Instruction Leaflet for the S701X25N3BP Soft Start Controller with Auxiliary Contact

Description

The S701 device is a reduced voltage soft start controller designed to control acceleration and deceleration of three-phase motors. With the Auxiliary Contact Option, it is possible to control an external bypass to reduce heating and lengthen acceleration and deceleration times.

The S701 provides the user with the ability to adjust initial torque, ramp up and down time, and also select kick start for high inertia loads.

Installation

⚠ WARNING

DO NOT INSTALL OR PERFORM MAINTENANCE ON THIS DEVICE WHILE EQUIPMENT IS ENERGIZED. DEATH OR SEVERE PERSONAL INJURY CAN RESULT FROM CONTACT WITH ENERGIZED EQUIPMENT. VERIFY THAT NO VOLTAGE IS PRESENT BEFORE PROCEEDING WITH INSTALLATION OR MAINTENANCE.

Only qualified persons, as defined in the National Electric Code, who are familiar with the installation, maintenance and operation of this device and the equipment onto which it is to be installed, as well as applicable local, state and national regulations and industry standards and accepted practices regarding safety of personnel and the equipment safety should be permitted to install, maintain or operate this device. These instructions are provided only as a general guide to such qualified persons and are not all-inclusive. They do not cover every application or circumstance which may arise in the installation, maintenance or operation of this equipment. Users are advised to comply with all local, state and national regulations and industry standards and accepted practices regarding safety of personnel and equipment.

⚠ CAUTION

REMOVE ALL POWER FROM THE INSTALLATION BEFORE ATTEMPTING TO INSTALL OR REMOVE THIS DEVICE. THIS INCLUDES L1, L2, L3 AS WELL AS A1, A2, 11, 12, 13 and 14.

Mounting Guidelines for S701X25N3BP

Important — The controller is designed for vertical mounting in free air. If the controller is mounted horizontally, the load current must be reduced to 50% of rated current.

Maintenance

Cooling fins must be kept clean and free from dust. The airflow must not be blocked.

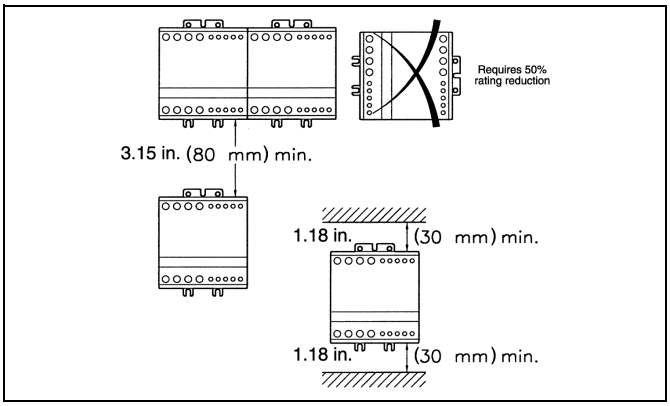


Figure 1. *Recommended Mounting Distance*

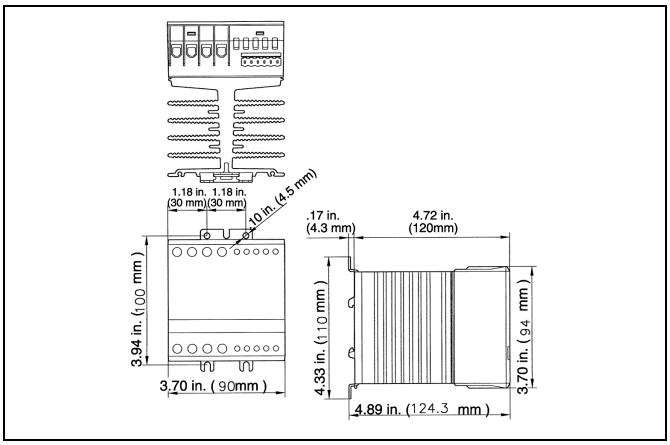


Figure 2. *Dimensions*

Wiring Directions

⚠ IMPORTANT

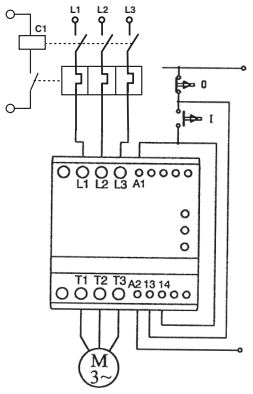
When using electrical or pnuematic tools for screw terminals, observe maximum torque limits.

