Contents

1 Warnings

When reading this manual you will come across different symbols that require special attention. The symbols used are the following:

NB!
Indicates something to be noted by the reader

Indicates a general warning

Indicates a high voltage warning

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

WARNING - ELECTRICAL SHOCK HAZARD
MCD 500 soft starters contain dangerous voltages when connected to mains voltage. Only a competent electrician should carry out the electrical installation. Improper installation of the motor or the soft starter may cause equipment failure, serious injury or death. Follow this manual and local electrical safety codes.

Disconnect the soft starter from mains voltage before carrying out repair work.
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.
Do not connect power factor correction capacitors to the output of MCD 500 soft starters. If static power factor correction is employed, it must be connected to the supply side of the soft starter.

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

Equipment containing electrical components may not be disposed of together with domestic waste.
It must be collected separately as electrical and electronic waste according to local and currently valid legislation.

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2 Troubleshooting

When a protection condition is detected, the MCD 500 will write this to the event log and may also trip or issue a warning. The soft starter's response to some protections may depend on the Protection Action settings (parameter group 16).

If the MCD 500 trips you will need to reset the soft starter before restarting. If the MCD 500 has issued a warning, the soft starter will reset itself once the cause of the warning has been resolved.

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

2.2 Functional Tests

Use the tests in this section to identify the cause of problems with the soft starter.

2.2.1 Power Circuit Test

This procedure tests the soft starter's power circuit, including the SCR, Interface PCB and Main Control PCB.

1. Disconnect the soft starter from mains voltage (L1, L2, L3), control voltage (A1, A2, A3) and from the motor (T1, T2, T3).
2. Use a 500 VDC insulation tester to measure the resistance across each phase in both directions (L1-T1, L2-T2, L3-T3 and vice versa). Low voltage ohm meters or multimeters are not adequate. The resistance should be between 250 kΩ and 500 kΩ and equal for all measurements.
    - If the resistance is below 250 kΩ for any measurement, the SCR on that phase may be faulty. For internally bypassed units (MCD5-0021B - MCD5-0215B) the bypass contactor on that phase may be closed. Replace the faulty SCR or bypass contactor.

NB!
There is no need to replace the Main Control PCB or the Backplane PCB just because an SCR has been damaged. Consider replacing these parts only after first replace the damaged SCR(s) and checking for correct operation.

    - If the resistance is above 500 kΩ for any measurement, the Main Control PCB or Interface PCB may be faulty or there may be a faulty connection between these two PCBs. To isolate the fault, perform the PCB integrity test.
3. Investigate the likely cause of SCR damage to prevent a repeat SCR failure. Analysis of the MOVs on the Backplane PCB and connected across each controlled phase can provide a good indication of the mode of SCR failure.
    - If the MOVs and/or surrounding circuitry on the Backplane PCB show signs of physical damage, the most likely cause is overvoltage.
    - If the MOVs and/or surrounding circuitry on the Backplane PCB do not show signs of physical damage, the most likely cause is over-current.

The modern SCRs used in MCD 500 soft starters are extremely reliable and it is extremely unlikely that they will fail due to faulty manufacture. SCR damage is almost always caused by external influences. Often these influences can be identified but in other cases the identification may prove difficult or impossible because the damaging event was temporary in nature. See *Avoiding Damage* for information on typical causes of SCR damage.

2.2.2 Start Performance Test

This procedure tests that the MCD 500 soft starts correctly. This test is performed using an AC voltmeter. During Start mode, the Run LED (green) on the LCP should flash.

1. Connect the MCD 500 to mains voltage, control voltage and to a motor.
2. Measure the voltage across each phase (L1-T1, L2-T2, L3-T3). This should be close to the nominal mains voltage (phase voltage for in-line connection and line voltage for inside delta connection).

