MVS

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 MVS Series 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.

AuCom cannot guarantee the correctness or completeness of the translated information in this document. In case of dispute the master document in English is the Reference Document.

WARNING - ELECTRICAL SHOCK HAZARD

MVS soft starters contain dangerous voltages when connected to mains voltage. Only a qualified 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

MVS 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

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

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

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

STORAGE

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

Section 2 General Description

2.1 Overview

The MVS provides compact and robust soft start solutions for control of medium voltage motors. MVS soft starters provide a complete range of motor and system protection features and have been designed for reliable performance in the most demanding installation situations.

The two primary components of a MVS soft starter are:

- a power assembly
- a Controller module

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

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 (two stages)
- 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
- 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
- 50 A to 600 A, nominal
- 2300 VAC to 13800 VAC

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

2.3 Key Features

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

Use 4 Protection Settings on page 45 to set the conditions in which each protection mechanism will activate.

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

Use 16 Protection Action on page 57 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
MVS 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 MVS will also prevent the soft starter from operating. Refer to *Troubleshooting* on page 73 for details.

- **Advanced Thermal Modelling**

Intelligent thermal modelling allows the soft starter to predict whether the motor can successfully complete a start. The MVS 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 MVS 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 MVS 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 MVS 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 conventional (squirrel-cage) motors which may start in two different conditions (such as loaded and unloaded conveyors).

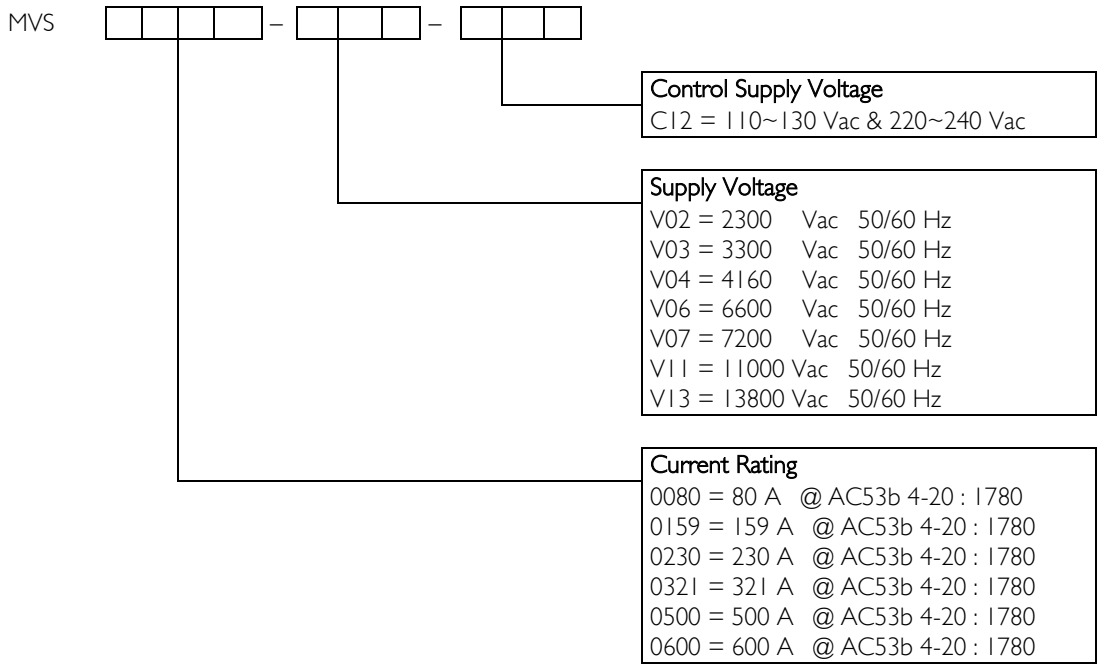
NOTE
MVS soft starters are not suitable for controlling two separate motors. The secondary parameter set should only be used for a secondary configuration of the primary motor.

The MVS 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 MVS uses two-line fibre optic connections between the low voltage control module and the high voltage power assembly for electrical isolation. This fibre optic link simplifies installation of chassis mount MVS starters into custom panels.

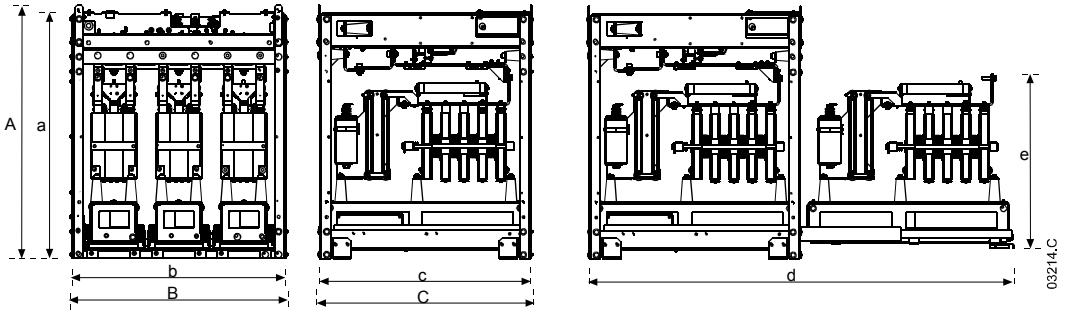
2.4 Model Code



Section 3 Specifications

3.1 Dimensions and Weights

Models V02 ~ V07 (Power Assembly)

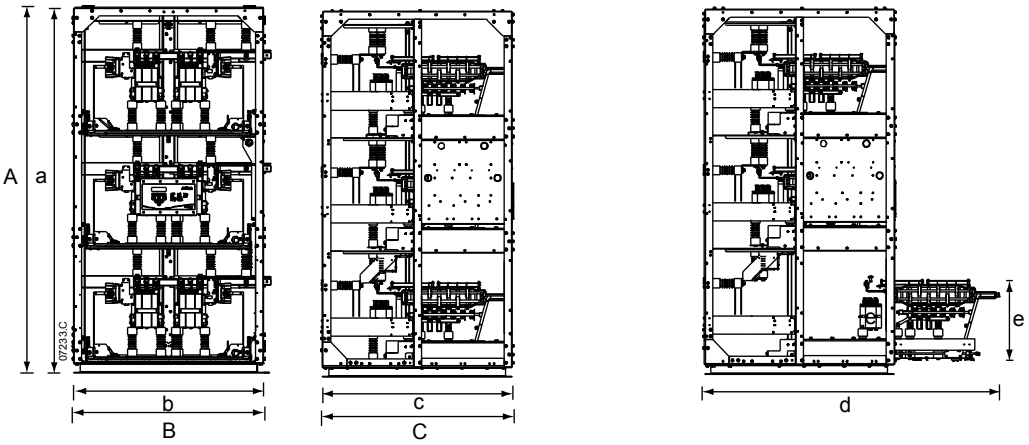


Front view Side view Phase arm extended

	A	B	C	a	b	c	d	e	Weight (phase arm)	Weight (power assembly)
	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	kg (lb)	kg (lb)
MVSxxxx-V02	772 (30.4)	669 (26.3)	667 (26.3)	750 (29.5)	658 (25.9)	650 (25.6)	1302 (51.3)	531 (20.9)	29 (63.9)	165 (363.8)
MVSxxxx-V03										
MVSxxxx-V04										
MVSxxxx-V06	832 (32.8)	875 (34.5)	817 (32.2)	810 (31.9)	864 (34.0)	800 (31.5)	1559 (61.4)	551 (21.7)	44 (97)	217 (478.4)
MVSxxxx-V07										

* For models MVSxxxx-V02 to MVSxxxx-V04, these dimensions apply up to 321 A. For the same models with current ratings of 500 and 600 A, the MVSxxxx-V06 dimensions apply.

Models V11 ~ V13 (Power Assembly)

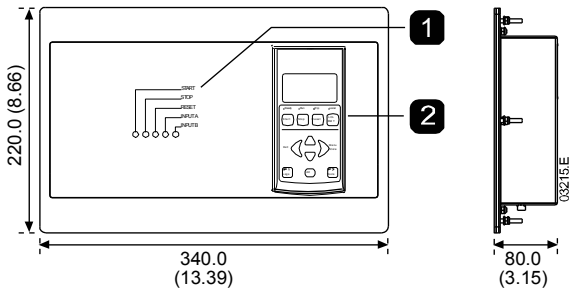


Front view Side view Phase arm extended

	A	B	C	a	b	c	d	e	Weight (phase arm)	Weight (power assembly)
	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	kg (lb)	kg (lb)
MVSxxxx-V11	2210 (87.0)	1170 (46.0)	1170 (46.0)	2220 (87.4)	1150 (45.3)	1150 (45.3)	1785 (70.3)	510 (20.1)	127 (279.9)	720 (1587)
MVSxxxx-V13										

3.2 Controller

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

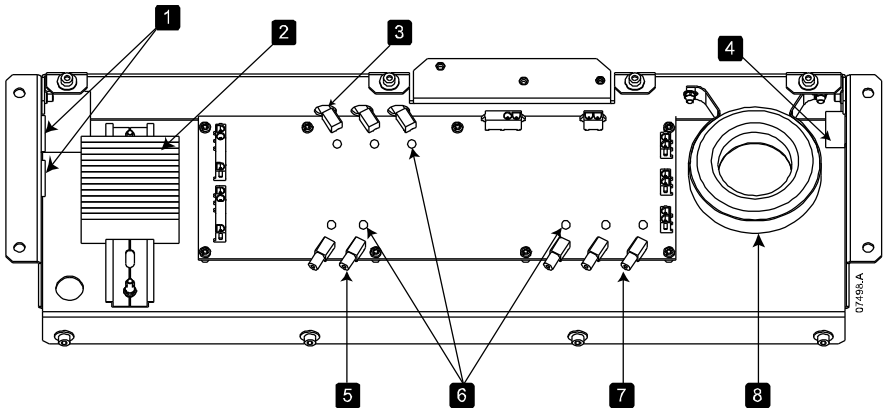


1	Control input LEDs
2	Keypad

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

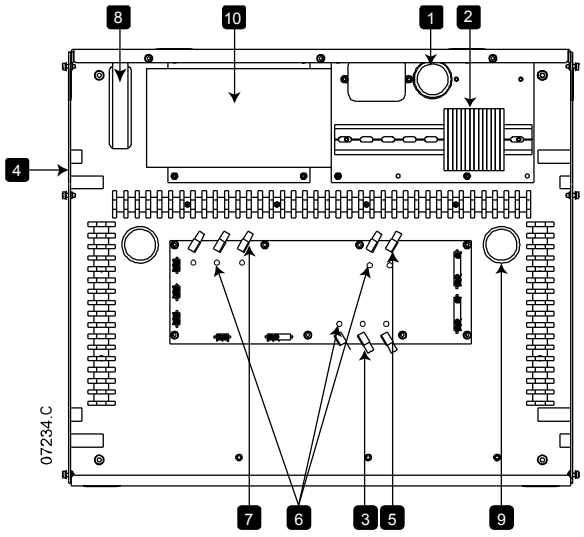
3.3 Low Voltage Section

Models V02 ~ V07



1	Access for LV wiring
2	Control voltage terminal block
3	Gate firing fibre optic connectors
4	Access hole for CT wiring
5	Fibre connections to controller
6	Fibre optic indication LEDs
7	Non-conduction readback fibre optic connectors
8	Ground current CT

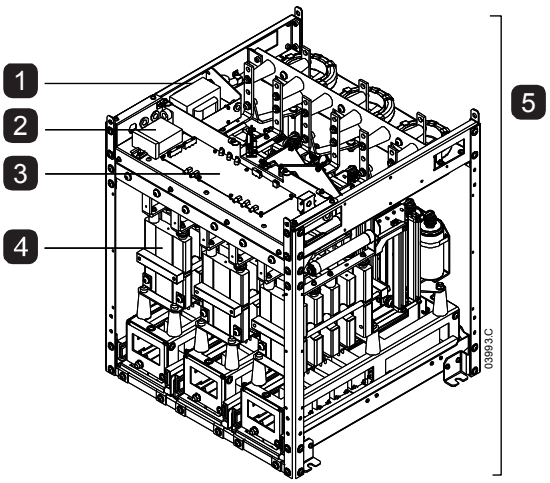
Models V11 and V13



1	Access for LV wiring
2	Control voltage terminal block
3	Gate firing fibre optic connectors
4	Access hole for CT wiring
5	Fibre connections to controller
6	Fibre optic indication LEDs
7	Non-conduction readback fibre optic connectors
8	Ground current CT
9	Access hole for Controller fibre optic cable
10	Switch mode power supply (SMPS)

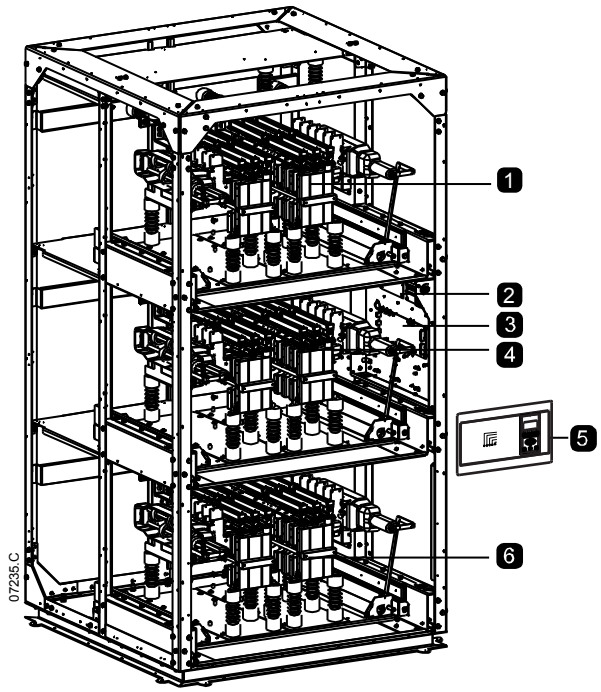
3.4 Key Components

Key Components (models V02 ~ V07)



1	Control transformer
2	Control voltage terminal block
3	Power interface PCB
4	Phase arm (x3)
5	Power assembly

Key Components (models V11 and V13)



1	Phase arm
2	Control voltage terminal block
3	Power interface PCB
4	Phase arm
5	Controller
6	Phase arm

3.5 Panel Specifications

AuCom switchgear panels are categorised as follows:

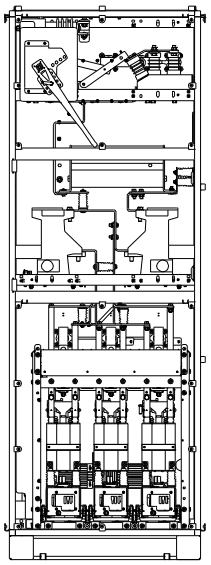
- Soft starter panel (SSP)
- Standard panels

NOTE
Panel layout views depict only typical panel configuration options.

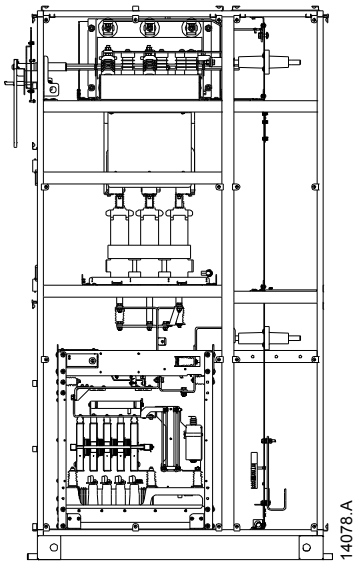
Soft Starter Panel (SSP)

The soft starter panel is designed to house the primary soft starter components and associated switchgear.

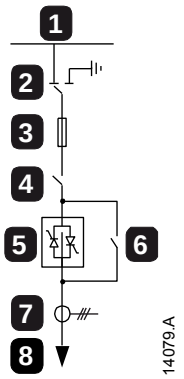
Typical Soft Starter Panel



Front view



Side view



1	Incoming supply [1]
2	No load isolator/Earth switch
3	R-Rated protection fuses
4	Main switching apparatus [2]
5	power assembly
6	Bypass switching apparatus [2]
7	Current transformer
8	Cables to motor [3]

[1] Cables (top or bottom entry) or horizontal busbar system. Cables and busbars are not supplied with the standard product, but AuCom can supply a horizontal busbar system on request.

[2] Contactor (a circuit breaker may be fitted instead, on request). Installations with a circuit breaker do not require R-rated protection fuses.

[3] Outgoing motor cables (top or bottom exit).

Standard Panels

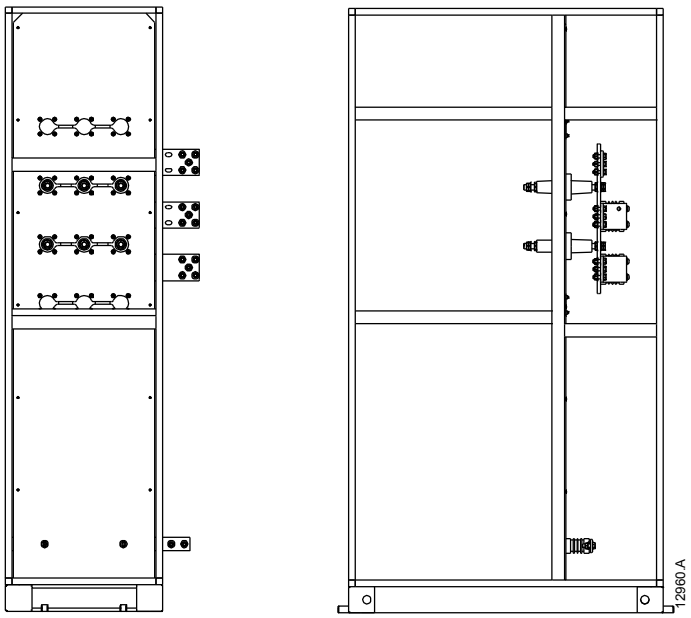
AuCom standard panels are designed to be directly connected to AuCom soft starter panels (SSP) in a panel line-up. Standard panels may be equipped with customisable switchgear options and are available as follows:

- Transition panel (TRP)
- Power factor correction panel (PFP)

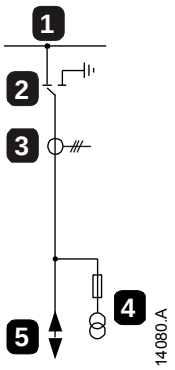
- **Transition Panel (TRP)**

Transition panels are used to connect cables or busbars between two different panels in a line-up. A transition panel may also be used to connect cables from one panel to busbars in another.

