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Instruction Bulletin

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3-Pole AC Magnetic Contactors and 3-Pole AC Magnetic Starters
Classes 8502 and 8536—Size 4
Type SF, Series A, Form H••

INTRODUCTION

This instruction bulletin illustrates and describes Class 8502 three-pole magnetic contactors and Class 8536 three-pole magnetic starters incorporating MOTOR LOGIC™ solid-state overload relays (SSOLRs). It also contains assembly, modification, and parts ordering instructions. To identify parts, refer to Figure 1.

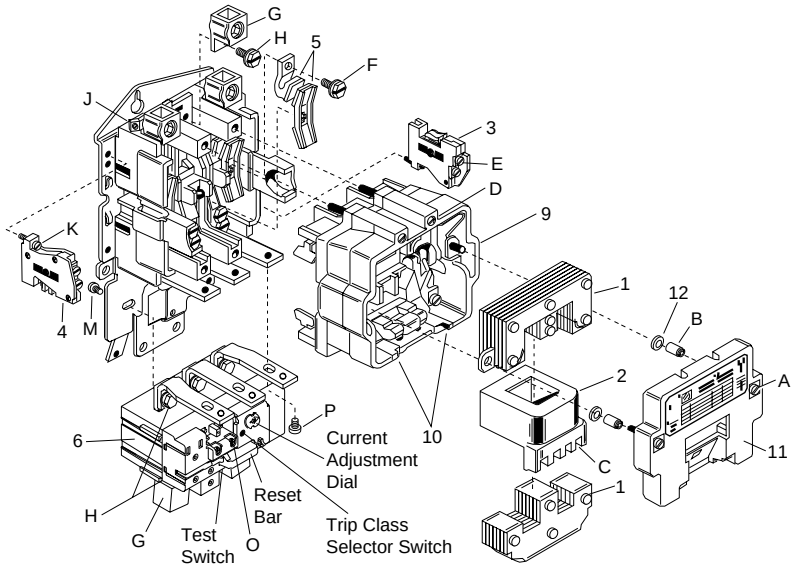

Figure 1: Contactor/Starter Assembly Drawing

⚠ DANGER

HAZARDOUS VOLTAGE

Disconnect all power before working on equipment.

Failure to follow this instruction will result in death or serious injury.

AUXILIARY CONTACTS

All contactors and starters are supplied with a normally open (N.O.) holding circuit contact as standard. Additional N.O. or normally closed (N.C.) auxiliary contacts can be installed in the field. Refer to Table 7 on page 7 for Class and Type. For application information, refer to bulletin 30072-013-21 or the Square D Digest.

COVER MOUNTED CONTROL UNITS

NEMA Type 1 general purpose enclosures with slip-on or hinged covers contain knockouts for field addition of the kits listed in Table 1.

Table 1: Field Modification Kits, Class 9999

Kit	**Type**	**Form** (Factory Mod.)
Push button, Start-Stop	SA3	A
Push button, On-Off	SA3	A3
Selector switch, Hand-Off-Auto	SC8	C
Red pilot light	SP28R	P1

WIRING

Use only copper wire on device power and control terminals.

Control Wiring

Pressure wire terminals are suitable for wire sizes #16–12 AWG, solid or stranded.

Power Wiring

Box lugs are suitable for wire sizes #8 AWG-250 kcmil.

Short-Circuit Withstand Ratings

The starter is suitable for use on a circuit capable of delivering not more than 10,000 rms symmetrical amperes, 600 volts maximum.