- If the voltage is zero, the SCR on that phase may have failed.
- If the voltage is not equivalent to the nominal mains voltage, the bypass contactor may be damaged and should be replaced (models MCD5-0021B - MCD5-0215B only).

1. Command the MCD 500 to start. While the MCD 500 is starting, measure the voltage across each phase. The voltage should fall to less than 2 VAC just before the soft starter reaches Run mode.

- If the voltage remains near nominal mains voltage, the SCR is not firing correctly. The Main Control PCB, Backplane PCB or connection between these items may be faulty.

If the voltage starts near nominal mains voltage then falls to less than 2 VAC just before the MCD 500 reaches Run mode, the MCD 500 is operating correctly and the cause of the starting problem is not the soft starter.

2.2.3 Run Performance Test

Models MCD5-0021B - MCD5-0215B incorporate internal bypass contactors. If the internal bypass contactor does not operate, the SCRs will eventually fail due to thermal stress. This procedure tests the operation of the internal bypass contactors. Use this test if the starter trips with "Bypass Fail" or "Time Overcurrent".

This test is performed using either an AC voltmeter.

1. Connect the MCD 500 to mains voltage, control voltage and to a motor.
2. Measure the voltage across each phase (L1-T1, L2-T2, L3-T3). This should be close to the nominal mains voltage (phase voltage for in-line connection and line voltage for inside delta connection).

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

1. Command the soft starter to start. When the Run LED (green) stops flashing, you should hear the bypass contactor close.

- If the bypass contactor does not close, the bypass contactor, Main Control PCB, Model PCB or Bypass Driver PCB (models MCD5-0131B - MCD5-0215B only) may be faulty or there may be a faulty connection between these components.

1. When the soft starter is running, measure the voltage across each phase. This should be less than 0.5 VAC.
2. Command the soft starter to stop and listen for the bypass contactor to open. If the MCD 500 is configured for soft stop, this should occur when the Run LED (green) starts flashing. If the MCD 500 is not configured for soft stop, this should occur when the Run LED turns off.

NB!
The bypass contactors used in the MCD 500 are latching. The MCD 500 control circuits are designed to open the bypass contactors even in the event of removal or loss of control voltage. However it is still possible that the bypass contactor may be closed when there is no control supply to the soft starter. The bypass contactors will open when control voltage is next applied.

Control Input Test

This procedure tests the condition of the soft starter control inputs. This test is performed using a wire link.

1. Disconnect all external wiring from the soft starter's control inputs.
2. Control voltage must still be connected to the soft starter.
3. Connect a wire link between each input.

- If the corresponding LED lights up then the input is operating correctly.

If the LED does not light up, the control input is damaged. Replace the Main Control PCB

2.3 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 2 *Protection* and parameter group 16 *Protection Action*, other settings are built-in system protections and cannot be set or adjusted.

Display	Possible cause/Suggested solution
Battery/Clock	A verification error has occurred on the real time clock, or the backup battery voltage is low. If the battery is low and the power is off, date/time settings will be lost. Reprogram the clock. Related Pars.: 16-12
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 Current imbalance can also be caused by incorrect cabling between the external bypass contactor and the soft starter or an internal problem with the soft starter, particularly an SCR that has failed open circuit. A failed SCR can only be definitely diagnosed by replacing the SCR and checking the starter's performance. Related Pars.: 2-2, 2-3, 16-2
Excess Start Time	Excess start time trip can occur in the following conditions: - The FLC setting is wrong - The Current Limit has been set too low - The Start Ramp Time has been set greater than the Excess Start Time setting The Start Ramp Time is set too short for a high inertia load when using adaptive acceleration control Related Pars.: 1-1, 1-6, 1-4, 1-9, 7-9, 7-1, 7-6, 7-4, 16-7
FLC Too High	The MCD 500 can support higher motor FLC values when connected to the motor using inside delta configuration rather than in-line connection. If the soft starter is connected in-line but the selected motor FLC is above the in-line maximum, the soft starter will trip at start. Related Pars.: 1-1, 7-1
Frequency	The mains frequency has gone beyond the specified range. Check for other equipment in the area that could be affecting the mains supply (particularly variable speed drives). If the MCD 500 is connected to a generator set supply, the generator may be too small or could have a speed regulation problem. Related Pars.: 2-8, 2-9, 2-10, 16-5

