Lauritz Knudsen
Electrical & Automation

TECHNICAL CATALOGUE
SOFT STARTERS

ABOUT US

Lauritz Knudsen Electrical & Automation, formerly known as L&T Switchgear, is a leading player in the electrical industry owing to its 70+ years of strong legacy and commitment to the nation's growth. The brand is dedicated to providing a wide range of electrical and automation products and solutions to vital sectors of the economy, including industries, utilities, infrastructure, buildings, and agriculture. Our extensive portfolio includes low-voltage and medium-voltage switchgear, automation solutions, tailored software, and services.

With manufacturing operations in Ahmednagar, Vadodara, and Coimbatore, we adhere to global standards of excellence. Our operations are supported by well-equipped, in-house design and development centers, as well as tooling facilities, ensuring precision in manufacturing.

We proudly operate six Switchgear Training Centers (STCs) across Pune, Lucknow, Coonoor, Vadodara, Delhi, and Kolkata. These centers offer tailor-made classroom courses and lab learning experiences for technicians, customers, engineers, professionals, and students.

With a deep national presence and one of the largest electrical distribution networks, comprising over 1500 partners across the country, we are committed to driving excellence and delivering superior products and solutions that power India's growth journey.

Index

Lauritz Knudsen
Electrical & Automation

Unveiling xS Series

Same Reliability, **New Identity**

A new identity for the trusted CSX & EMX4 products, delivering the same reliability, quality, and performance you've come to rely on. Experience the next evolution of excellence while maintaining the standards you trust.

BEFORE	AFTER
CSXi	xS2000
CSX	xS1000

BEFORE	AFTER
EMX4i	xS4000
EMX4e	xS3000

Selection of Right Starter

To receive the maximum benefit from soft starting, it is important to select the right starter for the situation.

The most important factors are the size of the motor and the type of application. Different applications have different starting characteristics, and applications can be grouped into generalised duty rating categories.

Typical Start Current Requirements - Application duty ratings

- Normal Duty: 300-350% FLC: 10 to 20 seconds
- Heavy Duty: 400% FLC: around 30 seconds
- Severe Duty: 450% FLC: around 50 seconds

Application	300%	350%	400%	450%
Agitator	•		•	
Atomiser			•	
Bottle Washer	•			
Bow Thruster		•		
Carding Machine		•		
Centrifuge				•
Chipper				•
Compressor - Centrifugal (Rotary)		•		
Compressor - Reciprocating (Loaded)				•
Compressor - Reciprocating (Unloaded)			•	
Compressor - Screw (Loaded)			•	
Compressor - Screw (Unloaded)		•		
Conveyer - Horizontal (Loaded)		•		
Conveyer - Horizontal (Unloaded)		•		
Conveyer - Vertical (Loaded)			•	
Conveyer - Vertical (Unloaded)		•		
Conveyer - Belt				•
Conveyer - Roller		•		
Conveyer - Screw			•	
Crusher Cone		•		
Crusher - Jaw				•
Crusher - Rotary (Unloaded)		•		
Crusher - Vertical Impact		•		
Debarker		•		
Drilling Machine		•		
Dryer				•
Dust Collector		•		
Edger		•		
Escalator		•		
Fan Axial (Damped)		•		
Fan - Axial (Un-damped)				•
Fan Centrifugal (Damped)		•		
Fan Centrifugal (Un-damped)				•
Fan - High Pressure				•
Grinder		•		

Application	300%	350%	400%	450%
Hydraulic Power Pack		•		
Mill				•
Mill - Ball				•
Mill Hammer				•
Mill - Roller				•
Milliscreen		•		
Mixer (High Viscosity)				•
Mixer (Low Viscosity)			•	
Palletiser				•
Planer		•		
Press		•		
Pump - Bore	•			
Pump Centrifugal		•		
Pump - Positive Displacement			•	
Pump - Slurry				•
Pump Submersible		•		
Pump - Vacuum		•		
Re-pulper				•
Rotary Table			•	
Sander			•	
Saw Bandsaw				•
Saw - Circular		•		
Screw Feed			•	
Separator (Liquids)				•
Separator (Solids)			•	
Shredder				•
Slabber		•		
Slicer	•			
Stirrer (Liquids)		•		
Travelator		•		
Tumbler			•	
Vibrating Screen			•	
Winch			•	
Wire Draw Machine (Hydraulic)		•		

Selecting the correct starter model

When you know the duty rating of the application, you can choose an appropriate soft starter. Select a starter which offers the features you want, and use the table below to ensure that the soft starter is appropriate for the application. Select a soft starter model which has a current rating at least equal to the motor's rated current, at the appropriate duty rating.

Range of Soft Starters

With a legacy spanning over 70 years, Lauritz Knudsen Electrical & Automation, formerly L&T Switchgear, is a trusted name in the electrical & automation industry. Our portfolio encompasses low-voltage and medium-voltage switchgear, automation systems, custom software, and expert services.

To meet the growing needs of industry and building applications, we have introduced the Revamped Series of Soft Starters. From basic control devices to advanced systems, our Soft Starter solutions cater to diverse and complex requirements.

xS1000 Series of Soft Starters

xS1000 Series Soft Starters provide soft start and soft stop control for new or existing motor control centers. These starters are compact and include a built-in bypass contactor to eliminate heat dissipation during run. This makes the xS1000 Series ideal for installation into switchboards or starter enclosures.

xS2000 Series Soft Starters

xS2000 Series Soft Starters have a comprehensive motor starting and protection system with a built-in bypass contactor. In addition to constant current start control, xS2000 soft starters provide advanced motor thermal modeling and a range of protection functions.

xS3000 Series of Soft Starters

The xS3000 series offers versatile motor control and protection, in a compact and user-friendly package.Optimized for pumping and compressor-related applications, the xS3000 delivers a refined feature set, including adaptive control to prevent water hammer.

xS4000 Series Soft Starters

The xS4000 designed to provide reliable and efficient motor starting and stopping, offering advanced features such as integrated bypass, motor protection, and communication capabilities.

With its user-friendly interface and robust design, the xS4000 is suitable for a wide range of industrial applications.

For easy customization in more complex applications, the xS4000 includes additional features such as soft braking and auto-scheduling.

xS1000 Soft Starters

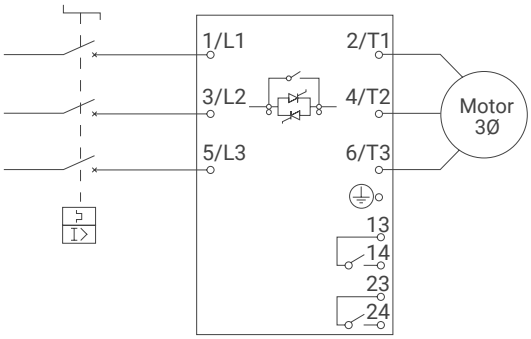
- Compact design, small footprint
- Built-in bypass contactor
- Easy installation and operation
- Complements existing motor protection
- Ratings from 18A to 200A

Features

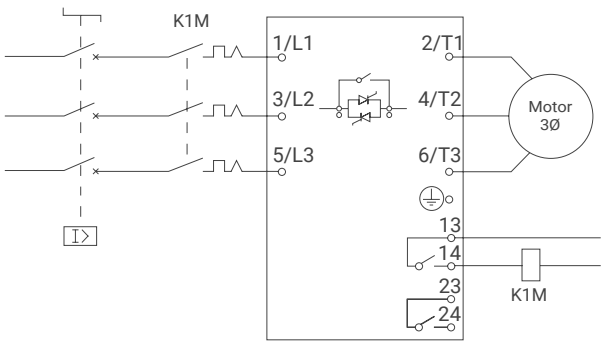
Starting
Timed voltage ramp (TVR)
Stopping
Soft stop
Protection
Supply fault
Shorted SCR
LED Indication
Ready/Tripped
Running/Starting-Stopping
Fault code
Relay Outputs
Main contactor
Options & Accessories
Modbus RTU
Modbus TCP
Ethernet IP
Profibus
Profinet
Devicenet
USB Interface
Remote Operator
PC Software

Schematics

xS1000 installed with motor protection circuit breaker



xS1000 installed with a moulded case circuit breaker, separate overload relay and line contactor



Note: Use semiconductor fuses at input

Ratings

Current Range	18A ~ 200A, AC53b
Supply Voltage	200 ~ 440VAC or 200 ~ 575VAC
Supply Frequency	45 to 66 Hz
Control Voltage	110 or 230 ~ 440 VAC (+ 10% / -15%) 24VAC / VDC (± 20%)
Enclosure	IP20 up to 100A IP00 for 140A and above
Approvals	CE

xS2000 Soft Starters

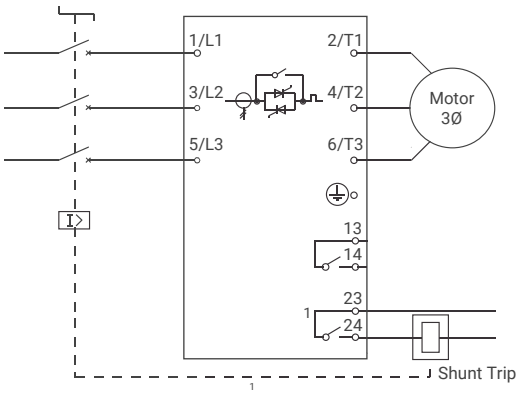
- Compact design, small footprint
- Built-in bypass contactor
- Easy installation and operation
- Complements existing motor protection
- Ratings from 18A to 200A

Features

Starting
Constant current
Current ramp
Stopping
Soft stop
Protection
Instantaneous over current
Bypass overload
Motor overload
Phase imbalance
Phase sequence
Excess start time
Motor thermistor
Supply fault
Shorted SCR
LED Indication
Ready/Tripped
Running/Starting-Stopping
Fault code
Relay Outputs
Main contactor
Run
Tripped
Options & Accessories
Modbus RTU
Modbus TCP
Ethernet IP
Profibus
Profinet
Devicenet
USB Interface
Remote Operator
PC Software

