AuCom CSXi Soft Starter User Manual

MOTOR CONTROL SPECIALISTS

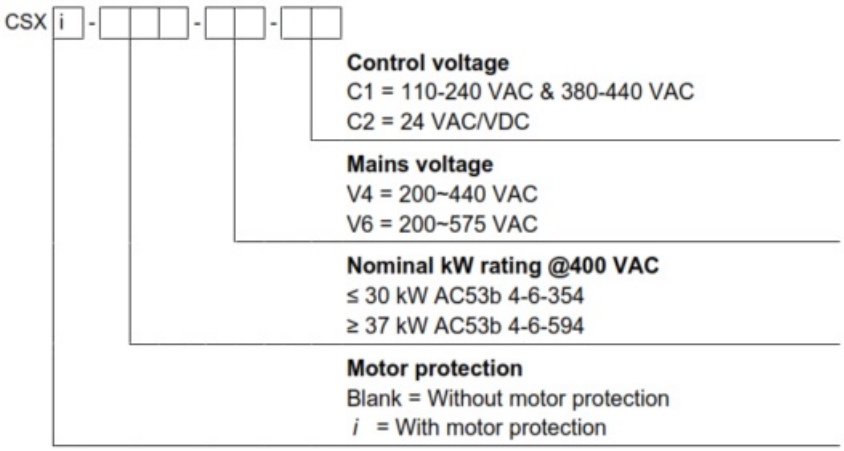
RIGHT FROM THE START

Contents

Product compatibility

This user manual is suitable for use with ESXi soft starters.

Model code



Certifications

RCM …….. IEC 60947-4-2
CE …… EN 60947-4-2
CCC ……. GB 14048.6
EAC …….. TP TC 004/2011, TP TC 020/2011
Marine …….. Lloyds Marine No 1 Specification
UL / C-UL …… UL 508

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Caution Statements

Caution Statements cannot cover every potential cause of equipment damage but can highlight common causes of damage. It is the installer's responsibility to read and understand all instructions in this manual prior to installing, operating or maintaining the equipment, to follow good electrical practice including applying appropriate personal
protective equipment and to seek advice before operating this equipment in a manner other than as described in this manual.

- Isolate the soft starter completely from the power supply before attempting any work on the soft starter or motor.
- Cables to the control inputs must be segregated from mains voltage and motor cabling.
- Some electronic contactor coils are not suitable for direct switching with PCB mount relays. Consult the contactor manufacturer/supplier to confirm suitability.
- Do not apply incorrect voltages to the control input terminals.

CAUTION

Power factor correction capacitors must be connected to the input side of the soft starter. Connecting power factor correction capacitors to the output side will damage the soft starter.

WARNING – ELECTRICAL SHOCK HAZARD

The soft starter contains dangerous voltages when connected to mains voltage. Only a qualified electrician should carry out the electrical installation. Improper installation of the motor or the soft starter may cause equipment failure, serious injury or death. Follow this manual and local electrical safety codes.

GROUNDING AND BRANCH CIRCUIT PROTECTION

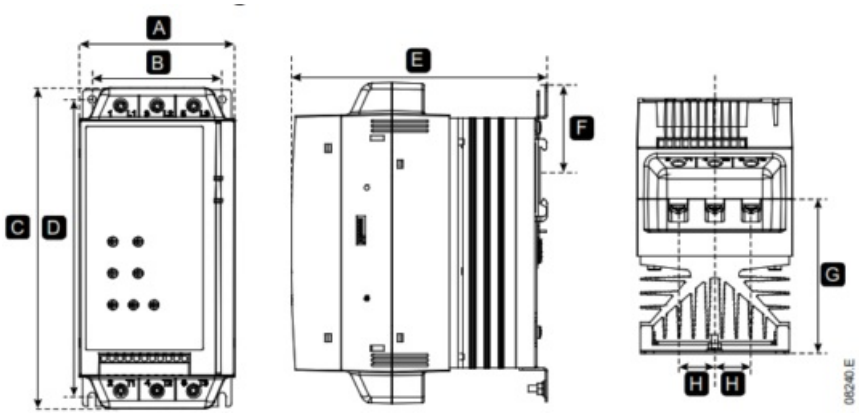
It is the responsibility of the user or person installing the soft starter to provide proper grounding and branch circuit protection according to local electrical safety codes.

SHORT CIRCUIT

The soft starter is not short circuit proof. After severe overload or short circuit, the operation of the soft starter should be fully tested by an authorized service agent.

