S801+ Soft Starter

User Manual

Effective November 2012
New Information

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Powering Business Worldwide

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Cover Photo: S801+ Soft Starters

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Safety

Definitions and Symbols

⚠ WARNING

This symbol indicates high voltage. It calls your attention to items or operations that could be dangerous to you and other persons operating this equipment. Read the message and follow the instructions carefully.

⚠

This symbol is the "Safety Alert Symbol." It occurs with either of two signal words: CAUTION or WARNING, as described below.

⚠ WARNING

Indicates a potentially hazardous situation which, if not avoided, can result in serious injury or death.

⚠ CAUTION

Indicates a potentially hazardous situation which, if not avoided, can result in minor to moderate injury, or serious damage to the product. The situation described in the CAUTION may, if not avoided, lead to serious results. Important safety measures are described in CAUTION (as well as WARNING).

Hazardous High Voltage

⚠ WARNING

Motor control equipment and electronic controllers are connected to hazardous line voltages. When servicing drives and electronic controllers, there may be exposed components with housings or protrusions at or above line potential. Extreme care should be taken to protect against shock.

Stand on an insulating pad and make it a habit to use only one hand when checking components. Always work with another person in case an emergency occurs. Disconnect power before checking controllers or performing maintenance. Be sure equipment is properly grounded. Wear safety glasses whenever working on electronic controllers or rotating machinery.

Warnings and Cautions

This manual contains clearly marked cautions and warnings which are intended for your personal safety and to avoid any unintentional damage to the product or connected appliances.

Please read the information included in cautions and warnings carefully.

⚠ CAUTION

Unit may weigh up to 103 pounds. Use suitable lifting device.

⚠ WARNING

Hazardous voltage can cause electric shock and burns. To avoid shock hazard, disconnect all power to the controller, motor or other control devices before any work is performed on this equipment. Failure to do so will result in personal injury, death or substantial property damage.

Do not apply a disconnect device on the output of the S801+ soft starter unless a means to turn off the soft starter when disconnect switch is open is used. Opening disconnect while the soft starter is operating may cause a malfunction. Closing disconnect switch while the soft starter is operating will result in a soft starter failure and potential equipment damage and personnel hazard.

⚠ CAUTION

Only apply 24 Vdc to Control Terminal Block. All control wiring is 22–12 AWG (0.33–2.5 mm^2).

⚠ CAUTION

If the AUTO Reset mode setting is used, CAUTION must be exercised to assure that any restart occurs in the safe manner.

⚠ CAUTION

If the AUTO Reset mode setting is used with level sensing, CAUTION must be exercised to assure that any restart occurs in a safe manner. Motor restart may occur immediately and unexpectedly after any fault condition has cleared.

⚠ **CAUTION**

In the AUTO Reset mode, CAUTION must be exercised to assure that any restart occurs in a safe manner.

⚠ **WARNING**

Make sure you read and understand the procedures in this manual before you attempt to set up or operate the equipment.

⚠ **WARNING**

Do not work on energized equipment unless absolutely required. If the troubleshooting procedure requires equipment to be energized, all work must be performed by properly qualified personnel, following appropriate safety practices and precautionary measures.

S801+ Soft Starter

Introduction

Overview

The Eaton S801+ Soft Starter from Eaton's electrical business is an electronic, self-contained, panel- or enclosure-mounted motor soft-starting device. It is intended to provide three-phase induction motors with a smooth start, both mechanically and electrically. The S801+ Soft Starters utilize six SCRs connected in a full wave power bridge. Varying the SCR conduction period controls the voltage applied to the motor. This in turn controls the torque developed by the motor. After the motor reaches speed, internal contacts are closed to bypass the SCRs.

The S801+ Soft Starter utilizes a Control Interface Module (CIM) that allows the user to configure the device and evaluate fault codes for troubleshooting.

The S801+ is designed to fulfill the industrial service requirements for applications such as Chillers, Pumps and Machine Tools that require less than 100% of the motor's rated starting torque for worst case starting condition.

The S801+ meets all relevant specifications set forth by UL 508, CSA 22.2-14-1995 IEC 60947-4-2, and CCC GB14048.

General Appearance Notes

Eaton S801+ Soft Starter

Line Input

Mounting Base

Base

Control Interface Module (CIM)

DIP Switch S1

Load Output

Factory Use Only

Detachable 12-Pin Locking Control Terminal Block
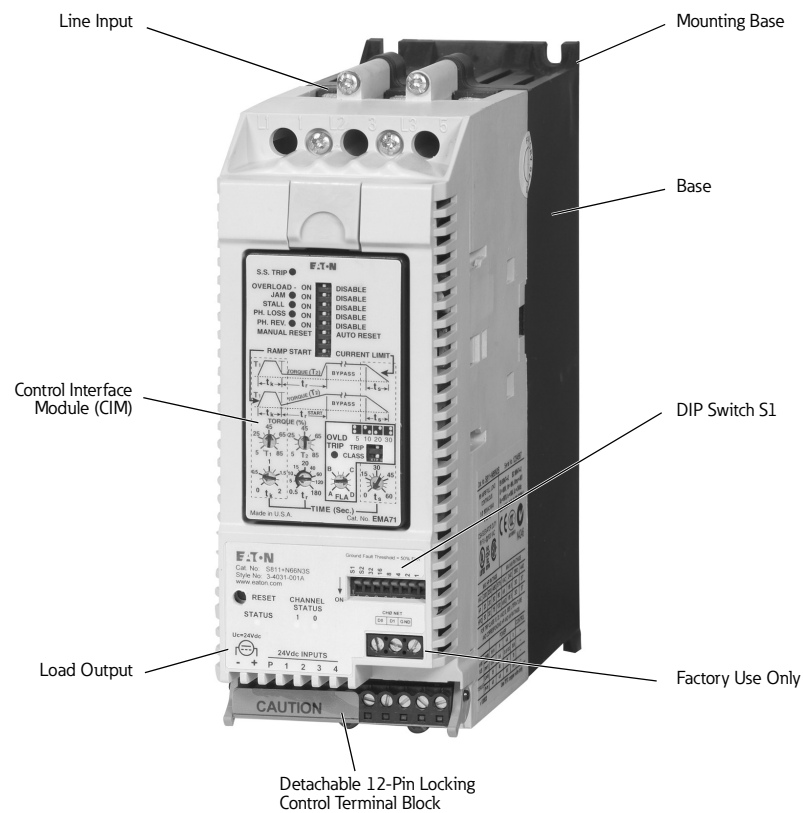
Standards and Certifications

- UL 508
- CSA 22.2-14-1995
- IEC 60947-4-2
- CCC GB14048

RF Susceptibility Statement

It is possible, in the presence of strong RF fields, and at specific RF frequencies, that this device could indicate an increase of up to 40V in the measured line voltages in the 370 to 420 kHz frequency range; or an increase of up to 10% (FLA) of the measured load currents in the 111 to 132 MHz and 152 to 155 MHz frequency range. Should this occur, and affect the functions of the required motor protection settings, refer to the troubleshooting section of this manual.

CE Conformance

EMC Conformance

Immunity	Severity Level
Electrostatic Discharge IEC 61000-4-2	4 kV contact discharge
	8 kV air discharge
Electromagnetic Field IEC 61000-4-3	10 V/m
	80–1000 MHz
	2 angles
Fast Transient Bursts IEC 61000-4-4	2 kV, 5 kHz rep, 2 min. intervals
1.2/50 uS to 8/20 uS Surges IEC61000-4-5	2 kV Line to earth
	1 kV Line to Line
	1 minute intervals
Conducted RF IEC 61000-4-6	10 V rms
	0.15 to 80 MHz
50 Hz Magnetic Field IEC 61000-4-8	N/A
Voltage dips Interrupt IEC 61000-4-11	30% dip at 10 mS
	60% dip at 100 mS
	100% dip at 5 S
Emissions	
Radiated	EN 55011, Class A
Conducted	EN 55011, Class A

1. The 24 Vdc power supply must be grounded.

2. Add ferrite, Fair-Rite #0446176451 to DC Control Power Leads and Control I/O Leads (all through one ferrite) at S801+.

Technical Data and Specifications

Environmental

Environmental Specifications

Description	Specification
Temperature range	
Operating	−40° to 122°F (−40° to 50°C)
Storage	−58° to 158°F (−50° to 70°C)
Elevation	Up to 6600 ft (2000m) above 6600 ft (2000m), derate 0.5% per 330 ft (100m)
Humidity	Functional to 95% noncondensing
Operating orientation	Any
Pollution degree IEC 60947-1	3
Shock resistance	15g in any direction
Vibration resistance	
Operating	3g in any direction
Non-Operating	3g in any direction

Physical

Unit Weight and Dimensions

Catalog Number	Unit Weight Lbs (kg)		Product Size—Inches (mm)						
			Length		Width		Height		
S801+N37…	5.8	(2.6)	7.37	(187.2)	2.66	(67.6)	6.45	(163.9)
S801+N66…	5.8	(2.6)	7.37	(187.2)	2.66	(67.6)	6.45	(163.9)
S801+R10…	10.5	(4.8)	7.92	(201.2)	4.38	(111.3)	6.64	(168.6)
S801+R13…	10.5	(4.8)	7.92	(201.2)	4.38	(111.3)	6.64	(168.6)
S801+T18…	41	(18.6)	12.71	(322.9)	7.65	(194.4)	6.47	(164.4)
S801+T24…	41	(18.6)	12.71	(322.9)	7.65	(194.4)	6.47	(164.4)
S801+T30…	41	(18.6)	12.71	(322.9)	7.65	(194.4)	6.47	(164.4)
S801+U36…	41	(18.6)	12.72	(323.1)	7.73	(196.3)	7.16	(196.3)
S801+U42…	41	(18.6)	12.72	(323.1)	7.73	(196.3)	7.16	(196.3)
S801+U50…	41	(18.6)	12.72	(323.1)	7.73	(196.3)	7.16	(196.3)
S801+V36…	91	(41.4)	16.57	(420.8)	11.05	(280.6)	7.39	(187.8)
S801+V42…	91	(41.4)	16.57	(420.8)	11.05	(280.6)	7.39	(187.8)
S801+V50…	91	(41.4)	16.57	(420.8)	11.05	(280.6)	7.39	(187.8)
S801+V65…	91	(41.4)	16.57	(420.8)	11.05	(280.6)	7.39	(187.8)
S801+V72…	91	(41.4)	16.57	(420.8)	11.05	(280.6)	7.39	(187.8)
S801+V85…	91	(41.4)	16.57	(420.8)	11.05	(280.6)	7.39	(187.8)
S801+V10…	91	(41.4)	16.57	(420.8)	11.05	(280.6)	7.39	(187.8)

Short-Circuit Ratings—Component

Frame Size	Fuses	Circuit Breaker	Voltage	SCCR Rating (A)
S801+N…	J	HFD	600	10 kA
S801+R…	RK5/J	HFD,HKD	600	10 kA
S801+T…	RK5/J	HLD	600	18 kA
S801+U…	RK5/J	HLD	600	30 kA
S801+V…	L	HND, RD	600	42 kA

Short-Circuit Ratings—Enclosed Control (Fuses)

Frame Size	Fuses	Voltage	SCCR Rating (A)	Switch Size (max), A	Switch Type
S801+N…	J	600	100 kA	100	K
S801+R…	RK5/J	600	100 kA	200	K
S801+T…	RK5/J	600	100 kA	600	K
S801+U…	RK5/J	600	100 kA	600	K
S801+V36…	RK5/J	600	100 kA	600	K
S801+V42…	L	600	100 kA	800	K
S801+V50…	L	600	100 kA	800	K
S801+V72…	L	600	100 kA	1200	ND
S801+V85…	L	600	100 kA	1200	ND
S801+V10…	L	600	100 kA	2000	K

Short-Circuit Ratings—Enclosed Control (Breaker)

Frame Size	Thermal Magnetic Circuit Breaker	Motor Circuit Protector	Voltage	SCCR Rating (A)	Max Size (breaker) A
S801+N…	HFD	HMCP	600	10kA	150
S801+R…	HFD,HKD	HMCP	600	10kA	150, 300
S801+T…	HLD	HMCP	600	18kA	600
S801+U…	HLD	HMCP	600	18kA	600
S801+V…	HND, RD	HMCP	600	35kA, 42kA	1000, 2000

Note: For more details on short-circuit protector selections and enclosure sizing, please refer to the linked spreadsheet on UL's website at: http://www.ul.com/global/documents/offerings/industries/buildingmaterials/industrialcontrolpanels/shortcut.Eaton.xls

Note: Suitable for use on a circuit capable of delivering not more than 100,000 rms symmetrical amperes, 600 volts maximum when protected by Class RK5 fuses.

Note: Suitable for use on a circuit capable of delivering not more than 65,000 rms symmetrical amperes, 480 volts maximum when protected by a circuit breaker.

Receipt/Unpacking

General

Upon receipt of the unit, verify that the catalog number and unit options stated on the shipping container match those stated on the order/purchase form.

Inspect the equipment upon delivery. Report any crate or carton damage to the carrier prior to accepting the delivery. Have this information noted on the freight bill. Eaton is not responsible for damage incurred in shipping.

Unpacking

Carefully remove the unit from the shipping container. Check the unit for any signs of shipping damage. If damage is found after unpacking, report it to the freight company. Retain the packaging materials for carrier to review.

Verify that the unit's catalog number and options match those stated on the order/purchase form.

⚠ CAUTION

Unit may weigh up to 103 pounds. Use suitable lifting device.

Storage

It is recommended that the unit be stored in its original shipping box/crate until it is to be installed.

The unit should be stored in a location where:

- The ambient temperature is –58° to 158°F (–50° to 70°C)

- The relative humidity is 0–95%, non-condensing

- The environment is dry, clean and non-corrosive

- The unit will not be subjected to shock in excess of 15g's and/or vibration exceeding 3g in any direction.

Shipping

S801+Soft Starters are to be shipped in packaging that adequately protects the unit.

S801+ units installed in an OEM system as a mounted assembly in a cabinet or panel in enclosed control systems are to be adequately secured and shipped via Air-Ride carrier to prevent damage from excessive shock or vibration during shipment.

Installation

Mounting

The S801+ does not require any special tools for mounting operations.

To aid with panel layout, refer to the dimension drawings on **Pages 7**–**9**. Drill holes per mounting hole location as shown. Mounting hardware may utilize either tapped holes in the panel or lock washers and nuts to secure the soft starter.

To mount the unit, use all the hardware specified in the table below.

Required Mounting Hardware

Frame Size	Bolt Dia.	Length— Minimum	Grade	Quantity— Minimum	Torque— Lb-in (Nm)
S801+N…	#10-32	0.5	5	4	15 (1.7)
S801+R…	1/4 in	0.625	5	4	25 (2.8)
S801+T…	1/4 in	0.625	5	6	30 (3.4)
S801+U…	1/4 in	0.625	5	6	30 (3.4)
S801+V…	1/4 in	1.50	8	8	50 (5.6)

Note: See **Page 3** for Weight Support Requirements.

Dimensions

Approximate Dimensions in inches (mm)

S801+N…
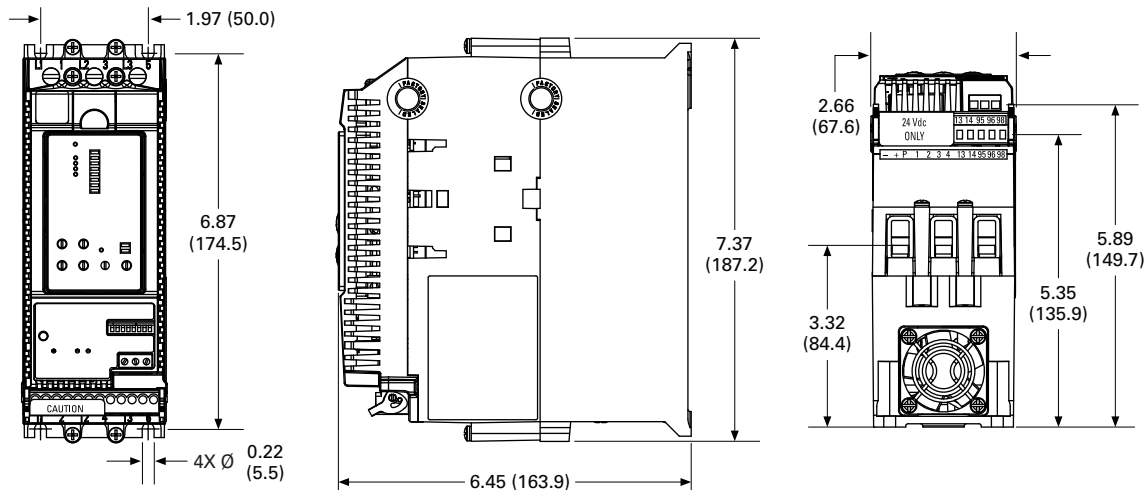
S801+R…
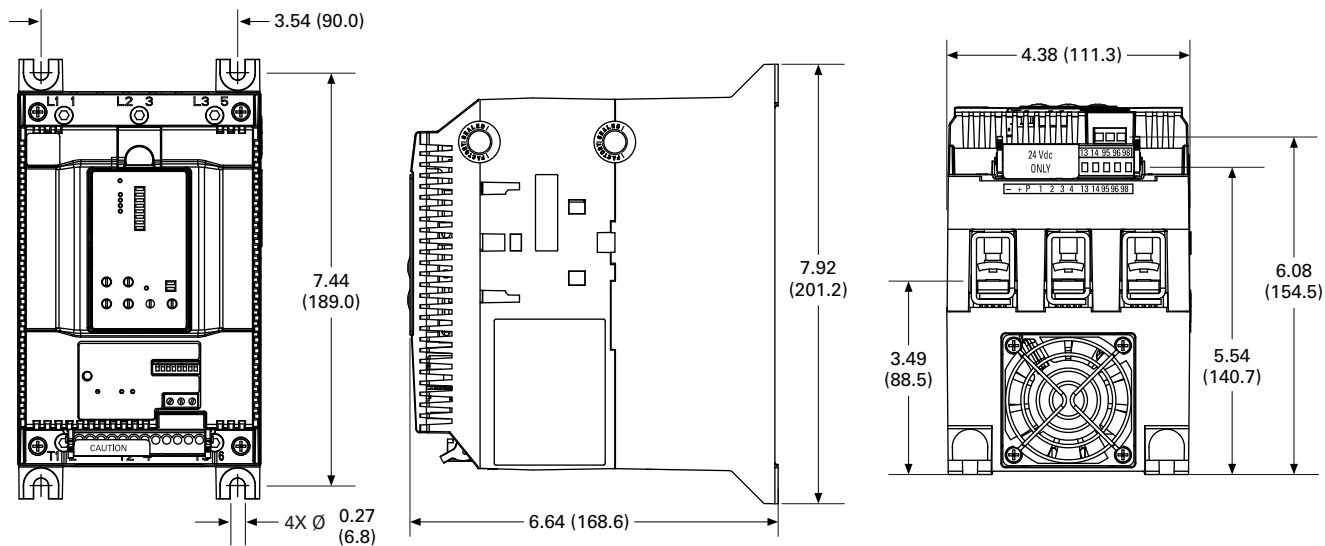
Installation

Approximate Dimensions in inches (mm)

S801+T...