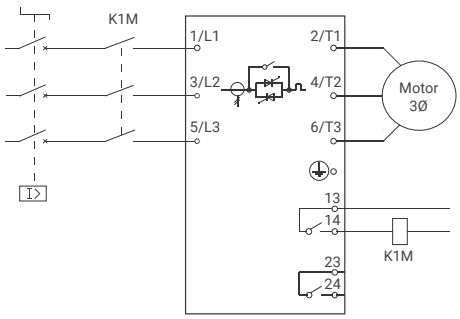
Schematics

xS2000 installed with moulded case circuit breaker withshunt trip device



Auxiliary Relay Function = Trip

xS2000 installed with moulded case circuit breaker withline contactor



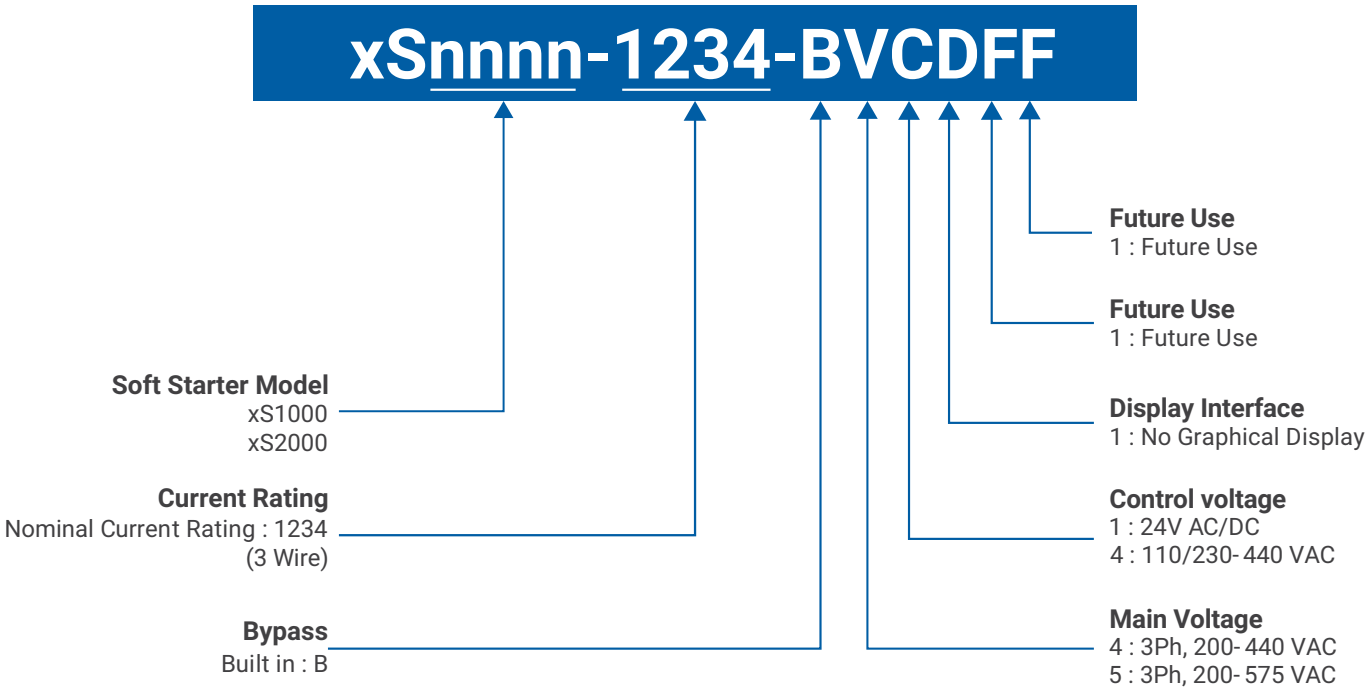
Note: Use semiconductor fuses at input

Ratings

Current Range	18A ~ 200A, AC53b
Supply Voltage	200 ~ 440VAC or 200 ~ 575VAC
Supply Frequency	45 to 66Hz
Control Voltage	110 or 230 ~ 440 VAC (+ 10% / -15%) 24VAC / VDC (± 20%)
Enclosure	IP20 up to 100A IP00 for 140A and above
Approvals	CE

xS1000 & xS2000 Selection Chart

Current Ratings



xS1000

CAT No.	Current Rating			
	AC53b 4-6:354		AC53b 4-20:340	
Ambient Temp	40°C	50°C	40°C	50°C
XS1000-0018-B□□111	18 A	17 A	17 A	15 A
XS1000-0034-B□□111	34 A	32 A	30 A	28 A
XS1000-0042-B□□111	42 A	40 A	36 A	33 A
XS1000-0048-B□□111	48 A	44 A	40 A	36 A
XS1000-0060-B□□111	60 A	55 A	49 A	45 A
	AC53b 4-6:594		AC53b 4-20:580	
Ambient Temp	40°C	50°C	40°C	50°C
XS1000-0075-B□□111	75 A	68 A	65 A	59 A
XS1000-0085-B□□111	85 A	78 A	73 A	67 A
XS1000-0100-B□□111	100 A	100 A	96 A	87 A
XS1000-0140-B□□111	140 A	133 A	120 A	110 A
XS1000-0170-B□□111	170 A	157 A	142 A	130 A
XS1000-0200-B□□111	200 A	186 A	165 A	152 A

xS2000

CAT No.	Current Rating			
	AC53b 4-6:354		AC53b 4-20:340	
Ambient Temp	40°C	50°C	40°C	50°C
XS2000-0018-B□□111	18 A	17 A	17 A	15 A
XS2000-0034-B□□111	34 A	32 A	30 A	28 A
XS2000-0042-B□□111	42 A	40 A	36 A	33 A
XS2000-0048-B□□111	48 A	44 A	40 A	36 A
XS2000-0060-B□□111	60 A	55 A	49 A	45 A
	AC53b 4-6:594		AC53b 4-20 580	
Ambient Temp	40°C	50°C	40°C	50°C
XS2000-0075-B□□111	75 A	68 A	65 A	59 A
XS2000-0085-B□□111	85 A	78 A	73 A	67 A
XS2000-0100-B□□111	100 A	100 A	96 A	87 A
XS2000-0140-B□□111	140 A	133 A	120 A	110 A
XS2000-0170-B□□111	170 A	157 A	142 A	130 A
XS2000-0200-B□□111	200 A	186 A	165 A	152 A

All ratings are calculated at altitude of <1000 metres.
Note: The above xS1000 & xS2000 ratings are based on 400% starting current,10 starts per hour up to 60A & 6 starts per hour for 75A & above, 6 seconds starting time and ambient temperature of 45°C.
For proper sizing of soft starter based on the application parameters please use Winstart Software.

Technical Specifications

Heat Dissipation

During Start	3 watts / ampere
During Run	10 watts typical

Short Circuit

xS1000	
Rated short-circuit current XS1000-0018 to XS1000-0048	5 kA
Rated short-circuit current XS1000-0060 to XS1000-0200	10 kA

xS2000	
Rated short-circuit current XS2000-0018 to XS2000-0048	5 kA
Rated short-circuit current XS2000-0060 to XS2000-0200	10 kA

*These short circuit ratings are with fuses used as given in the table under Semiconductor Fuses

Standards & Certifications

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)
Electrostatic discharge	4 kV contact discharge, 8 kV air discharge
Radio frequency 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
RCM	IEC 60947-4-2
CE	IEC 60947-4-2
Vibration	IEC 60068 Test Fc Sinusoidal ,4 Hz to 13.2 Hz: ± 1 mm displacement, 13.2 Hz to 200 Hz: ± 0.7 g

Accessories xS1000 & xS2000

Description	Catalogue No.
Modbus RTU Card	XSCI-RTU-121
Modbus TCP Card	XSCI-TCP-123
Ethernet IP Card	XSCI-ETH-122
Profibus Card	XSCI-PDP-121
Profinet Card	XSCI-PFN-122
DeviceNet Card	XSCI-DEN-121
USB Interface Card	XSCI-USB-121

Mounting & Side Clearance

xS1000

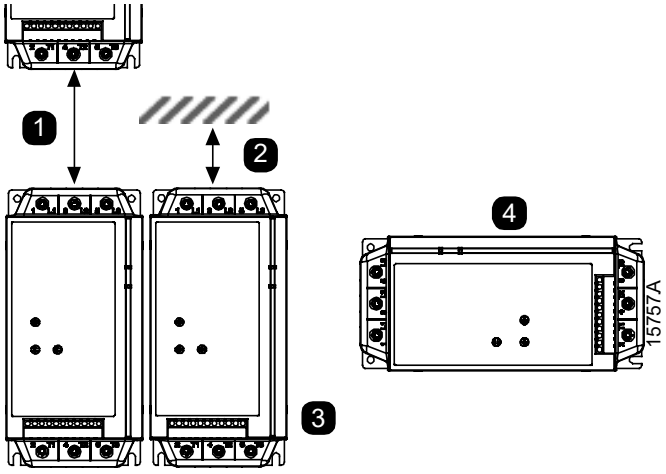
1. XS1000-0018 ~ XS1000-0100: Allow 100 mm (3.9 inch) between soft starters. XS1000-0140 ~ XS1000-0200: Allow 200 mm (7.9 inch) between soft starters.
2. XS1000-0018 ~ XS1000-0100: Allow 50 mm (2.0 inch) between the soft starter and solid surfaces.

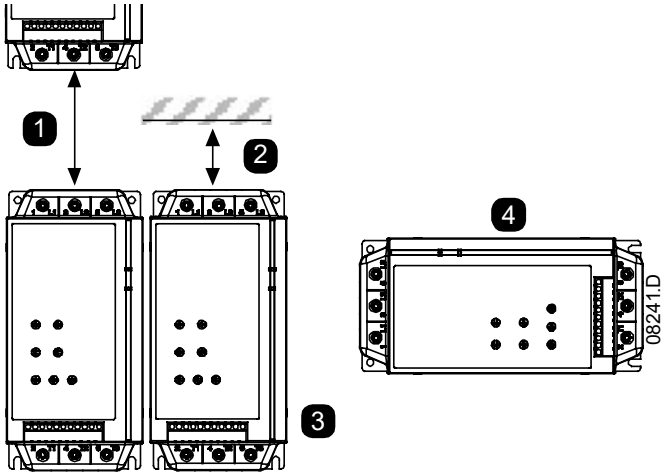
   XS1000-0140 ~ XS1000-0200: Allow 200 mm (7.9 inch) between the soft starter and solid surfaces.
3. Soft starters may be mounted side by side with no clearance (that is, if mounted without communications modules).
4. The soft starter may be mounted on its side. Derate the soft starter's rated current by 15%.

xS2000

1. XS2000-0018 ~ XS2000-0100: Allow 100 mm (3.9 inch) between soft starters. XS2000-0140 ~ XS2000-0200: Allow 200 mm (7.9 inch) between soft starters.
2. XS2000-0018 ~ XS2000-0100: Allow 50 mm (2.0 inch) between the soft starter and solid surfaces.

