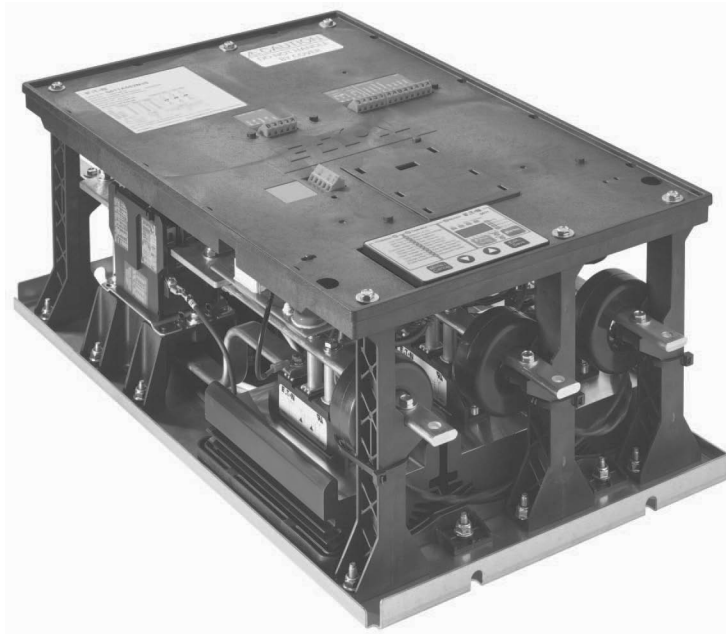


S611 Soft Starter

User Manual

Effective May 2012
Supersedes August 2011



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Cover Photo: S611 Soft Starter

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Safety

Definitions and Symbols

 **WARNING**

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



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

 **WARNING**

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

 **CAUTION**

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

Hazardous High Voltage

 **WARNING**

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

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

Warnings and Cautions

 **CAUTION**

Unit may weigh up to 102 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 S611 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 120 Vac 50/60 Hz to terminal blocks 1, 2, and 3 (TB1, TB2, TB3). All control wiring is 22–12 AWG (0.33–2.5 mm²).

Do not apply 120 Vac to comms port A terminal block 4 (TB4).

 **CAUTION**

Only apply 120 Vac 50/60 Hz to terminal blocks TB1, TB2, and TB3. All control wiring is 22–12 AWG (0.33–2.5 mm²). Failure to follow this caution may result in damage to the control circuit.

1. Connect 120 Vac supply neutral to *120V neutral* terminal, using a minimum wire of 14 AWG (2.5 mm²).
2. Connect 120 Vac line to *120V line* terminal, using a minimum wire of 14 AWG (2.5 mm²).

 **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**

Only apply 24 Vdc to the communication module fieldbus connection. Use of any other voltage may result in personal injury, property damage and damage to the module.

Introduction

Overview

The S611 soft starter from Eaton’s electrical sector 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 S611 soft starters use six SCRs composed of three SCR modules 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 S611 has built-in communications capabilities via two comms ports. Comms port A is a screw terminal block that is used for Modbus® RS-485 communications or communication to an EATON HMI. Comms port B uses a printed circuit board (PCB) connector that interfaces with three different communications adapters; PROFIBUS®, DeviceNet and Modbus communications adapters. Modbus communication may be accomplished via either comms port A and/or comms port B. In the event that the communications adapter located at comms port B adds excessive height to the S611, the adapter may be mounted to the side of the S611 and wired

to comms port A using an L-Adapter in combination with the Eaton brand communication adapters PROFIBUS, DeviceNet and Modbus.

The S611 soft starter uses a User Interface Module (UI) that allows the user to configure the device, read and write system parameters, and evaluate fault codes for troubleshooting. The UI includes an easy-to-read display and keypad to scroll through the parameters. The user interface module allows the user to modify control parameters, enable or disable protections, set communication variables, monitor system parameters such as line voltages and currents, and access the fault queue.

The S611 is designed to fulfill the industrial service requirements for applications such as chillers, pumps and machine tools that require less than 85% of the motor’s rated starting torque for worst case starting condition.

The S611 meets all relevant specifications set forth by NEMA ICS 1, ICS 2 and ICS 5, UL 508, IEC 60947-4-2, and CSA 22.2/14-05.

General Appearance Notes

S611 Soft Starter

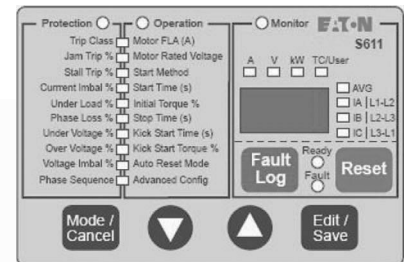
Control Circuit Terminal Block (TB3)
Relay Terminal Block (TB2)

Line Inputs
(Back of the Unit—Not Shown)

Comms Port B
(TB5)

Control Power Terminal Block
(TB1)

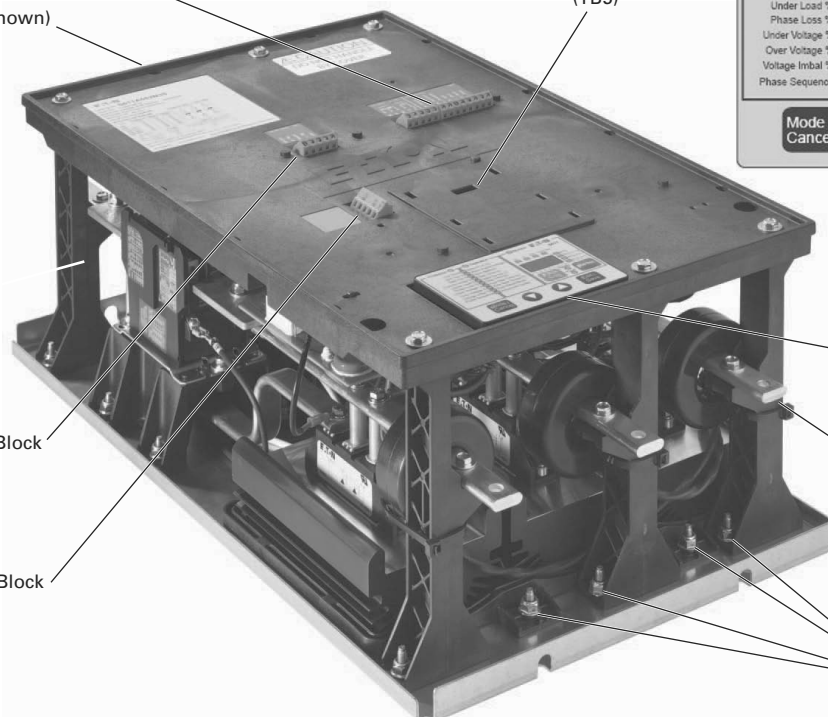
Comms Port A Terminal Block
(TB4)



User Interface
Module (UI)

Load Outputs

Mounting
Locations (8)



Standards and Certifications

- UL 508
- CSA 22.2/14-10
- IEC 60947-4-2



CE Conformance

EMC Immunity

Immunity	Severity Level
Electrostatic discharge IEC 61000-4-2	8 kV air discharge
	4 kV contact discharge
Electromagnetic field IEC 61000-4-3	10V/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–8/20 uS surges IEC61000-4-5	2 kV line to earth
	1 kV line to line
	1 minute intervals
Terminal connections	4 kV line to earth
	2 kV line to line
	1 minute intervals
Conducted RF IEC 61000-4-6	10V rms
	0.15–80 MHz
Radiated RF immunity N 61000-4-3	10V rms
	80 MHz–1 GHz
50/60 Hz magnetic field IEC 61000-4-8	Meets requirements
Voltage dips interrupt control power	30% dip at 10 ms
	60% dip at 100 ms
	100% dip at 5s
Emissions	
Radiated	EN 55011, Class A
Conducted	EN 55011, Class A

Technical Data and Specifications

Environmental

Environmental Specifications

Description	Specification
Temperature range	
Operating	−4° to 122°F (−20° to 50°C)
Storage	−40° to 185°F (−40° to 85°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	Vertical, line side up
Pollution degree IEC 60947-1	3
Shock resistance	15g up to 242A units, 5g on 302A to 414A units
Vibration resistance	
Non-operating	3g up to 242A units, 2g on 302A to 414A units
Operating	1g for all units

Physical

Unit Weight and Dimensions

Standard Units

Unit Weight Lbs (kg)	Product Size—Inches (mm)			Catalog Number
	Length	Width	Height	
24 (11)	19.45 (494)	11.58 (294)	7.46 (189)	S611A052XXX
24 (11)	19.45 (494)	11.58 (294)	7.46 (189)	S611A065XXX
24 (11)	19.45 (494)	11.58 (294)	7.46 (189)	S611A077XXX
24 (11)	19.45 (494)	11.58 (294)	7.46 (189)	S611B099XXX
24 (11)	19.45 (494)	11.58 (294)	7.46 (189)	S611B125XXX
33 (15)	20.83 (529)	11.58 (294)	8.37 (213)	S611C156XXX
33 (15)	20.83 (529)	11.58 (294)	8.37 (213)	S611C180XXX
38 (15)	20.83 (529)	11.58 (294)	8.37 (213)	S611D242XXX
86 (39)	31.15 (791)	17.56 (446)	9.54 (242)	S611E302XXX
86 (39)	31.15 (791)	17.56 (446)	9.54 (242)	S611E361XXX
102 (46)	31.15 (791)	17.56 (446)	9.54 (242)	S611F414XXX

Short-Circuit Ratings—Component

Frame Size	Fuses	Circuit Breaker	Voltage (V)	SCCR Rating (A)
A	RK5/K5/J	Eaton FDC thermal magnetic	600	10k
B	RK5/K5/J	Eaton FDC thermal magnetic	600	10k
C	RK5/K5/J	Eaton FDC thermal magnetic	600	10k
D	RK5/K5/J	Eaton FDC thermal magnetic	600	18k
E	RK5/K5/J	Eaton FDC thermal magnetic	600	18k
F	RK5/K5/J	Eaton FDC thermal magnetic	600	30k

Short-Circuit Ratings—Enclosed Control (Fuses)

Frame Size	Fuses	Voltage (V)	SCCR Rating (A)
A	RK5/K5/J	600	100k
B	RK5/K5/J	600	100k
C	RK5/K5/J	600	100k
D	RK5/K5/J	600	100k
E	RK5/K5/J	600	100k
F	RK5/K5/J	600	100k

Short-Circuit Ratings—Enclosed Control (Breaker)

Frame Size	Thermal Magnetic Circuit Breaker	Motor Circuit Protector	Voltage (V)	SCCR Rating (A)
A	Eaton FDC	HMCP	480	65k
B	Eaton FDC	HMCP	480	65k
C	Eaton FDC	HMCP	480	65k
D	Eaton FDC	HMCP	480	65k
E	Eaton FDC	HMCP	480	18k
F	Eaton FDC	HMCP	480	30k

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

Note: Suitable for use on a circuit capable of delivering not more than 100,000 rms symmetrical amperes, 600 volts maximum when protected by Class RK5 fuses or a circuit breaker having an interrupting rating not less than 65,000 rms symmetrical amperes, 480 volts maximum.

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

Note: Do not attempt to lift the unit by the cover only. Cover not designed for lifting the unit and may cause unit damage.

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 102 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 -40° to 185°F (-40° to 85°C)
- The relative humidity is 0–95%, noncondensing
- The environment is dry, clean, and non-corrosive
- The unit will not be subjected to shock or vibration in excess of unit specifications.

Shipping

S611 soft starters are to be shipped in packaging that adequately protects the unit.

S611 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 an air-ride carrier to prevent damage from excessive shock or vibration during shipment.

Installation

Mounting

The S611 does not require any special tools for mounting operations.

To aid with panel layout, refer to the dimension drawings below and on **Page 7** of this manual. Drill holes per mounting hole location as shown. Mounting hardware may use either tapped holes in the panel or lock washers and nuts to secure the soft starter.

For ease of installation, several slotted holes are provided on the muting plate for the S611. Slotted and/or round holes may be used as long as two holes top and two holes bottom (four total) are used, minimum.

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

Required Mounting Hardware

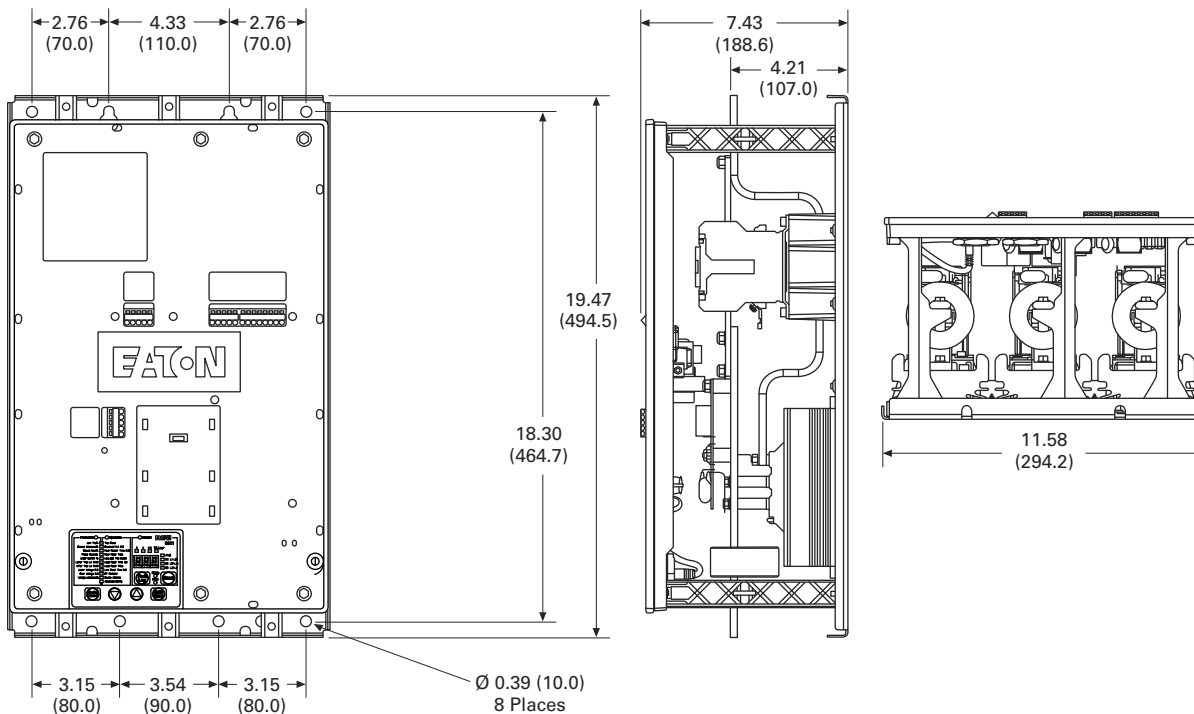
Frame Size	Bolt Size	Length	Grade	Minimum Quantity
A	3/8 -16	As required	5	4
B	3/8 -16	As required	5	4
C	3/8 -16	As required	5	4
D	3/8 -16	As required	5	4
E	3/8 -16	As required	5	4
F	3/8 -16	As required	5	4

Note: See **Page 3** for weight support requirements

Dimensions

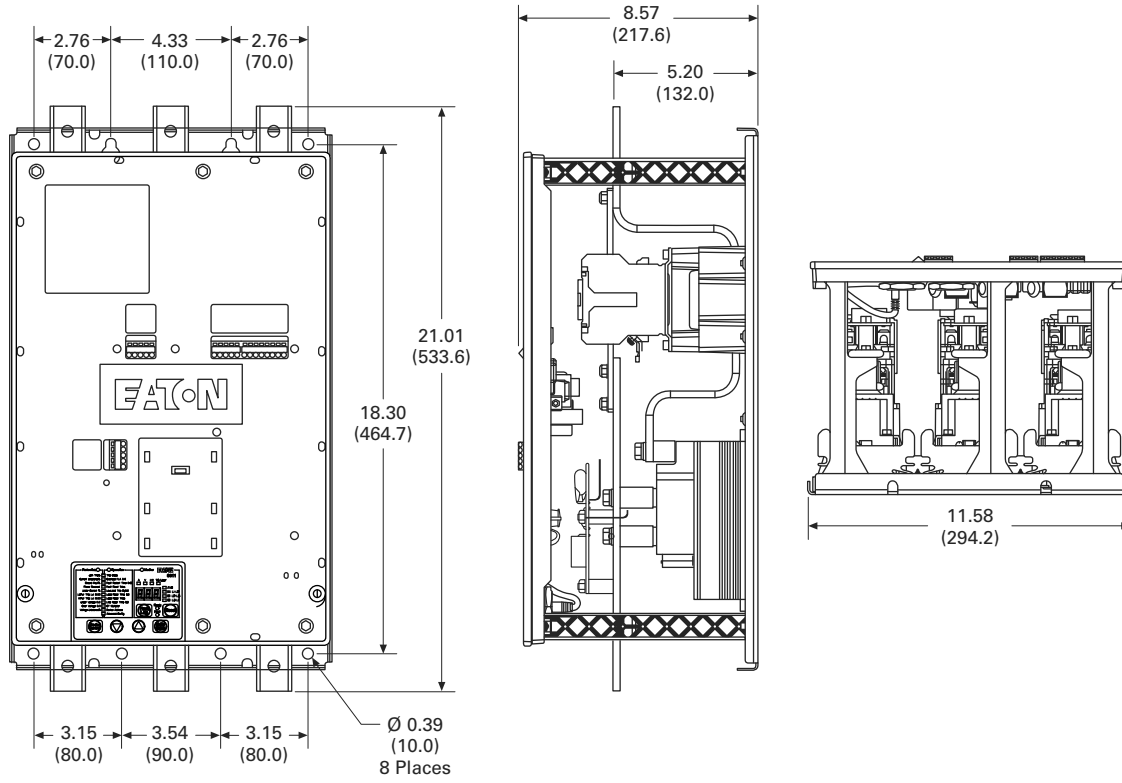
Approximate Dimensions in inches (mm)

A and B Frame

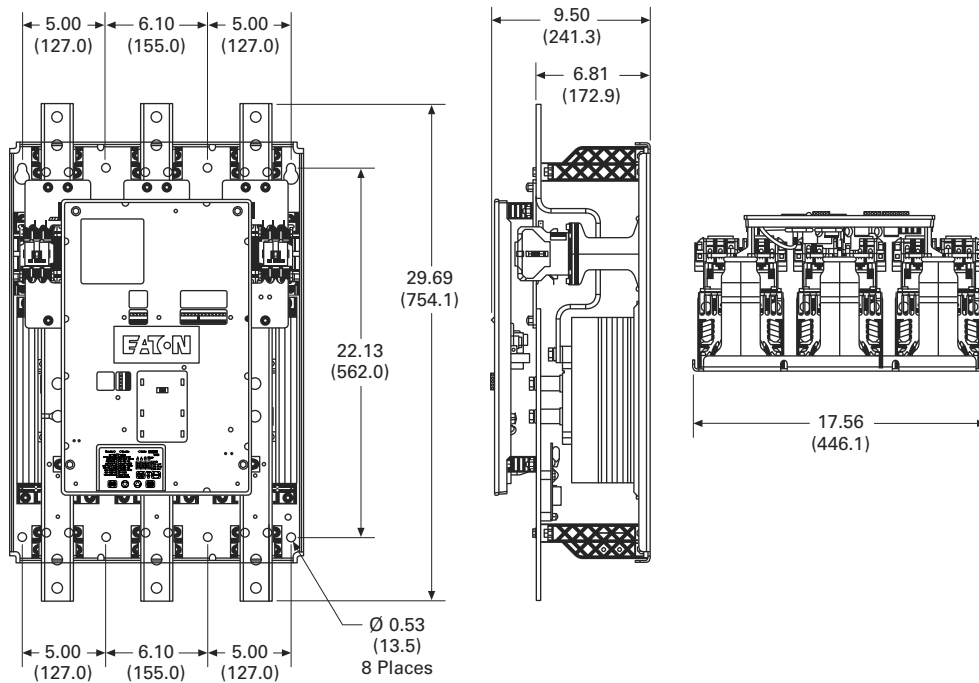


Approximate Dimensions in inches (mm)

C and D Frame



E and F Frame



Current Transformer Installation

When securing the Current Transformers (CTs) onto the T1, T2, and T3 bus bars of the soft starter, correct orientation of the CT must be observed to ensure proper operation of the soft starter. Each CT is marked with a symbol "IX" adjacent to the leads. This symbol shown in the figure below indicates the line side (or voltage source side) of the device.

CT Orientation

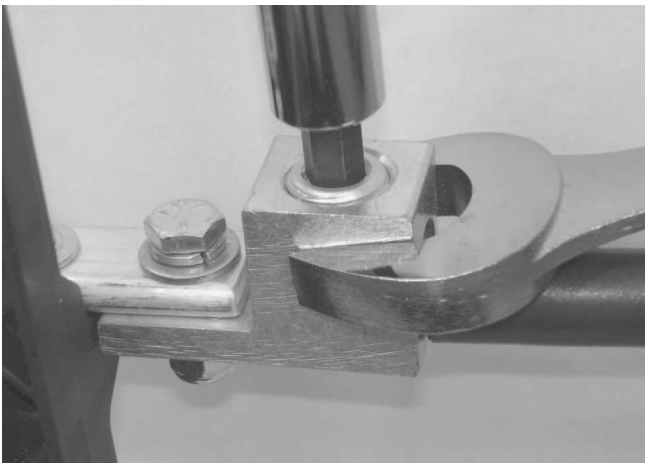


Lug Installation—Mechanical

The following procedures are to be followed during mechanical lug installation:

- The lug is mounted under the soft starter bus bar as shown
- Do Not overtorque lug attachment hardware. Damage to the supports may result
- The lug is to be supported with a wrench or other suitable device to prevent excessive side loads on the bus bar supports that may result in damage to the supports

Lug Mounted Under Soft Starter Bus Bar



Power Wiring

Using the wiring diagram on this page and the table on **Page 9** 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 S611.

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 S611 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.

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

The S611 is wired only in an inline connected configuration.

By factory default, the S611 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.

