Product improvement is a continuous process. For the latest information and special applications, please contact any of our offices listed here.
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.
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 an 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 be done based on the internal temperature rise inside the panel. The maximum internal temperature can be calculated using the following formula:

\[ T = P_d \left( \frac{1}{k \times S} + T_a \right) \]

Where, 
- \( P_d \) = Total power dissipated in the panel (in watts)
- \( k \) = constant defined by the material used to manufacture the enclosure.
- \( S \) = Effective surface area of the panel (in m²)
- \( T_a \) = Ambient temperature (in °C)

Frequently Asked Questions

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

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<table>
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<tr>
<td>90</td>
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<td>110</td>
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</table>

Note: Use semiconductor fuses at input
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.

- 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.
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 overvoltage. This overvoltage 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.
   - protects the soft starter SCRs from severe overvoltage situations (e.g., 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.

   - 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 ACI rated for the motor FLC. The AC1 rating is adequate because the bypass contactor does not carry start current or switch fault current.
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

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
- Instantaneous overcurrent
- Auxiliary trip input
- Heatsink overtemperature
- Excess start time
- Supply frequency
- Shorted SCR
- Power circuit
- Motor connection
- RS485 failure
- Motor overload
- Current imbalance
- Ground fault (optional)

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
- Powerthru - enables the choice of continuous operation despite a power assembly failure.
- Forward and reverse jog function
- I/O expansion card (optional)

Approvals
- CE

WinStart software

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.
L&T 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.

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

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**WinStart software**

**L&T WinStart software**

**EMX3 Acceleration Control**

**ADAPTIVE ACCELERATION PROFILE OPTIONS**

- Early Acceleration
- Constant Acceleration
- Late Acceleration
- Late Deceleration
- Constant Deceleration
- Early Deceleration

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**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.

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**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.

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**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.

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**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 Wiring Schematics**

### In-line installation, internally bypassed

[Diagram showing wiring schematics for in-line installation, internally bypassed]

### In-line installation, externally bypassed

[Diagram showing wiring schematics for in-line installation, externally bypassed]

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**Selection of Semiconductor Fuse**

Table for selection of semiconductor fuse for EMX3 series:

<table>
<thead>
<tr>
<th>Model</th>
<th>SCR F1 (A’S)</th>
<th>Bussmann Fuse</th>
<th>Ferraz Fuse</th>
<th>Ferraz Fuse</th>
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<td></td>
<td></td>
<td>Square Body</td>
<td>European</td>
<td>N. American</td>
<td>European</td>
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<tr>
<td></td>
<td></td>
<td>(170M)</td>
<td>Style</td>
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* Two parallel connected fuses required per phase.

** Two series connected fuses required per phase.

XXX Blade Type. Refer to Ferraz catalog for options.
Selection of Semiconductor Fuse

Short circuit protection device (SCPD) is an integral part of any motor starter / motor starting solution. For traditional starters like DOL or Star delta starter HRC Fuse / MCCB is widely used. Soft starter is now being widely used for starting of various loads as a replacement of DOL/ Star Delta starter. However to ensure that semiconductor devices are protected in the event of short circuit, fast acting fuses or Semiconductor Fuses are used as SCPD.

Installation Guidelines for CSX / CSXi / EMX3 range for soft starters to achieve Type 2 coordination:

Type 2 protection requires that in the event of a short circuit on the output of a soft starter the fault must be cleared without risk of injury to personnel or damage to the soft starter.

Type 2 protection is achieved by using semiconductor fuses. These fuses must be able to carry motor start current and have a total clearing I²t < the I²t of the soft starter SCRs.

Semiconductor fuses for Type 2 circuit protection are additional to HRC fuses or MCCBs that form part of the motor branch circuit protection.

The below mentioned charts specify the rating of the semiconductor fuse to be used along with the soft starter.

