

Cutler-Hammer Intelligent Technology (IT) S801N and S801R Soft Starter Models Quick Setup Guide

Introduction

The Intelligent Technology (IT) Soft Starter is an electronic, self-contained, panel or enclosure mounted motor soft-starting device. It is intended to provide 3-phase induction motors with a smooth start, both mechanically and electrically. The IT line of soft starters utilizes six thyristors connected in a full wave power bridge. The voltage and current applied to the motor is controlled by varying the thyristor conduction period. This, in turn, controls the torque supplied by the motor. After the motor reaches speed, single phase bypass contactors are energized to bypass the thyristors.

The Intelligent Technology (IT) Soft Starter is designed to fulfill the industrial service requirements for applications such as chiller starters, pump panels, and machine tools.

The Intelligent Technology (IT) Soft Starter meets all relevant specifications set forth by ICS-1, ICS-2, ICS-5, UL508, IEC 60947-4-2, CE, and CSA.

This leaflet is intended to cover basic installation and setup for Models S801N and S801R Soft Starters. For a copy of the S801 Soft Start User Manual (publication 49003), contact Cutler-Hammer.

No publication can take into account every possible situation. If you require further assistance with any aspect of this product or a particular application, feel free to contact us. You will find our address, phone number, and other contact information on the back cover of this instruction leaflet.

Inspection

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 carton damage to the carrier prior to accepting the delivery. Have this information noted on the freight bill. Cutler-Hammer is not responsible for damage incurred in shipping.

Unpacking

Remove all packing material from the unit. Be sure to remove all packing material from lug locations. Also, make sure no packing material blocks the air flow near the fans.

Check the unit for any signs of shipping damage. If further damage to the product is found after unpacking, report it to the freight company. Retain the packing materials for carrier to review.

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

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 between -50°C and 70°C (-58°F and 158°F).
- The relative humidity is between 0% and 95%, non-condensing
- The environment is dry, clean, and non-corrosive
- The unit will not be subjected to high shock or vibration conditions

Mounting Dimensions

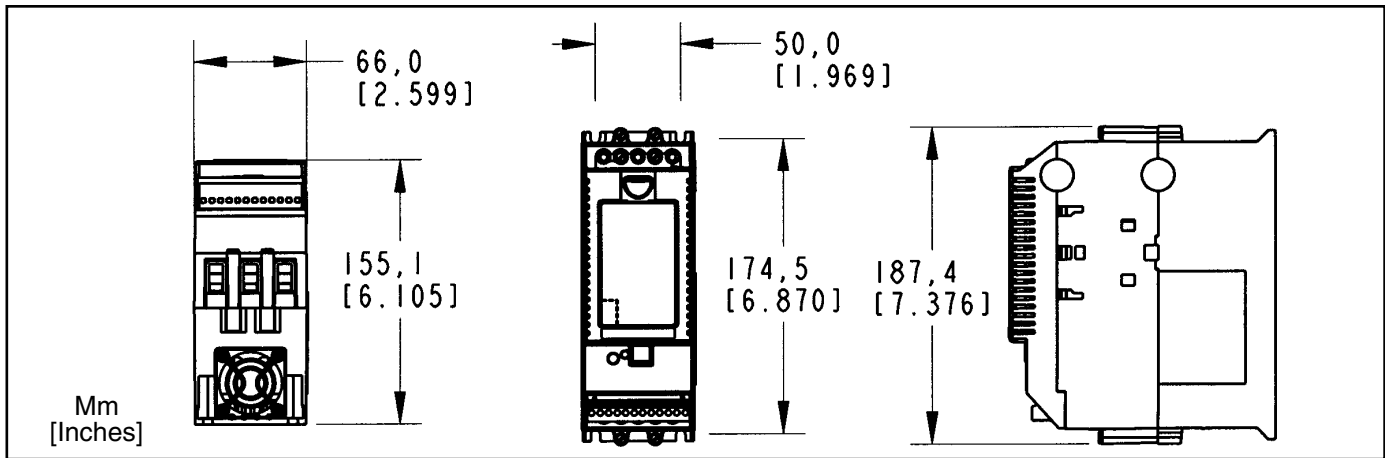


Fig. 1 Model S801N (65mm)

