

# S811+ Soft Starter

## User Manual

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## Safety

### Definitions and Symbols

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#### **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 S811+ 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<sup>2</sup>).

---

#### **CAUTION**

---

Do not apply 120 Vac to the control input terminals of the Control Power Terminal Block.

---

#### **CAUTION**

---

Do not apply 24 Vdc to Network communications Terminal Block.

---

 **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.**

---

 **WARNING**

**Setting the Overload Trip Class parameter to OFF disables this feature resulting in no thermal overload protection for the motor.**

---

 **WARNING**

**Certain protection parameters may be set for TRIP Faults, WARNING Faults, or DISABLE (No TRIP or WARNING indication). Parameters set to WARNING Fault, or DISABLE will not result in a TRIP Fault and system damage may occur. Disabling protection parameters is not recommended.**

## Introduction

### Overview

The Eaton S811+ 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 S811+ 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 S811+ has built-in communications capabilities via a Communications Port. The Communications Port is a screw terminal block that is utilized for ModBus® communications or communication to an EATON HMI. Communications adapters are available for other protocols. Please consult Eaton for availability.

The S811+ Soft Starter utilizes a Digital Interface Module (DIM) that allows the user to configure the device, read and write system parameters, and evaluate fault codes for troubleshooting.

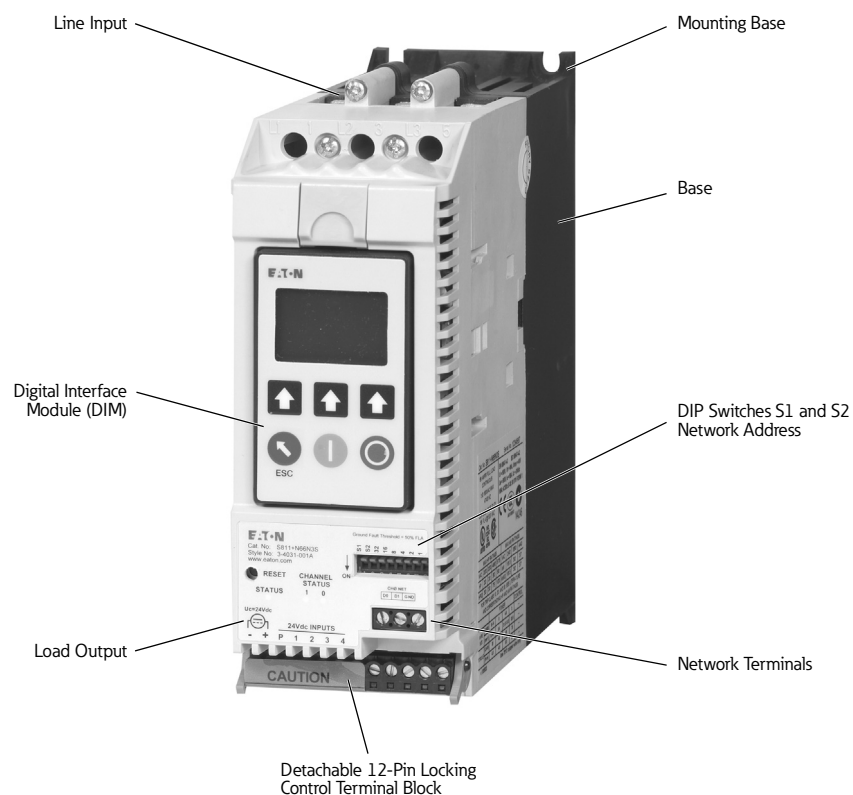
The DIM includes an easy-to-read display and keypad to scroll through the parameters. The Digital Interface Module allows the user to modify control parameters, enable or disable protections, set system variances from Fault TRIP to Fault WARNING, set communication variables, monitor system parameters such as line voltages and currents and access the fault queue.

The S811+ 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 S811+ 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 S811+ Soft Starter



## Introduction

### 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
<b>Emissions</b>	
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 S811+.

## 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
<b>S811+N37...</b>	5.8 (2.6)	7.37 (187.2)	2.66 (67.6)	6.45 (163.9)
<b>S811+N66...</b>	5.8 (2.6)	7.37 (187.2)	2.66 (67.6)	6.45 (163.9)
<b>S811+R10...</b>	10.5 (4.8)	7.92 (201.2)	4.38 (111.3)	6.64 (168.6)
<b>S811+R13...</b>	10.5 (4.8)	7.92 (201.2)	4.38 (111.3)	6.64 (168.6)
<b>S811+T18...</b>	41 (18.6)	12.71 (322.9)	7.65 (194.4)	6.47 (164.4)
<b>S811+T24...</b>	41 (18.6)	12.71 (322.9)	7.65 (194.4)	6.47 (164.4)
<b>S811+T30...</b>	41 (18.6)	12.71 (322.9)	7.65 (194.4)	6.47 (164.4)
<b>S811+U36...</b>	41 (18.6)	12.72 (323.1)	7.73 (196.3)	7.16 (196.3)
<b>S811+U42...</b>	41 (18.6)	12.72 (323.1)	7.73 (196.3)	7.16 (196.3)
<b>S811+U50...</b>	41 (18.6)	12.72 (323.1)	7.73 (196.3)	7.16 (196.3)
<b>S811+V36...</b>	91 (41.4)	16.57 (420.8)	11.05 (280.6)	7.39 (187.8)
<b>S811+V42...</b>	91 (41.4)	16.57 (420.8)	11.05 (280.6)	7.39 (187.8)
<b>S811+V50...</b>	91 (41.4)	16.57 (420.8)	11.05 (280.6)	7.39 (187.8)
<b>S811+V65...</b>	91 (41.4)	16.57 (420.8)	11.05 (280.6)	7.39 (187.8)
<b>S811+V72...</b>	91 (41.4)	16.57 (420.8)	11.05 (280.6)	7.39 (187.8)
<b>S811+V85...</b>	91 (41.4)	16.57 (420.8)	11.05 (280.6)	7.39 (187.8)
<b>S811+V10...</b>	91 (41.4)	16.57 (420.8)	11.05 (280.6)	7.39 (187.8)

## Technical Data and Specifications

### Short-Circuit Ratings—Component

Frame Size	Fuses	Circuit Breaker	Voltage	SCCR Rating (A)
S811+N...	J	HFD	600	10 kA
S811+R...	RK5/J	HFD,HKD	600	10 kA
S811+T...	RK5/J	HLD	600	18 kA
S811+U...	RK5/J	HLD	600	30 kA
S811+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
S811+N...	J	600	100 kA	100	K
S811+R...	RK5/J	600	100 kA	200	K
S811+T...	RK5/J	600	100 kA	600	K
S811+U...	RK5/J	600	100 kA	600	K
S811+V36...	RK5/J	600	100 kA	600	K
S811+V42...	L	600	100 kA	800	K
S811+V50...	L	600	100 kA	800	K
S811+V72...	L	600	100 kA	1200	ND
S811+V85...	L	600	100 kA	1200	ND
S811+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
S811+N...	HFD	HMCP	600	10 kA	150
S811+R...	HFD,HKD	HMCP	600	10 kA	150, 300
S811+T...	HLD	HMCP	600	18 kA	600
S811+U...	HLD	HMCP	600	18 kA	600
S811+V...	HND, RD	HMCP	600	35 kA, 42 kA	1000, 2000



**Short-Circuit Information with IEC Breakers**

Catalog Number Prefix	Starter— Maximum Rated Operational Current (Standard Duty) [A]	Motor Current— Based Upon Maximum Operational Voltage of 400 Vac [A]	Four-Pole Motor kW at 400V 50 Hz [kW]	Short Circuit Rating at 400V 50 Hz [kA]	Motor Current— Based Upon Maximum Operational Voltage of 690 Vac [A]	Four-Pole Motor kW at 690V 50 Hz [kW]	Short Circuit Rating at 690V 50 Hz [kA]	Recommended Mag—Only Breaker for IEC Markets
S811+N37...	37	34.9	18.5	50				NZMN1-S40
S811+N66...	66	55.5	30	50				NZMN1-S63
S811+R10...	105	99.7	55	50				NZMN1-S100
S811+R13...	135	135	75	50				NZMN2-S160
S811+T18...	180	161	90	50	163	160	18	NZMN2-S200
S811+T24...	240	196	110	50	253	250	18	NZMN2-S200
S811+T24...	240	231	132	50	253	250	18	NZMN3-S250
S811+T30...	304	279	160	50	303	300	18	NZMN3-S320
S811+V36...	360	351	200	50	357	355	20	NZMN3-S400
S811+V42...	420	351	200	50	357	355	20	NZMN3-S400
S811+V50...	500	437	250	50	500	500	20	NZMN3-S500
S811+V65...	650	544	315	50	628	630	20	NZMN4-ME875
S811+V72...	720	683	400	50	706	710	20	NZMN4-ME875
S811+V85...	850	769	450	50	844	850	20	NZMN4-ME875
S811+V10...	1000	863	500	50	991	1000	20	NZMN4-ME1400

These devices do not have 690 Vac ratings

**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/offering/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  $-58^{\circ}$  to  $158^{\circ}\text{F}$  ( $-50^{\circ}$  to  $70^{\circ}\text{C}$ )
- 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

S811+Soft Starters are to be shipped in packaging that adequately protects the unit.

S811+ 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 S811+ does not require any special tools for mounting operations.

To aid with panel layout, refer to the dimension drawings on **Pages 8–10**. 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)
S811+N...	#10-32	0.5	5	4	15 (1.7)
S811+R...	1/4 in	0.625	5	4	25 (2.8)
S811+T...	1/4 in	0.625	5	6	30 (3.4)
S811+U...	1/4 in	0.625	5	6	30 (3.4)
S811+V...	1/4 in	1.50	8	8	50 (5.6)

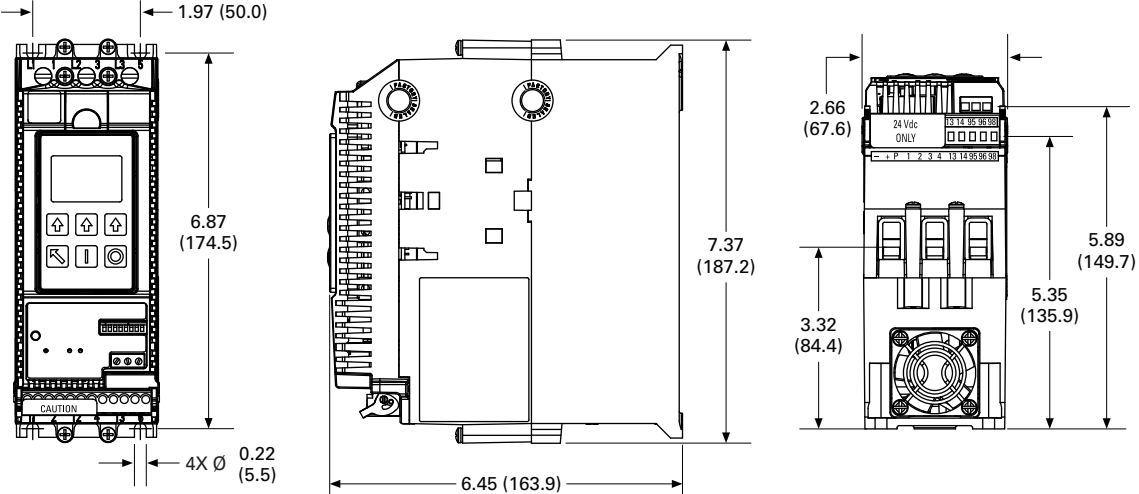
**Note:** See **Page 3** for Weight Support Requirements.

# Installation

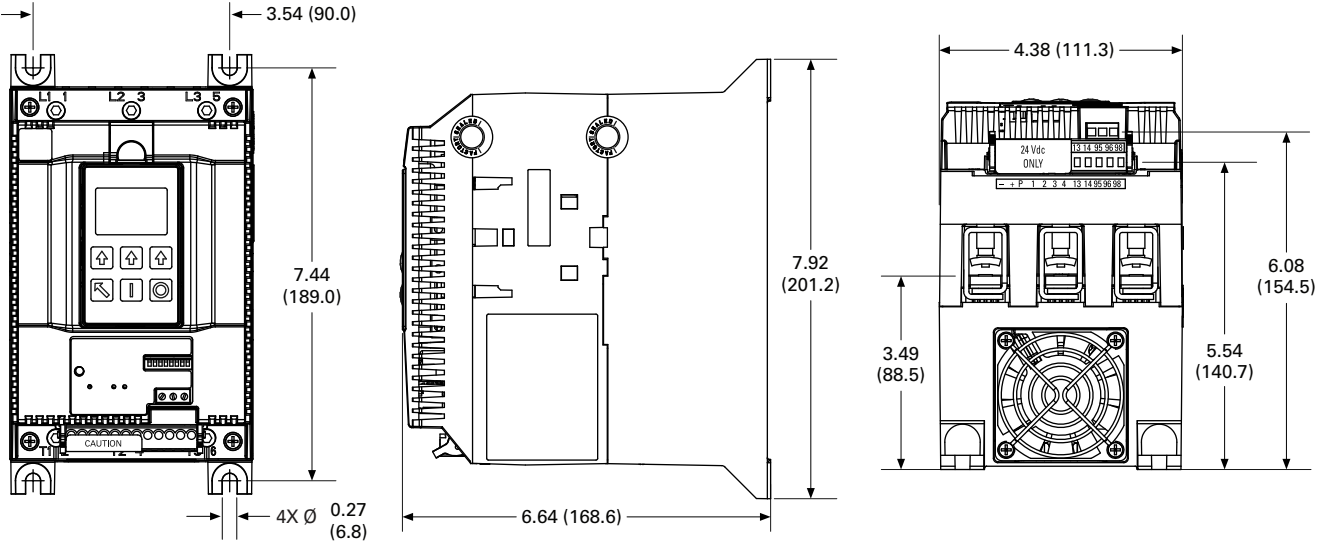
## Dimensions

Approximate Dimensions in inches (mm)

### S811+N...

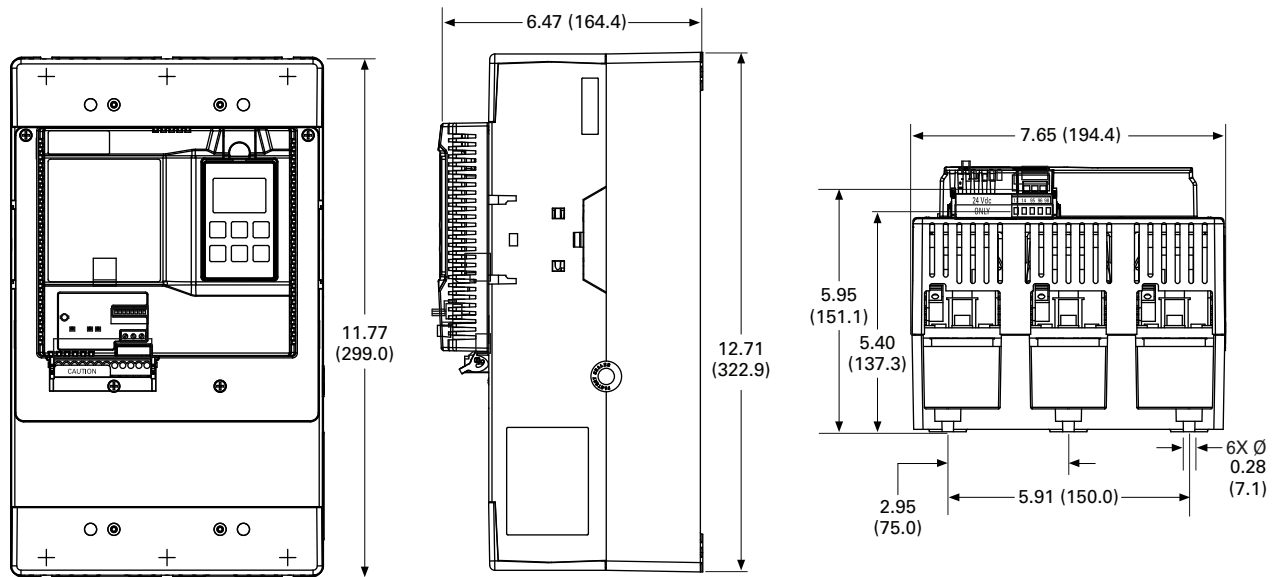


### S811+R...

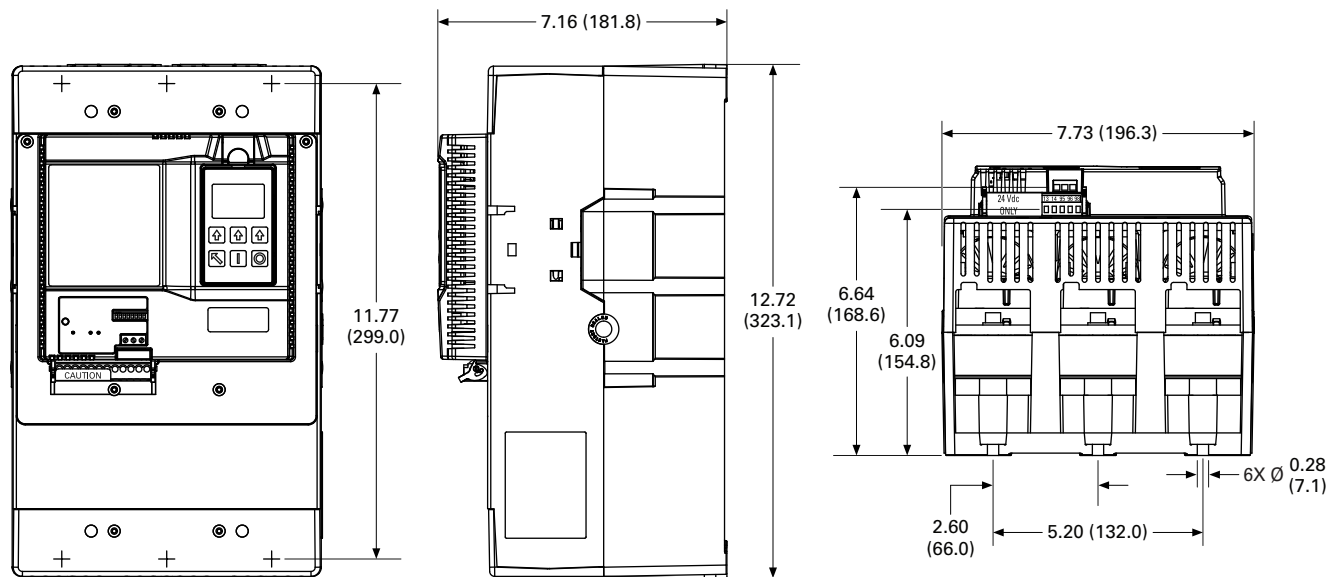


Approximate Dimensions in inches (mm)

**S811+T...**



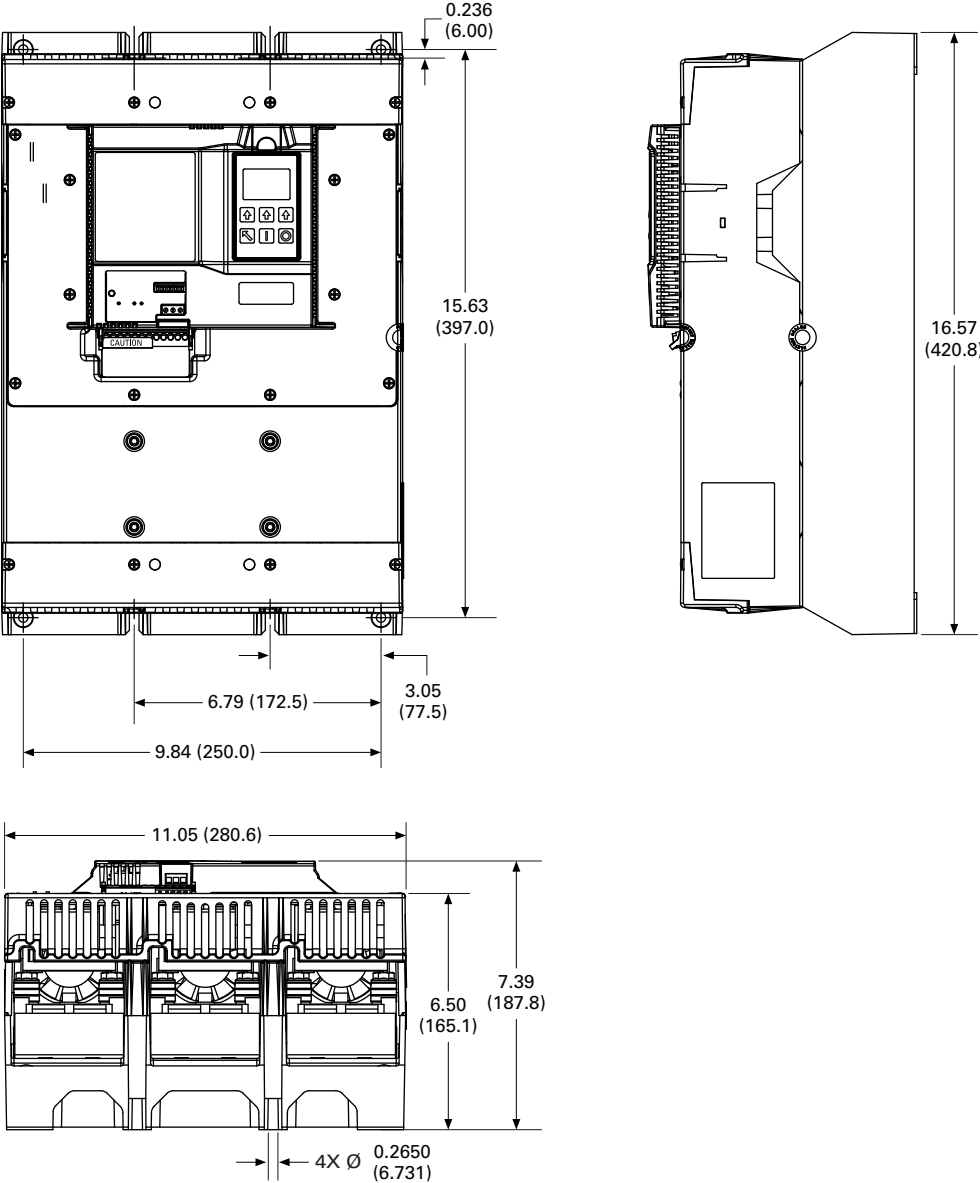
**S811+U...**



# Installation

Approximate Dimensions in inches (mm)

## S811+V...



## 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 S811+.

### 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 S811+ 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 S811+ may be wired in an inline, or inside-the-delta configuration.

By factory default, the S811+ 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.

