L&T SWITCHGEAR
SAFE & SURE

Soft Starters

LARSEN & TOUBRO
It's all about Imagineering

Larsen & Toubro Limited, India's leading manufacturer of low tension switchgear, introduces a new range of Soft Starters- SUPERNOVA. The range extends from simple soft start control devices to advanced systems that match complex requirements.

SUPERNOVA *Series*

L&T's Range of Soft Starters

CSX 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 CSX Series ideal for installation into switchboards or starter enclosures.

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

EMX3 Series Soft Starters come with total motor starting solution, combining high-level functionality with flexibility and ease of use. For advanced applications, an extensive range of functions makes the EMX3 suitable for nearly all motor starting and control requirements.

CSX
Soft Starters

- Compact design, small footprint
- Built-in bypass contactor
- Easy installation and operation
- Complements existing motor protection
- Ratings from 7.5kW to 110kW

FEATURES

	CSX
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	
Remote Operator	✓
PC Software	✓
Modbus RTU	✓
Profibus	✓
Device Net	✓
Finger Guard Kit	✓

SPECIFICATIONS

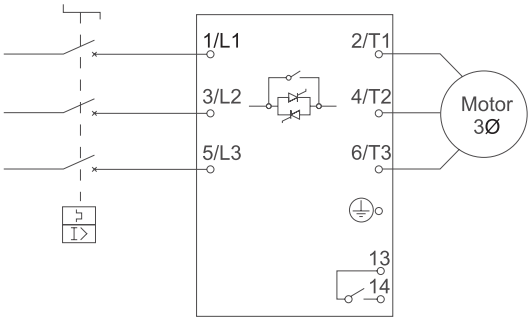
	Current Rating (Maximum Motor FLC)		Dimensions (mm)		
Motor kW	AC53b 4-6:354	AC53b 4-20:340	Width	Height	Depth
7.5	18 A	17 A			
15	34 A	30 A			
18.5	42 A	36 A	98	203	165
22	48 A	40 A			
30	60 A	49 A			
	AC53b 4-6:594	AC53b 4-20:580			
32	75 A	65 A			
45	85 A	73 A	145	215	193
55	100 A	96 A			
75	140 A	120 A			
90	170 A	142 A	202	240	214
110	200 A	165 A			

Ratings

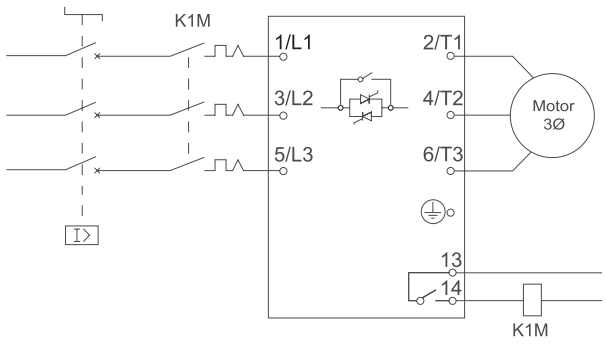
Current Range	18A ~ 200A, AC53b
Supply Voltage	200 ~ 440VAC or 200 ~ 575VAC
Supply Frequency	45/66Hz
Control Voltage	110 ~ 240VAC, 380 ~ 440VAC, 24VAC/VDC
Enclosure	IP20 up to 55kW, IP00 for 75kW and above
Approvals	CE

SCHEMATICS

CSX installed with motor protection circuit breaker



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



CSXi
Soft Starters

- Compact design, with built-in bypass contactor
- Essential motor protection
- Selectable soft starting profiles
- Flexible communication options
- Ratings from 7.5kW to 110kW

FEATURES

	CSXi
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	
Remote Operator	✓
PC Software	✓
Modbus RTU	✓
Profibus	✓
Device Net	✓
Finger Guard Kit	✓

Ratings

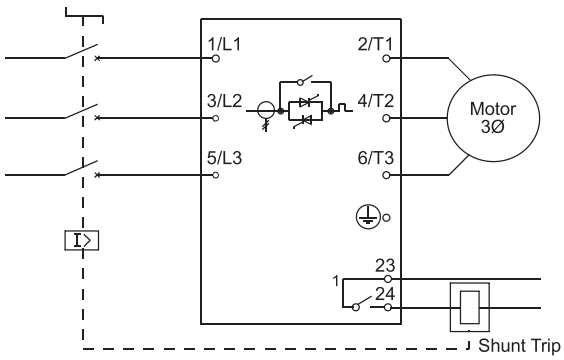
Current Range	18A ~ 200A, AC53b
Supply Voltage	200 ~ 440VAC or 200 ~ 575VAC
Supply Frequency	45/66Hz
Control Voltage	110 ~ 240VAC, 380 ~ 440VAC, 24VAC/VDC
Enclosure	IP20 up to 55kW, IP00 for 75kW and above
Approvals	CE

SPECIFICATIONS

	Current Rating (Maximum Motor FLC)		Dimensions (mm)		
Model kW	**ACc53b 4-6:354**	**AC53b 4-20:340**	Width	Height	Depth
7.5	18 A	17 A	98	203	165
15	34 A	30 A			
18.5	42 A	36 A			
22	48 A	40 A			
30	60 A	49 A			
	AC53b 4-6:594	**AC53b 4-20:580**	145	215	193
32	75 A	65 A			
45	85 A	73 A			
55	100 A	96 A			
75	140 A	120 A	202	240	214
90	170 A	142 A			
110	200 A	165 A			

