# MVX

Soft Starter

AuCom

# USER MANUAL

# Contents

# Section 1 Caution Statements

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

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

- Read and understand the entire manual before installing operating, or maintaining the starter. 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 starter is de-energised before servicing the starter.
- 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 soft starter completely from the power supply before attempting any work on the starter or motor.
- Always use a properly rated voltage sensing device to confirm power is off.
- Before servicing the starter, 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.

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 - ELECTRICAL SHOCK HAZARD

MVX soft starters contain dangerous voltages when connected to mains voltage. Only a competent electrician should carry out the electrical installation. Improper installation of the motor or the soft starter may cause equipment failure, serious injury or death. Follow this manual and local electrical safety codes.

### SHORT CIRCUIT

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

### GROUNDING AND BRANCH CIRCUIT PROTECTION

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

### ARC FLASH HAZARD

Soft starters have 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.

AuCom soft starters have 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.

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

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# Section 2 General Description

## 2.1 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.

Each MVX soft starter comprises of:

- a Phase Cassette
- a Controller module
- associated switchgear

These elements are enclosed in a robust panel which provides physical isolation between medium and low voltage elements.

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 the correct Controller and Phase Cassette are used together.

Fibre-optic cables are used to connect the Controller module to the Phase Cassette.

NOTE
Fibre-optic cables are only supplied in IP00 variants of the MVX soft starter. In all other MVX soft starters, this is part of the main assembly.

## 2.2 Feature List

Starting
- Constant current
- Current ramp

Stopping
- Coast to stop
- Soft stop

Protection
- Under/ Overvoltage
- Mains frequency
- Phase sequence
- Shorted SCR
- Motor overload (thermal model)
- Instantaneous overcurrent
- Time-overcurrent
- Ground fault
- Undercurrent
- Current imbalance
- Motor thermistor
- Excess start time
- Power circuit
- Auxiliary trip

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)

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 (starts, hours-run, kWh)
- Performance monitoring (current, voltage, power factor, kWh)
- User-programmable monitoring screen
- Multi-level password protection
- Emergency stop push button

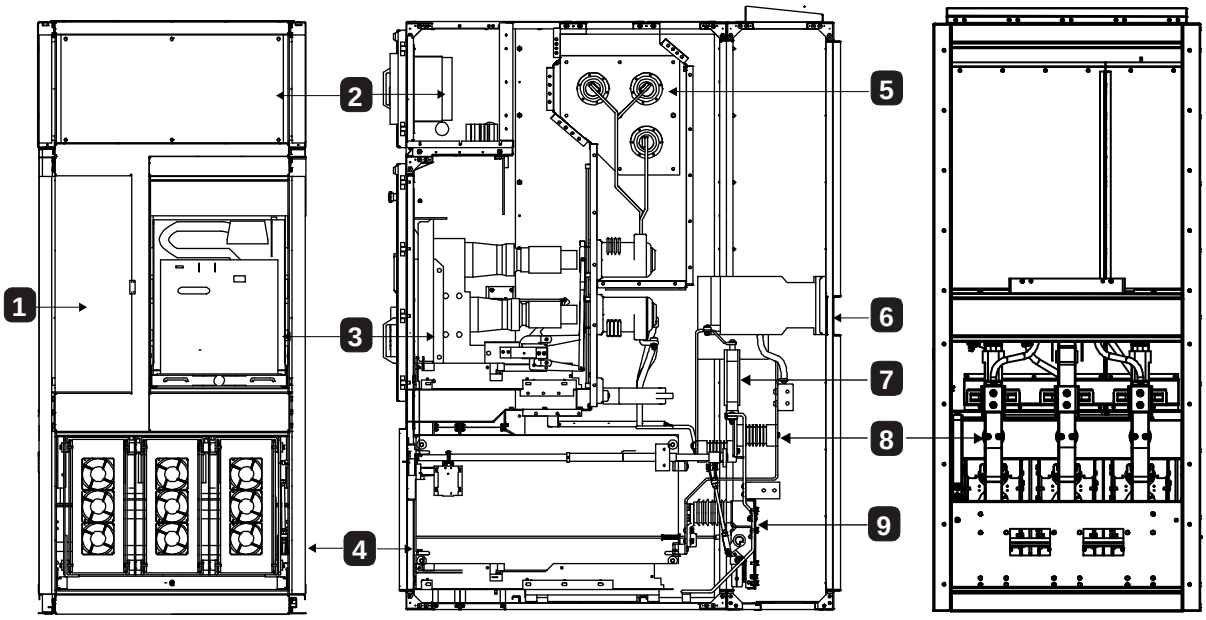
Power Connection
- 15 A to 800 A, nominal
- 2200 VAC to 12000 VAC (model dependent)

Accessories (optional)
- DeviceNet, Modbus, Profibus or USB communication modules
- Synchronous motor control
- PC Software
- Overvoltage protection
- Control supply transformer
- MV/LV Control transformer

## 2.3 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.




Side view Front 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 | Earth switch |
| 9 | Phase Cassette power connections |
| | |

NOTE
MVX enclosures vary in size and construction for different AuCom models. Refer to the relevant switchgear manual for more information.

## 2.4 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 parameter group 4 on page 27 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 parameter group 16 on page 40 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 53 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.

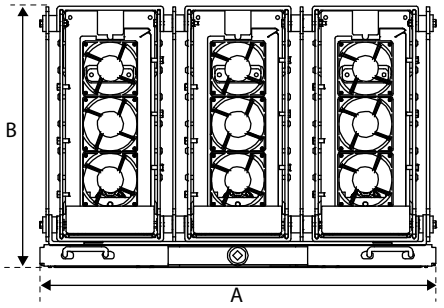
# Section 3 Specifications

## 3.1 Dimensions and Weights

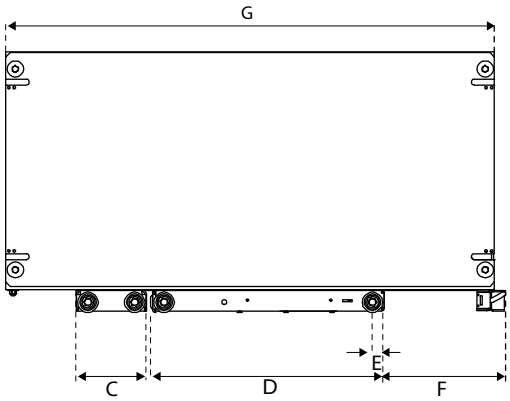
### Phase Cassette

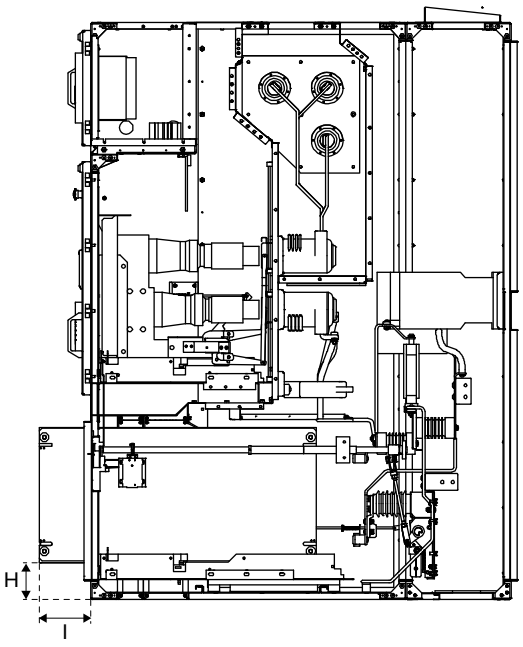
The Phase Cassette is affixed to a trolley which allows the whole unit to be drawn out.

Front view




Side view



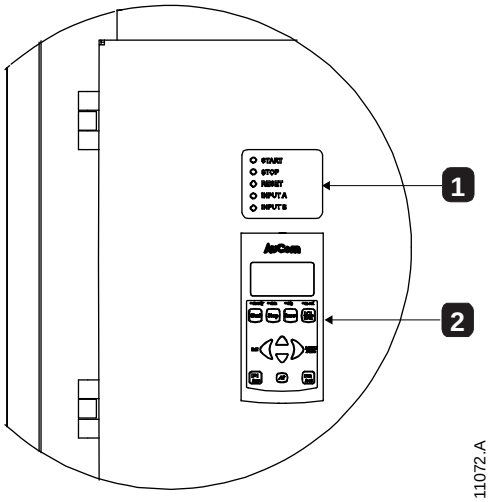

11071.A

Phase Cassette extended

| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| | mm (inch) | mm (inch) | mm (inch) | mm (inch) | mm (inch) | mm (inch) | mm (inch) | mm (inch) | mm (inch) |
| MVXxxxx-V12 | 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) |

## 3.2 Controller

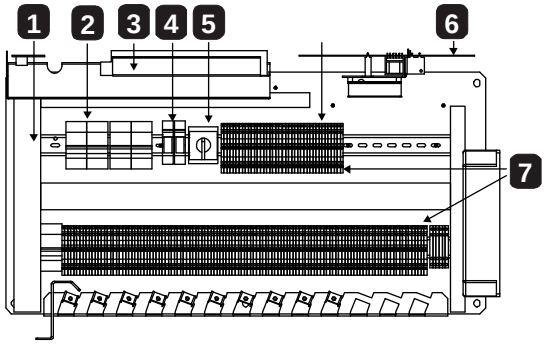
The Controller is suitable for use with all MVX soft starters.




| | |
|---|---|
| 1 | Control input LEDs |
| 2 | Keypad |

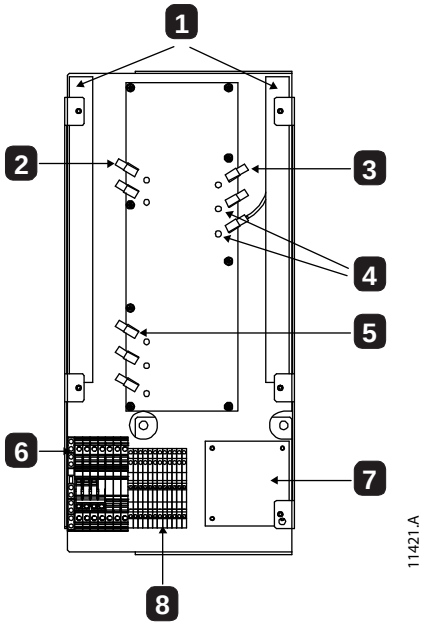
Dimensions are shown in mm (inch).
Weight: 2.1 kg (4.63 lb)

## 3.3 Low Voltage Sections




Upper LV section

| | |
|---|---|
| 1 | Conduit for LV wiring |
| 2 | Miniature circuit breakers (MCB) |
| 3 | Switch mode power supply (SMPS) |
| 4 | Surge protector |
| 5 | Soft start/DOL switch |
| 6 | Power supply isolator PCB |
| 7 | Terminal blocks - double tier |




Lower LV section

| | |
|---|---|
| 1 | Conduit for LV wiring |
| 2 | Fibre optic connectors for controller |
| 3 | Gate firing fibre optic connectors |
| 4 | Fibre optic LED |
| 5 | Non-conduction feedback fibre optic connectors |
| 6 | Current transformer test block (TB1) |
| 7 | Earth leakage PCB |
| 8 | Terminal blocks - double tier |