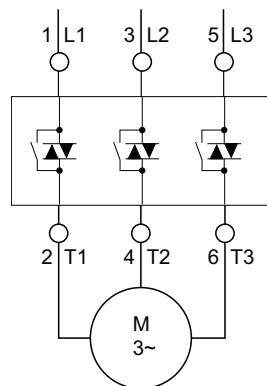
If the input phase sequence to the S811+ cannot be changed, the incoming Phase Sequence parameter in the Soft Start Config. Menu may be set to ACB. Setting ACB as the incoming phase sequence causes the S811+ to recognize the reverse direction of phase rotation. Phase rotation selection and monitoring may be turned off by setting the Phase Sequence Parameter in the Soft Start Config Menu.

### IMPORTANT

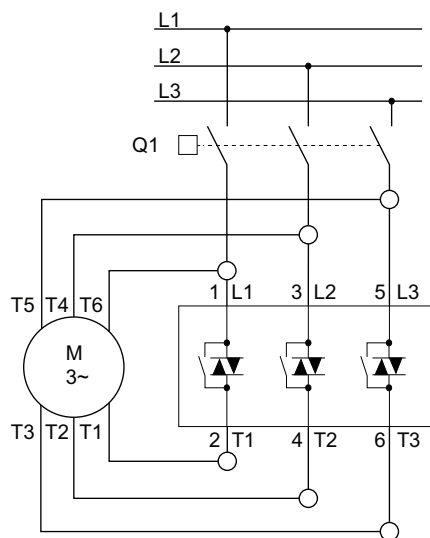
A reversing contactor must never be switched while the soft starter is operating. In order to gain the full benefit of the S811+ with a reversing contactor, the S811+ needs to be OFF when switching the direction of the motor. The soft starter settings must account for catching a motor spinning in the 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 E** for information on typical motor winding configurations.

### Inline Connected Soft Starter (default) Power Wiring Diagram S811+...N3S, S811+...P3S, S811+...V3S



### Inside-the-Delta Connected Soft Starter Power Wiring Diagram S811+...N3S, S811+P3S



## Installation

### Selecting Inline or Inside-the-Delta Operating Configuration

The mains wiring configuration is set with the Motor Wiring Config parameter located in the Soft Start Config menu to Inline (default) or Inside the Delta.

The Motor Nameplate FLA parameter range changes when the Motor Wiring Config parameter is changed from Inline to Inside Delta. If the Motor Nameplate FLA is not within the range, verify that the Motor Wiring Config parameter is correct and/or the proper size S811+ has been selected.

The following table lists the maximum wire sizes and number of conductors required per phase for line and load power wiring lugs.

### Line and Load Power Wiring

S811+N... and S811+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, S811+N... and S811+R...

Catalog Number	Conductor Size <sup>①</sup>	Number of Conductors	Torque Lb-in (Nm)
<b>S811+N...</b>	2 AWG	1	50 (5.6)
	4–6 AWG	1	45 (5.0)
	8 AWG	1	40 (4.5)
	10–14 AWG	1	35 (4.0)
<b>S811+R...</b>	14–8 AWG	1	90–100 (10.1–11.3)
	6–4 AWG	1	
	3–3/0 AWG	1	
	6–4 AWG	1	
	3–3/0 AWG	1	

**Note**

<sup>①</sup> Wire sizes Cu 75°C only.

#### Line and Load Power Wiring, S811+T..., S811+U..., and S811+V...

Catalog Number	Conductor Size	Number of Conductors	Torque Lb-in (Nm)	Lug Kit	Kits Required
<b>S811+T...</b>	4–1/0 MCM	2	250 (28.3)	EML22	2
	4/0–500 MCM	1	250 (28.3)	EML23	2
	4/0–500 MCM	2 <sup>②</sup>	250 (28.3)	EML24	2
	2/0–300 MCM	1	225 (25.5)	EML25	2
	2/0–300 MCM	2	225 (25.5)	EML26	2
<b>S811+U...</b>	4–1/0 MCM	2	250 (28.3)	EML22	2
	4/0–500 MCM	1	250 (28.3)	EML23	2
	4/0–500 MCM	2 <sup>②</sup>	250 (28.3)	EML24	2
	2/0–300 MCM	1	225 (25.5)	EML25	2
	2/0–300 MCM	2	225 (25.5)	EML26	2
<b>S811+V...</b>	4/0–500 MCM	2 <sup>②</sup>	250 (28.3)	EML28	2
	4/0–500 MCM	4 <sup>②</sup>	250 (28.3)	EML30	2
	4/0–500 MCM	6 <sup>②③</sup>	250 (28.3)	EML32	2
	2/0–300 MCM	4	225 (25.5)	EML33	2

**Notes**

<sup>②</sup> CSA approved 350–500 MCM.

<sup>③</sup> Requires special lug cover.

**Note:** S811+T..., S811+U..., and S811+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.



**S811+V10... Installation Requirements**

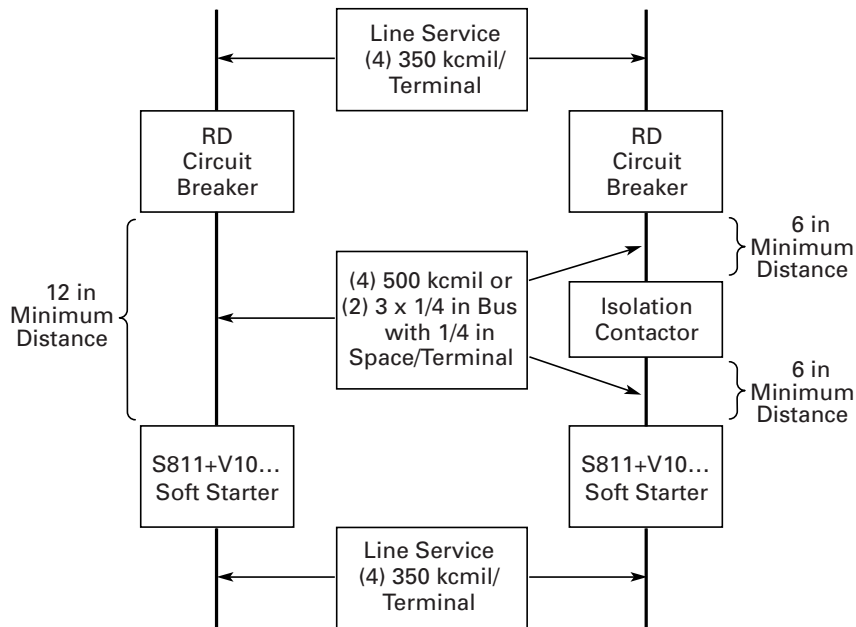
1. Install the device in a minimum enclosure size 30 ft<sup>3</sup>.
2. Two (2) forced air ventilation fans with a minimum 500 ft<sup>3</sup>/min, at a location for "air in"—bottom right or left corner and "air out"—opposite upper right or left corner.
3. RD circuit breaker.
4. For power wiring: Use 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**



## Installation

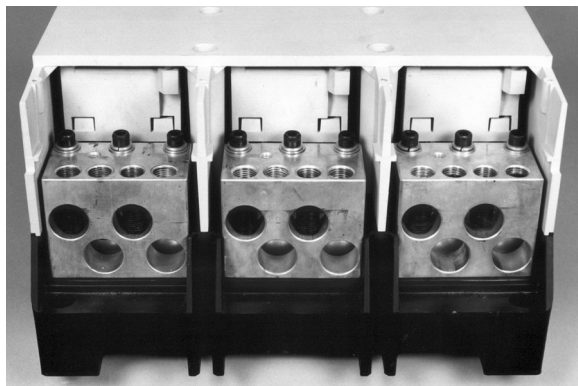
### Lug Installation, S811+N... and S811+R...

Wire the appropriate line and load conductors to the Soft starter in accordance with federal and local codes. Torque fasteners per table on **Page 12**.

### Lug Installation, S811+T..., S811+U..., and S811+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 12**.
5. Slide the line and load lug covers back into their original positions.
6. Secure with the screws previously removed.

### S811+V... Shown with Terminal Cover Removed and EML30 Lug Kit Installed on Load Side



### Control Wiring Inputs

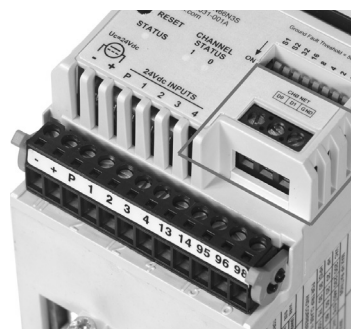
Control wiring is connected to the S811+ by two (2) terminal blocks and one (1) RJ12 connection located at the front of the unit.

**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.

**Network Communications Terminal Block**—A 3 position screw connector utilized to make connections for ModBus and other network connections.

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

### Control Terminal Block/Network Connection Terminal Block



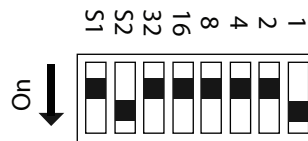
### DIP Switch

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

Switch S2 configures the remote communication port for Modbus (ON) or QCPort (OFF) upon 24 Vdc power up of the unit.

Switches 32–1 are utilized to set a unique remote field bus address (1–63).

### DIP Switch



Additional information on Level and Edge Sensing may be found in Functional Description starting on **Page 28**.

**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<sup>2</sup>).

**⚠ CAUTION**

Do not apply 120 Vac to the control input terminals of the 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 <sup>2</sup> )	2	3.5 Lb-in (0.4 Nm)
14–12 AWG (2.5–4.0 mm <sup>2</sup> )	1	3.5 Lb-in (0.4 Nm)

**S811+ Control Terminal Block Wiring**

**Control Terminal Block—Descriptions**

The S811+ Soft Starter has the following control terminal block control input and aux relay functions:

**Terminal Block Functions**

Position	Options	Minimum	Maximum	Default
"–"	Not Programmable	—	—	"–"
"+"	Not Programmable	—	—	"+"
P	Not Programmable	—	—	P
1	Input Config Entry 0	0	10	1
2	Input Config Entry 1	0	10	3
3	Input Config Entry 2	0	10	4
4	Input Config Entry 3	0	11	5
13	Relay Config Entry 0	0	10	2
14				
95	Relay Config Entry 1	0	10	1
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<sup>2</sup>) wire should be used between the power supply and the "+" and "–" inputs at the S811+ 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 or pump stop is selected, the soft stop or pump stop will begin and run to time-out. Required input for network commands.

## Installation

### Terminal Block Control Input Function Options

Programmable control input functions are available on terminals 1, 2, 3, and 4. Please note that all input signals except the analog input must be 18 Vdc or greater (High) and 5 Vdc or less (Low).

### Input Configuration Options

Option	Input Config Options	Notes
0	No Function	OFF
1	RUN1	One (1) RUN1 command required, minimum.
2	Ramp2	Selects 2nd ramp profile from Advanced I/O menu
3	JOG	Follows START ramp profile, no bypass operation
4	LOCAL	Enables Command control from the terminal block
5	RESET	Fault reset
6	E-Stop	External E-Stop
7	Alarm-No-Trip	Enables Alarm-No-Trip
8	Ext Trip	Fault Trip from external 24 Vdc signal
9	Ext Warn	Fault Warning Alarm from external 24 Vdc signal
10	Disable OL on Strt (edge only)	Disable Overload protection on Start Ramp
11	Analog	Analog Input

0—No Function—May be used to configure terminal so no input signal will be recognized. This option has no Fault Trip or Fault Warning functionality.

1—RUN1—Control Input 24 Vdc only (momentary input with 3 wire control, maintained for 2 wire control). Applying 24 Vdc to terminal 1 while terminal P is energized will initiate a START command. As shipped from the factory this input is “level” sensitive. Multiple RUN1 control commands are allowed.

**Note:** To achieve start control from the terminal block, at least one (1) terminal input must be assigned with RUN1. Not required for network control.

**Note:** There are three (3) Start Delay timers available in the Advanced I/O menu that may be used to select Start Delay Configurations.

Power On Start Delay—A timer will start upon 24 Vdc power up of the S811+. A RUN1 (Start) command or RUN2 (JOG) will not be recognized until the expiration of this timer.

Start Delay—A timer will start upon receiving a valid RUN1 (Start) command. The S811+ will initiate a Start ramp at the expiration of the timer in accordance with user selected Start Ramp parameter settings.

Run Change Delay—If the Ramp2 (second ramp profile) is enabled, a timer will start anytime the S811+ transitions from running to stop. The S811+ will initiate a Start at the expiration of the timer in accordance with user selected Ramp2 parameter settings.

If a RUN1 command is active prior to the expiration of an enabled timer, a Fault Warning will be displayed on the DIM.

2—Ramp2—Control Input 24 Vdc only. Applying a 24 Vdc signal prior to a RUN1 command will select the functionality of a second start/stop ramp profile. The start ramp time, initial torque, soft stop, and pump stop parameters are located in the Advanced I/O Menu.

3—JOG—Control Input 24 Vdc only (momentary). 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.

4—LOCAL—HAND/AUTO Control Input 24 Vdc only (maintained). The LOCAL option is HAND. Energizing this input will select the terminal block as the source of motor control. It must be energized to START or JOG the motor from the terminal block

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

6—E-Stop—Control Input 24 Vdc only (maintained). E-Stop action of the unit may be triggered by an external device. Removal of the 24 Vdc signal (maintained) from the E-Stop terminal will initiate a Fault Trip action. E-Stop functionality will remove power from the motor with no soft stop or pump stop, if enabled.

7—Alarm-No-Trip—Control Input 24 Vdc only (maintained). Removal or loss of the 24 Vdc signal will enable this function. Please refer to the Alarm-No-Trip information in the Operating Configuration section for additional information.

**Note:** The Alarm-No-Trip feature disables all but the most severe protection parameters, and may result in undesirable START ramp characteristics. The Alarm-No-Trip feature should not be used to address nuisance trip issues.

8–Ext Trip–Control Input 24 Vdc only (maintained) The S811+ unit may be tripped by an external device. Removal of the 24 Vdc signal (maintained) will initiate a Fault Trip action. Functionality of this feature will remove power from the motor with no soft stop ramp or pump stop ramp, if enabled.

9–Ext Warning–Control Input 24 Vdc only (maintained) The S811+ unit may receive a Warning signal from an external device. Removal of the 24 Vdc signal (maintained) will initiate a Fault Warning action. Functionality of this feature will report a Fault Warning and allow motor control by control input signals.

10–Disable OL on Strt–Control Input 24 Vdc only (maintained) Applying 24 Vdc to this input prior to the soft starter receiving a START command will disable the overload functionality of the soft starter during the start ramp profile only. When the motor reaches synchronous speed and the S811+ closes the internal bypass contactors, overload protection will be enabled.

11–Analog–Terminal #4 of the terminal control block may be configured for analog input. Analog input ranges are 0.0–20.0 ma DC and 4.0–20 ma DC. Range scaling is 0–100% with programmable high and low Fault Trip or Fault Warning alarms. The analog input trip threshold is user adjustable and may be set to Fault Trip, Fault Warning, or Disabled.

The S811+ Soft Starter contains two (2) auxiliary contacts to indicate status. Both relays accept user defined attributes.

**Relay Configuration Options**

Option	Relay Config Options	Notes
0	No Function	OFF
1	Fault	Relay changes state when any Fault occurs
2	Fault NOT	
3	Bypassed	Relay changes state when internal bypass contactors close
4	Bypassed NOT	
5	Motor Energized	Relay changes state during Start ramp, Top of Ramp (Run), Soft Stop, or Pump stop.
6	Motor Energized NOT	
7	Warning	Relay changes state when any Fault Warning occurs.
8	Warning NOT	
9	Custom Flt/Warn	Relay changes state when any selected fault/warning code is detected, up to a maximum of three (3). Faults + Warnings are allowed. Faults take priority in reporting.
10	Custom Flt/Warn NOT	

**Note:** The Custom Fault/Warning option will accept any combination of user selected fault trip or fault warning codes. The relay will change state when any one of the selected codes is present. If multiple codes occur simultaneously, the fault trips will have priority over fault warnings.

**Note:** Custom Fault/Warning relay operation is dependent on fault protection operating parameters. If a fault parameter is entered into the Custom Fault Warning option, but the fault parameter is disabled, the Custom Fault/Warning relay will not react to the fault condition.

## Installation

### Using Auxiliary Contacts

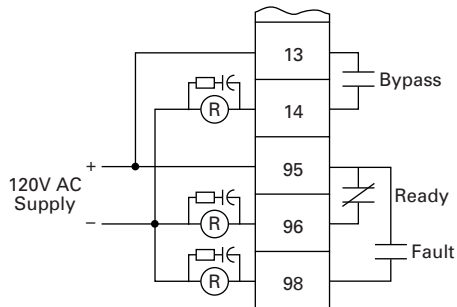
Often these contacts are used as shown in the illustrations on this page with indicating lamps. In some installations the user may wish to use an electromagnetic relay for indication of the status at a remote location for use by a programmable controller (PLC), or in a 120 Vac control circuit.

If the S811+ Soft Starter is subject to mechanical shock during operation, it is possible that these contacts may momentarily open, causing nuisance fault tripping of downstream 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.

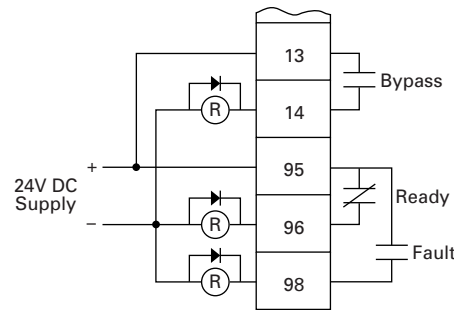
**120 Vac Signal Control**—When a relay is used in conjunction with an electronic control, it is highly recommended that a noise suppressor be used across the relay coil. In the case of an AC coil, the noise suppressor is made up of a series connected resistor and capacitor as shown in the figure below. 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  $\mu\text{F}$  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



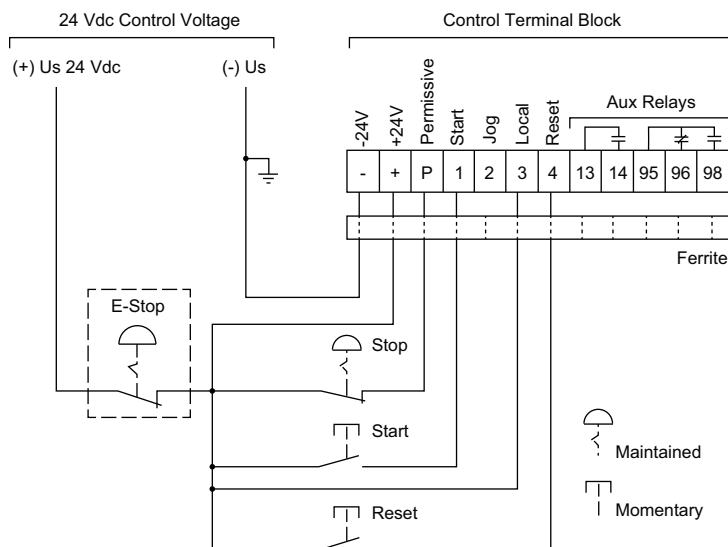
**Network Control Terminal Block**

The network control terminal block provides connections D0, D1, and Ground for connection directly to a ModBus system. Additional networks may be accommodated by utilizing communications adapters.

**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**

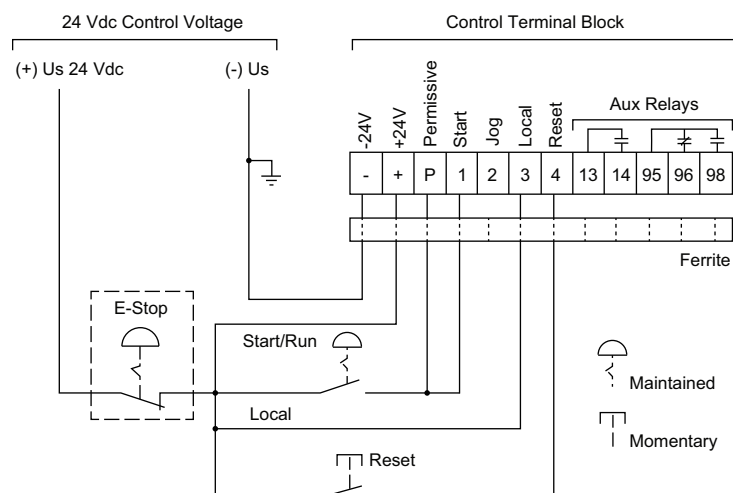


**Notes**

1. A minimum wire of 14 AWG (2.5 mm<sup>2</sup>) 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 S811+.
5. Functionality of terminals 1, 2, 3, and 4 are shown in the default configuration. These terminals are programmable for other functions. In a 3-wire control system, at least one terminal must be assigned to a Start command (RUN1) signal.
6. Auxiliary relays: 3 amps at 120 Vac or 24 Vdc, 10 amps max. (resistive) switching.

# Installation

## Basic Connection Diagram for 2-Wire Pushbutton

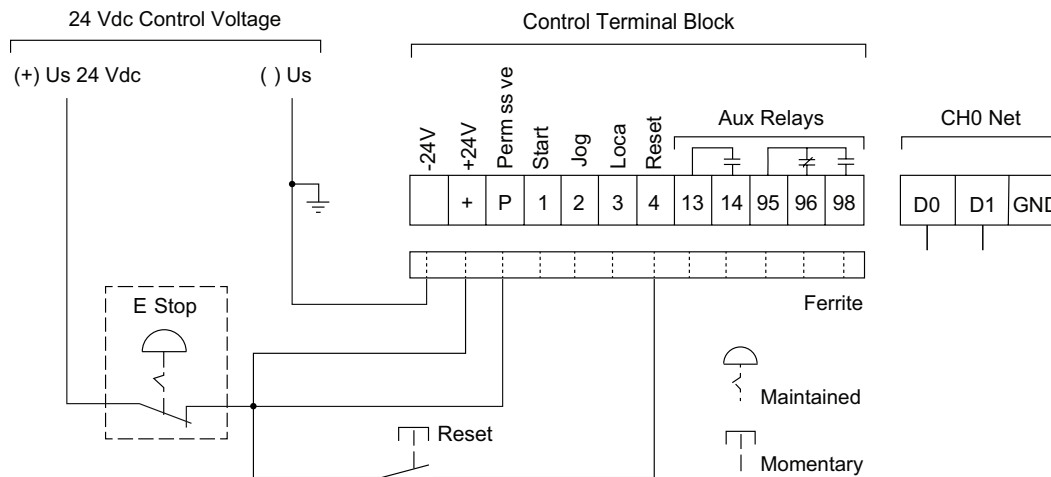


### Notes

1. A minimum wire of 14 AWG (2.5 mm<sup>2</sup>) 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 S811+.
5. Functionality of terminals 1, 2, 3, and 4 are shown in the default configuration. These terminals are programmable for other functions. In a 2-wire control system, at least one terminal must be assigned to a Start command (RUN1) signal.
6. Auxiliary relays: 3 amps at 120 Vac or 24 Vdc, 10 amps max. (resistive) switching.



