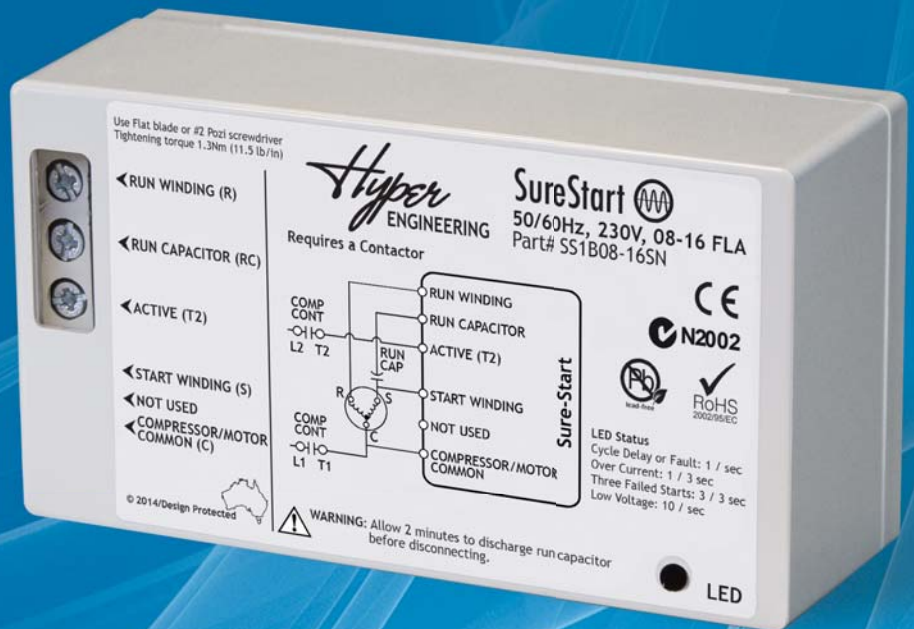


# SureStart

Single Phase Soft Starters

## Specification Catalog





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## Introduction

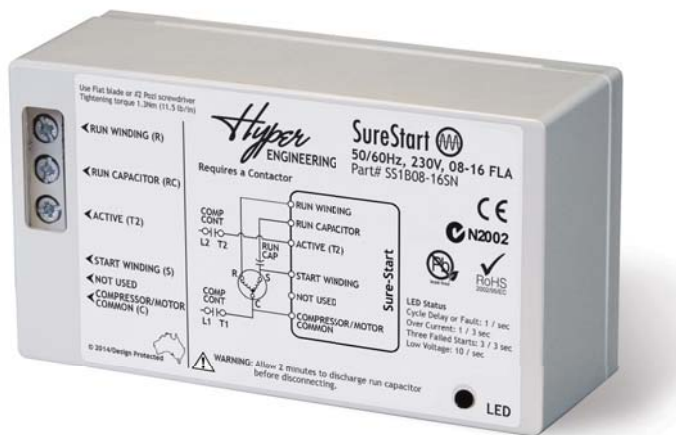
The SureStart Series soft-starter was the first of its kind invented by Hyper Engineering over a decade ago in Wollongong, Australia. It was originally invented for use in the residential heating, ventilation, and air-conditioning (HVAC) industry in Australia and Europe. In recent years, Hyper has expanded SureStart technology into commercial HVAC by offering 3 phase versions in commercial voltages. Whether it is for residential or commercial applications, SureStart's continued success worldwide is a testament to its reliability and performance that can be rivaled by none other.

## SureStart

SureStart Series is the original single-phase soft starter specifically targeted to reduce light flicker caused by the startup of fixed speed permanent split-capacitor motors (PSC). These motors are often of the scroll compressor types which are commonly used in air-conditioning and heat pump applications. The SureStart has the latest in innovations from Hyper Engineering that includes several new features:

- 60-70% reduction in direct on-line (DOL) or in-rush current.
- Sophisticated under voltage protection
- Motor reversal protection.
- Self-adjusting up to nominal 7 hp for optimal start performance.
- 50/60 Hz compatible.
- ETL, CE, EMC, and RoHs compliant.
- Tolerant to "dirty power" conditions.
- Versions available for retrofit installations or OEM production use.
- Fault LED
- Internal Current Limiting

## SureStart Module



## Optional Custom SureStart Versions: (Consult Hyper Engineering)

- Non air-conditioning applications (ie. submersible pumps, gate automation)
- Non-equalized pressure (compressors without bleed type expansion valves)

## Background

In air conditioning and heat pump applications, energy is moved through the air conditioner by a compressor which is an electrically driven pump that compresses refrigerant as it pumps to a heat exchanger. Compressors are the heart of air conditioning equipment so it is important to protect them against failure. Inside of every compressor is an electric motor that draws a significant electrical current at startup. This startup current is often referred to as the instantaneous current, in-rush current, locked-rotor amps (LRA), or direct-on-line (DOL) current. In-rush current on your home air conditioner is generally between 5-8 times higher than the current consumed by the compressor during normal operation. As the name suggests, in-rush current is very brief lasting for a fraction of a second until the motor begins operating at normal speed. This time period may appear trivial; however, it is the cause of many issues for homeowners, power companies, and equipment manufacturers. Here are some common problems created by high in-rush current.

- Flickering of lights
- Nuisance trips on safety protection equipment
- Disrupts sensitive electronics such as computers
- Increased stress on the motor which reduces the reliability of the air conditioning equipment.
- Higher installation cost due to insufficient transformer sizing
- Increased noise and vibration at compressor startup

Most contractors install hard start kits to eliminate these problems. Unfortunately, hard start kits don't provide a complete solution to the problem. Hard start kits do not reduce the startup current but only the startup time which may give a perceived improvement in light flicker, but still stress the compressor during every start. Mechanical shock is also increased to the compressor by use of a hard start device. Installing a SureStart corrects these problems by significantly reducing the start current, optimizing the start time to the compressor size, power supply and loading while providing vital protection to the compressor, and promoting improved reliability at startup.