6.47 (164.4)

7.65 (194.4)

11.77 (299.0)

12.71 (322.9)

5.95 (151.1)

5.40 (137.3)

6X Ø 0.28 (7.1)

2.95 (75.0)

5.91 (150.0)

S801+U...

7.16 (181.8)

7.73 (196.3)

11.77 (299.0)

12.72 (323.1)

6.64 (168.6)

6.09 (154.8)

6X Ø 0.28 (7.1)

2.60 (66.0)

5.20 (132.0)

Approximate Dimensions in inches (mm)

S801+V…

2X 0.236 (6.00)

15.63 (397.0)

6.79 (172.5)

3.05 (77.5)

9.84 (250.0)

16.57 (420.8)

11.05 (280.6)

7.39 (187.8)

6.50 (165.1)

4X Ø 0.2650 (6.731)
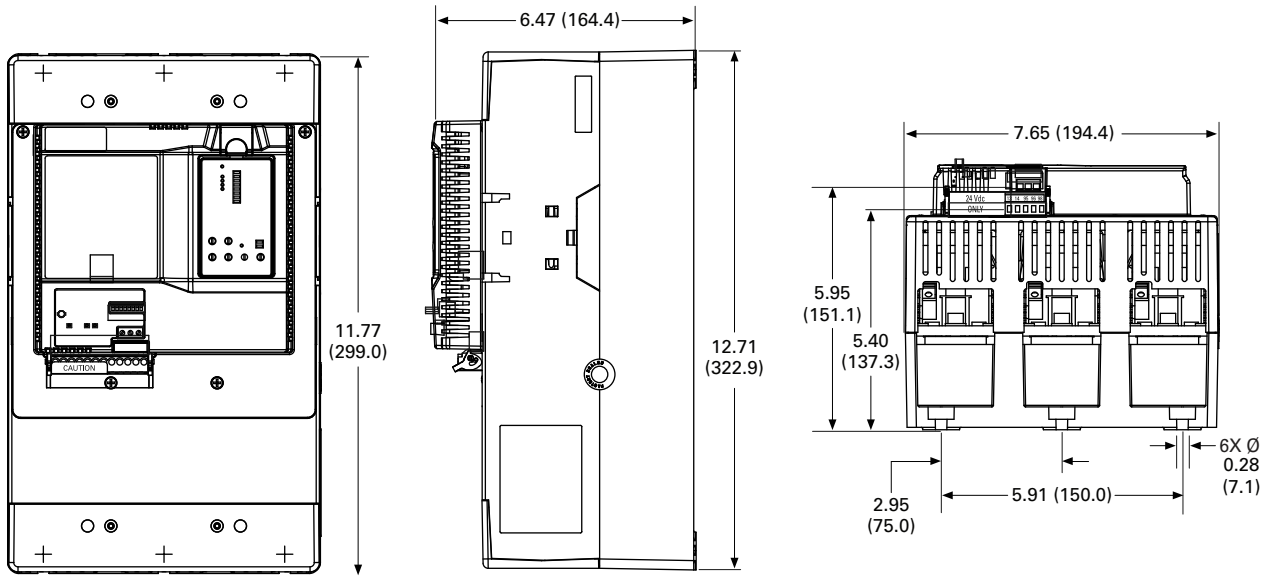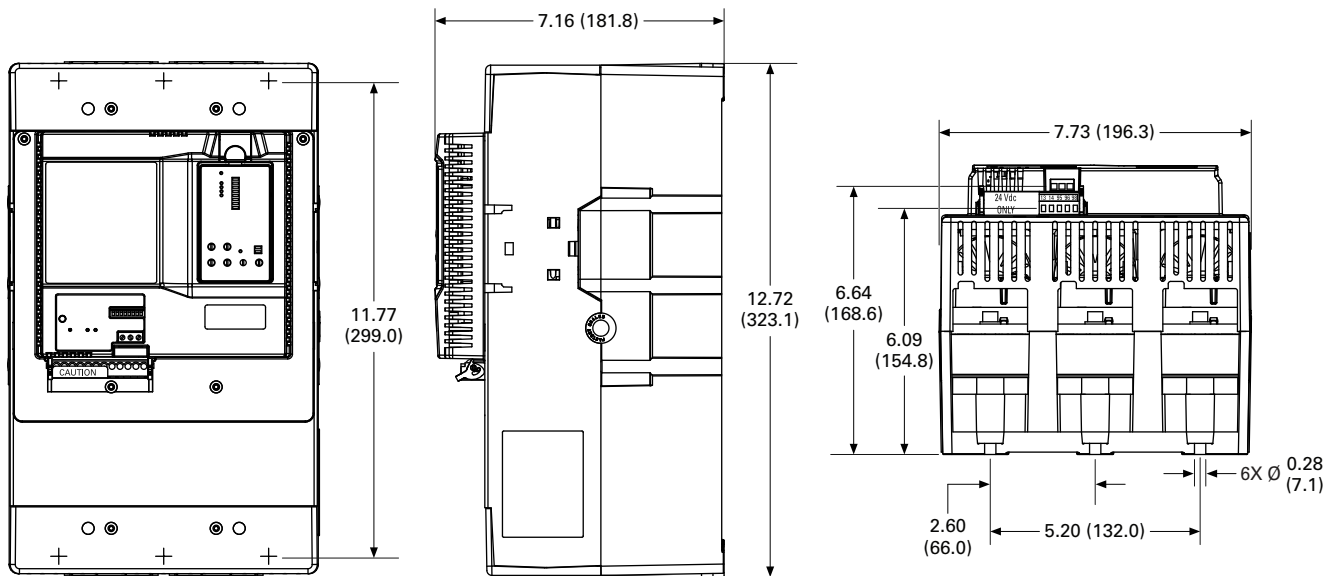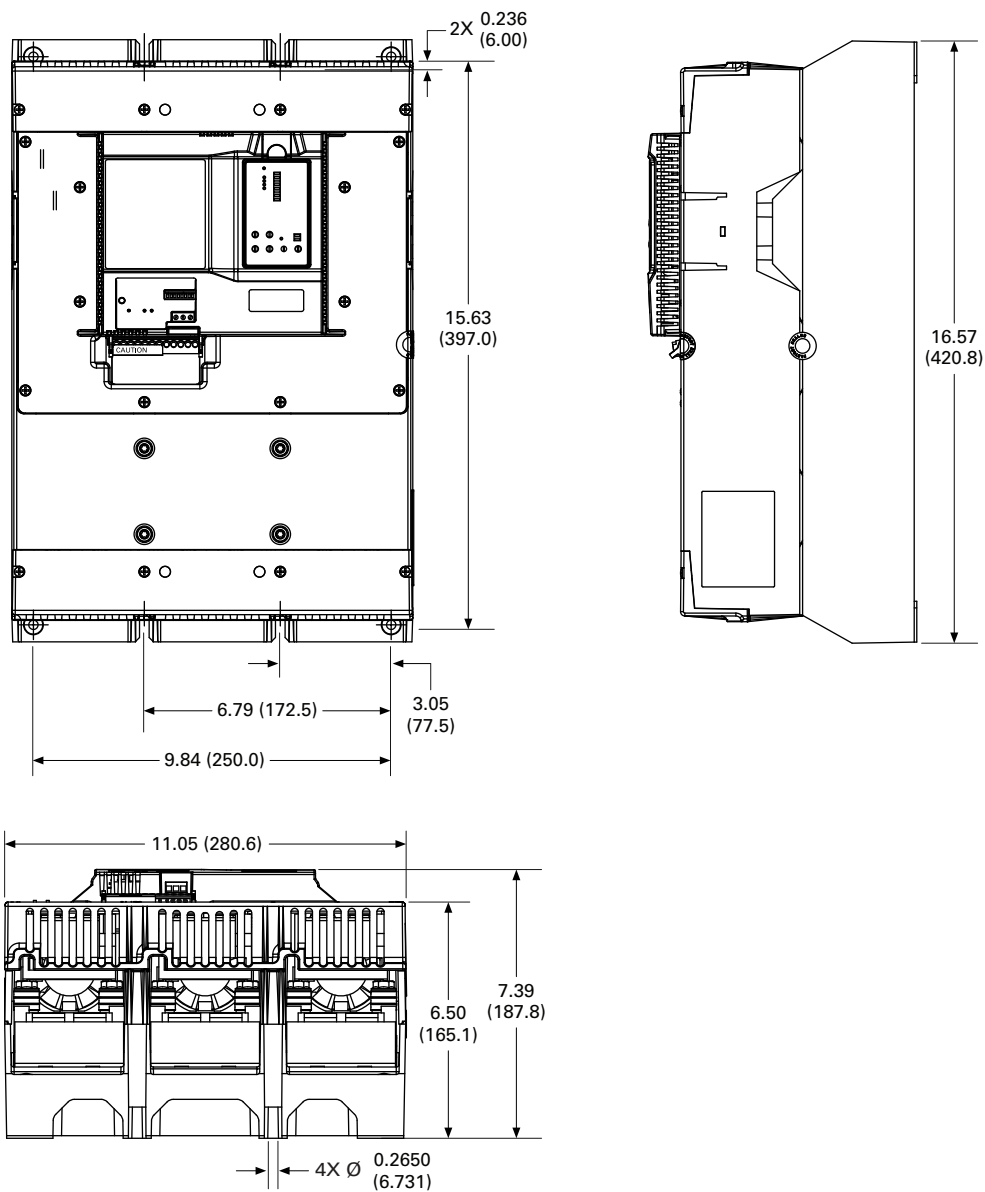
Power Wiring

Using the wiring diagrams in below as guides, connect the Line and Motor wiring in accordance with appropriate local and national codes.

Note: To provide optimum motor protection the Line and Motor power wiring should be tightly bundled and run perpendicular to the orientation of the S801+.

⚠ WARNING

Hazardous voltage can cause electric shock and burns. To avoid shock hazard, disconnect all power to the controller, motor or other control devices before any work is performed on this equipment. Failure to do so will result in personal injury, death or substantial property damage.

Do not apply a disconnect device on the output of the S801+ Soft Starter unless a means to turn off the soft starter when disconnect switch is open is utilized. Opening a disconnect while the Soft Starter is operating may cause a malfunction. Closing a disconnect switch while the Soft Starter is operating will result in a soft starter failure and potential equipment damage and personnel hazard.

Note: Short circuit protection must be applied on the line side of the soft starter.

The S801+ is wired in an inline configuration.

By factory default, the S801+ is to be connected with an ABC phase rotation on the incoming power wiring. If the motor turns in the incorrect direction upon energization, exchange two phases at the motor terminal box or at the output terminals of the soft starter. Changing the input wiring may cause a voltage phase reversal trip.

⚠ IMPORTANT

A reversing contactor must never be switched while the soft starter is operating. In order to gain the full benefit of the S801+ with a reversing contactor, the S801+ needs to be OFF when switching the direction of the motor. The soft starter control settings must account for catching a motor spinning in the opposite direction upon soft restarts. The time required for slowing the motor to a stop and then ramping up to speed in the opposite direction adds to the overall starting time. This condition will also impact the overload protection setting.

See the Motor/Application Considerations in **Appendix D** for information on typical motor winding configurations.

Inline Connected Soft Starter Power Wiring Diagram S801+…N3S
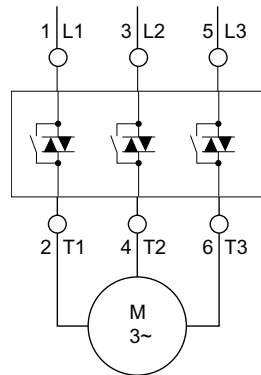
Line and Load Power Wiring

S801+N… and S801+R… soft starters utilize box lugs to accomplish line and load power wiring. Refer to the table below for wire sizing requirements.

Line and Load Power Wiring, S801+N… and S801+R…

Catalog Number	Conductor Size ①	Number of Conductors	Torque Lb-in (Nm)
S801+N…	2 AWG	1	50 (5.6)
	4–6 AWG		45 (5.0)
	8 AWG		40 (4.5)
	10–14 AWG		35 (4.0)
S801+R…	14–8 AWG	1	90–100 (10.1–11.3)
	6–4 AWG		
	3–3/0 AWG		
	6–4 AWG		
	3–3/0 AWG		

Note
① Wire sizes Cu 75°C only.

Line and Load Power Wiring, S801+T…, S801+U…, and S801+V…

Catalog Number	Conductor Size	Number of Conductors	Torque Lb-in (Nm)	Lug Kit	Kits Required
S801+T…	4–1/0 MCM	2	250 (28.3)	EML22	2
	4/0–500 MCM	1	250 (28.3)	EML23	
	4/0–500 MCM	2 ②	250 (28.3)	EML24	
	2/0–300 MCM	1	225 (25.5)	EML25	
	2/0–300 MCM	2	225 (25.5)	EML26	
S801+U…	4–1/0 MCM	2	250 (28.3)	EML22	2
	4/0–500 MCM	1	250 (28.3)	EML23	
	4/0–500 MCM	2 ②	250 (28.3)	EML24	
	2/0–300 MCM	1	225 (25.5)	EML25	
	2/0–300 MCM	2	225 (25.5)	EML26	
S801+V…	4/0–500 MCM	2 ②	250 (28.3)	EML28	2
	4/0–500 MCM	4 ②	250 (28.3)	EML30	
	4/0–500 MCM	6 ②③	250 (28.3)	EML32	
	2/0–300 MCM	4	225 (25.5)	EML33	

Notes

② CSA approved 350–500 MCM.

③ Requires special lug cover.

Note: S801+T…, S801+U…, and S801+V… units are supplied standard without lugs. One kit consists of required hardware to make connections for three (3) phases on either line or load side of the soft starter.

S801+V10… Installation Requirements

1. Install the device in a minimum enclosure size 30 ft^3.

2. Two (2) forced air ventilation fans with a minimum 500 ft^3/min, at a location for "air in"—bottom right or left corner and "air out"—opposite upper right or left corner.

3. RD circuit breaker.

4. For power wiring: Use four (4) 500 kcmil cables for each phase between RD circuit breaker and soft starter.

    OPTIONAL: Two (2) 3 in x 1/4 in bus with a 1/4 in spacer per terminal.

    Note: See the figure below for alternative layouts.

5. Line and load service entrance wiring must not cross in the enclosure.

Power Wiring Alternatives
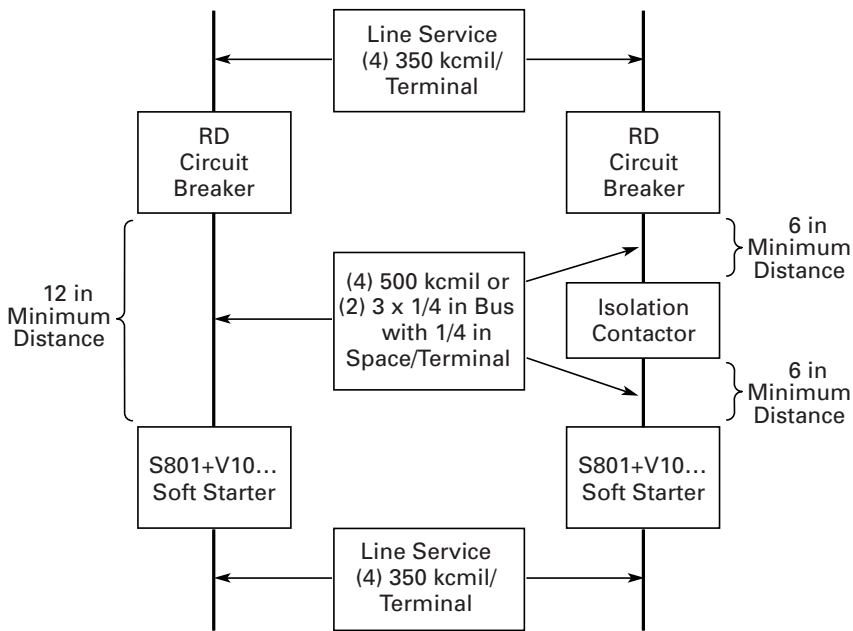
Lug Installation, S801+N… and S801+R…

Wire the appropriate line and load conductors to the Soft starter in accordance with federal and local codes. Torque fasteners per table on **Page 11**.