Typical Transition Panel



Front view Side view

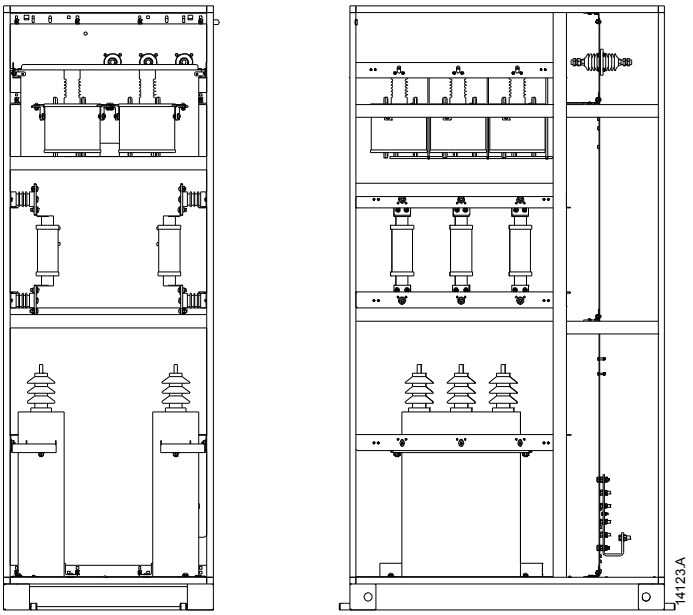


1	Horizontal busbar system
2	No load isolator/Earth switch (optional)
3	Current transformer (optional)
4	Voltage transformer (optional)
5	Incoming supply cables or busbar system (customer)

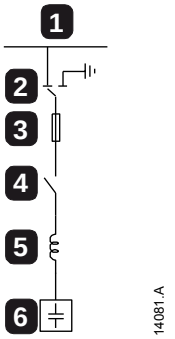
- **Power Factor Correction Panel (PFP)**

A power factor correction panel consists of capacitor banks which are switched by means of a contactor. This contactor is controlled by the soft starter or power factor controller, which measures power factor in an electrical network.

Typical Power Factor Correction Panel



Front view Side view



1	Incoming supply [1]
2	No load isolator/Earth switch [2]
3	E-rated protection fuses [2]
4	Line contactor [2]
5	Inrush reactors (3x single phase)
6	PFC capacitor bank (3-phase)

[1] Cables (top or bottom entry) or horizontal busbar system. Cables and busbars are not supplied with the standard product, but AuCom can supply a horizontal busbar system on request.

[2] Not required when incoming supply is fed from the soft starter panel (SSP).

3.6 General Technical Data

Supply

Mains Voltage

MVSxxxx-V02	2.3 kV Phase-phase
MVSxxxx-V03	3.3 kV Phase-phase
MVSxxxx-V04	4.2 kV Phase-phase
MVSxxxx-V06	6.6 kV Phase-phase
MVSxxxx-V07	7.2 kV Phase-phase
MVSxxxx-V11	11.0 kV Phase-phase
MVSxxxx-V13	13.8 kV Phase-phase
Rated Frequency (fr)	50/60 Hz

Rated lightning impulse withstand voltage (U_p)

MVSxxxx-V02 ~ 04	45 kV
MVSxxxx-V06 ~ V07	45 kV
MVSxxxx-V11 ~ V13	85 kV

Rated power frequency withstand voltage (U_d)

MVSxxxx-V02 ~ V04	11.5 kV
MVSxxxx-V06 ~ V07	20 kV
MVSxxxx-V11 ~ V13	35 kV

Rated normal current (I_r)

MVS0080-Vxx	80 A
MVS0159-Vxx	159 A
MVS0230-Vxx	230 A
MVS0321-Vxx	321 A
MVS0500-Vxx	500 A
MVS0600-Vxx	600 A

Rated short-time withstand current (symmetrical RMS) (I_k)

MVSxxxx-V02 ~ V07	48 kA [1]
MVSxxxx-V11 ~ V13	75 kA [2]
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 > 2.4 kΩ

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

Low Voltage Supply

Rated Voltage

MVSxxxx-V02 ~ 07	110 ~130 or 220 ~ 240 V
MVSxxxx-V11 ~ 13	110 ~ 240 V
Rated Frequency	50/60 Hz

Typical power consumption

MVSxxxx-V02 ~ 07	70 W [3] continuous
MVSxxxx-V11 ~ 13	100 W [3] continuous

Outputs

Relay Outputs	10 A @ 250 VAC resistive
	6 A @ 250 VAC 15 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	
Power Assembly	IP00
Controller	IP54/ NEMA 12
Operating Temperature	- 10 °C to + 60 °C, above 40°C with derating
Storage Temperature	- 25 °C to + 80 °C
Humidity	5% to 95% Relative Humidity
Pollution Degree	Pollution Degree 3
Vibration	Designed to IEC 60068
EMC Emission	
Equipment Class (EMC)	Class A
Conducted Radio Frequency Emission	10 kHz to 150 kHz: < 120 - 69 dB µV
	0.15 MHz to 0.5 MHz: < 79 dB µV
	0.5 MHz to 30 MHz: < 73 dB µV
Radiated Radio Frequency Emission	0.15 MHz to 30 MHz: < 80-50 dB µV/m
	30 MHz to 100 MHz: < 60-54 dB µV/m
	100 MHz to 2000 MHz: < 54 dB µV/m

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

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

[1] Short circuit current, with appropriate R rated fuses fitted.
[2] It is critical that the circuit breaker and associated protection relay are set to trip <150 ms. Failure to do so could result in SCR rupture and subsequent arc fault.
[3] Excludes contactors and/or circuit breakers.

Section 4 Receiving and Storage

All AuCom switchgear panels are individually packed and securely braced for shipment. Depending on the number of individual switchgear sections, it may be necessary to ship the switchgear in several sections to facilitate handling.

Panels may include relatively delicate equipment (protection relays, transformers, bushings, etc). Handle all sections with care when unloading. Some electrical components (eg switching device, power assembly, etc) may be shipped separately and then installed on-site. The shipping inventory should account for all individual components.

4.1 Receiving

Inspect equipment as soon as possible for any damage that may have occurred during transit. Before accepting delivery, examine packaging for any signs of damage. A damaged package may indicate that the panel and internal components may also be damaged.

Check that the shipping manifest accounts for all equipment delivered. Any missing or damaged equipment should be noted on the freight bill and the carrier notified immediately. A record of the missing or damaged equipment should also be sent to AuCom.

NOTE
Avoid using heavy or sharp-edged tools while unpacking, as these may damage the equipment. Use nail pliers to separate all four sides of the wooden packaging box.

4.2 Storage

If immediate installation is not possible, the switchgear should be stored in its original packaging in a clean and dry area indoors. Always store switchgear upright on its wooden pallet to keep it off the floor and allow air to pass under it freely.

NOTE
Switchgear can be stored for a maximum of 12 months from the date of packaging as the quality of the packaging material degrades over time.

The following storage conditions should be met (IEC 60721-3-1, classification 1K3):

Temperature	-5 °C ~ 40 °C
Relative humidity	50 ~ 95%
Rate of change of temperature	0.5 °C/min

The following general precautions should be followed when storing switchgear indoors:

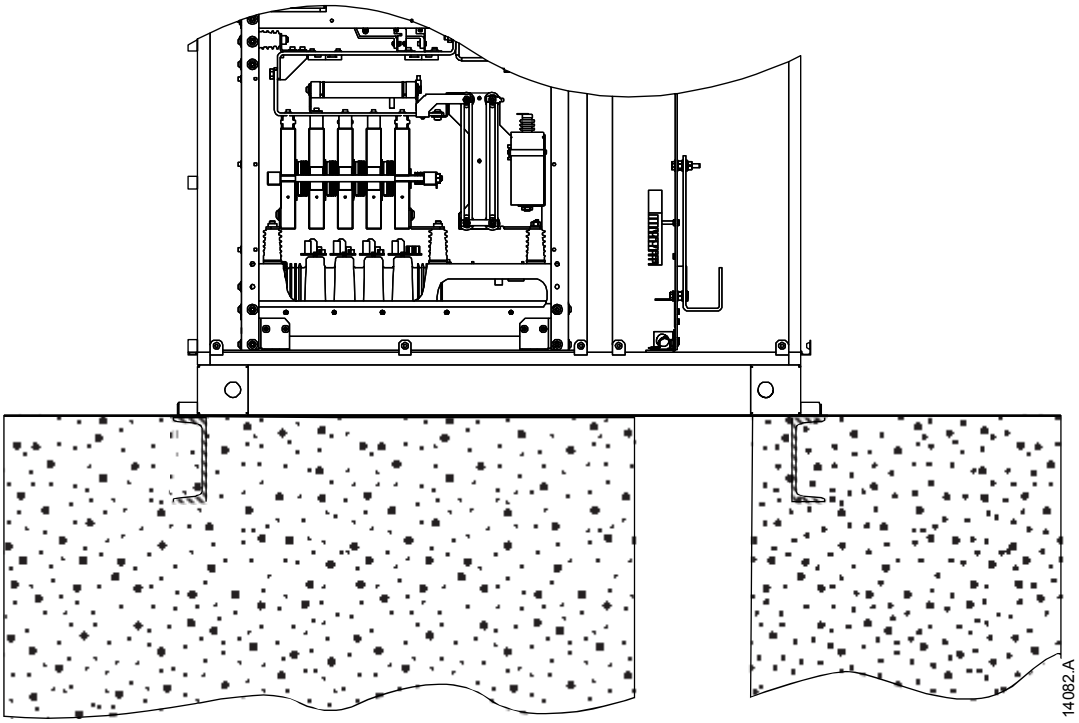
- Do not unpack the switchgear panel, power assembly or other components until they are ready for installation.
- If electrical components such as circuit breakers are to be stored for more than three months in humid conditions, space heaters should be used in the storage area to limit condensation. Switchgear panels with in-built anti-condensation heaters may be powered from an external supply during storage.
- Rats and other vermin may cause considerable damage and periodic inspection is necessary to minimise the danger they pose.
- Ensure the floor of the storage area is smooth and level to prevent mechanical strain to the structure and components.

Section 5 Installation

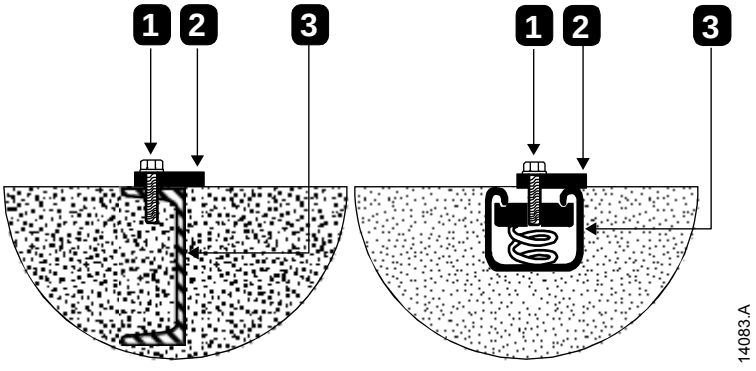
Site installation of switchgear panels should only be carried out by specially trained and skilled personnel. The switchgear location must be adequately prepared with wall openings, ventilation ducts and cabling connections to the power supply.

CAUTION
The maximum tolerance for switchroom floor is ±2 mm per metre (with a maximum of ±5mm over the entire panel line-up). Failure to comply with these recommendations may impair the electro-mechanical functionality of some components and the structural integrity of the entire panel system.

Switchgear panels are fitted with a base for mounting panels directly to the switchroom floor, it is recommended that buried steel channels are installed in a level concrete floor to support the equipment. The surfaces of the buried steel channels should be level with the finished floor and aligned with each other prior to final anchoring. The switchgear panel's base should be evenly supported by the concrete floor. If the switchgear panel is raised above the floor level by the mounting channels, the entire base frame must be supported at the same level. If the switchgear panel is part of a line-up, all channels must be level and aligned with each other.



The figure below illustrates typical methods for anchoring switchgear panels to buried steel channels.



1	Anchor bolt
2	Panel connection
3	Buried steel channel

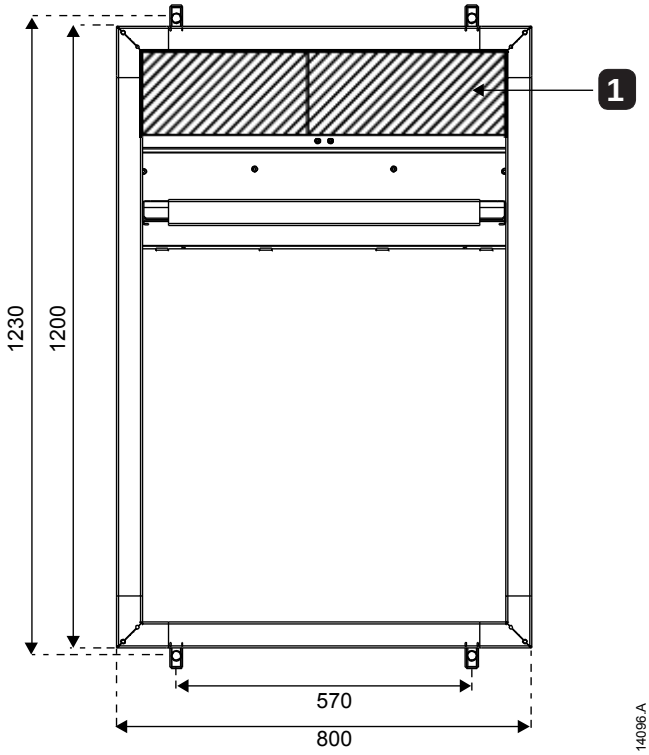
NOTE
Anchor bolts, channels, and other materials are not supplied as part of the switchgear arrangement.

Fastening Panels to the Foundation

Switchgear panels must be fastened securely to a level floor which has been adequately prepared.

- Soft Starter Panel (SSP)

It is recommended that all four bolt holes are used to securely bolt the panel to the floor using 10mm (0.39in) bolts.



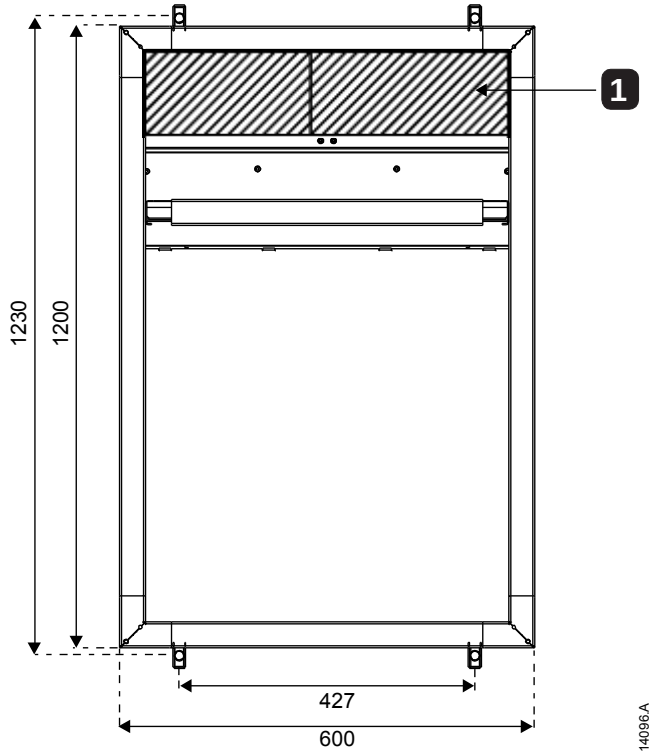
Plan view

1	Removable non-ferrous gland plate

	Width| mm (inch)	Depth mm (inch)
MVSxxxx-V02	800 (31.5)	1200 (47.2)
MVSxxxx-V03		
MVSxxxx-V04		
MVSxxxx-V06	1000 (39.3)	1200 (47.2)
MVSxxxx-V07		

- **Standard Panels**

It is recommended that all four bolt holes are used to securely bolt the panel to the floor using 10mm (0.39in) bolts.



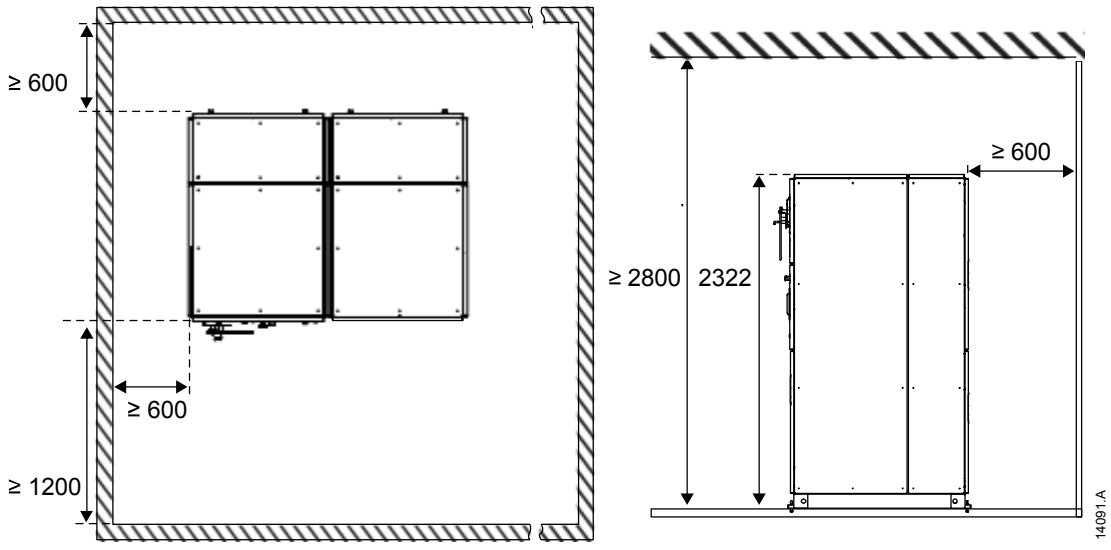
Plan view

1	Removable non-ferrous gland plate

	Width mm (inch)	Depth mm (inch)
Transition Panel (TRP)	600 (23.6)	1200 (47.2)
Power Factor Panel (PFP)	800/1000 (31.5/39.2)	1200 (47.2)

5.2 Clearance Requirements

While installing AuCom switchgear panels, ensure that minimum clearance requirements are met.



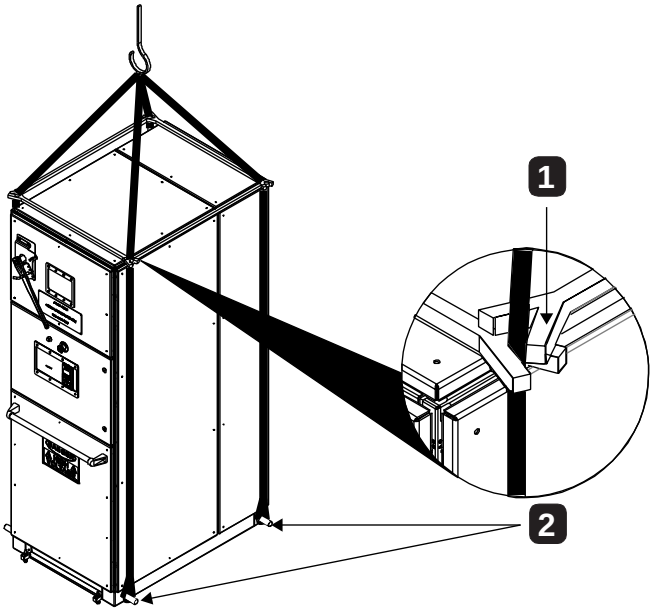
Plan view Side view

NOTE
Standard panels may be mounted closer to the wall if required. Consult AuCom if closer wall mounting is required.

5.3 Lifting and Moving

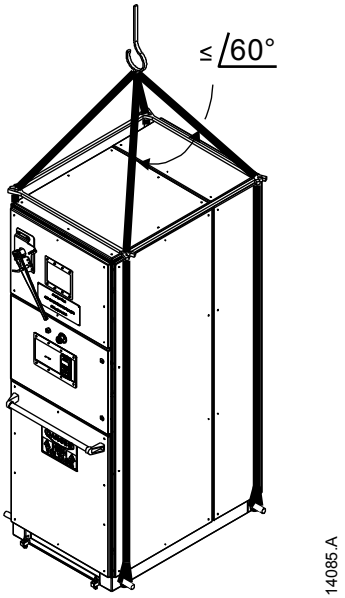
Switchgear panels can be moved in a number of ways. However, care should be taken to protect the panel sections or enclosed electrical components from damage during moving. Provision has been made along the base of the panel to fit lifting rods. Lifting cables can then be fitted for lifting with a crane.