Table for selection of semiconductor fuse for CSX and CSXi series:

<table>
<thead>
<tr>
<th>Model CSX &amp; CSXi</th>
<th>SCR I2t (A2S)</th>
<th>Ferraz Fuse European / IEC Style (North American Style)</th>
<th>Bussmann Fuse Square Body (170M)</th>
<th>Bussmann Fuse British Style (BS88)</th>
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xxx = Blade Type. Contact Ferraz for options.
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): 200 VAC ~ 440 VAC (+10% / -15%)
EMX3-xxxx-V7: 380 VAC ~ 690 VAC (+10%) (in-line connection)
EMX3-xxxx-V3: 380 VAC ~ 600 VAC (+10%) (inside delta connection)
Control Voltage (A1, A2, A3): 110 ~ 220 VAC (+10% / -15%)
230 ~ 440 VAC (+10% / -15%)
Mains Frequency: 45Hz to 66Hz

Inputs
Inputs: 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
Outputs: 10A at 250 VAC resistive
Run Relay (C23, C24): 5 A at 250 VAC, AC15pF 0.3
Programmable Outputs
Relay A (13, 14): Normally Open
Relay B (31, 32, 34): Changeover
Relay C (41, 42, 44): Changeover
Analog Outputs (B10, B11): 0.20 mA or 4-20 mA
24 VDC Output (P24, COM): 200mA

Environmental
Protection
EMX3-0023B ~ EMX3-0105B: IP20 & NEMA 1
EMX3-015B ~ EMX3-1600C: IP60
Operating temperature: 10°C ~ 60°C
Storage temperature: -10°C ~ 60°C
Humidity: 5% to 95% Relative Humidity

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 generalized 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

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.

<table>
<thead>
<tr>
<th>Application duty</th>
<th>Normal</th>
<th>Heavy</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSX Series</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>EMX3</td>
<td>✔</td>
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## Selection of Right Starter

### FEATURES

<table>
<thead>
<tr>
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<th>CSX</th>
<th>CSXi</th>
<th>EMX 3</th>
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</tr>
<tr>
<td>Torque control</td>
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<td>✓</td>
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<tr>
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<td>Auxiliary trip</td>
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<tr>
<td>Starter status LEDs</td>
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### Selection Chart

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<th>Severe</th>
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<td>1600A</td>
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</tbody>
</table>

The above EMX3 current ratings are based on 300% starting current, 10 starts per hour, 10 seconds starting time and ambient temperature of 45°C.

### 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

CSI/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

Example: EMX3 0220B411

- Nominal current rating
  - C = Non-bypassed (continuous connection)
  - B = Internally bypassed

- Current ratings
  - 23A
  - 43A
  - 53A
  - 76A
  - 97A
  - 105A
  - 145A
  - 170A
  - 220A
  - 256A
  - 360A
  - 430A
  - 620A
  - 650A
  - 790A
  - 930A
  - 1200A
  - 1410A
  - 1600A

- Power Range
  - 430A
  - 360A
  - 255A
  - 220A
  - 145A
  - 105A
  - 76A
  - 650A
  - 620A
  - 430A
  - 360A

- Bypass
  - Bypass inbuilt upto 220 A

- Mains voltage
  - 400 VAC ~ 440 VAC

- Control voltage
  - 110-220 VAC & 230-440 VAC

- Bank of starters due to flexibility in cabling options.

- Internal bypassed

- USB interface
  - An analog Output (B12[+], B13[Com])
    - 0-20 mA or 4-20 mA (selectable)

- Modbus Interface
  - Communication Modules
    - CAT No. PIMMB01
      - Protocol: Modbus RTU, AP ASCII
      - Address range: 0 to 79
      - Data rate (bps): 9.6 kbps to 12 kbps

- Communication Modules
  - CAT No. PIMP01
    - Protocol: Modbus RTU, AP ASCII
    - Address range: 0 to 79
    - Data rate (bps): 9.6 kbps to 12 kbps

- Input/Output Expansion Card
  - No additional wiring is required to install the expansion card.

- Inputs
  - Input C (C73, C74[Com])
    - Normally Open
  - Input D (C83, C74[Com])
    - Normally Open
  - Analog Input (B14[+], B13[Com])
    - 0-10 V or 0-20 V (selectable)

- Outputs
  - Relay D (D1, D2)
    - Normally Closed
  - Relay D (D3, D4)
    - Normally Open
  - Analog Output (B12[+], B13[Com])
    - 0-20 mA or 4-20 mA (selectable)

- RTD and Ground Fault Protection Card
  - The RTD and Ground Fault Protection Card provides one ground fault input and six RTD inputs.
  - No additional wiring is required to install the expansion card.