## 3.4 General Technical Data

| | |
|---|---|
| **Supply** | |
| Mains Voltage | |
| MVXxxxx-V12 | 12 kV Phase-phase |
| Rated Frequency (fr) | 50/60 Hz |
| Rated lightning impulse withstand voltage ($U_p$) | |
| MVXxxxx-V12 | 75 kV |
| Rated power frequency withstand voltage ($U_d$) | |
| MVXxxxx-V12 | 42 kV |
| Rated short-time withstand current (asymmetrical RMS peak) ($I_k$) | |
| MVXxxxx-V12 | 31.5 kA for 100 ms [1] |
| Form Designation | Bypassed semiconductor motor starter form 1 |
| **Control Inputs** | |
| Start (Terminals C23, C24) | 24 VDC, 8 mA approx |
| Stop (Terminals C31, C32) | 24 VDC, 8 mA approx |
| Reset (Terminals C41, C42) | 24 VDC, 8 mA approx |
| Input A (Terminals C53, C54) | 24 VDC, 8 mA approx |
| Input B (Terminals C63, C64) | 24 VDC, 8 mA approx |
| Motor Thermistor (Terminals B4, B5) | Trip point > 2.8 kΩ |

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

| | |
|---|---|
| **Low Voltage Supply** | |
| Rated Voltage | |
| MVXxxxx-V12 | 85 ~ 275 VAC |
| Rated Frequency | 50/60 Hz |
| Typical power consumption - MVXxxxx-V12 | |
| Start | 300 W |
| Stop | 100 W |
| **Outputs** | |
| Relay Outputs | 10 A @ 250 VAC resistive |
| | 6 A @ 250 VAC AC15 p.f. 0.3 |
| | 10 A @ 30 VDC resistive |
| Outputs on interface PCB | |
| Main Contactor (13, 14) | Normally Open |
| Bypass Contactor (23, 24) | Normally Open |
| Run Output/ PFC (33, 34) | 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 |
| **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 |
| Relative Humidity | 5% to 95% |
| Storage Environment | |
| IEC60721-3-1: IE12 | -5 °C to 45 °C |
| Relative Humidity | 5% to 95% |
| 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<br>100 MHz to 2000 MHz: < 54 dB µV/m |
| **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 | 5000 ms (at 0% nominal voltage safe shutdown) |
| **Standards Approvals** | |
| C✓ | EMC requirements |
| CE | EMC EU Directive |

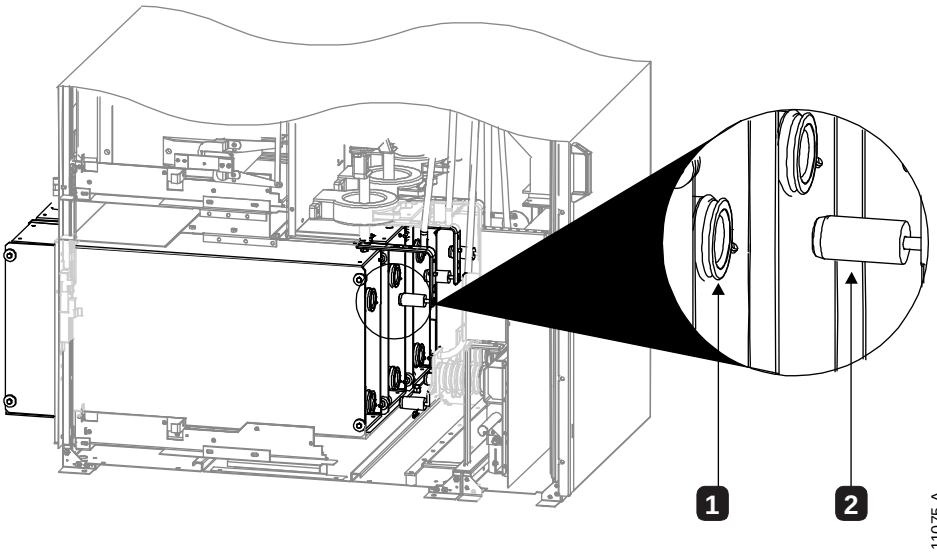
[1] Short circuit current, with appropriate protection.

# Section 4 Installation

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

## 4.1 Power Connections

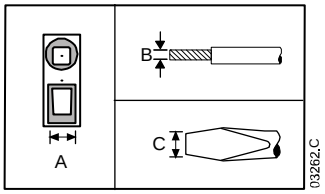
The Phase Cassette connects to enclosure power terminals using a clustered pin-plug arrangement.




| | |
|---|---|
| 1 | Cluster plug |
| 2 | Cluster pin |

## 4.2 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 |

## 4.3 Control Wiring

The soft starter can be controlled in three ways:

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

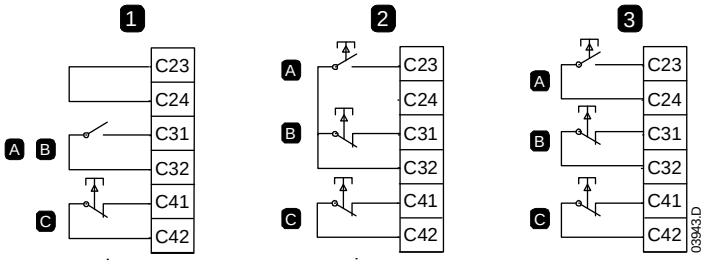
The LCL/RMT button controls whether the MVX will respond to local control (via the Controller) or remote control (via the remote inputs).

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

The STOP button on the Controller is always enabled.

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 |

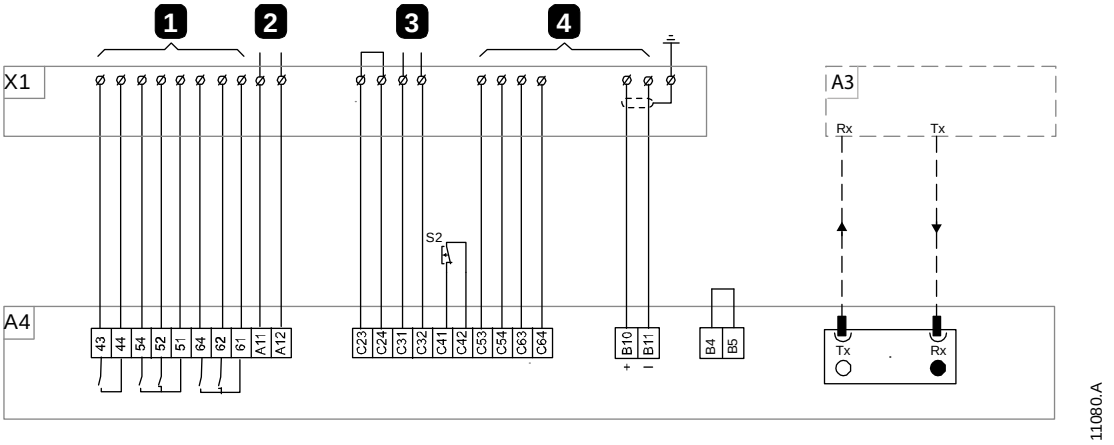
**CAUTION**
Do not apply voltage to the control input terminals. These are active 24 VDC inputs and must be controlled with potential free contacts.

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

**NOTE**
Reset input is normally closed by default.

## 4.4 Terminal Block Connections

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




| | |
|---|---|
| X1 | Terminal Block |
| 1 | For customer use |
| 2 | Internal 24 VDC supply |
| 3 | From selector switch S3 |
| 4 | For customer use |
| A3 | Power interface PCB |
| A4 | Controller |
| 43, 44 | Output A |
| 51, 52, 54 | Output B |

| | |
|---|---|
| 61, 62, 64 | Output C |
| A11, A12 | Control supply (24 VAC/VDC) |
| C23, C24 | Start input |
| C31, C32 | Stop input |
| C41, C42 | Reset input |
| C53, C54 | Program A input |
| C63, C64 | Program B input |
| B10, B11 | Analog output |
| B4, B5 | Thermistor input |

## 4.5 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 of the MVX (refer to *Power Circuit Configuration* on page 15).

## 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 of the MVX (refer to *Power Circuit Configuration on page 15)*.

## 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 are required if the cable run between the soft starter and the motor is greater than 200 m. Line inductors should be installed outside the panel, between the soft starter output (terminals T1, T2, T3) and the motor. Contact your local supplier for selection details.

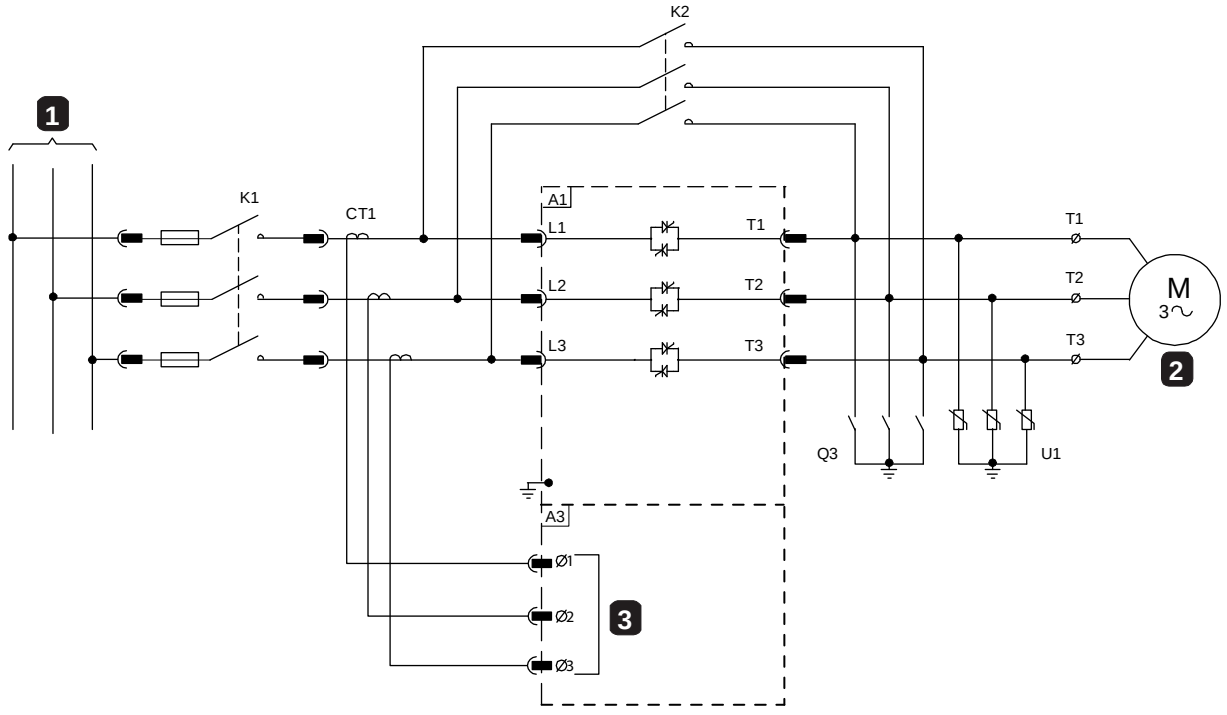
## Internal Control Supply Arrangement

The MVX uses an internal power supply arrangement to generate several independent low voltage (24 VDC) control supplies from the incoming supply.

Connect incoming power supply (110 ~ 240 VAC) to the terminal block supply inputs as indicated in *Internal Wiring* on page 17.