NOTE
The recommended method of moving the switchgear is using a crane. If height constraints prevent the use of a crane, a forklift or jack may be used before removal of the wooden pallet.



1	Spreader bar
2	Lifting rods fitted through lifting holes in base frame

1. Locate the four lifting holes in the base frame of the panel.
2. Pass lifting rods through the lifting holes from one side of the panel to the other. Use lifting rods which are approximately 30mm in diameter to ensure that rods are of sufficient tensile strength to bear the weight of the panel.
3. Loop lifting cables around the ends of the lifting rods on both sides of the panel.
4. Fit spreader bars to the lifting cables at the top of the panel. The lifting cables must have spreaders from front-to-rear and side-to-side to prevent twisting the lifting cables during transportation.



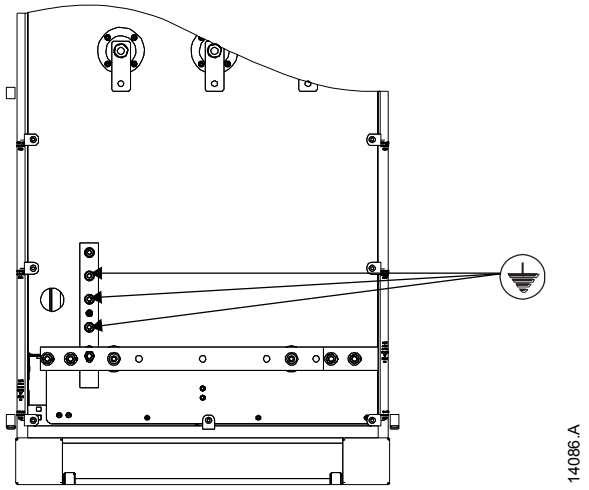
Before moving the switchgear:

- Ensure that the crane is tall enough that the angle formed between the arms of the sling is no more than 60° when viewed from the front or rear of the panel.
- Always use lifting equipment that is rated for the prescribed load. Only use a crane of sufficient lifting capacity to bear the weight of the equipment to be lifted.
- Identify the centre of gravity, physical dimensions, weight etc.
- Plan the path along which the switchgear will be moved, ensuring that it is free from obstructions.
- If moving more than one unit at a time, disconnect bus connections between panels to prevent damage to the busbars.
- Ensure that adequate precautions have been taken to protect personnel before moving the panel.
- Only use AuCom recommended bolts and metal connectors. Never replace or modify a manufactured lifting component.

NOTE
Spreader bar, lifting rods, and other materials are not supplied as part of the switchgear arrangement.

5.4 Earth Termination

An earth bar is located at the rear of the panel.



An earthing wire may be terminated anywhere along this bar using M10 high tensile grade 8.8 threaded fasteners for all terminations.

5.5 Assembling the Switchgear Line-up

Switchgear panels may be connected together to form a panel line-up. Assembling the panel line-up includes the following operations:

- Aligning the panels
- Fastening the panels together
- Connecting the earth bus

Aligning the panels

Switchgear sections may be shipped individually to facilitate loading and transportation. At the installation site, the shipping sections must be securely bolted together to form the switchgear line-up. Align the shipping sections side by side on the foundation as follows:

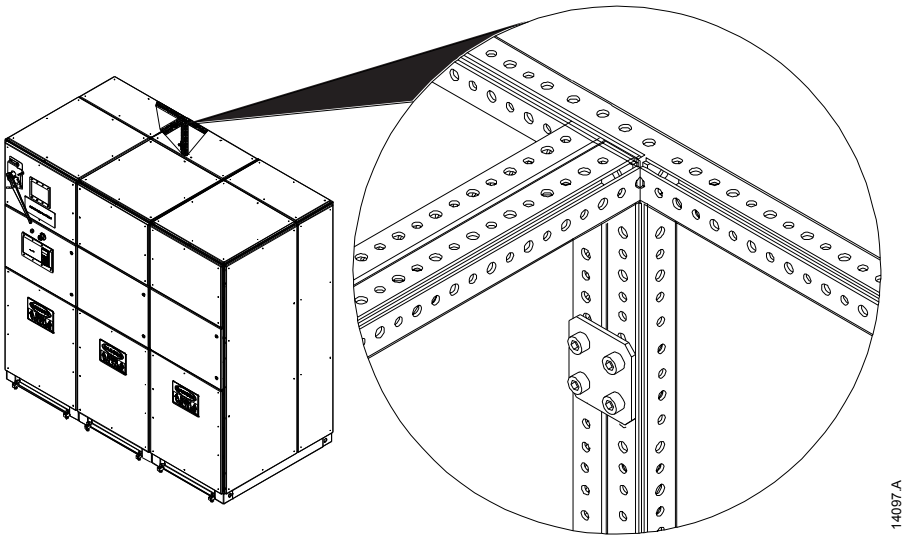
- Remove all packaging material from the first switchgear section to be installed, except the wooden pallet on which each panel is mounted. The wooden pallet protects the switchgear and reduces risk of damage during moving.
- Move the panel to the desired location (refer to *Lifting and Moving* on page 20 for details). Remove the bolts and discard the wooden pallet.
- Line up the bolt holes in the base frame of the switchgear with the holes in the foundation steel channels (refer to *Fastening Panels to the Foundation* on page 18 for details*)*.
- Once the individual panels have been placed in position, use a level or plumb line to make sure the panel line-up is level both across its depth and along its length. Draw an installation baseline the entire length of the complete switchgear.

Install the other switchgear sections following the above steps, with reference to the installation base line.

Fastening the panels together

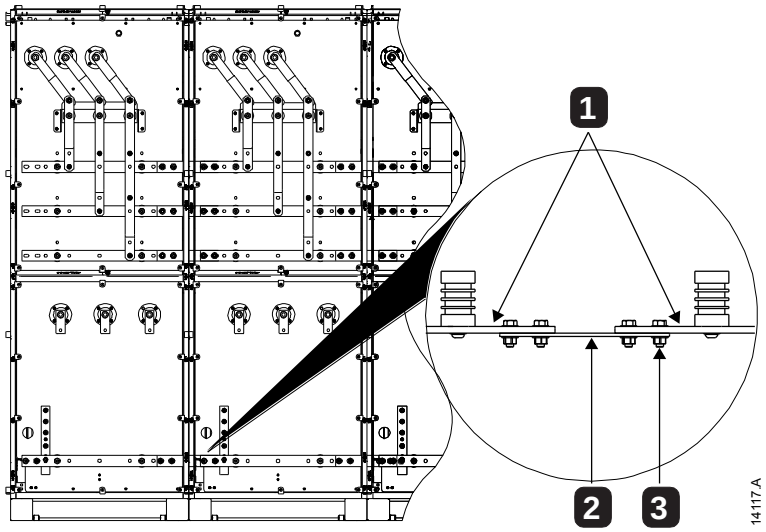
Once the sections of the switchgear line-up have been aligned exactly, fasten adjacent panels together securely.

Use M6x10 screws to fasten panels together using the joining brackets supplied.



Connecting the earth bus

The standard earth bus runs the entire length of the switchgear line-up. The earth bus in the switchgear line-up is assembled in sections, with a bus joint in each panel. Terminals are provided on each joint for connecting the earth bus to the earthing system of the switchgear building. Each panel is equipped with the facility to connect to the building earth (refer to *Earth Termination* on page 21 for more information).



1	Main bus (40x6mm)
2	Fish plate
3	M12x40 screws with Belleville washers

To connect the earth bus between panels in a line-up:

1. Slip the fish plate through the aperture in the panel.
2. Align the bolt holes of the splice plate with those in the bus joint of each panel and fasten together securely.

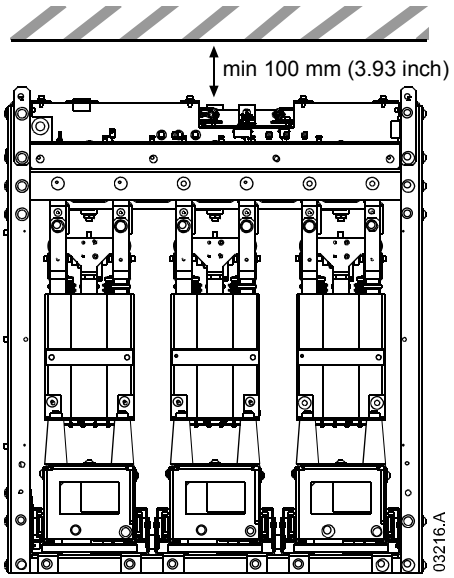
NOTE
The MVS soft starter should only be installed in a restricted access location suitable for electrical equipment.

NOTE
Ensure that the equipment room is clean and relatively dust-free before unpacking and installing the MVS soft starter. In particular, beware of concrete dust as it may cause corrosion.

5.6 Mounting Instructions - Power Assembly

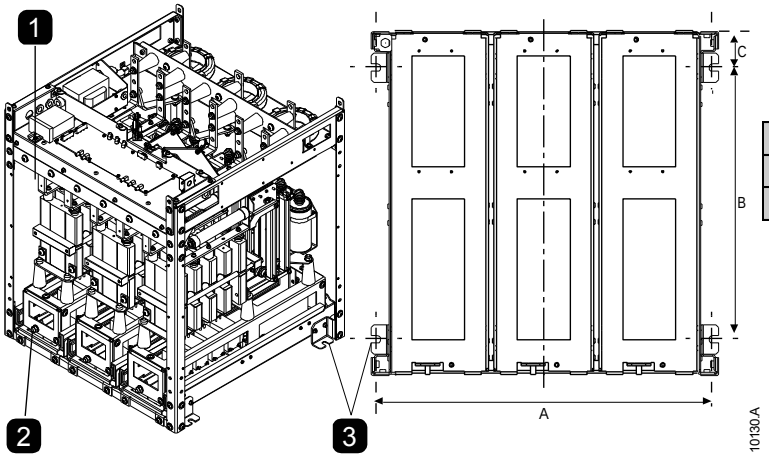
The MVS power assembly is rated IP00 and must be installed inside an enclosure.

No clearance is required below or at the sides. For models V02 ~ V07, the power assembly should be installed with 100 mm clearance above for isolation. Models V11 and V13 require no additional clearance beyond the external frame.



Mounting Points

The power assembly is mounted in place using four M12 bolts. One bolt is required through each corner at the base of the unit, tightened to a torque of 40 Nm. Individual phase arms are secured within the frame using one M10 nut and two M10 high tensile grade 8.8 bolts complete with Belleville washers, all tightened to a torque of 28 ~ 30 Nm.



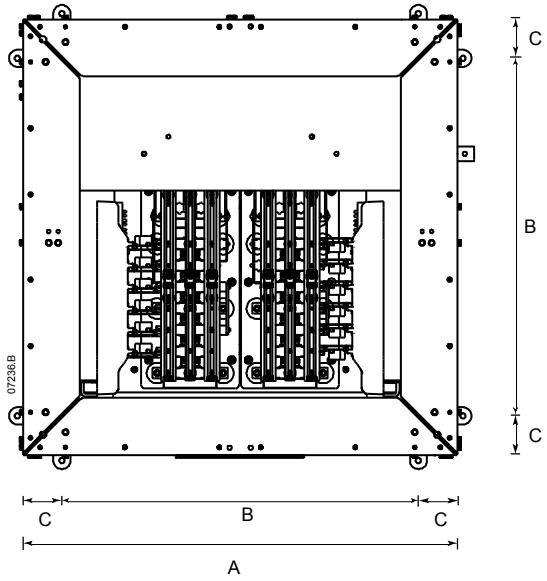
Plan View
Front of unit

1	M10 bolts with belleville washers
2	M10 nut
3	M12 mounting holes

For V11 and V13 models, the power assembly is mounted in place using eight M12 bolts (two bolts per side at 944 mm centres). Individual phase arms are secured within the frame using two locking rods and two lock nuts, tightened to a torque of 10 Nm.

MVS models V11 and V13 come with a travel plinth. For installation the frame should be bolted into a panel with eight M12 bolts, tightened to a torque of 28 ~ 30 Nm.

Plan view



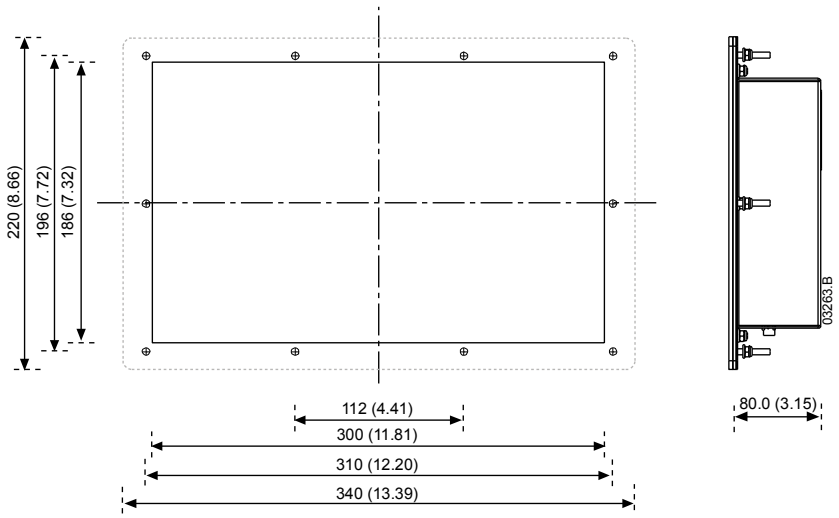
Front of unit

	A mm (inch)	B mm (inch)	C mm (inch)
MVSxxxx-V02*	636 (25.04)	513 (20.20)	68.5 (2.70)
MVSxxxx-V03*			
MVSxxxx-V04*			
MVSxxxx-V06	842 (33.15)	663 (26.10)	68.5 (2.70)
MVSxxxx-V07			
MVSxxxx-V11	1150 (45.28)	944 (37.17)	103 (4.06)
MVSxxxx-V13			

* For models MVSxxxx-V02 to MVSxxxx-V04, these dimensions apply up to 321 A. For the same models with current ratings of 500 and 600 A, the MVSxxxx-V06 dimensions apply.

5.7 Mounting Instructions - Controller

The Controller is secured into place using ten M4 nuts, affixed to the studs on the back of the controller.

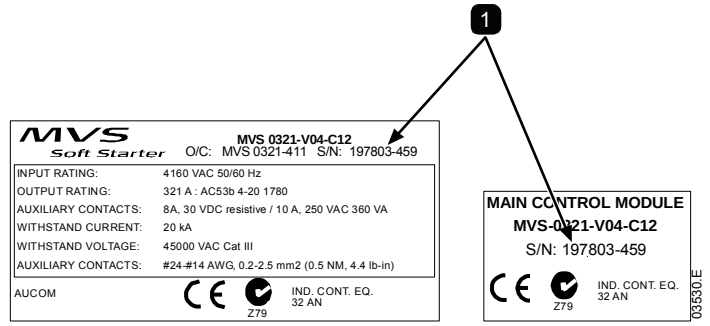


To mount the controller, make a 186 mm x 300 mm cutout at the desired mounting location. Ensure adequate clearance (>85 mm) is available behind the mounting location.If you intend to use a communication module, allow for a minimum clearance of 120 mm behind the mounting panel.

Drill 5 mm holes to accommodate the studs on the controller. Fit the controller through the cutout and tighten the nuts onto the studs.

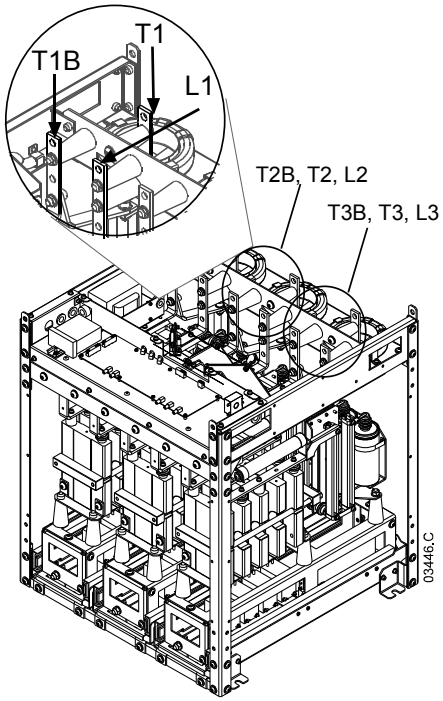
NOTE
Before installation, always ensure that you are using the correct controller for the soft starter. This can be checked by comparing the serial number on the back of the controller with the serial number on the front of the power assembly.

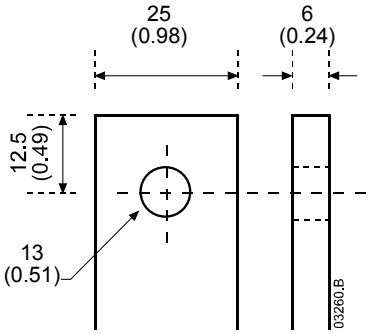
1	Serial number



5.8 Power Terminations

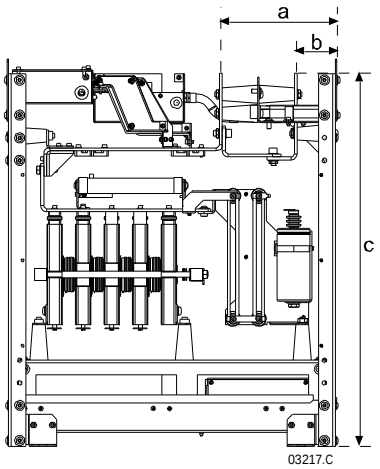
Models V02 ~ V07



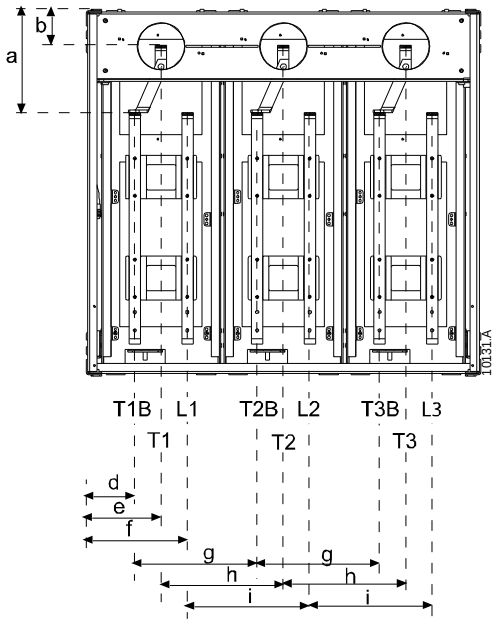


Use only M10 high tensile grade 8.8 threaded fasteners for all terminations. Use a pre-load torque setting between 28 ~ 30 Nm. Use only Belleville washers.