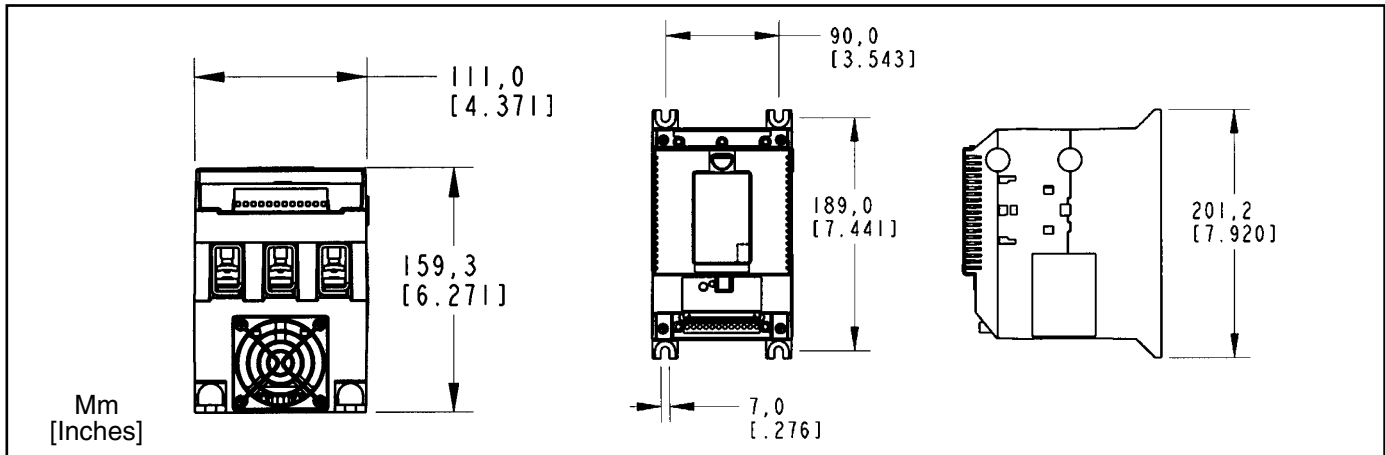


Fig. 2 Model S801R (110mm)

Table 1

Required Mounting Hardware				
Frame Size	Screw Size	Washer Size	Quantity Required	Torque Required
S801N 65mm (2.55 in)	#10 - 32 x 0.5	Standard #10 Lockwasher and Flat Washer	4	1.7 N-m (15 in-lb)
S801R 110mm (4.33 in)	1/4 - 20 x 0.625	Standard 1/4 Lockwasher and Flatwasher	4	2.8 N-m (25 in-lb)

Table 2

Weight Support Requirements	
Frame Size	Weight of Unit
65mm	2.6 Kg (5.8 pounds)
110mm	4.8 Kg (10.5 pounds)

Table 3


Environmental Requirements	
Operating Temperature Range	-40°C to 50°C (-40°F to 122°F)
Storage Temperature Range	-50°C to 70°C (-58°F to 158°F)
Elevation	Above 2000 Meters (6600 feet) consult factory
Humidity	Functional to 95% non-condensing
Operating Orientation	Any
Pollution Degree IEC 947-1	3
Shock Resistance	15g in any direction
Vibration Resistance	3g in any direction

Mounting Instructions for Models S801N and S801R

The IT Soft Starter is easy to mount. It does not require any special tools.

To aid you with panel layout, refer to the dimension drawings on page 2 of this leaflet. Drill and tap holes per mounting hole location as shown.

To mount the unit, use all the hardware specified in Table 1 on page 2 of this leaflet. Tighten to the torque specified.

