AuCom

USER MANUAL

Contents

Section 1 Caution Statements

This symbol is used throughout this manual to draw attention to topics of special importance to the installation and operation of EMX3 soft starters.

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

NOTE
The EMX3 soft starter is not user serviceable. The unit should only be serviced by authorised service personnel. Unauthorised tampering with the unit will void the product warranty.

1.1 Electrical Shock Risk

The voltages present in the following locations can cause severe electric shock and may be lethal:

- AC supply cables and connections
- Output cables and connections
- Many internal parts of the starter, and external option units

The AC supply must be disconnected from the starter using an approved isolation device before any cover is removed from the starter or before any servicing work is performed.

WARNING - ELECTRICAL SHOCK HAZARD
Models EMX3-0255B~EMX3-1000B, EMX3-0360C~EMX3-1600C: The bus bar and heatsink are live while the unit is operating (starting, running or stopping). If the starter is installed without a main contactor, the bus bar and heatsink are live whenever mains voltage is connected (including when the starter is ready or tripped).

SHORT CIRCUIT
EMX3 soft starters are not short circuit proof. After severe overload or short circuit, the operation of the soft starter should be fully tested by an authorised service agent.

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

FOR YOUR SAFETY

- The STOP function of the soft starter does not isolate dangerous voltages from the output of the starter. The soft starter must be disconnected by an approved electrical isolation device before accessing electrical connections.
- Soft starter protection features apply to motor protection only. It is the user's responsibility to ensure safety of personnel operating machinery.
- In some installations, accidental starts may pose an increased risk to safety of personnel or damage to the machines being driven. In such cases, it is recommended that the power supply to the soft starter is fitted with an isolating switch and a circuit-breaking device (eg power contactor) controllable through an external safety system (eg emergency stop, fault detector).
- The soft starter has built-in protections which can trip the starter in the event of faults and thus stop the motor. Voltage fluctuations, power cuts and motor jams may also cause the motor to trip.
- There is a possibility of the motor restarting after the causes of shutdown are rectified, which may be dangerous for certain machines or installations. In such cases, it is essential that appropriate arrangements are made against restarting after unscheduled stops of the motor.
- The soft starter is a component designed for integration within an electrical system; it is therefore the responsibility of the system designer/user to ensure the system is safe and designed to comply with relevant local safety standards.

AuCom cannot be held accountable for any damages incurred if the above recommendations are not complied with.

AUTO-START
Use the auto-start feature with caution. Read all the notes related to auto-start before operation.

The examples and diagrams in this manual are included solely for illustrative purposes. The information contained in this manual is subject to change at any time and without prior notice. In no event will responsibility or liability be accepted for direct, indirect or consequential damages resulting from the use or application of this equipment.

1.2 Disposal Instructions

Equipment containing electrical components may not be disposed of together with domestic waste.

It must be collected separately as electrical and electronic waste according to local and currently valid legislation.

Section 2 Introduction

The EMX3 is an advanced digital soft start solution for motors from 7 kW to 800 kW. EMX3 soft starters provide a complete range of motor and system protection features and have been designed for reliable performance in the most demanding installation situations.

2.1 Feature List

Selectable soft starting profiles
- XLR-8 Adaptive Control (for acceleration)
- Constant current
- Current ramp

Selectable soft stopping profiles
- Coast to stop
- Timed voltage ramp soft stop
- XLR-8 Adaptive Control (for deceleration)
- Brake

Extensive input and output options
- Remote control inputs
  (3 x fixed, 2 x programmable)
- Relay outputs
  (1 x fixed, 3 x programmable)
- Analog output
- Built-in PT100 RTD input
- Optional expansion cards

Easy-to-read display with comprehensive feedback
- Removable keypad
- Multi-language feedback
- Date and time stamped event logging
- Operational counters (number of starts, hours run, kWh)
- Performance monitoring (current, voltage, power factor, kWh)
- User-programmable monitoring screen

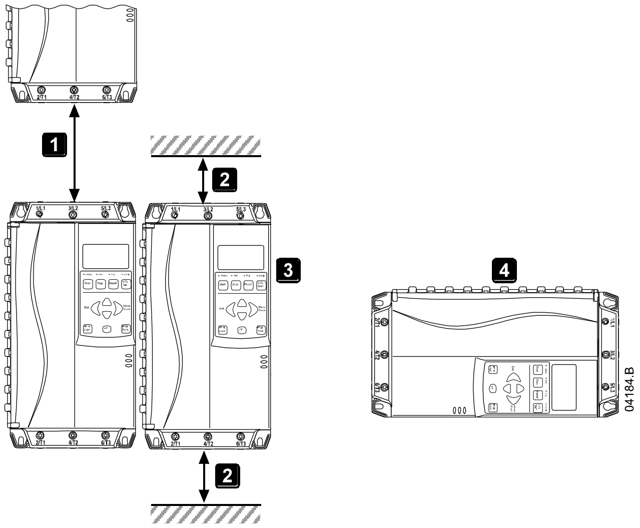
Fully customisable protection
- Motor overload
- Excess start time
- Undercurrent
- Instantaneous overcurrent
- Current imbalance
- Mains frequency
- Input trip
- Motor thermistor
- Power circuit
- Phase sequence

Models for all connection requirements
- 23 A to 1600 A (nominal)
- 200 VAC to 440 VAC
- 380 VAC to 690 VAC
- Internally bypassed options
- In-line or inside delta connection

Optional features for advanced applications
- Input/output expansion
- RTD and Ground fault protection
- DeviceNet, Modbus or Profibus communication interfaces

Section 3 Installation

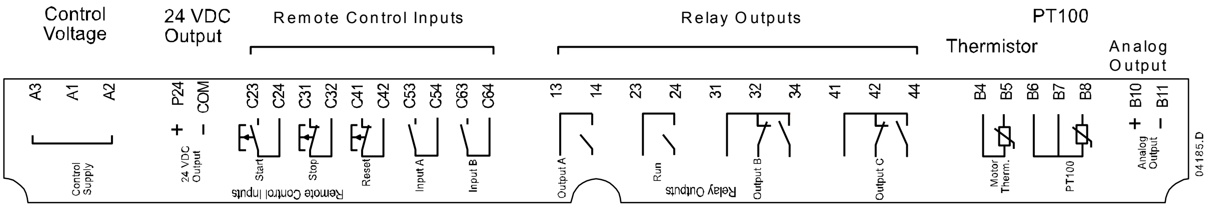
3.1 Physical Installation



1	EMX3-0023B ~ EMX3-0220B: Allow 100 mm (3.94 inches) between soft starters. EMX3-0255B ~ EMX3-1000B: Allow 200 mm (7.88 inches) between soft starters. EMX3-0255C: Allow 100 mm (3.94 inches) between soft starters. EMX3-0360C ~ EMX3-1600C: Allow 200 mm (7.88 inches) between soft starters.
2	EMX3-0023B ~ EMX3-0220B: Allow 50 mm (1.97 inches) between the soft starter and solid surfaces. EMX3-0255B ~ EMX3-1000B: Allow 200 mm (7.88 inches) between the soft starter and solid surfaces. EMX3-0255C: Allow 100 mm (3.94 inches) between the soft starter and solid surfaces. EMX3-0360C ~ EMX3-1600C: Allow 200 mm (7.88 inches) between the soft starter and solid surfaces.
3	Soft starters may be mounted side by side with no clearance (that is, if mounted without communications modules).
4	The soft starter may be mounted on its side. Derate the soft starter's rated current by 15%.

3.2 Control Terminals

Control terminations use 2.5mm² plug-in terminal blocks. Unplug each block, complete the wiring, then reinsert the block.

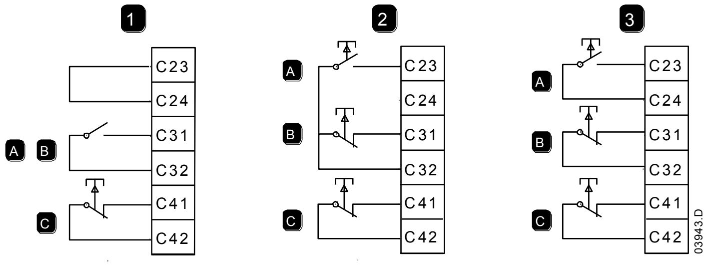


**Different models require different terminals for control voltage:

- C1 (110~210 VAC) A1, A2
- C1 (220~440 VAC) A2, A3
- C2 (24 VAC/VDC) A1, A3

3.3 Control Wiring

The EMX3 has three fixed inputs for remote control. These inputs should be controlled by contacts rated for low voltage, low current operation (gold flash or similar).



1	Two-wire control
2	Three-wire control
3	Four-wire control
A	Start
B	Stop
C	Reset

CAUTION
Do not apply voltage to the control input terminals. These are active 24 VDC inputs and must be controlled with potential free contacts.

Cables to the control inputs must be segregated from mains voltage and motor cabling.

The reset input can be normally open or normally closed. Use parameter 6M to select the configuration.

3.4 Relay Outputs

The EMX3 provides four relay outputs, one fixed and three programmable.

The Run output closes when the soft start is complete (when the starting current falls below 120% of the programmed motor full load current) and remains closed until the beginning of a stop (either soft stop or coast to stop).

Operation of the programmable outputs is determined by the settings of parameters 7A~7I.

- If assigned to Main Contactor, the output activates as soon as the soft starter receives a start command and remains active while the soft starter is controlling the motor (until the motor starts a coast to stop, or until the end of a soft stop).
- If assigned to a trip function, the output activates when a trip occurs.
- If assigned to a flag, the output activates when the specified flag is active (parameters 7M~7O).

CAUTION
Some electronic contactor coils are not suitable for direct switching with PCB mount relays. Consult the contactor manufacturer/supplier to confirm suitability.

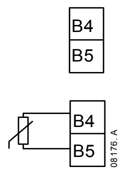
Three additional outputs are available on the input/output expansion card.

3.5 Motor Thermistors

Motor thermistors can be connected directly to the EMX3. The soft starter will trip when the resistance of the thermistor circuit exceeds approximately 3.6 kΩ or falls below 20 Ω.

No motor thermistors

Motor thermistors



Thermistor input

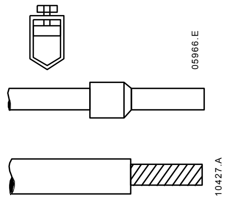
NOTE
If no motor thermistors are connected to the EMX3 thermistor input terminals B4, B5 must be open. If B4, B5 are shorted, the EMX3 will trip.
The thermistor circuit should be run in screened cable and must be electrically isolated from earth and all other power and control circuits.

3.6 Power Terminations

Use only copper stranded or solid conductors, rated for 75 °C.

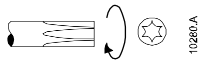
NOTE
Some units use aluminium bus bars. When connecting power terminations, we recommend cleaning the surface contact area thoroughly (using an emery or stainless steel brush) and using an appropriate jointing compound to prevent corrosion.

EMX3-0023B~EMX3-0105B

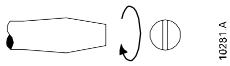


Cable size:
6-50 mm² (AWG 10-1/0)

14 mm (0.55 inch)



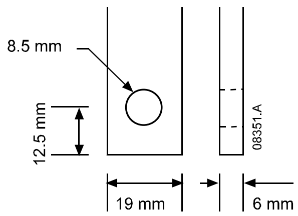
Torx T20 x 150
Torque: 4 Nm (2.9 Ft-lb)



Flat 7 mm x 150
Torque: 4 Nm (2.9 Ft-lb)

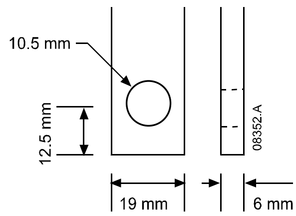
EMX3-0145B

8.5 Nm (6.3 ft-lb)



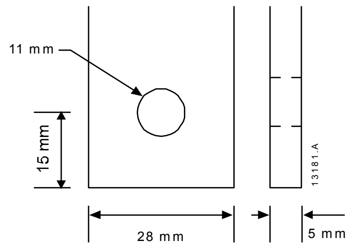
EMX3-0170B~EMX3-0220B

8.5 Nm (6.3 ft-lb)



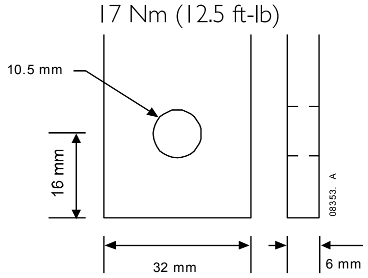
EMX3-0255B

38 Nm (28.5 ft-lb)



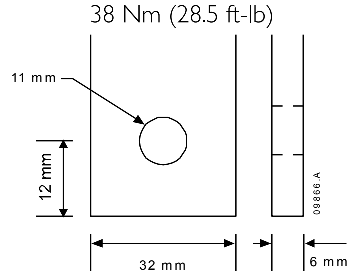
EMX3-0255C

17 Nm (12.5 ft-lb)



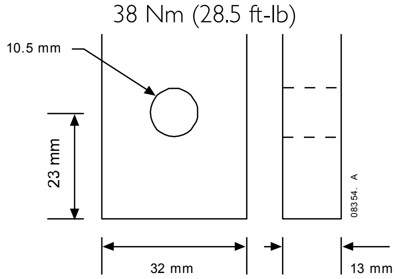
EMX3-0350B~EMX3-1000B

38 Nm (28.5 ft-lb)



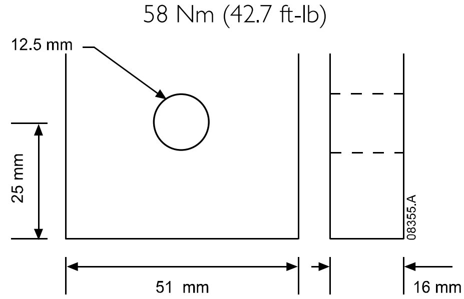
EMX3-0360C~EMX3-0930C

38 Nm (28.5 ft-lb)

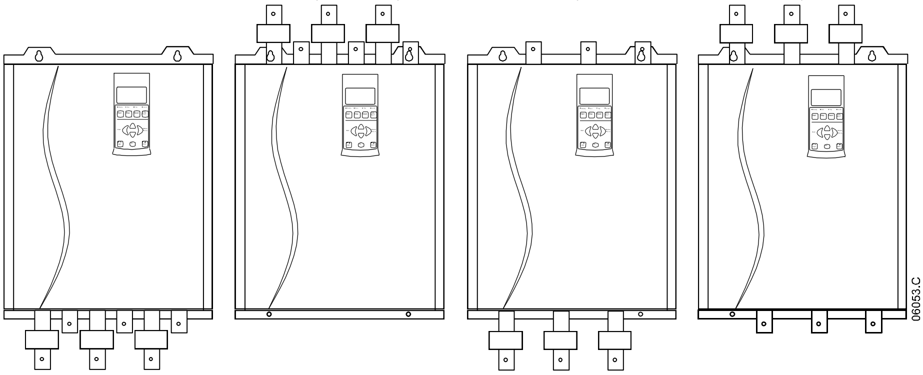


EMX3-1200C~EMX3-1600C

58 Nm (42.7 ft-lb)

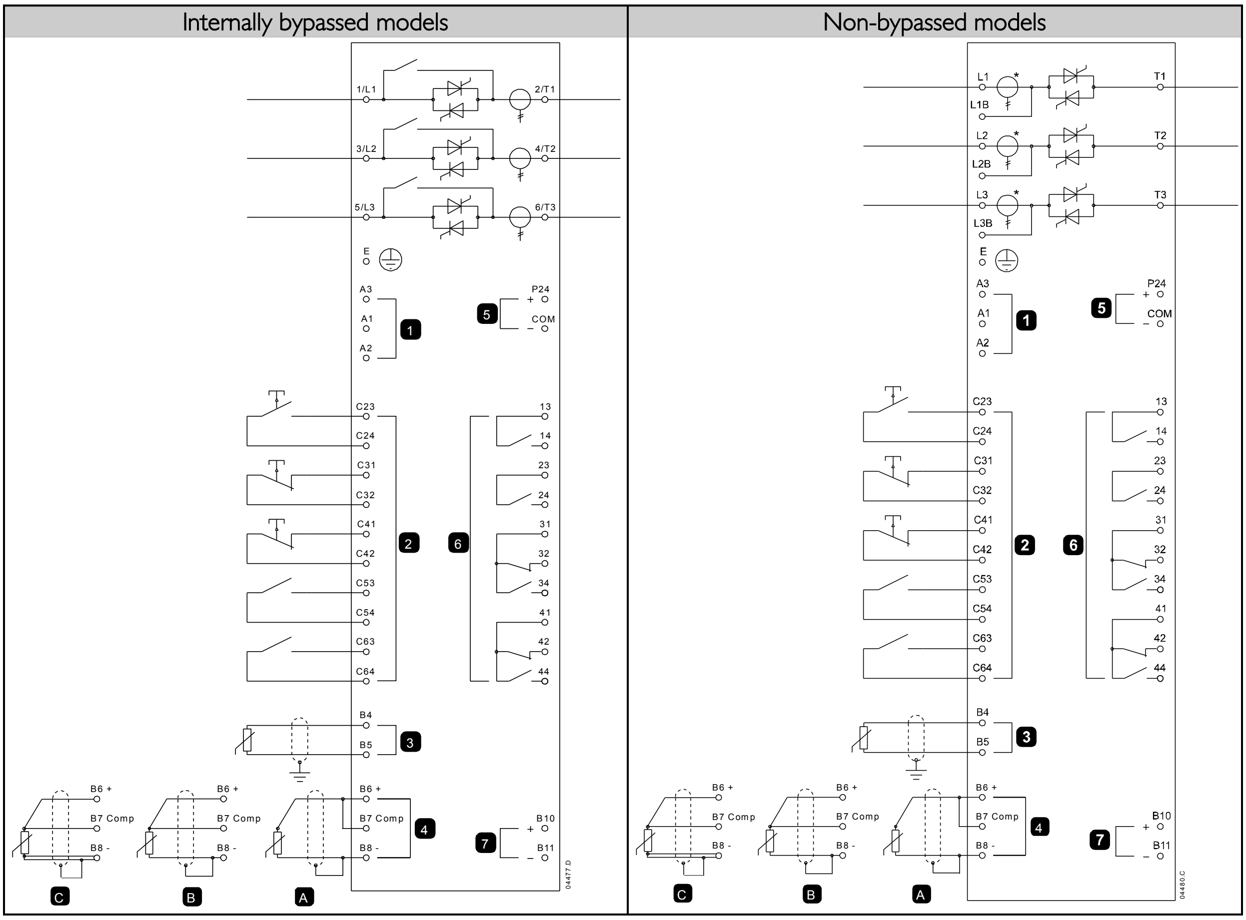


The bus bars on non-bypassed models EMX3-0360C ~ EMX3-1600C can be adjusted for top or bottom input and output as required. Refer to *Bus bar Adjustment Procedure* on page 88 for step-by-step instructions.



NOTE
Internally bypassed models EMX3-0255B ~ EMX3-1000B have input and output bus bars at both the top and bottom of the unit. These bus bars do not need to be adjusted.

3.7 Schematic Diagrams



NOTE
* EMX3-0255C current transformers are located on the output. Bypass terminals are labelled T1B, T2B and T3B.

1	Control voltage (model dependent)**
2	Remote control inputs
3	Motor thermistor input
4A	RTD/PT100 input - 2-wire
4B	RTD/PT100 input - 3-wire
4C	RTD/PT100 input - 4-wire
5	24 VDC output
6	Relay outputs
7	Analog output

C23, C24	Start
C31, C32	Stop
C41, C42	Reset
C53, C54	Programmable input A
C63, C64	Programmable input B
13, 14	Relay output A
23, 24	Run relay output
31, 32, 34	Relay output B
41, 42, 44	Relay output C

**Different models require different terminals for control voltage:

- C1 (110~210 VAC) A1, A2
- C1 (220~440 VAC) A2, A3
- C2 (24 VAC/VDC) A1, A3

Section 4 Power Circuits

4.1 Motor Connection

EMX3 soft starters can be connected to the motor in-line or inside delta (also called three-wire and six-wire connection). When connecting in inside delta, enter the motor full load current (FLC) for parameter 1A. The EMX3 will automatically detect whether the motor is connected in-line or inside delta and will calculate the correct inside delta current level.

NOTE
For personnel safety, the power terminals on models up to EMX3-0105B are protected by snap-off tabs. When using large cables, it may be necessary to break off these tabs.

Models which are internally bypassed do not require an external bypass contactor.

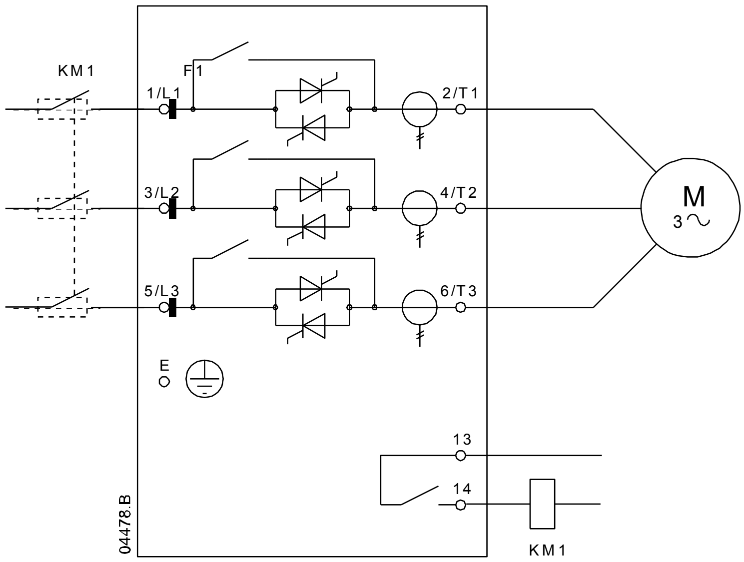
Internally bypassed models:

EMX3-0023B, EMX3-0043B, EMX3-0050B, EMX3-0053B, EMX3-0076B, EMX3-0097B, EMX3-0100B, EMX3-0105B, EMX3-0145B, EMX3-0170B, EMX3-0200B, EMX3-0220B, EMX3-0255B, EMX3-0350B, EMX3-0425B, EMX3-0500B, EMX3-0580B, EMX3-0700B, EMX3-0820B, EMX3-0920B, EMX3-1000B

Non-bypassed models:

EMX3-0255C, EMX3-0360C, EMX3-0380C, EMX3-0430C, EMX3-0620C, EMX3-0650C, EMX3-0790C, EMX3-0930C, EMX3-1200C, EMX3-1410C, EMX3-1600C

In-line installation, internally bypassed

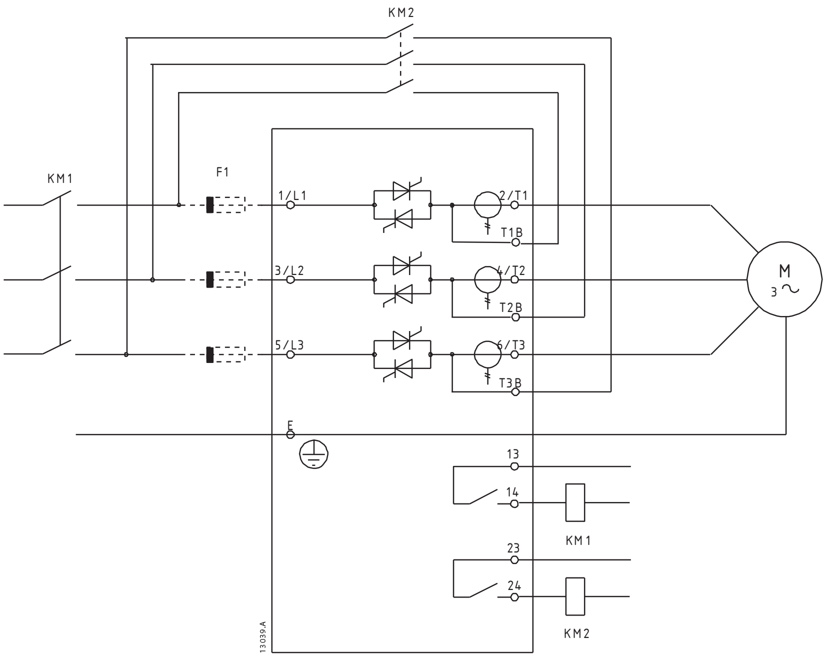


KM1	Main contactor (optional)
F1	Semiconductor fuses (optional)

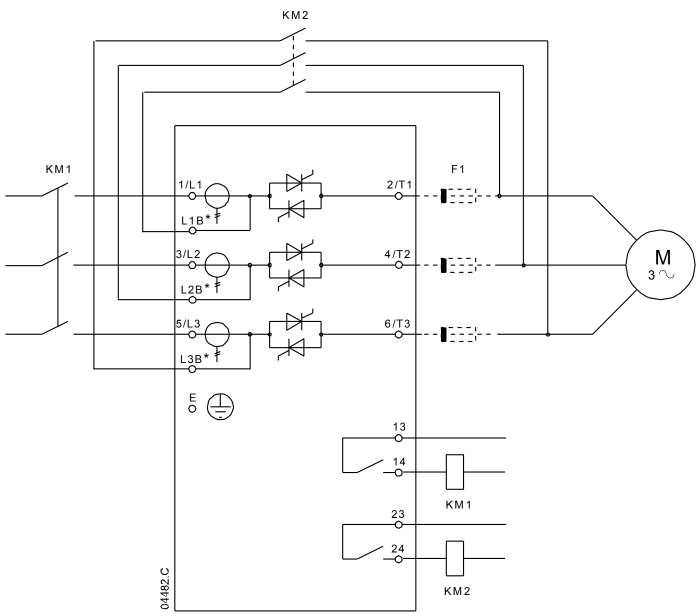
In-line installation, externally bypassed

Non-bypassed models have dedicated bypass terminals, which allow the EMX3 to continue providing protection and monitoring functions even when bypassed via an external bypass contactor. The bypass contactor must be connected to the bypass terminals and controlled by the soft starter's run output (terminals 23, 24).

Power connections - in-line installation, externally bypassed (EMX3-0255C)



Power connections - in-line installation, externally bypassed (EMX3-0360C to EMX3-1600C)

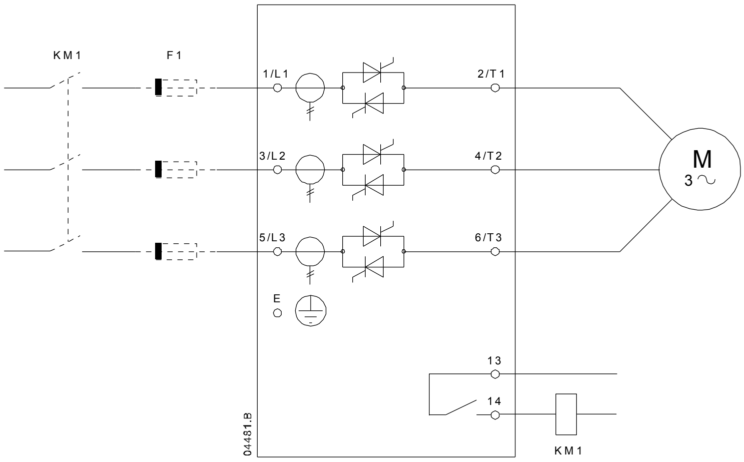


KM1	Main contactor
KM2	Bypass contactor (external)
F1	Semiconductor fuses (optional)

NOTE
The bypass terminals on EMX3-0255C are T1B, T2B, T3B. The bypass terminals on EMX3-0360C ~ EMX3-1600C are L1B, L2B, L3B.

The fuses can be installed on the input side if required.

In-line installation, non-bypassed

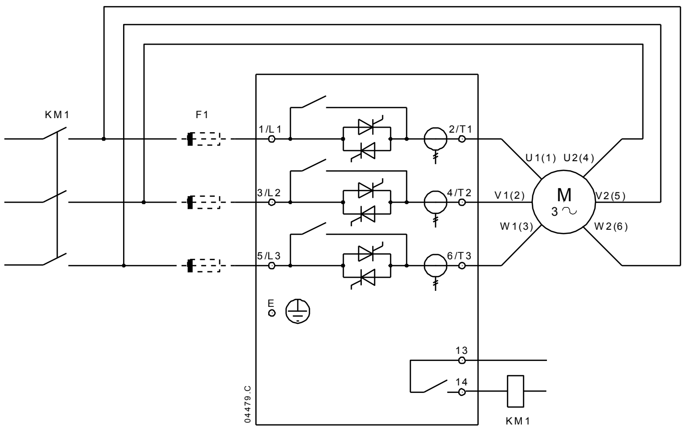


KM1	Main contactor (optional)
F1	Semiconductor fuses (optional)

CAUTION
When connecting the EMX3 in inside delta configuration, always install a main contactor or shunt trip circuit breaker.