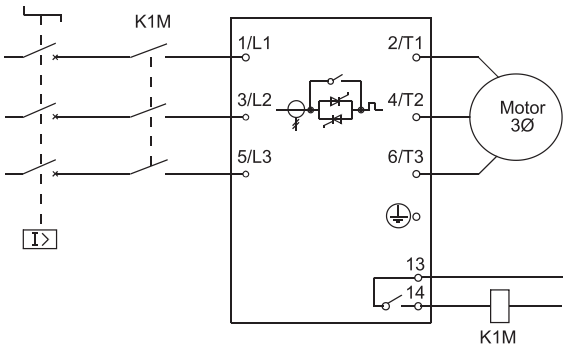
SCHEMATICS

CSXi installed with moulded case circuit breaker and shunt trip device



[1]Auxiliary Relay Function = Trip

CSXi installed with moulded case circuit breaker and line contactor



CSX & CSXi
Selection Chart

CSX	CSXi	Motor Rating (kW)	Motor Rating (HP)	AC-53b 4-6:354		AC-53b 4-20:340	
				40°C	50°C	40°C	50°C
CSX0007V4C1	CSXI007V4C1	7.5	10	18A	17A	17A	15A
CSX0015V4C1	CSXI015V4C1	15	20	34A	32A	30A	28A
CSX0018V4C1	CSXI018V4C1	18	25	42A	40A	36A	33A
CSX0022V4C1	CSXI022V4C1	22	30	48A	44A	40A	36A
CSX0030V4C1	CSXI030V4C1	30	40	60A	55A	49A	45A
				AC-53b 4-6:594		AC-53b 4-20:580	
				40°C	50°C	40°C	50°C
CSX0037V4C1	CSXI037V4C1	37	50	75A	68A	65A	59A
CSX0045V4C1	CSXI045V4C1	45	60	85A	78A	73A	67A
CSX0055V4C1	CSXI055V4C1	55	75	100A	100A	96A	87A
CSX0075V4C1	CSXI075V4C1	75	100	140A	133A	120A	110A
CSX0090V4C1	CSXI090V4C1	90	120	170A	157A	142A	130A
CSX0110V4C1	CSXI110V4C1	110	150	200A	186A	165A	152A

Ordering Information

CSX □ □□□ V □ C □

- 1:110-240VAC or 380-440VAC
  4:24VDC / VAC (On request)
- 4:200-440VAC 50/60Hz
  6:200-575VAC 50/60Hz
  (On request)
- Motor Rating in KW
- 0:CSX Soft Starter
  I:CSXi Soft Starter

IMS2
Digital Soft Starters

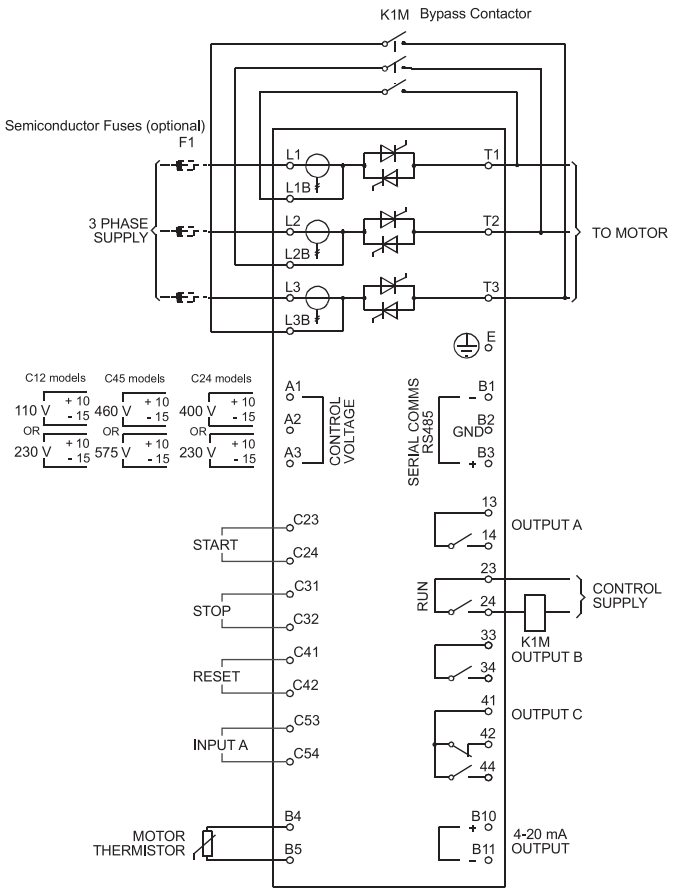
The IMS2 offers a choice of soft start and soft stop profiles to ensure optimum control for all load types.