**Basic Connection Diagram for Network Control**



**Notes**

1. A minimum wire of 14 AWG (2.5 mm<sup>2</sup>) 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 D/C Power Leads and Control I/O Leads (all through one ferrite) at S811+.
5. Functionality of terminals 1, 2, 3, and 4 are shown in the default configuration. These terminals are programmable for other functions.
6. Auxiliary relays: 3 amps at 120 Vac or 24 Vdc, 10 amps max. (resistive) switching.
7. The Local Control must be disabled to allow Network Control.

## Installation

### 24 Vdc Control Power Requirements

The S811+ Soft Starter requires 24 Vdc control power. The sealed in and inrush characteristics of the S811+ Soft Starter are summarized in the table below:

#### Control Power Requirements

Soft Starter Frame	Sealed		Inrush		Duration (ms)
	Amps	Watts	Amps	Watts	
S811+N...	1.0	25	10	240	150
S811+R...	1.0	25	10	240	150
S811+T...	1.0	25	10	240	150
S811+V...	1.0	25	10	240	150
S811+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  $\geq$  Sealed In Power of the Starter
- Outrush for the power supply  $\geq$  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  $\geq$  Sum of the Sealed In Power of all the Starters
- Outrush for the power supply  $\geq$  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  $\geq$  SI
- Outrush for the power supply  $\geq$  LO

The voltage on the S811+ Control Power Supply and Control Input terminals must be 24 Vdc  $\pm$ 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

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#### CAUTION

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Only apply 24 Vdc to the control terminal block. Control wiring is 22–12 AWG (0.33–4.0 mm<sup>2</sup>). 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<sup>2</sup>).
2. Connect 24 Vdc Supply negative to Terminal “-” using a minimum wire of 14 AWG (2.5 mm<sup>2</sup>).
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.

#### Exchanging a Digital Interface Module (DIM)

The S811+ utilizes the Digital Interface Module (DIM) to change the configuration of operating parameters with a display to indicate values and fault codes. When entering parameter changes, parameter information is stored on the S811+ printed circuit board.

The S811+ is configured to operate if the Digital Interface Module is removed from the soft starter (default). The soft starter may be configured to require installation of the DIM for operation.

Upon initial power up with 24 Vdc control voltage, the S811+ will auto detect an installed Digital Interface Module or a Control Interface Module (CIM)

#### 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.**

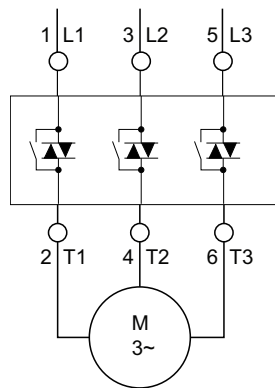
## Functional Description

### Functional Description

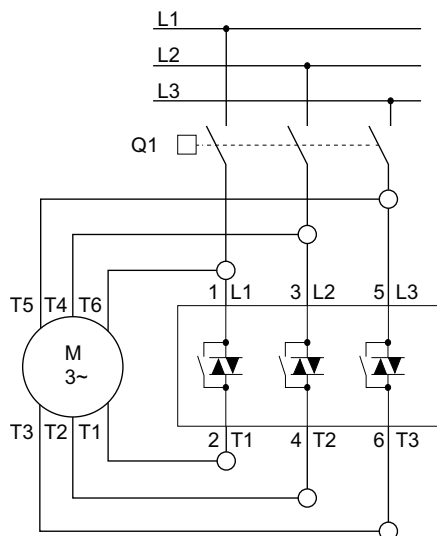
#### Power

The S811+ 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 (default)



#### Inside-the-Delta Connected Soft Starter



**Note:** For soft starters used in an Inside-the-Delta application, use of a shunt trip breaker is highly recommended. The S811+ may be configured to actuate a shunt trip breaker on user selected Fault Trip parameters.

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 D** gives the S811+'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, one (1) screw terminal connector, and one (1) RJ45 connector on the face of the S811+ 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. Network Communications—ModBus connection (native).
3. Digital Interface Module (DIM) or 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.

The software contained in the S811+ Soft Starter is the heart of the product. This software allows you to control nearly every aspect of the soft starter's functionality. In this section, various features and protection options are described.

**Note:** You will find a complete listing of these parameters in **Appendix A**.

## Starting/Stopping Options

The following starting options are available in the S811+ Soft Starter:

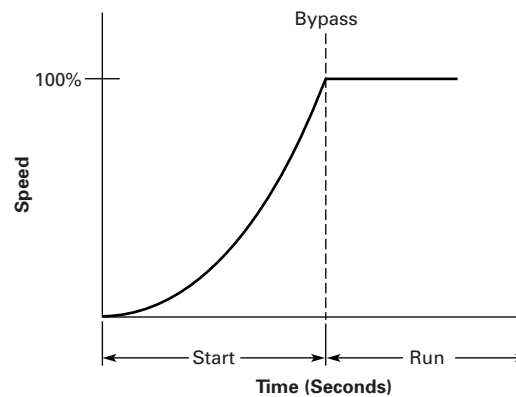
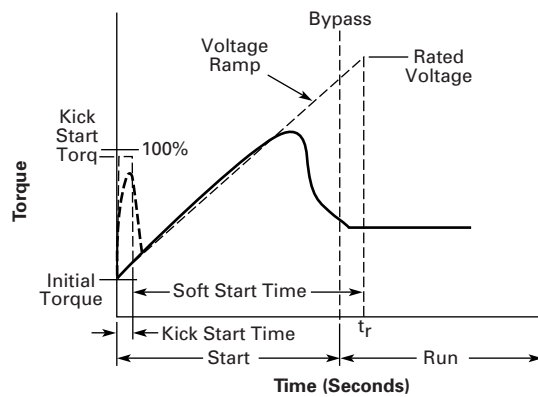
### Voltage Ramp Start

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 S811+ senses that the motor has achieved synchronous speed prior to 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 S811+ will go into bypass before the ramp reaches full voltage. In other words, the S811+ 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.

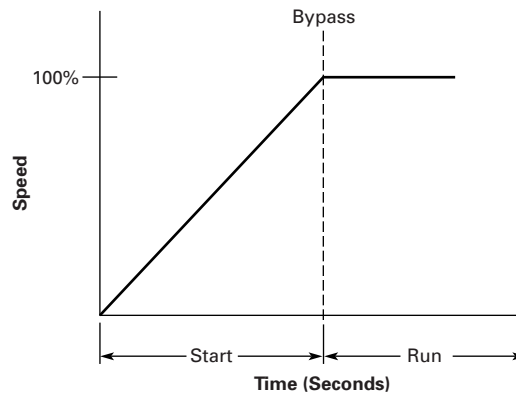
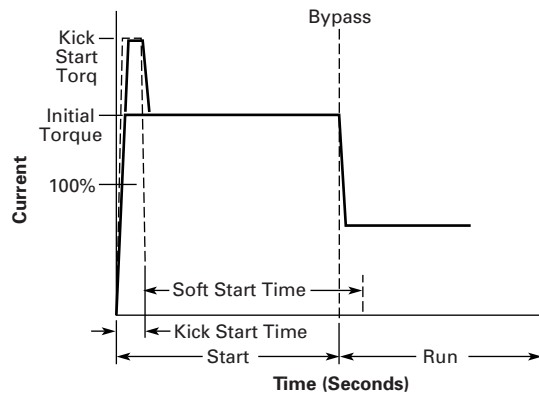
# Functional Description

## 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 S811+ 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

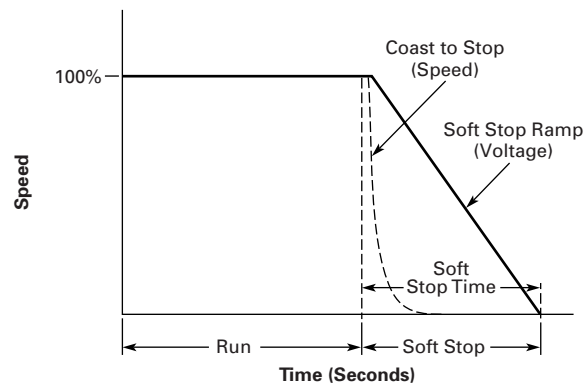


## Soft Stop/Pump Stop

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. The Pump Stop feature (optional) is used for pump applications that require special algorithms that bring the application to a controlled stop to prevent water hammer from occurring.

**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

### Network Control

When the S811+ is in Network control and a 24 Vdc signal is present at control block terminal "P", it is ready to respond to motor *START* control commands issued through the Network Comms Port.

The *Local Control* must be disabled to allow Network control. *Local Control* is available for configuration through a programmable function on the control terminal block (default—terminal #3) or enabling the *Local Ctrl Only* parameter in the Advanced I/O Menu.

The Comms Port enables complete communications between the S811+ and the Network including changing parameters settings, issuing control commands, and monitoring selected operational values via ModBus, or other networks. The Comms Port provides ModBus motor control commands as the native protocol.

### Local Control

S811+ Local Control (default) consists of *Permissive*, *Start*, *Jog*, *Local* and *Reset* 24 Vdc control commands to the Terminal Block. The S811+ can also be started/stopped from the Digital Interface Module.

The default configuration of the Control Terminal Block utilizes five (5) functions to control the S811+ soft starter. Terminals 1 thru 4 may be (re)programmed for other functions.

**Terminal P—Permissive** (run enable)—Must be energized with 24 Vdc to enable operation of the S811+ soft starters by either local and/or network control. If power is lost or removed from *Permissive* terminal at any time, the unit will initiate a coast Stop, Soft Stop, or Pump Stop in accordance with the setup parameter selections. If the S811+ is being controlled from a network, loss of the Permissive signal will initiate a coast Stop, Soft Stop, or Pump Stop in accordance with the setup parameter selections. Functionality of this terminal cannot be changed.

**Terminal 1—Start** (default)—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 S811+ 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 S811+ 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 28** 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** (default)—Application of 24 Vdc power to the *Jog* terminal will apply a Start command for as long as the signal is present. The S811+ 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 or Pump Stop parameter values.

**Terminal 3—Local** (default)—Application of 24 Vdc power to the *Local* terminal will allow Start or Jog control from the terminal block.

**Note:** Local Control only may be enabled by the Local Ctrl Only parameter in the Advanced I/O menu. If this parameter is enabled, control commands from any network will not be recognized.

**Terminal 4—Reset** (default)—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. A Reset signal may also be sent from any network connection.

## Functional Description

### 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 S811+ 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 S811+. The position of the switch is verified in the Run Input Ctrl parameter in the Advanced I/O Setup menu.

### Level Sensing

Level sensing selection may be verified by observing the status of the *Run Input Control* sub-parameter in the Advanced IO Setup Menu. 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 sensing (default) selection may be verified by observing the status of the *Run Input Control* sub-parameter in the Advanced IO Setup. Menu. 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—Three (3) modes of resetting Fault Trips are available:

0—Manual—Requires pressing Reset button on DIM, pressing Reset button on the face of the S811+, or by providing a signal to an Input Control Terminal configured for this function (Terminal 4 default).

1—AUTO—The S811+ firmware attempts to clear any active Fault Trips.

2—Powerup Reset—The S811+ will perform a Fault Reset action after the unit has completed the initialization process when 24 Vdc control power is applied. Fault trip reset action then reverts to Manual

Auto Reset Delay Timer—When the Reset Mode is set to one (1), the S811+ will automatically reset any fault or warning after the reset delay time has expired and the condition no longer is active. The delay timer will start as soon as any fault is detected. If the fault is still present after the delay time has expired, the reset protocol will remain active to attempt to clear the fault trip condition. The delay timer is user settable with a range of 0.1 (default)—600 seconds.

Auto Reset Count—A counter will log the number of successful Reset attempts. The Auto Reset Count may be observed in the Monitoring Menu. The Auto Reset Count will reset to zero (0) with each power cycle of the 24 Vdc control power.

Auto Reset Limit—The Auto Reset Limit is selected by the user, up to a maximum of 10000 Auto Reset attempts. When the maximum number of Auto Resets is attained, a Manual Reset is then required. When a Manual Reset is performed, the counter is set to zero (0). Setting this parameter to zero (0) disables the counter function.

Auto Rest Mode, Auto Reset Delay, and Auto Reset Limit parameters are located in the Soft Start Config. Menu.

### **FAULT WARNINGS**

Fault Warnings do not require any reset action. The Fault Warning indication in the DIM is discontinued when the Fault Warning condition is no longer active.

## S811+ Operating Configuration

### Introduction

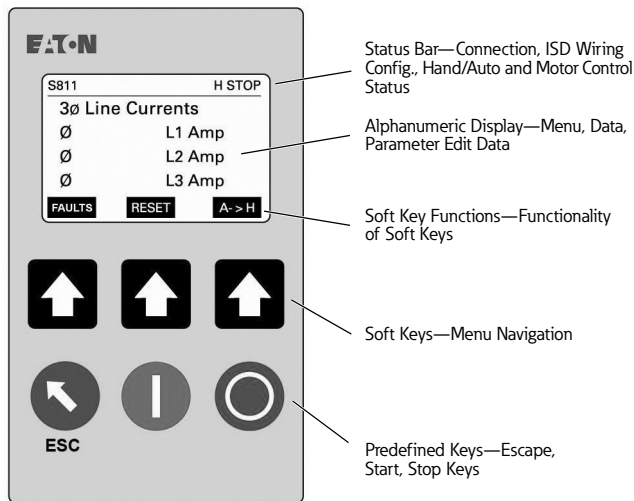
The S811+ has a wide range of operation and protection parameters to enable coordinated motor and load protection. Commonly used parameters are directly accessible through the Digital Interface Module (DIM).

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 Digital Interface Module (DIM) is used to configure all models of the S811+ Soft Starter.

#### Digital Interface Module (DIM)

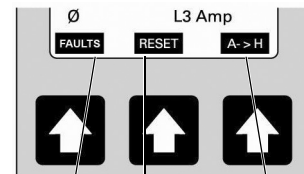


- The center of the display shows the value of the selected S811+ parameter. The default display at power-up is "3 ø Line Currents".
- The Alpha Numeric Data Display Area displays system and parameter values.
- Three Soft Key Functions at the bottom of the display indicate the functions of the Soft Keys (pushbuttons) directly below them. The Soft Key Functions will change as you navigate through the different menus of the DIM.
- Soft Keys are used to perform several functions and navigate through parameter menus. Functionality of the soft keys change with menu selection.

The Status Bar at the top of the display indicates the operating and communicating status of the S811+ and DIM.

- Motor control status may be;
  - Stop—Motor stopped.
  - Run1—Run (Start command) during ramp.
  - Run2—Jog
  - Ref—Motor at synchronous speed, internal bypass contactors closed.
  - Flt.—Faulted
  - Warn—Warning

#### Soft Keys

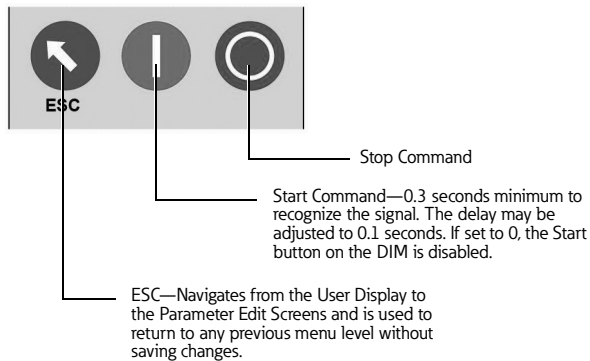


FAULTS	RESET	A->H	= Default Display at power up.
PREV	NEXT	<ENTER>	= Menu Navigation selections
PREV	NEXT		= Uneditable Parameter Navigation
PREV	NEXT	<EDIT>	= Editable Parameter Navigation
DEC	INC	<SAVE>	= Adjust or Save Parameter value
PREV	NEXT	<MORE>	= Fault/Warning Navigation
GROUP	MEMBER	<SEND>	= Network Navigation

**Note:** The FAULTS key (left-hand UP arrow key) shown in the Default Display at power up may be set to JOG function with the Local JOG button enable parameter found in the LCD DIM Setup menu.

- Predefined keys are used to perform critical functions:

#### Predefined Keys



#### Transfer of S811+ Configuration Parameters

The 811+ has the ability to capture (store) Configuration Parameters to the DIM. The Configuration Parameters can then be downloaded into other S811+ units.

To upload parameters: From the LCD DIM Setup Menu, select “Upload Settings”

To download parameters: From the LCD DIM Setup Menu, select “Download Settings”

To erase the parameter set stored in the DIM memory, select “Flush” from the “Upload Settings” parameter.

#### Access Level (Password) Option

Levels of edit may be set to protect parameter settings.

- Level 0—All parameters are Read Only
- Level 1—Basic Editing
- Level 2—Advanced Editing allows access to all editable parameters.
- Default Password for Levels 1 and 2 is 0. There is no password required for Level 0.

#### DIM Removal

The DIM may be removed at any time (default) and the S811+ will maintain functionality. The S811+ may be configured to Fault Trip if the DIM is removed by disabling the Removable DIM parameter located in the LCD DIM Setup Menu.

**Note:** If the S811+ received a START command from the DIM, the unit will Fault Trip if the DIM is removed while the unit is running. If the START command was received from the control terminal block or a network connection, the S811+ will continue to run.

## 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 S811+ 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 S811+ 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 S811+ 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 parameters for your application. In many cases, only the Motor FLA parameter requires adjustment to the proper value, and all other parameters may be used with the default values for the initial Start. Review the Protection Options of the S811+ **Appendix B** and adjust as required.

## S811+ Operating Configuration

### Initial Configuration:

1. It is suggested that the S811+ Soft Starter be configured before applying the line voltage. Before applying the Line voltage, apply 24 Vdc to the Supply connections of the S811+'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—S811+ ...N3S Standard

Soft Start Config Menu	Units	Minimum Inline (InsideDelta)	Maximum Inline (InsideDelta)	Default Inline (InsideDelta)	Notes	Access Level
Mtr Nameplate FLA						2
S811+N37...	Amps	11 (19)	37 (65)	11 (19)	Motor FLA parameter must be set to motor nameplate FLA to achieve proper overload protection.	2
S811+N66...	Amps	20 (35)	66 (114)	20 (35)		2
S811+R10...	Amps	32 (55)	105 (182)	32 (55)		2
S811+R13...	Amps	42 (73)	135 (234)	42 (73)		2
S811+T18...	Amps	56 (97)	180 (311)	56 (97)		2
S811+T24...	Amps	75 (130)	240 (415)	75 (130)		2
S811+T30...	Amps	95 (164)	304 (526)	95 (164)		2
S811+U36...	Amps	112 (195)	360 (623)	112 (195)		2
S811+U42...	Amps	131 (227)	420 (727)	131 (227)		2
S811+U50...	Amps	156 (270)	500 (865)	156 (270)		2
S811+V36...	Amps	112 (195)	360 (623)	112 (195)		2
S811+V42...	Amps	131 (227)	420 (727)	131 (227)		2
S811+V50...	Amps	156 (270)	500 (865)	156 (270)		2
S811+V65...	Amps	203 (352)	650 (1125)	203 (352)		2
S811+V72...	Amps	225 (389)	720 (1246)	225 (389)		2
S811+V85...	Amps	265 (458)	850 (1471)	265 (458)	2	
S811+V10...	Amps	312 (539)	1000 (1732)	312 (539)	2	
Ovrlid Trip Class		5	30	20		2
Phase Rev Fault		0	1	0	<b>0</b> = Enabled <b>1</b> = Disabled	2
Phase Sequence		0	1	0	<b>0</b> = ABC <b>1</b> = ACB	2
Start Method		0	1	0	<b>0</b> = Voltage Ramp <b>1</b> = Current Limit	2
Initial Torque	%	0	85	45		1
Soft Start Time	Seconds	0.5	180	20		1
Kick Start Torq	%	0	85	0		1
Kick Start Time	Seconds	0	2	0		1
Soft Stop Time	Seconds	0	60	0		1
Reset Mode		0	2	0	<b>0</b> = Manual <b>1</b> = Auto <b>2</b> = Powerup Reset	2
Auto Reset Delay	Seconds	0.1	600	0.1		2
Auto Reset Limit		0	10000	0		2
Motor Wiring Config		0	1	0	<b>0</b> = Inline <b>1</b> = InsideDelta	2

## Operating Parameters—Soft Start Configuration—S811+ ...P3S Premium

Soft Start Config Menu	Units	Minimum Inline (InsideDelta)	Maximum Inline (InsideDelta)	Default Inline (InsideDelta)	Notes	Access Level
Mtr Nameplate FLA						2
S811+N37...	Amps	11 (19)	37 (65)	11 (19)	Motor FLA parameter must be set to motor nameplate FLA to achieve proper overload protection.	2
S811+N66...	Amps	20 (35)	66 (114)	20 (35)		2
S811+R10...	Amps	32 (55)	105 (182)	32 (55)		2
S811+R13...	Amps	42 (73)	135 (234)	42 (73)		2
S811+T18...	Amps	56 (97)	180 (311)	56 (97)		2
S811+T24...	Amps	75 (130)	240 (415)	75 (130)		2
S811+T30...	Amps	95 (164)	304 (526)	95 (164)		2
S811+U36...	Amps	112 (195)	360 (623)	112 (195)		2
S811+U42...	Amps	131 (227)	420 (727)	131 (227)		2
S811+U50...	Amps	156 (270)	500 (865)	156 (270)		2
S811+V36...	Amps	112 (195)	360 (623)	112 (195)		2
S811+V42...	Amps	131 (227)	420 (727)	131 (227)		2
S811+V50...	Amps	156 (270)	500 (865)	156 (270)		2
S811+V65...	Amps	203 (352)	650 (1125)	203 (352)		2
S811+V72...	Amps	225 (389)	720 (1246)	225 (389)		2
S811+V85...	Amps	265 (458)	850 (1471)	265 (458)		2
S811+V10...	Amps	312 (539) ①	1000 (1732) ①	312 (539) ①	2	
Ovrl Trip Class		5	30	20		2
Phase Rev Fault		0	1	0	<b>0</b> = Enabled <b>1</b> = Disabled	2
Phase Sequence		0	1	0	<b>0</b> = ABC <b>1</b> = ACB	2
Start Method		0	3	0	<b>0</b> = Voltage Ramp <b>1</b> = Current Limit <b>2</b> = Not Used <b>3</b> = Pump Start	2
Initial Torque	%	0	85	45		1
Soft Start Time	Seconds	0.5	360	20		1
Kick Start Torq	%	0	85	0		1
Kick Start Time	Seconds	0	2	0		1
Pump Stop Time	Seconds	5	120	10		1
Soft Stop Time	Seconds	0	60	0		1
Reset Mode		0	2	0	<b>0</b> = Manual <b>1</b> = Auto <b>2</b> = Powerup Reset	2
Auto Reset Delay	Seconds	0.1	600	0.1		2
Auto Reset Limit		0	10000	0		2
Motor Wiring Config		0	1	0	<b>0</b> = Inline <b>1</b> = InsideDelta	2

**Note**

① Has no reference.