75°C	AWG (mm²)	AWG (mm²)
*	18 - 10 (1.5 -6)	20 - 16 (0.5 - 1.5)
	16 - 10 (2 x 1.5-6)	2 x 20 - 18 (2 x 0.5 - 0.75)
*	16 - 10 (1.5 - 6)	20 - 16 (0.5 - 1.5)
	2 x 16 - 10 (2 x 1.5 - 6)	2 x 20 - 16 (2 x 0.5 - 1.5)
*	18 - 8 (1 - 10)	20 - 16 (0.5 - 1.5)
	2 x 18 - 10 (2 x 1 - 6)	2 x 20 - 16 (2 x 0.5 - 1.5)
	Posidrive 1 1.2 Nm max. [4.4 lb-in max.]	N/A
	6 mm 1.2 Nm max. [4.4 lb-in max.]	3 mm 0.4 Nm max. [3.5 lb-in max.]

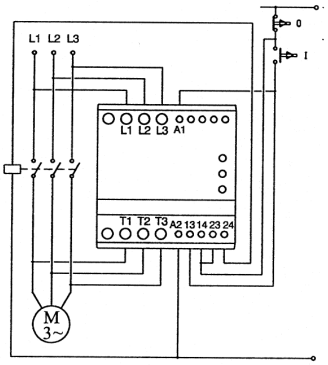
* UL Tested.

Wiring Diagrams

AC-53a Application — No Bypass and START/STOP



AC-53b Application — with Bypass and START/STOP



NOTE: Use thermal overload protection as required by the National Electric Code (NEC).

Figure 3. *Wiring Diagrams*

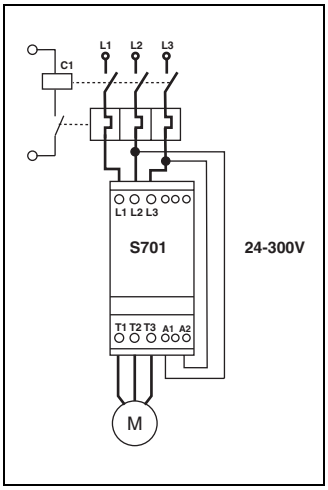


Figure 4. *Line Controlled Soft Start **

Using Line Voltage to Control S701

When the contactor C1 is switched to the ON state, the motor controller will soft start the motor according to the settings of the ramp-up time and initial torque adjustments.

When the contactor C1 is switched to the OFF state, the motor will be switched off instantaneously.

In this application, the contactor will have no load during making operation.

The contactor will carry and break the nominal motor current. Maximum voltage in this application is 300V AC.

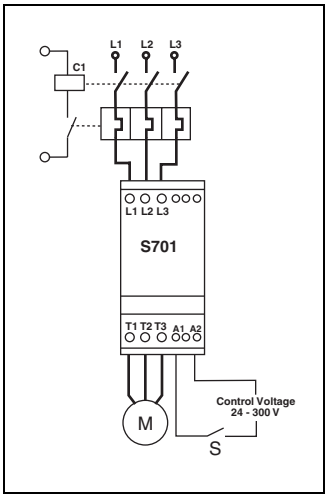


Figure 5. *Input Controlled Soft Start **

Separate Input Signal to S701

When the control input is switched to the ON state (S closed), the motor controller will soft start the motor according to the settings of the ramp-up time and initial torque adjustments.