OVERLOAD RELAY

A base version MOTOR LOGIC three-phase SSOLR is provided standard (feature version is optional) on starters. It is designed to protect three-phase motors from overload, phase loss, and phase unbalance conditions. Some of the characteristics of the SSOLR are:

- 3:1 current adjustment range:
  30–90 A (90 A SSOLR)
  45–135 A (135 A SSOLR)
- –25 to +70 °C operating range
- Class 10 or Class 20 operation (optional on base version, switch selectable on feature version)
- Overload contacts—A600/P300 rated
- Auxiliary contacts (optional)—A600/P300 rated
- Permanent tamper guard
- Visible trip indication
- Self-powered
- Trip-free operation
- Thermal memory
- Power-on LED
- 50/60 Hz operation
- Accepts optional communication modules (feature version only)

Contact Ratings

The trip contacts and the optional auxiliary contacts (N.O. or N.C.) are rated A600/P300. These ratings are summarized in Table 2.

Table 2: SSOLR Contact Rating

NEMA Rating	Maximum Application Voltage	Thermal Continuous Current	Max. Current Make/Break	Rated Volt-Amperes	
				Make	Break
A600	600 VAC	10 A	[1],[3]	7200 VA	720 VA
P300	300 VDC	5 A	[2]	138 VA	138 VA

[1] For application voltages between 120 volts and 600 volts, the maximum make and break currents are obtained by dividing the rated volt-amperes by the application voltage. For application voltages below 120 volts, the maximum make current is the same as for 120 volts, and the maximum break current is obtained by dividing the break volt-amperes by the application voltage, but these currents must not exceed the thermal continuous current.

[2] For application voltages of 300 volts or less, the maximum make and break currents are obtained by dividing the rated volt-amperes by the application voltage, but the current values must not exceed the thermal continuous current.

[3] 35% power factor.

Adjustment

For continuous-rated motors having a service factor (SF) of 1.0, set the SSOLR's current adjustment dial to 90% of the motor's full-load current (MFLC). For continuous-rated motors having a service factor of 1.15 to 1.25, set the SSOLR's current adjustment dial to the MFLC.

Examples:

- MFLC = 60, SF = 1.0
  SSOLR dial setting = 90% of 60 = 54 A
- MFLC = 60, SF = 1.25
  SSOLR dial setting = 60 A

Trip Class Selection

On starters incorporating the optional feature version SSOLR, select the desired trip class by placing the SSOLR's trip class selector switch to the appropriate position (Class 10 or Class 20).

Trip Current Rating

The trip current rating is 1.25 times the SSOLR's current adjustment dial setting.Thus, the trip current ratings for the previous examples are approximately 67.5 A for the 1.0 service factor (1.25 x 54 = 67.5) and approximately 75 A for the 1.25 service factor (1.25 x 60 = 75).

Trip Curves

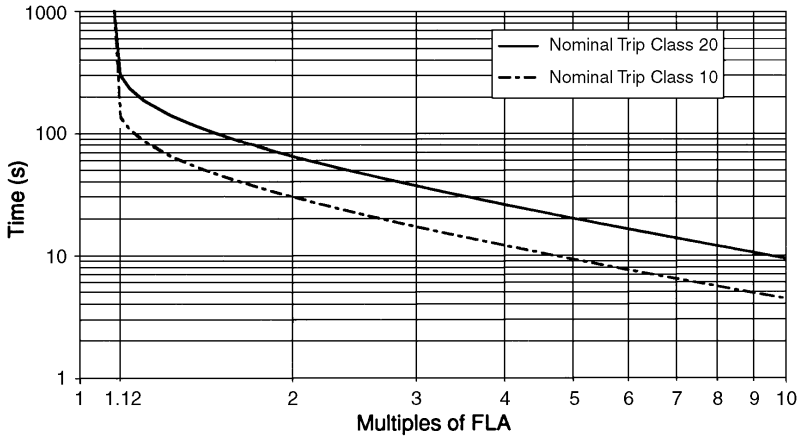

Figure 2: Trip Curves

OPERATION

The MOTOR LOGIC three-phase SSOLR monitors the motor current during start and run conditions, and it protects the motor against overload, phase loss, and phase unbalance. A mechanically-latched trip mechanism opens (unlatches) in the event of a protective trip, opening the N.C. *overload* contacts at terminals 95 and 96. A viewing window on the front of the SSOLR provides visible trip indication. A yellow marker appears when the device is tripped.