Lug Installation, S801+T…, S801+U…, and S801+V… Frames

1. Remove line and load terminal lug covers by removing the screws that hold each cover onto the soft starter.

2. With screws removed, slide the covers off the unit.

3. Position lugs and install lug mounting hardware according to the instructions included in the kit. Tighten lug mounting hardware included in the kit to 120 Lb-in (13.6 Nm).

4. Install line and load conductors and torque hardware in accordance with table on **Page 11**.

5. Slide the line and load lug covers back into their original positions.

6. Secure with the screws previously removed.

S801+V… Shown with Terminal Cover Removed and EML30 Lug Kit Installed on Load Side
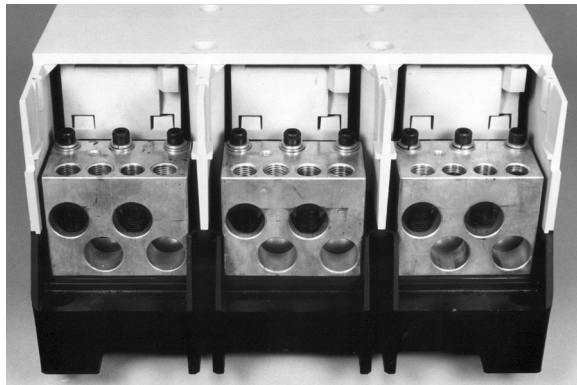
Control Wiring Inputs

Control wiring is connected to the S801+ by one (1) terminal block and one (1) RJ12 connection located at the front of the unit.

Control Terminal Block—A 12 position connector is utilized to make connections for 24 Vdc control power, soft starter control function commands, and Auxiliary Relay functions.

A 3 position screw connector utilized to make connections for factory use only and is not utilized with S801+ operations.

User Interface Module Terminal Block—An RJ12 connection utilized to make the connection to the Control Interface Module (CIM).

Control Terminal Block

DIP Switch

Switch S1 selects Edge (ON) or Level (OFF) sense detection on the Run1 input on control block Terminal 1 (default).

Switch S2 is not functional on the S801+.

Switches 32–1 are not functional on the S801+.

DIP Switch
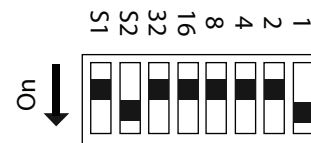
Additional information on Level and Edge Sensing may be found in Functional Description starting on **Page 23**.

Control Wiring Terminal Blocks

> ⚠ **CAUTION**
>
> Only apply 24 Vdc to Control Power Terminal Block. All control wiring is 22–12 AWG (0.33–2.5 mm^2).

> ⚠ **CAUTION**
>
> Do not apply 120 Vac to Control Power Terminal Block.

> ⚠ **CAUTION**
>
> Do not apply 24 Vdc to Network communications Terminal Block.

Terminal Block Wiring Capacity

Wire Size	Number of Conductors	Torque Requirements
22–14 AWG (0.33–2.5 mm^2)	2	3.5 Lb-in (0.4 Nm)
14–12 AWG (2.5–4.0 mm^2)	1	3.5 Lb-in (0.4 Nm)

S801+ Control Terminal Block Wiring

Control Terminal Block—Descriptions

The S801+ Soft Starter has the following control terminal block control input and aux relay functions:

Terminal Block Functions

Position	Function	Notes
"–"	24 Vdc power "–"	Power supply negative
"+"	24 Vdc power "+"	Power supply positive
P	Permissive	Hardwired STOP command
1	Start	Hardwired START command
2	Jog	Jog
3	Overload	Disable on START
4	Reset	Fault reset
13	Relay, NO contact	Changes state when unit achieves internal bypass operation
14		
95	Fault relay	Changes state when unit fault trips
96		
98		

"–" and "+" Control Power—Connect power supply negative to pin "–" and to system ground. Connect +24 Vdc output to pin "+". Verify that the 24 Vdc control power source has the recommended capacity. Minimum control voltage is 18 Vdc.

Note: To avoid voltage drop during bypass contactor inrush, a minimum of 14 AWG (2.5 mm^2) wire should be used between the power supply and the "+" and "–" inputs at the S801+ terminal block.

P-Permissive—Control Input 24 Vdc only (maintained). Permissive must be energized (+24 Vdc) to enable START or RUN operation of the unit from any source. If power is removed from the permissive circuit at any time, the unit will begin a STOP command. If a soft stop is selected, the soft stop will begin and run to time-out.

1–START—Control Input 24 Vdc only (momentary input with 3 wire control, maintained for 2 wire control). Applying 24 Vdc to terminal 1 while P is energized will initiate a START command. As shipped from the factory this input is "level" sensitive.

2–JOG—Control Input 24 Vdc only (momentary). Input 2 is JOG. Applying 24 Vdc to this input while P is energized will initiate a JOG. JOG will follow the selected ramp profile as long as the signal remains present. The unit will not close the internal bypass contactors.

3–Disable OL on Strt—Momentary application of +24 Vdc to Terminal 3 prior to a start raises the overload fault trip point to 125% of the maximum rating of the frame size for the next start only.

4–RESET—Fault RESET Control Input 24 Vdc only (momentary). Input 4 is Fault RESET. Energizing this input will reset a fault only if no active faults are present.

Using Auxiliary Contacts

Often these contacts are used as shown in the illustrations on this page with indicating lamps. In some installations the user may wish to use an electromagnetic relay for indication of the status at a remote location for use by a programmable controller (PLC), or in a 120 Vac control circuit.

If the S801+ Soft Starter is subject to mechanical shock during operation, it is possible that these contacts may momentarily open, causing nuisance fault tripping of down stream devices. When used with an indicating lamp, a momentary contact opening would not be observed. In order to assure proper application, it is suggested that the following recommendations be implemented:

PLC Interface—It is suggested that a 20 ms delay be programmed to assure the contact status before a change of status is indicated. The application and the environmental issues will determine the exact requirements.

120 Vac Signal Control—When a relay is used in conjunction with an electronic control, it is highly recommended that a noise suppressor be used across the relay coil. In the case of an AC coil, the noise suppressor is made up of a series connected resistor and capacitor as shown in the figure below. Usually the delay in the relay opening is very small, so if the system is subject to shock, a delay should be added in the external control before the contact change of state is recognized. The resistor is rated 100 ohms at 0.5 watts. The capacitor is 0.25 µF at 250 Vac.

120 Vac Control
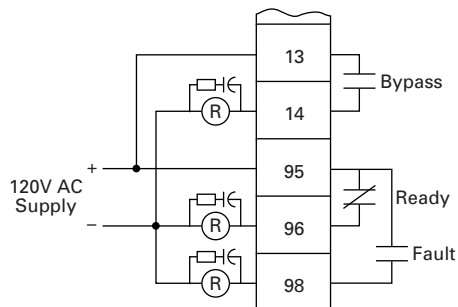
24 Vdc Signal Control—When a relay is used in conjunction with an electronic control, it is highly recommended that a noise suppression/snubber diode be placed across the relay coil as shown below. This diode offers two benefits. First, the suppression of any electrical noise generated when the relay coil is de-energized. Second, the diode delays the opening of the relay slightly as it dissipates the energy stored in the relay coil. This delay is often long enough to compensate for the potential effects of a mechanical shock opening the control contact. A typical suppression diode is a 1N4001.

24 Vdc Control
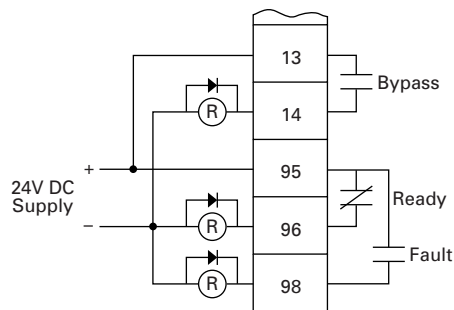
Typical Control Wiring Diagrams
Each diagram illustrates a typical wiring scheme for the
options described. The additional components shown on the
diagrams are not included, but may be purchased from
Eaton.

Basic Connection Diagram for 3-Wire Pushbutton
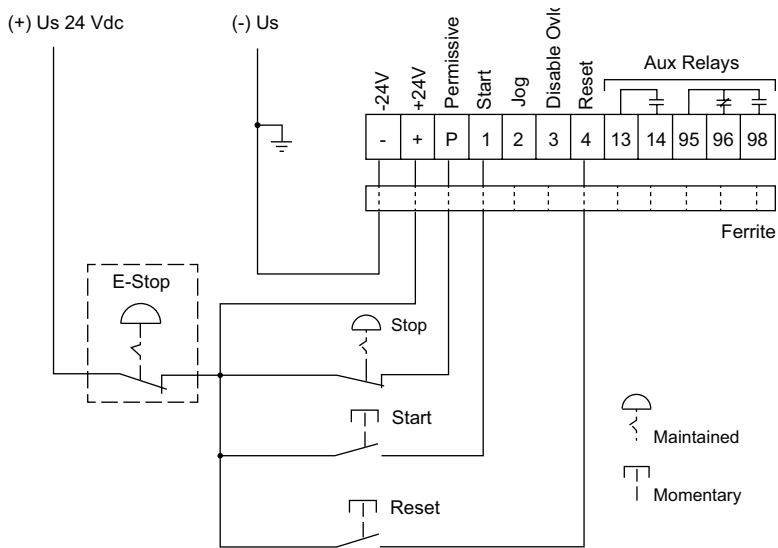
Notes

1. A minimum wire of 14 AWG (2.5 mm^2) should be used
   between the 24 Vdc control power supply and the
   control terminal block.

2. See Using an Auxiliary Relay section below if it is desired
   to use a relay instead of an indicating lamp for terminals
   13, 14, 95, 96 and 98.

3. 120 Vac may be applied to terminals 13, 14, 95, 96,
   and 98.

4. Add ferrite, Fair-Rite #0446176451 to DC Power Leads
   and Control I/O Leads (all through one ferrite) at S801+.

5. Auxiliary relays: 3 amps at 120 Vac or 24 Vdc, 10 amps
   max. (resistive) switching.

Basic Connection Diagram for 2-Wire Pushbutton
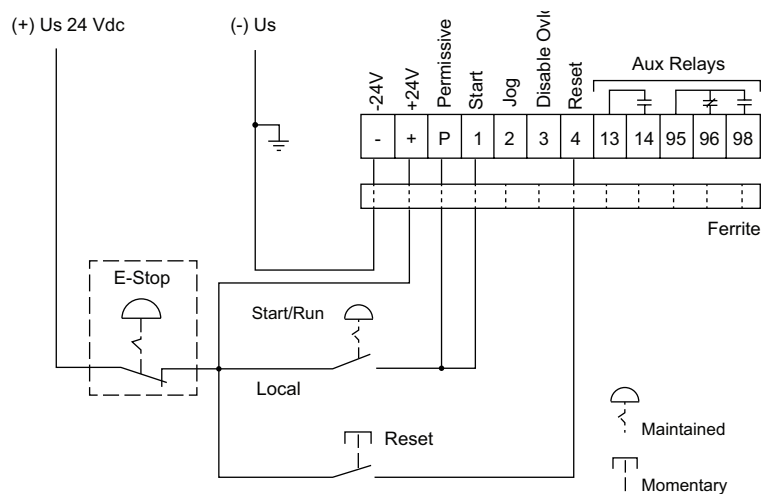
Notes

1. A minimum wire of 14 AWG (2.5 mm^2) should be used between the control power supply and the control terminal block.

2. See Using an Auxiliary Relay section below if it is desired to use a relay instead of an indicating lamp for terminals 13, 14, 95, 96 and 98.

3. 120 Vac may be applied to terminals 13, 14, 95, 96, and 98.

4. Add ferrite, Fair-Rite #0446176451 to DC Power Leads and Control I/O Leads (all through one ferrite) at S801+.

5. Auxiliary relays: 3 amps at 120 Vac or 24 Vdc, 10 amps max. (resistive) switching.

24 Vdc Control Power Requirements

The S801+ Soft Starter requires 24 Vdc control power. The sealed in and inrush characteristics of the S801+ Soft Starter are summarized in the table below:

Control Power Requirements

Soft Starter Frame	Sealed		Inrush		
	Amps	Watts	Amps	Watts	Duration (ms)
S801+N…	1.0	25	10	240	150
S801+R…	1.0	25	10	240	150
S801+T…	1.0	25	10	240	150
S801+V…	1.0	25	10	240	150
S801+U…	1.0	25	10	240	150

For applications where one starter is used with one power supply, the power supply selected must be equal to or greater than both the sealed in and inrush requirements of the starters.

- Max Steady State for the power supply ≥ Sealed In Power of the Starter

- Outrush for the power supply ≥ Inrush Power of the Starter

Multiple starters can be used with one power supply. If the application requires the starters to start at the same time, the power supply must be sized for the sum of the sealed in and inrush power for each starter.

- Max Steady State for the power supply ≥ Sum of the Sealed In Power of all the Starters

- Outrush for the power supply ≥ Sum of the Inrush Power of all the Starters

Formulas to calculate control power requirements are as follows:

- Definitions:

  SI = Sum of Seal Incurrent
  LS = Largest Seal Incurrent
  LI = Largest Inrush Needed
  TS = Total Seal Incurrent Needed
  LO = Largest Outrush Needed

- TS = (SI −LS)
  LO = TS +LI

- Max Steady State for the power supply ≥ SI

- Outrush for the power supply ≥ LO

The voltage on the S801+ Control Power Supply and Control Input terminals must be 24 Vdc ±10% to provide proper operation of the soft starter.

Eaton Recommended 24 Vdc Power Supplies

Catalog Number	Sealed		Inrush		Primary Voltage Vac
	Amps	Watts	Amps	Watts	
PSG240E	10	240	15	360	85–264
PSG240F	10	240	15	360	320–575
PSG480E	20	480	30	720	85–264
PSG480F	20	480	30	720	320–575

Control Wiring Application Notes

⚠ CAUTION

Only apply 24 Vdc to the control terminal block. Control wiring is 22–12 AWG (0.33–4.0 mm^2). Failure to follow this caution may result in damage to the control circuit.

1. Connect 24 Vdc Supply positive to Terminal "+" using a minimum wire of 14 AWG (2.5 mm^2).

2. Connect 24 Vdc Supply negative to Terminal "–" using a minimum wire of 14 AWG (2.5 mm^2).

3. 24 Vdc Control voltage must not exceed 30 Vdc to prevent hardware damage.

4. 24 Vdc Control voltage must not fall below 18 Vdc.

Using a Supplemental Line Contactor

In some installations, it may be necessary to use an electromagnetic contactor in series with the soft starter. In this case, it is recommended that the contactor be placed on the load side of the soft starter. The contactor must be closed prior to starting the soft starter and remain closed until the Soft Starter has been stopped to ensure proper soft starter and system operation.

If an electromagnetic contactor is used on the line side of the soft starter, additional control circuitry must be supplied by the user when using edge control to ensure the line power is supplied to the soft starter before control power is applied. If this sequence is not followed, the soft starter will fault on either a phase loss or zero voltage-crossing fault.

If it is desired to place an electromagnetic contactor on the line side of the soft starter, Eaton recommends using level sense option. With level sense, no additional control circuitry is required. A start can be completed when the line power is supplied to the unit after the control power, providing the *Reset Mode* parameter is set to AUTO and the unit has a Ready light status with 24 Vdc on the *Start* terminal.

If the AUTO Reset Mode setting is used, CAUTION must be exercised to assure that any restart occurs in the safe manner.

Functional Description

Power

The S801+ Soft Starter controls the voltage applied to a three-phase induction motor in order to control the starting torque and provide a smooth starting characteristic. Within the soft starter are three power poles, each of which includes a set of anti-parallel SCRs (thyristors) in parallel with a contact. During a start, the conduction periods of the SCRs are continuously adjusted to apply a gradually increasing voltage to the motor, resulting in gradually increasing torque and a smooth start. As the motor reaches its rated speed, the power pole contacts are closed, bypassing the SCRs for the most efficient operation.

Inline Connected Soft Starter
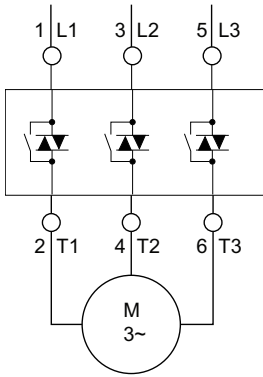
For each start, the length of time the SCRs are conducting current as well as the magnitude of that current determine how hot the SCRs will get. Between successive starts the SCRs must cool down to avoid exceeding their thermal limits. **Appendix C** gives the S801+'s application ratings for various starting conditions. Staying within these specified limits will aid in avoiding over temperature trips.

