MVX

IP00 SOFT STARTER

AuCom

USER MANUAL

Contents

1 About This Manual

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.

WARNING
Indicates a hazard that may cause personal injury or death.

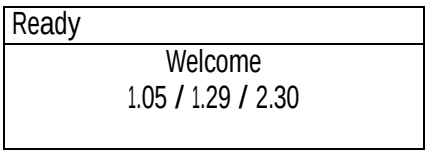
CAUTION
Indicates a hazard that may damage the equipment or installation.

NOTE
Provides helpful information.

1.1 User Manual Version

This user manual (710-13032-00D) is compatible with MVX soft starters using version 1.29 control software and version 2.30 interface software. For other software versions, please contact AuCom for the correct user manual.

The control software version is displayed on the Controller screen at power up.



Software versions: Controller, control software, interface software

2 Caution Statements

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

- Read and understand the entire manual before installing operating, or maintaining the MVX. Follow all applicable local and national codes.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices.
- Use only electrically insulated tools and clothing and insulated protective gear when working around electrical equipment.
- Disconnect all power and ensure that the MVX is de-energised before servicing the equipment.
- Do not rely on visual indications such as switch position or fuse removal for determining a de-energised condition. Always assume that a terminal is energised until it is checked with a properly rated meter to ensure that a terminal is de-energised and grounded.
- Isolate the MVX completely from the power supply before attempting any work on the MVX or motor.
- Always use a properly rated voltage sensing device to confirm power is off.
- Before servicing the MVX, ensure that all static charge has been discharged by grounding it with an appropriate grounding device.
- Metal swarf in the cabinet can cause equipment failure.
- Do not apply voltage to the control input terminals. These are active 24 VDC inputs and must be controlled with potential free contacts.
- Contacts or switches operating the control inputs must be suitable for low voltage, low current switching (ie gold flash or similar).
- Cables to the control inputs must be segregated from mains voltage and motor cabling.
- Some electronic contactor coils are not suitable for direct switching with PCB mount relays. Consult the contactor manufacturer/supplier to confirm suitability.

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

SHORT CIRCUIT
The MVX is not short circuit proof. After severe overload or short circuit, the operation of the MVX 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 MVX to provide proper grounding and branch circuit protection according to local electrical safety codes.

CAUTION
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.

ARC FLASH HAZARD
Medium voltage equipment has a potential risk of arc flash. When insulation or isolation between electrified conductors is breached or can no longer withstand the applied voltage, a short circuit occurs through the air. This may cause a phase-to-ground and/or a phase-to-phase fault.

Although unlikely, arc fault can be caused by:

- Contamination in the insulation caused by deterioration over time
- Inadequate insulation system on cable terminals
- Overvoltage
- Incorrect protection coordination settings
- Overheating of the contact area, due to incorrect tightening of connections
- Introduction of foreign matter, including swarf, vermin, tools or maintenance equipment left in the starter

AuCom medium voltage equipment has been designed to mitigate an arc fault, however it is the responsibility of the site engineer to ensure that personnel are protected from serious injury that may result from an arc fault.

STORAGE

The MVX must be stored in its original packaging in a clean and dry environment. The MVX should be unpacked only after the equipment room is ready for installation. Particular care should be taken to avoid exposure of the electronics to cement and/or concrete dust.

3 General Description

3.1 Overview

The MVX provides compact and robust soft start solutions for control of medium voltage motors. MVX 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.

The two primary components of a MVX soft starter are:

- a phase cassette
- a controller module

The phase cassette and controller module are supplied as a pair and share the same serial number. Care should be taken during installation to ensure that the correct controller and phase cassette are used together.

To integrate the MVX phase cassette within a custom enclosure, the following components are also included:

- Power interface board (including diagnostic board)
- Power supply isolator assembly
- Voltage sensor assembly
- Current sensor assembly
- Auxiliary power supply surge protection board
- Switched mode power supply
- Surge arrestor (x3)
- Cluster pin (x6)
- MVX transport assembly
- Rails for phase cassette (1 set)
- Tool kit for trolley

NOTE
Ensure that the enclosure is prepared to specification before installing the phase cassette. Refer to schematic drawings provided by AuCom for connecting and cabling information.

3.2 Feature List

Power connection
- 15 A to 450 A, nominal
- 11000 VAC

Starting
- Constant Current
- Current Ramp

Stopping
- Coast To Stop
- Soft stop

Protection
- Undervoltage / Overvoltage
- Mains frequency
- Phase sequence
- Shorted SCR
- Motor Overload (thermal model)
- Instantaneous Overcurrent (two stages)
- Time-overcurrent
- Ground Fault
- Undercurrent
- Current Imbalance
- Motor thermistor
- Excess Start Time
- Power circuit
- Auxiliary trip

Comprehensive feedback
- Digital display with multi-language support
- Controller buttons for quick access to common tasks
- Starter status LEDs
- 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
- Multi-level password protection
- Emergency stop pushbutton

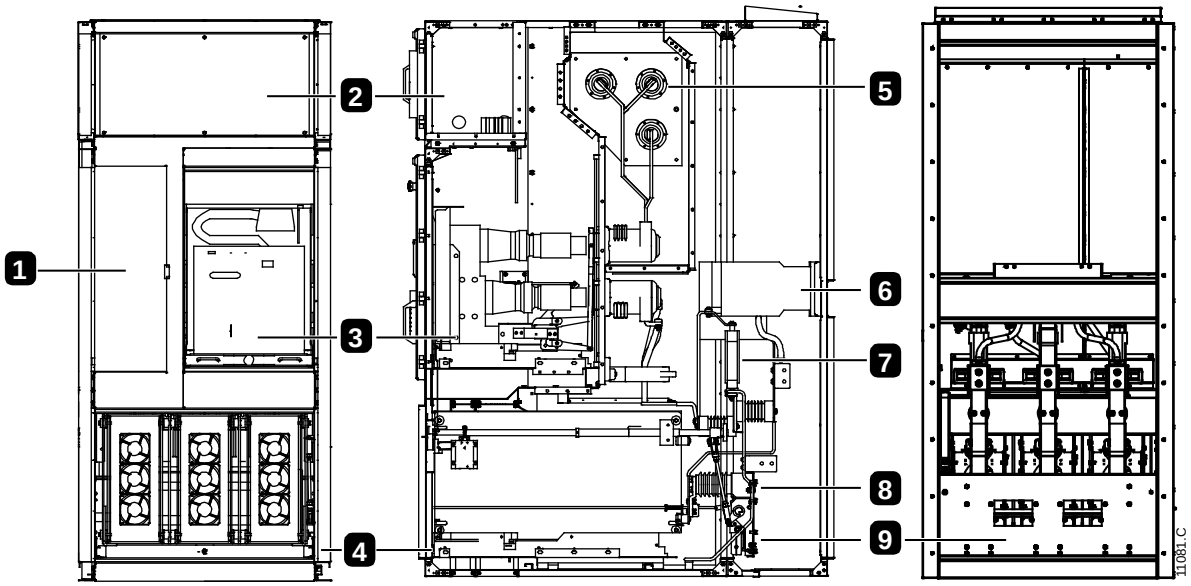
Extensive input and output options
- Remote control inputs
  (3 x fixed, 2 x programmable)
- Relay outputs
  (3 x fixed, 3 x programmable)
- Analog output
  (1 x programmable)
- Serial port (with module)

Accessories (optional)
- Communication modules: Ethernet (Profinet, Modbus TCP, Ethernet/IP), Profibus, DeviceNet, Modbus RTU, and USB
- Synchronous motor control
- PC software
- RTD relay
- Motor protection relay

3.3 Enclosures

MVX soft starters can be installed easily into standard enclosures to provide a complete motor control cabinet. The compact size of the power assembly leaves room for auxiliary equipment to be installed.

The phase cassette should be mounted at the bottom of the enclosure, and the controller can be mounted on the front panel. The diagrams below illustrate a possible configuration for installation.



Front view Side view Rear view

1	Controller compartment
2	Upper LV compartment
3	Main contactor/ circuit breaker compartment
4	Phase cassette
5	Input supply terminals

6	Bypass contactor/ Circuit breaker
7	Surge arrester
8	Phase cassette power connections
9	Earth switch

NOTE
For arc-fault resistant panels, allow at least 1 metre between top of panel and ceiling if gas exhaust ducts are not used.

3.4 Key Features

MVX soft starters offer several special functions to ensure ease of use and to provide optimal motor control in all environments and applications.

- Customisable Protection

The MVX offers comprehensive protection to ensure safe operation of the motor and soft starter. The protection characteristics can be customised extensively to match the exact requirements of the installation.

Use *4 Protection Settings* on page 32 to set the conditions in which each protection mechanism will activate.

> **Example:** use parameter 4C *Undercurrent* to set the level for an undercurrent trip and parameter 4D *Undercurrent Delay* to set a delay on the trip.

Use *16 Protection Action* on page 44 to select the soft starter's response when a protection mechanism activates. Each protection can be set to trip the starter, activate a warning flag, or be ignored. All protection activations are recorded in the event log, regardless of the protection class setting.

> **Example:** Use parameter 16C *Undercurrent* to select the response for an undercurrent trip (trip, warn or write to log). The default response is trip.

NOTE
MVX soft starters have built-in trip points to ensure operation remains within the soft starter's capability. These internal trips cannot be overridden. Certain faults within the MVX will also prevent the soft starter from operating. Refer to *Troubleshooting* on page 58 for details.

- Advanced Thermal Modelling

Intelligent thermal modelling allows the soft starter to predict whether the motor can successfully complete a start. The MVX uses information from previous starts to calculate the motor's available thermal capacity, and will only permit a start which is predicted to succeed.

This feature can be enabled or disabled using parameter *4N Motor Temperature Check*.

- Comprehensive Event and Trip Logging

The MVX has a 99-place event log to record information on soft starter operation. A separate trip log stores detailed information about the last eight trips.

- Informative Feedback Screens

A digital display screen allows the MVX to display important information clearly. Comprehensive metering information, details of starter status and last start performance allow easy monitoring of the starter's performance at all times.

- Dual Parameter Set

The MVX can be programmed with two separate sets of operating parameters. This allows the soft starter to control the motor in two different starting and stopping configurations.

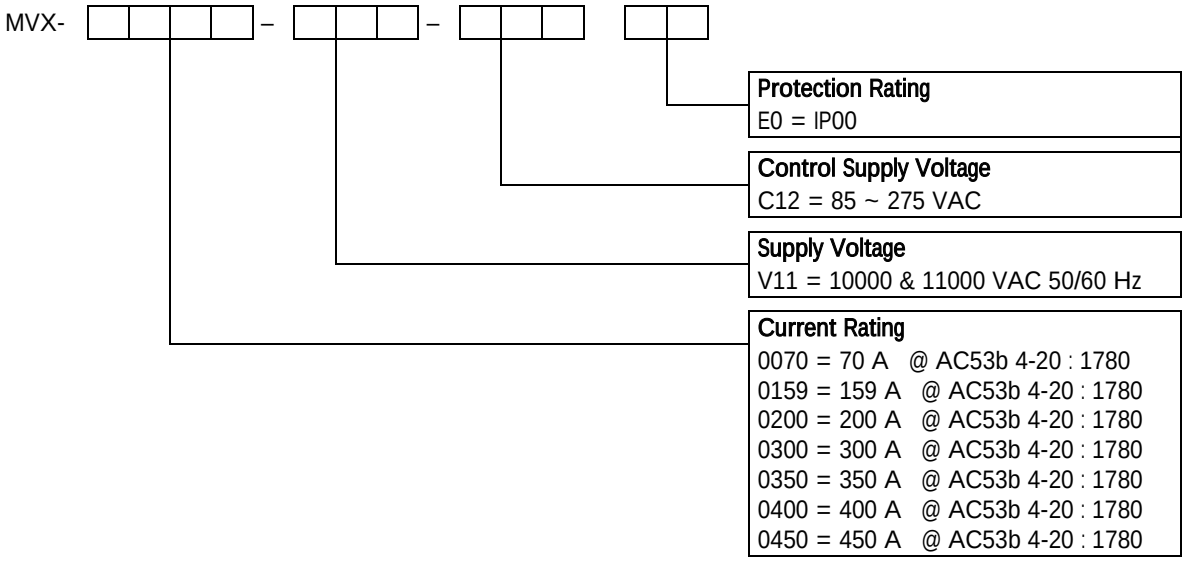
The secondary motor settings (parameter groups 9 and 10) are ideal for dual speed motors or conventional (squirrel-cage) motors which may start in two different conditions (such as loaded and unloaded conveyors).

The MVX will use the secondary motor settings to control a start when instructed via a programmable input (refer to parameters 6A and 6F, *Input A or B Function*).

- Fibre Optics

The MVX uses two-line fibre optic connections (per phase) between the low voltage control module and the high voltage phase cassette for electrical isolation. This fibre optic link simplifies installation of chassis mount MVX starters into custom panels.

3.5 Model Code

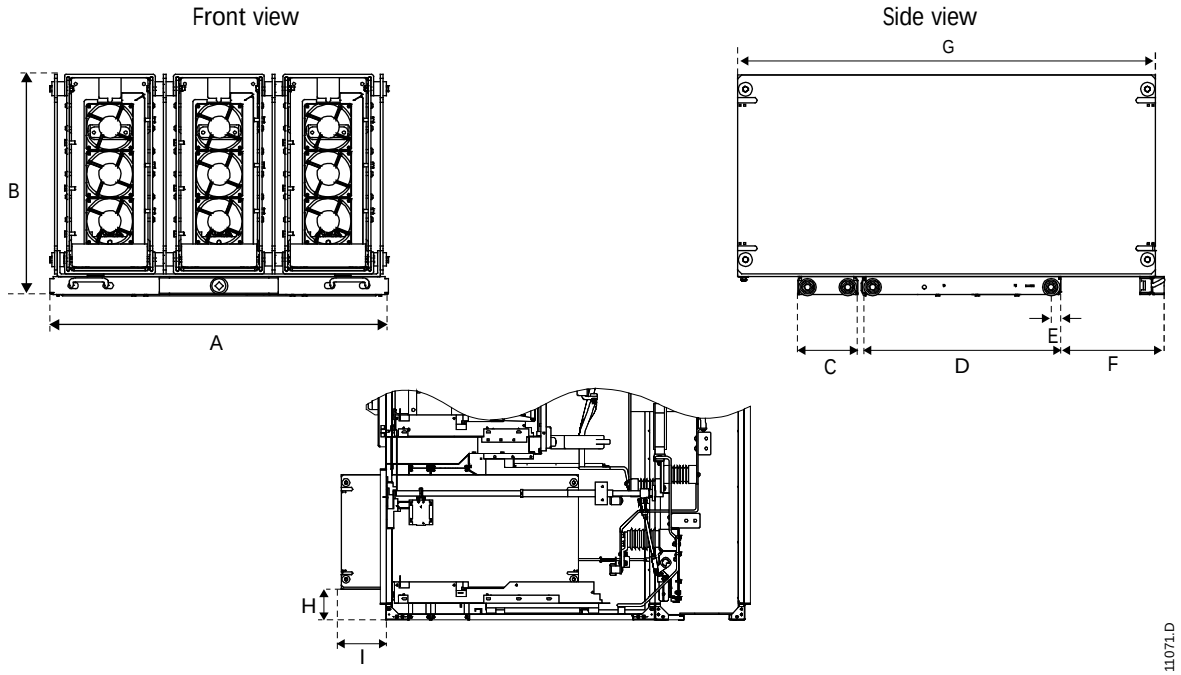


4 Specifications

4.1 Dimensions and Weights

Phase Cassette

The phase cassette is affixed to a trolley which allows the whole unit to be drawn out.

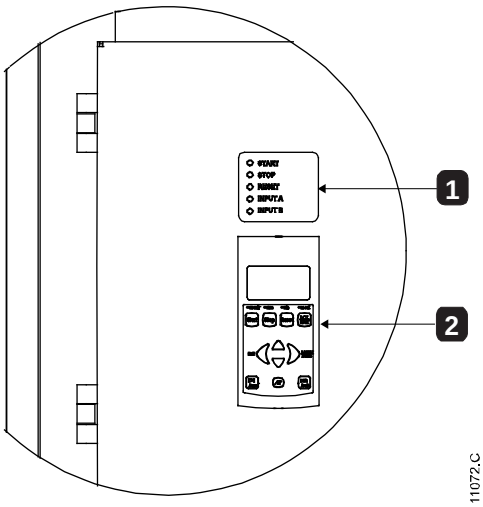


Phase cassette extended

	A	B	C	D	E	F	G	H	I	Weight
	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	kg (lb)
MVXxxxx-V11	853 (33.58)	563.2 (22.17)	151 (5.94)	504 (19.84)	25 (1)	260 (10.23)	1055 (41.53)	139 (5.47)	197 (7.75)	320 (705.4)

Controller

The controller is suitable for use with all MVX soft starters.