Overload

When the SSOLR detects motor currents in excess of 125% of the current adjustment dial setting, the *overload* contacts open and the *optional auxiliary* contacts change state (N.O. contacts close and N.C. contacts open). The time required for the SSOLR to trip depends upon:

- Current value
- Overload relay trip class (Class 10 or Class 20)
- Time elapsed since last trip

The SSOLR is designed to meet NEMA standards for a 1.15 service factor motor. This means that the SSOLR *must not trip for currents that are 100%* of its current adjustment dial setting, and that it *must trip for currents that are 125%* of its current adjustment dial setting. Refer to "Adjustment" on page 2 for applications involving motors with service factors other than 1.15.

The overload function of the SSOLR is an inverse time function—the higher the level of current causing the trip, the quicker the trip occurs.

Phase Loss/Phase Unbalance

The phase loss/phase unbalance circuitry can detect a phase loss and initiate a trip within three seconds. Phase loss detection extends to a phase loss in either the primary or the secondary of a wye-delta or delta-wye transformer. The circuitry also detects a phase unbalance and initiates a trip when any phase current drops 25% below or rises 25% above the average of the three phase currents.

In order to protect lightly loaded motors, the phase loss/phase unbalance detection circuitry is fully operational at currents as low as 75% of the minimum current adjustment dial setting.

Class 2 Ground Fault Detection (Feature Version Only)

Class 2 ground fault detection circuitry senses and inhibits phase loss/phase unbalance tripping of the SSOLR for current levels above 9 to 12 times the maximum FLA dial setting. The overload trip function is not affected. This feature provides an opportunity for circuit protection devices to interrupt these high currents.

Reset

The SSOLR is reset by depressing the reset bar on the front of the device. Since the SSOLR trip function is of the “trip-free” design, *it cannot be overridden by holding down the reset bar.*

For retrofit applications, a 9999 ER4 reset extender kit is available. With the reset extender kit installed, the reset mechanism height for the MOTOR LOGIC SSOLR is the same as for the Type S melting-alloy overload relay.

Power-On Indicator

A red LED indicates that the power necessary to operate the SSOLR’s protective circuitry is present. This power is derived from the current flowing in the motor leads. When sufficient power is extracted to enable normal operation, the LED blinks. It blinks faster as the current being monitored increases. No other source of power is needed to operate the SSOLR.

When a communication module is used in conjunction with the SSOLR (feature version only), power to the SSOLR is supplied by the communication module. In this mode, the LED on the SSOLR is continuously illuminated while the communication module is supplying power.

Functional Test

To test for proper operation of the overload contacts, deenergize the starter and disconnect the control circuit power. With a small, flat-blade screwdriver, slide the TEST switch located on the bottom of the SSOLR (Figure 1 on page 1) to the right. This operates the trip mechanism, opening the N.C. *overload* contacts at terminals 95 and 96. Verify proper operation of the *overload* contacts, then reset the device by depressing the red RESET bar. Reconnect the control circuit power and reenergize the starter as required.

TROUBLESHOOTING

Table 3: Troubleshooting Procedure

Problem	Possible Causes	Corrective Action
Overload trips on start-up (**greater** than 3 seconds)	Excessive motor load or motor is undersized	Remove excessive motor load or resize motor.
	Wrong overload trip class selected for the application	Change from Class 10 to Class 20.
	Incorrect overload current setting	Adjust overload current setting according to MFLC.
	Use of electronic DC injection brake	Do not use electronic DC injection brakes with the SSOLR.
Overload trips on start-up (**less** than 3 seconds)	Motor branch circuit fuse(s) blown	Replace blown motor branch fuse(s).
	Loose motor branch circuit connection	Tighten motor branch circuit connection.
	Starter incorrectly applied on motor circuit other than three phase	Select starter with overload relay designed for applications other than three phase.
	Voltage unbalance on feeder	Correct the voltage unbalance on feeder.
	Motor winding damage in one or more windings	Check motor winding impedance and rewind if necessary.
	Loss of phase in primary of wye-delta or delta-wye transformer	Replace blown fuse(s) or tighten loose connections.
Trips during normal running	Excessive motor load or motor is undersized	Remove excessive motor load or resize motor.
	Incorrect overload current setting	Adjust overload current setting according to MFLC.
	Use of electronic DC injection brake	Do not use electronic DC injection brakes with the SSOLR.