NOTE
When connecting in inside delta, enter the motor full load current (FLC) for parameter 1A. The EMX3 will automatically detect whether the motor is connected in-line or inside delta and will calculate the correct inside delta current level.

Inside delta installation, internally bypassed

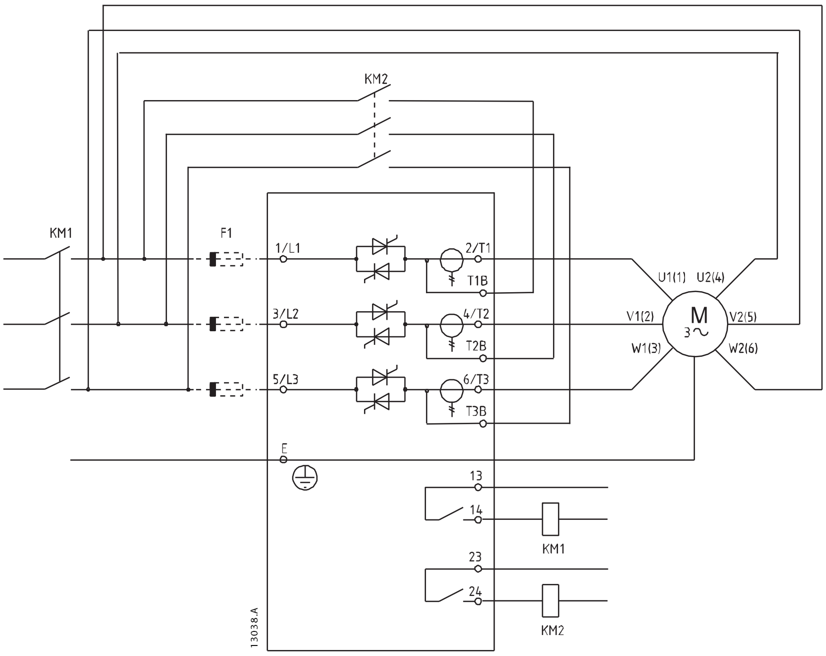


KM1	Main contactor
F1	Semiconductor fuses (optional)

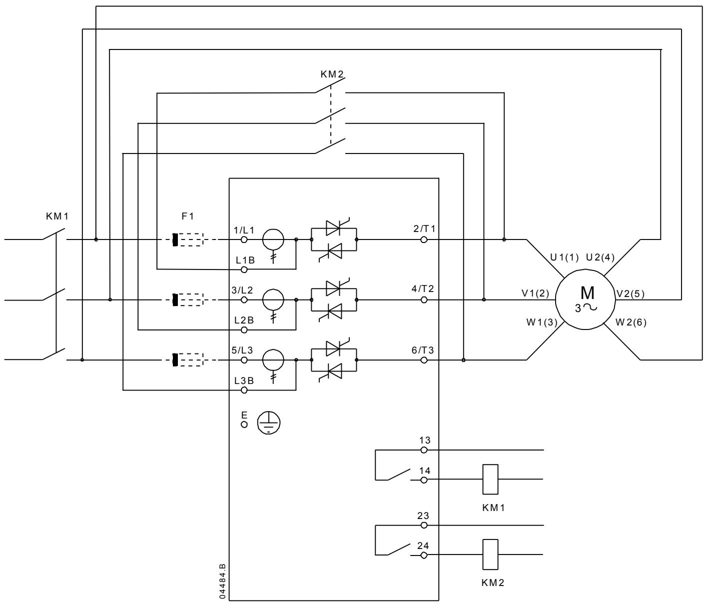
Inside delta installation, externally bypassed

Non-bypassed models have dedicated bypass terminals, which allow the EMX3 to continue providing protection and monitoring functions even when bypassed via an external bypass contactor. The bypass contactor must be connected to the bypass terminals and controlled by the soft starter's run output (terminals 23, 24).

Power connections - inside delta installation, externally bypassed (EMX3-0255C)



Power connections - inside delta installation, externally bypassed (EMX3-0360C to EMX3-1600C)

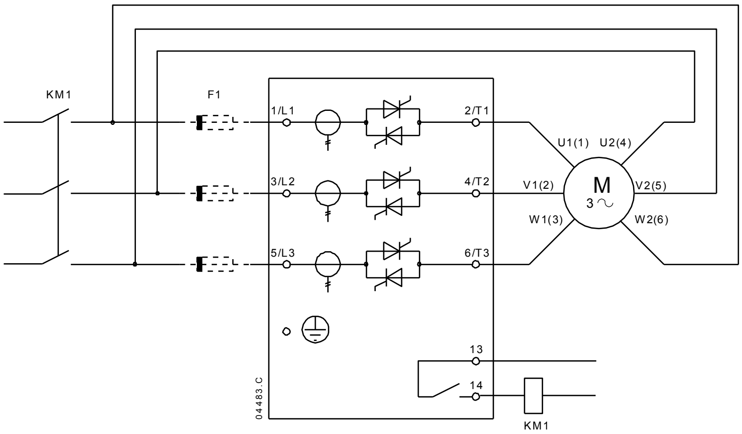


KM1	Main contactor
KM2	Bypass contactor (external)
F1	Semiconductor fuses (optional)

NOTE
The bypass terminals on EMX3-0255C are T1B, T2B, T3B. The bypass terminals on EMX3-0360C ~ EMX3-1600C are L1B, L2B, L3B.

The fuses can be installed on the input side if required.

Inside delta installation, non-bypassed



KM1	Main contactor
F1	Semiconductor fuses (optional)

4.2 Bypass Contactor

Some EMX3 soft starters are internally bypassed and do not require an external bypass contactor.

Non-bypassed soft starters may be installed with an external bypass contactor. Select a contactor with an AC1 rating greater than or equal to the full load current rating of the connected motor.

Internally bypassed models:

EMX3-0023B, EMX3-0043B, EMX3-0050B, EMX3-0053B, EMX3-0076B, EMX3-0097B, EMX3-0100B, EMX3-0105B, EMX3-0145B, EMX3-0170B, EMX3-0200B, EMX3-0220B, EMX3-0255B, EMX3-0350B, EMX3-0425B, EMX3-0500B, EMX3-0580B, EMX3-0700B, EMX3-0820B, EMX3-0920B, EMX3-1000B

Non-bypassed models:

EMX3-0255C, EMX3-0360C, EMX3-0380C, EMX3-0430C, EMX3-0620C, EMX3-0650C, EMX3-0790C, EMX3-0930C, EMX3-1200C, EMX3-1410C, EMX3-1600C

4.3 Main Contactor

A main contactor must be installed if the EMX3 is connected to the motor in inside delta format and is optional for in-line connection. Select a contactor with an AC3 rating greater than or equal to the full load current rating of the connected motor.

4.4 Circuit Breaker

A shunt trip circuit breaker may be used instead of a main contactor to isolate the motor circuit in the event of a soft starter trip. The shunt trip mechanism must be powered from the supply side of the circuit breaker or from a separate control supply.

4.5 Power Factor Correction

If power factor correction is used, a dedicated contactor should be used to switch in the capacitors.

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

4.6 Power supply fuses

Semiconductor fuses can be used for Type 2 coordination (according to IEC 60947-4-2 standard) and to reduce the risk of damage to SCRs from transient overload currents.

HRC fuses (such as Ferraz AJT fuses) can be used for Type 1 coordination according to IEC 60947-4-2 standard.

CAUTION
Adaptive Control controls the motor's speed profile, within the programmed time limit. This may result in a higher level of current than traditional control methods.

For applications using Adaptive Control to soft stop the motor with stop times greater than 30 seconds, motor branch protection should be selected as follows:

- standard HRC line fuses: minimum 150% motor full load current
- motor rated line fuses: minimum rating 100/150% motor full load current
- motor control circuit breaker minimum long time setting: 150% motor full load current,
- motor control circuit breaker minimum short time setting: 400% motor full load current for 30 seconds

NOTE
Fuse selection is based on a 400% FLC start for 20 seconds in conjunction with standard published starts per hour, duty cycle, 40°C ambient temperature and up to 1000 m altitude. For installations operating outside these conditions, consult your local supplier.

These fuse tables contain recommendations only. Always consult your local supplier to confirm the selection for your particular application.

Bussman Fuses - Square Body (170M)

Model	SCR I^2t (A^2s)	Supply Voltage (≤ 440 VAC)	Supply Voltage (≤ 575 VAC)	Supply Voltage (≤ 690 VAC)
EMX3-0023B	1150	170M1314	170M1314	170M1314
EMX3-0043B	8000	170M1316	170M1316	170M1316
EMX3-0050B	10500	170M1318	170M1318	170M1318
EMX3-0053B	15000	170M1318	170M1318	170M1318
EMX3-0076B	15000	170M1319	170M1319	170M1318
EMX3-0097B	51200	170M1321	170M1321	170M1319
EMX3-0100B	80000	170M1321	170M1321	170M1321
EMX3-0105B	125000	170M1321	170M1321	170M1321
EMX3-0145B	125000	170M1321	170M1321	170M1321
EMX3-0170B	320000	170M2621	170M2621	170M2621
EMX3-0200B	320000	170M2621	170M2621	170M2621
EMX3-0220B	320000	170M2621	170M2621	170M2621
EMX3-0255B	320000	170M2621	170M2621	170M2621
EMX3-0255C	320000	170M2621	170M2621	170M2621
EMX3-0350B	202000	170M5011	170M5011	—
EMX3-0360C	320000	170M6010	170M6010	170M6010
EMX3-0380C	320000	170M6011	170M6011	—
EMX3-0425B	320000	170M6011	—	—
EMX3-0430C	320000	170M6011	170M6011	—
EMX3-0500B	320000	170M6008*	—	—
EMX3-0580B	781000	170M6013	170M6013	170M6013
EMX3-0620C	1200000	170M6015	170M6015	170M6014
EMX3-0650C	1200000	170M6015	170M6015	170M6014
EMX3-0700B	781000	170M5015	170M5015	—
EMX3-0790C	2530000	170M6017	170M6017	170M6016
EMX3-0820B	1200000	170M5017	170M6015	—
EMX3-0920B	2530000	170M6017	170M6017	—
EMX3-0930C	4500000	170M6019	170M6019	170M6019
EMX3-1000B	2530000	170M6018	170M6013*	—
EMX3-1200C	4500000	170M6021	—	—
EMX3-1410C	6480000	—	—	—
EMX3-1600C	12500000	170M6019*	—	—

* Two parallel connected fuses required per phase.

Bussman Fuses - British Style (BS88)

Model	SCR I²t (A²s)	Supply Voltage (≤ 440 VAC)	Supply Voltage (≤ 575 VAC)	Supply Voltage (≤ 690 VAC)
EMX3-0023B	1150	63FE	63FE	63FE
EMX3-0043B	8000	120FEE	120FEE	120FEE
EMX3-0050B	10500	120FEE	120FEE	120FEE
EMX3-0053B	15000	200FEE	200FEE	200FEE
EMX3-0076B	15000	200FEE	200FEE	200FEE
EMX3-0097B	51200	200FEE	200FEE	200FEE
EMX3-0100B	80000	280FM	280FM	280FM
EMX3-0105B	125000	280FM	280FM	280FM
EMX3-0145B	125000	280FM	280FM	280FM
EMX3-0170B	320000	450FMM	450FMM	450FMM
EMX3-0200B	320000	450FMM	450FMM	450FMM
EMX3-0220B	320000	450FMM	450FMM	450FMM
EMX3-0255B	320000	450FMM	450FMM	450FMM
EMX3-0255C	320000	450FMM	450FMM	450FMM
EMX3-0350B	202000	315FM*	—	—
EMX3-0360C	320000	—	—	—
EMX3-0380C	320000	400FMM*	400FMM	400FMM*
EMX3-0425B	320000	400FMM*	—	—
EMX3-0430C	320000	—	—	—
EMX3-0500B	320000	450FMM*	—	—
EMX3-0580B	781000	500FMM*	500FMM*	500FMM*
EMX3-0620C	1200000	630FMM*	630FMM*	—
EMX3-0650C	1200000	630FMM*	630FMM*	—
EMX3-0700B	781000	630FMM*	—	—
EMX3-0790C	2530000	—	—	—
EMX3-0820B	1200000	—	—	—
EMX3-0920B	2530000	—	—	—
EMX3-0930C	4500000	—	—	—
EMX3-1000B	2530000	—	—	—
EMX3-1200C	4500000	—	—	—
EMX3-1410C	6480000	—	—	—
EMX3-1600C	12500000	—	—	—

* Two parallel connected fuses required per phase.

Ferraz Fuses - HSJ

Model	SCR I²t (A²s)	Supply Voltage (≤ 440 VAC)	Supply Voltage (≤ 575 VAC)	Supply Voltage (≤ 690 VAC)
EMX3-0023B	1150	HSJ40**	HSJ40**	Not suitable
EMX3-0043B	8000	HSJ80**	HSJ80**	
EMX3-0050B	10500	HSJ90**	HSJ90**	
EMX3-0053B	15000	HSJ110**	HSJ110**	
EMX3-0076B	15000	HSJ125**	HSJ125**	
EMX3-0097B	51200	HSJ175	HSJ175**	
EMX3-0100B	80000	HSJ175	HSJ175	
EMX3-0105B	125000	HSJ225	HSJ225	
EMX3-0145B	125000	HSJ250	HSJ250**	
EMX3-0170B	320000	HSJ300	HSJ300	
EMX3-0200B	320000	HSJ350	HSJ350	
EMX3-0220B	320000	HSJ400**	HSJ400**	
EMX3-0255B	320000	HSJ450**	HSJ450**	
EMX3-0255C	320000	HSJ450**	HSJ450**	
EMX3-0350B	202000	HSJ500**		

EMX3-0360C	320000	Not suitable	Not suitable	Not suitable
EMX3-0380C	320000			
EMX3-0425B	320000			
EMX3-0430C	320000			
EMX3-0500B	320000			
EMX3-0580B	781000			
EMX3-0620C	1200000			
EMX3-0650C	1200000			
EMX3-0700B	781000			
EMX3-0790C	2530000			
EMX3-0820B	1200000			
EMX3-0920B	2530000			
EMX3-0930C	4500000			
EMX3-1000B	2530000			
EMX3-1200C	4500000			
EMX3-1410C	6480000			
EMX3-1600C	12500000			

** Two series connected fuses required per phase.

Ferraz Fuses - North American Style (PSC 690)

Model	SCR I^2t (A^2s)	Supply Voltage $\leq$ 440 VAC	Supply Voltage $\leq$ 575 VAC	Supply Voltage $\leq$ 690 VAC
EMX3-0023B	1150	A070URD30XXX0063	A070URD30XXX0063	—
EMX3-0043B	8000	A070URD30XXX0125	A070URD30XXX0125	A070URD30XXX0125
EMX3-0050B	10500	A070URD30XXX0125	A070URD30XXX0125	A070URD30XXX0125
EMX3-0053B	15000	A070URD30XXX0125	A070URD30XXX0125	A070URD30XXX0125
EMX3-0076B	15000	A070URD30XXX0160	A070URD30XXX0160	A070URD30XXX0160
EMX3-0097B	51200	A070URD30XXX0200	A070URD30XXX0200	A070URD30XXX0200
EMX3-0100B	80000	A070URD30XXX0200	A070URD30XXX0200	A070URD30XXX0200
EMX3-0105B	125000	A070URD30XXX0315	A070URD30XXX0315	A070URD30XXX0315
EMX3-0145B	125000	A070URD30XXX0315	A070URD30XXX0315	A070URD30XXX0315
EMX3-0170B	320000	A070URD30XXX0315	A070URD30XXX0315	A070URD30XXX0315
EMX3-0200B	320000	A070URD30XXX0450	A070URD30XXX0450	A070URD30XXX0450
EMX3-0220B	320000	A070URD30XXX0450	A070URD30XXX0450	A070URD30XXX0450
EMX3-0255B	320000	A070URD30XXX0450	A070URD30XXX0450	A070URD30XXX0450
EMX3-0255C	320000	A070URD30XXX0450	A070URD30XXX0450	A070URD30XXX0450
EMX3-0350B	202000	A070URD31XXX0550	—	—
EMX3-0360C	320000	A070URD33XXX0630	A070URD33XXX0630	A070URD33XXX0630
EMX3-0380C	320000	A070URD33XXX0700	A070URD33XXX0700	—
EMX3-0425B	238000	A070URD32XXX0630	—	—
EMX3-0430C	320000	A070URD33XXX0700	A070URD33XXX0700	—
EMX3-0500B	320000	A070URD32XXX0700	—	—
EMX3-0580B	781000	A070URD32XXX0800	—	—
EMX3-0620C	1200000	A070URD33XXX1000	A070URD33XXX1000	A070URD33XXX1000
EMX3-0650C	1200000	A070URD33XXX1000	A070URD33XXX1000	A070URD33XXX1000
EMX3-0700B	781000	A070URD33XXX0900	—	—
EMX3-0790C	2530000	A070URD33XXX1400	A070URD33XXX1400	A070URD33XXX1400
EMX3-0820B	1200000	A070URD33XXX1100	—	—
EMX3-0920B	2530000	A070URD33XXX1250	—	—
EMX3-0930C	4500000	A070URD33XXX1400	A070URD33XXX1400	A070URD33XXX1400
EMX3-1000B	2530000	A070URD33XXX1400	—	—
EMX3-1200C	4500000	A055URD33XXX2250	—	—
EMX3-1410C	6480000	A055URD33XXX2250	—	—
EMX3-1600C	12500000	—	—	—

XXX = blade type. Refer to Ferraz catalog for details.

Ferraz Fuses - European Style (PSC 690)

Model	SCR I^2t (A^2s)	Supply Voltage (≤ 440 VAC)	Supply Voltage (≤ 575 VAC)	Supply Voltage (≤ 690 VAC)
EMX3-0023B	1150	6.9URD30D11A0050	6.9URD30D11A0050	6.9URD30D11A0050
EMX3-0043B	8000	6.9URD30D11A0125	6.9URD30D11A0125	6.9URD30D11A0125
EMX3-0050B	10500	6.9URD30D11A0125	6.9URD30D11A0125	6.9URD30D11A0125
EMX3-0053B	15000	6.9URD30D11A0125	6.9URD30D11A0125	6.9URD30D11A0125
EMX3-0076B	15000	6.9URD30D11A0160	6.9URD30D11A0160	6.9URD30D11A0160
EMX3-0097B	51200	6.9URD30D11A0200	6.9URD30D11A0200	6.9URD30D11A0200
EMX3-0100B	80000	6.9URD30D11A0200	6.9URD30D11A0200	6.9URD30D11A0200
EMX3-0105B	125000	6.9URD30D11A0315	6.9URD30D11A0315	6.9URD30D11A0315
EMX3-0145B	125000	6.9URD30D11A0315	6.9URD30D11A0315	6.9URD30D11A0315
EMX3-0170B	320000	6.9URD30D11A0315	6.9URD30D11A0315	6.9URD30D11A0315
EMX3-0200B	320000	6.9URD31D11A0450	6.9URD31D11A0450	6.9URD31D11A0450
EMX3-0220B	320000	6.9URD31D11A0450	6.9URD31D11A0450	6.9URD31D11A0450
EMX3-0255B	320000	6.9URD31D11A0450	6.9URD31D11A0450	6.9URD31D11A0450
EMX3-0255C	320000	6.9URD31D11A0450	6.9URD31D11A0450	6.9URD31D11A0450
EMX3-0350B	202000	6.9URD31D11A0550	—	—
EMX3-0360C	320000	6.9URD33D11A0630	6.9URD33D11A0630	6.9URD33D11A0630
EMX3-0380C	320000	6.9URD33D11A0700	6.9URD33D11A0700	6.9URD33D11A0700
EMX3-0425B	320000	6.9URD32D11A0630	—	—
EMX3-0430C	320000	6.9URD33D11A0700	6.9URD33D11A0700	6.9URD33D11A0700
EMX3-0500B	320000	6.9URD32D11A0700	—	—
EMX3-0580B	781000	6.9URD32D11A0800	—	—
EMX3-0620C	1200000	6.9URD33D11A1000	6.9URD33D11A1000	6.9URD33D11A1000
EMX3-0650C	1200000	6.9URD33D11A1000	6.9URD33D11A1000	6.9URD33D11A1000
EMX3-0700B	781000	6.9URD33D11A0900	—	—
EMX3-0790C	2530000	6.6URD33D11A1400	6.6URD33D11A1400	—
EMX3-0820B	1200000	6.9URD33D11A1100	—	—
EMX3-0920B	2530000	6.9URD33D11A1250	—	—
EMX3-0930C	4500000	6.6URD33D11A1400	6.6URD33D11A1400	—
EMX3-1000B	2530000	6.9URD33D11A1400	—	—
EMX3-1200C	4500000	6URD233PLAF2200	6.URD233PLAF2200	—
EMX3-1410C	6480000	6URD233PLAF2200	6URD233PLAF2200	—
EMX3-1600C	12500000	6URD233PLAF2800	6URD233PLAF2800	—

UL Tested Fuses - Short Circuit Ratings

Model	Nominal Rating (A)	Short Circuit Rating @ 480VAC (kA)	Short Circuit Rating @ 600VAC (kA)	Fuse (Ferraz)	
EMX3-0023B	23	65	10	AJT25	A070URD30XXX0063
EMX3-0043B	43	65	10	AJT50	A070URD30XXX0125
EMX3-0050B	50	65	10	AJT50	A070URD30XXX0125
EMX3-0053B	53	65	10	AJT60	A070URD30XXX0125
EMX3-0076B	76	65	10	AJT80	A070URD30XXX0200
EMX3-0097B	97	65	10	AJT100	A070URD30XXX0200
EMX3-0100B	100	65	10	AJT100	A070URD30XXX0200
EMX3-0105B	105	65	10	AJT125	A070URD30XXX0315
EMX3-0145B	145	65	18	AJT150	A070URD30XXX0315
EMX3-0170B	170	65	18	AJT175	A070URD30XXX0315
EMX3-0200B	200	65	18	AJT200	A070URD30XXX0450
EMX3-0220B	220	65	18	AJT250	A070URD30XXX0450
EMX3-0255B	255	-	85	AJT300	A070URD30XXX0450
EMX3-0255C	255	-	85	AJT300	A070URD30XXX0450
EMX3-0350B	350	-	30	AJT400	-
EMX3-0360C	360	-	85	AJT400	A070URD33XXX0630
EMX3-0380C	380	-	85	AJT450	A070URD33XXX0700

EMX3-0425B	425	-	30	AJT500	A070URD33XXX0630
EMX3-0430C	430	-	85	AJT450	A070URD33XXX0700
EMX3-0500B	500	-	30	AJT500	A070URD33XXX0700
EMX3-0580B	580	-	30	A4BQ800	-
EMX3-0620C	620	-	85	A4BQ800	A070URD33XXX1000
EMX3-0650C	650	-	85	A4BQ800	A070URD33XXX1000
EMX3-0700B	700	-	42	A4BQ800	-
EMX3-0790C	790	-	85	A4BQ1200	A070URD33XXX1400
EMX3-0820B	820	-	42	A4BQ1200	A070URD33XXX1000
EMX3-0920B	920	-	85	A4BQ1200	A070URD33XXX1400
EMX3-0930C	930	-	85	A4BQ1200	A070URD33XXX1400
EMX3-1000B	1000	-	85	A4BQ1200	A070URD33XXX1400
EMX3-1200C	1200	-	100	A4BQ1600	A065URD33XXX1800
EMX3-1410C	1410	-	100	A4BQ2000	A055URD33XXX2250
EMX3-1600C	1600	100	100	A4BQ2500	A055URD33XXX2500

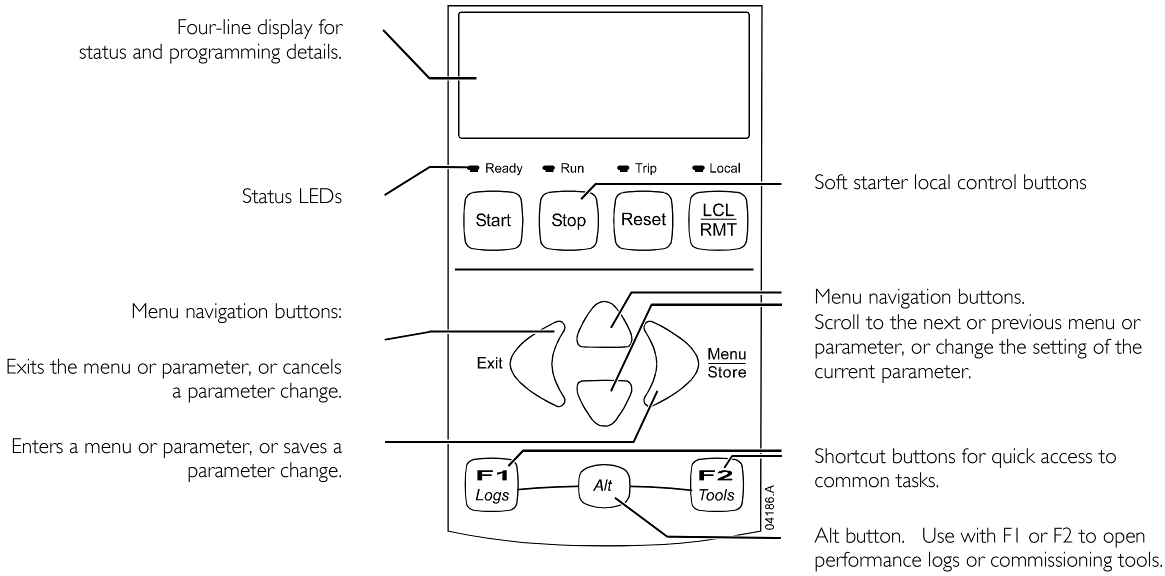
4.7 Earth Terminals

Earth terminals are located at the back of the soft starter.

- EMX3-0023B ~ EMX3-0105B have one terminal on the input side (top).
- EMX3-0145B ~ EMX3-1000B and EMX3-0255C ~ EMX3-1600C have two terminals, one on the input side (top) and one on the output side (bottom).

Section 5 Keypad and Feedback

5.1 The Keypad



Starter Status LEDs

LED name	On	Flash
Ready	The motor is stopped and the starter is ready to start.	The motor is stopped and the starter is waiting for the Restart Delay (parameter 4M) or Motor Temperature Check (parameter 4N).
Run	The motor is in run state (receiving full voltage).	The motor is starting or stopping.
Trip	The starter has tripped.	The starter is in warning state.
Local	The starter is in Local control mode.	–

If the starter is in Remote control mode, the Local LED will be off.

If all LEDs are off, the starter is not receiving control voltage.

Removing and Replacing the Keypad

The keypad can be removed from the soft starter and mounted remotely on a panel using the remote mounting kit.

The keypad stores a backup copy of the parameters in the soft starter, so one keypad can be used to program multiple EMX3 starters.

NOTE
The keypad can be removed or replaced while the starter is running. It is not necessary to remove mains or control voltage.

- **Removing the keypad**

The keypad is attached to the body of the soft starter by a DB9 serial connector and two screws. The screws are concealed behind a snap-on faceplate.

To remove the keypad:

1. Models EMX3-0023B to EMX3-1000B: open the EMX3's door.
   Models EMX3-0255C to EMX3-1600C: remove the EMX3's front cover.
2. Insert a small screwdriver under the faceplate, at the base of the keypad, and use the screwdriver to lever the faceplate off the keypad.
3. Lift the faceplate off completely.
4. Remove the two screws holding the keypad in place.
5. Lift the keypad gently off the soft starter. Pull the keypad forwards, to avoid damaging the DB9 connector.

- **Replacing the keypad**

To replace the keypad:

1. Align the connector on the back of the keypad with the socket on the soft starter and push the keypad firmly into place. The keypad will be held in place by the connector and two locating nibs in the top right and bottom left corners.
   For temporary installation (eg during commissioning) it is not necessary to screw the keypad in place.
2. Replace the two screws holding the keypad in place.
3. Slide the bottom edge of the faceplate over the body of the keypad, then swing the top edge of the faceplate into place and press onto the keypad. The retaining tabs on the back of the faceplate will snap into place.

- **Synchronising the Keypad and the Starter**

When a keypad is connected to an EMX3, it synchronises its parameter settings with the settings in the soft starter.

Every time a different keypad is plugged into the starter, an acknowledgement is displayed.

```
New Display Detected
```

Select the required option using the ▲ and ▼ buttons. Press STORE to proceed with the selection.

```
Copy Parameters
Display to Starter
Starter to Display
```

If any of the settings in the keypad are not valid for the starter, the keypad loads the default values.

5.2 Displays

The keypad displays a wide range of performance information about the soft starter. The top half of the screen shows real-time information on current or motor power (as selected in parameter 8D). Use the ▲ and ▼ buttons to select the information shown on the bottom half of the screen.