1	Control input LEDs
2	Keypad

4.2 General Technical Data

Supply

Rated Voltage	12 kV
Rated Frequency (fr)	50/60 Hz
Rated lightning impulse withstand voltage (U_p)	75 kV
Rated power frequency withstand voltage (U_d)	35 kV
Rated short-time withstand current (symmetrical RMS) (I_k)	31.5 kA for 100 ms [1]
Form designation	Bypassed semiconductor motor starter form 1

Control Inputs

Start (C23, C24)	24 VDC, 8 mA approx
Stop (C31, C32)	24 VDC, 8 mA approx
Reset (C41, C42)	24 VDC, 8 mA approx
Input A (C53, C54)	24 VDC, 8 mA approx
Input B (C63, C64)	24 VDC, 8 mA approx
Motor thermistor (B4, B5)	Trip point > 2.8 kW

NOTE
All control inputs are potential free. Do not apply external voltage to these inputs.

Low Voltage Supply

Rated Voltage	85 ~ 275 VAC
Rated Frequency	50/60 Hz
Typical power consumption	
Start	300 W
Stop	100 W

Outputs

Outputs on power interface board	
Main contactor (13, 14)	Normally Open
Bypass contactor (23, 24)	Normally Open
Run Output/ PFC (33, 34)	Normally Open
Fan control output (43, 44)	Normally Open
Outputs on Controller	
Output Relay A (43, 44)	Normally Open
Output Relay B (51, 52, 54)	Changeover
Output Relay C (61, 62, 64)	Changeover
Analog output (B10, B11)	0-20 mA or 4-20 mA
Characteristics	
	10 A @ 250 VAC resistive
	6 A @ 250 VAC 15 p.f. 0.3
	10 A @ 30 VDC resistive

Environmental

Degree of Protection	
Phase cassette	IP00
Controller (mounted on a panel)	IP54/ NEMA 12
Operating Environment	
IEC60721-3-3: IE34: Climatic 3K4	- 5 °C to + 40 °C, with derating to + 55 °C
Humidity	5% to 95% Relative Humidity
Storage Environment	
IEC60721-3-1: IE12: Climatic 1K3	- 5 °C to + 45 °C
Humidity	5% to 95% Relative Humidity
Operating Altitude	0 - 1000 m, above 1000 m with derating
Pollution degree	Pollution Degree 2
Vibration	IEC 60068-2-6 Fc

EMC Emission

Equipment class (EMC)	Class A

Conducted radio frequency emission	10 kHz to 150 kHz: < 120 - 69 dB µV
	0.15 MHz to 0.5 MHz: < 79 dB µV
	0.5 MHz to 30 MHz: < 73 dB µV
Radiated radio frequency emission	0.15 MHz to 30 MHz: < 80-50 dB µV/m
	30 MHz to 100 MHz: < 60-54 dB µV/m
	100 MHz to 2000 MHz: < 54 dB µV/m

This product has been designed as Class A equipment. Use of this product in domestic environments may cause radio interference, in which case the user may be required to employ additional mitigation methods.

EMC Immunity

Electrostatic Discharge	6 kV contact discharge, 8 kV air discharge
Radio Frequency Electromagnetic Field	80 MHz to 1000 MHz: 10 V/m
Fast Transients 5/50 ns (main and control circuits)	2 kV line to earth, 1 kV line to line
Surges 1.2/50 µs (main and control circuits)	2 kV line to earth, 1 kV line to line
Voltage dip and short time interruption (safe shutdown)	5000 ms (at 0% nominal voltage)

Standards Approvals

Cü	EMC requirements
CE	EMC EU Directive

[1] Short circuit current, with appropriate protection.

5 Installation

NOTE
The MVX soft starter should only be installed in a restricted access location suitable for electrical equipment.

WARNING
Ensure the following before connecting or disconnecting the phase cassette:

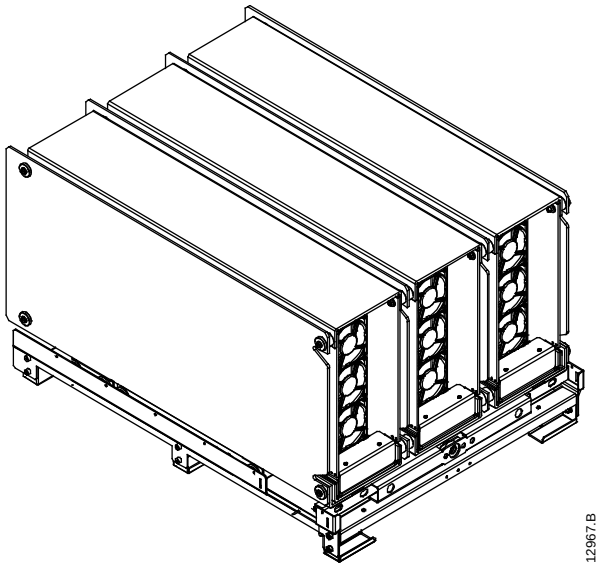
- The soft starter enclosure is isolated from the power supply.
- The main switching device (breaker/contactor) is disconnected.
- The soft starter enclosure is earthed by an earth switch.

CAUTION
Do not attempt to move the phase cassette without assistance. Because of its significant weight and construction, two or more persons are required to complete this procedure.

NOTE
MVX Pallet Transport Castors Assembly (part no: 992-11914-00) and *Tool Kit* (part no: 995-10998-00) are required for this operation.

5.1 Storing and Unpacking the Phase Cassette

The phase cassette is mounted on a steel pallet and then packed in a wooden crate for shipping and storage. Do not unpack the phase cassette until it is ready for installation.



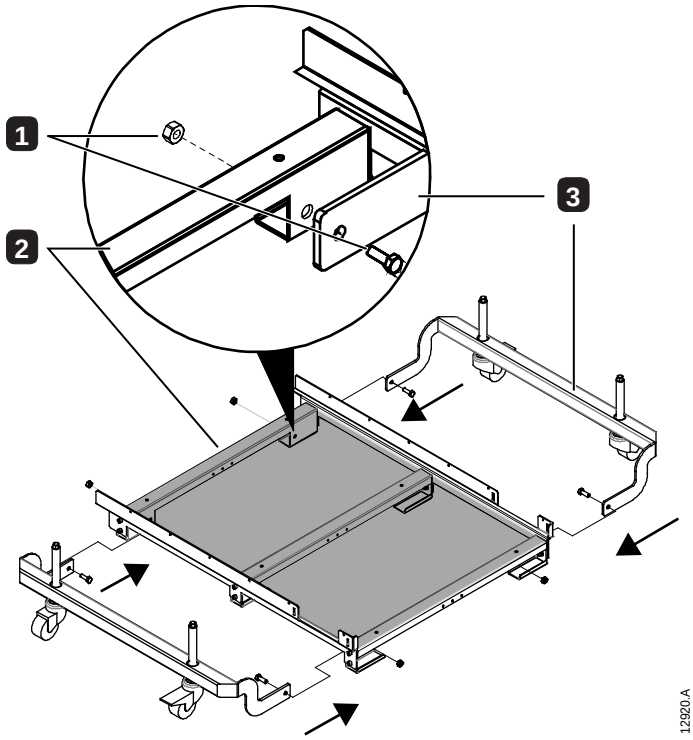
NOTE
Do not dispose the steel pallet after unpacking as it forms part of the transport assembly.

5.2 Assembling the Transport Assembly

The transport assembly is a movable platform arrangement for transporting the phase cassette. It is necessary for installation and maintenance operations.

Assemble the soft starter transport assembly as follows:

1. Slide the two pallet transport castors along the sides of the steel pallet. Make sure the bolt holes line up at both ends of the assembly.
2. Use M10 bolts to fasten the transport castors to the steel pallet at all four corners.

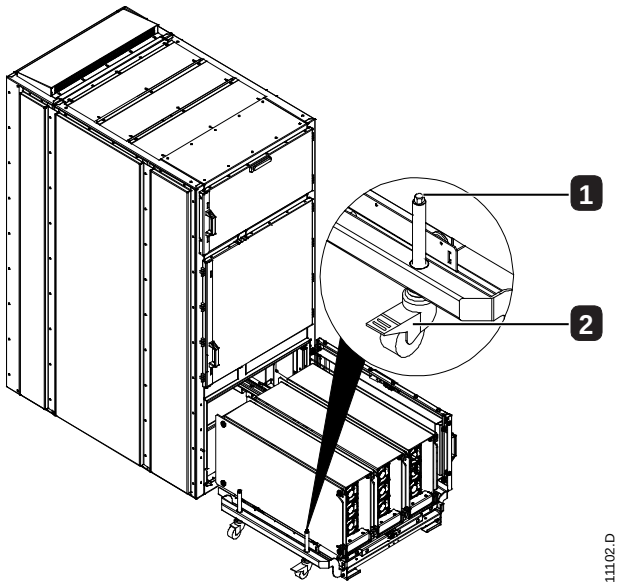


1	M10 fastening bolt
2	Steel pallet
3	Transport castors

5.3 Moving the Phase Cassette Using the Transport Assembly

Use the brace to raise the transport assembly off the ground:

1. Fit the brace to the adjustment screws on the sides of the assembly.
2. Rotate the brace in a clockwise direction to raise the assembly off the ground.
3. Lift the castor locking brakes to release the locking mechanism on both sides of the transport assembly.



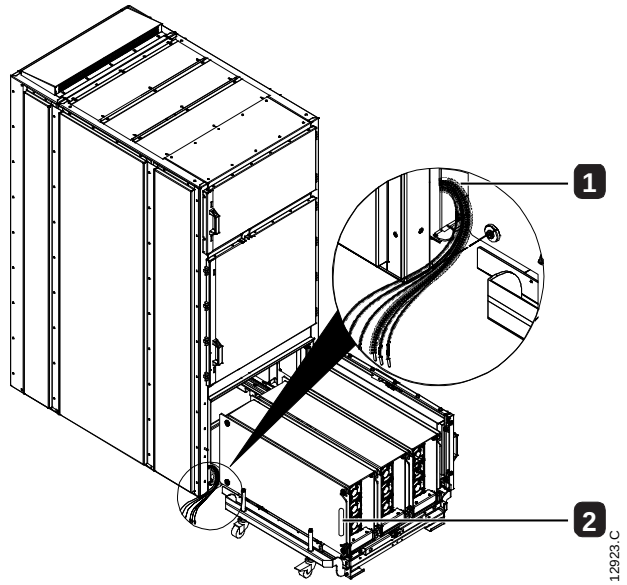
1	Transport assembly adjustment screw
2	Castor locking brake

Once the phase cassette is resting securely on the transport assembly it may be moved as required.

5.4 Installing the Phase Cassette

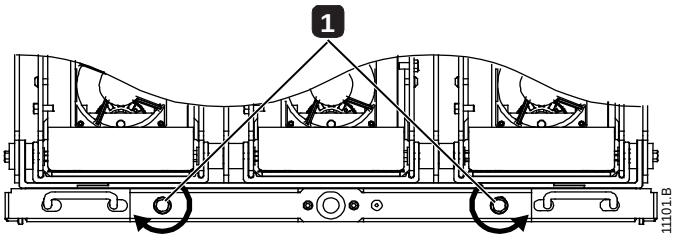
NOTE
Before installing the phase cassette into the panel, ensure that it is resting securely on the transport assembly.

1. Align the arms of the transport assembly along the trolley grooves of the panel. Press down on the castor locking brakes on both sides of the transport assembly to lock it in place.
2. Hold the phase cassette connection cables away from the panel. This protects the cables and fibre-optic connectors from damage during the operation.



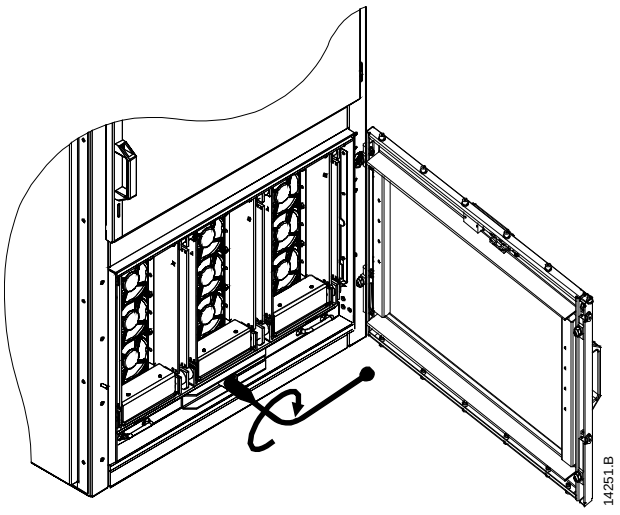
1	Phase cassette connection cables
2	Phase cassette side handle

3. Use the brace to disengage the trolley latching mechanism by turning in the direction indicated in the figure below.



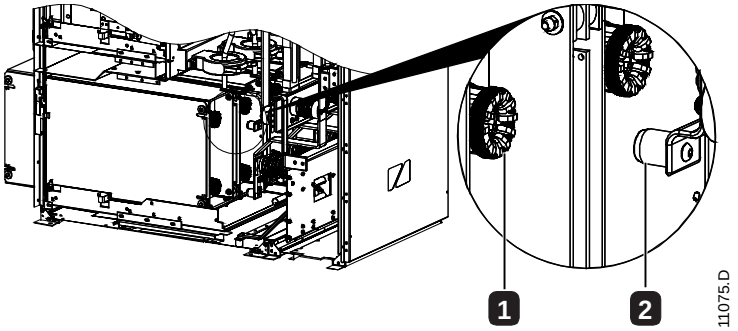
1	Trolley latching mechanism

4. Slide the phase cassette into the panel until the trolley latches into place inside the panel.
5. Use the crank to rack in the phase cassette, turning the crank clockwise until the phase cassette is completely racked in (approximately 20 turns).



5.5 Power Connections

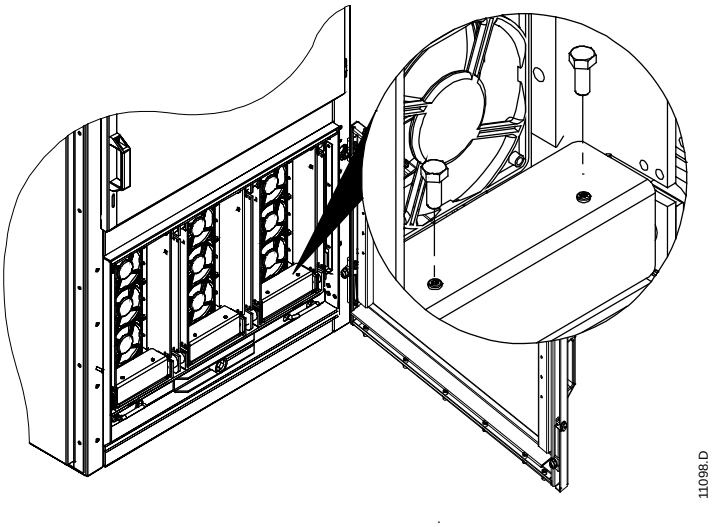
The phase cassette connects to enclosure power terminals using a clustered pin-plug arrangement.



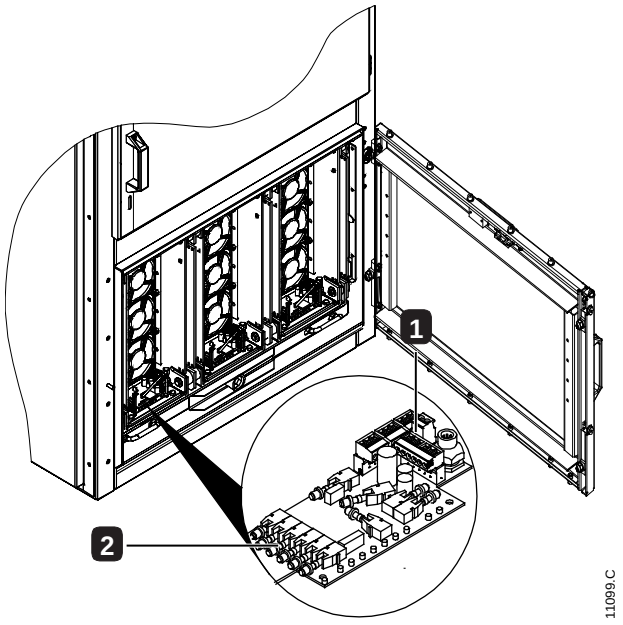
1	Cluster plug
2	Cluster pin

5.6 Connecting and Cabling the Phase Cassette

1. Locate the removable covers for the fibre-optic booster boards at the front of the phase cassette.



2. Unscrew the two M4 bolts used to fasten each cover. Unfasten all three covers to uncover the three fibre-optic booster boards.

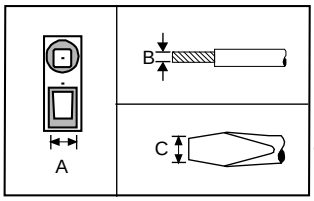


1	Six-way plug socket
2	Fibre-optic connectors

3. Locate the two fibre-optic cables, two-way connector plug and the six-way connector cable for the booster board.
4. Carefully connect these connectors and cables to each booster board.