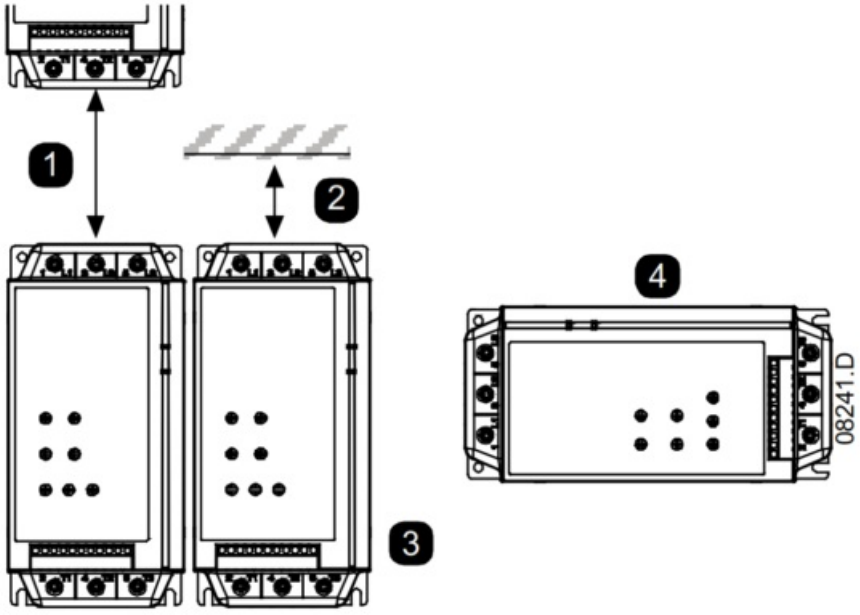
Mechanical Installation

2.1 Dimensions and Weights



	Width mm(inch)		Height mm (inch)		Depth mm (inch)	mm (inch)	mm (inch)	mm (inch)	Weight kg (lb)
Model	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	
018 034 042 048 060	98 (3. 85)	82 (3.22)	201 (8.)	188 (7.)	165 (6.)	55 (2.)	91. (4.)	23 (1.)	2.2 (5.)
075 085 100	145(5.70)	124(4.70)	215(8.)	196(8.46)	193(7.71)	–	111.	37(1.5)	4.0(8.81)
140 170 200	200(7.87)	160(6.30)	240(9.44)	216(8.50)	214(843.)	–	115. (4. 5)	51(2.0)	7. (14.33)

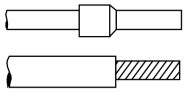
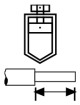
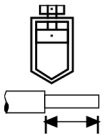
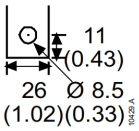
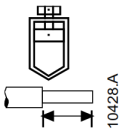
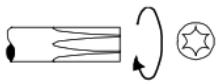
Physical Installation



1	018 ~ 100: Allow 100 mm (3.9 inches) between soft starters. 140 ~ 200: Allow 200 mm (7.9 inches) between soft starters.
2	018 ~100: Allow 50 mm (2.0 inches) between the soft starter and solid surfaces. 140 — 200: Allow 200 mm (7.9 inches) between the soft starter and solid surfaces.
3	Soft starters may be mounted side by side with no clearance (that is if mounted without communications modules).
4	The soft starter may be mounted on its side. Derate the soft starter’s rated current by 15%.

Electrical Installation

3.1 Power Terminations

	1/L1, 3/L2, 5/L3, 2/T1, 4/T2, 6/T3 mm2 (AWG)						A1, A2, A3, 01, 02, B4, B5, 13, 14, 23, 24 mm2 (AWG)	
	018 – 060		075 – 100		140 – 200		018 – 200	
	10 – 35 (8 – 2)	 14 mm (0.55 inch)	25 – 50 (4 – 1/10)	 14 mm (0.55 inch)	n/a	 mm (inch)	0.14 – 1.5 (26 – 16)	 6 mm (0.24 inch)
	Torx (T20) 3 Nm 2.2 ft-lb		Torx (T20) 4Nm 2.9 ft-lb		n/a		n/a	
	7mm 3 Nm 2.2 ft-lb		7mm 4Nm 2.9 ft-lb		n/a		3.5 mm 0.5 Nm max 4.4 in-lb max	

3.2 Control Voltage

Connect the control supply according to the supply voltage being used.

- xxx-xx-C1 (110~240 VAC): A1, A2
- xxx-xx-C1 (380-440 VAC): A2, A3
- xxx-xx-C2 (24 VAC/VDC): A1, A2

WARNING

Always apply control voltage before (or with) mains voltage.

CAUTION

With 24 VAC/VDC use contacts rated for low voltage and low current (gold flash or similar).