- Starter status
- Motor temperature
- Current
- Motor power
- Last start information
- Date and time
- SCR conduction

⚠ NOTE
Screens shown here are with the default settings.

Starter Status

The starter status screen shows details of the starter's operating status, motor temperature and motor power.

```
Ready
M1 000%          000.0kW
```

Programmable screen

The EMX3's user-programmable screen can be configured to show the most important information for the particular application. Use parameters 8E to 8H to select which information to display.

```
Ready
0000 hrs      - - %
```

Motor Temperature

The temperature screen shows which motor data set is in use, and the temperature of both motors as a percentage of total thermal capacity. If the EMX3 is configured for use on one motor, the temperature for the secondary motor (M2) will always show 0%.

```
    Primary Motor Set
➤ M1 000%      M2 000%
```

Current

The current screen shows real-time line current on each phase. If the RTD/PT100 and ground fault protection card is fitted, the screen will also show ground current.

```
      Phase Currents
000.0A    000.0A      000.0A
```

Motor Power

The motor power screen shows motor power (kW, HP and kVA) and power factor.

```
000.0kW              0000HP
0000kVA              -. - - pf
```

The motor power figures are calculated using the Mains Reference Voltage (parameter 8N).

Last Start Information

The last start information screen shows details of the most recent successful start:

- start duration (seconds)
- maximum start current drawn (as a percentage of motor full load current)
- calculated rise in motor temperature

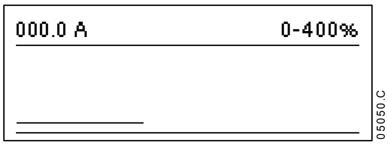
```
Last start  010 s
350 % FLC      Δ Temp 5%
```

Date and Time

The date/time screen shows the current system date and time (24 hour format). For details on setting the date and time, refer to *Set Date and Time* on page 25.

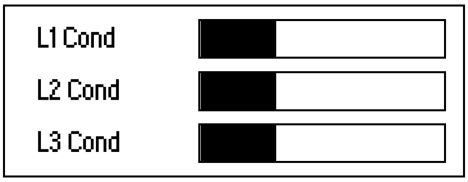
Performance Graph

The performance graph provides a real-time display of operating performance. Use parameters 8I~8L to select which information to display.



SCR Conduction Bargraph

The SCR conduction bargraph shows the level of conduction on each phase.



5.3 Menus

Commissioning Menu

The Commissioning Menu provides access to commissioning and testing tools.

To open the Commissioning Menu, press **ALT** then **F2** (Tools) while viewing the metering screens.

Programming Menu

The Programming Menu lets you view and change programmable parameters that control how the EMX3 operates.

To open the Programming Menu, press the MENU button while viewing the monitoring screens.

Logs menu

The Logs Menu provides information on events, trips and starter performance.

To open the Logs Menu, press ALT then F1 (LOGS).

Section 6 Maintenance Tools

6.1 Commissioning Menu

The Commissioning Menu provides access to commissioning and testing tools.

To open the Commissioning Menu, press ALT then F2 (Tools) while viewing the metering screens.

To navigate through the Commissioning Menu:

- to scroll to the next or previous item, press the ▲ or ▼ button.
- to open an item for viewing, press the ▶ button.
- to return to the previous level, press the ◀ button.
- to close the Commissioning Menu, press ◀ repeatedly.

Set Date and Time

To set the date and time:

1. Open the Commissioning Menu.
2. Scroll to the date/time screen.
3. Press the ▶ button to enter edit mode.
4. Press the ▶ and ◀ buttons to select which part of the date or time to edit.
5. Use the ▲ and ▼ buttons to change the value.
6. To save changes, press the ▶ button. The EMX3 will confirm the changes.
   To cancel changes, press the ◀ button.

Simulation Tools

Software simulation functions let you test the soft starter's operation and control circuits without connecting the soft starter to mains voltage. The EMX3 has three simulation modes:

- The run simulation simulates a motor starting, running and stopping to confirm that the soft starter and associated equipment have been installed correctly.
- The protection simulation simulates activation of each protection mechanism to confirm that the soft starter and associated control circuits are responding correctly.
- The output signal simulation simulates output signalling to confirm that outputs and associated control circuits are operating correctly.

The simulation tools are accessed via the Commissioning Menu. The simulations are only available when the soft starter is in Ready state, control voltage is available and the keypad is active.

NOTE
Access to the simulation tools is protected by the security access code.
The default access code is 0000.

- Run Simulation

You can end the simulation at any time by pressing EXIT.

To use the run simulation:

1. Open the Commissioning Menu.
2. Scroll to Run Simulation and press ▶.
3. Press START or activate the start input.

   The EMX3 simulates its pre-start checks and closes the main contactor (if installed). The Run LED flashes.

Run Simulation Ready Apply Start Signal

Run Simulation Pre-Start Checks STORE to Continue

NOTE
If the Mains voltage is connected an error message ("Power On") is shown. Remove the Mains voltage and proceed to next step.

Run Simulation ATTENTION! Remove Mains Volts STORE to Continue

4. Press ▶. The EMX3 simulates starting. The Run LED flashes.

Run Simulation Starting X:XXs STORE to Continue

5. Press ▶. The EMX3 simulates running. The Run LED stays on without flashing and the bypass contactor closes (if installed)

Run Simulation Running Apply Stop Signal

6. Press STOP or activate the stop input. The EMX3 simulates stopping. The Run LED flashes and the bypass contactor opens (if installed)

Run Simulation Stopping X:XXs STORE to Continue

7. Press ▶. The Ready LED flashes and the main contactor opens (if installed)

Run Simulation Stopped STORE to Continue

8. Press ▶ to return to the commissioning menu.

- Testing the Installation

The EMX3 can be connected to a small motor for testing. During this test, the soft starter's control input and relay output protection settings can be tested. This test mode is not suitable for testing soft starting or soft stopping performance.

The FLC of the test motor must be at least 2% of the soft starter's minimum FLC (refer to Minimum and Maximum Current Settings).

NOTE
When testing the soft starter with a small motor, set parameter 1A *Motor Full Load Current* to the minimum allowable value.

- Protection Simulation

The protection simulation simulates activation of each protection mechanism to confirm that the soft starter and associated control circuits are responding correctly.

To use the protection simulation:

1. Open the Commissioning Menu.
2. Scroll to Protection Simulation and press ▶.
3. Use the ▲ and ▼ buttons to select the protection you want to simulate.
4. Press and hold ▶ to simulate the selected protection.
5. The screen is displayed momentarily. The soft starter's response depends on the Protection Action setting (parameter group 16).

0.0A Tripped Selected Protection

6. Use ▲ or ▼ to select another simulation, or press ◀ to exit.

NOTE
If the protection trips the soft starter, reset before simulating another protection. If the protection action is set to 'Warning & Log', no reset is required.

If the protection is set to 'Warning & Log', the warning message can be viewed only while the STORE button is pressed.

If the protection is set to 'Log only', nothing appears on the screen but an entry will appear in the log.

- Output Signal Simulation

The output signal simulation simulates output signalling to confirm that outputs and associated control circuits are operating correctly.

NOTE
To test operation of the flags (motor temperature and low/high current), set an output relay to the appropriate function and monitor the relay's behaviour.

To use the output signal simulation:

1. Open the Commissioning Menu.
2. Scroll to Output Signalling Simulation and press ▶.
3. Use the ▲ and ▼ buttons to select a function to simulate, then press ▶.
4. Use the ▲ and ▼ buttons to turn the signal on and off.
   To confirm correct operation, monitor the state of the output.

```
      Prog Relay A
Off
On
```

5. Press ◀ to return to the simulation list.

- Analog Output Simulation

The analog output simulation uses the ▲ and ▼ buttons to change the current at the analog output terminals.

```
Analog Output A
0%
4.0mA
```

Attach a current measuring device to the analog output terminals. Use the ▲ or ▼ button to adjust the percentage value on the display. The current measuring device should indicate the same level of current as shown on the display.

If the input/output expansion card is fitted, the simulation can also be used to test the operation of Relays D, E, F and Analog Output B.

- Temperature Sensors State

This screen shows the state of the motor thermistors and RTD/PT100s.

```
Temp Sensors State
Thermistor: O
RTD/PT100s:OOOOOOO
S = Shrt   H=Hot   C=Cld   O=Opn
```

RTD/PT100s B ~ G are only available if the RTD/PT100 and Ground Fault expansion card is fitted.

- Digital I/O State

This screen shows the current status of the digital inputs and outputs.

```
    Digital I/O State
 Inputs:   0110000
 Outputs: 0000100
```

The top line of the screen shows the start, stop, reset and programmable inputs (A and B, then inputs on the I/O expansion card (if fitted).

The bottom line of the screen shows programmable output A, the fixed Run output, programmable outputs B and C, then the outputs on the expansion card (if fitted).

- Analog I/O State

This screen shows the current status of the Analog I/O

```
    Analog I/O State
Input: - - - - %
Output A: 04.0mA
```

This screen will also show Analog Output B if the expansion card is fitted.

Reset Thermal Models

The EMX3's advanced thermal modelling software constantly monitors the motor's performance. This allows the EMX3 to calculate the motor's temperature and ability to start successfully at any time. If the EMX3 is configured for use on two motors, each motor's temperature is modelled separately.

The thermal model for the active motor can be reset if required.

1. Open the Commissioning Menu.
2. Scroll to Reset Thermal Models and press ▶.

```
Reset Thermal Models
      M1 X%
      M2 X%
    ▶ to Reset
```

3. Use ▼ to select Reset and press **STORE** to confirm.

```
Do Not Reset
Reset
```

4. When the thermal model has been reset, the screen will display a confirmation message then return to the previous screen.

> ⚠ CAUTION
> Resetting the motor thermal model may compromise motor life and should only be done in the case of emergency.

6.2 Logs Menu

The Logs Menu provides information on events, trips and starter performance.

To open the Logs Menu, press ALT then F1 (LOGS).

To navigate through the Logs Menu:

- to open a log, press the ▶ button.
- to scroll through the entries in each log, press the ▲ and ▼ buttons.
- to view details of a log entry, press the ▶ button.
- to return to the previous level, press the ◀ button.
- to close the Logs Menu, press ◀ repeatedly.

The Logs Menu can only be opened while viewing the metering screens.

Trip Log

The Trip Log stores details of the eight most recent trips, including the date and time the trip happened. Trip 1 is the most recent and trip 8 is the oldest stored trip.

To open the Trip Log:

1. Open the Logs Menu.
2. Scroll to Trip Log and press ▶.
3. Use the ▲ and ▼ buttons to select a trip to view, and press ▶ to display details.

To close the log and return to the main display, press ◀ repeatedly.

Event Log

The Event Log stores time-stamped details of the starter's 99 most recent events (actions, warnings and trips), including the date and time of the event. Event 1 is the most recent and event 99 is the oldest stored event.

To open the Event Log:

1. Open the Logs Menu.
2. Scroll to Event Log and press ▶.
3. Use the ▲ and ▼ buttons to select an event to view, and press ▶ to display details.

To close the log and return to the main display, press ◀ repeatedly.

Performance Counters

The performance counters store statistics on the starter's operation:

- Hours run (lifetime and since counter last reset)
- Number of starts (lifetime and since counter last reset)
- Motor kWh (lifetime and since counter last reset)

- Number of times the thermal model has been reset

The resettable counters (hours run, starts and motor kWh) can only be reset if the Adjustment Lock (parameter 15B) is set to Read & Write.

To view the counters:

1. Open the Logs Menu.
2. Scroll to counters and press ▶.
3. Use the ▲ and ▼ buttons to scroll through the counters. Press ▶ to view details.
4. To reset a counter, press ▶ then use the ▲ and ▼ buttons to select Reset/Do Not Reset. Press STORE to confirm the action.

To close the counter and return to the Logs Menu, press ▶.

Section 7 Operation

7.1 Start, Stop and Reset Commands

The soft starter can be controlled in three ways:

- using the buttons on the keypad
- via remote inputs
- via a serial communication link

The LCL/RMT button controls whether the EMX3 will respond to local control (via the keypad) or remote control (via the remote inputs).

- The Local LED on the keypad is on when the soft starter is in local control mode and off when the soft starter is in remote control mode.
- The Remote LED on the EMX3 is on when the soft starter is in Remote mode and off when in Local mode. The Remote LED is located on the main body of the starter (behind the keypad) and is only visible if the keypad is remotely mounted.

Control via the serial communication network is always enabled in local control mode, and can be enabled or disabled in remote control mode (refer to parameter 6R). Control via the serial communication network requires an optional communication interface.

The STOP button on the keypad is always enabled.

Using the Soft Starter to Control a Motor

To soft start the motor, press the START button on the keypad or activate the Start remote input. The motor will start using the start mode selected in parameter 2A.

To stop the motor, press the STOP button on the keypad or activate the Stop remote input. The motor will stop using the stop mode selected in parameter 2H.

To reset a trip on the soft starter, press the RESET button on the keypad or activate the Reset remote input.

To emergency stop the motor, press the local STOP and RESET buttons at the same time. The soft starter will remove power from the motor and open the main contactor, and the motor will coast to stop. Emergency stop can also be controlled via a programmable input.

NOTE
Adaptive Control, Jog, Brake and PowerThrough functions are not supported with inside delta (six-wire) operation. Refer to *Inside Delta Operation* on page 36.

Auto-Start/Stop

The EMX3 can also be configured to auto-start or auto-stop. Auto-start/stop operation is only available in Remote mode, and must be configured using parameters 3A~3D. In Local mode, the starter will ignore any auto-start/stop setting.

7.2 Soft Start Methods

Soft starters offer a variety of methods to control motor starting. Each soft start method uses a different primary control parameter.

Soft Start Method	Parameter Controlled	Performance Parameters Influenced
Timed Voltage Ramp	Voltage	Start current, start torque, acceleration
Constant Current	Current	Start torque, acceleration
Torque Control	Torque	Start current, acceleration
Adaptive Control	Acceleration	Start current, start torque

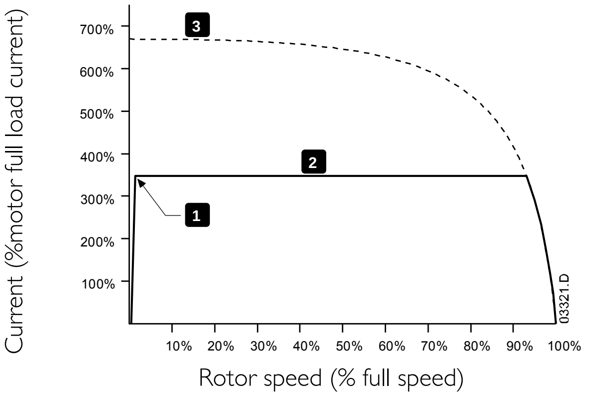
Best results are obtained by selecting the soft start method that directly controls the parameter of most importance for the application. Typically soft starters are used to limit motor start current or control load acceleration and/or deceleration. The EMX3 can be set to either Constant Current or Adaptive Control.

To Control	Use
Motor Start Current	Constant Current
Motor/Load Acceleration or Deceleration	Adaptive Control

Constant Current

Constant current is the traditional form of soft starting, which raises the current from zero to a specified level and keeps the current stable at that level until the motor has accelerated.

Constant current starting is ideal for applications where the start current must be kept below a particular level.



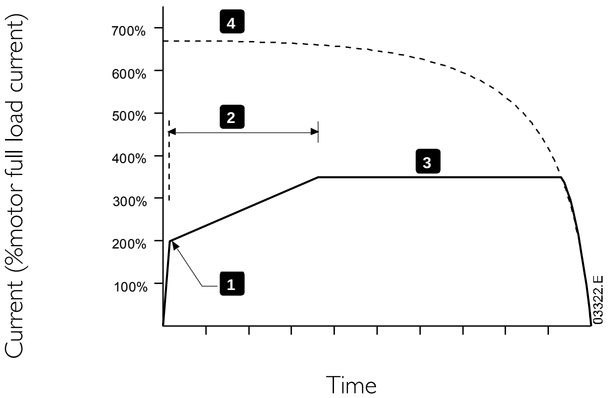
1: Initial current (parameter 2C)
2: Current limit (parameter 2D)
3: Full voltage current

Current Ramp

Current ramp soft starting raises the current from a specified starting level (1) to a maximum limit (3), over an extended period of time (2).

Current ramp starting can be useful for applications where:

- the load can vary between starts (for example a conveyor which may start loaded or unloaded). Set the initial current (parameter 2C) to a level that will start the motor with a light load, and the current limit (parameter 2D) to a level that will start the motor with a heavy load.
- the load breaks away easily, but starting time needs to be extended (for example a centrifugal pump where pipeline pressure needs to build up slowly).
- the electricity supply is limited (for example a generator set), and a slower application of load will allow greater time for the supply to respond.



1: Initial current (parameter 2C)
2: Start ramp time (parameter 2B)
3: Current limit (parameter 2D)
4: Full voltage current

Adaptive Control for Starting

Adaptive Control is a new intelligent motor control technique. In an adaptive control soft start, the EMX3 adjusts the current in order to start the motor within a specified time and using a selected acceleration profile.

CAUTION
Adaptive Control cannot start the motor faster than a direct on-line (DOL) start. If the start ramp time (parameter 2B) is shorter than the motor's DOL start time, starting current may reach DOL levels.

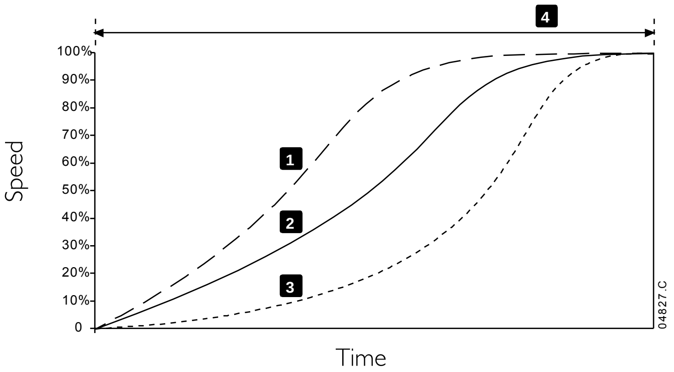
Every application has a particular starting profile, based on characteristics of the load and the motor. Adaptive Control offers three different starting profiles, to suit the requirements of different applications. Selecting a profile that matches the inherent profile of the application can help smooth out acceleration across the full start time. Selecting a dramatically different Adaptive Control profile can somewhat neutralise the inherent profile.

The EMX3 monitors the motor's performance during each start, to improve control for future soft starts.

- **Adaptive Control**

To use Adaptive Control to control starting performance:

1. Select Adaptive Control from the Start Mode menu (parameter 2A)
2. Set the desired Start Ramp Time (parameter 2B)
3. Select the desired Adaptive Start Profile (parameter 2E)
4. Set a start Current Limit (parameter 2D) sufficiently high to allow a successful start. The first start will be a Constant Current start. This allows the EMX3 to learn the characteristics of the connected motor. This motor data is used by the EMX3 during subsequent Adaptive Control starts.



Adaptive start profile (parameter 2E):
1. Early acceleration
2. Constant acceleration
3. Late acceleration
4. Start ramp time (parameter 2B)

NOTE
Adaptive Control will control the load according to the programmed profile. Start current will vary according to the selected acceleration profile and the programmed start time.

If replacing a motor connected to an EMX3 programmed for Adaptive Control starting or stopping, or if the starter has been tested on a different motor prior to actual installation, the starter will need to learn the characteristics of the new motor. The EMX3 will automatically re-learn the motor's characteristics if parameter 1A *Motor Full Load Current* or parameter 2K *Adaptive Control Gain* is changed.

- **How to Select the Adaptive Control Start Profile**

The best profile will depend on the exact details of each application.

Some loads, such as submersible pumps, should not be run at slow speeds. An early acceleration profile will raise the speed quickly, then control acceleration through the rest of the start.

CAUTION
Adaptive Control controls the motor's speed profile, within the programmed time limit. This may result in a higher level of current than traditional control methods.

- **Fine-tuning Adaptive Control**

If the motor does not start or stop smoothly, adjust the adaptive control gain (parameter 2K). The gain setting determines how much the EMX3 will adjust future adaptive control starts and stops, based on information from the previous start. The gain setting affects both starting and stopping performance.

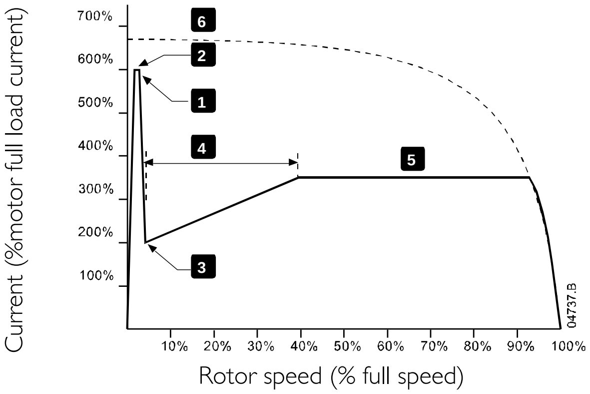
- If the motor accelerates or decelerates too quickly at the end of a start or stop, increase the gain setting by 5%~10%.
- If the motor speed fluctuates during starting or stopping, decrease the gain setting slightly.

NOTE
Changing the gain setting resets the starter's adaptive control learning. The first start after changing the gain will use constant current.

Kickstart

Kickstart provides a short boost of extra torque at the beginning of a start, and can be used in conjunction with current ramp or constant current starting.

Kickstart can be useful to help start loads that require high breakaway torque but then accelerate easily (for example flywheel loads such as presses).



1: Kickstart level (parameter 2G)
2: Kickstart time (parameter 2F)
3: Initial current (parameter 2C)
4: Start ramp time (parameter 2B)
5: Current limit (parameter 2D)
6: Full voltage current

7.3 Stop Methods

Soft starters offer a variety of methods for the control of motor stopping.

Stop Method	Performance Result
Coast To Stop	Natural load run down
TVR Soft Stop	Extended run down time
Adaptive Control	Extended run down time according to selected deceleration profile
Brake	Reduced run down time

Soft starters are often used in pumping applications to eliminate the damaging effects of fluid hammer. Adaptive Control should be the preferred stop method for these applications.

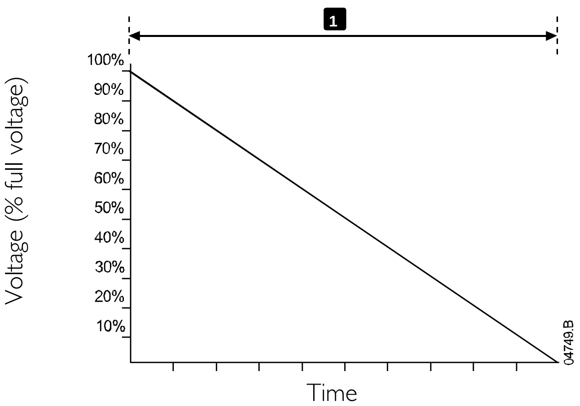
Coast to Stop

Coast to stop lets the motor slow at its natural rate, with no control from the soft starter. The time required to stop will depend on the type of load.

TVR Soft Stop

Timed voltage ramp reduces the voltage to the motor gradually over a defined time. The load may continue to run after the stop ramp is complete.

Timed voltage ramp stopping can be useful for applications where the stop time needs to be extended, or to avoid transients on generator set supplies.



1: Stop time (parameter 2I)

Adaptive Control for Stopping

In an adaptive control soft stop, the EMX3 controls the current in order to stop the motor within a specified time and using a selected deceleration profile. Adaptive Control can be useful in extending the stopping time of low inertia loads.

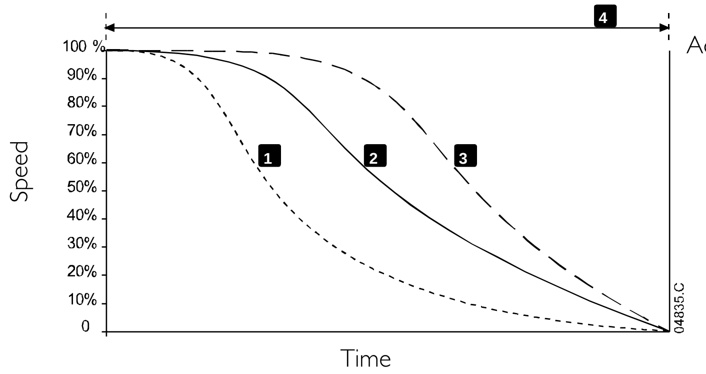
NOTE
Adaptive control does not actively slow the motor down and will not stop the motor faster than a coast to stop. To shorten the stopping time of high inertia loads, use brake.

Every application has a particular stopping profile, based on characteristics of the load and the motor. Adaptive Control offers three different stopping profiles. Choose the adaptive control profile that best matches your application requirements.

- **Adaptive Control**

To use Adaptive Control to control stopping performance:

1. Select Adaptive Control from the Stop Mode menu (parameter 2H)
2. Set the desired Stop Time (parameter 2I)
3. Select the required Adaptive Stop Profile (parameter 2J)



Adaptive Control stop profile (parameter 2J):
1. Early deceleration
2. Constant deceleration
3. Late deceleration
4. Stop time (parameter 2I)

NOTE
Pump stopping: The hydraulic characteristics of pump systems vary considerably. This variation means the ideal deceleration profile and stop time will vary from application to application. The table provides guidelines on selecting between Adaptive Control deceleration profiles, but we recommend testing the three profiles to identify the best profile for the application.

Adaptive Stop Profile	Application
Late Deceleration	High head systems where even a small decrease in motor/pump speed results in a rapid transition between forward flow and reverse flow.
Constant Deceleration	Low to medium head, high flow applications where the fluid has high momentum.
Early Deceleration	Open pump systems where fluid must drain back through the pump without driving the pump in reverse.

The first Adaptive Control stop will be a normal soft stop. This allows the EMX3 to learn the characteristics of the connected motor. This motor data is used by the EMX3 during subsequent Adaptive Control stops.

NOTE
Adaptive Control will control the load according to the programmed profile. Stopping current will vary according to the selected deceleration profile and stop time.

If replacing a motor connected to an EMX3 programmed for Adaptive Control starting or stopping, or if the starter has been tested on a different motor prior to actual installation, the starter will need to learn the characteristics of the new motor. The EMX3 will automatically re-learn the motor's characteristics if parameter 1A *Motor Full Load Current* or parameter 2K *Adaptive Control Gain* is changed.

- **How to Select the Adaptive Control Stop Profile**

The best profile will depend on the exact details of each application.

CAUTION
Adaptive Control controls the motor's speed profile, within the programmed time limit. This may result in a higher level of current than traditional control methods.

Brake

Brake reduces the time the motor requires to stop.

During braking an increased noise level from the motor may be audible. This is a normal part of motor braking.

CAUTION
If the brake torque is set too high, the motor will stop before the end of the brake time and the motor will suffer unnecessary heating which could result in damage. Careful configuration is required to ensure safe operation of the starter and motor.

A high brake torque setting can result in peak currents up to motor DOL being drawn while the motor is stopping. Ensure protection fuses installed in the motor branch circuit are selected appropriately.

CAUTION
Brake operation causes the motor to heat faster than the rate calculated by the motor thermal model. If you are using brake, install a motor thermistor or allow sufficient restart delay (parameter 4M).

- Brake

When brake is selected, the EMX3 uses DC injection to slow the motor.

EMX3 braking:

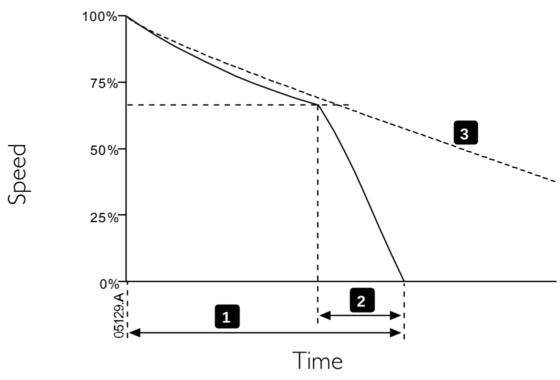
- Does not require the use of a DC brake contactor
- Controls all three phases so that the braking currents and associated heating are evenly distributed through the motor.

Braking has two stages:

1. Pre-brake: provides an intermediate level of braking to slow motor speed to a point where full brake can be operated successfully (approximately 70% speed).
2. Full brake: brake provides maximum braking torque but is ineffective at speeds greater than approximately 70%.

To configure the EMX3 for brake operation:

1. Set parameter 2I for the desired stopping time duration (1). This is the total braking time and must be set sufficiently longer than the brake time (parameter 2M) to allow the pre-braking stage to reduce motor speed to approximately 70%. If the stop time is too short, braking will not be successful and the motor will coast to stop.
2. Set Brake Time (parameter 2M) to approximately one quarter of the programmed Stop Time. This sets the time for the Full Brake stage (2).
3. Adjust the Brake Torque (parameter 2L) so that the desired stopping performance is achieved. If set too low, the motor will not stop completely and will coast to stop by the end of the braking period.



