

Service Guide

VLT® Soft Starter MCD 600



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1 Introduction

1.1 Purpose of this Service Guide

The purpose of this manual is to provide detailed technical information and instructions to enable an authorized technician to identify faults and perform repairs on VLT® Soft Starter MCD 600 drives.

The service guide includes the following information:

- Data for the different enclosure sizes.
- Description of user interfaces and internal processing.
- Troubleshooting and test instructions.
- Assembly and disassembly instructions.

1.2 Additional Resources

Other resources are available to understand advanced soft starter functions and programming.

- VLT® Soft Starter MCD 600 Operating Guide.
- Operating guides for operation with optional equipment.
- Installation guides for installing various accessories.

Supplementary publications and manuals are available from www.danfoss.com/en/search/?filter=type%3Adocumentation.




1.3 Document Version

This manual is regularly reviewed and updated. All suggestions for improvement are welcome.

Table 1: Document Version

Edition	Remarks
AX272231952447	Initial version.

1.4 Approvals and Certifications

		
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2 Safety

2.1 Safety Symbols

The following symbols are used in this manual:

⚠ DANGER ⚠

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING ⚠

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION ⚠

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

⚠ NOTICE ⚠

Indicates a property damage message.

2.2 Qualified Personnel

Correct and reliable transport, storage, installation, operation, and maintenance are required for the trouble-free and safe operation of the soft starter. Only qualified personnel are allowed to install or operate this equipment.

Qualified personnel are defined as trained staff, who are authorized to install, commission, and maintain equipment, systems, and circuits in accordance with pertinent laws and regulations. Also, the qualified personnel must be familiar with the instructions and safety measures described in this manual.

2.3 Safety Precautions

Safety precautions 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 before installing, operating, or maintaining the equipment.
- Follow good electrical practice including applying appropriate personal protective equipment.
- Seek advice before operating this equipment in a manner other than described in this manual.

⚠ NOTICE ⚠

The VLT® Soft Starter MCD 600 is not user serviceable. The unit should only be serviced by authorized service personnel. Unauthorized tampering with the unit voids the product warranty.

⚠ WARNING ⚠**PROPER GROUNDING**

It is the responsibility of the installer of the soft starter to provide proper grounding and branch circuit protection according to local electrical safety codes. Not providing proper grounding and branch circuit protection may lead to death, personal injury, or equipment damage.

- Disconnect the soft starter from mains voltage before carrying out repair work.

⚠ WARNING ⚠**UNINTENDED START**

When the soft starter is connected to AC mains, DC supply, or load sharing, the motor can start at any time. Unintended start during programming, service, or repair work can result in death, serious injury or property damage. The motor can start with an external switch, a fieldbus command, an input reference signal from the LCP, or after a cleared fault condition.

- Press [Off/Reset] on the LCP before programming parameters.
- Disconnect the soft starter from the mains.
- Completely wire and assemble the soft starter, motor, and any driven equipment before connecting the soft starter to AC mains, DC supply, or load sharing.
- Fit the power supply to the soft starter with an isolating switch and a circuit-breaking device (for example a power contactor) controllable through an external safety system (for example an emergency stop or a fault detector).

⚠ CAUTION ⚠**POWER FACTOR CORRECTION**

Connecting power factor correction capacitors to the output side will damage the soft starter.

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

⚠ CAUTION ⚠**SHORT CIRCUIT**

The VLT® Soft Starter MCD 600 is not circuit proof.

- After severe overload or short circuit, the operation of the MCD 600 should be fully tested by an authorized service agent.

⚠ CAUTION ⚠**MECHANICAL DAMAGE FROM UNEXPECTED RESTART**

The motor could restart after the causes of a shutdown are rectified, which may be dangerous for certain machines or installations.

- Ensure that appropriate arrangements are made against restarting after unscheduled stops of the motor.

⚠ WARNING ⚠**SAFETY OF PERSONNEL**

The soft starter is not a safety device and does not provide electrical isolation or disconnection from the supply.

- If isolation is required, the soft starter must be installed with a main contactor.
- Do not rely on the start and stop functions for safety of personnel. Faults occurring in the mains supply, the motor connection, or the electronics of the soft starter can cause motor starts or stops.
- If faults occur in the electronics of the soft starter, a stopped motor may start. A temporary fault in the mains supply or loss of motor connection can also cause a stopped motor to start.
- To provide safety of personnel and equipment, control the isolation device through an external safety system.

⚠ NOTICE ⚠

- Before changing any parameter settings, save the current parameter set to a file using MCD PC Software or the Save User Set function.

⚠ NOTICE ⚠

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

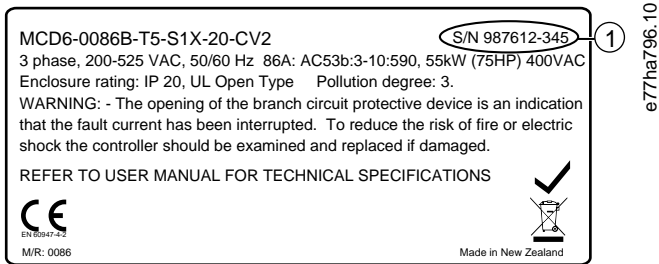
Disclaimer

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. Responsibility or liability is never accepted for direct, indirect, or consequential damage resulting from the use or application of this equipment.

3 Identifying Serial Number and Version

3.1 Unit Serial Number and Version

The serial number is on the nameplate on the soft starter. The soft starter version number is the last 2 digits of the 1st part of the serial number (xxxxVV-xxx).



1 Serial number

Illustration 1: Nameplate

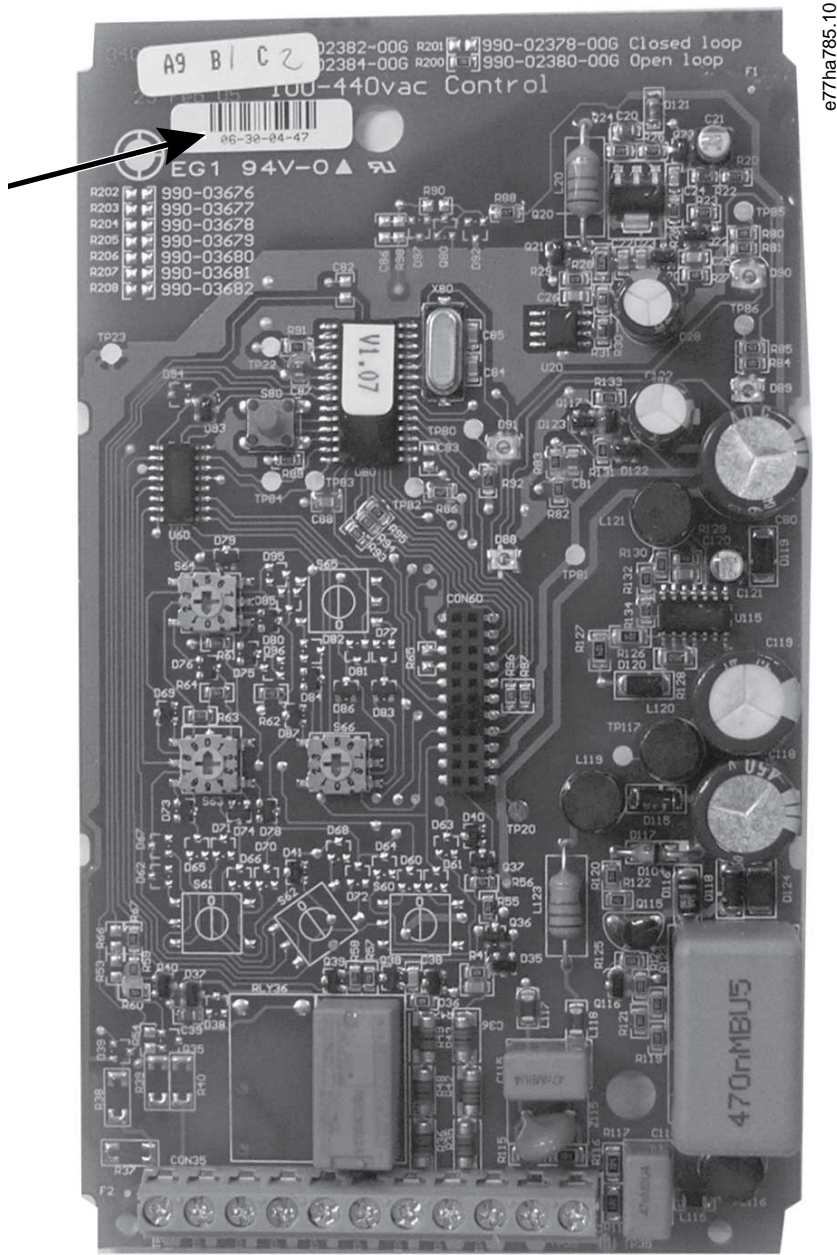
3.2 Date of Manufacture

The date of manufacture is the last 3 digits of the unit serial number (XXXXXX-WWY).