5.7 Control Terminations

On the control voltage terminal block, control wiring is secured in place by 3 mm spring terminals. Use a screwdriver to open the terminal clamp, then insert the wire into the terminal cage. Release the clamp by removing the screwdriver.

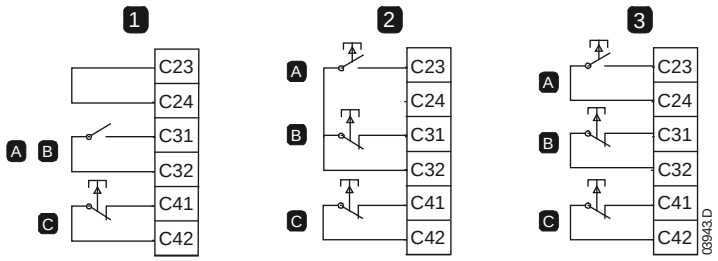


A (mm)	B (mm²)	C (mm)
3	2.5	3

5.8 Wiring Terminations on the Controller

Control Wiring

The MVX 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.

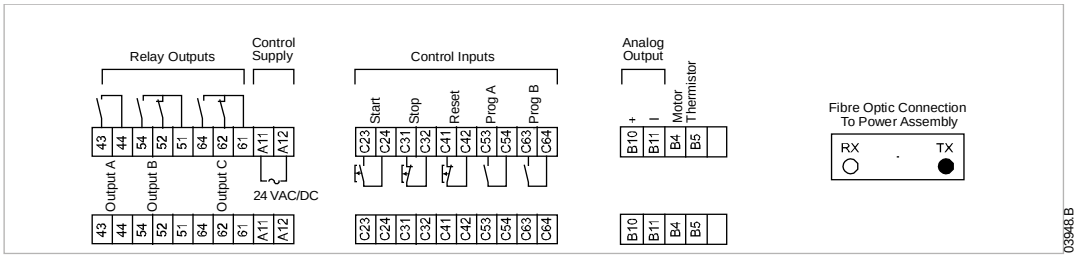
Cables to the control inputs must be segregated from mains voltage and motor cabling.

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

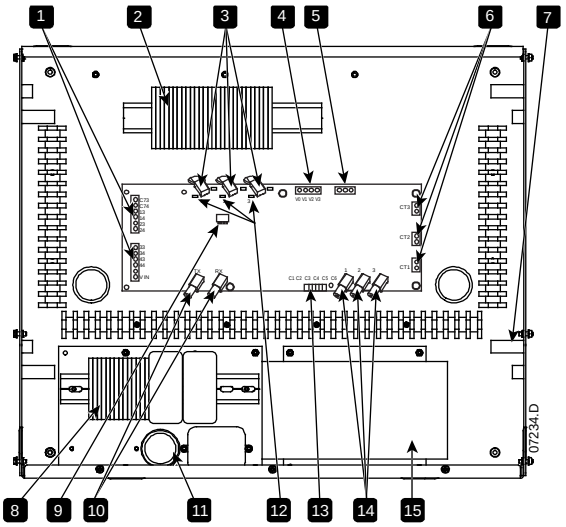
NOTE
Reset input is normally closed by default.

Terminal Block (controller)

Terminations on the controller use plug-in terminals. Unplug the terminal blocks, complete the wiring, then re-plug the terminal blocks into the controller.



5.9 Wiring Terminations on the Power Interface Board



1	Control terminals (refer to Power Circuit Configuration for details)
2	LV terminal block X1 and X10
3	Gate firing fibre optic connectors and firing LEDs (red)
4	Voltage sensing input connector
5	Ground fault CT connector
6	Line CT connectors
7	Access hole for CT wiring
8	Control voltage terminal block
9	CT ratio selector DIP switch S1
10	Fibre optic connections to controller, and LEDs
11	Access for LV wiring
12	Non-conduction LEDs (green)
13	Alarm inputs
14	Non-conduction readback fibre optic connectors
15	Switch mode power supply SMPS1

5.10 Ground Current

The ground current selector switch on the power interface board (S1) must be set to match the method for calculating ground current and the ratio of the line current CTs.

NOTE
The soft starter will check the ground current settings when control power is applied. If the switch settings are changed, control power must be cycled for the new setting to take effect.

§ Switch settings for ground current summation method

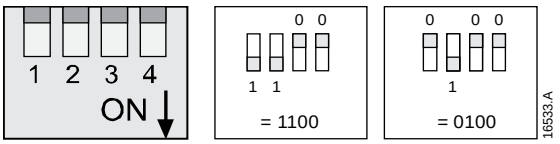
Line CT ratio	Switch setting
200:1	1000
500:1	0100
1000:1	1100

§ Switch settings for ground current zero sequence method

NOTE
Zero sequence ground current measurement requires a customer-supplied ground current CT. The CT must be 1000:1, 1 VA, minimum protection class rating 5P10.

Line CT ratio	Switch setting
200:1	0010
500:1	1010
1000:1	1100

§ Example settings for S1



5.11 Power Circuits

Overview

MVX soft starters are designed to operate as part of a system including other components.

Depending on the type of installation, the following additional components may also be installed:

- main isolator/ earth switch
- metal oxide varistors (MOV)
- motor protection relay (MPR)

Main Contactor or Circuit Breaker

The MVX must always be installed with either a main contactor and fuses or a circuit breaker.

The main contactor or circuit breaker is associated with terminals L1, L2, L3 on the supply side of the soft starter. The coil is associated with output terminals 13, 14 of the MVX (refer to *Power Circuit Configuration (with Contactors)* on page 20).

NOTE
Always use a suitable external protection relay with a circuit breaker to ensure instantaneous overcurrent trip functionality.

Bypass Contactor or Circuit Breaker

The MVX must always be installed with either a bypass contactor and fuses or circuit breaker.

The bypass contactor or circuit breaker is associated with terminals L1, L2, L3 on the supply side of the soft starter, and terminals T1, T2, T3 on the motor side. The coil is associated with output terminals 23, 24 of the MVX (refer to *Power Circuit Configuration (with Contactors) on page 20)*.

NOTE
Always use a suitable external protection relay with a circuit breaker to ensure instantaneous overcurrent trip functionality.

Power Factor Correction

NOTE
Do not connect power factor correction capacitors to the output of MVX soft starters. If static power factor correction is employed, it must be connected to the supply side of the soft starter.

Power factor correction capacitors should be selected based on the motor data and the required final power factor.

If power factor correction capacitors are being used, select a contactor according to the required kVAr. The contactor must be connected on the supply side of the soft starter. The power factor correction capacitor contactor coil is associated with output terminals 33, 34 of the soft starter's Interface PCB.

Line Inductors

Output line inductors may be required if the cable run between the soft starter and the motor is greater than 200 metres. Line inductors are typically installed in a shielded caged enclosure at the soft starter end of the motor cable. Factors which determine the requirement of line inductors are; the soft starter model, system operating voltage, output cable length and cable type.

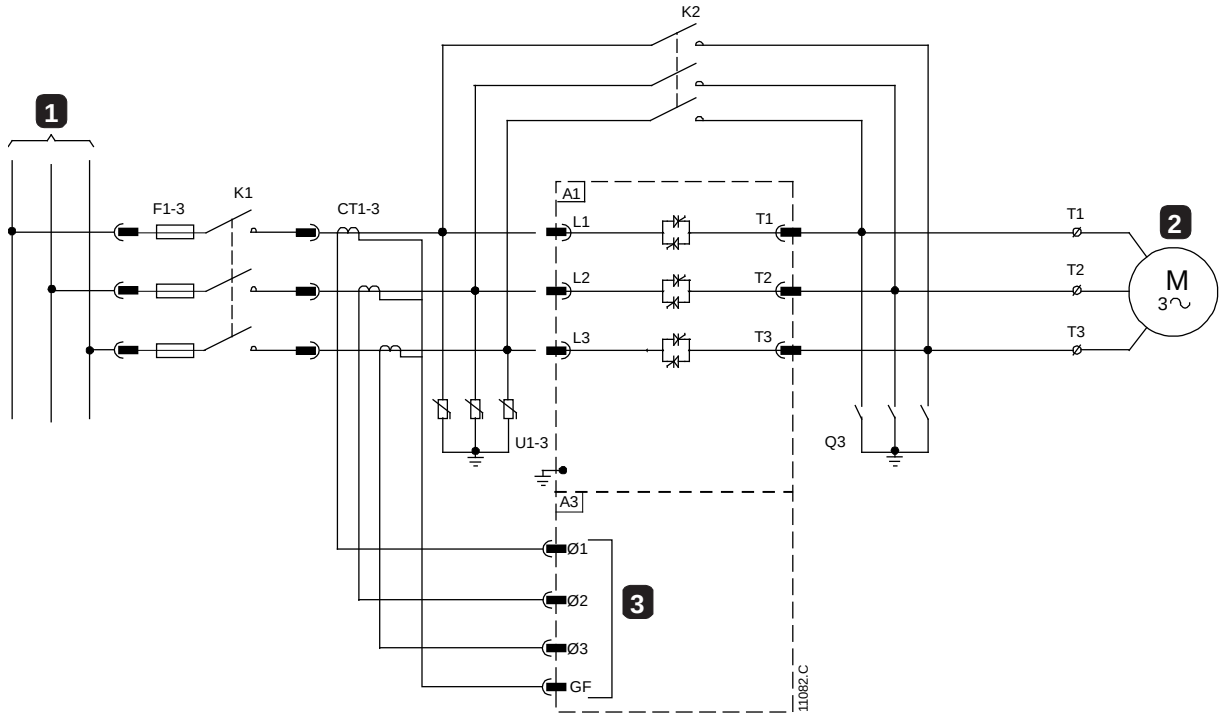
Contact your local supplier for advice when using motor output cables exceeding 200 metres. Cable data will be required, including the capacitance per km of the cable to be used.

Internal Control Supply Arrangement

The MVX includes an internal switched mode power supply, the output of which is distributed within the panel.

Power Circuit Configuration (with Contactors)

MVX power circuit with fused main contactor and bypass contactor.

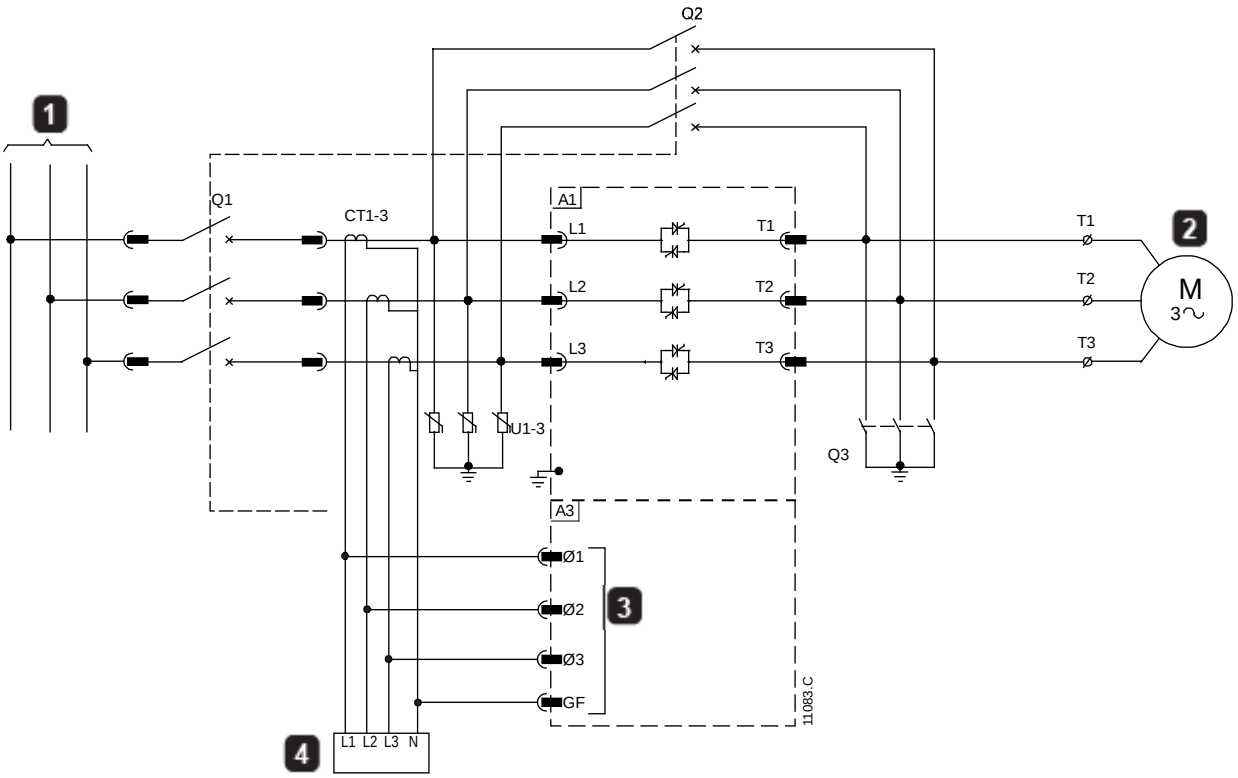


A1	Phase cassette
1	3 Phase 50/60 Hz Supply
K1	Main contactor (fused/ withdrawable)
K2	Bypass contactor (fixed)
CT1-3	Current transformers (x3)
F1-3	Motor protection fuses (x3)
U1-3	Metal oxide varistors (MOVs)

L1-L3	Input power terminals (supply side)
2	Motor
Q3	Earth switch
T1-T3	Output power terminals (motor side)
A3	Power interface board
3	Current transformer inputs

Power Circuit Configuration (with Circuit Breakers)

MVX power circuit with main circuit breaker and bypass circuit breaker.

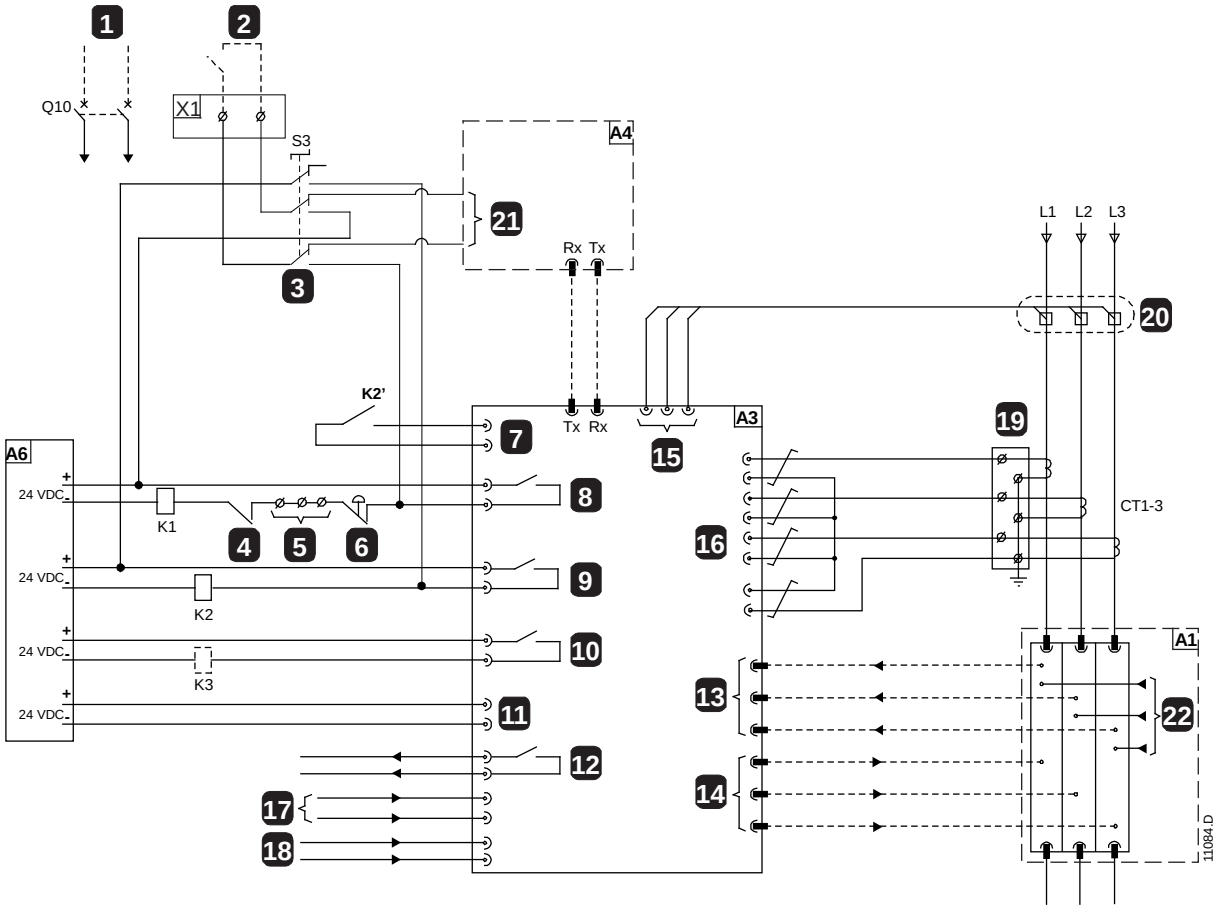


A1	Phase cassette
1	3 Phase 50/60 Hz Supply
Q1	Main circuit breaker (withdrawable)
Q2	Bypass circuit breaker (fixed)
CT1-3	Current transformers (x3)
U1-3	Metal oxide varistors (MOVs)
L1-L3	Input power terminals (supply side)