1: Stop time (parameter 2I)
2: Brake time (parameter 2M)
3: Coast to stop time

NOTE
When using DC brake, the mains supply must be connected to the soft starter (input terminals L1, L2, L3) in positive phase sequence and parameter 4G *Phase Sequence* must be set to Positive only.

NOTE
For loads which may vary between braking cycles, install a zero speed sensor to ensure that the soft starter ends DC braking when the motor stops. This avoids unnecessary heating of the motor.

For more information on using the EMX3 with an external speed sensor (eg for applications with variable load during the braking cycle), refer to *DC Brake with External Zero Speed Sensor*.

7.4 Jog Operation

Jog runs the motor at reduced speed, to allow alignment of the load or to assist servicing. The motor can be jogged in either forward or reverse direction.

CAUTION
Slow speed running is not intended for continuous operation due to reduced motor cooling.

Jog operation causes the motor to heat faster than the rate calculated by the motor thermal model. If you are using jog, install a motor thermistor or allow sufficient restart delay (parameter 4M)

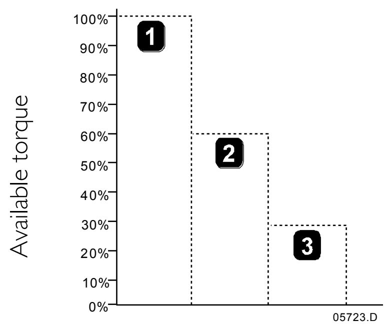
NOTE
Soft start and soft stop are not available during jog operation.

Jog is only available for the primary motor. For more information on primary and secondary motor sets, refer to *Secondary motor set*.

The maximum available torque for jog forward is approximately 50%~75% of motor full load torque (FLT) depending on the motor. The torque when the motor is jogged in reverse is approximately 25% to 50% of FLT.

Parameter 15E controls how much of the maximum available jog torque the soft starter will apply to the motor.

NOTE
Setting parameter 15E above 50% may cause increased shaft vibration.



1. Motor FLT
2. Jog forward maximum torque
3. Jog reverse maximum torque

To activate jog operation, use either a programmable input (refer to parameters 6A and 6F (will operate only in Remote Mode) or a shortcut key (parameters 8B and 8C).

To stop a jog operation, perform one of the following:

- Remove the jog command.
- Press the STOP button on the keypad.
- Activate Emergency Stop using the keypad programmable inputs.

Jog will recommence at the end of a restart delay if the jog command is still present. All other commands except the above, will be ignored during jog operation.

7.5 Inside Delta Operation

Adaptive Control, Jog, Brake and PowerThrough functions are not supported with inside delta (six-wire) operation. If these functions are programmed when the starter is connected inside delta the behaviour is as given below:

Adaptive Control Start	The starter performs a constant current start.
Adaptive Control Stop	The starter performs a TVR soft stop if parameter 2I *Stop Time* is >0 secs. If parameter 2I is set to 0 secs the starter performs a coast to stop.
Jog	The starter issues a warning with the error message Unsupported Option.
Brake	The starter performs a coast to stop.
PowerThrough	The starter trips with the error message Lx-Tx Shorted.

NOTE
When connected in inside delta, current imbalance is the only phase loss protection that is active during run. Do not disable current imbalance protection (parameter 4H) during inside delta operation.

Section 8 Programming Menu

You can access the Programming Menu at any time, including while the soft starter is running. Any changes to the start profile take effect immediately.

The Programming Menu contains four sub-menus:

Quick Setup	Quick Setup guides you through the parameters required to configure the EMX3 for common applications. Quick Setup suggests a value for each parameter, but you can change these as required.
Standard Menu	The Standard Menu provides access to commonly used parameters, allowing you to configure the EMX3 to suit your application.
Extended Menu	The Extended Menu provides access to all the EMX3's programmable parameters, allowing experienced users to take advantage of advanced features.
Load/Save Settings	Load/Save Settings lets you save the current parameter settings to a file, load parameters from a previously saved file, or reset all parameters to default values.

8.1 Programming Menu

The Programming Menu lets you view and change programmable parameters that control how the EMX3 operates.

To open the Programming Menu, press the MENU button while viewing the monitoring screens.

To navigate through the Programming Menu:

- to scroll through parameter groups, press the ▲ or ▼ button.
- to open a submenu, press the ▶ button.
- to view the parameters in a group, press the ▶ button.
- to return to the previous level, press the ◀ button.
- to close the Programming Menu, press ◀ repeatedly.

To change a parameter value:

- scroll to the appropriate parameter in the Programming Menu and press ▶ to enter edit mode.
- to alter the parameter setting, use the ▲ and ▼ buttons. Pressing ▲ or ▼ once will increase or decrease the value by one unit. If the button is held for longer than five seconds, the value will increase or decrease at a faster rate.
- to save changes, press STORE. The setting shown on the display will be saved and the keypad will return to the parameter list.
- to cancel changes, press EXIT. The keypad will ask for confirmation, then return to the parameter list without saving changes.

8.2 Adjustment Lock

You can lock the Programming Menu to prevent users from altering parameter settings. The adjustment lock can be turned on and off using parameter 15B.

To lock the programming menu:

1. Open the Programming Menu.
2. Open the Extended Menu.
3. Select 'Advanced'
4. Enter the Access Code
5. Select parameter 15B Adjustment Lock.
6. Select and store 'Read Only'

If a user attempts to change a parameter value when the adjustment lock is active, an error message is displayed:

```
Access Denied
Adj Lock is On
```

8.3 Access Code

Critical parameters (parameter group 15 and higher) are protected by a four-digit security access code, preventing unauthorised users from viewing or modifying parameter settings.

When a user attempts to enter a restricted parameter group, the keypad prompts for an access code. The access code is requested once for the programming session, and authorisation continues until the user closes the menu.

To enter the access code, use the ◀ and ▶ buttons to select a digit, and the ▲ and ▼ buttons to change the value. When all four digits match your access code, press STORE. The keypad will display an acknowledgement message before continuing.

```
Enter Access Code
      0###
```

STORE

```
 Access Allowed
   SUPERVISOR
```

To change the access code, use parameter 15A.

The simulation tools and counter resets are also protected by the security access code.

The default access code is 0000.

8.4 Quick Setup

The Quick Setup Menu makes it easy to configure the EMX3 for common applications. The EMX3 selects the parameters relevant to the application and suggests a typical setting, and you can adjust each parameter to suit your exact requirements.

Always set parameter 1A *Motor Full Load Current* to match the motor's nameplate full load current. The suggested value is the starter's minimum full load current.

On the display, the highlighted values are suggested values and the values indicated by a ➤ are the loaded values.

Application	Parameter	Suggested value
Pump Centrifugal	*Motor Full Load Current* *Start Mode* *Adaptive Start Profile* *Start Ramp Time* *Stop Mode* *Adaptive Stop Profile* *Stop Time*	Model dependent Adaptive Control Early Acceleration 10 seconds Adaptive Control Late Deceleration 15 seconds
Pump Submersible	*Motor Full Load Current* *Start Mode* *Adaptive Start Profile* *Start Ramp Time* *Stop Mode* *Adaptive Stop Profile* *Stop Time*	Model dependent Adaptive Control Early Acceleration 5 seconds Adaptive Control Late Deceleration 5 seconds
Fan Damped	*Motor Full Load Current* *Start Mode* *Current Limit*	Model dependent Constant Current 350%
Fan Undamped	*Motor Full Load Current* *Start Mode* *Adaptive Start Profile* *Start Ramp Time* *Excess Start Time* *Locked Rotor Time*	Model dependent Adaptive Control Constant Acceleration 20 seconds 30 seconds 20 Seconds
Compressor Screw	*Motor Full Load Current* *Start Mode* *Start Ramp Time* *Current Limit*	Model dependent Constant Current 5 seconds 400%
Compressor Recip	*Motor Full Load Current* *Start Mode* *Start Ramp Time* *Current Limit*	Model dependent Constant Current 5 seconds 450%
Conveyor	*Motor Full Load Current* *Start Mode* *Start Ramp Time* *Current Limit* *Stop Mode*	Model dependent Constant Current 5 seconds 400% Adaptive Control

	Adaptive Stop Profile *Stop Time*	Constant Deceleration 10 seconds
Crusher Rotary	*Motor Full Load Current* *Start Mode* *Start Ramp Time* *Current Limit* *Excess Start Time* *Locked Rotor Time*	Model dependent Constant Current 10 seconds 400% 30 seconds 20 seconds
Crusher Jaw	*Motor Full Load Current* *Start Mode* *Start Ramp Time* *Current Limit* *Excess Start Time* *Locked Rotor Time*	Model dependent Constant Current 10 seconds 450% 40 seconds 30 seconds

8.5 Standard Menu

The standard menu provides access to commonly used parameters, allowing the user to configure the EMX3 as required for the application. For details of individual parameters, refer to *Parameter Descriptions* on page 44.

		Parameter Group	Default Setting
1		Motor Data-1	
	1A	*Motor Full Load Current*	Model dependent
2		Start/Stop Modes-1	
	2A	*Start Mode*	Constant Current
	2B	*Start Ramp Time*	10 s
	2C	*Initial Current*	350%
	2D	*Current Limit*	350%
	2H	*Stop Mode*	Coast to Stop
	2I	*Stop Time*	0s
3		Auto-Start/Stop	
	3A	*Auto-Start Type*	Off
	3B	*Auto-Start Time*	1m
	3C	*Auto-Stop Type*	Off
	3D	*Auto-Stop Time*	1m
4		Protection Settings	
	4A	*Excess Start Time*	20s
	4C	*Undercurrent*	20%
	4D	*Undercurrent Delay*	5s
	4E	*Instantaneous Overcurrent*	400%
	4F	*Instantaneous Overcurrent Delay*	0s
	4G	*Phase Sequence*	Any sequence
6		Inputs	
	6A	*Input A Function*	Motor Set Select
	6B	*Input A Name*	Input Trip
	6C	*Input A Trip*	Always Active
	6D	*Input A Trip Delay*	0s
	6E	*Input A Initial Delay*	0s
	6F	*Input B Function*	Input Trip (N/O)
	6G	*Input B Name*	Input Trip
	6H	*Input B Trip*	Always Active
	6I	*Input B Trip Delay*	0s
	6J	*Input B Initial Delay*	0s
7		Outputs	
	7A	*Relay A Function*	Main Contactor
	7B	*Relay A On Delay*	0s
	7C	*Relay A Off Delay*	0s
	7D	*Relay B Function*	Run
	7E	*Relay B On Delay*	0s

	7F	*Relay B Off Delay*	0s
	7G	*Relay C Function*	Trip
	7H	*Relay C On Delay*	0s
	7I	*Relay C Off Delay*	0s
	7M	*Low Current Flag*	50%
	7N	*High Current Flag*	100%
	7O	*Motor Temperature Flag*	80%
8		Display	
	8A	*Language*	English
	8B	*F1 Button Action*	Auto-Start/Stop Menu
	8C	*F2 Button Action*	None
	8D	*Display A or kW*	Current
	8E	*User Screen - Top Left*	Starter State
	8F	*User Screen - Top Right*	Blank
	8G	*User Screen - Bottom Left*	Hours Run
	8H	*User Screen - Bottom Right*	Analog Input

8.6 Extended Menu

The extended menu gives access to all of the EMX3's programmable parameters.

		Parameter Group	Default Setting
1		Motor Data-1	
	1A	*Motor Full Load Current*	Model dependent
	1B	*Locked Rotor Time*	0m:10s
	1C	*Locked Rotor Current*	600%
	1D	*Motor Service Factor*	105%
2		Start/Stop Modes-1	
	2A	*Start Mode*	Constant Current
	2B	*Start Ramp Time*	10 s
	2C	*Initial Current*	350%
	2D	*Current Limit*	350%
	2E	*Adaptive Start Profile*	Constant Acceleration
	2F	*Kickstart Time*	0000ms
	2G	*Kickstart Level*	500%
	2H	*Stop Mode*	Coast To Stop
	2I	*Stop Time*	0m:00s
	2J	*Adaptive Stop Profile*	Constant Deceleration
	2K	*Adaptive Control Gain*	75%
	2L	*Brake Torque*	20%
	2M	*Brake Time*	0m:01s
3		Auto-Start/Stop	
	3A	*Auto-Start Type*	Off
	3B	*Auto-Start Time*	00h:01m
	3C	*Auto-Stop Type*	Off
	3D	*Auto-Stop Time*	00h:01m
4		Protection Settings	
	4A	*Excess Start Time*	0m:20s
	4B	*Excess Start Time-2*	0m:20s
	4C	*Undercurrent*	20%
	4D	*Undercurrent Delay*	0m:05s
	4E	*Instantaneous Overcurrent*	400%
	4F	*Instantaneous Overcurrent Delay*	0m:00s
	4G	*Phase Sequence*	Any sequence
	4H	*Current Imbalance*	30%
	4I	*Current Imbalance Delay*	0m:03s
	4J	*Frequency Check*	Start/Run
	4K	*Frequency Variation*	± 5Hz

	4L	*Frequency Delay*	0m:01s
	4M	*Restart Delay*	10s
	4N	*Motor Temperature Check*	Do Not Check
	4O	*Ground Fault Level*	100 mA
	4P	*Ground Fault Delay*	0m:03s
	4Q	*Reserved*	-
	4R	*Reserved*	-
	4S	*Reserved*	-
	4T	*Reserved*	-
5		Auto-Reset Trips	
	5A	*Auto-Reset Action*	Do Not Auto-Reset
	5B	*Maximum Resets*	1
	5C	*Reset Delay Groups A&B*	00m:05s
	5D	*Reset Delay Group C*	05 m
6		Inputs	
	6A	*Input A Function*	Motor Set Select
	6B	*Input A Name*	Input Trip
	6C	*Input A Trip*	Always Active
	6D	*Input A Trip Delay*	0m:00s
	6E	*Input A Initial Delay*	0m:00s
	6F	*Input B Function*	Input Trip (N/O)
	6G	*Input B Name*	Input Trip
	6H	*Input B Trip*	Always Active
	6I	*Input B Trip Delay*	0m:00s
	6J	*Input B Initial Delay*	00m:00s
	6K	*Input C Function*	Off
	6L	*Input D Function*	Off
	6M	*Remote Reset Logic*	Normally Closed
	6N	*Analog Input Trip*	Do Not Trip
	6O	*Analog Input Scale*	2-10 V
	6P	*Analog Trip Point*	50%
	6Q	*Local/Remote*	LCL/RMT Anytime
	6R	*Comms in Remote*	Enable Cntrl in RMT
7		Outputs	
	7A	*Relay A Function*	Main Contactor
	7B	*Relay A On Delay*	0m:00s
	7C	*Relay A Off Delay*	0m:00s
	7D	*Relay B Function*	Run
	7E	*Relay B On Delay*	0m:00s
	7F	*Relay B Off Delay*	0m:00s
	7G	*Relay C Function*	Trip
	7H	*Relay C On Delay*	0m:00s
	7I	*Relay C Off Delay*	0m:00s
	7J	*Relay D Function*	Off
	7K	*Relay E Function*	Off
	7L	*Relay F Function*	Off
	7M	*Low Current Flag*	50%
	7N	*High Current Flag*	100%
	7O	*Motor Temperature Flag*	80%
	7P	*Analog Output A*	Current (% FLC)
	7Q	*Analog A Scale*	4-20 mA
	7R	*Analog A Maximum Adjustment*	100%
	7S	*Analog A Minimum Adjustment*	000%
	7T	*Analog Output B*	Current (% FLC)
	7U	*Analog B Scale*	4-20 mA
	7V	*Analog B Maximum Adjustment*	100%
	7W	*Analog B Minimum Adjustment*	000%

8		Display	
	8A	*Language*	English
	8B	*F1 Button Action*	Auto-Start/Stop Menu
	8C	*F2 Button Action*	None
	8D	*Display A or kW*	Current
	8E	*User Screen - Top Left*	Starter State
	8F	*User Screen - Top Right*	Blank
	8G	*User Screen - Bottom Left*	Hours Run
	8H	*User Screen - Bottom Right*	Analog Input
	8I	*Graph Data*	Current (% FLC)
	8J	*Graph Timebase*	10 seconds
	8K	*Graph Maximum Adjustment*	400%
	8L	*Graph Minimum Adjustment*	000%
	8M	*Current Calibration*	100%
	8N	*Mains Reference Voltage*	400 V
	8O	*Voltage Calibration*	100%
9		Motor Data-2	
	9A	*Dual Thermal Model*	Single
	9B	*Motor FLC-2*	Model Dependent
	9C	*Locked Rotor Time-2*	0m:10s
	9D	*Locked Rotor Current-2*	600%
	9E	*Motor Service Factor-2*	105%
10		Start/Stop Modes-2	
	10A	*Start Mode-2*	Constant Current
	10B	*Start Ramp-2*	0m:10s
	10C	*Initial Current-2*	350%
	10D	*Current Limit-2*	350%
	10E	*Adaptive Start Profile-2*	Constant Acceleration
	10F	*Kickstart Time-2*	0000 ms
	10G	*Kickstart Level-2*	500%
	10H	*Stop Mode-2*	Coast To Stop
	10I	*Stop Time-2*	0m:00s
	10J	*Adaptive Stop Profile-2*	Constant Deceleration
	10K	*Adaptive Control Gain-2*	75%
	10L	*Brake Torque-2*	20%
	10M	*Brake Time-2*	0m:01s
11		RTD Temperatures	
	11A	*RTD/PT100 A °C*	50 °C (122 °F)
	11B	*RTD/PT100 B °C*	50 °C (122 °F)
	11C	*RTD/PT100 C °C*	50 °C (122 °F)
	11D	*RTD/PT100 D °C*	50 °C (122 °F)
	11E	*RTD/PT100 E °C*	50 °C (122 °F)
	11F	*RTD/PT100 F °C*	50 °C (122 °F)
	11G	*RTD/PT100 G °C*	50 °C (122 °F)
12		Slip-Ring Motors	
	12A	*Motor Data-1 Ramp*	Single Ramp
	12B	*Motor Data-2 Ramp*	Single Ramp
	12C	*Changeover Time*	150 ms
	12D	*Slip Ring Retard*	50%
15		Advanced (Requires Access Code. Default: 0000)	
	15A	*Access Code*	0000
	15B	*Adjustment Lock*	Read & Write
	15C	*Emergency Run*	Disable
	15D	*Shorted SCR Action*	3-Phase Control Only
	15E	*Jog Torque*	50%

16		Protection Action	
	16A	*Motor Overload*	Trip Starter
	16B	*Excess Start Time*	Trip Starter
	16C	*Undercurrent*	Trip Starter
	16D	*Instantaneous Overcurrent*	Trip Starter
	16E	*Current Imbalance*	Trip Starter
	16F	*Frequency*	Trip Starter
	16G	*Input A Trip*	Trip Starter
	16H	*Input B Trip*	Trip Starter
	16I	*Motor Thermistor*	Trip Starter
	16J	*Starter Communication*	Trip Starter
	16K	*Network Communication*	Trip Starter
	16L	*Heatsink Overtemperature*	Trip Starter
	16M	*Battery/Clock*	Trip Starter
	16N	*Ground Fault*	Trip Starter
	16O	*RTD/PT100 A*	Trip Starter
	16P	*RTD/PT100 B*	Trip Starter
	16Q	*RTD/PT100 C*	Trip Starter
	16R	*RTD/PT100 D*	Trip Starter
	16S	*RTD/PT100 E*	Trip Starter
	16T	*RTD/PT100 F*	Trip Starter
	16U	*RTD/PT100 G*	Trip Starter
	16V	*Reserved*	-
	16W	*Reserved*	-
	16X	*Low Control Volts*	Trip Starter
20		Restricted	
		Factory Use Only	

8.7 Load/Save Settings

The Load/Save Settings menu requires an access code and allows users to:

- Load the EMX3's parameters with default values
- Reload previously saved parameter settings from an internal file
- Save the current parameter settings to an internal file

In addition to the factory default values file, the EMX3 can store two user-defined parameter files. These files contain default values until a user file is saved.

To load or save parameter settings:

1. Open the Programming Menu.
2. Scroll to Load/Save Settings and press the ▶ button.
3. Scroll to the required function and press the ▶ button.

Load/Save Settings
Load Defaults
Load Backup
Load User Set 1

4. At the confirmation prompt, select YES to confirm or NO to cancel and then STORE to load/save the selection.

Load Defaults
No
Yes

When the action has been completed, the screen will briefly display a confirmation message, then return to the status screens.

NOTE
The saved files and current operating settings are stored in both the keypad and in the soft starter. The keypad will prompt you to synchronise the settings whenever it is plugged into a new EMX3.

8.8 Parameter Descriptions

1 Motor Data-1

The parameters in Motor Data-1 configure the soft starter to match the connected motor. These parameters describe the motor's operating characteristics and allow the soft starter to model the motor's temperature.

1A – Motor FLC

Range: Model dependent

Description: Matches the starter to the connected motor's full load current. Set to the full load current (FLC) rating shown on the motor nameplate.

1B – Locked Rotor Time

Range: 0:01 - 2:00 (minutes:seconds) **Default:** 10 seconds

Description: Sets the maximum length of time the motor can sustain locked rotor current from cold before reaching its maximum temperature. Set according to the motor datasheet.

1C – Locked Rotor Current

Range: 400% - 1200% FLC **Default:** 600%

Description: Sets the locked rotor current of the connected motor, as a percentage of full load current. Set according to the motor datasheet.

1D – Motor Service Factor

Range: 100% - 130% **Default:** 105%

Description: Sets the motor service factor used by the thermal model. If the motor runs at full load current, it will reach 100%. Set according to the motor datasheet.

2 Start/Stop Modes-1

2A – Start Mode

Options: CONSTANT CURRENT (Default)
ADAPTIVE CONTROL

Description: Selects the soft start mode.

2B – Start Ramp Time

Range: 1 - 180 (seconds) **Default:** 10 seconds

Description: Sets the total start time for an Adaptive Control start or the ramp time for current ramp starting (from the initial current to the current limit).

2C – Initial Current

Range: 100% - 600% FLC **Default:** 350%

Description: Sets the initial start current level for current ramp starting, as a percentage of motor full load current. Set so that the motor begins to accelerate immediately after a start is initiated.
If current ramp starting is not required, set the initial current equal to the current limit.

2D – Current Limit

Range: 100% - 600% FLC **Default:** 350%

Description: Sets the current limit for constant current and current ramp soft starting, as a percentage of motor full load current.

2E Adaptive Start Profile

Options: EARLY ACCELERATION
CONSTANT ACCELERATION (Default)
LATE ACCELERATION

Description: Selects which profile the EMX3 will use for an Adaptive Control soft start.

2F, 2G – Kickstart

Parameter 2F *Kickstart Time*

Range: 0 – 2000 milliseconds **Default:** 0000 milliseconds
Description: Sets the kickstart duration. A setting of 0 disables kickstart.

Parameter 2G *Kickstart Level*

Range: 100% - 700% FLC **Default:** 500%
Description: Sets the level of the kickstart current.

CAUTION
Kickstart subjects the mechanical equipment to increased torque levels. Ensure the motor, load and couplings can handle the additional torque before using this feature.

2H – Stop Mode

Options: COAST TO STOP (Default)
TVR SOFT STOP
ADAPTIVE CONTROL
BRAKE
Description: Selects the stop mode.

2I – Stop Time

Range: 0:00 - 4:00 (minutes:seconds) **Default:** 0 seconds
Description: Sets the time for soft stopping the motor using timed voltage ramp or Adaptive Control. This also sets the total stopping time when using brake.
If a main contactor is installed, the contactor must remain closed until the end of the stop time. Use one of the programmable relays to control the main contactor.

2J – Adaptive Stop Profile

Options: EARLY DECELERATION
CONSTANT DECELERATION (Default)
LATE DECELERATION
Description: Selects which profile the EMX3 will use for an Adaptive Control soft stop.

2K – Adaptive Control Gain

Range: 1% - 200% **Default:** 75%
Description: Adjusts the performance of Adaptive Control. This setting affects both starting and stopping control.

NOTE
We recommend leaving the gain setting at the default level unless performance is not satisfactory.
If the motor accelerates or decelerates too quickly at the end of a start or stop, increase the gain setting by 5%~10%. If the motor speed fluctuates during starting or stopping, decrease the gain setting slightly.

2L, 2M – Brake

Brake uses DC injection to actively slow the motor.

Parameter 2L *Brake Torque*

Range: 20% - 100% **Default:** 20%
Description: Sets the amount of brake torque the EMX3 will use to slow the motor.

Parameter 2M *Brake Time*

Range: 1 - 30 (seconds) **Default:** 1 second
Description: Sets the duration for DC injection during a braking stop.

NOTE
Parameter 2M is used in conjunction with parameter 2I. Refer to *Brake* on page 35 for details.

3 Auto-Start/Stop

The EMX3 can be programmed to start and stop automatically, after a specified delay or at a specified time of day. Auto-start and auto-stop can be set separately.

CAUTION
The auto-start timer overrides any other form of control. The motor may start without warning.

WARNING
This function should not be used in conjunction with remote two-wire control.
The soft starter will still accept start and stop commands from the remote inputs or serial communication network. To disable local or remote control, use parameter 6Q.
If auto-start is enabled and the user is in the menu system, auto-start will become active if the menu times out (if no keypad activity is detected for five minutes).

3A, 3B – Auto-Start

Parameter 3A *Auto-Start Type*

Options:	Off (Default)	The soft starter will not auto-start.
	Timer	The soft starter will auto-start after a delay from the next stop, as specified in parameter 3B.
	Clock	The soft starter will auto-start at the time programmed in parameter 3B.

Description: Selects whether the soft starter will auto-start after a specified delay, or at a time of day.

Parameter 3B *Auto-Start Time*

Range: 00:01 - 24:00 (hours:minutes) Default: 1 minute
Description: Sets the time for the soft starter to auto-start, in 24 hour clock format.

3C, 3D – Auto-Stop

Parameter 3C *Auto-Stop Type*

Options:	Off (Default)	The soft starter will not auto-stop.
	Timer	The soft starter will auto-stop after a delay from the next start, as specified in parameter 3D.
	Clock	The soft starter will auto-stop at the time programmed in parameter 3D.

Description: Selects whether the soft starter will auto-stop after a specified delay, or at a time of day.

Parameter 3D *Auto-Stop Time*

Range: 00:01 - 24:00 (hours:minutes) Default: 1 minute
Description: Sets the time for the soft starter to auto-stop, in 24 hour clock format.

4 Protection Settings

These parameters determine when the soft starter's protection mechanisms will activate. The activation point for each protection mechanism can be set to suit the installation.

The soft starter responds to protection events by tripping, warning, or writing the event to the event log. The response is determined by the Protection Action settings (parameter group 16). The default response is a trip.

CAUTION
The protection settings are vital for safe operation of the soft starter and motor. Defeating the protection may compromise the installation and should only be done in the case of emergency.

4A, 4B – Excess Start Time

Excess start time is the maximum time the EMX3 will attempt to start the motor. If the motor does not transition to Run mode within the programmed limit, the starter will trip. Set for a period slightly longer than required for a normal healthy start. A setting of 0 disables excess start time protection.

Range: 0:00 - 4:00 (minutes:seconds) Default: 20 seconds
Description: Parameter 4A sets the time for the primary motor and parameter 4B (*Excess Start Time-2*) sets the time for the secondary motor.

4C, 4D – Undercurrent

The EMX3 can be configured to trip if the average current of all three phases drops below a specified level while the motor is running.

Parameter 4C *Undercurrent*

Range: 0% - 100% **Default:** 20%

Description: Sets the trip point for undercurrent protection, as a percentage of motor full load current. Set to a level between the motor's normal working range and the motor's magnetising (no load) current (typically 25% to 35% of full load current). A setting of 0% disables undercurrent protection.

Parameter 4D *Undercurrent Delay*

Range: 0:00 - 4:00 (minutes:seconds) **Default:** 5 seconds

Description: Slows the EMX3's response to undercurrent, avoiding trips due to momentary fluctuations.

4E, 4F – Instantaneous Overcurrent

The EMX3 can be configured to trip if the average current of all three phases exceeds a specified level while the motor is running.

Parameter 4E *Instantaneous Overcurrent*

Range: 80% - 600% FLC **Default:** 400%

Description: Sets the trip point for instantaneous overcurrent protection, as a percentage of motor full load current.

Parameter 4F *Instantaneous Overcurrent Delay*

Range: 0:00 - 1:00 (minutes:seconds) **Default:** 0 seconds

Description: Slows the EMX3's response to overcurrent, avoiding trips due to momentary overcurrent events.