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Display	Possible cause/Suggested solution
Heatsink Overtemp	Check if cooling fans are operating. If mounted in an enclosure check if ventilation is adequate. On models with internal bypass, the cooling fans will operate: - During the Start sequence and for 10 minutes after transition to Run. - For 10 minutes after Stop. Models without internal bypass will operate the cooling fans from a Start until 10 minutes after a Stop. Related Pars.: 16-6
Input A Trip	Identify and resolve the condition which caused Input A to activate. Related Pars.: 3-3, 3-4, 3-5, 3-6, 3-7, 16-8
Inst Overcurrent	The motor has experienced a sharp rise in motor current, probably caused by a locked rotor condition (shearpin) while running. This may indicate a jammed load. Related Pars.: 2-6, 2-7, 16-4
Internal Fault X	The MCD 500 has tripped on an internal fault. Contact your local supplier with the fault code (X). Related Pars.: None
L1 Phase Loss L2 Phase Loss L3 Phase Loss	During prestart 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 Pars.: None
L1-T1 Shorted L2-T2 Shorted L3-T3 Shorted	During prestart checks the starter has detected a shorted SCR or a short within the bypass contactor as indicated. Related Pars.: none
Motor Overload	The motor has reached its maximum thermal capacity. Overload can be caused by: - The soft starter protection settings not matching the motor thermal capacity. - Excessive starts per hour - Excessive throughput - Damage to the motor windings. Resolve the cause of the overload and allow the motor to cool. Related Pars.: 1-1, 1-2, 1-3, 1-4, 16-1
Motor Connection	The motor is not connected correctly to the soft starter for inline or inside delta use. - Check individual motor connections to the soft starter for power circuit continuity. - Check connections at the motor terminal box. Related Pars.: 15-7
Motor Thermistor	The motor thermistor input has been enabled and: - The resistance at the thermistor input has exceeded 3.6 kΩ for more than one second. - The motor winding has overheated. Identify the cause of the overheating and allow the motor to cool before restarting. - The motor thermistor input has been open. Note: If a valid motor thermistor is no longer used, a 1.2 kΩ resistor must be fitted across terminals 05, 06. Related Pars.: 16-9
Network Comms	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 Pars.: 16-11
Parameter out of Range	- A parameter value is outside the valid range. The LCP will indicate the first parameter which is out of range. Press **RESET** to go to the parameter and adjust the setting. Related Pars.: None
Phase Sequence	The phase sequence on the soft starter's input terminals (L1, L2, L3) is not valid. Check the phase sequence on L1, L2, L3 and ensure the setting in Par. 2-1 is suitable for the installation. Related Pars.: 2-1

Display	Possible cause/Suggested solution
Power Loss	The starter is not receiving mains supply on one or more phases when a Start Command is given. Check that the main contactor closes when a start command is given, and remains closed until the end of a soft stop. Related Pars.: 15-5
Secondary Motor Fail	Control voltage has been applied to the MCD 500 with a link across input A (11, 16). The default function for input A is Motor Set Select. Remove the link, change the setting for Par. 3-3 then replace the link. Related Pars.: 3-3
Starter/Comms	- There is 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. - There is an internal communications error within the soft starter. Contact your local distributor. Related Pars.: 16-10
Thermistor Cct	The thermistor input has been enabled and: - The resistance at the input has fallen below 20 Ω (the cold resistance of most thermistors will be over this value) or - A short circuit has occurred. Check and resolve this condition. Check that a PT100 (RTD) is not connected to 05, 06. Related Pars.: None.
Time - Overcurrent	The MCD 500 is internally bypassed and has drawn high current during running. (The 10A protection curve trip has been reached or the motor current has risen to 600% of the motor FLC setting.) Related Pars.: None
Undercurrent	The motor has experienced a sharp drop in current, caused by loss of load. Causes can include broken components (shafts, belts or couplings), or a pump running dry. Related Pars.: 2-4, 2-5, 16-3
Unsupported Option	The selected function is not available (e.g. jog is not supported in inside delta configuration). Related Pars.: None