2	Motor
Q3	Earth switch
T1-T3	Output power terminals (motor side)
A3	Power interface board
3	Current transformer inputs
4	Protection relay

6 Internal Wiring

6.1 Internal Wiring (with Contactors)

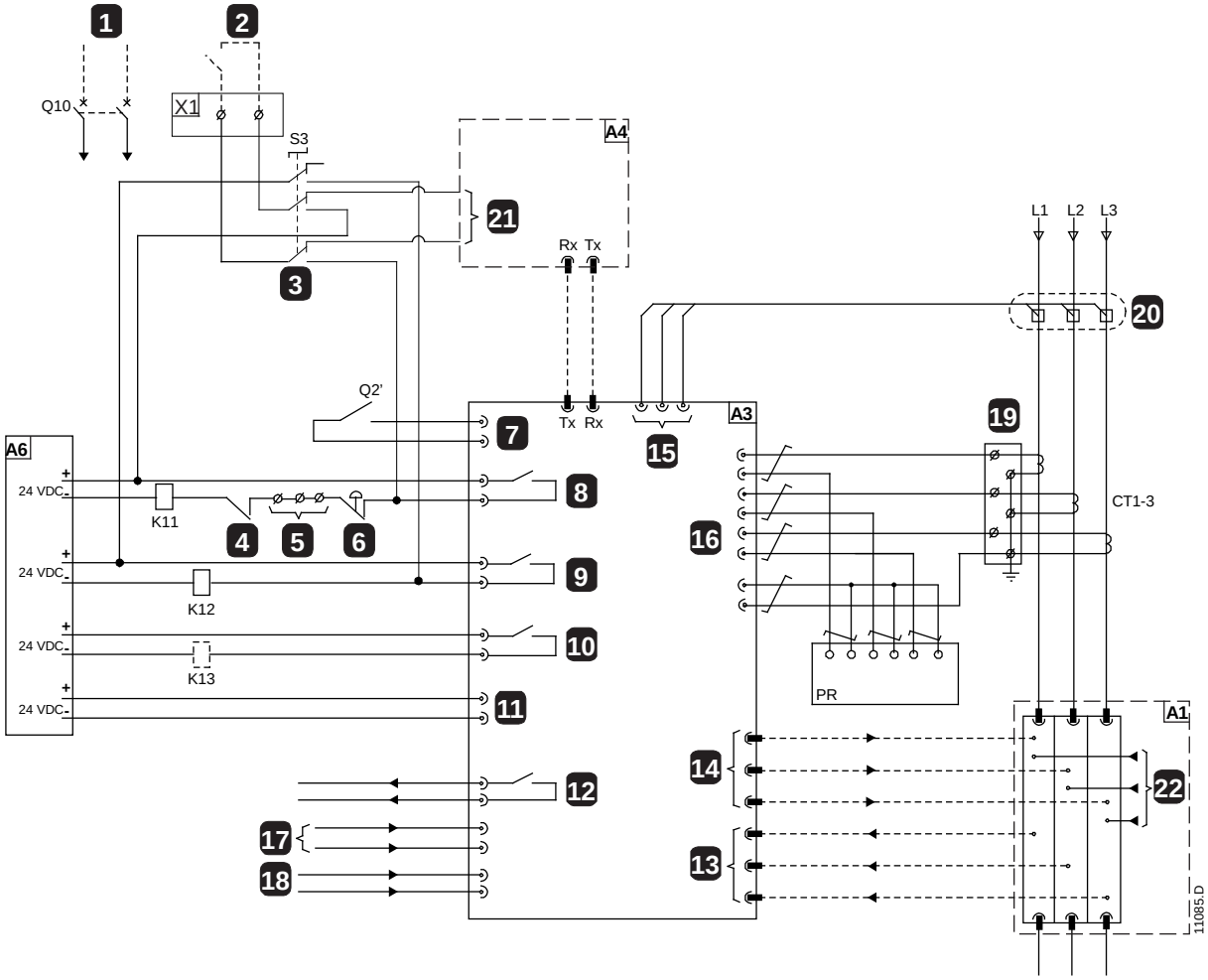


X1	LV terminal block
1	85 ~ 275 VAC control supply
Q10	Miniature circuit breakers (MCB)
2	Customer 2-wire Start/ Stop signal
3	Soft start/ DOL selector switch (S3)
A1	Phase cassette
K2'	Bypass readback signal
K1	Main contactor control module
K2	Bypass contactor control module
K3	PFC contactor control module
4	Door interlock
5	Links on terminal block (X1)
6	Emergency stop pushbutton
A4	Controller
21	Controller STOP input
A6	Power supply isolator PCB

A3	Power interface board
7	Bypass readback input
8	Main contactor output
9	Bypass contactor output
10	PFC output
11	24 VDC supply
12	Fan run output
13	Non conduction F/O inputs
14	Firing F/O outputs
15	Voltage sense inputs
16	Current transformer inputs (L1, L2, L3 and ground fault)
17	Fan fail input signal
18	Power supply fail input signal
19	Current transformer test block (TB1)
CT1-3	Current transformers
20	Voltage sensors
22	24 VDC supply

NOTE
A contactor (K3) is only supplied when PFC switching is required.

6.2 Internal Wiring (with Circuit Breakers)



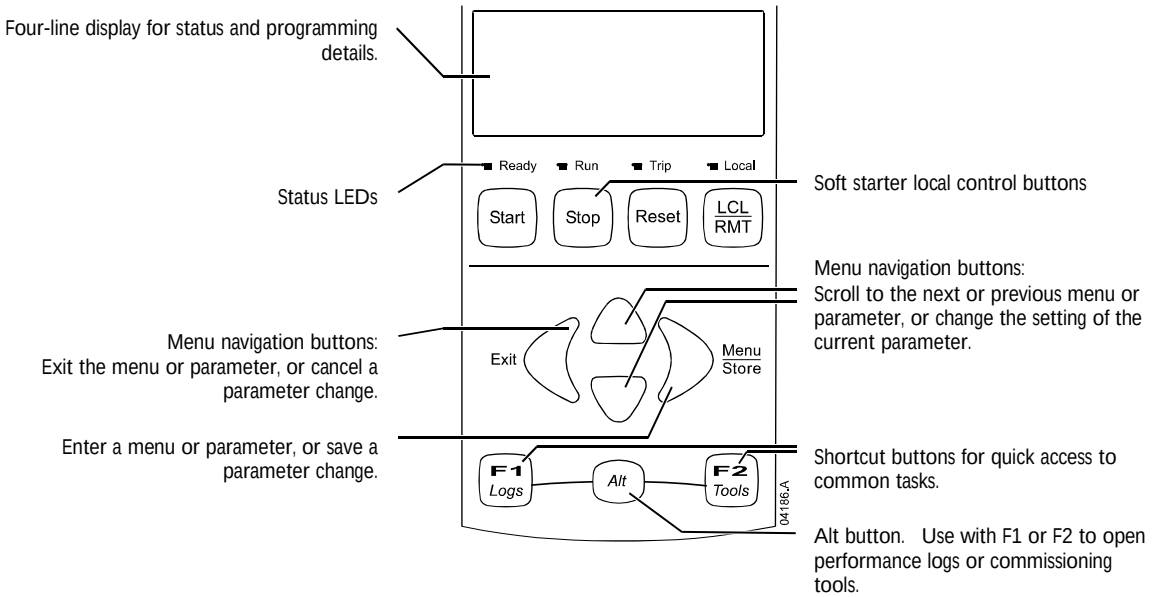
X1	LV terminal block
1	85 ~ 275 VAC control supply
Q10	Miniature circuit breakers (MCB)
2	Customer 2-wire Start/ Stop signal
3	Soft start/ DOL selector switch (S3)
A1	Phase cassette
Q2'	Bypass readback signal
K11	Main circuit breaker control relay
K12	Bypass circuit breaker control relay
K13	PFC circuit breaker control relay
4	Door interlock
5	Links on terminal block (X1)
6	Emergency stop pushbutton
A4	Controller
21	Controller STOP input
A6	Power supply isolator PCB
PR	Protection relay

A3	Power interface board
7	Bypass readback input
8	Main contactor output
9	Bypass contactor output
10	PFC output
11	24 VDC supply
12	Fan run output
13	Non conduction F/O inputs
14	Firing F/O outputs
15	Voltage sense inputs
16	Current transformer inputs (L1, L2, L3 and ground fault)
17	Fan fail input signal
18	Power supply fail input signal
19	Current transformer test block (TB1)
CT1-3	Current transformers
20	Voltage sensors
22	24 VDC supply

NOTE
A circuit breaker control relay (K13) is only supplied when PFC switching is required.

7 Keypad and Feedback

7.1 The Controller



NOTE
When the Controller is powered up, the Ready LED flashes for 5 seconds as part of the initialisation routine.

7.2 Menu Shortcuts

The F1 and F2 buttons offer keyboard shortcuts to the Auto-Stop menu. Use parameters 8B and 8C (*8B, 8C – F1 and F2 Button Action* on page 39) to select the shortcut target.

7.3 Displays

The controller 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
- User programmable screen
- Motor temperature
- Current
- Motor power
- Voltage
- Last start information
- Date and time
- Performance graphs
- SCR conduction

Refer to *Operating Feedback* on page 56, for further details.

8 Configuration

8.1 Programming Menu

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

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.

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.

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

Altering Parameter Values

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 controller will return to the parameter list.
- to cancel changes, press **EXIT**. The controller will ask for confirmation, then return to the parameter list without saving changes.

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 controller 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 controller will display an acknowledgement message before continuing.

Enter Access Code 0###

STORE

Access Allowed SUPERVISOR

To change the access code, use parameter 15A.

8.2 Standard Menu

The standard menu provides access to commonly used parameters, allowing the user to configure the MVX as required for the application. For details of individual parameters, refer to *Parameter Descriptions* on page 30.

1		**Motor Data-1**
	1A	*Motor Full Load Current*
2		**Start/Stop Modes-1**
	2A	*Start Mode*
	2B	*Start Ramp Time*
	2C	*Initial Current*
	2D	*Current Limit*
	2H	*Stop Mode*
	2I	*Stop Time*
3		**Auto-Start/Stop**
	3C	*Auto-Stop Type*
	3D	*Auto-Stop Time*
4		**Protection**
	4A	*Excess Start Time*
	4C	*Undercurrent*
	4D	*Undercurrent Delay*
	4E	*Instantaneous Overcurrent*
	4F	*Instantaneous Overcurrent Delay*
	4G	*Phase Sequence*
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*
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*
	7M	*Low Current Flag*
	7N	*High Current Flag*
	7O	*Motor Temperature Flag*
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*

8.3 Extended Menu

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

1		**Motor Data-1**
	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	*Reserved*
	2F	*Kickstart Time*
	2G	*Kickstart Level*
	2H	*Stop Mode*
	2I	*Stop Time*
3		**Auto-Start/Stop**
	3A	*Reserved*
	3B	*Reserved*
	3C	*Auto-Stop Type*
	3D	*Auto-Stop Time*
4		**Protection**
	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	*Undervoltage*
	4R	*Undervoltage Delay*
	4S	*Overvoltage*
	4T	*Overvoltage Delay*
	4U	*Instantaneous Overcurrent S2*
	4V	*Instantaneous Overcurrent Delay S2*
5		**Auto-Reset Trips (*Reserved*)**
	5A	*Reserved*
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	*Reserved*
	6L	*Reserved*
	6M	*Remote Reset Logic*
	6N	*Reserved*
	6O	*Reserved*
	6P	*Reserved*
	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	*Reserved*
	7K	*Reserved*
	7L	*Reserved*
	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	*Reserved*
	7U	*Reserved*
	7V	*Reserved*
	7W	*Reserved*
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	*Mains Reference Voltage*
9		**Motor Data-2**
	9A	*Reserved*
	9B	*Motor FLC-2*
	9C	*Reserved*
	9D	*Reserved*
	9E	*Reserved*
10		**Start/Stop Modes-2**
	10A	*Start Mode-2*
	10B	*Start Ramp-2*
	10C	*Initial Current-2*
	10D	*Current Limit-2*

	10E	*Reserved*
	10F	*Kickstart Time-2*
	10G	*Kickstart Level-2*
	10H	*Stop Mode-2*
	10I	*Stop Time-2*
11		**RTD/PT100 (*Reserved*)**
	11A	*Reserved*
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*
16		**Protection Action**
	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	*Reserved*
	16M	*Battery/Clock*
	16N	*Ground Fault*
	16O	*Reserved*
	16P	*Reserved*
	16Q	*Reserved*
	16R	*Reserved*
	16S	*Reserved*
	16T	*Reserved*
	16U	*Reserved*
	16V	*Undervoltage*
	16W	*Overvoltage*

8.4 Load/Save Settings

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

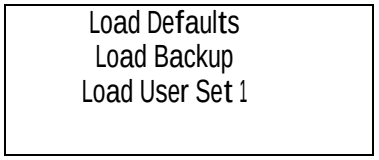
- Load the MVX's parameters with default values
- Reload previously saved parameter settings from an internal file
- Save the current parameter settings to an internal file

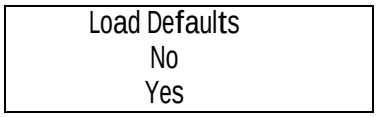
In addition to the factory default values file, the MVX can store two user-defined parameter files. These files contain default values until a user file is saved.

To load or save 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. Enter the access code when prompted.
4. At the confirmation prompt, select YES to confirm or NO to cancel and then **STORE** to load/save the selection.

   When the action has been completed, the screen will briefly display a confirmation message, then return to the Load/Save Settings screen





8.5 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: 5 - 1200 A **Default:** 100 A
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)
Description: Selects the soft start mode.

2B – Start Ramp Time

Range: 0:01 - 3.00 (minutes:seconds) **Default:** 1 second
Description: Sets the ramp time for current ramp starting (from the initial current to the current limit).

2C – Initial Current

Range: 100% - 600% FLC **Default:** 400%

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:** 400%

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

2E – Reserved

Description: This parameter is reserved for future use.

2F – Kickstart Time

Range: 0 – 2000 milliseconds **Default:** 0000 milliseconds

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

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

Description: Selects the stop mode.

2I – Stop Time

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

Description: Sets the time for soft stopping the motor using timed voltage ramp.
If a main contactor is installed, the contactor must remain closed until the end of the stop time.

3 Auto-Stop

The MVX can be programmed to stop automatically, after a specified delay or at a specified time of day.

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.

3A, 3B – Reserved

Description: These parameters are reserved for future use.

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.

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. 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 – Excess Start Time

Excess start time is the maximum time the MVX 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: Set as required.

4B – Excess Start Time-2

Range: 0:00 - 4:00 (minutes:seconds) **Default:** 20 seconds
Description: Set as required.

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.

4D – Undercurrent Delay

Range: 0:00 - 4:00 (minutes:seconds) **Default:** 5 seconds
Description: Slows the MVX's response to undercurrent, avoiding trips due to momentary fluctuations.

4E – Instantaneous Overcurrent

The MVX can be configured to trip if the average current of all three phases exceeds a specified level while the motor is running. Refer to *4U, 4V – Instantaneous Overcurrent Stage 2* on page 34 for more information and examples.

Range: 80% - 600% FLC **Default:** 400%
Description: Sets the trip point for instantaneous overcurrent protection, as a percentage of motor full load current.

NOTE
This protection is only active during run and must be coordinated with *Instantaneous Overcurrent Stage 2* (parameters 4U, 4V).

4F – Instantaneous Overcurrent Delay

Range: 0:00 - 1:00 (minutes:seconds) **Default:** 0 second
Description: Slows the MVX's response to overcurrent, avoiding trips due to momentary overcurrent events.

4G – Phase Sequence

Options: Any Sequence
Positive Only (default)
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 – Current Imbalance

Range: 10% - 50% **Default:** 30%
Description: Sets the trip point for current imbalance protection.

4I – Current Imbalance Delay

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

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

NOTE
The MVX will display a Current Imbalance trip only when phase loss at the supply terminals occurs during Run mode. When a phase loss occurs during other modes of operation, the MVX will trip on Motor Connection.