FEATURES

	IMS2
Starting	
Constant current	✓
Current ramp	✓
Torque control	✓
Kickstart	✓
Stopping	
Soft stop	✓
Pump stop	✓
Soft braking	✓
Protection	
Motor thermal model	✓
Motor thermistor input	✓
Phase imbalance	✓
Phase sequence	✓
Electronic shearpin	✓
Undercurrent	✓
Auxiliary trip input	✓
Starter heatsink overtemperature	✓
Excess start time	✓
Supply frequency	✓
Shorted SCR	✓
Power circuit	✓
Human Interface	
Local pushbuttons (Start, Stop, Reset, Local/Remote)	✓
Numeric display	✓
Remote input status LEDs	✓
Phase indicator LEDs	✓
Control Interface	
Control inputs (3 x fixed, 1 x programmable)	✓
Relay outputs (1 x fixed, 3 x programmable)	✓
Analogue output (1 x programmable)	✓
Serial output (1 x RS485)	✓
Sundry	
Current & Motor Temperature readout	✓
Trip Log & Start Counter	✓
Multiple function sets	✓
Function lock, Password protection	✓
Store/Restore function settings	✓
Emergency Mode operation	✓
Wall mount (models up to 253 A)	✓
Adjustable bus bar configuration (models above 302 A)	✓
Approvals	
CE	✓

- Advanced soft start and soft stop control
- Protection functions operate even when bypassed
- External input/outputs for remote management
- Fully programmable restart delay and auto-reset

SCHEMATIC
IMS2 installed with bypass contactor (controlled by Run output)



Ratings

Current Range	**18A ~ 1574A, AC53a**
Supply Voltage	**200 ~ 690VAC**
Supply Frequency	**50/60Hz**
Control Voltage	**110VAC / 240VAC / 440VAC**
Enclosure	**IP42 or IP54 up to 253A**
Approvals	CE

IMS2 Selection Chart

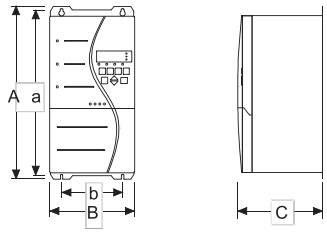
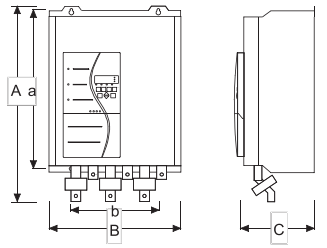
IMS2 soft starters can be installed with or without a bypass contactor, and in three-wire or six-wire (inside delta) configuration.

Bypassing the soft starter during operation reduces heating while the motor is running, reducing the amount of ventialtion and cooling required.

Continuous Operation (Bypassed)

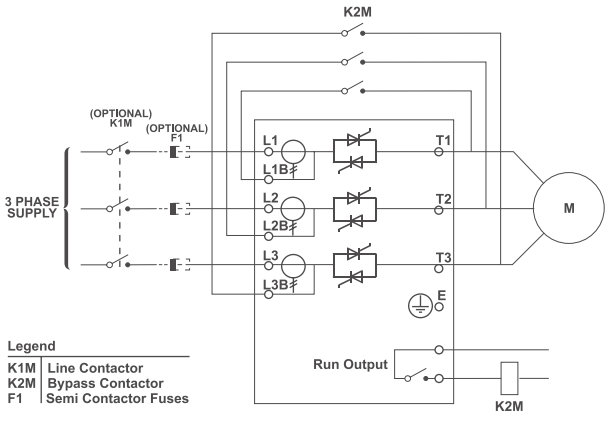
	Motor Current Rating @ 3.0 × FLC		Motor Current Rating @ 3.5 × FLC		Motor Current Rating @ 4.0 × FLC		Motor Current Rating @ 4.5 × FLC	
	AC53a 3-10:350 45°C <1000m		AC53a 3.5-15:345 45°C <1000m		AC53a 4-20:340 45°C <1000m		AC53a 4.5-30:330 45°C <1000m	
	3 Wire	6 Wire	3 Wire	6 Wire	3 Wire	6 Wire	3 Wire	6 Wire
IMS20018V5C12F1E4	18	27	18	27	16	24	14	20
IMS20034V5C12F1E4	34	51	34	51	34	51	28	42
IMS20041V5C12F1E4	41	62	41	62	41	62	34	52
IMS20047V5C12F1E4	47	71	47	71	47	71	39	59
IMS20067V5C12F1E4	67	101	62	94	54	82	47	71
IMS20088V5C12F1E4	88	132	82	122	71	106	61	91
IMS20096V5C12F1E4	96	144	90	136	78	117	66	99
IMS20125V5C12F1E4	125	188	120	181	103	155	88	132
IMS20141V5C12F1E4	141	212	127	190	111	166	96	145
IMS20202V5C12F1E4	202	303	187	281	162	243	140	210
IMS20238V5C12F1E4	238	357	224	336	194	290	166	250
IMS20253V5C12F1E4	253	381	228	342	198	297	172	259
IMS20302V5C12F1E0	302	453	285	427	245	368	209	314
IMS20405V5C12F1E0	405	608	395	592	336	504	282	424
IMS20513V5C12F1E0	513	770	513	770	435	653	356	534
IMS20585V5C12F1E0	585	878	585	878	504	756	410	614
IMS20628V5C12F1E0	628	942	626	939	528	793	436	654
IMS20775V5C12F1E0	775	1163	775	1163	672	1009	542	813
IMS20897V5C12F1E0	897	1346	897	1346	798	1197	632	948
IMS21153V5C12F1E0	1153	1730	1153	1730	1006	1509	850	1276
IMS21403V5C12F1E0	1403	2105	1403	2105	1275	1912	1060	1591
IMS21574V5C12F1E0	1574	2361	1574	2361	1474	2212	1207	1811