INSPECTING AND REPLACING CONTACTS

Discoloration and slight pitting do not harm contacts. Do not file contacts; this wastes contact material. Replace contacts (item 5 in Table 7) only when worn thin.

To inspect or replace contacts, disconnect all power. Do not remove any wiring. Loosen the four captive screws (item D) holding the contact actuator to the contact block. Lift the contact actuator to expose the contacts.

MANUAL OPERATION

⚠ WARNING

UNINTENTIONAL EQUIPMENT OPERATION

Disconnect all power before manually operating the equipment to avoid contact arcing and unexpected load energization.

Failure to follow this instruction can result in death, serious injury or equipment damage.

Manually operate the contactor or starter with a screwdriver by pushing down the contact carrier. There is a step on the outside of the contact carrier suitable for this use.

COIL REPLACEMENT

To remove the coil:

1. Loosen the two captive cover screws (item A in Figure 1).
2. Disconnect the wires from the coil terminals and remove the cover.
3. Loosen the two nuts (item B) holding the magnet in place.
4. Remove the coil and magnet.
5. Manually operate the contact carrier and remove the armature.
6. Separate the coil from the magnet.

To replace the coil:

1. Assemble the magnet, coil, and armature.
2. Manually operate the contact carrier and insert the complete unit.
3. Make sure that the magnet is pressed firmly against the backplate. Install the nuts (item B) and lock washers that hold the magnet in place.
4. Manually operate the device as described in “Manual Operation” to ensure that all parts function properly.
5. Install the cover.

ASSEMBLY INSTRUCTIONS

Table 4 and the device instructions contain factory-recommended torques for mechanical, electrical, and pressure wire connections. Use these torques to ensure proper device operation.

Table 4: Factory-Recommended Tightening Torques

Item	Description	Tightening Torque	
		lb-in	N•m
A	Cover screws (2 per cover)	24–28	2.7–3.2
B	Nuts (2 per magnet)	90–100	10.2–11.3
C	Coil terminal pressure wire connector (2 per coil)	9–12	1.0–1.4
D	Power plant screws (4 per device)	45–55	5.1–6.2
E	Auxiliary contact pressure wire connector (2 per contact)	9–12	1.0–1.4
F	Stationary contact fasteners (2 per pole)	110–120	12.4–13.6
G	Lug screws (2 per pole)	see device instructions	
H	Lug/connector retaining screw (3 per pole)	110–120	12.4–13.6
J	Control circuit pressure wire connector (1 per pole)	9–12	1.0–1.4
K	Auxiliary contact fastening screw (1 per contact)	13–16	1.5–1.8
M	SSOLR fastening screws (3 per overload block)	50–60	5.7–6.8
Not shown	Optional auxiliary contact fastening screw (1 per module) (adjacent to overload contact)	3–6	0.3–0.7
O	Overload contact pressure wire connector (2 per SSOLR)	9–12	1.0–1.4
P	Overload-to-contactor fasteners (3 per device)	85–100	9.6–11.3
Not Shown	Optional auxiliary contact pressure wire connector (2 per SSOLR) (adjacent to overload contact)	9–12	1.0–1.4

SHORT CIRCUIT PROTECTION

Provide branch-circuit overcurrent protection in accordance with the National Electrical Code. Do not exceed the maximum protective device ratings listed in Table 5.

Provide overcurrent protection for control circuits in accordance with the National Electrical Code and/or other applicable electrical codes. For applications requiring compliance with I.E.C. 947-5-1, use only Class CC fuses or better, 30 A maximum.