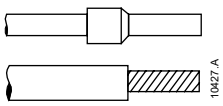
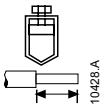
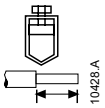
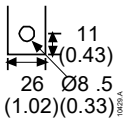
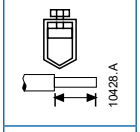
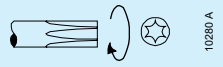
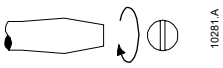
   XS2000-0140 ~ XS2000-0200: Allow 200 mm (7.9 inch) between the soft starter and solid surfaces.
3. Soft starters may be mounted side by side with no clearance (that is, if mounted without communications modules).
4. The soft starter may be mounted on its side. Derate the soft starter's rated current by 15%.



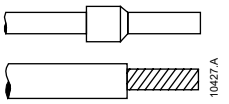
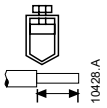
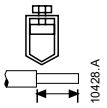
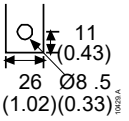
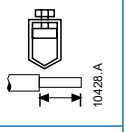
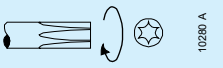
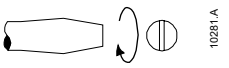


Cable Sizing - Power Terminations

xS1000

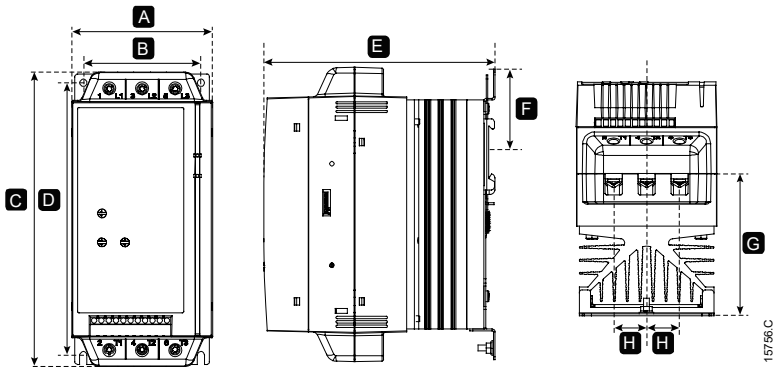
	1/L1, 3/L2, 5/L3, 2/T1, 4/T2, 6/T3 mm² (AWG)						A1, A2, A3, 01, 02, 13, 14, 23, 24 mm² (AWG)	
	XS1000-B□□111 to XS1000-B□□111		XS1000-B□□111 to XS1000-B□□111		XS1000-B□□111 to XS1000-B□□111		XS1000-B□□111 to XS1000-B□□111	
	10 - 35 (8-2)	 14 mm (0.55 inch)	25 - 50 (4- 1/10)	 14 mm (0.55 inch)	n/a	 mm (inch)	0.14 - 1.5 (26 - 16)	 6 mm (0.24 inch)
	Torx (T20) 3 Nm 2.2 ft-lb		Torx (T20) 4 Nm 2.9 ft-lb		n/a		n/a	
	7 mm 3 Nm 2.2 ft-lb		7 mm 4 Nm 2.9 ft-lb		n/a		3.5 mm 0.5 Nm max 4.4 in-lb max	

xS2000

	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)	
	XS2000-B□□111 to XS2000-B□□111		XS2000-B□□111 to XS2000-B□□111		XS2000-B□□111 to XS2000-B□□111		XS2000-B□□111 to XS2000-B□□111	
	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) 4 Nm 2.9 ft-lb		n/a		n/a	
	7 mm 3 Nm 2.2 ft-lb		7 mm 4 Nm 2.9 ft-lb		n/a		3.5 mm 0.5 Nm max 4.4 in-lb max	

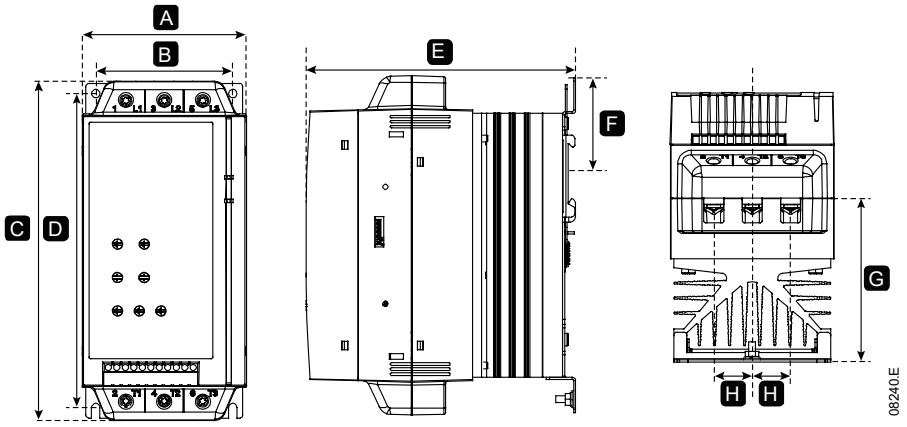
Dimensions, Frame and Weights

xS1000



Frame	Model	Width mm		Height mm		Depth mm				Weight kg
		A	B	C	D	E	F	G	H	
A	XS1000-0018-B□□111 XS1000-0034-B□□111 XS1000-0042-B□□111 XS1000-0048-B□□111 XS1000-0060-B□□111	98	82	201	188	165	55	90.5	23	2.1
B	XS1000-0075-B□□111 XS1000-0085-B□□111 XS1000-0100-B□□111	145	124	215	196	193	-	110.5	37	3.8
C	XS1000-0140-B□□111 XS1000-0170-B□□111 XS1000-0200-B□□111	200	160	240	216	214	-	114.5	51	6.1

xS2000



Frame	Model	Width mm		Height mm		Depth mm				Weight kg
		A	B	C	D	E	F	G	H	
A	XS2000-0018-B□□111 XS2000-0034-B□□111 XS2000-0042-B□□111 XS2000-0048-B□□111 XS2000-0060-B□□111	98	82	201	188	165	55	90.5	23	2.1
B	XS2000-0075-B□□111 XS2000-0085-B□□111 XS2000-0100-B□□111	145	124	215	196	193	-	110.5	37	4.0
C	XS2000-0140-B□□111 XS2000-0170-B□□111 XS2000-0200-B□□111	200	160	240	216	214	-	114.5	51	6.1

Features

Feature	xS1000	xS2000
Starting		
Timed voltage ramp	✓	
Constant current		✓
Current ramp		✓
Stopping		
Soft stop	✓	✓
Protection		
Mains frequency	✓	✓
Phase sequence		✓
Shorted SCR	✓	✓
Motor overload (thermal model)		✓
Current imbalance		✓
Motor thermistor		✓
Excess start time	✓	✓
Power loss		✓
Human Interface		
Starter status LEDs	✓	✓
Control Interface		
Programmable control inputs	✓	✓
Options & Accessories		
Modbus RTU	✓	✓
Modbus TCP	✓	✓
Ethernet IP	✓	✓
Profibus	✓	✓
Profinet	✓	✓
Devicenet	✓	✓
USB Interface	✓	✓
Remote Operator	✓	✓
PC Software	✓	✓
Approvals		
CE	✓	✓

xS3000 & xS4000 Soft starters

Advantages

- Compact design saves valuable space within your motor control panel
- Full graphical display with support for multiple languages. A simple menu structure with quick setup option makes it easy to commission and maintain your system
- Remote keypad option provides full remote control and graphical monitoring in place of separate meters and interfaces
- Adaptive control provides optimal start and stop in pumping applications, eliminating water hammer
- On-board USB provides quick setup and backup of starting parameters to greatly improve the level of in-field support and minimise downtime.
- Internal bypass across the entire range
- Integrate your starter with external sensors or a communications network, using slot-in accessory modules

Space-saving footprint

The compact form makes this series starters easier to integrate into electrical panels where space is limited, saving you time and effort in the panel design process.

With two frame size serving the entire range from 24A to 1250A, they are up to 30% smaller than other soft starter solutions.

Energy saving

All models have an intemal bypass to reduce your energy usage and operating expenditure. A bypassed soft starter is the most efficient electronic motor control solution for fixed speed applications, and provides maximum energy saving when used in conjunction with an E3 motor.

Accessory Modules

The specialised smart module provides enhanced functionality and control for a variety of standalone applications, including pumping and compressors. For larger networked installations, a wide range of communication options are available. All accessory modules slot directly into the starter, making them easy to fit and use without adding to the footprint.

Features

Streamlined setup process

- Configuration profiles for common applications
- Built-in metering and inputs/outputs

Easy to understand interface

- Multi-language menus and displays
- Descriptive option names and feedback messages
- Real-time performance graphs

Support energy efficiency

- IE3 compatible
- 99% energy efficient when running
- Internal bypass
- Soft start technology avoids harmonic distortion

Extensive range of models

- 24 A to 1250 A (nominal)
- 200 VAC to 525 VAC
- 380 VAC to 690 VAC
- Inside delta installation

Versatile starting and stopping options

- Adaptive control
- Constant current
- Current ramp
- Timed voltage ramp soft stop
- Coast to stop
- DC brake
- Soft brake

Customisable protection

- Motor overload
- Excess start time
- Undercurrent
- Overcurrent
- Current imbalance
- Input trip
- Motor thermistor

Extensive input and output options

- Remove control inputs (2 x fixed, 2 x programmable)
- Relay outputs (1 x fixed, 2 x programmable)
- Analog output

Optional features for advanced applications

- Smart cards
- Communication modules:

  Device Net, Ethernet/IP, Modbus RTU, Modbus TCP, Profibus, Profinet

Specifications

General

xS3000

Current range.....24 A~580 A (nominal)
Bypass.....Internal (24 A to 580 A)

xS4000

Current range.....24 A~1250 A (nominal)
Bypass.....Internal (24 A to 1250 A)
.....External (735 A to 1220 A)