IMS2
Enclosure Details

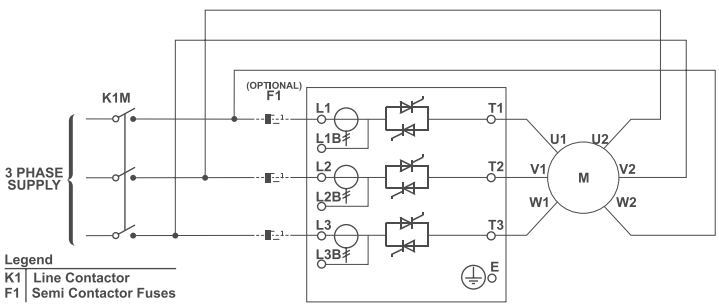
Dimensions	A (mm)	B (mm)	C (mm)	a (mm)	b (mm)	Weight (kg)	IP Rating	
IMS20018 IMS20034 IMS20041 IMS20047	380	185	180	365	130	6	IP42 or 54	
IMS20067 IMS20088 IMS20096 IMS20125	380	185	250	365	130	7	IP42 or 54	
IMS20141 IMS20202 IMS20238	425	270	275	410	2001	7.5	IP42 or 54	
IMS20253	425	390	275	410	300	23	IP42 or 54	
IMS20302 IMS20405	690	430	294	522	320	38	IP00	
IMS20513 IMS20585 IMS20628	690	430	294	522	320	50	IP00	
IMS20775 IMS20897	690	430	294	522	320	53	IP00	
IMS21153 IMS21403 IMS21574	855	574	353	727	500	121	IP00	

IMS2
Wiring Schematics

IMS2 in 3 Wire Configuration (Bypass Mode)



IMS2 in 6 Wire Configuration*



* kindly refer IMS2 user manual for 6 wire bypass configuration.

EMX3
Digital Soft Starters

The EMX3 is the latest development in soft starter technology providing a complete motor starting and management system. With an impressive range of features in a single user friendly package, never before has motor control been so simple.

- Advanced soft start and soft stop control
- Protection functions operate even when bypassed
- External input/outputs for remote management
- Fully programmable auto start and auto stop
- LCD display for programming & monitoring

FEATURES

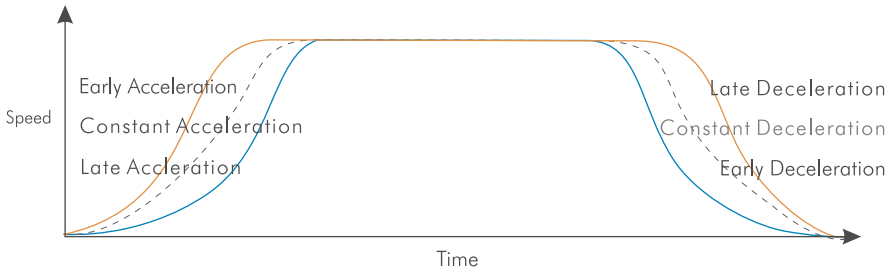
	EMX3
Starting Functions	
XLR-8 adaptive acceleration	✓
Constant current start mode	✓
Current ramp start mode	✓
Kickstart	✓
Stopping Functions	
XLR-8 adaptive deceleration	✓
TVR soft stop	✓
Brake mode	✓
Coast to stop	✓
Keypad	
Large LCD screen	✓
Remote Mounting option	✓
Status LED's	✓
Easy to read screen	✓
Real language feedback	✓
Multi-language options	✓
Shortcut button	✓
Protection	
Fully customisable protection	✓
Motor thermal model	✓
Motor thermistor input	✓
Phase sequence	✓
Undercurrent	✓
Instaneous overcurrent	✓
Auxilary trip input	✓
Heatsink overtemperature	✓
Excess start time	✓
Supply frequency	✓
Shorted SCR	✓
Power circuit	✓
Motor connection	✓
RS485 failure	✓
Motor overload	✓
Current imbalance	✓
Ground fault(optional)	✓

	EMX3
Control Interface	
Control inputs(3 x fixed, 2 x programmable)	✓
Motor thermistor input	✓
PT100 RTD input	✓
Relay outputs(1 x fixed, 3 x programmable)	✓
Analogue output (1 x programmable)	✓
Serial output(1 x RS485)	✓
Additional Features	
Starter communication timeout	✓
Network communication trip	✓
Auto detection of inline or inside delta power connection	✓
Programmable auto start/stop	✓
24 VDC auxiliary power supply	✓
PT 100 (RTD) input	✓
Real time clock with battery backup	✓
Powerthrough - enables the choice of continuous operation despite a power assembly failure.	✓
Forward and reverse jog function	✓
I/O expansion card (optional)	✓
Approvals	
CE	✓

EMX3

Acceleration Control

ADAPTIVE ACCELERATION PROFILE OPTIONS



Adaptive acceleration offers threestop profiles according to your needs.

XLR-8 ADAPTIVE ACCELERATION CONTROL

L&T's new EMX3 soft starter introduces a new generation in soft start technology XLR-8 Adaptive Acceleration Control. XLR-8 gives you an unprecedented level of control over your motor's acceleration and deceleration profiles. Using XLR-8, the soft starter learns your motor's performance during start and stop, then adjusts control to optimise performance. Simply select the profile that best matches your load type and the soft starter automatically ensures the smoothest possible acceleration for your load.