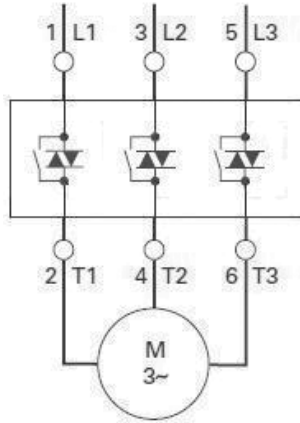
If the input phase sequence to the S611 cannot be changed, the incoming phase sequence protection will need to be set to ACB. Setting ACB as the incoming phase sequence causes the S611 to recognize the reverse direction of phase rotation. Phase rotation monitoring may be turned off by adjusting the phase sequence parameter in the protection mode list.

IMPORTANT

A reversing contactor must never be switched while the soft starter is operating. In order to gain the full benefit of the S611 with a reversing contactor, the S611 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 **Appendix D—Motor/Application Considerations** in this manual for information on typical motor winding configurations.

Line Connected Soft Starter Power Wiring Diagram



The following table lists the maximum wire sizes and number of conductors required per phase for mechanical and compression type lugs. Due to difficulties bending large diameter conductors, the maximum single conductor gauge is limited to 350 kcmil.

Power terminal wire connectors are not shipped with the product. To maintain the agency certifications/listings, Eaton recommends using the wire connectors (lugs) in the table below.

Customers may select lugs that are commercially available and suitable for use, from industry standard sources that meet the general specifications in the table below. Refer to **Appendix D** for alternate lug cross reference tables.

Note: When securing the lugs onto the bus bars of the soft starters, use a suitable tool such as another wrench to counteract the bolt torque and prevent excessive side loads being placed on the supports.

Line and Load Power Wiring ^{①②}

Current Rating	Conductor Size ^③	Number of Conductors	Mechanical Lug— IlSCO Part Number	Torque lb-in	Mechanical Lug Range	Soft Starter Catalog Number	Mechanical Lug— Eaton Catalog Number
52A	6 AWG	1	TA-2/0	120	14 AWG–2/0	S611A052XXX	S611-LUG-M01
65A	4 AWG	1	TA-2/0	120	14 AWG–2/0	S611A065XXX	S611-LUG-M01
77A	3 AWG	1	TA-2/0	120	14 AWG–2/0	S611A072XXX	S611-LUG-M01
99A	1/0 AWG	1	TA-300	275	14 AWG–2/0	S611B099XXX	S611-LUG-M02
125A	2/0 AWG	1	TA-300	275	2 AWG–600 kcmil	S611B125XXX	S611-LUG-M02
156A	3/0 AWG	1	TA-600	500	2 AWG–600 kcmil	S611C156XXX	S611-LUG-M03
180A	4/0 AWG	1	TA-600	500	2 AWG–600 kcmil	S611C180XXX	S611-LUG-M03
242A	350 kcmil	1	TA-600	500	2 AWG–600 kcmil	S611D242XXX	S611-LUG-M03
302A	3/0 AWG	2	AU-600-2NS	500	2 AWG–600 kcmil	S611E302XXX	S611-LUG-M04
361A	4/0 AWG	2	AU-600-2NS	500	2 AWG–600 kcmil	S611E361XXX	S611-LUG-M04
414A	300 kcmil	2	AU-600-2NS	500	300–800 kcmil	S611F414XXX	S611-LUG-M04

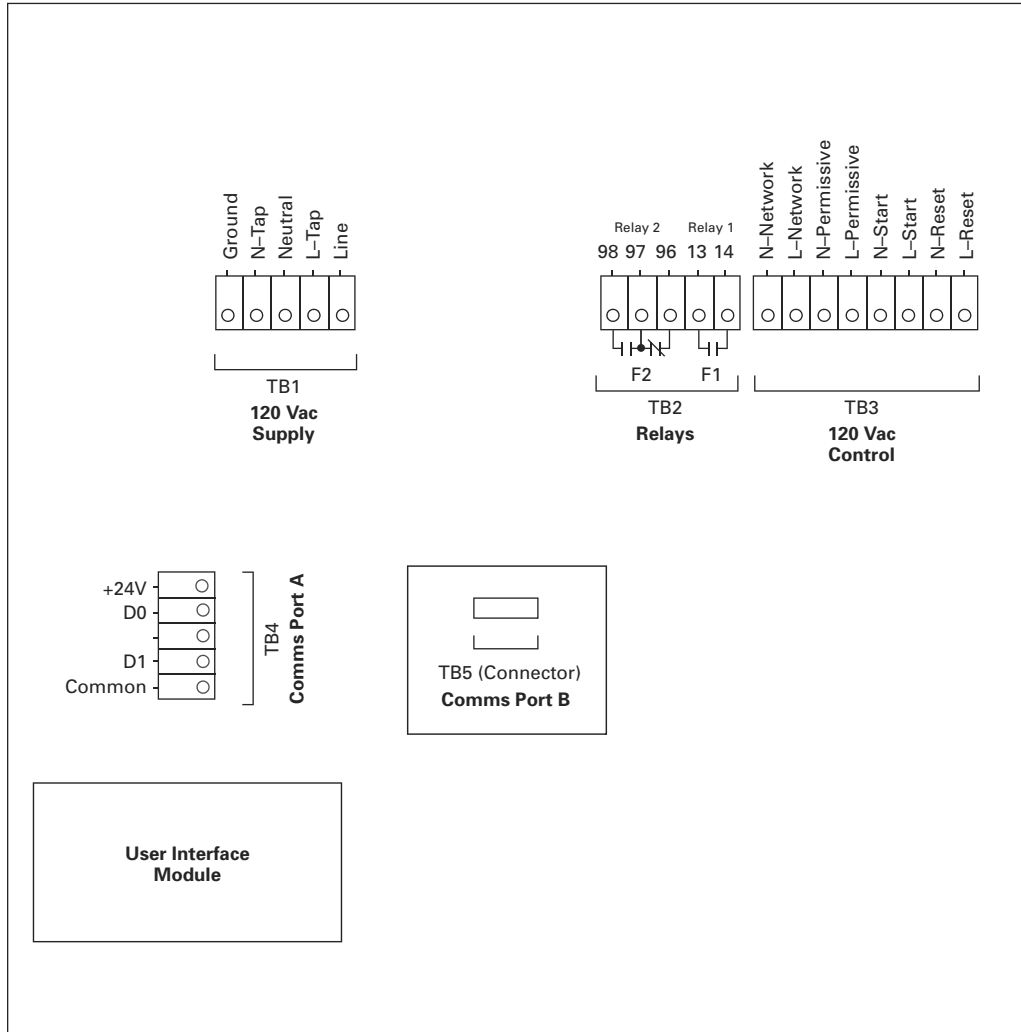
Notes

- ① Additional lug information may be found in **Appendix D**.
- ② Each lug kit consists of three lugs. Two kits are required for both line and load connections.
- ③ Wire size based on 125% of UL 508 Table 43.2.

Control Wiring Inputs

Control wiring is connected to the S611 by terminal blocks located at the front of the unit. Using the wiring diagrams below and on **Pages 12–14**, and table on **Page 11** as guides, connect the control wiring as required for your application. Failure to follow this caution may result in severe damage to the controller.

Control Wiring Terminal Blocks



CAUTION

Only apply 120 Vac 50/60 Hz to terminal blocks 1, 2, and 3 (TB1, TB2, TB3). All control wiring is 22–12 AWG (0.33–2.5 mm²).

Do not apply 120 Vac to comms port A terminal block 4 (TB4).

The following table provides the terminal block wiring capacity and torque requirements for the control wiring.

Terminal Block Wiring Capacity

Wire Size	Number of Conductors	Torque Requirements
22–16 AWG (0.33–2.5 mm ²)	2	3.5 lb-in (0.4 Nm)
14–12 AWG (4.0 mm ²)	1	3.5 lb-in (0.4 Nm)

Control Terminal Descriptions

The S611 soft starter has the following control terminal block connections:

S611 Terminal Block Control Wiring

Name	Terminal	Function	Connections
Control supply power	Line TB1	Control supply power input 120 Vac, 50/60 Hz	Connect power to terminals supply 1 and supply 2 ①
Supply power tap	L-tap TB1	120V power tap 5A unfused output 120 Vac, 50/60 Hz	120V power to external devices ②
Relay 2 F2	97 TB2	Common for 96 and 98	Form C contacts: These contacts will change state to NC and NO once unit is energized. They will remain in this state until a fault is generated
Relay 2 F2	96 TB2	NC energized 6A at 120V	
Relay 2 F2	98 TB2	NO energized 6A at 120V	
Relay 1 F1	13 TB2	Common	NO Form A contact: Programmable contact closes according to user specified requirements
Relay 1 F1	14 TB2	NO de-energized 6A at 120V	
Network control	Network TB3	Enable network control input 120 Vac, 50/60 Hz (maintained)	Energize (120 Vac) to enable network control of the unit. If power is removed from the permissive circuit at any time, the unit will begin a STOP command. If a soft stop is selected, the soft stop will begin and run for stop ramp time
Permissive	Permissive TB3	STOP control input 120 Vac, 50/60 Hz (maintained)	Permissive must be energized (120 Vac) to enable operation of the unit. If power is removed from the permissive circuit at any time, the unit will begin a STOP command. If a soft stop is selected, the soft stop will begin and run to time-out
Start (run)	Start TB3	START (RUN) control input 120 Vac, 50/60 Hz (momentary)	Applying 120 Vac to input 1 while P is energized will initiate a START. As shipped from the factory this input is "level" sensitive
Reset	Reset TB3	RESET control input 120 Vac (momentary)	Energizing this input will reset a fault only after the fault condition has been corrected
Comms port A RS-485 communications	+24V TB4	24 Vdc at 2.5W	24 Vdc used to power L-adapter and secondary communication adapter. No more that 2.5W should be loaded onto this 24 Vdc supply
	D0 TB4	Comms port D0	Modbus RS-485 communication port D0
	D1 TB4	Comms port D1	Modbus RS-485 communication port D1
	Common TB4	Comms port ground	Common ground used for Modbus RS-485 and 24 Vdc
Comms port B RS-485 communications	TB5	Comms Port	Connections as per adapter module requirements

Notes

① To avoid voltage drop during bypass contactor inrush, a minimum of 14 AWG wire should be used.

② 5A maximum current allowed.

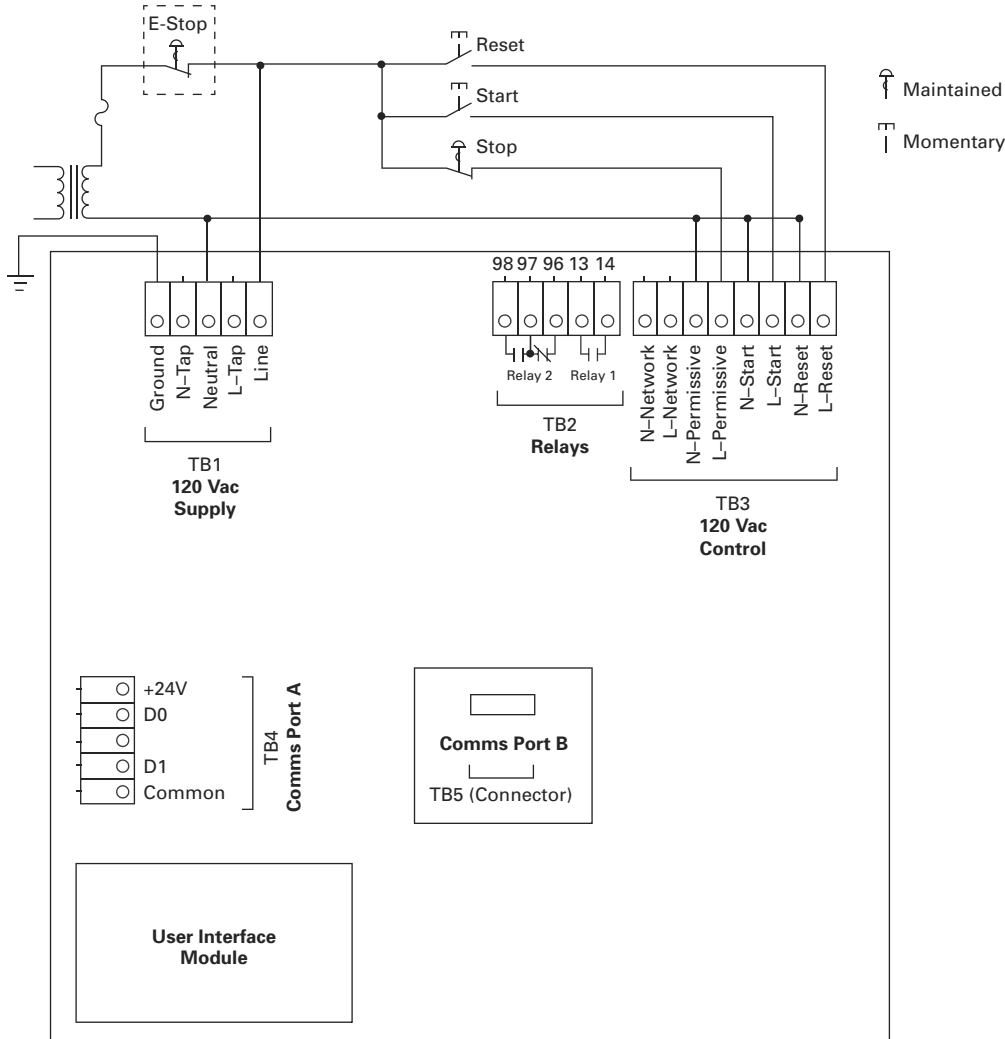
Typical Control Wiring Diagrams

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.

Mains power is not required to energize the control circuit of the S611. All protection and operation parameters may be adjusted using only control power.

Compliance with all local, state, and national codes is required if an external 120 Vac power source other than the normal control power source is used to power the control circuit.

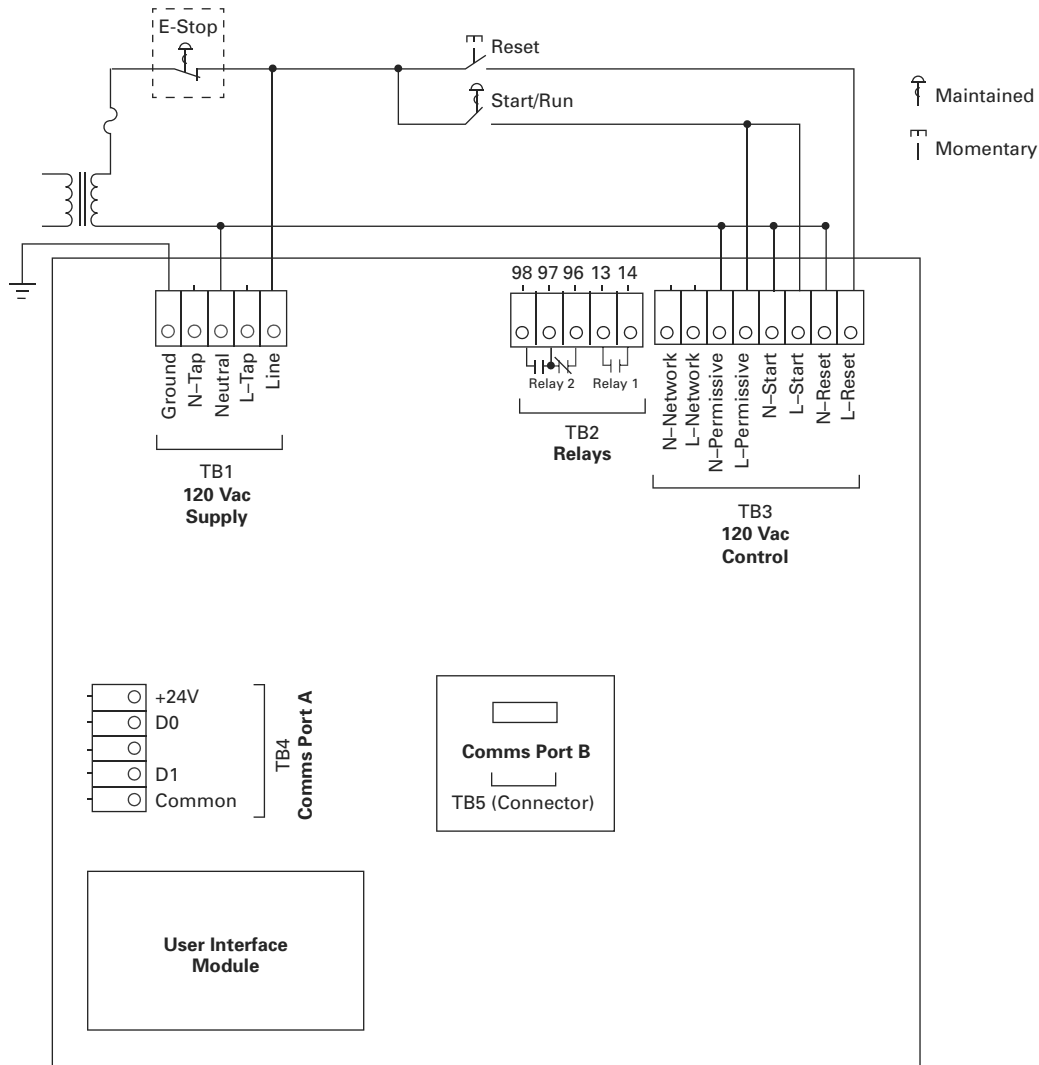
Basic Connection Diagram for 120 Vac Three-Wire Pushbutton



Notes:

1. For a single conductor, a minimum wire of 14 AWG (2.5 mm²) should be used between the control power transformer and the supply terminals.
2. See "Using Auxiliary Contacts" section if it is desired to use a relay instead of an indicating lamp for terminals 13, 14, 95, 96 and 98.
3. If an isolation or reversing contactor is used upstream of the S611, Eaton recommends that the operator uses the level sensing option (default value) of the Start Control Parameter Code in the Advanced Parameters Menu.

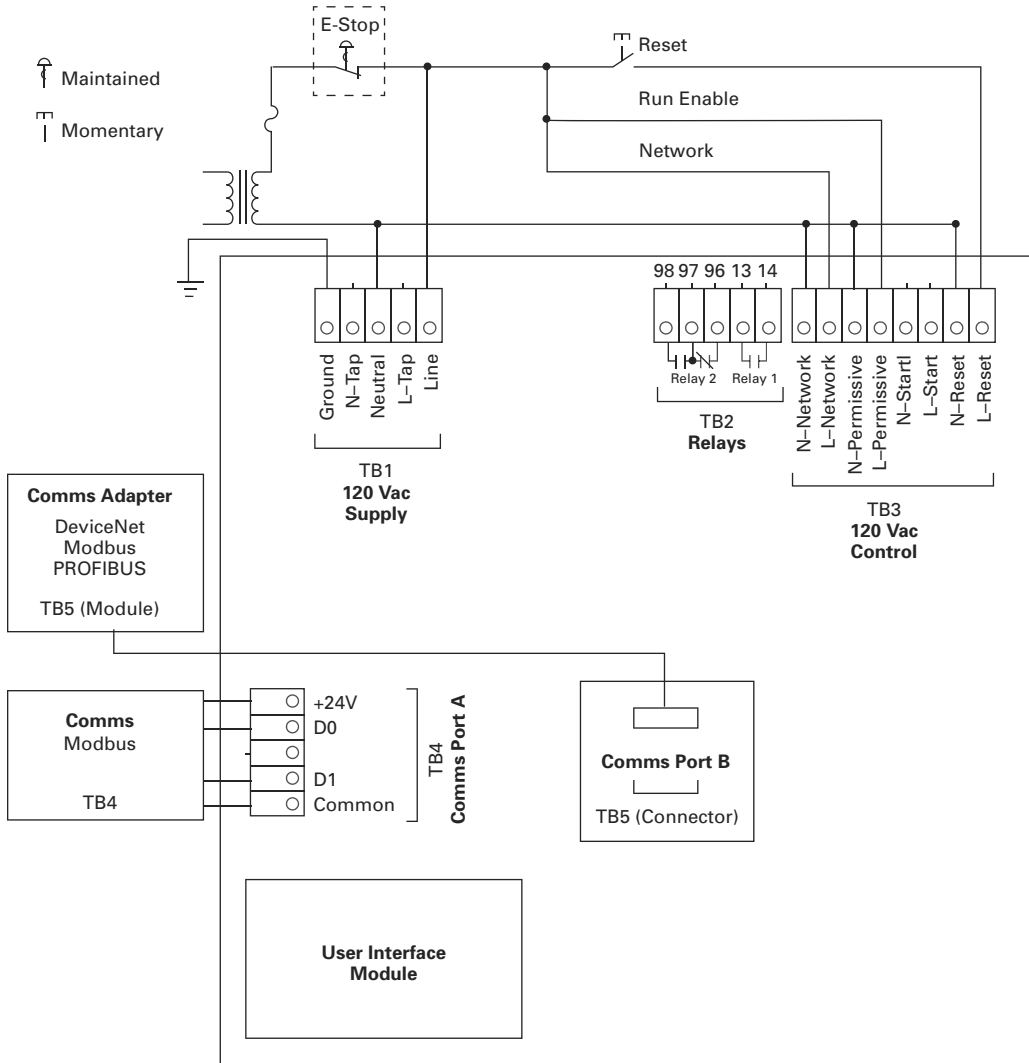
Basic Connection Diagram for 120 Vac Two-Wire Pushbutton



Notes:

1. For a single conductor, a minimum wire of 14 AWG (2.5 mm²) should be used between the control power transformer and the supply terminals.
2. See "Using Auxiliary Contacts" section if it is desired to use a relay instead of an indicating lamp for terminals 13, 14, 95, 96 and 98.
3. If an isolation or reversing contactor is used upstream of the S611, Eaton recommends that the operator uses the level sensing option (default value) of the Start Control Parameter Code in the Advanced Parameters Menu.

Basic Connection Diagram for 120 Vac Network Control



Notes:

1. For a single conductor, a minimum wire of 14 AWG (2.5 mm²) should be used between the control power transformer and the supply terminals.
2. See "Using Auxiliary Contacts" section if it is desired to use a relay instead of an indicating lamp for terminals 13, 14, 95, 96 and 98.
3. If an isolation or reversing contactor is used upstream of the S611, Eaton recommends that the operator uses the level sensing option (default value) of the Start Control Parameter Code in the Advanced Parameters Menu.