! WARNING	TO AVOID SHOCK HAZARD, DISCONNECT ALL POWER BEFORE ANY FUNCTIONS ARE PERFORMED ON THIS EQUIPMENT.
! AVERTISSEMENT	
	POUR EVITER TOUT CHOC ELECTRIQUE, COUPLER L'ALIMENTATION DE CET EQUIPEMENT AVANT D'Y EFFECTUER DES TRAVAUX.
Hazard of Burn or Electrical Shock	
Risque de Brulure ou de Choc Electrique	

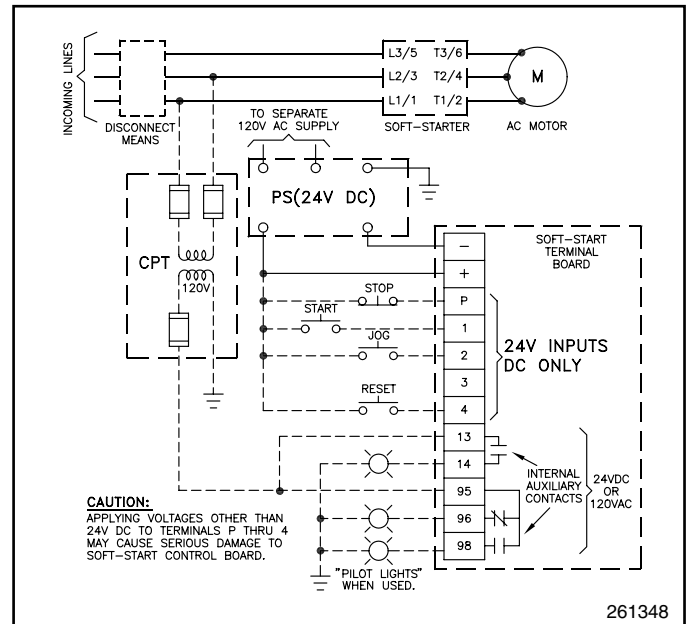


Fig. 3 Elementary Diagram for Soft Starter with START/STOP/RESET/JOG with 120VAC Alarm and Run Indication

Wiring Diagrams

Each diagram illustrates a typical wiring scheme for the options described. The soft starter is represented by the terminal board. The additional items shown on the diagrams are not included, but they may be purchased from Cutler-Hammer.

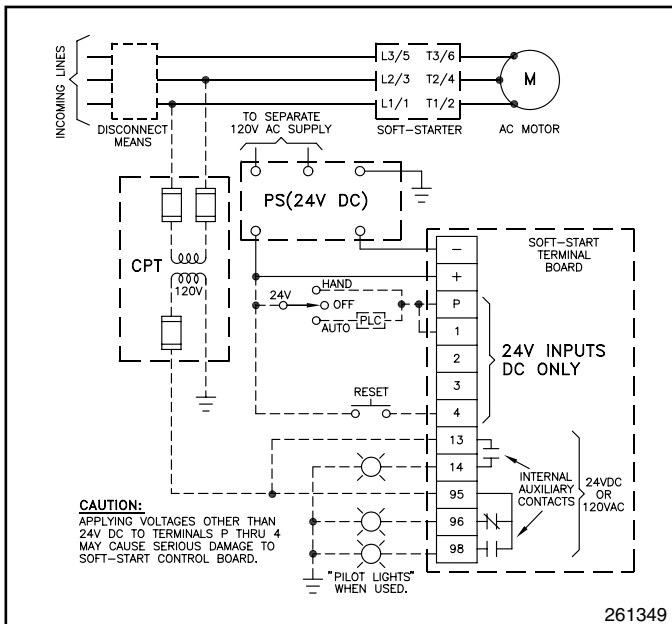


Fig. 4 Elementary Diagram for Soft Starter with HAND/OFF/AUTO/RESET with PLC with 120VAC Alarm and Run Indication

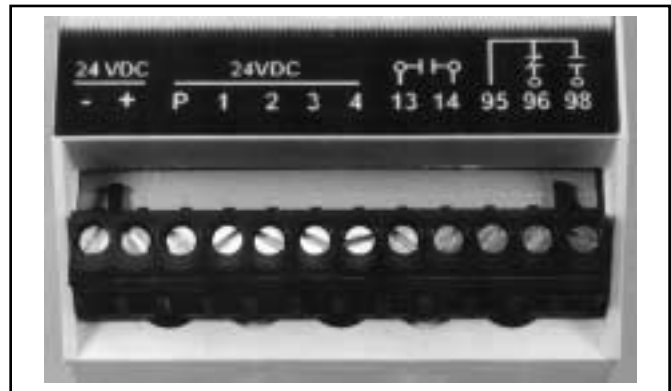


Fig. 5 Terminal Board

Power Wiring

Control Wiring Inputs

The controller on the IT Soft Starter has the inputs shown in Table 4 on Page 5 of this leaflet.