**Note:** S811+... units cannot be configured with Pump Start + Inside-the-Delta functionality enabled at the same time.

## S811+ Operating Configuration

### Operating Parameters—Soft Start Configuration—S811+ ...V3S Premium (690 Volt)

Soft Start Config Menu	Units	Minimum Inline	Maximum Inline	Default Inline	Notes	Access Level
Mtr Nameplate FLA						2
S811+T18...	Amps	56	180	56	Motor FLA parameter must be set to motor nameplate FLA to achieve proper overload protection.	2
S811+T24...	Amps	75	240	75		2
S811+T30...	Amps	95	304	95		2
S811+V36...	Amps	112	360	112		2
S811+V42...	Amps	131	420	131		2
S811+V50...	Amps	156	500	156		2
S811+V65...	Amps	203	650	203		2
S811+V72...	Amps	225	720	225		2
S811+V85...	Amps	265	850	265		2
Ovrlid Trip Class		5	30	20		
Phase Rev Fault		0	1	0	0 = Enabled 1 = Disabled	2
Phase Sequence		0	1	0	0 = ABC 1 = ACB	2
Start Method		0	3	0	0 = Voltage Ramp 1 = Current Limit 2 = Unavailable 3 = Pump Start	2
Initial Torque	%	0	85	45		1
Soft Start Time	Seconds	0.5	360	20		1
Kick Start Torq	%	0	85	0		1
Kick Start Time	Seconds	0	2	0		1
Pump Stop Time	Seconds	5	120	10		1
Soft Stop Time	Seconds	0	60	0		1
Reset Mode		0	2	0	0 = Manual 1 = Auto 2 = Powerup Reset	2
Auto Reset Delay	Seconds	0.1	600	0.1		2
Auto Reset Limit		0	10000	0		2
Motor Wiring Config		0	0	0	0 = Inline	2

### Protection Parameters

In addition to motor overload protection, the S811+ 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.

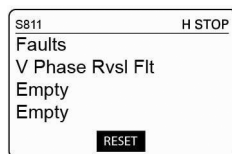
A Phase Reversal Fault is a likely fault condition on new installations. It can be addressed by either changing the *Phase Sequence* from ABC to ACB, disabling phase rotation monitoring, or removing Mains power and switching the incoming line connections at L1 and L2 of the S811+.

For troubleshooting purpose trips are recorded, as they occur, in the S811+'s Fault Log.

Apply the Mains voltage and verify that no fault is present. The S811+ indicates faults with a Fault message and corresponding Fault Code in the DIM.

When a Fault Trip occurs, the Fault Trip screen will automatically display on the DIM. Fault Trips are displayed with the most current Fault at the top of the list. If the Fault is no longer active, the S811+ may be Manually reset by pressing the corresponding soft key on the DIM.

### Fault History



The Fault history may be displayed at any time by pressing the Faults soft key on Digital Interface Module (DIM).

### Fault Codes

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

### Fault Trips

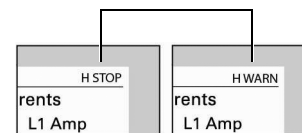
The S811+ is configured from the factory with most protection parameters enabled. Selected protection parameters may be changed to Fault Warnings in which case the fault is detected and reported, but the soft starter remains in operation. It is recommended that all appropriate protection parameters are enabled for proper operation and protection of the soft starter and the load.

### Fault Warnings

Selected S811+ Configuration and Protection parameters may be configured to provide warning indications only. If a parameter is set to Warning status, the unit will not trip if operation is not within the protection level of the parameter.

A Fault Warning is displayed on the DIM by the "Warning" message being toggled with the current motor status in the status bar of the DIM.

### Fault Warning



## S811+ Operating Configuration

### Fault Trip/Fault Warning/Disable Options

The S811+ has a comprehensive array of protection parameters. Selected Protection Parameters have options to be set to a Fault Trip, Fault Warning, or disabled. Disabling fault protections is not recommended.

#### Fault Code Options

Code	Description	Fault Options
1	Firmware incompatible	Fault Trip, Fault Warning, Disable
3	Internal Com fault	Fault Trip
4	Low Control V	Fault Trip
5	Pole Overtemp	Fault Trip, Fault Warning, Disable
6	PhaseLoss	Fault Trip, Fault Warning, Disable
7	Phase Imbalance	Fault Trip, Fault Warning, Disable
9	Underload	Fault Trip, Fault Warning, Disable
10	Overcurrent(contactor)Jam disabled	Fault Trip
11	Jam	Fault Trip, Fault Warning, Disable
13	Bypass dropout	Fault Trip, Fault Warning, Disable
14	Overload	Fault Trip, Fault Warning, Disable
18	Inst I overcurrent	Fault Trip
32	Internal NV error	Fault Trip
36	ComLoss Stop fault	Fault Trip
38	Temperature sensor fault	Fault Trip, Fault Warning, Disable
39	Internal CPU fault	Fault Trip
40	Motor Low Power	Fault Trip, Fault Warning, Disable
41	Motor High Power	Fault Trip, Fault Warning, Disable
42	UnderVoltage	Fault Trip, Fault Warning, Disable
43	OverVoltage	Fault Trip, Fault Warning, Disable
44	Phase Reversal Fault	Fault Trip, Fault Warning, Disable
54	E-Stop	Fault Trip
55	MotorControl Device missing	Fault Trip
56	Internal Com2 fault	Fault Trip
57	Internal Fault	Fault Trip
58	SCR Not Firing	Fault Trip, Fault Warning, Disable
59	Shorted SCR	Fault Trip, Fault Warning, Disable
60	SCR Overcurrent (Stall disabled)	Fault Trip
61	Mains AC V Lost	Fault Trip
63	Motor Stall Fault	Fault Trip, Fault Warning, Disable
64	V Zero cross	Fault Trip
65	Analog Input Out of range (high)	Fault Trip, Fault Warning, Disable
66	Analog Input Out of range (low)	Fault Trip, Fault Warning, Disable
71	Analog Input Overdrive	Fault Trip, Fault Warning, Disable
72	External trip/warning	Fault Trip, Fault Warning, Disable
73	Motor Load Disconnect	Fault Trip
74	Line Frequency (high)	Fault Trip, Fault Warning, Disable
75	Line Frequency (low)	Fault Trip, Fault Warning, Disable
76	Auto Reset Limit	Fault Trip



### Alarm-No-Trip Option

The Alarm-No-Trip option is intended for use with applications that have motor run-to-destruction protocols in the application specifications. This feature allows the S811+ to Start/Run the motor under the most severe of conditions with minimal motor protections and will Start/Run until;

- A) the S811+ can no longer maintain effective control of the load, and/or;
- B) catastrophic motor failure occurs.

Enabling the Alarm-No-Trip parameter from the Protections Menu will dramatically change how the S811+ reacts to fault conditions, defeating some of the normal protection protocols of the S811+. Alarm-No-Trip functionality must be thoroughly understood before enabling this feature.

**Note:** User settable parameters that have been disabled in the Protections Menu will also disable the Alarm-No-Trip Fault(s) in table (1).

Alarm-No-Trip functionality will respond in accordance with the protocols listed in tables (1), (2) and (3).

Fault Warnings may be displayed on the DIM or the network connection. Fault Warnings will not Trip the S811+.

**Note:** The Alarm-No-Trip terminal signal is active low. This means that any time the 24 Vdc signal falls below 5 Vdc, the Alarm-No-Trip option will be enabled.

When the Alarm-No-Trip option is enabled, only faults critical to motor control are effective. These faults are noted in table (1) below:

#### (1) Alarm-No-Trip Faults

Code	Alarm-No-Trip Fault Trip Parameters
*	Watchdog
*	Watchdog Reset
*	FRam
*	Comm Failure
*	Flash CRC
5	Pole Overtemp
58	SCR Not Firing
59	Shorted SCR
18	SCR Instantaneous Overcurrent
60	SCR Overcurrent

#### (1) S811+ Alarm-No-Trip Fault Trip protocol:

##### Condition

1. Alarm-No-Trip feature is enabled;
2. One or more faults noted in table (1) are active.

##### Action

1. Motor not running = S811+ Inhibits motor START/RUN function.
2. Motor running, Top of Ramp = S811+ conducts Fault Trip action, motor stop.

## S811+ Operating Configuration

When the Alarm-No-Trip option is enabled, mains voltage operating conditions noted in table (2) below are monitored by the S811+.

### (2) Mains Voltage Operating Faults—Full SCR Start

Code	Alarm-No-Trip Condition Full Voltage Start Parameters
64	Zero Voltage Cross Lost
61	Mains Loss
6	Voltage Phase Loss
74	Line Frequency High
75	Line Frequency Low

### (2) S811+ Mains Voltage Operating Faults—Full SCR Start protocol:

#### Condition

1. Motor not running
2. Alarm-No-Trip feature is enabled;
3. No faults noted in table (1) are active;
4. One or more faults noted in table (2) are active.
5. START command is received by the S811+

#### Action

1. Motor not running = SCRs commanded to full gate + internal bypass contactors close.
2. Motor running = no action.

When the Alarm-No-Trip option is enabled, faults noted in table (3) below are monitored by the S811+. One or more faults will actuate the Fault Trip Relay only.

### (3) Fault Trip Warnings

Code	Alarm-No-Trip Condition Fault Relay Only Parameters
44	Phase Reversal
7	Phase Imbalance
14	Overload
11	Jam
63	Stall
42	Mains Voltage Low
43	Mains Voltage High
9	Underload
13	Bypass Dropout
40	Low Power
41	High Power

### (3) S811+ Alarm-No-Trip Condition Fault Relay Only protocol:

#### Condition

1. Alarm-No-Trip feature is enabled;
2. No faults in tables (1) or (2) active.
3. One or more faults noted in table (3) are active.

#### Action

1. Motor not running = Fault Trip Relay changes state, Start ramp occurs in accordance with Start parameter settings when Start command received.
2. Motor running = Fault Trip Relay changes state, no change in Run status.

### Thermal Overload

The S811+ 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.

Entering the motor's full load current rating, using the *Motor Nameplate FLA* parameter programs the overload. The *Motor Nameplate FLA* is settable from 32–100% of the S811+'s rated current (frame size).

The overload's trip class (default = 20) is set in the *Ovld Trip Class* parameter in the Soft Start Config Menu.

Thermal Overload may be disabled during the Voltage Ramp or Current Limit start ramps (default = Enabled) by disabling the *Overload on Start* parameter located in the Protections menu. 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.

## S811+ Operating Configuration

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:

$$\text{Locked Rotor Current} = \frac{\text{Horsepower} \times KVA_{hp} \times 1000}{E \times 1.73}$$

**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;

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

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

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 S811+.

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:

<b>Order Number:</b>
<b>Catalog Number:</b>
<b>Style Number:</b>
<b>Serial Number:</b>

### Before You Begin to Troubleshoot

---

 **WARNING**

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

---

 **WARNING**

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**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 S811+ Soft Starter.

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

- Multimeter
- Clamp-on ammeter

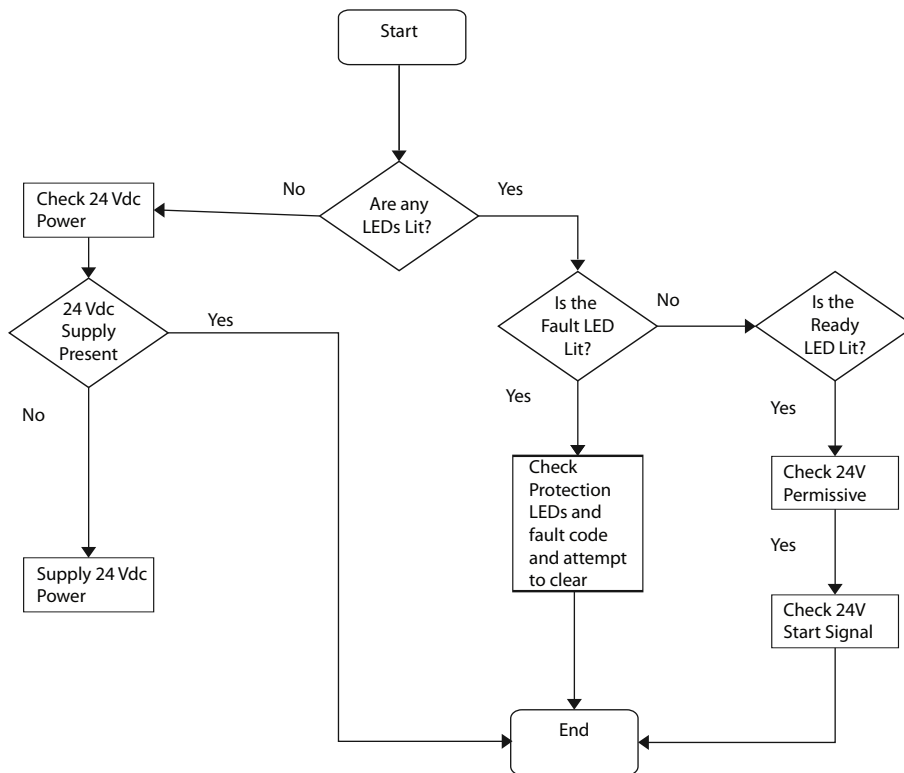
Always assume the S811+ has high voltage applied and take proper precautions while troubleshooting the soft starter and associated equipment. Read all precautions at the front of this manual before starting the troubleshooting process.

# Troubleshooting

## Define the Problem

1. If the S811+ Soft Starter fails to respond in any way to a start command., look at the Digital Interface Module of the S811+ 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 Flowchart



### Troubleshooting—S811+ Does Not START

Start Source Attempted	Suggested Corrective Action
Digital Interface Module	Verify that the Status LED is GREEN prior to the Start attempt.
Terminal Block	Verify that the 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 S811+ can be started locally from TB1 or the DIM. Verify that the 24 Vdc Permissive signal is at the proper voltage. Verify that the Status LED is GREEN.

- With the Status LED illuminated RED, the device will not start. Attempt to reset the S811+ Soft Starter by pressing the S811+'s RESET button for one second. If the Status LED remains RED, use the Digital Interface Module (DIM) to determine the fault and fault code and go to the Troubleshooting Fault Table in **Appendix I** to find the corrective action for the fault.
- If the Status LED is GREEN, the S811+ 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 S811+ the Control Input terminal block. If the S811+ does not start, verify that the *Start* input terminal is at 24 Vdc.

**Note:** If connected to a network, starting the S811+ from the Control Input terminal block may isolate problems associated with the network and not with the soft starter.

2. It is often useful in determining the nature of the fault condition by noting when the trip occurs during operation of the S811+ soft starter. The operation of the S811+ may be categorized into the following periods;
  - The S811+ Soft Starter trips Immediately when the START command is issued.
  - The S811+ Soft Starter trips during the START ramp and never reaches bypass.
  - The S811+ Soft Starter trips when the bypass contactors are closing.
  - The S811+ Soft Starter trips during running operation while bypass contactors are closed.
  - The S811+ Soft Starter trips after the Stop command is received.
  - The S811+ 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 S811+ 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 44** to aid in determining the appropriate corrective action during the various run phases of operation.

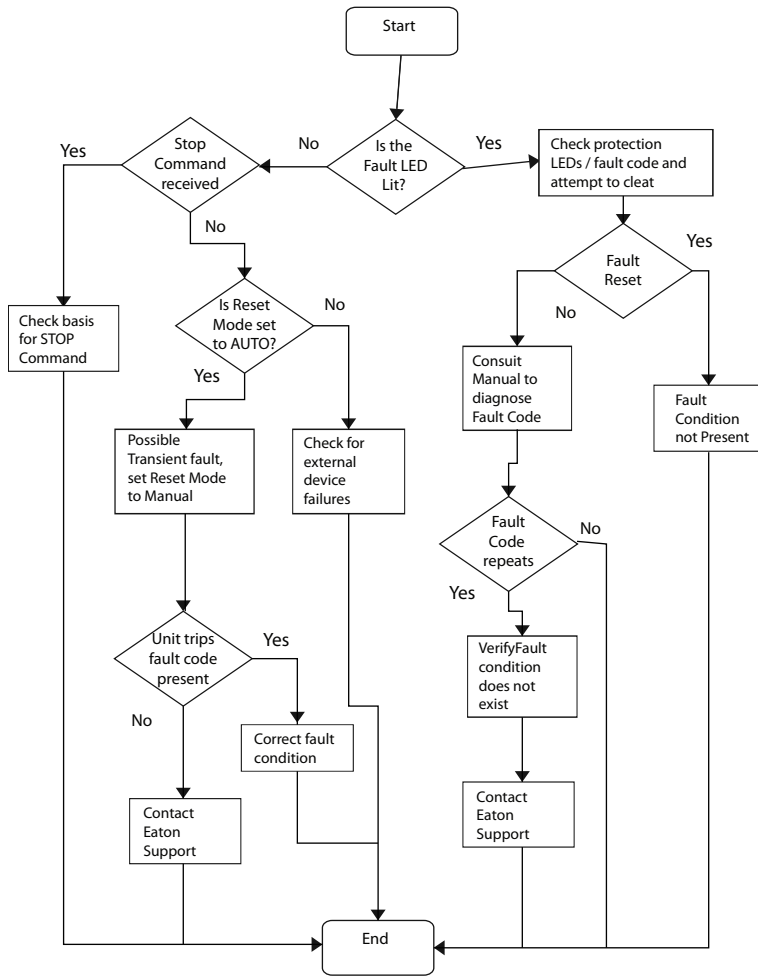
**Note:** If no fault codes are present during an unexpected “trip” of the soft starter, verify that the soft starter did not receive a STOP command.

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

**Troubleshooting—S811+ Stopped or Faulted**

<b>Condition</b>	<b>Possible Problem</b>	<b>Suggested Corrective Action</b>
Status LED is GREEN	Stop command received. Terminal block wiring not secure. Loss of 24 Vdc control power. Transient fault when Reset Mode set to AUTO. External control device failure. External mains device failure or trip condition. Control board failure.	24 Vdc permissive signal lost—investigate control system. Check control wiring for security. Check 24 Vdc power source for correct sizing and circuit connections. Change Reset Mode to Manual to capture fault condition. Inspect external control devices for proper operation. Inspect external devices for condition and proper operation. Possible device fatal error.
Status LED is RED	Protection/Operation parameters not set to proper values. Fault condition exists. Fault not reset from previous trip. Reset Mode set to Manual.	Determine Fault condition from the Fault History. Adjust Protection parameter values to prevent recurring fault trips. Correct problems with mains voltages and/or phase conditions. 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, DIM display dark.	No Control Power supply Device failure.	Provide 24 Vdc to Control power terminal block. Check Control Power for proper value and reliability.

**Local Control Troubleshooting Flow Chart**



In extreme cases, it may be necessary to reset parameter settings and operating values to restore proper operation. The S811+ may be reset by following the instruction below.

**Resetting the S811+**

- #1 Place all DIP switches on the front cover of the S811+ in the OFF position**
- #2 Using the table below, toggle (ON-OFF) the indicated switch 5 times to perform the desired Reset**
- #3 After the reset is complete, set the DIP switches back to the desired Network Communication Port Node ID (1-63)**

Switch "1"	Factory Reset (Reset to default Factory [Out-of-Box] state)
Switch "2"	Application Configuration Reset (Resets all application parameters to defaults. Leaves QCP network parameters unchanged.)
Switch "4"	Commission Reset (Reset Mode and Baud Rate only)
Switch "8"	Network Config Reset (Reset Node ID, Baud and Mode only)



## Accessories

### Lug Kits

#### Lug Kits—S811+T, U...

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

#### Lug Kits—S811+V...

Description	Part Number
2 cable connections, 4/0 to 500 kcmil cable	<b>EML28</b>
4 cable connections, 4/0 to 500 kcmil cable	<b>EML30</b>
6 cable connections, 4/0 to 500 kcmil cable	<b>EML32</b>
2 cable connections, 2/0 to 300 kcmil cable	<b>EML33</b>

### Optional Accessory Kits

#### Accessory Kits

Description	S811+ Frame	Accessory Kit Part Number
Panel Mounting Kit—3 ft cable	S811+...	<b>EMA69A</b>
Panel Mounting Kit—5 ft cable	S811+...	<b>EMA69B</b>
Panel Mounting Kit—8 ft cable	S811+...	<b>EMA69C</b>
Panel Mounting Kit—10 ft cable	S811+...	<b>EMA69D</b>
Mounting Plate, S811+N...	S811+N...	<b>EMM13N</b>
Mounting Plate, S811+R...	S811+R...	<b>EMM13R</b>
Mounting Plate, S811+T...	S811+T...	<b>EMM13T</b>
Mounting Plate, S811+U...	S811+U...	<b>EMM13T</b>
Mounting Plate, S811+V...	S811+V...	<b>EMM13V</b>
Vibration Plate, S811+N...	S811+N...	<b>EMM14N</b>
Vibration Plate, S811+R...	S811+R...	<b>EMM14R</b>
Vibration Plate, S811+T...	S811+T...	<b>EMM14T</b>
Vibration Plate, S811+U...	S811+U...	<b>EMM14T</b>
Vibration Plate, S811+V...	S811+V...	<b>EMM14V</b>
IP20 Kit, S811+N...	S811+N...	<b>SS-IP20-N</b>
IP20 Kit, S811+R...	S811+R...	<b>SS-IP20-R</b>
IP20 Kit, S811+T...	S811+T...	<b>SS-IP20-TU</b>
IP20 Kit, S811+U...	S811+U...	<b>SS-IP20-TU</b>
IP20 Kit, S811+V...	S811+V...	<b>SS-IP20-V</b>
Fan Kit	S811+...	<b>EMM18</b>

### Communications

Contact EatonCare for availability of communications adapters.