4J – Frequency Check

Options:
Do Not Check
Start Only
Start/Run
Run Only (default)

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

4K – Frequency Variation

Options:
± 2 Hz
± 5 Hz (default)
± 10 Hz
± 15 Hz

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

4L – Frequency Delay

Range: 0:01 - 4:00 (minutes:seconds) **Default:** 5 seconds

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

4M – Restart Delay

Range: 00:01 - 60:00 (minutes:seconds) **Default:** 30 minutes

Description: The MVX 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.

4N – Motor Temperature Check

Options:
Do Not Check (default)
Check

Description: Selects whether the MVX 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 – Ground Fault Level

Range: 1 A - 40 A **Default:** 1 A

Description: Sets the trip point for ground fault protection. Ground fault is a dynamic trip based on phase current measurements every half-cycle.

NOTE
Ground fault accuracy is within ± 1 A of the set value.

4P – Ground Fault Delay

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

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

4Q Undervoltage Level

Range: 100 – 18000 V **Default:** 100 V

Description: Sets the trip point for undervoltage protection. Set as required.

4R Undervoltage Trip Delay

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

Description: Slows the MVX's response to undervoltage, avoiding trips due to momentary fluctuations.

4S Overvoltage Level

Range: 100 – 18000 V **Default:** 7200 V

Description: Sets the trip point for overvoltage protection. Set as required.

4T Overvoltage Trip Delay

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

Description: Slows the MVX's response to overvoltage, avoiding trips due to momentary fluctuations.

4U, 4V – Instantaneous Overcurrent Stage 2

The MVX has two instantaneous trip functions, stage 1 and 2. These protection functions are configured to be complementary.

Stage 1 must be configured to protect the motor against a locked rotor (shearpin) situation during run mode. Stage 1 should trigger at lower current/higher time values than Stage 2.

Stage 2 must be configured to protect the main switching device. When Stage 2 triggers, the starter opens the main switching device.

If the main switching element is a contactor (protected by a fuse), then this function must be coordinated with the fuse to ensure that the contactor does NOT open until the fuse ruptures.

If the main switching element is a breaker, then the delay must be minimised to provide the best possible protection to the SCR.

Parameter 4U *Instantaneous Overcurrent S2*

Range: 30 A – 4400 A **Default:** 4400 A

Description: Sets the trip point for instantaneous overcurrent stage 2 protection in amperes. Set as required.

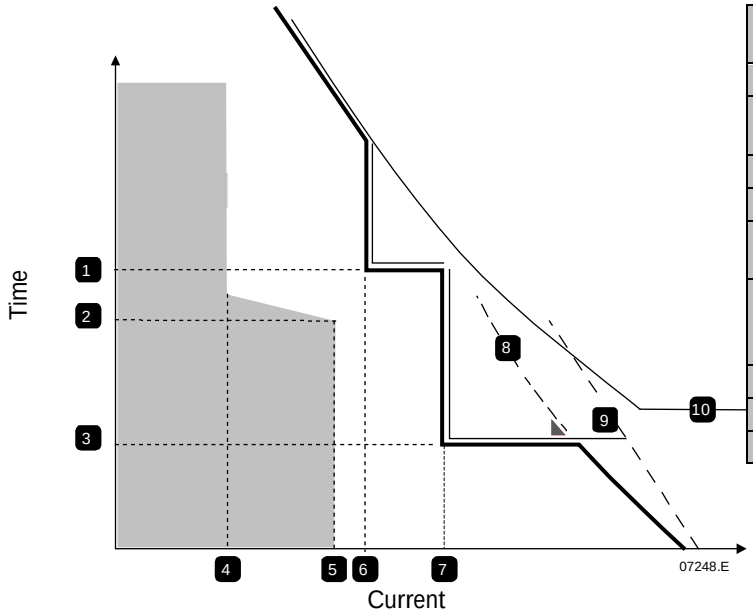
Parameter 4V *Instantaneous Overcurrent Delay S2*

Range: 10 – 1000 ms **Default:** 10 milliseconds

Description: Sets the duration required for current to exceed the level set in parameter 4U before a trip occurs. Set as required.

NOTE
This protection is active during starting, running and stopping. It must be coordinated with *Instantaneous Overcurrent* (parameters 4E, 4F).

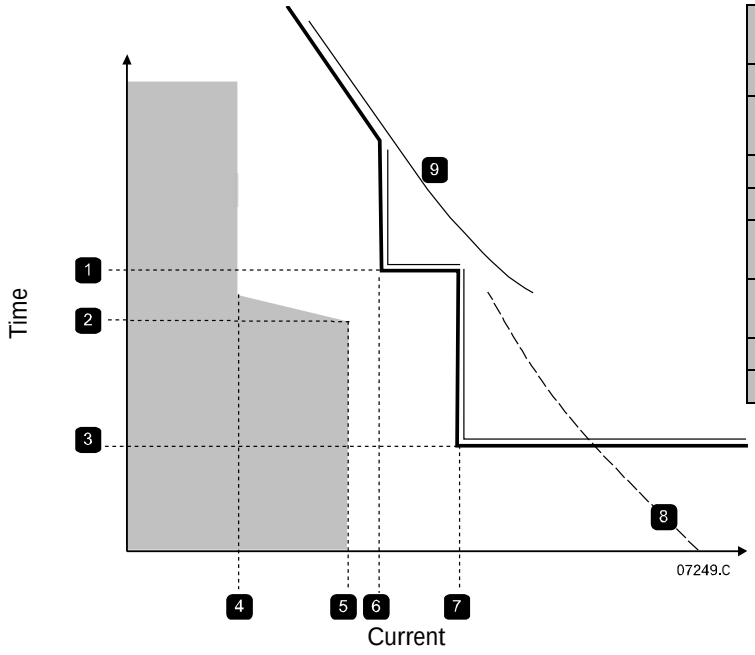
Example: Contactor and Fuse



1	Instantaneous Overcurrent Delay - Stage 1 (4F)
2	Motor start time
3	Instantaneous Overcurrent Delay - Stage 2 (4V)
4	FLC
5	Motor start current
6	Instantaneous Overcurrent- Stage 1 (4E)
7	Instantaneous Overcurrent - Stage 2 (4U) to trip external upstream breaker
8	Fuse
9	SCR
10	Thermal model curve

Shaded area indicates motor operation

Example: Circuit Breaker



1	Instantaneous Overcurrent Delay - Stage 1 (4F)
2	Motor start time
3	Instantaneous Overcurrent Delay - Stage 2 (4V)
4	FLC
5	Motor start time
6	Instantaneous Overcurrent -Stage 1 (4E)
7	Instantaneous Overcurrent -Stage 2 (4U) to trip main breaker
8	SCR
9	Thermal model curve

Shaded area indicates motor operation

5 Auto-Reset Trips (Reserved)

This parameter group is reserved for future use.

6 Inputs

The MVX has two programmable inputs, which allow remote control of the soft starter.

6A – Input A Function

Options:	Motor Set Select	The MVX 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 MVX 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) (default)	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. (Refer to parameters 6C, 6D, 6E)
	Input Trip (N/C)	When parameter 6A is set to Input Trip (N/C), an open circuit across C53, C54 trips the soft starter. (Refer to parameters 6C, 6D, 6E)
	Local/Remote Select	Input A can be used to select between local and remote control, instead of using the **LCL/RMT** button on the controller. When the input is open, the starter is in local mode and can be controlled via the controller. 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 MVX stops the motor.
	Starter Disable	The MVX can be disabled via the control inputs. An open

circuit across C53, C54 will disable the starter. The MVX will not respond to start commands. If running, the soft starter will allow the motor to coast to stop, ignoring the soft stop mode set in parameter 2H.

Description: Selects the function of Input A.

6B – Input A Name

Options:

Input Trip (default)	Controller
Low Pressure	PLC
High Pressure	Vibration
Pump Fault	Field Trip
Low Level	Interlock Trip
High Level	Motor Temp
No Flow	Motor Prot
Starter Disable	Feeder Prot

Description: Selects a message for the controller 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 second

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 second

Description: Sets a delay before an input trip can occur, after the soft starter has entered the state selected in 6C.

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 – Reserved

These parameters are reserved for future use.

6M – Remote Reset Logic

Options:

Normally Closed (default)
Normally Open

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

6N, 6O, 6P – Reserved

These parameters are reserved for future use.

6Q – Local/Remote

Options:	LCL/RMT Anytime (default)	**LCL/RMT** selection is always enabled.
	LCL/RMT When Off	**LCL/RMT** selection is enabled when the starter is off.
	Local Control Only	The **LCL/RMT** button and 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 controller is always enabled.	

WARNING
The **STOP** button on the controller 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 Control in RMT Enable Control in RMT (default)
Description:	Selects whether the starter will accept Start, Stop and Reset commands from the serial communication network when in Remote mode. The Force Comms Trip and Local/Remote commands are always enabled.

7 Outputs

The MVX has three programmable outputs, which can be used to signal different operating conditions to associated equipment.

7A – Relay A Function

Options:	Off	Relay A is not used.
	Main Contactor (default)	The relay closes when the MVX 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 16X).
	Warning	The relay closes when the starter issues a warning (refer to parameter 16A to 16X).
	Low Current Flag	The relay closes when the low current flag activates while the motor is running (refer to parameter 7M *Low Current Flag*).
	High Current Flag	The relay closes when the high current flag activates while the motor is running (refer to parameter 7N *High Current Flag*).
	Motor Temperature 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.
	Instantaneous 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 Overtemperature	Not applicable to this product.
	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.

Undervoltage	The relay closes when the mains voltage drops below the level set in parameter 4Q.
Ready	The relay closes when the starter transitions into Ready mode.

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

7B – Relay A On Delay

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

Description: Sets the delay for closing Relay A.

7C – Relay A Off Delay

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

Description: Sets the delay for re-opening Relay A.

7D~7I – Output Relays B and C

Parameters 7D~7I configure the operation of Relays B and C 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* **Default:** 0 second
- 7F *Relay B Off Delay* **Default:** 0 second

Relay C is a changeover relay.

- 7G *Relay C Function* **Default:** Trip
- 7H *Relay C On Delay* **Default:** 0 second
- 7I *Relay C Off Delay* **Default:** 0 second

These parameters are reserved for future use.

- 7J ~ 7L *Reserved*

7M – Low Current Flag

The MVX 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 flag value.

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.

7N – 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 MVX 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 MVX has an analog output, which can be connected to associated equipment to monitor motor performance.

Parameter 7P *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 rated current (calculated by the soft starter's thermal model).
Motor kW (%)	Motor kilowatts. 100% is motor FLC (parameter 1A) multiplied by mains voltage. 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 mains voltage. $\frac{\sqrt{3} \cdot V \cdot I_{FLC}}{1000}$
Motor pf	Motor power factor, measured by the soft starter.
Voltage (%Mains)	The average voltage measured on three phases as a percentage of the mains voltage.

Description: Selects which information will be reported via Analog Output A.

Parameter 7Q *Analog A Scale*

Range:
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~7W – Reserved

These parameters are reserved for future use.

8 Display

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

8A – Language

Options:

English (default)	Português
Chinese	Français
Español	Italiano
Deutsch	Russian

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

8B, 8C – F1 and F2 Button Action

Options:
None
Setup Auto-Start/Stop

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

- 8B *F1 Button Action* **Default:** Setup Auto-Start/Stop
- 8C *F2 Button Action* **Default:** None

8D – Display A or kW

Options:
Current (default)
Motor kW

Description: Selects whether the MVX 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	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	n/a
	Mains Voltage	The average voltage measured on three phases.

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:** kWh
- 8H *User Screen - Bottom Right* **Default:** Hours Run

8I, 8J, 8K, 8L – Performance Graphs

The MVX 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 rated current (calculated by the soft starter's thermal model).
	Motor kW (%)	Motor kilowatts. 100% is motor FLC (parameter 1A) multiplied by mains voltage. 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 mains voltage. $\frac{\sqrt{3} \cdot V \cdot I_{FLC}}{1000}$
	Motor pf	Motor power factor, measured by the soft starter.
	Voltage (%Mains)	The average voltage measured on three phases as a percentage of the mains voltage.

Description: Selects which information the graph will display.

Parameter 8J *Graph Timebase*

Options:	10 seconds (default)	10 minutes
	30 seconds	30 minutes
	1 minute	1 hour
	5 minutes	

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:

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

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

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

8M – Mains Reference Voltage

Range: 100 – 14000 V **Default:** 400 V

Description: Provides the reference voltage for the analog output and performance graphs.

8O – Voltage Calibration

Range: 85% – 115% **Default:** 100%

Description: Adjusts the soft starter's voltage monitoring circuits. The MVX 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 MVX can support two different starting and stopping motor data sets.

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

Parameter 9A *Reserved*

This parameter is reserved for future use.

Parameter 9B *Motor FLC-2*

Range: 5 - 1000 A **Default:** 100 A

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

Parameter 9C *Reserved*

This parameter is reserved for future use.

Parameter 9D *Reserved*

This parameter is reserved for future use.

Parameter 9E *Reserved*

This parameter is reserved for future use.

10 Start/Stop-2

10A ~ 10I – Start/Stop-2

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

Parameter 10A *Start Mode-2*

Options: Constant Current (default)
Description: Selects the soft start mode.

Parameter 10B *Start Ramp-2*

Range: 0:01 - 3.00 (minutes:seconds) **Default:** 1 second
Description: Sets the ramp time for current ramp starting (from the initial current to the current limit).

Parameter 10C *Initial Current-2*

Range: 100% - 600% **Default:** 400%
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:** 400%
Description: Sets the current limit for constant current and current ramp soft starting, as a percentage of motor full load current.

Parameter 10E *Reserved*

Description: This parameter is reserved for future use.

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
Description: Selects the stop mode.

Parameter 10I *Stop Time-2*

Range: 0:00 - 4:00 (minutes:seconds) **Default:** 0 second
Description: Sets the stop time.

11 RTD/PT100 (Reserved)

This parameter group is reserved for future use.

12 Slip-Ring Motors

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

12A – Motor 1 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.

12B – Motor 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 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 after the rotor resistance contactor 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. After the last digit is set press **STORE**.

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 controller will allow parameters to be changed via the Programming Menu.

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.

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.

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

16A~16W – Protection Actions

Options: Trip Starter (default)
Warn 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 *Reserved*
- 16M *Battery/Clock*
- 16N *Ground Fault*
- 16O~16U *Reserved*
- 16V *Undervoltage*
- 16W *Overvoltage*

20 Restricted

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

9 Commissioning

9.1 Commissioning Menu (Tools)

The Commissioning Menu provides access to commissioning and testing tools.

Press **ALT** then **TOOLS** to open the Tools.

The Commissioning Menu is protected by the access code.

The default access code is 0000.

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.

9.2 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 MVX will confirm the changes.
   To cancel changes, press the ◀ button.

9.3 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 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 controller is active.

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

Run Simulation

To use the run simulation:

1. Open the Commissioning Menu.
2. Scroll to Run Simulation and press ▶.

Run Simulation Ready Apply Start Signal

3. Press **START** or activate the start input. The MVX simulates its pre-start checks and closes the main contactor relay. The Run LED flashes.

Run Simulation Pre-Start Checks **STORE** to Continue

NOTE
If mains voltage is connected, an error message is shown. Remove mains voltage and proceed to the next step.

Run Simulation ATTENTION! Remove Mains Volts **STORE** to Continue

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

Run Simulation Starting X:XXs **STORE** to Continue

5. Press ▶. The MVX simulates running. The Run LED stays on without flashing and the bypass contactor relay closes.

Run Simulation Running Apply Stop Signal

6. Press **STOP** or activate the stop input. The MVX simulates stopping. The Run LED flashes and the bypass contactor relay opens.

Run Simulation Stopping X:XXs **STORE** to Continue

7. Press ▶. The Ready LED flashes and the main contactor relay opens.

Run Simulation Stopped **STORE** to Continue

8. Press ▶ to return to the commissioning menu.

NOTE
Run simulation can be exited at any stage by pressing the ◀.

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 'Warn and Log', no reset is required.

If the protection is set to 'Warn and 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 analog output current at terminals B10, B11 of the controller.

```
Analog Output
0%                    4 mA
```

Attach an external current measuring device to terminals B10, B11 of the controller. Use the ▲ or ▼ button to adjust the percentage value in the lower left hand corner of the display. The current measuring device should indicate the same level of current as shown at the lower right corner of the display.

9.4 Input/Ouput Status

Temperature Sensors State

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

```
Temp Sensors State
Thermistor: 0
RTDs A->G:0000000
S = Shrt H=Hot C=Cld O=Opn
```

NOTE
The use of RTDs is not supported by this product and this screen will always indicate 0 (ie Open) for RTDs A->G.

Digital I/O State

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

```
Digital I/O State
Inputs:  1000000
Outputs: 0000000
```

The top line of the screen shows the start, stop, reset and programmable inputs A and B, then '00'. The screen shows input C23~C24 closed with all other inputs open.

The bottom line of the screen shows programmable output A, the fixed Run output, programmable outputs B and C, then '000'. The screen shows all outputs open.