Control

There is one (1) 12-position connector and one (1) RJ45 connector on the face of the S801+ soft starter that are used for control circuit functions:

1. 24 Vdc Control Inputs—Soft Starter Permissive, Start, Reset, and Auxiliary Relay control functions.

2. Control Interface Module (CIM)—soft starter communication with a user interface device.

Note: Do not apply 120 Vac to any Terminal Block Control Input. 120 Vac will permanently destroy the printed circuit board.

Starting/Stopping Options

The following starting options are available in the S801+ Soft Starter:

Voltage Ramp Start

This is the most commonly used mode of soft starting. Starting at an initial value set by the *Initial Torque* parameter, the voltage applied to the motor is gradually increased at a rate that will reach rated voltage at the end of the Start Ramp time, set by the *Soft Start Time* parameter. As the voltage increases the motor develops torque that accelerates the load toward full speed. When the S801+ senses that the motor has achieved synchronous

speed prior expiration of the Start Ramp time, it quickly completes the voltage ramp and closes the bypass contactor(s).

It should be noted that a lightly loaded motor takes less torque, and thus lower voltage and time, to accelerate to full speed. For this case the S801+ will go into bypass before the ramp reaches full voltage. In other words, the S801+ may go into bypass before the *Soft Start Time* has elapsed.

Voltage Ramp Start
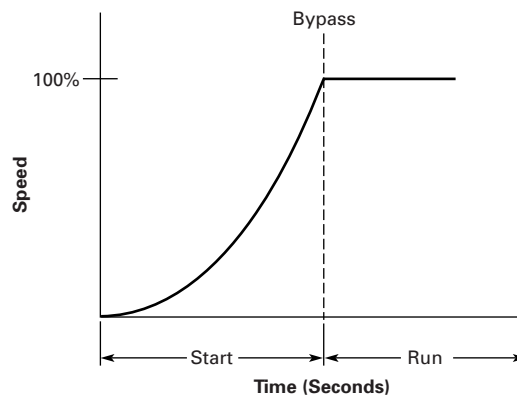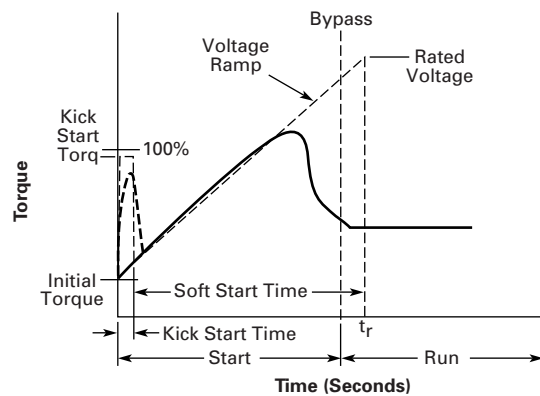
Kick Start

The Kick Start feature works in both the Voltage Ramp Start and Current Limit Start modes. By momentarily applying up to a two (2) second pulse of current to the motor, it provides an initial boost in torque to overcome the static friction or high inertial loads common in some applications. The level of torque boost is set by the *Kick Start Torq* parameter and the duration of the "kick" is set by the *Kick Start Time*. Setting the *Kick Start Time* to 0 effectively disables this feature.

Functional Description

Current Limit Start

This mode is typically used when it is necessary to limit the maximum current during start-up due to line power limitations or other considerations. During a Current Limit Start the S801+ applies a constant voltage to the motor, resulting in limited current flowing through the motor's windings. The level of current is set by the *Initial Torque* parameter. See below.

Note: Current Limit Starts are not recommended on variable torque load applications like fans and pumps. Attempting starts with the Current Limit set to a value of 20% *Initial Torque* or lower are not recommended as the motor may not develop adequate torque to accelerate properly.

Current Limit
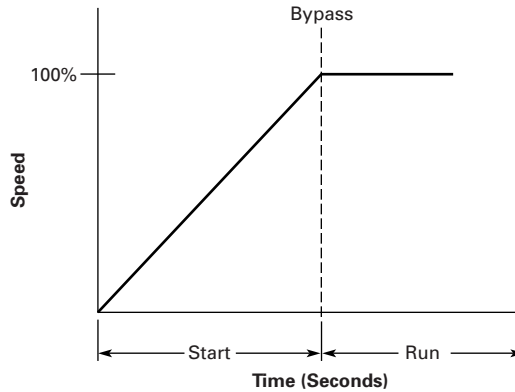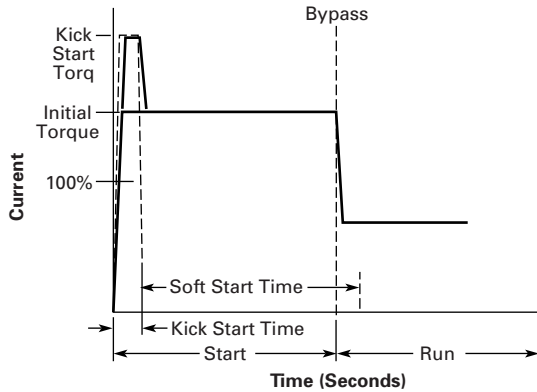
Soft Stop

The Soft Stop feature is used for applications that require a controlled (ramp) extended stop. It is designed for high frictional loads that tend to stop suddenly when voltage to the motor is removed. During Soft Stop the voltage is ramped to zero in the time set by the *Soft Stop Time* parameter.

Note: The Soft Stop mode is not an electronic brake function and will not stop a motor any faster than it would normally take to coast to a stop under load.

Soft Stop
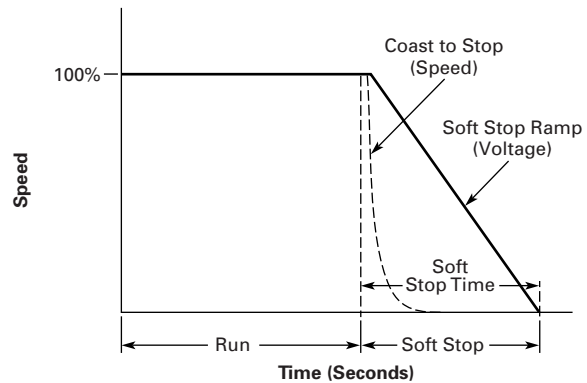
Control Functions

Local Control

S801+ Local Control consists of *Permissive*, *Start*, *Jog*, *Disable Overload on Start* and *Reset* 24 Vdc control commands to the Terminal Block.

The Control Terminal Block utilizes five (5) functions to control the S801+ soft starter.

Terminal P–*Permissive* (run enable)—Must be energized with 24 Vdc to enable operation of the S801+ soft starters. If power is lost or removed from *Permissive* terminal at any time, the unit will initiate a coast Stop or Soft Stop in accordance with the setup parameter selections.

Terminal 1–*Start*—If 24 Vdc is present at the *Permissive* terminal, momentary application of 24 Vdc to the *Start* terminal will initiate a Voltage Ramp or Current Limit start for the S801+ soft starter. Application of 24 Vdc may be maintained

Note: With level sensing control, if 24 Vdc is lost or removed from the *Permissive* terminal at any time, the unit will initiate a stop in accordance with setup parameter selections. A restart may occur when 24 Vdc is restored or reapplied if:

   a) 24 Vdc is present on the *Start* terminal (maintained), and;

   b) the S801+ shows a Ready LED (not faulted) status. If the starter has faulted and the fault condition clears AND the *Auto Reset Mode* parameter in the Operation Mode list is set to AUTO, the starter will restart.

See the Edge and Level Sensing sections on **Page 23** for additional details.

If the AUTO Reset Mode setting is used with level sensing, CAUTION must be exercised to assure that any restart occurs in a safe manner. Motor restart may occur immediately and unexpectedly after any fault condition has cleared.

Terminal 2–*Jog*—Application of 24 Vdc power to the *Jog* terminal will initial a momentary Start command for as long as the signal is present. The S801+ will perform a Start ramp in accordance with Start parameters. If the motor achieves synchronous speed, the internal bypass contactors will not close. When the 24 Vdc signal is removed, the soft starter will perform a coast stop, irrespective of any Soft Stop parameter values.

Terminal 3–*Overload on Start*—Momentary application of +24 Vdc to Terminal 3 prior to a start raises the overload fault trip point to 125% of the maximum rating of the frame size for the next start only.

Terminal 4–*Reset*—Application of 24 Vdc power to the Reset terminal will reset the soft starter after all fault conditions are cleared and no active fault is present. If the Fault LED is not able to be reset, a fault condition still exists and must be corrected.

Level or Edge Sensing

Level or Edge Sensing determines how the soft starter reacts to Start control commands after a fault trip has occurred. It is important to be aware if the *Start* command is a momentary or maintained signal. If the *Start* control signal is momentary, then either Edge or Level Sensing may be selected and S801+ operation will be the same, as in either case only a momentary signal is placed on the Start terminal. If the Start control signal is maintained, then the signal must be removed, then reapplied to initiate a start if Edge Sensing is selected.

Level or Edge Sensing is selected with the S1 DIP switch located on the face of the S801+.

Level Sensing

Level sense means that the 24 Vdc signal at the Start terminal may be continuous and does not require voltage to be removed and reapplied after a fault trip has occurred.

Level sensing will result in an automatic motor restart after a fault when:

- Fault condition is cleared.
- The *Permissive* terminal is supplied with 24 Vdc.
- The *Reset Mode* parameter is set to AUTO,
- There is 24 Vdc power to the *Start* terminal (*Start* command—maintained).

Level sensing will allow a motor restart after a fault when:

- All faults remain cleared or reset.
- The *Permissive* terminal is supplied with 24 Vdc.
- The *Reset Mode* parameter is set to AUTO or MANUAL.
- 24 Vdc power to the *Start* terminal is again applied (*Start* command—momentary)

This control configuration can be used where it is desirable to restart a motor after a fault without additional manual or automatic control. An example of this condition would be on a remote pumping station where it is desirable to automatically restart a pump after a power outage without operator intervention.

In the AUTO RESET MODE, CAUTION must be exercised to assure that any restart occurs in a safe manner.

Edge Sensing

Edge sense means that the 24 Vdc signal at the *Start* terminal must be removed (if maintained) and reapplied after a fault trip has occurred. If the *Start* signal is momentary, no further action is required to restart the motor. The cycling of 24 Vdc power to the *Start* terminal before starting is required regardless of the setting of the *Reset Mode* parameter.

Edge sensing will allow a motor restart when:

• Fault condition is cleared.

• The *Permissive* terminal is supplied with 24 Vdc

• The *Reset Mode* parameter is set to AUTO or MANUAL,

• 24 Vdc power to the *Start* terminal is reapplied (*Start* command—momentary)

Edge sensing will allow a motor restart when:

• Fault condition is cleared.

• The *Permissive* terminal is supplied with 24 Vdc

• The *Reset Mode* parameter is set to AUTO or MANUAL,

• 24 Vdc power to the *Start* terminal is removed, then reapplied (*Start* command—maintained)

This control configuration can be used when restarting of the motor after a stop command or fault must be supervised manually or as a part of a control scheme.

AUTO RESET

Reset Mode—Two (2) modes of resetting Fault Trips are available:

0–Manual—Requires pressing Reset button on CIM, pressing Reset button on the face of the S801+, or by providing a signal to Input Control Terminal 4.

1–AUTO—The S801+ firmware attempts to clear any active Fault Trips.

S801+ Operating Configuration

Introduction

The S801+ has a wide range of operation and protection parameters to enable coordinated motor and load protection. Several protections options and Ramp Start/Current Limit start profiles may be selected on the Control Interface Module (CIM).

The unit is supplied with default settings that accommodate general induction motor applications that provide very basic motor protection. The user should adjust the parameters to their specific application.

User Interface

A Control Interface Module (CIM) is used to configure all models of the S801+ Soft Starter.

Control Interface Module (CIM)

Control Interface Module (CIM)

The S. S. trip LED indicates the operating status of the S801+.

- S. S. Trip
  - General fault (Fault codes)
  - Overload
  - Hardware failure
- Protections
  - Overload
  - Jam
  - Stall
  - Phase loss
  - Phase reversal
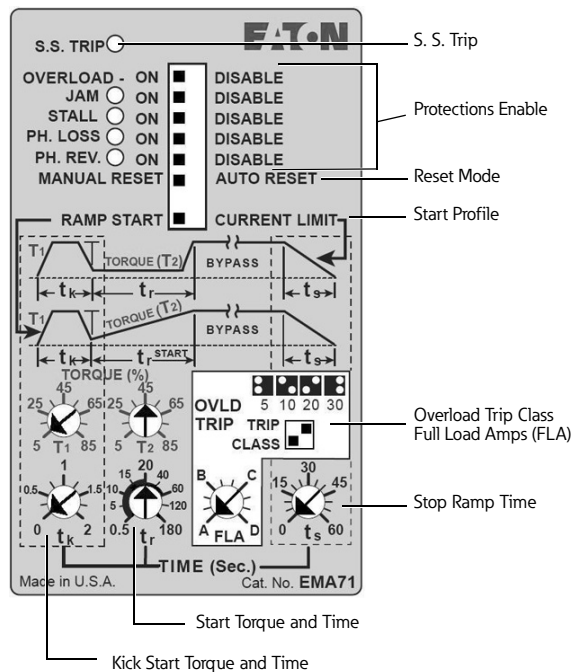
- Fault Reset Method
- Ramp Start/Current Limit Selection
- Ramp Start or Current Limit Start Ramp Time and Initial Torque Potentiometers
- Kick Start Ramp Time and Kick Start Torque Potentiometers
- Soft Stop Ramp Time Potentiometer
- Overload Class DIP Switches
- Motor Full Load Amps (FLA) Setting

FLA Potentiometer Setting Values

Catalog Number	I_{FLA}	Potentiometer Setting			
		A	B	C	D
S801N37…		11	19	27	37
S801N66…		20	35	50	66
S801R10…		32	56	80	105
S801R13…		42	73	104	135
S801T18…		56	97	138	180
S801T24…		75	130	185	240
S801T30…		95	164	233	304
S801U36…		112	194	276	360
S801U42…		131	227	323	420
S801U50…		156	270	384	500
S801V36…		112	194	276	360
S801V42…		131	227	323	420
S801V50…		156	270	384	500
S801V65…		203	352	501	650
S801V72…		225	390	555	720
S801V85…		265	460	655	850
S801V10…		320	547	773	1000

Setup and Starting

Before You Begin

Be Aware of the Following:

1. The Permissive terminal must have 24 Vdc applied to ENABLE start or run commands from any source.

2. To initiate a Stop remove the 24 Vdc *Permissive* terminal input.

3. For 2-wire local control, jumper *Permissive* and *Start* terminal inputs together.

4. After an Overload Trip, the S801+ Soft Starter cannot be restarted until the prescribed cool-down time has elapsed. Review the START Inhibit times noted in **Appendix B**. Cycling 24 Vdc control power does not reset the timer. If control power is removed, the soft starter will retain the remaining time and will resume the cool-down timing when power is again reapplied.

5. When the S801+ internal bypass contactor(s) close, a sound similar to contactor chatter may be heard. This sound is the result of multiple contactors in some models closing one after the other in a very short period. It is normal operation intended to reduce the surge current requirements of your power supply. During normal operation, the S801+ will cycle the internal bypass contactors at random intervals to clean the contacts. During this operation, the contactors may be heard to release then pull in again as described above.

Setup

After all power and control connections have been made and you have read and understood the different operating modes and protection features of the soft starter, set the Operations and Protection potentiometers for your application. In many cases, only the Motor FLA potentiometer requires adjustment to the proper value, and all other settings may be used with the default values for the initial Start. Review the Protection Options of the S801+ **Appendix A** and **Appendix B** adjust as required.

Initial Configuration:

1. It is suggested that the S801+ Soft Starter be configured before applying the line voltage. Before applying the Line voltage, apply 24 Vdc to the Supply connections of the S801+'s control terminal block.

2. Set the Operating Parameters to the desired values. These settings assume the motor has a 1.15 Service Factor.

Operating Parameters—Soft Start Configuration—S801+ …N3S Standard

Soft Start Config Line Connected Motor	Units	Minimum	Maximum	Default	Notes
Overld Trip FLA					
S801+N37…	Amps	11	37	11	Motor FLA parameter must be set to motor nameplate FLA to achieve proper overload protection
S801+N66…	Amps	20	66	20	
S801+R10…	Amps	32	105	32	
S801+R13…	Amps	42	135	42	
S801+T18…	Amps	56	180	56	
S801+T24…	Amps	75	240	75	
S801+T30…	Amps	95	304	95	
S801+U36…	Amps	112	360	112	
S801+U42…	Amps	131	420	131	
S801+U50…	Amps	156	500	156	
S801+V36…	Amps	112	360	112	
S801+V42…	Amps	131	420	131	
S801+V50…	Amps	156	500	156	
S801+V65…	Amps	203	650	203	
S801+V72…	Amps	225	720	225	
S801+V85…	Amps	265	850	265	
S801+V10…	Amps	312	1000	312	
Overload		On	Disable	On	
Jam		On	Disable	On	
Stall		On	Disable	On	
Phase Loss		On	Disable	On	
Phase Reversal		On	Disable	On	
Reset Mode		Manual	Auto	Manual	
Ramp Start/Current Limit		Ramp	Current	Ramp	
Kick Start Torque	%	0	85	0	
Kick Start Time	Seconds	0	2	0	
Initial Torque	%	0	85	45	
Ramp Time	Seconds	0.5	180	20	
Ovrld Trip Class		5	30	20	
Soft Stop Time	Seconds	0	60	0	

FLA Potentiometer Setting Values

Catalog Number	I$_{FLA}$	Potentiometer Setting				
		A	B	C	D	Default
S801N37…		11	19	27	37	11
S801N66…		20	35	50	66	20
S801R10…		32	56	80	105	32
S801R13…		42	73	104	135	42
S801T18…		56	97	138	180	56
S801T24…		75	130	185	240	75
S801T30…		95	164	233	304	95
S801U36…		112	194	276	360	112
S801U42…		131	227	323	420	131
S801U50…		156	270	384	500	156
S801V36…		112	194	276	360	112
S801V42…		131	227	323	420	131
S801V50…		156	270	384	500	156
S801V65…		203	352	501	650	203
S801V72…		225	390	555	720	225
S801V85…		265	460	655	850	265
S801V10…		320	547	773	1000	320

Protection Parameters

In addition to motor overload protection, the S801+ has many programmable features designed to protect the motor.