- Specifications
  - RTD accuracy
    - -20°C to 0°C: ± 2°C
    - 0°C to +100°C: ± 0.5°C
    - +100°C to +150°C: ± 2°C

- 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 flexibility in cabling options.
  - Internal bypassed starters further reduce the overall size of your soft starter.
EMX3 Soft Starters

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

**Nominal current rating**

- C: Non-bypassed (continuous connection)
- B: Internally bypassed

**Mains voltage**

- 400 VAC ± 5% (for 220A)
- 690 VAC ± 5% (for 200A)

**Bypass**

- B = Internally bypassed
- E = Non-bypassed (continuous connection)

**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.

**Current ratings**

- 23A
- 43A
- 53A
- 76A
- 97A
- 105A
- 145A
- 170A
- 220A
- 255A
- 360A
- 430A
- 620A
- 650A
- 790A
- 930A
- 1200A
- 1410A
- 1600A

**Power Range**

- 1600A
- 1410A
- 1200A
- 930A
- 650A
- 620A
- 430A
- 360A
- 255A
- 220A
- 170A
- 145A
- 105A
- 97A
- 76A
- 53A
- 43A
- 23A

**USB interface**

- Analog Output (B12[+], B13[Com]).................................0-20 mA or 4-20 mA (selectable)

**Modbus Interface**

- CAT No. .............................................................. PIMMB01
- Node address range ................................................... 00 to 99
- Data rate ............................................................ 9.6 kbps to 12 kbps

**Profibus Interface**

- CAT No. .......................................................... PIMPB01
- Node address range ................................................... 0 to 99
- Data rate ............................................................ 125 kbps, 250 kbps, 500 kbps

**Input/Output Expansion Card**

The Input/Output expansion card provides two digital inputs, three relay outputs, one analog input and one analog output. No additional wiring is required to install the expansion card.

**Inputs**

- Input C (C73, C74[Com]) ............................................ Normally Open
- Input D (C83, C74[Com]) ............................................ Normally Open
- Analog Input (B14[+], B13[Com])................................. 0-10V or 0-20V (selectable)

**Outputs**

- Relay D (73, 74) ......................................................... Normally Open
- Relay D (63, 64) ......................................................... Normally Open
- Analog Output (B12[+], B13[Com])................................. 0-20 mA or 4-20 mA (selectable)

**RTD and Ground Fault Protection Card**

The RTD and Ground Fault Protection Card provides one ground fault input and six RTD inputs for use with PT100 temperature sensors.

**Specifications**

- RTD accuracy:
  - -20°C to 0°C ......................................................... ± 0.5°C
  - 0°C to +100°C ........................................................ ± 0.5°C
  - +100°C to +150°C .................................................... ± 2°C

**Accessories**

**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.

**Device Net Interface**

- CAT No. .......................................................... PIMDN01
- Node address range ................................................... 0 to 63
- Data rate ............................................................ 9600, 19200, 38400

**DeviceNet Protocol**

- CSX and CSXi ........................................................ AP ASCII
- EMX3 ........................................................................................................ Binary
- Address ................................................................. 20
- Data Rate (bps) ..................................................... 9600
Selection of Right Starter

**FEATURES**

<table>
<thead>
<tr>
<th>Starting</th>
<th>CSX</th>
<th>CSXi</th>
<th>EMX3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timed voltage ramp</td>
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<td>☑</td>
<td>☑</td>
</tr>
<tr>
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<td>☑</td>
<td>☑</td>
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<td></td>
</tr>
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<td></td>
<td></td>
<td>☑</td>
</tr>
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</table>

<table>
<thead>
<tr>
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<tbody>
<tr>
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<tr>
<td>Hard stop</td>
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<table>
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<tr>
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<tr>
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<th>CSX</th>
<th>CSXi</th>
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<tr>
<td>Starter status LEDs</td>
<td>☑</td>
<td>☑</td>
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<th>EMX3</th>
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<tr>
<td>Auto-stop</td>
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<table>
<thead>
<tr>
<th>Options &amp; Accessories</th>
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<th>CSXi</th>
<th>EMX3</th>
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</tr>
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<td>Modbus RTU</td>
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<tr>
<td>Profibus</td>
<td>☑</td>
<td>☑</td>
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</tr>
<tr>
<td>PC Software</td>
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<td>☑</td>
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<tr>
<td>Remote Operator</td>
<td>☑</td>
<td>☑</td>
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</tr>
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</table>