## In-Rush Current

Motor in-rush occurs due to low resistance in motor windings essentially acting like a short circuit. This temporary short circuit causes an immediate spike in current and simultaneous drop in supply Voltage. Voltage drops for air conditioning compressors are often 15% or more which is 3-4 times greater than what most electrical power distributors prefer. The more frequently the compressor starts, the more noticeable the problem becomes. For most homes in the US, air conditioners usually start at a rate of 6-10 starts per hour.

To add to the problem, the standard of living in the US has increased over time where air conditioning has become a basic want for most homeowners. As government regulations tighten, calling for higher efficiency air conditioning, compressor manufacturers have responded with higher efficiency motors in the compressors. The downside to improved efficiency is that in-rush current generally goes up as motor efficiency increases. Also, the larger home size results in larger air conditioning units, and ultimately result in higher in-rush currents. Figure 1 is a graph of typical in-rush current for air conditioners in the US along with the SureStart reduced in-rush current.

## Measuring In-Rush

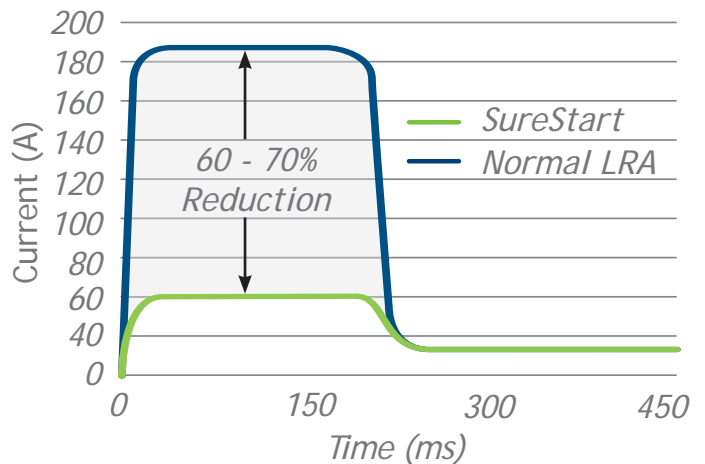
The effect of these electrical spikes can be observed by watching the lights flicker; however, this does not help quantify the problem. In order to properly measure in-rush current, the right tool is needed for the job. In this case, that tool is an oscilloscope which has the ability to observe electrical signals with great detail. Oscilloscopes are used by engineers in a laboratory environment to study the magnitude and shape of signals at specific points in time. An oscilloscope is an expensive device that is more powerful than what is needed by most service technicians for diagnostic use in the field. Instead technicians carry a handheld device called a digital multi-meter (DMM) that is capable of basic current, voltage, and resistance measurements. Some DMMs are also able to capture maximum amperage or current value as well. It is likely that a technician will use a DMM when trying to capture the in-rush current of compressor at start-up. This can be accomplished before and after adding hard start kit to observe the reduced in-rush value. Unfortunately, it is likely this maximum value does not reflect the true instantaneous spike in current. The DMM is only capable of recording current at defined time intervals. If the time interval of the event is too fast the DMM will have a portion of the interval where it recorded

very low values. Low values will shift the average down making it appear less significant. The faster the event the less likely the DMM is to display accurate results. Furthermore, the DMM is limited on the type of signal that it can detect. If the signal is smooth and characteristic of an ideal sine waveform; then it is likely to be okay. However, if the signal is a complicated waveform like measuring with a SureStart in the circuit; then it won't be accurate. This is an important concept since the wrong tool used for measurement may lead to false interpretation therefore not actually solving the problem. For example, hard start kits provide a start boost to the compressor which reduces the start time. It doesn't lower the actual spike in current instead just makes it less noticeable by speeding up the time. A DMM might show that the spike is reduced; however, it is due to a longer period of lower running current value offsetting the average.

## SureStart In-Rush Reduction

HVAC Tons	Compressor RLA	Before In-Rush	After SureStart	% Reduction
1.5	9	48	15	69
2.0	14	73	22	70
2.5	17	79	24	69
3.0	20	109	33	70
4.0	26	134	40	71
5.0	30	158	47	71
7.0	32	185	56	54

Figure 1: Normal 5.0 Ton LRA vs SureStart



## Hard Start kits vs. SureStart

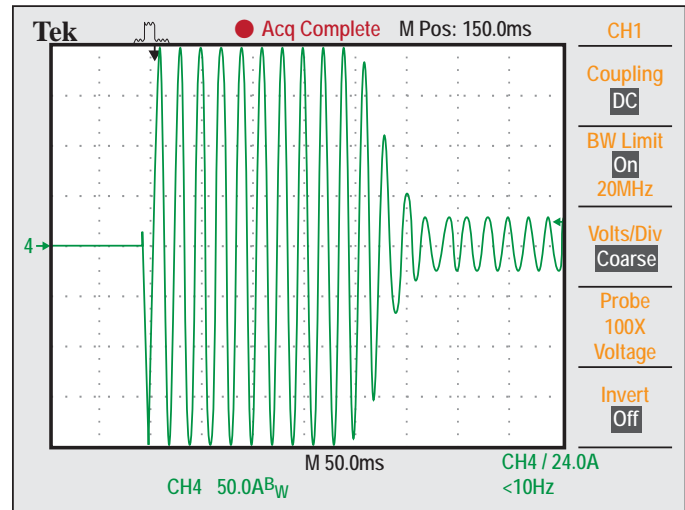
Off-the-shelf products, such as a hard start kit, are available for service technicians to install on an air conditioner to solve the light flicker problem. It is relatively low cost and simple to install to attempt to satisfy the homeowner complaints. As previously mentioned, hard start kits are a simple device that is used to provide a boost to the compressor to start it faster. It does not reduce the in-rush current, therefore does not eliminate problems created by high in-rush current. A hard start also adds additional stress; hence the name “hard start”. Compressors contain mechanical moving parts and like most mechanical parts don’t respond well to extra stress. When hard starts are used the startup torque is increased which reduces life of the compressor. In contrast, SureStart provides optimal mechanical advantage keeping torque at a minimum; therefore, improving long term reliability.

