	O	O	O	O	O	O	1B, 1H, 3A, 10 (ALL), 11C
●	O	●	O	⊗	O	O	O	O	O	1H
●	O	●	O	O	⊗	O	O	O	O	1E, 1H
●	O	●	O	O	O	⊗	O	O	O	1D, 1I, 11 (ALL), 17 (ALL)
●	O	●	O	O	O	O	⊗	O	O	24 (ALL)
●	O	●	O	O	O	O	O	⊗	O	23 (ALL)
●	O	●	O	O	O	O	O	O	⊗	22 (ALL)
●	●	●	O	O	O	⊗	O	O	O	8 (ALL), 9 (ALL), 17 (ALL)
●	●	●	●	O	O	⊗	O	O	O	8 (ALL), 9 (ALL), 10 (ALL), 17 (ALL)
●	O	●	●	O	O	O	O	O	O	8 (ALL), 9 (ALL), 23 (ALL)
●	O	O	O	⊗	O	O	O	O	O	3 (ALL), 13 (ALL), 16 (ALL), 20 (ALL)
●	O	O	O	O	⊗	O	O	O	O	6 (ALL), 13 (ALL), 14 (ALL), 16 (ALL), 20 (ALL)
●	O	●	O	O	O	O	O	⊗	⊗	22 (ALL), 23 (ALL)
●	O	●	O	O	O	⊗	O	⊗	O	1D, 1H, 11 (ALL), 17 (ALL), 23 (ALL)
●	●	●	O	O	O	⊗	O	⊗	O	1H, 8 (ALL), 9 (ALL), 10 (ALL), 17 (ALL), 20 (ALL), 23 (ALL)

SQUARE D COMPANY
P.O. Box 9247
Columbia, S.C. 29290
1-803-776-7500
PRINTED IN U.S.A. CPG