#### Communications

Description	Catalog Number
CH0 RJ-12 Adapter	<b>S811+QCPA</b>
EtherNet/IP / Modbus TCP Communication Adapter with 120 Vac I/O	<b>C441U</b>
EtherNet/IP / Modbus TCP Communication Adapter with 24 Vdc I/O	<b>C441V</b>

### Replacement Parts

#### Replacement Parts

Description	S811+ Frame	Replacement Part Number
DIM for Standard Unit	S811+...	<b>EMA91</b>
Control Wire Connector	S811+...	<b>EMA75</b>
CIM for Standard Unit	S811+...	<b>EMA71</b>

## Appendix A—Parameters

### Monitoring Menu

#### Monitoring Menu

Description	Units	Access Level
Flt/Warn Active		0
Fault/Warn List		0
Fault/Warn History		0
3Ø Line Currents	Amps	0
Current as % FLA	%	0
DC Cntrl Voltage	Volts	0
3Ø Pole Voltages	Volts	0
Line Frequency	Hz	0
Phase Sequence		0
Ave Line Power	kW	0
Power Factor		0
Thermal Memory	%	0
Pole Temp	°C	0
Start Count		0
Auto Reset Count		0

## Soft Start Config Menu

### Soft Start Config—S811+ ...N3S Standard

Soft Start Config Menu	Units	Minimum Inline (InsideDelta)	Maximum Inline (InsideDelta)	Default Inline (InsideDelta)	Notes	Access Level
Mtr Nameplate FLA						2
S811+N37...	Amps	11 (19)	37 (65)	11 (19)	Motor FLA parameter must be set to motor nameplate FLA to achieve proper overload protection.	2
S811+N66...	Amps	20 (35)	66 (114)	20 (35)		2
S811+R10...	Amps	32 (55)	105 (182)	32 (55)		2
S811+R13...	Amps	42 (73)	135 (234)	42 (73)		2
S811+T18...	Amps	56 (97)	180 (311)	56 (97)		2
S811+T24...	Amps	75 (130)	240 (415)	75 (130)		2
S811+T30...	Amps	95 (164)	304 (526)	95 (164)		2
S811+U36...	Amps	112 (195)	360 (623)	112 (195)		2
S811+U42...	Amps	131 (227)	420 (727)	131 (227)		2
S811+U50...	Amps	156 (270)	500 (865)	156 (270)		2
S811+V36...	Amps	112 (195)	360 (623)	112 (195)		2
S811+V42...	Amps	131 (227)	420 (727)	131 (227)		2
S811+V50...	Amps	156 (270)	500 (865)	156 (270)		2
S811+V65...	Amps	203 (352)	650 (1125)	203 (352)		2
S811+V72...	Amps	225 (389)	720 (1246)	225 (389)		2
S811+V85...	Amps	265 (458)	850 (1471)	265 (458)		2
S811+V10...	Amps	312 (539)	1000 (1732)	312 (539)	2	
OvrlD Trip Class		5	30	20		2
Phase Rev Fault		0	1	0	<b>0</b> = Enabled <b>1</b> = Disabled	2
Phase Sequence		0	1	0	<b>0</b> = ABC <b>1</b> = ACB	2
Start Method		0	2	0	<b>0</b> = Voltage Ramp <b>1</b> = Current Limit	2
Initial Torque	%	0	85	45		1
Soft Start Time	Seconds	0.5	180	20		1
Kick Start Torq	%	0	85	0		1
Kick Start Time	Seconds	0	2	0		1
Soft Stop Time	Seconds	0	60	0		1
Reset Mode		0	2	0	<b>0</b> = Manual <b>1</b> = Auto <b>2</b> = Powerup Reset	2
Auto Reset Delay	Seconds	0.1	600	0.1		2
Auto Reset Limit		0	10000	0		2
Motor Wiring Config		0	1	0	<b>0</b> = Inline <b>1</b> = InsideDelta	2

## Appendix A—Parameters

### Soft Start Config—S811+ ...P3S Premium

Soft Start Config Menu	Units	Minimum Inline (InsideDelta)	Maximum Inline (InsideDelta)	Default Inline (InsideDelta)	Notes	Access Level
Mtr Nameplate FLA						2
S811+N37...	Amps	11 (19)	37 (65)	11 (19)	Motor FLA parameter must be set to motor nameplate FLA to achieve proper overload protection.	2
S811+N66...	Amps	20 (35)	66 (114)	20 (35)		2
S811+R10...	Amps	32 (55)	105 (182)	32 (55)		2
S811+R13...	Amps	42 (73)	135 (234)	42 (73)		2
S811+T18...	Amps	56 (97)	180 (311)	56 (97)		2
S811+T24...	Amps	75 (130)	240 (415)	75 (130)		2
S811+T30...	Amps	95 (164)	304 (526)	95 (164)		2
S811+U36...	Amps	112 (195)	360 (623)	112 (195)		2
S811+U42...	Amps	131 (227)	420 (727)	131 (227)		2
S811+U50...	Amps	156 (270)	500 (865)	156 (270)		2
S811+V36...	Amps	112 (195)	360 (623)	112 (195)		2
S811+V42...	Amps	131 (227)	420 (727)	131 (227)		2
S811+V50...	Amps	156 (270)	500 (865)	156 (270)		2
S811+V65...	Amps	203 (352)	650 (1125)	203 (352)		2
S811+V72...	Amps	225 (389)	720 (1246)	225 (389)		2
S811+V85...	Amps	265 (458)	850 (1471)	265 (458)		2
S811+V10...	Amps	312 (539)	1000 (1732)	312 (539)	2	
OvrlD Trip Class		5	30	20		2
Phase Rev Fault		0	1	0	<b>0</b> = Enabled <b>1</b> = Disabled	2
Phase Sequence		0	1	0	<b>0</b> = ABC <b>1</b> = ACB	2
Start Method		0	3	0	<b>0</b> = Voltage Ramp <b>1</b> = Current Limit <b>2</b> = Unavailable <b>3</b> = Pump Start	2
Initial Torque	%	0	85	45		1
Soft Start Time	Seconds	0.5	360	20		1
Kick Start Torq	%	0	85	0		1
Kick Start Time	Seconds	0	2	0		1
Pump Stop Time	Seconds	5	120	10		1
Soft Stop Time	Seconds	0	60	0		1
Reset Mode		0	2	0	<b>0</b> = Manual <b>1</b> = Auto <b>2</b> = Powerup Reset	2
Auto Reset Delay	Seconds	0.1	600	0.1		2
Auto Reset Limit		0	10000	0		2
Motor Wiring Config		0	1	0	<b>0</b> = Inline <b>1</b> = Inside-the-Delta	2

**Note:** S811+... units cannot be configured with Pump Start + Inside-the-Delta functionality enabled at the same time.

**Soft Start Config—S811+ ...V3S Premium (690 Volt)**

<b>Soft Start Config Menu</b>	<b>Units</b>	<b>Minimum Inline</b>	<b>Maximum Inline</b>	<b>Default Inline</b>	<b>Notes</b>	<b>Access Level</b>
Mtr Nameplate FLA						2
S811+T18...	Amps	56	180	56	Motor FLA parameter must be set to motor nameplate FLA to achieve proper overload protection.	2
S811+T24...	Amps	75	240	75		2
S811+T30...	Amps	95	304	95		2
S811+V36...	Amps	112	360	112		2
S811+V42...	Amps	131	420	131		2
S811+V50...	Amps	156	500	156		2
S811+V65...	Amps	203	650	203		2
S811+V72...	Amps	225	720	225		2
S811+V85...	Amps	265	850	265		2
Ovrl Trip Class		5	30	20		
Phase Rev Fault		0	1	0	<b>0</b> = Enabled <b>1</b> = Disabled	2
Phase Sequence		0	1	0	<b>0</b> = ABC <b>1</b> = ACB	2
Start Method		0	3	0	<b>0</b> = Voltage Ramp <b>1</b> = Current Limit <b>2</b> = Unavailable <b>3</b> = Pump Start	2
Initial Torque	%	0	85	45		1
Soft Start Time	Seconds	0.5	360	20		1
Kick Start Torq	%	0	85	0		1
Kick Start Time	Seconds	0	2	0		1
Pump Stop Time	Seconds	5	120	10		1
Soft Stop Time	Seconds	0	60	0		1
Reset Mode		0	2	0	<b>0</b> = Manual <b>1</b> = Auto <b>2</b> = Powerup Reset	2
Auto Reset Delay	Seconds	0.1	600	0.1		2
Auto Reset Limit		0	10000	0		2
Motor Wiring Config		0	0	0	<b>0</b> = Inline	2

## Appendix A—Parameters

### Protection Menu

#### Protections Menu—All Catalog Numbers

Fault Code	Protections Menu	Units	Minimum	Maximum	Default	Notes
14	Overload Fault Enable		0	2	1	<b>0</b> = Disable <b>1</b> = Enable <b>2</b> = Warning
*	Ovld On Start		0	1	1	<b>0</b> = Disable <b>1</b> = Enable
*	Motor Rated Volt	volts	115	600	480	
		volts	115	690	480	690 volt option
42	Low Volt Trip Enable		0	2	1	<b>0</b> = Disable <b>1</b> = Enable <b>2</b> = Warning
	Low Volt Level	%	1	99	90	
	Low V Trip Dly	seconds	1	60	3	
43	Hi Volt Trip—Enable		0	2	0	<b>0</b> = Disable <b>1</b> = Enable <b>2</b> = Warning
	Hi Volt Level	%	101	120	110	
	Hi V Trip Dly	seconds	1	60	3	
7	V Imbal Trip Lev	%	1	100	6	
	V Imbal Trip Dly	seconds	1	60	0.5	
6	Phase Loss Fault		0	2	1	<b>0</b> = Disable <b>1</b> = Enable <b>2</b> = Warning
	Phase Loss % Trp	%	1	100	80	
	Ph Loss Trip Dly	seconds	1	60	0.5	
9	Lo I Trip Enable		0	2	1	<b>0</b> = Disable <b>1</b> = Enable <b>2</b> = Warning
	Low I Trip % FLA	%	0	100	6	
	Lo I Trip Delay	seconds	1	60	2	
7	Phase Imb Fault—Enable		0	2	1	<b>0</b> = Disable <b>1</b> = Enable <b>2</b> = Warning
	I Imbal Trip Lev	%	1	100	40	
	I Imbal Trip Dly	seconds	1	60	0.5	
11	Jam Fault—Enable		0	2	1	<b>0</b> = Disable <b>1</b> = Enable <b>2</b> = Warning
63	Stall Fault—Enable		0	2	1	<b>0</b> = Disable <b>1</b> = Enable <b>2</b> = Warning

**Protections Menu, continued**

<b>Fault Code</b>	<b>Protections Menu</b>	<b>Units</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Default</b>	<b>Notes</b>
40	3Ø Power Fault—Enable		0	2	0	<b>0</b> = Disable <b>1</b> = Enable <b>2</b> = Warning
	Low Power Trip Level	%	0	100	50	
	High Power Trip Level	%	0	800	125	
	Pwr Flt Trip Dly	seconds	1	60	3	
74, 75	Rated Line Freq	Hz	50	60	60	
	Line Freq Fault—Enable		0	2	0	<b>0</b> = Disable <b>1</b> = Enable <b>2</b> = Warning
	Freq Deviatn Trp	%	5	150	50	
	Freq Trip Delay	seconds	1	60	3	
59	SCR Short Fault—Enable		0	2	1	<b>0</b> = Disable <b>1</b> = Enable <b>2</b> = Warning
58	SCR Cnduct Fault—Enable		0	2	1	<b>0</b> = Disable <b>1</b> = Enable <b>2</b> = Warning
38	Temp Sense Fault—Enable		0	2	1	<b>0</b> = Disable <b>1</b> = Enable <b>2</b> = Warning
*	Alarm-No-Trip		0	1	0	<b>0</b> = Disable <b>1</b> = Enable

**Advanced I/O Menu**

**Parameter List—Advanced I/O Setup—All Catalog Numbers**

<b>Advanced I/O Setup Menu</b>	<b>Units</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Default</b>	<b>Notes</b>	<b>Access Level</b>
Input Config	Entry 0 = Terminal "1"	0	10	1	<b>0</b> = No Function	2
	Entry 1 = Terminal "2"	0	10	3	<b>1</b> = RUN1	
	Entry 2 = Terminal "3"	0	10	4	<b>2</b> = Ramp2	
	Entry 3 = Terminal "4"	0	11	5	<b>3</b> = JOG	
	Entry 4 = Network Input 1	0	10	0	<b>4</b> = LOCAL	
	Entry 5 = Network Input 2	0	10	0	<b>5</b> = RESET	
	Entry 6 = Network Input 3	0	10	0	<b>6</b> = E-Stop	
	Entry 7 = Network Input 4	0	10	0	<b>7</b> = Alarm-No-Trip	
Run Input Ctrl	0	0	0	<b>8</b> = Ext Trip	0	
Local Ctrl Only		0	1	0	<b>9</b> = Ext Warn	2
					<b>10</b> = Disable OL on Strt (edge only) <b>11</b> = Analog	

## Appendix A—Parameters

### Parameter List—Advanced I/O Setup—All Catalog Numbers, continued

Advanced I/O Setup Menu	Units	Minimum	Maximum	Default	Notes	Access Level	
Relay Config	Entry 0 = Terminals 13, 14	0	10	3	<b>0</b> = No Function <b>1</b> = Fault <b>2</b> = Fault NOT <b>3</b> = Bypassed <b>4</b> = Bypassed NOT <b>5</b> = Motor Energized <b>6</b> = Motor Energized NOT <b>7</b> = Warning <b>8</b> = Warning NOT <b>9</b> = Custom Flt/Warn <b>10</b> = Custom Flt/Warn NOT	2	
	Entry 1 = Terminals 95, 96, 98	0	10	1			
	Entry 2 = Network Output 1	0	10	0			
	Entry 3 = Network Output 2	0	10	0			
Relay Custom Cfg	User-Entered Fault Warning Codes	—	—	—			2
Pwr On Start Dly	Seconds	0	60	0			2
Start Delay	Seconds	0	60	0			2
Run Chg Strt Dly	Seconds	0	60	0			2
Start Delay Warn		0	1	1		<b>0</b> = Disable <b>1</b> = Enable	2
R2 Phase Seq		0	1	0		<b>0</b> = ABC <b>1</b> = ACB	2
R2 Start Method		0	3	0	<b>0</b> = Voltage Ramp <b>1</b> = Current Limit <b>2</b> = Unavailable <b>3</b> = Pump Start (Opt.)	2	
R2 Initial Torq	%	0	85	45		1	
R2 Soft Start Tm	Seconds	5	180	20		1	
R2 Kick St Torq	%	0	85	0		1	
R2 Kick St Time	Seconds	0	2	0		1	
R2 Pump Stop Tm	Seconds	20	120	60		1	
R2 Soft Stop Tm	Seconds	0	60	0		1	
Analog Input Flt		0	2	0	<b>0</b> = Disable <b>1</b> = Enable <b>2</b> = Warning	2	
Analog Low Trip	%	0	100	10		2	
Analog High Trip	%	0	100	90		2	
Analog Trip Dly	Seconds	1	60	3		2	
Analog In Range		2	3	3	<b>2</b> = 0–20.0 ma DC <b>3</b> = 4.0–20.0 ma DC	2	
Analog In Sense	%					0	
Analog In Status						0	



## Network Setup Menu

### Network Setup

Network Setup	Minimum	Maximum	Default	Notes	Access Level
Comm Loss Action	0	7	0	<b>0</b> = Auto Stop <b>1</b> = Auto Run1 <b>2</b> = Unavailable <b>3</b> = Hold Last <b>4</b> = Unavailable <b>5</b> = Unavailable <b>6</b> = Unavailable <b>7</b> = All Stop Fault	2
Modbus Baud Rate	0	7	4	<b>0</b> = 1200 <b>1</b> = 2400 <b>2</b> = 2800 <b>3</b> = 9600 <b>4</b> = 19200 <b>5</b> = 38400 <b>6</b> = 57600 <b>7</b> = 115200	2
Modbus Address					0
Modbus Parity	0	1	0	<b>0</b> = Even (1 stop bit) <b>1</b> = Odd (1 stop bit)	2
Modbus Stop Bits	1	2	1		2
Modbus Mode					2
Config CRC					0
Firmware Version					0
Hardware Version					0
Discrete Input					0
Discrete Output					0
Motor Status					0
Modbus User Name					2
Product Code					0
Network 2 Enable	0	1	0	<b>0</b> = disabled, register 500 active <b>1</b> = enabled, register 501 active	2

## Appendix A—Parameters

### LCD DIM Setup Menu

#### LCD DIM Setup

LCD DIM Setup	Units	Minimum	Maximum	Default	Access Level
Upload Settings					2
Dnload Settings					2
DIM Access Level		0	3	2	0
Access Timeout	seconds	0	600	600	2
Change Password					2
Clear Fault Hist					1
Get Register					0
Set Register					2
Run Button Delay	seconds	0	0.3	0.3	2
Removable DIM <sup>①②</sup>		0.3	0	1	2
Fault Disp Tmout					1
Menu Disp Tmout					1
Reset—Soft					2
Backlight Level				3	1
Backlite Tmout		0	300	0	1
DIM Firmware Ver					0
Local jog button enable <sup>③</sup>		0	1	0	2

#### Notes

- ① Digital Interface Module.
- ② 0 = Disabled (Fault)  
1 = Enabled (No Fault).
- ③ 0 = Disabled (Fault)  
1 = Enabled (Jog).

## Appendix B—Protection

### Thermal Overload

The S811+ 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, using the *Mtr Nameplate FLA* parameter in the Soft Start Config Menu to program the trip current. It is programmable from 32–100% of the unit's rated current.

#### Overload—Adjustment Range—Inline Connected

Catalog Number	Min	Max	Default	Notes
S811+N37...	11	37	11	Motor FLA parameter must be set to motor nameplate FLA to achieve proper overload protection
S811+N66...	20	66	20	
S811+R10...	32	105	32	
S811+R13...	42	135	42	
S811+T18...	56	180	56	
S811+T24...	75	240	75	
S811+T30...	95	304	95	
S811+V36...	112	360	112	
S811+V42...	131	420	131	
S811+V50...	156	500	156	
S811+V65...	203	650	203	
S811+V72...	225	720	225	
S811+V85...	265	850	265	
S811+V10...	312	1000	312	

#### Overload—Adjustment Range—Inside-the-Delta Connected

Catalog Number	Min	Max	Default	Notes
S811+N37...	19	65	19	Motor FLA parameter must be set to motor nameplate FLA to achieve proper overload protection
S811+N66...	35	114	35	
S811+R10...	55	182	55	
S811+R13...	73	234	73	
S811+T18...	97	311	97	
S811+T24...	130	415	130	
S811+T30...	164	526	164	
S811+V36...	193	623	193	
S811+V42...	227	727	227	
S811+V50...	270	865	270	
S811+V65...	352	1125	352	
S811+V72...	389	1246	389	
S811+V85...	458	1471	458	
S811+V10...	539	1732	539	

**Note:** *Mtr Nameplate FLA* parameter 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* parameter.

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.

## Appendix B—Protection

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

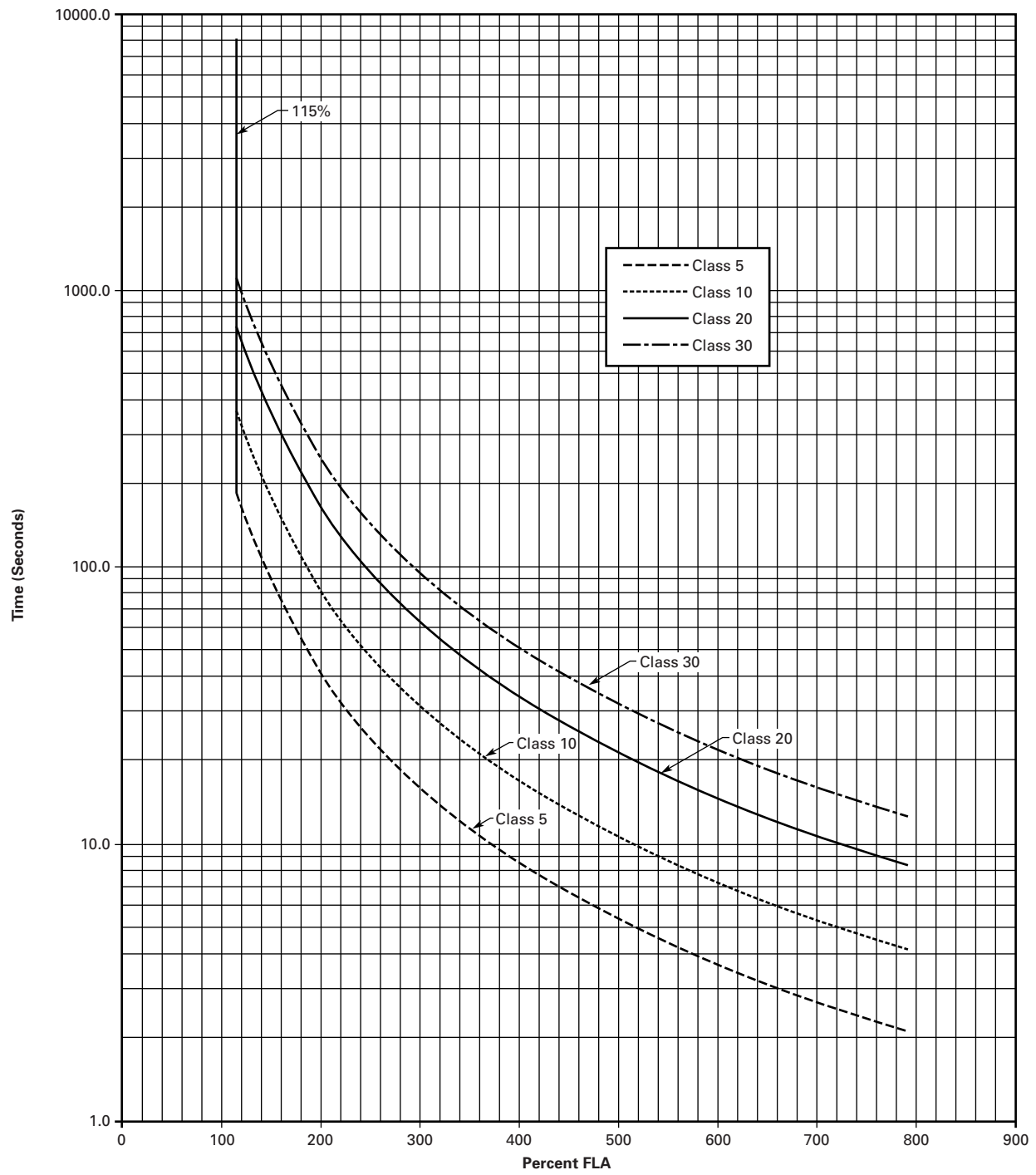
<b>Trip Level</b>	<b>Preset Inhibit Time</b>	<b>Reset Time to Previous Trip Level</b>
1	3 minutes	N/A
2	6 minutes	96 minutes
3	9 minutes	144 minutes