## Other Compressor Starting Technologies

Conventional soft start philosophy adopts a simple voltage reduction to contain this large starting current. This begins by ramping up the input from say 30 % to full voltage in a fixed time interval. This, however badly impacts the starting torque. So, under heavily loaded conditions, the motor might stall. This implies poor efficiency during starting. In any case, this simplistic solution will not reduce the starting current by more than 30 to 40% and light flicker is not reduced due to a significantly increased start time.

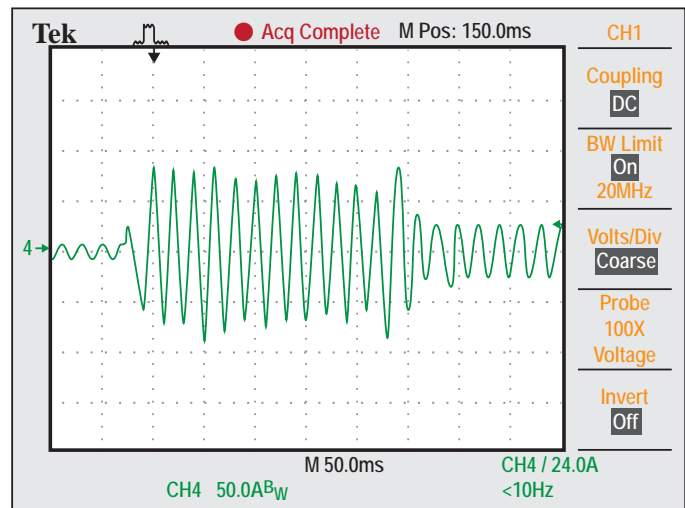
## Before

Locked Rotor Amperage (LRA)



## After

Using SureStart



## The SureStart Difference

The term “softstart” is used generically when referring to devices such as SureStart. It is worthwhile to note that SureStart is not a “hard start” device. As the name implies, it is a SureStart™ which ensures the compressors starts optimally every time by not delivering too much nor too little torque.

SureStart applies power electronics combined with intelligent software to provide optimal mechanical advantage during motor starting. SureStart technology maintains optimal torque while maximizing starting efficiency over a range of power supply conditions.

By comparison, other softstarters normally have only a Voltage ramp up where run and start windings are not controlled separately.

- SureStart does not compromise the torque or the time needed to achieve rotational speed.
- It compensates for poor power conditions such as high cable impedance, low Voltage or both.
- It has a sophisticated learning algorithm to optimize the starting time performance based upon various factors some of them being: the line impedance (reflected from the input voltage to motor) and the time it takes for the motor to reach up to full speed. This ensures auto regulation of start performance for different sized motors without any human intervention.
- The SureStart also reduces the voltage dip in the power line during starting.
- Light flickering reduced by up to 10 times during start up when units have a SureStart in the circuit.
- Built-in firmware inside SureStart helps eliminate arc damage to the motor contactor due to chattering.
- SureStart is out of the circuit after startup. It consumes less than 2W average in running mode.
- The SureStart protects against motor reversal by preventing restarts in event of intermittent lapse in power supply. Motor reversal is possible during turn off cycles when the back pressure forces the compressor to rotate in reverse direction.
- SureStart will protect the motor by not allowing it to start under adverse low voltage conditions.
- Loss of power detection includes sensing of low voltage sags and intermittent power drop outs (lasting 0.1-3 seconds).

## Application Types

The SureStart is versatile enough to be used in many applications other than HVAC/R with guidance from our Hyper Engineering Technical Support.

- |               |                                |
|---------------|--------------------------------|
| • HVAC/R      | • Irrigation/Submersible Pumps |
| • Marine      | • RV/Truck                     |
| • Compressors | • Military/Government          |
| • Solar Power |                                |



HVAC/R



Irrigation Pumps



Marine



RV/Luxury Buses



Military/Government



Solar Power



Backup Generators

## Increasing Utility Regulation

Most of the problems discussed so far relate specifically to the homeowner. However, power distribution companies experience issues when it comes to in-rush current. Depending on whether the utility is dealing with an existing network or working on plans for a network expansion, additional investment and operational costs could be required. As more homes get retrofitted or built with air conditioning it will require utilities to boost distribution equipment sizing such as transformers and conductors accordingly. This additional cost is driven higher since they must size the equipment for worst case scenario. As stated previously, in-rush current is 5-8 times greater than operating current; therefore, in-rush current is a significant parameter to the power distribution company. Even if the time period is very fast they still must overcome the instantaneous demand of the in-rush current. Currently, the in-rush current regulations in the US are lenient. As energy costs continue to rise, it is only a matter of time before limits are established for in-rush. The table below illustrates some of the limits that have started

to emerge from utility companies on the West Coast. The in-rush current listed in the table is a standard air conditioning scroll compressor that would be used in a residential application.

Other countries such as the United Kingdom, Ireland, Germany, and Australia have already implemented regulations that limit the inrush current that can be installed on a residence. This is often referred to as the “45 Amp Rule” where the in-rush current is limited to 45 A. If adopted in the US, it would limit most homes to 1.5 ton air conditioning system. Most homes in the US are larger than homes in European countries and generally require a minimum of 2-3 tons of capacity. Larger homes can require up to 4-5 tons which is almost 3 times the European limit. However, when a SureStart is installed it reduces those values by 70%. A compressor with 158 Amp in-rush will be reduced to 47 A. Since the US power supply and distribution network was designed differently from other countries, it is likely these limits, if established, will be slightly higher than the 45 A European model and unique for North American countries.

## Utility Regulation on Motor Starting Current

Air Conditioner (Tons)	Anaheim Electric 240V	Maui Electric Company		PG&E 240V	Vancouver Electric 240V	Scroll Compressor Manufacturer	
		208V	240V			Copeland	Danfoss
1 & Less	36	60	100	-	48	-	-
1.5	48	60	100	-	-	48	-
2	60	60	100	60	60	73	-
3	80	60	100	80	80	109	115
4	-	-	-	-	-	134	150
5	120	60	100	120	120	158	145
7.5	170	60	100	170	-	185	145
10	220	60	100	-	220	-	-

## Off-Grid & Generators

SureStart offers an ideal solution for homeowners or industrial solutions looking to use their HVAC units on off-grid power or unstable power supply conditions. This is especially applicable for situations in remote locations where power is limited or where long cable layouts are required, or necessitate use of generator or solar based service.