<table>
<thead>
<tr>
<th>Approvals</th>
<th>CSX</th>
<th>CSXi</th>
<th>EMX3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE</td>
<td>☑</td>
<td>☑</td>
<td>✓</td>
</tr>
</tbody>
</table>

---

**Selection chart**

**EMX3**

The above EMX3 current ratings are based on 300% starting current, 10 starts per hour, 10 seconds starting time and ambient temperature of 45°C.

### 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.

#### AC53a 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.

#### Model | Light | Medium | Heavy | Severe
---|---|---|---|---
**AC53b** | | | | |
EMX3-0023B | 23A | 20A | 17A | 15A |
EMX3-0043B | 43A | 40A | 34A | 29A |
EMX3-0063B | 53A | 53A | 46A | 37A |
EMX3-0076B | 76A | 64A | 55A | 47A |
EMX3-0097B | 97A | 82A | 69A | 58A |
EMX3-0105B | 105A | 105A | 95A | 78A |
EMX3-0145B | 145A | 123A | 106A | 90A |
EMX3-0170B | 170A | 145A | 121A | 97A |
EMX3-0220B | 220A | 210A | 178A | 148A |
EMX3-0255C | 255A | 222A | 195A | 171A |
EMX3-0360C | 360A | 351A | 303A | 259A |
EMX3-0430C | 430A | 413A | 355A | 301A |
EMX3-0620C | 620A | 614A | 515A | 419A |
EMX3-0660C | 650A | 628A | 532A | 437A |
EMX3-0790C | 790A | 790A | 694A | 567A |
EMX3-0900C | 900A | 900A | 800A | 644A |
EMX3-1200C | 1200A | 1200A | 1135A | 983A |
EMX3-1410C | 1410A | 1355A | 1187A | 1023A |
EMX3-1600C | 1600A | 1600A | 1433A | 1227A |

---

**AC53b 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.

#### Model | Light | Medium | Heavy | Severe
---|---|---|---|---
**AC53b** | | | | |
EMX3-0255C | 255A | 222A | 195A | 171A |
EMX3-0360C | 360A | 351A | 303A | 259A |
EMX3-0430C | 430A | 413A | 355A | 301A |
EMX3-0620C | 620A | 614A | 515A | 419A |
EMX3-0660C | 650A | 628A | 532A | 437A |
EMX3-0790C | 790A | 790A | 694A | 567A |
EMX3-0900C | 900A | 900A | 800A | 644A |
EMX3-1200C | 1200A | 1200A | 1135A | 983A |
EMX3-1410C | 1410A | 1355A | 1187A | 1023A |
EMX3-1600C | 1600A | 1600A | 1433A | 1227A |

---

*The above EM3 current ratings are based on 300% starting current, 10 starts per hour, 10 seconds starting time and ambient temperature of 45°C.*
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-V7 200 VAC – 440 VAC (+10%)
EMX3-xxxx-V7 380 VAC – 690 VAC (+10%)
EMX3-xxxx-V7 380 VAC – 600 VAC (+10%)
Control Voltage: A1, A2, A3
EMX3-xxxx-V7 110 ~ 220 VAC (+10% / -15%)
EMX3-xxxx-V7 380 ~ 690 VAC (+10%)
EMX3-xxxx-V4 200 ~ 440 VAC (+10%)
Mains Frequency: 45 Hz to 66 Hz
Control Voltage: (A1, A2, A3)
EMX3-xxxx-V7 110 ~ 220 VAC (+10% / -15%)

Inputs
Inputs: Start (C23, C24) Normally Open
Stop (C31, C32) Normally Closed
Reset (C41, C42) Normally Open or Closed
Programmable Inputs: Input A (C53, C54)
Input B (C63, C64) Normally Open or Closed
Motor Thermistor: (B4, B5)
PT100 RTD: (B6, B7, B8)

Outputs
Relay Outputs: Relay A (13, 14) Normally Open
Programmable Outputs: Relay B (31, 32, 34) Changeover
Relay C (41, 42, 44) Changeover
Analog Outputs: 0-20 mA or 4-20 mA
24 VDC Output: (P24, COM) 200mA

Environmental
Protection: EMX3-0023B – EMX3-0158 IP20 & NEMA 1
EMX3-0145B – EMX3-1600C IP00
Operating temperature: 10 °C – 60 °C
Storage temperature: 10 °C – 60 °C
Humidity: 5% to 95% Relative Humidity

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 general 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 30 seconds

Selection of Correct Starter Method

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.