4G – Phase Sequence

Range: Any sequence (Default)
Positive only
Negative only

Description: Selects which phase sequences the soft starter will allow at a start. During its pre-start checks, the starter examines the sequence of the phases at its input terminals and trips if the actual sequence does not match the selected option.

4H, 4I – Current Imbalance

The EMX3 can be configured to trip if the currents on the three phases vary from each other by more than a specified amount. The imbalance is calculated as the difference between the highest and lowest currents on all three phases, as a percentage of the highest current.

Current imbalance detection is desensitised by 50% during starting and soft stopping.

Parameter 4H *Current Imbalance*

Range: 10% - 50% **Default:** 30%

Description: Sets the trip point for current imbalance protection.

Parameter 4I *Current Imbalance Delay*

Range: 0:00 - 4:00 (minutes:seconds) **Default:** 3 seconds

Description: Slows the EMX3's response to current imbalance, avoiding trips due to momentary fluctuations.

4J, 4K, 4L – Frequency Trip

The EMX3 monitors mains frequency throughout operation, and can be configured to trip if the frequency varies beyond a specified tolerance.

Parameter 4J *Frequency Check*

Range: Do Not Check
Start Only
Start/Run (Default)
Run Only

Description: Determines when and if the starter will monitor for a frequency trip.

Parameter 4K *Frequency Variation*

Range: ± 2 Hz
± 5 Hz (Default)
± 10 Hz
± 15 Hz

Description: Selects the soft starter's tolerance for frequency variation.

Parameter 4L *Frequency Delay*

Range: 0:01 - 4:00 (minutes:seconds) **Default:** 1 second

Description: Slows the EMX3's response to frequency disturbances, avoiding trips due to momentary fluctuations.

NOTE
If the mains frequency drops below 35 Hz or rises above 75 Hz, the starter will trip immediately.

CAUTION
Running a motor outside its specified frequency for long periods can cause damage and premature failure.

4M – Restart Delay

Range: 00:01 - 60:00 (minutes:seconds) **Default:** 10 seconds

Description: The EMX3 can be configured to force a delay between the end of a stop and the beginning of the next start. During the restart delay period, the display shows the time remaining before another start can be attempted.

NOTE
The restart delay is measured from the end of each stop. Changes to the restart delay setting take effect after the next stop.

4N – Motor Temp Check

Range: Do Not Check (Default)
Check

Description: Selects whether the EMX3 will verify the motor has sufficient thermal capacity for a successful start. The soft starter compares the motor's calculated temperature with the temperature rise from the last motor start and only operates if the motor is cool enough to start successfully.

4O, 4P – Ground Fault Level

The EMX3 can be configured to trip if ground fault exceeds a specified level while the motor is running. Ground fault is a dynamic trip based on phase current measurements every half-cycle.

Parameter 4O *Ground Fault Level*

Range: 20 mA - 50 A (21 steps) **Default:** 100mA

Description: Sets the trip point for ground fault protection.

Parameter 4P *Ground Fault Delay*

Range: 0:01 - 4:00 (minutes:seconds) **Default:** 3 seconds

Description: Slows the EMX3's response to ground fault variation, avoiding trips due to momentary fluctuations.

NOTE
Ground fault protection is only available if the RTD/PT100 and ground fault protection card is fitted.

4Q, 4R – Reserved

This parameter is reserved for internal use.

4S, 4T – Reserved

This parameter is reserved for internal use.

5 Auto-Reset Trips

The EMX3 can be programmed to automatically reset certain trips, which can help minimise operating downtime. Trips are divided into three categories for auto-reset, depending on the risk to the soft starter:

Group	Trips
A	Current Imbalance Phase loss Power loss Frequency
B	Undercurrent Instantaneous overcurrent Input A trip Input B trip
C	Motor overload RTD/PT100 temperature trips Motor thermistor Heatsink overtemperature

Other trips cannot be automatically reset.

This function is ideal for remote installations using 2-wire control in Remote mode. If the 2-wire start signal is present after an auto-reset, the EMX3 will restart.

5A – Auto-Reset Action

Options: DO NOT AUTO-RESET (Default)
RESET GROUP A
RESET GROUP A & B
RESET GROUP A, B & C

Description: Selects which trips can be auto-reset.

5B – Maximum Resets

Range: 1 - 5 **Default:** 1

Description: Sets how many times the soft starter will auto-reset, if it continues to trip. The reset counter increases by one each time the soft starter auto-resets, and decreases by one after each successful start/stop cycle.

5C, 5D – Auto-Reset Delay

The EMX3 can be configured to wait before auto-resetting a trip. Separate delays can be set for trips in Groups A and B, or in Group C.

<u>Parameter 5C</u> *Reset Delay Groups A&B*

Range: 00:05 - 15:00 (minutes:seconds) **Default:** 5 seconds

Description: Sets the delay before resetting Group A and Group B trips.

<u>Parameter 5D</u> *Reset Delay Group C*

Range: 5 - 60 (minutes) **Default:** 5 minutes

Description: Sets the delay before resetting Group C trips.

6 Inputs

The EMX3 has two programmable inputs, which allow remote control of the soft starter. If required, two extra inputs are available on the input/output expansion card.

6A – Input A Function

Options:

MOTOR SET SELECT (Default): The EMX3 can be configured with two separate sets of motor data.
To use the secondary motor data, parameter 6A must be set to Motor Set Select and C53, C54 must be closed when a start command is given. The EMX3 checks which motor data to use at a start, and will use that motor data for the entire start/stop cycle.

INPUT TRIP (N/O): Input A can be used to trip the soft starter. When parameter 6A is set to Input Trip (N/O), a closed circuit across C53, C54 trips the soft starter.

INPUT TRIP (N/C)	When parameter 6A is set to Input Trip (N/C), an open circuit across C53, C54 trips the soft starter.
LOCAL/REMOTE SELECT	Input A can be used to select between local and remote control, instead of using the **LCL/RMT** button on the keypad. When the input is open, the starter is in local mode and can be controlled via the keypad. When the input is closed, the starter is in remote mode. The **START** and **LCL/RMT** buttons are disabled, and the soft starter will ignore any Local/Remote select command from the serial communications network. To use Input A to select between local and remote control, parameter 6Q must be set to LCL/RMT Anytime or LCL/RMT when Off.
EMERGENCY RUN	In emergency run the soft starter continues to run until stopped, ignoring all trips and warnings (refer to parameter 15C for details). Closing the circuit across C53, C54 activates emergency run. Opening the circuit ends emergency run and the EMX3 stops the motor.
EMERGENCY STOP	The EMX3 can be commanded to emergency stop the motor, ignoring the soft stop mode set in parameter 2H. When the circuit across C53, C54 is opened, the soft starter allows the motor to coast to stop.
JOG FORWARD	Activates jog operation in a forward direction (will operate only in Remote mode).
JOG REVERSE	Activates jog operation in reverse direction (will operate only in Remote mode).

Description: Selects the function of Input A.

6B – Input A Name

Options:

INPUT TRIP (Default)
LOW PRESSURE
HIGH PRESSURE
PUMP FAULT
LOW LEVEL
HIGH LEVEL
NO FLOW
EMERGENCY STOP
CONTROLLER
PLC
VIBRATION ALARM

Description: Selects a message for the keypad to display when Input A is active.

6C, 6D, 6E – Input A Trip

Parameter 6C *Input A Trip*

Options:

ALWAYS ACTIVE (Default)	A trip can occur at any time when the soft starter is receiving power.
OPERATING ONLY	A trip can occur while the soft starter is running, stopping or starting.
RUN ONLY	A trip can only occur while the soft starter is running.

Description: Selects when an input trip can occur.

Parameter 6D *Input A Trip Delay*

Range: 0:00 - 4:00 (minutes:seconds) **Default:** 0 seconds
Description: Sets a delay between the input activating and the soft starter tripping.

Parameter 6E*Input A Initial Delay*

Range: 00:00 - 30:00 (minutes:seconds) **Default:** 0 seconds
Description: Sets a delay before an input trip can occur. The initial delay is counted from the time a start signal is received. The state of the input is ignored until the initial delay has elapsed.

6F, 6G, 6H, 6I, 6J – Input B Trip

Parameters 6F~6J configure the operation of Input B, in the same way as parameters 6A~6E configure Input A. Refer to Input A for details.

- 6F *Input B Function* (Default: Input Trip N/O)
- 6G *Input B Name* (Default: Input Trip)
- 6H *Input B Trip* (Default: Always Active)
- 6I *Input B Trip Delay* (Default: 0:00)

- 6J *Input B Initial Delay* (Default: 0:00)

6K, 6L – Inputs C and D

Parameters 6K and 6L select the function of Inputs C and D. Refer to parameter 6A for details.

Inputs C and D are only available if the input/output expansion card has been installed.

Options: MOTOR SET SELECT
LOCAL/REMOTE SELECT
EMERGENCY RUN
EMERGENCY STOP (N/C)
OFF (Default)

6M – Remote Reset Logic

Options: NORMALLY CLOSED (Default)
NORMALLY OPEN

Description: Selects whether the EMX3's remote reset input (terminals C41, C42) is normally open or normally closed.

6N, 6O, 6P – Analog Input

An analog input can be fitted to the EMX3 if required. An external device can activate the analog input to trip the soft starter in response to external conditions.

Parameter 6N *Analog Input Trip*

Options: DO NOT TRIP (Default)
TRIP HIGH
TRIP LOW

Description: Selects the soft starter's response to the analog input signal.

Parameter 6O *Analog Input Scale*

Options: 0-10 V (Default)
2-10 V

Description: Selects the scale of the analog input.

Parameter 6P *Analog Trip Point*

Range: 0% - 100% **Default:** 50%

Description: Sets the signal level at which an analog input trip will occur, as a percentage of the maximum signal on the input.

6Q – Local/Remote

Options:		
	LCL/RMT ANYTIME (Default)	**LCL/RMT** button is always enabled.
	LCL/RMT WHEN OFF	**LCL/RMT** button is enabled when the starter is off.
	LOCAL CONTROL ONLY	All remote inputs are disabled.
	REMOTE CONTROL ONLY	Local control buttons (**START**, **RESET**, **LCL/RMT**) are disabled.

Description: Selects when the **LCL/RMT** button can be used to switch between local and remote control, and enables or disables the local control buttons and remote control inputs. The **STOP** button on the keypad is always enabled.

CAUTION
The **STOP** button on the keypad is always enabled. When using two-wire remote control, the soft starter will restart if the remote start/stop and reset inputs are still active.

6R – Comms in Remote

Options: DISABLE CTRL IN RMT
ENABLE CTRL IN RMT (Default)

Description: Selects whether the starter will accept Start and Stop commands from the serial communication network when in Remote mode. The Reset, Force Comms Trip and Local/Remote Control commands are always enabled.

7 Outputs

The EMX3 has three programmable outputs, which can be used to signal different operating conditions to associated equipment. Three additional outputs are available on the input/output expansion card.

7A – Relay A Function

Options:	OFF	Relay A is not used.
	MAIN CONTACTOR (Default)	The relay closes when the EMX3 receives a start command, and remains closed as long as the motor is receiving voltage.
	RUN	The relay closes when the starter changes to run state.
	TRIP	The relay closes when the starter trips (refer to parameter 16A to 16W).
	WARNING	The relay closes when the starter issues a warning (refer to parameter 16A to 16W).
	LOW CURRENT FLAG	The relay closes when the low current flag activates (refer to parameter 7M *Low Current Flag*, while the motor is running).
	HIGH CURRENT FLAG	The relay closes when the high current flag activates (refer to parameter 7N *High Current Flag*, while the motor is running).
	MOTOR TEMP FLAG	The relay closes when the motor temperature flag activates (refer to parameter 7O *Motor Temperature Flag*).
	INPUT A TRIP	The relay closes when Input A activates to trip the soft starter.
	INPUT B TRIP	The relay closes when Input B activates to trip the soft starter.
	MOTOR OVERLOAD	The relay closes when the starter trips on Motor Overload.
	CURRENT IMBALANCE	The relay closes when the starter trips on Current Imbalance.
	UNDERCURRENT	The relay closes when the starter trips on Undercurrent.
	INST OVERCURRENT	The relay closes when the starter trips on Instantaneous Overcurrent.
	FREQUENCY	The relay closes when the starter trips on Frequency.
	GROUND FAULT	The relay closes when the starter trips on Ground Fault.
	HEATSINK OVERTEMP	The relay closes when the starter trips on Heatsink Overtemperature.
	PHASE LOSS	The relay closes when the starter trips on Phase Loss.
	MOTOR THERMISTOR	The relay closes when the starter trips on Motor Thermistor.
	CHANGEOVER CONTACTOR	The relay closes when the high rotor resistance current ramp has reached full voltage, allowing use with a slip-ring motor.

Description: Selects the function of Relay A (normally open).

7B, 7C – Relay A Delays

The EMX3 can be configured to wait before opening or closing Relay A.

<u>Parameter 7B</u> *Relay A On Delay*

Range: 0:00 - 5:00 (minutes:seconds) **Default:** 0 seconds
Description: Sets the delay for closing Relay A.

<u>Parameter 7C</u> *Relay A Off Delay*

Range: 0:00 - 5:00 (minutes:seconds) **Default:** 0 seconds
Description: Sets the delay for re-opening Relay A.

7D~7L – Output Relays B, C, D, E, F

Parameters 7D~7L configure the operation of Relays B, C, D, E and F in the same way as parameters 7A~7C configure Relay A. Refer to Relay A for details.

Relay B is a changeover relay.

- 7D *Relay B Function* **Default:** Run
- 7E *Relay B On Delay*
- 7F *Relay B Off Delay*

Relay C is a changeover relay.

- 7G *Relay C Function* **Default:** Trip
- 7H *Relay C On Delay*
- 7I *Relay C Off Delay*

Relays D, E and F are only available if the input/output expansion card has been installed. These relays do not support on or off delays and do not support 'Changeover Contactor' function. Relay D is normally closed, relays E and F are normally open.

- 7J *Relay D Function* **Default:** Off
- 7K *Relay E Function* **Default:** Off
- 7L *Relay F Function* **Default:** Off

7M, 7N – Low Current Flag and High Current Flag

The EMX3 has low and high current flags to give early warning of abnormal operation. The current flags can be configured to indicate an abnormal current level during operation, between the normal operating level and the undercurrent or instantaneous overcurrent trip levels. The flags can signal the situation to external equipment via one of the programmable outputs. The flags clear when the current returns within the normal operating range by 10% of the programmed motor full load current.

<u>Parameter 7M</u> *Low Current Flag*

Range: 1% - 100% FLC **Default:** 50%

Description: Sets the level at which the low current flag operates, as a percentage of motor full load current.

<u>Parameter 7N</u> *High Current Flag*

Range: 50% - 600% FLC **Default:** 100%

Description: Sets the level at which the high current flag operates, as a percentage of motor full load current.

7O – Motor Temperature Flag

The EMX3 has a motor temperature flag to give early warning of abnormal operation. The flag can indicate that the motor is operating above its normal operating temperature but lower than the overload limit. The flag can signal the situation to external equipment via one of the programmable outputs.

Range: 0% - 160% **Default:** 80%

Description: Sets the level at which the motor temperature flag operates, as a percentage of the motor's thermal capacity.

7P, 7Q, 7R, 7S – Analog Output A

The EMX3 has an analog output, which can be connected to associated equipment to monitor motor performance. If required, a second analog output and an analog input are available on the input/output expansion card.

<u>Parameter 7P</u> *Analog Output A*

Options:

CURRENT (% FLC) (Default)	Current as a percentage of motor full load current.
MOTOR TEMP (%)	Motor temperature as a percentage of the motor service factor (calculated by the soft starter's thermal model).
MOTOR kW (%)	Motor kilowatts. 100% is motor FLC (parameter 1A) multiplied by line voltage (reference voltage parameter 8N). Power factor is assumed to be 1.0. $\frac{\sqrt{3} . V . I_{FLC} . pf}{1000}$
MOTOR kVA (%)	Motor kilovolt amperes. 100% is motor FLC (parameter 1A) multiplied by line voltage (reference voltage parameter 8N). $\frac{\sqrt{3} . V . I_{FLC}}{1000}$
MOTOR PF	Motor power factor, measured by the soft starter.

Description: Selects which information will be reported via analog output A.

Parameter 7Q *Analog A Scale*

Options: 0-20 mA
4-20 mA (Default)

Description: Selects the range of the analog output.

Parameter 7R *Analog A Maximum Adjustment*

Range: 0% - 600% **Default:** 100%

Description: Calibrates the upper limit of the analog output to match the signal measured on an external current measuring device.

Parameter 7S *Analog A Minimum Adjustment*

Range: 0% - 600% **Default:** 0%

Description: Calibrates the lower limit of the analog output to match the signal measured on an external current measuring device.

7T, 7U, 7V, 7W – Analog Output B

Parameters 7T~7W configure the operation of analog output B, in the same way as parameters 7P~7S configure analog output A. Refer to analog output A for details.

Output B is only available if the input/output expansion card has been installed.

8 Display

These parameters allow the keypad to be tailored to individual users' requirements.

8A – Language

Options: English (Default)
Chinese
Español
Deutsch

Description: Selects which language the keypad will use to display messages and feedback.

8B, 8C – F1 and F2 Button Action

Options: None
Auto-Start/Stop Menu
Jog Forward
Jog Reverse

Description: Selects the function of the **F1** and **F2** buttons on the keypad.

NOTE
The access code is not required to use the F1 and F2 buttons. Users can access these functions regardless of the setting of parameter 15B *Adjustment Lock*.

8D – Display A or kW

Options: Current (Default)
Motor kW

Description: Selects whether the EMX3 will display current (amperes) or motor kilowatts on the main monitoring screen.

8E, 8F, 8G, 8H – User-Programmable Screen

Options:	Blank	Displays no data in the selected area, allowing long messages to be shown without overlapping.
	Starter State (Default)	The starter's operating state (starting, running, stopping or tripped). Only available for top left and bottom left positions on the screen.
	Motor Current	The average current measured on three phases.
	Motor pf	The motor's power factor, measured by the soft starter.
	Mains Frequency	The average frequency measured on three phases.
	Motor kW	The motor's running power in kilowatts.
	Motor HP	The motor's running power in horsepower.
	Motor Temp	The motor's temperature, calculated by the thermal model.

KWH	The number of kilowatt hours the motor has run via the soft starter.
HOURS RUN	The number of hours the motor has run via the soft starter.
ANALOG INPUT	The level of analog input A (refer to parameters 6N~6P). This setting is only available if the input/output expansion option is installed.

Description: Selects which information will be displayed on the programmable monitoring screen.

- 8E *User Screen - Top Left* **Default:** Starter State
- 8F *User Screen - Top Right* **Default:** Blank
- 8G *User Screen - Bottom Left* **Default:** Hours Run
- 8H *User Screen - Bottom Right* **Default:** Analog Input

8I, 8J, 8K, 8L – Performance Graphs

The EMX3 has a real-time performance graph to report the behaviour of critical operating parameters.

Parameter 8I *Graph Data*

Options:

CURRENT (% FLC) (Default)	Current as a percentage of motor full load current.
MOTOR TEMP (%)	Motor temperature as a percentage of the motor service factor (calculated by the soft starter's thermal model).
MOTOR KW (%)	Motor kilowatts. 100% is motor FLC (parameter 1A) multiplied by line voltage (reference voltage parameter 8N). Power factor is assumed to be 1.0. $\frac{\sqrt{3} \cdot V \cdot I_{FLC} \cdot pf}{1000}$
MOTOR KVA (%)	Motor kilovolt amperes. 100% is motor FLC (parameter 1A) multiplied by line voltage (reference voltage parameter 8N). $\frac{\sqrt{3} \cdot V \cdot I_{FLC}}{1000}$
MOTOR PF	Motor power factor, measured by the soft starter.

Description: Selects which information the graph will display.

Parameter 8J *Graph Timebase*

Options:
10 SECONDS (Default)
30 SECONDS
1 MINUTE
5 MINUTES
10 MINUTES
30 MINUTES
1 HOUR

Description: Sets the graph time scale. The graph will progressively replace the old data with new data.

Parameter 8K *Graph Maximum Adjustment*

Range: 0% – 600% **Default:** 400%

Description: Adjusts the upper limit of the performance graph.

Parameter 8L *Graph Minimum Adjustment*

Range: 0% – 600% **Default:** 0%

Description: Adjusts the lower limit of the performance graph.

8M – Current Calibration

Range: 85% - 115% **Default:** 100%

Description: Calibrates the soft starter's current monitoring circuits to match an external current metering device.
Use the following formula to determine the necessary adjustment:

$$\text{Calibration (\%)} = \frac{\text{Current shown on EMX3 display}}{\text{Current measured by external device}}$$

$$\text{eg } 102\% = \frac{66A}{65A}$$

NOTE
This adjustment affects all current-based functions and protections.

8N – Mains Reference Voltage

Range: 100 – 690 V **Default:** 400 V

Description: Sets the nominal mains voltage for the keypad's monitoring functions. This is used to calculate motor kilowatts and kilovolt amperes (kVA) but does not affect the EMX3's motor control or protection.

8O – Voltage Calibration

Range: 85% – 115% **Default:** 100%

Description: Adjusts the soft starter's voltage monitoring circuits. The EMX3 is factory-calibrated with an accuracy of ± 5%. This parameter can be used to adjust the voltage readout to match an external voltage metering device.

Set as required, using the following formula:

$$\text{Calibration (\%)} = \frac{\text{Voltage shown on soft starter display}}{\text{Voltage measured by external device}}$$

$$\text{eg } 90\% \quad \frac{6000}{6600}$$

NOTE
This adjustment affects all voltage-based functions.

9 Motor Data-2

The EMX3 can support two different starting and stopping motor data sets.

- To use the EMX3 with two separate motors (such as a duty-standby configuration), use parameter 9A to select dual thermal modelling and configure parameters 9B~9E to suit the second motor.
- To use the EMX3 with two different motor data sets for the same motor (for dual speed motors or applications where starting conditions may vary), use parameter 9A to select a single thermal model, and configure the starting and stopping profiles as required in parameters 10A~10G. The soft starter will ignore parameters 9B~9E and will use settings from the primary motor.

To select the secondary motor data set, a programmable input must be configured to parameter set selection (parameters 6A and 6F) and the input must be active when the soft starter receives a start signal.

NOTE
You can only choose which motor data set to use while the soft starter is stopped.

9A ~ 9E – Secondary Motor Settings

Refer to Motor Data-1 (parameters 1A~1D) for details.

Parameter 9A *Dual Thermal Model*

Options: SINGLE (Default)
DUAL

Description: Activates dual thermal modelling. The dual thermal model is required only if the EMX3 is controlling two physically separate motors.

Parameter 9B *Motor FLC-2*

Range: Model dependent

Description: Sets the secondary motor's full load current.

Parameter 9C *Locked Rotor Time-2*

Range: 0:01 - 2:00 (minutes:seconds) **Default:** 10 seconds

Description: Sets the maximum length of time the motor can sustain locked rotor current from cold before reaching its maximum temperature. Set according to the motor datasheet.

Parameter 9D *Locked Rotor Current-2*

Range: 400% - 1200% FLC **Default:** 600%

Description: Sets the locked rotor current of the connected motor, as a percentage of full load current. Set according to the motor datasheet.

Parameter 9E *Motor Service Factor-2*

Range: 100% - 130% FLC **Default:** 105%

Description: Sets the secondary motor's service factor.

10 Start/Stop-2

10A ~ 10M – Start/Stop-2

Refer to Start/Stop Modes-1 (parameters 2A~15E) for details.

Parameter 10A *Start Mode-2*

Options: CONSTANT CURRENT (Default)
ADAPTIVE CONTROL

Description: Selects the soft start mode.

Parameter 10B *Start Ramp-2*

Range: 1 - 180 (seconds) **Default:** 10 seconds

Description: Sets the total start time for an Adaptive Control start or the ramp time for current ramp starting (from the initial current to the current limit).

Parameter 10C *Initial Current-2*

Range: 100% - 600% **Default:** 350%

Description: Sets the initial start current level for current ramp starting, as a percentage of motor full load current. Set so that the motor begins to accelerate immediately after a start is initiated.
If current ramp starting is not required, set the initial current equal to the current limit.

Parameter 10D *Current Limit-2*

Range: 100% - 600% FLC **Default:** 350%

Description: Sets the current limit for constant current and current ramp soft starting, as a percentage of motor full load current.

Parameter 10E *Adaptive Start Profile-2*

Options: EARLY ACCELERATION
CONSTANT ACCELERATION (Default)
LATE ACCELERATION

Description: Selects which profile the EMX3 will use for an Adaptive Control soft start.

Parameter 10F *Kickstart Time-2*

Range: 0 - 2000 (milliseconds) **Default:** 0000 milliseconds

Description: Sets the kickstart duration. A setting of 0 disables kickstart.

Parameter 10G *Kickstart Level-2*

Range: 100% - 700% FLC **Default:** 500%

Description: Sets the level of the kickstart current.

Parameter 10H *Stop Mode-2*

Options: COAST TO STOP (Default)
TVR SOFT STOP
ADAPTIVE CONTROL
BRAKE

Description: Selects the stop mode.

Parameter 10I *Stop Time-2*

Range: 0:00 - 4:00 (minutes:seconds) **Default:** 0 seconds

Description: Sets the stop time.

Parameter 10J *Adaptive Stop Profile-2*

Options: EARLY DECELERATION
CONSTANT DECELERATION (Default)
LATE DECELERATION

Description: Selects which profile the EMX3 will use for an Adaptive Control soft stop.

Parameter 10K *Adaptive Control Gain-2*

Range: 1% - 200% **Default:** 75%

Description: Adjusts the performance of Adaptive Control. This setting affects both starting and stopping control.

> **NOTE**
> We recommend leaving the gain setting at the default level unless performance is not satisfactory. If the motor accelerates or decelerates too quickly at the end of a start or stop, increase the gain setting by 5%~10%. If the motor speed fluctuates during starting or stopping, decrease the gain setting slightly.

<u>Parameter 10L</u> *Brake Torque-2*

Range: 20% - 100% **Default:** 20%

Description: Sets the amount of brake torque the EMX3 will use to slow the motor.

<u>Parameter 10M</u> *Brake Time-2*

Range: 1 - 30 (seconds) **Default:** 1 second

Description: Sets the duration for DC injection during a braking stop.

11 RTD Temperatures

The EMX3 has one RTD/PT100 input and can be fitted with another six PT100 inputs by using the RTD/PT100 and ground fault protection card. The inputs can trip the soft starter when the temperature exceeds a specified point, and different trip temperatures can be set for each input.

PT100 inputs B ~ G are only available if the RTD/PT100 and ground fault protection card has been installed.

Range: 0 - 250 ° C **Default:** 50 ° C

Description: Sets the trip points for the RTD/PT100 inputs.

- 11A *RTD A Trip Temp*
- 11B *RTD B Trip Temp*
- 11C *RTD C Trip Temp*
- 11D *RTD D Trip Temp*
- 11E *RTD E Trip Temp*
- 11F *RTD F Trip Temp*
- 11G *RTD G Trip Temp*

12 Slip-Ring Motors

These parameters allow the soft starter to be configured for use with a slip-ring motor.

12A, 12B – Motor Data-1 and Motor Data-2 Ramp

Options: SINGLE RAMP (Default)
DUAL RAMP

Description: Selects whether to use a single or dual current ramp profile for soft starting. Set to single ramp for non-slip ring induction motors, or dual ramp for slip-ring induction motors.
Parameter 12A selects the ramp configuration for the primary motor and parameter 12B selects the ramp configuration for the secondary motor.

12C – Changeover Time

Range: 100 - 500 (milliseconds) **Default:** 150 milliseconds

Description: Sets the delay between the rotor resistance relay closing and the low resistance current ramp starting. Set so that the contactor has enough time to close, but the motor does not slow down.
Parameter 12C only applies if parameter 12A or 12B is set to 'Dual Ramp', and an output relay is set to 'Changeover Contactor'.

12D – Slip-Ring Retard

Range: 10% - 90% **Default:** 50%

Description: Sets the level of conduction while the rotor resistor closes, as a percentage of full conduction.
Set so that no current pulse occurs, but the motor retains enough speed to start correctly.

15 Advanced

15A – Access Code

Range: 0000 - 9999 **Default:** 0000

Description: Sets the access code to control access to restricted sections of the menus.
Use the ◀ and ▶ buttons to select which digit to alter and use the ▲ and ▼ buttons to change the value.

NOTE
In the event of a lost access code, contact your supplier for master access code that allows you to re-program a new access code.

15B – Adjustment Lock

Options:

Read & Write (Default)	Allows users to alter parameter values in the Programming Menu.
Read Only	Prevents users altering parameter values in the Programming Menu. Parameter values can still be viewed.

Description: Selects whether the keypad will allow parameters to be changed via the Programming Menu.

NOTE
Changes to the Adjustment Lock setting take effect only after the Programming Menu has been closed.