Side View



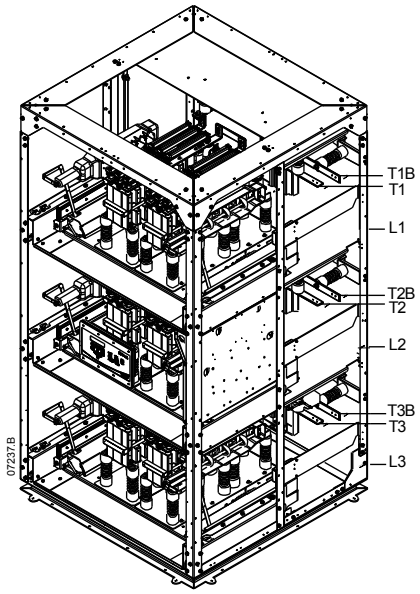
Top View

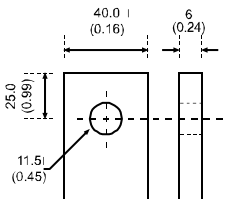


	a	b	c	d	e	f	g	h	i
	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)	mm (inch)
MVSxxxx-V02*	228 (8.98)	79 (3.11)	744 (29.29)	79 (3.11)	129 (5.08)	179 (7.05)	200 (7.87)	200 (7.87)	200 (7.87)
MVSxxxx-V03*									
MVSxxxx-V04*									
MVSxxxx-V06	228 (8.98)	79 (3.11)	804 (31.65)	107 (4.19)	164 (6.46)	222 (8.72)	268 (10.55)	268 (10.55)	268 (10.55)
MVSxxxx-V07									

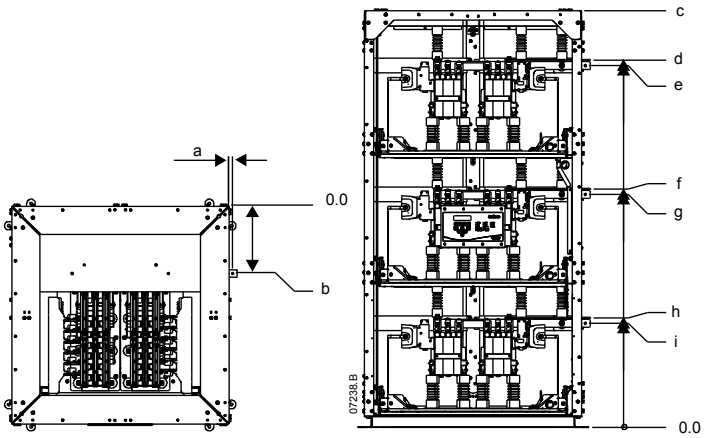
* For models MVSxxxx-V02 to MVSxxxx-V04, these dimensions apply up to 321 A. For the same models with current ratings of 500 and 600 A, the MVSxxxx-V06 dimensions apply.

Models V11 and V13





Bus bar termination detail

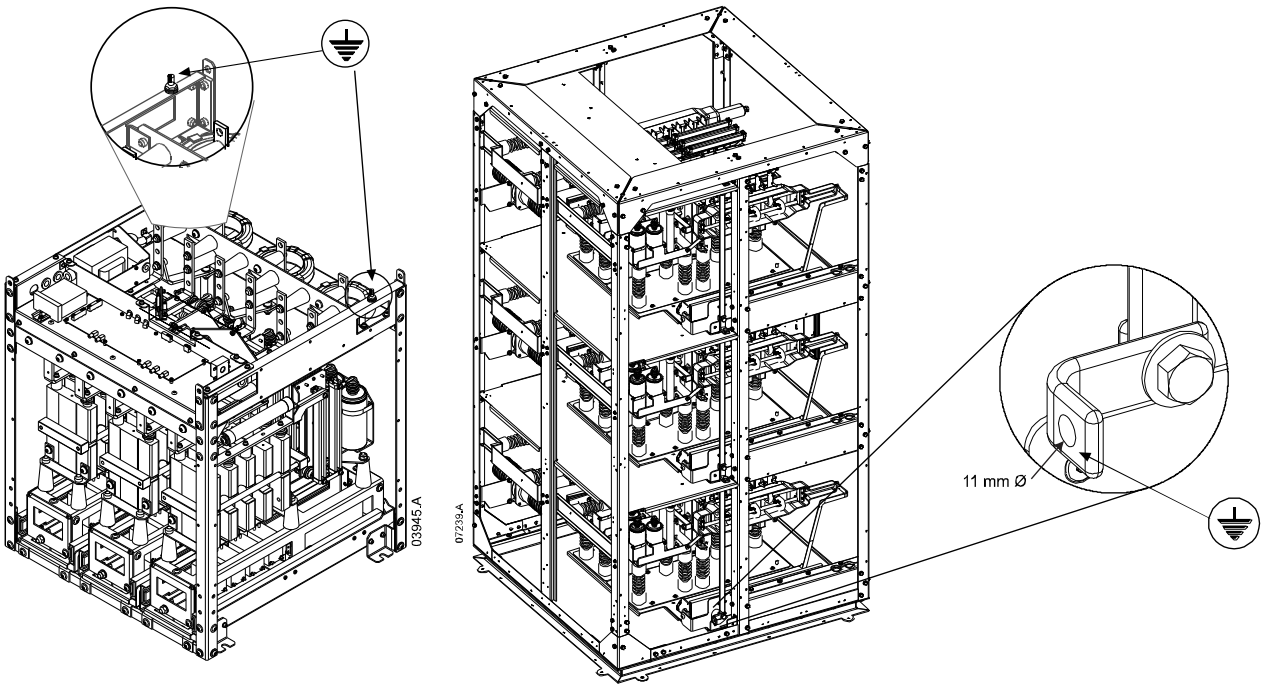


Use only M10 high tensile grade 8.8 threaded fasteners for all terminations. Use a pre-load torque setting between 28 ~ 30 Nm. Use only Belleville washers.

	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)
MVSxxxx-V11	19.8 (0.78)	355.0 (13.98)	2200 (86.6)	1965.5 (77.4)	1936.5 (76.2)	1274.8 (50.2)	1245.8 (49.0)	584.1 (23.0)	555.1 (21.9)
MVSxxxx-V13									

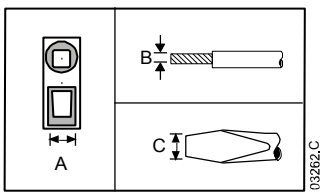
5.9 Earth Terminations

A 10 mm earth stud is located on each side of the power assembly, at the rear of the unit. Use only M10 high tensile grade 8.8 threaded fasteners for all terminations. Use a pre-load torque setting between 28 ~ 30 Nm. Use only Belleville washers.



5.10 Control Terminations

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



A (mm)	B (mm²)	C (mm)
3	2.5	3

5.11 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

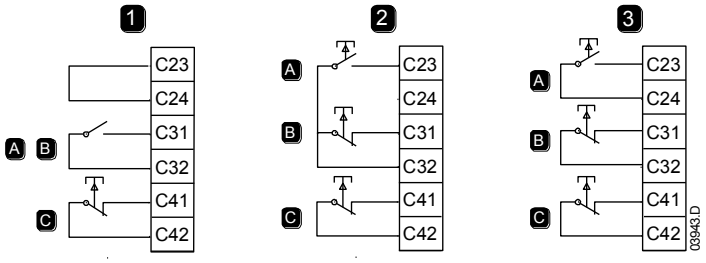
The LCL/RMT button controls whether the MVS will respond to local control (via the Controller) or remote control (via the remote inputs).

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



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

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

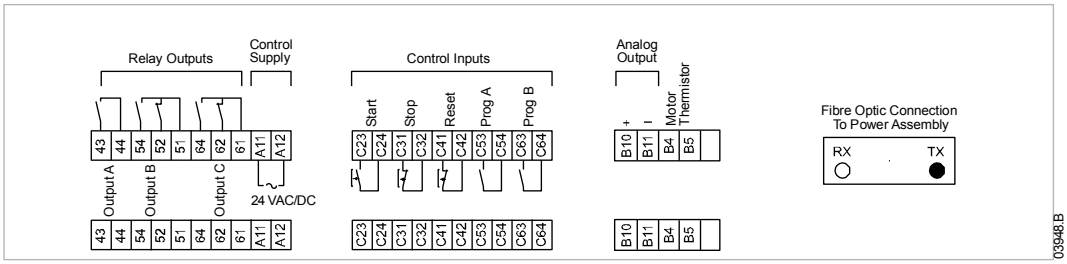
Cables to the control inputs must be segregated from mains voltage and motor cabling.

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

NOTE
Reset input is normally closed by default.

5.12 Terminal Block (Controller)

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



5.13 Power Circuits

Overview

MVS soft starters are designed to operate as part of a system including other components. A main contactor and bypass contactor are required in all installations. MVS models V02 ~ V07 must be installed with fuses. MVS models V11 ~ V13 must be installed with either contactor and fuses or a circuit breaker.

The following additional components may also be required:

- main isolator/ earth switch
- power factor correction
- line inductors
- transient/ overvoltage protection
- MV/LV control supply transformer

Main Contactor

The MVS must always be installed with a main contactor. Select a contactor with an AC3 rating greater than or equal to the full load current rating of the connected motor or there is an option for a circuit breaker above 7.2 kV.

The main contactor is associated with terminals L1, L2, L3 on the supply side of the soft starter. The coil is associated with output terminals 13, 14 of the MVS (refer to *Power Circuit Configuration (models V02 ~ V07)* on page 30).

To ensure that the potentially dangerous medium voltage area is isolated from the low voltage control area, power is supplied to the main contactor coil from the control voltage terminal block (refer to *Internal Wiring (models V02 ~ V07)* on page 34).

Bypass Contactor

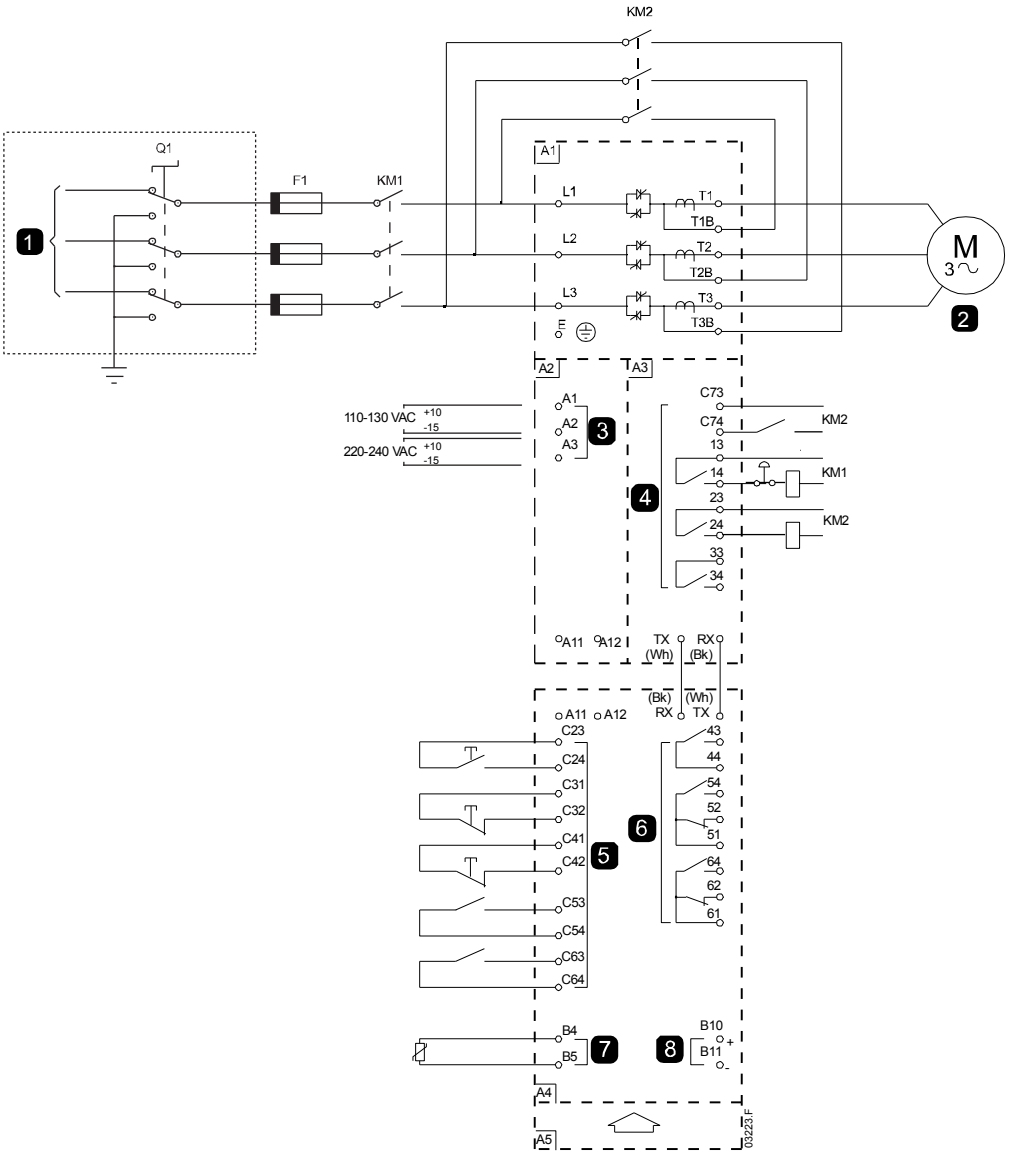
The MVS must always be installed with a bypass contactor. Select a contactor with an AC1 rating greater than or equal to the full load current rating of the connected motor or there is an option for a circuit breaker above 7.2 kV.

The bypass contactor is associated with terminals L1, L2, L3 on the supply side of the soft starter, and bypass terminals T1B, T2B, T3B on the motor side. The coil is associated with output terminals 23, 24, and the auxiliary Normally Open contact is associated with input terminals C73, C74 of the soft starter (refer to *Power Circuit Configuration (models V02 ~ V07)* on page 30).

To ensure that the potentially dangerous medium voltage area is isolated from the low voltage control area, power is supplied to the bypass contactor coil from the control voltage terminal block (refer to *Internal Wiring (models V02 ~ V07)* on page 34).

Power Circuit Configuration (models V02 ~ V07)

MVS power circuit with main contactor, bypass contactor, main isolator/ earth switch, R Rated fuses and control supply. Configured for four-wire start/ stop control. Models V02 to V07 must be installed with backup/R-rated fuses (refer to R-Rated Protection Fuses)

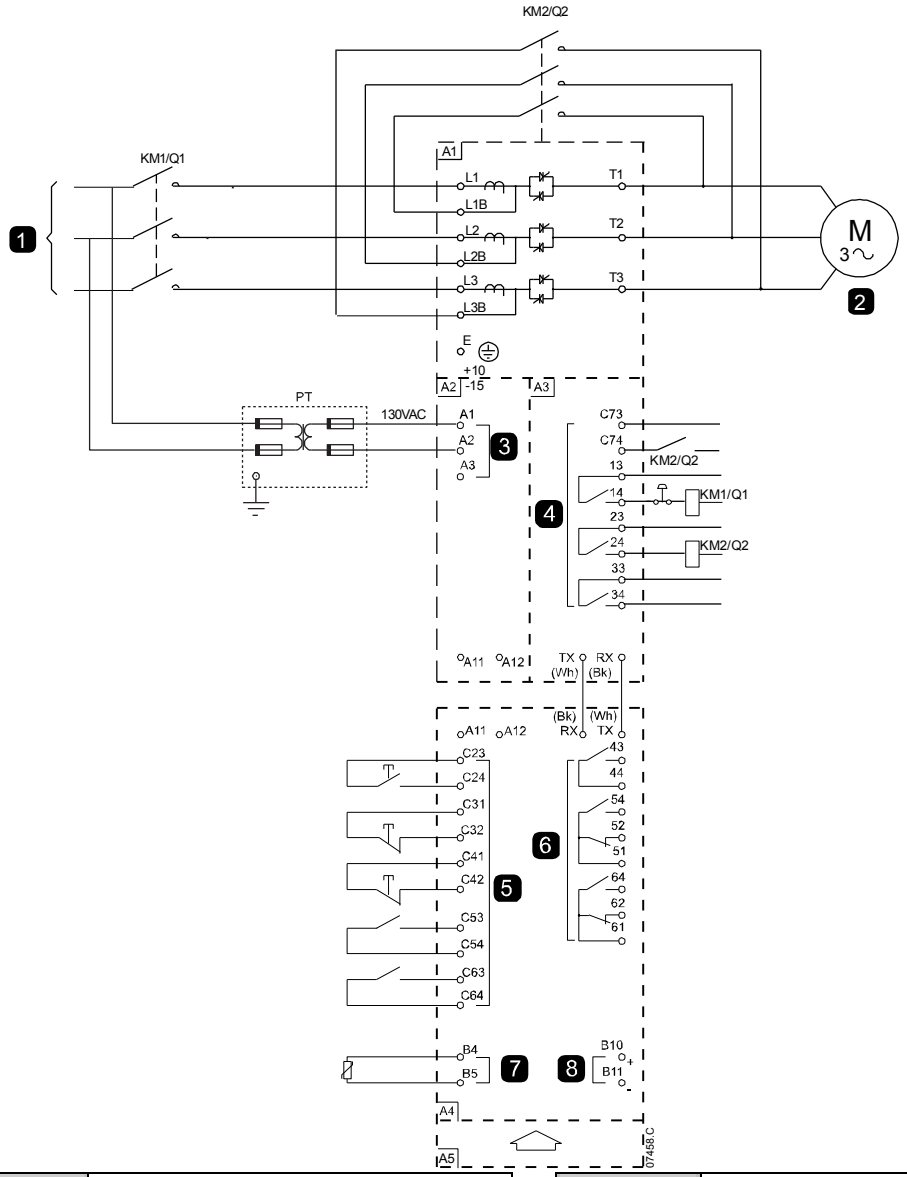


A1	Power assembly
1	3 Phase 50/60 Hz Supply
Q1	Main isolator/Earth switch
F1	R-Rated protection fuses
KM1	Main contactor
KM2	Bypass contactor (external)
2	To motor
A2	Control voltage terminals
3	Control supply
A3	Power interface PCB
4	Relay outputs
C73~C74	Bypass contactor feedback signal
13~14	Main contactor KM1
23~24	Bypass contactor KM2
33~34	Run output (PFC) (refer to *Internal Wiring (models V02 ~ V07)* on page 34).

A4	Controller
5	Remote control inputs
C23~C24	Start
C31~C32	Stop
C41~C42	Reset
C53~C54	Programmable input A
C63~C64	Programmable input B
6	Programmable outputs
43, 44	Programmable Relay output A
51, 52, 54	Programmable Relay output B
61, 62, 64	Programmable Relay output C
7	Motor thermistor input
8	Analog output
A5	Communications module (optional)

Power Circuit Configuration (models V11 and V13)

MVS power circuit with main contactor/circuit breaker and bypass contactor/circuit breaker. Configured for four-wire start/ stop control with optional MV/LV potential transformer.