Supply

xS3000

Main Voltage (L1, L2, L3)
XS3000-□□□□-B5□111.....200~525 VAC (+/- 10%)
XS3000-□□□□-B6□111.....380~600 VAC (+/- 10%)
.....50~60 Hz (+/- 5%)
Control voltage (A1, A2, A3)
XS3000-□□□□-B□2111...110~120 VAC (+10%/-15%), 600mA
XS3000-□□□□-B□2111...220~240 VAC (+10%/-15%), 600mA
XS3000-□□□□-B□1111.....24 VAC/VDC (+/- 20%), 2.8A

xS4000

Main Voltage (L1, L2, L3)
XS4000-□□□□-B5□111.....200~525 VAC (+/- 10%)
XS4000-□□□□-B7□111.....380~690 VAC (+/- 10%)
.....50~60 Hz (+/- 5%)
Control voltage (A1, A2, A3)
XS4000-□□□□-B□2111...110~120 VAC (+10%/-15%), 600mA
XS4000-□□□□-B□2111...220~240 VAC (+10%/-15%), 600mA
XS4000-□□□□-B□1111.....24 VAC/VDC (+/- 20%), 2.8A

Inputs

Inputs ..... Active 24 VDC, 8mA approx.
Reset/Starter disable (10, 11) ..... Normally closed
Start/Stop(11,12) ..... Normally open
Programmable input A (13,14) ..... Normally open or closed
Programmable input B (13, 15) ..... Normally open or closed
Motor thermistor (B4, B5)

Outputs

Relay outputs.....10 A at 250 VAC resistive
.....5 A at 250 VAC, AC15 pf 0.3
Main contactor (33, 34) .....Normally open
Programmable relay A (41, 42, 44) ..... Changeover
Programmable relay B (53, 54) .....Normally open
Analog output (21, 22) .....0-20 mA or 4-20 mA

Feature set	xS3000	xS4000
Integration & Management		
Multi-language graphical display	✓	✓
I/O and networking expansion options	✓	✓
USB port and data logging	✓	✓
Analog output	✓	✓
Emergency run	✓	✓
SCR fail PowerThrough operation		✓
Daily on/off scheduling		✓
Motor Control		
Motor sets	1	2
Constant current and current ramp start	✓	✓
Adaptive control starting/stopping	✓	✓
Coast to stop and TVR stop	✓	✓
Kickstart		✓
DC brake		✓
Soft brake		✓
Jog (forward and reverse)		✓
Inside delta (6 wire) control		✓
Soft trip		✓
Motor Protection		
Motor thermistor	✓	✓
Current imbalance	✓	✓
Under/overcurrent	✓	✓
Phase sequence	✓	✓
Phase loss	✓	✓
Power loss	✓	✓
Under/Over voltage		✓

Environmental

XS4000-0024-B~XS4000-0135-B IP20
XS4000-0184-B~XS4000-0580-B IP00
XS4000-0835-B~XS4000-1250-B IP00
XS4000-0735-C~XS4000-1220-C IP00
Operating temperature (with derating) ..... -10°C~60°C
Storage temperature ..... -25°C~60°C
Humidity ..... 5% to 95% Relative humidity

Accessories

Optional Cards

This soft starter offers optional cards for users requiring advance functionality. Each xS3000 & xS4000 can support a maximum of one optional card.

› Smart Pump Control Card

The smart card has been designed to support integration with pumping applications and provides the following additional inputs and outputs:

- 4 x digital inputs
- 3 x 4-20 mA transducer inputs
- 1 x RTD input
- 1 x USB-B port
- Remote keypad connector

› Communication Optional Cards

These soft starters support network communication via easy-to-install communications optional cards. Each communication card includes a remote keypad connector port.

Available protocols:

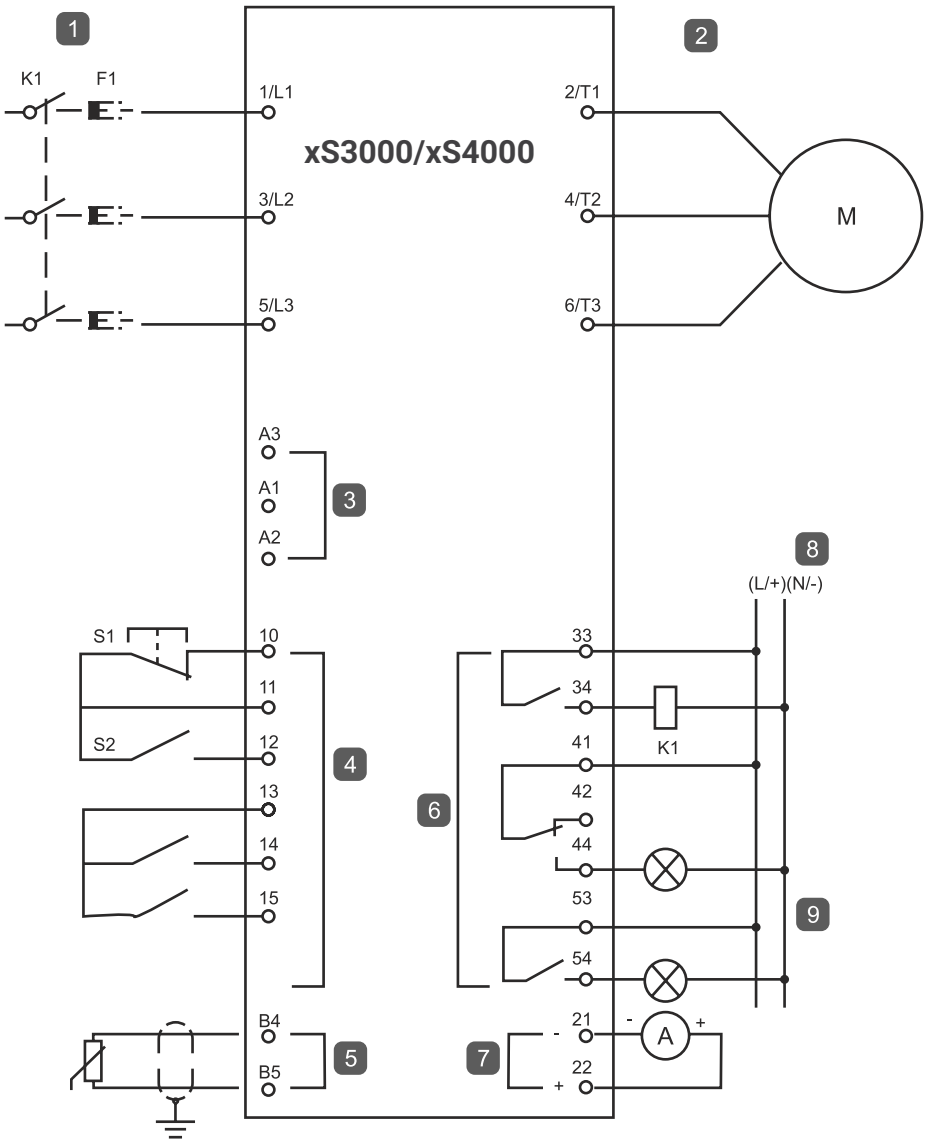
DeviceNet, Ethernet/IP, Modbus RTU, Modbus TCP, Profibus, Profinet.

› Remote Keypad

These Soft starters can be used with a remote keypad, mounted upto 3 meters away from the starter. Each optional card includes a keypad connection port, or a dedicated keypad connector card is available.

Typical Motor Connection

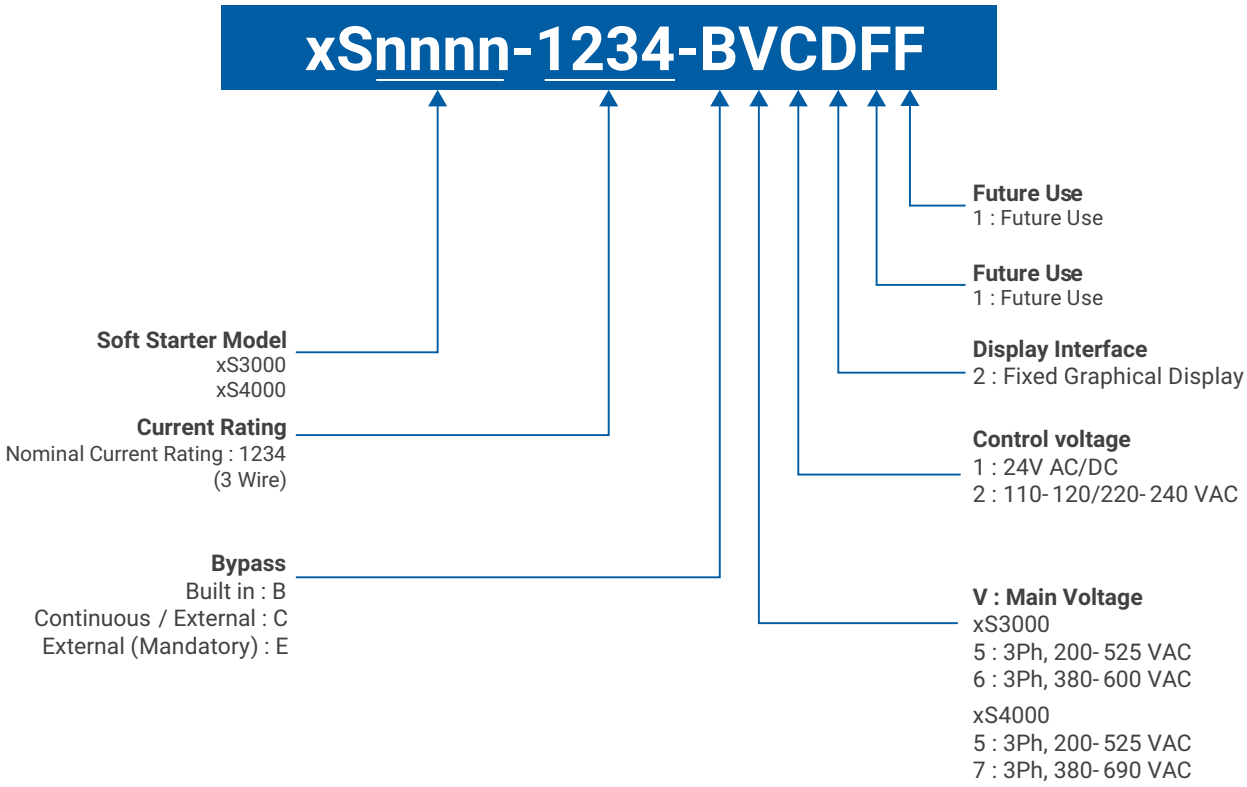
It is installed with a main contactor (AC3 rated). Control voltage must be supplied from the input side of the contactor.
The main contactor is controlled by the main contactor output (33, 34).