- Y shows the last digit of the year of manufacture (1 is 2001, 2011, 2021).
- WW shows the number of the week within that year.

3.3 PCB Serial Number

Each PCB is labeled with an individual serial number. For boards with a barcode, the serial number is written below the barcode. For boards with no barcode, the serial number is a 6-digit number on a white label.



e77ha785.10

Illustration 2: PCB with Barcode

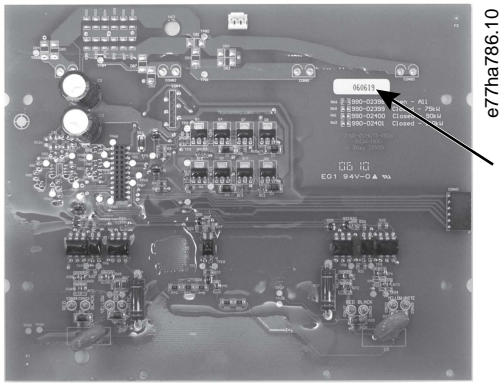


Illustration 3: PCB with No Barcode

4 Diagnostics

4.1 Power Circuit Test

Context:

This procedure tests the power circuit, including the SCRs, motor control board, and user interface board.

Prerequisites:

⚠ NOTICE ⚠

Before changing any parameter settings, save the current parameter set to a file using MCD PC software or the soft starter's Save User Set function (see VLT® Soft Starter MCD 600 Operating Guide).

Procedure

1. Isolate the soft starter from the incoming mains supply and the motor, and remove the control voltage.
2. Using a 500 V DC insulation tester on the 200 Ω scale or a standard multimeter, check the resistance across the phase of the soft starter in both directions.
 - A Test L1/1 to 2/T1, 2/T1 to 1/L1, 3/L2 to 4/T2, 4/T2 to 3/L2, 5/L3 to 6/T3 and 6/T3 to 5/L3.

The readings should be similar on all phases in both directions. If any reading is less than 200 Ω , the SCR or internal bypass has failed short circuit and must be replaced.

4.2 Basic Functionality Test

Prerequisites:

⚠ NOTICE ⚠

Before changing any parameter settings, save the current parameter set to a file using MCD PC software or the soft starter's Save User Set function (see VLT® Soft Starter MCD 600 Operating Guide).

Procedure

1. Remove all external wiring from the soft starter control inputs.
2. Connect the control supply according to the supply voltage being used.
 - MCD6-xxxxB-xx-CV2 (110–120 V AC): A8, A9.
 - MCD6-xxxxB-xx-CV2 (220–240 V AC): A7, A9.
 - MCD6-xxxxB-xx-CV1 (24 V AC/V DC): A8, A9.
3. The LCP should show the welcome message. The Ready, Run, Trip, and Local LEDs should illuminate.

If the LCP or LEDs do not illuminate, replace the user interface board.

If the Ready LED flashes and the screen shows the message *Not Ready*, the reset input may be active. Check the setting of parameter 7-9 Reset/Enable Logic.

4.3 Review the Event Log

The event log stores details about the 384 most recent events (actions, warnings, and trips). For trips, the log also includes details such as supply voltage and frequency, and current to the motor.

- Select *Menu*⇒*Logs*⇒*Event log*.
- To export the event log as a CSV file for analysis away from the soft starter, select *Menu*⇒*USB Save & Load*⇒*Save Params and Logs*.

4.4 Run Simulation Test

Context:

The run simulation simulates a motor starting, running, and stopping. The test can help identify faults within the soft starter.

- If the soft starter does not respond to commands correctly, the user interface board may be faulty.
- If the internal bypass does not open and close, the internal bypass or power circuit may be faulty.

Prerequisites:

⚠ NOTICE ⚠

The simulation is only available when the soft starter is in ready state.

⚠ NOTICE ⚠

Before changing any parameter settings, save the current parameter set to a file using MCD PC Software or the soft starter's Save User Set function (see the VLT® Soft Starter MCD 600 Operating Guide).

Procedure

1. Disconnect the soft starter from mains voltage.
2. Ensure that the soft starter is in ready state.

If necessary, place a link across the reset input RESET, COM+, or change *parameter 7-9 Reset/Enable Logic*.
3. Press [Menu] and select *Setup Tools*.
4. Scroll to *Run Simulation* and press [Menu/Store].
5. Apply a start command from the selected command source.
 - The soft starter simulates its prestart checks and closes the main contactor relay.
 - The Run LED flashes.
 - The fan starts to operate (models 0042~0579).
 - Use a multimeter to check that the main contactor output 13, 14 is closed.
6. Press [Menu/Store].
 - The soft starter simulates starting.
 - The Run LED is on.
 - The internal bypass closes.
 - Use a multimeter to measure the resistance across 1/L1-2/T1, 3/L2-4/T2, 5/L3-6/T3. The resistance should be less than 0.2 Ω.
7. Press [Menu/Store].
 - The soft starter simulates running.
8. Apply a stop command from the selected command source.
 - The soft starter simulates stopping.
 - The Run LED flashes.
 - The internal bypass opens.
9. Press [Menu/Store].
 - The Ready LED flashes and the main contactor relay opens.
10. Press [Menu/Store].
 - The soft starter activates then deactivates each programmable output.
 - Use a multimeter to check that each output relay operates as expected.
11. Press [Menu/Store] to end the simulation.

4.5 Control Input Test

Context:

This procedure tests the condition of the soft starter control inputs. To do the test, use a wire link.

Prerequisites:**⚠ NOTICE ⚠**

Before changing any parameter settings, save the current parameter set to a file using MCD PC Software or the soft starter's Save User Set function (see the VLT® Soft Starter MCD 600 Operating Guide).

Procedure

1. Disconnect all external wiring from the soft starter's control inputs.

Control voltage must still be connected to the soft starter.

2. Navigate to the soft starter's digital I/O status screen.

→ The top line of the screen shows the status of the start/stop, reset, and programmable inputs.

3. Connect a wire link between each input.

→ If the shown status of the input changes, the input operates correctly.

If the shown status does not change, the user interface board is damaged.

4.6 Start/Run Performance Test

Context:

This procedure tests that the soft starter operates correctly during a soft start.

Procedure

1. Connect the soft starter to mains voltage, control voltage, and to a motor.
2. Set *parameter 1-2 Motor Full Load Current* to match the motor.
3. Set *parameter 2-1 Start Mode* to *Constant Current*.
4. Set *parameter 2-4 Current Limit* to a level which supplies enough start current for the connected motor to accelerate easily to full speed.
5. Use an AC voltmeter to measure the voltage across each controlled phase (1/L1-2/T1, 3/L2-4/T2, 5/L3-6/T3).

The voltage should be close to the nominal mains voltage (phase voltage for in-line connection and mains voltage for inside delta connection).

- If the voltage is 0, the SCR on that phase may have failed.
- If the voltage is not equivalent to the nominal mains voltage, the internal bypass may be damaged and should be replaced.

6. Calculate the expected start current by multiplying motor full load current by current limit.
7. Scroll to the motor current screen on the LCP and initiate a start.

If the shown current is equal to the calculated start current on all 3 phases, the soft starter performs correctly.

8. When the soft starter is starting, measure the voltage across each phase.

The voltage should be less than 0.5 V AC when the soft starter reaches run mode.

If the voltage remains near nominal mains voltage, the SCR is not firing correctly. Check the connections between the motor control board and SCRs.

4.7 After Repair Tests

Context:**⚠ NOTICE ⚠**

The servicing technician is responsible for ensuring that all electrical safety tests have been completed in accordance with local regulations.

Prerequisites:

⚠ NOTICE ⚠

Before changing any parameter settings, save the current parameter set to a file using MCD PC Software or the soft starter's Save User Set function (see the VLT® Soft Starter MCD 600 Operating Guide).

Procedure

1. Apply control power to the soft starter.
2. Ensure that the welcome screen shows the correct firmware version.
3. Perform a Run Simulation test using both the LCP and the remote switches.
4. Connect mains supply and motor.
5. Test that the soft starter functions as expected.

4.7.1 After Repair Test - Small Motors

Context:

Testing the operation of the soft starter with a small motor (a motor with a current rating which is much lower than that of the soft starter).

Prerequisites:**⚠ NOTICE ⚠**

Before changing any parameter settings, save the current parameter set to a file using MCD PC Software or the soft starter's Save User Set function (see the VLT® Soft Starter MCD 600 Operating Guide).

Procedure

1. Use *Setup Tools* ⇒ *Load/Save Settings* to load the factory default parameter values into the soft starter.
2. Disable *parameter 5-3 Undercurrent*.
3. Connect a small motor to the output terminals of the soft starter.
Test that the soft starter functions as expected.
4. Reset *parameter 5-3 Undercurrent* to its default after conducting tests.

5 Troubleshooting

5.1 Trip Messages

5.1.1 2-Phase-damaged SCR

Cause

This message is shown if the soft starter has tripped on *Lx-Tx shorted* during the prestart checks and PowerThrough is enabled. It indicates that the soft starter now operates in PowerThrough mode (2-phase control only).