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										Catalog Number	
	kW Rating (50 Hz)			hp Rating (60 Hz)				575–690V				
	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
<b>Frame Size N</b>												
37	10	18.5	18.5	10	10	10	10	25	20	30	30	<b>S811+N37N3S</b>
66	18.5	30	37	20	15	20	20	50	40	60	50	<b>S811+N66N3S</b>
<b>Frame Size R</b>												
105	30	55	59	30	25	40	30	75	60	100	75	<b>S811+R10N3S</b>
135	40	63	80	40	30	50	40	100	75	125	100	<b>S811+R13N3S</b>
<b>Frame Size T</b>												
180	51	90	110	60	50	60	60	150	125	150	150	<b>S811+T18N3S</b>
240	75	110	147	75	60	75	75	200	150	200	200	<b>S811+T24N3S</b>
304	90	160	185	100	75	100	100	250	200	300	250	<b>S811+T30N3S</b>
<b>Frame Size U</b>												
360	110	185	220	125	100	150	125	300	250	350	300	<b>S811+U36N3S</b>
420	129	220	257	150	125	175	150	350	300	450	350	<b>S811+U42N3S</b>
500	150	257	300	150	150	200	150	400	350	500	450	<b>S811+U50N3S</b>
<b>Frame Size V</b>												
360	110	185	220	125	100	150	125	300	250	350	300	<b>S811+V36N3S</b>
420	129	220	257	150	125	175	150	350	300	450	350	<b>S811+V42N3S</b>
500	150	257	300	150	150	200	150	400	350	500	450	<b>S811+V50N3S</b>
650	200	355	425	250	200	250	200	500	450	600	500	<b>S811+V65N3S</b>
720	220	400	450	Ⓢ	Ⓢ	300	250	600	500	700	600	<b>S811+V72N3S</b>
850	257	475	500	Ⓢ	Ⓢ	350	300	700	600	900	700	<b>S811+V85N3S</b>
1000	277	525	500	Ⓢ	Ⓢ	400	350	800	700	900	800	<b>S811+V10N3S</b>

**Notes**

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

Ⓢ 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)				575–690V				
	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
<b>Frame Size N</b>												
22	5.5	10	11	5	5	7.5	5	15	10	20	15	<b>S811+N37N3S</b>
42	11	18.5	22	10	10	15	10	30	25	40	30	<b>S811+N66N3S</b>
<b>Frame Size R</b>												
65	15	30	33	15	15	20	15	50	40	50	50	<b>S811+R10N3S</b>
80	22	40	45	25	20	30	25	60	50	75	60	<b>S811+R13N3S</b>
<b>Frame Size T</b>												
115	33	59	63	30	30	40	30	75	75	100	100	<b>S811+T18N3S</b>
150	45	80	90	50	40	50	50	100	100	150	125	<b>S811+T24N3S</b>
192	55	100	110	60	50	75	60	150	125	200	150	<b>S811+T30N3S</b>
<b>Frame Size U</b>												
240	75	110	147	75	60	75	75	200	150	200	200	<b>S811+U36N3S</b>
305	90	160	185	100	75	100	100	250	200	300	250	<b>S811+U42N3S</b>
<b>Frame Size V</b>												
240	75	110	147	75	60	75	75	200	150	200	200	<b>S811+V36N3S</b>
305	90	160	185	100	75	100	100	250	200	300	250	<b>S811+V42N3S</b>
365	110	185	220	125	100	150	125	300	250	350	300	<b>S811+V50N3S</b>
420	129	220	257	150	125	150	150	350	300	450	350	<b>S811+V65N3S</b>
480	147	257	295	150	150	200	150	400	350	500	450	<b>S811+V72N3S</b>
525	160	280	335	150	150	200	150	450	350	500	450	<b>S811+V85N3S</b>
575	172	303	370	200	150	250	200	500	450	600	500	<b>S811+V10N3S</b>

**Notes**

1.0SF = 1.0 Service Factor.

1.15SF = 1.15 Service Factor.

## Appendix D—Ratings, Cooling and Power Losses—Inside-the-Delta

### Power Ratings

#### Standard Duty—15 Second Ramp, 300% Current Limit at 40°C—Inside-the-Delta Connection

Maximum Continuous Line Current	Three-Phase Motors										Catalog Number	
	kW Rating (50 Hz)			hp Rating (60 Hz)				575–690V				
	230V	380–400V	440V	200V	230V	460V	575–690V	1.0SF	1.15SF	1.0SF		1.15SF
	1.0SF	1.0SF	1.0SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	
<b>Frame Size N</b>												
65	10	18.5	18.5	15	15	15	15	40	30	50	50	<b>S811+N37N3S</b>
114	18.5	30	37	30	25	30	30	75	60	100	75	<b>S811+N66N3S</b>
<b>Frame Size R</b>												
182	30	55	59	50	40	60	50	125	100	150	125	<b>S811+R10N3S</b>
234	40	63	80	60	50	75	60	150	125	200	150	<b>S811+R13N3S</b>
<b>Frame Size T</b>												
311	51	90	110	100	75	100	100	250	200	250	250	<b>S811+T18N3S</b>
415	75	110	147	125	100	125	125	300	250	300	300	<b>S811+T24N3S</b>
526	90	160	185	150	125	150	150	400	300	400	400	<b>S811+T30N3S</b>
<b>Frame Size U</b>												
623	110	185	220	200	150	250	200	450	400	550	450	<b>S811+U36N3S</b>
727	129	220	257	250	200	300	250	550	450	700	550	<b>S811+U42N3S</b>
865	150	257	300	250	250	300	250	600	550	750	700	<b>S811+U50N3S</b>
<b>Frame Size V</b>												
623	110	185	220	200	150	250	200	450	400	550	450	<b>S811+V36N3S</b>
727	129	220	257	250	200	300	250	550	450	700	550	<b>S811+V42N3S</b>
865	150	257	300	250	250	300	250	600	550	750	700	<b>S811+V50N3S</b>
1125	200	355	425	400	300	400	300	750	700	900	750	<b>S811+V65N3S</b>
1246	①	①	①	①	①	①	①	①	①	①	①	<b>S811+V72N3S</b>
1471	①	①	①	①	①	①	①	①	①	①	①	<b>S811+V85N3S</b>
①	①	①	①	①	①	①	①	①	①	①	①	<b>S811+V10N3S</b>

**Notes**

- 1.0SF = 1.0 Service Factor.
- 1.15SF = 1.15 Service Factor.
- ① Consult factory.



Appendix D—Ratings, Cooling and Power Losses—Inside-the-Delta

**Severe Duty—30 Second Ramp and/or 450% Current Limit at 50°C—Inside-the-Delta Connection**

Maximum Continuous Line Current	Three-Phase Motors										Catalog Number	
	kW Rating (50 Hz)			hp Rating (60 Hz)				575–690V				
	230V	380–400V	440V	200V	230V	460V	575–690V	1.0SF	1.15SF	1.15SF		
	1.0SF	1.0SF	1.0SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	
<b>Frame Size N</b>												
39	5.5	10	11	7.5	7.5	10	7.5	25	15	30	25	<b>S811+N37N3S</b>
73	11	18.5	22	15	15	25	15	50	40	60	50	<b>S811+N66N3S</b>
<b>Frame Size R</b>												
111	15	30	33	25	25	30	25	75	60	75	75	<b>S811+R10N3S</b>
138	22	40	45	40	30	50	40	100	75	125	100	<b>S811+R13N3S</b>
<b>Frame Size T</b>												
199	33	59	63	50	50	60	50	125	125	150	150	<b>S811+T18N3S</b>
257	45	80	90	75	60	75	75	150	150	250	200	<b>S811+T24N3S</b>
324	55	100	110	100	75	100	100	250	200	300	250	<b>S811+T30N3S</b>
<b>Frame Size U</b>												
415	75	110	147	125	100	125	125	300	250	300	300	<b>S811+U36N3S</b>
526	90	160	185	150	125	150	150	400	300	450	400	<b>S811+U42N3S</b>
623	110	185	220	200	150	250	200	450	400	550	450	<b>S811+U50N3S</b>
<b>Frame Size V</b>												
415	75	110	147	125	100	125	125	300	250	300	300	<b>S811+V36N3S</b>
526	90	160	185	150	125	150	150	400	300	450	400	<b>S811+V42N3S</b>
623	110	185	220	200	150	250	200	450	400	550	450	<b>S811+V50N3S</b>
727	129	220	257	250	200	250	250	550	450	700	550	<b>S811+V65N3S</b>
816	147	257	295	250	250	300	250	600	550	750	700	<b>S811+V72N3S</b>
908	160	280	335	250	250	300	250	700	550	750	700	<b>S811+V85N3S</b>
①	①	①	①	①	①	①	①	①	①	①	①	<b>S811+V10N3S</b>

**Notes**

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

① Consult factory.

## Appendix D—Ratings, Cooling and Power Losses—Inside-the-Delta

### Power Losses

The following table lists the maximum power loss for each S811+ 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	FLA Current Range Inside-the-Delta	Power Loss (Watts)
<b>S811+N37...</b>	11–37 amps	19–65 amps	30
<b>S811+N66...</b>	20–66 amps	35–114 amps	33
<b>S811+R10...</b>	32–105 amps	55–182 amps	47
<b>S811+R13...</b>	42–135 amps	73–234 amps	55
<b>S811+T18...</b>	56–180 amps	97–311 amps	37
<b>S811+T24...</b>	75–240 amps	130–415 amps	40
<b>S811+T30...</b>	95–304 amps	164–526 amps	45
<b>S811+U36...</b>	112–360 amps	193–623 amps	76
<b>S811+U42...</b>	131–420 amps	227–727 amps	92
<b>S811+U50...</b>	156–500 amps	270–865 amps	116
<b>S811+V36...</b>	112–360 amps	193–623 amps	56
<b>S811+V42...</b>	131–420 amps	227–727 amps	64
<b>S811+V50...</b>	156–500 amps	270–865 amps	78
<b>S811+V65...</b>	203–650 amps	352–1125 amps	109
<b>S811+V72...</b>	225–720 amps	389–1246 amps	127
<b>S811+V85...</b>	265–850 amps	458–1471 amps	164
<b>S811+V10...</b>	312–1000 amps	Not Available	215

## Appendix E—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 insight disconnect means should be installed, per local code. The S811+ 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 F—Pump Control Option

### Pump Control Option

This option is intended to reduce the potential for water hammer in a centrifugal pump system by utilizing a starting and stopping algorithm developed for pump control. Upon a start command, the speed of the motor is increased, under the control of the S811+ Soft Starter microprocessor, to achieve a gentle start. After the speed has reached its nominal value, the bypass contactors close and the pump operates as with any other starter. Upon a stop command, the bypass contactors are opened and the motor speed is decreased in a tapered manner, to gradually slow the flow until the motor is brought to a stop. The start and stop ramp times are user adjustable and are to be set for the application requirements.

### Installation

Install and wire your S811+ Soft Starter per the instructions found in the beginning of this manual.

### Setup

All pump control parameters are set via the DIM or network connection. Units configured with the pump control option can activate this feature by selecting the pump option under the DIM "Start Method" parameter.

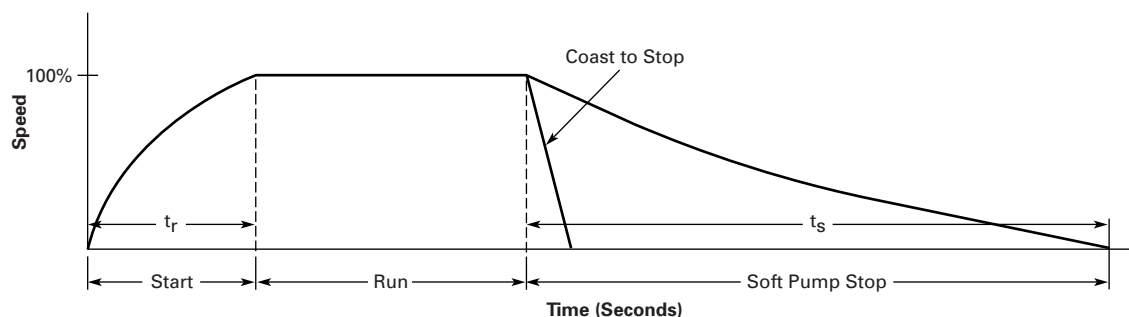
### Adjustment

All of the adjustments to the S811+ Premium Soft Starter are made as noted in this user manual. The major difference between the standard S811+ Soft Starter and Premium is the special algorithm for gentle start and stop with centrifugal flow loads to minimize the potential for water hammer.

Using the DIM, set the S811+ Soft Start Configuration parameters described below:

The *Pump Start Ramp Time* parameter adjusts the start ramp. It has a standard range of 0.5 to 180.0 seconds. The factory default is 20.0 seconds. The pump stop time is adjusted by *Pump Stop*, which has a range of 5.0 to 120.0 seconds with the factory default being 10.0 seconds. (**NOTE:** The *Stop Ramp Time* setting used in non-pump S811+'s has no effect on units with the Pump Control Option installed if start method is Pump Start.) These adjustments are application dependent, and should be made to minimize any surge or water hammer effects. Typically *Pump Stop* would not be set short, since the stop might not differ much from a coast-to-stop. The soft stop time adjustment may often be in the range of 30 to 40 seconds, but needs to be set appropriately for the system requirements. If reduction or elimination of water hammer is not achieved, it may be necessary to lengthen *Pump Stop* to achieve the desired result. Note that long stop times will result in greater motor heating than shorter stop times. This can affect the number of start/stop cycles allowed per hour due to the S811+ Soft Starter or motor thermal limits.

### Pump Control Option



## Appendix G—Modbus Register Map

### Register Map

Parameter	Data Length	Modbus Register Number	Read/Write	Data Type	Description	
Motor Control Status	1	300	R	UINT8	<b>bit</b> <b>status</b>	
					0	Running1
					1	Running2
					2	Permissive
					3	Ramp2
					4	LocalControlStatus
					5	Faulted
					6	Warning
7	In bypass					
Active Faults & Warning List (latest Fault)	2	301	R	UINT16	Latest Fault/Warning code	
	2	302	R	UINT16	2nd Latest Fault/Warning code	
	2	303	R	UINT16	3rd Latest Fault/Warning code	
Motor Control Faults	2	304	R	UINT16	<b>bit</b> <b>fault</b>	
					0	Phaseloss
					1	Phase Imbalance
					2	Thermal Pile
					3	Overcurrent
					4	Breaker Fault
					5	GND Fault
					6	Motor Stall
					7	Motor Jam
					8	OverTemp
					9	UnderLoad
					10	Reserved
					11	Estop
					12	Reserved
					13	Reserved
					14	Reserved
15	Other					
Motor Control Warnings	2	305	R	UINT16	<b>bit</b> <b>warning</b>	
					0	0 Phaseloss
					1	Phase Imbalance
					2	Thermal Pile
					3	Overcurrent
					4	Breaker Fault
					5	GND Fault
					6	Motor Stall
					7	Motor Jam
					8	OverTemp
					9	UnderLoad
					10	Overload Impending Trip
					11	Reserved
					12	Reserved
					13	Reserved
					14	Reserved
15	Other					
Ave 3phase RMS AC Current as a % of FLA	2	306	R	UINT8	0–255%; Percent of FLA setting	
Thermal Pile Percentage	1	307	R	UINT8	0–255%; Thermal Pile % used (100% trip)	

## Appendix G—Modbus Register Map

### Register Map, continued

Parameter	Data Length	Modbus Register Number	Read/Write	Data Type	Description																		
Three-Phase RMS AC Voltage	2	308	R	UINT16	L1 RMS Voltage																		
	2	309	R	UINT16	L2 RMS Voltage																		
	2	310	R	UINT16	L3 RMS Voltage																		
Total Number of Motor Starts	4	311	R	UINT32	# of motor starts																		
		312	R		Reg311 = LSB1, LSB0 Reg312 = MSB, LSB2																		
Analog Input Percent of Rated Range	1	313	R	UINT8	0–255%; Analog input status reported as% of selected range																		
Analog Input Value Status	1	314	R	UINT8	<table border="0"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0x00</td> <td>Not Active</td> </tr> <tr> <td>0x01</td> <td>Under Range</td> </tr> <tr> <td>0x02</td> <td>Over Range</td> </tr> <tr> <td>0x03</td> <td>Input Overdrive</td> </tr> <tr> <td>0x04</td> <td>Input in range</td> </tr> </tbody> </table>	Value	Description	0x00	Not Active	0x01	Under Range	0x02	Over Range	0x03	Input Overdrive	0x04	Input in range						
Value	Description																						
0x00	Not Active																						
0x01	Under Range																						
0x02	Over Range																						
0x03	Input Overdrive																						
0x04	Input in range																						
Discrete Data Input	1	315	R	UINT8	<table border="0"> <thead> <tr> <th>bit</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>S811 TB Input#1 status</td> </tr> <tr> <td>1</td> <td>S811 TB Input#2 status</td> </tr> <tr> <td>2</td> <td>S811 TB Input#3 status</td> </tr> <tr> <td>3</td> <td>S811 TB Input#4 status</td> </tr> <tr> <td>4</td> <td>C441 Input#1 status</td> </tr> <tr> <td>5</td> <td>C441 Input#2 status</td> </tr> <tr> <td>6</td> <td>C441 Input#3 status</td> </tr> <tr> <td>7</td> <td>C441 Input#4 status</td> </tr> </tbody> </table>	bit	Description	0	S811 TB Input#1 status	1	S811 TB Input#2 status	2	S811 TB Input#3 status	3	S811 TB Input#4 status	4	C441 Input#1 status	5	C441 Input#2 status	6	C441 Input#3 status	7	C441 Input#4 status
					bit	Description																	
					0	S811 TB Input#1 status																	
					1	S811 TB Input#2 status																	
					2	S811 TB Input#3 status																	
					3	S811 TB Input#4 status																	
					4	C441 Input#1 status																	
					5	C441 Input#2 status																	
6	C441 Input#3 status																						
7	C441 Input#4 status																						
Discrete Data Output	1	316	R	UINT8	<table border="0"> <thead> <tr> <th>bit</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>S811 form1C relay</td> </tr> <tr> <td>1</td> <td>S811 formA relay</td> </tr> <tr> <td>2</td> <td>C441—Q1/Network output0</td> </tr> <tr> <td>3</td> <td>C441—Q2/Network output1</td> </tr> <tr> <td>4</td> <td></td> </tr> <tr> <td>5</td> <td></td> </tr> <tr> <td>6</td> <td></td> </tr> <tr> <td>7</td> <td></td> </tr> </tbody> </table>	bit	Description	0	S811 form1C relay	1	S811 formA relay	2	C441—Q1/Network output0	3	C441—Q2/Network output1	4		5		6		7	
					bit	Description																	
					0	S811 form1C relay																	
					1	S811 formA relay																	
					2	C441—Q1/Network output0																	
					3	C441—Q2/Network output1																	
					4																		
					5																		
6																							
7																							
Network Outputs	1	317	R	UINT8	<table border="0"> <thead> <tr> <th>bit</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>C441—Q1/Network output0</td> </tr> <tr> <td>1</td> <td>C441—Q2/Network output1</td> </tr> <tr> <td>2</td> <td></td> </tr> <tr> <td>3</td> <td></td> </tr> <tr> <td>4</td> <td></td> </tr> <tr> <td>5</td> <td></td> </tr> <tr> <td>6</td> <td></td> </tr> <tr> <td>7</td> <td></td> </tr> </tbody> </table>	bit	Description	0	C441—Q1/Network output0	1	C441—Q2/Network output1	2		3		4		5		6		7	
					bit	Description																	
					0	C441—Q1/Network output0																	
					1	C441—Q2/Network output1																	
					2																		
					3																		
					4																		
					5																		
6																							
7																							

**Register Map, continued**

Parameter	Data Length	Modbus Register Number	Read/Write	Data Type	Description
Fault Queue (Fault/Warning codes are not repeated in the list)	2	318	R	UINT16	Latest Fault/Warning code
	2	319	R	UINT16	2nd Latest Fault/Warning code
	2	320	R	UINT16	3rd Latest Fault/Warning code
	2	321	R	UINT16	4th Latest Fault/Warning code
	2	322	R	UINT16	5th Latest Fault/Warning code
	2	323	R	UINT16	6th Latest Fault/Warning code
	2	324	R	UINT16	7th Latest Fault/Warning code
	2	325	R	UINT16	8th Latest Fault/Warning code
	2	326	R	UINT16	9th Latest Fault/Warning code
	2	327	R	UINT16	10th Latest Fault/Warning code
Average RMS AC Current—Line	4	328	R	FLOAT	Average RMS Line Current
		329	R		Reg329 = LSB1, LSB0 Reg330 = MSB, LSB2
Three-Phase RMS Current On the line	4	330	R	FLOAT	L1 RMS Line Current
		331	R		Reg331 = LSB1, LSB0 Reg332 = MSB, LSB2
	4	332	R	FLOAT	L2 RMS Line Current
		333	R		Reg333 = LSB1, LSB0 Reg334 = MSB, LSB2
	4	334	R	FLOAT	L3 RMS Line Current
		335	R		Reg335 = LSB1, LSB0 Reg336 = MSB, LSB2
Scaled Average Three-Phase Currents in Amps—Line	2	336	R	UINT16	Scaled Average current in Amps
Scaled Three Phase Currents in Amps—Line	2	337	R	UINT16	L1 RMS current in Amps
	2	338	R	UINT16	L2 RMS current in Amps
	2	339	R	UINT16	L3 RMS current in Amps
Scaled Average Three-Phase Currents in deciamps—Line	2	340	R	UINT16	Scaled Average current in 0.1 Amps
Scaled Three Phase Currents in deciamps—Line	2	341	R	UINT16	L1 RMS current in 0.1 Amps
	2	342	R	UINT16	L2 RMS current in 0.1 Amps
	2	343	R	UINT16	L3 RMS current in 0.1Amps
Average RMS AC Current—Pole	4	344	R	FLOAT	Average RMS Pole Current
		345	R		Reg345 = LSB1, LSB0 Reg346 = MSB, LSB2
3 Phase RMS Current on the Pole itself	4	346	R	FLOAT	L1 RMS Pole Current
		347	R		Reg347 = LSB1, LSB0 Reg348 = MSB, LSB2
	4	348	R	FLOAT	L2 RMS Pole Current
		349	R		Reg349 = LSB1, LSB0 Reg350 = MSB, LSB2
	4	350	R	FLOAT	L3 RMS Pole Current
		351	R		Reg351 = LSB1, LSB0 Reg352 = MSB, LSB2