CAUTION

APPLY ONLY 24VDC TO CONTROL TERMINAL BOARD UNLESS SPECIFIED OTHERWISE IN THIS MANUAL. ALL CONTROL WIRING IS 22 - 12 AWG. FAILURE TO FOLLOW THIS CAUTION COULD RESULT IN SEVERE DAMAGE TO THE CONTROLLER.

ATTENTION

APPLIQUER UNE TENSION DE 24V C.C. AUX BORNES SAUF AVIS CONTRAIRE DANS CE MANUEL. TOUTE LA FILIERE DE COMMANDE EST DE CALIBRE 22 A 12 AWG. L'INOBSERVATION DE CETTE MESURE POURRAIT CAUSER DES DOMMAGES IMPORTANTS AU CONTROLEUR.

CAUTION

THERE CAN BE LINE VOLTAGE POTENTIAL AT THE MOTOR LOAD TERMINALS EVEN WITH THE STARTER IN THE OFF STATE. THIS IS DUE TO THE POSSIBLE LEAKAGE ACROSS SCRS. ALWAYS DISCONNECT INPUT POWER BEFORE SERVICING STARTER MOTOR.

ATTENTION

IL PEUT EXISTER UNE TENSION DE LIGNE AUX BORNES DU COTE CHARGE DU MOTEUR BIEN QUE LE MOTEUR SOIT ARRETE. CELAS'EXPLIQUE DU FAIT DE FUITES POSSIBLES A TRAVERS LES REDRESSEURS AU SILICIUM. TOUJOURS DEBRANCHER L'ALIMENTATION AVANT D'EFFECTUER DES TRAVAUX SUR LE DEMARREUR.

Table 4

Control Wiring Inputs			
Name	Terminal Board Designation	Default	Input
Common	-	-	Negative
Power	+	-	24VDC nominal
Permissive	P (24VDC only)	Hardwired Stop	24 VDC only
Input 1	1 (24VDC only)	Start	24VDC only
Input 2	2 (24VDC only)	Jog Forward	24VDC only
Input 3	3 (24VDC only)	Overload Disable	24VDC only
Input 4	4 (24VDC only)	Fault Reset	24VDC only
Common	13	-	Relay close connects to 14
NO Contact in Bypass	14	-	3 Amps @ 120VAC/24VDC 10 Amps, Max (Resistive) Switching
Common	95	-	NC Connects to 96. Relay closure connects to 98.
Ready	96	-	3 Amps @ 120VAC/24VDC 10 Amps, Max (Resistive) Switching
Fault	98	-	3 Amps @ 120VAC/24VDC 10 Amps, Max (Resistive) Switching

13 and 14 - Closes when in bypass. Contact is normally open.
 95 and 96 Close - System OK, Open Fault. Pins 95, 96, and 98 are Form C contact. 95 acts as the common, 96 is a normally closed contact, and 98 is a normally open contact. On any fault that trips the unit or causes it not to start, 96 opens and 98 closes.

95 and 98 Open - System OK, Close - Fault

95 and 96 Open - Fault

The control wiring is connected to the soft starter by a 12-pin terminal strip connector located on the front of the unit. Each connection is capable of holding one or two #22 - #16 AWG wires, or one #14 or #12 AWG wire. Each terminal should be tightened to 3.5 in-lb.

Providing Control Power



CAUTION

APPLY ONLY 24VDC TO CONTROL TERMINAL BOARD UNLESS SPECIFIED OTHERWISE IN THIS MANUAL. ALL CONTROL WIRING IS 22 - 12 AWG. FAILURE TO FOLLOW THIS CAUTION COULD RESULT IN SEVERE DAMAGE TO THE CONTROLLER.