## Power Circuit Configuration (with Contactors)

*MVX power circuit with fused main contactor and bypass contactor.*

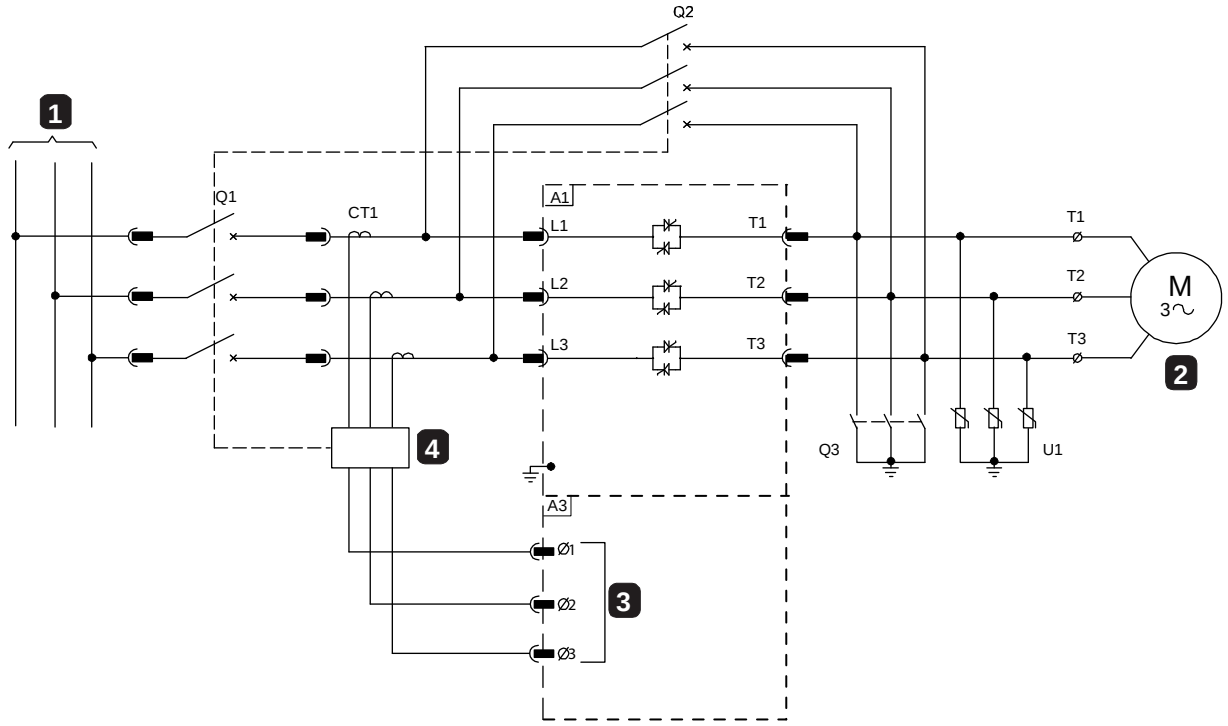



| | |
|---|---|
| A1 | Phase Cassette |
| 1 | 3 Phase 50/60 Hz Supply |
| K1 | Main contactor (fixed/ withdrawable) |
| K2 | Bypass contactor (fixed) |
| CT1 | Current transformers (x3) |
| L1-L3 | Input power terminals (supply side) |

| | |
|---|---|
| 2 | Motor |
| Q3 | Earth switch |
| U1 | Metal oxide varistors (MOVs) |
| T1-T3 | Output power terminals (motor side) |
| A3 | Power interface PCB |
| 3 | Current transformer inputs |

## Power Circuit Configuration (with Circuit Breakers)

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

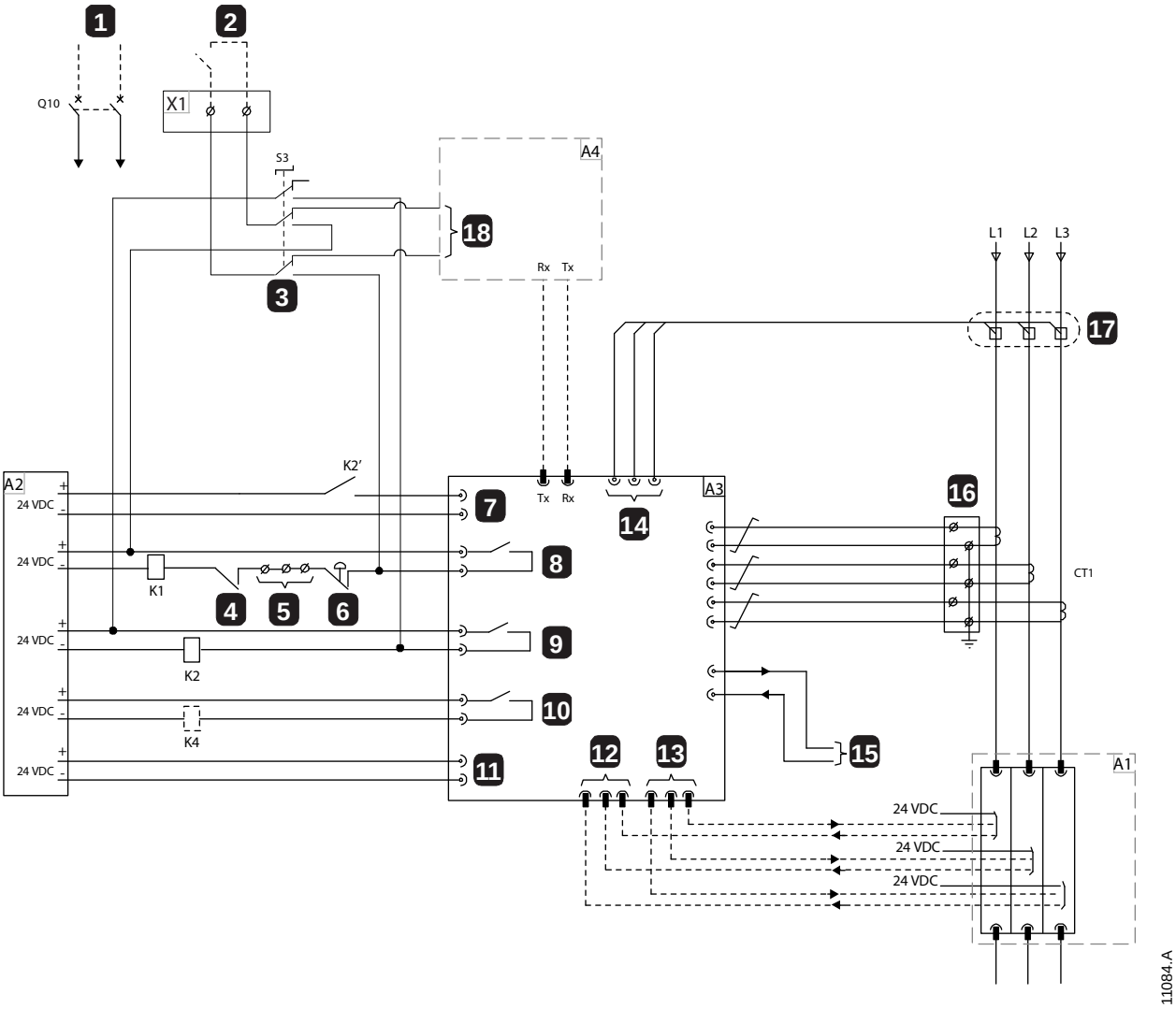



| | |
|---|---|
| A1 | Phase cassette |
| 1 | 3 Phase 50/60 Hz Supply |
| Q1 | Main circuit breaker (withdrawable) |
| Q2 | Bypass circuit breaker (fixed) |
| CT1 | Current transformers (x3) |
| L1-L3 | Input power terminals (supply side) |

| | |
|---|---|
| 2 | Motor |
| Q3 | Earth switch |
| U1 | Metal oxide varistors (MOVs) |
| T1-T3 | Output power terminals (motor side) |
| A3 | Power interface PCB |
| 3 | Current transformer inputs |
| 4 | Motor protection relay (MPR) |

# Section 5 Internal Wiring

## 5.1 Internal Wiring (with Contactors)

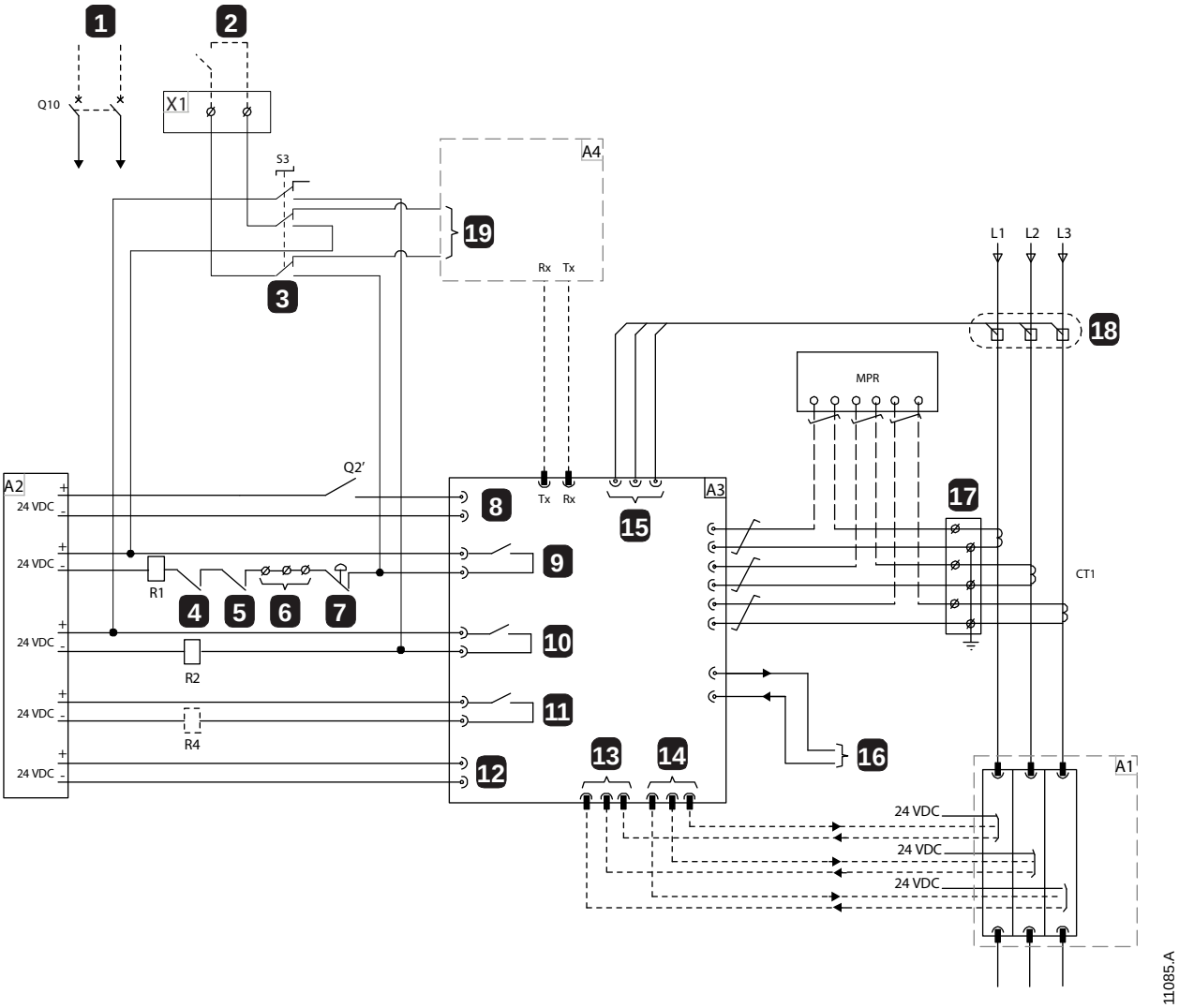



| | |
|---|---|
| X1 | Terminal block |
| 1 | 110 ~ 240 VAC control supply |
| Q10 | Miniature circuit breaker |
| 2 | Customer 2-wire Start/ Stop signal |
| 3 | Soft start/ DOL selector switch (S3) |
| A1 | Phase Cassette |
| A2 | Internal power supply PCB |
| K2' | Bypass contactor feedback signal |
| K1 | Main contactor coil |
| K2 | Bypass contactor coil |
| K4 | PFC contactor coil |
| 4 | Door interlock |
| 5 | Links on terminal block (X1) |
| 6 | Emergency stop button |

| | |
|---|---|
| A3 | Power interface PCB |
| 7 | Bypass feedback input |
| 8 | Main contactor output |
| 9 | Bypass contactor output |
| 10 | PFC output |
| 11 | 24 VDC supply |
| 12 | Non conduction F/O inputs |
| 13 | Firing F/O outputs |
| 14 | Voltage sense inputs |
| 15 | Fan run and fan fail signals |
| 16 | CT test block (TB1) |
| CT1 | Current transformers |
| 17 | Voltage sensors |
| A4 | Controller |
| 18 | Controller STOP input |

NOTE
A contactor (K4) is only supplied when PFC switching is required.