SMARTER STARTING

The EMX3 puts you in control of motor starting. Depending on your application requirements you can select the best soft start control method.

For applications requiring precise control of motor start current the EMX3 offers a choice of Constant Current or Current Ramp start modes. For superior control over acceleration or deceleration choose Adaptive Acceleration Control.

SMOOTHER STOPPING

Adaptive Acceleration Control also provides precise control over soft stopping and is ideal for applications requiring a smoother soft stop.

It is ideal for low inertia loads such as pumps and conveyors, and can substantially reduce or eliminate the effects of water hammer.

SIMULATIONS

Need to test the installation before connecting a motor? The EMX3 simulation functions let you test the soft starter's operation, external control circuits and associated equipment without connecting the soft starter to line voltage or a motor. The EMX3 has three simulation modes:

Run simulation:
Simulates a motor starting, running and stopping to ensure correct installation.

Protection simulation:
Simulates activation of each protection mechanism to confirm correct protection response.

Signalling simulation:
Simulates output signalling.

EMX3
Specifications

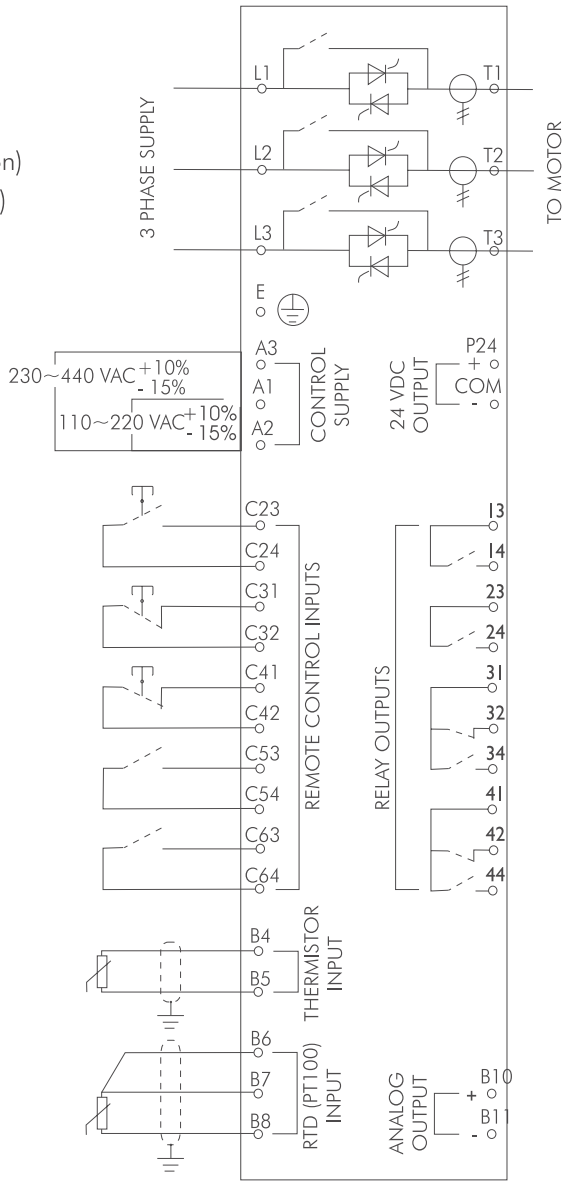
General
Current Range. ---------- 23A ~ 1600A(nominal)
Motor Connection ---------- In-Line or inside delta
By pass ---------- Integrated internal or external

Supply
Mains Voltage (L1, L2, L3)
EMX3-xxxx-V4 ---------- 200 VAC ~ 440 VAC (+10%)
EMX3-xxxx-V7 ---------- 380 VAC ~ 690 VAC (+10%) (in-line connection)
EMX3-xxxx-V7 ---------- 380 VAC ~ 600 VAC (+10%) (inside delta connection)
Control Voltage (A1, A2, A3) ---------- 110 ~ 220 VAC (+10% / -15%)
---------- or 230 ~ 440 VAC (+10% / -15%)
Mains Frequency ---------- 45 Hz to 66 Hz

Inputs
Inputs ---------- Active 24 VDC, 8 mA approx.
Start (C23, C24) ---------- Normally open
Stop (C31, C32) ---------- Normally closed
Reset (C41, C42) ---------- Normally open or closed
Programmable Inputs
Input A (C53, C54) ---------- Normally open or closed
Input B (C63, C64) ---------- Normally open or closed
Motor Thermistor (B4, B5)
PT100 RTD (B6, B7, B8)

Outputs
Relay outputs ---------- 10 A at 250 VAC resistive
---------- 5 A at 250 VAC, AC15 pf 0.3
Run Relay (23, 24) ---------- Normally Open
Programmable Outputs
Relay A (13, 14) ---------- Normally Open
Relay B (31, 32, 34) ---------- Changeover
Relay C (41, 42, 44) ---------- Changeover
Analog Output(B10, B11) ---------- 0-20 mA or 4-20 mA
24 VDC Output (P24, COM) ---------- 200mA

Environmental
Protection
EMX3-0023B ~ EMX3-0105B ---------- IP20 & NEMA1
EMX3-0145B ~ EMX3-1600C ---------- IP00
Operating temperature ---------- -10 °C ~ 60 °C
Storage temprature ---------- -10 °C ~ 60 °C
Humidity ---------- 5% to 95% Relative Humidity



The internal bypass feature is inluded only on units with the suffix 'B'.