Without a softstart or even installations incorporating a hard start kit, one would have to ensure that generator or inverter surge capacity is sized to at least 5 times motor rating. Higher efficiency compressor motors can even demand 6-7 times its nominal kW rating at start. This is to ensure that the motor does not stall during

each start. The excess surge due to in-rush current can easily lead to brown outs, light flicker and even cause other equipment in same circuit to trip. The obvious consequence is the need to oversize the local generator and inverters to avoid this issue. SureStart can reduce the cost of going off-grid by reducing the generator size.

SureStart easily overcomes this by reducing the peak surge demand at start. In single phase, it is sufficient enough to size the generator surge requirements to roughly 2.5 times the kW rating of the motor. For three phase applications, it is recommended to size the generator surge requirements to 4 times the kW rating of the motor.



## Generator Sizing Methods

If SureStart is used in systems which are powered through an inverter setup fed from alternate renewable energy sources like photovoltaic cells or generators, a new installation will easily benefit from lower demands on inrush requirements through lower inverter and solar panel sizing. Depending on kW rating of the installation, this could easily lead to potential savings higher than cost of the SureStart device itself.

The following are two methods of sizing the generator to show the reduction effect of a SureStart up generator size in each method. These are for example only and do not account for other potential equipment loads such as lighting and appliances. It may be advisable to average the two for the most conservative approach. These are examples only and a professional should select and size a generator for your home using guidelines from the generator manufacturer.

Example Generators

Generator Model Size (kW)	Rated Output (Running Amps) 240V 1ph	Residential Surge Capability (LRA @ 30% Voltage Dip) 240V 1ph
	Column F	Column G
7	29	46
10	42	63
13	54	95
16	67	117
18	75	133
20	83	145
25	104	138
30	125	205
35	146	225
45	188	292

Example Heat Pumps

Example HP	Equipment Tonnage [kW]	No SureStart		With SureStart		Normal Operation	Accessory Pumps	Normal Operation w/Accessory Pumps	Continuous Power
		Starting Amps	Starting Power	Starting Amps	Starting Power				
		(A)	(kW)	(A)	(kW)				
		Column A	Column B	Column C	Column D				(A)
Model 026	2 [1.5]	52	6.8	18.2	2.4	7.4	1.0	8.4	1.7
Model 038	3 [2.2]	82	10.7	28.7	3.7	10.7	1.0	11.7	2.4
Model 049	4 [3.0]	96	12.5	33.6	4.4	14.3	2.0	16.3	3.4
Model 064	5 [3.7]	118	15.3	41.3	5.4	19.6	2.0	21.6	4.5
Model 072	6 [4.5]	150	19.5	52.5	6.8	22.2	2.0	24.2	5.0

## Power (kW) Rating Method

Multiply the Power (kW) rating of the compressor by 2.5 times for the generator capacity required for SureStart and 6 times without the SureStart.

### Model 064 without SureStart:

Equipment kW = 3.7 therefore  $3.7 \text{ kW} * 6 = 22.2 \text{ kW}$   
 Generator Size kW (Column G) = 25 kW

### Model 064 with SureStart:

Equipment kW = 3.7 therefore  $3.7 \text{ kW} * 2.5 = 9.3 \text{ kW}$   
 Generator Size kW (Column G) = 10 kW

So the reduction is over 60% with SureStart due to the reduction in LRA.

## Locked Rotor/Start Power Rating Method

When more detailed compressor data is available the Locked Rotor/Start power method can be more precise. Using locked rotor current and starting power, select a generator by rounding up to the nearest generator size.

### Model 064 without SureStart:

Startup Amps (Column A) = 118, Start Power (Column B) = 15.3 kW  
 Generator Size kW (Column G) = 16 kW with 117 amp LRA capability.

### Model 064 with SureStart:

Startup Amps (Column C) = 41.3, Start Power (Column D) = 5.4 kW  
 Generator Size kW (Column G) = 7 kW with 46 amp LRA capability.

So the reduction is a little more than 50% with SureStart due to the reduction in LRA.



**Warning!** Always consult with the generator manufacturer for specific sizing guidelines.

## SureStart Operation

When the system control calls for compressor operation, the compressor contactor will energize. If the supply voltage to the SureStart is less than “Minimum Startup Voltage”, a 50 second delay is initiated. At the end of the delay, another attempt to start the compressor will begin unless the supply voltage remains unchanged. SureStart uses an optimized starting process that learns the starting characteristics of the compressor to further refine the starting cycle on each recurring start. If the compressor fails to start, the module will terminate the start attempt after 1 second and initiate a 3 minute lockout before attempting a restart. If the supply voltage falls below “Shutdown on Low voltage” limit for 2 seconds or below 130 volts for 0.1 seconds while the compressor is running the module will stop the compressor and initiate a 3 minute lockout. A restart will be attempted after 3 minutes if the supply voltage is equal to “Minimum Startup Voltage” or higher. This is done to protect the compressor against a sudden drop in supply voltage.

SureStart is able to detect an interruption in power, when the interruption is 0.1 seconds or longer. When a power interrupt is detected, SureStart will shut down the compressor for 3 minutes. SureStart is also able to determine if the compressor is running backwards. If this condition is detected, SureStart will stop the compressor for 3 minutes before a restart is attempted. A power interrupt that is shorter duration than 0.1 seconds may result in a compressor running backwards, which the SureStart can detect and stop compressor operation.

If the run capacitor is faulty or has failed, SureStart will shutdown the compressor for 3 minutes before attempting a restart.

## Led Flash Codes

A Red LED indicator will flash under the following conditions.

[NOTE: LED fault indicator is turned off in normal running mode.]

- a) Rapid Flash (10 / sec) : Low Voltage
- b) Triple Flash Every Three Seconds (3 / 3 secs): Lockout on Three Failed Starts
- c) Slow Flash (1 / 3 secs): Lockout on Over Current
- d) Slow Steady Flash (1 / sec): Cycle Delay / Fault Mode

### Flash Code (Rapid Flash (10 / sec) : Low Voltage)

- Displayed for “Low supply voltage” before or after a softstart.
- If Low voltage is detected before a start, a re-start is attempted after 50 seconds.
- If Low voltage is detected after a start, a re-start is attempted after 3 minutes.