## 5.2 Internal Wiring (with Circuit Breakers)



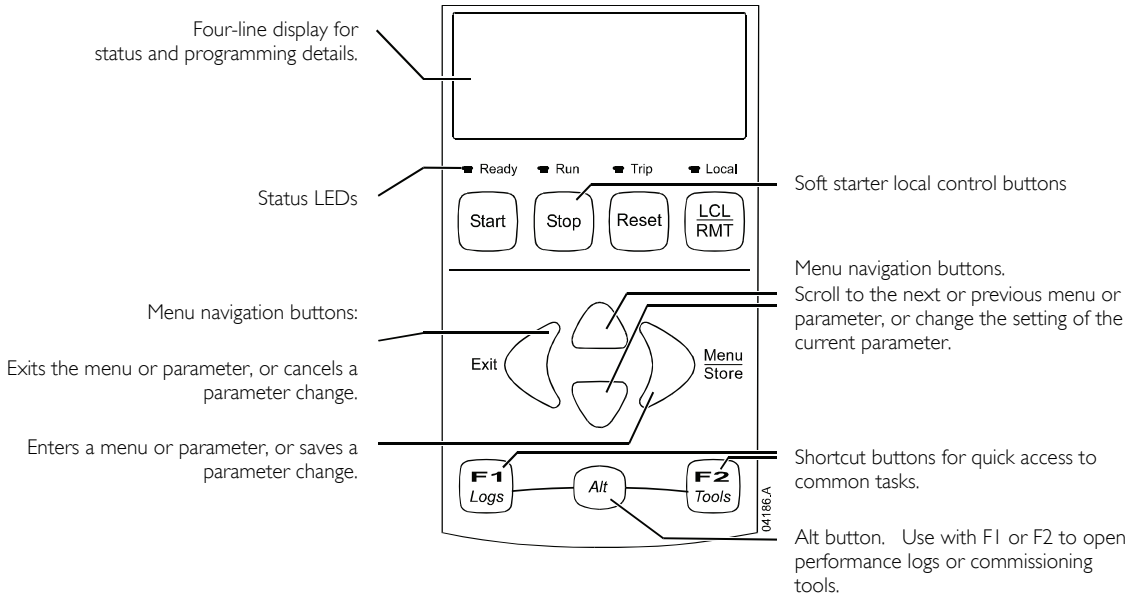

| | |
|---|---|
| X1 | Terminal block |
| 1 | 110 ~ 240 VAC control supply |
| Q10 | Miniature circuit breaker |
| 2 | Customer 2-wire Start/ Stop signal |
| 3 | Soft start/ DOL selector switch (S3) |
| A1 | Phase Cassette |
| A2 | Internal power supply PCB |
| Q2' | Bypass circuit breaker feedback signal |
| R1 | Main circuit breaker control relay |
| R2 | Bypass circuit breaker control relay |
| R4 | PFC circuit breaker control relay |
| 4 | Door interlock |
| 5 | MPR trip output (N/C) |
| 6 | Links on terminal block (X1) |
| 7 | Emergency stop button |

| | |
|---|---|
| A3 | Power interface PCB |
| 8 | Bypass feedback input |
| 9 | Main contactor output |
| 10 | Bypass contactor output |
| 11 | PFC output |
| 12 | 24 VDC supply |
| 13 | Non conduction F/O inputs |
| 14 | Firing F/O outputs |
| 15 | Voltage sense inputs |
| 16 | Fan run and fan fail signals |
| 17 | CT test block (TB1) |
| CT1 | Current transformers |
| 18 | Voltage sensors |
| MPR | Motor protection relay |
| A4 | Controller |
| 19 | Controller STOP input |

NOTE
A circuit breaker control relay (R4) is only supplied when PFC switching is required.

# Section 6 Keypad and Feedback

## 6.1 The Controller




## 6.2 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 50, for further details.

## 6.3 Menus

### Commissioning Menu

The Commissioning Menu provides access to commissioning and testing tools.

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

Refer to *Commissioning Menu* on page 41, for further details.

### Programming Menu

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

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

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 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

- Menu Shortcuts

The F1 and F2 buttons offer keyboard shortcuts to the Auto-Stop menu. Use parameters 8B and 8C (*F1 and F2 Button Action* on page 36) to select the shortcut target.

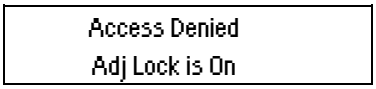
- Adjustment Lock

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:




- 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.


To change the access code, use parameter 15A.

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

The default access code is 0000.

## Logs Menu

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

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

Refer to *Logs Menu* on page 45, for further details.

# Section 7 Programming Menu

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

The Programming Menu contains three sub-menus:

| | |
|---|---|
| Standard Menu | The Standard Menu provides access to commonly used parameters, allowing you to configure the MVX to suit your application. |
| Extended Menu | The Extended Menu provides access to all the MVX's programmable parameters, allowing experienced users to take advantage of advanced features. |
| Load/Save Settings | Load/Save Settings lets you save the current parameter settings to a file, load parameters from a previously saved file, or reset all parameters to default values. |

## 7.1 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 26.

| | | |
|---|---|---|
| 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* |

## 7.2 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 | *Current Calibration* |
| | 8N | *Mains Reference Voltage* |
| | 8O | *Voltage Calibration* |
| 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* |
| | 10G | *Kickstart Level-2* |
| | 10F | *Kickstart Time-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* |

## 7.3 Load/Save Settings

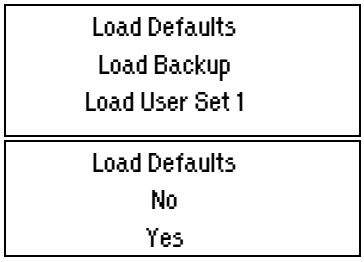
The Load/Save Settings menu requires an access code and allows users to:

- 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

## 7.4 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:** 5-1000A **Default:** 100A
**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 run at 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, 2G – Kickstart

Parameter 2F *Kickstart Time*

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

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

Parameter 2G *Kickstart Level*

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

**Description:** Sets the level of the kickstart current.

CAUTION

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

### 2H – Stop Mode

**Options:** Coast To Stop **(Default)**
TVR Soft Stop

**Description:** Selects the stop mode.

### 2I – Stop Time

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

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

## 3 Auto-Start/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, 3D – Auto-Stop

Parameter 3C *Auto-Stop Type*

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

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

Parameter 3D *Auto-Stop Time*

**Range:** 00:01 - 24:00 (hours:minutes) **Default:** 1 minute

**Description:** Sets the time for the soft starter to auto-stop, in 24 hour clock format.

## 4 Protection Settings

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

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

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

### 4A, 4B – Excess Start Time

Excess start time is the maximum time the 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:** Parameter 4A sets the time for the primary motor and parameter 4B (*Excess Start Time-2*) sets the time for the secondary motor.

### 4C, 4D – Undercurrent

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

Parameter 4C *Undercurrent*

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

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

Parameter 4D *Undercurrent Delay*

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

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

### 4E, 4F – 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.

Parameter 4E *Instantaneous Overcurrent*

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

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

Parameter 4F *Instantaneous Overcurrent Delay*

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

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

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

### 4G – Phase Sequence

**Range:** Any sequence **(Default)**
Positive only
Negative only

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

### 4H, 4I – Current Imbalance

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

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

Parameter 4H *Current Imbalance*

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

Parameter 4I *Current Imbalance Delay*

**Range:** 0:00 - 4:00 (minutes:seconds) **Default:** 3 seconds
**Description:** Slows the 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, 4K, 4L – Frequency Trip

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

Parameter 4J *Frequency Check*

**Range:** Do Not Check
Start Only
Start/Run **(Default)**
Run Only
**Description:** Determines when and if the starter will monitor for a frequency trip.

Parameter 4K *Frequency Variation*

**Range:** ± 2 Hz
± 5 Hz **(Default)**
± 10 Hz
± 15 Hz
**Description:** Selects the soft starter's tolerance for frequency variation.

Parameter 4L *Frequency Delay*

**Range:** 0:01 - 4:00 (minutes:seconds) **Default:** 1 second
**Description:** Slows the MVX's response to frequency disturbances, avoiding trips due to momentary fluctuations.

NOTE
If the mains frequency drops below 35 Hz or rises above 75 Hz, the starter will trip immediately, irrespective of the settings for Frequency Trip parameters.

### 4M – Restart Delay

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

**Range:** 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, 4P – Ground Fault Level

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

Parameter 4O *Ground Fault Level*

**Range:** 1 A - 40 A **Default:** 10 A
**Description:** Sets the trip point for ground fault protection.

Parameter 4P *Ground Fault Trip Delay*

**Range:** 0:01 - 4:00 (minutes:seconds) **Default:** 3 seconds
**Description:** Slows the starter's response to ground fault variation, avoiding trips due to momentary fluctuations.

### 4Q, 4R – Undervoltage

The MVX can be configured to trip if the average voltage on all three phases of the mains supply falls below a specified level while the motor is running.

Parameter 4Q *Undervoltage Level*

**Range:** 100 – 18000 V **Default:** 100 V
**Description:** Sets the trip point for undervoltage protection. Set as required.

Parameter 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, 4T – Overvoltage

The MVX can be configured to trip if the average voltage on all three phases of the mains supply exceeds a specified level while the motor is running.

Parameter 4S *Overvoltage Level*

**Range:** 100 – 18000 V **Default:** 7200 V
**Description:** Sets the trip point for overvoltage protection. Set as required.

Parameter 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 SCR. When Stage 1 triggers, the SCRs continue to conduct current for some time and the starter performs a controlled stop. 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*

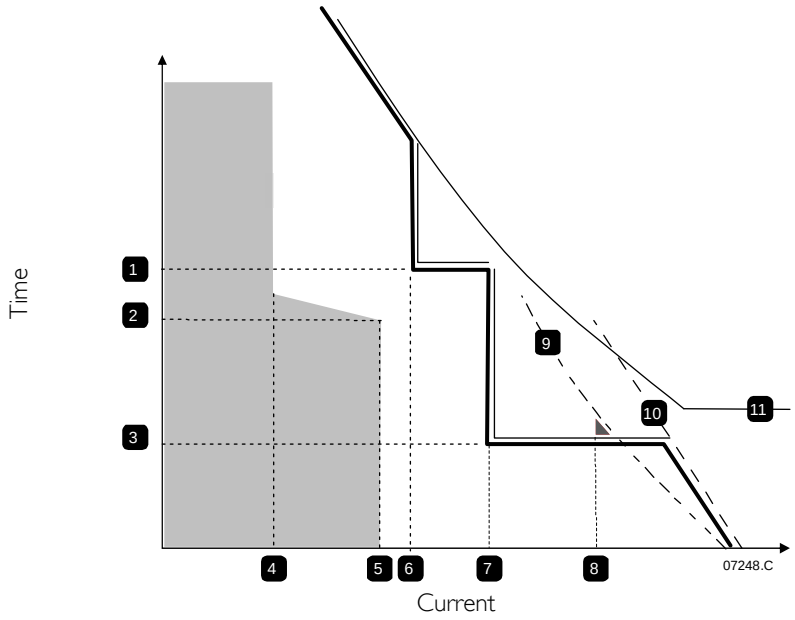
**Range:** 30 A – 4400 A **Default:** 4400 A
**Description:** Sets the trip point for instantaneous overcurrent stage 2 protection in amperes. Set as required.