3.3 Control Circuits

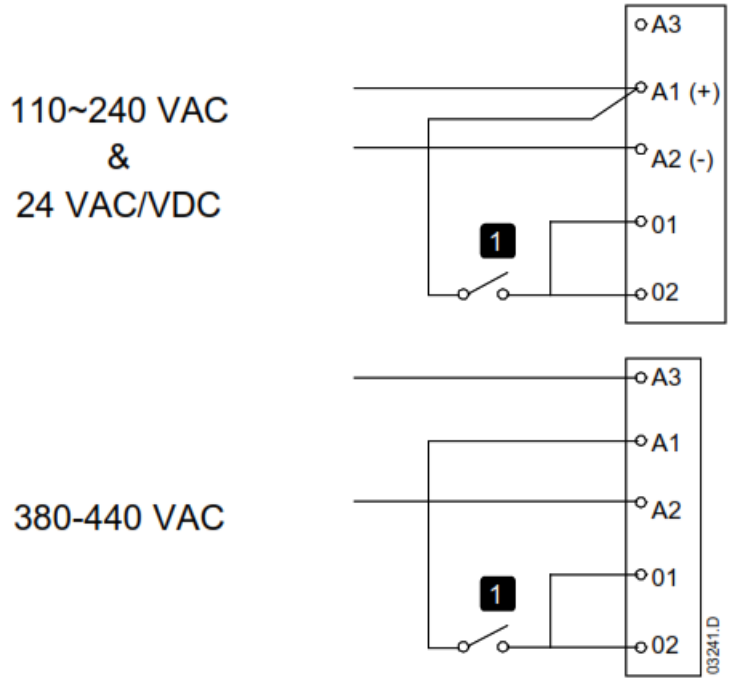
WARNING

Isolate the soft starter completely from the power supply before attempting any work on the soft starter or motor. Control terminals may be at phase voltagepotential.

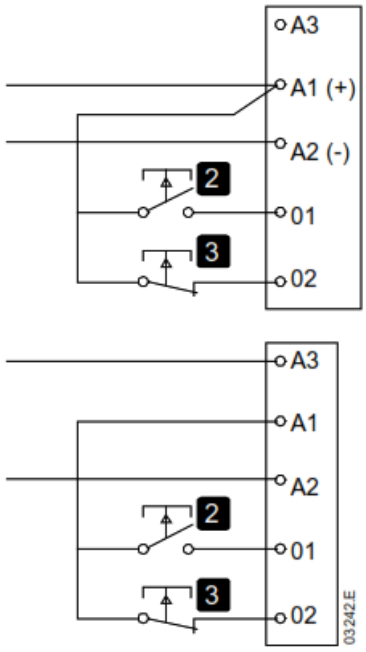
CAUTION

For xxx-xx-C2 (24 VAC/VDC control voltage) units you can connect an external 24 VDC supply into the control input terminals 01, and 02.

Two-wire control

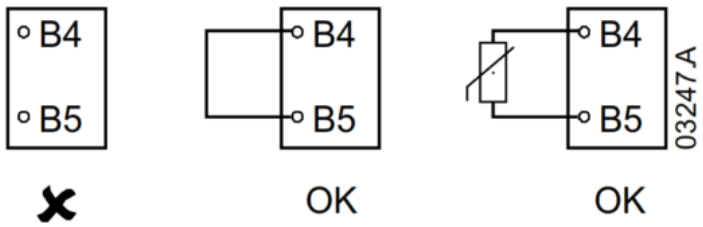


Three-wire control



1	Start/Stop. To reset a trip, open then close 02.
2	Start
3	Stop. To reset a trip, open then close 02.

Motor Thermistor
Motor thermistors can be connected directly to the soft starter terminals B4, B5. If motor thermistors are not used, there must be a link between B4, B5 (the soft starter is supplied with a link fitted).