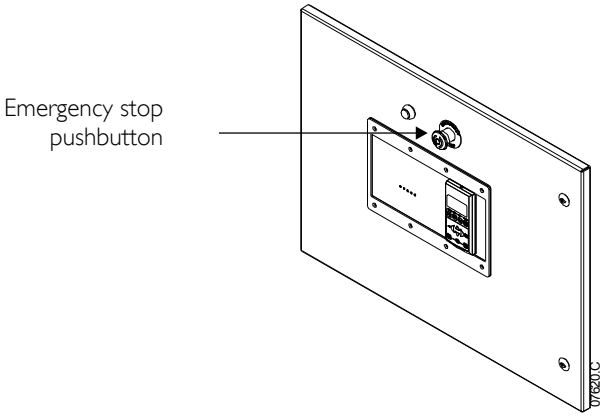


A1	Power assembly
1	3 Phase 50/60 Hz Supply
KM1/Q1	Main contactor or circuit breaker
KM2/Q2	Bypass contactor or circuit breaker
2	To motor
A2	Control voltage terminals
3	Control supply
A3	Power interface PCB
4	Relay outputs
C73-74	Bypass contactor or circuit breaker feedback signal
13-14	Main contactor KM1 or circuit breaker Q1
23-24	Bypass contactor KM2 or circuit breaker Q2
33-34	Run output (PFC) (refer to *Internal Wiring (models V02 ~ V07)* on page 34).

A4	Controller
5	Remote control inputs
C23-24	Start
C31-32	Stop
C41-42	Reset
C53-54	Programmable input A
C63-64	Programmable input B
6	Programmable outputs
43-44	Programmable Relay output A
51, 52, 54	Programmable Relay output B
61, 62, 64	Programmable Relay output C
7	Motor thermistor input
8	Analog output
A5	Communications module (optional)

Emergency Stop Button

In the event of an emergency, press the emergency stop button located on the front of the panel.

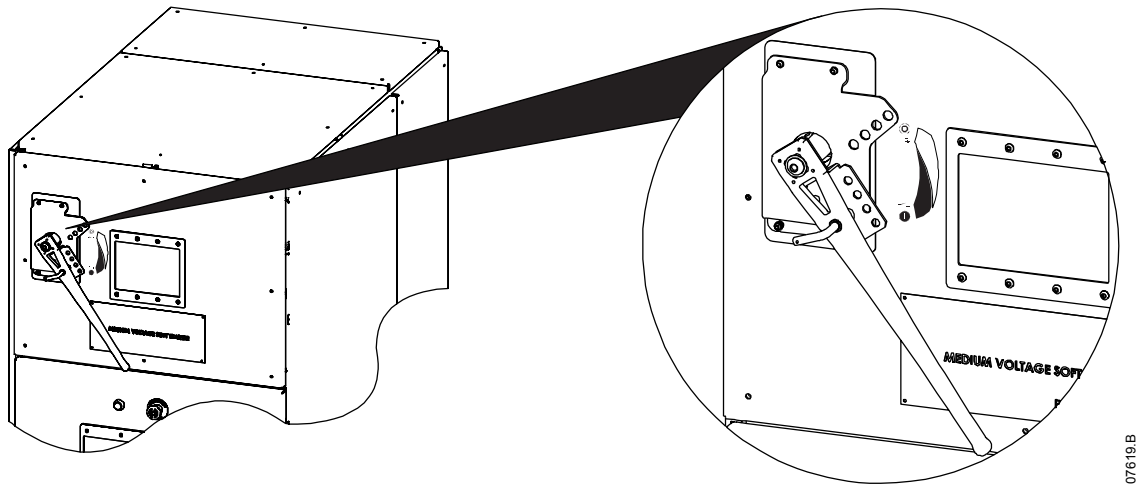


Main Isolator/ Earth Switch (models V02 ~ V07)

A main isolator/ earth switch can be connected on the supply side of the main contactor (refer to *Power Circuit Configuration (models V02 ~ V07)* on page 30)

CAUTION
The main isolator/ earth switch must only be operated when the motor is not running and the incoming mains supply has been disconnected.

To open the isolator, pull out the pin and switch off. If the starter is operating, removing the pin will open the main contactor.



R Rated Protection Fuses

If specified, R Rated protection fuses can be installed on the supply side of the soft starter to provide Type 2 coordination and short circuit protection for the motor branch circuit. The appropriate fuse should be selected from the table below, based on the motor's rated full load current. MVS models V02 ~ V07 must be installed with fuses.

Fuse ratings:

Starter Rated FLC	Fuse
80 A	12R
159 A	12R
230 A	24R
321 A	24R
500 A	–-
600 A	400RC315*

* two fuses in parallel

Fuse type code formats:

	System Voltage 2.3 kV	System Voltage 3.3 ~ 4.2 kV	System Voltage 6 ~ 7.2 kV
Ferraz	A240Rrr	A480Rrr-1	A072xxDxRO-rr
Bussmann	JCK-x-rr	JCL-x-rr	JCR-x-rr
Siba	–	400RC315*	400RC315*

* two fuses in parallel
rr = R rating of the fuse
x = physical format of the fuse (select according to installation requirements)

Examples:

12R fuse for 3.3 kV: A480R12R-1 or JCL-B-12R
24R fuse for 6.6 kV: A072B1DARO-24R or JCR-B-24R

Power Factor Correction

NOTE
Do not connect power factor correction capacitors to the output of MVS 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.

Transient/ Overvoltage Protection

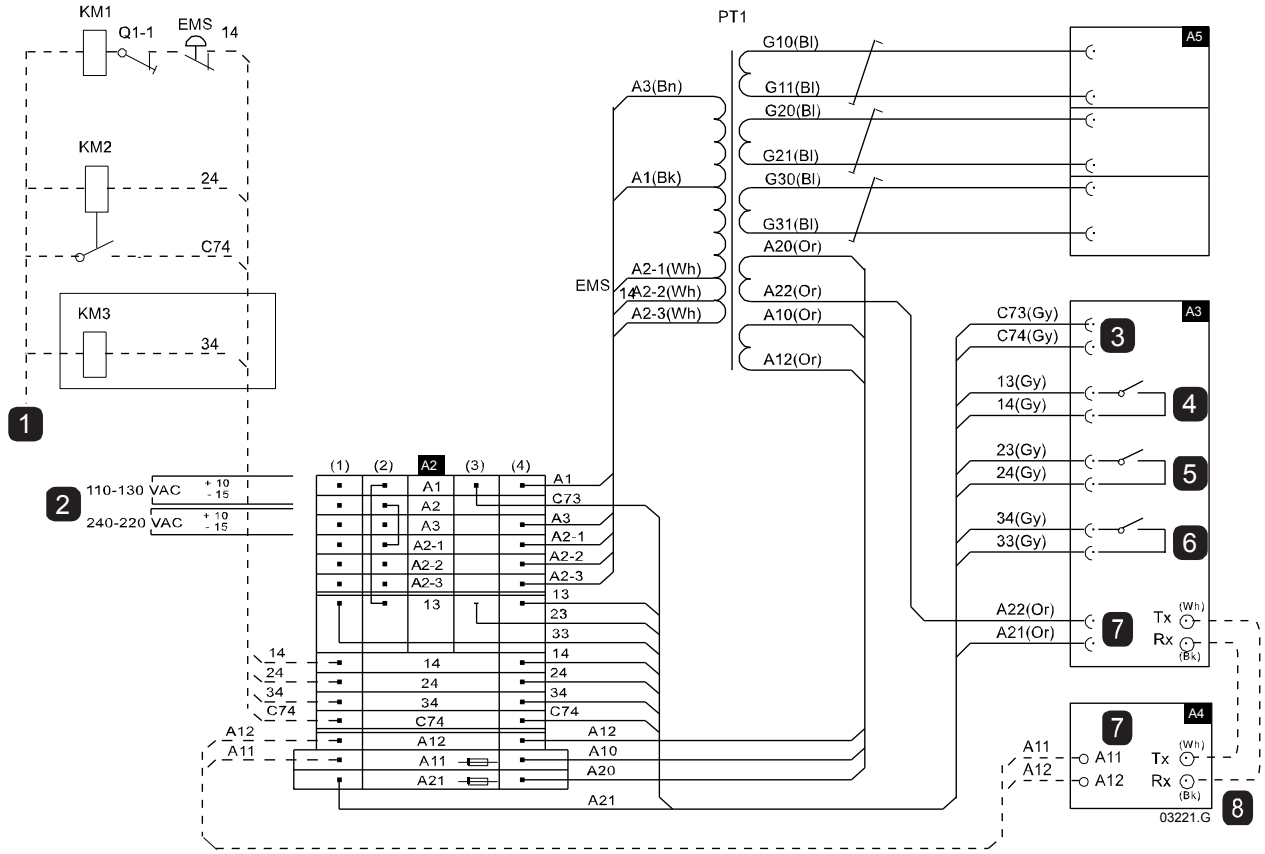
Overvoltage protection should be installed if there is a risk of high voltage transients at the installation. Contact your local supplier for details.

Control Supply Transformer (PT/VT)

The MVS requires a low voltage control supply. If low voltage is not available, a transformer is required. Use a transformer with primary voltage matching the MV mains voltage, and secondary voltage to suit the MVS starter. Use a single phase 550 VA transformer with protection fuses on both the primary and secondary sides.

Section 6 Internal Wiring

6.1 Internal Wiring (models V02 ~ V07)



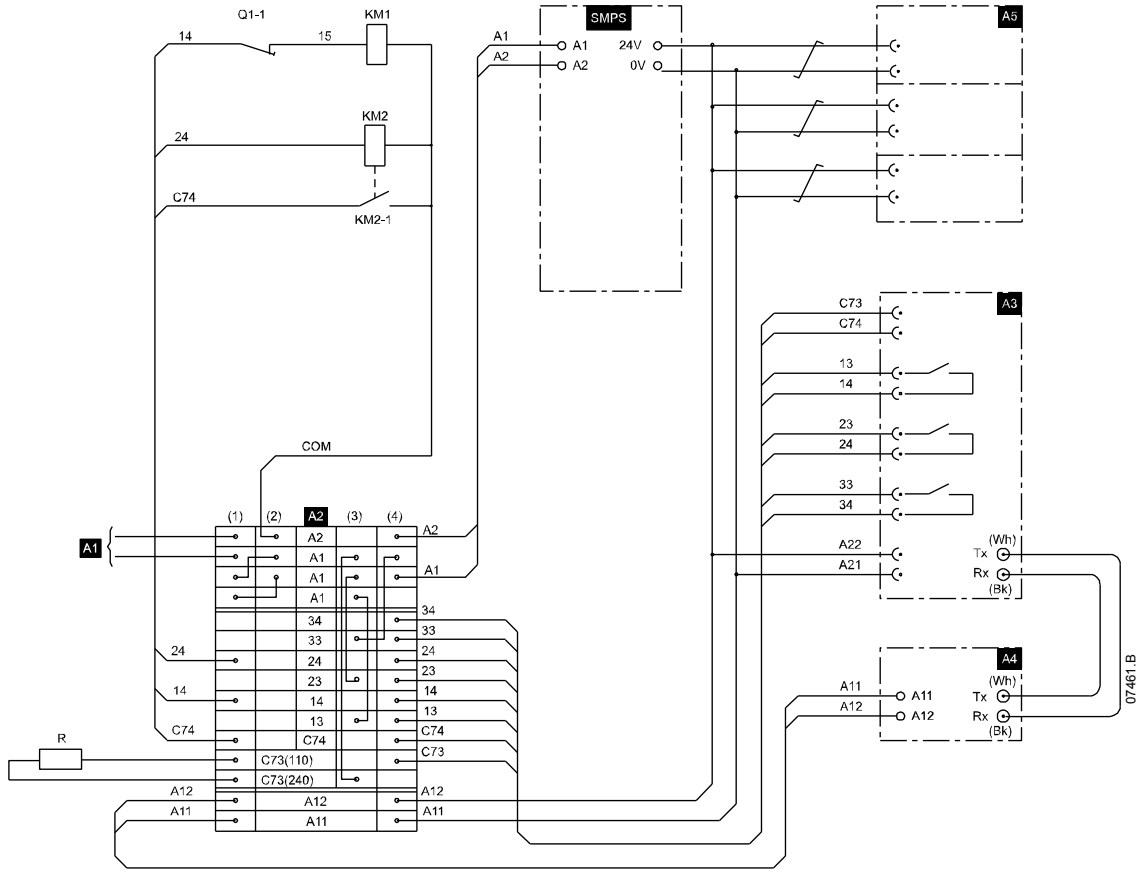
KM1	Main contactor (external)
KM2	Bypass contactor (external)
KM3	PFC contactor (optional)
1	COM. Connect to:
	A2-1(1) for 110 or 220 VAC coils
	A2-2(1) for 120 or 230 VAC coils
	A2-3(1) for 130 or 240 VAC coils
A2	Control voltage terminal block
2	Feed connected to A1 or A3 must be externally fused.

A3	Power interface PCB
3	Bypass feedback input
4	Main contactor relay output
5	Bypass contactor relay output
6	Run (PFC) relay output
7	Power supply (24 VAC/VDC)
A4	Controller
8	Fibre optic cables (supplied, but must be connected at site)
A5	Gate drive PCBs

NOTE
The control voltage terminal section (A2) has links fitted for 110 VAC external control and contactor coil voltages. For other voltages, remove these links and refit as indicated.

External control supply			Contactor coil supply (KM1 - KM3)	
Voltage	Connect into	Link from	Voltage	Link from
110 VAC	A1 and A2	A2(2) to A2-1(2)	110 VAC	A1(2) to 13(2)
120 VAC		A2(2) to A2-2(2)	120 VAC	
130 VAC		A2(2) to A2-3(2)	130 VAC	
220 VAC	A3 and A2	A2(2) to A2-1(2)	220 VAC	A3(2) to 13(2)
230 VAC		A2(2) to A2-2(2)	230 VAC	
240 VAC		A2(2) to A2-3(2)	240 VAC	

6.2 Internal Wiring (models V11 and V13)



A1	Control supply (110 ~ 240 VAC)
A2	Control voltage terminal block
A3	Power interface PCB
A4	Controller
A5	Gate Drive PCBs
SMPS	Switch mode power supply (control)
KM1	Main contactor or circuit breaker
KM2	Bypass contactor or circuit breaker
Tx, Rx	Fibre optic cables

Q1-1	Main isolator/Earth switch (early break, late make contact)
R	Resistor
C73, C74	Bypass feedback
13, 14	Main contactor/breaker output
23-24	Bypass contactor/breaker output
33, 34	Run output for PFC contactor
A21, A22	Electronics power supply

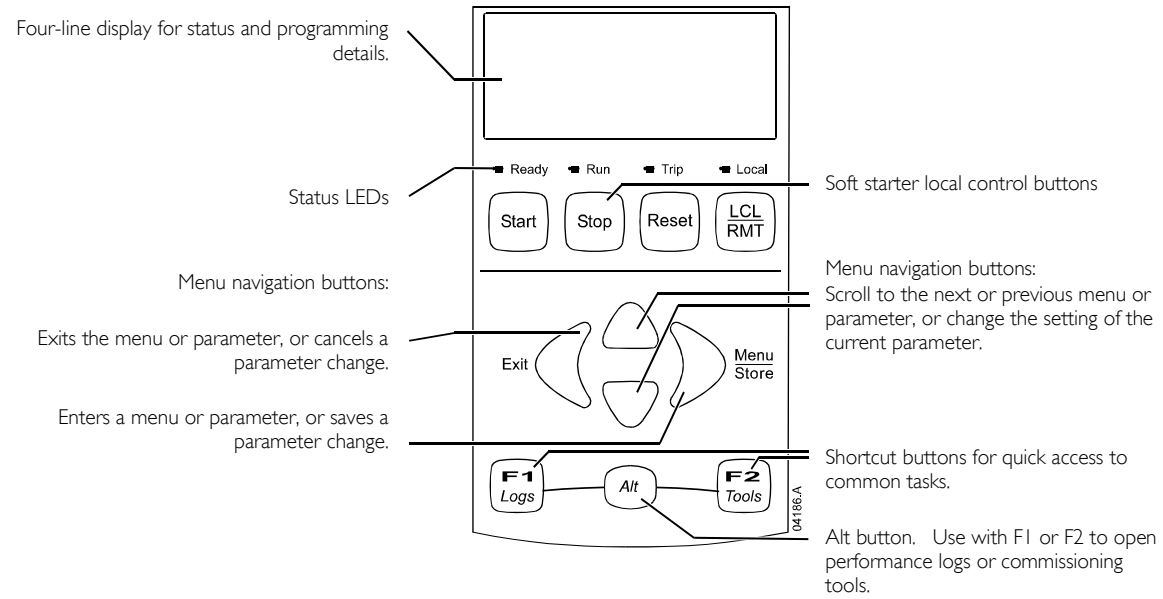
NOTE

A resistor (R) is only required for 220 ~ 240 VAC control supplies.

If using circuit breakers instead of contactors, contact your local supplier for more information.

Section 7 Keypad and Feedback

7.1 The Controller



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

7.2 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 71, for further details.

7.3 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* on page 59, for further details.

Programming Menu

The Programming Menu lets you view and change programmable parameters that control how the MVS 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 (*8B, 8C – F1 and F2 Button Action* on page 53) to select the shortcut target.

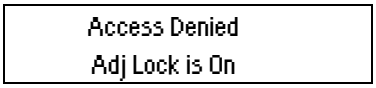
- **Adjustment Lock**

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:

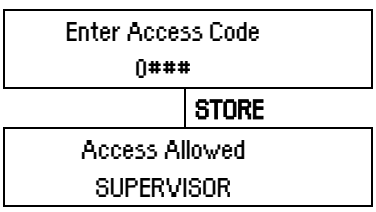
- scroll to the appropriate parameter in the Programming Menu and press ▶ to enter edit mode.
- to alter the parameter setting, use the ▲ and ▼ buttons. Pressing ▲ or ▼ once will increase or decrease the value by one unit. If the button is held for longer than five seconds, the value will increase or 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 the **F1 (LOGS)** button.

Refer to *Logs Menu* on page 64, for further details.

Section 8 Programming Menu

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

The Programming Menu contains three sub-menus:

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

8.1 Standard Menu

The standard menu provides access to commonly used parameters, allowing the user to configure the MVS as required for the application. For details of individual parameters, refer to *Parameter Descriptions* on page 43.