- Incoming Line Phase Reversal, Loss, Imbalance, Over Voltage, and Under Voltage trips.

- Selectable Overcurrent trip levels.

- Stall and Jam trips.

A Phase Reversal Fault is a likely fault condition on new installations. It can be addressed by disabling phase rotation monitoring, or removing Mains power and switching the incoming line connections at L1 and L2 of the S801+.

Apply the Mains voltage and verify that no fault is present. The S801+ indicates faults with a Flash Code on the CIM.

When a Fault Trip occurs, the S.S. Trip LED will illuminate along with the corresponding dedicated LED if applicable. If the Fault is no longer active, the S801+ may be Manually reset by pressing the reset button on the face of the soft starter.

Fault Trips

The S801+ is configured from the factory with all protection parameters enabled. It is recommended that all appropriate protection parameters are enabled for proper operation and protection of the soft starter and the load.

Fault Codes

For additional details on troubleshooting fault codes and fault conditions, please refer to **Troubleshooting** and **Appendix E**.

To obtain the fault flash codes from the CIM, hold the RESET button (located below the CIM) down or apply 24 Vdc to terminal 4 and count the number of times all the LEDs on the CIM flash.

For example, if you see three flashes, and then two more flashes after a short pause, the flash code is 32.

The CIM can provide multiple flash codes, if more than one error condition caused a stop. Once you see the same flash code repeated, you have seen all the flash codes for the error conditions that caused the stop.

For example, if you see three flashes, a pause, then two flashes, a slightly longer pause, then four flashes, a pause, then one flash, the flash codes are 32 and 41.

If you then see three flashes, a pause, then two flashes, you are seeing the first code again. This means you have seen all the flash codes for this stop.

You may now release the RESET button or remove 24 Vdc from Control terminal Block Terminal 4.

Note: If an overload trip has occurred, 24 Vdc power must be applied to allow the overload thermal memory to reset. Depending on the overload history prior to the latest trip, this may be as long as 9 minutes.

A list of flash codes and the faults they represent is shown below.

Fault Codes

Fault Code	Fault
11	Thermal Overload
12	Motor Stall (LED)
13	Motor Jam (LED)
14	Phase Reversal (LED)
15	Pole Over temperature
16	SCR Failed to fire
22	Phase loss (LED)
23	Internal bypass contactor dropout
24	SCR/Contactor overcurrent
25	Phase imbalance
26	Non-volatile memory error
31	Zero voltage cross failure
32	Shorted SCR, Phase loss, Load disconnect
33	Load disconnect
34	SCR instantaneous overcurrent
41	24V power supply low
42	Timer system fault
43	Watchdog reset occurred
44	PLL (DSP) fault
45	Illegal address (DSP)

Thermal Overload

The S801+ Soft Starter features an electronic motor overload protection feature. It is designed to protect the motor and power wiring against overheating caused by operating at excessive current levels for extended periods of time.

Adjusting the FLA potentiometer to the motor nameplate Full Load Amps (FLA) programs the overload. The *FLA* is settable from 32–100% of the S801+'s rated current (frame size).

The overload's trip class (default = 20) is set with the Overload trip Class DIP switches.

Thermal Overload may be disabled during the Voltage Ramp or Current Limit start ramps (default = Enabled) by providing a 24 Vdc signal to Terminal #3 on the Control Terminal block prior to the START command. Disabling this protection parameter is not recommended.

Additional details on the Thermal Overload can be found in **Appendix B**.

Soft Start Configuration Application Notes

a) Voltage Ramp Start Configuration

Default values may be used for Start Time and initial Torque.

Kick Start Torque = 0% (fans and pumps), 75% (high breakaway loads)

Kick Start Time = 0 sec (fans and pumps), 1 sec (high breakaway loads)

Start the motor and determine the worst case starting conditions. Adjust Initial Torque for smooth start without hesitation. Motor rotation should begin within 2 seconds.

If Stall Faults occur at the end of the ramp time, increase *Initial Torque*, *Kick Start Torque and Time* and/or *Soft Start Time* to get into bypass before the Soft Start Time elapses. Also, verify that the motor is not overloaded.

b) Current Limit Start Configuration

Initial settings:

Initial Torque = 50%
Soft Start Time = 60 sec
Kick Start Torque = 0%
Kick Start Time = 0 sec (disabled)

c) Start the motor and determine the worst case starting conditions. Adjust *Initial Torque* for smooth start without hesitation. Rotation should begin within 2 seconds and the motor should smoothly accelerate to full speed.

d) If Stall Faults occur, increase *Initial Torque* and/or *Soft Start Time* to get into bypass before the Soft Start Time elapses. Also, verify that the motor is not overloaded. Verify that the motor is not in a stall condition. A stall condition will be noted when the motor does not continue to accelerate during the start ramp.

e) After suitable performance has been achieved, determine the starting time to bypass and set *Soft Start Time* at 1.25 times this time. For example, if it takes 10 seconds to accelerate the motor and go into bypass, set the *Soft Start Time* for 12.5 seconds. Adjust the *Soft Stop Time* for the desired stopping time.

f) The Initial Torque setting is adjusted to achieve motor rotation within 2 seconds of motor energization. The Initial Torque value also determines the upper limit of applied current during a Current Limit start.

The table below notes the values of Initial Torque settings as a percentage of Locked Rotor Current.

Initial Torque Settings

Torque Setting	Current as % Locked Rotor	Initial Motor Torque
85%	92%	Maximum
71%	84%	
56%	75%	
45%	67%	Default Value
36%	60%	
33%	57%	Wye-Delta Equivalent
27%	52%	
19%	44%	Current Limit Minimum
14%	37%	
1%	10%	Minimum

The National Electrical Code requires that all alternating current motors of 1/2 horsepower and higher must have code letters on the data plate indicating motor current in a locked rotor condition. This code denotes the Kilovolt-Ampere per horsepower of the motor.

The KVA$_{hp}$ value is obtained from NEMA and/or NEC publications. The table below is provided as a reference.

Locked rotor current of a three phase motor may be calculated using the following formula:

$$\text{Locked Rotor Current} = \frac{\text{Horsepower x KVA}_{hp} \text{ x 1000}}{\text{E x 1.73}}$$

Example: To calculate the locked rotor current range of a 50 horsepower motor operating at 460 volts with a code letter B, proceed as follows;

$$\text{Locked Rotor Current (minimum)} = \frac{50 \text{ x 3.15 x 1000}}{460 \text{ x 1.73}} = 197.91 \text{ Amps}$$

$$\text{Locked Rotor Current (maximum)} = \frac{50 \text{ x 3.54 x 1000}}{460 \text{ x 1.73}} = 222.42 \text{ Amps}$$

To determine the expected Initial Current value of the above example, apply the corresponding current reduction value base on the initial Torque setting of the soft starter. Using the default Initial Torque value of 45%, the expected current will be 67% of the above values, or 132.26 amps to 149.02 amps respectively.

Note: The current in the motor circuit will be subject to the total impedance of the motor circuit, so actual values may be slightly different than calculated values.

Code Letters

Code Letter	Kilovolt-Ampere per hp with Locked Rotor	
	Minimum	Maximum
A	0	3.14
B	3.15	3.54
C	3.55	3.99
D	4.0	4.49
E	4.5	4.99
F	5.0	5.59
G	5.6	6.29
H	6.3	7.09
J	7.1	7.99
K	8.0	8.99
L	9.0	9.99
M	10.0	11.19
N	11.2	12.49
P	12.5	13.99
R	14.0	15.99
S	16.0	17.99
T	18.0	19.99
U	20.0	22.39
V	22.4	>22.41

Troubleshooting

General

In this section of the manual, we present a procedure you can follow to diagnose a problem with your S801+.

While many potential situations are outlined in this section, it is possible you may run into a problem that is not covered here. If you have worked through the following troubleshooting procedure and find that you require further assistance, please contact Eaton.

Please have the following information ready when you call:

Order Number:	
Catalog Number:	
Style Number:	
Serial Number:	

Before You Begin to Troubleshoot

⚠ WARNING

Make sure you read and understand the procedures in this manual before you attempt to set up or operate the equipment.

⚠ WARNING

HIGH VOLTAGE. Do not work on energized equipment unless absolutely required. If the troubleshooting procedure requires equipment to be energized, all work must be performed by properly qualified personnel, following appropriate safety practices and precautionary measure.

We highly recommend that you read this entire section of the manual before you begin to troubleshoot the S801+ Soft Starter.

You may want to obtain the following equipment to aid you in troubleshooting:

• Multimeter

• Clamp-on ammeter

Always assume the S801+ has high voltage applied and take proper precautions while troubleshooting the soft starter and associated equipment. Read all precautions at the front of this manual before starting the troubleshooting process.

Fault Codes

To obtain the fault flash codes from the CIM, hold the RESET button (located below the CIM) down or apply 24 Vdc to terminal 4 and count the number of times all the LEDs on the CIM flash.

For example, if you see three flashes, and then two more flashes after a short pause, the flash code is 32.

The CIM can provide multiple flash codes, if more than one error condition caused a stop. Once you see the same flash code repeated, you have seen all the flash codes for the error conditions that caused the stop.

For example, if you see three flashes, a pause, then two flashes, a slightly longer pause, then four flashes, a pause, then one flash, the flash codes are 32 and 41.

If you then see three flashes, a pause, then two flashes, you are seeing the first code again. This means you have seen all the flash codes for this stop.

You may now release the RESET button or remove 24 Vdc from Control terminal Block Terminal 4.

Note: If an overload trip has occurred, 24 Vdc power must be applied to allow the overload thermal memory to reset. Depending on the overload history prior to the latest trip, this may be as long as 9 minutes.

A list of flash codes and the faults they represent is shown below.

Fault Codes

Fault Code	Fault
11	Thermal Overload
12	Motor Stall (LED)
13	Motor Jam (LED)
14	Phase Reversal (LED)
15	Pole Over temperature
16	SCR Failed to fire
22	Phase loss (LED)
23	Internal bypass contactor dropout
24	SCR/Contactor overcurrent
25	Phase imbalance
26	Non-volatile memory error
31	Zero voltage cross failure
32	Shorted SCR, Phase loss, Load disconnect
33	Load disconnect
34	SCR instantaneous overcurrent
41	24V power supply low
42	Timer system fault
43	Watchdog reset occurred
44	PLL (DSP) fault
45	Illegal address (DSP)

Define the Problem

1. If the S801+ Soft Starter fails to respond in any way to a start command., look at the Control Interface Module of the S801+ Soft Starter and determine the fault status of the unit. The following troubleshooting flowcharts provide a logical sequence to determine issues and suggest probable solutions to each problem.

Start Command Troubleshooting Flow Chart

```
                              ┌────────┐
                              │ Start  │
                              └────┬───┘
                                   │
                                   ▼
┌──────────────┐      No    ┌─────────────┐    Yes
│ Check 24 Vdc │◄───────────│   Are any   │──────────┐
│    Power     │            │  LEDs Lit?  │          │
└──────┬───────┘            └─────────────┘          │
       │                                             ▼
       ▼                    ┌─────────────┐  No  ┌─────────────┐
┌──────────────┐   Yes      │   Is the    │─────►│   Is the    │
│   24 Vdc     │────────┐   │  Fault LED  │      │   Ready     │
│   Supply     │        │   │    Lit?     │      │  LED Lit?   │
│   Present    │        │   └─────────────┘      └─────────────┘
└──────┬───────┘        │         │ Yes                │ Yes
       │ No             │         ▼                    ▼
       │                │   ┌────────────┐      ┌────────────┐
       ▼                │   │   Check    │      │  Check 24V │
┌──────────────┐        │   │ Protection │      │ Permissive │
│ Supply 24 Vdc│        │   │  LEDs and  │      └────────────┘
│    Power     │        │   │ fault code │            │ Yes
└──────────────┘        │   │ and attempt│            ▼
                        │   │  to clear  │      ┌────────────┐
                        │   └─────┬──────┘      │  Check 24V │
                        │         │             │Start Signal│
                        │         │             └────────────┘
                        │         ▼                    │
                        │   ┌──────────┐               │
                        └──►│   End    │◄──────────────┘
                            └──────────┘
```
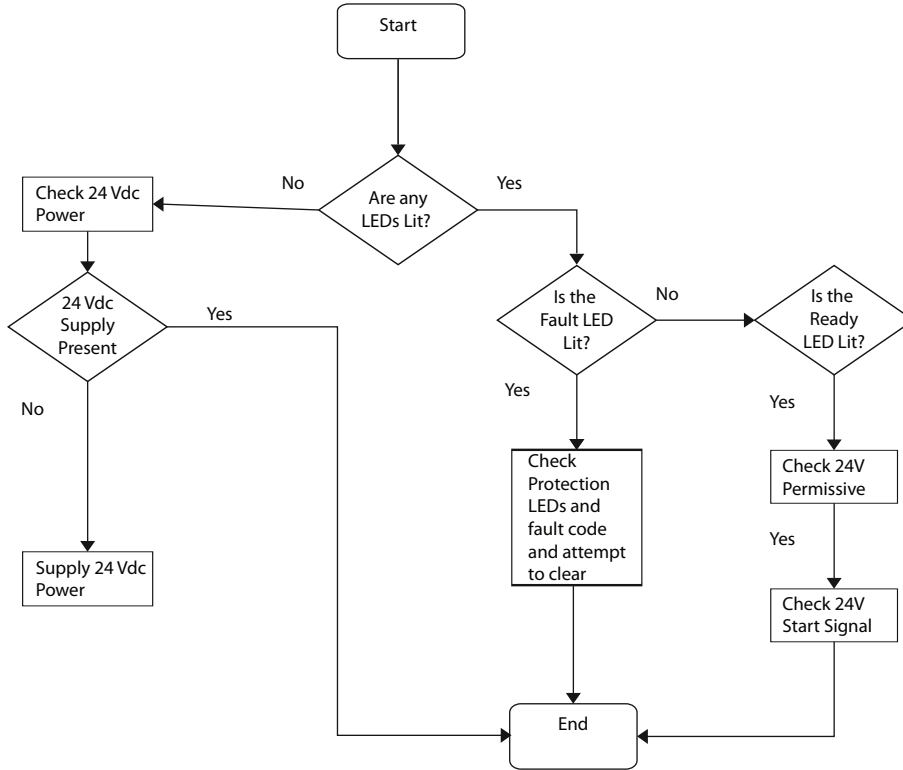
Troubleshooting—S801+ Does not START

Start Source Attempted	Suggested Corrective Action
Control Interface Module	Verify that the Status LED is GREEN prior to the Start attempt.
Terminal Block	Verify that the S. S. Trip or Status LED is not RED.
	Verify that the 24 Vdc Permissive signal is at the proper voltage.
	Verify that the 24 Vdc Start signal is at the proper voltage.
	If the Start Control parameter is set to Edge, verify that the 24 Vdc Start signal is transitioned from 0 Vdc after a fault trip.
Network	Determine if the S801+ can be started locally from TB1.
	Verify that the 24 Vdc Permissive signal is at the proper voltage.
	Verify that the Status LED is GREEN.

a. With the Status LED illuminated RED, the device will not start. Attempt to reset the S801+ Soft Starter by pressing the S801+'s RESET button for one second. If the Status LED remains RED, use the Control Interface Module (CIM) to determine the fault and fault code and go to the Troubleshooting Fault Table in **Appendix E** to find the corrective action for the fault.

b. If the Status LED is GREEN, the S801+ Soft Starter is ready to start. Determine the Start source in table above to aid in determining the appropriate corrective action. Verify that the *Permissive* input terminal is at 24 Vdc. Then start the S801+ the Control Input terminal block. If the S801+ does not start, verify that the *Start* input terminal is at 24 Vdc.

2. It is often useful in determining the nature of the fault condition by noting when the trip occurs during operation of the S801+ soft starter. The operation of the S801+ may be categorized into the following periods;

    •   The S801+ Soft Starter trips Immediately when the START command is issued.

    •   The S801+ Soft Starter trips during the START ramp and never reaches bypass.

    •   The S801+ Soft Starter trips when the bypass contactors are closing.

    •   The S801+ Soft Starter trips during running operation while bypass contactors are closed.

    •   The S801+ Soft Starter trips after the Stop command is received.