When the control input is switched to the OFF state (S open), the motor will be switched off instantaneously only if the ramp-down time is adjusted to 0.

With any other setting, the motor will be soft stopped according to the settings of the ramp-down time adjustment.

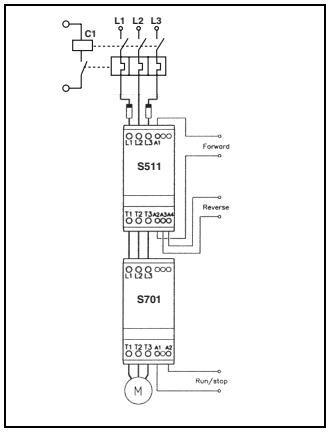


Figure 6. *Combining Reversing Electronic Contactor and Soft Start Controller **

Soft Reversing of Motors up to 5 hp/4 kW

A soft reversing of a motor can easily be achieved by connecting a reversing relay to the soft start controller.

The reversing relay type S511 will determine the direction of rotation forward or reverse and the soft start type S701 will perform soft-starting and soft-stopping of the motor.

If soft stop is not required, the application can be simplified by connecting the control circuit of the soft start controller to the main terminals as shown in **Figure 6**. A delay of approximately 0.5 seconds between forward and reverse control signal must be allowed to avoid influence from the voltage generated by the motor during turnoff.

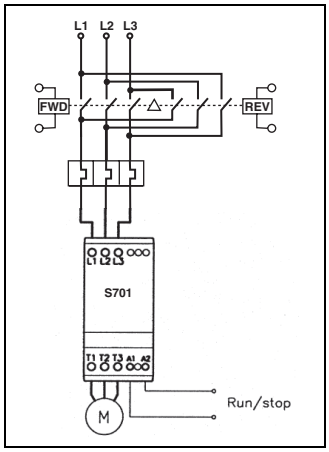


Figure 7. *Combining Reversing Mechanical Contactor and Soft Start Controller **

Reversing of Motors Up to 15 hp/11 kW

A soft-reversing of motors can easily be achieved when the motor load exceeds 5 hp/4 kW by connecting a mechanical reversing contactor to the soft start controller.

The reversing contactor will determine the direction of rotation forward or reverse and the soft start controller type S701 will perform soft-starting and soft-stopping of the motor.

If the contactors are always switched in no load conditions, the lifetime of the contactors will normally exceed 10 million cycles.

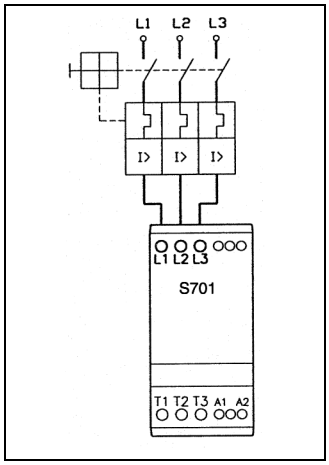


Figure 8. *Overload Protection with Manual Motor Starter**

Overload Protection with Manual Motor Starter

Overload protection of the motor is easily achieved by installing a manual motor starter on the supply side of the motor.

The manual motor starter provides means for padlocking and the necessary clearance for use as a circuit isolator according to EN60204-1.

Adjust the current limiter on the manual motor starter according to the rated nominal current of the motor.

***** Use **UL** specified backup fuse.

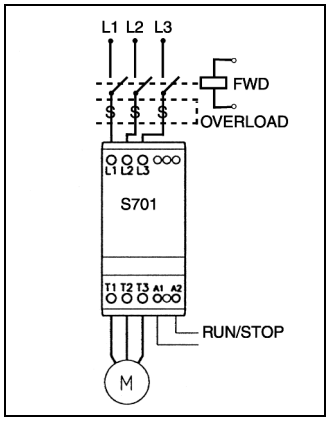


Figure 9. *Overload Protection with Mechanical Starter **

Overload Protection with Mechanical Starter

Overload protection of the motor is easily achieved by installing a mechanical starter on the supply side of the soft start controller.