## Appendix G—Modbus Register Map

### Register Map, continued

Parameter	Data Length	Modbus Register Number	Read/Write	Data Type	Description																		
Scaled Average Three Phase Currents in amps—Pole	2	352	R	UINT16	Scaled Average pole current in Amps																		
Scaled Three Phase Currents in amps—Pole	2	353	R	UINT16	L1 RMS pole current in Amps																		
	2	354	R	UINT16	L2 RMS pole current in Amps																		
	2	355	R	UINT16	L3 RMS pole current in Amps																		
Scaled Average Three Phase Currents in deciamps—Pole	2	356	R	UINT16	Scaled Average pole current in 0.1 Amps																		
Scaled Three Phase Currents in deciamps—Pole	2	357	R	UINT16	L1 RMS pole current in 0.1 Amps																		
	2	358	R	UINT16	L2 RMS pole current in 0.1 Amps																		
	2	359	R	UINT16	L3 RMS pole current in 0.1Amps																		
Power Factor	2	360	R	SINT16	0 to 1.0000 (in 0.0001)																		
Integer Average Three Phase Real Power kW	2	361	R	UINT16	Average Real Power (kW)																		
Power Device Pole Temperature	2	362	R	SINT16	L1 pole temp in 0.1°C																		
	2	363	R	SINT16	L2 pole temp in 0.1°C																		
	2	364	R	SINT16	L3 pole temp in 0.1°C																		
DC Control Voltage	2	365	R	UINT16	DC voltage reported in 0.001V																		
Device Temperature in Degrees C	2	366	R	SINT16	Device temp in 0.1°C																		
Auto Reset Count	2	367	R	UINT16	# of times S811+ has been auto reset																		
Line Frequency	2	368	R	UINT16	Line Frequency (in 0.01Hz)																		
Line Phase Sequence	1	369	R	UINT8	0x01—ABC Phase sequence 0x02—ACB Phase sequence																		
Fault List (Fault/Warning codes will be repeated in the list)	2	370	R	UINT16	Latest Fault/Warning code																		
	2	371	R	UINT16	2nd Latest Fault/Warning code																		
	2	372	R	UINT16	3rd Latest Fault/Warning code																		
	2	373	R	UINT16	4th Latest Fault/Warning code																		
	2	374	R	UINT16	5th Latest Fault/Warning code																		
	2	375	R	UINT16	6th Latest Fault/Warning code																		
	2	376	R	UINT16	7th Latest Fault/Warning code																		
	2	377	R	UINT16	8th Latest Fault/Warning code																		
	2	378	R	UINT16	9th Latest Fault/Warning code																		
	2	379	R	UINT16	10th Latest Fault/Warning code																		
Application Status	2	380	R	UINT16	Applications status (present fault)																		
Motor RUN1 input level sense enable	1	381	R	UINT8	0x00—edge sense 0x01—level sense																		
Modbus Motor Control (3-Wire)	1	500	R/W	UINT8	<table border="0"> <thead> <tr> <th>bit</th> <th>Description</th> </tr> </thead> <tbody> <tr><td>0</td><td>Run1</td></tr> <tr><td>1</td><td>Run2</td></tr> <tr><td>2</td><td>Permissive</td></tr> <tr><td>3</td><td>Fault Reset</td></tr> <tr><td>4</td><td>reserved</td></tr> <tr><td>5</td><td>reserved</td></tr> <tr><td>6</td><td>reserved</td></tr> <tr><td>7</td><td>Ramp2 enable</td></tr> </tbody> </table>	bit	Description	0	Run1	1	Run2	2	Permissive	3	Fault Reset	4	reserved	5	reserved	6	reserved	7	Ramp2 enable
bit	Description																						
0	Run1																						
1	Run2																						
2	Permissive																						
3	Fault Reset																						
4	reserved																						
5	reserved																						
6	reserved																						
7	Ramp2 enable																						



## Register Map, continued

Parameter	Data Length	Modbus Register Number	Read/Write	Data Type	Description	
Modbus Motor Two Wire Control	1	501	R/W	UINT8	<b>bit</b> <b>Description</b>	
					0	Run1—Level Sense
					1	Run2—Level Sense
					2	reserved
					3	Fault Reset
					4	reserved
					5	reserved
					6	reserved
7	Ramp2 enable					
Network Inputs	1	502	R/W	UINT8	<b>bit</b> <b>Description</b>	
					0	C441/Network Input#1
					1	C441/Network Input#2
					2	C441/Network Input#3
					3	C441/Network Input#4
					4	
					5	
					6	
7						
MODBUS Baud Rate	1	503	R/W	UINT8	<b>Value</b> <b>Description</b>	
					0x00	1200 baudrate
					0x01	2400 baudrate
					0x02	4800 baudrate
					0x03	9600 baudrate
					0x04	19.2k baudrate
					0x05	38.4k baudrate
					0x06	57.6k baudrate
					0x07	115.2k baudrate
					0x08	230.4k baudrate
0x09	460.8k baudrate					
MODBUS Slave Address	1	504	R	UINT8	address values 1–63	
MODBUS Parity	1	505	R/W	UINT8	<b>Value</b> <b>Description</b>	
					0x00	Even parity
					0x01	Odd parity
0x02	None					
MODBUS Stop Bits	1	506	R/W	UINT8	<b>Value</b> <b>Description</b>	
					0x01	1 stop bit
0x02	2 stop bits					
MODBUS Transmission Mode (RTU/ASCII)	1	507	R/W	UINT8	<b>Value</b> <b>Description</b>	
					0x00	RTU mode
0x01	ASCII mode					
Motor FLA Value	4	600	R/W	FLOAT	Motor nameplate fla	
		601	R/W		Reg600 = LSB1, LSB0 Reg601 = MSB, LSB2	
Motor FLA Value scaled in 0.1A	2	602	R/W	UINT16	110–10,000 range	
Overload Trip Class Value	1	603	R/W	UINT8	Class 5–30	
Motor Rated Volts	2	604	R/W	UINT16	115V–600V (Motor nameplate voltage)	
Motor Line Frequency Rating	2	605	R/W	UINT16	50.00–60.00Hz (in 0.01Hz)	
Motor Wiring Cfg	1	606	R/W	BOOL	0 = Inline Wiring	
					1 = Inside Delta	
Motor Phase Sequence	1	607	R/W	UINT8	0 = ABC Phase sequence	
					1 = ACB Phase sequence	

## Appendix G—Modbus Register Map

### Register Map, continued

Parameter	Data Length	Modbus Register Number	Read/Write	Data Type	Description								
Motor Start Method	1	608	R/W	UINT8	0 = Voltage Ramp 1 = Current Limit 2 = Unavailable 3 = Pump Start (w pump option)								
Percent Initial Torque	1	609	R/W	UINT8	0–100%								
Motor Start Ramp Time	2	610	R/W	UINT16	0.5–180s (in 0.1 sec)								
Motor Stop Ramp Time	2	611	R/W	UINT16	0.0–60.0s (in 0.1 sec)								
Motor Pump Stop Time	2	612	R/W	UINT16	20.0–120.0 (in 0.1 sec)								
Kick Start Initial Torque	1	613	R/W	UINT8	0–100%								
Kick Start Time	1	614	R/W	UINT8	0.0–2.0 sec (in 0.1 sec)								
Ramp2 Motor Phase Sequence	1	615	R/W	UINT8	0 = ABC Phase sequence 1 = ACB Phase sequence								
Ramp2 Motor Start Method	1	616	R/W	UINT8	0 = Voltage Ramp 1 = Current Limit 2 = Unavailable 3 = Pump Start (w pump option)								
Ramp2 Motor Percent Initial Torque	1	617	R/W	UINT8	0–100%								
Ramp2 Motor Start Ramp Time	2	618	R/W	UINT16	0.5–180s (in 0.1 sec)								
Ramp2 Motor Stop Ramp Time	2	619	R/W	UINT16	0.0–60.0s (in 0.1 sec)								
Ramp2 Motor Pump Stop Time	2	620	R/W	UINT16	20.0–120.0 (in 0.1 sec)								
Ramp2 Motor Kick Start Initial Torque	1	621	R/W	UINT8	0–100%								
Ramp2 Motor Kick Start Time	1	622	R/W	UINT8	0.0–2.0 sec (in 0.1 sec)								
Motor Control Terminal Block Local Control Enable	1	623	R/W	UINT8	1 = local control only enabled 0 = disable (terminal block input selects local/network control)								
Motor Control Input Configuration					0 = No function								
S811 input#1 cfg	2	624	RW	UINT16	1 = Run1								
S811 input#2 cfg	2	625	RW	UINT16	2 = Ramp2								
S811 input#3 cfg	2	626	RW	UINT16	3 = Jog								
S811 input#4 cfg	2	627	RW	UINT16	4 = Local control enable								
Network input#1 cfg	2	628	RW	UINT16	5 = Fault reset								
Network input#2 cfg	2	629	RW	UINT16	6 = E-stop input								
Network input#3 cfg	2	630	RW	UINT16	7 = Alarm-No-Trip								
Network input#4 cfg	2	631	RW	UINT16	8 = External Trip 9 = External Warning 10 = Disable overload on start 11 = Analog Input (S811 input #4 only)								
Analog Input Data Range	1	632	R/W	UINT8	<table border="1"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0x01</td> <td>not supported</td> </tr> <tr> <td>0x02</td> <td>0–20 mA range</td> </tr> <tr> <td>0x03</td> <td>4–20 mA range</td> </tr> </tbody> </table>	Value	Description	0x01	not supported	0x02	0–20 mA range	0x03	4–20 mA range
Value	Description												
0x01	not supported												
0x02	0–20 mA range												
0x03	4–20 mA range												

## Register Map, continued

Parameter	Data Length	Modbus Register Number	Read/Write	Data Type	Description
Motor Control Output Configuration					0 = No function 1 = Faulted 2 = Not Faulted 3 = Bypass 4 = Not Bypass 5 = Motor Energized 6 = Motor Not Energized 7 = Warning 8 = Not Warning 9 = Custom Codes 10 = Not Custom Codes
S811 output#1 cfg	2	633	R/W	UINT16	
S811 output#2 cfg	2	634	R/W	UINT16	
Network output#1 cfg	2	635	R/W	UINT16	
Network output#2 cfg	2	636	R/W	UINT16	
Motor Control Output Custom Fault Configuration	2 2 2	637 638 639	R/W R/W R/W	UINT16 UINT16 UINT16	Custom fault code#1 Custom fault code#2 Custom fault code#3
Fault Reset Mode	1	640	R/W	UINT8	0 = Manual reset 1 = Auto reset 2 = Power on reset
Auto Reset Delay Time	2	641	R/W	UINT16	0.1–600.0 sec (in 0.1 sec)
Auto Reset Number of Reset Attempts Limit	2	642	R/W	UINT16	0–10000
Overload Fault Enable	1	643	R/W	UINT8	0 = Protection disabled 1 = Fault enabled 2 = Warning enabled
Motor Overload During Start Enable	1	644	R/W	UINT8	1 = enable 0 = disable
Phase Reversal Fault Enable	1	645	R/W	UINT8	0 = Protection disabled 1 = Fault enabled 2 = Warning enabled
Motor Undercurrent Fault (Warning) Trip Enable	1	646	R/W	UINT8	0 = Protection disabled 1 = Fault enabled 2 = Warning enabled
Motor Undercurrent Fault Trip Level (% FLA)	1	647	R/W	UINT8	0–100%
Motor Undercurrent Fault Duration	2	648	R/W	UINT16	0.1–60.0 sec (in 0.1 sec)
Motor Jam Fault Enable	1	649	R/W	UINT8	0 = Protection disabled 1 = Fault enabled 2 = Warning enabled
Motor Stall Fault Enable	1	650	R/W	UINT8	0 = Protection disabled 1 = Fault enabled 2 = Warning enabled
Motor Phase Loss Fault Enable	1	651	R/W	UINT8	0 = Protection disabled 1 = Fault enabled 2 = Warning enabled
Motor Phase Loss Trip Level	1	652	R/W	UINT8	1–100%
Motor Phase Loss Duration	2	653	R/W	UINT16	0.1–60.0 sec (in 0.1 sec)
Motor Phase Imbalance Fault Enable	1	654	R/W	UINT8	0 = Protection disabled 1 = Fault enabled 2 = Warning enabled
Motor Phase Imbalance Fault Level	1	655	R/W	UINT8	1–100%
Motor Phase Imbalance Fault Duration	2	656	R/W	UINT16	0.1–60.0 sec (in 0.1 sec)

## Appendix G—Modbus Register Map

### Register Map, continued

Parameter	Data Length	Modbus Register Number	Read/Write	Data Type	Description
Motor Voltage Imbalance Fault Level	1	657	R/W	UINT8	1–100%
Motor Voltage Imbalance Fault Duration	2	658	R/W	UINT16	0.1–60.0 sec (in 0.1 sec)
Motor Under Voltage Fault Enable	1	659	R/W	UINT8	0 = Protection disabled 1 = Fault enabled 2 = Warning enabled
Motor Under Voltage Fault ( % of Rated Voltage )	1	660	R/W	UINT8	1–99%
Motor Under Voltage Fault Duration (Running)	2	661	R/W	UINT16	0.1–60.0 sec (in 0.1 sec)
Motor Over Voltage Fault Enable	1	662	R/W	UINT8	0 = Protection disabled 1 = Fault enabled 2 = Warning enabled
Motor Over Voltage Fault ( % of Rated Voltage )	1	663	R/W	UINT8	101–120%
Motor Over Voltage Fault Duration	2	664	R/W	UINT16	0.1–60.0 sec (in 0.1 sec)
Motor Line Frequency Fault (Warning) Enable, Len=1	1	665	R/W	UINT8	0 = Protection disabled 1 = Fault enabled 2 = Warning enabled
Motor Line Frequency Deviation From Rated Fault Level	1	666	R/W	UINT8	0–100% deviation from setting
Motor Line Frequency Fault Duration	2	667	R/W	UINT16	0.1–60.0 sec (in 0.1 sec)
Motor Average Power Fault (Warning) Enable	1	668	R/W	UINT8	0 = Protection disabled 1 = Fault enabled 2 = Warning enabled
Motor Average Power Percent Rated Low Fault Level	2	669	R/W	UINT16	0.0–100.0% (in 0.1%)
Motor Average Power Percent Rated High Fault Level	2	670	R/W	UINT16	0.0–800.0% (in 0.1%)
Motor Average Power Fault Duration	2	671	R/W	UINT16	0.1–60.0 sec (in 0.1 sec)
Analog Input Fault (Warning) Enable	1	672	R/W	UINT8	0 = Protection disabled 1 = Fault enabled 2 = Warning enabled
Analog Input Percent of Rated Range Low Fault Level	1	673	R/W	UINT8	0–100% (of range)
Analog Input Percent of Rated Range High Fault Level	1	674	R/W	UINT8	0–100% (of range)
Analog Input Fault Duration	2	675	R/W	UINT16	0.1–60.0 sec (in 0.1 sec)
Temperature Sensor Fault Enable	1	676	R/W	UINT8	0 = Protection disabled 1 = Fault enabled 2 = Warning enabled
SCR Not Firing Fault Enable	1	677	R/W	UINT8	0 = Protection disabled 1 = Fault enabled 2 = Warning enabled

## Register Map, continued

Parameter	Data Length	Modbus Register Number	Read/Write	Data Type	Description
SCR Shorted Fault Enable	1	678	R/W	UINT8	0 = Protection disabled 1 = Fault enabled 2 = Warning enabled
Alarm-No-Trip Enable	1	679	R/W	UINT8	1 = enable 0 = disable
Motor Control Start Delay Warning Enable	1	680	R/W	UINT8	1 = enable 0 = disable
Motor Control Power on Start Delay	2	681	R/W	UINT16	0.0–600.0 sec (in 0.1 sec)
Motor Control Start Delay	2	682	R/W	UINT16	0.0–600.0 sec (in 0.1 sec)
Motor Control Run Command Change Start Delay	2	683	R/W	UINT16	0.0–600.0 sec (in 0.1 sec)
Motor Comm Loss Action	1	684	R/W	UINT8	0 = Auto Stop 1 = Auto Run1 2 = Unavailable 3 = Hold Last 4 = Unavailable 5 = Unavailable 6 = Unavailable 7 = All Stop Fault
Transient Motor Control Timeout	2	685	R	UINT16	2000 ms
Motor Control Device Command Missing Timeout	2	686	R	UINT16	2000 ms
Network 2 Wire Enable	1	687	R	UINT8	0 = Disabled, #500 register active 1 = Enabled, #501 register active
Modbus Device Reset Register	1	800	R/W	UINT8	0 = No Reset 1 = Soft Reset 2 = Factory Reset 3 = App parameter Reset 4 = reserved 5 = reserved 6 = Flush Fault History/Queue 7 = Reset Motor Starts
Modbus_User_App_Name	2	900	R/W	UINT8	ASCII char#0
	2	901	R/W	UINT8	ASCII char#1
	2	902	R/W	UINT8	ASCII char#2
	2	903	R/W	UINT8	ASCII char#3
	2	904	R/W	UINT8	ASCII char#4
	2	905	R/W	UINT8	ASCII char#5
	2	906	R/W	UINT8	ASCII char#6
	2	907	R/W	UINT8	ASCII char#7
	2	908	R/W	UINT8	ASCII char#8
	2	909	R/W	UINT8	ASCII char#9
	2	910	R/W	UINT8	ASCII char#10
	2	911	R/W	UINT8	ASCII char#11
	2	912	R/W	UINT8	ASCII char#12
	2	913	R/W	UINT8	ASCII char#13
	2	914	R/W	UINT8	ASCII char#14
	2	915	R/W	UINT8	ASCII char#15

## Appendix G—Modbus Register Map

### Register Map, continued

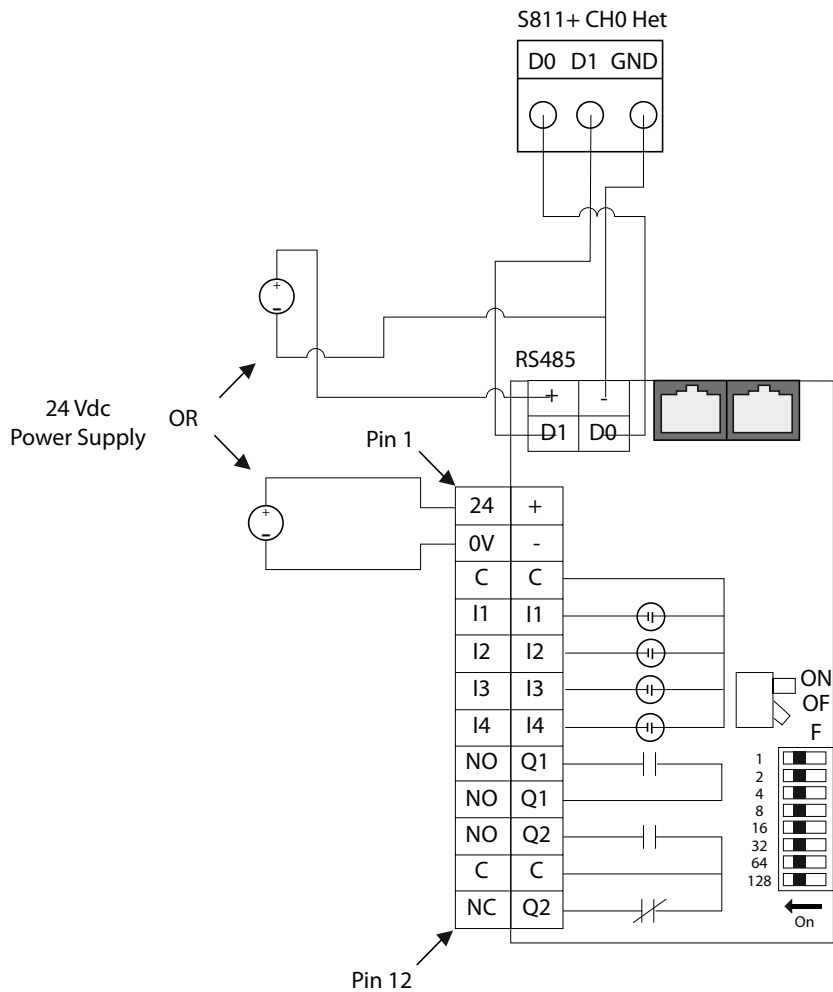
Parameter	Data Length	Modbus Register Number	Read/Write	Data Type	Description
Modbus_Production List	2	1000	R/W	UINT16	1st Modbus Production Register#
Note that the values must be	2	1001	R/W	UINT16	2nd Modbus Production Register#
Modbus Register Address (i.e.,	2	1002	R/W	UINT16	3rd Modbus Production Register#
Register Number-1) not Register	2	1003	R/W	UINT16	4th Modbus Production Register#
Number.	2	1004	R/W	UINT16	5th Modbus Production Register#
	2	1005	R/W	UINT16	6th Modbus Production Register#
	2	1006	R/W	UINT16	7th Modbus Production Register#
	2	1007	R/W	UINT16	8th Modbus Production Register#
	2	1008	R/W	UINT16	9th Modbus Production Register#
	2	1009	R/W	UINT16	10th Modbus Production Register#
	2	1010	R/W	UINT16	11th Modbus Production Register#
	2	1011	R/W	UINT16	12th Modbus Production Register#
	2	1012	R/W	UINT16	13th Modbus Production Register#
	2	1013	R/W	UINT16	14th Modbus Production Register#
	2	1014	R/W	UINT16	15th Modbus Production Register#
	2	1015	R/W	UINT16	16th Modbus Production Register#
Modbus_Production Data	2	2000	R		1st Modbus Production Register data
	2	2001	R		2nd Modbus Production Register data
	2	2002	R		3rd Modbus Production Register data
	2	2003	R		4th Modbus Production Register data
	2	2004	R		5th Modbus Production Register data
	2	2005	R		6th Modbus Production Register data
	2	2006	R		7th Modbus Production Register data
	2	2007	R		8th Modbus Production Register data
	2	2008	R		9th Modbus Production Register data
	2	2009	R		10th Modbus Production Register data
	2	2010	R		11th Modbus Production Register data
	2	2011	R		12th Modbus Production Register data
	2	2012	R		13th Modbus Production Register data
	2	2013	R		14th Modbus Production Register data
	2	2014	R		15th Modbus Production Register data
	2	2015	R		16th Modbus Production Register data
Modbus_Consumption List Note	2	3000	R/W	UINT16	1st Modbus Consumption Register#
that the values must be Modbus	2	3001	R/W	UINT16	2nd Modbus Consumption Register#
Register Address (i.e., Register	2	3002	R/W	UINT16	3rd Modbus Consumption Register#
Number-1) not Register Number.					
Modbus_Consumption_Data	2	4000	W		1st Modbus Consumption Register data
	2	4001	W		2nd Modbus Consumption Register data
	2	4002	W		3rd Modbus Consumption Register data
Communication Device Product	2	65521	R	UINT16	Device Product Code used for UCA adapter
Code					

## Appendix H—Universal Communications Adapter

External adapters can be connected to the S811+ to enable the unit to be controlled by networks other than Modbus.

Connect the adapter in accordance with the wiring diagram below.