1		Motor Data-1
	1A	*Motor Full Load Current*
2		Start/Stop Modes-1
	2A	*Start Mode*
	2B	*Start Ramp Time*
	2C	*Initial Current*
	2D	*Current Limit*
	2H	*Stop Mode*
	2I	*Stop Time*
3		Auto-Start/Stop
	3C	*Auto-Stop Type*
	3D	*Auto-Stop Time*
4		Protection
	4A	*Excess Start Time*
	4C	*Undercurrent*
	4D	*Undercurrent Delay*
	4E	*Instantaneous Overcurrent*
	4F	*Instantaneous Overcurrent Delay*
	4G	*Phase Sequence*
6		Inputs
	6A	*Input A Function*
	6B	*Input A Name*
	6C	*Input A Trip*
	6D	*Input A Trip Delay*
	6E	*Input A Initial Delay*
	6F	*Input B Function*
	6G	*Input B Name*
	6H	*Input B Trip*
	6I	*Input B Trip Delay*
	6J	*Input B Initial Delay*
7		Outputs
	7A	*Relay A Function*
	7B	*Relay A On Delay*
	7C	*Relay A Off Delay*
	7D	*Relay B Function*
	7E	*Relay B On Delay*
	7F	*Relay B Off Delay*
	7G	*Relay C Function*
	7H	*Relay C On Delay*
	7I	*Relay C Off Delay*
	7M	*Low Current Flag*
	7N	*High Current Flag*

	7O	*Motor Temperature Flag*
8		Display
	8A	*Language*
	8B	*F1 Button Action*
	8C	*F2 Button Action*
	8D	*Display A or kW*
	8E	*User Screen - Top Left*
	8F	*User Screen - Top Right*
	8G	*User Screen - Bottom Left*
	8H	*User Screen - Bottom Right*

8.2 Extended Menu

The extended menu gives access to all of the MVS'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*
	10I	*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 Time-2*
	10F	*Kickstart Level-2*
	10H	*Stop Mode-2*
	10I	*Stop Time-2*
11		RTD/PT100 (Reserved)
	11A	*Reserved*
12		Slip-Ring Motors
	12A	*Motor Data-1 Ramp*
	12B	*Motor Data-2 Ramp*
	12C	*Changeover Time*
	12D	*Slip Ring Retard*
15		Advanced
	15A	*Access Code*
	15B	*Adjustment Lock*
	15C	*Emergency Run*
16		Protection Action
	16A	*Motor Overload*
	16B	*Excess Start Time*
	16C	*Undercurrent*
	16D	*Instantaneous Overcurrent*
	16E	*Current Imbalance*
	16F	*Frequency*
	16G	*Input A Trip*
	16H	*Input B Trip*
	16I	*Motor Thermistor*
	16J	*Starter Communication*
	16K	*Network Communication*
	16L	*Reserved*
	16M	*Battery/Clock*
	16N	*Ground Fault*
	16O	*Reserved*
	16P	*Reserved*
	16Q	*Reserved*
	16R	*Reserved*
	16S	*Reserved*
	16T	*Reserved*
	16U	*Reserved*
	16V	*Undervoltage*
	16W	*Overvoltage*

8.3 Load/Save Settings

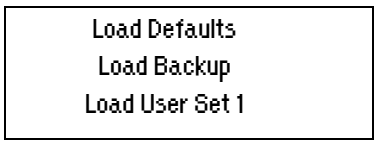
The Load/Save Settings menu requires an access code and allows users to:

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

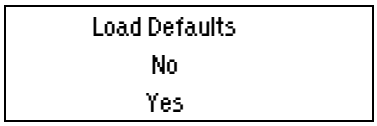
In addition to the factory default values file, the MVS can store two user-defined parameter files. These files contain default values until a user file is saved.

To load or save settings:

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



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



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

8.4 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 sustain locked rotor current from cold before reaching its maximum temperature. Set according to the motor datasheet.

1C – Locked Rotor Current

Range: 400% - 1200% FLC **Default:** 600%
Description: Sets the locked rotor current of the connected motor, as a percentage of full load current. Set according to the motor datasheet.

1D – Motor Service Factor

Range: 100% - 130% **Default:** 105%
Description: Sets the motor service factor used by the thermal model. If the motor runs at full load current, it will reach 100%. Set according to the motor datasheet.

2 Start/Stop Modes-1

2A – Start Mode

Options: CONSTANT CURRENT (Default)
Description: Selects the soft start mode.

2B – Start Ramp Time

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

2C – Initial Current

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

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

2D – Current Limit

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

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

2E – Reserved

Description: This parameter is reserved for future use.

2F, 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-Stop

The MVS 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. 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 MVS 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 MVS 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 MVS's response to undercurrent, avoiding trips due to momentary fluctuations.

4E, 4F – Instantaneous Overcurrent

The MVS 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 second
Description: Slows the MVS'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

Options: 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 MVS 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 MVS's response to current imbalance, avoiding trips due to momentary fluctuations.

4J, 4K, 4L – Frequency Trip

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

Parameter 4J *Frequency Check*

Options: 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*

Options: ± 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 MVS'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 MVS 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

Options: DO NOT CHECK (default)
CHECK

Description: Selects whether the MVS 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 MVS 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 MVS 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 MVS's response to undervoltage, avoiding trips due to momentary fluctuations.

4S, 4T – Overvoltage

The MVS 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 MVS's response to overvoltage, avoiding trips due to momentary fluctuations.

4U, 4V – Instantaneous Overcurrent Stage 2

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

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

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

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

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

Parameter 4U *Instantaneous Overcurrent S2*

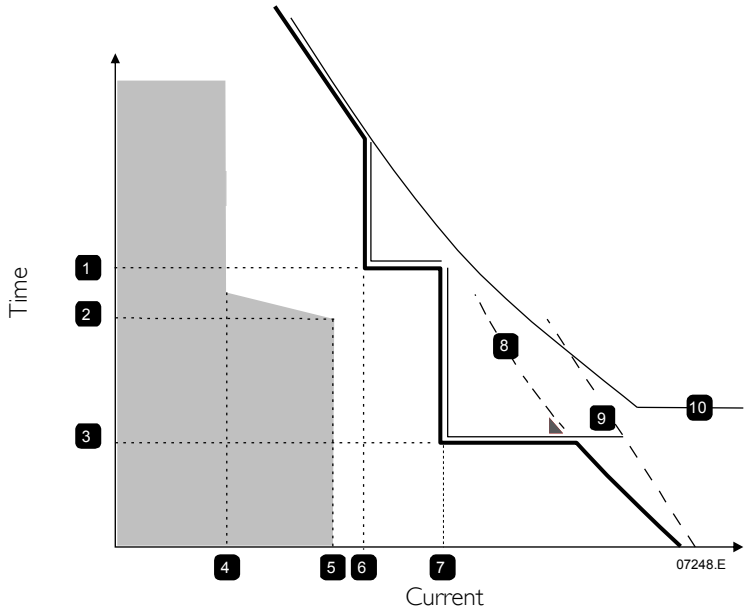
Range: 30 A – 4400 A **Default:** 4400 A
Description: Sets the trip point for instantaneous overcurrent stage 2 protection in amperes. Set as required.

Parameter 4V *Instantaneous Overcurrent Delay S2*

Range: 10 – 1000 ms **Default:** 10 milliseconds
Description: Sets the duration required for current to exceed the level set in parameter 4U before a trip occurs. Set as required.

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

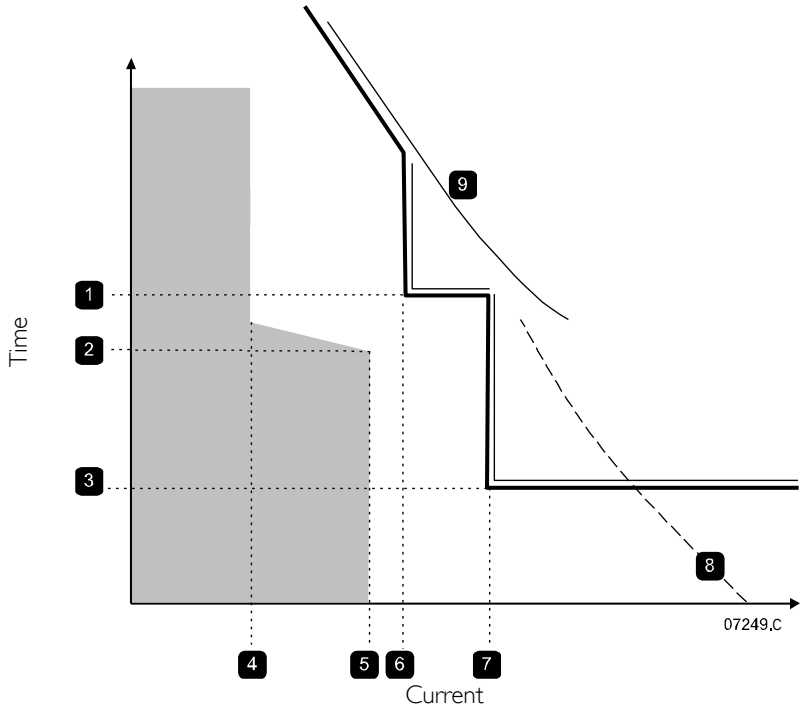
Example: Contactor and Fuse



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

Shaded area indicates motor operation

Example: Circuit Breaker



1	Instantaneous Overcurrent Delay Stage 1 (4F)
2	Motor start time
3	Instantaneous Overcurrent Delay Stage 2 (4V)
4	FLC
5	Motor start 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 MVS has two programmable inputs, which allow remote control of the soft starter.

6A – Input A Function

Options:

MOTOR SET SELECT (Default)	The MVS can be configured with two separate sets of motor data. To use the secondary motor data, parameter 6A must be set to 'Motor Set Select' and C53, C54 must be closed when a start command is given. The MVS 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. (Refer to parameters 6C, 6D, 6E)
INPUT TRIP (N/C)	When parameter 6A is set to Input Trip (N/C), an open circuit across C53, C54 trips the soft starter. (Refer to parameters 6C, 6D, 6E)
LOCAL/REMOTE SELECT	Input A can be used to select between local and remote control, instead of using the **LCL/RMT** button on the Controller. When the input is open, the starter is in local mode and can be controlled via the Controller. When the input is closed, the starter is in remote mode. The **START** and **LCL/RMT** buttons are disabled, and the soft starter will ignore any Local/Remote select command from the serial communications network. To use Input A to select between local and remote control, parameter 6Q must be set to 'LCL/RMT Anytime' or 'LCL/RMT When Off'.
EMERGENCY RUN	In emergency run the soft starter continues to run until stopped, ignoring all trips and warnings (refer to parameter 15C for details). Closing the circuit across C53, C54 activates emergency run. Opening the circuit ends emergency run and the MVS stops the motor.
EMERGENCY STOP	The MVS 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 second

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

Parameter 6E*Input A Initial Delay*

Range: 00:00 - 30:00 (minutes:seconds) **Default:** 0 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 MVS'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 MVS 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 MVS receives a start command, and remains closed as long as the motor is receiving voltage.
	RUN	The relay closes when the starter changes to run state.

TRIP	The relay closes when the starter trips (refer to parameter 16A to 16W).
WARNING	The relay closes when the starter issues a warning (refer to parameter 16A to 16W).
LOW CURRENT FLAG	The relay closes when the low current flag activates (refer to parameter 7M *Low Current Flag*, while the motor is running).
HIGH CURRENT FLAG	The relay closes when the high current flag activates (refer to parameter 7N *High Current Flag*, while the motor is running).
MOTOR TEMPERATURE FLAG	The relay closes when the motor temperature flag activates (refer to parameter 7O *Motor Temperature Flag*).
INPUT A TRIP	The relay closes when Input A activates to trip the soft starter.
INPUT B TRIP	The relay closes when Input B activates to trip the soft starter.
MOTOR OVERLOAD	The relay closes when the starter trips on Motor Overload.
CURRENT IMBALANCE	The relay closes when the starter trips on Current Imbalance.
UNDERCURRENT	The relay closes when the starter trips on Undercurrent.
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.
UNDERVOLTAGE	The relay closes when the mains voltage drops below the level set in parameter 4Q.
READY	The relay closes when the starter transitions into Ready mode.

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

7B, 7C – Relay A Delays

The MVS 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 second
Description: Sets the delay for closing Relay A.

Parameter 7C *Relay A Off Delay*

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

7D~7I – Output Relays B and C

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

Relay B is a changeover relay.

- 7D *Relay B Function* **Default:** Run
- 7E *Relay B On Delay* **Default:** 0 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 MVS 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 MVS 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 MVS 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 10I). 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 10I). $\frac{\sqrt{3} \cdot V \cdot I_{FLC}}{1000}$
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 10I.

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

Parameter 7Q *Analog A Scale*

Range: 0-20 mA
4-20 mA (default)

Description: Selects the range of the analog output.

Parameter 7R *Analog A Maximum Adjustment*

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

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

Parameter 7S *Analog A Minimum Adjustment*

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

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

7T~7W – Reserved

These parameters are reserved for future use.

8 Display

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

8A – Language

Options: ENGLISH (default)
CHINESE
ESPAÑOL
DEUTSCH
PORTUGUÊS
FRANÇAIS
ITALIANO
RUSSIAN

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

8B, 8C – F1 and F2 Button Action

Options: NONE
SETUP AUTO-START/STOP 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 MVS will display current (amperes) or motor kilowatts on the main monitoring screen.

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

Options:

BLANK	Displays no data in the selected area, allowing long messages to be shown without overlapping.
STARTER STATE	The starter's operating state (starting, running, stopping or tripped). Only available for top left and bottom left positions on the screen.
MOTOR CURRENT	The average current measured on three phases.
MOTOR PF	The motor's power factor, measured by the soft starter.
MAINS FREQUENCY	The average frequency measured.
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 MVS 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 10I). 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 10I). $\frac{\sqrt{3} \cdot V \cdot I_{FLC}}{1000}$
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 10I.

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:

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

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

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

10I – 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 MVS 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:

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

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

NOTE
This adjustment affects all voltage-based functions.

9 Motor Data-2

The MVS 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 ~ 10I – Start/Stop-2

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

Parameter 10A *Start Mode-2*

Options: Constant Current (Default)

Description: Selects the soft start mode.

Parameter 10B *Start Ramp 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.

Parameter 10I *Stop Time-2*

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

11 RTD/PT100 (Reserved)

This parameter group is reserved for future use.

12 Slip-Ring Motors

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

12A, 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 after the rotor resistance contactor closes, as a percentage of full conduction.
Set so that no current pulse occurs, but the motor retains enough speed to start correctly.

15 Advanced

15A – Access Code

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

Description: Sets the access code to control access to restricted sections of the menus.
Use the ◀ and ▶ buttons to select which digit to alter and use the ▲ and ▼ buttons to change the value. After the last digit is set press **STORE**.

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

15B – Adjustment Lock

Options:	READ & WRITE (default)	Allows users to alter parameter values in the Programming Menu.
	READ ONLY	Prevents users altering parameter values in the Programming Menu. Parameter values can still be viewed.

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

15C – Emergency Run

Options: DISABLE (default)
ENABLE

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

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 9 Commissioning

9.1 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 MVS 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 MVS 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.

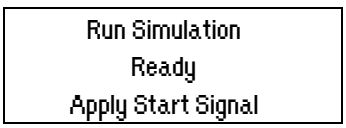
The simulation tools are accessed via the Commissioning Menu. The simulations are only available when the soft starter is in Ready state, control voltage is available and the Controller is active.

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

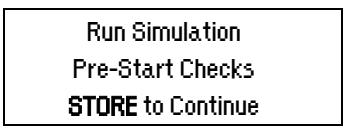
- **Run Simulation**

To use the run simulation:

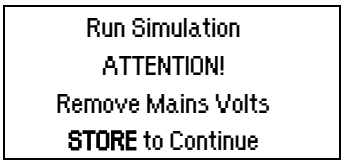
1. Open the Commissioning Menu.
2. Scroll to Run Simulation and press ▶.
3. Press START or activate the start input.



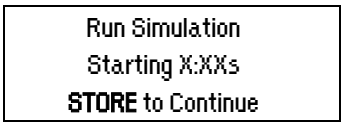
The MVS simulates its pre-start checks and closes the main contactor (if installed). The Run LED flashes.



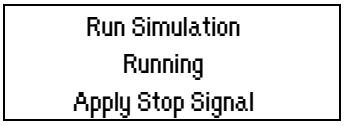
NOTE
If the Mains voltage is connected an error message ("Power On") is shown. Remove the Mains voltage and proceed to next step.



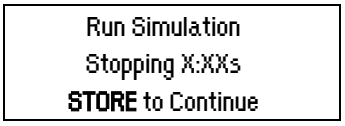
4. Press ▶. The MVS simulates starting. The Run LED flashes.



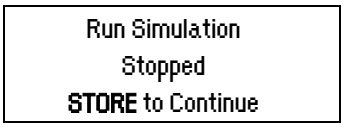
5. Press ▶. The MVS simulates running. The Run LED stays on without flashing and the bypass contactor closes (if installed).



6. Press STOP or activate the stop input. The MVS 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.

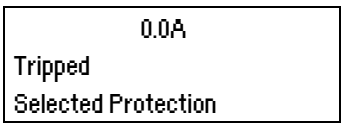
NOTE
Run simulation can be exited at any stage by pressing the ◀.

- Protection Simulation

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

To use the protection simulation:

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



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

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

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

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

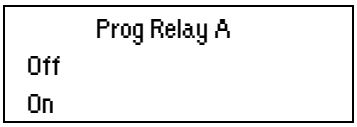
- Output Signal Simulation

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

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

To use the output signal simulation:

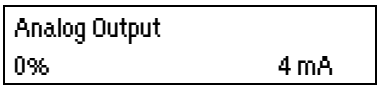
1. Open the Commissioning Menu.
2. Scroll to Output Signalling Simulation and press ▶.
3. Use the ▲ and ▼ buttons to select a function to simulate, then press ▶.
4. Use the ▲ and ▼ buttons to turn the signal on and off. To confirm correct operation, monitor the state of the output.



5. Press ◀ to return to the simulation list.

- Analog Output Simulation

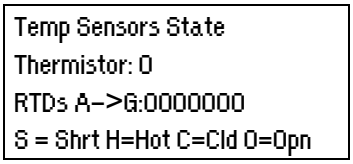
The analog output simulation uses the ▲ and ▼ buttons to change the analog output current at terminals B10, B11 of the Controller.



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

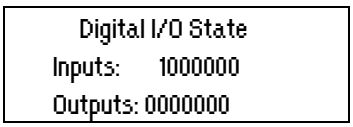
This screen shows the state of the motor thermistors and RTD/PT100s.



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

- Digital I/O State

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

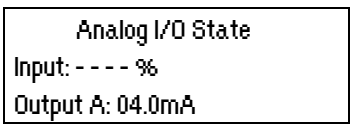


The top line of the screen shows the start, stop, reset and programmable inputs A and B, then '00'. The screen shows input C23~C24 closed with all other inputs open.

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

- Analog I/O State

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



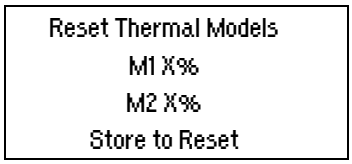
NOTE
Input is not supported by this product and this screen will always indicate Input: - - - - %

- **Reset Thermal Models**

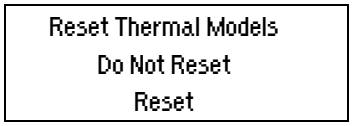
The MVS's advanced thermal modelling software constantly monitors the motor's performance. This allows the MVS to calculate the motor's temperature and ability to start successfully at any time.

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

1. Open the Commissioning Menu.
2. Scroll to Reset Thermal Models and press ▶.
3. At the confirmation prompt press STORE to confirm or ◀ to cancel the action. You may have to enter your access code.



4. Select Reset and press ▶.
   Selecting Do Not Reset returns to previous screen.



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

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

9.2 Low Voltage Test Mode

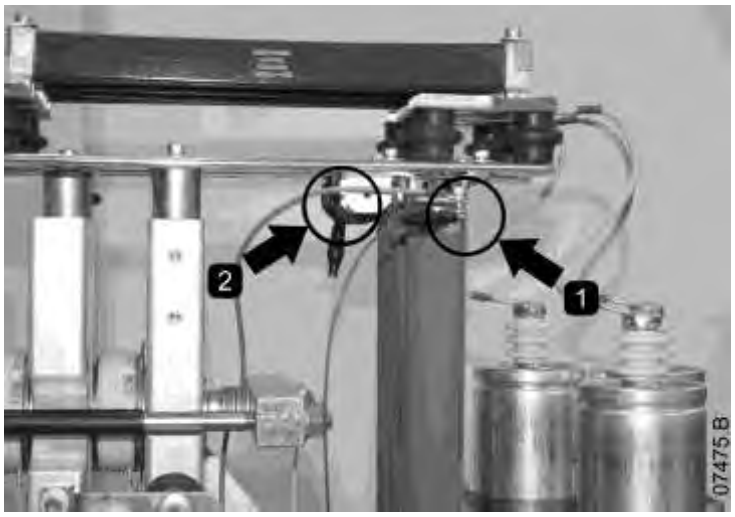
The MVS can be connected to a low voltage motor (≤ 500 VAC) for testing. This allows the user to thoroughly test the soft starter and its associated power and control circuits. The low voltage test mode provides a means of testing the soft starter's configuration without requiring a full medium voltage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

For models V06 and higher, one non-conduction resistor assembly must be connected to each phase arm (three assemblies are supplied with the soft starter). The non-conduction resistor assembly is not required for models V02 ~ V04.