K1	Main contactor
F1	Semiconductor fuses (optional)
10, 11 (S1)	Reset
11, 12 (S2)	Start/Stop
13, 14	Programmable input A (default = Input Trip (N/O)
13, 15	Programmable input B (default = Input Trip (N/O)
B4, B5	Motor thermistor input
33, 34	Main contactor output
41, 42, 44	Relay output A (default = Run)
53, 54	Relay output B (default = Trip)
21, 22	Analog output

1	Three-phase supply
2	Motor
3	Control voltage (soft starter)
4	Digital inputs
5	Motor thermistor input
6	Relay outputs
7	Analog outputs
8	Control voltage (external equipment)
9	Pilot lamps

Current Ratings



xS3000

All ratings are calculated at altitude of <1000 meters and ambient temperature of 40°C.

Cat No.	Current Ratings				
	3.0-10:350	**3.5-15:345**	**4.0-10:350**	**4.0-20:340**	**5.0-5:355**
XS3000-0024-B□□211	24	20	19	16	17
XS3000-0042-B□□211	42	34	34	27	32
XS3000-0052-B□□211	52	42	39	35	34
	3.0-10:590	**3.5-15:585**	**4.0-10:590**	**4.0-20:580**	**5.0-5:595**
XS3000-0064-B□□211	64	63	60	51	54
XS3000-0069-B□□211	69	69	69	62	65
XS3000-0105-B□□211	105	86	84	69	77
XS3000-0115-B□□211	115	108	105	86	95
XS3000-0135-B□□211	135	129	126	103	115
XS3000-0184-B□□211	184	144	139	116	127
XS3000-0200-B□□211	200	171	165	138	150
XS3000-0229-B□□211	229	194	187	157	170
XS3000-0250-B□□211	250	244	230	200	202
XS3000-0352-B□□211	352	287	277	234	258
XS3000-0397-B□□211	397	323	311	263	289
XS3000-0410-B□□211	410	410	410	380	400
XS3000-0550-B□□211	550	527	506	427	464
XS3000-0580-B□□211	580	579	555	470	508

Cat No.	Current Ratings				
	3.0-10:350	3.5-15:345	4.0-10:350	4.0-20:340	5.0-5:355
XS4000-0024-B□□211	24	20	19	16	17
XS4000-0042-B□□211	42	34	34	27	32
XS4000-0052-B□□211	52	42	39	35	34
	3.0-10:590	3.5-15:585	4.0-10:590	4.0-20:580	5.0-5:595
XS4000-0064-B□□211	64	62	60	50	53
XS4000-0069-B□□211	69	69	69	62	64
XS4000-0105-B□□211	105	86	84	68	76
XS4000-0115-B□□211	115	107	104	86	95
XS4000-0135-B□□211	135	129	126	103	115
XS4000-0184-B□□211	184	143	139	115	127
XS4000-0200-B□□211	200	170	165	138	150
XS4000-0229-B□□211	229	194	187	157	170
XS4000-0250-B□□211	250	244	230	200	202
XS4000-0352-B□□211	352	285	277	234	257
XS4000-0397-B□□211	397	322	311	262	288
XS4000-0410-B□□211	410	410	410	379	400
XS4000-0550-B□□211	550	526	505	427	462
XS4000-0580-B□□211	580	578	554	469	507
XS4000-0835-B□□211	835	654	630	535	592
XS4000-0940-B□□211	940	736	708	603	663
XS4000-1070-B□□211	1070	950	905	785	834
XS4000-1230-B□□211	1230	1154	1090	959	989
XS4000-1250-B□□211	1250	1250	1250	1155	1250
XS4000-0735-C□□211	835	732	716	593	695
XS4000-0830-C□□211	940	822	803	667	776
XS4000-1025-C□□211	1210	1067	1033	874	982
XS4000-1170-C□□211	1430	1307	1252	1076	1170
XS4000-1220-C□□211	1620	1620	1616	1309	1620

Inside delta installation, bypassed

Cat No.	Current Ratings				
	3.0-10:350	**3.5-15:345**	**4.0-10:350**	**4.0-20:340**	**5.0-5:355**
XS4000-0024-B□□211	36	30	29	24	24
XS4000-0042-B□□211	63	51	51	41	47
XS4000-0052-B□□211	78	62	59	51	51
	3.0-10:590	**3.5-15:585**	**4.0-10:590**	**4.0-20:580**	**5.0-5:595**
XS4000-0064-B□□211	96	93	90	75	80
XS4000-0069-B□□211	104	104	104	93	96
XS4000-0105-B□□211	158	129	126	102	114
XS4000-0115-B□□211	173	161	156	129	143
XS4000-0135-B□□211	203	194	189	155	173
XS4000-0184-B□□211	276	215	209	173	191
XS4000-0200-B□□211	300	255	248	207	225
XS4000-0229-B□□211	344	291	281	236	255
XS4000-0250-B□□211	375	366	345	300	303
XS4000-0352-B□□211	528	428	415	351	386
XS4000-0397-B□□211	596	484	466	393	433
XS4000-0410-B□□211	615	615	615	568	600
XS4000-0550-B□□211	825	789	758	640	694
XS4000-0580-B□□211	870	868	832	704	760
XS4000-0835-B□□211	1253	981	945	803	888
XS4000-0940-B□□211	1410	1104	1062	905	995
XS4000-1070-B□□211	1605	1425	1358	1178	1251
XS4000-1230-B□□211	1845	1731	1635	1439	1484
XS4000-1250-B□□211	1875	1875	1875	1733	1875
	3.0-10:590	**3.5-15:585**	**4.0-10:590**	**4.0-20:580**	**5.0-5:595**
XS4000-0735-C□□211	1253	1098	1074	890	1043
XS4000-0830-C□□211	1410	1233	1205	1001	1164
XS4000-1025-C□□211	1815	1601	1550	1311	1473
XS4000-1170-C□□211	2145	1961	1878	1614	1755
XS4000-1220-C□□211	2430	2430	2424	1964	2430

Motor Overload Protection

Motor Overload Protection: Class 10, Trip Current 105% of FLA (full load amperage) or equivalent.

Heat Dissipation

During Start	4.5 watts per ampere				
During Run (Bypassed)	0024-B~0052-B ≤ 35 watts approx	0064-B~0135-B ≤ 50 watts approx	0184-B~0259-B ≤ 120 watts approx	0352-B~0580-B ≤ 140 watts approx	0835-B~1250-B ≤ 180 watts approx
During Run (Non-bypassed)	0735-C~1220-C 4.5 watts per ampere				

Certifications

Electromagnetic capability (compliant with EU Directive 2014/35/EU)

EMC Immunity.. ..... IEC 60947-4-2

EMC Emissions ..... IEC 60947-4-2 Class B

Vibration ..... IEC 60068-2-6

Certification

CE ..... EN 60947-4-2

WEEE..... 2002/96/EC

RoHS..... **RoHS**

Fuse Ratings

IEC Coordination with Short Circuit Protection Devices

These fuses were selected based on start current of 300% FLC for 10 seconds

Cat No.	Nominal Rating (A)	SCR I^2t (A^2s)	Type 1 coordination	Type 2 coordination
			480 VAC, 65 kA Bussmann NH fuse links	600 VAC, 65 kA Bussmann DIN 43 653
XS3000-0024-B□□211	24	1150	40NHG000B	170M3010
XS3000-0042-B□□211	42	7200	63NHG000B	170M3013
XS3000-0052-B□□211	52		80NHG000B	
XS3000-0064-B□□211	64	15000	100NHG000B	170M3014
XS3000-0069-B□□211	69			
XS3000-0105-B□□211	105	80000	160NHG00B	170M3015
XS3000-0115-B□□211	115			
XS3000-0135-B□□211	135	125000		170M3016
XS3000-0184-B□□211	184	320000	250NHG2B	
XS3000-0200-B□□211	200			170M3020
XS3000-0229-B□□211	229		315NHG2B	
XS3000-0250-B□□211	250			170M3021
XS3000-0352-B□□211	352	202000	355NHG2B	170M6009
XS3000-0397-B□□211	397		400NHG2B	
XS3000-0410-B□□211	410	320000	425NHG2B	170M6010
XS3000-0550-B□□211	550	781000	630NHG3B	170M6012
XS3000-0580-B□□211	580			

Cat No.	Nominal Rating (A) 300%, 10 s	SCR I^2t (A^2s)	Type 1 coordination 480 VAC, 65 kA	Type 2 coordination 690 VAC, 65 kA
XS4000-0024-B□□211	24	1150	40NHG000B	170M3010
XS4000-0042-B□□211	42	7200	63NHG000B	170M3013
XS4000-0052-B□□211	52		80NHG000B	
XS4000-0064-B□□211	64	15000	100NHG000B	170M3014
XS4000-0069-B□□211	69			
XS4000-0105-B□□211	105	80000	160NHG00B	170M3015
XS4000-0115-B□□211	115			
XS4000-0135-B□□211	135	125000		170M3016
XS4000-0184-B□□211	184	320000	250NHG2B	170M3020
XS4000-0200-B□□211	200			
XS4000-0229-B□□211	229		315NHG2B	
XS4000-0250-B□□211	250			170M3021
XS4000-0352-B□□211	352	202000	355NHG2B	170M6009
XS4000-0397-B□□211	397		400NHG2B	

XS4000-0410-B□□211	410	320000	425NHG2B	170M6010
XS4000-0550-B□□211	550	781000	630NHG3B	170M6012
XS4000-0580-B□□211	580			

Cat No.	Nominal rating (A) 350%, 30 s	SCR I^2t (A^2s)	Type 1 coordination 500 VAC, 100 kA	Type 2 coordination 690 VAC, 100 kA
XS4000-0835-B□□211	565	2530000	1000NHG4G	170M6016
XS4000-0940-B□□211	638			170M6017
XS4000-1070-B□□211	854		1200NHG4G	Not available
XS4000-1230-B□□211	1055	3920000	OFAA5GG1250	
XS4000-1250-B□□211	1249	7220000		170M6019
XS4000-0735-C□□211	621	2530000	1000NHG4G	170M6016
XS4000-0830-C□□211	699			170M6017
XS4000-1025-C□□211	945		OFAA5GG1250	Not available
XS4000-1170-C□□211	1178	3920000	OFAA5GG1600	Not available
XS4000-1220-C□□211	1403	7220000		170M6021 (at 500 VAC)

Optional Accessories

Description	Catalogue No.
Modbus RTU Card	XSCI-RTU-341
Modbus RTU + GF Card	XSCI-RTU-342
Modbus TCP + GF Card	XSCI-TCP-343
Ethernet + GF Card	XSCI-ETH-343
Profibus Card	XSCI-PDP-341
Profinet + GF Card	XSCI-PFN-343
DeviceNet Card	XSCI-DEN-341

Description	Catalogue No.
Digital Operator Card & Cable	XSOP-DOP-200
Digital Operator Interface Card	XSOP-DOC-200
Digital Operator Kit (Interface Card, Operator & Cable)	XSOP-DOK-200
Smart Control Card Pump Application	XSSC-PSC-341

Cable Sizing - Power Terminations

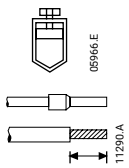
xS3000

Some units use aluminium busbars. When connecting power terminations, we recommend cleaning the surface contact area thoroughly (using an emery or stainless steel brush) and using an appropriate jointing compound to prevent corrosion.