The overload provides the necessary motor protection for an overload condition.

A short circuit protective device is required to meet UL requirements.

***** Use **UL** specified backup fuse.

Specifications

Table 1. *Thermal Specifications*

Description	Specification
Power dissipation for continuous operation PD max.	2 W/A
Power dissipation for intermittent operation PD	2 W/A x duty cycle
Cooling Method	Natural convection
Mounting (No Derating)	Vertical ±30°
Operating temperature range, EN60947-4-2 (no derating)	-5° to 40°C* [23° to 104°F]
Storage temperature, EN60947-4-2	-20° to 80°C [-4° to 176°F]
Max. operating temperature with current derating according to table	60°C [140°F]

* UL Tested.

Table 2. *Insulation Specifications*

Description	Specification
Rated insulation voltage	Ui 660 Volt
Rated impulse withstand voltage	Uimp 4 kVolt
Installation category	III

Current Derating

Current Derating in High Temperature Applications

Operation in ambient temperatures exceeding 40°C is possible if the power dissipation is limited either by reducing the steady-state current or by reducing the duty cycle of the soft starter as shown in **Table 3**.

Table 3. *Temperature Specifications*

Ambient Temperature	S701X25N3BP
50°C [122°F]	20A continuous
Limited Duty Cycle Rating by 50°C	On-time max. 15 min. Duty cycle max. 0.8
60°C [140°F]	17A continuous
Limited Duty Cycle Rating by 60°C	On-time max. 15 min. Duty cycle max. 0.65

Table 4. *Current Derating by Trip Class*

Overload Trip Class	Without Bypass	With Bypass
10A	25A	30A
10	25A	30A
20	20A	24A
30	15A	19.5A

EMC

This compartment meets the requirements of the product standard EN60947-4-2 and is CE marked according to this standard.

Approvals: UL Std. No. 508
Environment: Degree of Protection / Pollution Degree: IP20 / 3

Table 5. *Output Specifications — Main Circuit*

Description	Specification
Short circuit protecting fuse (max.)	80 A $_gL/_gG$. No time delay
Operational current (max.)	25A AC-53a, 30A AC-53b
Semiconductor protecting fuse (max.)	6300 A^2S
Overload relay trip class	10 or 10A

Table 6. *Control Specifications*

Description	Specification
Control voltage range	24 – 300V AC/DC
Control current/power (max.)	15 mA/2 VA
Ramp-Up time	Adjustable from 0.5 to 20 sec.
Ramp-Down time	Adjustable from 0.5 to 20 sec.
Initial torque	Adjustable from 0 to 85% of nominal torque with optional Kick Start
Output/Current voltage (max.)	0.5A AC14, AC15, 24 – 480V AC 50 – 60 Hz
Fuse (max.)	10 A $_gL/_gG$. I^2t max. 72 A^2S

Product Selection

Table 7. *Product Description and Item Selection*

Line Voltage (V AC)	Motor Size w/o Bypass hp / kW	Motor w/ Bypass hp / kW	Control Voltage Range* AC/DC	Controller Type Designation
208 – 230	10 / 7.5	10 / 7.5	24 – 300V	S701C25N3BP
400 – 480	15 / 11	20 / 15	24 – 300V	S701E25N3BP
550 – 600	20 / 15	25 / 18	24 – 300V	S701G25N3BP

* 24 – 480V for CE only.

Short Circuit Protection

Two types of short circuit protection can be used:

short circuit protection by circuit breaker
short circuit protection by fuses

Short circuit protection is divided into two levels — Type 1 and Type 2.

Type 1 — protects the installation
Type 2 — protects the installation and the semiconductors inside the motor controller

Short Circuit Protection by Circuit Breaker

A 3-phase motor with a correctly installed and adjusted overload relay will not short-circuit totally to earth or between the 3 phases. Part of the winding will normally limit the short circuit current to a value that will cause instantaneous magnetic tripping of the circuit breaker without damage to the soft starter. The magnetic trip response current is approximately 11 times the maximum adjustable current.