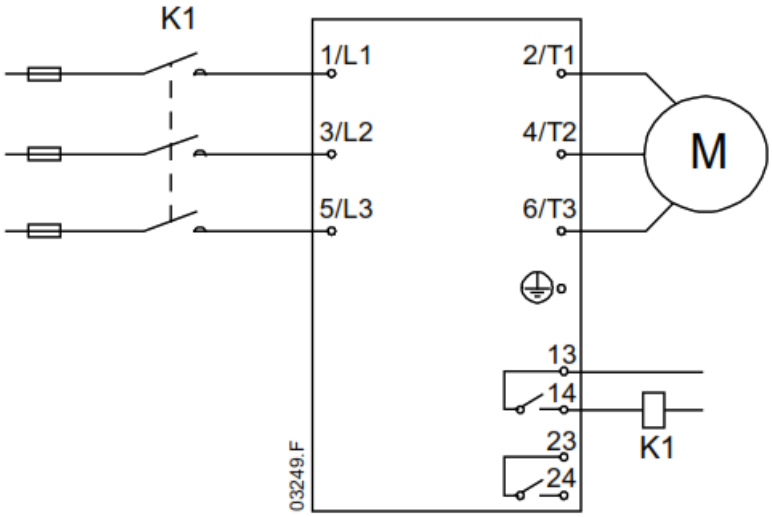


3.4 Outputs
Main Contactor Output
The Main Contactor output (terminals 13, 14) closes as soon as the soft starter receives a start command and remains closed while the soft starter is controlling the motor (until the motor starts a coast to stop, or until the end of a soft stop). The Main Contactor output willalso open if the soft starter trips. The Main Contactor output can be used to directly control the main contactor coil.

Programmable Output
The programmable output relay (terminals 23, 24) can be used to signal either trip or run status. This relay is normally open.
Trip:
The relay closes when the soft starter trips. The relay can be used to operate the shunt-trip mechanism of an upstream circuit breaker (in order to isolate the motor branch circuit), or to signal the trip to an automation system or externally. The relay will open when the trip is reset.
Run:
The relay operates when the soft start is complete, the bypass relays are closed and full voltage is being applied to the motor. The relay can be used to operate a contactor for power factor correction capacitors or to signal soft starter run status to an automation system.

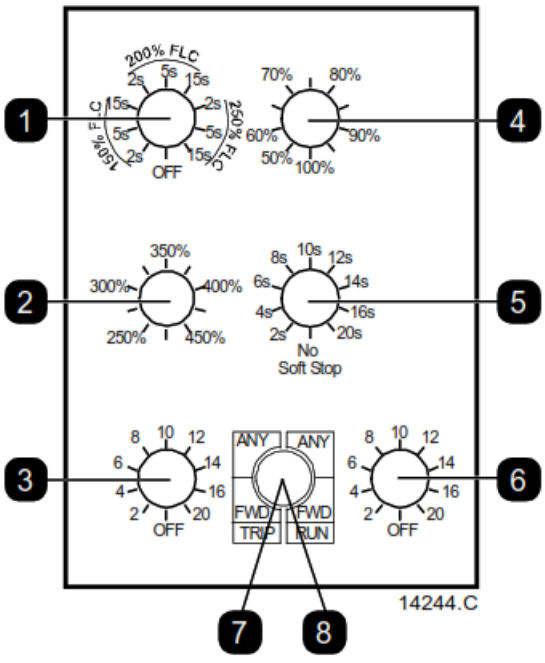
3.5 Electrical Schematics

Soft starter installed with fuses and the main contractor.

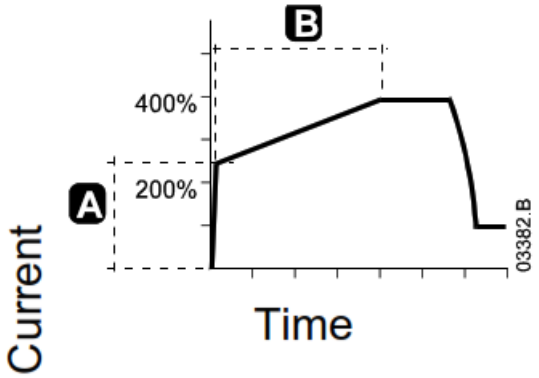
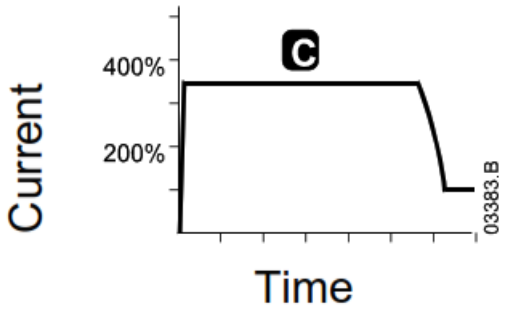