Troubleshooting

- Check for either a shorted SCR or a short within the bypass contactor.
- Check also *parameter 6-19 Shorted SCR Action*.

5.1.2 Battery/Clock

Cause

A verification error has occurred on the real-time clock, or the back-up battery voltage is low. If the battery is low and the power is off, date/time settings are lost.

Troubleshooting

- Reprogram the date and time.
- The battery is not removable. To replace the battery, the main control PCB must be replaced.
- Check also *parameter 6-20 Battery Clock*.

5.1.3 Current Imbalance

Cause

Current imbalance can be caused by:

- A faulty current transformer.
- A poor connection between a current transformer and the motor control board.
- An SCR that has failed open circuit.

Troubleshooting

- Check the resistance of each CT. The resistance should be between approximately 5–20 Ω and similar for both CTs.
- Check that the connections between a current transformer and the motor control board are sound.
- A failed SCR can only be diagnosed accurately by replacing the SCR and checking the soft starter performance.

5.1.4 Current Read Err Lx

Cause

Where X is 1, 2, or 3. This trip can be caused by:

- A faulty current transformer.
- A poor connection between a current transformer and the motor control board.
- A faulty motor control board.

Troubleshooting

- Check the resistance of each CT. The resistance should be between approximately 5–20 Ω and similar for both CTs.
- Check that the connections between a current transformer and the motor control board are sound.

5.1.5 EEPROM Fail

Cause

An error occurred loading data from the EEPROM to RAM when the LCP powered up.

Troubleshooting

- Replace the user interface board.

5.1.6 Firing Fail Px

Cause

Where X is phase 1, 2, or 3. The SCR did not fire as expected.

Troubleshooting

- Check for faulty SCRs and internal wiring faults.
- Check the resistance of each SCR. The resistance of a healthy SCR should be $\geq 0.2 \text{ M}\Omega$.
- Check that the SCR firing looms are connected correctly.
- Check the SCR gate resistance. The SCR gate resistance should be between approximately $5 \Omega \leq 25 \Omega$.
- Replace the motor control board.

5.1.7 Heatsink Overtemperature

Troubleshooting

- Check that the internal bypass contactors are operating. Use the run simulation to operate the soft starter and measure resistance across each controlled phase. Resistance should be $> 0.2 \text{ M}\Omega$ when the bypass contactor is open and $< 0.2 \Omega$ when the bypass contactor is closed.
- Measure the voltage across 1/L1-2/T1, 3/L2-4/T2, 5/L3-6/T3 while the soft starter is running. If the bypass contactor has closed, the voltage should be $\leq 0.5 \text{ V AC}$. If the bypass contactor does not close, the voltage should be approximately 2 V AC .
- Check that the cooling fans are operating (models MCD6-0042B~MCD6-0579B).

5.1.8 Internal Fault X

Cause

Where X is a number. This trip is not adjustable. The soft starter has tripped on an internal fault.

Troubleshooting

- Contact Danfoss with the fault code (X).

5.1.9 L1-T1/L2-T2/L3-T3 Shorted

Cause

During prestart checks, the soft starter has detected a short-circuited SCR or a short circuit within the bypass contactor as indicated. To identify which phase is short-circuited, use a multimeter to measure the resistance between the input and output terminations on each phase. The resistance of a healthy SCR should be $\geq 0.2 \text{ M}\Omega$. Once the affected phase has been identified, test the SCR and bypass contactor separately.

Troubleshooting

- Check that the SCR firing looms are connected correctly.
- Check the SCR gate resistance. The SCR gate resistance should be between approximately $5 \Omega \leq 25 \Omega$.
- Check that the internal bypass contactors are operating. Use the run simulation to operate the soft starter and measure resistance across each controlled phase. Resistance should be $> 0.2 \text{ M}\Omega$ when the bypass contactor is open and $< 0.2 \Omega$ when the bypass contactor is closed.
- Measure voltages across 1/L1-2/T1, 3/L2-4/T2, 5/L3-6/T3 while the soft starter is running. If the bypass contactor has closed, the voltage should be $\leq 0.5 \text{ V AC}$. If the bypass contactor does not close, the voltage should be approximately 2 V AC .

5.1.10 Low Control Volts

Cause

The soft starter has detected a drop in the internal control voltage. If the external control supply is stable:

- The 24 V supply on the motor control board may be faulty.
- The bypass driver board may be faulty.

Troubleshooting

- Unplug the bypass driver board and begin run simulation. If the fault persists, replace the user interface board. If the soft starter operates correctly, replace the bypass driver board.

5.1.11 Motor Thermistor

Cause

The motor thermistor input has been enabled and:

- The resistance at the thermistor input has exceeded $3.6 \text{ k}\Omega$ for more than 1 s.
- The motor winding has overheated. Identify the cause of the overheating and allow the motor to cool before restarting.
- The motor thermistor input has been opened.

⚠ NOTICE ⚠

If thermistors have previously been connected to the soft starter but are no longer required, use the thermistor reset function to disable the thermistor.

Troubleshooting

- Check the following parameter:
 - *Parameter 6-17 Motor Overtemperature.*
- Use the thermistor reset function to disable the thermistor circuit.
- Check for a short circuit across terminals TER-05, TER-06.

5.1.12 Not Ready

Cause

- The reset input may be active. If the reset input is active, the soft starter does not operate.
- The soft starter may be waiting for the restart delay to elapse. The length of the restart delay is controlled by *parameter 5-16 Restart Delay*.
- Check the following parameters:
 - *Parameter 5-16 Restart Delay.*
 - *Parameter 7-9 Reset/Enable Logic.*

5.1.13 Power Loss

Cause

This trip is not adjustable. The soft starter is not receiving mains supply on 1 or more phases.

Troubleshooting

- If testing the soft starter with a small motor, it must draw at least 10% of the soft starter's programmed setting on each phase.

5.1.14 Thermistor Cct (Thermistor Circuit)

Cause

The motor thermistor circuit is not functioning correctly.

Troubleshooting

- Replace the motor control board.

5.2 Internal Fault X

Table 2: Internal Faults

Internal fault	Message shown on the LCP
70–72	Current Read Err Lx
73	ATTENTION! Remove Mains Volts
74–76	Motor Connection Tx
77–79	Firing Fail Px
80–82	VZC Fail Px

Internal fault	Message shown on the LCP
83	Low Control Volts
84–98	Internal fault X ⁽¹⁾

¹ Contact Danfoss with the fault code (X).

5.3 SCRs

SCR damage is often caused by overcurrent, overvoltage, or overtemperature. To prevent future damage, check that the soft starter has been installed properly. Common causes of SCR problems include:

- Overcurrent:
 - Cable fault on soft starter output.
 - Motor fault.
 - Start current and/or start time exceeds the soft starter's rating.
 - Starts per hour exceed the soft starter rating.
- Overvoltage:
 - Power supply transient or surge.
 - Lightning strike (direct or indirect) on power supply.
 - Motor fault.
 - Loose connection in power circuit, before or after the soft starter.
 - Power factor correction connected to the output of the soft starter.
 - Overcorrected bulk power factor correction on a lightly loaded system causing severe ringing voltages.
- Overtemperature:
 - Blocked heat sinks or restricted ventilation.
 - Inadequate ventilation.
 - Excessive ambient temperature.
 - Bypass relay fails to close during running (internally bypassed starters only).

5.3.1 Protecting SCRs

Modern SCRs are normally rugged and reliable. However, the risk of SCR damage can be reduced by using semiconductor fuses and/or a main contactor.

5.3.1.1 Semiconductor Fuses

Semiconductor fuses reduce the potential for SCR damage caused by short circuits on the output of the soft starter.

Protection systems such as circuit breakers or HRC fuses do not operate quickly enough to protect SCRs from short circuits.

5.3.1.2 Main Contactors

SCRs are most vulnerable to overvoltage damage when voltage is applied to their input terminal while they are off. In this condition, the SCR blocks the full mains voltage. Using a main contactor to remove voltage from the SCR input when the soft starter is off eliminates the risk of SCR damage due to overvoltage.