<table>
<thead>
<tr>
<th>Application duty</th>
<th>Normal</th>
<th>Heavy</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starter Model</td>
<td>CSX Series</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EMX3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Use semiconductor fuses at input units with the suffix 'B'. The internal bypass feature is included only on ~110 220 VAC ~- 15% +10% 3 PHASE SUPPLY 3 PHASE SUPPLY 3 PHASE SUPPLY.
Selection of Semiconductor Fuse

Short circuit protection device (SCPD) is an integral part of any motor starter / motor starting solution. For traditional starters like DOL or Star delta starter HRC Fuse / MCCB is widely used. Soft starter is now being widely used for starting of various loads as a replacement of DOL/Start Delta starter. However, to ensure that semiconductor devices are protected in the event of short circuit, fast acting fuses or Semiconductor Fuses are used as SCPD.

Installation Guidelines for CSX / CSXi / EMX3 range for soft starters to achieve Type 2 coordination:

Type 2 protection requires that in the event of a short circuit on the output of a soft starter the fault must be cleared without risk of injury to personnel or damage to the soft starter.

Type 2 protection is achieved by using semiconductor fuses. These fuses must be able to carry motor start current and have a total clearing $I^2t$ < the $I^2t$ of the soft starter SCRs.

Semiconductor fuses for Type 2 circuit protection are additional to HRC fuses or MCCBs that form part of the motor branch circuit protection.

The below mentioned charts specify the rating of the semiconductor fuse to be used along with the soft starter.

Table for selection of semiconductor fuse for CSX and CSXi series:

<table>
<thead>
<tr>
<th>Model CSX &amp; CSXi</th>
<th>SCR I2t (A2S)</th>
<th>Ferraz Fuse European/IEC Style (North American Style)</th>
<th>Bussmann Fuse European Square Body (170M)</th>
<th>Bussmann Fuse British Style (BS88)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSX-007</td>
<td>1150</td>
<td>6.6URD30xxxA0063 (A070URD30xxx0063)</td>
<td>170M-1314 63FE</td>
<td></td>
</tr>
<tr>
<td>CSX-015</td>
<td>8000</td>
<td>6.6URD30xxxA0125 (A070URD30xxx0125)</td>
<td>170M-1317 160FE</td>
<td></td>
</tr>
<tr>
<td>CSX-018</td>
<td>10500</td>
<td>6.6URD30xxxA0160 (A070URD30xxx0160)</td>
<td>170M-1318 180FE</td>
<td></td>
</tr>
<tr>
<td>CSX-022</td>
<td>15000</td>
<td>6.6URD30xxxA0160 (A070URD30xxx0160)</td>
<td>170M-1319 180FM</td>
<td></td>
</tr>
<tr>
<td>CSX-030</td>
<td>18000</td>
<td>6.6URD30xxxA0160 (A070URD30xxx0160)</td>
<td>170M-1319 180FM</td>
<td></td>
</tr>
<tr>
<td>CSX-037</td>
<td>51200</td>
<td>6.6URD30xxxA0250 (A070URD30xxx0250)</td>
<td>170M-1321 250FM</td>
<td></td>
</tr>
<tr>
<td>CSX-045</td>
<td>80000</td>
<td>6.6URD30xxxA0315 (A070URD30xxx0315)</td>
<td>170M-1321 250FM</td>
<td></td>
</tr>
<tr>
<td>CSX-055</td>
<td>97000</td>
<td>6.6URD30xxxA0315 (A070URD30xxx0315)</td>
<td>170M-1321 250FM</td>
<td></td>
</tr>
<tr>
<td>CSX-075</td>
<td>168000</td>
<td>6.6URD31xxxA0450 (A070URD31xxx0450)</td>
<td>170M-1322 500FMM</td>
<td></td>
</tr>
<tr>
<td>CSX-090</td>
<td>245000</td>
<td>6.6URD31xxxA0450 (A070URD31xxx0450)</td>
<td>170M-3022 500FMM</td>
<td></td>
</tr>
<tr>
<td>CSX-110</td>
<td>320000</td>
<td>6.6URD31xxxA0450 (A070URD31xxx0450)</td>
<td>170M-3022 500FMM</td>
<td></td>
</tr>
</tbody>
</table>