Table 5: Maximum Ampere Ratings

Maximum Voltage	Class K5, RK5 or RK1 Fuse [1]	Class J or T Fuse	Inverse-Time Circuit Breaker
600 V	200 A	400 A	225 A

[1] Time delay fuse may be required.

DISTANT CONTROL

Series impedance and shunt capacitance of the control circuit must be considered to assure proper operation of contactors/starters when controlled from remote operator stations. Depending upon the voltage, wire size, and number of control wires used, series impedance or shunt capacitance may limit the maximum distance of the wire run. If distances to start or stop stations are longer than those listed in Table 6, the wire-run configuration and materials must be analyzed. For further information, request data bulletin M379 from D-FAX (document #1188), the Square D website (www.squared.com), or your local Square D field office.

Table 6: Maximum Control Distance

Coil Voltage (60 Hz)	Maximum Control Distance			
	#14 AWG Copper Wire		#10 AWG Copper WIre	
	ft	m	ft	m
120 (2/3-wire)	230	70.1	540	164.6
240 (2-wire)	925	281.9	2100	640.1
240 (3-wire)	925	281.9	1100	335.3
480 (2-wire)	890	271.3	590	179.8
480 (3-wire)	445	135.6	295	89.9

ORDERING INSTRUCTIONS

Specify the quantity, the part number or class and type, and the description of the part, giving complete nameplate data of the device (for example, one armature and magnet kit 31091-831-50 for a Class 8536, Type SFO1, Series A, Form H20 starter).

Table 7: Parts List

Item	Description	Part Number	Qty
1	Armature and magnet kit	31091-831-50	1
2	Coil	See Table 8	1
3	Auxiliary contact N.O. N.C.	Class 9999: Type SX6 Type SX7	 — —
4	Holding circuit contact, 1 N.O.	Class 9999, Type SX6	1
5	Contact kit	Class 9998, Type SL9	1
6 Not shown Not shown	MOTOR LOGIC SSOLR SSOLR auxiliary contact N.O. or N.C. (field convertible) Reset extender kit	See Table 9 Class 9999, Type AC04 Class 9999, Type ER4	1 — —
9	Housing-barrier assembly (included item 10)	31091-025-52	1
10	Drop-out pad	31091-157-01	2
11	Cover	31091-049-01	1
12	Washer	23701-00200	2
A	Cover screw	21916-16281	2
B	Nut	31091-121-01	2
G	Lug assembly	25050-34404	6
H	Lug/connector retaining screw 5/16-18 X 5/8	21944-22201	9
P	Overload-to-contactor fastening screw, 5/16-18 X 1/2	21906-22162	3

The complete part number of the magnet coil consists of the prefix followed by the suffix (e.g.: for 120 V 60 Hz coil, select 31091-400-38). When ordering replacement coils, give the part number, voltage, and frequency of the coil being replaced.

Table 8: Magnet Coil Part Numbers

Coil Prefix	Hz	Coil Suffix										Coil VA	
		110 V	120 V	208 V	220 V	240 V	277 V	380 V	440 V	480 V	550 V	600 V	Inrush	Sealed
31091-400	60	Use 120 V	38	44	Use 240 V	47	49	53	Use 480 V	57	Use 600 V	60	1185	85
	50	38	39	—	47	48	—	54	57	58	60	61	1260	89

The complete part number of the SSOLR consists of the Class and Type number (e.g.: Class 9065, Type SR410).

Table 9: Class 9065 SSOLR Type Numbers

	FLC Range	Trip Class 10	Trip Class 20	Trip Class 10/20 [1]
Starter-Mounted SSOLR	30–90 A 45–135 A	SR314 SR410	SR324 SR420	ST324 ST420
Separately Mounted SSOLR	30–90 A 45–135 A	SS314 SS410	SS324 SS420	SF324 SF420

[1] Feature version, with selectable trip class and capable of accepting communication modules.

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