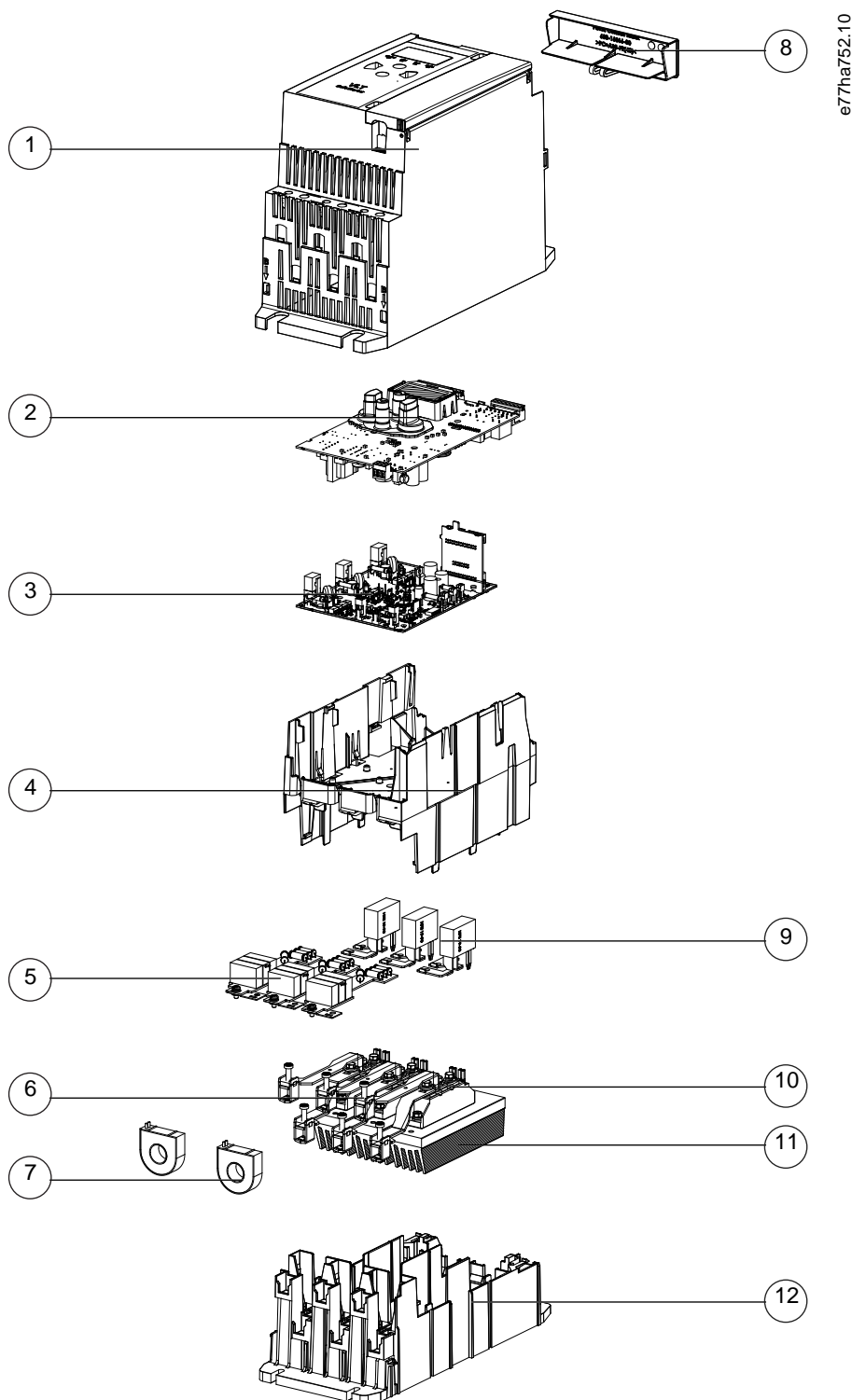
6 Product Overview

6.1 Frame Sizes

Table 3: Frame Sizes and Layout Configurations

Frame size	Build configuration	Models
S1	F1	MCD6-0020B
		MCD6-0034B
		MCD6-0042B
		MCD6-0063B
		MCD6-0069B
		MCD6-0086B
		MCD6-0108B
		MCD6-0129B
S2	F2	MCD6-0144B
		MCD6-0171B
		MCD6-0194B
		MCD6-0244B
	F3	MCD6-0287B
		MCD6-0323B
		MCD6-0410B
	F4	MCD6-0527B
		MCD6-0579B

6.2 MCD6-0020B ~ MCD6-0034B

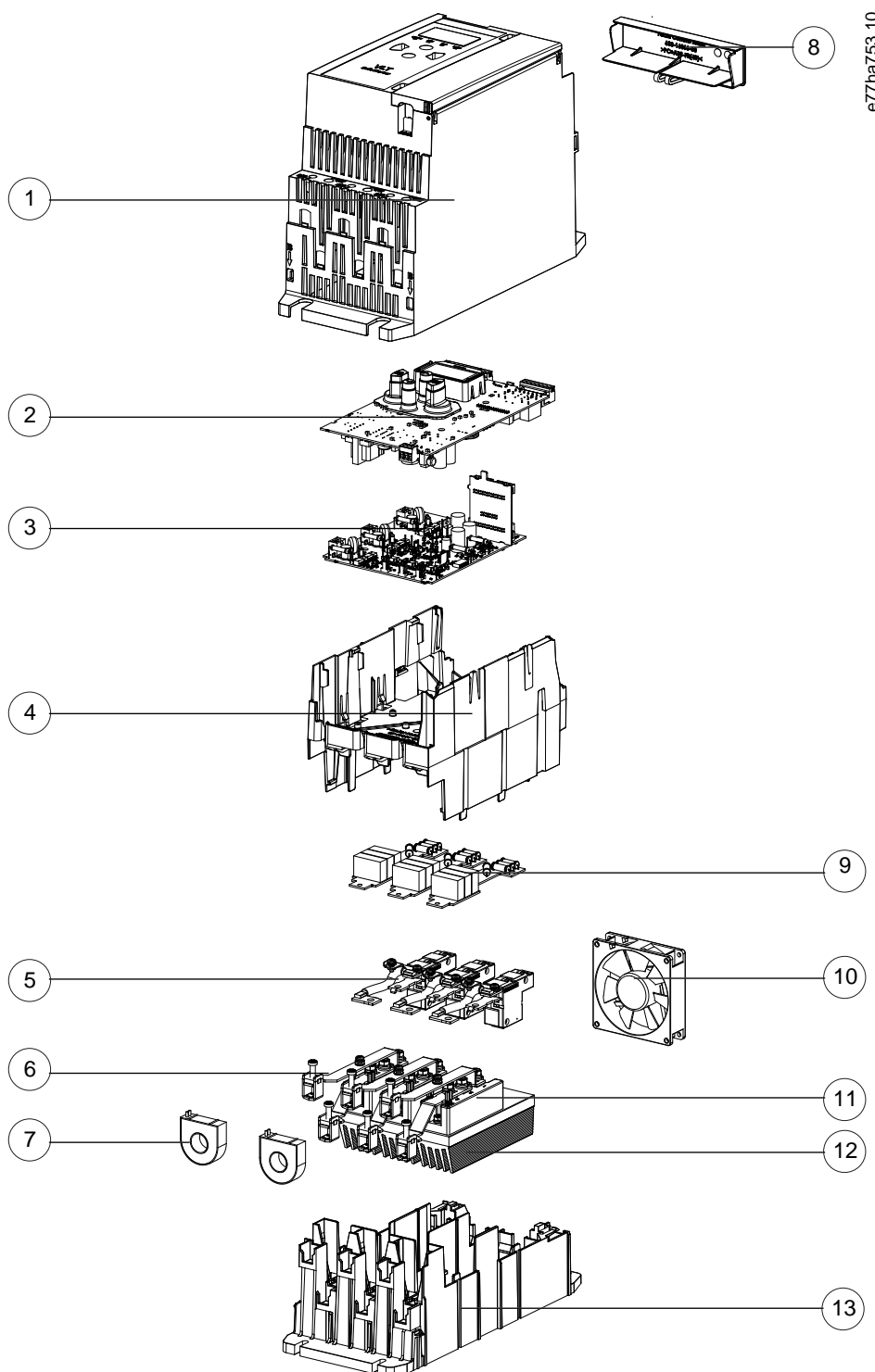


1 Cover	2 User interface board
3 Motor control board	4 Upper skeleton

5 Snubbers	6 Busbars
7 Current transformers	8 Expansion port cover
9 Internal bypass	10 SCRs
11 Heat sink	12 Lower skeleton