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

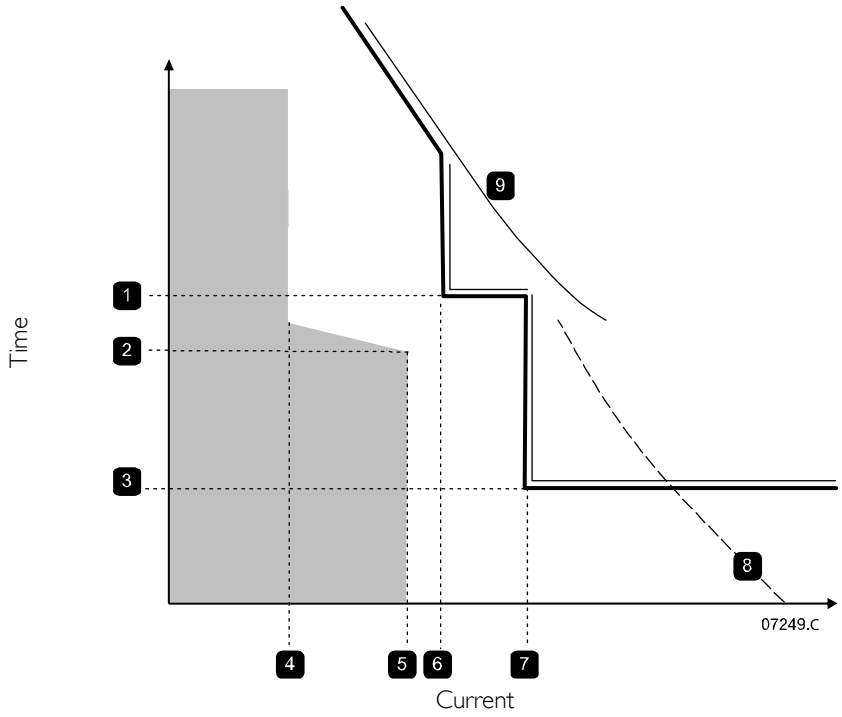



| | |
|---|---|
| 1 | Instantaneous Overcurrent Delay Stage 1 (4F) |
| 2 | Motor start time |
| 3 | Instantaneous Overcurrent Delay Stage 2 (4V) |
| 4 | FLC |
| 5 | Motor start current |

| | |
|---|---|
| 6 | Instantaneous Overcurrent Stage 1 (4E) |
| 7 | Instantaneous Overcurrent Stage 2 (4U) to trip external upstream breaker |
| 8 | SCR |
| 9 | Fuse |
| 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 current |

| | |
|---|---|
| 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 **(Default)** | The MVX can be configured with two separate sets of motor data.<br>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) | 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.<br>(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.<br>(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.<br>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).<br>Closing the circuit across C53, C54 activates emergency run.<br>Opening the circuit ends emergency run and the MVX stops the motor. |
| Emergency Stop | The MVX can be commanded to emergency stop the motor, ignoring the soft stop mode set in parameter 2H. When the circuit across C53, C54 is opened, the soft starter allows the motor to coast to stop. |

**Description:** Selects the function of Input A.

### 6B – Input A Name

**Options:**

| | |
|---|---|
| Input Trip **(Default)** | No Flow |
| Low Pressure | Emergency Stop |
| High Pressure | Controller |
| Pump Fault | PLC |
| Low Level | Vibration Alarm |
| High Level | |

**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 seconds

**Description:** Sets a delay between the input activating and the soft starter tripping.

Parameter 6E*Input A Initial Delay*

**Range:** 00:00 - 30:00 (minutes:seconds) **Default:** 0 seconds

**Description:** Sets a delay before an input trip can occur, 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. | |

CAUTION
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 Ctrl in RMT | |
| | Enable Ctrl 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 16U). |
| | Warning | The relay closes when the starter issues a warning (refer to parameter 16A to 16U). |
| | Low Current Flag | The relay closes when the low current flag activates (refer to parameter 7M *Low Current Flag*, while the motor is running). |
| | High Current Flag | The relay closes when the high current flag activates (refer to parameter 7N *High Current Flag*, while the motor is running). |
| | Motor Temp Flag | The relay closes when the motor temperature flag activates (refer to parameter 7O *Motor Temperature Flag*). |
| | Input A Trip | The relay closes when Input A activates to trip the soft starter. |
| | Input B Trip | The relay closes when Input B activates to trip the soft starter. |
| | Motor Overload | The relay closes when the starter trips on Motor Overload. |
| | Current Imbalance | The relay closes when the starter trips on Current Imbalance. |
| | Undercurrent | The relay closes when the starter trips on Undercurrent. |
| | Inst Overcurrent | The relay closes when the starter trips on Instantaneous Overcurrent. |
| | Frequency | The relay closes when the starter trips on Frequency. |
| | Ground Fault | The relay closes when the starter trips on Ground Fault. |
| | Heatsink Overtemp | 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. |

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

### 7B, 7C – Relay A Delays

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

Parameter 7B *Relay A On Delay*

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

**Description:** Sets the delay for closing Relay A.

Parameter 7C *Relay A Off Delay*

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

**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 seconds
- 7F *Relay B Off Delay* **Default:** 0 seconds

Relay C is a changeover relay.

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

The following parameters are reserved for future use:

- 7J ~ 7L *Reserved*

### 7M, 7N – Low Current Flag and High 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 motor full load current.

Parameter 7M *Low Current Flag*

**Range:** 1% - 100% FLC **Default:** 50%
**Description:** Sets the level at which the low current flag operates, as a percentage of motor full load current.

Parameter 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 reference voltage (parameter 8N). Power factor is assumed to be 1.0. $\frac{\sqrt{3} \cdot V \cdot I_{FLC} \cdot pf}{1000}$ |
| Motor kVA (%) | Motor kilovolt amperes. 100% is motor FLC (parameter 1A) multiplied by mains reference voltage (parameter 8N). $\frac{\sqrt{3} \cdot V \cdot I_{FLC}}{1000}$ |
| 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 reference voltage parameter 8N.

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

Parameter 7Q *Analog A Scale*

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

**Description:** Selects the range of the analog output.

Parameter 7R *Analog A Maximum Adjustment*

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

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

Parameter 7S *Analog A Minimum Adjustment*

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

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

## 8 Display

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

### 8A – Language

**Options:** English **(Default)**
Chinese

**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 Menu

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

- 8B *F1 Button Action* **Default:** SetupAuto-Start/Stop Menu
- 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 **(Default)** | The starter's operating state (starting, running, stopping or tripped). Only available for top left and bottom left positions on the screen. |
| Motor Current | The average current measured on three phases. |
| Motor pf | The motor's power factor, measured by the soft starter. |
| Mains Frequency | The average frequency measured. |
| 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 | Not applicable to this product. |
| 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 reference voltage (parameter 8N). Power factor is assumed to be 1.0. $\frac{\sqrt{3} \cdot V \cdot I_{FLC} \cdot pf}{1000}$ |
| Motor kVA (%) | Motor kilovolt amperes. 100% is motor FLC (parameter 1A) multiplied by mains reference voltage (parameter 8N). $\frac{\sqrt{3} \cdot V \cdot I_{FLC}}{1000}$ |
| 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 reference voltage parameter 8N. |

**Description:** Selects which information the graph will display.

Parameter 8J *Graph Timebase*

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

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

Parameter 8K *Graph Maximum Adjustment*

**Range:** 0% – 600% **Default:** 400%

**Description:** Adjusts the upper limit of the performance graph.

Parameter 8L *Graph Minimum Adjustment*

**Range:** 0% – 600% **Default:** 0%

**Description:** Adjusts the lower limit of the performance graph.

### 8M – Current Calibration

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

**Description:** Calibrates the soft starter's current monitoring circuits to match an external current metering device.

Use the following formula to determine the necessary adjustment:

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

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

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

### 8N – Mains Ref Volt

**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*

**Description:** 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 ~ 10M – 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 Time-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.
**Range:** 0:00 - 4:00 (minutes:seconds) **Default:** 0 seconds
**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, 12B – Motor Data-1 and Motor Data-2 Ramp

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

### 12C – Changeover Time

**Range:** 100 - 500 (milliseconds) **Default:** 150 milliseconds
**Description:** Sets the delay between the rotor resistance relay closing and the low resistance current ramp starting. Set so that the contactor has enough time to close, but the motor does not slow down.
Parameter 12C only applies if parameter 12A or 12B is set to 'Dual Ramp', and an output relay is set to 'Changeover Contactor'.

### 12D – Slip-Ring Retard

**Range:** 10% - 90% **Default:** 50%
**Description:** Sets the level of conduction while the rotor resistor closes, as a percentage of full conduction. Set so that no current pulse occurs, but the motor retains enough speed to start correctly.

## 15 Advanced

### 15A – Access Code

**Range:** 0000 - 9999 **Default:** 0000
**Description:** Sets the access code to control access to restricted sections of the menus.
Use the ◀ and ▶ buttons to select which digit to alter and use the ▲ and ▼ buttons to change the value. 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.

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

### 15C – Emergency Run

**Options:** Disable **(Default)**
Enable

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

## 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)**
Warning & 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.

# Section 8 Commissioning

## 8.1 Commissioning Menu

The Commissioning Menu provides access to commissioning and testing tools.

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

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.

### 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.

### 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 MVX has three simulation modes:

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

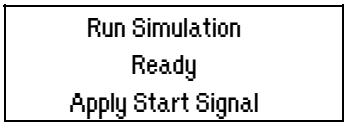
The simulation tools are accessed via the Commissioning Menu. The simulations are only available when the soft starter is in Ready state, control voltage is available and the Controller is active.

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

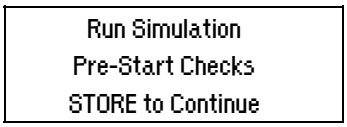
- **Run Simulation**

To use the run simulation:

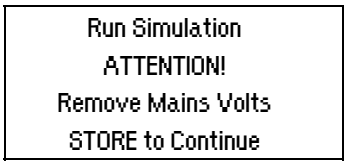
1. Open the Commissioning Menu.
2. Scroll to Run Simulation and press ▶.
3. Press START or activate the start input.



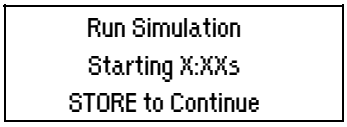

The MVX simulates its pre-start checks and closes the main contactor (if installed). The Run LED flashes.



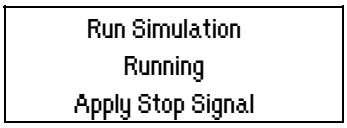
NOTE
If the Mains voltage is connected an error message is shown. Remove the Mains voltage and proceed to next step.



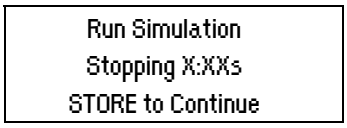

4. Press ▶. The MVX simulates starting. The Run LED flashes.



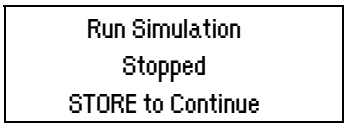

5. Press ▶. The MVX simulates running. The Run LED stays on without flashing and the bypass contactor closes (if installed)




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




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



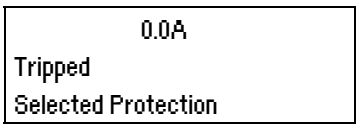

8. Press ▶ to return to the commissioning menu.

- 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).