ATTENTION

APPLIQUER UNE TENSION DE 24V C.C. AUX BORNES SAUF AVIS CONTRAIRE DANS CE MANUEL. TOUTE LA FILERIE DE COMMANDE EST DE CALIBRE 22 A 12 AWG. L'INOBSERVATION DE CETTE MESURE POURRAIT CAUSER DES DOMMAGES IMPORTANTS AU CONTROLEUR.

1. Connect DC common (negative) to pin -.
2. Connect +24VDC positive to pin +.
3. Pin P, permissive circuit, must be energized (+24VDC) to allow operation of unit. If power is removed from permissive circuit at any time, unit will initiate a stop.
4. If 24VDC power is toggled to Input 1 while P is at 24V, device will initiate a start.
5. Input 2 is Forward Jog. If 24VDC power is applied to Input 2 while P is at 24V, the soft starter will initiate motor jog.
6. Input 3 is Overload Disable. When Input 3 is toggled, the overload will be disabled for the next start.
7. If +24VDC input power is applied to Input 4, the soft starter is reset. Faults are cleared only if fault has been corrected.
8. Pins 13 and 14 - 120VAC or 24VDC provide for the integral bypass contact. The integral bypass contact will close upon bypass and will remain closed until stop is initiated. Motor may continue to run even after stop is initiated during soft stop until programmed ramp has been completed.
9. Pins 95, 96, and 98 provide alarm circuit NO-NC change state on any fault. Form C Max. 24VDC, 120VAC, 3 amps.

NOTE - When control power (+24VDC) is first applied, all the LEDs on the CIM will illuminate briefly. This is a normal startup test that verifies communication to the CIM. Pressing "Fault Reset" also momentarily lights all the LEDs. This verifies the CIM board is functional, and tests all LEDs for functionality.

Procedure for Starting

Application Note - Permissive (P)

- (P) must be held high (24VDC) in order to START the Soft Starter.
- Remove 24VDC from terminal P to initiate a stop.
- Run inputs (terminals 1 through 4) are a momentary high (24VDC).
- If the inputs (Input 1, 2, 3, 4) are high when the Permissive opens, the Soft Starter will STOP.
- The Soft Starter will not start when 24VDC is applied to the Permissive (P) until Input 1 changes from 0 volts (open) to a high (+24V) condition. (Once P is at 24 volts, Input 1 must cycle from 0 volts to 24 volts to start.)
- On the larger soft starters when the bypass contactors close, a sound similar to contactor chattering can be heard. This sound is caused by more than one contactor closing in a staggered manner over a very short period of time. This is part of normal operation and should not be misinterpreted as a dirty pickup.
- For two-wire control, jumper permissive (P) and Input 1, together.

24VDC Power Requirements

When sizing a 24VDC power supply for your IT soft starter, it must meet the following steady state and inrush characteristics.

Steady State Minimum = 25 watts

Inrush Minimum = 240 watts for 150 msecs

Voltage on the unit cannot exceed 30VDC. The soft starter will turn off at approximately 20.9VDC.

It is recommended that power supplies from Cutler-Hammer be used.

The following C-H power supplies are available:

Table 5

Catalog Number	Steady State Wattage	Inrush Wattage	Input Voltage
PSS55A	55W	250W	115VAC
PSS55B	55W	250W	230VAC
PSS55C	55W	250W	360 - 480VAC

NOTE: A minimum of #14 AWG should be used between the power supply and the 24V (+) and (-) terminals of the soft starter.

Protective Features

The soft starter cannot be restarted until the calculated cool-down time has passed. Cycling power does not reset

Protective Features, Cont'd

timer. If 24VDC power is removed, the soft starter remembers the remaining cool-down time and will not reset until the total cool-down time has elapsed.

The unit monitors these conditions for overload:

- Thermal (current) Overload - monitors RMS, with a 5, 10, 20, or 30-second delay time based on Trip Class setting.