15C – Emergency Run

Options: Disable (Default)
Enable

Description: Selects whether the soft starter will permit emergency run operation. In emergency run, the soft starter will start (if not already running) and continue to operate until emergency run ends, ignoring stop commands and trips.
Emergency run is controlled using a programmable input.

CAUTION
Continued use of Emergency Run is not recommended. Emergency Run may compromise the starter life as all protections and trips are disabled.

Using the starter in Emergency Run mode will void the product warranty.

15D – Shorted SCR Action

Options: 3-Phase Control only (Default)
PowerThrough

Description: Selects whether the soft starter will allow PowerThrough operation. For critical applications this allows the soft starter to control the motor with two-phase control, if the soft starter is damaged on one phase. PowerThrough only operates after the soft starter has tripped on "Lx-Tx Shorted" and has been reset.

CAUTION
PowerThrough uses a two-phase soft start technology and additional care is required when sizing circuit breakers and protection. Contact your local supplier for assistance.

PowerThrough remains active until '3-Phase Control Only' is reselected.

PowerThrough operation does not support Adaptive Control soft starting or soft stopping. In PowerThrough, the EMX3 will automatically select constant current soft starting and timed voltage ramp soft stopping. If PowerThrough is enabled, parameters 2C and 2D must be set appropriately.

PowerThrough can only operate with internally bypassed soft starters.

NOTE
PowerThrough only operates with in-line connected motors.

NOTE
PowerThrough is only available with in-line installations. If the EMX3 is installed inside delta, PowerThrough will not operate.

The starter will trip on Lx-Tx Shorted on the first start attempt after control power is applied. PowerThrough will not operate if control power is cycled between starts.

15E – Jog Torque

The EMX3 can jog the motor at a reduced speed, which allows precise positioning of belts and flywheels. Jog can be used for either forward or reverse operation.

Range: 20% - 100% Default: 50%

Description: Sets the current limit for jog operation.

16 Protection Action

These parameters define how the soft starter will respond to different protection events. The soft starter can trip, issue a warning, or ignore different protection events as required. All protection events are written to the event log. The default action for all protections is to trip the soft starter.

Protections 16N *Ground Fault* and 16P~16U *RTD/PT100* are only available if the RTD/PT100 and ground fault protection card has been fitted.

CAUTION
Defeating the protection may compromise the starter and motor, and should only be done in the case of emergency.

16A~16U – Protection Actions

Options: TRIP STARTER (Default)
WARNING AND LOG
LOG ONLY

Description: Selects the soft starter's response to each protection.

- 16A *Motor Overload*
- 16B *Excess Start Time*
- 16C *Undercurrent*
- 16D *Instantaneous Overcurrent*
- 16E *Current Imbalance*
- 16F *Frequency*
- 16G *Input A Trip*
- 16H *Input B Trip*
- 16I *Motor Thermistor*
- 16J *Starter Communication*
- 16K *Network Communication*
- 16L *Heatsink Overtemperature*
- 16M *Battery/Clock*
- 16N *Ground Fault*
- 16O~16U *RTD A~G Overtemp*
- 16V *Reserved*
- 16W *Reserved*
- 16X *Low Control Volts*

20 Restricted

These parameters are restricted for Factory use and are not available to the user.

Section 9 Application Examples

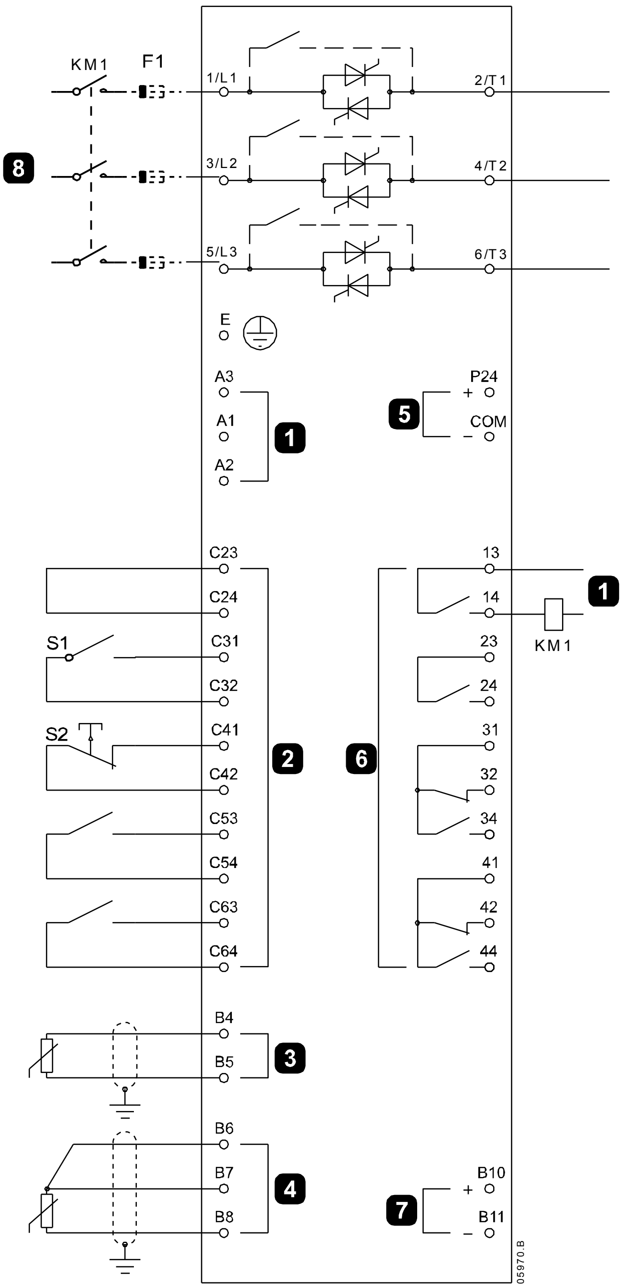
A selection of Application Notes are available describing advanced installation or configuration of the EMX3 for situations with specific performance requirements. Application notes are available for situations including brake and jog operation, pumping and advanced protection options.

Visit http://www.aucom.com or contact support@aucom.com for more information.

9.1 Installation with Main Contactor

The EMX3 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 EMX3 Main Contactor output, which by default is assigned to Output Relay A (terminals 13, 14).



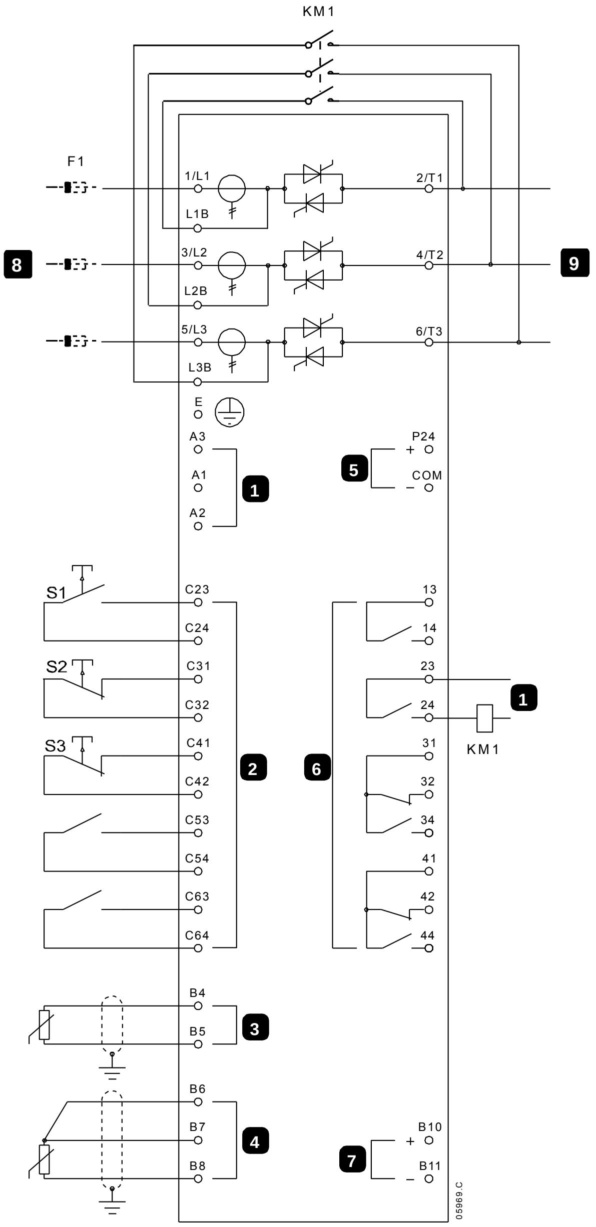
1	Control voltage (model dependent)
2	Remote control inputs
3	Motor thermistor input
4	RTD/PT100 input
5	24 VDC output
6	Relay outputs
7	Analog output
8	Three-phase supply
9	Motor terminals
KM1	Main contactor
F1	Semiconductor fuses (optional)
S1	Start/stop contact
S2	Reset contact
13, 14	Relay output A
23, 24	Run relay output
31, 32, 34	Relay output B
41, 42, 44	Relay output C

Parameter settings:

- Parameter 7A *Relay A Function*
  - Select 'Main Contactor' - assigns the Main Contactor function to Relay Output A (default setting)

9.2 Installation with External Bypass Contactor

The EMX3 is installed with an external bypass contactor (AC1 rated). The bypass contactor is controlled by the EMX3 Run Output (terminals 23, 24).



1	Control voltage (model dependent)
2	Remote control inputs
3	Motor thermistor input
4	RTD/PT100 input
5	24 VDC output
6	Relay outputs
7	Analog output
8	Three-phase supply
9	Motor terminals
KM1	Bypass contactor (external)
F1	Semiconductor fuses (optional)
S1	Start contact
S2	Stop contact
S3	Reset contact
13, 14	Relay output A
23, 24	Run relay output
31, 32, 34	Relay output B
41, 42, 44	Relay output C

Parameter settings:

- No special settings required.

9.3 Emergency Run Operation

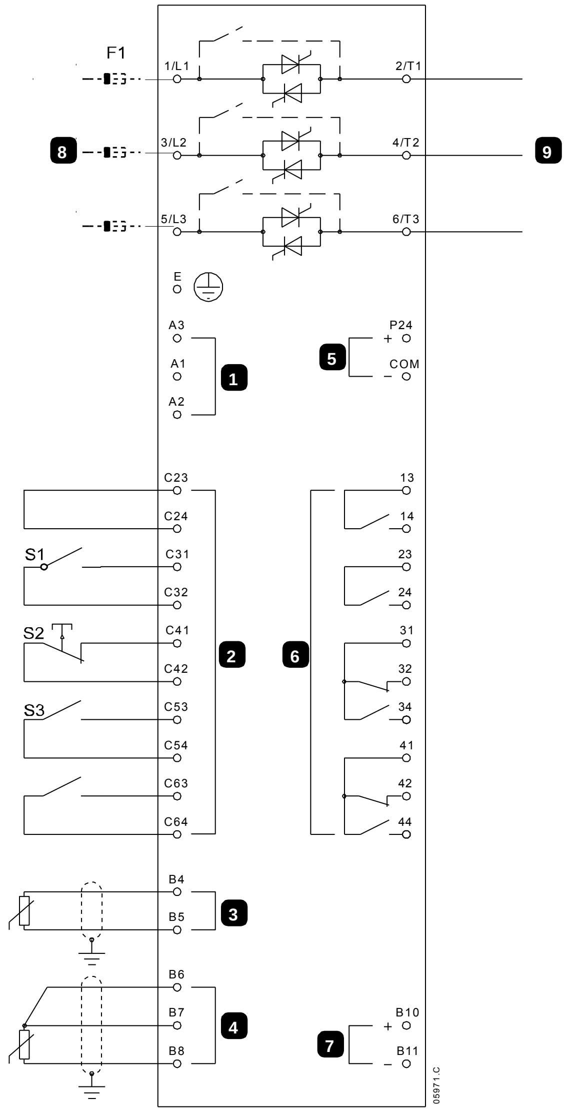
In normal operation the EMX3 is controlled via a remote two wire signal (terminals C31, C32).

Emergency Run is controlled by a two wire circuit connected to Input A (terminals C53, C54). Closing Input A causes the EMX3 to run the motor and ignore certain trip conditions.

NOTE
Although the Emergency Run satisfies the functionality requirements of Fire Mode, AuCom does not recommend its use in situations that require testing and/or compliance with specific standards as it is not certified.

CAUTION
Continued use of Emergency Run is not recommended. Emergency Run may compromise the starter life as all protections and trips are disabled.

Using the starter in Emergency Run mode will void the product warranty.



1	Control voltage (model dependent)
2	Remote control inputs
3	Motor thermistor input
4	RTD/PT100 input
5	24 VDC output
6	Relay outputs
7	Analog output
8	Three-phase supply
9	Motor terminals
S1	Start/stop contact
S2	Reset contact
S3	Emergency Run Contact
F1	Semiconductor fuses (optional)
13, 14	Relay output A
23, 24	Run relay output
31, 32, 34	Relay output B
41, 42, 44	Relay output C

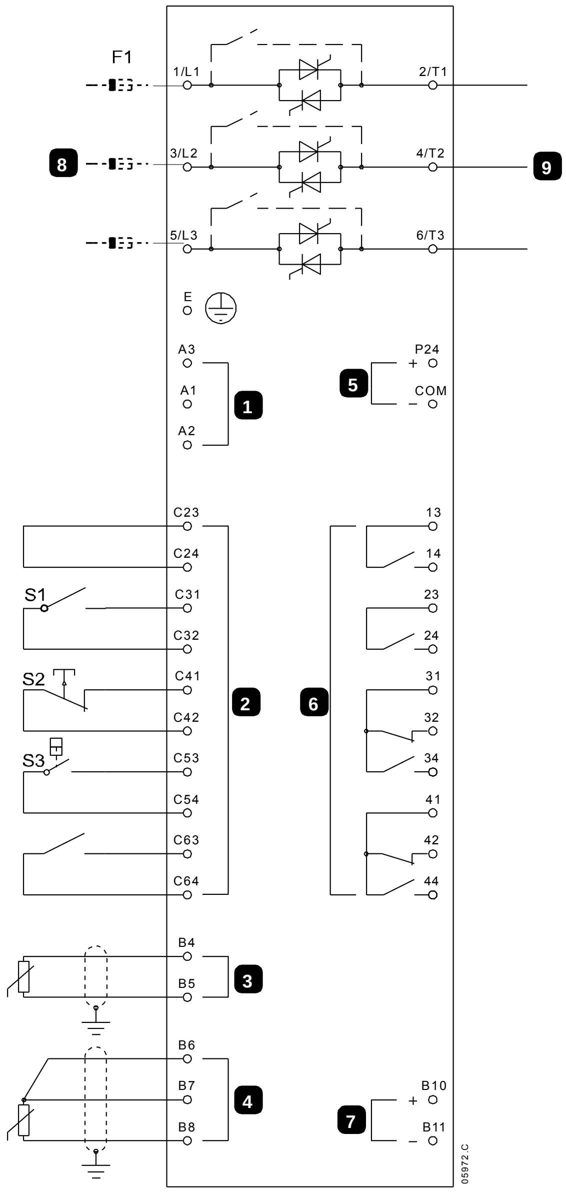
Parameter settings:

- Parameter 6A *Input A Function*
  - Select 'Emergency Run' - assigns Input A for Emergency Run function.
- Parameter 15C *Emergency Run*
  - Select 'Enable' - Enables Emergency Run mode

9.4 Auxiliary Trip Circuit

In normal operation the EMX3 is controlled via a remote two wire signal (terminals C31, C32).

Input A (terminals C53, C54) is connected to an external trip circuit (such as a low pressure alarm switch for a pumping system). When the external circuit activates, the soft starter trips, which stops the motor.



1	Control voltage (model dependent)
2	Remote control inputs
3	Motor thermistor input
4	RTD/PT100 input
5	24 VDC output
6	Relay outputs
7	Analog output
8	Three-phase supply
9	Motor terminals
S1	Start/stop contact
S2	Reset contact
S3	Auxiliary trip contact
F1	Semiconductor fuses (optional)
13, 14	Relay output A
23, 24	Run relay output
31, 32, 34	Relay output B
41, 42, 44	Relay output C

Parameter settings:

- Parameter 6A *Input A Function*
  - Select 'Input Trip (N/O)'. Assigns the Input A to Auxiliary Trip (N/O) function.
- Parameter 6B *Input A Name*
  - Select a name eg Low Pressure. Assigns a name to Input A.
- Parameter 6C *Input A Trip*
  - Set as required. For example, Run Only limits the input trip to when the soft starter is running only.
- Parameter 6D *Input A Trip Delay*
  - Set as required. Sets a delay between the input activating and the soft starter tripping.
- Parameter 6E *Input A Initial Delay*
  - Set at around 120 seconds. Limits operation of the input trip to 120 seconds after the start signal. This allows time for pressure to build up in the piping before the low pressure input becomes active.

9.5 DC Brake with External Zero Speed Sensor

For loads which may vary between braking cycles, there are benefits in using an external zero-speed sensor to interface with the EMX3 for brake shut-off. This control method ensures that the EMX3 braking will always shut off when the motor has reached a standstill, thus avoiding unnecessary motor heating.

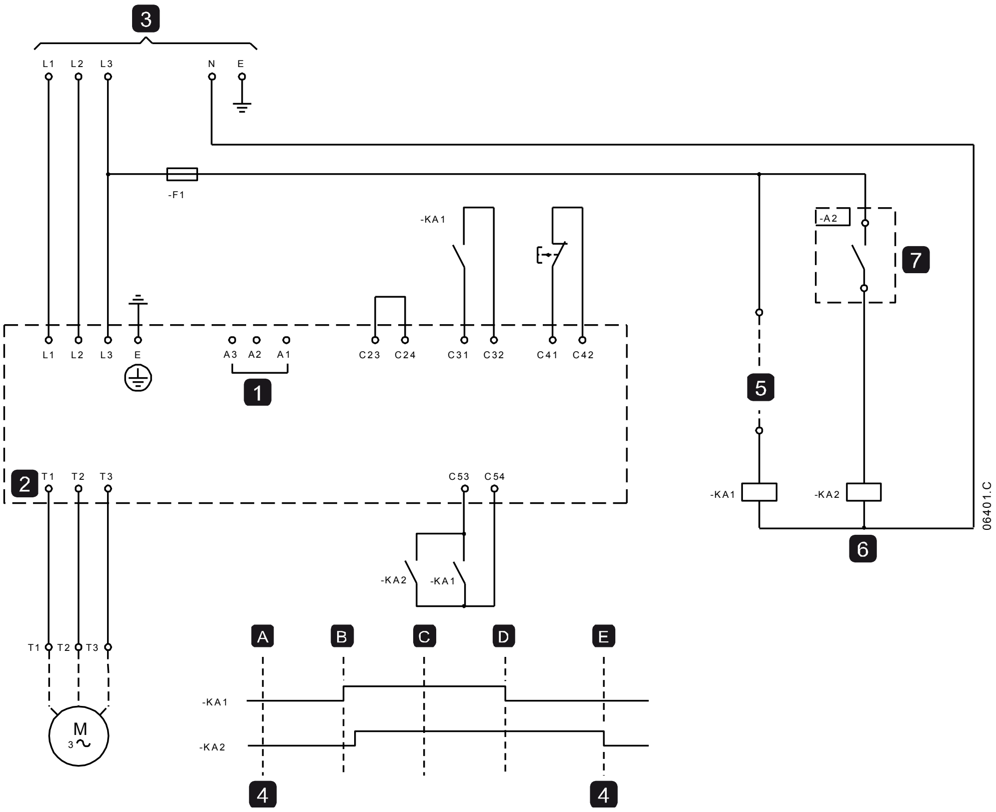
The following schematic diagram shows how you can use a zero-speed sensor with the EMX3 to turn the brake function off at motor standstill. The zero-speed sensor (-A2) is often referred to as an under-speed detector. Its internal contact is open at zero-speed and closed at any speed above zero-speed. Once the motor has reached a standstill, the EMX3 will go into Emergency Stop mode and remain in this state until the next start command is given (ie next application of –KA1).

The EMX3 must be operated in remote mode and parameter 6A *Input A Function* must be set to emergency stop.

CAUTION
If the brake torque is set too high, the motor will stop before the end of the brake time and the motor will suffer unnecessary heating which could result in damage. Careful configuration is required to ensure safe operation of the starter and motor.

A high brake torque setting can result in peak currents up to motor DOL being drawn while the motor is stopping. Ensure protection fuses installed in the motor branch circuit are selected appropriately.

CAUTION
Brake operation causes the motor to heat faster than the rate calculated by the motor thermal model. If you are using brake, install a motor thermistor or allow sufficient restart delay (parameter 4M).



1	Control voltage
C23, C24	Start
C31, C32	Stop
C41, C42	Reset
2	Motor terminals
3	Three-phase supply
4	Emergency stop mode (shown on starter display)

A	Off (Ready)
B	Start
C	Run
D	Stop
E	Zero speed
5	Start signal
6	Zero speed detect
7	Zero speed sensor

For details on configuring DC Brake, refer to *Brake* on page 35.

NOTE
When using DC brake, the mains supply must be connected to the soft starter (input terminals L1, L2, L3) in positive phase sequence and parameter 4G *Phase Sequence* must be set to Positive only.

CAUTION
If the brake torque is set too high, the motor will stop before the end of the brake time and the motor will suffer unnecessary heating which could result in damage. Careful configuration is required to ensure safe operation of the starter and motor.

A high brake torque setting can result in peak currents up to motor DOL being drawn while the motor is stopping. Ensure protection fuses installed in the motor branch circuit are selected appropriately.

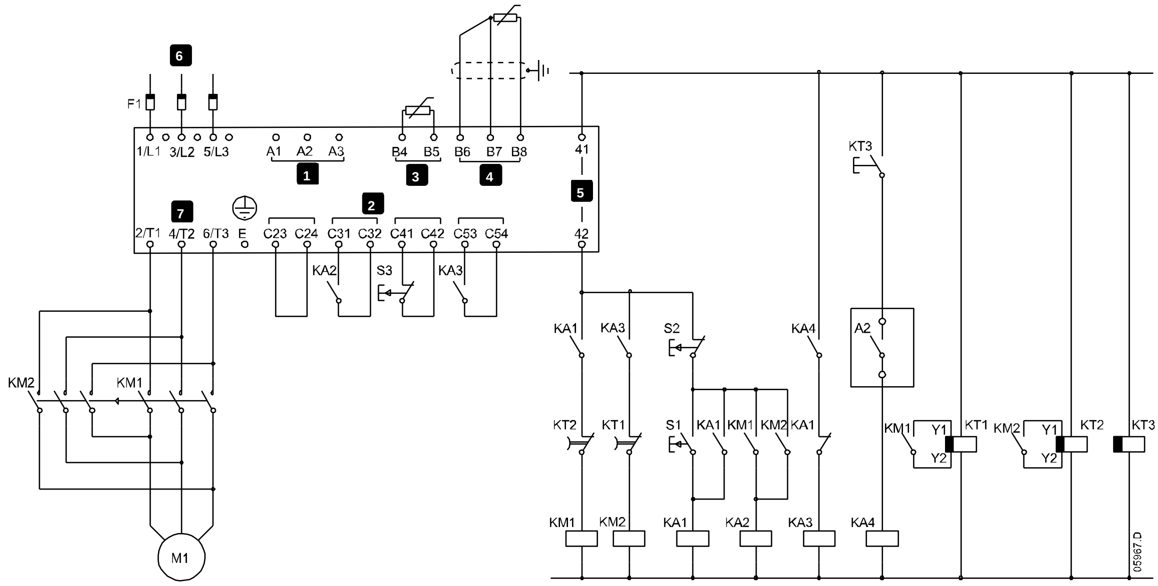
9.6 Soft Braking

For applications with high inertia and/or a variable load, the EMX3 can be configured for soft braking.

In this application the EMX3 is employed with forward run and braking contactors. When the EMX3 receives a start signal (pushbutton S1), it closes the forward run contactor (KM1) and controls the motor according to the programmed primary motor settings.

When the EMX3 receives a stop signal (pushbutton S2), it opens the forward run contactor (KM1) and closes the braking contactor (KM2) after a delay of approximately 2-3 seconds (KT1). KA3 is also closed to activate the secondary motor settings, which should be user programmed for the desired stopping performance characteristics.

When motor speed approaches zero, the zero speed detector (A2) stops the soft starter and opens the braking contactor (KM2).



1	Control voltage (model dependent)
2	Remote control inputs
3	Motor thermistor input
4	RTD/PT100 input
5	Relay outputs
6	Three-phase supply
7	Motor terminals
A2	Zero speed detector
F1	Semiconductor fuses (optional)
KA1	Run relay
KA2	Start relay

KA3	Brake relay
KA4	Zero speed detector relay
KM1	Line contactor (Run)
KM2	Line contactor (Brake)
KT1	Run delay timer
KT2	Brake delay timer
KT3	Zero speed detector delay timer*
S1	Start contact
S2	Stop contact
S3	Reset contact

* The KT3 timer is only required if the zero speed detector is the type that performs a self-test upon power-up and momentarily closes the output relay.

Parameter settings:

- Parameter 6A *Input A Function* (terminals C53, C54)
  - Select 'Motor Set Select' - assigns Input A for Motor set selection.
  - Set starting performance characteristics using the primary motor set.
  - Set braking performance characteristics using the secondary motor settings.
- Parameter 7G *Relay C Function*
  - Select 'Trip' - assigns Trip function to Relay Output C.

NOTE
If the EMX3 trips on supply frequency (parameter 16F *Frequency*) when the braking contactor KM2 opens, modify the frequency protection settings.

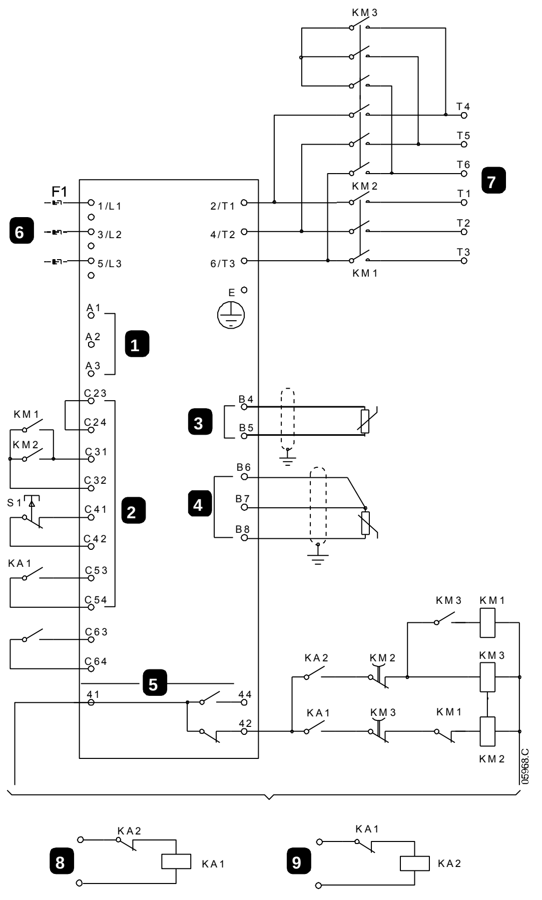
9.7 Two-Speed Motor

The EMX3 can be configured for control of dual speed Dahlander type motors, using a high speed contactor (KM1), low speed contactor (KM2) and a star contactor (KM3).

NOTE
Pole Amplitude Modulated (PAM) motors alter the speed by effectively changing the stator frequency using external winding configuration. Soft starters are not suitable for use with this type of two-speed motor.

When the soft starter receives a high speed start signal, it closes the high speed contactor (KM1) and star contactor (KM3), then controls the motor according to the primary motor settings.

When the soft starter receives a low speed start signal, it closes the low speed contactor (KM2). This closes Input A and the EMX3 controls the motor according to the secondary motor settings.



1	Control voltage
2	Remote control inputs
3	Motor thermistor input
4	RTD/PT100 input
5	Relay outputs
6	Three-phase supply
7	Motor terminals
8	Remote low speed start input
9	Remote high speed start input
F1	Semiconductor fuses (optional)
KA1	Remote start relay (low speed)
KA2	Remote start relay (high speed)
KM1	Line contactor (high speed)
KM2	Line contactor (low speed)
KM3	Star contactor (high speed)
S1	Reset contact
41, 42, 44	Relay output C

NOTE
Contactors KM2 and KM3 must be mechanically interlocked.