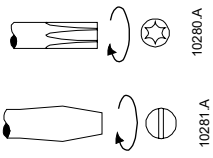
The power input and output terminals are at the bottom of the unit. Models XS3000-0024 ~XS3000-0135 use cage clamps. Use only copper stranded or solid conductors, rated for 75ºC or higher.

Models XS3000-0184 ~ XS3000-0580 use busbars. Use copper or aluminium conductors, stranded or solid, rated for 60ºC/75ºC.

XS3000-0024-B to XS3000-0135-B



Cable size:
6-70 mm² (AWG 10-2/0)
Torque: 4 Nm (2.9 ft-lb)
14 mm (0.55 inch)

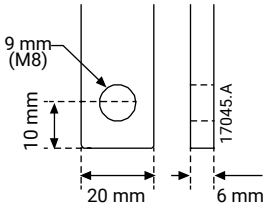


Torx T20 x 150

Flat 7 mm x 150

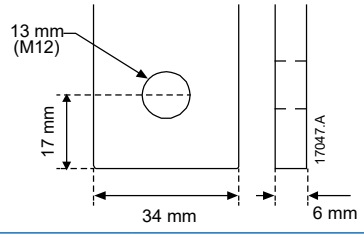
XS3000-0184-B to XS3000-0250-B

19 Nm (14.0 ft-lb)



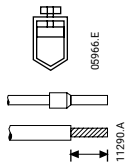
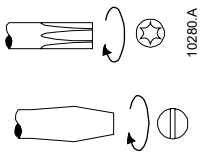
XS3000-0352-B to XS3000-0580-B

66 Nm (49.0 ft-lb)

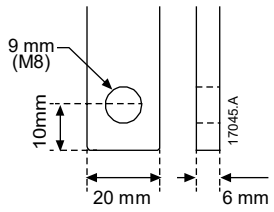
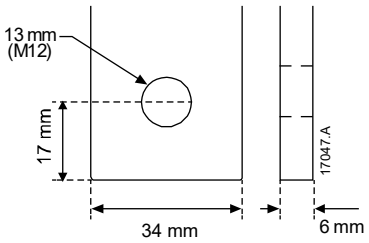
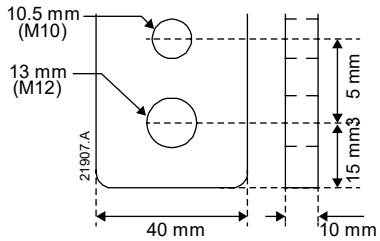


xS4000

- Models 0024-B~0135-B use cage clamps. Use only copper stranded or solid conductors, rated for 75ºC or higher.
- Models 0184-B~0580-B use busbars at the bottom of the unit. Use copper or aluminium conductors, stranded or solid, rated for 60ºC/75ºC.
- Models 0835-B~1250-B/0735-C~1220-C use busbars. Input terminals are at the top of the unit and output terminals are at the bottom.
- Models 0735-C~1220-C have dedicated bypass terminals, if the soft starter will be installed with an external bypass contactor. The bypass busbars are at the top of the unit and are labeled T1B, T2B, T3B.

<table>
<tr><th colspan="3">XS4000-0024-B to XS4000-0135-B</th></tr>
<tr><td> 
</td><td>Cable size:
6-70 mm² (AWG 10-2/0)
Torque: 4 Nm (2.9 ft-lb)
14 mm (0.55 inch)</td><td> 

Torx T20 x 150

Flat 7 mm x 150</td></tr>
<tr><th>XS3000-0184-B
to
XS3000-0250-B</th><th>XS4000-0352-B
to
XS4000-0580-B</th><th>XS4000-0835-B to XS4000-1250-B
&
XS4000-0735-C to XS4000-1220-C</th></tr>
<tr><td>19 Nm (14.0 ft-lb)
 
</td><td>66 Nm (49.0 ft-lb)
 
</td><td>66 Nm (49.0 ft-lb)
 
</td></tr>
</table>

Wiring connectors xS3000 & xS4000

Select a connector according to the wire size, material and your application requirements.

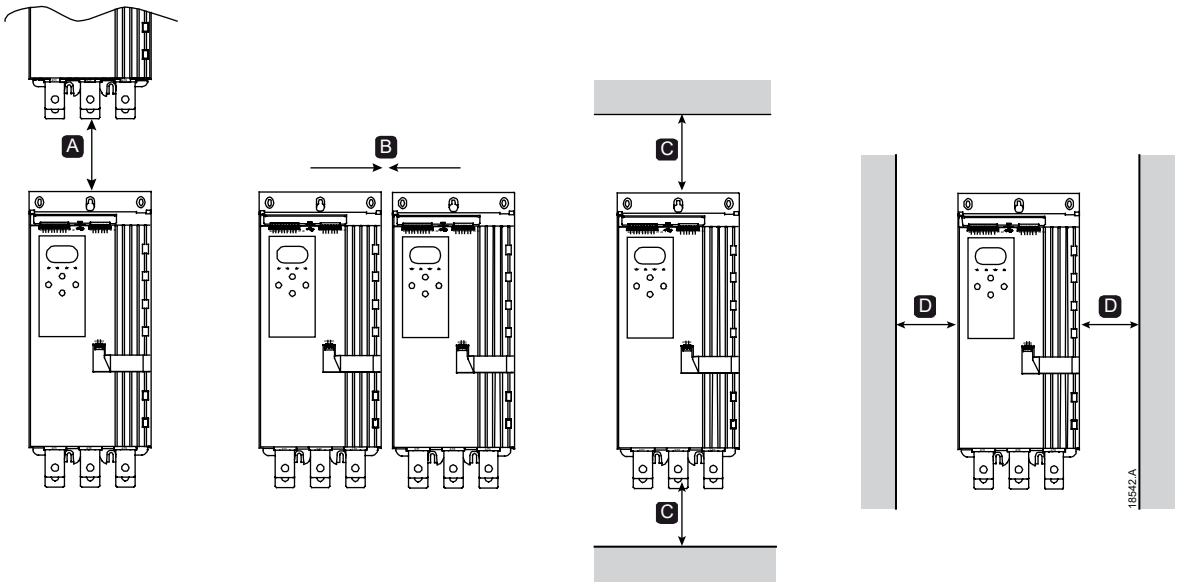
Models 0024~0580

A compression connector is recommended for models 0184 to 0580. The recommended crimping tool is TBM8-750.

Model	Example connector - aluminium cable	Example connector - copper cable
0184-B	61162	60150
0200-B	61165	60156
0229-B	61171	60165
0250-B		
0352-B	61162	60150
0397-B	61165	60156
0410-B		60162
0550-B	61178	60171
0580-B		

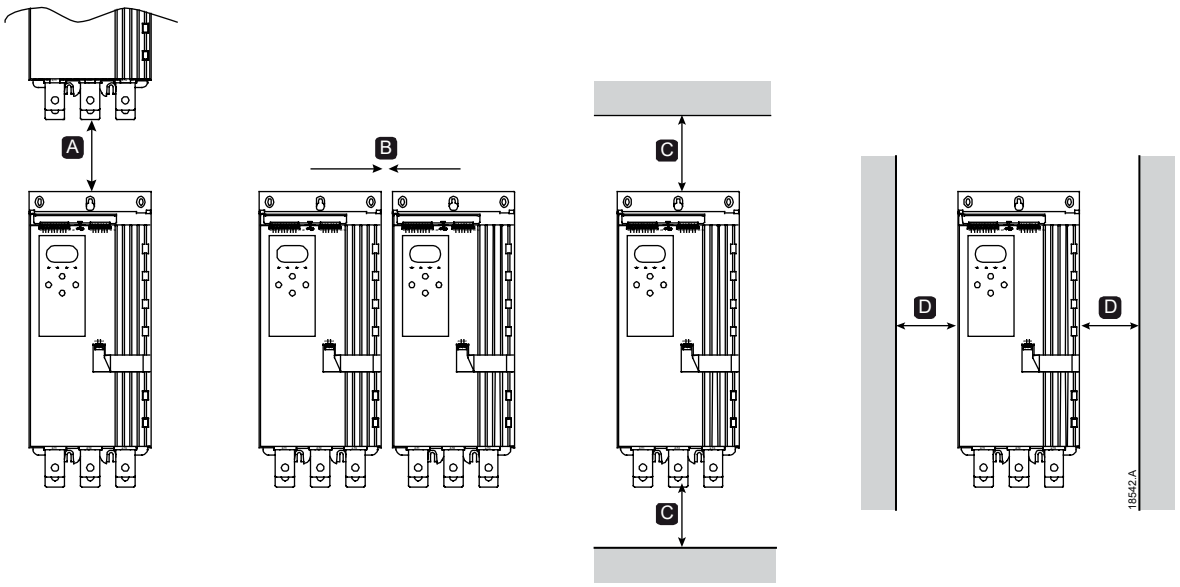
Mounting & Side Clearance

xS3000



Between starters		Solid surfaces	
A	B	C	D
> 100 mm (3.9 inch)	> 10 mm (0.4 inch)	> 100 mm (3.9 inch)	> 10 mm (0.4 inch)