Illustration 4: Exploded View of MCD6-0020B ~ MCD6-0034B

6.3 MCD6-0042B ~ MCD6-0129B

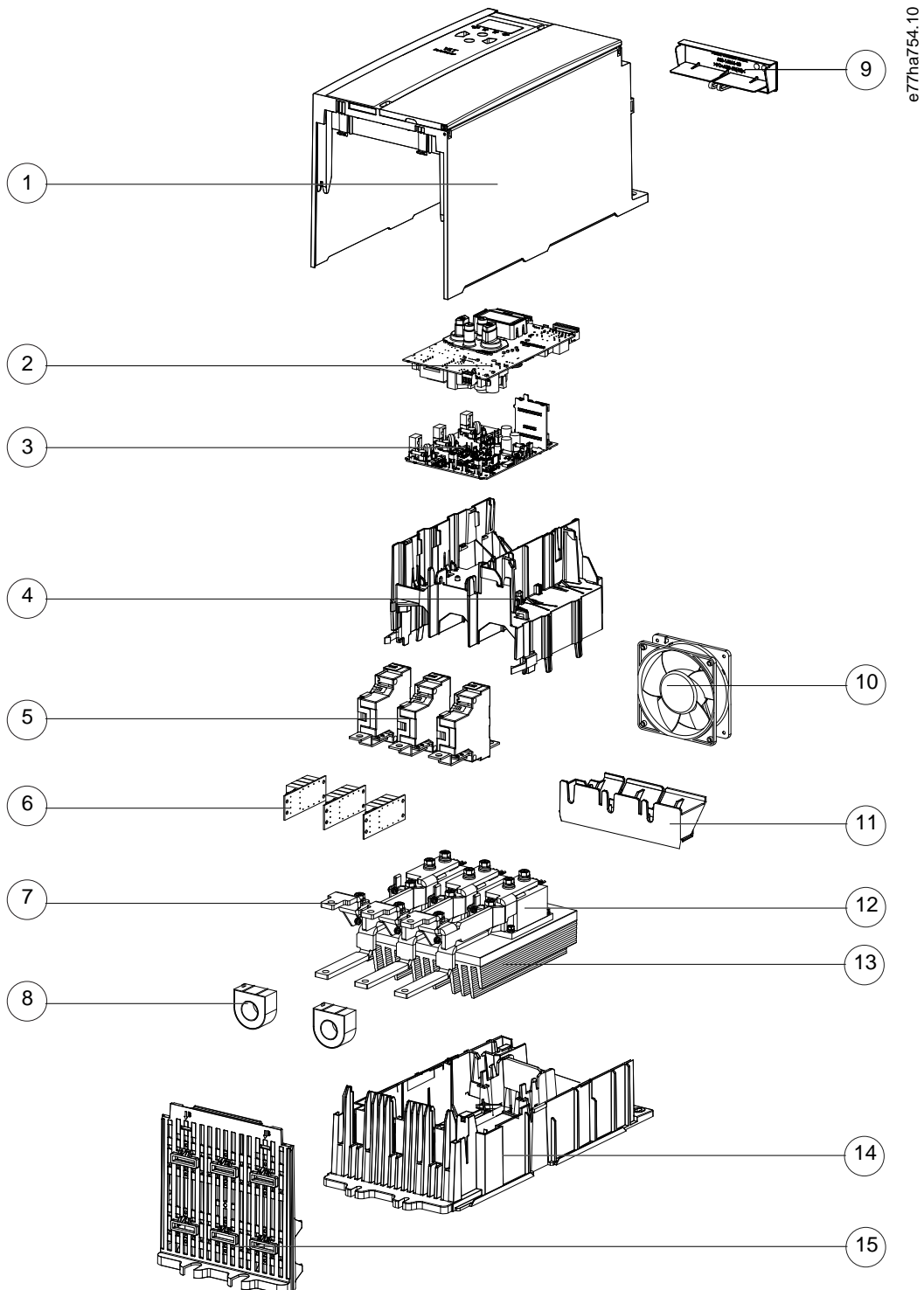


1 Cover	2 User interface board
3 Motor control board	4 Upper skeleton

5 Snubbers	6 Busbars
7 Current transformers	8 Expansion port cover
9 Internal bypass	10 Fan
11 SCRs	12 Heat sink
13 Lower skeleton	

Illustration 5: Exploded View of MCD6-0042B ~ MCD6-0129B

6.4 MCD6-0144B ~ MCD6-0244B

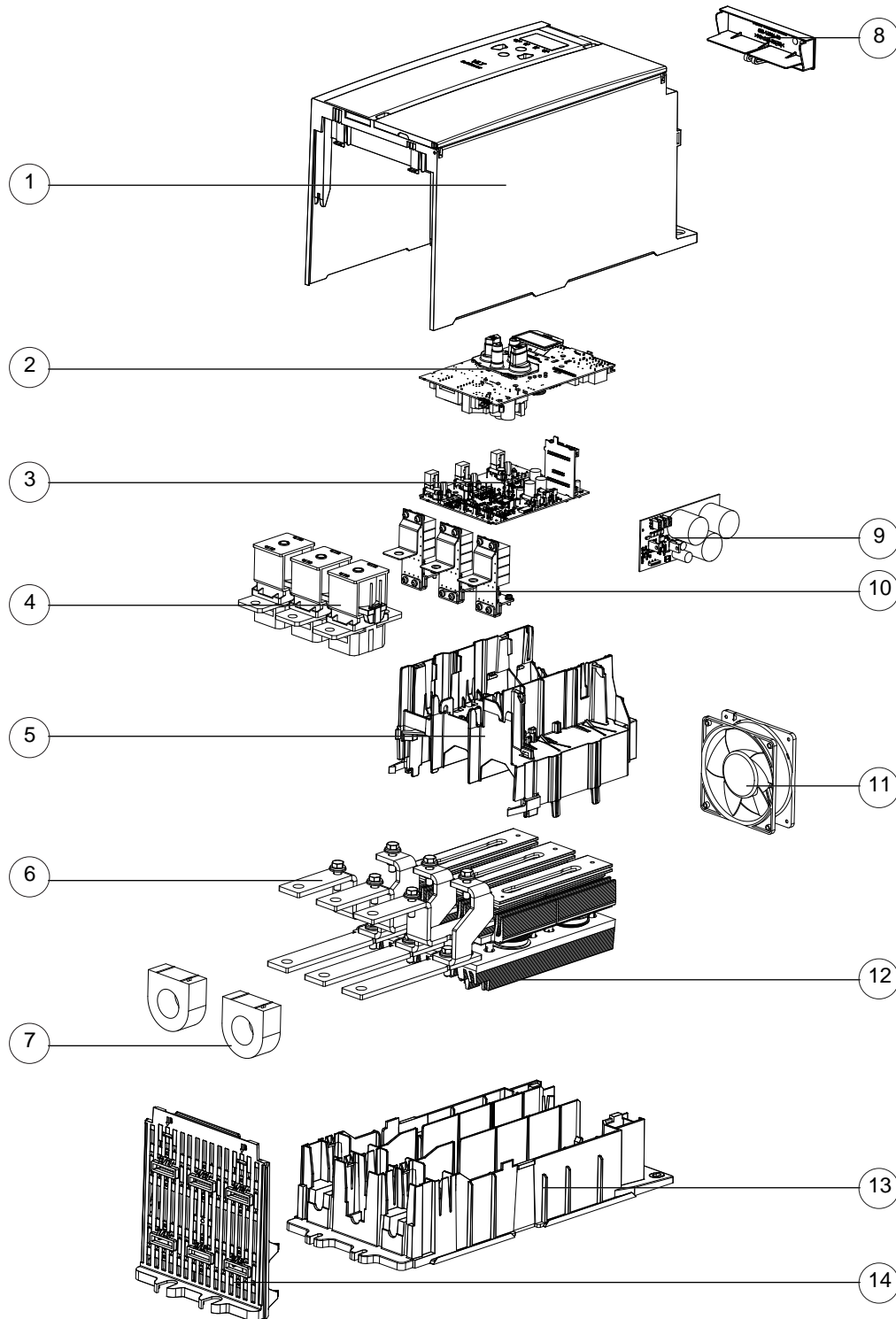


1 Cover	2 User interface board
3 Motor control board	4 Upper skeleton

5 Internal bypass	6 Snubbers
7 Busbars	8 Current transformers
9 Expansion port cover	10 Fan
11 Air duct	12 SCRs
13 Heat sink	14 Lower skeleton
15 End grille	

Illustration 6: Exploded View of MCD6-0144B ~ MCD6-0244B

6.5 MCD6-0287B ~ MCD6-0579B



e77ha755.10

1 Cover	2 User interface board
3 Motor control board	4 Internal bypass

5 Upper skeleton	6 Busbars
7 Current transformers	8 Expansion port cover
9 Bypass driver board	10 Snubbers
11 Fan	12 Power assembly
13 Lower skeleton	14 End grille

Illustration 7: Exploded View of MCD6-0287B ~ MCD6-0579B

7 Firmware Updates

7.1 Overview

The VLT® Soft Starter MCD 600 has 2 sets of operating firmware run from microcontrollers on the motor control board and the user interface board.

⚠ NOTICE ⚠

Boards sent as spare parts are not loaded with firmware. After replacing the motor control boards and/or user interface board, load firmware into the soft starter.

7.2 Firmware Versions

Each firmware carries a version number and the version numbers are independent. Software version information is shown on the welcome screen when control power is connected or can be checked via *Setup Tools* ⇒ *Software Versions*. More information about software versions is available in the version control document.

Select to load the latest firmware or an older version depending on what matches the other soft starters in the network.

⚠ NOTICE ⚠

Some hardware/firmware version combinations may not be compatible. Make sure to check compatibility information in the version control document available from the support website.

7.3 Loading New Firmware

Before loading new firmware, reassemble the soft starter and check that it is electrically safe.

Firmware is loaded into the soft starter via the on-board USB port using a file available from the product support website. The firmware update package contains all files required to load both the motor control and the user interface software in single operation.

If control power is applied and no firmware has been loaded, the soft starter shows dashes or an error message.