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.

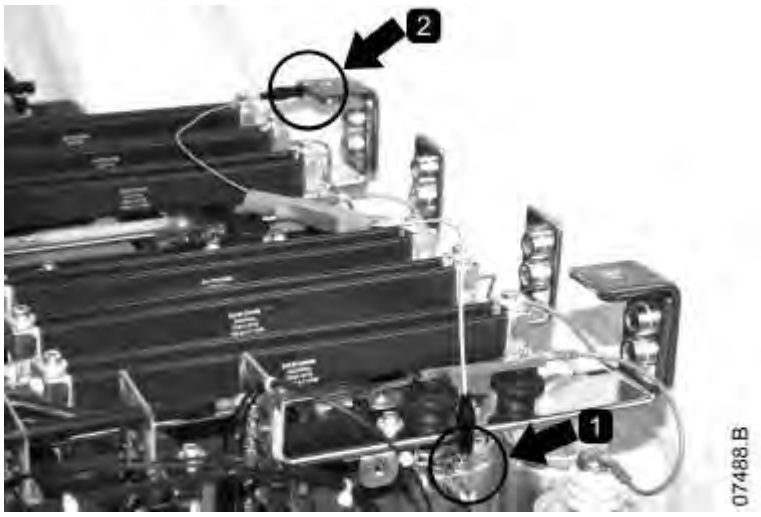
MVSxxxx-V06, V07

1. Clip one end of the resistor assembly to the bolt on the non-conduction PCB. The non-conduction PCB is located on the side of the phase arm, at the top of the long round grading resistor (on the left hand side of the phase arm when viewed from the back). There is a small steel bracket just in front of the PCB.
2. Pass the other end of the assembly through the phase arm, in front of the three grading resistors, and clip it to the steel bracket in front of the grading resistor on the other side of the phase arm (this bracket looks the same as the bracket in front of the non-conduction PCB).



MVSxxxx-V11, V13

1. Clip one end of the resistor assembly to the bolt on the non-conduction PCB (do not connect to earth bolt, ie green/yellow wire). The non-conduction PCB is located on the side of the phase arm, at the top of the long round grading resistor (on the left hand side of the phase arm when viewed from the back).
2. Pass the other end of the assembly over the phase arms and clip it to the bus bar at the other side of the phase arm.



WARNING
After low voltage mode testing, ensure that the non-conduction resistor assembly is removed from each phase arm before connecting the soft starter to a medium voltage motor. If the non-conduction resistor assemblies remain on the phase arms, the soft starter may suffer severe damage.

To operate the MVS in low voltage test mode:

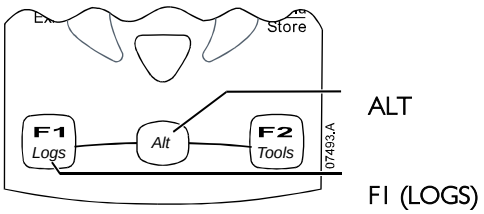
1. Isolate the soft starter from the motor and the mains supply.
2. Connect one non-conduction resistor assembly to each phase arm.
3. Connect T1, T2, T3 of the soft starter to a three phase motor with full load current of 5 ~ 20 A. Connect L1, L2, L3 of the soft starter to three phase mains supply with voltage less than 500 VAC (frequency 50 Hz or 60 Hz).
4. Set parameter 1A *Motor Full Load Current* to the value shown on the motor name plate.
5. Switch on control and mains supply, and use the MVS 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. Remove the non-conduction resistor assembly from each phase arm.

Section 10 Monitoring

10.1 Logs Menu

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

To open the Logs Menu, press ALT then 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 11 Operation

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

11.1 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.

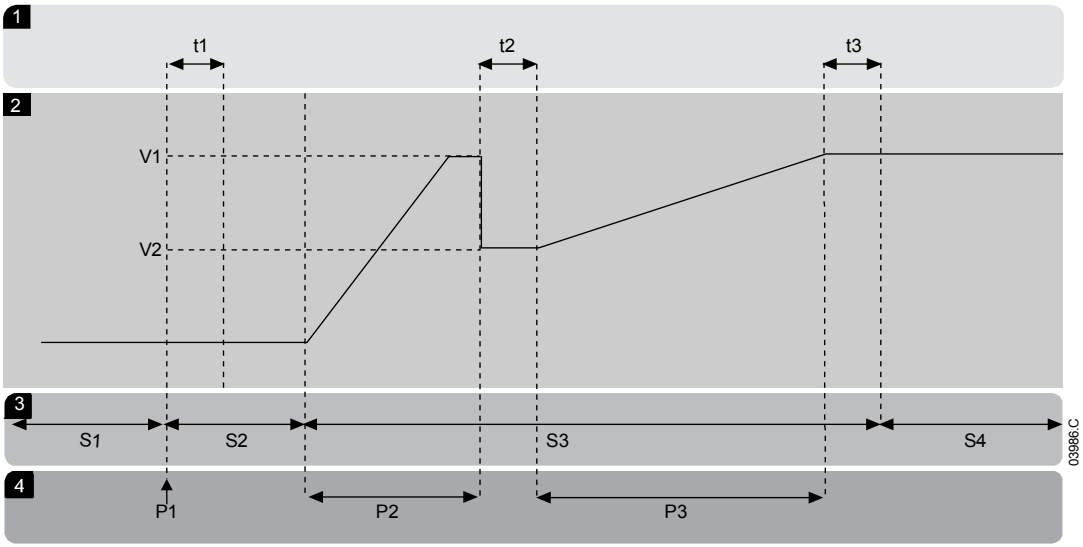
To stop the motor, press the STOP button on the Controller or activate the Stop remote input. The motor will stop using the stop mode selected in parameter 2H.

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.

11.2 Using the MVS to Control a Slip-Ring Motor

The MVS 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

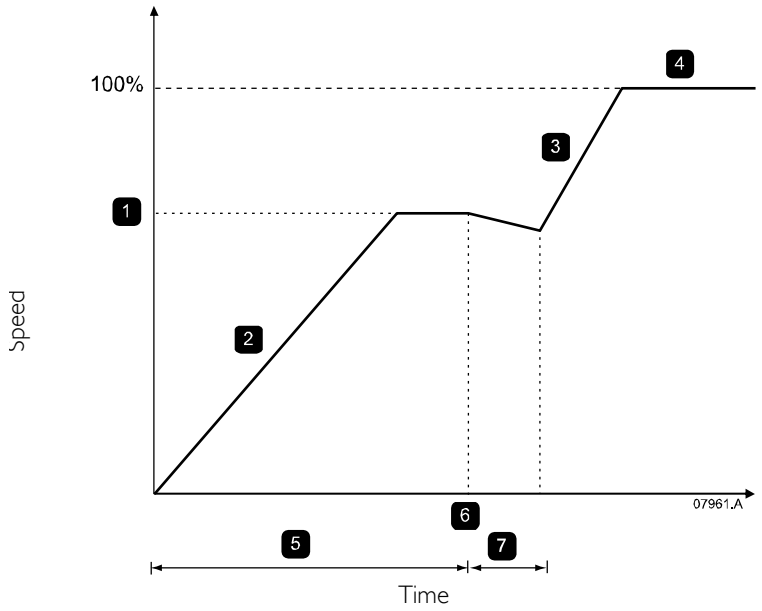
3	States
S1	Ready
S2	Pre-start tests
S3	Starting
S4	Running
4	Phases of operation
P1	Start command
P2	Rotor resistance current ramp
P3	Shorted rotor current ramp

Commissioning

1. Configure the MVS 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.

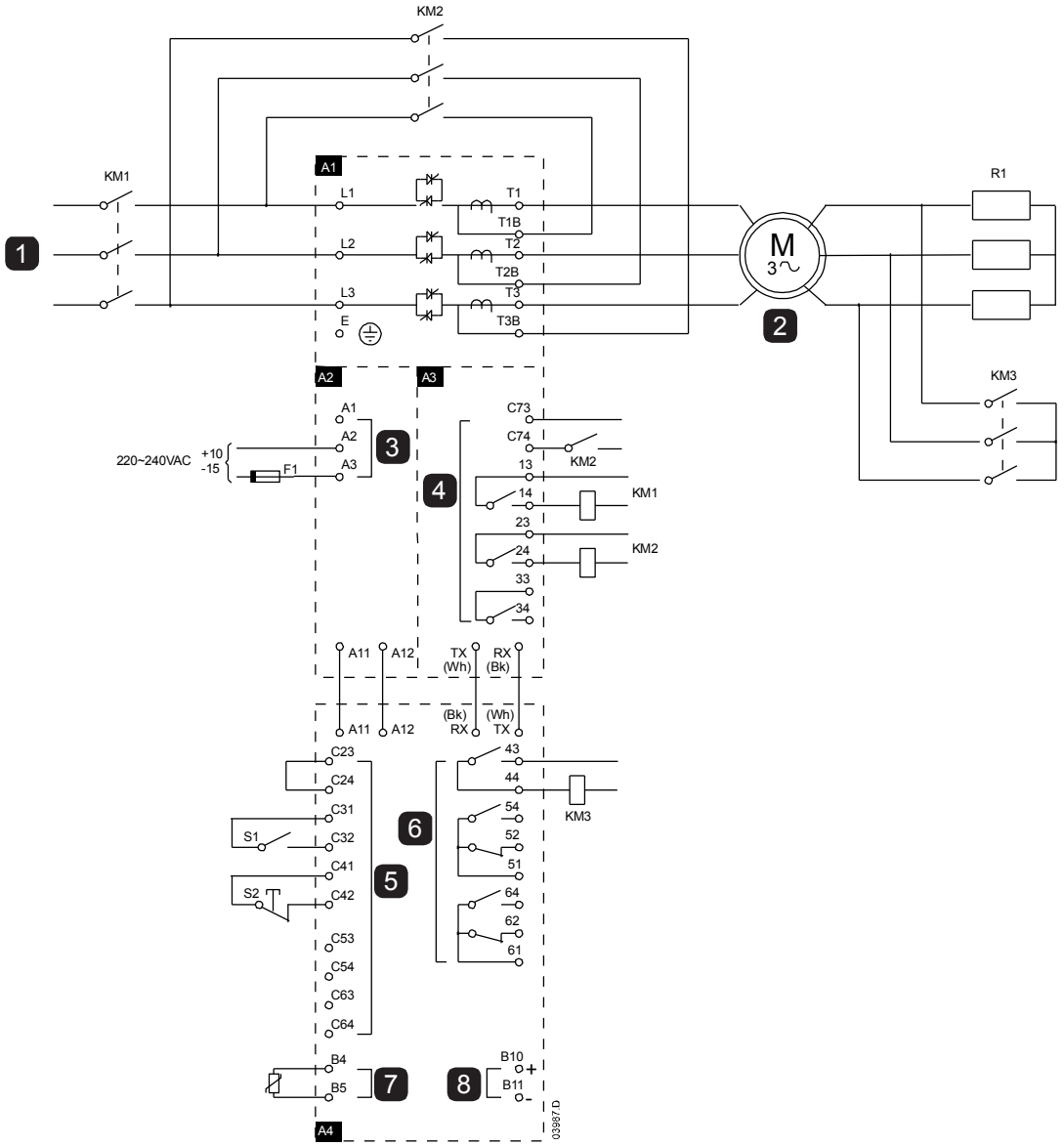
2. Start the motor under normal load conditions and record the time it takes to reach a constant speed with external rotor resistance (R1) in the circuit. Stop the motor soon after a constant speed has been reached. Change parameter 7B to the recorded time value.
3. Start the motor under normal load 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 primary motor settings with constant current start method (parameter 2A *Start Mode*).

Slip-Ring Motor Connection



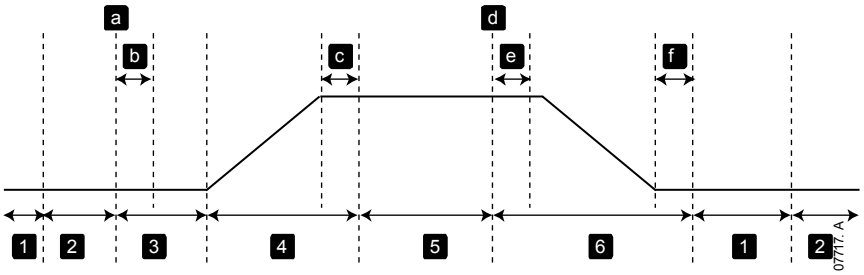
A1	Power assembly
1	3 Phase 50/60 Hz Supply
KM1	Main contactor
KM2	Bypass contactor
2	Motor
R1	Rotor Resistance
KM3	Changeover contactor
A2	Control voltage terminals
3	Control supply
A3	Power interface PCB
4	Relay outputs
C73~C74	Bypass contactor feedback signal
13~14	Main contactor KM1
23~24	Bypass contactor KM2
33~34	Run relay output

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

11.3 Operating States

Start and Run States

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



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

Trip States

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

- **Trip while starting (bypass contactor not yet closed)**

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

- **Trip while running (bypass contactor closed)**

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

- **Instantaneous Overcurrent Stage 2 trip**

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

11.4 Motor Protection

Motor, System and Soft Starter Protection Mechanisms

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

- Protection Coordination

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

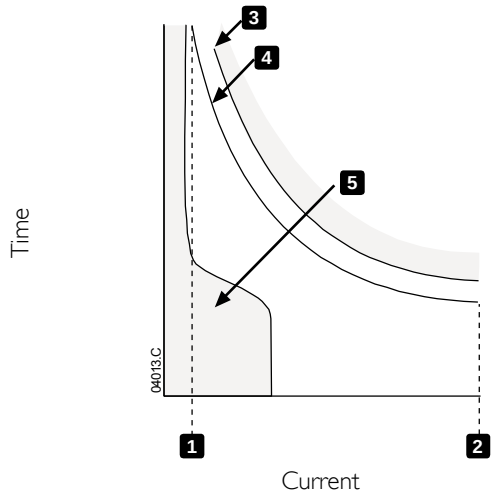
When using fuse and main contactors, set the upstream circuit breaker protection parameters according to the ratings for fuse and contactor. The contactor must not open if the current is above its maximum breaking current value. The fuse must act first or the upstream breakers instantaneous trip level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

If using circuit breakers only, set the maximum instantaneous trip time < 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 MVS offers thermal model motor overload protection which monitors the performance of the motor and calculates its temperature in all states. This protection is based on the motor information programmed in parameter groups 1 and 9, and the thermal model adjusts itself according to the motor's recent operating history (including temperature rise from previous operation).