120 Vac 50/60 Hz Control Power

The S611 soft starter requires 120 Vac 50/60 Hz control power. The sealed in and inrush characteristics of the S611 soft starter are summarized in the table below:

Control Power Requirements

Soft Starter Frame	Sealed		Inrush		Duration (ms)
	VA	Watts	VA	Watts	
A	85	60	600	420	50
B	85	60	600	420	50
C	85	60	600	420	50
D	85	60	600	420	50
E	115	80	1200	840	50
F	115	80	1200	840	50

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

- Max steady state for the CPT \geq sealed in power of the starter
- Outrush for the CPT \geq inrush power of the starter

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

- Max steady state for the CPT \geq sum of the sealed in power of all the starters
- Outrush for the CPT \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 CPT \geq SI
- Outrush for the CPT \geq LO

The voltage on the S611 control power supply and control input terminals must be 120 Vac \pm 10% to provide proper operation of the soft starter.

Control Wiring Application Notes

CAUTION

Only apply 120 Vac 50/60 Hz to terminal blocks TB1, TB2, and TB3. All control wiring is 22–12 AWG (0.33–2.5 mm²). Failure to follow this caution may result in damage to the control circuit.

1. Connect 120 Vac supply neutral to *Neutral* terminal, using a minimum wire of 14 AWG (2.5 mm²).
2. Connect 120 Vac line to *Line* terminal, using a minimum wire of 14 AWG (2.5 mm²).

Connecting a New or Replacement User Interface Module (UI)

The S611 uses the User Interface Module (UI) to change the configuration of operating parameters with a display to indicate values and fault codes. By entering parameter changes, parameter information is stored on the S611 printed circuit board. By default, the UI may be removed at any time.

The S611 may be configured to fault if the user interface module is removed for any reason.

Using Auxiliary Contacts

The S611 soft starter contains two (2) auxiliary contacts to indicate status. Both relays have user defined attributes. Relay contact configuration is selectable in the Advanced configuration Menu.

Relay 1 uses contacts 13 and 14.

The following contact configurations are available for Relay 1:

- 0 = Faulted
- 1 = Not faulted
- 2 = Run (in bypass)—default value
- 3 = Not in bypass
- 4 = Motor energized
- 5 = Motor not energized

Relay 2 uses contacts 96 (common), 97, and 98. The following contact configurations are available for Relay 2:

- 0 = Faulted—default value
- 1 = Not faulted

Often these contacts are used as shown with indicating lamps (see figures on this page). 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 S611 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 followed:

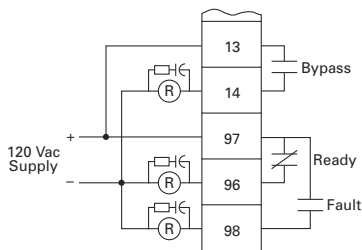
PLC Interface

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 0.5W. The capacitor is 0.25 μ F at 250 Vac.

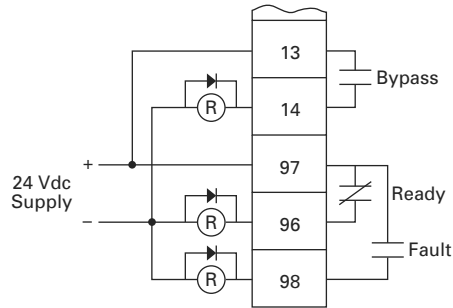
120 Vac Control



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 in the figure 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



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 when using level control, 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 120 Vac on the start terminal.

⚠ CAUTION

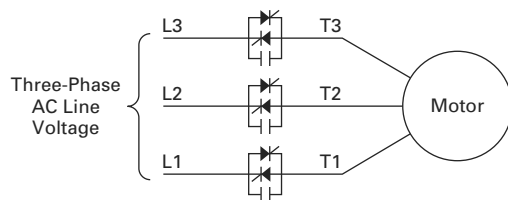
If the AUTO Reset mode setting is used, CAUTION must be exercised to assure that any restart occurs in the safe manner.

Functional Description

Power

The S611 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.

Line Connected Soft Starter SCRs



For each start, the length of time the SCRs are conducting current as well as the magnitude of that current determine how hot the SCRs will get. Between successive starts, the SCRs must cool down to avoid exceeding their thermal limits. **Appendix C—Ratings, Cooling and Power Losses** gives the S611's application ratings for various starting conditions. Staying within these specified limits should avoid over temperature trips.

Control

There are four (4) terminal blocks and one (1) connector on the face of the S611 soft starter that are used for control circuit functions:

1. 120 Vac supply voltage (TB1)—Soft starter control power input.
2. 120 Vac control inputs (TB2)—Remote (network) select, permissive, start, and reset control functions.
3. Relay contact terminals (TB3)—One (1) Form A relay, one (1) Form C relay.
4. Network communications (TB4)—Modbus connection.
5. Network communications (TB5) (connector)—Connections to network adapter modules.

Note: Do not apply 120 Vac to the network communications terminal block. 120 Vac will permanently destroy the printed circuit board.

The software contained in the S611 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—Parameters**.

Starting/Stopping Options

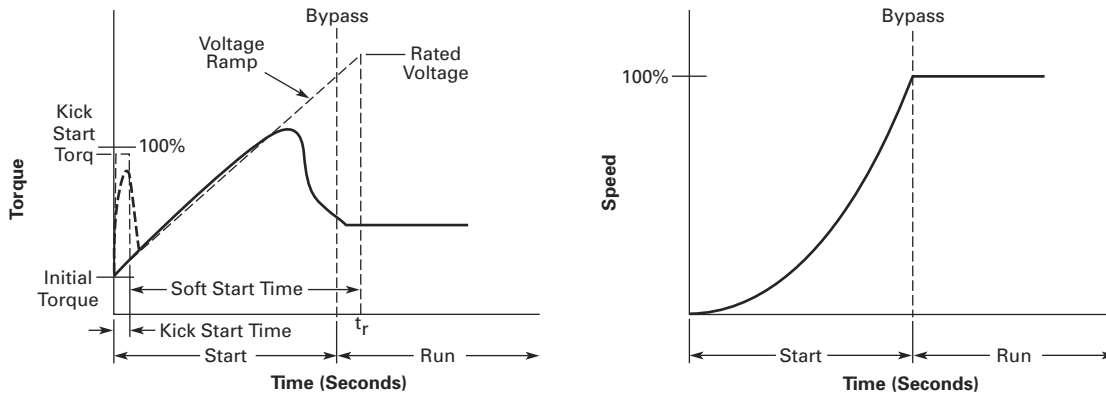
The following starting options are available in the S611 soft starter:

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 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 S611 senses that the motor has achieved synchronous speed, it quickly completes the voltage ramp and closes the bypass contactor. (See figure below.)

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 S611 will go into bypass before the ramp reaches full voltage. In other words, the S611 will go into bypass before the *Soft Start Time* has elapsed.

Ramp Start



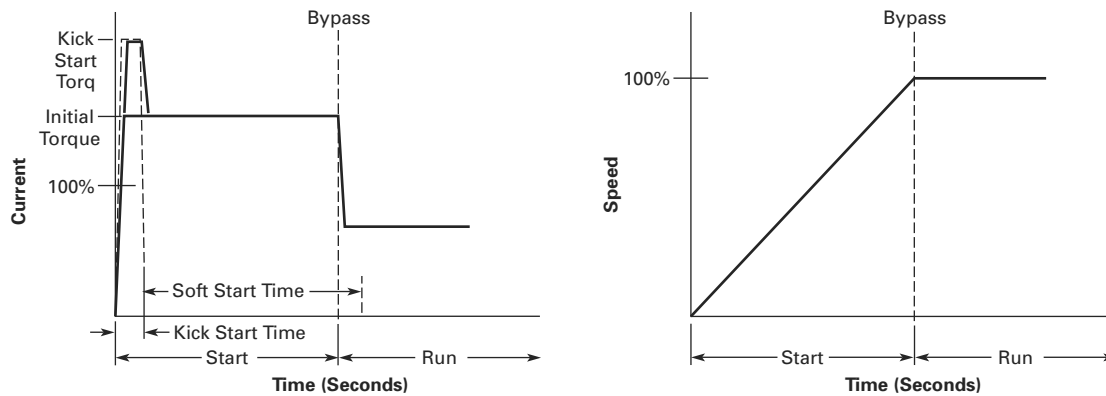
Kick Start—The Kick Start feature works in both the Voltage Ramp Start and Current Limit Start modes. By momentarily applying up to a two (2) second pulse of current to the motor, it provides an initial boost in torque to overcome the static friction common in some applications. The level of torque boost 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 disables this feature.

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 S611 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 figure 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.

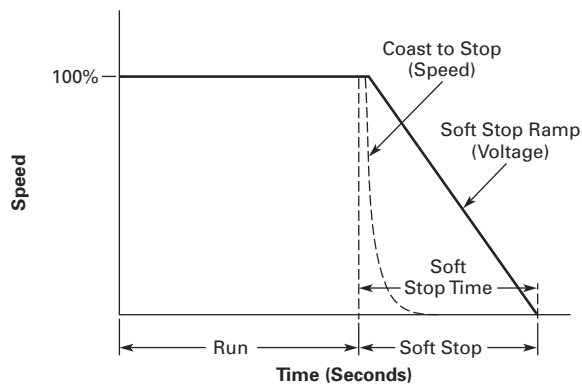
Current Limit



Soft Stop/Pump Stop—This feature is used for applications that require a controlled extended stop. It is designed for high frictional loads that tend to stop suddenly or to prevent water hammer (pumps) when voltage to the motor is removed. During soft stop, the voltage is gradually reduced to zero in the time set by the *Soft Stop Time* parameter. (See figure below.)

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 S611 is in network control, it is ready to respond to motor START control commands issued only through the network comms ports A and/or B. It is not necessary to select either comms port A or comms port B.

The comms ports A and B enable complete communications between the S611 and the network including changing parameters settings, issuing control commands, and monitoring selected operational values via DeviceNet, Modbus, or PROFIBUS Networks. Comms port A provides Modbus motor control commands.

Both comms ports may be used simultaneously and independently configured.

Refer to **Appendix F** for Modbus Network control information.

Profibus Network control information may be found in Eaton publication MN04210003E.

DeviceNet Network control information may be found in Eaton publication MN04210002E.

Local Control

S611 local control consists of *Comms Select*, *Permissive*, *Start*, and *Reset* 120 Vac control commands to terminal block 3 (TB3). The S611 cannot be started from the User Interface Module.

Terminal block 3 (TB3) uses four (4) functions to control the S611 soft starter.

1. *Permissive* (run enable)—Must be energized with 120 Vac to enable operation of all S611 soft starters by both local and 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 S611 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.
2. *Start*—If 120 Vac is present at the *Permissive* terminal, momentary application of 120 Vac to the *Start* terminal will initiate a voltage ramp or current limit start for the S611 soft starter. Application of 120 Vac may be maintained.

Note: With level sensing control, if 120 Vac 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 will occur when 120 Vac is restored or reapplied if:

- a) 120 Vac is present on the *Start* terminal (maintained), and;
- b) the UI device shows a ready LED (not faulted). 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 Level or Edge Sensing section on **Page 21** for additional details.

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.

3. *Reset*—Application of 120 Vac power to the *Reset* terminal will reset the soft starter after all fault conditions are cleared. 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.

Network—When energized (maintained), selects the network communications port A terminal block (TB4) and/or network communications port B (TB5) as the source of motor control. Both network communications ports may be used to operate the S611 from a Modbus (native), DeviceNet, or PROFIBUS network. When this terminal is energized, *Start* commands from the start terminal block (TB3) are not recognized. Both comms ports may be used simultaneously and independently configured.

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 S611 operation will be the same, as in either case only a momentary signal is placed on the start terminal of TB3. If the start control signal is maintained and edge sensing is selected, the signal must be removed, then reapplied to initiate a start.

Level Sensing

Level sensing (default) is selected with the *Start Control* sub-parameter in the Advanced Config. menu. Level sensing means that the 120 Vac 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 when:

- All faults remain cleared or reset
- The *Permissive* terminal is supplied with 120 Vac
- The *Reset Mode* parameter is set to AUTO
- There is 120 Vac power to the *Start* terminal (*Start* command—maintained)

Level sensing will allow a motor restart when:

- All faults remain cleared or reset
- The *Permissive* terminal is supplied with 120 Vac
- The *Reset* mode parameter is set to AUTO or MANUAL
- 120 Vac 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.



CAUTION

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

Edge Sensing

Edge sensing is selected with the *Start Control* sub-parameter in the Advanced Config. menu. Edge sensing means that the 120 Vac 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 120 Vac 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:

- All faults remain cleared or reset
- The *Permissive* terminal is supplied with 120 Vac
- The *Reset Mode* parameter is set to AUTO or MANUAL
- 120 Vac power to the *Start* terminal is reapplied (*Start* command—momentary)

Edge sensing will allow a motor restart when:

- All faults remain cleared or reset
- The *Permissive* terminal is supplied with 120 Vac
- The *Reset Mode* parameter is set to AUTO or MANUAL
- 120 Vac 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.

Auxiliary Relays

Terminal block 2 (TB2) uses two (2) auxiliary relay functions to indicate status of S611 soft starter.

1. Terminals 13 and 14 (Programmable)—At default setting, relay contacts use 120 Vac to provide bypass contactor status. The contact closes upon bypass and will remain closed until a stop is initiated or a fault occurs. The motor and load may continue to rotate after a stop is initiated if soft stop is being used or if the load inertia is high.
2. Terminals 96, 97 and 98 (Programmable)—At default setting, relay contacts use 120 Vac to provide fault or ready status indication.

S611 Operating Configuration

Introduction

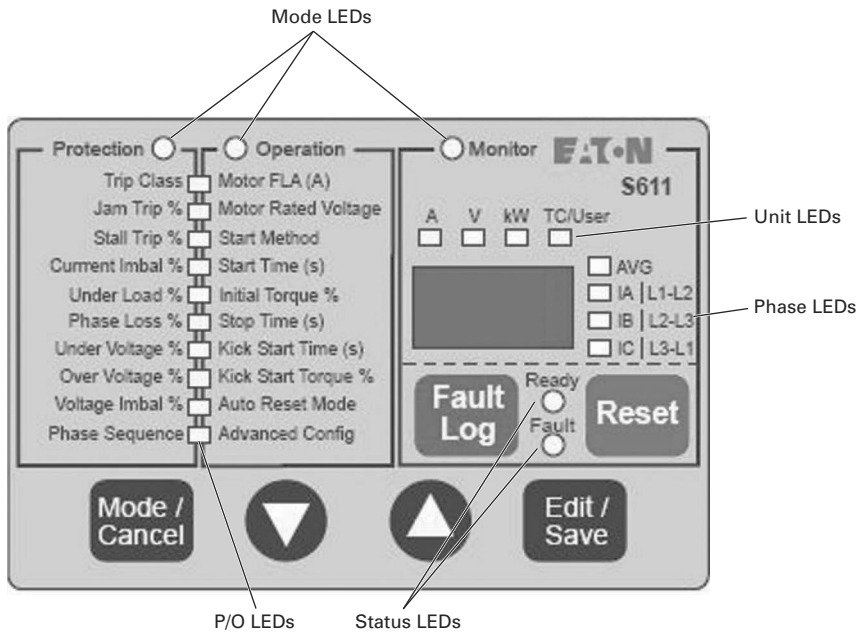
The S611 has a wide range of set points to enable coordinated motor and load protection. Commonly used set points are directly accessible through the user interface; advanced configuration of the device must be performed through the Advanced Config operation or over the network.

The unit comes out of the box with default settings that accommodate general induction motor applications that provide very basic motor protection. Parameters should be fine-tuned for the user's application.

User Interface

The User Interface Module (UI) on the S611 has been designed to allow intuitive configuration of typically used parameters without constant need for references to this manual.

User Interface Module (UI)



User Interface Components

Component	Interface	Description
Buttons	Mode/Cancel	<ul style="list-style-type: none"> Used to navigate the three operational modes (“Protection”, “Operation”, “Monitor”) Pressing this button when editing a parameter exits the editing mode WITHOUT saving the new parameter value
	Up (▲)	<ul style="list-style-type: none"> In “Protection” and “Operation” (P/O) modes, this key is used to navigate up the P/O LED list. After the “Edit/Save” button is pressed in either of these modes, the Up button is used to increment the parameter value In the “Monitor” mode, this button navigates up through the display parameter list
	Down (▼)	<ul style="list-style-type: none"> In “Protection” and “Operation” (P/O) modes, this key is used to navigate down the P/O LED list. After the “Edit/Save” button is pressed in either of these modes, the Down button is used to decrement the parameter value In the “Monitor” mode, this button navigates down through the display parameter list
	Edit/Save	<ul style="list-style-type: none"> In “Protection” and “Operation” (P/O) modes, the first press of this button enables modification of the selected parameter value. The second press of the button saves the modified parameter value When the Advanced Config parameter is selected, the first press enables parameter selection. The second press enables editing of the parameter value. The third press saves the edited value This button has no effect in the “Monitor” mode
	Fault Log	<ul style="list-style-type: none"> Press the Fault Log button to view the 10 most recent fault codes. The most recent fault is displayed first Press the (▼) key to view past faults. When the last fault is exceeded, the display will show “bOt” to indicate the bottom of the list has been reached Press the (▲) key to view more recent faults. When the most recent fault is exceeded, the display will show “tOP” to indicate the top of the list has been reached Exit the Fault Log mode by pressing the Fault Log button
	Reset	<ul style="list-style-type: none"> Trip reset button—the indicated fault is cleared and the S611 returns to the “Ready” state. Any active fault will prevent the S611 from being reset
Discrete LEDs	Status	<ul style="list-style-type: none"> The Ready Light indicates that the S611 soft starter is ready to run The Fault Light indicates that a fault has been detected
	Mode	<ul style="list-style-type: none"> Indicates the active mode Used in conjunction with the P/O LEDs to select a parameter for editing or to indicate the reason for trip
	Protection/Operation (P/O)	<ul style="list-style-type: none"> Indicates the selected Protection or Operation (P/O) parameter Used in conjunction with the Mode LED to select a parameter for display/editing or to indicate the reason for trip
	Units	<ul style="list-style-type: none"> Indicate the units of the displayed parameters Used in conjunction with the phase parameters to identify the displayed parameters A = amps V = volts kW = kilowatts TC/User = By default the thermal capacity is shown, the user can also configure this parameter
	Phase	<p>Indicates the selected phase. Used in conjunction with the unit LEDs to identify the display parameter</p> <ul style="list-style-type: none"> AVG = average of all phases IA L1-L2—phase A current or L1-L2 voltage IB L2-L3—phase B current or L2-L3 voltage IC L3-L1—phase C current or L3-L1 voltage
Display	Alpha numeric display	3 digits, 7-segment alphanumeric display for numeric parameter display and editing (flashing) and fault codes

Operation of the user interface is broken into three modes listed across the top of the device. Pressing the Mode key enables mode navigation.

Interface Mode Keys

Mode	Description
Protection	Used to set motor protection thresholds and/or disable protection parameters
Operation	Used to set operational parameters, including auto reset modes
Monitoring	Used to display run-time data parameters

The Mode and Protection/Operation (P/O) LEDs are used in conjunction to identify a selected parameter.

Setup and Starting

Before You Begin

Be Aware of the Following:

1. The *Permissive* terminal must have 120 Vac applied to ENABLE starts.
2. To Start: Apply 120 Vac to the *Start* terminal while the *Permissive* terminal is energized.
3. To initiate a stop, remove the *Permissive* terminal input.
4. For two-wire control, jumper *Permissive* and *Start* terminal inputs together.
5. The *Permissive* and *Network* inputs must be energized (120 Vac) to enable starting of the soft starter from the network.
6. After an overload trip, the S611 soft starter cannot be restarted until the prescribed cool-down time has elapsed. Cycling control power does not reset the timer. If 120 Vac power is removed, the soft starter will remember the remaining time and will resume the cool-down timing when power is again reapplied.

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 Advanced Protection options of the S611 shown in **Appendix B—Protection** and select the appropriate ones for your application.

Initial Configuration

1. The S611 Operation and Protection parameters may be edited using only 120 Vac control power applied to 120 Vac Supply (TB1). Mains power is not required to edit and save Operation and/or Protection parameters.

If any 120 Vac power source other than the normal system control power source is used to power the control circuit to edit parameters, connections must be made in compliance with all local, state, and national electrical codes.

2. In the Operation mode, set the operating parameters to the desired values. These settings assume the motor has a 1.15 service factor.

Operating Parameters—Standard

Operating Parameter	Units	Min	Max	Default	Notes
Motor FLA	Amps				Motor FLA parameter must be set to motor nameplate FLA to achieve proper overload protection
Frame Size A–52		26	52	26	
Frame Size A–65		32.5	65	32.5	
Frame Size A–77		38.5	77	38.5	
Frame Size B–99		48	99	48	
Frame Size B–125		62.5	125	62.5	
Frame Size C–156		78	156	78	
Frame Size C–180		90	180	90	
Frame Size D–242		120	242	120	
Frame Size E–302		151	302	151	
Frame Size E–361		180.5	361	180.5	
Frame Size F–414		207	414	207	
Motor rated voltage	Volts	200	600	480	—
Start method	—	0	2	0	0 = Voltage ramp 1 = Current limit
Start time	Seconds	0.5	180	20	—
Initial torque	%	0	100	45	—
Stop time	Seconds	0	60	0	—
Kick start time	Seconds	0	2	0	—
Kick start torque	%	0	100	0	—
Auto reset mode	—	0	1	0	0 = Manual 1 = Auto
Advanced config	—	N/A	N/A	N/A	—

Operating Parameters—Pump Option

Operating Parameter	Units	Min	Max	Default	Notes
Motor FLA	Amps				Motor FLA parameter must be set to motor nameplate FLA to achieve proper overload protection
Frame Size A-52		26	52	26	
Frame Size A-65		32.5	65	32.5	
Frame Size A-77		38.5	77	38.5	
Frame Size B-99		48	99	48	
Frame Size B-125		62.5	125	62.5	
Frame Size C-156		78	156	78	
Frame Size C-180		90	180	90	
Frame Size D-242		120	242	120	
Frame Size E-302		151	302	151	
Frame Size E-361		180.5	361	180.5	
Frame Size F-414		207	414	207	
Motor rated voltage	Volts	200	600	480	—
Start method		0	2	2	0 = Voltage ramp 1 = Current limit 2 = Pump start
Start time	Seconds	0.5	180	20	—
Initial torque	%	0	100	45	—
Stop time	Seconds	0	60	5	—
Kick start time	Seconds	0	2	0	—
Kick start torque	%	0	100	0	—
Auto reset mode	—	0	1	0	0 = Manual 1 = Auto
Advanced config	—	N/A	N/A	N/A	—

3. In the Protection mode, set the Protection parameters to the desired values.

Protection Parameters

Protection Parameter	Units	Min	Max	Default
Trip class	—	Off, 5	30	20
Jam trip	%	Off, 150	400	300
Start stall trip	%	Off, 150	400	200
Current imbalance	%	Off, 1	100	20
Under load	%	Off, 1	50	6
Phase loss	%	Off, 1	100	40
Under voltage	%	Off, 1	99	90
Over voltage	%	Off, 101	120	110
Voltage imbalance	%	Off, 1	20	6
Phase sequence	—	Off, ABC	ACB	ABC

Note: Editing the Trip Class parameter to “OFF” will disable overload protection.