Table 6

Protective Feature	Setting	Factory Default
Overload (FLA Dial Range)	32% - 100% of rated current	32%
Trip Class	5, 10, 20, 30	5
Fault Reset	Auto, Manual	Manual
Jam	On, Disable	On
Stall	On, Disable	On
Phase Loss	On, Disable	On
Phase Reversal	On, Disable	On
Overload	On, Disable	On

Programming Settings

General

To program and operate the IT Soft Starter, a "Control Interface Module" (CIM) is required (see Fig. 6). The CIM (Catalog No. EMA71) is for use with all models: S801N, S801R, S801T, and S801V. The CIM (Catalog No. EMA72) is used with all model S801N, S801R, S801T and S801V with the pump control option (see Fig. 7). The CIM serves as the interface between the operator and the Soft Starter control circuitry to program the Soft Starter. The CIM dip switches and rotary controls are used to select the Soft Starter settings. When making adjustment to the CIM under normal operation, the LED's will function as follows:

A change to any dip switch will cause all LED's to flash momentarily.

An adjustment to any POT will cause all LED's to light and stay lit until adjustment of POT has been completed.

While selecting these parameters, 24VDC power may be applied to the Soft Starter, but it is not required.

NOTE: The IT Soft Starter does not have to be powered to make adjustment to the control interface module. Once the unit is energized, it will communicate with the CIM and load the program into the Soft Starter. Allow the unit 2 seconds to ensure communication checks complete and values are set. To verify CIM is operational, press "Fault Reset." If the CIM is powered and communicating, all LED's will momentarily flash.

See the user manual for additional detail on the standard and pump control option.

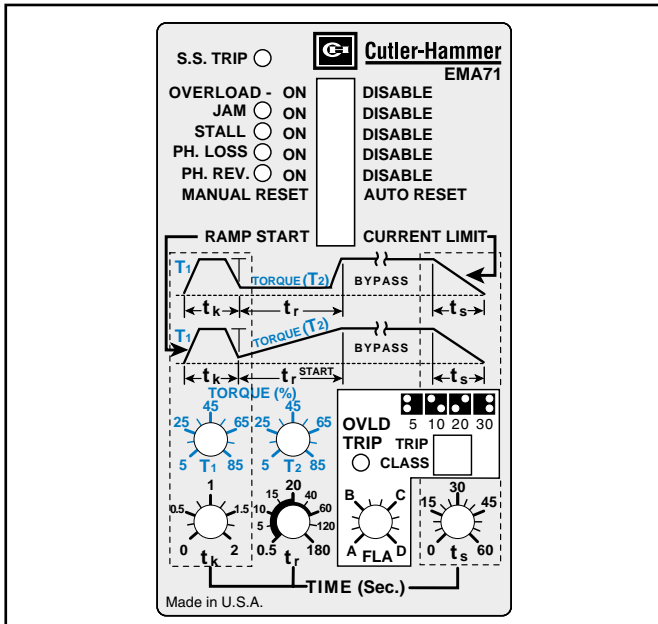


Fig. 6 Soft Start Control Interface Module (CIM)

Auto Reset

Select auto or manual reset on the Control Interface Module.

When a fault is present, the auto-reset will attempt to reset the fault every 2.5 seconds. If the fault is clear, the system resets the fault(s). The soft starter is ready for use, and may be restarted by selecting “Run 1” (assuming power is present.)

The motor does NOT automatically restart after a fault is reset.

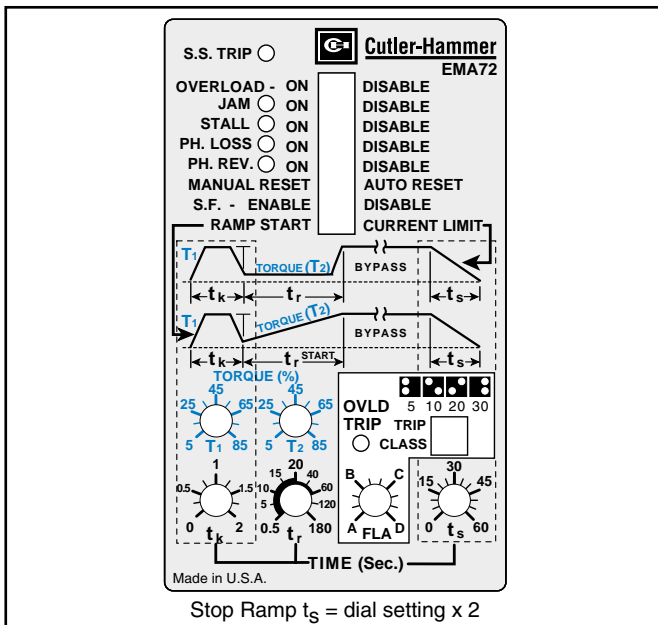


Fig. 7 Soft Starter Pump Control Interface Module (CIM)

Soft Starter Flash Codes Sent to CIM

To obtain flash codes from the CIM, hold the RESET button down and count the number of times all the LEDs on the CIM flash.