6. Use ▲ or ▼ to select another simulation, or press ◀ to return to the commissioning menu.

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

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

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

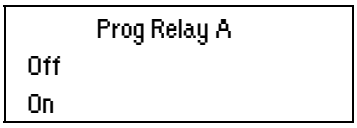
- Output Signal Simulation

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

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

To use the output signal simulation:

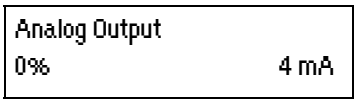
1. Open the Commissioning Menu.
2. Scroll to Output Signalling Simulation and press ▶.
3. Use the ▲ and ▼ buttons to select a function to simulate, then press ▶.
4. Use the ▲ and ▼ buttons to turn the signal on and off.
   To confirm correct operation, monitor the state of the output.




5. Press ◀ to return to the simulation list.

- Analog Output Simulation

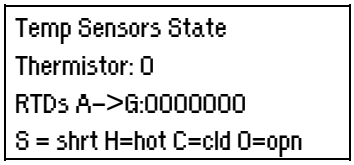
The analog output simulation uses the ▲ and ▼ buttons to change the analog output current at terminals B10, B11 of the Controller.




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.

- Temperature Sensors State

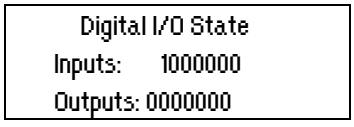
This screen shows the state of the motor thermistors and RTD/PT100s.




NOTE
The use of RTDs is not supported by this product and this screen will always indicate Open = o.

- Digital I/O State

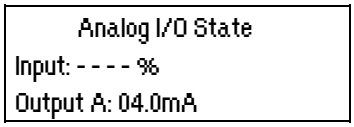
This screen shows the current status of the digital inputs and outputs.




This screen shows the current state of the Digital I/O in order. The screen shows input C23~C24 closed with all other inputs open. The outputs follow a similar patter and show all open.

- Analog I/O State

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



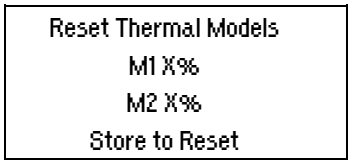

NOTE
Input is not supported by this product and this screen will always indicate Input: - - - - %

- Reset Thermal Models

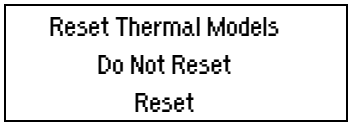
The MVX's advanced thermal modelling software constantly monitors the motor's performance. This allows the MVX to calculate the motor's temperature and ability to start successfully at any time.

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.

## 8.2 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 *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.

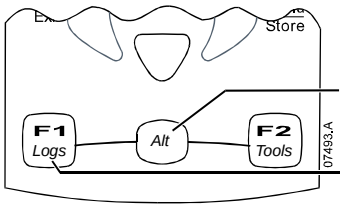
NOTE
Reset parameters 1A *Motor Full Load Current* and 16M *Undervoltage Trip Action* (or 2H *Undervolt Trip Level*) to their operating values once low voltage testing is complete.

# Section 9 Monitoring

## 9.1 Logs Menu

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

To open the Logs Menu, press ALT then F1 (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. Open the Logs Menu.
2. Scroll to Trip Log and press ▶.
3. Use the ▲ and ▼ buttons to select a trip to view, and press ▶ to display details.
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. Open the Logs Menu.
2. Scroll to Event Log and press ▶.
3. Use the ▲ and ▼ buttons to select an event to view, and press ▶ to display details.

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

### Performance Counters

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

- Hours run (lifetime and since counter last reset)
- Number of starts (lifetime and since counter last reset)
- Motor kWh (lifetime and since counter last reset)
- Number of times the thermal model has been reset

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

To view the counters:

1. Open the Logs Menu.
2. Scroll to Counters and press ▶.
3. Use the ▲ and ▼ buttons to scroll through the counters. Press ▶ to view details.

4. To reset a counter, press 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.

# Section 10 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.

## 10.1 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.

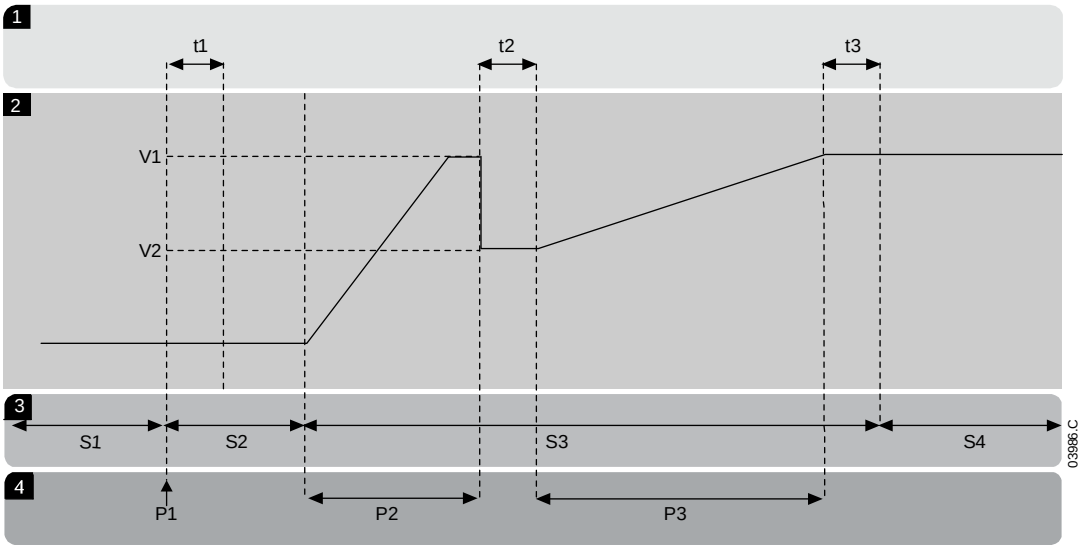
To stop the motor, press the STOP button on the Controller or activate the Stop remote input. The motor will stop using the stop mode selected in parameter 2H.

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

To emergency stop the motor, press the local STOP and RESET buttons at the same time. Alternatively, one of the programmable inputs can be configured for emergency stop (parameters 6A and 6F). The soft starter will remove power from the motor and open the main contactor, and the motor will coast to stop.

## 10.2 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 |

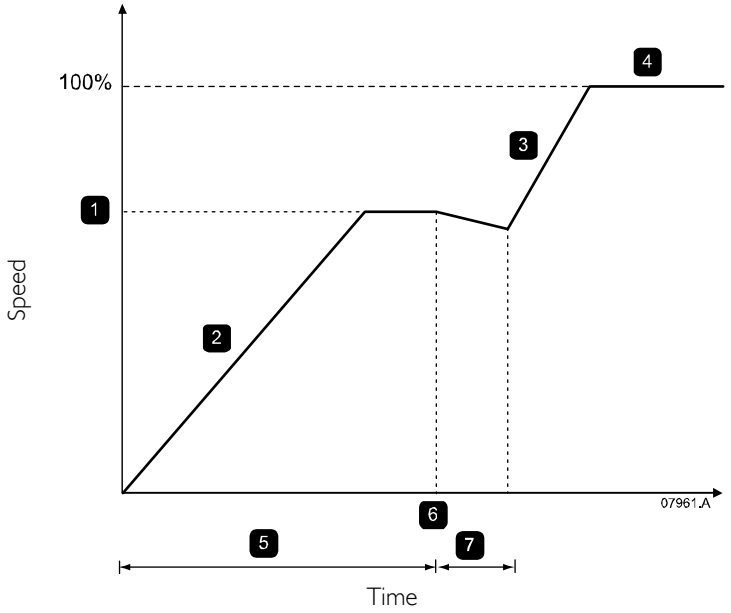
| | |
|---|---|
| 3 | States |
| S1 | Ready |
| S2 | Pre-start tests |
| S3 | Starting |
| S4 | Running |
| 4 | Phases of operation |
| P1 | Start command |
| P2 | Rotor resistance current ramp |
| P3 | Shorted rotor current ramp |

### 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 (KM3) 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 (KM3) 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) |

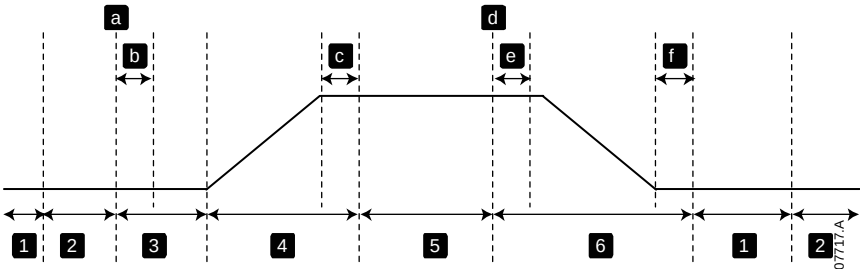
| | |
|---|---|
| 5 | Parameter 7B |
| 6 | KM3 closes |
| 7 | Parameter 12C |

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.

## 10.3 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.

## 10.4 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 to control the situation where the protections will activate and parameter group 16 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 discrimination with the soft starter.

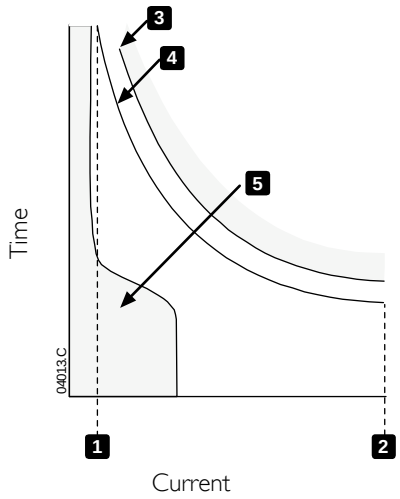
When using fuse and main contactors, set the breaker current parameters to coordinate with the fuse and contactor. The contactor must not open if the current is above its maximum value. The fuse must act first or the upstream breakers instantaneous trip level must be less than the contactor's fault break current level.

If using breakers only, set breaker so that the maximum instantaneous trip time is < 150 ms.

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.