Analog I/O State

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

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

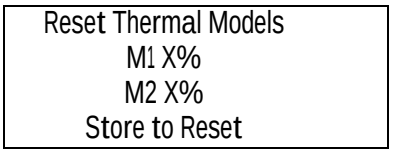
NOTE
Input is not supported by this product and this screen will always indicate Input: - - - - %

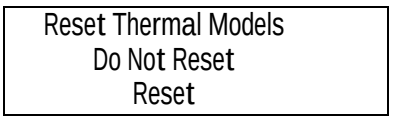
9.5 Reset Thermal Models

The MVX's advanced thermal modelling software constantly monitors the motor's performance. This allows the MVX to calculate the motor's temperature and ability to start successfully at any time.

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 ▶.
3. At the confirmation prompt press **STORE** to confirm or ◀ to cancel the action. You may have to enter your access code.
4. Select Reset and press ▶.
   Selecting Do Not Reset returns to previous screen.





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.

9.6 Low Voltage Test Mode

The MVX can be connected to a low voltage motor (£ 500 VAC) for testing. This allows the user to thoroughly test the soft starter and its associated power and control circuits. The low voltage test mode provides a means of testing the soft starter's configuration without requiring a full medium voltage test facility.

During the low voltage test, the soft starter's control input, relay output and protection settings can be tested. Low voltage mode is not suitable for testing soft starting or soft stopping performance.

To operate the MVX in low voltage test mode:

1. Isolate the soft starter from the motor and the mains supply.
2. Connect T1, T2, T3 of the soft starter to a three phase motor which draws current between 5A and 20 A. Connect L1, L2, L3 of the soft starter to three phase mains supply with voltage less than 500 VAC (frequency 50 Hz or 60 Hz).
3. Set parameter 1A *1A Motor Full Load Current* to the value shown on the motor name plate.
4. Set parameter 16M *Undervoltage Trip Action* to 'Warn & Log'. Alternatively, set parameter 2H *Undervolt Trip Level* to a value which is less than the LV supply voltage.
5. Switch on control and mains supply, and use the MVX to start the motor. The start command can be sent from the controller or via the remote input. Monitor the soft starter's display and verify the line current and voltage readings.
6. Stop and restart the motor several times to confirm correct and consistent operation.
7. When testing is complete, isolate the soft starter from the mains supply. Disconnect the soft starter from the motor and then remove control voltage.

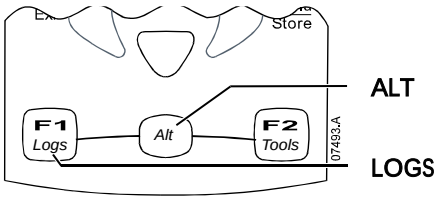
NOTE
Reset parameters 1A *Motor Full Load Current* and 16M *Undervoltage Trip Action* (or 2H *Undervolt Trip Level*) to their operating values once low voltage testing is complete.

10 Monitoring

10.1 Logs Menu

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

To open the Logs Menu, press **ALT** then **LOGS** while viewing the metering screens.



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.

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. Press **ALT** then **LOGS** to open the Logs.
2. Scroll to Trip Log and press ▶.
3. Use the ▲ and ▼ buttons to select a trip to view, and press ▶ to display details.
4. Use the ▲ and ▼ buttons to scroll through available 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. Press **ALT** then **LOGS** to open the Logs.
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.

Starter Trip and Event Logger Software

The Starter Trip and Event Logger Software allows you to download the trip and event logs from the soft starter, for separate analysis.

The software is compatible with all AuCom medium voltage soft starters using control software version 1.29 or later.

For further information, or to download the software, visit www.aucom.com.

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 **STORE** (enter access code if required) then use the ▼ button to select Reset. Press **STORE** to confirm the action.

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

11 Operation

CAUTION
We recommend testing the soft starter's setup on a low voltage motor before beginning operation on a medium voltage motor. This allows the operator to test that the soft starter is correctly connected to the auxiliary equipment.

11.1 Start, Stop and Reset Commands

The soft starter can be controlled in three ways:

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

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

The Local LED on the controller is on when the soft starter is in local control mode and off when the soft starter is in remote control mode.

Control via the fieldbus communication network is always enabled in local control mode, and can be enabled or disabled in remote control mode (parameter 6R *Comms in Remote*). Control via the serial communication network requires an optional communication module.

The **STOP** button on the controller is always enabled.

11.2 Using the Soft Starter to Control a Motor

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

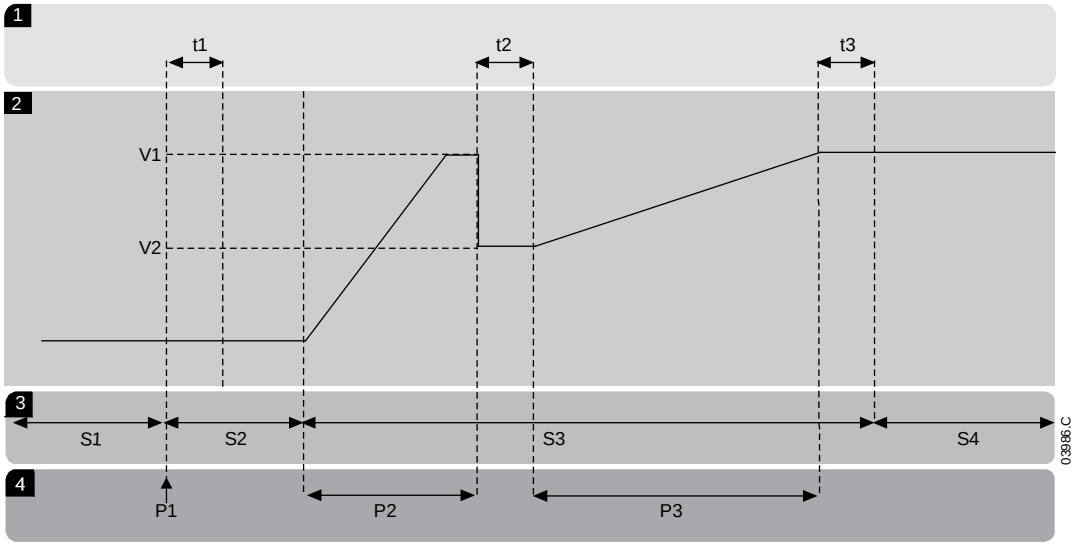
To stop the motor, press the **STOP** button on the controller or activate the Stop remote input. The motor will stop using the stop mode selected in parameter 2H.

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

To stop the motor with a coast to stop, regardless of the setting of parameter 2H *Stop Mode*, 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.

11.3 Using the MVX to Control a Slip-Ring Motor

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

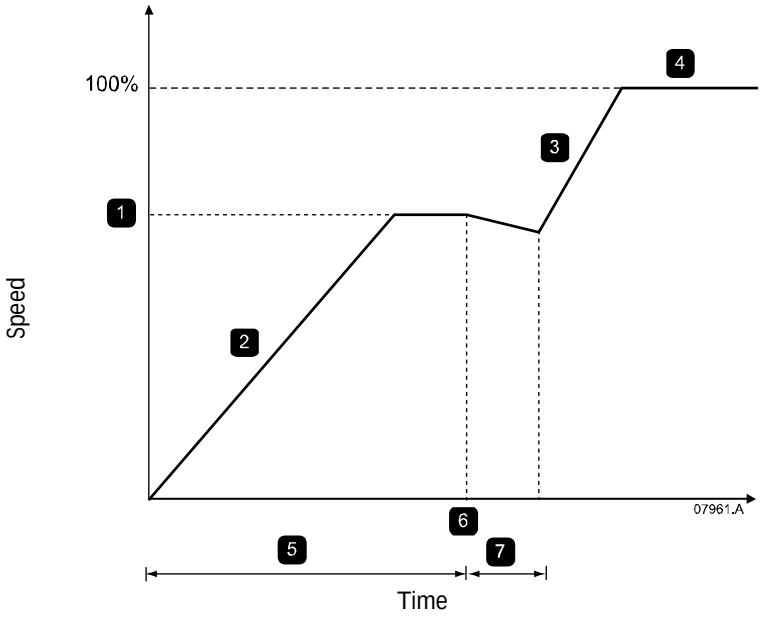


1	Sub-states
t1	Main contactor close time
t2	Rotor resistance contactor close time
t3	Bypass contactor close time
2	Output voltage
V1	100% voltage
V2	Slip-ring retard voltage

3	States
S1	Ready
S2	Pre-start tests
S3	Starting
S4	Running
4	Phases of operation
P1	Start command
P2	Rotor resistance current ramp
P3	Shorted rotor current ramp

Commissioning

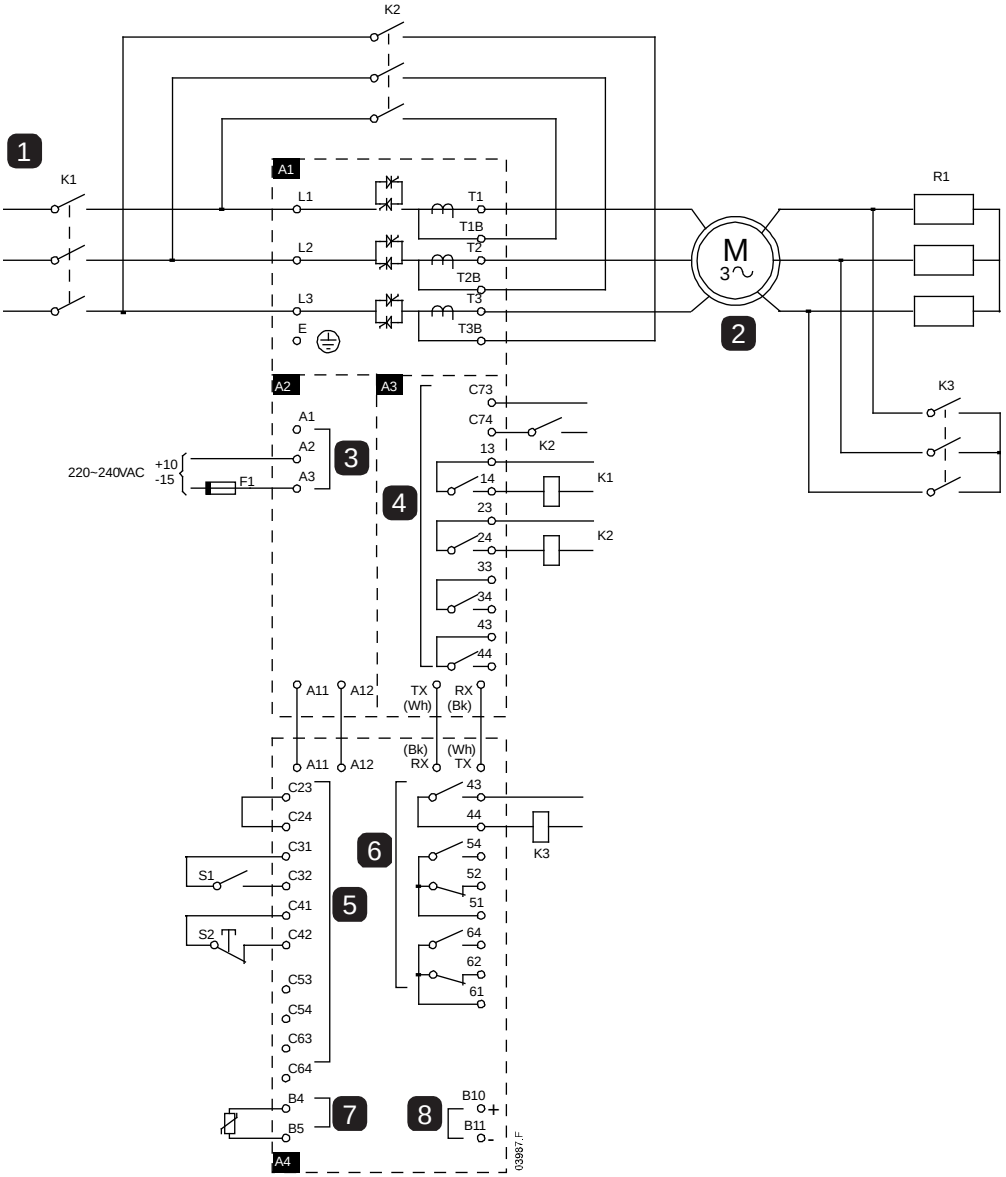
1. Configure the MVX as follows:
   Parameter settings:
   - Parameter 7A *Relay A Function*
     - Select 'Changeover Contactor'
   - Parameter 7B *Relay A On Delay*
     - Set this to the maximum time (5m:00s).
   - Parameter 12A *Motor Data-1 Ramp*
     - Select 'Dual Ramp' (for slip-ring induction motor control)
   - Parameter 12C *Changeover Time*
     - Default setting is 150 milliseconds. Set this to a value just greater than the changeover contactor (K3) 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.
2. Start the motor under normal load conditions and record the time it takes to reach a constant speed with external rotor resistance (R1) in the circuit. Stop the motor soon after a constant speed has been reached. Change parameter 7B to the recorded time value.
3. Start the motor under normal load conditions and monitor the motor speed behaviour and motor current when the changeover contactor (K3) switches in to short-out the rotor resistance (R1)
   If the motor does not start to accelerate immediately after changeover, increase the setting of parameter 12D.
   If there is a pulse in motor current immediately after changeover, reduce the setting of parameter 12D.



1	R1 constant speed
2	First ramp
3	Second ramp
4	Run mode (I < 120% FLC)
5	Parameter 7B
6	K3 closes
7	Parameter 12C

NOTE
For this installation to function correctly, only use the constant current start method (parameter 2A *Start Mode*). To use the secondary motor settings, parameter 12B *Motor Data-2 Ramp* must be set to 'Dual Ramp'.

Slip-Ring Motor Connection



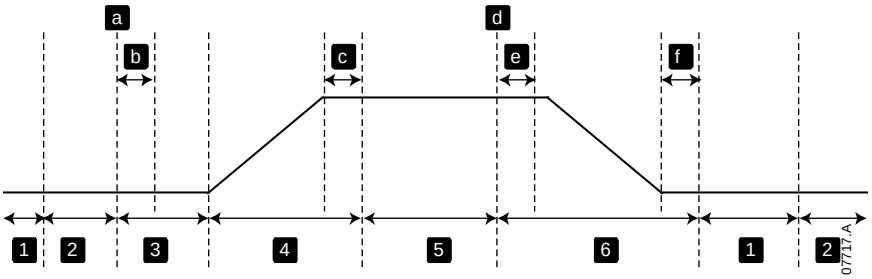
A1	Power assembly
1	3 Phase 50/60 Hz Supply
K1	Main contactor
K2	Bypass contactor
2	Motor
R1	Slip-ring rotor resistance
K3	Changeover contactor
A2	Control voltage terminals
3	Control supply
A3	Power interface board
4	Relay outputs
C73~C74	Bypass contactor feedback signal
13~14	Main contactor K1
23~24	Bypass contactor K2
33~34	Run relay output
43~44	Fan control output

A4	Controller
5	Remote control inputs
C23~C24	Control Input - Start
C31~C32	Control Input - Stop
C41~C42	Control Input - Reset
C53~C54	Control Input - Programmable input A
C63~C64	Control Input - Programmable input B
6	Programmable outputs
43, 44	Relay output A Functionality = Changeover contactor
51, 52, 54	Relay output B
61, 62, 64	Relay output C
7	Motor thermistor input
8	Analog output

11.4 Operating States

Start and Run States

The MVX soft starter has six operating states, and performs the following actions in each state:



State		Starter actions
1	Not ready	Control power is on and the starter performs system checks. The starter may be waiting for the motor to cool before allowing a start.
2	Ready	The starter is initialised and waiting for a start command.
3	Pre-start checks	A start command has been received (a). The main contactor closes (b) and the starter performs connection checks.
4	Starting	The starter ramps the SCRs up to full conduction and closes the bypass contactor (c).
5	Running	The motor is running normally.
6	Stopping	A stop command has been received (d). The starter opens the bypass contactor (e), ramps the SCRs down to no conduction, then opens the main contactor (f).

Trip States

The starter's response to a trip depends on the starter's state when the trip occurs.

- Trip while starting (bypass contactor not yet closed)

State	Function
Not ready	Perform system checks.
Ready	Wait for start command.
Start command received	Main contactor closes.
Pre-Start Checks	Perform connection checks.
Starting	Ramp up SCR firing angles.
Trip command	Turn SCRs off then open main contactor.
Tripped	Wait for reset command.
Reset command received	Trip cleared and starter returns to Not Ready state or Ready state.

- Trip while running (bypass contactor closed)

State	Starter action
Not ready	Perform system checks.
Ready	Wait for start command.
Start command received	Main contactor closes.
Pre-Start Checks	Perform connection checks.
Starting	Ramp up SCR firing angles.
Full conduction	SCRs at 100% conduction. Verify current is < 120% FLC then close bypass contactor.
Running	Normal motor run state (bypassed mode).
Trip command	Open bypass contactor. Turn SCRs off then open main contactor.
Tripped	Wait for reset command.
Reset command received	Trip cleared and starter returns to Not Ready or Ready state.