2.4 General Faults

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

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Symptom	Probable Cause
Soft starter does not respond to commands.	- If the soft starter does not respond to the **RESET** button on the LCP: The soft starter may be in Auto On mode and will only accept commands from the remote control inputs. In Auto On mode, the Auto On LED on the LCP is active. Press the **Hand On** or **Off** button to enable control via the LCP (this will also send a start or stop command to the MCD 500). - If the soft starter does not respond to commands from the control inputs: The soft starter may be in Hand On mode and will only accept commands from the LCP. When the soft starter is in Hand On control mode, the Off or Hand On LED on the LCP is active. To change to Auto On mode, press the **Auto On** button once. The control wiring may be incorrect. Check that the remote start, stop and reset inputs are configured correctly (=> *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 LCP. The soft starter will only execute a start command from the remote inputs if the remote reset input is closed. Check that the remote reset input is also active (the Reset LED on the starter will be on). - If 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 Par. 2-11 *Restart Delay*. The motor may be too hot to permit a start. If Par. 2-12 *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 Par. 3-3 is set to Emergency Stop and there is an open circuit on the corresponding input, the MCD 500 will not start. If the emergency stop situation has been resolved, close the circuit on the input.
The soft starter does not control the motor correctly during starting.	- Start performance may be unstable when using a low Motor Full Load Current setting Par. 1-1). This can affect use on a small test motor with full load current between 5 A and 50 A. - Power factor correction (PFC) capacitors must be installed on the supply side of the soft starter. To control a dedicated PFC capacitor contactor, connect the contactor to run relay terminals.
Motor does not reach full speed.	- If the start current is too low, the motor will not produce enough torque to accelerate to full speed. The soft starter may trip on excess start time. **NB!** Make sure the motor starting parameters are appropriate for the application and that you are using the intended motor starting profile. If Par. 3-3 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 MCD 500 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 Pars. 1-10, 1-11, 7-10 and 7-11. - If the motor is very lightly loaded, soft stop will have limited effect.
AAC adaptive acceleration control, DC brake and Jog functions not working	- These features are only available with in-line installation. If the MCD 500 is installed inside delta, these features will not operate.

Symptom	Probable Cause
A reset does not occur after an Auto-Reset, when using a remote 2-wire control.	- The remote 2-wire start signal must be removed and reapplied for a re-start.
Remote start/stop command is overriding Auto Start/Stop settings when using remote 2-wire control.	- Auto Start/Stop function should only be used in HAND ON mode or in tandem with HAND OFF mode, 3 and 4-wire control.
After selecting AAC the motor used an ordinary start and/or the second start was different to the first.	- The first AAC start is current limit so that the starter can learn from the motor characteristics. Subsequent starts use AAC.
Non-resettable THERMISTOR FAIL trip, when there is a link between Thermistor input 05, 06 or when the motor thermistor connected between 05, 06 is permanently removed.	- The thermistor input is enabled once a link is fitted and short circuit protection has activated. Remove the link then load the default parameter set. This will disable the thermistor input and clear the trip. Place a 1k2 Ω resistor across the thermistor input. Turn thermistor protection to 'Log only' (Par. 16-9).
Parameter settings cannot be stored.	- Make sure you are saving the new value by pressing the **OK** button after adjusting a parameter setting. If you press **BACK**, the change will not be saved. - Check that the adjustment lock (Par. 15-2) is set to Read/Write. If the adjustment lock is on, settings can be viewed but not changed. You need to know the security access code to change the adjustment lock setting. - The EEPROM may be faulty on the LCP or the Main Control PCB. A faulty EEPROM will also trip the soft starter, and the LCP will display the message EEPROM Fail. Contact your local supplier for advice.