## 10.5 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%          00000kW
```

- 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              0A
00000 kWh       00000hrs
```

- Motor Temperature

The temperature screen shows which motor data set is in use, and the temperature of the motors 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)
0000A    0000A    0000A
```

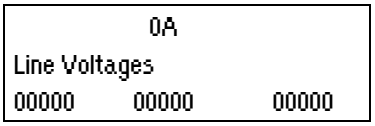
- Motor Power

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

```
          0A
00000kW          00000HP
00000kVA          -.--pf
```

- Voltage

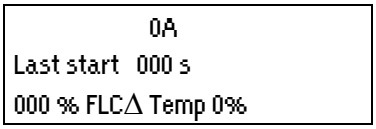
The voltage screen shows real-time line voltage across each phase.




- Last Start Information

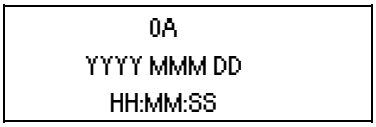
The last start information screen shows details of the most recent successful start:

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



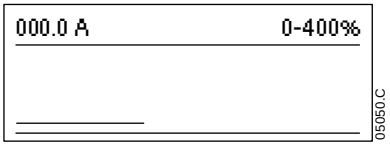

- Date and Time

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 41.



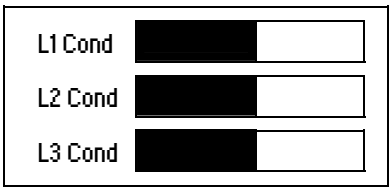

- Performance Graph

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.



# Section 11 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.

## 11.1 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 to some protections may depend on the Protection Action settings (parameter group 16).

If the MVX trips you will need to reset the soft starter before restarting. If the MVX has issued a warning, the soft starter will reset itself once the cause of the warning has been resolved.

Some protections cause a fatal trip. This response is pre-defined and cannot be overridden. These protection mechanisms are designed to protect the soft starter, or can be caused by a fault within the soft starter.

## 11.2 Diagnosing Problems

The following tables can help you diagnose the cause of problems with your MVX.

### 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. Reprogram the date and time.<br>Related parameters: 16M |
| Bypass Fail | The bypass contactor has welded closed or is not operating correctly. There may be a problem with the control circuit or the contactor coil.<br>Check the condition of the bypass contactor's main poles. Check the operation of the contactor control circuitry and contactor coil.<br>  <br>NOTE<br>You can use the Run Simulation to check the bypass contactor's operation without mains voltage connected. |
| Current Imbalance | Current imbalance can be caused by problems with the motor, the environment or the installation, such as:<br>• An imbalance in the incoming mains voltage<br>• A problem with the motor windings<br>• A light load on the motor<br>• A phase loss occurs across the soft starter's input terminals L1, L2, L3 in Run mode<br>Current imbalance can also be caused by incorrect cabling between the external bypass contactor and the soft starter or an internal problem with the soft starter, particularly an SCR that has failed open circuit.<br>• If you have recently replaced or repaired a phase arm, the connector at the back of the phase arm may not be securely plugged into the connector on the body of the power assembly.<br>Remove the securing bolts and slide the phase arm out, then slide it back in firmly. Ensure the connectors on the PCBs meet properly then retighten the bolts.<br>• There may be an open circuit SCR gate lead, or damage to the SCR gate.<br>Check the SCR gate connections (check at the SCRs and at the firing PCB). Consult your local supplier for details of the SCR gate testing procedure.<br>Related parameters: 4H, 4I, 16E |

| | |
|---|---|
| EEPROM Fail | • An error occurred loading data from the EEPROM to RAM when the Controller powered up.<br>• The parameter set or values in the Controller do not match the parameters in the starter.<br>• "Load User Set" has been selected but no saved file is available.<br>Reset the fault and then reload the default settings. If the problem persists, contact your local distributor.<br>Related parameters: None |
| Excess Start Time | The motor was unable to accelerate to full speed in the time allowed.<br>Excess start time trip can occur in the following conditions:<br>• The FLC setting is wrong<br>• The Current Limit has been set too low<br>• The Start Ramp Time has been set greater than the Excess Start Time setting<br>• The motor may have experienced an abnormal increase in loading or might be jammed.<br>Related parameters: 1A, 2A-2D, 4A, 16B |
| Frequency | The mains frequency has gone beyond the specified range.<br>Check for other equipment in the area that could be affecting the mains supply (particularly variable speed drives).<br>If the MVX is connected to a generator set supply, the generator may be too small or could have a speed regulation problem.<br>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.<br>Related parameters: 4O, 4P, 16N |
| Input A Trip | Identify and resolve the condition which caused Input A to activate.<br>Related parameters: 6A, 6B, 6C, 6D, 6E, 16G |
| Input B Trip | Identify and resolve the condition which caused Input B to activate.<br>Related parameters: 6F, 6G, 6H, 6I, 6J, 16H |
| Inst Overcurrent | The motor has experienced a sharp rise in motor current, probably caused by a locked rotor condition (shearpin) while running. This may indicate a jammed load.<br>A trip may also occur when a medium level fault current has been detected. This may indicate a system short circuit.<br>Related parameters: 4E, 4F, 4U, 4V, 16D |
| Internal Fault X | The MVX has tripped on an internal fault. Contact your local supplier with the fault code (X).<br>Related parameters: None |
| L1 Phase Loss<br>L2 Phase Loss<br>L3 Phase Loss | During pre-start checks the starter has detected a phase loss as indicated.<br>In run state, the starter has detected that the current on the affected phase has dropped below 3.3% of the programmed motor FLC for more than 1 second, indicating that either the incoming phase or connection to the motor has been lost.<br>Check the supply and the input and output connections at the starter and at the motor end.<br>Phase loss can also be caused by a failed SCR, particularly an SCR that has failed open circuit.<br>Related parameters: None |
| L1-T1 Shorted<br>L2-T2 Shorted<br>L3-T3 Shorted | During prestart checks the starter has detected a shorted power assembly or a short within the bypass contactor as indicated.<br>Related parameters: None |
| Motor Connection | There is a problem with the soft starter's connection to the motor.<br>The motor is connected incorrectly, or no motor is connected to the soft starter.<br>• 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.<br>Check each output phase of the soft starter for power circuit continuity.<br>This trip will also occur when there is a phase imbalance across the soft starter's input terminals L1, L2, L3.<br>Related parameters: None |
| Motor Overload | The motor has reached its maximum thermal capacity. Overload can be caused by:<br>• The soft starter protection settings not matching the motor thermal capacity<br>• Excessive starts per hour<br>• Excessive throughput<br>• Damage to the motor windings<br>Resolve the cause of the overload and allow the motor to cool.<br>If you think the soft starter has tripped incorrectly, check the parameter settings. |

| | |
|---|---|
| | Related parameters: 1A, 1B, 1C, 1D, 9B, 16A |
| Motor Thermistor | The external resistance across the motor thermistor input (terminals B4, B5) has exceeded 2.4 kΩ.<br>• 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.<br>• If the starter tripped during operation, the temperature of the motor winding has increased. Resolve the cause of the overheating.<br>Related parameters: 16I |
| Network Comms | The network master has sent a trip command to the starter, or there may be a network communication problem.<br>Check the network for causes of communication inactivity.<br>Related parameters: 16K |
| 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.<br>• Check that the starter is configured appropriately for local conditions.<br>• Monitor the mains voltage to determine the cause of the voltage fluctuation, and resolve the cause.<br>Related parameters: 4S, 4T, 16W |
| Phase Sequence | The phase sequence on the soft starter's input terminals (L1, L2, L3) is not valid.<br>Check the phase sequence on L1, L2, L3 and ensure the setting in parameter 4G is suitable for the installation.<br>Related parameters: 4G |
| Power Loss | The starter is not receiving mains supply on one or more phases when a Start Command is given.<br>• Check that the main contactor closes when a start command is given, and remains closed until the end of a soft stop.<br>• Check MVX fuses and confirm that all three mains supply phases are present.<br>Related parameters: none |
| Starter Comms | 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.<br>The communications module has been powered down while the soft starter remains powered up.<br>Related parameters: 16J |
| 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.<br>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.<br>• Check that the starter is configured appropriately for local conditions.<br>• Monitor the mains voltage to determine the cause of voltage fluctuation.<br>Related parameters: 4Q, 4R, 16V |
| Unsupported Option | Contact your local supplier for advice. |

## Internal Soft Starter Errors

The following error messages report internal soft starter faults. These faults must be resolved before the soft starter can be operated again.

| Error Message | Description | Suggested Solution |
|---|---|---|
| Low Control Volts | Control voltage to the power interface PCB has dropped below the required level. | Check that the control voltage transformer and control circuit fuses are healthy, and that voltage is present at the terminal block (terminals A1-A2 or A2-A3) within the specified range. |
| Current Reading | There is an error in the current monitoring circuit. | Check the connections between the power interface PCB and the current transformers. If the connections are all sound, there may be a fault in the power interface PCB. Contact AuCom for advice. |
| Firing Fail | There is a problem with the SCR gate drive. | • Check that the fibre-optic cables are properly connected between:<br>1. the power interface PCB and the gate drive adaptor PCBs and |

| | | |
|---|---|---|
| | | 2. the gate drive PCB and gate current firing PCBs.<br>• Check the supply to the gate drive adaptor PCBs, gate drive PCB and gate circuit firing PCBs.<br>• There may be a fault with the PCBs. Contact AuCom for advice. |