Thermal Overload

The S611 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 FLA* parameter programs the overload. The *Motor FLA* is settable from 50% to 100% of the S611's rated current (frame size).

The overload's trip class is set using the *Trip Class* parameter in the Protection menu. Editing the Trip Class parameter to "OFF" will disable overload protection.

Additional details on the thermal overload can be found in **Appendix B—Protection**.

Protection

In addition to motor overload protection, the S611 has many programmable features designed to protect the motor as well as the soft starter itself.

- Incoming line phase reversal, loss, imbalance, over voltage, and under voltage trips
- Three overcurrent trip levels
- Stall and jam trips

For troubleshooting purpose trips are recorded, as they occur, in the S611's fault log.

Apply the mains voltage and verify that no fault is present. The S611 indicates most faults with a fault code in the alphanumeric display and by illuminating the corresponding mode and Protection/Operation (P/O) LEDs. When a fault is indicated, the dedicated Fault P/O LED will be illuminated.

4. The fault history may be displayed by pressing the Fault Log button.

A Phase Reversal fault is a likely candidate on new installations. It can be remedied by either changing the Phase sequence P/O LED from ABC to ACB or removing mains power and switching the incoming line connections at L1 and L2 of the S611.

Fault Codes

Fault	FC	User Interface		Display
		Mode LED	P/O LED	
Watchdog firmware	3	None	None	F.03
FRam	5	None	None	F.05
User interface com failure	6	None	None	F.06
Flash CRC	7	None	None	F.07
Zero volt cross lost	8	None	None	F.08
Comm lost port A	9	None	None	F.09
Comm lost port B	10	None	None	F.10
Pole over temp	15	None	None	F.15
Bypass dropout	16	None	None	F.16
SCR not firing	17	None	None	F.17
Shorted SCR	18	None	None	F.18
Instantaneous SCR overcurrent	19	None	None	F.19
Motor overload	20	Operation	Motor FLA	F.20
Mains loss	21	Protection	Under voltage (V)	F.21
Under voltage	22	Protection	Under voltage (V)	F.22
Over voltage	23	Protection	Over voltage (V)	F.23

Fault Codes, continued

Fault	FC	User Interface		
		Mode LED	P/O LED	Display
Phase reversal	24	Protection	Phase sequence	F.24
Stall	25	Protection	Stall trip %	F.25
SCR overcurrent	27	None	None	F.27
Under load	28	Protection	Under load	F.28
Current imbalance	29	Protection	Current imbalance %	F.29
Phase loss	30	Protection	Phase loss %	F.30
Voltage imbalance	31	Protection	Voltage imbalance %	F.31
Jam	33	Protection	Jam trip %	F.33
Contactors overcurrent	34	None	None	F.34
Missing temp sensor	35	None	None	F.35

Note: For additional details on troubleshooting fault codes and fault conditions, please refer to **Troubleshooting** section starting on **Page 29** and **Appendix G—Troubleshooting Guide**.

Soft Start Configuration Application Notes

1. 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 two 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.

2. Current Limit Start Configuration

Initial settings:

Initial Torque = 50%

Soft Start Time = 60 sec

Kick Start Torque = 0%

Kick Start Time = 0 sec (disabled)

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

Troubleshooting

General

In this section of the manual, we present a procedure you can follow to diagnose a problem with your S611.

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

Please have the following information ready when you call:

Order Number:

Catalog Number:

Style Number:

Serial Number:

Before You Begin to Troubleshoot

 **WARNING**

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

 **WARNING**

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.

We highly recommend that you read this entire section of the manual before you begin to troubleshoot the S611 soft starter.

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

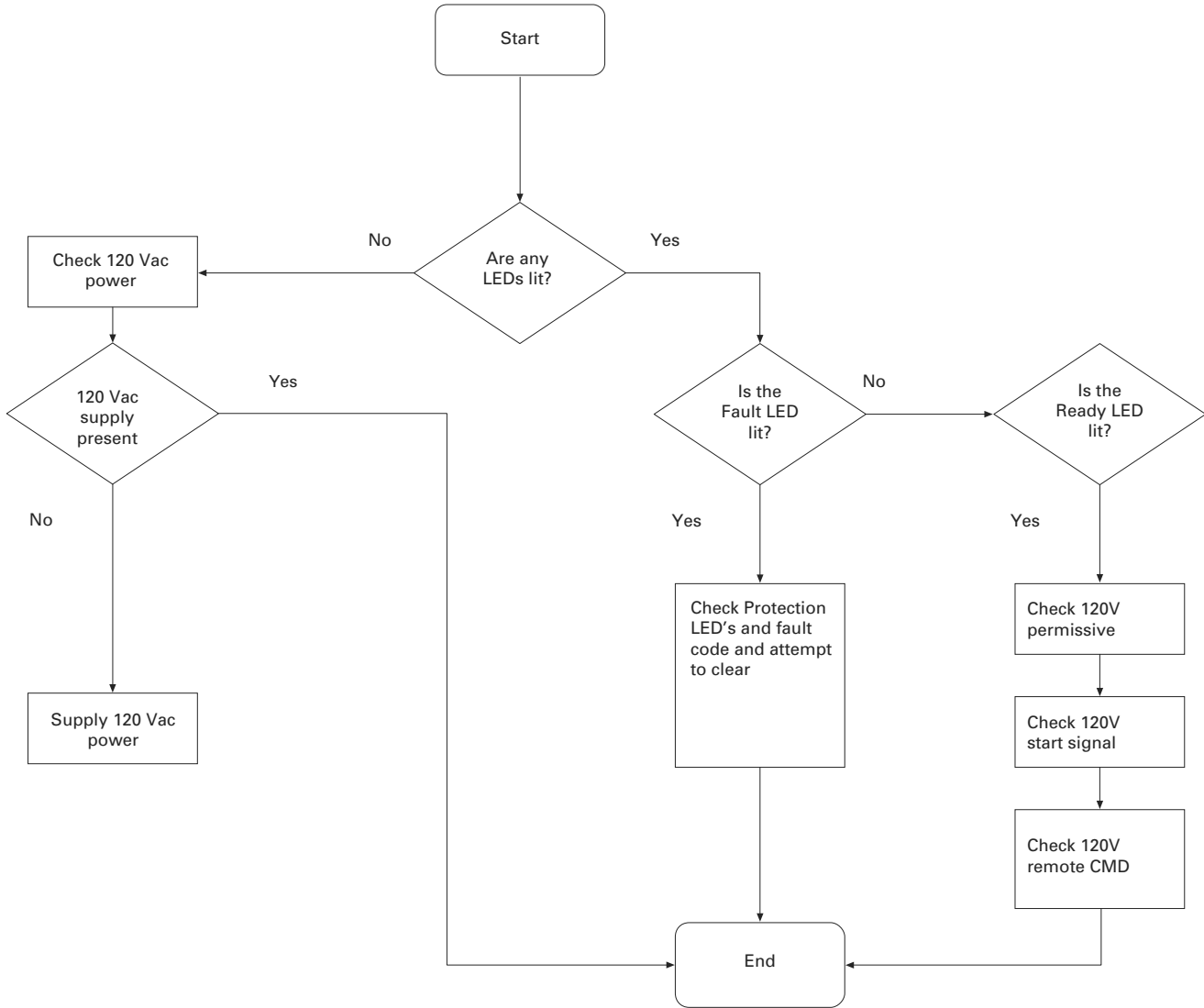
- Multimeter
- Clamp-on ammeter

Always assume the S611 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.

Define the Problem

1. The S611 soft starter fails to respond in any way to a start command. Look at the front panel of the S611 soft starter and determine the state of the LEDs on the User Interface Module (UI). The following troubleshooting flowcharts provide a logical sequence to determine issues and suggest probable solutions to each problem.

Start Command Troubleshooting Flowchart



S611 Does Not START

Start Source Attempted

Suggested Corrective Action

Terminal block

Verify that the Ready LED is illuminated prior to the start attempt

Verify that the Fault LED is not illuminated

Verify that the 120V permissive signal is at the proper voltage

Verify that the 120V start signal is at the proper voltage

Verify that there is no voltage to the 120V comms select terminal

If the Start Control parameter is set to Edge, verify that the 120V start signal is transitioned from 0 Vac after a fault trip

Network

Determine if the S611 can be started locally from TB3

Verify that the 120V permissive signal is at the proper voltage

Verify that the 120V comms select terminal is at the proper voltage

Verify that the Fault LED is not illuminated

2. With the Fault LED illuminated, the device will not start. Attempt to reset the S611 soft starter by pressing the S611's RESET button for one second. If the LED remains illuminated, use the User Interface Module (UI) to determine the Protection Fault LED or fault code and go to the **S611 Fault Codes** in **Appendix G—Troubleshooting Guide** to find the corrective action for the fault code.
3. The Ready LED is illuminated and the S611 soft starter is ready to start. Determine the start source from the table on **Page 30** to aid in determining the appropriate corrective action. Verify that the permissive input terminal is at 120 Vac, then start the S611 from the Control Input terminal block, TB3.

Note: If connected to a network, starting the S611 from the Control Input terminal block (TB3) may isolate problems associated with the network and not with the soft starter.

4. It is often useful in evaluating a trip condition to note when the trip occurs during operation of the S611 soft starter. The operation of the S611 may be categorized into the following periods:
 - The S611 soft starter trips during the START ramp and never reaches bypass

- The S611 soft starter trips when the bypass contactors are closed
- The S611 soft starter trips during running operation while bypass contactors are closed
- The S611 soft starter trips after the Stop command is received
- The S611 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 S611 soft starter will detect this stalling due to the increase in current flow and end the stop immediately and not indicate any faults

Use the flowchart on **Page 32** to aid in determining the appropriate corrective action during the various run phases of operation.

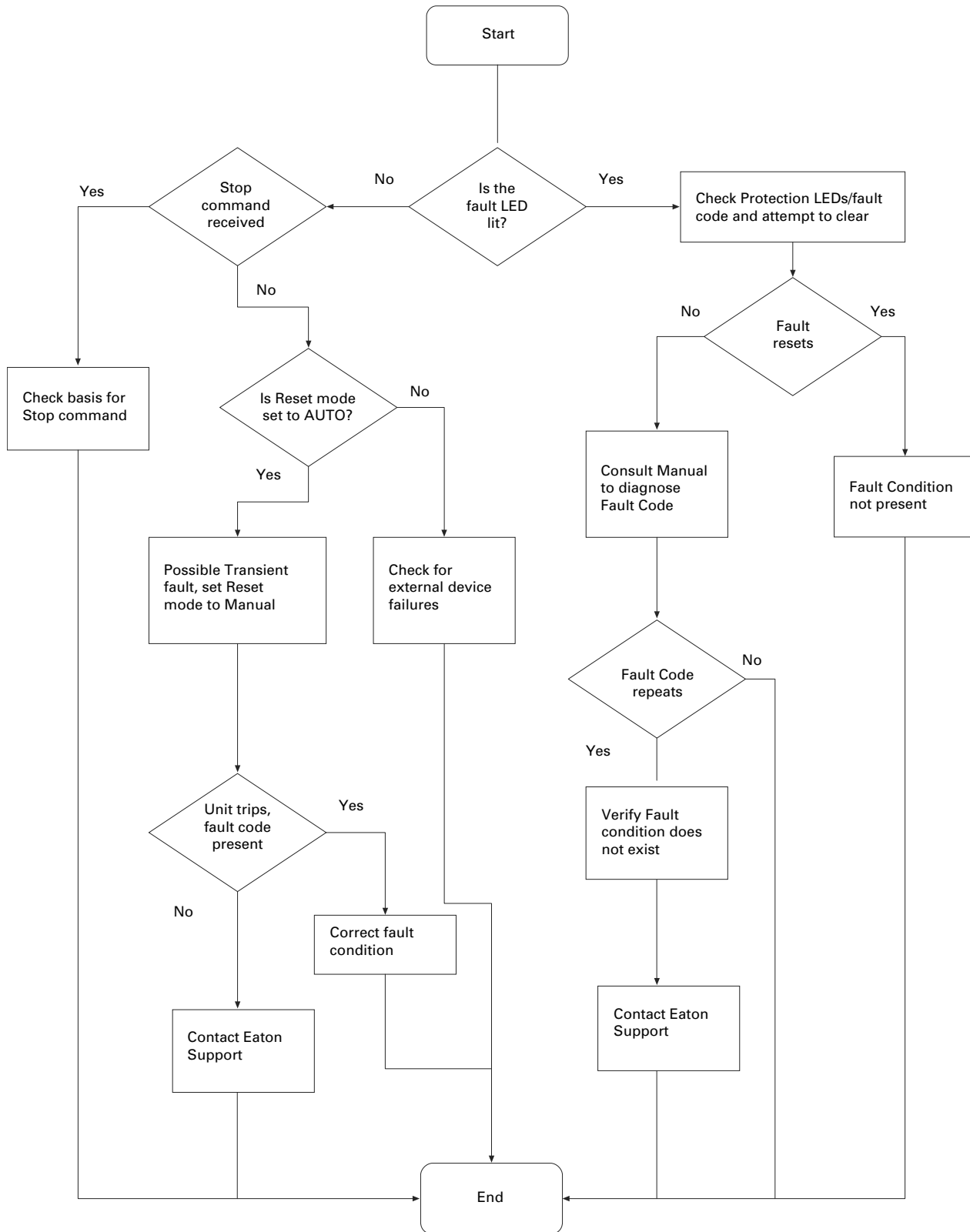
Note: If no fault codes are present during an unexpected "trip" of the soft starter, verify that the soft starter did not receive a STOP command.

Detailed information describing fault codes and corrective action may be found in **Appendix G—Troubleshooting Guide**.

S611 Stopped or Faulted

Condition	Possible Problem	Suggested Corrective Action
Ready LED illuminated, no Fault LED	<ul style="list-style-type: none"> • Stop command received • Terminal block wiring not secure • Loss of 120 Vac control power • Transient fault when Reset mode set to AUTO • External control device failure • External mains device failure or trip condition • Control board failure 	<ul style="list-style-type: none"> • 120 Vac permissive signal lost—investigate control system • Check control wiring for security • Check 120 Vac 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
Fault LED illuminated	<ul style="list-style-type: none"> • Protection/Operation parameters not set to proper values • Fault condition exists in mains circuit • Fault not reset from previous trip • Reset mode set to Manual 	<ul style="list-style-type: none"> • Determine Fault condition from the Mode LEDs and the fault code displayed in the alpha numeric display • Adjust Protection/Operation 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 • 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 LEDs illuminated, alpha numeric display dark	<ul style="list-style-type: none"> • No control power supply • Device failure 	<ul style="list-style-type: none"> • Provide 120 Vac to control power terminal block TB1 • Check control power for proper value and reliability

Local Control Troubleshooting Flow Chart



Parts and Service

Servicing the S611

S611 Printed Circuit Board (PCB) Replacement

Disconnect power in accordance with federal, state, and local codes and remove the S611 from the enclosure or mounting panel.

Note: Servicing the S611 while installed in an enclosure or mounted vertically on a panel is not recommended.

Place the unit on a clean work surface.

Cover Removal

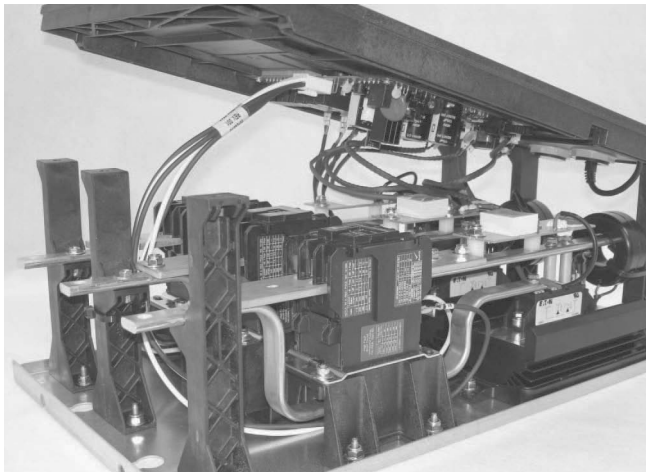
1. Disconnect all control wiring and tie wraps securing any wiring to the cover assembly.
2. Remove cover screws with nuts, six each on Frames A–D, four each on Frames E–F.

Note: Cover screw nuts are prevented from rotating but are not retained in place by the pole supports. Do not allow hardware to fall into the soft starter.

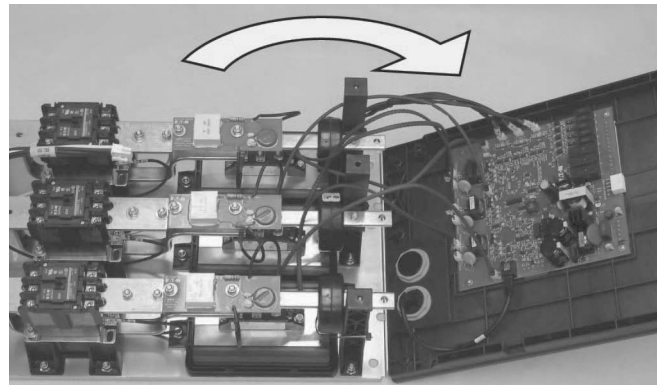
3. Lift top of cover approximately 6 in to gain access to the BYPASS VOLTAGE contactor connector mounted on the Printed Circuit Board (PCB). Note placement of wiring from PCB to soft starter components. See "Contactor Connector" figure below.

4. Press locking tab on BYPASS VOLTAGE contactor connector and disconnect from the PCB.
5. Carefully rotate cover to rest onto work surface as shown. See "Cover Position" figure below. If replacing an internal bypass contactor, the cover may be simply moved aside after disconnecting the BYPASS VOLTAGE connector to gain access to the contactors.

Contactor Connector



Cover Position



Printed Circuit Board (PCB) Removal

If necessary, mark all cables to aid in proper reattachment. The PCB is marked with component identification information adjacent to each connector base. See “PCB Connector IDs” figure below.

PCB Connector IDs



1. Disconnect leads from the PCB:
 - a) SCR gate leads—two per phase.
 - b) Temperature sensor leads—one per phase.
 - c) Current transformer leads— one per phase.
 - d) User Interface cable.

Note: All connectors except the User Interface cable use detents to secure the connection. To remove, pull each connector directly away from the PCB. Do not twist or pry to remove connector from PCB. Do not attempt to separate the connector by pulling on the wires.

User Interface cable assembly locking tab is located between connector and the cover. Use a small screwdriver to depress locking tab. The cable may also be removed after PCB is removed from the cover.

2. Remove the 5 #1 Phillips self tapping screws—one in each corner, one in center.
3. Remove PCB from cover assembly.

PCB Reinstallation

1. Place the PCB into position on the cover assembly.
2. Install all five screws by first turning the screw counterclockwise until you feel the screw “drop” into place. Torque to 8–10 lb-in.
3. Connect all leads, pressing firmly until you feel the connector snap into place.
4. Reinstall cover assembly.

Cover Reinstallation

1. As the cover is placed onto the supports, carefully guide wiring into place.
2. Ensure that the BYPASS VOLTAGE contactor connector is properly connected prior to installing the cover screws.
3. Install and torque all cover assembly screws to 22–27 lb-in.
4. Reinstall control wiring.

S611 Internal Bypass Contactor Replacement

Disconnect power in accordance with federal, state, and local codes and remove the S611 from the enclosure or mounting panel.

Note: Servicing the S611 while installed in an enclosure or mounted vertically on a panel is not recommended.

Place the unit on a clean work surface.

Cover Removal

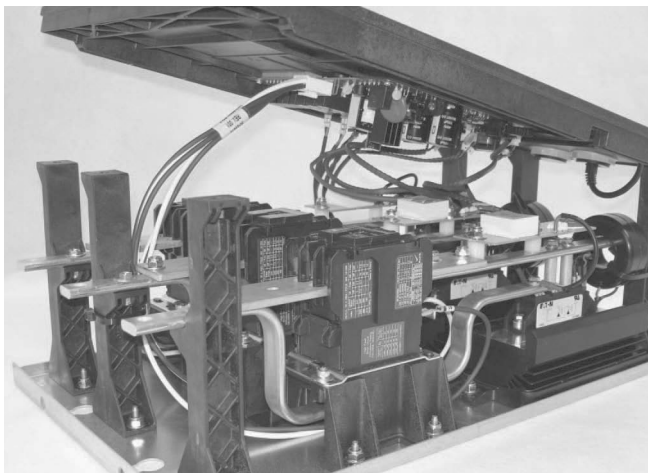
1. Disconnect all control wiring and tie wraps securing any wiring to the cover assembly.
2. Remove cover screws with nuts, six each on Frames A–D, four each on Frames E–F.

Note: Cover screw nuts are prevented from rotating but are not retained in place by the pole supports. Do not allow hardware to fall into the soft starter.