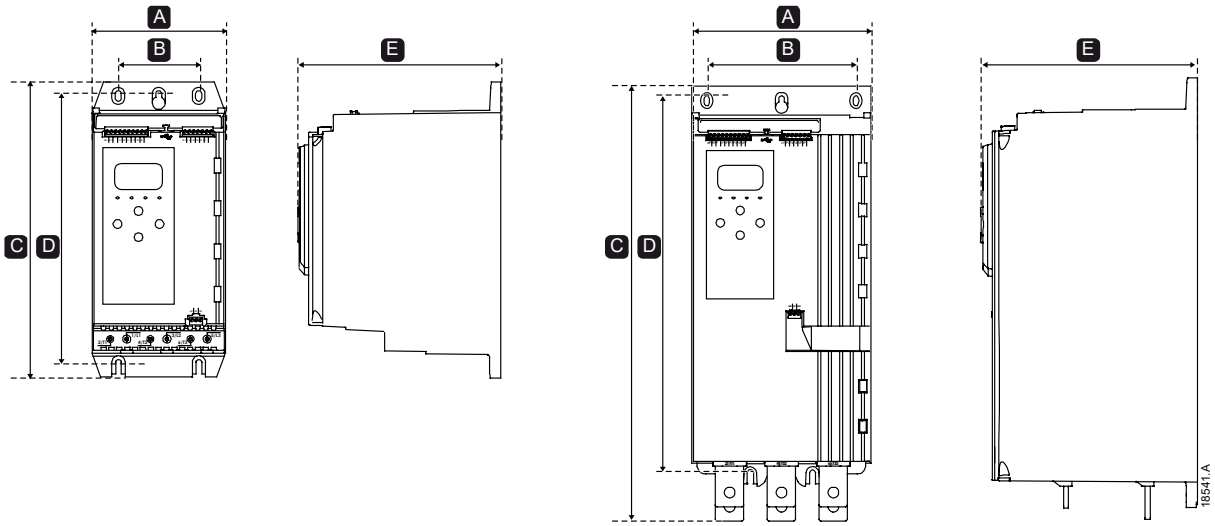
xS4000



Between starters		Solid surfaces	
A	B	C	D
> 100 mm (3.9 inch)	> 10 mm (0.4 inch)	> 100 mm (3.9 inch)	> 10 mm (0.4 inch)

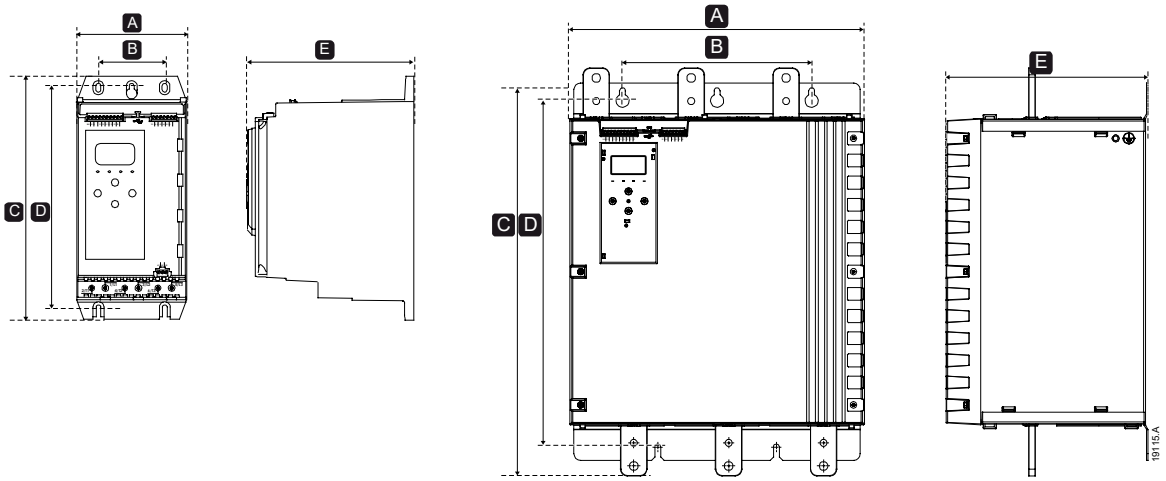
Dimensions, Frame and Weights

xS3000



Model	Width mm		Height mm		Depth mm	Weight kg
	A	B	C	D	E	
XS3000-0024-B□□211	152	92	336	307	233	4.7
XS3000-0042-B□□211						
XS3000-0052-B□□211						4.8
XS3000-0064-B□□211						
XS3000-0069-B□□211						
XS3000-0105-B□□211						5
XS3000-0115-B□□211						
XS3000-0135-B□□211						
XS3000-0184-B□□211	216	180	495	450	245	11.7
XS3000-0200-B□□211						
XS3000-0229-B□□211						
XS3000-0250-B□□211						
XS3000-0352-B□□211	216	180	523	450	245	12.5
XS3000-0397-B□□211						
XS3000-0410-B□□211						
XS3000-0550-B□□211						15
XS3000-0580-B□□211						

xS4000



CAT No.	Width mm		Height mm		Depth mm	Weight kg
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XS4000-0024-B□□211	152	92	336	307	233	4.8
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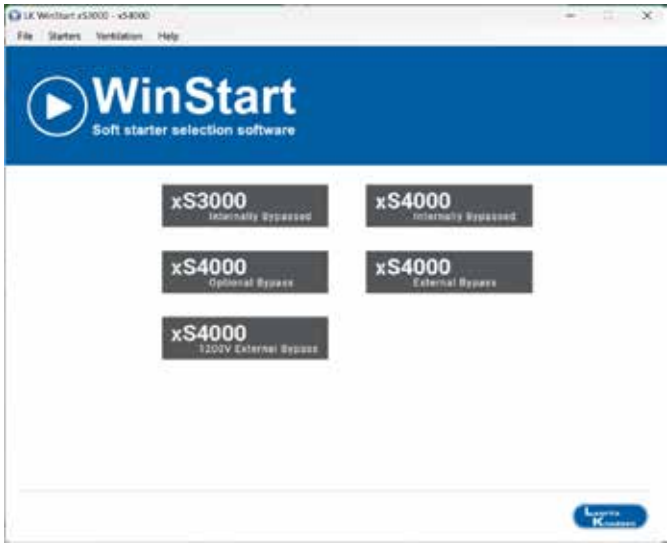
XS4000-0069-B□□211						
XS4000-0105-B□□211						5.5
XS4000-0115-B□□211						
XS4000-0135-B□□211						
XS4000-0184-B□□211	216	180	495	450	245	12.7
XS4000-0200-B□□211						
XS4000-0229-B□□211						
XS4000-0250-B□□211						
XS4000-0352-B□□211	216	180	523	450	245	15.5
XS4000-0397-B□□211						
XS4000-0410-B□□211						
XS4000-0550-B□□211						19
XS4000-0580-B□□211						
XS4000-0835-B□□211	447	287	618	525	310	51
XS4000-0940-B□□211						
XS4000-1070-B□□211						62
XS4000-1230-B□□211						63
XS4000-1250-B□□211						65
XS4000-0735-C□□211	447	287	618	525	310	47
XS4000-0830-C□□211						
XS4000-1025-C□□211						58
XS4000-1170-C□□211						59
XS4000-1220-C□□211						61

Winstart - Selection Software tool

Lauritz Knudsen Electrical & Automation's WinStart software is used for selecting the right soft starter. The selection of the soft starter can be done on basis of calculation of Maximum FLC or type of connection, whether inline connection is used or inside delta, for both bypassed and non-bypassed combinations.

Following are the steps to be followed for selection of the soft starter:

1. Click on the desired soft starter to be selected.ck the power dissipated in soft starter



2. Enter the application parameters as given in white fields. Based on these parameters, the recommended soft starter model is displayed.

White fields indicate data to be entered

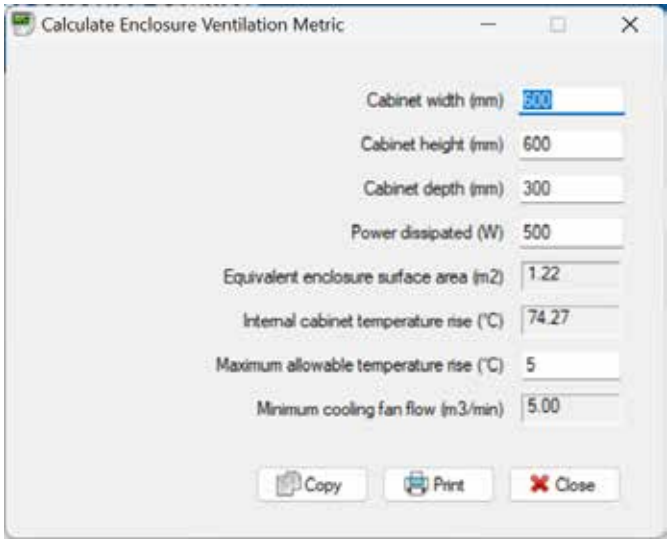
Grey fields indicate data to be checked

Winstart - Selection Software tool

3. After selecting the soft starter, the full load current should not exceed the calculated value mentioned in Inline Max FLC. Also check the power dissipated in soft starter

4. The temperature rise inside the cabinet in which the soft starter is installed can also be calculated. Provide the necessary dimensions, power dissipated (given by previous calculations) & maximum allowable temperature rise, to obtain the internal cabinet temperature rise & minimum cooling fan flow, which are displayed in ft³/min or m³/min.

For IP54 enclosure, refer Frequently Asked Questions point no. 9.



Note: After selecting the soft starter, you can click on Copy and paste the details of selection in any format, like notepad, word file etc.