    •   The S801+ Soft Starter stops sooner than expected during a soft stop. If the *Soft Stop Time* is set too long for the motor loading (high loads), the motor will begin to stall when delaying SCR firing reduces the voltage. The S801+ Soft Starter will detect this stalling due to the increase in current flow and end the stop immediately and not indicate any faults.

Refer to the flowchart on **Page 34** to aid in determining the appropriate corrective action during the various run phases of operation.

Note: If no fault codes are present during an unexpected "trip" of the soft starter, verify that the soft starter did not receive a STOP command.

Detailed information describing fault codes and corrective action may be found in Appendix E.

Troubleshooting—S801+ Stopped or Faulted

Condition	Possible Problem	Suggested Corrective Action
Status LED is GREEN	Stop command received.	24 Vdc permissive signal lost—investigate control system.
	Terminal block wiring not secure.	Check control wiring for security.
	Loss of 24 Vdc control power.	Check 24 Vdc power source for correct sizing and circuit connections.
	Transient fault when Reset Mode set to AUTO.	Change Reset Mode to Manual to capture fault condition.
	External control device failure.	Inspect external control devices for proper operation.
	External mains device failure or trip condition.	Inspect external devices for condition and proper operation.
	Control board failure.	Possible device fatal error.
Status LED is RED	Protection/Operation parameters not set to proper values.	Determine Fault condition from the Fault Codes.
	Fault condition exists.	Adjust Protection parameter values to prevent recurring fault trips.
	Fault not reset from previous trip.	Correct problems with mains voltages and/or phase conditions.
	Reset Mode set to Manual.	Attempt to reset fault—the fault will not reset if the fault condition exists.
		Set Reset Mode to Manual to retain soft starter in fault condition for troubleshooting. Correct fault condition and change Reset Mode to Auto if desired.
		Set Protection parameters to Warning.
		Reset Mode set to Manual and no Reset signal was sent to the soft starter. Reset soft starter or change Reset Mode to AUTO.
No status LEDs illuminated, CIM display dark.	No Control Power supply	Provide 24 Vdc to Control power terminal block.
	Device failure.	Check Control Power for proper value and reliability.

Troubleshooting

Local Control Troubleshooting Flow Chart

```
                                    ┌─────────┐
                                    │  Start  │
                                    └────┬────┘
                                         │
          Yes         No          ◇──────┴──────◇   Yes    ┌──────────────────┐
    ┌──────────◇ Stop Command ◇◄──────── Is the ─────────►│ Check protection │
    │           received              Fault LED           │ LEDs / fault code│
    │              │                    Lit?               │ and attempt to   │
    │             No                                       │ cleat            │
    │              │                                       └────────┬─────────┘
┌───┴──────┐      │                                                 │
│ Check    │      │                                          ◇──────┴──────◇   Yes
│ basis    │  ◇───┴────◇   No                               │   Fault      │
│ for STOP │  │ Is Reset│─────────┐                         │   Reset      │
│ Command  │  │ Mode set│         │                         ◇──────┬──────◇
└───┬──────┘  │ to AUTO?│         │                          No    │
    │         ◇────┬────◇         │                   ┌───────┘    │ Yes
    │             Yes             │                   │            │
    │              │              │          ┌────────┴───┐   ┌────┴──────┐
    │       ┌──────┴──────┐  ┌────┴────┐     │ Consuit    │   │ Fault     │
    │       │ Possible    │  │ Check   │     │ Manual to  │   │ Condition │
    │       │ Transient   │  │ for     │     │ diagnose   │   │ not       │
    │       │ fault, set  │  │ external│     │ Fault Code │   │ Present   │
    │       │ Reset Mode  │  │ device  │     └──────┬─────┘   └────┬──────┘
    │       │ to Manual   │  │ failures│            │              │
    │       └──────┬──────┘  └────┬────┘     ◇──────┴──────◇  No   │
    │              │              │          │  Fault      │───┐   │
    │       ◇──────┴──────◇  Yes  │          │  Code       │   │   │
    │       │ Unit trips  │───┐   │          │  repeats    │   │   │
    │       │ fault code  │   │   │          ◇──────┬──────◇   │   │
    │       │ present     │   │   │               Yes│        │   │
    │       ◇──────┬──────◇   │   │          ┌───────┴────┐   │   │
    │            No           │   │          │ VerifyFault│   │   │
    │              │    ┌─────┴─┐ │          │ condition  │   │   │
    │              │    │Correct│ │          │ does not   │   │   │
    │              │    │fault  │ │          │ exist      │   │   │
    │       ┌──────┴──┐ │condit.│ │          └──────┬─────┘   │   │
    │       │ Contact │ └───┬───┘ │          ┌──────┴─────┐   │   │
    │       │ Eaton   │     │     │          │ Contact    │   │   │
    │       │ Support │     │     │          │ Eaton      │   │   │
    │       └──────┬──┘     │     │          │ Support    │   │   │
    │              │        │     │          └──────┬─────┘   │   │
    │              │        └─────┤                 │         │   │
    │              │              │    ┌─────────┐  │         │   │
    └──────────────┴──────────────┴───►│   End   │◄─┴─────────┴───┘
                                       └─────────┘
```

Accessories

Lug Kits

Lug Kits—S801+T, U…

Description	Part Number
2 cable connections, 4 AWG to 1/0 cable	**EML22**
1 cable connection, 4/0 to 500 kcmil cable	**EML23**
2 cable connections. 4/0 to 500 kcmil cable	**EML24**
1 cable connection, 2/0 to 300 kcmil cable	**EML25**
2 cable connections, 2/0 to 300 kcmil cable	**EML26**

Lug Kits—S801+V…

Description	Part Number
2 cable connections. 4/0 to 500 kcmil cable	**EML28**
4 cable connections. 4/0 to 500 kcmil cable	**EML30**
6 cable connections. 4/0 to 500 kcmil cable	**EML32**
2 cable connections, 2/0 to 300 kcmil cable	**EML33**

Replacement Parts

Replacement Parts

Description	S801+ Frame	Replacement Part Number
Control Wire Connector	S801+…	**EMA75**
CIM for Standard Unit	S801+…	**EMA71**

Optional Accessory Kits

Accessory Kits

Description	S801+ Frame	Accessory Kit Part Number
Panel Mounting Kit—3 ft cable	S801+…	**EMA69A**
Panel Mounting Kit—5 ft cable	S801+…	**EMA69B**
Panel Mounting Kit—8 ft cable	S801+…	**EMA69C**
Panel Mounting Kit—10 ft cable	S801+…	**EMA69D**
Mounting Plate, S801+N…	S801+N…	**EMM13N**
Mounting Plate, S801+R…	S801+R…	**EMM13R**
Mounting Plate, S801+T…	S801+T…	**EMM13T**
Mounting Plate, S801+U…	S801+U…	**EMM13T**
Mounting Plate, S801+V…	S801+V…	**EMM13V**
Vibration Plate, S801+N…	S801+N…	**EMM14N**
Vibration Plate, S801+R…	S801+R…	**EMM14R**
Vibration Plate, S801+T…	S801+T…	**EMM14T**
Vibration Plate, S801+U…	S801+U…	**EMM14T**
Vibration Plate, S801+V…	S801+V…	**EMM14V**
IP20 Kit, S801+N…	S801+N…	**SS-IP20-N**
IP20 Kit, S801+R…	S801+R…	**SS-IP20-R**
IP20 Kit, S801+T…	S801+T…	**SS-IP20-TU**
IP20 Kit, S801+U…	S801+U…	**SS-IP20-TU**
IP20 Kit, S801+V…	S801+V…	**SS-IP20-V**
Fan Kit	S801+…	**EMM18**

Appendix A—Parameters

Soft Start Config—S801+ …N3S Standard

Soft Start Config Line Connected Motor	Units	Minimum	Maximum	Default	Notes
Overld Trip FLA					
S801+N37…	Amps	11	37	11	Motor FLA parameter must be set to motor nameplate FLA to achieve proper overload protection
S801+N66…	Amps	20	66	20	
S801+R10…	Amps	32	105	32	
S801+R13…	Amps	42	135	42	
S801+T18…	Amps	56	180	56	
S801+T24…	Amps	75	240	75	
S801+T30…	Amps	95	304	95	
S801+U36…	Amps	112	360	112	
S801+U42…	Amps	131	420	131	
S801+U50…	Amps	156	500	156	
S801+V36…	Amps	112	360	112	
S801+V42…	Amps	131	420	131	
S801+V50…	Amps	156	500	156	
S801+V65…	Amps	203	650	203	
S801+V72…	Amps	225	720	225	
S801+V85…	Amps	265	850	265	
S801+V10…	Amps	312	1000	312	
Overload		On	Disable	On	
Jam		On	Disable	On	
Stall		On	Disable	On	
Phase Loss		On	Disable	On	
Phase Reversal		On	Disable	On	
Reset Mode		Manual	Auto	Manual	
Ramp Start/Current Limit		Ramp	Current	Ramp	
Kick Start Torque	%	0	85	0	
Kick Start Time	Seconds	0	2	0	
Initial Torque	%	0	85	45	
Ramp Time	Seconds	0.5	180	20	
Ovrld Trip Class		5	30	20	
Soft Stop Time	Seconds	0	60	0	

Protections

Fault Codes

To obtain the fault flash codes from the CIM, hold the RESET button (located below the CIM) down or apply 24 Vdc to terminal 4 and count the number of times all the LEDs on the CIM flash.

For example, if you see three flashes, and then two more flashes after a short pause, the flash code is 32.

The CIM can provide multiple flash codes, if more than one error condition caused a stop. Once you see the same flash code repeated, you have seen all the flash codes for the error conditions that caused the stop.

For example, if you see three flashes, a pause, then two flashes, a slightly longer pause, then four flashes, a pause, then one flash, the flash codes are 32 and 41.

If you then see three flashes, a pause, then two flashes, you are seeing the first code again. This means you have seen all the flash codes for this stop.

You may now release the RESET button or remove 24 Vdc from Control terminal Block Terminal 4.

Note: If an overload trip has occurred, 24 Vdc power must be applied to allow the overload thermal memory to reset. Depending on the overload history prior to the latest trip, this may be as long as 9 minutes.

A list of flash codes and the faults they represent is shown below.

Fault Codes

Fault Code	Fault
11	Thermal Overload
12	Motor Stall (LED)
13	Motor Jam (LED)
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26	Non-volatile memory error
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32	Shorted SCR, Phase loss, Load disconnect
33	Load disconnect
34	SCR instantaneous overcurrent
41	24V power supply low
42	Timer system fault
43	Watchdog reset occurred
44	PLL (DSP) fault
45	Illegal address (DSP)

Appendix B—Overload Protection

Thermal Overload

The S801+ Soft Starter features an electronic motor overload protection feature. This is intended to protect the motor and power wiring against overheating caused by excessive current for extended periods of time.

Note: Short circuit protection must be applied on the line side of the soft starter.

Enter the motor full load current rating by adjusting the FLA potentiometer on the face of the CIM. It is adjustable from 32–100% of the unit's rated current.

Overload—Adjustment Range—Inline Connected

Catalog Number	Min	Max	Default	Notes
S801+N37…	11	37	11	Motor FLA potentiometer must be set to motor nameplate FLA to achieve proper overload protection
S801+N66…	20	66	20	
S801+R10…	32	105	32	
S801+R13…	42	135	42	
S801+T18…	56	180	56	
S801+T24…	75	240	75	
S801+T30…	95	304	95	
S801+U36…	112	360	112	
S801+U42…	131	420	131	
S801+U50…	156	500	156	
S801+V36…	112	360	112	
S801+V42…	131	420	131	
S801+V50…	156	500	156	
S801+V65…	203	650	203	
S801+V72…	225	720	225	
S801+V85…	265	850	265	
S801+V10…	312	1000	312	

Motor FLA Potentiometer Values

Catalog Number	I_{FLA}	Potentiometer Setting				
		A	B	C	D	Default
S801N37…		11	19	27	37	11
S801N66…		20	35	50	66	20
S801R10…		32	56	80	105	32
S801R13…		42	73	104	135	42
S801T18…		56	97	138	180	56
S801T24…		75	130	185	240	75
S801T30…		95	164	233	304	95
S801U36…		112	194	276	360	112
S801U42…		131	227	323	420	131
S801U50…		156	270	384	500	156
S801V36…		112	194	276	360	112
S801V42…		131	227	323	420	131
S801V50…		156	270	384	500	156
S801V65…		203	352	501	650	203
S801V72…		225	390	555	720	225
S801V85…		265	460	655	850	265
S801V10…		320	547	773	1000	320

Note: *Mtr Nameplate FLA* potentiometer is adjustable to any point within its range.

The thermal overload is designed to protect the motor from overheating caused by excessive current. If the motor is overloaded, the current drawn rises and heats the motor. The FLA sets the trip threshold and the trip class (5 to 30) is set with the *Ovrld Trip Class* potentiometer.

If the device trips on a thermal overload, an internal timer is started which inhibits a reset for three minutes. After this timer expires, the device may be reset and the thermal fault is cleared. At this point another internal timer is started, this timer is 26 x 3 or 48 minutes. If another trip occurs before this timer expires, the reset inhibit time is increased to 6 minutes.

Once the trip level reaches level 3, it will take 144 minutes to go back to level 2, then 96 minutes to get back to level 1. To get from level 3 to a reset thermal overload at level 1, it takes 240 minutes without a trip. A reset thermal overload at level 1 means the next thermal overload trip will have a 3-minute reset inhibit as in the table below.

Thermal Motor Overload Times

Trip Level	Preset Inhibit Time	Reset Time to Previous Trip Level
1	3 minutes	N/A
2	6 minutes	96 minutes
3	9 minutes	144 minutes

Total 240 minutes to reset to level 1.

Cycling power on the device will NOT clear the thermal trip. The thermal memory and the reset inhibit time are saved to the non-volatile memory. These values are reloaded when the device boots and the timer is restarted at the full reset time. This means if the 3-minute inhibit timer has been running two minutes, cycling power will require the user to wait the full three minutes before a reset can clear the overload fault.

If the device is shut down when the overload fault is tripped, the temperature is also saved to the non-volatile memory. If the device is left to cool and then powered, the temperature read from the sensor is compared to the saved temperature. If the current temperature is 87% or less of the saved temperature, a full thermal memory reset is initiated.

Overload Trip Curves
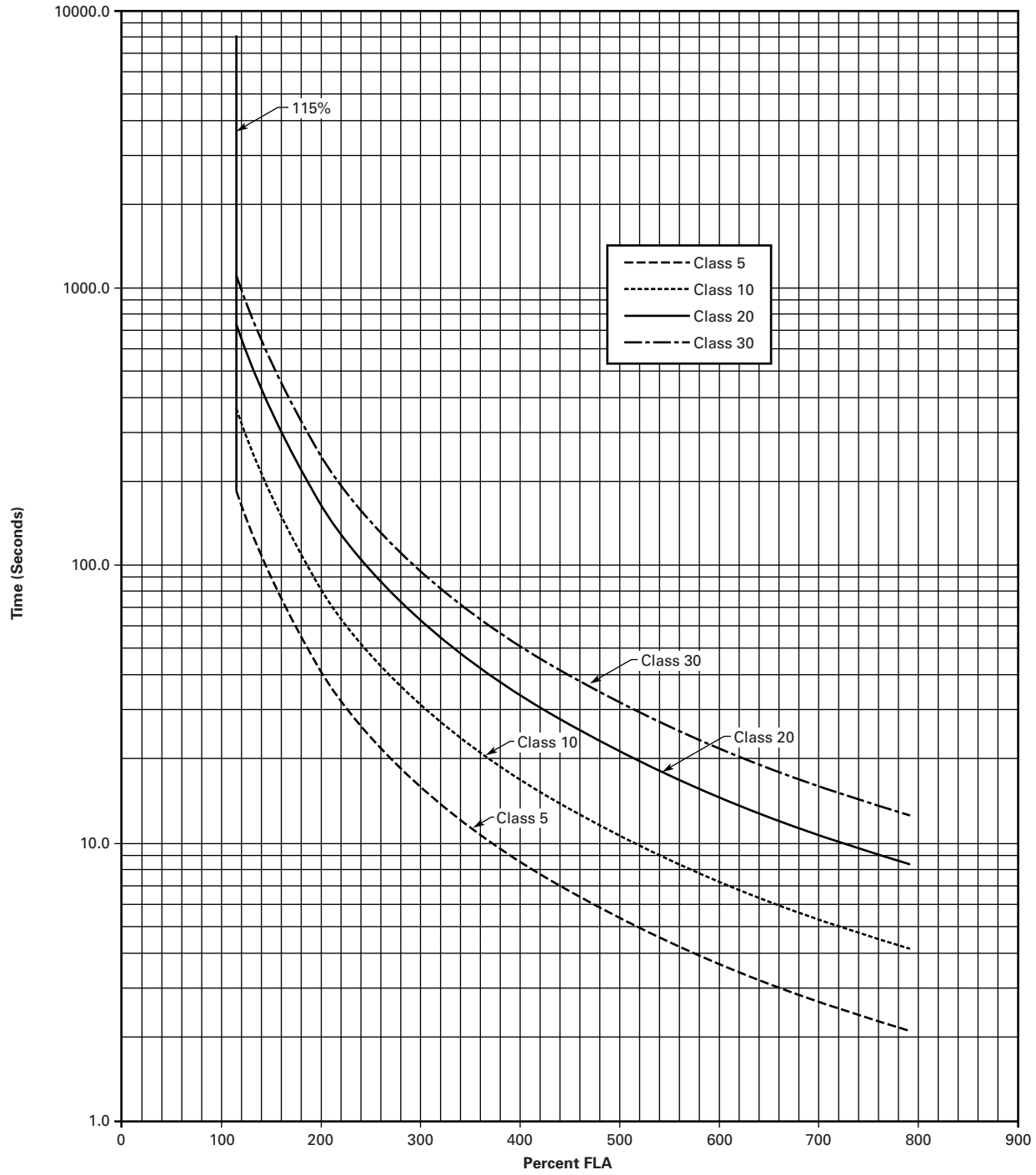
Appendix C—Ratings, Cooling and Power Losses—Inline