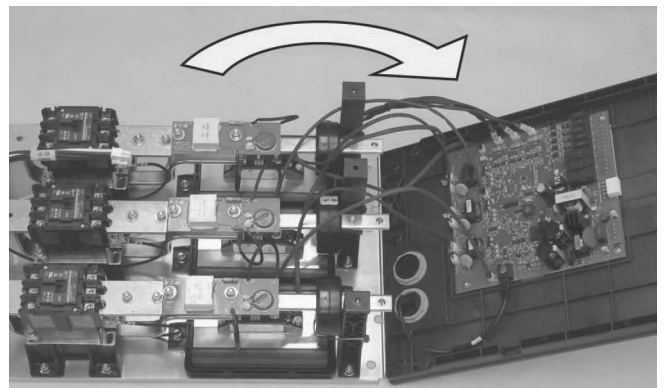
3. Lift top of cover approximately 6 in to gain access to the BYPASS VOLTAGE contactor connector mounted on the Printed Circuit Board (PCB). Note placement of wiring from PCB to soft starter components. See “Contactor Connector” figure below.

4. Press locking tab on BYPASS VOLTAGE contactor connector and disconnect from the PCB.
5. Carefully rotate cover to rest onto work surface as shown. See “Cover Position” figure below. If replacing an internal bypass contactor, the cover may be simply moved aside after disconnecting the BYPASS VOLTAGE connector to gain access to the contactors.

Contactor Connector



Cover Position



Cover Reinstallation

1. As the cover is placed onto the supports, carefully guide wiring into place.
2. Ensure that the BYPASS VOLTAGE contactor connector is properly connected prior to installing the cover screws.
3. Install and torque all cover assembly screws to 22–27 lb-in.
4. Reinstall control wiring.

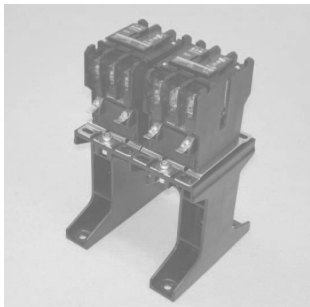
Bypass Contactor Removal

If necessary, mark all cables to aid in reattachment.

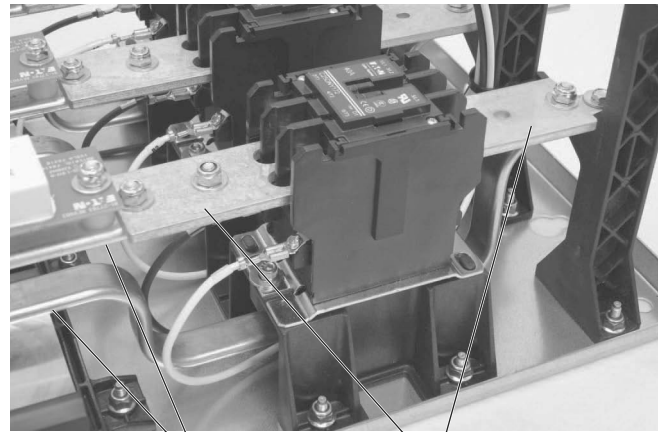
A–D Frame Contactor Assembly



E and F Frame Contactor



Terminal Plates and Bus Bars



Bus Bars

Terminal Plates

A–D Frame Units

Note: All three contactors and the contactor support are removed as an assembly from the baseplate to aid individual contactor replacement. See “Contactor Connector” figure on **Page 35**.

1. Remove coil wires from the contactors.
2. Loosen lug screws securing terminal plates to bypass contactors with a 5/32 in hex driver.
3. Remove nuts securing terminal plates to bus bars.

Note: Do not pry terminal plates from the contactor. Damage to contactor and/or terminal plate may occur.

4. Remove nuts securing contactor support assembly to baseplate.
5. Lift contactor support assembly from the baseplate.
6. Remove terminal plates from contactor(s).
7. Remove the socket head cap screws and the contactor from the support assembly.

E-F Frame Units

1. Remove auxiliary relays from both contactors by pressing locking tab and sliding relays upwards.
2. Remove coil wires from both contactors on the pole.
3. Remove auxiliary contact wires.
4. Loosen lug screws securing terminal plates to bypass contactor with a 5/32 in hex driver.
5. Remove nuts securing terminal plates to bus bar.

Note: Do not pry terminal plates from the contactor. Damage to contactor and/or terminal plate may occur.

6. Remove nuts securing contactor support assembly to baseplate.
7. Lift contactor support assembly from the baseplate.
8. Remove terminal plates from contactors.
9. Remove the socket head cap screws and the contactor from the support.

Bypass Contactor Reinstallation

1. Place the contactor into position on the support (E-F) or support assembly (A-D).
2. Install socket head cap screws securing the contactor to the support and torque to 22–27 lb-in.

3. Replace the terminal plates in the contactors ensuring that the terminal plate is **under** the copper bar on each pole of each contactor.

Note: Lightly tighten one lug screw on each terminal plate only enough to retain the terminal plate(s) in position and still allow positioning to aid in installation of the contactor support or contactor support assembly onto the baseplate.

4. Install contactor support (E-F) or support assembly (A-D) onto baseplate. Take care not to pinch coil wires that are routed under the support.
5. Install nuts securing support or support assembly to baseplate and torque to 22–27 lb-in.
6. Fully seat terminal plates into contactor and torque nuts on bus bar(s) to 22–27 lb-in.
7. Torque lug screws securing terminal plates to bypass contactor to 22–27 lb-in.
8. Install electrical leads to contactor coils.
9. Reinstall auxiliary contacts on each contactor (Frames E-F only)
10. Reinstall cover assembly.

Optional Accessory Kits

Description	S611 Current Rating	Accessory Kit Part Number
User interface remote mounting kit—3.28 ft (1m)	52–414A	S611-RMK-100
User interface remote mounting kit—6.56 ft (2m)	52–414A	S611-RMK-200
User interface remote mounting kit—9.84 ft (3m)	52–414A	S611-RMK-300
User interface communication cable—3.28 ft (1m)	52–414A	D77E-QPIP100
User interface communication cable—6.56 ft (2m)	52–414A	D77E-QPIP200
User interface communication cable—9.84 ft (3m)	52–414A	D77E-QPIP300
Lug kit—mechanical	52–77A	S611-LUG-M01
	99–125A	S611-LUG-M02
	156–242A	S611-LUG-M03
	302–414A	S611-LUG-M04

Communications

Description	Catalog Number
Modbus communication adapter without I/O	C441M
Modbus communication adapter with 120 Vac I/O	C441N
Modbus communication adapter with 24 Vdc I/O	C441P
DeviceNet communication adapter with 120 Vac I/O	C441K
DeviceNet communication adapter with 24 Vdc I/O	C441L
PROFIBUS communication adapter with 120 Vac I/O	C441S
PROFIBUS communication adapter with 24 Vdc I/O	C441Q
Ethernet IP/Modbus TCP communication adapter with 120 Vac I/O	C441R
Ethernet IP/Modbus TCP communication adapter with 24 Vdc I/O	C441T
Communication adapter	C440-COM-ADP

Replacement Parts

Description	Part Number
User interface	S611-KEYPAD
User interface communication cable—0.25m (0.82 ft)	D77E-QPIP25
Control board assembly—52A standard	S611-PCB-052S
Control board assembly—65A standard	S611-PCB-065S
Control board assembly—77A standard	S611-PCB-077S
Control board assembly—99A standard	S611-PCB-099S
Control board assembly—125A standard	S611-PCB-125S
Control board assembly—156A standard	S611-PCB-156S
Control board assembly—180A standard	S611-PCB-180S
Control board assembly—242A standard	S611-PCB-242S
Control board assembly—302A standard	S611-PCB-302S
Control board assembly—361A standard	S611-PCB-361S
Control board assembly—414A standard	S611-PCB-414S
Control board assembly—52A pump	S611-PCB-052P
Control board assembly—65A pump	S611-PCB-065P
Control board assembly—77A pump	S611-PCB-077P
Control board assembly—99A pump	S611-PCB-099P
Control board assembly—125A pump	S611-PCB-125P
Control board assembly—156A pump	S611-PCB-156P
Control board assembly—180A pump	S611-PCB-180P
Control board assembly—242A pump	S611-PCB-242P
Control board assembly—302A pump	S611-PCB-302P
Control board assembly—361A pump	S611-PCB-361P
Control board assembly—414A pump	S611-PCB-414P
Frame A/B CT	S611-CT-AB
Frame C/D CT	S611-CT-CD
Frame E/F CT	S611-CT-EF
Contactors assembly—52–180A	C25DNY172
Contactors assembly—242–414A	C25DNY173

Appendix A—Parameters

Parameter Lists

Operation Mode—Standard

Operating Parameter	Units	Minimum	Maximum	Default	Notes
Motor FLA	Amps				Motor FLA parameter must be set to motor nameplate FLA to achieve proper overload protection
Frame Size A-52		26	52	26	
Frame Size A-65		32.5	65	32.5	
Frame Size A-77		38.5	77	38.5	
Frame Size B-99		48	99	48	
Frame Size B-125		62.5	125	62.5	
Frame Size C-156		78	156	78	
Frame Size C-180		90	180	90	
Frame Size D-242		120	242	120	
Frame Size E-302		151	302	151	
Frame Size E-361		180.5	361	180.5	
Frame Size F-414		207	414	207	
Motor rated voltage	Volts	200	600	480	—
Start method	—	0	1	0	0 = Voltage ramp 1 = Current limit
Start time	Seconds	0.5	180	20	—
Initial torque	%	0	100	45	—
Stop time	Seconds	0	60	0	—
Kick start time	Seconds	0	2	0	—
Kick start torque	%	0	100	0	—
Auto reset mode	—	0	1	0	0 = Manual 1 = Auto
Advanced config	—	N/A	N/A	N/A	—

Operation Mode—Pump Option

Operating Parameter	Units	Minimum	Maximum	Default	Notes
Motor FLA	Amps				Motor FLA parameter must be set to motor nameplate FLA to achieve proper overload protection
Frame Size A-52		26	52	26	
Frame Size A-65		32.5	65	32.5	
Frame Size A-77		38.5	77	38.5	
Frame Size B-99		48	99	48	
Frame Size B-125		62.5	125	62.5	
Frame Size C-156		78	156	78	
Frame Size C-180		90	180	90	
Frame Size D-242		120	242	120	
Frame Size E-302		151	302	151	
Frame Size E-361		180.5	361	180.5	
Frame Size F-414		207	414	207	
Motor rated voltage	Volts	200	600	480	—
Start method	—	0	2	2	0 = Voltage ramp 1 = Current limit 2 = Pump start
Start time	Seconds	0.5	180	20	—
Initial torque	%	0	100	45	—
Stop time	Seconds	0	60	5	—
Kick start time	Seconds	0	2	0	—
Kick start torque	%	0	100	0	—
Auto reset mode	—	0	1	0	0 = Manual 1 = Auto
Advanced config	—	N/A	N/A	N/A	—

Protection Mode

Protection Parameter	Units	Minimum	Maximum	Default
Trip class	—	Off, 5	30	20
Jam trip	%	Off, 150	400	300
Stall trip	%	Off, 150	400	200
Current imbalance	%	Off, 1	100	20
Under load	%	Off, 1	50	Off
Phase loss	%	Off, 1	100	40
Under voltage	%	Off, 1	99	90
Over voltage	%	Off, 101	120	110
Voltage imbalance	%	Off, 1	20	6
Phase sequence	—	Off, ABC	ACB	ABC

Note: Setting any parameter to OFF disables the protection.

Advanced Operation Mode

Code	Parameter	Minimum	Maximum	Default	Notes
P.00	Device Address Port	1	254	1	Port A—Top cover port
P.01	Modbus Baud Rate Port A	0	7	4	0 = 1200 1 = 2400 2 = 4800 3 = 9600 4 = 19200 5 = 38400 6 = 57600 7 = 115200
P.02	Modbus Parity Port A	0	2	0	0 = Even (1 stop bit) 1 = Odd (1 stop bit) 2 = No parity (2 stop bits) 3 = Even (2 stop bits) 4 = Odd (2 stop bits) 5 = No parity (1 stop bit)
P.03	Device Address Port B	1	254	1	Port B—Hardwire port
P.04	Modbus Baud Rate Port B	0	7	4	0 = 1200 1 = 2400 2 = 4800 3 = 9600 4 = 19200 5 = 38400 6 = 57600 7 = 115200
P.05	Modbus Parity Port B	0	2	0	0 = Even (1 stop bit) 1 = Odd (1 stop bit) 2 = No parity (2 stop bits) 3 = Even (2 stop bits) 4 = Odd (2 stop bits) 5 = No parity (1 stop bit)
P.06	User Interface Edit Lock	0	1	0	0 = UIM editing enabled (unlocked) 1 = UIM editing disabled (locked) This is the only parameter that can be edited when locked
P.07	User Display Parameter	0	10	0	Value displayed in TC LED 0 = Thermal capacity (%) 1 = Power factor 2 = Line frequency 3 = Residual ground current 4 = Voltage imbalance (%) 5 = Current imbalance (%) 6 = Run time 7 = Average pole temperature 8 = Pole temp A phase 9 = Pole temp B phase 10 = Pole temp C phase
P.08	Configuration Reset	N/A	N/A	0	1 = Power cycle 2 = Restore factory default parameters

Advanced Operation Mode, continued

Code	Parameter	Minimum	Maximum	Default	Notes
P.09	Relay 2 (96, 97, 98)	0	1	0	0 = Faulted 1 = Not faulted
P.10	Relay 1 (13, 14)	0	5	2	0 = Faulted 1 = Not faulted 2 = Run (in bypass) 3 = Not in bypass 4 = Motor energized 5 = Motor not energized
P.11	Start Control (Level/Edge)	0	1	1	1 = Level 0 = Edge
P.12	Jam Trip Delay	1	20	2	—
P.13	Ground Fault Trip Enable	0	1	0	0 = Disable 1 = Enable
P.15	Ground Fault Trip Delay	1	20	2	Value in seconds
P.16	Ground Fault Start Delay	0	20	1	Value in seconds
P.17	Current Imbalance Trip Delay	1	20	5	Value in seconds
P.18	Current Phase Loss Trip Delay	1	20	2	Value in seconds
P.19	Under Load Trip Delay	1	60	5	Value in seconds
P.20	Under Load Source	0	1	0	0 = Trip on low kW% 1 = Trip on under current %
P.21	Under Voltage Trip Delay	1	20	10	Value in seconds
P.22	Over voltage Trip Delay	1	20	10	Value in seconds
P.23	Voltage Imbalance Trip Delay	1	20	10	Value in seconds
P.24	UI Comm Loss Fault Enable	0	1	1	0 = No fault on UI disconnect or comm loss 1 = Faulted
P.25	Shorted SCR Fault Enable	0	1	1	0 = Disable 1 = Enable
P.26	SCR Not Firing Fault Enable	0	1	1	0 = Disable 1 = Enable
P.27	Over Temperature Fault Enable	0	1	1	0 = Disable 1 = Enable
P.28	Overload on Start Enable	0	1	1	0 = Disable 1 = Enable
P.29	Command Register	0	3	0	0 = No action 1 = Clear motor run hours 2 = Clear motor start count 3 = Clear fault queue

User Interface Monitoring

In the monitoring mode, the up-button (▲) and down-button (▼) are used to scroll through the parameters that are available for display. When the end of the parameter list is reached (from either direction), the next button press wraps to the beginning or end of the list. The following table describes the operation of the monitoring mode.

Operation of the Monitoring Mode

Action	Display Parameter	Format (Example)	LEDs ON
Default	Average rms current	x.xx if Avg <10 xx.x if Avg <100 xxx if Avg ≥100	Mode—Monitor Units—A Phase—AVG Status—Ready
Down—(▼)	Phase A rms current	x.xx if Ia <10 xx.x if Ia <100 xxx if Ia ≥100	Mode—Monitor Units—A Phase—IA L1-L2 Status—Ready
Down—(▼)	Phase B rms current	x.xx if Ib <10 xx.x if Ib <100 xxx if Ib ≥100	Mode—Monitor Units—A Phase—IB L2-L3 Status—Ready
Down—(▼)	Phase C rms current	x.xx if Ic <10 xx.x if Ic <100 xxx if Ic ≥100	Mode—Monitor Units—A Phase—IC L3-L1 Status—Ready
Down—(▼)	Average rms voltage	480	Mode—Monitor Units—V Phase—AVG Status—Ready
Down—(▼)	Phase A rms voltage	480	Mode—Monitor Units—V Phase—IA L1-L2 Status—Ready
Down—(▼)	Phase B rms voltage	480	Mode—Monitor Units—V Phase—IB L2-L3 Status—Ready
Down—(▼)	Phase C rms voltage	480	Mode—Monitor Units—V Phase—IC L3-L1 Status—Ready
Down—(▼)	Total motor power	X.XX if kW <10 XX.X if kW <100 XXX if kW ≥100	Mode—Monitor Units—kW Phase—AVG Status—Ready
Down—(▼)	Motor thermal capacity/User selected	0–100	Mode—Monitor Units—TC Phase—None Status—Ready

Display Messages

The following display messages may appear on the S611 User Interface Module (UIM) to indicate status.

Display Messages

Message	Description
tOP	Indicates that the top of the fault list has been reached
bOt	Indicates that the bottom of the fault list has been reached
OFF	The protection parameter is disabled.
999	The display parameter exceeds the display range.
F.XX	Fault codes (see table on Page 27)
EOX	Error codes (see table on Page 47)
A.XX	Auxiliary relay codes

Motor Protection/Basic Programming Set Points

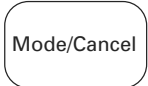
The 611 is capable of advanced, intelligent motor protection. Programming the basic protection parameters can be accomplished directly through the User Interface Module (UI). More advanced control and protection parameters can also be programmed using the UI or over network communications.

Viewing and editing protection set points can be performed in the Protection and Operation (P/O) mode. The following diagram outlines the procedure for modifying any of the set points.




Note: The editing mode can be exited (without saving the parameter value) by pressing the Mode/Cancel button.

Motor Protection/Basic Programming Set Points

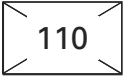
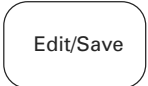
Step 1: Press Mode button until Protection or Operation (P/O) mode LED is lit.



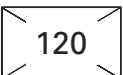


Step 2: Press Up or Down button until the desired P/O LED is lit. Display shows the current parameter value.




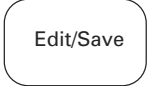
Step 3: Press the Edit/Save button. The display shows the parameter value but it is now flashing.



Step 4: Use the Up/Down buttons to adjust the parameter to the desired value.



Step 5: Press the Edit/Save button. The display now stops flashing and shows the new parameter value that has been saved by the device.



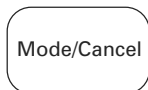
Motor Protection/Advanced Programming Set Points

The basic operation of the S611 is fully programmable through dedicated Protection and Operation LEDs (P/O LEDs). More advanced settings are available indirectly (through parameter codes) by selecting the Operation mode and the Advanced Config parameter. The following diagram outlines the procedure for editing the advanced set points of the S611. See table on **Page 41** in **Appendix A—Parameters** for advanced parameters.

Note: The editing mode can be exited at any time (without saving the parameter value) using the Mode/Cancel button.

Motor Protection/Advanced Programming Set Points

Step 1: Press Mode button until Operation mode LED is lit.



Step 2: Press Up or Down button until Advanced Param P/O LED is lit. Display shows the current parameter code.



Step 3: Press the Edit/Save button. The display now shows the parameter code but it is now flashing.



Step 4: Use the Up/Down buttons to select the desired parameter.



Step 5: Press the Edit/Save button. The display now shows the parameter value corresponding to the selected parameter code. The value will be flashing as editing is enabled.



Step 6: Use the Up/Down buttons to select the desired parameter value.



Step 7: Press the Edit/Save button to store the new parameter value.

Fault Display

The S611 indicates most faults with a fault code and by illuminating the corresponding mode and Protection/Operation (P/O) LEDs. In addition, the dedicated Fault LED will be illuminated when the device is faulted.

Fault Display

Fault	FC	User Interface		Display
		Mode LED	P/O LED	
Watchdog firmware	3	None	None	F.03
FRam	5	None	None	F.05
User interface com failure	6	None	None	F.06
Flash CRC	7	None	None	F.07
Zero volt cross lost	8	None	None	F.08
Comm lost port A	9	None	None	F.09
Comm lost port B	10	None	None	F.10
Pole over temp	15	None	None	F.15
Bypass dropout	16	None	None	F.16
SCR not firing	17	None	None	F.17
Shorted SCR	18	None	None	F.18
Instantaneous SCR overcurrent	19	None	None	F.19
Motor overload	20	Operation	Motor FLA	F.20
Mains loss	21	Protection	Under voltage (V)	F.21
Under voltage	22	Protection	Under voltage (V)	F.22
Over voltage	23	Protection	Over voltage (V)	F.23
Phase reversal	24	Protection	Phase sequence	F.24
Stall	25	Protection	Stall trip %	F.25
SCR overcurrent	27	None	None	F.27
Under load	28	Protection	Under load	F.28
Current imbalance	29	Protection	Current imbalance %	F.29
Phase loss	30	Protection	Phase loss %	F.30
Voltage imbalance	31	Protection	Voltage imbalance %	F.31
Jam	33	Protection	Jam trip %	F.33
Contactor overcurrent	34	None	None	F.34
Missing temp sensor	35	None	None	F.35

Fault History

The S611 stores the last 10 fault codes in a queue stored in non-volatile memory. This fault queue can be traversed using the following sequence of button presses.

Fault History

Step 1: Press the Fault Log button when the Fault LED is lit. The display starts flashing, shows the last fault code, and illuminates the corresponding Protection/Operation LEDs as appropriate to identify the fault.



Step 2: Press the Down button to view older fault codes or the Up button to view more recent fault codes.



Step 3: Press the Fault Log button to exit the Fault History mode. The display now shows the last fault and is no longer flashing. Pressing Reset will reset the device if the fault no longer is present and exits the Fault History mode.



Error Codes

The following table describes error messages and codes that can be generated by the S611. If these error codes cannot be cleared by a reset or power cycle, contact the factory for service.