EMX3
Selection chart

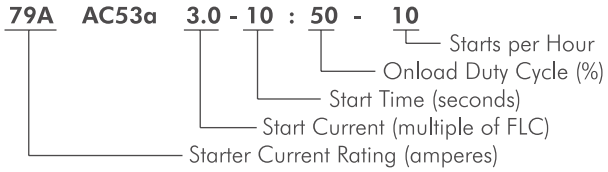
Model	Light	Medium	Heavy	Severe
	AC53b 3.0-10:350	AC53b 3.5-15:345	AC53b 4.0-20:340	AC53b 4.5-30:330
EMX3-0023B	23A	20A	17A	15A
EMX3-0043B	43A	40A	34A	29A
EMX3-0050B	50A	44A	37A	30A
EMX3-0053B	53A	53A	46A	37A
	AC53b 3.0-10:590	AC53b 3.5-15:585	AC53b 4.0-20:580	AC53b 4.5-30:570
EMX3-0076B	76A	64A	55A	47A
EMX3-0097B	97A	82A	69A	58A
EMX3-0100B	100A	88A	74A	61A
EMX3-0105B	105A	105A	95A	78A
EMX3-0145B	145A	123A	106A	90A
EMX3-0170B	170A	145A	121A	97A
EMX3-0200B	200A	189A	160A	134A
EMX3-0220B	220A	210A	178A	148A
	AC53a 3.0-10:50-6	AC53a 3.5-15:50-6	AC53a 4.0-20:50-6	AC53a 4.5-30:50-6
EMX3-0255C	255A	222A	195A	171A
EMX3-0360C	360A	351A	303A	259A
EMX3-0380C	380A	380A	348A	292A
EMX3-0430C	430A	413A	355A	301A
EMX3-0620C	620A	614A	515A	419A
EMX3-0650C	650A	629A	532A	437A
EMX3-0790C	790A	790A	694A	567A
EMX3-0930C	930A	930A	800A	644A
EMX3-1200C	1200A	1200A	1135A	983A
EMX3-1410C	1410A	1355A	1187A	1023A
EMX3-1600C	1600A	1600A	1433A	1227A

All Ratings are at 40 °C and <1000 meters. To calculate inside-delta ratings, multiply by 1.5

Ratings are detailed using the AC53 utilisation code specified by IEC60947-4-2

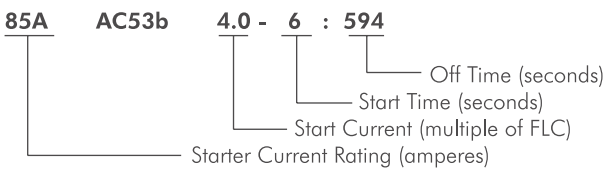
AC53a Utilization Category Format

IMS2 Soft-Starter rating are detailed using the AC53a utilization code (for control of squirrel cage induction motor on 8-hour duty with on load current for start, acceleration and run) specified by IEC 60947-4-2.



AC53b Utilization Category Format

CSX/CSXi Soft Starters rating are defined using the AC53b utilization code (for control of squirrel cage induction motors on intermittent duty) as per IEC 60947-4-2.



EMX3 Soft Starters

EMX3 ☐☐☐☐ ☐ - ☐☐ - ☐☐ - ☐

- **Nominal current rating**
- **Bypass**
  B=Internally bypassed
  C=Non-bypassed (continuous connection)
- **Mains voltage**
  4=200 VAC ~ 440 VAC
  7=380 VAC ~ 690 VAC
- **Control voltage**
  1=110-220 VAC & 230-440 VAC
- **Keypad**
  1=With Keypad
  0=Without Keypad

Example: EMX3 0220B411
(EMX3 220A with Built-in Bypass and Keypad)

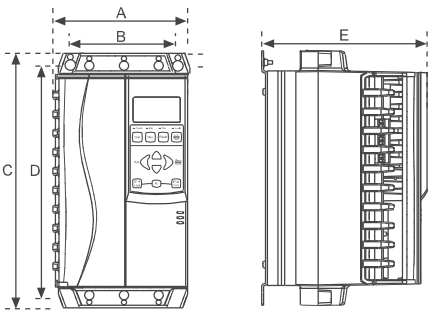
Power Range
Current ratings
23A
43A
50A
53A
76A
97A
100A
105A
145A
170A
200A
220A
255A
360A
380A
430A
620A
650A
790A
930A
1200A
1410A
1600A

*Bypass inbuilt upto 220 A

DIMENSIONS AND WEIGHTS

Model	A mm (inches)	B mm (inches)	C mm (inches)	D mm (inches)	E mm (inches)	Weight kg (lbs)
EMX3-0023B~ EMX3-0053B	156·4	124.0	294.6	278.0	192.2 (7.57)	3.2 (7.05)
EMX3-0076B				(10.94)		3.5 (7.22)
EMX3-0097B~ EMX3-0105B	(6.16)	(4.88)	(11.60)		222.7 (8.77)	4.8 (10.58)
EMX3-0145B~ EMX3-0220B	282 (11.10)	250 (9.84)	438 (17.24)	380 (14.96)	250 (9.84)	16 (35.27)
EMX3-0255C	390 (15.35)	20 (12.60)	417 (16.42)	400 (15.75)	281 (11.06)	25 (55·12)
EMX3-0360C~ EMX3-0930C	430 (16.93)	320 (12.60)	545 (21.46)	522 (20.55)	299 (11.77)	50.5 (111.33)
EMX3-1200C~ EMX3-1600C	574 (22.60)	500 (19.69)	750 (29.53)	727 (28.62)	361 (14.21)	136 (299.83)

For EMX3-0145B ~ EMX3-1600C, dimensions A & C are the unit footprint.
Bus bars are not included as this dimension will vary with bus bar configuration.