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

Motor Thermal Model Protection Set-up

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

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

11.5 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%          000.0kW
```

- Programmable screen

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

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

- Motor Temperature

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

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

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

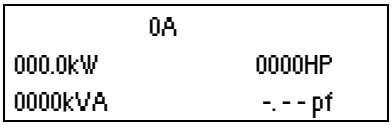
- Current monitoring screen

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

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

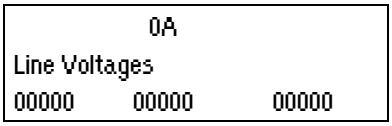
- Motor Power

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



- Voltage

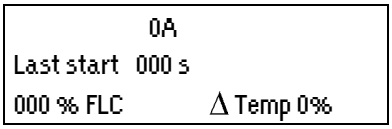
The voltage screen shows real-time line voltage across each phase.



- Last Start Information

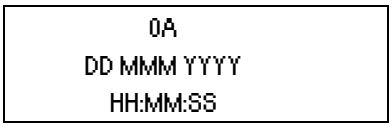
The last start information screen shows details of the most recent successful start:

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



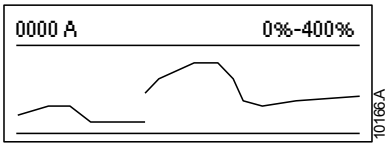
- Date and Time

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 59.



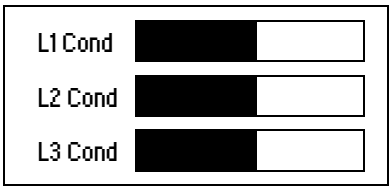
- Performance Graph

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 12 Troubleshooting

The MVS 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 MVS reports in detail on the starter's own state. Any internal failure will cause the soft starter to trip, and full details will be recorded in the trip log and event log.

12.1 Protection Responses

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

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

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

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

12.2 Trip Messages

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

Error Message	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. Related parameters: 16M
Bypass fail (bypass contactor)	The bypass contactor has welded closed or is not operating correctly. There may be a problem with the control circuit or the contactor coil. Check the condition of the bypass contactor's main poles. Check the operation of the contactor control circuitry and contactor coil. This trip is not adjustable.  NOTE You can use the Run Simulation to check the bypass contactor's operation without mains voltage connected.
Cond 1 Invalid Cond 2 Invalid Cond 3 Invalid	There is a problem with the SCR firing or feedback system. • Check that the fibre-optic cables between the power interface PCB and the MVS is properly connected. • The value of the grading resistor may not be suitable for the nominal mains voltage. If you are using a low voltage motor for testing purposes, contact your local supplier for advice. This trip is not adjustable.
Current imbalance	Current imbalance can be caused by problems with the motor, the environment or the installation, such as: • An imbalance in the incoming mains voltage • A problem with the motor windings • A light load on the motor • A phase loss on input terminals L1, L2 or L3 during Run mode An SCR that has failed open circuit. A failed SCR can only be definitely diagnosed by replacing the SCR and checking the starter's performance. Related parameters:4H, 4I, 16E
EEPROM fail	• An error occurred loading data from the EEPROM to RAM when the Controller powered up. • "Load User Set" has been selected but no saved file is available. Reset the fault and then reload the default settings. If the problem persists, contact your local distributor. Related parameters: None

Excess start time	The motor was unable to accelerate to full speed in the time allowed. Excess start time trip can occur in the following conditions: • parameter 1A *Motor Full Load Current* is not appropriate for the motor • parameter 2D *Current Limit* has been set too low • parameter 2B *Start Ramp Time* has been set greater than the setting for 4A *Excess Start Time* setting • The motor may have experienced an abnormal increase in loading or might be jammed. Related parameters:1A, 2A-2D, 4A, 16B
Frequency (Mains supply)	The mains frequency has gone beyond the specified range. Check for other equipment in the area that could be affecting the mains supply, particularly variable speed drives and switch mode power supplies (SMPS). If the MVS is connected to a generator set supply, the generator may be too small or could have a speed regulation problem. Related parameters:4J, 4K, 4L, 16F
Ground fault	Ground current (monitored through a dedicated current transformer) has exceeded the selected level. Test the insulation of the output cables and the motor. Identify and resolve the cause of any ground fault. Related parameters: 4O, 4P, 16N
Heatsink overtemperature	The soft starter is operating at a dangerously high temperature. • Check if ventilation and cooling are adequate. • Reduce the number of consecutive starts by increasing the value set in parameter 4M *Restart Delay*. Related parameters: 4M
Input A trip	Identify and resolve the condition which caused Input A to activate. Related parameters: 6A, 6B, 6C, 6D, 6E, 16G
Input B trip	Identify and resolve the condition which caused Input B to activate. Related parameters: 6F, 6G, 6H, 6I, 6J, 16H
Instantaneous overcurrent	There has been a sharp rise in motor current, probably caused by a locked rotor condition (shearpin) while running. This may indicate a jammed load. A trip may also occur when a medium level fault current has been detected. This may indicate a system short circuit. Related parameters: 4E, 4F, 16D
Instantaneous overcurrent S2	There has been a sharp rise in output current, possibly caused by a short circuit condition. Identify and resolve the cause of the fault. Related parameters: 4U, 4V, 16D
Int Comms Fail	Communication has failed between the Controller and the power interface PCB. • Check that the Controller is receiving control voltage within the specified range (terminals A11, A12). • Check that the fibre-optic cables between the Controller and the interface PCB are firmly connected. • Check that each fibre-optic cable is emitting light at the Rx end. This trip is not adjustable.
Internal fault	The MVS has tripped on an internal fault. Contact your local supplier with the fault code (X). Related parameters: None
L1 phase loss **L2 phase loss** **L3 phase loss**	During pre-start checks the starter has detected a phase loss as indicated. In run state, the starter has detected that the current on the affected phase has dropped below 3.3% of the programmed motor FLC for more than 1 second, indicating that either the incoming phase or connection to the motor has been lost. Check the supply and the input and output connections at the starter and at the motor end. Phase loss can also be caused by a failed SCR, particularly an SCR that has failed open circuit. A failed SCR can only be definitely diagnosed by replacing the SCR and checking the starter's performance. Related parameters: None
L1-T1 shorted **L2-T2 shorted** **L3-T3 shorted**	During prestart checks the starter has detected a shorted power assembly or a short within the bypass contactor as indicated. This trip is not adjustable.
Low Control Volts	Control voltage to the Controller has dropped below the required level. This trip is not adjustable.

Motor connection	There is a problem with the soft starter's connection to the motor. If only one phase is affected, the error message will indicate which phase (T1, T2, T3). • Ensure the motor is connected to terminals T1, T2, T3 using in-line (three wire) connection. The MVS does not support inside delta (six wire) connection. • Check that the fibre-optic cables between the power interface PCB and the MVS are firmly connected. • Check each output phase of the soft starter for power circuit continuity. This trip will also occur when there is a phase imbalance across the soft starter's input terminals L1, L2, L3. Related parameters: None
Motor connection Tx	Where 'X' is 1, 2 or 3. The motor is not connected correctly to the soft starter for in-line or inside delta use. • Check individual motor connections to the soft starter for power circuit continuity. • Check connections at the motor terminal box. This trip is not adjustable. Related parameters: None
Motor overload (thermal model)	The motor has reached its maximum thermal capacity. Overload can be caused by: • The soft starter protection settings not matching the motor thermal capacity • Excessive starts per hour • Excessive throughput • Damage to the motor windings Resolve the cause of the overload and allow the motor to cool. Related parameters: 1A, 1B, 1C, 1D, 9B, 16A
Motor thermistor	The external resistance across the motor thermistor input (terminals B4, B5) has exceeded 2.4 kΩ. • If the starter tripped at power-up, no thermistor is present at terminals B4, B5. If you are not using a thermistor, you must attach a link across terminals B4-B5. • If the starter tripped during operation, the temperature of the motor winding has increased. Resolve the cause of the overheating. Related parameters: 16I
Network communication (between module and network)	The network master has sent a trip command to the starter, or there may be a network communication problem. Check the network for causes of communication inactivity. Related parameters: 16K
Overvoltage	There has been a voltage surge on the mains. Causes can include problems with a transformer tap regulator or off-loading of a large transformer load. • Check that the starter is configured appropriately for local conditions. • Monitor the mains voltage to determine the cause of the voltage fluctuation, and resolve the cause. Related parameters: 4S, 4T, 16W
Phase sequence	The phase sequence on the soft starter's input terminals (L1, L2, L3) is not valid. Check the phase sequence on L1, L2, L3 and ensure the setting in parameter 4G is suitable for the installation. Related parameters: 4G
Power loss/Power circuit	The starter is not receiving mains supply on one or more phases when a Start Command is given. • Check that the main contactor closes when a start command is given, and remains closed until the end of a soft stop. • Check MVS fuses and confirm that all three mains supply phases are present. This trip is not adjustable.
Starter communication (between module and soft starter)	There could be a problem with the connection between the soft starter and the optional communications module. Remove and reinstall the module. If the problem persists, contact your local distributor. The communications module has been powered down while the soft starter remains powered up. Related parameters: 16J
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. 4C, 4D, 16C

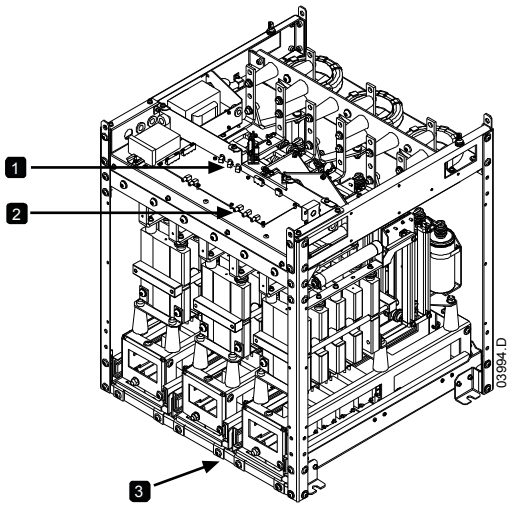
Undervoltage	Mains voltage has fallen below the level selected in parameter 4Q. Causes can include an undersized supply or adding a large load to the system. • Check that the starter is configured appropriately for local conditions. • Monitor the mains voltage to determine the cause of voltage fluctuation. Related parameters: 4Q, 4R, 16V
VZC Fail Px	Where 'X' is 1, 2 or 3. The voltage detection system has failed. The voltage dividing resistors have failed or the power interface PCB may be faulty. Contact AuCom for advice.

LED locations

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

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

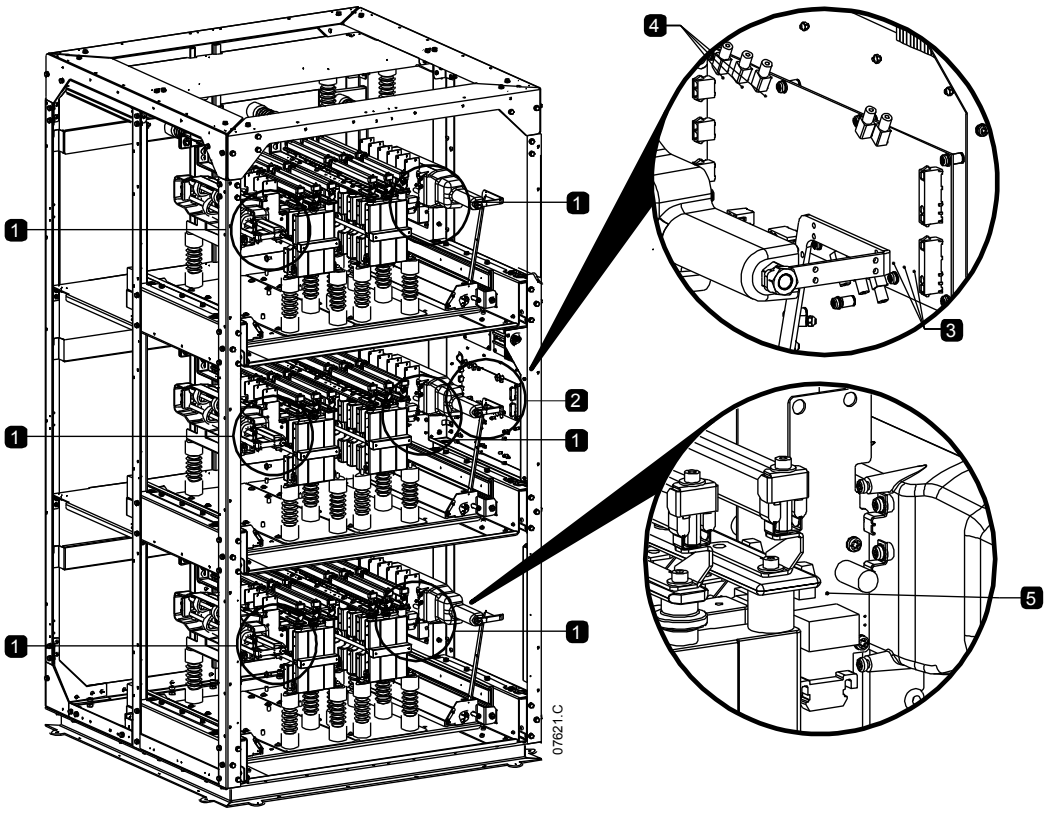
MVS (models V02 ~ V07)



1	Firing LEDs (Red)
2	Non-conduction LEDs (Green)

3	Gate Drive PCB's, Gate Drive Adaptor PCB's and Gate Drive Firing PCB's

MVS (models V11 and V13)



1	Location of Gate Drive Firing PCB
2	Location of Power Interface PCB
3	Power Interface Firing LEDs (Red)

4	Non-conduction LEDs (Green)
5	Gate Drive Firing LEDs

12.3 General Faults

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

Symptom	Probable Cause
The soft starter does not respond to the START or RESET button on the Controller.	• The soft starter may be in Remote control mode. When the soft starter is in Remote control mode, the Local LED on the starter is off. Press the LCL/RMT button once to change to Local control.
The soft starter does not respond to commands from the control inputs.	• The soft starter may be in Local control mode. When the soft starter is in Local control mode, the Local LED on the starter is on. Press the LCL/RMT button once to change to Remote control. • The control wiring may be incorrect. Check that the remote start, stop and reset inputs are configured correctly (refer to *Control Wiring* for details). • The signals to the remote inputs may be incorrect. Test the signalling by activating each input signal in turn. The appropriate remote control input LED should activate on the starter.
The soft starter does not respond to a start command from either the local or remote controls.	• The soft starter may be waiting for the restart delay to elapse. The length of the restart delay is controlled by parameter 4M *Restart Delay*. • The motor may be too hot to permit a start. If parameter 4N *Motor Temperature Check* is set to Check, the soft starter will only permit a start when it calculates that the motor has sufficient thermal capacity to complete the start successfully. Wait for the motor to cool before attempting another start. • The 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 MVS will not start. If the emergency stop situation has been resolved, close the circuit on the input. NOTE Parameter 6Q *Local/Remote* controls when the LCL/RMT button is enabled.
Motor does not reach full speed.	• If the start current is too low, the motor will not produce enough torque to accelerate to full speed. The soft starter may trip on excess start time. NOTE Make sure the motor starting parameters are appropriate for the application and that you are using the intended motor starting profile. If parameter 6A or 6F is set to Motor Set Select, check that the corresponding input is in the expected state. • The load may be jammed. Check the load for severe overloading or a locked rotor situation.
Erratic motor operation.	• The SCRs in the MVS require at least 5 A of current to latch. If you are testing the soft starter on a motor with full load current less than 5 A, the SCRs may not latch correctly.
Soft stop ends too quickly.	• The soft stop settings may not be appropriate for the motor and load. Review the settings of parameters 2H, 2I, 10H and 10I. • If the motor is very lightly loaded, soft stop will have limited effect.
Remote start/stop command is overriding Auto Start/Stop settings when using remote 2-wire control.	• Auto Start/Stop function should only be used in Local mode or in Remote mode with 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 EXIT, the change will not be saved. • Check that the adjustment lock (parameter 15B) is set to *Read & Write*. If the adjustment lock is set to *Read Only*, settings can be viewed but not changed. You need to know the security access code to change the adjustment lock setting. • The EEPROM may be faulty on the Controller. A faulty EEPROM will also trip the soft starter, and the Controller will display the message Parameter Out Of Range. Contact your local supplier for advice.
Starter reports "Power On" when Run Simulation is activated.	• The soft starter will not activate Run Simulation with three-phase power connected. This prevents unintentional direct on-line (DOL) start.

Section 13 Maintenance

13.1 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 MVS	Cleanliness	Every 2 years

13.2 Tools required

MVS starters can be serviced with the following tools:

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

13.3 Thermal Image

After completing commissioning of the MVS 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.

13.4 Contactor Maintenance

Refer to your contactor manual for operation and maintenance instructions.

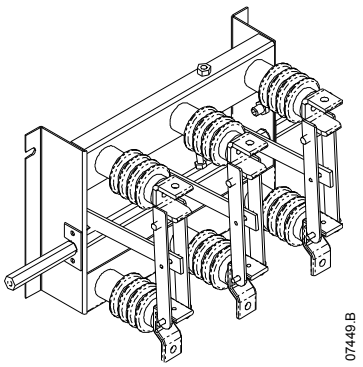
1. As part of normal operation, run the withstand voltage test at not less than half the rated test value.
2. Follow the manufacturer's maintenance instructions and check the torque values on all connections.

13.5 Isolation Switch Maintenance

WARNING
Do not operate the switch while current is flowing (motor or capacitor).
The isolation switch is designed for use in an AuCom MVS panel and it is not designed for outdoor use.
The isolation switch must be installed with a breaker or similar device on the supply side to limit the prospective fault energy. Fuses must be used on the motor side of the switch.

1. Isolate the power supply before beginning any work on the isolation switch.
2. Inspect the switch contacts for signs of wear. If there is evidence of wear, contact your local supplier for replacement parts.
3. Check that the microswitch activates when removing the isolator locking pin.
4. With the switch in the closed position check the contact resistance for each pole of the switch.

5. Use a lint-free cloth to clean the isolation switch. Warm soapy water may be necessary in cleaning.
6. Wipe the main contacts and main arms with Electrolube (Electrolube part # CG35A) at points of contact.



Adjust to less than 60 μΩ (micro ohms)

13.6 Phase Arm Assembly Alignment (models V11 and V13)

The phase arm locates itself at the fully withdrawn state when sliding in and out of the frame.

During the commissioning process, during maintenance and when installing a phase arm check the phase arm alignment.

WARNING
Do not extend more than one phase arm at any one time.

NOTE
Torque all bolts after alignment.

1. Loosen both rear bus bar captive bolts and four (4) domed socket head cap screws on the rear of the phase arm. The bus bar captive bolts are loose at the point of resistance.

2. Loosen the phase block mounting bolts on both sides of the phase assembly that hold it to the tray.
3. Remove the phase arm locking nuts on both sides.

4. Slide out the phase arm assembly.
5. Slide in the phase arm assembly to check alignment.
6. Align the phase block on left or right as required.
7. Align and secure the main phase connection captive bolts.
8. Tighten locking rod on both sides to 10 Nm.
9. Tighten nut and washer on both sides of the phase arm to 10 Nm.
10. Secure dome head bolts (nip and secure) on the bus work to 30 Nm.
11. Secure the cap head dome bolts on the phase blocks. Torque to 12 Nm.
12. Re-adjust if required by repeating steps 3-10 above.

13.7 Removing Phase Arms (models V11 and V13)

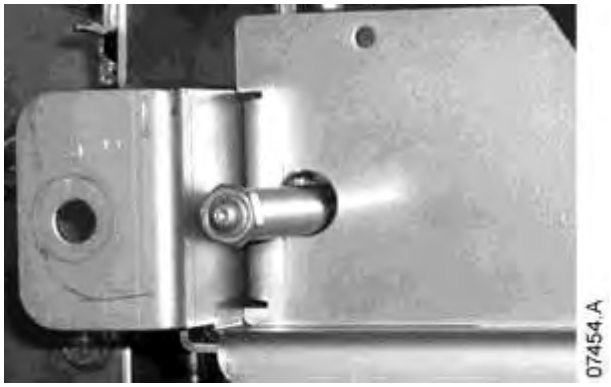
WARNING
Do not extend more than one phase arm at any one time.

1. Undo the two phase connection bolts at the rear of the phase arm.

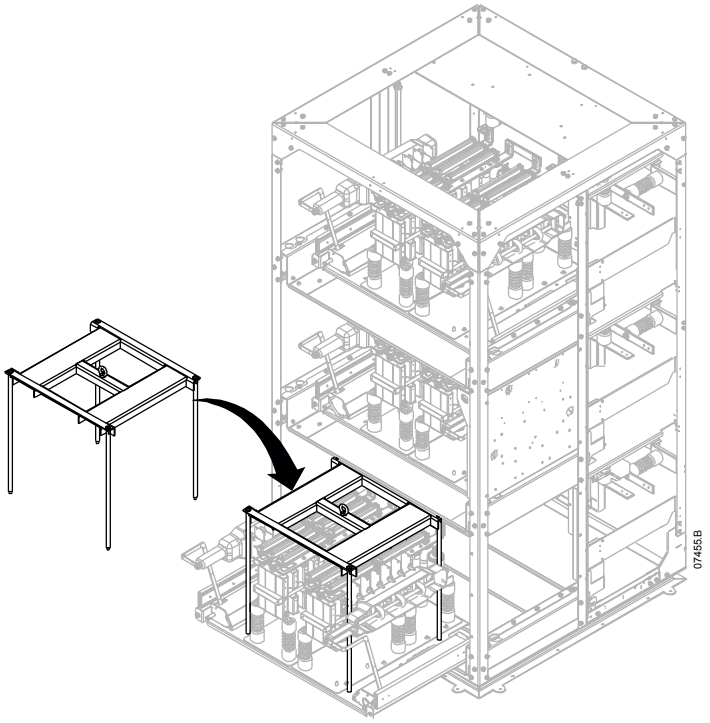
2. Remove the nut and washer and undo the rod bolt on both sides.
3. Unplug the controls on the right hand side.

4. On both sides, remove the nut and washer and undo the rod bolt.

5. Withdraw the phase arm.



Removing Phase Arms with a Lifting Frame



To remove a phase arm with a forklift:

1. Slide the phase arm out from the panel.
2. Place the lifting frame on the phase arm and tighten bolts.
3. Position the forks at 210 mm from fork to fork.
4. Taking care not to touch any other components, slowly slide the forks into the fork guide slot under the lifting frame.
5. Raise forks slightly to allow frame to clear location holes.
6. Remove the phase arm.

To remove a phase arm using a hoist:

1. Slide the phase arm out from the panel.
2. Secure a cable from the hoist to the lifting eye
3. Lift the phase arm slowly, stabilising the phase arm to prevent it spinning.

NOTE
Lifting Frame Assembly (part no: 995-06391-00) is required for this.

Section 14 Appendix

14.1 Parameter Defaults

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

1	Primary Motor Settings	User Set 1	User Set 2	Default
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%
10I	*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			

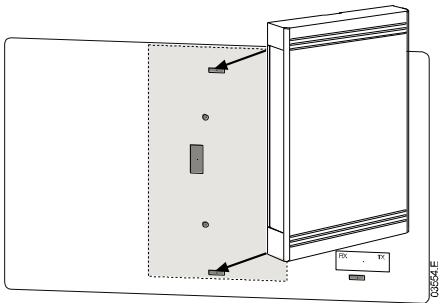
14.2 Accessories

Communication Modules

MVS 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 MVS, 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 MVS Accessories

Other accessories available to enhance your MVS starter include:

- RTD protection relay
- Motor protection relay (external to MVS)
- 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.

710-13937-00A

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