Error Codes

Error Code	Description
NC	Communication between the main unit and user interface has been lost
E01	The user interface clock has failed. Pressing RESET on the user interface will allow the user interface to continue to function, but performance will be degraded
E02	A switch on the user interface is active (stuck) at power-up
E03	The user interface controller has detected an internal error

Locking the User Interface

The ability to modify set-point values from the user interface can be disabled by changing the User Interface Edit Lock parameter in the Advanced Config parameter.

Configuring the S611

Entering values for the basic protection parameters and the advanced configuration parameters can be accomplished directly through the User Interface Module (UI). The UI or the Network connection may be used to configure all models of the S611 soft starter.

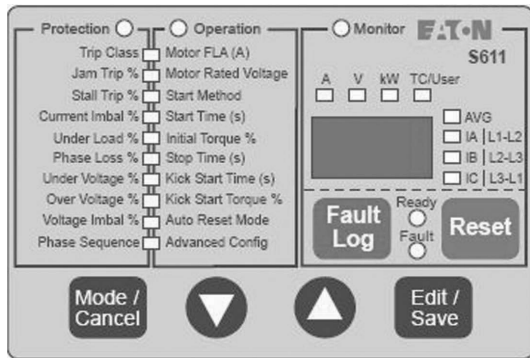
Viewing and editing protection set-points can be performed in the Protection and Operation (P/O) mode. The following diagram outlines the procedure for modifying any of the set points.

Note that the editing mode can be exited (without saving the parameter) value by pressing the Mode button.

Functions that can be performed and parameters that can be monitored include the following on the User Interface Module (UI):

- Mode LED Indicators—Protection, Operation, Monitor
- Units LED Indicators—Amps, Volts, kW, User Defined
- Phase Indicator LED Indicators—Average, Phase A, Phase B, Phase C
- Status LED Indicators—Ready, Fault
- Alpha Numeric Display—Parameter values and Fault Codes
- Function Keys—Mode/Cancel, Up, Down, Edit/Save, Fault Log, Reset

Entering Basic Operating Parameters



Step 1: Press Mode button until Protection or Operation (P/O) mode LED is lit.

Step 2: Press Up or Down button until the desired P/O LED is lit. Display shows the current parameter value.

Step 3: Press the Edit/Save button. The display shows the parameter value but it is now flashing.

Step 4: Use the Up/Down buttons to adjust the parameter to the desired value.

Step 5: Press the Edit/Save button. The display now stops flashing and shows the new parameter value that has been saved by the device.

Appendix B—Protection

Thermal Overload

The S611 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 *Overld Trip FLA* parameter to program the trip current. It is programmable from 50–100% of the unit's rated current.

Overload—Adjustment Range

Frame Size	FLA Current Range	Catalog Number
A	26–52A	S611A052N3S
	32.5–65A	S611A065N3S
	38.5–77A	S611A077N3S
B	48–99A	S611B099N3S
	62.5–125A	S611B125N3S
C	78–156A	S611C156N3S
	90–180A	S611C180N3S
D	120–242A	S611D242N3S
E	151–302A	S611E302N3S
	180.5–361A	S611E361N3S
F	207–414A	S611F414N3S

WARNING

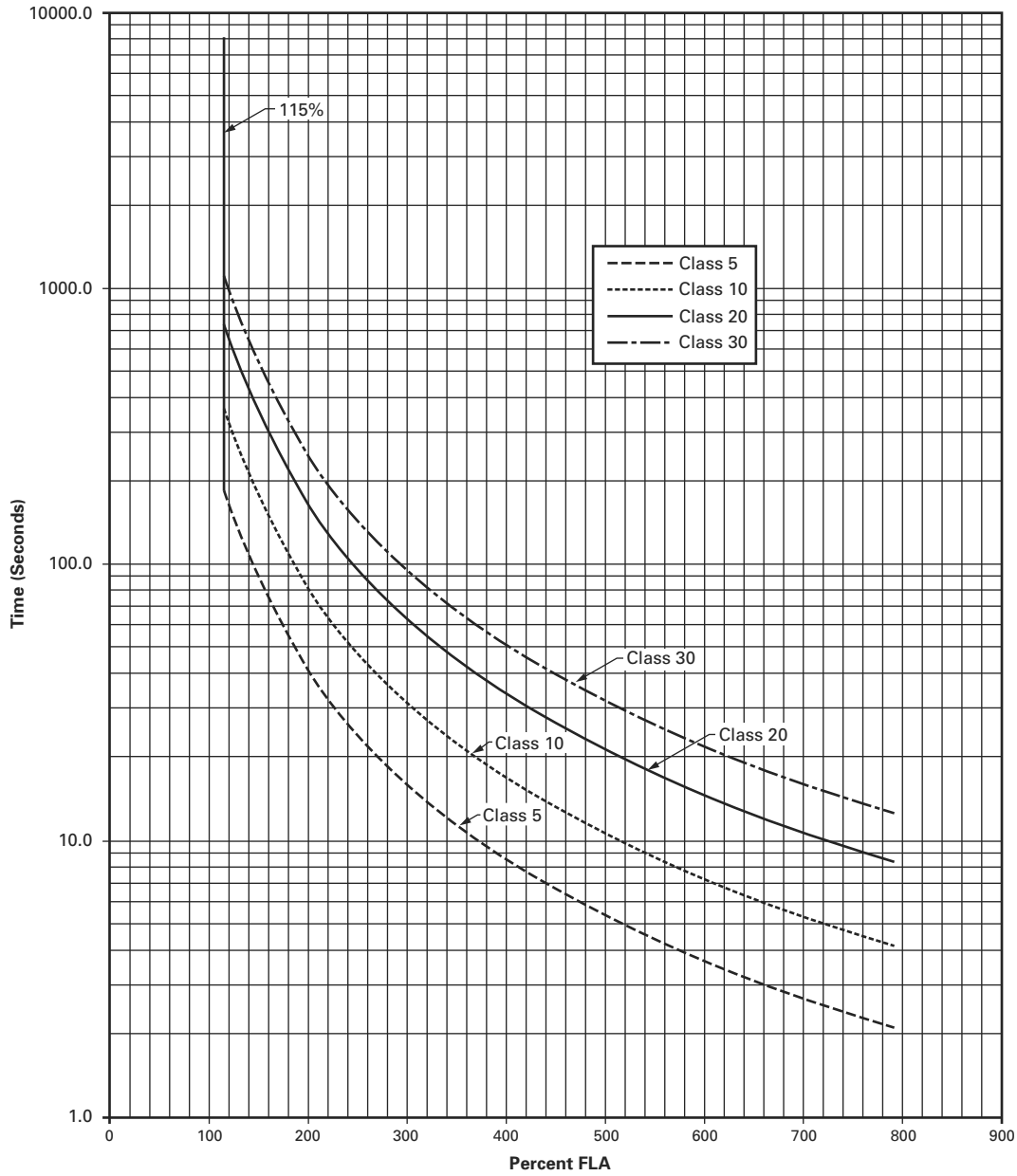
Setting the Overload Trip Class parameter to OFF disables this feature resulting in no thermal overload protection for the motor.

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 (OFF, 5 0 30) is set with the *Overld Trip Class* parameter.

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

Overload Trip Curves



S611 Motor Protection Parameters

The S611 implements the following protection features. Each protection feature is individually configured and enabled by the user. Some of the features are designed to protect the motor and others are for internal protection of the S611.

Motor Parameters

One or more of the motor protection features need the following motor parameters. The user must input these values prior to enabling protection.

Motor Parameters Required for Protection

Parameter	Set Point Range	Step	Default	Notes
Motor rated voltage	130–600	1	480	Settable from the UI Mode O/P LED Operation Motor rated voltage
Motor FLA	26–414 (depends on unit ID)	FLA <100, 0.1A FLA ≥100, 1A	Depends on unit ID	Settable from the UI Mode O/P LED Operation Motor FLA
Trip class	Off, 5–30	1	20	Settable from the UI Mode O/P LED Protection Trip class
Phase sequence	0 = Don't care 1 = ABC 2 = ACB	N/A	1 = ABC	Settable from UI Mode O/P LED Protection Phase sequence

Instantaneous Overcurrent

When the bypass contactors are not engaged, the S611 monitors the maximum rms value of the three-phase currents. The unit will trip with an instantaneous overcurrent fault if the maximum value exceeds six times the catalog FLA setting for 1.5 seconds. This internal protection mechanism is most useful for protecting the S611 from starting a motor too large for its ratings.

Instantaneous Overcurrent Settings

Parameter	Set Point Range	Step	Default	Notes
Trip threshold	600% of catalog FLA	N/A	N/A	Not user settable
Trip delay	1.5 seconds	N/A	N/A	Not user settable

Motor Stall

The S611 monitors the maximum rms value of the three-phase currents. The unit will trip with a motor stall fault if the stall fault is enabled and the maximum rms value exceeds the trip threshold setting when the start time setting expires.

Motor Stall Settings

Parameter	Set Point Range	Step	Default	Notes
Trip threshold	OFF, 150–300% of FLA setting	1%	200%	Settable from the UI Mode O/P LED Protection Stall trip %
Trip delay	N/A	N/A	N/A	Instantaneous rms value at end-of-ramp is used

Motor Jam

When the bypass contactors are closed, the S611 monitors the maximum rms value of the three-phase currents. The unit will trip with a motor jam fault if the jam trip is enabled and the maximum rms value exceeds the trip threshold for the duration of the trip delay.

Motor Jam Settings

Parameter	Set Point Range	Step	Default	Notes
Trip threshold	OFF, 150–400% of FLA setting	1%	300%	Settable from the UI
				Mode O/P LED
				Protection Jam trip %
Trip delay	1–20 seconds	1	2 seconds	Settable from the UI
				Mode O/P LED
				Protection Advanced Conf—P.14

Contactors Overcurrent

The contactor overcurrent trip is active only if the jam fault trip is disabled. When the bypass contactors are closed, the S611 monitors the maximum rms value of the three-phase currents. The unit will trip with a contactor overcurrent fault if the maximum rms value exceeds four times the catalog FLA for the class dependent trip delay.

Motor (Contactor) Overcurrent Settings

Parameter	Set Point Range	Step	Default	Notes
Trip threshold	400% of catalog FLA	N/A	N/A	Not user settable
Trip delay		N/A	N/A	Not user settable
Class = 5	4.5 seconds			S611 never trips on overload at catalog FLA
Class ≤ 10	9.0 seconds			S611 is programmed to let overload fault trip first at catalog FLA
Class ≤ 20	16.0 seconds			
Class ≤ 30	23.0 seconds			

SCR Overcurrent

The SCR overcurrent trip is only active if the stall fault trip is disabled. The S611 monitors the maximum rms value of the three-phase currents. The unit will trip with an SCR overcurrent fault if the stall fault is disabled and the maximum rms value exceeds three times the FLA setting when the start time setting expires.

SCR Overcurrent Settings

Parameter	Set Point Range	Step	Default	Notes
Trip threshold	300% FLA	N/A	N/A	Only active if stall is disabled
Trip delay	N/A	N/A	N/A	Instantaneous rms value at end-of-ramp is used

Under Load

When the bypass contactors are closed, the S611 monitors the average value of the three-phase power or currents as a percent of rated kW or Current. The unit will trip with a load disconnect fault if the monitored value falls below the trip threshold for greater than the trip delay time. The low power setting should be used when trying to detect a dead headed pump.

Under Load Settings

Parameter	Set Point Range	Step	Default	Notes
Trip threshold	OFF, 1–50% rated	1%	Off	Settable from the UI
				Mode O/P LED
				Protection Load disconnect %
Trip delay	1–60 seconds	1	5 seconds	Settable from the UI
				Mode O/P LED
				Operation Advanced Conf—P.18
Trip source	0 = Rated kW 1 = Current	N/A	0	Settable from the UI
				Mode O/P LED
				Operation Advanced Conf—P.19

Current Imbalance

The S611 monitors the current imbalance when the motor is running. The unit will trip with a motor phase imbalance fault if the current imbalance trip is enabled and the percent imbalance exceeds the trip threshold for the trip delay and the maximum current is greater than half the FLA setting.

Current Imbalance Settings

Parameter	Set Point Range	Step	Default	Notes
Trip threshold	OFF, 1–100% imbalance	1%	20%	Settable from the UI
				Mode O/P LED
				Protection Current unbal %
Trip delay	1–20 seconds	1	5 seconds	Settable from the UI
				Mode O/P LED
				Operation Advanced Conf—P.16

Phase Loss

The S611 monitors the current imbalance when the motor is running. Phase loss is an extreme case of current imbalance. The unit will trip with a motor phase loss fault if the phase loss trip is enabled, the percent imbalance exceeds the trip threshold for the trip delay and current increases above FLA trip setting.

Phase Loss Settings

Parameter	Set Point Range	Step	Default	Notes
Trip threshold	OFF, ON	N/A	ON	Settable from the UI
				Mode O/P LED
				Protection Phase loss
Trip delay	N/A	N/A	N/A	N/A

Motor Phase Reversal

The S611 monitors the phase voltages to determine the incoming phase sequence (ABC or ACB). If the monitored sequence differs from the trip setpoint setting, a motor phase reversal fault is issued. The phase reversal trip will need to be disabled when using an upstream reverser.

Motor Phase Reversal Settings

Parameter	Set Point Range	Step	Default	Notes
Trip threshold	OFF (0)	N/A	ABC (1)	Settable from the UI
	ABC (1)			Mode O/P LED
	ACB (2)			Protection Phase sequence
Trip delay	N/A	N/A	N/A	N/A

Voltage Phase Imbalance

The S611 monitors the voltage imbalance when the motor is off and checks the value just prior to starting to determine if a fault shall be issued and the start will be terminated. When the bypass contactors are engaged, the S611 monitors the voltage imbalance and issues a voltage imbalance fault if the measured value exceeds the threshold for the trip delay time. Note that the S611 will not generate a voltage imbalance fault when the motor is starting.

Voltage Phase Imbalance Settings

Parameter	Set Point Range	Step	Default	Notes
Trip threshold	OFF, 1–20% imbalance	1%	6%	Settable from the UI
				Mode O/P LED
				Protection Voltage unbal %
Trip delay	1–60 seconds	1	10 seconds	Settable from the UI
				Mode O/P LED
				Operation Advanced Conf—P.22

Under Voltage

The S611 monitors the minimum rms voltage and checks the value just prior to starting to determine if a fault shall be issued and the start terminated. When the bypass contactors are engaged, the S611 monitors the minimum rms voltage and issues an under voltage fault if the measured value drops below the threshold for the trip delay time. Note that the S611 will not generate an under voltage fault when the motor is starting.

Under Voltage Settings

Parameter	Set Point Range	Step	Default	Notes
Trip threshold	OFF, 1–99% rated voltage	1%	90%	Settable from the UI
				Mode O/P LED
				Protection Under voltage %
Trip delay	1–60 seconds	1	10 seconds	Settable from the UI
				Mode O/P LED
				Operation Advanced Conf—P.20

Over Voltage

The S611 monitors the maximum rms voltage and checks the value just prior to starting to determine if a fault shall be issued and the start will be terminated. When the bypass contactors are engaged, the S611 monitors the maximum rms voltage and issues a over voltage fault if the measured value exceeds the threshold for the trip delay time. Note that the S611 will not generate an over voltage fault when the motor is starting.

Over Voltage Settings

Parameter	Set Point Range	Step	Default	Notes
Trip threshold	OFF, 101–120% rated voltage	1%	110%	Settable from the UI
				Mode O/P LED
				Protection Under voltage %
Trip delay	1–60 seconds	1	10 seconds	Settable from the UI
				Mode O/P LED
				Operation Advanced Conf—P.21

Device Current Protection

The S611 has a number of protection mechanisms that cannot be disabled by the customer. These are to protect both the motor and the starter itself.

Device Current Protection Values

Type	Trip Threshold	Time Before Trip (Seconds)	When in Effect
SCR inrush current	6x (Cat# FLA)	<1.5	Always, when not in bypass
SCR overcurrent	3x (FLA)	At end of ramp	Stall disabled, on SCRs
Contactor overcurrent	4x (Cat# FLA)	4.5 seconds	<ul style="list-style-type: none"> Jam DIP switch and in bypass Note these have been modified from S811 based on contactor evaluation
		9.0 seconds	
		16.0 seconds	
		23.0 seconds	
Pole over temperature	>100°C	1 second	Always

SCR Not Firing (SCR Not Conducting)

The S611 has detection for SCRs not firing. This typically catches broken wires to the SCRs, disconnected cables, nonfunctioning SCRs, and firing circuit failure. This also captures Open SCR condition. The firmware monitors the number of current stops detected after firing. If no current stops are detected on a phase for a number of cycles, then the SCR not firing fault is issued.

Shorted SCR

The S611 has detection for shorted SCRs. The shorted SCR fault is triggered if the S611 detects current flowing when the motor is off or if the BEMF pulses for a phase disappear and the voltage across the SCR is near 0 (not exactly 0 due to noise considerations) when a start is commanded.

The soft starter has several different modes of current and voltage protection to help protect the motor and the starter itself. Depending on how the device is set up, different levels of protection can be attained.

Appendix C—Ratings, Cooling and Power Losses

Power Ratings

Note: Always refer to motor plate FLA and ensure that the motor plate FLA is equal to or lower than the maximum current value in the tables.

Standard Duty—300% Current for 15 Seconds, 115% Continuous

Maximum Current (Amps)	Horsepower Rating				Catalog Number
	208V	240V	480V	600V	
52	15	15	40	50	S611A052N3S
65	20	20	50	60	S611A065N3S
77	25	25	60	75	S611A077N3S
99	30	30	75	100	S611B099N3S
125	40	40	100	125	S611B125N3S
156	50	60	125	150	S611C156N3S
180	60	60	150	150	S611C180N3S
242	75	75	200	250	S611D242N3S
302	100	100	250	300	S611E302N3S
361	125	150	300	350	S611E361N3S
414	150	150	350	450	S611F414N3S

Standard Duty Plus—350% FLA for 30 Seconds, 115% Continuous

Maximum Current (Amps)	Horsepower Rating				Catalog Number
	208V	240V	480V	600V	
52	15	15	40	50	S611A052N3S
65	20	20	50	60	S611A065N3S
71	20	25	60	75	S611A077N3S
99	30	30	75	100	S611B099N3S
119	40	40	100	125	S611B125N3S
156	50	60	125	150	S611C156N3S
180	60	60	150	150	S611C180N3S
242	75	75	200	250	S611D242N3S
302	100	100	250	300	S611E302N3S
361	125	150	300	350	S611E361N3S
407	150	150	350	400	S611F414N3S

Note: Always refer to motor plate FLA and ensure that the motor plate FLA is equal to or lower than the maximum current value in the tables.

Heavy Duty—500% FLA for 30 Seconds, 125% Continuous

Maximum Current (Amps)	Horsepower Rating				Catalog Number
	208V	240V	480V	600V	
49	15	15	40	50	S611A052N3S
83	25	30	60	75	S611B099N3S
142	40	60	125	150	S611C156N3S
225	75	75	200	200	S611D242N3S
256	75	100	200	250	S611E361N3S
285	100	125	250	300	S611F414N3S

Severe Duty—600% FLA for 30 Seconds, 125% Continuous

Maximum Current (Amps)	Horsepower Rating				Catalog Number
	208V	240V	480V	600V	
41	10	15	30	40	S611A052N3S
69	20	30	60	60	S611B099N3S
117	30	50	100	125	S611C180N3S
187	60	75	150	200	S611D242N3S
213	75	75	150	200	S611E361N3S
238	75	100	200	250	S611F414N3S

Power Losses

The following table lists the maximum power loss for each S611 soft starter when it is operating in the across-the-line mode with its bypass contactor pulled in. 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

Frame Size	FLA Current Range	Power Loss (Watts)	Catalog Number
A	26–52A	32	S611A052N3S
	32.5–65A	37	S611A065N3S
	38.5–77A	42	S611A072N3S
B	48–99A	44	S611B099N3S
	62.5–125A	55	S611B125N3S
C	78–156A	61	S611C156N3S
	90–180A	73	S611C180N3S
D	120–242A	100	S611D242N3S
E	151–302A	70	S611E302N3S
	180.5–361A	89	S611E361N3S
F	207–414A	110	S611F414N3S

Appendix D—Motor/Application Considerations

Line and Load Power Wiring—Cross Reference Tables

These tables are provided as a cross reference of various wire connector manufacturers only.

The wire connectors (lugs) in these tables have not been evaluated under all conditions. Customers are instructed to contact the wire connector (lug) manufacturers for the latest technical details on these wire connectors.

Mechanical terminals may be used with copper or aluminum conductors.

Mechanical Terminals

Manufacturer	S611A052XXX	S611A065XXX	S611A077XXX	S611B099XXX	S611B125XXX	S611C156XXX
IlSCO	TA-2/0	TA-2/0	TA-2/0	TA-300	TA-300	TA-600

Mechanical Terminals, continued

Manufacturer	S611C180XXX	S611D242XXX	S611E302XXX	S611E361XXX	S611F414XXX
IlSCO	TA-600	TA-600	AU-600-2NS	AU-600-2NS	AU-600-2NS

Compression terminals cannot be used with aluminum conductors.