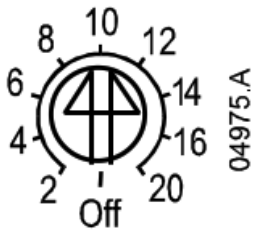
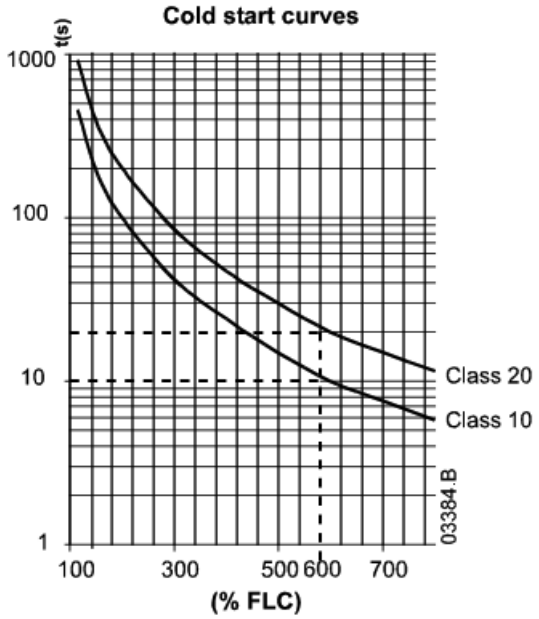
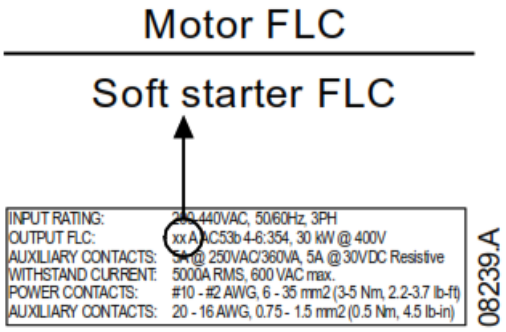
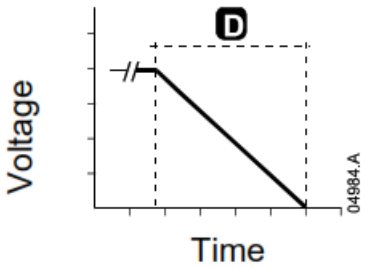
M	Motor (three-phase)
K1	Main contactor
13, 14	Main contactor output
23, 24	Programmable output (set to Trip)

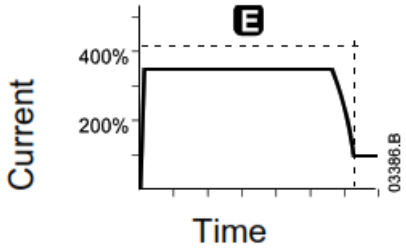
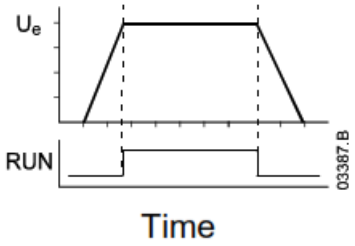
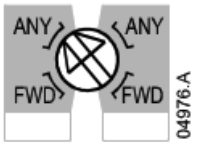
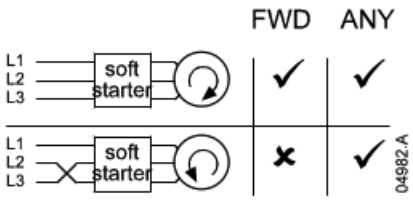
Adjustments



1	Current Ramp
2	Current Limit
3	Motor Trip Class
4	Motor FLC
5	Soft Stop Time
6	Excess Start Time
7	Auxiliary Relay Function
8	Phase Sequence Protection

1	**Current Ramp**  Select the initial start current (A) a nd ramp time (B). Current ramp st arting xtends the time soft starter takes to each the current limit and is suitable for generator set suppli es, loads requiring an extended st art time or applications with trem e load variation between starts. T he ramps time does not control th e time the motor will take to reach full speed.	
2	Current Limit  Select the current limit (C). The c urrent limit is the maximum level of current the soft starter will deliv er to the motor during the soft sta rt.	

3	Motor Trip  Class Select the trip class for mot or overload protection. The trip class reflects t he maximum time (in seconds) th at the motor can run at locked rot or current. The Motor Trip Class s etting assumes a locked rotor curr ent of 600%. Setting the motor tri p class to “Off” disables motor ov erload protection.	
4	Motor FLC  Configure the soft starter to matc h the motor’s full load current (FL C). Configure according to the mo tor’s nameplate current. Divide th e motor’s FLC by the soft starter’s maximum current rating (on the s oft starter’s nameplate abel).	
5	Soft Stop  Time Select the soft stop ramp ti me (D). Soft stop extends the tim e soft starter takes to reduce volt age to zero. The ramp time does not control the time the motor will take to stop completely.	