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

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

For example, if you see three flashes, a pause, then two flashes, a pause, then four flashes, a pause, then one flash, the flash codes are 32 and 41. If you then see three flashes, a pause, then two flashes, you are seeing the first code again. This means you have seen all the flash codes for this stop. You may now release the RESET button.

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

Table 7

Code	Fault
11	Thermal overload trip
12	Motor stall
13	Motor jam
14	Phase sequence ACB
15	Pole over-temperature
16	SCR failed to fire
21	15V Power supply low
22	Phase loss
23	Bypass dropout
24	SCR/Contactor overcurrent
25	Phase imbalance
26	Non-volatile memory error
31	Zero voltage cross failure
32	Short SCR, phase loss, load disconnect
33	Serial communication lost
34	SCR instantaneous overcurrent
41	24V power supply low
42	Timer system fault
43	Watchdog reset occurred
44	PLL (DSP)
45	Illegal address (DSP)

Ratings

HP and KW Ratings

Standard Duty Ratings

25-Second Ramp, 4 Starts per Hour, 300% Current Limit @ 40°C

Frame Width	Max Current	Three-Phase Motor											Catalog Number
		kW Rating (50 Hertz)			hp Rating (60 Hertz)								
		230	380-400	440	200V		230V		460V		575V		
		Volt	Volt	Volt	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	
65mm	34	9	15	18.5	10	7.5	10	10	25	20	30	25	S801N37N3S N66N3S
	63	15	30	33	20	15	20	20	40	40	60	50	
110 mm	96	25	45	55	30	25	30	30	75	60	75	75	S801R10N3S R13N3S
	120	33	63	63	40	30	40	40	75	75	100	100	

15-Second Ramp, 4 Starts per Hour, 300% Current Limit @ 50°C

Frame Width	Max Current	Three-Phase Motor											Catalog Number
		kW Rating (50 Hertz)			hp Rating (60 Hertz)								
		230	380-400	440	200V		230V		460V		575V		
		Volt	Volt	Volt	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	
65mm	34	9	15	18.5	10	7.5	10	10	25	20	30	25	S801N37N3S N66N3S
	63	15	30	33	20	15	20	20	40	40	60	50	
110 mm	96	25	45	55	30	25	30	30	75	60	75	75	S801R10N3S R13N3S
	120	33	63	63	40	30	40	40	75	75	100	100	

50-Second Ramp, 2 Starts per Hour, 300% Current Limit @ 50°C

Frame Width	Max Current	Three-Phase Motor											Catalog Number
		kW Rating (50 Hertz)			hp Rating (60 Hertz)								
		230	380-400	440	200V		230V		460V		575V		
		Volt	Volt	Volt	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	
65mm	21	5.5	10	11	5	5	5	5	15	10	15	15	S801N37N3S N66N3S
	42	11	18.5	22	10	10	15	10	30	25	40	30	
110 mm	60	15	30	33	15	15	20	15	40	40	50	50	S801R10N3S R13N3S
	80	22	40	45	25	20	30	25	60	50	75	60	

15-Second Ramp, 4 Starts per Hour, 450% Current Limit @ 40°C

Frame Width	Max Current	Three-Phase Motor											Catalog Number
		kW Rating (50 Hertz)			hp Rating (60 Hertz)								
		230	380-400	440	200V		230V		460V		575V		
		Volt	Volt	Volt	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	
65mm	29	7.5	12.5	15	7.5	7.5	10	7.5	20	15	25	20	S801N37N3S N66N3S
	49	12.5	22	25	15	10	15	15	30	30	40	40	
110 mm	73	18.5	37	40	20	20	25	20	50	40	60	60	S801R10N3S R13N3S
	94	25	45	55	30	25	30	30	60	60	75	75	