### Flash Code (Triple Flash every three seconds (3 / 3 secs): Lockout on Three Failed Starts)

- Displayed after failure to start on “Three consecutive start attempts”.
- Re-start is attempted after 50 minutes.
- Standard lockout period is revised to 3 minutes after a successful start.

In circumstances where the compressor may have seized or is unable to startup due to failure of other components in the HVAC system, the software will check for three consecutive failed starts. On the third sequential failed start, the program goes into Lockout for 50 mins. On failing to get a good start even after 50 mins, it will re-attempt start again after duration of 50 mins. Once a good start is eventually achieved, it will reset the hardstart counter and will require 3 failed starts again to force it back into Lockout mode. Lockout can be cleared anytime through a power reset of the SureStart device.

### Flash Code (Slow Flash (1 / 3 secs): Lockout on Over current)

- Displayed for “Overcurrent” in running mode of the compressor motor.
- Overcurrent limit is “25A for 08-16A version” and “50A for 16-32A rated version”.
- Also displayed, if internal Klixon of the compressor trips out on overheat.
- Re-start is attempted after 10 minutes.

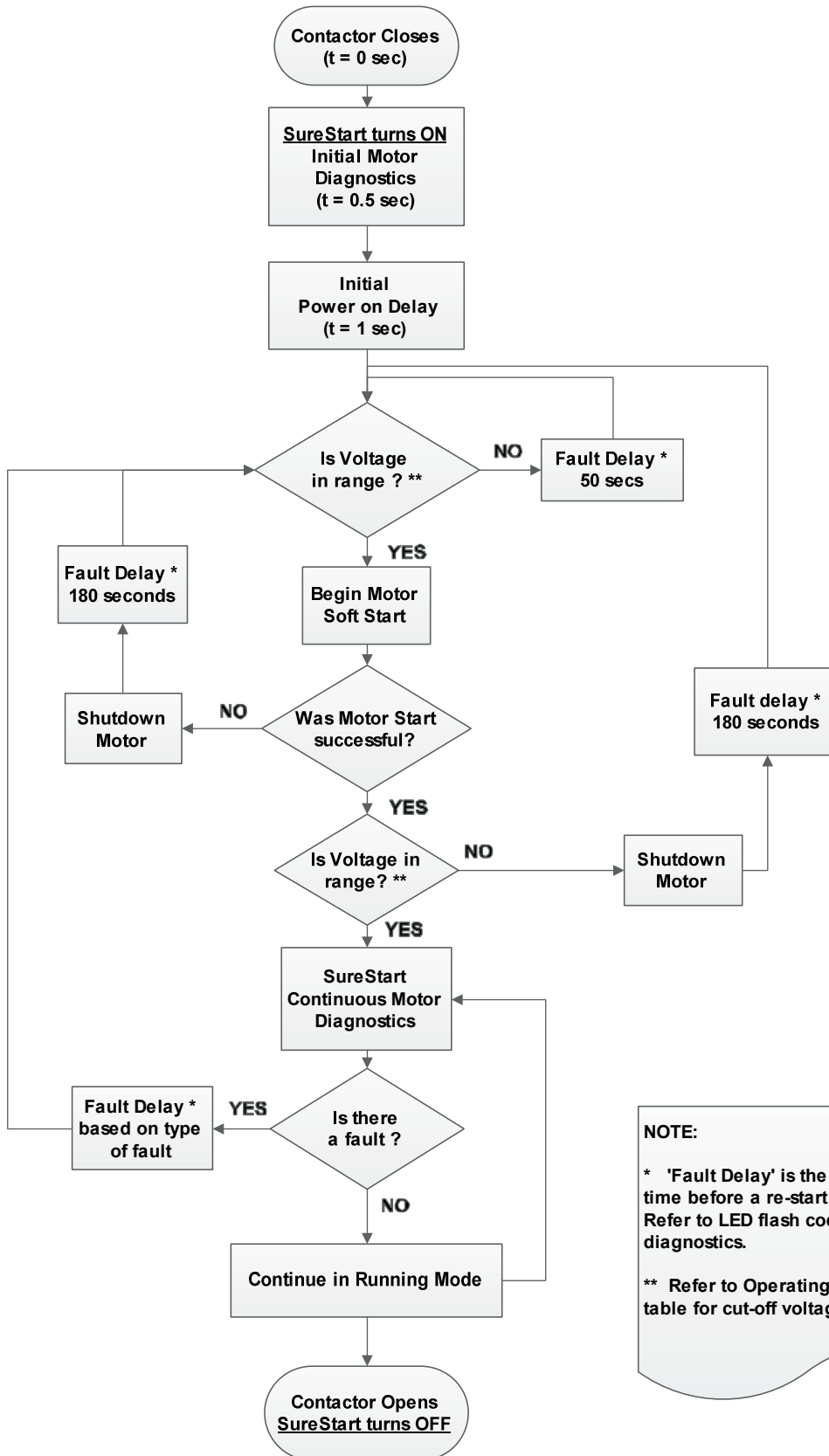
To limit the current in compressors from extending abnormally beyond its stated capacities, SureStart is also equipped with Overcurrent limit protection. For models rated from 16-32A, SureStart is designed to trip out in overload conditions exceeding 50A. In smaller models, it is designed to cutoff power to the compressor if the current drawn exceeds 25A. On overcurrent lockout, SureStart attempts a re-start automatically after 10 minutes.

Both failed start lockout and overcurrent limit protection have been designed to prevent the compressor from drawing abnormal currents in conditions not feasible for the compressor operation.

### Flash Code (Slow Steady Flash (1 / sec): Cycle Delay / Fault Mode)

- Displayed for “Cycle delay” between two consecutive softstarts or other faults mentioned below.
- Re-start is attempted after a default period of 3 minutes.
- Other possible reasons for this Fault mode indicator can be due to
  - incorrect wiring during installation,
  - a failed Softstart attempt,
  - intermittent power loss (duration longer than 100ms),
  - frequency out of range, or
  - failed run capacitor.