COMPACT DESIGN

The design of the EMX3 allows for multiple units to be mounted side by side, or in a bank of starters due to the flexibility in cabling options. Internally bypassed starters further reduce the overall size of your soft starter.

Communication Modules

All the soft starters can be integrated into serial communication networks for remote monitoring and control.
All communication interfaces have a compact physical form, designed to attach to the CSX and EMX3 series with very little extra space, and IMS2 soft starters have support for Modbus RTU and AP ASCII communications built-in.

Device Net Interface

CAT No.	**PIMDN01**
Node address range	0 to 63
Data rate	125 kB, 250 kB, 500 kB
Power consumption	
steady state	19 mA at 25 VDC, 31 mA at 11 VDC
in-rush (at 24 VDC)	1.8 A maximum for 2 ms

Profibus Interface

CAT No.	**PIMPB01**
Node address range	00 to 99
Data rate	9.6 kB/s ~ 12 MB/s
Power consumption (steady state, maximum)	35 mA at 24 VDC
Galvanically isolated, Reverse polarity protected	

Modbus Interface

CAT No.	**PIMMB01**
Protocol	Modbus RTU, AP ASCII
Address range	0 to 31
Data rate (bps)	4800, 9600, 19200, 38400
Parity	None, Odd, Even, 10-bit
Timeout	None (off), 10 s, 60 s, 100 s

Remote Operator

Remote operator can be used to monitor performance and to command the soft starter, including emergency stop.

The Remote Operator can be installed into the flat surface of an enclosure, or can be mounted up to 100 metres away for remote control and monitoring. Designed for use with CSX and IMS2 soft starters, the Remote Operator can show soft starter trip codes as well as real-time information on motor current and motor temperature (function depends on soft starter model).

Power consumption	250 mA (max)
Voltage	18 - 30 VDC/VAC (50/60 Hz)
RS485 Network Interface	AP ASCII or Modbus RTU protocol (selectable)
Analogue output (motor current monitoring)	4-20 mA
Enclosure Rating	IP54 or NEMA 12 when correctly panel mounted

Ordering Information

Remote Operator for CSX/CSXi	PIMRO01
Remote Operator for IMS2	RCM01

FEATURES	CSX	CSXi	IMS2	EMX3
Starting				
Timed voltage ramp	✓			
Constant current		✓	✓	✓
Current ramp		✓	✓	✓
Torque control			✓	
Kickstart			✓	✓
XLR8 Adaptive acceleration				✓
Stopping				
Soft stop	✓	✓	✓	✓
Pump stop			✓	
XLR8 Adaptive acceleration				✓
Protection				
Mains frequency	✓	✓	✓	✓
Phase sequence		✓	✓	✓
Shorted SCR	✓	✓	✓	✓
Motor overload (thermal model)		✓	✓	✓
Instantaneous overcurrent			✓	✓
Undercurrent			✓	✓
Current imbalance		✓	✓	✓
Motor thermistor		✓	✓	✓
Excess start time		✓	✓	✓
Power loss	✓	✓	✓	✓
Auxiliary trip			✓	✓
Human Interface				
Starter status LEDs	✓	✓	✓	✓
Trip log and start counters			✓	✓
Store/reload user settings			✓	✓
Performance metering			✓	✓
Lage LCD screen				✓
Control Interface				
Programmable control inputs			✓	✓
Programmable relay outputs		✓	✓	✓
Analog output			✓	✓
Serial port*	✓	✓	✓	✓
Sundry				
Dual motor sets			✓	✓
Emergency start			✓	✓
Auto-stop			✓	✓
Options & Accessories				
Device Net	✓	✓	✓	✓
Modbus RTU	✓	✓	✓**	✓
Profibus		✓	✓	✓
PC Software	✓	✓	✓	✓
Remote Operator	✓	✓	✓	✓
Approvals				
CE	✓	✓	✓	✓

*Optional

**Modbus RTU built in as standard in IMS2 as standard.

Selecting the 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.

Application duty ratings

- Normal duty applications require start current up to 3.5 times the motor's full load current, and starting time of 10 to 20 seconds.
- Heavy duty loads have more inertia than normal duty loads, and require starting current up to 4.5 times full load current for around 30 seconds.
- Severe duty loads have extremely high inertia, requiring extremely long start time and start current up to 5.5 times full load current.