508 AS
SERVICE
BULLETIN

TROUBLESHOOTING PROCEDURE FOR STANDARD STARTER OR CONTROLLER

PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION
1. Starter or controller will not turn on.	A. Control voltage and/or current not within ratings or missing.	Measure AC voltage across Starter control circuit Terminals #1 and #5. If no voltage is present, refer to wiring diagram and check continuity * of circuit from these terminals back to control power source. Correct cause of power loss. If voltage is present, but measures less than 102 VAC at 60 HZ or 93.5 VAC at 50 HZ refer to "Control circuit transformer" for VA requirements in "BRANCH SHORT CIRCUIT COORDINATION" section.
	B. Overload relay tripped.	Refer to Item 10 in PROBLEM column.
	C. Shorted SCR condition.	Refer to Item 8 in PROBLEM column.
	D. Phase loss condition.	Refer to Item 17 in PROBLEM column.
	E. Shorted SCR switch in "YES" position.	Place switch in "NO" position.
	F. Thermal sensors tripped.	Refer to Item 21 in PROBLEM column.
	G. 2-wire or 3-wire pilot device not making contact.	Remove plug-in fuseholder from starter terminal #4. Check continuity * between starter terminals #1 and #3 on the starter terminal block with the pilot device in the "START" or closed position. If no continuity, check the continuity of the circuit back to the pilot device. Correct open circuit or (if no continuity at pilot device) replace the pilot device.
	H. Control modules loose.	Check to be sure module(s) are tight in sockets.**
	I. SR1 or SR2 relay not energizing and/or holding in.	Refer to Item 7 in PROBLEM column.
2. Open (blown) control-circuit fuse(s).	A. Incorrect fuses.	Replace fuse(s) with correct size fuse.
	B. Control voltage and/or current not within ratings.	Refer to Item 1A under PROBLEM/POSSIBLE CAUSES columns.
	C. Coils of SR1 and/or SR2 shorted.	Refer to Item 7 in PROBLEM column.
	D. Coil of shorting contactor, isolation contactor, timing relays, control relays or auxiliary control circuit device is shorted.	Refer to Service Bulletins for these specific devices.**
	E. Coil on shunt trip breaker shorted.	Refer to Item 9 in PROBLEM column.
3. Starter or controller turns ON momentarily then stays off.	A. Overload condition.	Refer to Item 10 in PROBLEM column.
	B. Thermal sensor(s) tripped.	Refer to Item 21 in PROBLEM column.
	C. Isolation contactor picks up and drops out.	Refer to Item 1A in the PROBLEM/POSSIBLE CAUSES columns.
	D. Energy saving module (#8) improperly calibrated.	Refer to "ENERGY SAVING MODULE" (#8) calibration procedure.
	E. Linear acceleration module (#4B) improperly calibrated.	Refer to "LINEAR TIMED ACCELERATION MODULE (#4B)" calibration procedure.
4. Starter or Controller does not remain ON when "START" button is released.	A. "START-STOP" push buttons wired incorrectly.	Remove plug-in fuse holder from Starter terminal #4. Check continuity * between Starter control circuit terminals #2 and #3. If continuity exists, press "STOP" push button. An open circuit indicates the "START-STOP" pilot device is wired incorrectly.
	B. Relays loose or defective.	Refer to Item 7 in Problem column.
5. Starter or Controller does not remain OFF when "STOP" button is released or pilot device is opened.	A. SR2 relay contacts do not open or short circuit in wiring for "START-STOP" push button or pilot devices.	Remove plug-in fuseholder from Starter terminal #4. Check continuity * between Starter control circuit terminals #1 and #3. If continuity exists, remove relay SR2. If continuity still exists, check pilot device wiring for a short circuit or improper wiring. If an open circuit exists, replace SR2.
6. Starter or Controller will not turn OFF.	A. "STOP" switch or pilot device (eg. float switch) not opening.	* Check pilot device for proper operation. Replace, if necessary.
	B. Control circuit wiring shorted between controller and "START" switch or pilot device (eg. float switches, etc.).	1. If controller is equipped with "START" and "STOP" buttons, either remote or enclosure-mounted, remove plug-in fuseholder from its housing and check for continuity * between terminals #1 and #2. If continuity remains when any "STOP" is depressed, a short circuit is present in the wiring and must be corrected. Check for continuity between terminals #2 and #3. If it exists, remove wire from terminal #3 and check continuity between terminals #2 and #3. If continuity still exists replace SR-2. If not, check wiring for a possible short. Check contact on "START" push button for a welded or closed contact.
		2. If controller is connected to a remote pilot switch (e.g. thermostat, float switch, etc.), remove plug-in fuseholder from its housing and disconnect * wires from one terminal of the pilot switch. Check continuity between terminals #1 and #3 on the terminal block. If continuity exists, a short circuit is present in the wiring and must be removed. If continuity does not exist, check remote pilot switch.
	C. SR1 and SR2 relay contacts do not open.	* Remove relays SR-1 and SR-2 from their sockets. Check all relay contacts in accordance with the pin layout located on the side of each relay. Replace relays, if necessary.
	D. Shorting contact does not drop out upon de-energization.	* Check the shorting contactor contacts and the external control relay CR2 contacts for continuity. If continuity exists, replace the contacts and/or relay.

* Always open disconnect switch on line side of controller before making continuity, resistance checks or removing any connection. On controllers with Form S also disconnect the separate control power source.