- Instantaneous Overcurrent Stage 2 trip

The main contactor opens immediately, regardless of the starter's state.

11.5 Motor Protection

Motor, System and Soft Starter Protection Mechanisms

The MVX incorporates extensive protection features to ensure safe operation of the motor, system and soft starter. Most protection features can be customised to suit the installation. Use parameter group 4 Protection Settings to control the situation where the protections will activate and parameter group 16 Protection Action to select the soft starter's response. The default response is to trip the soft starter.

· Protection Coordination

Check protection settings on the supply side of the starter to ensure correct coordination with the parameters of the soft starter. .

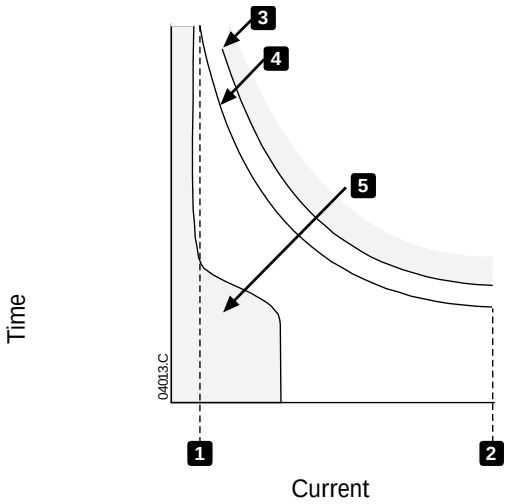
When using fuse and main contactors, set the upstream circuit breaker protection parameters according to the ratings for fuse and contactor. The contactor must not open if the current is above its maximum breaking current value. The fuse must act first or the upstream breakers instantaneous trip level must be less than the contactor's maximum breaking current level.

If using circuit breakers only, set the soft starter's maximum instantaneous trip time < 150 ms. Always use a suitable external protection relay with a circuit breaker to ensure instantaneous overcurrent trip functionality.

Voltage must not be continuously maintained on the phase arms while the motor is off. Short circuit protective equipment must be installed in all cases.

· Motor Overload Protection

The MVX offers thermal model motor overload protection which monitors the performance of the motor and calculates its temperature in all states. This protection is based on the motor information programmed in parameter groups 1 and 9, and the thermal model adjusts itself according to the motor's recent operating history (including temperature rise from previous operation).



1	Motor service factor
2	Locked rotor current
3	Motor failure curve
4	Motor thermal model protection curve
5	Typical motor operating current

Motor Thermal Model Protection Set-up

To enable motor and starter protection using the motor thermal model, the soft starter must be programmed with accurate information on the motor's characteristics.

1. Set parameters 1B *Locked Rotor Time*, 1C *Locked Rotor Current* and 1D *Motor Service Factor* according to the motor datasheet.
2. Use instantaneous overcurrent protection (parameters 4E, 4F) to provide protection for locked rotor situations. Refer to individual parameters for details.
3. Use instantaneous overcurrent protection stage 2 (parameters 4U, 4V) to trip circuit breaker or main contactor in the event of extreme overcurrent situations.

11.6 Operating Feedback

Displays

The controller 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
- User programmable screen
- Motor temperature
- Current
- Motor power
- Voltage
- Last start information
- Date and time
- Performance graphs
- 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, including motor current, power and temperature.

```
          0A
Ready
M1 000%          000.0kW
```

- Programmable screen

The MVX'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.

```
          0A
Ready
00000 kWh        00000hrs
```

- Motor Temperature

The temperature screen shows which motor data set is in use, and the temperature of the motor as a percentage of total thermal capacity.

```
          0A
Primary Motor Set
➢ M1 000%        M2 000%
```

NOTE
M2 xxx% temperature is not applicable to this product.

- Current monitoring screen

The current screen shows real-time line current on each phase.

```
          0A
 Phase Currents (Gnd Crnt XX.XA)
000.0A   000.0A   000.0A
```

- Motor Power

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

```
          0A
000.0kW          0000HP
0000kVA          -. - - pf
```

- Voltage

The voltage screen shows real-time line voltage across each phase.

```
          0A
Line Voltages
00000    00000    00000
```

- 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

```
          0A
Last start 000 s
000 % FLC      D Temp 0%
```

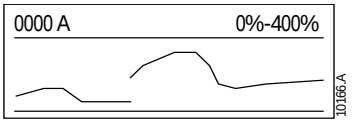
- Date and Time

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 45.

```
          0A
      DD MMM YYYY
        HH:MM:SS
```

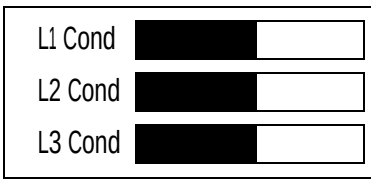
- Performance Graph

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.



12 Troubleshooting

The MVX provides extensive information to help the operator diagnose and remedy any operating difficulties.

In addition to the motor and load protection features already described, the MVX reports in detail on the starter's own state. Any internal failure will cause the soft starter to trip, and full details will be recorded in the Trip Log and Event Log.

12.1 Protection Responses

When a protection condition is detected, the MVX will write this to the event log and may also trip or issue a warning. The soft starter's response depends on the Protection Action setting (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 MVX trips you will need to identify and clear the condition that triggered the trip, then reset the soft starter before restarting. To reset the starter, press the **RESET** button on the controller or activate the Reset remote input.

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

12.2 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
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. The MVX will continue to soft start and soft stop correctly. Reprogram the date and time. The battery is not removable. In order to replace the battery, the main control PCB must be replaced. Related parameters: 16M
Bypass fail (bypass contactor)	The bypass contactor has welded closed or is not operating correctly. There may be a problem with the control circuit or the contactor coil. Check the condition of the bypass contactor's main poles. Check the operation of the contactor control circuitry and contactor coil. This trip is not adjustable.  **NOTE** You can use the Run Simulation to check the bypass contactor's operation without mains voltage connected.
Controller	This is a name selected for a programmable input. Refer to Input A trip.
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
EEPROM fail	· An error occurred loading data from the EEPROM to RAM when the controller powered up. · "Load User Set" has been selected but no saved file is available. Reset the fault and then reload the default settings. If the problem persists, contact your local distributor. Related parameters: None

Display	Possible cause/Suggested solution
Excess start time	The motor was unable to accelerate to full speed in the time allowed. 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 · The motor may have experienced an abnormal increase in loading or might be jammed. Related parameters:1A, 2A-2D, 4A, 16B
Feeder Prot	This is a name selected for a programmable input. Refer to Input A trip.
Field Trip	This is a name selected for a programmable input. Refer to Input A trip.
Frequency	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 MVX 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	Ground current (monitored through a dedicated current transformer) has exceeded the selected level. 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	The soft starter is operating at a dangerously high temperature. · Check if ventilation and cooling are adequate. · Reduce the number of consecutive starts by increasing the value set in parameter 4M *Restart Delay*. Related parameters: 4M
High Level	This is a name selected for a programmable input. Refer to Input A trip.
High Pressure	This is a name selected for a programmable input. Refer to Input A trip.
Input A trip	The soft starter's programmable input is set to a trip function and has activated. Resolve the trigger condition. Related parameters: 6A, 6B, 6C, 6D, 6E, 6F, 6G, 6H, 6I, 6J, 16G, 16H
Instantaneous overcurrent	There has been a sharp rise in motor current, probably caused by a locked rotor condition (shearpin) while running. This may indicate a jammed load. A trip may also occur when a medium level fault current has been detected. This may indicate a system short circuit. Related parameters: 4E, 4F, 16D
Instantaneous overcurrent S2	There has been a sharp rise in output current, possibly caused by a short circuit condition. Identify and resolve the cause of the fault. Related parameters: 4U, 4V, 16D
Int Comms Fail	Communication has failed between the controller and the power interface board. · Check that the controller is receiving control voltage within the specified range (terminals A11, A12). · Check that the fibre-optic cables between the controller and the interface board are firmly connected. · Check that each fibre-optic cable is emitting light at the Rx end. This trip is not adjustable.
Interlock Trip	This is a name selected for a programmable input. Refer to Input A trip.
Internal fault 94 ~ Internal fault 98	There has been an internal communication error within the soft starter. Remove then restore control power. This trip is not adjustable.
Internal fault 99 - Internal fault 101	There is a problem with the non-conduction fibre-optic connections. Internal Fault 99 corresponds to phase 1, Internal Fault 100 corresponds to phase 2, Internal Fault 101 corresponds to phase 3. · Check that the fibre-optic cable is properly connected between the non-conduction PCB on the phase arm and the non-conduction readback connector on the power interface board. · If the problem persists, replace the fibre-optic cable. This trip is not adjustable.

Display	Possible cause/Suggested solution
Internal fault 102	The fan fail input (C1, C2 on the power interface board) is open circuit while the fans should be running. · A fan may have stalled. · There may be a wiring fault with a fan. This trip is not adjustable.
Internal fault 103	The external alarm input (C3, C4 on the power interface board) is closed circuit. · Check the wiring and associated equipment. This trip is not adjustable.
Internal fault 104	The power fail input is open circuit. · Check that control voltage is available. · There may be a wiring fault. This trip is not adjustable.
Internal fault 105	The power interface board is faulty or damaged. Replace the board. This trip is not adjustable.
Internal fault 106	The selected configuration for the CT ratio selection switches on the power interface board is not valid. · Check the DIP switch settings on the interface PCB. Refer to *Ground Current*. This trip is not adjustable.
Internal fault X	The MVX 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	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 2% 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 prestart checks the starter has detected a shorted phase arm or a short within the bypass contactor as indicated. This trip is not adjustable.
Low Control Volts	Control voltage to the controller has dropped below the required level. · Check that supply voltage at the interface PCB is 24 VAC/VDC (± 20 %). This trip is not adjustable.
Low Level	This is a name selected for a programmable input. Refer to Input A trip.
Low Pressure	This is a name selected for a programmable input. Refer to Input A trip.
Motor connection	There is a problem with the soft starter's connection to the motor. If only one phase is affected, the error message will indicate which phase (T1, T2, T3). · Ensure the motor is connected to terminals T1, T2, T3 using in-line (three wire) connection. The MVX does not support inside delta (six wire) connection. · Check that the fibre-optic cables between the power interface board and the MVX are firmly connected. · Check each output phase of the soft starter for power circuit continuity. This trip will also occur when there is a phase imbalance across the soft starter's input terminals L1, L2, L3, during starting and stopping. Related parameters: None
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

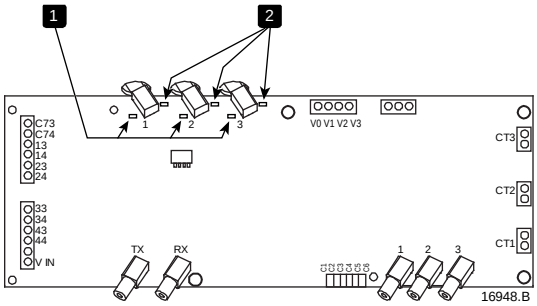
Display	Possible cause/Suggested solution
Motor overload	The motor has reached its maximum thermal capacity. Overload can be caused by: · The soft starter protection settings not matching the motor thermal capacity · Excessive starts per hour · Excessive throughput · Damage to the motor windings Resolve the cause of the overload and allow the motor to cool. Related parameters: 1A, 1B, 1C, 1D, 9B, 16A
Motor Prot	This is a name selected for a programmable input. Refer to Input A trip.
Motor Temp	This is a name selected for a programmable input. Refer to Input A trip.
Motor thermistor	The external resistance across the motor thermistor input (terminals B4, B5) has exceeded 2.4 kΩ. · If the starter tripped at power-up, no thermistor is present at terminals B4, B5. If you are not using a thermistor, you must attach a link across terminals B4-B5. · If the starter tripped during operation, the temperature of the motor winding has increased. Resolve the cause of the overheating. Related parameters: 16I
Network communication (between module 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
No Flow	This is a name selected for a programmable input. Refer to Input A trip.
Overvoltage	There has been a voltage surge on the mains. Causes can include problems with a transformer tap regulator or off-loading of a large transformer load. · Check that the starter is configured appropriately for local conditions. · Monitor the mains voltage to determine the cause of the voltage fluctuation, and resolve the cause. Related parameters: 4S, 4T, 16W
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
PLC	This is a name selected for a programmable input. Refer to Input A trip.
Power loss	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 MVX fuses and confirm that all three mains supply phases are present. This trip is not adjustable.
Pump Fault	This is a name selected for a programmable input. Refer to Input A trip.
Starter communication (between module and soft starter)	There could be a problem with the connection between the soft starter and the optional communications module. Remove and reinstall the module. If the problem persists, contact your local distributor. The communications module has been powered down while the soft starter remains powered up. Related parameters: 16J
Starter Disable	This is a name selected for a programmable input. Refer to Input A trip.
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
Undervoltage	Mains voltage has fallen below the level selected in parameter 4Q. Causes can include an undersized supply or adding a large load to the system. · Check that the starter is configured appropriately for local conditions. · Monitor the mains voltage to determine the cause of voltage fluctuation. Related parameters: 4Q, 4R, 16V
Vibration	This is a name selected for a programmable input. Refer to Input A trip.

Display	Possible cause/Suggested solution
VZC Fail Px	Where 'X' is 1, 2 or 3. The voltage detection system has failed. The voltage dividing resistors have failed or the power interface board may be faulty. Contact AuCom for advice.

12.3 LED locations

The non-conduction and firing LEDs are located on the power interface board. The non-conduction LEDs should dim during starting, and should be off when the bypass contactor closes. The firing LEDs should be on during starting, and off just before the bypass contactor closes and the soft starter enters run mode.

The gate drive adaptor, gate drive and gate drive firing PCBs are located on individual phase arm power assemblies.



1	Non-conduction LEDs (green)
2	Firing LEDs (red)

12.4 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
The soft starter does not respond to the **START** or **RESET** button on the controller.	· 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 arfe configured correctly (refer to *Control Wiring* on page 17 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 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 starter may be disabled via a programmable input. If parameter 6A is set to Starter Disable and there is an open circuit on C53, C54, the MVX will not start. If there is no further need to disable the starter, close the circuit on the input. **NOTE** Parameter 6Q *Local/Remote* controls when the **LCL/RMT** button is enabled.

Symptom	Probable Cause
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 MVX 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.
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.
Remote start/stop command is overriding Auto-Stop settings when using remote two-wire control.	· Auto-Stop should only be used in remote mode with three-wire or four-wire control.
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 set to *Read & Write*. If the adjustment lock is set to *Read Only*, 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 controller. A faulty EEPROM will also trip the soft starter, and the controller will display the message Parameter Out Of Range. Contact your local supplier for advice.
ATTENTION! Remove Mains Volts	· The soft starter will not activate Run Simulation with three-phase power connected. This prevents unintentional direct on-line (DOL) start.
Current values shown on the display are incorrect.	· Check that the setting of the CT ratio selector DIP switch on the power interface board matches the ratio of the CT used. Refer to *Ground Current*.

13 Maintenance

13.1 Safety

NOTE
The MVX 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.

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
Always ensure that all tools have been removed from the soft starter panel after conducting maintenance operations. There is a significant risk of arc fault due to bridging between panel conductors and conductive foreign bodies such as tools.

13.2 Maintenance Schedule

The table below lists the minimum maintenance requirements. Your maintenance program may include more frequent maintenance. In certain environmental conditions (such as dusty or humid environments), increase the frequency of maintenance to every year.

Part	Instructions	Timing
Control terminals	Check tightness	Every 2 years
Earthing terminals	Check tightness	Every 2 years
Cable lugs	Check tightness	Every 2 years
Metal oxide varistors (MOVs)	Visual inspection, cleanliness	Every year
General MVX	Cleanliness	Every 2 years

13.3 Tools required

MVX starters can be serviced with the following tools:

- Allen keys (standard metric)
- 16 mm spanners
- 16 mm socket
- Torque wrench <20 Nm
- Torx drive screwdriver #20
- Small flat bladed screwdriver 3 mm
- Multimeter
- MV Insulation tester

13.4 Thermal Image

After completing commissioning of the MVX and after the motor has been running fully loaded, take a thermal image of the busbars and other critical parts.

As part of the maintenance program, compare a recent thermal image with the post-commissioning image.

Perform the usual inspection for dust and debris.

13.5 Switching Apparatus Maintenance

Refer to your switching apparatus manual for operation and maintenance instructions.

1. As part of normal operation, run the withstand voltage test at not less than half the rated test value.
2. Follow the manufacturer's maintenance instructions and check the torque values on all connections.

13.6 Phase Cassette Maintenance

WARNING
Ensure the following before connecting or disconnecting the phase cassette:

- The soft starter enclosure is isolated from the power supply.
- The main switching device (breaker/contactor) is disconnected.
- The soft starter enclosure is earthed by an earth switch.