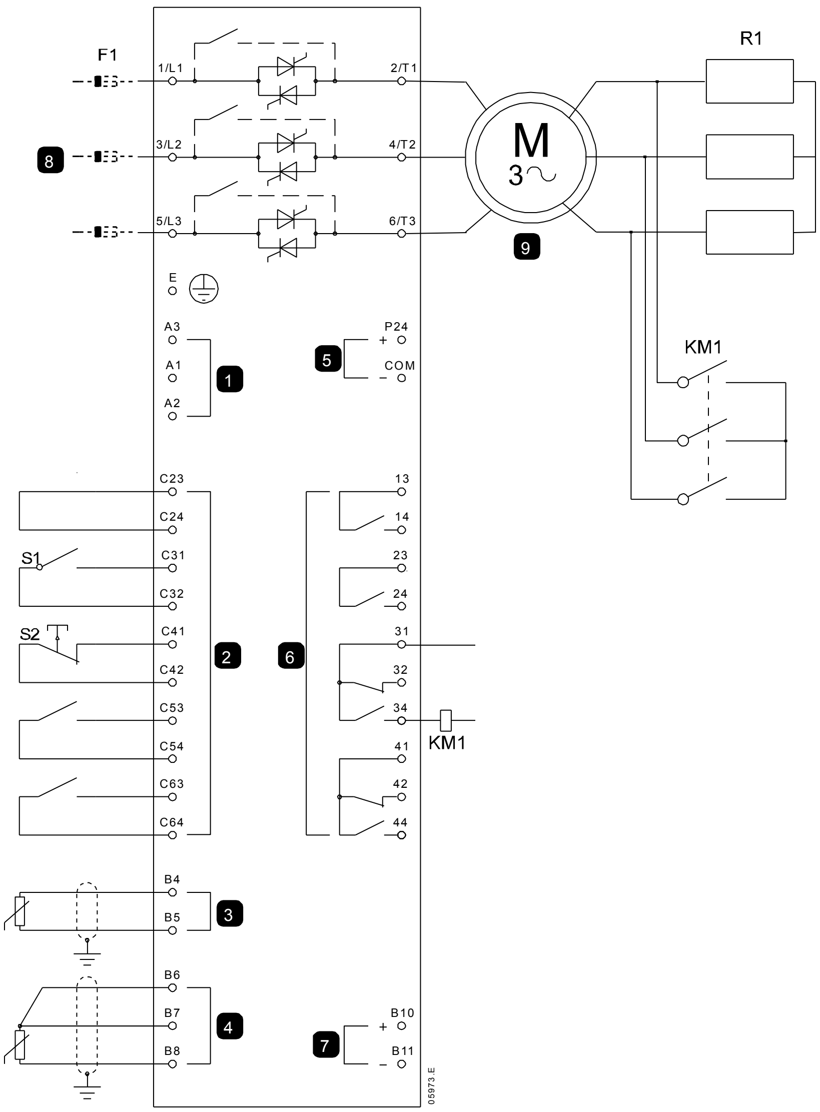
Parameter settings:

- Parameter 6A *Input A Function* (terminals C53, C54)
  - Select 'Motor Set Select' - assigns Input A for Motor set selection.
  - Set high speed performance characteristics using the primary motor settings.
  - Set low speed performance characteristics using the secondary motor settings.
- Parameter 5A *Relay C Action*
  - Select 'Trip' - assigns Trip function to Relay Output C

NOTE
If the EMX3 trips on supply frequency (parameter 16F *Frequency*) when the high-speed start signal (9) is removed, modify the frequency protection settings.

9.8 Slip-Ring Motor

The EMX3 can be used to control a slip-ring motor, using rotor resistance.



1	Control voltage (model dependent)
2	Remote control inputs
3	Motor thermistor input
4	RTD/PT100 input
5	24 VDC output
6	Relay outputs
7	Analog output
8	Three-phase supply
9	Slip-ring induction motor
KM1	Changeover contactor
F1	Semiconductor fuses (optional)
S1	Start/stop contact
S2	Reset contact
R1	Rotor resistance (external)

Parameter settings:

- Parameter 7D *Relay B Function*
  - Select 'Changeover Contactor'
- Parameter 7E *Relay B On Delay*
  - Set this to the maximum time (5m:00s).
- Parameter 12A *Motor Data-1 Ramp*
  - Select 'Dual Ramp' (for slip-ring induction motor control)
- Parameter 12C *Changeover Time*
  - Default setting is 150 milliseconds. Set this to a value just greater than the changeover contactor (KM1) pole closing time.
- Parameter 12D *Slip Ring Retard*
  - Default setting is 50%. Set this parameter to a value which is high enough to cause the motor to instantly accelerate once the rotor resistance (R1) has been bridged out and low enough to avoid a motor current pulse.

NOTE
For this installation to function correctly, only use the primary motor settings. Only use the constant current start method (parameter 2A *Start Mode*).

Section 10 Troubleshooting

10.1 Protection Responses

When a protection condition is detected, the EMX3 will write this to the event log and may also trip or issue a warning. The soft starter's response to some protections may depend on the Protection Action settings (parameter group 16).

Some protection responses cannot be adjusted by the user. These trips are usually caused by external events (such as phase loss) or by a fault within the soft starter. These trips do not have associated parameters and cannot be set to Warn or Log.

If the EMX3 trips you will need to identify and clear the condition that triggered the trip, then reset the soft starter before restarting. To reset a the starter, press the RESET button on the keypad or activate the Reset remote input.

If the EMX3 has issued a warning, the soft starter will reset itself once the cause of the warning has been resolved.

10.2 Trip Messages

This table lists soft starter's protection mechanisms and the probable cause of the trip. Some of these can be adjusted using parameter group 4 Protection Settings and parameter group 16 Protection Action, other settings are built-in system protections and cannot be set or adjusted.

Display	Possible cause/Suggested solution
Analog input trip	Identify and resolve the condition which caused Analog Input A to activate. Related parameters: 6N, 6O, 6P
Awaiting data	The keypad is not receiving data from the control PCB. Check the cable connection and the fitting of the display on the starter.
Battery/clock	A verification error has occurred on the real time clock, or the backup battery voltage is low. If the battery is low and the power is off, date/time settings will be lost. Reprogram the date and time. Related parameters: 16M
Current imbalance	Current imbalance can be caused by problems with the motor, the environment or the installation, such as: • An imbalance in the incoming mains voltage • A problem with the motor windings • A light load on the motor • A phase loss on input terminals L1, L2 or L3 during Run mode An SCR that has failed open circuit. A failed SCR can only be definitely diagnosed by replacing the SCR and checking the starter's performance. Related parameters: 4H, 4I, 16E
Current Read Err Lx	Where 'X' is 1, 2 or 3. *Internal fault* (PCB fault). The output from the CT circuit is not close enough to zero when the SCRs are turned off. Contact your local supplier for advice. This trip is not adjustable. Related parameters: None
Excess start time	Excess start time trip can occur in the following conditions: • parameter 1A *Motor Full Load Current* is not appropriate for the motor • parameter 2D *Current Limit* has been set too low • parameter 2B *Start Ramp Time* has been set greater than the setting for 4A *Excess Start Time* setting • parameter 2B *Start Ramp Time* is set too short for a high inertia load when using Adaptive Control Related parameters: 1A, 2B, 2D, 4A, 4B, 9B, 10B, 10D, 16B
Firing fail SCRx	Where 'X' is phase 1, 2 or 3. The SCR did not fire as expected. The SCR may be faulty or there may be an internal wiring fault. This trip is not adjustable. Related parameters: None

FLC too high (FLC out of range)	This trip is not adjustable. The EMX3 can support higher motor full load current values when connected to the motor using inside delta configuration rather than in-line connection. If the soft starter is connected in-line but the programmed setting for parameter 1A *Motor Full Load Current* is above the in-line maximum, the soft starter will trip at start. If the soft starter is connected to the motor using inside delta configuration, the soft starter may not be correctly detecting the connection. Contact your local supplier for advice. Related parameters: 1A, 9B
Frequency (Mains supply)	This trip is not adjustable. The mains frequency has gone beyond the specified range. Check for other equipment in the area that could be affecting the mains supply (particularly variable speed drives and switch mode power supplies (SMPS). If the EMX3 is connected to a generator set supply, the generator may be too small or could have a speed regulation problem. Related parameters: 4J, 4K, 4L, 16F
Ground fault	This fault only occurs if the RTD/Ground Fault card is fitted. Test the insulation of the output cables and the motor. Identify and resolve the cause of any ground fault. Related parameters: 4O, 4P, 16N
Heatsink overtemperature	Check if cooling fans are operating. If mounted in an enclosure, check if ventilation is adequate. Fans operate during Start, Run and for 10 minutes after the starter exits the Stop state. NOTE Models EMX3-0023B to EMX3-0053B and EMX3-0170B do not have a cooling fan. Models with fans will operate the cooling fans from a Start until 10 minutes after a Stop. Related parameters: 16L
Input A trip	Identify and resolve the condition which caused Input A to activate. Related parameters: 6A, 6B, 6C, 6D, 6E, 16G
Input B trip	Identify and resolve the condition which caused Input B to activate. Related parameters: 6F, 6G, 6H, 6I, 6J, 16H
Instantaneous overcurrent	The EMX3 will report this trip if one of the following conditions occur: • The motor has experienced a sharp rise in power. Causes can include a momentary overload condition which has exceeded the adjustable delay time. Related parameters: 4E, 4F, 16D Current to the motor has exceeded the soft starter's built-in trip points: • 7.2 times the parameter 1A *Motor Full Load Current* • 6 times the starter's nominal current rating Causes can include a locked rotor condition or an electrical fault in the motor or cabling. This trip is not adjustable. Related parameters: None
Internal fault X	This trip is not adjustable. The EMX3 has tripped on an internal fault. Contact your local supplier with the fault code (X). Related parameters: None
L1 phase loss **L2 phase loss** **L3 phase loss**	This trip is not adjustable. During pre-start checks the starter has detected a phase loss as indicated. In run state, the starter has detected that the current on the affected phase has dropped below 3.3% of the programmed motor FLC for more than 1 second, indicating that either the incoming phase or connection to the motor has been lost. Check the supply and the input and output connections at the starter and at the motor end. Phase loss can also be caused by a failed SCR, particularly an SCR that has failed open circuit. A failed SCR can only be definitely diagnosed by replacing the SCR and checking the starter's performance. Related parameters: None

L1-T1 shorted L2-T2 shorted L3-T3 shorted	During pre-start checks the starter has detected a shorted SCR or a short within the bypass contactor as indicated. If the starter is connected in-line with the motor, consider using PowerThrough to allow operation until the starter can be repaired. NOTE PowerThrough is only available with in-line installations. If the EMX3 is installed inside delta, PowerThrough will not operate. The starter will trip on Lx-Tx Shorted on the first start attempt after control power is applied. PowerThrough will not operate if control power is cycled between starts. Related parameters: 15D
Low Control Volts	The EMX3 has detected a drop in the control voltage. • Check the external control supply (terminals A1, A2, A3) and reset the starter. If the external control supply is stable: • the 24 V supply on the main control PCB may be faulty; or • the bypass driver PCB may be faulty (internally bypassed models only). This protection is not active in Ready state. Related parameters: 16X
Motor overload (thermal model)	The motor has reached its maximum thermal capacity. Overload can be caused by: • The soft starter protection settings not matching the motor thermal capacity • Excessive starts per hour • Excessive throughput • Damage to the motor windings Resolve the cause of the overload and allow the motor to cool. Related parameters: 1A, 1C, 1B, 1D, 16A
Motor 2 overload	Refer to 'Motor Overload' above. NOTE Applicable only if the second motor set has been programmed. Related parameters: 9A, 9B, 9C, 9D, 9E, 16A
Motor connection Tx	Where 'X' is 1, 2 or 3. The motor is not connected correctly to the soft starter for in-line or inside delta use. • Check individual motor connections to the soft starter for power circuit continuity. • Check connections at the motor terminal box. This trip is not adjustable. Related parameters: None
Motor thermistor	The motor thermistor input has been enabled and: • The resistance at the thermistor input has exceeded 3.6 kΩ for more than one second. • The motor winding has overheated. Identify the cause of the overheating and allow the motor to cool before restarting. • The motor thermistor input has been opened. NOTE If a valid motor thermistor is no longer used, a 1.2 kΩ resistor must be fitted across terminals B4, B5. Related parameters: 16I
Network communication (between interface and network)	The network master has sent a trip command to the starter, or there may be a network communication problem. Check the network for causes of communication inactivity. Related parameters: 16K
Not ready	Check Input A (C53, C54). The emergency stop function may be active. If parameter 6A or 6F is set to Emergency Stop and there is an open circuit on the corresponding input, the EMX3 will not start.

Parameter out of Range	This trip is not adjustable. • A parameter value is outside the valid range. The keypad will indicate the first invalid parameter. • An error occurred loading data from the EEPROM to RAM when the keypad powered up. • The parameter set or values in the keypad do not match the parameters in the starter. • "Load User Set" has been selected but no saved file is available. Reset the fault. The starter will load the default settings. If the problem persists, contact your local distributor. Related parameters: None
Phase sequence	The phase sequence on the soft starter's input terminals (L1, L2, L3) is not valid. Check the phase sequence on L1, L2, L3 and ensure the setting in parameter 4G is suitable for the installation. Related parameters: 4G
Power loss/Power circuit	This trip is not adjustable. The starter is not receiving mains supply on one or more phases when a Start Command is given. Check that the main contactor closes when a start command is given, and remains closed until the end of a soft stop. Check the fuses. If testing the soft starter with a small motor, it must draw at least 2% of its minimum FLC setting on each phase. Related parameters: None
RTD A overtemperature RTD B overtemperature RTD C overtemperature RTD D overtemperature RTD E overtemperature RTD F overtemperature RTD G overtemperature	The RTD/PT100 set temperature has been exceeded and tripped the soft starter. Identify and resolve the condition which caused the appropriate input to activate. NOTE PT100 B to PT100 G are applicable only if a RTD/PT100 and Ground Fault card is fitted. Related parameters: 11A, 11B, 11C, 11D, 11E, 11F, 11G, 16O ~ 16U
RTD circuit fail	Indicates that the indicated RTD/PT100 has short circuited. Check and resolve this condition. Related parameters: None.
Starter communication (between interface and soft starter)	• There is a problem with the connection between the soft starter and the optional communications interface. Remove and reinstall the interface. If the problem persists, contact your local distributor. • There is an internal communications error within the soft starter. Contact your local distributor. Related parameters: 16J
Thermistor circuit	The thermistor input has been enabled and: • The resistance at the input has fallen below 20 Ω (the cold resistance of most thermistors will be over this value) or • A short circuit has occurred. Check and resolve this condition. Related parameters: None
Time-overcurrent	The EMX3 is internally bypassed and has drawn high current during running. (The 10A protection curve trip has been reached or the motor current has risen to 600% of the motor FLC setting.) Related parameters: None
Undercurrent	The motor has experienced a sharp drop in current, caused by loss of load. Causes can include broken components (shafts, belts or couplings), or a pump running dry. Related parameters: 4C, 4D, 16C
Unsupported option (function not available in inside delta)	This trip is not adjustable. The selected function is not available (eg jog is not supported in inside delta configuration). Related parameters: None
VZC Fail Px	Where 'X' is 1, 2 or 3. *Internal fault* (PCB fault). Contact your local supplier for advice. This trip is not adjustable. Related parameters: None

10.3 General Faults

This table describes situations where the soft starter does not operate as expected but does not trip or give a warning.

Symptom	Probable Cause
Starter "Not Ready"	• Check Input A (C53, C54). The emergency stop function may be active. If parameter 6A or 6F is set to Emergency Stop and there is an open circuit on the corresponding input, the EMX3 will not start.
The soft starter does not respond to the START or RESET button on the keypad.	• The soft starter may be in Remote control mode. When the soft starter is in Remote control mode, the Local LED on the starter is off. Press the LCL/RMT button once to change to Local control.
The soft starter does not respond to commands from the control inputs.	• The soft starter may be in Local control mode. When the soft starter is in Local control mode, the Local LED on the starter is on. Press the LCL/RMT button once to change to Remote control. • The control wiring may be incorrect. Check that the remote start, stop and reset inputs are configured correctly (refer to *Control Wiring* on page 7 for details). • The signals to the remote inputs may be incorrect. Test the signalling by activating each input signal in turn. The appropriate remote control input LED should activate on the starter. • The soft starter will only execute a start command from the remote inputs if the remote stop and reset inputs are closed.
The soft starter does not respond to a start command from either the local or remote controls.	• The soft starter may be waiting for the restart delay to elapse. The length of the restart delay is controlled by parameter 4M *Restart Delay*. • The motor may be too hot to permit a start. If parameter 4N *Motor Temperature Check* is set to Check, the soft starter will only permit a start when it calculates that the motor has sufficient thermal capacity to complete the start successfully. Wait for the motor to cool before attempting another start. • The emergency stop function may be active. If parameter 6A or 6F is set to Emergency Stop and there is an open circuit on the corresponding input, the EMX3 will not start. If the emergency stop situation has been resolved, close the circuit on the input. NOTE Parameter 6Q *Local/Remote* controls when the LCL/RMT button is enabled.
A reset does not occur after an Auto-Reset, when using a remote two-wire control.	• The remote 2-wire start signal must be removed and reapplied for a re-start.
Remote start/stop command is overriding Auto Start/Stop settings when using remote two-wire control.	• Auto Start/Stop function should only be used in Remote mode, 3 and 4-wire control.

Non-resettable Thermistor Cct trip, when there is a link between the thermistor input B4, B5 or when the motor thermistor connected between B4, B5 is permanently removed.	• The thermistor input is enabled once a link is fitted and short circuit protection has activated.
	  ◦ Remove the link then load the default parameter set. This will disable the thermistor input and clear the trip.
	  ◦ Place a 1k2 Ω resistor across the thermistor input.
	  ◦ Turn thermistor protection to 'Log only' (parameter 16I).

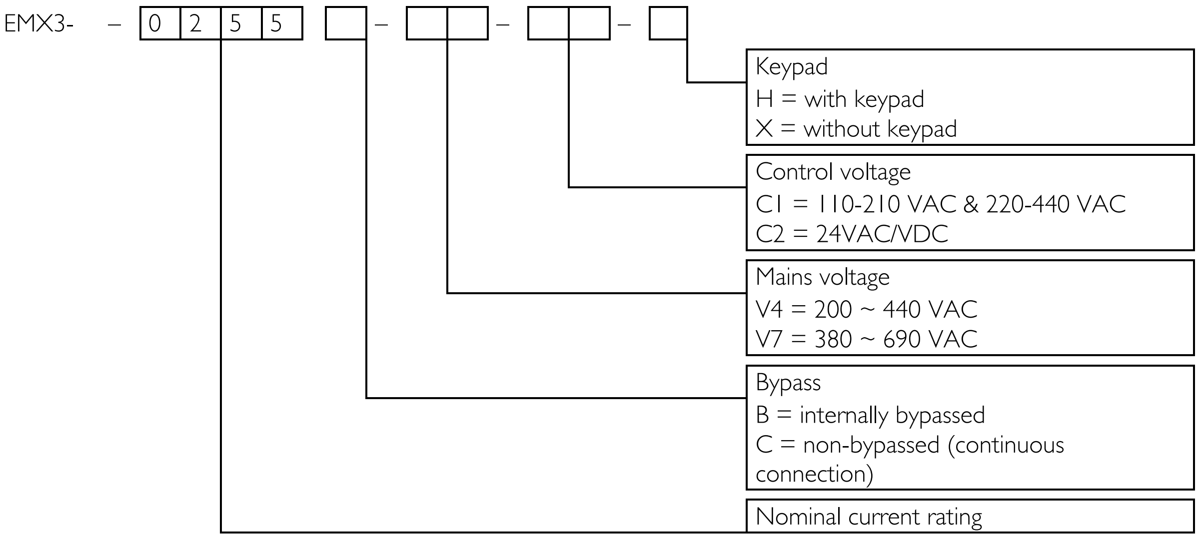
The soft starter does not control the motor correctly during starting.	• Start performance may be unstable when using a low Motor Full Load Current setting (parameter 1A). This can affect use on a small test motor with full load current between 5 A and 50 A. • Power factor correction (PFC) capacitors must be installed on the supply side of the soft starter. To control a dedicated PFC capacitor contactor, connect the contactor to run relay terminals.

Motor does not reach full speed.	• If the start current is too low, the motor will not produce enough torque to accelerate to full speed. The soft starter may trip on excess start time. NOTE Make sure the motor starting parameters are appropriate for the application and that you are using the intended motor starting profile. If parameter 6A or 6F is set to Motor Set Select, check that the corresponding input is in the expected state. • The load may be jammed. Check the load for severe overloading or a locked rotor situation.
Erratic motor operation.	• The SCRs in the EMX3 require at least 5 A of current to latch. If you are testing the soft starter on a motor with full load current less than 5 A, the SCRs may not latch correctly.
Erratic and noisy motor operation	• If the soft starter is connected to the motor using inside delta configuration, the soft starter may not be correctly detecting the connection. Contact your local supplier for advice.
Soft stop ends too quickly.	• The soft stop settings may not be appropriate for the motor and load. Review the settings of parameters 2H, 2I, 10H and 10I. • If the motor is very lightly loaded, soft stop will have limited effect.
Adaptive Control, brake, jog and PowerThrough functions not working	• These features are only available with in-line installation. If the EMX3 is installed inside delta, these features will not operate.
After selecting Adaptive Control the motor used an ordinary start and/or the second start was different to the first.	• The first Adaptive Control start is constant current so that the starter can learn from the motor characteristics. Subsequent starts use Adaptive Control.
PowerThrough does not operate when selected.	• The starter will trip on Lx-Tx Shorted on the first start attempt after control power is applied. PowerThrough will not operate if control power is cycled between starts.
Starter "awaiting data"	• The keypad is not receiving data from the control PCB. Check the cable connection and the fitting of the display on the starter.
Corrupted text shown on keypad display.	• The keypad may not be screwed down, resulting in an intermittent connection. Screw down the keypad or hold squarely in place.
Display is distorted	• Check that the keypad has not been screwed down too tightly. Loosen screws slightly.
Parameter settings cannot be stored.	• Make sure you are saving the new value by pressing the STORE button after adjusting a parameter setting. If you press EXIT, the change will not be saved. • Check that the adjustment lock (parameter 15B) is turned off. If the adjustment lock is on, settings can be viewed but not changed. You need to know the security access code to change the adjustment lock setting. • The EEPROM may be faulty on the keypad. A faulty EEPROM will also trip the soft starter, and the keypad will display the message Parameter Out Of Range. Contact your local supplier for advice.
Starter reports "Power On" when Run Simulation is activated.	• The soft starter will not activate Run Simulation with three-phase power connected. This prevents unintentional direct on-line (DOL) start.

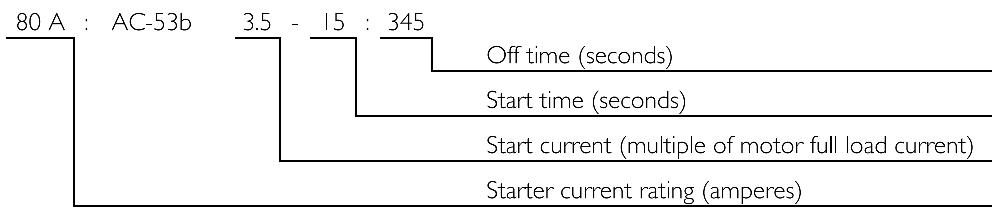
Section 11 Appendix

11.1 Specifications

Model Code



Current Ratings for Bypass Operation



NOTE
Models EMX3-0255C, EMX3-0360C, EMX3-0380C, EMX3-0430C, EMX3-0620C, EMX3-0650C, EMX3-0790C, EMX3-0930C, EMX3-1200C, EMX3-1410C, EMX3-1600C must be externally bypassed.

In-line connection

	AC53b 3.0-10:350 40 °C <1000 metres	AC53b 3.5-15:345 40 °C <1000 metres	AC53b 4.0-20:340 40 °C <1000 metres	AC53b 4.5-30:330 40 °C <1000 metres
EMX3-0023B	23 A	20 A	17 A	15 A
EMX3-0043B	43 A	37 A	31 A	26 A
EMX3-0050B	50 A	44 A	37 A	30 A
EMX3-0053B	53 A	53 A	46 A	37 A
	AC53b 3.0-10:590 40 °C <1000 metres	AC53b 3.5-15:585 40 °C <1000 metres	AC53b 4.0-20:580 40 °C <1000 metres	AC53b 4.5-30:570 40 °C <1000 metres
EMX3-0076B	76 A	64 A	55 A	47 A
EMX3-0097B	97 A	82 A	69 A	58 A
EMX3-0100B	100 A	88 A	74 A	61 A
EMX3-0105B	105 A	105 A	95 A	78 A
EMX3-0145B	145 A	123 A	106 A	90 A
EMX3-0170B	170 A	145 A	121 A	97 A
EMX3-0200B	200 A	189 A	160 A	134 A
EMX3-0220B	220 A	210 A	178 A	148 A
EMX3-0255B	255 A	231 A	201 A	176 A
EMX3-0255C	255 A	231 A	201 A	176 A
EMX3-0350B	350 A	306 A	266 A	230 A

EMX3-0360C	360 A	360 A	310 A	263 A
EMX3-0380C	380 A	380 A	359 A	299 A
EMX3-0425B	425 A	371 A	321 A	276 A
EMX3-0430C	430 A	430 A	368 A	309 A
EMX3-0500B	500 A	445 A	383 A	326 A
EMX3-0580B	580 A	492 A	425 A	364 A
EMX3-0620C	620 A	620 A	540 A	434 A
EMX3-0650C	650 A	650 A	561 A	455 A
EMX3-0700B	700 A	592 A	512 A	438 A
EMX3-0790C	790 A	790 A	714 A	579 A
EMX3-0820B	820 A	705 A	606 A	516 A
EMX3-0920B	920 A	804 A	684 A	571 A
EMX3-0930C	930 A	930 A	829 A	661 A
EMX3-1000B	1000 A	936 A	796 A	664 A
EMX3-1200C	1200 A	1200 A	1200 A	1071 A
EMX3-1410C	1410 A	1410 A	1319 A	1114 A
EMX3-1600C	1600 A	1600 A	1600 A	1353 A

Inside delta connection

	AC53b 3.0-10:350 40 °C <1000 metres	AC53b 3.5-15:345 40 °C <1000 metres	AC53b 4.0-20:340 40 °C <1000 metres	AC53b 4.5-30:330 40 °C <1000 metres
EMX3-0023B	34 A	30 A	26 A	22 A
EMX3-0043B	64 A	59 A	51 A	44 A
EMX3-0050B	75 A	66 A	55 A	45 A
EMX3-0053B	79 A	79 A	69 A	55 A
	AC53b 3.0-10:590 40 °C <1000 metres	AC53b 3.5-15:585 40 °C <1000 metres	AC53b 4.0-20:580 40 °C <1000 metres	AC53b 4.5-30:570 40 °C <1000 metres
EMX3-0076B	114 A	96 A	83 A	70 A
EMX3-0097B	145 A	123 A	104 A	87 A
EMX3-0100B	150 A	132 A	112 A	92 A
EMX3-0105B	157 A	157 A	143 A	117 A
EMX3-0145B	217 A	184 A	159 A	136 A
EMX3-0170B	255 A	217 A	181 A	146 A
EMX3-0200B	300 A	283 A	241 A	200 A
EMX3-0220B	330 A	315 A	268 A	223 A
EMX3-0255B	382 A	346 A	302 A	264 A
EMX3-0255C	382 A	346 A	302 A	264 A
EMX3-0350B	525 A	459 A	399 A	345 A
EMX3-0360C	540 A	540 A	465 A	395 A
EMX3-0380C	570 A	570 A	539 A	449 A
EMX3-0425B	638 A	557 A	482 A	414 A
EMX3-0430C	645 A	645 A	552 A	464 A
EMX3-0500B	750 A	668 A	575 A	490 A
EMX3-0580B	870 A	738 A	637 A	546 A
EMX3-0620C	930 A	930 A	810 A	651 A
EMX3-0650C	975 A	975 A	842 A	683 A
EMX3-0700B	1050 A	889 A	768 A	658 A
EMX3-0790C	1185 A	1185 A	1071 A	868 A
EMX3-0820B	1230 A	1058 A	910 A	774 A
EMX3-0920B	1380 A	1206 A	1026 A	857 A
EMX3-0930C	1395 A	1395 A	1244 A	992 A
EMX3-1000B	1500 A	1404 A	1194 A	997 A
EMX3-1200C	1800 A	1800 A	1800 A	1606 A
EMX3-1410C	2115 A	2115 A	1979 A	1671 A
EMX3-1600C	2400 A	2400 A	2400 A	2030 A

Current Ratings for Continuous Operation (Not bypassed)

351 A : AC-53a 3.5 - 15 : 50 - 6

- 6 — Starts per hour
- 50 — On-load duty cycle (%)
- 15 — Start time (seconds)
- 3.5 — Start current (multiple of motor full load current)
- 351 A — Starter current rating (amperes)