Illustration 8: Missing User Interface Firmware

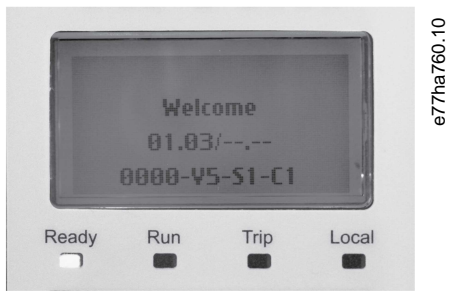
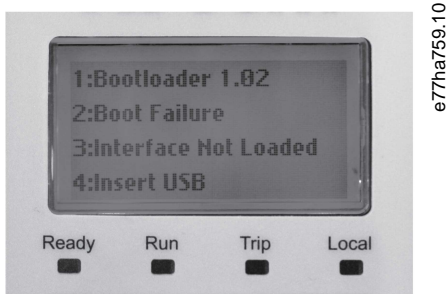


Illustration 9: Missing Motor Control Firmware

7.3.1 Loading User Interface Firmware

Procedure

1. Download the firmware update package from the support website formatted with FAT32.
2. Unzip the files and copy to the root of a USB memory stick.
3. Apply control power to the soft starter.
 - The soft starter shows an error message.



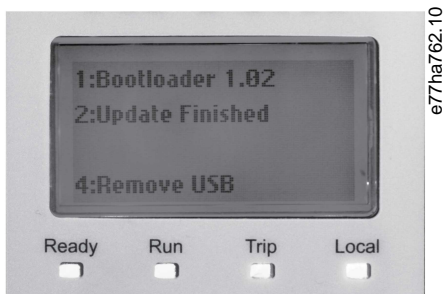
e77ha759.10

4. Insert the memory stick into the USB port on the soft starter.
 - The soft starter automatically loads the new firmware.



e77ha761.10

5. Wait for the firmware to load.
 - When the firmware has successfully loaded and verified, the soft starter shows a confirmation.



e77ha762.10

6. Remove the memory stick.
 - The soft starter briefly shows the message *Loading Language*, followed by the welcome screen.
7. Wait for the power-up checks to complete.
 - Once the checks are complete, the soft starter shows the main status view. The status is *Not ready* unless the reset input is closed.

- Set the date and time before operating the soft starter.

7.3.2 Loading Motor Control Firmware

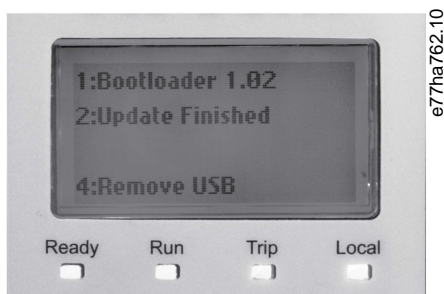
Procedure

- Download the firmware update package from the support website formatted with FAT32.
- Unzip the files and copy to the root of a USB memory stick.
- Insert the memory stick into the USB port on the soft starter.
- Press and hold [Back] and [Menu/Store] keys.
- While holding the keys, apply control power to the soft starter.
 - The soft starter automatically loads the new firmware.



- Release the keys.

→ When the firmware has successfully loaded and verified, the soft starter shows a confirmation.



- Remove the memory stick.

→ The soft starter briefly shows the message *Loading Language*, followed by the welcome screen.

- Wait for the power-up checks to complete.

→ When the checks are complete, the soft starter shows the main status view. The soft starter is *Not ready* unless the reset input is closed.

7.4 Reusing Boards

If reusing a board that has been installed in another soft starter, update the firmware.

7.5 Model Name, Model Rating, Serial Number, Parameter Defaults

The model rating is an internal reference stored on both the motor control board and the user interface board. The model rating matches the nominal current rating of the soft starter. If 1 board is replaced, the soft starter reloads the information from the other board. If both boards are replaced, reprogram the rating in *parameter 20-4 Model Rating*.

The model name and soft starter serial number are stored on the user interface board. If the user interface board is replaced, the information is lost.

Updating the firmware restores all parameters to default values. If the parameter list version has not changed, restore parameter settings from an external back-up file.

8 Spare Parts

8.1 Notice

⚠ NOTICE ⚠

Unless otherwise indicated, spare part kits contain only 1 of each item. All images in this section are indicative.

8.2 Enclosure Opening Tools

When disassembling the soft starter before repair, use the recommended tools to open the enclosure. Use the tool appropriate to the soft starter frame size.

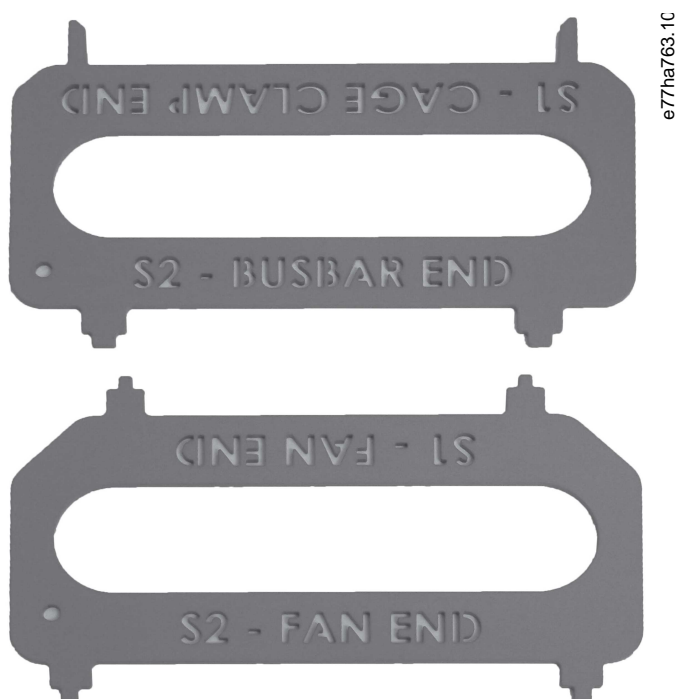


Illustration 15: Enclosure Opening Tools

8.3 User Interface PCB

⚠ NOTICE ⚠

Boards sent as spare parts are not loaded with firmware. After replacing the motor control board and/or user interface board, load firmware into the soft starter.

Each soft starter requires 1 user interface board. Different spare parts are required for CV1 and CV2 (control voltage) models.

Table 4: Ordering Numbers for User Interface PCBs

	CV1	CV2
MCD6-0020B	175G1038	175G0136
MCD6-0034B		
MCD6-0042B		
MCD6-0063B		
MCD6-0069B		
MCD6-0086B		
MCD6-0108B		
MCD6-0129B		
MCD6-0144B		175G0137
MCD6-0171B		
MCD6-0194B		
MCD6-0244B		
MCD6-0287B		
MCD6-0323B		
MCD6-0410B		
MCD6-0527B		
MCD6-0579B		

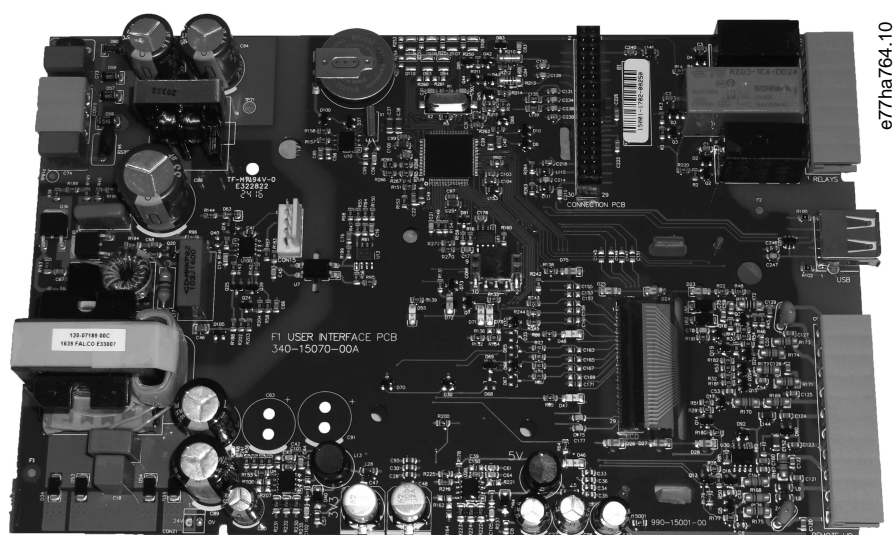
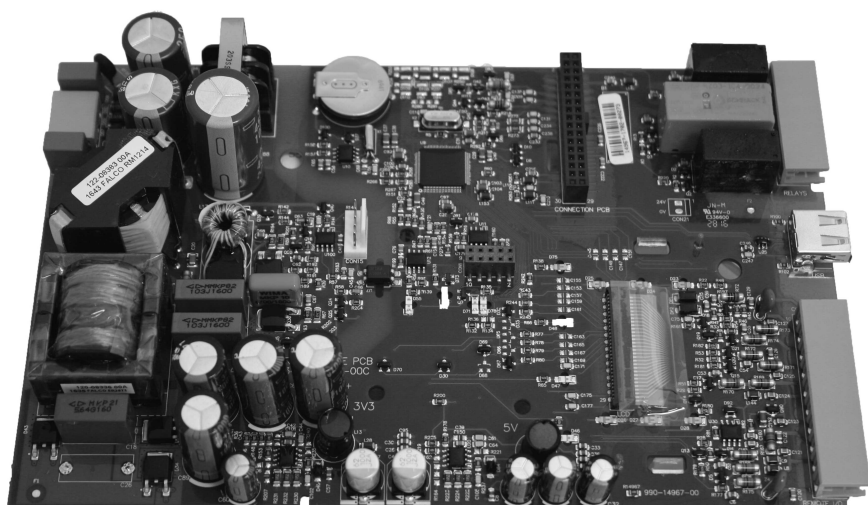
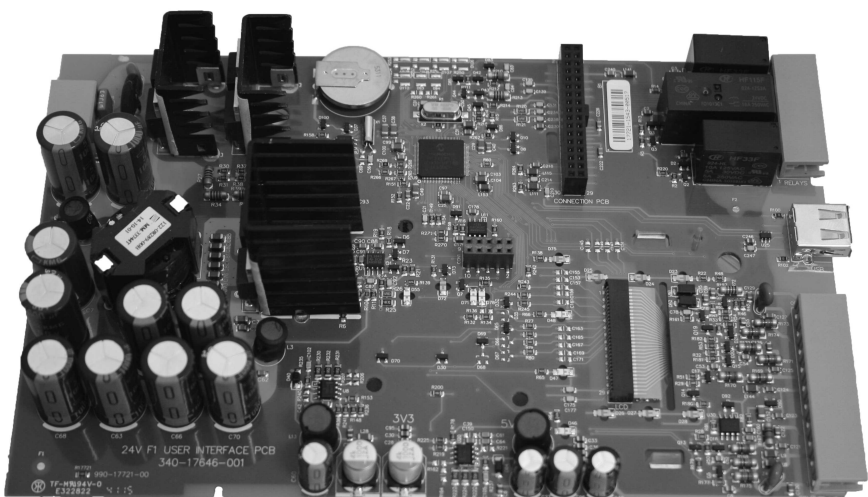