Compression Terminals (IlSCO)

Conductor Size	S611A052XXX	S611A065XXX	S611A077XXX	S611B099XXX	S611B125XXX	S611C156XXX
8 AWG	CSWS-8-14	CSWS-8-14	CSWS-8-14	—	—	—
6 AWG	CSWS-6-14	CSWS-6-14	CSWS-6-14	CSWS-6-14	CSWS-6-14	—
5 AWG	CSWS-4-14	CSWS-4-14	CSWS-4-14	CSWS-4-14	CSWS-4-14	—
4 AWG	CSWS-4-14	CSWS-4-14	CSWS-4-14	CSWS-4-14	CSWS-4-14	—
3 AWG	CSWS-3-14	CSWS-3-14	CSWS-3-14	CSWS-3-14	CSWS-3-14	CSWS-3-38
2 AWG	—	—	—	CSWS-2-14	CSWS-2-14	CSWS-2-38
1 AWG	—	—	—	CSWS-1-14	CSWS-1-14	CSWS-1-38
1/0 AWG	—	—	—	CSWS-1/0-14	CSWS-1/0-14	CSWS-1/0-38
2/0 AWG	—	—	—	CSWS-2/0-14	CSWS-2/0-14	CSWS-2/0-38
3/0 AWG	—	—	—	—	—	CSWS-3/0-38
4/0 AWG	—	—	—	—	—	CSWS-4/0-38
250 kcmil	—	—	—	—	—	—
300 kcmil	—	—	—	—	—	—
350 kcmil	—	—	—	—	—	—

Compression Terminals (Ilsco), continued

Conductor Size	S611C180XXX	S611D242XXX	S611E302XXX	S611E361XXX	S611F414XXX
8 AWG	—	—	—	—	—
6 AWG	—	—	—	—	—
5 AWG	—	—	—	—	—
4 AWG	—	—	—	—	—
3 AWG	CSWS-3-38	—	—	—	—
2 AWG	CSWS-2-38	—	—	—	—
1 AWG	CSWS-1-38	—	—	—	—
1/0 AWG	CSWS-1/0-38	CSWS-1/0-38	—	—	—
2/0 AWG	CSWS-2/0-38	CSWS-2/0-38	—	—	—
3/0 AWG	CSWS-3/0-38	CSWS-3/0-38	CSWD-4/0-12-134	CSWD-4/0-12-134	—
4/0 AWG	CSWS-4/0-38	CSWS-4/0-38	CSWD-4/0-12-134	CSWD-4/0-12-134	—
250 kcmil	—	CSWS-250-38	CSWD-250-12-134	CSWD-250-12-134	—
300 kcmil	—	CSWS-300-38	CSWD-300-12-134	CSWD-300-12-134	CSWD-300-12-134
350 kcmil	—	CSWS-350-38	CSWD-350-12-134	CSWD-350-12-134	CSWD-350-12-134

Compression Terminals (Burdny)

Conductor Size	S611A052XXX	S611A065XXX	S611A077XXX	S611B099XXX	S611B125XXX	S611C156XXX
8 AWG	YA8CL1-BOX	YA8CL1-BOX	YA8CL1-BOX	—	—	—
6 AWG	YA6CL-BOX	YA6CL-BOX	YA6CL-BOX	YA6CL-BOX	YA6CL-BOX	—
5 AWG	YA5CL-BOX	YA5CL-BOX	YA5CL-BOX	YA5CL-BOX	YA5CL-BOX	—
4 AWG	YA4CL-BOX	YA4CL-BOX	YA4CL-BOX	YA4CL-BOX	YA4CL-BOX	—
3 AWG	YA3CL	YA3CL	YA3CL	YA3CL	YA3CL	YA3CTC38
2 AWG	—	—	—	YA2CL2-BOX	YA2CL2-BOX	YA2CL4-BOX
1 AWG	—	—	—	YA1CL2	YA1CL2	YA1CL4-BOX
1/0 AWG	—	—	—	YA1CL2	YA1CL2	YA25L4-BOX
2/0 AWG	—	—	—	YA26L2-BOX	YA26L2-BOX	YA26L-BOX
3/0 AWG	—	—	—	—	—	YA27L4-BOX
4/0 AWG	—	—	—	—	—	YA28L4-BOX
250 kcmil	—	—	—	—	—	—
300 kcmil	—	—	—	—	—	—
350 kcmil	—	—	—	—	—	—

Compression Terminals (Burndy), continued

Conductor Size	S611C180XXX	S611D242XXX	S611E302XXX	S611E361XXX	S611E414XXX
8 AWG	—	—	—	—	—
6 AWG	—	—	—	—	—
5 AWG	—	—	—	—	—
4 AWG	—	—	—	—	—
3 AWG	YA3CTC38	—	—	—	—
2 AWG	YA2CL4-BOX	—	—	—	—
1 AWG	YA1CL4-BOX	—	—	—	—
1/0 AWG	YA25L4-BOX	YA25L4-BOX	—	—	—
2/0 AWG	YA26L-BOX	YA26L-BOX	—	—	—
3/0 AWG	YA27L4-BOX	YA27L4-BOX	YA27-2LN	YA27-2LN	—
4/0 AWG	YA28L4-BOX	YA28L4-BOX	YA28-2LN	YA28-2LN	—
250 kcmil	—	YA29L4	YA29-2LN	YA29-2LN	—
300 kcmil	—	YA30L24	YA30-2LN	YA30-2LN	YA30-2LN
350 kcmil	—	YA31L11	YA31-2LN	YA31-2LN	YA31-2LN

Compression Terminals (Penn-Union)

Conductor Size	S611A052XXX	S611A065XXX	S611A077XXX	S611B099XXX	S611B125XXX	S611C156XXX
8 AWG	BLU-8S15	BLU-8S15	BLU-8S15	—	—	—
6 AWG	BLU-6S1	BLU-6S1	BLU-6S1	BLU-6S1	BLU-6S1	—
5 AWG	BLU-5S1	BLU-5S1	BLU-5S1	BLU-5S1	BLU-5S1	—
4 AWG	BLU-4S1	BLU-4S1	BLU-4S1	BLU-4S1	BLU-4S1	—
3 AWG	BLU-3S1	BLU-3S1	BLU-3S1	BLU-3S1	BLU-3S1	BLU-3S3
2 AWG	—	—	—	BLU-2S	BLU-2S	BLU-2S2
1 AWG	—	—	—	BLU-1S9	BLU-1S9	BLU-1S1
1/0 AWG	—	—	—	BLU-1/0S19	BLU-1/0S19	BLU-1/0S1
2/0 AWG	—	—	—	BLU-2/0S20	BLU-2/0S20	BLU-2/0S
3/0 AWG	—	—	—	—	—	BLU-3/0S
4/0 AWG	—	—	—	—	—	BLU-4/0S
250 kcmil	—	—	—	—	—	—
300 kcmil	—	—	—	—	—	—
350 kcmil	—	—	—	—	—	—

Compression Terminals (Penn-Union), continued

Conductor Size	S611C180XXX	S611D242XXX	S611E302XXX	S611E361XXX	S611F414XXX
8 AWG	—	—	—	—	—
6 AWG	—	—	—	—	—
5 AWG	—	—	—	—	—
4 AWG	—	—	—	—	—
3 AWG	BLU-3S3	—	—	—	—
2 AWG	BLU-2S2	—	—	—	—
1 AWG	BLU-1S1	—	—	—	—
1/0 AWG	BLU-1/0S1	BLU-1/0S1	—	—	—
2/0 AWG	BLU-2/0S	BLU-2/0S	—	—	—
3/0 AWG	BLU-3/0S	BLU-3/0S	BLU-3/0D	BLU-3/0D	—
4/0 AWG	BLU-4/0S	BLU-4/0S	BLU-4/0D	BLU-4/0D	—
250 kcmil	—	BLU-025S2	BLU-025D	BLU-025D	—
300 kcmil	—	BLU-030S7	BLU-030D	BLU-030D	BLU-030D
350 kcmil	—	BLU-035S1	BLU-035D	BLU-035D	BLU-035D

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. A disconnecting means should be installed within sight of the S611, 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. A disconnecting means should be installed within sight of the S611, per local code. The S611 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 motor's 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 used 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 ft 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.

Appendix E—Special Function Option

Pump Control Option

This option is intended to reduce the potential for water hammer in a centrifugal pump system by using 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 S611 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.

The pump control option is a factory installed feature. Factory installed options are designated by the eighth character in the catalog number. Unmodified S611 soft starters have an **N** as their eighth character. S611 soft starters with the pump control option have a **P** as their eighth character, as in S611xxx**P**3S.

Installation

Install and wire your S611 soft starter per the instructions found in the beginning of this manual.

Setup

All pump control parameters are set via the UI. Units configured with the pump control option can activate this feature by selecting the pump option under the UI “Start Method” parameter.

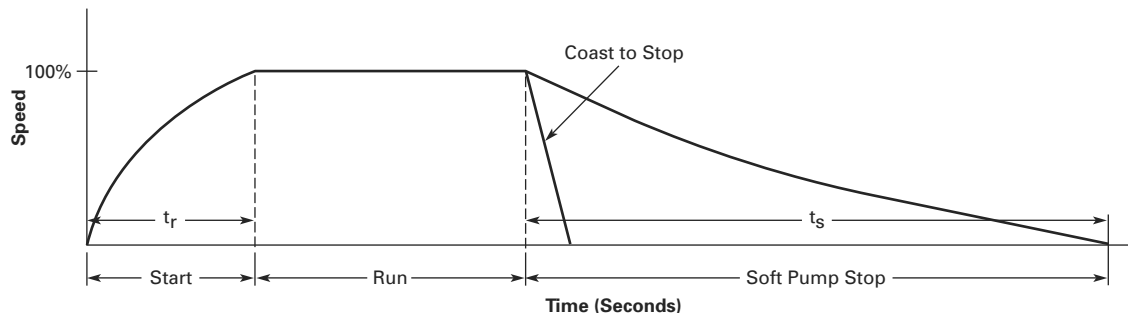
Adjustment

All of the adjustments to the S611 soft starter are made as noted in this user manual. The major difference between the standard S611 soft starter and one with the pump start option is the special algorithm for gentle start and stop with centrifugal flow loads to minimize the potential for water hammer.

Using the UI, set the S611 soft start configuration parameters described below:

The *Start Ramp Time* parameter adjusts the start ramp. It has a standard range of 0.5–180.0 seconds. The factory default is 20.0 seconds. The soft stop time is adjusted by *Pump Stop*, which has a range of 5.0–120.0 seconds with the factory default being 10.0 seconds. (**Note:** The *Stop Ramp Time* setting used in non-pump S611s 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 because the stop might not differ much from a coast-to-stop. The soft stop time adjustment may often be in the range of 30–40 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 S611 soft starter or motor thermal limits.

Pump Control Option



Appendix F—Network Communications (Modbus)

Modbus with IO Functionality

Modbus General Specifications

Parameter	Value
Mode	Slave mode only
Byte characteristics	RTU: 8 bit, even parity, 1 stop bit ASCII: 7 bit, even parity, 1 stop bit
Slave response to master	10 ms plus the time it takes to transmit response (when applicable)
Commands supported	0x01 Read Coils 0x02 Read Discrete Inputs 0x03 Read Holding Registers 0x04 Read Input Register 0x05 Write Single Coil 0x06 Write Single Register 0x0F Write Multiple Coils (15) 0x10 Write Multiple Registers (16) 0x17 Read/Write Multiple Registers (23) 0x2B/0x0E Read Device Identification Get Device Identity (43/14)
Protocol supported	ASCII or RTU
Electrical signaling	RS-485 (ANSI/TIA/EIA-485), two-wire
Checksum	CRC 16 bit 0x8005 (or CRC-CCITT 0x1021)
Maximum data signaling error accepted	2% in reception, 1% in transmission
Maximum number of devices ^①	32 (1 unit load per RS-485)
LED indication	Device busy
Maximum cable length	Dependent on baud rate, cable characteristics (gauge, capacitance, or impedance), number of loads, 4000 ft maximum theoretical. Reference <i>Modbus-IDA over Serial Line Specification and Implementation Guide</i> and EIA-485 for details
Maximum number of writes to non-volatile memory	Unlimited
Connector style	Screw terminal
Network topology	Two-wire Modbus, daisy-chain and/or repeater
Line polarization	Not required. Reference <i>Modbus over Serial Line Specification and Implementation Guide</i> and EIA-485 for more information

Note

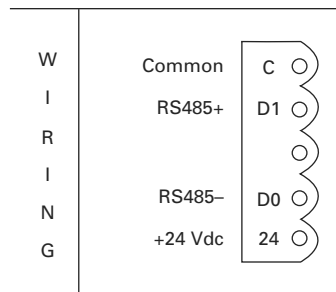
^① Line polarization will reduce maximum number of devices by four.

Circuit Descriptions

Circuit Descriptions

Pin Number	Circuit	EIA-485 Name	Recommended Wire Color	Description
1	Common	C/C	Grey	Power supply common
2	D1	B/B	Yellow	Transceiver terminal 1, V1 voltage, data + (V1 >V0 for binary 1 [OFF] state)
3	N/C	—	—	—
4	D0	A/A	Brown	Transceiver terminal 0, V0 voltage, data –(V0 >V1 for binary 0 [ON] state)
5	24 Vdc	—	Red	Power supply positive

Modbus RS-485 Connections



Additional Modbus Registers

The following Modbus data is provided in addition to the previously listed Modbus registers.

Note: The Modbus register address is –1 of the Modbus register number.

Note: All 32 bit values are Low word first LLLLHHHH. Example: Register 7 = Low word of serial number; Register 8 = High word of serial number.

Modbus Registers

Modbus Coil Number	Modbus Register Number	R/W	Parameter Name	Description
—	1	R	Field inputs	This is a bitfield of inputs. Bit 0 corresponds with input 1, bit 1 corresponds with input 2, and so on
1	—	—	—	Field input 1
2	—	—	—	Field input 2
3	—	—	—	Field input 3
4	—	—	—	Field input 4

Modbus Registers, continued

Modbus Coil Number	Modbus Register Number	R/W	Parameter Name	Description
—	2	R	Control voltage (24 Vdc)	The control voltage register is displayed in millivolts
—	3	R	Ambient board temperature	Temperature is displayed in degrees celsius
—	4	R	Maximum PC board temperature	The maximum ambient temperature seen by the PCB
—	5	R	DIP switch value	Present value of the configuration DIP switch
—	6	R	Configuration CRC	A CRC is calculated on the non-volatile configuration values. The CRC value is intended to provide a quick assessment of configuration state
—	7	R	Communication module serial number	The serial number of the communication module
—	9	R	Communication module firmware revision	Present firmware revision of the communication adapter
—	11	R	Communication module hardware revision	Present hardware revision for the communication adapter PCB
—	101	R/W	Field relay outputs	Present hardware revision for the communication adapter PCB
1601	—	—	—	Field relay output 1
1602	—	—	—	Field relay output 2
—	102	R/W	Field input 1 debounce time	The input debounce can be set for each input point. The debounce value is set in milliseconds. Minimum time is 1 ms. Maximum debounce time is 1000 ms
—	104	R/W	Field input 2 debounce time	
—	106	R/W	Field input 3 debounce time	
—	108	R/W	Field input 4 debounce time	
—	110	R/W	Modbus comm loss timeout value (ms)	Modbus communication loss timeout. The timeout can be set from 0 ms (disabled) to 65535 ms
—	112	R/W	Remote Modbus parity	0 = Even parity, 1 stop bit 1 = Odd parity, 1 stop bit 2 = No parity, 2 stop bits 3 = Even parity, 2 stop bits 4 = Odd parity, 2 stop bits 5 = No parity, 1 stop bit
—	222	R	Product code	0x1108 Modbus 24 Vdc standalone I/O 0x1109 Modbus 120 Vac standalone I/O 0x111C S611 Modbus adapter 24 Vdc I/O 0x111D S611 Modbus adapter 120 Vdc I/O
—	1000	R/W	Modbus production list	The production and consumption registers can be used to create custom Modbus interface ranges. Example: If field inputs register address 0 is put into the first slot of the production list, the field inputs register value will be available in the first slot of the Modbus production data register range. Production data is data provided by the device and consumption data is for data provided (written) to the device. Note that the values must be Modbus register address (for example, register number –1) not register number
—	2000	R	Modbus production data	
—	3000	R/W	Modbus consumption list	
—	4000	R/W	Modbus consumption data	

Modbus Map

Modbus Coil Number	Modbus Register Number	R/W	DCI Descriptor	Notes
—	300	R	DCI_MOTOR_CONTROL_STATUS	—
4785	—	R	Run—bit 0	—
4786	—	R	—	—
4787	—	R	In Bypass—bit 2	—
4788	—	R	—	—
4789	—	R	—	—
4790	—	R	Fault—bit 5	—
4791	—	R	—	—
4792	—	R	—	—
4793	—	R	—	—
4794	—	R	—	—
4795	—	R	—	—
4796	—	R	Relay 1—bit 11	—
4797	—	R	Relay 2—bit 12	—
4798	—	R	Control From Net—bit 13	—
4799	—	R	Permissive—bit 14	—
4800	—	R	—	—
—	301	R	DCI_ORION_CURRENT_SCALE_FACTOR	Scale factor 10
—	302	R	DCI_RMS_CURRENT_IA	Amps * 10
—	303	R	DCI_RMS_CURRENT_IB	Amps * 10
—	304	R	DCI_RMS_CURRENT_IC	Amps * 10
—	305	R	DCI_RMS_CURRENT_AVG	Amps * 10
—	306	R	DCI_RMS_VOLTAGE_VAB	Volts
—	307	R	DCI_RMS_VOLTAGE_VBC	Volts
—	308	R	DCI_RMS_VOLTAGE_VCA	Volts
—	309	R	DCI_RMS_VOLTAGE_AVG	Volts
—	310	R	DCI_TOTAL_KW	kW * 10
—	311	R	DCI_APPARENT_PF	PF * 100
—	312	R	DCI_POWER_SIGN	—
—	313	R	DCI_FREQUENCY	Freq * 100
—	314	R	DCI_OVERLOAD_THERMAL_PILE	Percent
—	315	R	DCI_CURRENT_UNBAL_PERCENT	Percent
—	316	R	DCI_VOLTAGE_UNBAL_PERCENT	Percent
—	317	R	Reserved	—
—	318	R	DCI_TEMP_POLE_1	Deg C * 10
—	319	R	DCI_TEMP_POLE_2	Deg C * 10
—	320	R	DCI_TEMP_POLE_3	Deg C * 10
—	321	R	DCI_POLE_TEMP_AVG	Deg C * 10
—	322	R	DCI_NUMBER_OF_STARTS	Reset though DCI_COMMAND_REGISTER
—	323	R	DCI_RUN_TIME	Hours, reset though DCI_COMMAND_REGISTER

Modbus Map, continued

Modbus Coil Number	Modbus Register Number	R/W	DCI Descriptor	Notes
—	324	R	DCI_TRIP_REASON	—
5169	—	R	Overload	—
5170	—	R	Jam	—
5171	—	R	Stall	—
5172	—	R	Imbalance	—
5173	—	R	Load Disconnect	—
5174	—	R	Phase Loss	—
5175	—	R	Mains Fault	—
5176	—	R	Phase Reversal	—
5177	—	R	Shorted SCR	—
5178	—	R	SCR Not Firing	—
5179	—	R	Pole Overtemp	—
5180	—	R	Bypass Dropout	—
5181	—	R	SCR Overcurrent	—
5182	—	R	Contactors Overcurrent	—
5183	—	R	Communication Fault	—
5184	—	R	Device Fault	—
—	325	R	DCI_FAULT_QUEUE 1	—
—	326	R	DCI_FAULT_QUEUE 2	—
—	327	R	DCI_FAULT_QUEUE 3	—
—	328	R	DCI_FAULT_QUEUE 4	—
—	329	R	DCI_FAULT_QUEUE 5	—
—	330	R	DCI_FAULT_QUEUE 6	—
—	331	R	DCI_FAULT_QUEUE 7	—
—	332	R	DCI_FAULT_QUEUE 8	—
—	333	R	DCI_FAULT_QUEUE 9	—
—	334	R	DCI_FAULT_QUEUE 10	—
—	335	R	DCI_DSP_FIRMWARE_VERSION	—
—	336	R	DCI_DSP_FIRMWARE_BUILD_NUMBER	—
—	337	R	DCI_PIC_FIRMWARE_VERSION	—
—	338	R	DCI_UNIT_ID	—
—	400	R/W	DCI_MOTOR_CONTROL	—
6385	—	—	Run	—
6386	—	—	—	—
6387	—	—	Permissive	—
6388	—	—	Reset	—
6389	—	—	—	—
—	401	R/W	DCI_START_CONTROL_EDGE_LEVEL	0 = Edge 1 = Level (1)

Modbus Map, continued

Modbus Coil Number	Modbus Register Number	R/W	DCI Descriptor	Notes
—	402	R/W	DCI_COMMAND_REGISTER	1 = Clear motor run hours 2 = Clear motor start count 3 = Clear fault queue
—	403	R/W	DCI_CONFIGURATION_RESET	1 = Soft reset 2 = Factory defaults
—	404	R/W	DCI_OVERLOAD_FL A	Amps * 10
—	405	R/W	DCI_MOTOR_RATED_VOLTAGE	Volts, 115–600, (Default = 480)
—	406	R/W	DCI_START_METHOD	0 = Vramp 1 = Limit 2 = Pump
—	407	R/W	DCI_START_TIME	Seconds*10, 0.5–180 (20)
—	408	R/W	DCI_INITIAL_TORQUE	%, 0–100 (45)
—	409	R/W	DCI_STOP_TIME	Seconds*10, 0–120 (0, no pump stop option, 50 with pump stop enabled)
—	410	R/W	Reserved	—
—	411	R/W	DCI_KICK_START_TIME	Seconds*10, 0–2 (0)
—	412	R/W	DCI_KICK_START_TORQUE	%, 0–100 (0)
—	413	R/W	DCI_RESET_MODE	0 = Manual 1 = Auto
—	414	R/W	DCI_ENABLE_DISABLE_TRIP	—
6609	—	—	Overload	—
6610	—	—	Jam	—
6611	—	—	Stall	—
6612	—	—	Current Imbalance	—
6613	—	—	Load Disconnect	—
6614	—	—	Phase Loss	—
6615	—	—	Under Voltage	—
6616	—	—	Over Voltage	—
6617	—	—	Voltage Unbalance	—
6618	—	—	Phase Reversal	—
6619	—	—	Ground Fault	—
6620	—	—	Overload On Start	—
6621	—	—	Shorted SCR	—
6622	—	—	SCR Not Firing	—
6623	—	—	Over Temp	—
6624	—	—	—	—
—	415	R/W	DCI_OVERLOAD_TRIP_CLASS	5–30, (20)
—	416	R/W	DCI_JAM_TRIP_LEVEL	%FLA, 150–400 (300)
—	417	R/W	DCI_JAM_TRIP_DELAY_SECONDS	Seconds 1–20 (2)
—	418	R/W	DCI_STALL_TRIP_LEVEL	%FLA, 150–300 (200)