Power Ratings

Standard Duty—15 Second Ramp, 300% Current Limit at 40°C—Inline Connection

Maximum Current	Three-Phase Motors kW Rating (50 Hz) 230V 1.0SF	380–400V 1.0SF	440V 1.0SF	hp Rating (60 Hz) 200V 1.0SF	1.15SF	230V 1.0SF	1.15SF	460V 1.0SF	1.15SF	575–690V 1.0SF	1.15SF	Catalog Number
Frame Size N												
37	10	18.5	18.5	10	10	10	10	25	20	30	30	**S801+N37…**
66	18.5	30	37	20	15	20	20	50	40	60	50	**S801+N66…**
Frame Size R												
105	30	55	59	30	25	40	30	75	60	100	75	**S801+R10…**
135	40	63	80	40	30	50	40	100	75	125	100	**S801+R13…**
Frame Size T												
180	51	90	110	60	50	60	60	150	125	150	150	**S801+T18…**
240	75	110	147	75	60	75	75	200	150	200	200	**S801+T24…**
304	90	160	185	100	75	100	100	250	200	300	250	**S801+T30…**
Frame Size U												
360	110	185	220	125	100	150	125	300	250	350	300	**S801+U36…**
420	129	220	257	150	125	175	150	350	300	450	350	**S801+U42…**
500	150	257	300	150	150	200	150	400	350	500	450	**S801+U50…**
Frame Size V												
360	110	185	220	125	100	150	125	300	250	350	300	**S801+V36…**
420	129	220	257	150	125	175	150	350	300	450	350	**S801+V42…**
500	150	257	300	150	150	200	150	400	350	500	450	**S801+V50…**
650	200	355	425	250	200	250	200	500	450	600	500	**S801+V65…**
720	220	400	450	①	①	300	250	600	500	700	600	**S801+V72…**
850	257	475	500	①	①	350	300	700	600	900	700	**S801+V85…**
1000	277	525	500	①	①	400	350	800	700	900	800	**S801+V10…**

Notes
1.0SF = 1.0 Service Factor.
1.15SF = 1.15 Service Factor.

① Consult factory.

Severe Duty—30 Second Ramp and/or 450% Current Limit at 50°C—Inline Connection

| Maximum Current | Three-Phase Motors | | | | | | | | | | | Catalog Number |
| | kW Rating (50 Hz) | | | hp Rating (60 Hz) | | | | | | | | |
	230V 1.0SF	380–400V 1.0SF	440V 1.0SF	200V 1.0SF	1.15SF	230V 1.0SF	1.15SF	460V 1.0SF	1.15SF	575–690V 1.0SF	1.15SF	
Frame Size N												
22	5.5	10	11	5	5	7.5	5	15	10	20	15	**S801+N37…**
42	11	18.5	22	10	10	15	10	30	25	40	30	**S801+N66…**
Frame Size R												
65	15	30	33	15	15	20	15	50	40	50	50	**S801+R10…**
80	22	40	45	25	20	30	25	60	50	75	60	**S801+R13…**
Frame Size T												
115	33	59	63	30	30	40	30	75	75	100	100	**S801+T18…**
150	45	80	90	50	40	50	50	100	100	150	125	**S801+T24…**
192	55	100	110	60	50	75	60	150	125	200	150	**S801+T30…**
Frame Size U												
240	75	110	147	75	60	75	75	200	150	200	200	**S801+U36…**
305	90	160	185	100	75	100	100	250	200	300	250	**S801+U42…**
Frame Size V												
240	75	110	147	75	60	75	75	200	150	200	200	**S801+V36…**
305	90	160	185	100	75	100	100	250	200	300	250	**S801+V42…**
365	110	185	220	125	100	150	125	300	250	350	300	**S801+V50…**
420	129	220	257	150	125	150	150	350	300	450	350	**S801+V65…**
480	147	257	295	150	150	200	150	400	350	500	450	**S801+V72…**
525	160	280	335	150	150	200	150	450	350	500	450	**S801+V85…**
575	172	303	370	200	150	250	200	500	450	600	500	**S801+V10…**

Notes
1.0SF = 1.0 Service Factor.
1.15SF = 1.15 Service Factor.

Power Losses

The following table lists the maximum power loss for each S801+ Soft Starter when it is operating in bypass at the maximum frame size current. These losses should be used in conjunction with the losses of another cabinet mounted device to determine the enclosure size and any cooling requirements.

Maximum Power Loss

Catalog Number	FLA Current Range Inline	Power Loss (Watts)
S801+N37…	11–37 amps	30
S801+N66…	20–66 amps	33
S801+R10…	32–105 amps	47
S801+R13…	42–135 amps	55
S801+T18…	56–180 amps	37
S801+T24…	75–240 amps	40
S801+T30…	95–304 amps	45
S801+U36…	112–360 amps	76
S801+U42…	131–420 amps	92
S801+U50…	156–500 amps	116
S801+V36…	112–360 amps	56
S801+V42…	131–420 amps	64
S801+V50…	156–500 amps	78
S801+V65…	203–650 amps	109
S801+V72…	225–720 amps	127
S801+V85…	265–850 amps	164
S801+V10…	312–1000 amps	215

Appendix D—Motor/Application Considerations

Squirrel Cage Motor

This is the most common application.

The motor is configured with three motor leads available.

In this case, wire the motor to the soft starter with one lead per phase, observing proper phase rotation. An in-sight disconnect means should be installed, per code requirements.

Wye-Delta Motor

The wye-delta motor is a traditional way of achieving a reduced voltage start using regular contactors and starters. In this method, the motor is constructed with all six leads brought out to connect the unit in a wye configuration. This allows about 58% of the current (33% starting torque) to be applied during start-up. A timer is used to control the circuit and switch to the delta configuration as the unit approaches full speed.

In this case, wire the six-lead motor in a standard delta configuration. The soft starter is then used to control the voltage and motor torque without the need for additional circuitry. An inline disconnect means should be installed, per local code. The S801+ Soft Starter must be wired into the three-phase line feeding the three main motor input leads as would be done for normal across-the-line starting. **It must not be wired internally between motor windings in an inside-the-delta configuration**.

Part Winding Motor

The part winding motor is another design created to help achieve a soft start to the load. A part winding motor is constructed of two separate (but parallel) windings. When using a traditional starter, the first winding would receive full voltage. This winding supplies as much as 400% of the motors FLA; about 45% starting torque in a delta configuration for motor startup. After a timed delay, full voltage is applied to the second winding. The second winding acts in parallel with the first to provide for normal running current. Part winding motors are available in both a wye and delta configuration, dependent upon the manufacturer. Refer to the motor nameplate for the correct wiring information. In this case, wire the two windings in parallel. The soft starter is then used to control the current applied to the motor. An in-sight disconnect means should be installed, per code requirements.

Dual Voltage Motor

A dual voltage motor should be wired into the appropriate configuration for the line voltage it is being applied to. Refer to the motor nameplate for the correct wiring information. The soft starter must be selected for the appropriate line voltage.

Multi-Speed Motor

Some motors have multiple windings to allow operation at different base speeds. The multiple speeds are sometimes utilized for soft starting and other times for a process requirement of the machine to which it is attached. If only one speed is required, the motor should be wired for that speed. If multiple speeds are required, the appropriate contactors will need to be connected to the output of the Soft Starter. The contactors must be in the selected speed position before the soft starter is started. The motor must be stopped and the soft starter turned off before the speed selection contactors are changed.

Other Winding Configurations

Motors with other winding configurations, designed for specific characteristics, should be wired in a fashion consistent with their intended use. The motor nameplate contains information on the available configurations. The motor winding configuration chosen must be appropriate for the available line voltage. The soft starter must also be selected on the basis of the configuration chosen.

Power Factor Correction Capacitors

Power factor correction capacitors should be installed on the line side of the soft starter. It is recommended that at least 10 feet of cable be between the capacitor and the soft starter. The power factor correction capacitors can be switched with a separate contactor. NEMA ICS2-1988 Part 2-210.81.01 provides recommendations for when a separate contactor should be used to switch the power factor correction capacitor including high inertia loads, reversing motors, frequently jogged motors and multi-speed motors.

It is not recommended that the power factor correction capacitors be used on the load side of the soft starter. If used on the load side, the overload relay will measure the combination of capacitor and motor current causing the overload relay to not function correctly.

Appendix E—Troubleshooting Guide

This guide is intended to provide the information necessary to successfully troubleshoot issues that may occur during the operation of the S801+ Soft Starter. The troubleshooting sequence and fault codes (FC) are identified below in two basic groups, New Applications and Existing Installations. While any fault may occur in either category, experience has shown that some faults are routinely experienced in one category. The following information is intended to be a reference guide to quickly move through the process to achieve or restore operational status of the Soft Starter.

New Applications Checklist—During Commissioning

Note: It is not unusual for the S801+ Soft Starter to trip in the process of being commissioned as it is likely that one or more parameter(s) setting are not appropriate.

24 Vdc control power applied.

- Sufficient minimum wattage and voltage value and inrush capacity.

Mains applied.

- All circuit breakers closed, fuses installed—no open fuses.
- All isolation devices closed.
- Verify continuity of mains power to soft starter.

Load connected.

- All isolation devices closed.
- Reversing contactors (if used) in proper position.
- Continuity of circuit from soft starter to the motor.

Parameter Setup—Operation Mode

- Motor FLA (A)—Motor Nameplate FLA value (Default—frame size minimum).
- Motor Rated Voltage (Default—480V).
- Start Method—Voltage Ramp or Current Limit (Default—Voltage Ramp).
- Start Time—As required (Default—20 seconds).
- Initial Torque—As required (Default—45%).
- Auto Reset Mode—As Required (Default—Manual)

Parameter Setup—Protection Mode

- Overld Trip Class—As Required (Default—20)
- Start Control—As Required (Default—Level)

The following Fault Codes may be experienced during commissioning of a new installation or a new soft start into an existing application. Verify all connections and settings with test equipment as appropriate.

Common Commissioning Fault Codes

- FC11—Overload
- FC12—Motor Stall Fault
- FC13—Jam
- FC14—Motor Voltage Phase Reversal
- FC16—SCR Not Firing
- FC22—Phase Loss
- FC25—Phase Imbalance

Existing Installations Checklist

External Circuit Components Issues

- 24 Vdc control power undersized and/or failed.
- Isolation contactors open or damaged.
- Mains power faulty.
- Load disconnected.
- Load failure.
- Line/Load/Control circuits not restored after component replacement.

Verification of Recent Maintenance Functions

- All disconnected connections restored.
- Isolation devices restored to proper operating positions
- Proper selection of replacement components
- Verify suitability of added or modified components to circuitry.

Fault Code Verification

- Use of test equipment to confirm/refute validity of fault code.
- Determine if the fault can be reset.
- Determine if the fault is continuous or intermittent.
- Note operating conditions at time of fault if possible.

Common Fault Codes

- FC11—Overload
- FC13—Jam
- FC15—Power Pole Over Temperature
- FC16—SCR Not Firing
- FC22—Phase Loss
- FC25—Phase Imbalance
- FC31—Voltage Zero Cross
- FC32—Shorted SCR.

General Information

24 Vdc Control Power—Terminal Block Connections

- Run Enable ⟶ 24 Vdc applied to Terminal "P". This 24 Vdc input must be maintained continuously during RUN operation from either the terminal block or a network.

- START Command enable from Terminal Block ⟶ Voltage applied to terminal "3" of the control power terminal block. When a 120 Vac signal is applied to the Comms Select terminal, START control from the terminal block will not be recognized.

- START Command ⟶ with 24 Vdc applied to Terminal "P", apply 24 Vdc to Terminal "1". The signal requirement is momentary, but maintained is acceptable. Terminals "P" and "1" may be tied together for 2-wire control START/ STOP commands.

- STOP Command ⟶ Remove 24 Vdc from Terminal "P". Terminals "P" and "1" may be tied together for 2-wire control START/STOP commands.

- Wire size, minimum—14 AWG to all Terminal Block connections. Wire should have no stands missing or damaged during wire stripping. The use of terminal ferrules is recommended to maintain connection integrity.

- Control Power Supply Requirements.

  - Must meet or exceed steady state and inrush capacity requirements.

    - Steady State (sealed) = 25 Watts, 24 Vdc.

    - Outrush = 240Watts, 24 Vdc for 150 ms minimum.

    - Minimum supply voltage 24 Vdc measured at the Terminal Block.

    - Maximum allowable voltage drop measured at the Terminal Block = 5 Vac.

Fault Reset Details

- If the Status led is RED, the soft starter is in a fault condition and will not recognize a START command. If a reset attempt is unsuccessful, the fault is still present and must be corrected.

- If the soft starter appear s to have "tripped", but the Status LED is GREEN and there is no new Fault code in memory, verify that the soft starter has not stopped due to a STOP command.

- Terminal "P" (permissive) must be energized (maintained) to enable operation, but will not prevent a fault from being reset. The Status LED can be GREEN without a signal at the "P" terminal.

- Terminal "1" is energized (momentary or maintained) to issue a START command. Signal duration must be a minimum of 500ms for the Soft Starter to recognize the START command.

- Terminal "P" is de-energized to issue a STOP command.

- LEVEL Sense

  - Most commonly used Start Control parameter setting

  - **Maintained** Terminal "1" energized:
    - START command is present when Terminal "P" is energized (maintained).
    - START command is present when any fault clears and is then RESET.

      RESET function may be either AUTO or MANUAL.

  - IMPORTANT NOTE: If the LEVEL sense parameter AND the AUTO RESET parameters are selected, a motor START command will exist if a 24 Vdc signal is present on Terminal "P" and Terminal "1 and remains energized when the fault condition clears. After a transient fault, this condition may cause the motor to start unexpectedly.

  - **Momentary** Terminal "1" energized:
    - START command is present when Terminal "P" is energized (maintained).
    - START command is not present when any fault clears and is then RESET.
    - Terminal "1" must be again energized to issue a START command.

- EDGE Sense

  - **Maintained** Terminal "1" energized:

    - After a fault has been RESET the 24 Vdc signal must be removed from the Terminal "1" to enable a START command. After a fault has been RESET, re-energizing Terminal "1" (maintained or momentary) will issue a START command.

  - **Momentary** Terminal "1" energized:
    - If Terminal "1" is energized (momentary) by the soft starter control system, the START signal must be reapplied after the RESET has been accomplished.

  - In either case above, Terminal "1" must be de-energized momentarily if the RESET parameter is in either MANUAL or AUTO to enable a START command.

- Thermal Overload

  - After an Overload trip—no restart is allowed until the prescribed time period has elapsed.

  - Trip Rest Time Periods
    - 1st Trip = 3 minute RESET inhibit.
    - 2nd Trip (within 48 minutes of 1st Trip) = 6 minute RESET inhibit.

      96 minutes to restore 3 minute inhibit level.
    - 3rd Trip (within 48 minutes of 2nd Trip) = 9 minute RESET inhibit.

      144 minutes to restore 6 minute inhibit level.

      240 minutes to restore 3 minute inhibit level.
    - Cycling 24 Vdc control power does not reset the inhibit times.

- Thermal Memory

  - This parameter is not the same as Thermal Overload.

  - At 100% Thermal memory the soft starter will stop with a RED status LED.

  - At 99% thermal Memory a START command will be allowed BUT, as soon as 100% is again reached, as it will be during the start sequence, the soft starter will again stop.

  - Cycling 24 Vdc control power will not reduce the Thermal Memory value.

- Fault Occurrence Categories

  - Immediately when START command is issued.

  - During the START ramp, before the internal bypass contactors close.

  - During the Internal Bypass Contactor closure event.

  - Anytime during the RUN operation.

  - During the STOP (SOFT STOP) command.

- Status LED Indication Conditions

  - RED

    – Active fault is present, cannot RESET.

  - GREEN

    – Not responding to START command from field wiring.

      LEVEL Sense

      Insufficient voltage at Terminal "P".

      Insufficient voltage at Terminal "1".

      EDGE Sense

      Cycle 24 Vdc at Terminal "1"

      Insufficient voltage at Terminal "P".

      Insufficient voltage at Terminal "1".

  - OFF—All

    – Check for loss of 24 Vdc control power and/or less than 17 Vdc.

    – Check Terminal Block for condition and security.

    – Verify 24 Vdc at appropriate terminals

    – Verify proper operation and capacity of control power supply.

- START Command Troubleshooting

  - From the Terminal Block

    – Verify that Terminal "P" is energized continuously.

    – Verify that 24 Vdc is applied to Terminal "1" to issue START command.

    – If Terminals "P" and "1" are tied together, verify that both Terminals receive 24 Vdc START signal.

    – If Start Control parameter is set to EDGE, verify that 24 Vdc has been cycled (removed, then reapplied) after faults have been reset.