### Wiring Diagram



### Notes

1. Connect the C441 RS485 Modbus Port on the Universal Communications Adapter to the S811+ CH0 Net terminal block.
2. Connect 24 Vdc to either the RS485 port or the 12 position I/O terminal as shown. Only one (1) connection is required.
3. Set the S811+ communications port for Modbus by setting dip switch S2 (on).
4. Use the S811+ address dip switches to set the S811+ Modbus address to 1.
5. Dip switch S2 is used for level/edge sense, and has no effect on the Communications adapter.

## Appendix I—Troubleshooting Guide

This guide is intended to provide the information necessary to successfully troubleshoot issues that may occur during the operation of the S611 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 S811+ 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

- Overload Trip Class—As Required (Default—20).

#### Parameter Setup—Operation Mode—Advanced Config Parameters

- Start Control—As Required (Default—Level).
- Aux Relay 1—As Required (Default—Run).
- Aux Relay 2—As Required (Default—Faulted).
- Network Communications Parameter Setup As Required.

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

- FC6—Phase Loss
- FC7—Phase Imbalance
- FC11—Jam
- FC14—Overload
- FC44—Motor Voltage Phase Reversal
- FC58—SCR Not Firing
- FC63—Motor Stall Fault

### 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

- FC5—Power Pole Over Temperature
- FC7—Phase Imbalance
- FC11—Jam
- FC14—Overload
- FC38—Temperature Sensor
- FC58—SCR Not Firing
- FC59—Shorted SCR.
- FC61—Mains AC Voltage Lost
- FC64—Voltage Zero Cross



## 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 appears 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.

## Appendix I—Troubleshooting Guide

- Thermal Memory
  - This parameter is not the same as Thermal Overload.
  - Parameter may be viewed in the Monitoring Menu.
  - 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 (PUMP 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.

**S811+ Fault Codes**

<b>Code</b>	<b>Fault</b>	<b>Status</b>	<b>Condition</b>	<b>Solution</b>
<b>NA</b>		Fault Warning	Impending OL Trip	Overload trip is impending. Motor current 120% above FLA parameter setting.
<b>1</b>	Firmware Incompatibility or Hardware failure.	Fault Trip/Fault Warning/Disable	Component failure on printed circuit board. Firmware corrupt.	Failed unit. Contact EatonCare for service information.
<b>3</b>	Internal Communications.	Fault Trip	Communications to DSP have been interrupted. Possible hardware failure.	Firmware is not communicating internally. Cycle 24 Vdc control voltage power to attempt to clear problem.
<b>4</b>	Low Control Voltage	Fault Trip	Low 24 Vdc Control Terminal Supply Voltage. 24 Vdc power supply of Insufficient capacity (less than 240 watts)	Verify power capacity (amperage) of 24V power supply to close contactors. 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 S811+. 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 FC4. 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.				
<b>5</b>	Power Pole Over Temperature	Fault Trip Fault Warning Disable	One or more power poles exceed 100°C	Ventilate to specified maximum temperatures Clear obstructions. Verify fans are operational, Verify system is not exceeding the specified maximum starts per hour. Verify bypass contacts are closing at the end of ramp time. Reduce excessive cabinet temperature. Soft Starter running continuously in JOG mode.
Notes:				
Any power pole temperature in excess of 100°C will cause a fault trip. Observe the temperature values in the Monitoring Menu to verify that they make sense for the application and that they are reasonably close to each other. If one value is significantly higher than the others, the sensor on the power pole may be suspect. A value significantly lower than the others would indicate a damaged and/or open sensor lead. Note: If the temperature values observed in the Monitoring Menu are all significantly higher than normal, they are very likely indicating an actual over heating condition on the power poles and/or the starter in general.				
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 a over temperature fault trip.				
<b>6</b>	Phase Loss	Fault Trip Fault Warning Disable	Loss of one or more phases	Repair broken connection. Replace fuse. Inspect system for phase imbalance conditions.
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) Prior to disabling this protection, adjust the <i>Phase Loss % Trip</i> parameter value (default is 80%) to see if it will improve the condition. Adjusting the <i>Phase Loss Delay</i> (default is 0.5 seconds) may also improve performance in cases where phase instability is a problem. 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.				

## Appendix I—Troubleshooting Guide

### S811+ Fault Codes, continued

Code	Fault	Status	Condition	Solution
<b>7</b>	Phase Imbalance	Fault Trip	Phase imbalance exceeds parameter value.	Correct imbalance problem with mains.
		Fault Warning		Increase the <i>Current</i> and/or <i>Voltage Fault Imbalance</i> parameters.
		Disable		Disable the fault if the other issues cannot be resolved.
Notes:				
Phase imbalance may be impacted by voltage issues and/or current issues.				
Current Imbalance Trip threshold range is 1–100% (default 40%). Current Imbalance Trip Delay range is 0–60 seconds (default is 0.5 seconds).				
Voltage imbalance Trip threshold range is 1–100% (default 6%). Voltage Imbalance Trip Delay range is 0–10 seconds (default is 0.5 seconds).				
Both Current and Voltage Phase Imbalance protections may be disabled (not recommended).				
<b>9</b>	Low Current Fault	Fault Trip	No load	Repair/replace failed couplings.
		Fault Warning	Motor being driven by application.	Increase load.
		Disable		Reduce <i>Low I Trip % FLA</i> to an acceptable value (0% will disable).
Notes:				
When the internal bypass contactors are closed, the average value of the 3 phase currents is monitored as a % of FLA.				
Low I Trip (Motor Under Load) threshold range is 1–100% (default 6%). The Trip Delay is 2 seconds, and is not user settable.				
<b>10</b>	Motor Over Current	Fault Trip	Motor over current with Jam parameter disabled.	Remove obstruction in motor drive train.
				Verify S811+ is properly sized for the application.
Notes:				
This feature is active only with the <i>Jam</i> Fault Trip parameter disabled, and the internal bypass contactor(s) is closed. This results in a higher current trip threshold in most cases. Monitors the maximum RMS value of the 3 phase current. Catalog FLA refers to the maximum continuous line current capacity of the frame size of the S811+, NOT the motor rated FLA. Do not confuse this parameter with Instantaneous Over Current (FC18), Thermal Overload (FC14), or SCR Over Current (FC60).				
<b>11</b>	Jam	Fault Trip	Excessive mechanical load on motor.	Remove obstruction.
		Fault Warning		Verify proper FLA setting in Protections Menu.
		Disable		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. Jam Trip Delay is 1.5 seconds and is not user settable. This parameter results in a lower current trip threshold than Over Current (FC10) when enabled in most cases.				
<b>13</b>	Internal Bypass Contactor Open	Fault Trip	One or more internal bypass contactors open or fail to seal electrically during Run operation.	Verify all bypass contactor(s) close (audible noise).
		Fault Warning		Verify all bypass contactor(s) not opening during run cycle due to excessive vibration and/or shock. Reduce levels of vibration and/or shock.
		Disable		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, or 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 run 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 OT soft starter is running continuously on the SCRs (JOG mode) pole overtemperature 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).				

**S811+ Fault Codes, continued**

<b>Code</b>	<b>Fault</b>	<b>Status</b>	<b>Condition</b>	<b>Solution</b>
<b>14</b>	Overload Fault	Fault Trip Fault Warning Disable	Motor operation in excess of 115% or rated FLA. Excessive ramp times. Excessive starts per hour.	Reduce the motor's load. Verify the <i>Overld Trip FLA</i> and/or <i>Ovrld Trip Class</i> 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: Normal thermal memory during routine operation may be observed in the <i>Monitoring</i> menu. Higher than normal thermal memory may indicate an abnormal operating condition and signal an impending <i>Overload</i> fault. After a motor start, the thermal memory should stabilize at a value consistent with the load.				
<b>18</b>	Instantaneous Over Current	Fault Trip	Excessive motor load. Undersized soft starter.	Reduce starting 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 6 X catalog FLA. The Trip Delay is 1.5 seconds and is not user settable. Catalog FLA refers to the maximum continuous line current capacity of the S811+ soft starter, NOT the motor rated FLA. Do not confuse this parameter with Over Current (FC10), Thermal Overload (FC14), or SCR Over Current (FC60).				
<b>32</b>	Internal NV Memory	Fault Trip	Component failure on printed circuit board.	Not repairable in the field. Contact EatonCare for service.
Notes: Failure can potentially be caused by component exposure to excessive heat or vibration.				
<b>36</b>	CommLoss Stop Fault	Fault Trip	Control communications lost.	Reattach network controller, verify that the unit is recognized by the system controller. Contact EatonCare for service.
Notes: This fault corresponds only to network communications. It does not relate to internal communications among components on the printed circuit board (PCB).				
<b>38</b>	Temperature Sensor Fault	Fault Trip Fault Warning Disable	Failed sensor. Failed sensor cable or cable connection.	Internal hardware failure (sensor and/or cable). Note: Disabling this feature ( <i>Temp Sense Fault</i> in <i>Protection</i> menu) will remove protection from excessive temperature exposure (not recommended). Not field repairable, contact Eaton support.
Notes: There are three (3) independent temperature sensors that incorporate a current sensor on each power pole (phase). This fault may be generated by any one of the sensors. Temperature and/or current values observed in the <i>Monitoring</i> Menu should be within $\pm 5\%$ of each other. Verify that the values of all phases are approximately equal. Sensors are calibrated to the printed circuit board (PCB) during manufacture and are not field serviceable. The <i>Device Temp</i> value shown in the <i>Monitoring</i> Menu monitors a sensor mounted directly on the PCB and is not related to any Temperature Sensor Fault. Contact EatonCare for service.				
<b>39</b>	Internal CPU	Fault Trip	Hardware failure on the printed circuit board (PCB) Firmware is corrupted.	Contact EatonCare for support.
Notes: Failure can potentially be caused by component exposure to excessive heat or vibration.				
<b>40</b>	Motor Low Power	Fault Trip Fault Warning Disable	Average power has decreased below the low threshold set by user.	Inspect application for cause of low power. Decrease Low Power Trip threshold
Notes: Rated Power = $\sqrt{3} \times .8 \text{ Power Factor} \times \text{Motor FLA} \times \text{Motor Voltage}$ . As an example, the Rated Power for an application with a Motor FLA or 156 amps at a voltage 460 Vac = 99.4kW. <i>Motor Low Power</i> range is 0–100% (default 50%) of this calculated value.				

## Appendix I—Troubleshooting Guide

### S811+ Fault Codes, continued

Code	Fault	Status	Condition	Solution
41	Motor High Power	Fault Trip	Average power has increased above the high threshold set by user.	Inspect application for cause of high power. Increase High Power Trip threshold
		Fault Warning		
		Disable		
Notes:				
Rated Power = $\sqrt{3} \times 0.8 \text{ Power Factor} \times \text{Motor FLA} \times \text{Motor Voltage}$ . As an example, the Rated Power for an application with a Motor FLA or 156 amps at a voltage 460 Vac = 99.4kW. <i>Motor High Power</i> range is 0–800% (default 125%) of this calculated value.				
42	Under Voltage	Fault Trip	Mains voltage below trip threshold.	Connect to correct supply voltage. Verify that mains voltage is within acceptable values. Verify <i>Motor Rated Volt</i> in the Protection Setup Menu is set to correct value
		Fault Warning		
		Disable		
Notes:				
Verify that the value in the <i>Motor Rated Volt</i> parameter is set to the correct line voltage and not to a nominal value. <i>Under Voltage</i> trip level threshold range is 1–99% (default 90%) of line voltage. The <i>Under Voltage Trip Delay</i> range is 1–60 seconds (default 3 seconds). This feature may be disabled (not recommended). Verify that the mains voltage levels are not decreasing to unacceptable levels during the start sequence or during motor run operation. The <i>Motor Rated Volt</i> range is 115 to 690 Vac. The trip threshold is not user settable.				
MAINS LOW—a similar fault that may occur if the incoming mains voltage is less than 80 volts AC. The trip threshold is not user settable.				
43	OverVoltage	Fault Trip	Mains voltage above trip threshold	Connect to correct supply voltage. Verify <i>Motor Rated Volt</i> in the <i>Protection</i> menu is set to correct value.
		Fault Warning		
		Disable		
Notes:				
Verify that the value in the <i>Motor Rated Volt</i> parameter is set to the correct line voltage and not to a nominal value. <i>Hi Voltage</i> trip level threshold range is 101–120% (default 110%) of line voltage. The <i>Hi Voltage Trip Delay</i> range is 1–60 seconds (default 3 seconds). This feature may be disabled (not recommended). Verify that the mains voltage levels are not increasing to unacceptable levels during the start sequence or during motor run operation. The <i>Motor Rated Volt</i> range is 115 to 690 Vac. MAINS HIGH—a similar fault that may occur if the mains voltage is in excess of 800 Vac. The trip threshold is not user settable.				
44	Phase Reversal Fault	Fault Trip	Incoming line phase rotation sequence opposite of device setting. One phase missing and/or open fuse or breaker.	Set <i>Phase Sequence</i> to match incoming sequence OR Exchange two incoming mains phases. Verify that all circuit breakers are closed or fuses are serviceable.
		Fault Warning		
		Disable		
Notes:				
If mains leads need to be changed, swap incoming leads and set <i>Phase Sequence</i> to match incoming sequence. If an upstream reverser is used, disable <i>Phase Rev Fault</i> (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.				
54	E-Stop	Fault Trip	External E-Stop input signal removed or lost.	E-Stop action commanded by external device. E-Stop signal lost due to broken or damaged external circuitry.
		Fault Warning		
		Disable		
Notes:				
This fault may be a result of a commanded E-Stop function by an external device. 24 Vdc is maintained on the terminal selected by the user. When the signal is removed, an E-Stop function will occur. The S811+ will shut down without any stop ramp or pump stop if so enabled.				
55	Motor Control Device Missing	Fault Trip	Motor control command device was removed (DIM, Cover Control, or similar device).	Re-attach motor control command device, i.e. the Digital Interface Module (DIM) and reset the fault.
		Fault Warning		
		Disable		
Notes:				
The S811+ by default will run without an installed DIM in accordance with the parameter settings stored on the printed circuit board. If the DIM is removed, or communications lost during operation, this fault trip will occur. To reinstall a DIM that has been removed, remove 24 Vdc control power, reinstall the DIM, then restore 24 Vdc control power. The DIM or CIM will be recognized during the initialization process.				

**S811+ Fault Codes, continued**

<b>Code</b>	<b>Fault</b>	<b>Status</b>	<b>Condition</b>	<b>Solution</b>
<b>56</b>	Internal Comm2 Fault	Fault Trip	Internal communications error. Excessive electrical noise or hardware failure.	Try a 24 Vdc control voltage power cycle to attempt to clear problem. Contact EatonCare for service.
<p>Notes</p> <p>This fault concerns communication of devices located on the 2 printed circuit boards (PCB's) inside the unit. It is not relevant to an external communications to networks faults.</p>				
<b>57</b>	Internal Fault	Fault trip	Corrupted firmware or memory.	Cycle 24 Vdc control power to the S811+. Contact EatonCare for service.
<b>58</b>	SCR Not Firing	Fault Trip Fault Warning Disable	SCR is not conducting when gated. Incoming phase lost. Special application—undersized or high impedance motor Load disconnected.	SCR failure. Re-apply lost phase. Review S811+ application. Circuitry damaged by megger testing. Contact EatonCare for service.
<p>Notes:</p> <p>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. This feature may be disabled (not recommended).</p>				
<b>59</b>	Shorted SCR	Fault Trip Fault Warning Disable	SCR is shorted. Internal bypass contactor welded shut. No load on the SCRs when START command is issued.	Test resistance of each phase. Contact EatonCare for service.
<p>Notes:</p> <p>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).</p>				
<b>60</b>	SCR Over Current (Stall Disabled)	Fault Trip	Excessive SCR Current during the start ramp. Only active when <i>Stall</i> Fault is disabled.	Increase <i>Soft Start Time</i> and/or <i>Initial Torque</i> parameters in <i>Soft Start Config</i> menu. Reduce starting load. Verify S811+ is properly rated for current (undersized unit).
<p>Notes:</p> <p>The maximum RMS value of the three phase currents is monitored. The current values observed in the <i>Monitoring</i> Menu should be within <math>\pm 5\%</math> of each other. The SCR Over Current Trip threshold is 3 X FLA and is not user settable.</p>				
<b>61</b>	Mains AC Voltage Loss	Fault Trip	Fuses or breaker open. Disconnect open.	Replace fuses, close disconnect, or reset breaker.
<p>Notes:</p> <p>The Mains Loss Fault trip threshold is 80 Volts AC and is not user settable.</p>				
<b>63</b>	Motor Stall	Fault Trip Fault Warning Disable	Motor not at rated RPM at end of start ramp time and/or current is in excess of 2 X FLA. Bypass contactors not closed at the end of the start time (start current low/ramp time short).	Lengthen <i>Soft Start Time</i> and/or increase <i>Initial Torque</i> in the <i>Soft Start Config</i> Menu. 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 <i>Kick Start</i> parameters.
<p>Notes:</p> <p>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 2 X FLA. This feature is not user settable. Verify that the motor is properly sized for the load.</p>				

## Appendix I—Troubleshooting Guide

### S811+ Fault Codes, continued

Code	Fault	Status	Condition	Solution
<b>64</b>	V Zero Cross Lost	Fault Trip	Mains voltage lost. Phase L1 or L3 lost. Load disconnected	Restore mains or lost phases. Verify that the load is connected and any disconnect devices are properly engaged. Contact EatonCare for service.
<p>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.</p>				
<b>65</b>	Analog Input Out-of-Range (high)	Fault Trip Fault Warning Disable	Upper range limit exceeded.	Set operating range of input to correct value. Validate calibration of analog circuit. Inspect analog circuit for failed components or circuitry. Set range limit to proper value.
<p>Notes: Two ranges of analog operation are available and are user settable: Analog input ranges are 2.0–20.0 ma DC and 4.0–20 ma DC. If analog input is above maximum limit of the range, the input range or scaling should be adjusted.</p>				
<b>66</b>	Analog Input Out-of-Range (low)	Fault Trip Fault Warning Disable	Lower range limit exceeded.	Set operating range of input to correct value. Validate calibration of analog circuit. Inspect analog circuit for failed components or circuitry. Set range limit to proper value.
<p>Notes: Two ranges of analog operation are available and are user settable: Analog input ranges are 2.0–20.0 ma DC and 4.0–20 ma DC. If analog input is below the minimum limit of the range, the input range or scaling should be adjusted.</p>				
<b>71</b>	Analog Input Overdrive	Fault Trip Fault Warning Disable	Analog input current has exceeded 25ma.	Analog current input has exceeded maximum limitation.
<p>Notes: This input will revert to a voltage input functionality. A soft reset is required to restore current input functionality.</p>				
<b>72</b>	External Trip/Warning	Fault Trip Fault Warning Disable	External input signal indicates fault or warning	Trip/Warning action commanded by external device. Trip/Warning signal lost due to broken or damaged external circuitry.
<p>Notes: Input signal is 24 Vdc maintained. Removal or loss of signal will initiate Trip/Warning action in accordance with user selected parameter settings.</p>				
<b>73</b>	Motor Load Disconnect	Fault Trip	No load Motor being driven by application.	Repair/replace failed couplings. Increase load. Reduce <i>Low I Trip % FLA</i> to an acceptable value (0% will disable).
<p>Notes: When the internal bypass contactors are closed, the average value of the 3 phase currents is monitored as a % of FLA. Low I Trip (Motor Under Load) threshold range is 1–100% (default 6%). The Trip Delay is 2 seconds, and is not user settable.</p>				
<b>74</b>	Line Frequency (high)	Fault Trip Fault Warning Disable	Mains input voltage frequency has increased above the threshold set by the user.	Reduce line frequency to within limits. Adjust parameter limits.
<p>Notes: To address line frequency instability and/or excessive variations, adjust limit parameters according. This protection may be set to Fault Warning Status to allow continued operation during excessive frequency variations. <i>Line Frequency (high)</i> trip level threshold range is 5–150% (default 150%) of line voltage. The <i>Line Frequency Trip Delay</i> range is 1–60 seconds (default 3 seconds).</p>				



**S811+ Fault Codes, continued**

<b>Code</b>	<b>Fault</b>	<b>Status</b>	<b>Condition</b>	<b>Solution</b>
<b>75</b>	Line Frequency (low)	Fault Trip Fault Warning Disable	Mains input voltage frequency has decreased below the threshold set by the user.	Increase line frequency to within limits. Adjust parameter limits.
Notes: To address line frequency instability and/or excessive variations, adjust limit parameters according. This protection may be set to Fault Warning Status to allow continued operation during excessive frequency variations. <i>Line Frequency (low)</i> trip level threshold range is 5–150% (default 50%) of line voltage. The <i>Line Frequency Trip Delay</i> range is 1–60 seconds (default 3 seconds).				
<b>76</b>	Auto Reset Limit	Fault Trip	Number of AUTO reset attempts has been exceeded.	Reset limit counter with a Manual reset. Adjust reset limit counter threshold.
Notes: This condition requires a MANUAL reset. A Manual reset clears the Fault Trip condition and resets the limit counter to zero (0).				
*	Product Fault Control Fault	Fault Trip	Internal PCB problems	Contact EatonCare for service.
*	LCD DIM setup	Fault Trip	Communications adapter connected to CH1 with DIM installed. Failure of PCB Firmware fault	Install communications adapter to correct port. Cycle 24 Vdc to attempt to clear fault. Perform a hard reset to attempt to clear fault.
*	DIM Display Unreadable	Fault Trip	Digital Interface Module failure	Replace the DIM to restore operation. Purge command device (DIM) from memory to enable the soft starter to run without the DIM.
Notes: There is only one model DIM, part number EMA91 for all S811+ soft starters. All operating parameters for the soft starter are stored in non-volatile memory on the printed circuit board, so the DIM's may be exchanged between all models (sizes) of soft starters if a replacement DIM is not available.				
*	Cannot RESET fault	Fault Trip	Fault condition still exists. Soft Starter has not received RESET signal	Troubleshoot fault and correct defective condition. Attempt alternate methods of RESET
Notes: The RESET signal can be applied from any one of three locations: the DIM soft key, 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 push button, but <u>can</u> be RESET by applying 24 Vdc to Terminal Block "4", the push button switch is damaged.				
*	Run without DIM	—	DIM is non-functional or intermittent.	Soft Starter may be run with existing parameters without the DIM installed. DIM may be reinstalled and control power applied, initialization process will recognize DIM.
Notes: To run the soft starter without the DIM, simply remove the DIM from the S811+. To reinstall a DIM that has been removed, remove 24 Vdc control power, reinstall the DIM, then restore 24 Vdc control power. If the START command was issued from the Start button on the DIM, removal of the DIM will initiate a TRIP due to lost communication. If the START command was issued from the control terminal block or the network, the S811+ will continue to run.				

**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.

## Appendix I—Troubleshooting Guide



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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