Short Circuit Protection by Fuses

Type 1

S701X25N3BP — protection max. 80A $_{g}I/_{g}L/_{g}G$ 63A T

Type 2

S701X25N3BP — protection max. I^2t of the fuse $6300A^2S$

NOTE: S701X25N3BP — When protected by H class fuses, this device is rated for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 600V maximum.

How to Adjust Time and Torque, Figure 10

The Soft Starter will read time and torque settings in the OFF state. Repeated starts may trip the motor protection relay. DO NOT set the rotary switches in between positions. This corrupts the time and torque adjustment. Use screwdriver 2 mm x 0.5 mm.

Ramp-Up Time and Initial Torque

Table 8. *Ramp-Up Time and Initial Torque (Standard Load)*

Position	Setting/Adjustment
8,2 0	Set the **Ramp-Up** switch to maximum.
0	Set the **Ramp-Down** switch to minimum.
0	Set the **Initial Torque** switch to minimum.
	Apply control signal for a few seconds. If the load does not rotate immediately, increment the **Initial Torque** and try again. Repeat until the load starts to rotate immediately on startup.
	Adjust **Ramp-Up** time to the estimated start time (the scale is in seconds) and start the motor.
	Decrease the **Ramp-Up** time until mechanical surge is observed during start.
	Increase the time one step to eliminate the surge.

Kick Start/Break Loose

If it is not possible to reach a time sufficient for the application, it may be necessary to kick start the load.

Table 9. *Kick Start/Break Loose (High Inertia Loads)*

Position	Setting/Adjustment
8,2 0	Set the **Ramp-Up** switch to maximum.
0	Set the **Ramp-Down** switch to minimum.
0	Set the **Initial Torque** switch to minimum kick start torque.
	Apply control signal for a few seconds. If the load stops right after the 200ms “kick”, increment the **Initial Torque** and try again. Repeat until the load continues to rotate after the “kick”.
	Adjust **Ramp-Up** time to the desired start time (the scale is in seconds) and start the motor.

Ramp-Down Time

Follow **Table 8** to set **Ramp-Up** and **Initial Torque**.

Table 10. *Ramp-Down Time, e.g. Pump Loads*

Position	Setting/Adjustment
8,2 0	Set the **Ramp-Down** switch to maximum.
0	Switch off the control voltage and observe any mechanical surges on the load. If there are none, decrement **Ramp-Down** switch and try again. Repeat until mechanical surge on the load is observed.
	Increase the time one step to eliminate the surge.

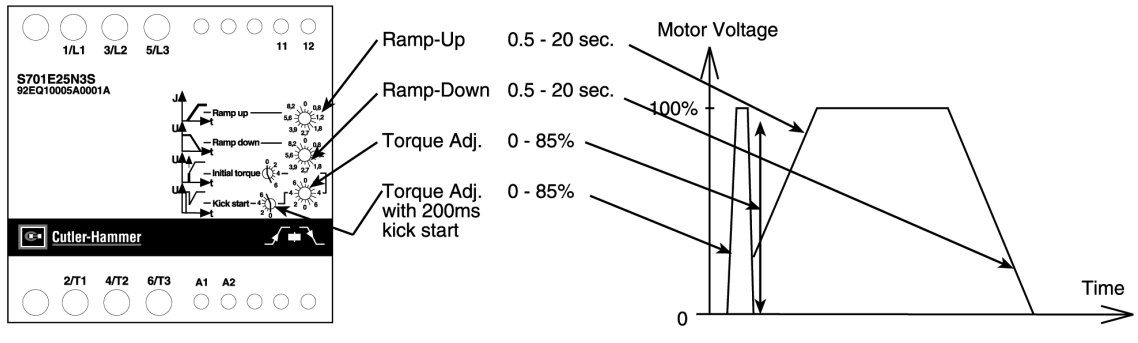


Figure 10. *Time and Torque Adjustment*

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