** If the starter/controller is still inoperative, consult your local Square D Field Office.

PRINTED IN U.S.A. CPG
P.O. Box 9247
Columbia, S.C. 29290
1-803-776-7500

508 AS
SERVICE BULLETIN

TROUBLESHOOTING PROCEDURE FOR STANDARD STARTER OR CONTROLLER — Cont'd		
PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION
7. SR1 or SR2 not being energized on start-up.	A. Control voltage and/or current not within ratings or missing.	Refer to Item 1A in PROBLEM/POSSIBLE CAUSES columns.
	B. Thermal sensors or overload contacts open.	Refer to Item 21 in PROBLEM column.
	C. Relays loose or defective.	* Confirm that the relays are properly seated in their sockets. Remove relays and check coil impedance (approximately 3.9K ohms for SR1 and SR2). Replace if necessary.
	D. Control module #2 may be loose.	* Check if all control modules are properly seated, tightly screwed and in their proper locations.
8. Shorted SCR detector tripped.	A. SCR(s) in one or more phases (power poles) shorted.	Check for continuity * between Starter power terminals L1 and T1, L2 and T2, or L3 and T3. If continuity exists, replace power pole in question. Refer to "POWER POLE ASSEMBLY" section for removal procedures.
	B. TR timer in circuit with isolation contactor incorrectly set.	TR timer is factory set at 2 seconds. If Shorted SCR Detector trips after "STOP" is pressed, increase TR timer setting in 1 second increments up to 5 seconds or until tripping ceases when motor is stopped.**
	C. Shorted SCR switch defective.	* Remove all wires from Starter terminal #14. Check for continuity between starter terminals #14 and #15. With the switch in the "YES" position, continuity should exist. With the switch in the "NO" position, continuity should not exist. Replace the switch if necessary.
	D. Module #2 may be loose.	Check that Module #2 is properly seated and tightly screwed into its proper location.
	E. Loose or missing connections on starter load terminals T1, T2 or T3 or at motor terminal box.	* Inspect Starter power terminals T1, T2 and T3 as well as the corresponding motor terminals. All wires should be tightened to the proper torques. (See torque table for proper torques values).
	F. Leads to SCR(s) loose.	* Visually check if red clip lead on each SCR is firmly connected to the tab on the SCR. This can be checked by removing the power poles and inspecting connections.
	G. Conductive debris across heat sinks.	Refer to POWER POLE ASSEMBLY paragraph in MAINTENANCE section.
9. Shunt trip circuit breaker trips.	A. Shunt coil energized by shorted SCR detector.	Refer to Item 8 in PROBLEM column.
	B. Power connections to circuit breaker are loose.	Check that power connections are tightened as specified in circuit breaker service bulletin.
	C. Circuit breaker incorrectly sized.	Change to correct size circuit breaker.
	D. Motor draws excessive current.	Check for shorted windings in motor. Take corrective action.
10. Overload relay trips.	A. Motor draws too much current.	Check if motor is overloaded or single phased. Take corrective action.
	B. Overload relay Module #3 not correctly set.	Refer to "OVERLOAD RELAY" section for calibration procedures.
	C. Current limit not correctly set.	Refer to "CURRENT LIMIT" section for adjustment procedures.
	D. Overload switch in TEST position or switch defective.	Put switch in NORMAL position.**
	E. Recycling rate too high.	Consult your local Square D Field Office for allowable cycling rates.
	F. Module #2 or #3 may be loose.	Check that Module #2 and #3 are properly seated and tightly screwed into their proper location.
11. Isolation contactor does not pick up. (If used.)	A. Control voltage and/or current not within ratings or missing.	Refer to Item 1A in the PROBLEM/POSSIBLE CAUSES columns.
	B. Isolation contactor coil does not energize.	* Remove a wire from the isolation contactor coil. Measure and compare the isolation contactor coil resistance with the resistance specified in the isolation contactor service bulletin. Replace contactor coil if necessary.
	C. Overload tripped.	Refer to "Overload tripped" in PROBLEM column.
	D. Pilot device(s) not functioning properly.	Observe operation of the pilot device to be sure it switches on and off when intended. Remove plug-in fuseholder from Starter terminal #4. Check the continuity * between Starter terminals #1 and #3 when pilot device is "open" and "closed". Replace pilot device, if necessary.
	E. SR2 relay may be loose.	Refer to Item 7 in PROBLEM column.
	F. CR1 energized.	Check if TRIP light on Module #3 is "ON". If it is, refer to "Overload tripped" in PROBLEM column. * Remove the wire from Module #2 terminals #3 and #4. If continuity exists, replace Module #2.
	G. TR timer coil is not energized.	Remove a wire from the TR timer coil. Measure and compare the TR timer coil resistance with the resistance specified in the TR timer service bulletin. Replace coil if necessary.
12. Isolation contactor does not drop out. (If used.)	A. Contacts on contactor do not open.	* Check continuity of isolation contactor between Starter power terminals L1 and T1, L2 and T2 or L3 and T3. Continuity indicates a welded contact. Replace contacts if necessary.
	B. TR timer does not time out.	Check that TR timer is set for approximately 2 to 5 seconds. * Remove all wires from one contact terminal of the TR timer. If continuity exists between the output terminals of the timer, replace the timer.

* Always open disconnect switch on line side of controller before making continuity, resistance checks or removing any connection. On controllers with Form S also disconnect the separate control power source.