xxx = Blade Type. Contact Ferraz for options.
**Table for selection of semiconductor fuse for EMX3 series:**

<table>
<thead>
<tr>
<th>Model</th>
<th>SCR F1 (A'S)</th>
<th>Bussmann Fuse</th>
<th>Bussmann Fuse</th>
<th>Ferraz Fuse (N'S)</th>
<th>Ferraz Fuse European Style (PSC-690)</th>
<th>Ferraz Fuse N. American Style (PSC-690)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMX3-0023B</td>
<td>1150</td>
<td>170M1314</td>
<td>63FE</td>
<td>HSJ40**</td>
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<tr>
<td>EMX3-0043B</td>
<td>8000</td>
<td>170M1318</td>
<td>120FE</td>
<td>HSJ60</td>
<td>6.9URD30011A0125</td>
<td>A070URD30000125</td>
</tr>
<tr>
<td>EMX3-0050B</td>
<td>10500</td>
<td>170M1318</td>
<td>200FE</td>
<td>HSJ80**</td>
<td>6.9URD30011A0125</td>
<td>A070URD30000125</td>
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<tr>
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<td>170M1318</td>
<td>200FE</td>
<td>HSJ90**</td>
<td>6.9URD30011A0125</td>
<td>A070URD30000125</td>
</tr>
<tr>
<td>EMX3-0076B</td>
<td>15000</td>
<td>170M1319</td>
<td>200FE</td>
<td>HSJ110**</td>
<td>6.9URD30011A0200</td>
<td>A070URD30000200</td>
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<tr>
<td>EMX3-0097B</td>
<td>51200</td>
<td>170M1321</td>
<td>280FM</td>
<td>HSJ150</td>
<td>6.9URD30011A0200</td>
<td>A070URD30000200</td>
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<tr>
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<td>80000</td>
<td>170M1321</td>
<td>280FM</td>
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<td>A070URD30000200</td>
</tr>
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<td>EMX3-0105B</td>
<td>125000</td>
<td>170M1321</td>
<td>280FM</td>
<td>HSJ225</td>
<td>6.9URD30011A0315</td>
<td>A070URD30000315</td>
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<tr>
<td>EMX3-0145B</td>
<td>125000</td>
<td>170M1321</td>
<td>280FM</td>
<td>HSJ250</td>
<td>6.9URD30011A0315</td>
<td>A070URD30000315</td>
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<td>EMX3-0170B</td>
<td>320000</td>
<td>170M1321</td>
<td>450FM</td>
<td>HSJ300</td>
<td>6.9URD30011A0315</td>
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<tr>
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<td>320000</td>
<td>170M1321</td>
<td>450FM</td>
<td>HSJ350</td>
<td>6.9URD30011A0450</td>
<td>A070URD30000450</td>
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<tr>
<td>EMX3-0220B</td>
<td>320000</td>
<td>170M1321</td>
<td>450FM</td>
<td>HSJ350</td>
<td>6.9URD30011A0450</td>
<td>A070URD30000450</td>
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<td>320000</td>
<td>170M1321</td>
<td>450FM</td>
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<td>6.9URD30011A0450</td>
<td>A070URD30000450</td>
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<td>EMX3-0360C</td>
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<td>170M6010</td>
<td>-</td>
<td>HSJ400**</td>
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<td>A070URD30000630</td>
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<td>EMX3-0380C</td>
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<td>6.9URD30011A0800</td>
<td>A070URD30000700</td>
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<tr>
<td>EMX3-0430C</td>
<td>320000</td>
<td>170M6011</td>
<td>400FM*</td>
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<td>6.9URD30011A0800</td>
<td>A070URD30000700</td>
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<tr>
<td>EMX3-0620C</td>
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<td>170M6015</td>
<td>630FM*</td>
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<td>630FM*</td>
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<td>6.9URD30011A1000</td>
<td>A070URD30001000</td>
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<td>EMX3-0790C</td>
<td>2530000</td>
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<td>-</td>
<td>-</td>
<td>6.9URD30011A1250</td>
<td>A070URD30001250</td>
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<tr>
<td>EMX3-0930C</td>
<td>4500000</td>
<td>170M6019</td>
<td>-</td>
<td>-</td>
<td>6.9URD30011A1400</td>
<td>A070URD30001400</td>
</tr>
<tr>
<td>EMX3-1200C</td>
<td>4500000</td>
<td>170M6019</td>
<td>-</td>
<td>-</td>
<td>6.9URD233PLAF1800</td>
<td>A045URD30001800</td>
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<td>EMX3-1410C</td>
<td>6480000</td>
<td>170M6021</td>
<td>-</td>
<td>-</td>
<td>6.9URD233PLAF2200</td>
<td>-</td>
</tr>
<tr>
<td>EMX3-1600C</td>
<td>12500000</td>
<td>170M6018*</td>
<td>-</td>
<td>-</td>
<td>6.9URD233PLAF2500</td>
<td>A050URD30001400*</td>
</tr>
</tbody>
</table>