PC Software Soft Starter Management

WinMaster can be used with LK-EA soft starters to provide the following functionality for networks of up to 99 soft starters:

- Operational control (Start, Stop, Reset, Quick Stop)
- Starter status monitoring (Ready, Starting, Running, Stopping, Tripped)

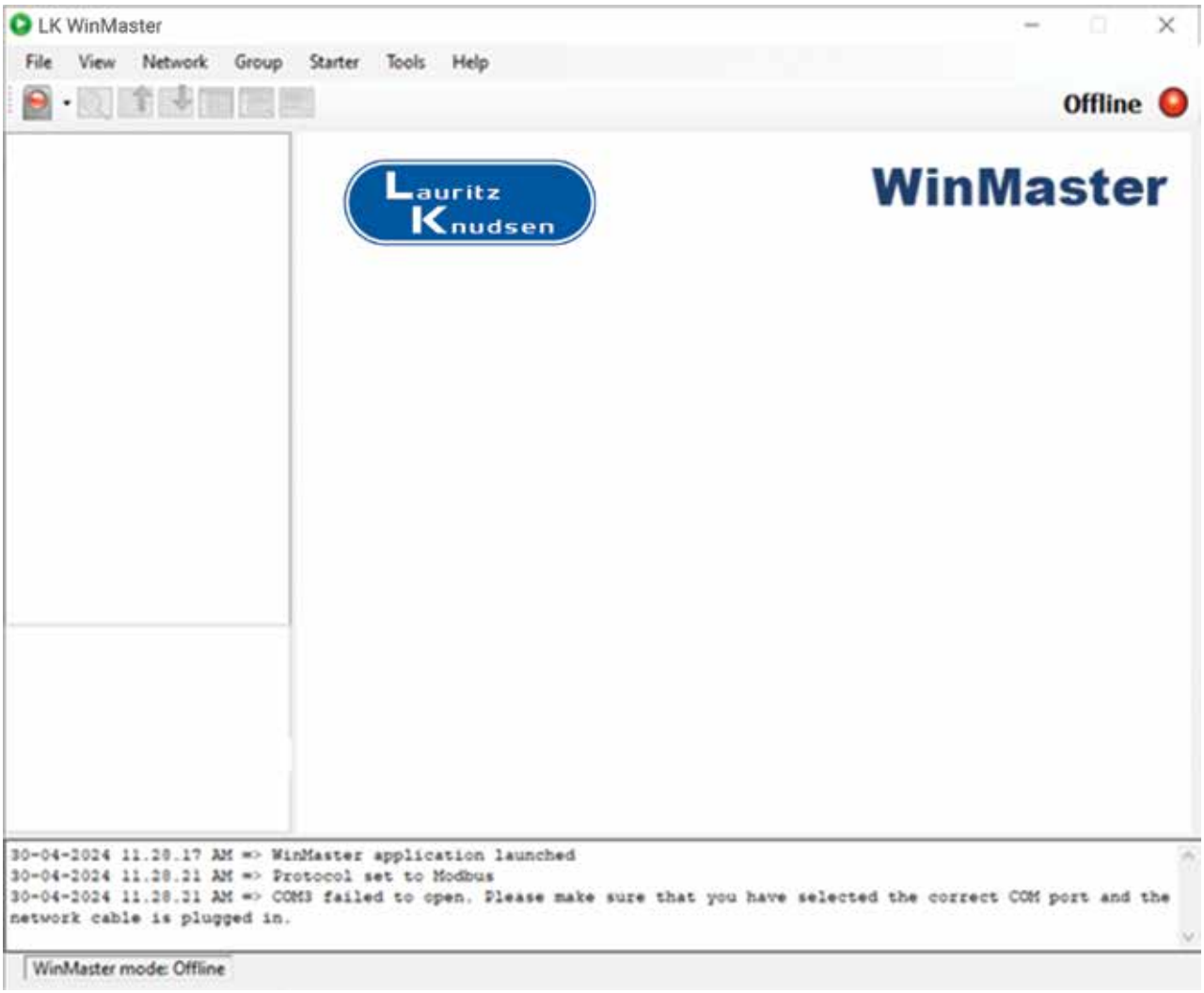
To use WinMaster with the xS1000, the soft starter must be fitted with a USB Interface, Modbus Interface or a Remote Operator.

PC software can provide real-time or offline management of soft starters.

For real-time management in a network of up to 254 starters, the software must connect to the soft starter via a Modbus TCP or Modbus RTU card. The software can monitor, control and program the starter across the network.

The software can be used to program the starter via the USB port on the pumping smart card.

For offline management, a configuration file generated in the software can be loaded into the starter via the USB port.

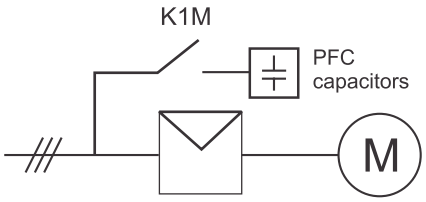


Frequently Asked Questions

1. Power Factor Correction: can it be used with soft starters?

Individual power factor correction capacitors can be used with soft starters, provided that they are installed on the input side of the soft starter and switched in using a dedicated contact or when the motor is running at full speed. The contact or should be AC6 rated for the motor full load current.

Connecting power factor correction capacitors to the output of a soft starter will cause equipment failure due to severe over voltage. This over voltage is created by resonance between the inductance of the motor and the power factor capacitance.



2. When and how should the Main Contactors be used?

Soft starters can be installed with or without a main contactor.

A main contactor:

- may be required to meet local electrical regulations.
- provides physical isolation when the starter is not in use and in the event of a soft starter trip.

  Even in the off state SCRs do not offer a high degree of isolation due to leakage through the SCR and protection networks. protects the soft starter SCRs from severe overvoltage situations (eg lightning strikes).
- SCRs are most susceptible to overvoltage damage when in the off state. A main contactor disconnects the SCRs from the supply when the motor is not running, preventing possible damage.

  Main contactors should be AC3 rated for the motor FLC.

3. When and how should Bypass Contactors be used?

Bypass contactors bridge out a soft starter's SCRs when the motor is running at full speed. This eliminates heat dissipation from the SCRs during run state.

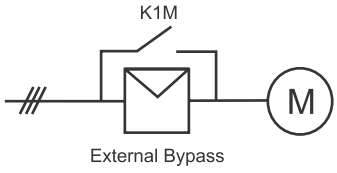
Some soft starters include built-in bypass contactors, others require an external bypass contactor.

Bypass contactors:

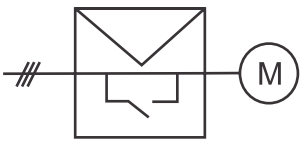
- allow soft starters to be installed in sealed enclosures
- eliminate the cost of forced-air cabinet ventilation
- save energy by eliminating SCR losses during run

  Bypass contactors should be AC1 rated for the motor FLC.

  The AC1 rating is adequate because the bypass contactor does not carry start current or switch fault current.



External Bypass



Internal Bypass

Frequently Asked Questions

4. What is Inside Delta Connection and why should it be used?

Inside delta connection (also called six-wire connection) places the soft starter SCRs in series with each motor winding. This means that the soft starter carries only phase current, not line current. This allows the soft starter to control a motor of larger than normal full load current.

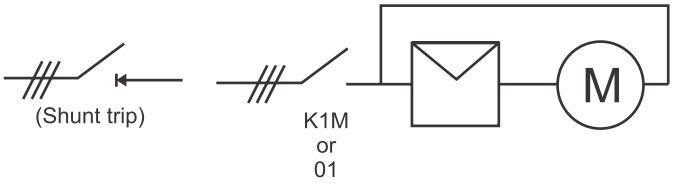
When using an inside delta connection, a main contactor or shunt trip MCCB must also be used to disconnect the motor and soft starter from the supply in the event of a trip.

Inside delta connection:

- Simplifies replacement of star/delta starters because the existing wiring can be used.
- May reduce installation cost. Soft starter cost will be reduced but there are additional cabling and main contractor costs. The cost equation must be considered on an individual basis.

  Only motors that allow each end of all three motor windings to be connected separately can be controlled using the inside delta connection method.

Not all soft starters can be connected in inside delta.

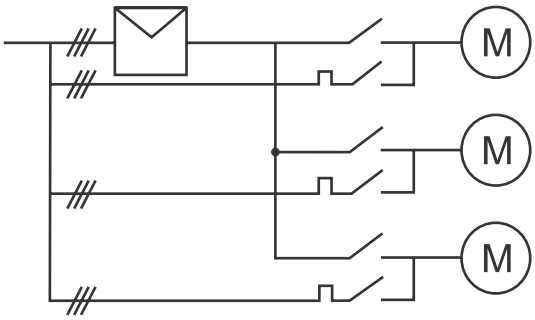


5. Sequential Starting: Can one soft starter be used to separately control multiple motors?

Yes, one soft starter can control multiple motors in sequence. However, the control and wiring needs to be engineered for proper operation.

In order to use a soft starter in a sequential starting situation,
1. Each motor must have a separate:
- main contactor
- bypass contactor
- overload protection

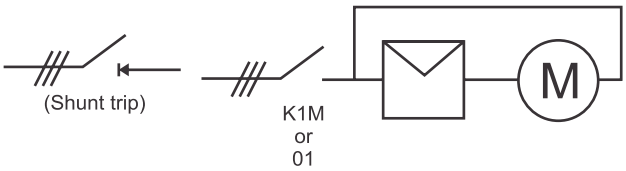
2. The soft starter must be suitably rated for the total start duty.



6. Can a star/delta starter be replaced with a soft starter?

Yes.
If the soft starter is capable of inside delta connection, simply connect it in place of the star/delta starter.

If the soft starter is not capable of inside delta connection, connect the delta connection to the output side of the soft starter.

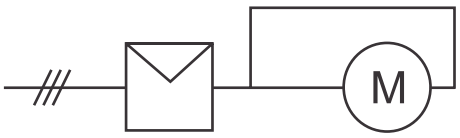


Frequently Asked Questions

7. Can one soft starter be used to control multiple motors i.e. Parallel Starting?

Yes. The circuit configuration and soft starter selection depends on the application.

1. Each motor must have its own overload protection.
2. If the motors are the same size and are mechanically coupled, a constant current soft starter can be used.
3. If the motors are different sizes and/or the loads are not mechanically interlocked, a soft starter with a timed voltage ramp (TVR) start profile should be used.
4. The combined motor FLCs must not exceed the soft starter FLC.



8. Can soft starters control an already rotating motor (flying load)?

Yes, soft starters can start motors that are already rotating. In general, the faster the motor is still rotating, the shorter the start time will be. If the motor is rotating in the reverse direction, it will be slowed to a standstill and then accelerate forwards. No special wiring or soft starter setup is required.

9. How to calculate the rise in internal temperature for IP54 enclosure?

For any panel, the temperature rise can be reduced either by operating at lower ambient temperature, or by dissipating the excess heat, so that temperature rise is controlled. This condition depends upon the design of the model. By offering effective cooling methods, the excess heat generated by the equipments can be dissipated. Selection of the cooling methods can decided based on the internal temperature rise inside the panel. The maximum internal temperature can be calculated using the following formula:

$$\text{Internal Temperature } (T_i) = \frac{P_d}{k \times S} + T_a$$

Where, P_d = Total power dissipated in the panel (in watts)
k = constant defined by the material used to manufacture the enclosure.
For painted sheet-steel enclosure, k = 5.5 W/m² °C
S = effective surface area of the panel (in m²)
T_a = Ambient temperature (in °C)