Modbus Map, continued

Modbus Coil Number	Modbus Register Number	R/W	DCI Descriptor	Notes
—	419	R/W	Reserved	—
—	420	R/W	Reserved	—
—	421	R/W	Reserved	—
—	422	R/W	DCI_CURRENT_UNBALANCE_TRIP_LEVEL	%, 0–100 (2)
—	423	R/W	DCI_CURRENT_UNBALANCE_TRIP_DELAY	Seconds 1–20 (5)
—	424	R/W	DCI_LOAD_DISCONNECT_TRIP_LEVEL	%rated, 1–50 (6)
—	425	R/W	DCI_LOAD_DISCONNECT_TRIP_DELAY_SECONDS	Seconds, 1–60 (5)
—	426	R/W	DCI_LOAD_DISCONNECT_SOURCE	0 = Under power 1 = Under current
—	427	R/W	DCI_PHASE_LOSS_TRIP_LEVEL	%, 0–100 (40)
—	428	R/W	DCI_PHASE_LOSS_TRIP_DELAY	Seconds 1–20 (2)
—	429	R/W	DCI_UNDER_VOLTAGE_PERCENT	%, 1–99 (90)
—	430	R/W	DCI_UNDER_VOLTAGE_TRIP_DELAY_SECONDS	Seconds 1–60 (10)
—	431	R/W	DCI_OVER_VOLTAGE_PERCENT	%, 101–120 (110)
—	432	R/W	DCI_OVER_VOLTAGE_TRIP_DELAY_SECONDS	Seconds 1–60 (10)
—	433	R/W	DCI_VOLTAGE_UNBALANCE_PERCENT	%, 1–20 (6)
—	434	R/W	DCI_VOLTAGE_UNBALANCE_TRIP_DELAY	Seconds 1–60 (10)
—	435	R/W	DCI_PHASE_SEQUENCE	1 = ABC 2 = ACB
—	436	R/W	DCI_FAULT_RELAY_CONFIGURATION	0 = Faulted 1 = Not faulted
—	437	R/W	DCI_AUX_RELAY_CONFIGURATION	0 = Faulted 1 = Not faulted 2 = Bypass 3 = Not in bypass 4 = Motor energized 5 = Not motor energized
—	438	R/W	DCI_UI_EDIT_LOCK	0 = Unlocked 1 = Locked
—	439	R/W	DCI_USER_DISPLAY_CONFIG	0 = Thermal capacity 1 = Power factor 2 = Line frequency 3 = Reserved 4 = Voltage imbal % 5 = Current imbal % 6 = Run time 7 = Average pole temp 8 = Pole A temp 9 = Pole B temp 10 = Pole C temp
—	440	R/W	DCI_MODBUS_ADDRESS	1–247 (1)
—	441	R/W	DCI_MODBUS_BAUD_RATE	0 = 1200 1 = 2400 2 = 4800 3 = 9600 4 = 19200 (default) 5 = 38400 6 = 57600 7 = 115200 8 = Reserved Changes take place on next power cycle

Modbus Map, continued

Modbus Coil Number	Modbus Register Number	R/W	DCI Descriptor	Notes
—	442	R/W	DCI_MODBUS_PARITY	0 = Even parity, 1 stop bit (default) 1 = Odd parity, 1 stop bit 2 = No parity, 2 stop bits 3 = Even parity, 2 stop bits 4 = Odd parity, 2 stop bits 5 = No parity, 1 stop bit
—	443	R/W	DCI_COMM_LOSS_TIMEOUT_MILLISECS	Milliseconds, 1–65000 (2000)
—	444	R/W	DCI_COMM_LOSS_BEHAVIOR	1 = Fault (default) 2 = Hold last state 3 = Stop
—	445	R/W	DCI_NETWORK_WATCHDOG_ENABLE	0 = Disable 1 = Enable (0)

Appendix G—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 S611 soft starter to trip in the process of being commissioned as it is likely that one or more parameter(s) setting are not appropriate.

120 Vac 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)—Overld trip FLA value (Default—frame size minimum)
- Motor rated voltage (Default—480V)
- Start method—Voltage ramp or current limit (Default—voltage ramp)
- Start time—As required (Default—20 seconds)
- Initial torque—As required (Default—45%)
- Auto reset mode—As required (Default—Manual)

Parameter setup—protection mode

- Overld trip class—As required (Default—20)

Parameter setup—operation mode—advanced config parameters

- Start control—As required (Default—Level)
- Relay 1—As required (Default—Run)
- Relay 2—As required (Default—Faulted)
- Network communications parameter setup as required

Note: 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

- FC30—Current phase loss
- FC31—Voltage imbalance
- FC33—Jam
- FC20—Overload
- FC24—Phase reversal
- FC17—SCR not firing
- FC25—Start stall

Existing Installations Checklist

External circuit components issues

- 120 Vac 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

- FC15—Power pole over temperature
- FC31—Voltage imbalance
- FC33—Jam
- FC20—Overload
- FC35—Temperature sensor
- FC17—SCR not firing
- FC18—Shorted SCR
- FC21—Mains AC voltage loss
- FC8—Voltage zero cross lost

General Information

120 Vac control power—terminal block connections

- Run Enable → 24 Vdc applied to terminal “Permissive”. This 120 Vac input must be maintained continuously during RUN
- START Command enable from terminal block → No voltage applied to Network terminals. When a 120 Vac signal is applied to the Network terminal, START control from the terminal block will not be recognized
- START Command → with 120 Vac applied to terminal “Permissive”, apply 120 Vac to terminal “Start”. The signal requirement is momentary, but maintained is acceptable. Terminals “Permissive” and “Start” may be tied together for two-wire control START/STOP commands
- STOP Command → Remove 120 Vac from terminal “Permissive”. Terminals “Permissive” and “Start” may be tied together for two-wire control START/STOP commands
- Wire size, minimum—14 AWG (single conductor) to all terminal block connections. Wire should have no strands 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) A–D Frames = 85 VA, 120 Vac
 - Outrush A–D Frames = 600 VA, 120 Vac for 50 ms minimum
 - Steady state (sealed) E–F Frames = 115 VA, 120 Vac
 - Outrush E–F Frames = 1200 VA, 120 Vac for 50 ms minimum
 - Minimum supply voltage 120 Vac measured at the terminal block
 - Maximum allowable voltage drop measured at the terminal block = 5 Vac

Fault reset details

- If the Fault led is RED, the soft starter is in a fault condition and will not recognize a START command. If a reset attempt is unsuccessful, the fault is still present and must be corrected
- If the soft starter appear to have “tripped”, but the Ready LED is illuminated and there is no new Fault code in memory, verify that the soft starter has not stopped due to a STOP command
- Terminal “Permissive” must be energized (maintained) to enable operation, but will not prevent a fault from being reset. The Ready LED will not be illuminated without a signal at the “Permissive” terminal
- Terminal “Start” energized (momentary or maintained) to issue START command. Signal duration must be a minimum of 500 ms for the soft starter to recognize the START command
- Terminal “Permissive” is de-energized to issue STOP command
- LEVEL sense
 - Most commonly used START control parameter setting
 - **Maintained** “Start” energized:
 - START command is present when terminal “Permissive” 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 120 Vac signal is present on terminal “Start” and terminal “Permissive” and remains energized when the fault condition clears. After a transient fault, this condition may cause the motor to start unexpectedly
 - **Momentary** “Start” energized:
 - Same as maintained

- EDGE sense
 - **Maintained** “Start” energized:
 - After a fault has been RESET the 120 Vac signal must be removed from the terminal “Start” to enable a START command. After a fault has been RESET, re-energizing terminal “Start” (maintained or momentary) will issue a START command
 - **Momentary** “Start” energized:
 - If terminal “Start” 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 “Start” 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
- 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 fault 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 120 Vac control power will not zero the thermal memory

- 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 command
- LED indication conditions
 - Fault
 - Active fault is present, cannot RESET
 - Ready
 - Not responding to START command from field wiring
 - LEVEL sense
 - Insufficient voltage at terminal “Permissive”
 - Insufficient voltage at terminal “Start”
 - EDGE sense
 - Cycle 24 Vdc at terminal “Start”
 - Insufficient voltage at terminal “Permissive”
 - Insufficient voltage at terminal “Start”
 - OFF—All
 - Check for loss of 120 Vac control power and/or less than 100 Vac
 - Check terminal block for condition and security
 - Verify 120 Vac at appropriate terminals
 - Verify proper operation and capacity of CTs

- START command troubleshooting
 - From the terminal block
 - Verify that terminal “Permissive” is energized continuously
 - Verify that 120 Vac is applied to terminal “Start” to issue START command
 - If terminals “Permissive” and “Start” are tied together, verify that both terminals receive 120 Vac START signal
 - If START control parameter is set to EDGE, verify that 120 Vac has been cycled (removed, then reapplied) after faults have been reset

Torque Settings and Corresponding Current Values

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%	Minimum for Current Limit
14%	37%	—
9%	30%	—
1%	10%	Minimum

S611 Fault Codes

Code	Fault	Condition	Solution
3	Watchdog	<ul style="list-style-type: none"> Firmware fault 	—
5	Internal Memory	<ul style="list-style-type: none"> Internal FRam memory error 	<ul style="list-style-type: none"> Component failure on printed circuit board Contact EatonCare for service
6	User Interface Communications Failure	<ul style="list-style-type: none"> Communications to UI have been interrupted Possible hardware failure 	<ul style="list-style-type: none"> Firmware is not communicating internally Cycle 120 Vac control voltage power to attempt to clear problem
<p>Note: The User Interface module is not required (default) for operation of the S611 after the parameters have been set. The S611 may be configured to fault if the User Interface module is removed by enabling the User Interface Comm Loss Fault parameter setting in the Advanced Config. menu. To reinstall a UI that has been removed, remove 120 Vac control power, reinstall the UI, then restore 120 Vac control power.</p>			
7	Internal Program Memory	<ul style="list-style-type: none"> Corrupted firmware or memory Flash CRC 	<ul style="list-style-type: none"> Cycle 120 Vac control power to the S611 Contact EatonCare for service
<p>Note: Internal memory issues may be either a hardware or firmware failure. In the event of a firmware problem, cycling 120 Vac control power may restore proper operation to the S611. If cycling power does not correct the fault condition, contact EatonCare for service.</p>			
8	Voltage Zero Cross Lost	<ul style="list-style-type: none"> Mains voltage lost Phase L1 or L3 lost Load disconnected 	<ul style="list-style-type: none"> Restore mains or lost phases Verify that the load is connected and any disconnect devices are properly engaged Contact EatonCare for service
<p>Note: The SCRs are unable to fire if there is no source voltage and/or load on the unit. Verify that all mains control devices are properly connected and powered prior to initiating a START command.</p>			
9	Communications Loss Port A	<ul style="list-style-type: none"> Communications to a remote network controller was lost during run cycle Device disconnected Connection lost 	<ul style="list-style-type: none"> Reattach network controller, verify that the unit is recognized by the system controller
<p>Note: This fault corresponds only to network communications. It does not relate to internal communications among components on the printed circuit board (PCB).</p>			
10	Communications Loss Port B	<ul style="list-style-type: none"> Communications to a remote network controller was lost during run cycle Device disconnected Connection lost 	<ul style="list-style-type: none"> Reattach network controller, verify that the unit is recognized by the system controller Comms Port B adapter module failed or disconnected
<p>Note: This fault corresponds only to network communications. It does not relate to internal communications among components on the printed circuit board (PCB).</p>			

S611 Fault Codes, continued

Code	Fault	Condition	Solution
15	Power Pole Over Temperature	<ul style="list-style-type: none"> SCR temperature is above limits Operating environment above specified maximum temperature Ventilation holes blocked Fans are not operational Starts/hour exceed specifications Sensor failure on power pole Bypass contactor(s) failed to close 	<ul style="list-style-type: none"> 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
<p>Note:</p> <p>Any power pole temperature in excess of 100°C will cause a fault trip. Observe the temperature values in the UI display 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 UI display 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.</p> <p>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, and so on, 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.</p> <p>Running continuously on the SCRs will generate more heat than can be dissipated by the internal fans, resulting in an over temperature fault trip.</p>			
16	Bypass Failure	<ul style="list-style-type: none"> Internal bypass contactor(s) not closed and/or electrically sealed after ramp time Contactor(s) opened in bypass 	<ul style="list-style-type: none"> Verify all bypass contactor(s) close (audible noise) Verify all bypass contactor(s) not opening during run cycle due to excessive vibration and/or shock Reduce levels of vibration and/or shock Verify control power and wire size meet specifications Verify that the control power supply meets the 120 Vac voltage and current requirements of the soft starter
<p>Note:</p> <p>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 using the SCRs. Bypass contactors may open during the motor run from excessive shock or 120 Vac control voltage sag (insufficient voltage and/or current to maintain contact closure).</p>			
17	SCR Not Firing	<ul style="list-style-type: none"> SCR is not conducting when gated Incoming phase lost Special application—undersized or high impedance motor Load disconnected 	<ul style="list-style-type: none"> SCR failure Re-apply lost phase Review S611 application Circuitry damaged by megger testing Contact EatonCare for service
<p>Note:</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>			
18	Shorted SCR	<ul style="list-style-type: none"> SCR is shorted Internal bypass contactor welded shut No load on the SCRs when START command is issued 	<ul style="list-style-type: none"> Test resistance of each phase Contact EatonCare for service
<p>Note:</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>			

S611 Fault Codes, continued

Code	Fault	Condition	Solution
19	Instantaneous Overcurrent	<ul style="list-style-type: none"> Excessive starting current Excessive load 	<ul style="list-style-type: none"> Reduce starting load Increase soft starter capacity (be sure model ratings can handle current demands)
<p>Note: During the start ramp time, the maximum rms value of the three-phase current(s) are monitored. Instantaneous overcurrent 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 S611 soft starter, NOT the motor rated FLA. Do not confuse this parameter with Thermal Overload (FC20), SCR Overcurrent (FC27), or Contactor Overcurrent (FC34).</p>			
20	Overload	<ul style="list-style-type: none"> Motor overloaded for an extended period of time Thermal memory is over 100% 	<ul style="list-style-type: none"> 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 (5–30 maximum) and/or reduce ramp time setting
<p>Note: Normal thermal memory during routine operation may be observed in the <i>UI</i> display. 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. The thermal memory is stored in non-volatile memory so that the overload fault will not be cleared by cycling control power.</p>			
21	Mains AC Voltage Loss	<ul style="list-style-type: none"> Fuses or breaker open Disconnect open 	<ul style="list-style-type: none"> Replace fuses, close disconnect, or reset breaker
<p>Note: The Mains Loss Fault trip threshold is 80 Vac and is not user settable.</p>			
22	Under Voltage	<ul style="list-style-type: none"> Incoming AC line voltage below trip threshold Incorrect mains supply voltage 	<ul style="list-style-type: none"> Connect to correct supply voltage Verify that mains voltage is within acceptable values Verify <i>Motor Rated Voltage</i> in the <i>Operation</i> mode is set to the correct value
<p>Note: Verify that the value in the <i>Under Voltage</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 80%) of line voltage. The <i>Under Voltage Trip Delay</i> range is 1–60 seconds (default 10 seconds). This feature may be disabled (not recommended). Verify that the mains voltage levels are not decreasing to unacceptable levels during motor run operation. Under voltage during the start ramp time is not monitored. The <i>Motor Rated Voltage</i> range is 115–690 Vac (480 Vac default).</p>			
23	Over Voltage	<ul style="list-style-type: none"> Incoming AC line voltage above trip threshold Incorrect mains supply voltage 	<ul style="list-style-type: none"> Connect to correct supply voltage Verify <i>Motor Rated Voltage</i> in the <i>Operation</i> mode is set to correct value
<p>Note: Verify that the value in the <i>Motor Rated Voltage</i> parameter is set to the correct line voltage and not to a nominal value. <i>Over Voltage</i> trip level threshold range is 101–120% (default 110%) of line voltage. The <i>Over Voltage</i> trip delay range is 1–60 seconds (default 10 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 Voltage</i> range is 115–690 Vac (480 Vac default). Over voltage during the start ramp time is not monitored. Over Voltage—a similar fault that may occur if the mains voltage is in excess of 800 Vac.</p>			
24	Phase Reversal	<ul style="list-style-type: none"> Incoming line phase rotation sequence opposite of device setting Single-phase missing and/or open fuse or breaker 	<ul style="list-style-type: none"> 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
<p>Note: If mains leads need to be changed, exchange 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.</p>			

S611 Fault Codes, continued

Code	Fault	Condition	Solution
25	Start Stall	<ul style="list-style-type: none"> Motor not at rated RPM at end of start ramp time and/or current is in excess of trip threshold Bypass contactors not closed at the end of the start time (start current low/ramp time short) 	<ul style="list-style-type: none"> Lengthen <i>Soft Start Time</i> and/or increase <i>Initial Torque</i> in the <i>Operations</i> mode Increase trip threshold 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>Note: Motor RPM is monitored for a synchronous speed condition when the start ramp time expires. 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 the trip threshold. Stall trip threshold range is 150–300% (default 200%) of motor FLA setting. Verify that the motor is properly sized for the load.</p>			
27	SCR Overcurrent	<ul style="list-style-type: none"> Excessive SCR current during the start ramp Only active when Stall Fault is disabled 	<ul style="list-style-type: none"> Increase <i>Soft Start Time</i> and/or <i>Initial Torque</i> parameters in <i>Operation</i> mode Reduce starting load Verify S611 is properly rated for current
<p>Note: The maximum rms value of the three-phase currents is monitored. The current values observed in the <i>UI</i> display should be within $\pm 5\%$ of each other. The SCR overcurrent trip threshold is 3 x FLA at the end of the start ramp time and is not user settable.</p>			
28	Under Load	<ul style="list-style-type: none"> Loss of motor load Trip threshold set too high Excessive current fluctuation during operation 	<ul style="list-style-type: none"> Inspect for failed motor coupling or pump cavitation Reduce trip threshold Increase trip delay time to ride through transient load changes
<p>Note: When the bypass contactors are closed, the average value of the three-phase power as a percentage of rated power is monitored. Trip occurs when the value falls below the trip threshold for the selected trip delay time. Trip threshold range is 1–50% (default Off) of rated power. Trip delay range is 1–60 seconds (default 5 seconds). Rated kW = $\sqrt{3}$ x Motor Rated voltage x Motor FLA x 0.9 (power factor).</p>			
29	Current Unbalance	<ul style="list-style-type: none"> The current imbalance of the incoming phases exceeds the trip threshold 	<ul style="list-style-type: none"> Correct imbalance problem with mains Increase the <i>Current Imbalance</i> parameters Disable the fault if the other issues cannot be resolved
<p>Note: Current imbalance trip threshold range is 1–100% (default 20%). Current imbalance trip delay range is 0–20 seconds (default is 5 seconds). This feature may be disabled (not recommended).</p>			
30	Current Phase Loss	<ul style="list-style-type: none"> Incoming phase disconnected Open fuse or breaker Phase imbalance exceeds specifications or trip parameter Severe voltage phase imbalance 	<ul style="list-style-type: none"> Repair broken connection Replace fuse Inspect system for phase imbalance conditions
<p>Note: 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 %</i> trip 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.</p>			

S611 Fault Codes, continued

Code	Fault	Condition	Solution
31	Voltage Phase Imbalance	<ul style="list-style-type: none"> The voltage imbalance of the incoming phases exceeds the trip threshold 	<ul style="list-style-type: none"> Correct imbalance problem with mains Increase the <i>Voltage Fault Imbalance</i> parameters Disable the fault if the other issues cannot be resolved
<p>Note: Phase imbalance may be impacted by voltage issues and/or current issues. Voltage imbalance trip threshold range is 1–100% (default 6%). Voltage imbalance trip delay range is 0–60 seconds (default 10 seconds). Voltage phase imbalance protections may be disabled (not recommended).</p> <p>Note: 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 %</i> trip 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.</p>			
33	Jam	<ul style="list-style-type: none"> Soft starter in bypass: Motor below rated RPM and/or current exceeds 3 x motor FLA 	<ul style="list-style-type: none"> Remove obstruction Verify proper FLA setting in Operation mode Jam fault can be disabled if trips occur during normal operation (Overcurrent fault will provide protection at a higher current threshold of 4 x catalog FLA)
<p>Note: The jam fault may be disabled (not recommended). The maximum rms value of the three-phase currents is monitored when the internal bypass contactors are closed. The jam fault trip threshold range is 150–400% of motor FLA. Jam trip delay range is 1–20 seconds (default is 2.0 seconds).</p>			
34	Contactor Overcurrent	<ul style="list-style-type: none"> Only active in bypass if the jam fault is disabled Current exceeds the fault threshold of 4 x catalog FLA 	<ul style="list-style-type: none"> Remove obstruction in motor drive train Verify S611 is properly sized for the application
<p>Note: This feature is active only with the <i>Jam Fault</i> trip parameter disabled, and the internal bypass contactor(s) are closed. This results in a higher current trip threshold in most cases. Monitors the maximum rms value of the three-phase current and is not user settable. Catalog FLA refers to the maximum continuous line current capacity of the frame size of the S611, NOT the motor rated FLA. At 4 x FLA, the following approximate trip delay times are; Class 5 = 4.5 seconds, Class 10 = 9.0 seconds, Class 20 = 16.0 seconds, Class 30 = 23.0 seconds. Do not confuse this parameter with Instantaneous Overcurrent (FC19), Thermal Overload (FC20), or SCR Overcurrent (FC27).</p>			
35	Missing Temp Sensor	<ul style="list-style-type: none"> Temperature sensor failure Internal connection failure 	<ul style="list-style-type: none"> Internal hardware failure (sensor and/or cable) Note: Disabling this feature (<i>Temp Sense</i> fault in <i>Protection</i> menu) will remove protection from excessive temperature exposure (not recommended) Not field repairable, contact Eaton Support
<p>Note: 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>UI</i> display 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>UI</i> display monitors a sensor mounted directly on the PCB and is not related to any Temperature Sensor fault. Contact EatonCare for service.</p>			
*	Cannot RESET fault	<ul style="list-style-type: none"> Fault condition still exists Soft starter has not received RESET signal 	<ul style="list-style-type: none"> Troubleshoot fault and correct defective condition Attempt alternate methods of RESET
<p>Note: The RESET signal can be applied to the “Reset” terminal of the control voltage terminal block.</p>			
NC	No communication	<ul style="list-style-type: none"> Firmware not programmed, firmware corrupted 	<ul style="list-style-type: none"> Contact EatonCare for service

Note: 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.

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