30-Second Ramp, 4 Starts per Hour, 450% Current Limit @ 40°C

Frame Width	Max Current	Three-Phase Motor											Catalog Number
		kW Rating (50 Hertz)			hp Rating (60 Hertz)								
		230	380-400	440	200V		230V		460V		575V		
		Volt	Volt	Volt	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	
65mm	21	5.5	10	12.5	5	5	5	5	15	10	15	15	S801N37N3S N66N3S
	40	11	18.5	22	10	10	10	10	30	25	30	30	
110 mm	55	15	25	30	15	15	20	15	40	30	50	40	S801R10N3S R13N3S
	75	22	37	45	20	20	25	20	50	50	60	60	

15-Second Ramp, 4 Starts per Hour, 300% Current Limit @ 40°C

Frame Width	Max Current	Three-Phase Motor										Catalog Number	
		kW Rating (50 Hertz)			hp Rating (60 Hertz)								
		230	380-400	440	200V		230V		460V		575V		
		Volt	Volt	Volt	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF		1.15SF
65mm	37	10	18.5	18.5	10	10	10	10	25	20	30	30	S801N37N3S N66N3S
	66	18.5	30	37	20	15	20	20	50	40	60	50	
110 mm	105	30	55	59	30	25	40	30	75	60	100	75	S801R10N3S R13N3S
	135	40	63	80	40	30	50	40	100	75	125	100	

Severe Duty Ratings

Frame Width	Max Current	Three-Phase Motor										Catalog Number	
		kW Rating (50 Hertz)			hp Rating (60 Hertz)								
		230	380-400	440	200V		230V		460V		575V		
		Volt	Volt	Volt	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF	1.15SF	1.0SF		1.15SF
65mm	22	5.5	10	11	5	5	7.5	5	15	10	20	15	S801N37N3S N66N3S
	42	11	18.5	22	10	10	15	10	30	25	40	30	
110 mm	65	15	30	33	15	15	20	15	50	40	50	50	S801R10N3S R13N3S
	80	22	40	45	25	20	30	25	60	50	75	60	

Severe Duty Ratings are defined as any combination of parameters that exceed the Standard Duty Ratings. Example; 35-Second Ramp, 5 Starts per Hour, 350% Current Limit @ 40 Deg C Ambient.

Cooling

Fans are used to cool the IT Soft Starter. The fans are turned on when the temperature of any of the thermal sensors exceeds a preset value. If the temperature is below this value, the fans will be off.

The fans will also be turned on whenever the IT is started, stopped, or jogged. The fans will remain on for 15 minutes to assure the SCRs are adequately cooled prior to the next start or jog.

If a temperature is sensed above a second preset level, a Pole Over-Temperature Fault will occur. This fault cannot be reset until the temperature returns to a safe level.

Note that the fans will only operate if 24 VDC is applied to the + and – terminals.

CE Conformity

S801N will meet IEC 60947-4-2 and EN60947-4-2 Radiated Immunity Test requirements, except for the following frequency bands:

- 80 to 89.2 MHz @ 9 V/m
- 90.1 to 92 MHz @ 6 V/m

S801R will meet IEC 60947-4-2 and EN60947-4-2 Radiated Immunity Test requirements, except for the following frequency bands:

- 90.04 to 92.87 MHz @ 6 V/m
- 91.9 to 92.8 MHz @ 9 V/m

Short Circuit Ratings

Soft Starter Frame Size	Three Phase Short Circuit Rating		
	240V	480V	600V
S801N 65mm	10KA	10KA	10KA
S801R 110mm	10KA	10KA	10KA

Cutler-Hammer Solid State Reduced Voltage Motor Starter Aftermarket Services

- **Technical/telephone support.**
- **Resident service engineers in major trading centers.**
- **Factory repair services.**
- **Warranty administration.**
- **Equipment Modification and upgrading services**
- **Training seminars.**

**For additional information on this product,
please call our Customer-Support
Center at: 1-800-356-1243**

**For service or start-up assistance,
24 hours/day, 7 days/week
please call:
1-800-498-2678**

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