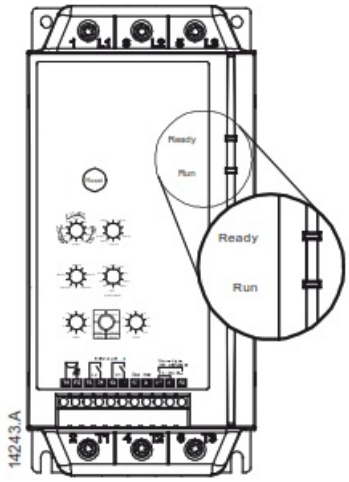
6	Excess Start  Time Configure the soft starter's excess start time protection. Sele ct a time slightly onger than the motor requires for a normal healthy start. The soft starter will t rip if the start does not complete within the selected time (E)	
7	Auxiliary Relay  Function Select the function of th e soft starter's programmable out put (terminals 23, 24). When set o "Run", the relay will operate wh en the soft start is complete. Whe n set to"Trip", the relay will operat e hen the soft starter trips.	
8	Configure the soft starter's phase sequence  protection. Select the allowable p hase sequences. A setting of "Fw d" allows forward sequence (posit ive rotation) only and a setting of "Anydefeats the protection.	

NOTE

The Auxiliary relay function and phase sequence are configured using a shared switch. Set the auxiliary relay function as required, then set phase sequence protection.

Troubleshooting

5.1 Feedback LEDs



LED Status	Ready	Run
Off	No control power	Motor not running
On	Ready	Motor running at full speed
Flash	Starter tripped	Motor starting or stopping

5.2 Trip Codes

The Ready LED will flash a different number of times to indicate the cause of the trip.

Ready LED	Description
x 1	Power Circuit: Check mains supply (L1, L2, L3), motor circuit (T1, T2, T3), soft starter SCRs and bypass relays.
x 2	Excess Start Time: Check load, increase Current Limit or adjust the Excess Start Time setting.
x 3	Motor Overload: Allow motor to cool, reset soft starter and restart. The soft starter cannot be reset until the motor has cooled.
x 4	Motor Thermistor: Check motor ventilation and thermistor connection B4, B5. Allow motor to cool.
x 5	Current imbalance: Check for mains supply or line current imbalance (L1, L2, L3).
x 6	Supply Frequency: Check mains voltage is available and supply frequency is in range.
x7	Phase sequence: Check for correct phase sequence.
x 8	Network Communication Failure (between module and network): Check network connections, settings and configuration.
x 9	Starter Communication Failure (between starter and module): Remove and refit the accessory module.
x 10	Bypass Overload: The starter rating may be too low for the application.

5.3 Protections

The soft starter includes the following types of protection for the motor and starter:

Excess Start Time Protection

The soft starter will trip on excess start time if the motor does not successfully start within the time selected in the Excess Start Time setting. This may indicate that the load has
stalled.

If the soft starter frequently trips on excess start time:

- check that the Current Limit setting is high enough for the application
- check that the Excess Start Time setting is long enough for the application
- check that the load has not stalled or increased since the soft starter was installed

Motor Overload Protection

The soft starter will trip on motor overload if it calculates that the motor has been running above its operating range for longer than the time selected in the Motor Trip Class setting. Motor Trip Class should be set to match the motor's locked rotor time. If this information is not available from the motor datasheet, use the default setting (Motor Trip lass = 10). Using a higher setting can damage the motor.

NOTE

Motor overload protection does not protect the soft starter and does not protect the motor from short circuits.

Current Imbalance Protection
The soft starter will trip on current imbalance if the highest and lowest currents on the three phases vary by an average of 30% for more than 3 seconds. Current imbalance protection is not adjustable and is only active when the average motor current is 50% or more of the programmed motor FLC.
If the soft starter frequently trips on the current imbalance:

- check that there is no imbalance on the mains voltage (on the input side of the soft starter)
- insulation test the motor
- move all input cables over one position (move L1 cable to L2, move L2 cable to L3, move L3 cable to L1) to rule out a cabling fault

Supply Frequency Protection
The soft starter will trip on supply frequency if the frequency rises above 72 Hz or falls below 40 Hz for more than five seconds while the soft starter is running. These trip points are not adjustable.
In pre-start, starting and stopping modes the high and low-frequency limits both apply with no time delay.
A supply frequency trip will also occur if:

- all three input phases are lost while the soft starter is running
- all three input phases fall below 120 VAC at start or while the soft starter is running
- the line contactor opens while running

Bypass Overload Protection
Bypass overload protection protects the soft starter from severe operating overloads while running. The protection is not adjustable and has two components:

- The soft starter will trip if it detects overcurrent at 600% of the programmed motor full load current.
- The soft starter models the temperature of the internal bypass relays and will trip if the temperature exceeds the safe operating level.

If the trip occurs frequently, this indicates that the soft starter has not been selected correctly for the application.

5.4 Reset
Trips can be cleared by pressing the Reset button on the soft starter, sending a Reset command from the serial communications network, or by switching the control inputs. To lear a trip via the control inputs, the soft starter requires a closed to open transition on the stop input (02).