| Starter Comms | Communication has failed between the Controller and the power interface PCB. | • Check that the Controller is receiving control voltage within the specified range (terminals A11, A12).<br>• Check that the fibre-optic cables between the Controller and the interface PCB are firmly connected.<br>• Check that each fibre-optic cable is emitting light at the Rx end. |
| Motor Conn T1<br>Motor Conn T2<br>Motor Conn T3 | One of the motor connections is missing, or the power interface PCB is not receiving non-conduction signals. | • 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.<br>• Check that the fibre-optic cables between the power interface PCB and the gate drive adaptor PCBs are firmly connected. |
| VZC fail p1<br>VZC Fail P2 | The voltage detection system has failed. | The voltage dividing resistors (located between L1, L2, L3 and the power interface PCB) have failed or the power interface PCB may be faulty. Contact AuCom for advice. |

## 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 |
|---|---|
| Soft starter does not respond to commands. | If the soft starter does not respond to the START or RESET button on the Controller:<br>• The soft starter may be in Remote mode. When the soft starter is in Remote mode, the Local LED on the Controller is inactive. Press the LCL/RMT button once to change to Local control (refer to parameter 6Q *Local/Remote* for details).<br>If the soft starter does not respond to commands from the remote control inputs:<br>• The soft starter may be in Local mode. When the soft starter is in Local mode, the Local LED on the Controller is active. Press the LCL/RMT button once to change to Remote control (refer to parameter 6Q *Local/Remote* for details).<br>• The control wiring may be incorrect. Check that the remote start, stop and reset inputs are configured correctly (refer to *Control Wiring* on page 12 for details).<br>• 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 Controller.<br>• The soft starter will only execute a start command from the remote inputs if the remote reset input is closed. Check that the remote reset input is also active (the Reset LED on the Controller will be on).<br>If the soft starter does not respond to a start command from either the local or remote controls:<br>• 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*.<br>• 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.<br>• The emergency stop function may be active. If parameter 6A or 6F is set to Emergency Stop and there is an open circuit on the corresponding input, the MVX will not start. If the emergency stop situation has been resolved, close |

| | |
|---|---|
| | the circuit on the input. |
| The soft starter does not control the motor correctly during starting. | • Start performance may be unstable when using a low Motor Full Load Current setting (parameter 1A). This can affect use on a small test motor with full load current between 5 A and 50 A.<br>• Power factor correction (PFC) capacitors must be installed on the mains supply side of the soft starter. To control a dedicated PFC capacitor contactor, connect the contactor to run relay terminals. |
| Motor does not reach full speed. | • If the start current is too low, the motor will not produce enough torque to accelerate to full speed. The soft starter may trip on excess start time.<br>NOTE<br>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.<br>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 and 2I.<br>• If the motor is very lightly loaded, soft stop will have limited effect. |
| Remote start/stop command is overriding Auto Start/Stop settings when using remote 2-wire control. | • Auto Start/Stop function should only be used in LOCAL mode or in tandem with REMOTE mode, 3 and 4-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 ◀, the change will not be saved.<br>• Check that the adjustment lock (parameter 15B) is set to Read & Write. If the adjustment lock is set to Read Only, parameters can be viewed but not changed. You need to know the security access code to change the adjustment lock setting.<br>• The EEPROM may be faulty on the Controller or the power interface PCB. A faulty EEPROM will also trip the soft starter, and the Controller will display the message EEPROM Fail. Contact your local supplier for advice. |

# Section 12 Maintenance

## 12.1 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 |
|---|---|---|
| Switch | Check contact condition | Every 2 years |
| Contactor – main | Check for wear, torque bolts | Every 2 years |
| Contactor – bypass | Check for wear, torque bolts | Every 2 years |
| Contactor for PFCC | Check for wear, torque bolts | Every 2 years |
| Control terminals | Check tightness | Every 2 years |
| Earthing terminals | Check tightness | Every 2 years |
| Cable lugs | Check tightness | Every 2 years |
| General MVX | Cleanliness | Every 2 years |

## 12.2 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

## 12.3 Thermal Image

After completing commissioning of the MVX and after the motor has been running fully loaded, take a thermal image of the bus bars 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.

## 12.4 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.

## 12.5 Air Filter Maintenance

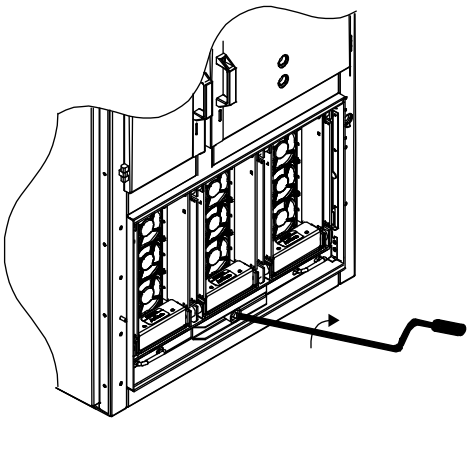
Air filters are located on the Phase Cassette door inside the panel. It is recommended that air filters are cleaned every 6 months to ensure that they are unclogged and free from dust and debris.

## 12.6 Phase Cassette Maintenance

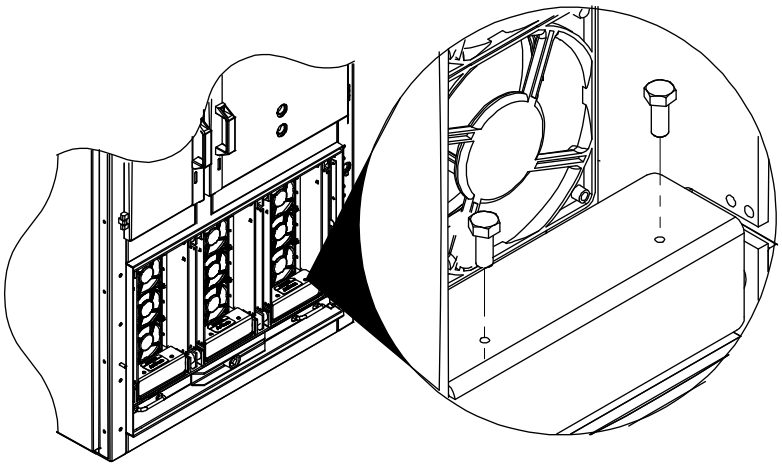
The Phase Cassette is mounted on a wheeled trolley which allows the Phase Cassette to be racked-in and racked-out as required.

To remove the Phase Cassette from the panel enclosure:

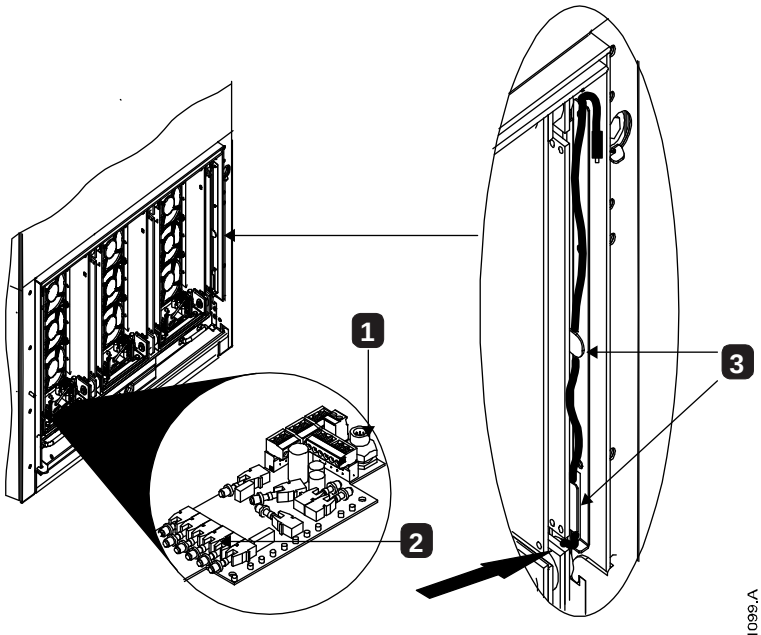
1. Use the racking-in/out lever to rack out the Phase Cassette, turning the lever clockwise until the Phase Cassette is completely racked out (approximately 20 turns of the racking arm).




2. Locate the removable covers for the fiber optic booster boards at the front of the Phase Cassette.

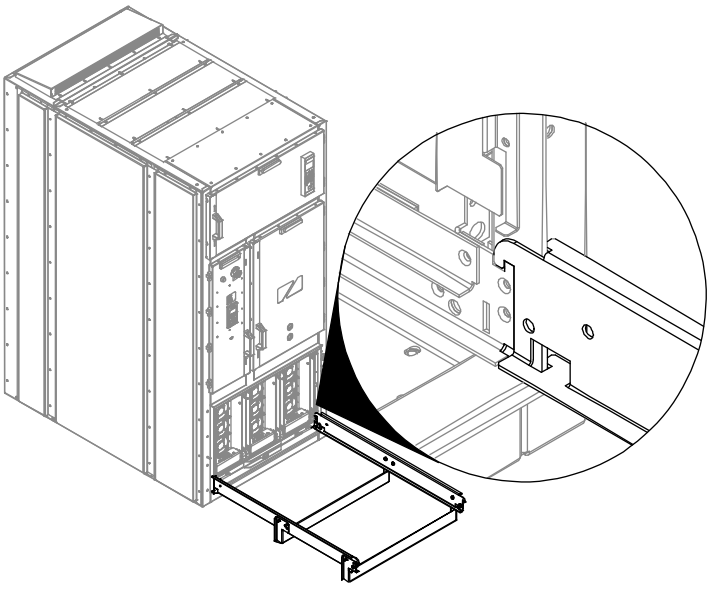



3. Unscrew the two M8 screws used to fasten each cover. Unfasten all three covers to uncover the three fiber optic booster boards.
4. Disconnect the two fiber optic cables and the 6-way plug for each booster board. Draw the disconnected cables away from the Phase Cassette and hook them to the side of the panel, tucking them under the cable securing recesses.

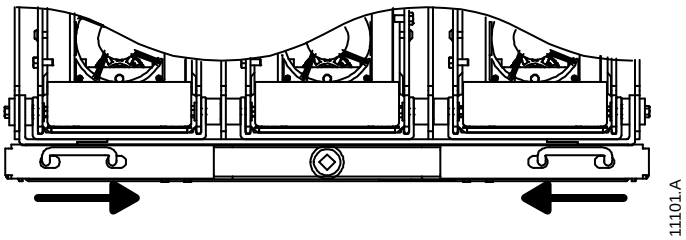


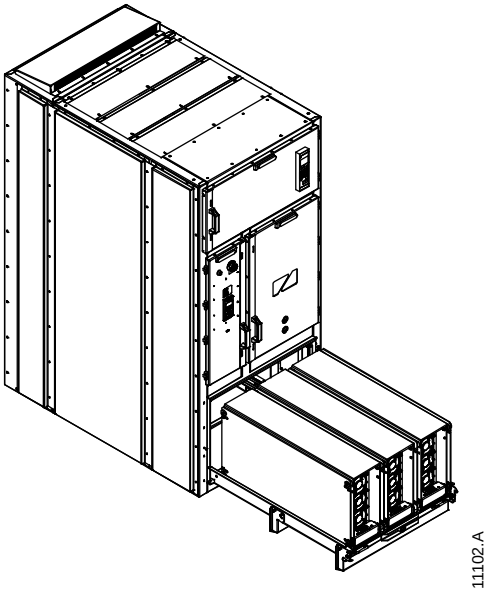

| | |
|---|---|
| 1 | 6-way plug |
| 2 | Fiber optic cable |
| 3 | Cable securing recess |

5. Attach the removable platform to the MVX panel, making sure that the alignment hooks on each arm lock into the slots on the sides of the panel.




6. Hold and draw the handles on the trolley towards each other to release the latching mechanism and draw the entire Phase Cassette onto the removable platform.




NOTE
*Removable Platform Assembly* (part no: 992-11136-00) and *Racking-In/Out Lever* (part no: 995-10998-00) are required for this.

## Lifting and Moving the Phase Cassette

Once the Phase Cassette has been completely rolled out and is resting securely on the removable platform, it may be moved using a crane, fork-lift or lifting trolley.

# Section 13 Appendix

## 13.1 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 |
|---|---|---|---|---|
| 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* | | | Any sequence |
| 4H | *Current Imbalance* | | | 30% |
| 4I | *Current Imbalance Delay* | | | 00m:03s |
| 4J | *Frequency Check* | | | Start/Run |
| 4K | *Frequency Variation* | | | ±5 Hz |
| 4L | *Frequency Delay* | | | 00m:01s |
| 4M | *Restart Delay* | | | 00m:10s |
| 4N | *Motor Temperature Check* | | | Do not check |
| 4O | *Ground Fault Level* | | | 10 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* | | | Motor set select |
| 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 remote |
| 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 | *Current Calibration* | | | 100% |
| 8N | *Mains Reference Voltage* | | | 400 V |
| 8O | *Voltage Calibration* | | | 100% |
| **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 and write |
| 15C | *Emergency Run* | | | Disable |
| **16** | **Protection Actions** | | | |
| 16A | *Motor Overload* | | | Trip starter |
| 16B | *Excess Start Time* | | | Trip starter |
| 16C | *Undercurrent* | | | Trip starter |
| 16D | *Instantaneous Overcurrent* | | | Trip starter |
| 16E | *Current Imbalance* | | | Trip starter |
| 16F | *Frequency* | | | Trip starter |
| 16G | *Input A Trip* | | | Trip starter |
| 16H | *Input B Trip* | | | Trip starter |
| 16I | *Motor Thermistor* | | | Trip starter |
| 16J | *Starter Communication* | | | Trip starter |
| 16K | *Network Communication* | | | Trip starter |
| 16L | *Reserved* | | | |
| 16M | *Battery/Clock* | | | Trip starter |
| 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** | | | |

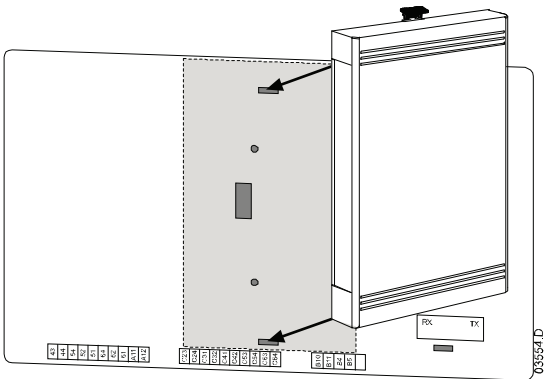
## 13.2 Accessories

### Communication Modules

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

- Installing Communication Modules

Communication modules attach to the back of the Controller:




- Modbus Module

Part Number: PIM-MB-01

The Modbus Module enables control and monitoring via a Modbus RTU network.

Refer to the Modbus Module Instructions for further details.

- Profibus Module

Part Number: PIM-PB-01

The Profibus Module enables control and monitoring via a Profibus network.

Refer to the Profibus Module Instructions for further details.

- DeviceNet Module

Part Number: PIM-DN-01

The DeviceNet Module enables control and monitoring via a DeviceNet network.

Refer to the DeviceNet Module Instructions for further details.

- USB Module

Part Number: PIM-USB-01

The USB Module enables connectivity to the WInMaster software suite.

Refer to the USB Module Instructions for further details.

### Trip Codes (Serial Communication Network)

| Description | Profibus DP | Modbus RTU | DeviceNet |
|---|---|---|---|
| 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 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 | 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-T2shorted | 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 User Manual for further details.

## 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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