Illustration 16: 175G0136



e77ha765.10

Illustration 17: 175G0137



e77ha766.10

Illustration 18: 175G0138

8.4 Motor Control Board

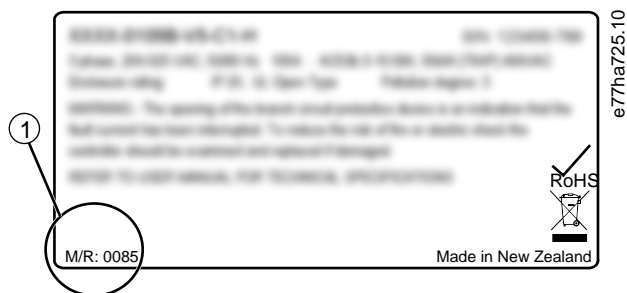
⚠ NOTICE ⚠

Boards sent as spare parts are not loaded with firmware. After replacing the motor control board and/or user interface board, load firmware into the soft starter.

Each soft starter requires 1 motor control board. Different spare parts are required for T5 and T7 (mains voltage) models.

⚠ NOTICE ⚠

If the motor control board and user interface board are replaced at the same time, set *parameter 20-4 Model Rating* for the soft starter to operate correctly. Set *parameter 20-4 Model Rating* to match the rating shown on the nameplate on the side of the soft starter.

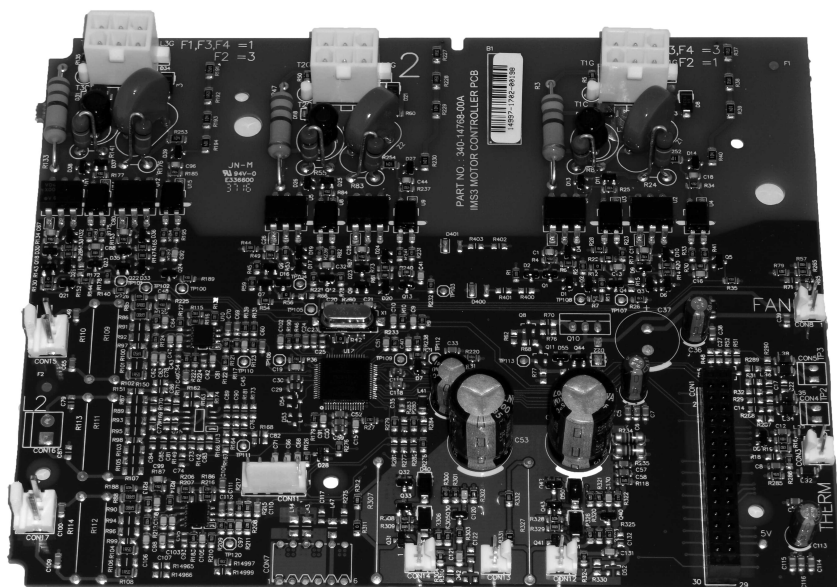


1 Model rating

Illustration 19: Nameplate

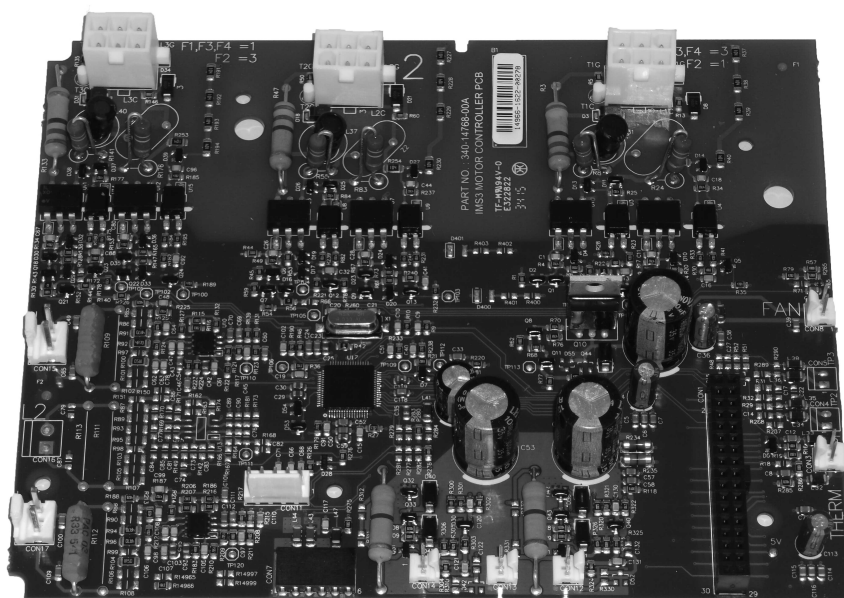
Table 5: Ordering Numbers for Motor Control Board

	T5	T7
MCD6-0020B	175G0139	175G0141
MCD6-0034B		
MCD6-0042B		
MCD6-0063B		
MCD6-0069B		
MCD6-0086B		
MCD6-0108B		
MCD6-0129B		
MCD6-0144B	1745G0140	175G0142
MCD6-0171B		
MCD6-0194B		
MCD6-0244B		
MCD6-0287B		
MCD6-0323B		
MCD6-0410B		
MCD6-0527B		
MCD6-0579B		



e77ha767.10

Illustration 20: 175G0139, 175G0140



e77ha768.10

Illustration 21: 175G0141, 175G0142

⚠ NOTICE ⚠

Setting *parameter 20-4 Model Rating* to a lower model may cause unreliable starting and stopping behavior. Setting *parameter 20-4 Model Rating* to a higher model can damage the soft starter. Once the model rating is set, it cannot be changed.

8.5 Bypass Driver PCB

Internally bypassed models MCD6-0287B ~ MCD6-0579B include a bypass driver board. Each soft starter requires 1 bypass driver board.

Table 6: Ordering Numbers for Bypass Driver PCB

Model	Ordering number
MCD6-0020B	Not required
MCD6-0034B	
MCD6-0042B	
MCD6-0063B	
MCD6-0069B	
MCD6-0086B	
MCD6-0108B	
MCD6-0129B	
MCD6-0144B	
MCD6-0171B	
MCD6-0194B	
MCD6-0244B	
MCD6-0287B	175G0143
MCD6-0323B	
MCD6-0410B	
MCD6-0527B	
MCD6-0579B	

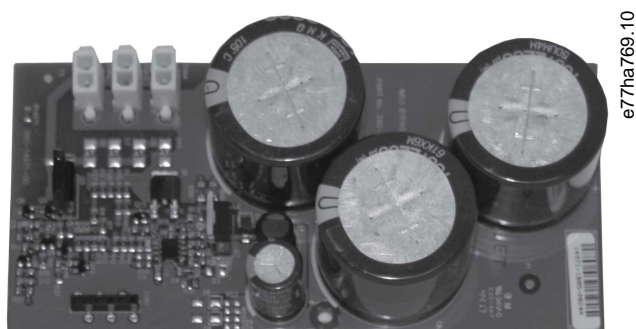


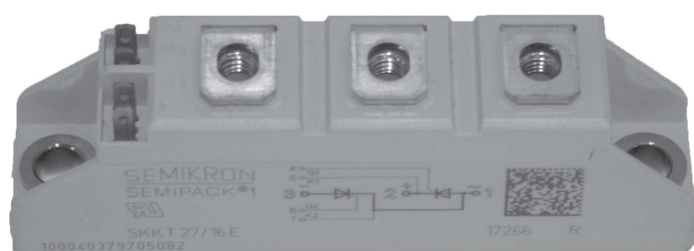
Illustration 22: 175G0143

8.6 SCRs and SCR Connections

Models MCD6-0020B ~ MCD6-0244B use SCRs. Each kit contains 1 SCR. Each soft starter requires 3 SCRs.