- In three-wire control, use the external stop button to momentarily open the stop input (open A1-02).
- In two-wire control, if the soft starter tripped with a start signal present, remove the start signal (open A1 to 01, 02).
- In two-wire control, if the soft starter tripped with no start signal present (eg soft starter motor thermistor trip), apply then remove the start signal (close then reopen A1 to 01, 02).

The Reset button is located on the front of the unit, above the adjustment switches.
The soft starter will trip again immediately if the cause of the trip still exists.

Accessories

6.1 Finger Guard Kit
Finger guards may be specified for personnel safety. Finger guards fit over the soft star terminals to prevent

accidental contact with live terminals. Finger guards provide IP20 protection when used with a cable of diameter 22 mm or greater.

6.2 Remote Operator

The Remote Operator can control and monitor the soft starter's performance. Functionalincludes:

- Operational control (Start, Stop, Reset, Quick stop)
- Starter status monitoring (Ready, Starting, Running, Stopping, Tripped)
- Performance monitoring (Motor current, Motor temperature)
- Trip code display
- 4-20 mA analog output (Motor Current)

6.3 Communication Module**s**

The soft starters support network communication via easy-to-install communications modules. Each soft starter can support one communications module at a time.

Available protocols:

Ethernet (Profinet, Modbus TCP, Ethernet/IP), Profibus, DeviceNet, Modbus RTU, and USB.

NOTE

Ethernet communication modules are not suitable for use with starters using 380/440 VAC control voltage.

6.4 PC Software

The software allows comprehensive management of soft starters. It provides the following functionality:

- Operation of soft starter networks containing up to 254 individual soft starters
- Operational control (Start, Stop, Reset, Quick stop)
- Starter status monitoring (Ready, Starting, Running, Stopping, Tripped)
- Performance monitoring (Motor current, Motor temperature)

To use the software with the soft starter, the soft starter must be fitted with a USB ModulModbus Module or a Remote Operator.

Specifications

7.1 General Technical Data

Mains Supply

Mains voltage (L1, L2, L3)
V4 ..... 3 x 200 VAC ~ 440 VAC (+ 10% / – 15%)
V6 ..... 3 x 200 VAC ~ 575 VAC (+ 10% / – 15%)
Mains frequency (at the start) ..... 45 Hz to 66 Hz
Rated insulation voltage ..... 600 VAC
Form designation ..... Bypassed semiconductor motor starter form 1

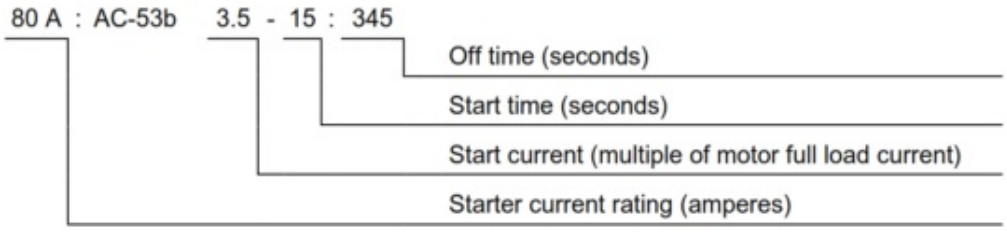
Control voltage (01, 02)

xxx-xx-C1 ..... 110-240 VAC (+ 10% / – 15%)
..... or 380-440 VAC (+ 10% / – 15%)
xxx-xx-C2 ..... 24 VAC/VDC (± 20%)
Current consumption (during the run) ..... < 100 mA
Current consumption (inrush)
xxx-xx-C1 ..... 10 A
xxx-xx-C2 ..... 2 A

Inputs
Start (terminal 01) …… Normally open
…… 150 kΩ @ 300 VAC and 5.6 kΩ @ 24 VAC/VDC
Stop (terminal 02) …… Normally closed
…… 150 kΩ @ 300 VAC and 5.6 kΩ @ 24 VAC/VDC
Outputs
Main contactor relay (terminals 13, 14) …… Normally open
…… 6 A, 30 VDC / 6 A, 250 VAC resistive
Programmable relay (terminals 23, 24) …… Normally open
…… 6 A, 30 VDC / 6 A, 250 VAC resistive
Environmental
Degree of Protection 018 to 100 …….. IP20
Degree of Protection 140 to 200 …….. IP00
Operating temperature …….. – 10 °C to + 60 °C
Storage temperature ……. -25 °C~+ 60 °C (to +70 °C for less than 24 hours)
Humidity …… 5%~95% Relative Humidity
Pollution degree ……. Pollution Degree 3
Vibration …….. IEC 60068 Test Fc Sinusoidal
…… 4 Hz to 13.2 Hz: ± 1 mm displacement
…….. 13.2 Hz to 200 Hz: ± 0.7 g
EMC Emission
Equipment class (EMC) ……. Class B
Conducted radio frequency emission …….. 0.15 MHz to 0.5 MHz: < 56-46 dB (µV)
…….. 0.5 MHz to 5 MHz: < 46 dB (µV)
…….. 5 MHz to 30 MHz: < 50 dB (µV)
Radiated radio frequency emission …….. 30 MHz to 230 MHz: < 30 dB (µV/m)
…… 230 MHz to 1000 MHz: < 37 dB (µV/m)