## SureStart - Basic Operation

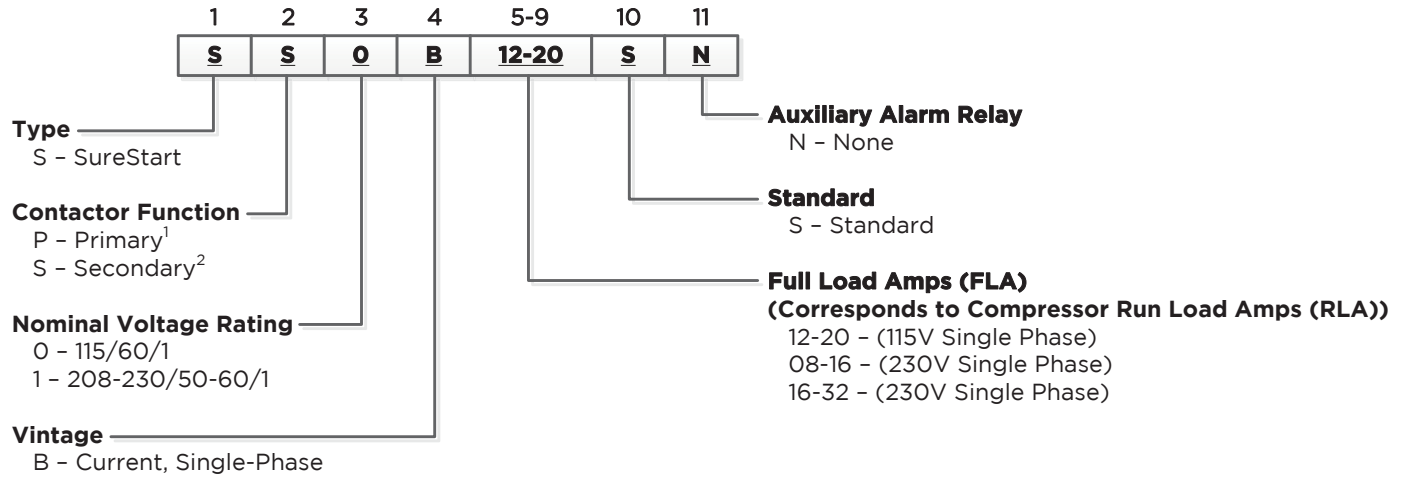


### NOTE:

\* 'Fault Delay' is the cycle waiting time before a re-start is attempted. Refer to LED flash codes for any fault diagnostics.

\*\* Refer to Operating Characteristics table for cut-off voltage ranges

Model Nomenclature



Rev.: 27 February 2014D

Notes:

- 1 - Not available in the United States.
- 2 - Primary includes a contactor. Secondary operates in series with contactor.

Selection Example

1. Locate Compressor Data. Example Copeland ZPS40 in Model 049 Geothermal Unit. Electrical Table is below.

Dual Capacity Unit with Variable Speed ECM Motor

Model	Rated Voltage	Voltage Min/Max	Compressor				HWG Pump FLA	Ext Loop FLA	Blower Motor FLA	Total Unit FLA	Min Circ Amp	Max Fuse/HACR
			MCC	RLA	LRA	LRA**						
026	208-230/60/1	187/253	18.2	11.6	58.3	21.0	0.4	5.4	4.0	21.4	24.4	35
038	208-230/60/1	187/253	23.8	15.2	83.0	30.0	0.4	5.4	4.0	25.0	28.8	40
038*	208-230/60/1	187/253	23.8	15.2	83.0	30.0	0.4	5.4	7.0	28.0	31.8	50
049	208-230/60/1	187/253	33.0	21.1	104.0	37.0	0.4	5.4	4.0	30.9	36.2	50
049*	208-230/60/1	187/253	33.0	21.1	104.0	37.0	0.4	5.4	7.0	33.9	39.2	60
064	208-230/60/1	187/253	42.3	27.1	152.9	54.0	0.4	5.4	7.0	39.9	46.6	70
072	208-230/60/1	187/253	46.3	29.6	179.2	63.0	0.4	5.4	7.0	42.4	49.8	70

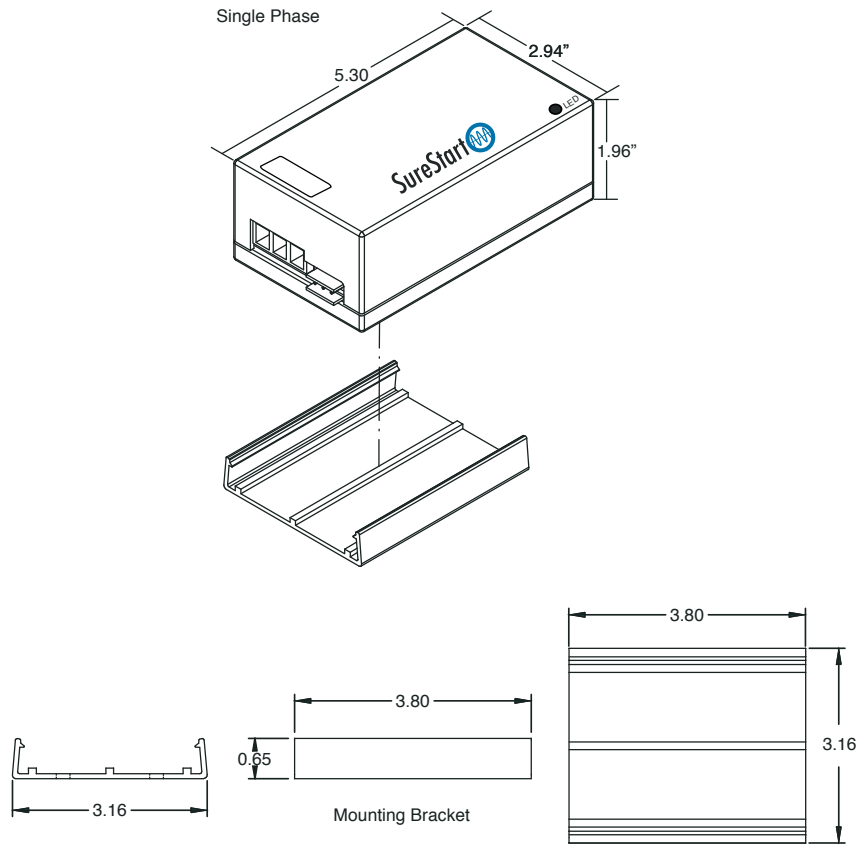
7/15/13

2. or from the equipment nameplate.