** If the starter/controller is still inoperative, consult your local Square D Field Office.

SQUARE D COMPANY
P.O. Box 9247
Columbia, S.C. 29290
1-803-776-7500
PRINTED IN U.S.A. CPG

508 AS
SERVICE BULLETIN

TROUBLESHOOTING PROCEDURE FOR STANDARD STARTER OR CONTROLLER — Cont'd		
PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION
13. Shorting contactor does not pick up. (If used.)	A. Control voltage and/or current not within rating or missing.	Refer to Item 1A in PROBLEM/POSSIBLE CAUSES columns.
	B. Shorting contactor coil does not energize.	* Remove a wire from coil terminal of the shorting contactor. Measure and compare the shorting contactor coil resistance the resistance specified in the shorting contactor's service bulletin. Replace the contactor coil if necessary.
	C. Relays SR2 and/or SR3 may be loose.	Refer to Item 7 or Item 16 in the PROBLEM column.
	D. Relay CR2 defective.	* Remove a wire from the coil terminal of relay CR2. Measure and compare the coil resistance specified in the CR2 service bulletin. Replace if necessary.
	E. Module(s) #2 and/or #4 loose.	Check that Module #2 and/or #4 are seated properly and are tightly screwed to their proper locations.
	F. Motor does not reach full speed.	Refer to Item 20 in PROBLEM column.
14. Shorting contactor does not drop out. (If used.)	A. Contacts on contactor do not open.	* Check the continuity of the shorting contactor between Starter power terminals L1 and T1, L2 and T2, and L3 and T3. Continuity indicates a welded contact. Replace contacts if necessary.
	B. CR2 contacts do not open.	* Remove all wires from one contact terminal of CR2. If continuity exists between the output terminals of the relay, replace the relay.
15. Shorting contactor picks up immediately after start. (If used.)	A. SR3 contacts do not open.	* Remove all wires from Starter terminal #A2. If continuity exists between Starter terminals #A1 and #A2, replace SR3.
	B. Module #4 loose.	Check that Module #4 is seated properly and is tightly screwed to the proper location.
16. SR3 not being energized on start-up.	A. Control voltage and/or current not within ratings or missing.	Refer to Item 1A in PROBLEM/POSSIBLE CAUSES columns.
	B. Control module #4 may be loose.	Check that module #4 is properly seated and tightly screwed into its proper location.
	C. Control module #3 incorrectly calibrated.	Refer to "OVERLOAD RELAY" for calibration instructions.
	D. Relay loose or defective.	* Confirm that the relay is properly seated in its socket. Remove the relay and check the coil resistance (approximately 650 ohms for SR3). Replace if necessary.
17. Phase loss condition.	A. No power at L1, L2 or L3 of circuit breaker.	* Check power source and correct any open circuits.
	B. Circuit breaker not closed on L1, L2 and L3 when handle in "ON" position — No power at load side of circuit breaker.	* Check if operating mechanism is closing the circuit breaker. If it is not, consult "Operating Mechanism Service Bulletin," for proper set-up procedure.
	C. Power fuse(s) blown ahead of starter.	* Check if fuse(s) are correctly sized, motor is overloaded, or fuses were loose in fuse clips. Take corrective action.
	D. Isolation contactor not closed on L1, L2 and L3 when coil energized.	Refer to Item 11 in PROBLEM column.
	E. Modules #2, #5 and/or #6 are loose.	Check that Modules #2, #5 and/or #6 are seated properly and are tightly screwed into their proper locations.
18. Motor accelerates too fast.	A. Current limit set too high.	Refer to "CURRENT LIMIT" section for adjustment procedure.
	B. Module #3 not calibrated correctly.	Refer to "OVERLOAD RELAY" section for calibration procedures.
	C. Wires on Module #3 not tight or incorrectly positioned on terminals #1, 2, 3 and 4.	* Check that the wires on Module #3 are properly located and are securely tight on the terminal block.
	D. Module #4 not adjusted correctly.	Refer to Module #4 adjusting procedures where adjustment procedures apply (eg. See "LINEAR TIMED ACCELERATION" section for adjustment procedure of Module #4B).
19. Motor accelerates too slowly.	A. Current limit set too low.	Refer to "CURRENT LIMIT" section for adjustment procedure.
	B. Module #3 not calibrated correctly.	Refer to "OVERLOAD RELAY" section for calibration procedure.
	C. Module #4 not adjusted correctly.	Refer to applicable optional module adjustment procedure.
20. Motor does not reach full speed or stalls.	A. Loss of phase.	Refer to Item 17 in PROBLEM column.
	B. Motor draws excessive current.	Check if motor is overloaded or single phased. Take corrective action.
	C. Current limit set too low.	Refer to "CURRENT LIMIT" section for adjustment procedure.
	D. Module #3 not calibrated correctly.	Refer to "OVERLOAD RELAY" section for adjustment procedures.
	E. Module(s) #2 thru #6 are loose.	Check that Modules #2 to #6 are seated properly and are tightly screwed into their proper locations.
	F. Wiring to front of Module #3 loose or incorrectly connected.	* Check that the wires on front of Module #3 are properly located and securely tight on the terminal block.
	G. Power poles loose.	* Confirm that the power pole bolts, accessible after the "service door" is opened, are tightened as specified in the "TIGHTENING TORQUE TABLE."