S801+ Fault Codes

Code	Fault	Condition	Solution
S. S. Trip LED	General Fault	Occurs when any dedicated LED and/or Fault Code is logged into the S801+ memory	Check for presence of dedicated LEDs
			Check for presence of fault codes.
			Note: Fault codes are not time stamped. Verify that the code is a recent occurrence rather than an "old" code.
	Notes:		
	The most common occurrences of faults may be; Overtemperature (High operating temperature); T_r setting (Ramp time too long); Hardware failure, Load disconnect (Insufficient motor load). These faults may be corrected by the appropriate actions.		
	If the RVSS has stopped and the S.S. Trip LED is not illuminated, verify that a STOP command was not errantly received by the unit. Failure to note the validity of a STOP command and failing to note an old fault code may result in needless troubleshooting activities.		
JAM LED (FC13)	Jam	Soft Starter in Bypass: Motor below rated RPM and/or current exceeds 3X FLA.	Remove obstruction.
			Verify proper FLA setting on FLA potentiometer.
			Jam Fault can be disabled if trips occur during normal operation
	Notes:		
	The Jam Fault may be disabled (not recommended). The maximum RMS value of the 3 phase currents is monitored when the internal bypass contactors are closed.		
	The Jam Fault Trip threshold is 3X Motor FLA and is not user settable. Jam Trip Delay is 1.5 seconds and is not user settable.		
STALL LED (FC12)	Unit railed to reach synchronous speed	Motor failed to reach synchronous speed (90% motor rpm or greater) prior to the expiration of the START time.	Clear application of the cause of the Stall condition.
			Verify ramp time is sufficient for the application.
			Verify the Initial Torque setting is appropriate for the application
	Notes:		
	Motor rotation should begin within 2 seconds of energization. If motor rotation does not begin within 2 seconds, increase Initial Torque or utilize the Kick Start feature to initialize motor rotation.		
PH. Loss LED (FC22)	One or more phase voltages not present.	One or more phase voltages not present.	Verify that all connections are correct and tight and voltage is of the proper value.
		Phase voltages and/or currents have significant imbalance.	Verify continuity of fuses or breakers, disconnects or isolation contactors
			Verify all connections are correct and tight.
			Verify that imbalance is within limits during Run operation in bypass.
	Notes:		
	Verify fuse integrity by using the proper test methods. Performing a resistance test with an ohmmeter across a fuse may not necessarily produce accurate measurements. This fault may also be triggered by an excessive degree of phase imbalance. Imbalance may be generated by degraded connections due to loose hardware, loose connections, cracked or damaged connections/hardware, degraded contacts in isolation contactors, and loose connections in junction boxes.		
Ph. REV LED (FC14)	Phase rotation is not ABC	Improper phase connections.	Exchange any two phase in the line connections of the soft starter.
		Phase loss.	Correct phase loss and/or current imbalance conditions.
	Notes:		
	In new applications, phase connections may not be proper when setting the correct direction of rotation of the motor. In existing applications, momentary phase loss and/or current imbalance may trigger phase reversal as with only 2 phases present, the unit cannot determine the direction of phase rotation.		
OVLD Trip LED (FC11)	Motor Overload	Motor is operating in excess of rated FLA.	Verify motor load is within specs.
	FLA setting not correct.	FLA potentiometer not set correctly.	Verify that the FLA potentiometer is set correctly for the application.
	Improper Trip class.	Trip class potentiometer not set correctly.	Verify that the trip class potentiometer is set correctly for the application.
	Failed current sensor	RVSS Hardware failure.	Possibly current sensor failure—contact EatonCare for service.
	Notes:		
	Verify that the service factor has been accommodated in the FLA potentiometer setting. This trip condition may not be immediately reset, depending on the overload condition. If the unit cannot be reset until a period of time has elapsed strongly suggests that an actual overload condition occurred, rather than a device or component failure. In a true overload condition, a period of time may be required before the unit is able to be RESET. Initiating another START after a reset may result in another overload trip due to retained thermal memory.		

S801+ Fault Codes, continued

Code	Fault	Condition	Solution
11	Overload Fault	Motor overloaded for an extended period of time.	Reduce the motor's load.
		Thermal Memory is over 100%	Verify the *Overld Trip FLA* and/or *Ovrld Trip Class* for proper adjustment.
			Note: Exceeding nameplate ratings will shorten equipment life.
			Fault during motor start: Verify system is not exceeding the specified maximum starts per hour.
			Increase the initial torque and/or reduce ramp time to bring the motor up to speed faster.
			Increase Trip Class setting (30 maximum) and/or reduce ramp time setting.
	Notes: Higher than normal thermal memory may indicate an abnormal operating condition and signal an impending *Overload* fault.		
12	Motor Stall	Motor not at rated RPM at end of start ramp time and/or current is in excess of 2X FLA.	Lengthen *Soft Start Time* and/or increase *Initial Torque* potentiometers
		Bypass contactors not closed at the end of the start time (start current low/ramp time short).	Loads that are heavily loaded (high inertia) during a start such as fans will often need an initial torque setting much greater than the factory default.
			Set *Kick Start* parameters.
	Notes: Motor rpm is monitored for a synchronous speed condition. A Motor Stall fault will occur at the end of the ramp time (default is 20 seconds) if the motor is not at synchronous speed and the current is in excess of 2X FLA. This feature is not user settable. Verify that the motor is properly sized for the load.		
13	Jam	Soft Starter in Bypass: Motor below rated RPM and/or current exceeds 3X FLA.	Remove obstruction.
			Verify proper FLA setting in Protections Menu.
			Jam Fault can be disabled if trips occur during normal operation (Over Current Fault will provide protection at a higher current threshold of 4X catalog FLA).
	Notes: The Jam Fault may be disabled (not recommended). The maximum RMS value of the 3 phase currents is monitored when the internal bypass contactors are closed. The Jam Fault Trip threshold is 3X Motor FLA and is not user settable.		
14	Motor Voltage Phase Reversal	Incoming line phase rotation sequence opposite of device setting.	Exchange two incoming mains phases.
		One phase missing and/or open fuse or breaker.	Verify that all circuit breakers are closed or fuses are serviceable.
	Notes: If mains leads need to be changed, swap incoming leads and set *Phase Sequence* to match incoming sequence. If an upstream reverser is used, disable *Phase Rev Fault (not recommended)*. This fault is not uncommon in new installations. In the event of a blown fuse prior to a START command, this fault may occur as the unit is not able to determine phase rotation with one open fuse. If motor rotation requires exchange of phases, exchange the cables between the soft starter and the motor.		

S801+ Fault Codes, continued

Code	Fault	Condition	Solution
15	Power Pole Over Temperature	SCR temperature is above limits.	Ventilate to specified maximum temperatures
		Operating environment above specified maximum temperature.	Clear obstructions.
		Ventilation holes blocked.	Verify fans are operational,
		Fans are not operational.	Verify system is not exceeding the specified maximum starts per hour.
		Starts/hour exceed specifications.	Verify bypass contacts are closing at the end of ramp time.
		Sensor failure on power pole.	Reduce excessive cabinet temperature.
		Bypass contactor(s) failed to close.	Soft Starter running continuously in JOG mode.

Notes:

Any power pole temperature in excess of 100°C will cause a fault trip. The soft starter will attempt to close the bypass contactors at the end of the ramp time, or if the motor is up to synchronous speed for 30 seconds. If the bypass contactors close, then open, then close, etc. several times, the contactor(s) may be failing to seal electrically. A common report of this condition is "chattering" of the soft starter. After the 30 second time period, the unit will discontinue attempting to close the bypass contactors and will continue to run on the SCRs. At some point in the future, the unit will very likely overheat due to insufficient cooling of the power poles.

If the soft starter is run continuously in the JOG mode, the starter will use the normal start parameters, BUT the bypass contactors will not close. Running continuously on the SCRs will generate more heat than can be dissipated by the internal fans, resulting in an over temperature fault trip.

Code	Fault	Condition	Solution
16	SCR Not Firing	SCR is not conducting when gated. Incoming phase lost.	SCR failure.
		Special application—undersized or high impedance motor	Re-apply lost phase.
		Load disconnected.	Review S801+ application.
			Circuitry damaged by megger testing.
			Contact EatonCare for service.

Notes:

Verify that both mains and load lines are connected and secure. Verify that any isolation and/or reversing contactors are properly engaged prior to the soft starter receiving a START command. If the current draw is significantly less than the frame size of the soft starter (less than 1/16 of motor FLA), not enough current may be flowing to allow the SCRs to fire. If this fault occurs immediately when the START command is issued, isolation contactors may be open and/or in transition.

Code	Fault	Condition	Solution
22	Phase Loss	Incoming phase disconnected.	Repair broken connection.
		Open fuse or breaker.	Replace fuse.
		Phase imbalance exceeds specifications or trip parameter.	Inspect system for phase imbalance conditions.
		Severe voltage phase imbalance.	

Notes:

Phase loss is a severe condition of phase imbalance, even momentarily. In cases of severe imbalance causing nuisance trips, this feature may be disabled (not recommended). Phase performance should be monitored for an appropriate length of time to ensure that the phase is not dropping just long enough for the soft starter to detect the condition.

S801+ Fault Codes, continued

Code	Fault	Condition	Solution
23	Bypass Failure	Internal bypass contactor(s) not closed and/or electrically sealed after ramp time.	Verify all bypass contactor(s) close (audible noise). Measure voltage drop line to load.
		Contactor(s) opened in bypass.	Verify all bypass contactor(s) not opening during run cycle due to excessive vibration and/or shock. Reduce levels of vibration and/or shock.
		Starter is being operated continuously in JOG mode.	Verify control power and wire size meet specifications.
			Verify that the control power supply meets the 24 Vdc voltage and current requirements of the IT soft starter.

Notes:

This fault may occur even if just one contactor (larger soft starters have multiple contactors) fails to seal electrically, of if the contactors opens during operation. If the firmware detects that the bypass contactor(s) have failed to close (as measured by the voltage drop across the power poles), the firmware will command the contactors to release (open) and then reapply the signal to the coil of the contactor(s). this process may repeat for 30 seconds. If after 30 seconds, and the bypass contactor(s) have failed to close electrically, the firmware will discontinue the signal to close the contactor(s) and the soft starter will rum utilizing the SCRs. Bypass contactors may open during the motor run from excessive shock or 24 Vdc control voltage sag (insufficient voltage and/or current to maintain contact closure). If the soft starter is running continuously on the SCRs (or in JOG mode) an S.S. Trip fault may occur after a period of time. If the fault occurs after the STOP command, it is likely that one or more contactors did not seal electrically during the START ramp and the unit has been running on the SCR(s).

Code	Fault	Condition	Solution
24	Instantaneous Over Current	Excessive starting current.	Reduce starting load.
		Excessive load.	Increase soft starter capacity (be sure model ratings can handle current demands).

Notes:

During the Start Ramp Time, the maximum RMS value of the 3 phase current(s) are monitored. Instantaneous Over Current Trip threshold is 6X catalog FLA. Catalog FLA refers to the maximum continuous line current capacity of the S801+ soft starter, NOT the motor rated FLA.

Code	Fault	Condition	Solution
25	Phase Imbalance	The voltage or current imbalance of the incoming phases exceeds the trip threshold.	Correct imbalance problem with mains.
			Disable the fault if the other issues cannot be resolved.

Notes:

Phase imbalance may be impacted by voltage issues and/or current issues.

Code	Fault	Condition	Solution
26	Internal NV Memory	Internal memory error.	Component failure on printed circuit board.
			Contact EatonCare for service.
31	Voltage Zero Cross Lost	Mains voltage lost.	Restore mains or lost phases.
		Phase L1 or L3 lost.	Verify that the load is connected and any disconnect devices are properly engaged.
		Load disconnected	Contact EatonCare for service.

Notes:

The SCRs are unable to fire if there is no source voltage or load on the unit. Verify that all mains control devices are properly connected and powered prior to initiating a START command.

Code	Fault	Condition	Solution
32	Shorted SCR	SCR is shorted.	Test resistance of each phase.
		Internal bypass contactor welded shut.	Contact EatonCare for service.
		No load on the SCRs when START command is issued (motor disconnected).	

Notes:

Shorted SCRs are the most common mode of SCR failure. With power completely removed from the unit, measure the resistance of each pole, line to load. If the resistance is near zero (less than 5 ohms), it is most likely that the SCR is shorted. Resistance of a serviceable SCR is approximately 10k ohms. Resistance typically moves to a lower value as the SCR ages. This feature may be disabled (not recommended).

Unit compares voltage drop across the SCRs to conclude if the SCRs are "shorted". When a Start command is issued with no load connected, there is no voltage drop as there is no current flow.

S801+ Fault Codes, continued

Code	Fault	Condition	Solution
33	Motor Under Load (Disconnect)	Current drawn by the motor is below trip threshold.	Repair/replace failed couplings.
		Failed motor coupling.	Increase load.
		Load engagement device is not operating.	
		Motor is not loaded	
	Notes:		
	When the internal bypass contactors are closed, the average value of the 3 phase currents is monitored as a % of FLA.		
34	SCR Instantaneous Over Current	Excessive SCR Current during the start ramp.	Increase *Soft Start Time* and/or *Initial Torque* potentiometers.
		Only active when *Stall* Fault is disabled.	Reduce starting load.
			Verify S801+ is properly rated for current.
	Notes:		
	The maximum RMS value of the three phase currents is monitored. The SCR Over Current Trip threshold is 3X FLA.		
41	Low Control Voltage	Voltage at Terminal "+" falls below 17 Vdc.	Verify power capacity (amperage) of 24V power supply to close contactors.
		The external 24V power supply voltage is below specifications and/or insufficient current capacity.	Power supply voltage is intermittent and/or drifting. Read value on Monitoring Menu.
			Verify correct wire size (14 gage minimum) used to connect power supply to S801+. Inspect for wire damage or corrosion.
			Check voltage drop between power supply and Terminal "+".
			Possible internal hardware failure.
	Notes:		
	Only voltage at Terminal "+" is monitored for condition that may generate this fault. Inspect control voltage circuit for proper configuration. If the 24 Vdc control voltage is lost at Terminal "P" just prior to the voltage loss at Terminal "+", the soft starter will recognize this condition as a STOP command. This condition would cause a shutdown of the soft starter without logging FC41. Suspect source voltage should be monitored for the appropriate length of time to determine if the voltage drifts more than 0.1 Vdc from nominal, or if the voltage is intermittent.		
	When selecting a power supply, ensure that the outrush capacity of the power supply meet or exceed 240 watts at 24 Vdc for 100ms, minimum.		
42	Firmware Incompatibility or Hardware failure.	Hardware failure.	Failed unit. Contact EatonCare for service information.
43	Internal Communications	Communications to DSP have been interrupted.	Firmware is not communicating internally.
		Possible hardware failure.	Cycle 24 Vdc control voltage power to attempt to clear problem.
44	Internal CPU	Firmware Incompatibility or	Hardware failure on the printed circuit board (PCB) and/or the firmware is corrupted.
		Hardware failure.	Contact EatonCare for support.
45	Internal Program Memory	Corrupted firmware or memory.	Cycle 24 Vdc control power to the S801+.
			Contact EatonCare for service.
*	CIM LEDs Non-functional	<u>C</u>ontrol <u>I</u>nterface <u>M</u>odule failure	Replace the CIM to restore operation.
	Notes:		
	There is only one model CIM, part number EMA71 for all S801+ soft starters. All operating parameters for the soft starter are stored in non-volatile memory on the printed circuit board, so the CIMs may be exchanged between all models (sizes) of soft starters if a replacement CIM is not available.		
	The S801+ may be operated without the CIM installed by simply removing the control prior to energizing the unit (24 Vdc).		

S801+ Fault Codes, continued

Code	Fault	Condition	Solution
*	Cannot RESET fault	Fault condition still exists.	Troubleshoot fault and correct defective condition.
		Soft Starter has not received RESET signal	Attempt alternate methods of RESET
	Notes: The RESET signal can be applied from any one of two locations: the small recessed RESET button on the face of the soft starter, and by applying 24 Vdc to terminal "4" of the Control Voltage Terminal Block. The small recessed RESET button on the face of the soft starter is a sub-miniature switch mounted on the PCB. You will feel a slight detent when the switch closes. Pressing the switch beyond this point does not increase your chances of clearing a fault, but may cause permanent damage to the switch. If the detent cannot be felt when pushing the button, proper operation of the switch is suspect. If the soft starter <u>cannot</u> be RESET with the Reset push button, but <u>can</u> be RESET by applying 24 Vdc to Terminal Block "4", the push button switch is damaged.		
*	Run without CIM	CIM is non-functional or intermittent.	Soft Starter may be run with existing parameters without the CIM installed.
			CIM may be reinstalled and control power applied, initialization process will recognize CIM.
	To run the soft starter without the CIM, simply disconnect the CIM prior to a START command.		
	To reinstall a CIM that has been removed, remove 24 Vdc control power, reinstall the CIM, then restore 24 Vdc control power.		

Notes

All mains and control power connections must be completed and voltage applied prior to a START command. Failure to make all connections will result in one or more faults.

All isolation and/or reversing contactors must be staged prior to any START commands. Manipulating contactors after the START command will result in one or more faults.

General Information

Eaton is dedicated to ensuring that reliable, efficient and safe power is available when it's needed most. With unparalleled knowledge of electrical power management across industries, experts at Eaton deliver customized, integrated solutions to solve our customers' most critical challenges.

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