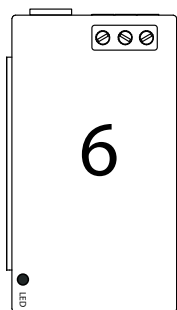
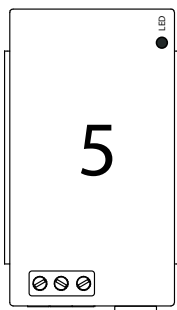
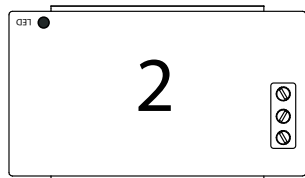
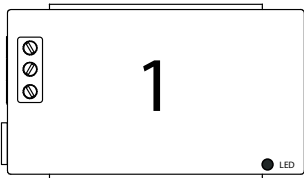
Model 049 Heat Pump	
Voltage	208-230/60/1
Compressor MCC	33.0 A
Compressor RLA	21.1 A
Compressor LRA	104 A
Fan Mtr FLA	4.0 A
Access FLA	5.8 A
Total FLA	30.9 A
Min Circ Amp	36.2 A
Max Fuse/HACR	50 A

3. Find rated FLA (RLA for Compressor), and Rated Voltage:
  - Compressor RLA is 21.1 Amps from chart or nameplate for Model 049
  - Compressor Rated Voltage is 208-230V/60 Hz/ 1 ph
4. Select SureStart Model From Nomenclature:
  - SS1B16-32SN rated for 208-230V/60/1 and 16-32 FLA (RLA on compressors)

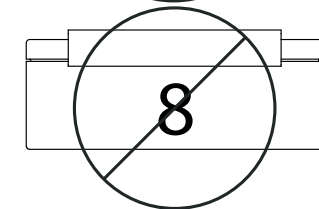
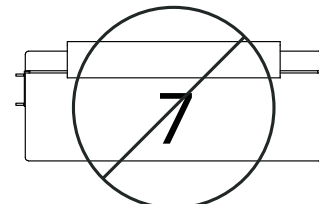
## Dimensional Data



## Approved Mounting Positions



## Not Approved



## Physical Characteristics

SureStart Model	Single Phase		
	SSOB12-20	SS1B08-16	SS1B16-32
Storage Temperature, °F [°C]	-40 [-40] to 185 [85]		
Case Material	ABS Flameproof UL-94 V0		
IP Rating	IP207		
Line Conductor, AWG	14 - 6	14 - 6	14 - 6
Line Conductor Strip Length, in. [mm]	0.47 [12]	0.47 [12]	0.47 [12]
Minimum Line Conductor Length, in. [mm]	15.7 [400]	15.7 [400]	15.7 [400]
Line Terminal Tightening Torque, in-lbs [N-m]	11.5 [1.3]	11.5 [1.3]	11.5 [1.3]
Start Winding & Compressor Common, AWG	16-12	16-12	16-12

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## Operating Characteristics

SureStart Model	Single Phase		
	SSOB12-20	SS1B08-16	SS1B16-32
Rated Voltage, VAC	115	208-230	208-230
Rated Phase	1	1	1
Rated Frequency, Hz	60	50/60	50/60
Maximum Load Current, Amps	20	16	32
Maximum Starting Current, Amps	35	35	65
Control input, VAC	Auto-Start at Power Up		
Number of Starts/Hour (Evenly Distributed)	15	15	15
Short Circuit Current Rating (SCCR), kA	5	5	5
Shutdown on Low Voltage	98	175	175
Minimum Startup Voltage	103	180	180
Maximum High Voltage	126	253	253
Operating Ambient, °F [°C]	-4 [-20] to 140 [60]		
Life Expectancy (At Maximum Rated Load)	Minimum 100,000 Operations		

03/06/14

## Software Characteristics

SureStart Model	Single Phase		
	SSOB12-20	SS1B08-16	SS1B16-32
Software Fault Delay, seconds	300	300	300
Initial Power on Delay, seconds, 60 Hz [50Hz]	1 [2]	1 [2]	1 [2]
Power Loss Reset, milliseconds	100	100	100
Contactors Chatter Protection	Yes	Yes	Yes
Motor Reversal Protection	Yes	Yes	Yes
Software Optimization	Auto tune		

10/01/13

## Application Notes

### Scroll Compressors

SureStart technology can be applied to most scroll compressors as long as they fall within the correct range of Full Load amperage rating of the listed models. All scroll compressors have an internal equalization mechanism. SureStart is not compatible with all Digital scroll compressors. Consult Hyper Engineering when using SureStart on Digital compressors.

### Reciprocating & Rotary Compressors

SureStart technology can be applied to most reciprocating and rotary compressors as long as they fall within the correct range of Full Load amperage rating of the listed models. Systems using these types of compressors must equalize differential pressure across the compressor during off cycle. SureStart is not intended to start compressors that are under a large differential pressure at startup. Doing so will compromise the life of the SureStart.

### Other Applications

For all other applications please consult Hyper Engineering Technical Support

### Inverter Driven Compressors

SureStart cannot be applied to inverter driven compressors.

### Schematics

Refer to the wiring diagram Figure 1, which shows how the SureStart module should be wired into a new or existing system. The wiring diagram illustrates SureStart wired with a two pole contactor. SureStart can be also be used with a one pole contactor with the contacts located in either the L1 or L2 lines. If the compressor is wired with a conventional start capacitor and relay, PTCR start device, or other type of hard start kit, those devices should be removed. Run capacitor values must match the specifications listed by compressor manufacturer. To determine the specified run capacitor value refer to the nameplate of the Copeland Scroll® compressor. The compressor must be wired as a permanent split capacitor (PSC) with the SureStart module. SureStart is compatible with Comfort Alert® technology. Conductor type shall be stranded copper with a 75°C minimum temperature rating. The system must be grounded and all applicable codes adhered to.