* Two parallel connected fuses required per phase.
** Two series connected fuses required per phase.
XXX Blade Type. Refer to Ferraz catalog for options.
WinStart software

L&T 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.
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

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.

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.

ADAPTIVE ACCELERATION PROFILE OPTIONS

Early Acceleration
Constant Acceleration
Late Acceleration

Early Deceleration
Constant Deceleration
Late Deceleration

Adaptive acceleration offers three stop profiles according to your needs.

XLR-8 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:

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Protection simulation: Simulates activation of each protection mechanism to confirm correct protection response.
Signalling simulation: Simulates output signalling.
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/output for remote management
• Fully programmable auto start and auto stop
• LCD display for programming & monitoring

FEATURES

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
- Instantaneous overcurrent
- Auxiliary trip input
- Heatsink overtemperature
- Excess start time
- Supply frequency
- Shorted SCR
- Power circuit
- Motor connection
- RS485 failure
- Motor overload
- Current imbalance
- Ground fault (optional)

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
- PT100 (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

WinStart software

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.
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 overvoltage. This overvoltage 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.
     - protects the soft starter SCRs from severe overvoltage situations (e.g., lightning strikes).
     SCRs are most susceptible to overvoltage damage when the SCRs are 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 need for 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.

---

**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 overvoltage. This overvoltage 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.
     - protects the soft starter SCRs from severe overvoltage situations (e.g., lightning strikes).
     SCRs are most susceptible to overvoltage damage when the SCRs are 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 need for 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.
SPECIFICATIONS

<table>
<thead>
<tr>
<th>Model</th>
<th>Current Rating (Maximum Motor FLC)</th>
<th>Dimensions (mm)</th>
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<tbody>
<tr>
<td></td>
<td>AC53b 4-6</td>
<td>AC53b 4-20</td>
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<tr>
<td>7.5</td>
<td>18 A</td>
<td>17 A</td>
</tr>
<tr>
<td>15</td>
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<tr>
<td>110</td>
<td>200 A</td>
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</tr>
</tbody>
</table>

FEATURES

- 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

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

Inside delta connection (also called six-wire connection) places the soft starter SCRIs 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 contactor 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.

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:

\[ T_e = P_d \times k \times S + T_a \]

Where, \( P_d \) = Total power dissipated in the panel (in watts)
\( k \) = constant defined by the material used to manufacture the enclosure.
\( S \) = effective surface area of the panel (in m²)
\( T_a \) = Ambient temperature (in °C)

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

Optional Accessories
Remote Operator
PC Software
Modbus RTU
Profibus
Device Net
Finger Guard Kit

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

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%)
- Control Voltage: 24VAC / VDC (± 20%)
- 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

Note: Use semiconductor fuses at input
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.
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*Product improvement is a continuous process. For the latest information and special applications, please contact any of our offices listed here.*

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**Soft Starters**

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