* Always open disconnect switch on line side of controller before making continuity, resistance checks or removing any connection. On controllers with Form S also disconnect the separate control power source.

** If the starter/controller is still inoperative, consult your local Square D Field Office.

PRINTED IN U.S.A. CPG
P.O. Box 9247
Columbia, S.C. 29290
1-803-776-7500

508 AS
SERVICE BULLETIN

TROUBLESHOOTING PROCEDURE FOR STANDARD STARTER OR CONTROLLER — Cont'd		
PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION
21. Thermal sensor(s) tripping.	A. Enclosure temperature exceeds normal operating temperatures.	* Inspect enclosure vents for foreign material. Check that the ambient temperature does not exceed the limits specified.**
	B. Operation rate too high.	Refer to "OPERATION RATES" section for further information on maximum allowable rates.
	C. Debris on heat sinks.	Refer to "POWER POLE" section for power pole removal and cleaning instructions.
	D. Power pole and heat sink electrical and mechanical connections not tightened to correct torque value.	Refer to "TIGHTENING TORQUES" for details.
	E. Fan(s) not running.	Check for proper control voltage and/or current (Refer to "Starter or controller will not turn on "/" Control voltage and/or current not within ratings or missing" in PROBLEM/POSSIBLE CAUSES columns). Inspect the fan motor(s) lead connector(s) for proper connections. Inspect the fan motor(s) for signs of the burned windings. The fan blades should not be missing and should spin freely.
	F. Shorting contactor does not pick up.	Refer to Item 13 in PROBLEM column.
22. Incorrect phase sequence (Applies only when Module #7 is used).	A. Incoming lines L1, L2 or L3 are out of sequence.	Check the voltage phase sequence at Starter power terminals L1, L2, and L3.
	B. Modules #5, #6 and/or #7 are loose.	Check that Modules #5, #6 and #7 are properly seated and tightly screwed into their proper locations.
23. Unbalance condition between L1, L2 and L3 (Applies only when Module #7 is used).	A. Lines L1, L2 and/or L3 have a voltage unbalance beyond setting on Module #7.	* Set UNBAL for a higher setting. (Refer to "VOLTAGE MONITOR MODULE" section for adjustment procedures.)
	B. Isolation contactor or shunt trip circuit breaker opens before "STOP" condition is initiated by the pilot device.	Press RESET. Avoid opening line power to the Starter before pressing "STOP".
	C. Impedance or motor and/or power lines to motor not equal.	* Check that all power connections between Starter and the power source are tight. Check that all connections between Starter and motor are tight.
	D. Modules #5, #6 and/or #7 are loose.	Check that Modules #5, #6 and #7 are seated properly and are tightly screwed to their proper locations.
	E. Power poles loose.	* Confirm that the power pole bolts, accessible after the "service door" is opened, are tightened as specified in the "TIGHTENING TORQUE TABLE."
24. Underload Condition (Applies only when Module #7 is used).	A. Motor loaded below setting on Module #7.	Increase motor load and/or adjust Module #7 for a lower underload (Refer to "VOLTAGE MONITOR MODULE" section for adjustment procedures).
	B. Modules #3 and/or #7 are loose.	Check that Modules #3 and/or #7 are seated properly and are tightly screwed into their proper locations.
	C. Isolation contactor or shunt trip circuit breaker opens before "STOP" condition is initiated by the pilot device.	Press RESET. Avoid opening line power to the starter before pressing "STOP".
25. Motor stalls or speed varies after "up to speed".	A. Current limit set too low.	Refer to "CURRENT LIMIT" section for adjustment procedures.
	B. Module #3 not calibrated correctly.	Refer to "OVERLOAD RELAY" section for calibration procedures.
	C. Module #8 not calibrated correctly.	Refer to "ENERGY SAVING MODULE" for adjustment procedure.
	D. Module(s) #3, #4, or #8 may be loose.	Check that Modules #3, #4, and/or #8 are seated properly and are tightly screwed into their proper locations.

* Always open disconnect switch on line side of controller before making continuity, resistance checks or removing any connection. On controllers with Form S also disconnect the separate control power source.