## Application

Use of SureStart with compressors that have nameplate RLA values above 32 amps must be tested by the system designer to ensure that the application of the compressor does not exceed the operating limits of the SureStart module. SureStart can be applied with the Copeland Scroll compressors listed in the SureStart Compatibility Guide.

## Installation Notes



### WARNING!

Remove all other starters (e.g. PTC, hardstarters). Do not swap the run and start windings. The module shall not be installed into an enclosure smaller than 10x8x6 inches.

Allow two minutes to discharge run capacitor before disconnecting.



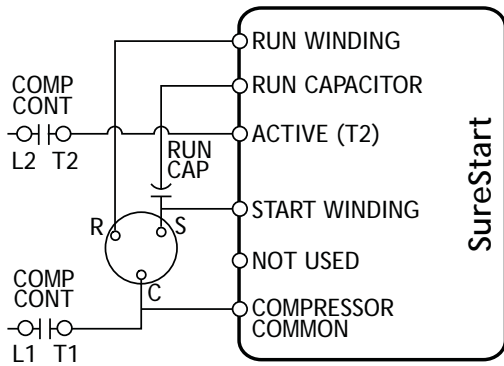
### SureStart Compatibility Guide

Nominal Supply Voltage*	Single Phase		
	SS0B12-20	SS1B08-16	SS1B16-32
115/60/1	•		
208-230/50-60/1		•	•
Full Load Amperage, FLA (Typical)	12-20	08-16	16-32

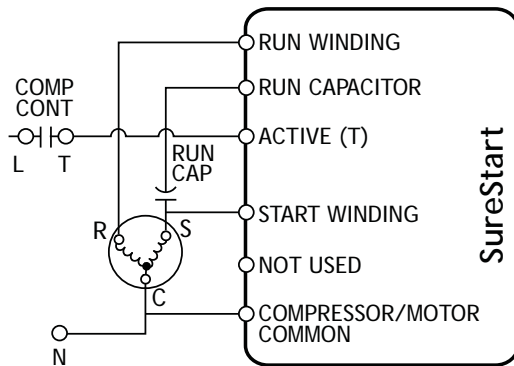
\* - Voltage/Hz/Phase

11/21/13

### Wiring Schematics



230V with Two Pole Contactor



115V/230V with Single Pole Contactor



**CAUTION:** SureStart must be installed in a location that ensures that the external heat from a hot gas line, compressor discharge piping, or similar heat source will not cause damage. Minimum 3" [76mm] clearance is recommended.

## Declaration of Conformity

SureStart technology has been tested and certified under the following standards that apply.

For United States, Canada, & Mexico

UL 508/ CSA 22.2 # 14 (ETL control # 4004190)

For European Union, Australia, and other countries accepting CE Marking

Low Voltage Directive (LVD)

IEC/ EN 60947-4-2: Low Voltage switchgear and control gear: contactors and motor-starters

IEC/ EN 60335-1 & IEC/ EN 60335-2-40: Safety requirements for electrical heat pumps, air conditioners, dehumidifiers.

Electromagnetic Compliance (EMC)

IEC/ EN 55014-1	Conducted & radiated emissions
IEC/ EN 61000-3-11	Flicker
IEC/ EN 61000-3-12	Harmonics emissions
IEC/ EN 61000-3-2	Harmonic current emissions
IEC/ EN 55014-2	Conducted & radiated immunity
IEC/ EN 61000-6-1	Immunity for residential, light commercial, and light industrial
IEC EN 61000-3-3	Voltage fluctuations
IEC/ EN 61000-4-2	Electrostatic discharge (ESD) immunity test
IEC/ EN 61000-4-3	Radiated, radio-frequency, electromagnetic field immunity test
IEC/ EN 61000-4-4	Electrical fast transient/burst immunity test
IEC/ EN 61000-4-5	Surge Immunity Test
IEC/ EN 61000-4-6	Conducted radio-frequency immunity
IEC/ EN 61000-4-11	Voltage dips, short interruptions, and voltage variations immunity tests

EMC compliance tested in accordance with:

ANSI C63.4

EN55022 + A1:2000 + A2:2003

CISPR16 and CISPR22

VCCI V-3/2007.04

## Definitions

Case Material - SureStart enclosure material

Line conductor - Wiring that connects to the “run winding” and “active” terminations on single phase SureStart.

Line Conductor Strip Length - This is the length of insulation stripped away in order to properly insert into the SureStart.

Line Terminal Tightening Torque - The necessary torque needed to secure line conductors to the SureStart.

Rated Voltage - This is the nominal supply voltage to the SureStart.

Rated Frequency - This is the nominal frequency, Hz, of the power supply to the SureStart.

Maximum Starting Current - The maximum current at motor startup for the largest motor that can be applied to the SureStart.

Control Input - Any AC/DC voltage that needs to be applied in addition to active supply to SureStart.

Short Circuit Current Rating - This is the maximum fault current that can be applied without damaging the SureStart.

Shutdown on Low Voltage - SureStart will shutdown motor if the supply voltage falls below this threshold.

Maximum High Voltage - The maximum voltage that can be applied to SureStart.

Maximum Operating Ambient - The maximum temperature the SureStart can properly operate.

Maximum Load Current - This is the maximum current the SureStart is capable of handling.

Minimum Startup Voltage - SureStart will not attempt a motor start if the supply voltage is below this limit.

Software Fault Delay - This is the time delay that will initiate if the SureStart encounters a problem during motor operation.

Initial Power Delay - The time delay from when the SureStart receives power and motor start occurs.

Power Loss Reset - SureStart is designed to turn motor off in the event power is lost for more than this time period.

Contactors Chatter Protection - SureStart can detect faulty contactor conditions and shut the motor off.

Motor Reversal Protection - SureStart will prevent a single phase motor from reverse rotation due to intermittent power outages.

Software Optimization - The maximum number of starts required to achieve optimized motor starting.



Revision Guide

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