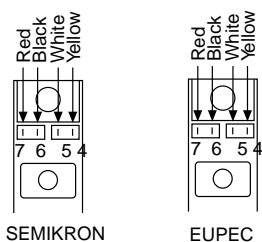
Table 7: Ordering Numbers for SCRs

Model	Ordering number
MCD6-0020B	175G0144
MCD6-0034B	175G0145
MCD6-0042B	
MCD6-0063B	175G0146
MCD6-0069B	
MCD6-0086B	175G0147
MCD6-0108B	
MCD6-0129B	175G0148
MCD6-0144B	175G0149
MCD6-0171B	
MCD6-0194B	
MCD6-0244B	175G0185



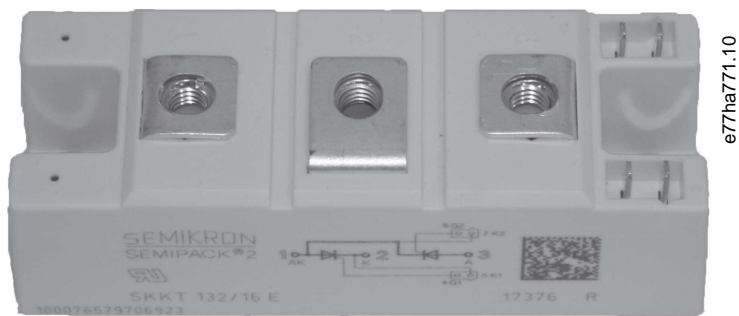
e77ha770.10

Illustration 23: 175G0144 ~ 175G0146



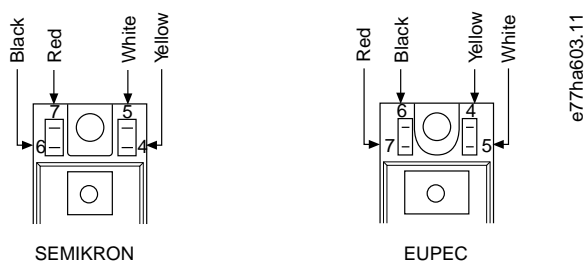
e77ha600.11

Illustration 24: Connection Diagram for 175G0144 ~ 175G0146



e77ha771.10

Illustration 25: 175G0147, 175G0148



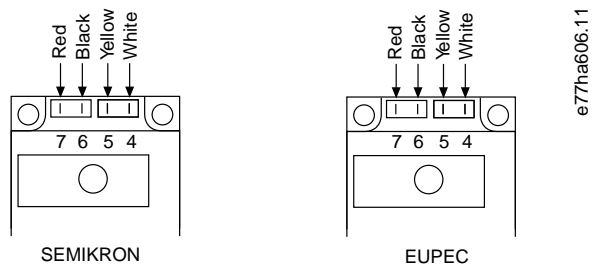
e77ha603.11

Illustration 26: Connection Diagram for 175G0147 and 175G0148



e77ha772.10

Illustration 27: 175G0149, 175G0185



e77ha606.11

Illustration 28: Connection Diagram for 175G0149 and 175G0185

8.7 Phase Arms

Models MCD6-0287B ~ MCD6-0579B use phase arms. Each kit contains 1 phase arm. Each soft starter requires 3 phase arms.

Table 8: Ordering Numbers for Phase Arms

Model	Ordering number
MCD6-0287B	175G0150
MCD6-0323B	
MCD6-0410B	175G0151
MCD6-0527B	175G0152
MCD6-0579B	



Illustration 29: 175G0150–175G0152

8.8 Fans

Models MCD6-0042B ~ MCD6-0579B require a fan.

Table 9: Ordering Numbers for Fans

Model	Ordering number
MCD6-0020B	Fan not required
MCD6-0034B	

Model	Ordering number
MCD6-0042B	175G0153
MCD6-0063B	
MCD6-0069B	
MCD6-0086B	
MCD6-0108B	
MCD6-0129B	
MCD6-0144B	175G0154
MCD6-0171B	
MCD6-0244B	
MCD6-0287B	
MCD6-0323B	
MCD6-0410B	
MCD6-0527B	
MCD6-0579B	



e77ha774.10

Illustration 30: 175G0153



e77ha775.10

Illustration 31: 175G0154

8.9 Internal Bypass Contactor

Each kit contains 1 internal bypass contactor. Each soft starter requires 3 internal bypass contactors.

Table 10: Ordering Numbers for Internal Bypass Contactors

Model	Ordering number
MCD6-0020B	175G0155
MCD6-0034B	
MCD6-0042B	
MCD6-0063B	
MCD6-0069B	
MCD6-0086B	175G0156
MCD6-0108B	
MCD6-0129B	
MCD6-0144B	175G0157
MCD6-0171B	
MCD6-0244B	
MCD6-0287B	175G0158
MCD6-0323B	
MCD6-0410B	
MCD6-0527B	175G0159
MCD6-0579B	



e77ha778.10

Illustration 32: 175G0155



e77ha779.10

Illustration 33: 175G0156



e77ha780.10

Illustration 34: 175G0157



Illustration 35: 175G0158, 175G0159

9 Appendix

9.1 Bolt Tightening Torques

When assembling soft starter components, each bolt should be tightened using a calibrated torque driver set to the appropriate assembly torque. This chapter provides information on the different types of bolts and bolt tightening torques for each assembly.

9.1.1 SCRs to Heat Sink

Table 11: Tightening Torques SCR to Heat Sink

Model	Bolt size	Torque [Nm (in-lb)]
MCD6-0020B	M5x25	5 (44.25)
MCD6-0034B		
MCD6-0042B		
MCD6-0063B		
MCD6-0069B		
MCD6-0086B		
MCD6-0108B		
MCD6-0129B		
MCD6-0144B		
MCD6-0171B		
MCD6-0194B		
MCD6-0244B		

9.1.2 Busbars to SCRs

Table 12: Tightening Torques Busbars to SCRs

Model	Bolt size	Torque [Nm (in-lb)]
MCD6-0020B	M5x12	3 (26.55)
MCD6-0034B		
MCD6-0042B		
MCD6-0063B		
MCD6-0069B		
MCD6-0086B	M6x16	5 (44.25)
MCD6-0108B		
MCD6-0129B		

Model	Bolt size	Torque [Nm (in-lb)]
MCD6-0144B	M8x20	9 (79.65)
MCD6-0171B		
MCD6-0194B		
MCD6-0244B		

9.1.3 Internal Bypass Connections

Table 13: Tightening Torques for Internal Bypass Connections

Model	Bolt size	Torque [Nm (in-lb)]
MCD6-0020B	M5x12	3 (26.55)
MCD6-0034B		
MCD6-0042B		
MCD6-0063B		
MCD6-0069B		
MCD6-0086B	M6x16	5 (44.25)
MCD6-0108B		
MCD6-0129B		
MCD6-0144B	M8x20	9 (79.65)
MCD6-0171B		
MCD6-0194B		
MCD6-0244B		
MCD6-0287B	M8x30	13 (115)
MCD6-0323B		
MCD6-0410B		
MCD6-0527B		
MCD6-0579B		

9.2 Symbols and Abbreviations

°C	Degrees Celsius
°F	Degress Fahrenheit
AC	Alternating current
CT	Current transformer
DC	Direct current
DOL	Direct on-line
EMC	Electromagnetic campatibility
FLA	Full load amperage
FLC	Full load current
FLT	Full load torque
IP	Ingress protection
LCP	Local control panel
PCB	Printed circuit board
PELV	Protective extra low voltage
PFC	Power factor correction
SCCR	Short-circuit current rating
TVR	Timed voltage ramp

9.3 Conventions

- Numbered lists indicate procedures.
- Bulleted and dashed lists indicate listings of other information where the order of the information is not relevant.
- Bolded text indicates highlighting and section headings.
- Italicized text indicates the following:
 - Cross-reference.
 - Link.
 - Footnote.
 - Parameter name.
 - Parameter option.
 - Parameter group name.
- All dimensions in drawings are in metric values (imperial values in brackets).
- An asterisk (*) indicates the default setting of a parameter.

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