	normal	heavy	severe
Bow thruster	■		
Carding machine	■		
Centrifuge			■
Chipper		■	
Compressor, centrifugal (rotary)	■		
Compressor, reciprocating (piston)		■	
Compressor, screw (unloaded)	■		
Conveyor, horizontal (loaded)	■		
Conveyor, horizontal (unloaded)	■		
Conveyor, vertical (loaded)		■	
Conveyor, vertical (unloaded)	■		
Crusher, cone	■		
Crusher, jaw		■	
Crusher, rotary (unloaded)	■		
Debarker	■		
Drilling machine	■		
Dryer		■	
Edger	■		
Escalator	■		
Fan, centrifugal (damped)	■		
Fan, centrifugal (undamped)		■	
Grinder	■		
Hydraulic power pack	■		
Mill, ball			■
Mill, hammer			■
Mill, roller		■	
Milliscreen	■		

	normal	heavy	severe
Mixer (high viscosity)		■	
Mixer (low viscosity)	■		
Pelletiser		■	
Planer	■		
Press	■		
Pump, centrifugal	■		
Pump, positive displacement		■	
Pump, slurry		■	
Pump, submersible	■		
Pump, vacuum	■		
Re-pulper			■
Rotary table		■	
Sander	■		
Saw, band			■
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

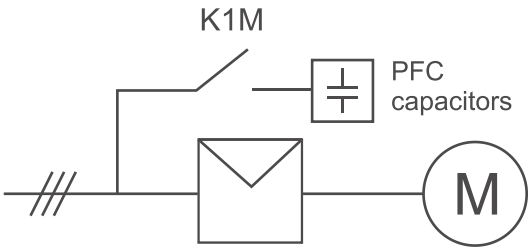
When you know the duty rating of the application, you can choose an appropriate soft starter. Select a starter which offers the features you want, and use the table below to ensure that the soft starter is appropriate for the application. Select a soft starter model which has a current rating at least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

Starter duty		Application duty		
		Normal	Heavy	Severe
	CSX Series	✓	✓	
	IMS2	✓	✓	✓
	EMX3	✓	✓	✓

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.

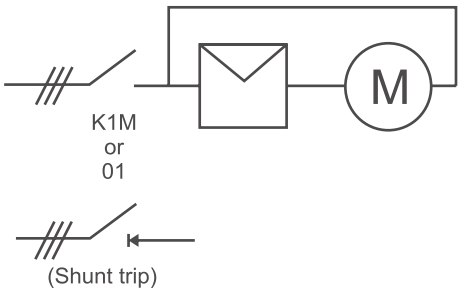
- protects the soft starter SCRs from severe overvoltage situations (eg lightning strikes).

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 can AC1 rated for the motor FLC.

3. 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.

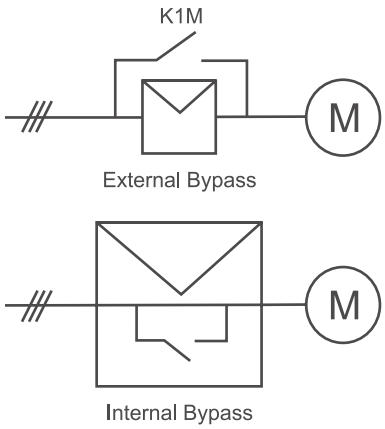
Only motors that allow each end of all three motor windings to be connected separately can be controlled using the inside delta connection method.

Not all soft starters can be connected in inside delta.

4. 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

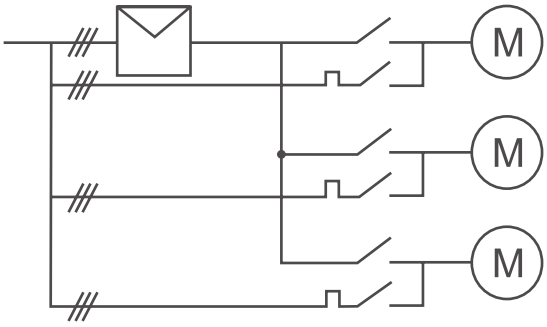
Bypass contactors should be AC1 rated for the motor FLC. The AC1 rating is adequate because the bypass contactor does not carry start current or switch fault current.

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,

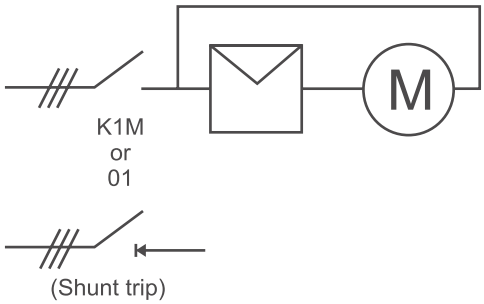
1. Each motor must have a separate:
   - main contactor
   - bypass contactor
   - overload protection
2. The soft starter must be suitably rated for the total start duty.



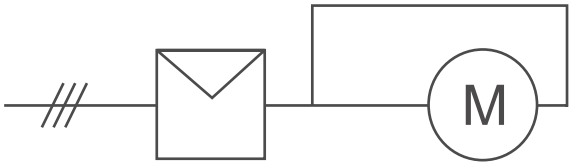
6. Can a star/delta starter be replaced with a soft starter?

Yes.

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



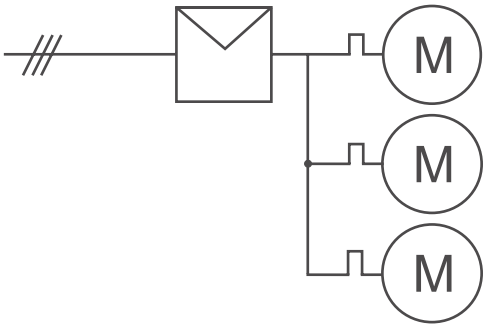
If the soft starter is not capable of inside delta connection, connect the delta connection to the output side of the soft starter.



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.

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