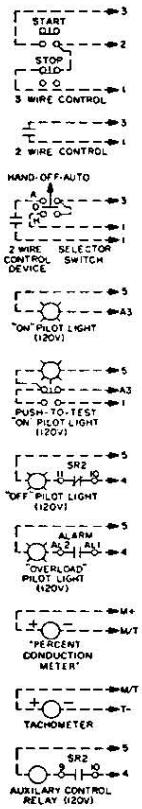
** If the starter/controller is still inoperative, consult your local Square D Field Office.

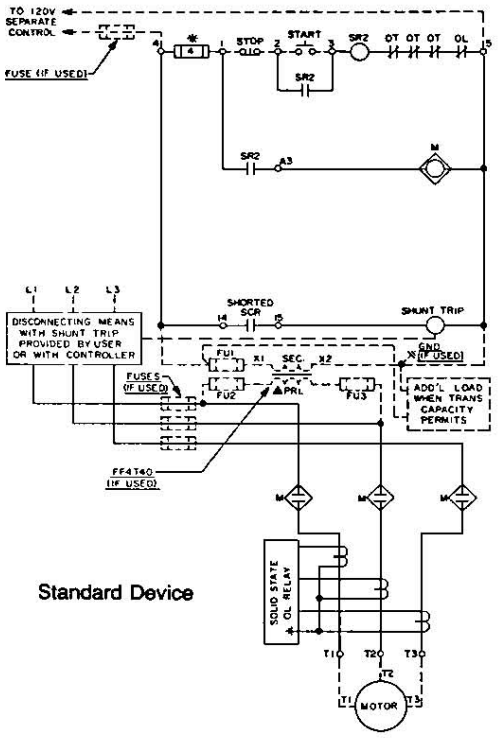
PRINTED IN U.S.A. CPG

SQUARE D COMPANY
P.O. Box 9247
Columbia, S.C. 29290
1-803-776-7500

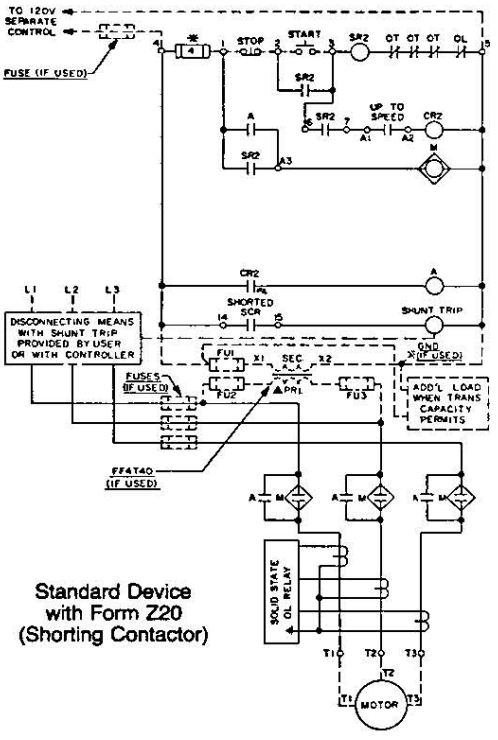
508 AS
SERVICE
BULLETIN

ELEMENTARY DIAGRAMS





Standard Device



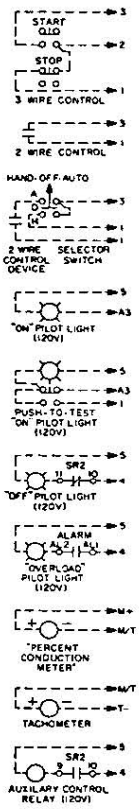
Standard Device
with Form Z20
(Shorting Contactor)

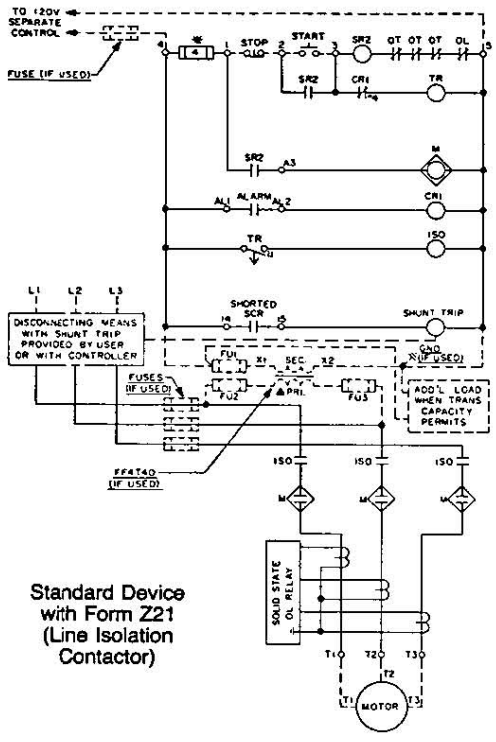
NOTES:

1. M, SR2, OT, ALARM, SHORTED SCR, and UP-TO-SPEED Relays are mounted on the starter and wired internally.
2. M denotes the coil function of the solid state reduced voltage starter.
3. The SR2 Relay controls the start and stop sequence, and also has contacts that may be used as electrical interlocks.
4. OT is an Over Temperature switch that opens when that condition exists.
5. OL is the Overload Relay contact. It opens when: an overload is detected; L1, L2, or L3 voltage is not present; or the 120V control voltage is missing.
6. The alarm contact closes when an overload is detected.
7. The shorted SCR contact closes when that condition exists. It is used with a circuit breaker or disconnecting switch with a shunt trip coil.
8. The UP-TO-SPEED contact closes when the SCR'S are in full conduction. It is used with a shorting contactor.
9. *This fuse is used for starter circuitry only. Use "Bussman KTK-3" or equivalent on MG, MH, MJ and MK. Use "Bussman KTK-6" or equivalent on MM.
10. POWER FACTOR CORRECTION CAPACITORS (IF USED) These capacitors must be placed ahead of the starter on the line side of the SSRVS. A contactor is necessary to isolate the capacitors from the line when the SSRVS is not energized.

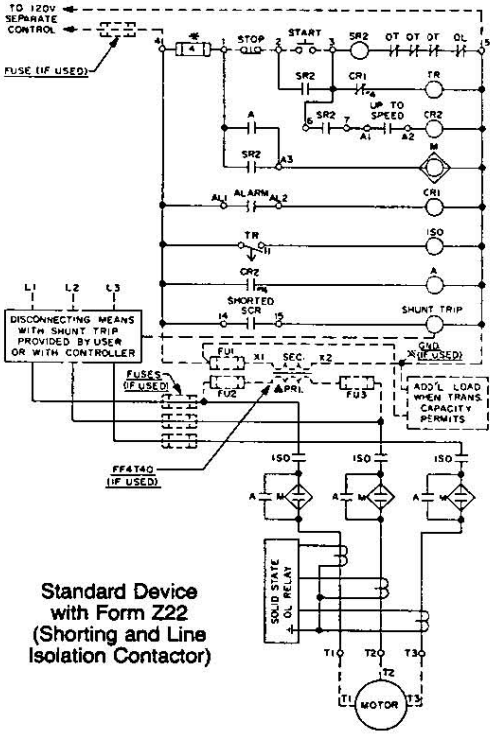
508 AS
SERVICE
BULLETIN

ELEMENTARY DIAGRAMS





Standard Device with Form Z21 (Line Isolation Contactor)



Standard Device with Form Z22 (Shorting and Line Isolation Contactor)

NOTES:

1. M, SR2, OT, ALARM, SHORTED SCR, and UP-TO-SPEED Relays are mounted on the starter and wired internally.
2. M denotes the coil function of the solid state reduced voltage starter.
3. The SR2 Relay controls the start and stop sequence, and also has contacts that may be used as electrical interlocks.
4. OT is an Over Temperature switch that opens when that condition exists.
5. OL is the Overload Relay contact. It opens when: an overload is detected; L1, L2, or L3 voltage is not present; or the 120V control voltage is missing.
6. The alarm contact closes when an overload is detected.
7. The shorted SCR contact closes when that condition exists. It is used with a circuit breaker or disconnecting switch with a shunt trip coil.
8. The UP-TO-SPEED contact closes when the SCR'S are in full conduction. It is used with a shorting contactor.
9. *This fuse is used for starter circuitry only. Use "Bussman KTK-3" or equivalent on MG, MH, MJ and MK. Use "Bussman KTK-6" or equivalent on MM.
10. POWER FACTOR CORRECTION CAPACITORS (IF USED) These capacitors must be placed ahead of the starter on the line side of the SSRVS. A contactor is necessary to isolate the capacitors from the line when the SSRVS is not energized.