In-line connection

	AC53a 3-10:50-6 40 °C <1000 metres	AC53a 3.5-15:50-6 40 °C <1000 metres	AC53a 4-20:50-6 40 °C <1000 metres	AC53a 4.5-30:50-6 40 °C <1000 metres
EMX3-0255C	255 A	222 A	195 A	171 A
EMX3-0360C	360 A	351 A	303 A	259 A
EMX3-0380C	380 A	380 A	348 A	292 A
EMX3-0430C	430 A	413 A	355 A	301 A
EMX3-0620C	620 A	614 A	515 A	419 A
EMX3-0650C	650 A	629 A	532 A	437 A
EMX3-0790C	790 A	790 A	694 A	567 A
EMX3-0930C	930 A	930 A	800 A	644 A
EMX3-1200C	1200 A	1200 A	1135 A	983 A
EMX3-1410C	1410 A	1355 A	1187 A	1023 A
EMX3-1600C	1600 A	1600 A	1433 A	1227 A

Inside delta connection

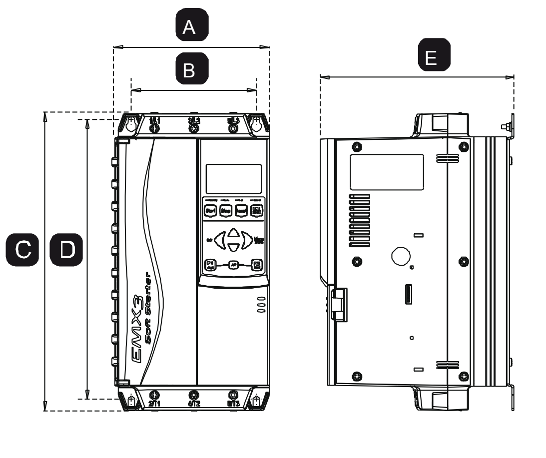
	AC53a 3-10:50-6 40 °C <1000 metres	AC53a 3.5-15:50-6 40 °C <1000 metres	AC53a 4-20:50-6 40 °C <1000 metres	AC53a 4.5-30:50-6 40 °C <1000 metres
EMX3-0255C	382 A	334 A	293 A	257 A
EMX3-0360C	540 A	527 A	455 A	388 A
EMX3-0380C	570 A	570 A	522 A	437 A
EMX3-0430C	645 A	620 A	533 A	451 A
EMX3-0620C	930 A	920 A	773 A	628 A
EMX3-0650C	975 A	943 A	798 A	656 A
EMX3-0790C	1185 A	1185 A	1041 A	850 A
EMX3-0930C	1395 A	1395 A	1200 A	966 A
EMX3-1200C	1800 A	1800 A	1702 A	1474 A
EMX3-1410C	2115 A	2033 A	1780 A	1535 A
EMX3-1600C	2400 A	2400 A	2149 A	1840 A

Minimum and Maximum Current Settings

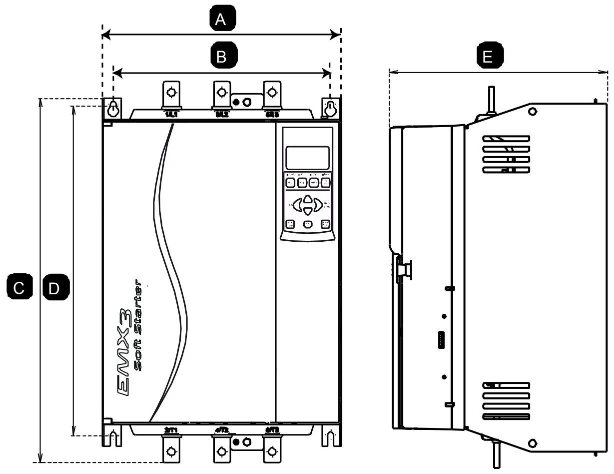
The EMX3's minimum and maximum full load current settings depend on the model:

	In-line connection		Inside delta connection	
Model	Minimum	Maximum	Minimum	Maximum
EMX3-0023B	5 A	23 A	5 A	34 A
EMX3-0043B	9 A	43 A	9 A	64 A
EMX3-0050B	10 A	50 A	10 A	75 A
EMX3-0053B	11 A	53 A	11 A	79 A
EMX3-0076B	15 A	76 A	15 A	114 A
EMX3-0097B	19 A	97 A	19 A	145 A
EMX3-0100B	20 A	100 A	20 A	150 A
EMX3-0105B	21 A	105 A	21 A	157 A
EMX3-0145B	29 A	145 A	29 A	217 A
EMX3-0170B	34 A	170 A	34 A	255 A
EMX3-0200B	40 A	200 A	40 A	300 A
EMX3-0220B	44 A	220 A	44 A	330 A
EMX3-0255B	51 A	255 A	51 A	382 A
EMX3-0255C	51 A	255 A	51 A	382 A
EMX3-0350B	70 A	350 A	70 A	525 A
EMX3-0360C	72 A	360 A	72 A	540 A
EMX3-0380C	76 A	380 A	76 A	570 A
EMX3-0425B	85 A	425 A	85 A	638 A
EMX3-0430C	86 A	430 A	86 A	645 A
EMX3-0500B	100 A	500 A	100 A	750 A
EMX3-0580B	116 A	580 A	116 A	870 A
EMX3-0620C	124 A	620 A	124 A	930 A
EMX3-0650C	130 A	650 A	130 A	975 A
EMX3-0700B	140 A	700 A	140 A	1050 A
EMX3-0790C	158 A	790 A	158 A	1185 A
EMX3-0820B	164 A	820 A	164 A	1230 A
EMX3-0920B	184 A	920 A	184 A	1380 A
EMX3-0930C	186 A	930 A	186 A	1395 A
EMX3-1000B	200 A	1000 A	200 A	1500 A
EMX3-1200C	240 A	1200 A	240 A	1800 A
EMX3-1410C	282 A	1410 A	282 A	2115 A
EMX3-1600C	320 A	1600 A	320 A	2400 A

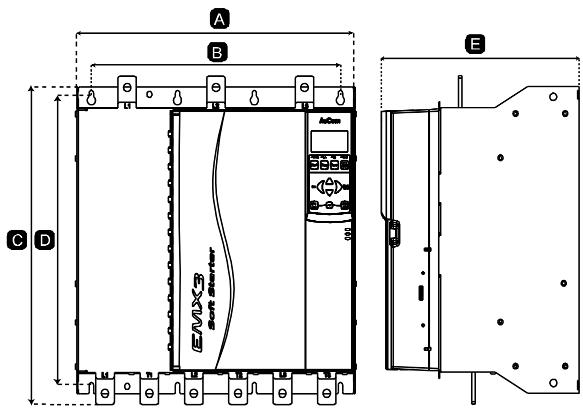
Dimensions and Weights



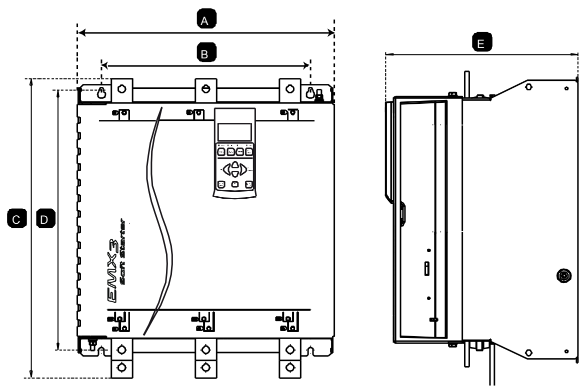
G1B



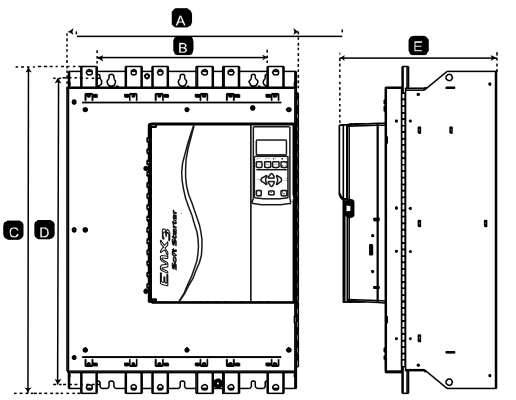
G2B



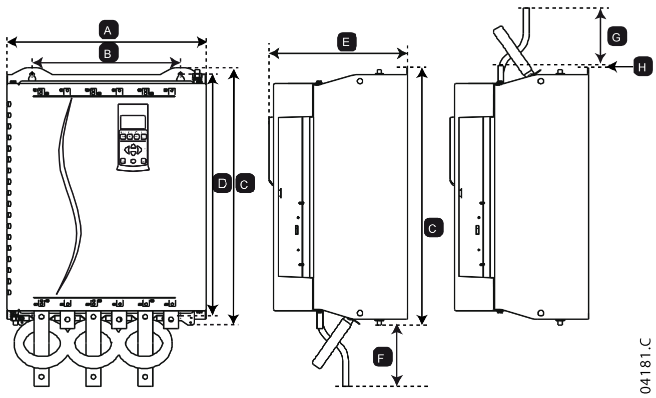
G3B



G3C



G4B



G4C - G5C

<table>
<tr><th>Model</th><th>Size</th><th>A
mm
(inch)</th><th>B
mm
(inch)</th><th>C
mm
(inch)</th><th>D
mm
(inch)</th><th>E
mm
(inch)</th><th>F
mm
(inch)</th><th>G
mm
(inch)</th><th>H
mm
(inch)</th><th>Weight
kg
(lb)</th></tr>
<tr><td>EMX3-0023B</td><td rowspan="8">G1B</td><td rowspan="8">156
(6.2)</td><td rowspan="8">124
(4.9)</td><td rowspan="8">295
(11.6)</td><td rowspan="8">278
(10.9)</td><td rowspan="4">192
(7.6)</td><td rowspan="8">N/A</td><td rowspan="8">N/A</td><td rowspan="8">N/A</td><td rowspan="4">3.2
(7.1)</td></tr>
<tr><td>EMX3-0043B</td></tr>
<tr><td>EMX3-0050B</td></tr>
<tr><td>EMX3-0053B</td></tr>
<tr><td>EMX3-0076B</td><td rowspan="4">223
(8.8)</td><td>3.5 (7.2)</td></tr>
<tr><td>EMX3-0097B</td><td rowspan="3">4.8
(10.6)</td></tr>
<tr><td>EMX3-0100B</td></tr>
<tr><td>EMX3-0105B</td></tr>
<tr><td>EMX3-0145B
EMX3-0170B
EMX3-0200B
EMX3-0220B</td><td>G2B</td><td>282
(11.1)</td><td>250
(9.8)</td><td>438
(17.2)</td><td>380
(15.0)</td><td>250
(9.8)</td><td>N/A</td><td>N/A</td><td>N/A</td><td>16
(35.3)</td></tr>
<tr><td>EMX3-0255B</td><td>G3B</td><td>424
(16.5)</td><td>376
(14.8)</td><td>440
(17.3)</td><td>392
(15.4)</td><td>298
(11.7)</td><td>N/A</td><td>N/A</td><td>N/A</td><td>26 (57.2)</td></tr>
<tr><td>EMX3-0350B
EMX3-0425B
EMX3-0500B
EMX3-0580B
EMX3-0700B
EMX3-0820B
EMX3-0920B
EMX3-1000B</td><td>G4B</td><td>438
(17.24)</td><td>320
(12.60)</td><td>640
(25.20)</td><td>600
(23.62)</td><td>300
(11.81)</td><td>N/A</td><td>N/A</td><td>N/A</td><td>60.0
(132.3)</td></tr>
<tr><td>EMX3-0255C</td><td>G3C</td><td>390
(15.4)</td><td>320
(12.6)</td><td>417
(16.4)</td><td>400
(15.8)</td><td>284
(11.2)</td><td>N/A</td><td>N/A</td><td>N/A</td><td>25 (55.1)</td></tr>
<tr><td>EMX3-0360C</td><td rowspan="7">G4C</td><td rowspan="7">430
(16.9)</td><td rowspan="7">320
(12.6)</td><td rowspan="7">698
(27.1)</td><td rowspan="7">522
(20.6)</td><td rowspan="7">302
(11.9)</td><td rowspan="7">104.5
(4.1)</td><td rowspan="7">104.5
(4.1)</td><td rowspan="7">5.5
(0.2)</td><td rowspan="3">50.5
(111.3)</td></tr>
<tr><td>EMX3-0380C</td></tr>
<tr><td>EMX3-0430C</td></tr>
<tr><td>EMX3-0620C</td><td rowspan="4">53.5
(118.0)</td></tr>
<tr><td>EMX3-0650C</td></tr>
<tr><td>EMX3-0790C</td></tr>
<tr><td>EMX3-0930C</td></tr>
<tr><td>EMX3-1200C
EMX3-1410C
EMX3-1600C</td><td>G5C</td><td>574
(22.6)</td><td>500
(19.7)</td><td>750
(29.5)</td><td>727
(28.6)</td><td>361
(14.2)</td><td>132.5
(5.2)</td><td>129
(5.1)</td><td>5
(0.2)</td><td>140
(308.7)</td></tr>
</table>

Specifications

- Supply

Mains voltage (L1, L2, L3)
EMX3-xxxx-V4 .... 200 VAC ~ 440 VAC (± 10%)
EMX3-xxxx-V7 .... 380 VAC ~ 600 VAC (± 10%)
EMX3-xxxx-V7 .... 380 VAC ~ 690 VAC (± 10%) (earthed star supply system only)
Control voltage (A1, A2, A3)
EMX3-xxxx-xx-C1 (A1, A2)........ 110 ~ 210 VAC (+ 10% / -15%), 600mA
EMX3-xxxx-xx-C1 (A2, A3)........ 220 ~ 440 VAC (+ 10% / -15%), 600mA
EMX3-xxxx-xx-C2 (A1, A3)........ 24 VAC/VDC (± 20%), 100VA
Mains frequency .... 45 Hz to 66 Hz
Rated insulation voltage to earth .... 600 VAC
Rated impulse withstand voltage .... 4 kV
Form designation .... Bypassed or continuous, semiconductor motor starter form 1
Short circuit capability
Coordination with semiconductor fuses........ Type 2
Coordination with HRC fuses........ Type 1
EMX3-0023B to EMX3-0220B .... prospective current 65 kA
EMX3-0255B to EMX3-1000B, EMX3-0255C .... prospective current 85 kA
EMX3-1200C to EMX3-1600C .... prospective current 100 kA

- **Electromagnetic capability (compliant with EU Directive 89/336/EEC)**

EMC Emissions
EMX3-0023B to EMX3-0220B .... IEC 60947-4-2 Class B and Lloyds Marine No 1 Specification
EMX3-0255B to EMX3-1000B, EMX3-0255C to EMX3-1600C
.... IEC 60947-4-2 Class A and Lloyds Marine No 1 Specification
EMC Immunity .... IEC 60947-4-2

- **Inputs**

Input rating .... Active 24 VDC, 8 mA approx
Start (C23, C24) .... Normally open
Stop (C31, C32) .... Normally closed
Reset (C41, C42) .... Normally closed
Programmable inputs
Input A (C53, C54) .... Normally open
Input B (C63, C64) .... Normally open
Motor thermistor (B4, B5) .... Trip >3.6 kΩ, reset <1.6kΩ
PT100 RTD (B6, B7, B8) .... Accuracy 0 ~ 100 °C ± 0.5 °C, 100 °C ~ 150 °C ± 2 °C, -20 ~ 0 °C ± 2°C

- **Outputs**

Relay outputs .... 10A @ 250 Vac resistive, 5A @ 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 (selectable)
Maximum load .... 600 Ω (12 VDC @ 20 mA)
Accuracy .... ± 5%
24 VDC output (P24, COM) Maximum load .... 200 mA
Accuracy .... ± 10%

- **Environmental**

Protection
EMX3-0023B ~ EMX3-0105B IP20
EMX3-0145B ~ EMX3-1000B and EMX3-0255C ~ EMX3-1600C IP00
Keypad (when installed with remote mounting kit) .... IP65 & NEMA12
Operating temperature .... -10 °C to 60 °C, above 40 °C with derating
Storage temperature .... - 25 °C to + 60 °C
Operating altitude .... 0 - 1000 m, above 1000 m with derating
Humidity .... 5% to 95% Relative Humidity
Pollution degree .... Pollution Degree 3
Vibration (EMX3-0023B ~ EMX3-1000B) .... IEC 60068-2-6

- **Heat dissipation**

During start .... 4.5 watts per ampere
During run
EMX3-0023B ~ EMX3-0053B .... ≤ 39 watts approx
EMX3-0076B ~ EMX3-0105B .... ≤ 51 watts approx
EMX3-0145B ~ EMX3-0220B .... ≤ 120 watts approx
EMX3-0255B ~ EMX3-0500B .... ≤ 140 watts approx
EMX3-0580B ~ EMX3-1000B .... ≤ 357 watts approx
EMX3-0255C ~ EMX3-0930C .... 4.5 watts per ampere approx
EMX3-1200C ~ EMX3-1600C .... 4.5 watts per ampere approx

- **Certification**

UL/ C-UL .... UL 508
EMX3-0023B ~ EMX3-0105B .... IP20 & NEMA1, UL Indoor Type 1
EMX3-0145B ~ EMX3-1000B and EMX3-0255C ~ EMX3-1600C .... IP00, UL Indoor Open Type
CE .... IEC 60947-4-2

CCC .... GB 14048.6
C✓ .... IEC 60947-4-2
Marine .... Lloyds Marine No 1 Specification
RoHS .... Compliant with EU Directive 2002/95/EC

- Operational life (internal bypass contacts)

EMX3-0023B ~ EMX3-0105B .... 1,000,000 operations
EMX3-0145B ~ EMX3-1000B .... 100,000 operations

WARNING
EMX3-0220B~EMX3-1000B: The contacts on the internal bypass contactors should be checked for wear after the stated number of operations. Periodic servicing/replacements may be required.

11.2 Accessories

Communication Interfaces

EMX3 soft starters support network communication using the Profibus, DeviceNet, Modbus RTU and USB protocols, via an easy-to-install communications interface.

Hardware Expansion Cards

The EMX3 offers hardware expansion cards for users requiring additional inputs and outputs or advanced functionality. Each EMX3 can support a maximum of one expansion card.

- Input/Output

The input/output expansion card provides the following additional inputs and outputs:

- 2 x digital inputs
- 3 x output relays
- 1 x analog input
- 1 x analog output

- RTD/Ground Fault

The RTD/PT100 and ground fault protection card provides the following additional inputs:

- 6 x PT100 RTD inputs
- 1 x ground fault input

To use ground fault protection a 1000:1, 5 VA current transformer is also required.

Finger Guard Kit

Finger guards may be specified for personnel safety and can be used on EMX3 soft starter models 0145B~0255B. Finger guards fit over the soft starter terminals to prevent accidental contact with live terminals. Finger guards provide IP20 protection when used with cable of diameter 22 mm or greater.

Keypad Mounting Kit

The keypad mounting kit allows remote mounting of the keypad up to 3 m away from the soft starter. Different kits are available with two or three metre cables.

PC Software

WinMaster PC software provides monitoring, programming and control of up to 99 soft starters.

A Modbus or USB communication module is required for each starter to use WinMaster.

11.3 Parameter Values

If you require assistance from your supplier or a service technician, please note all parameter settings in the table below.

1	Motor Data 1	User Set 1	User Set 2
1A	*Motor Full Load Current*		
1B	*Locked Rotor Time*		
1C	*Locked Rotor Current*		
1D	*Motor Service Factor*		
2	Start/Stop Modes-1		
2A	*Start Mode*		
2B	*Start Ramp Time*		
2C	*Initial Current*		
2D	*Current Limit*		
2E	*Adaptive Start Profile*		
2F	*Kickstart Time*		
2G	*Kickstart Level*		
2H	*Stop Mode*		
2I	*Stop Time*		
2J	*Adaptive Stop Profile*		
2K	*Adaptive Control Gain*		
2L	*Brake Torque*		
2M	*Brake Time*		
3	Auto-Start/Stop		
3A	*Auto-Start Type*		
3B	*Auto-Start Time*		
3C	*Auto-Stop Type*		
3D	*Auto-Stop Time*		
4	Protection Settings		
4A	*Excess Start Time*		
4B	*Excess Start Time-2*		
4C	*Undercurrent*		
4D	*Undercurrent Delay*		
4E	*Instantaneous Overcurrent*		
4F	*Instantaneous Overcurrent Delay*		
4G	*Phase Sequence*		
4H	*Current Imbalance*		
4I	*Current Imbalance Delay*		
4J	*Frequency Check*		
4K	*Frequency Variation*		
4L	*Frequency Delay*		
4M	*Restart Delay*		
4N	*Motor Temperature Check*		
4O	*Ground Fault Level*		
4P	*Ground Fault Delay*		
4Q	*Reserved*		
4R	*Reserved*		
4S	*Reserved*		
4T	*Reserved*		
5	Auto-Reset Trips		
5A	*Auto-Reset Action*		
5B	*Maximum Resets*		
5C	*Reset Delay Groups A&B*		
5D	*Reset Delay Group C*		
6	Inputs		
6A	*Input A Function*		

6B	*Input A Name*		
6C	*Input A Trip*		
6D	*Input A Trip Delay*		
6E	*Input A Initial Delay*		
6F	*Input B Function*		
6G	*Input B Name*		
6H	*Input B Trip*		
6I	*Input B Trip Delay*		
6J	*Input B Initial Delay*		
6K	*Input C Function*		
6L	*Input D Function*		
6M	*Remote Reset Logic*		
6N	*Analog Input Trip*		
6O	*Analog Input Scale*		
6P	*Analog Trip Point*		
6Q	*Local/Remote*		
6R	*Comms in Remote*		
7	Outputs		
7A	*Relay A Function*		
7B	*Relay A On Delay*		
7C	*Relay A Off Delay*		
7D	*Relay B Function*		
7E	*Relay B On Delay*		
7F	*Relay B Off Delay*		
7G	*Relay C Function*		
7H	*Relay C On Delay*		
7I	*Relay C Off Delay*		
7J	*Relay D Function*		
7K	*Relay E Function*		
7L	*Relay F Function*		
7M	*Low Current Flag*		
7N	*High Current Flag*		
7O	*Motor Temperature Flag*		
7P	*Analog Output A*		
7Q	*Analog A Scale*		
7R	*Analog A Maximum Adjustment*		
7S	*Analog A Minimum Adjustment*		
7T	*Analog Output B*		
7U	*Analog B Scale*		
7V	*Analog B Maximum Adjustment*		
7W	*Analog B Minimum Adjustment*		
8	Display		
8A	*Language*		
8B	*F1 Button Action*		
8C	*F2 Button Action*		
8D	*Display A or kW*		
8E	*User Screen - Top Left*		
8F	*User Screen - Top Right*		
8G	*User Screen - Bottom Left*		
8H	*User Screen - Bottom Right*		
8I	*Graph Data*		
8J	*Graph Timebase*		
8K	*Graph Maximum Adjustment*		
8L	*Graph Minimum Adjustment*		
8M	*Current Calibration*		
8N	*Mains Reference Voltage*		
8O	*Voltage Calibration*		

9	Motor Data-2		
9A	*Dual Thermal Model*		
9B	*Motor FLC-2*		
9C	*Locked Rotor Time-2*		
9D	*Locked Rotor Current-2*		
9E	*Motor Service Factor-2*		

10	Start/Stop Modes-2		
10A	*Start Mode-2*		
10B	*Start Ramp-2*		
10C	*Initial Current-2*		
10D	*Current Limit-2*		
10E	*Adaptive Start Profile-2*		
10F	*Kickstart Time-2*		
10G	*Kickstart Level-2*		
10H	*Stop Mode-2*		
10I	*Stop Time-2*		
10J	*Adaptive Stop Profile-2*		
10K	*Adaptive Control Gain-2*		
10L	*Brake Torque-2*		
10M	*Brake Time-2*		

11	RTD Temperatures		
11A	*RTD/PT100 A °C*		
11B	*RTD/PT100 B °C*		
11C	*RTD/PT100 C °C*		
11D	*RTD/PT100 D °C*		
11E	*RTD/PT100 E °C*		
11F	*RTD/PT100 F °C*		
11G	*RTD/PT100 G °C*		

12	Slip-Ring Motors		
12A	*Motor Data-1 Ramp*		
12B	*Motor Data-2 Ramp*		
12C	*Changeover Time*		
12D	*Slip Ring Retard*		

15	Advanced		
15A	*Access Code*		
15B	*Adjustment Lock*		
15C	*Emergency Run*		
15D	*Shorted SCR Action*		

16	Protection Actions		
16A	*Motor Overload*		
16B	*Excess Start Time*		
16C	*Undercurrent*		
16D	*Instantaneous Overcurrent*		
16E	*Current Imbalance*		
16F	*Frequency*		
16G	*Input A Trip*		
16H	*Input B Trip*		
16I	*Motor Thermistor*		
16J	*Starter Communication*		
16K	*Network Communication*		
16L	*Heatsink Overtemperature*		
16M	*Battery/Clock*		
16N	*Ground Fault*		
16O	*RTD/PT100 A*		
16P	*RTD/PT100 B*		
16Q	*RTD/PT100 C*		

16R	*RTD/PT100 D*		
16S	*RTD/PT100 E*		
16T	*RTD/PT100 F*		
16U	*RTD/PT100 G*		
16V	*Reserved*		
16W	*Reserved*		

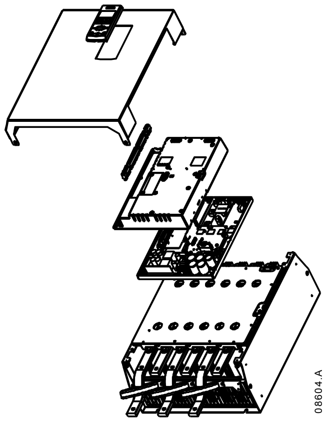
20	Restricted		

Section 12 Bus bar Adjustment Procedure

The bus bars on non-bypassed models EMX3-0360C ~ EMX3-1600C can be adjusted for top or bottom input and output as required.

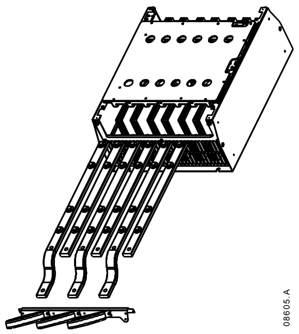
NOTE
Many electronic components are sensitive to static electricity. Voltages so low that they cannot be felt, seen or heard, can reduce the life, affect performance, or completely destroy sensitive electronic components. When performing service, proper ESD equipment should be used to prevent possible damage from occurring.

All units are manufactured with input and output bus bars at the bottom of the unit as standard. The input and/or output bus bars can be moved to the top of the unit if required.

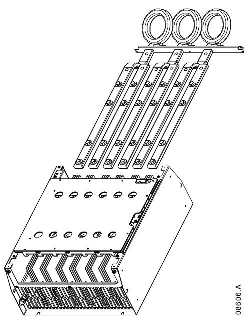


1. Remove all wiring and links from the soft starter before dismantling the unit.
2. Remove the unit cover (4 screws).
3. Remove the keypad faceplate, then gently remove the keypad (2 screws).
4. Remove the control terminal plugs.
5. Gently fold the main plastic away from the starter (12 screws).
6. Unplug the keypad loom from CON 1 (see note).
7. Label each SCR firing loom with the number of the corresponding terminal on the backplane PCB, then unplug the looms.
8. Unplug the thermistor, fan and current transformer wires from the model board.
9. Remove the plastic tray from the starter (four screws).

NOTE
Remove the main plastic slowly to avoid damaging the keypad wiring loom which runs between the main plastic and the backplane PCB.



10. Unscrew and remove the magnetic bypass plates (models EMX3-0620C to EMX3-1600C only).
11. Remove the current transformer assembly (three screws).
12. Identify which bus bars are to be moved. Remove the bolts holding these bus bars in place then slide the bus bars out through the bottom of the starter (four bolts per bus bar).



13. Slide the bus bars in through the top of the starter. For input bus bars, the short curved end should be outside the starter. For output bus bars, the unthreaded hole should be outside the starter.
14. Replace the dome washers with the flat face towards the bus bar, then tighten the bolts holding the bus bars in place to 20 Nm.
15. Place the current transformer assembly over the input bus bars and screw the assembly to the body of the starter (see note).
16. Run all wiring to the side of the starter and secure with cable ties.Run all wiring to the side of the starter and secure with cable ties.

NOTE
If moving the input bus bars, the current transformers (CTs) must also be reconfigured.

1. Label the CTs L1, L2 and L3 (L1 is leftmost when looking from the front of the starter). Remove the cable ties and unscrew the CTs from the bracket.
2. Move the CT bracket to the top of the starter. Position the CTs for the correct phases, then screw the CTs to the bracket. For models EMX3-0360C ~ EMX3-0930C, the CTs must be placed on an angle (the left hand legs of each CT will be on the top row of holes and the right hand legs will be on the bottom tabs).

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