EMC Immunity
Electrostatic discharge …… 4 kV contact discharge, 8 kV air discharge
Radiofrequency electromagnetic field ……. 0.15 MHz to 1000 MHz: 140 dB (µV)
Rated impulse withstand voltage
(Fast transients 5/50 ns) …….. 2 kV line to earth, 1 kV line to line
Voltage dip and short time interruption …….. 100 ms (at 40% nominal voltage)
Harmonics and distortion …….. IEC61000-2-4 (Class 3), EN/IEC61800-3
Short Circuit
Rated short-circuit current 018 to 048 ……. 5 kA
1Rated short-circuit current 060 to 200 …….. 10 kA
1These short circuit ratings are with fuses used as given in the table under Semiconductor Fuses on page 17.
Heat Dissipation
During Start …….. 3 watts/ampere
During Run …….. 10 watts typical
Operational Life
018~100 …… 1,000,000 operations
140~200 …….. 30,000 operations
Certification
For a list of certifications, refer to the inside cover of this manual.

7.2 Current Ratings
Contact your local supplier for ratings under operating conditions not covered by these rating charts.
AC53b format



Ratings

	AC53b 4-6:354 < 1000 metres		**AC53b < 10004-20:3 metres**	
	40 °C	**50 °C**	**40 °C**	**50 °C**
18	18A	17A	17A	15A
34	34 A	32 A	30 A	28 A
42	42 A	40 A	36 A	33 A
48	48 A	44 A	40 A	36 A
60	60 A	55 A	49 A	45A
	AC53b 4-6:594 < 1000 metres		**AC53b 4-20 580 < 1000 metres**	
	40 °C	**50 °C**	**40 °C**	**50 °C**
75	75 A	68 A	65 A	59 A
85	85 A	78 A	73 A	67 A
100	100 A	100 A	96 A	87 A
140	140 A	133 A	120 A	110 A
170	170 A	157 A	142 A	130 A
200	200 A	186 A	165 A	152 A

7.3 Semiconductor Fuses

Semiconductor fuses can be used with the soft starters to reduce the potential for damage to SCRs from transient overload currents and for Type 2 coordination. The soft starters have been tested to achieve Type 2 coordination with semiconductor fuses. SuitableBussmann and Ferraz/Mersen semiconductor fuses are detailed below.

Model	SCR 12t (A s)	Ferraz/Mersen Fuse European/IEC Style (North American Style)	Bussmann Fuse Square Body (170M)	Bussmann Fuse British Style (BS88)
18	1150	6.6URD30xxxA0063 (A07OURD30xxx0063)	170M-1314	63 FE
34	8000	6.6URD30xxxA0125 (A07OURD30xxx0125)	170M-1317	160 FEE
42	10500	6.6URD30xxxA0160 (A07OURD30xxx0160)	170M-1318	160 FEE
48	15000	6.6URD30xxxA0160 (A07OURD30xxx0160)	170M-1318	180 FM
60	18000	6.6URD30xxxA0160 (A07OURD30xxx0160)	170M-1319	180 FM
75	51200	6.6URD30xxxA0250 (A07OURD30xxx0250)	170M-1321	250 FM
85	80000	6.6URD30xxxA0315 (A07OURD30xxx0315)	170M-1321	250 FM
100	97000	6.6URD30xxxA0315 (A07OURD30xxx0315)	170M-1321	250 FM
140	168000	6.6URD31xxxA0450 (A07OURD31xxx0450)	170M-1322	500 FMM
170	245000	6.6URD31xxxA0450 (A07OURD31xxx0450)	170M-3022	500 FMM
200	320000	6.6URD31xxxA0450 (A07OURD31xxx0450)	170M-3022	500 FMM

xxx = Blade Type. Contact Ferraz/Mersen for options.

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Documents / Resources

	AuCom CSXi Soft Starter [pdf] User Manual CSXi, Soft Starter, CSXi Soft Starter

References

- Antriebstechnik.com Das Branchenportal für Antriebstechnik, Anbieter, Deutschland
- Home | ESCO