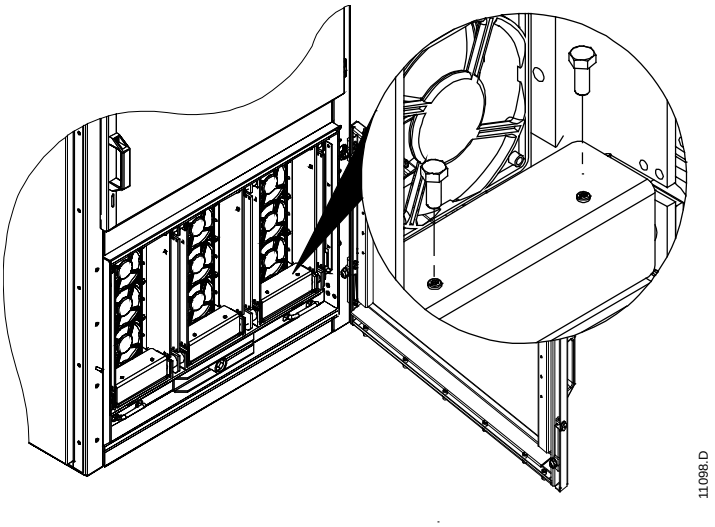
CAUTION
Do not attempt to move the phase cassette without assistance. Because of its significant weight and construction, two or more persons are required to complete this procedure.

NOTE
MVX Pallet Transport Castors Assembly (part no: 992-11914-00) and *Tool Kit* (part no: 995-10998-00) are required for this operation.

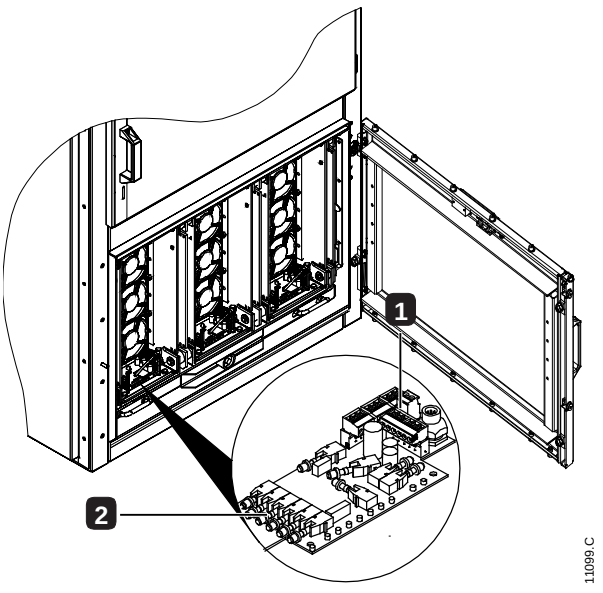
The phase cassette is mounted on a wheeled trolley which allows the phase cassette to be racked-in and racked-out as required.

To remove the phase cassette from the panel enclosure:

1. Assemble the MVX soft starter transport assembly. Refer to *Assembling the Transport Assembly* on page 14 for details.
2. Locate the removable covers for the fibre-optic booster boards at the front of the phase cassette.

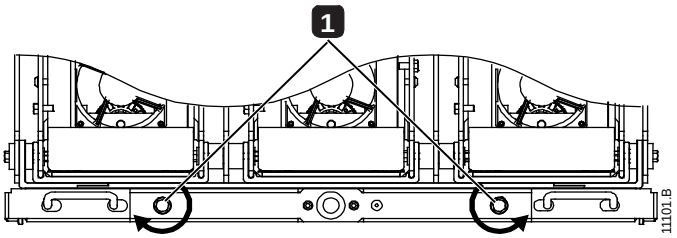


3. Unscrew the two M4 bolts used to fasten each cover. Unfasten all three covers to uncover the three fibre-optic booster boards.



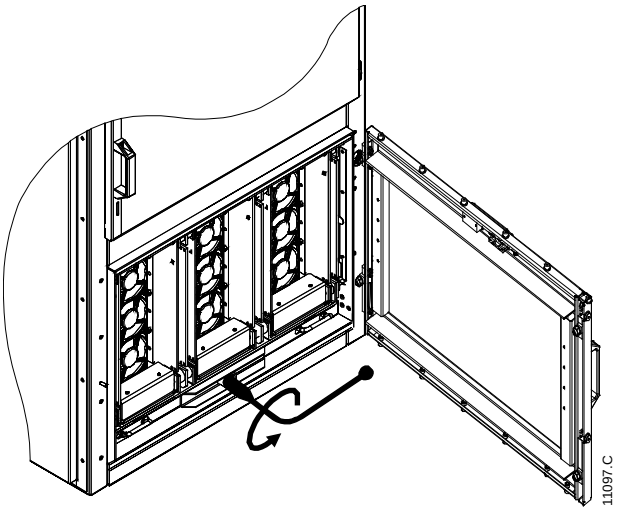
1	Six-way plug socket
2	Fibre-optic connectors

4. Locate the two fibre-optic cables, two-way connector plug and the six-way connector cable for the booster board.
5. Carefully disconnect these connectors and cables from each booster board.
6. Use the brace to disengage the trolley latching mechanism by turning in the direction indicated in the figure below.

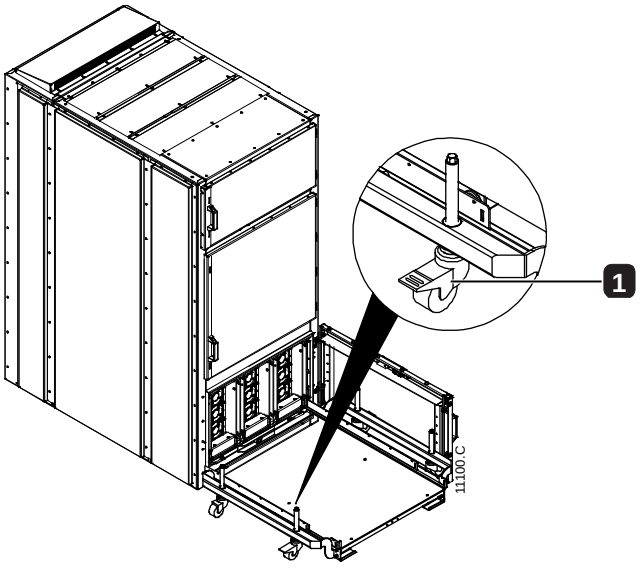


1	Trolley latching mechanism

7. Use the brace to rack out the phase cassette, turning the arm anticlockwise until the phase cassette is completely racked out (approximately 20 turns).

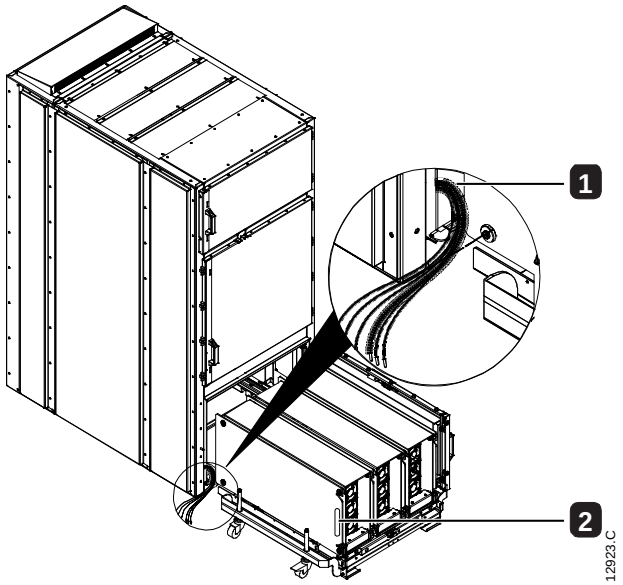


8. Align the arms of the transport assembly along the trolley grooves of the panel. Press down on the castor locking brakes on both sides of the transport assembly to lock it in place.



1	Castor locking brake

9. Hold the phase cassette connection cables away from the panel. This protects the cables and fibre-optic connectors from damage during the operation.



1	Phase cassette connection cables
2	Phase cassette side handle

10. Use the side handles on the phase cassette to draw it on to the transport assembly.
11. Use the brace to engage the trolley latching mechanism, turning in the direction opposite to that used to dis-engage it.

Refer to *Moving the Phase Cassette Using the Transport Assembly* on page 14 for instructions on moving the transport assembly.

14 Appendix

14.1 Parameter Defaults

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

1	Primary Motor Settings	User Set 1	User Set 2	Default Value
1A	*Motor Full Load Current*			100 A
1B	*Locked Rotor Time*			00m:10s
1C	*Locked Rotor Current*			600% FLC
1D	*Motor Service Factor*			105%
2	**Start/Stop Modes-1**			
2A	*Start Mode*			Constant Current
2B	*Start Ramp Time*			00m:01s
2C	*Initial Current*			400% FLC
2D	*Current Limit*			400% FLC
2E	*Reserved*			
2F	*Kickstart Time*			0 ms
2G	*Kickstart Level*			500% FLC
2H	*Stop Mode*			Coast To Stop
2I	*Stop Time*			00m:00s
3	**Auto-Start/Stop**			
3A	*Reserved*			
3B	*Reserved*			
3C	*Auto-Stop Type*			Off
3D	*Auto-Stop Time*			00h:01m
4	**Protection Settings**			
4A	*Excess Start Time*			00m:20s
4B	*Excess Start Time-2*			00m:20s
4C	*Undercurrent*			20% FLC
4D	*Undercurrent Delay*			00m:05s
4E	*Instantaneous Overcurrent*			400% FLC
4F	*Instantaneous Overcurrent Delay*			00m:00s
4G	*Phase Sequence*			Positive Only
4H	*Current Imbalance*			30%
4I	*Current Imbalance Delay*			00m:05s
4J	*Frequency Check*			Run
4K	*Frequency Variation*			±5 Hz
4L	*Frequency Delay*			00m:05s
4M	*Restart Delay*			30m:00s
4N	*Motor Temperature Check*			Do Not Check
4O	*Ground Fault Level*			1 A
4P	*Ground Fault Delay*			00m:03s
4Q	*Undervoltage*			100 V
4R	*Undervoltage Delay*			00m:05s
4S	*Overvoltage*			7200 V
4T	*Overvoltage Delay*			00m:05s
4U	*Instantaneous Overcurrent S2*			4400 A
4V	*Instantaneous Overcurrent Delay S2*			10 ms
5	**Auto-Reset Trips (*Reserved*)**			
5A	*Reserved*			
6	**Inputs**			
6A	*Input A Function*			Input Trip (N/O)
6B	*Input A Name*			Input Trip
6C	*Input A Trip*			Always Active
6D	*Input A Trip Delay*			00m:00s
6E	*Input A Initial Delay*			00m: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*			00m:00s
6J	*Input B Initial Delay*			00m:00s
6K	*Reserved*			
6L	*Reserved*			
6M	*Remote Reset Logic*			Normally Closed (N/C)
6N	*Reserved*			
6O	*Reserved*			
6P	*Reserved*			
6Q	*Local/Remote*			LCL/RMT Anytime
6R	*Comms in Remote*			Enable Control in RMT
7	**Outputs**			
7A	*Relay A Function*			Main Contactor
7B	*Relay A On Delay*			00m:00s
7C	*Relay A Off Delay*			00m:00s
7D	*Relay B Function*			Run
7E	*Relay B On Delay*			00m:00s
7F	*Relay B Off Delay*			00m:00s
7G	*Relay C Function*			Trip
7H	*Relay C On Delay*			00m:00s
7I	*Relay C Off Delay*			00m:00s
7J	*Reserved*			
7K	*Reserved*			
7L	*Reserved*			
7M	*Low Current Flag*			50% FLC
7N	*High Current Flag*			100% FLC
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*			0%
7T	*Reserved*			
7U	*Reserved*			
7V	*Reserved*			
7W	*Reserved*			
8	**Display**			
8A	*Language*			English
8B	*F1 Button Action*			Setup Auto-Start/Stop
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*			kWh
8H	*User Screen - Bottom Right*			Hours Run
8I	*Graph Data*			Current (% FLC)
8J	*Graph Timebase*			10 seconds
8K	*Graph Maximum Adjustment*			400%
8L	*Graph Minimum Adjustment*			0%
8M	*Mains Reference Voltage*			400 V
9	**Motor Data-2**			
9A	*Reserved*			
9B	*Motor FLC-2*			100 A
9C	*Reserved*			
9D	*Reserved*			
9E	*Reserved*			
10	**Start/Stop Modes-2**			
10A	*Start Mode-2*			Constant Current
10B	*Start Ramp-2*			00m:01s

10C	*Initial Current-2*			400% FLC
10D	*Current Limit-2*			400% FLC
10E	*Reserved*			
10F	*Kickstart Time-2*			0 ms
10G	*Kickstart Level-2*			500% FLC
10H	*Stop Mode-2*			Coast To Stop
10I	*Stop Time-2*			00m:00s
11	**RTD/PT100 (*Reserved*)**			
11A	*Reserved*			
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**			
15A	*Access Code*			0000
15B	*Adjustment Lock*			Read & Write
15C	*Emergency Run*			Disable
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*			Warn and Log
16L	*Reserved*			
16M	*Battery/Clock*			Warn and Log
16N	*Ground Fault*			Trip Starter
16O	*Reserved*			
16P	*Reserved*			
16Q	*Reserved*			
16R	*Reserved*			
16S	*Reserved*			
16T	*Reserved*			
16U	*Reserved*			
16V	*Undervoltage*			Trip Starter
16W	*Overvoltage*			Trip Starter
20	**Restricted**			

14.2 Accessories

Communication Interfaces

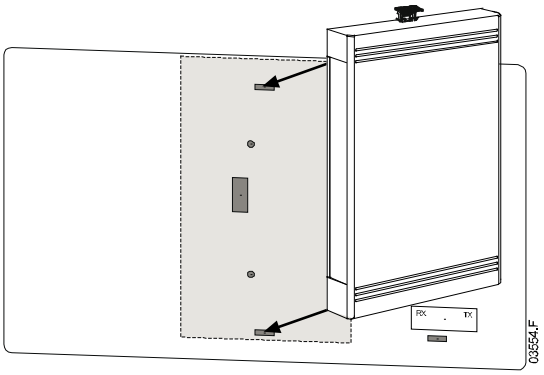
MVX soft starters support network communication via easy-to-install communications interfaces. Each soft starter can support one communications interface at a time.

Available protocols:

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

Installing Communication Modules

Communication modules attach to the back of the controller:



Trip Codes (Serial Communication Network)

Description	Profibus DP / Profinet	Modbus RTU / Modbus TCP	DeviceNet / Ethernet/IP
Excess start time	1	1	101
Motor overload	2	2	20
Motor thermistor	3	3	75
Current imbalance	4	4	26
Frequency	5	5	55
Phase sequence	6	6	54
Instantaneous overcurrent	7	7	28
Power loss	8	8	50
Undercurrent	9	9	29
Motor connection	11	11	102
Input A trip	12	12	11
Starter communication (between module and soft starter)	15	15	113
Network communication (between module and network)	16	16	114
Internal fault/error	17	17	104
Overvoltage	18	18	52
Undervoltage	19	19	51
Ground fault	20	20	27
EEPROM fail	23	23	62
Input B trip	24	24	110
Bypass fail (bypass contactor)	25	25	105
L1 phase loss	26	26	23
L2 phase loss	27	27	24
L3 phase loss	28	28	25
L1-T1 shorted	29	29	115
L2-T2 shorted	30	30	116
L3-T3 shorted	31	31	117
Battery/clock	35	35	121
Miscellaneous	n/a	n/a	70
No trip	255	255	0

PC Software

WinMaster is a purpose-designed software suite for control and monitoring a soft starter. WinMaster is compatible with all AuCom soft starter ranges and is ideal for parameter management during commissioning. WinMaster has the following features:

- Operational control (Start, Stop, Reset, Quick Stop)
- Starter status monitoring (Ready, Starting, Running, Stopping, Tripped)
- Performance monitoring (motor current, motor temperature)
- Upload parameter settings
- Download parameter settings

To use WinMaster with the MVX, the soft starter must be fitted with a USB Module (PIM-USB-01) or a Modbus Module (PIM-MB-01).

Refer to the WinMaster Help for further details.

Starter Trip and Event Logger Software

The Starter Trip and Event Logger Software allows you to download the trip and event logs from the soft starter, for separate analysis.

The software is compatible with all AuCom medium voltage soft starters using control software version 1.29 or later.

For further information, or to download the software, visit www.aucom.com.

Other MVX Accessories

Other accessories available to enhance your MVX starter include:

- RTD protection relay
- Motor protection relay (external to MVX)
- Power meter
- Indication lamps
- Start, stop and reset pushbuttons
- Local/remote selector switch
- Internal panel light for low voltage section
- Panel heater
- Power supply and contactor for motor heater
- Control transformers
- Metering VT
- MV/LV control supply transformer

NOTE
Other accessories may be available on request.

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