3

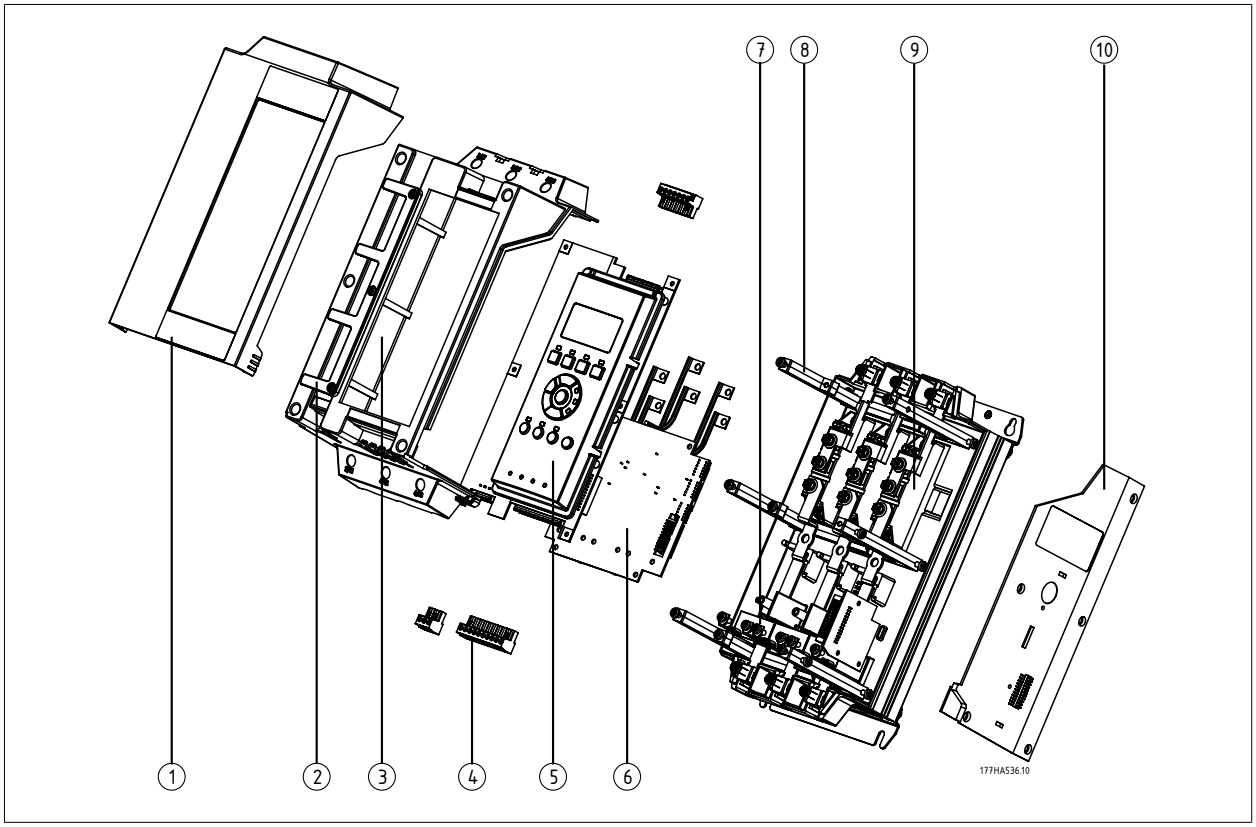
3 Service Instructions

3.1 Frame Sizes

The physical layout and spare parts for MCD 500 vary according to the size of the starter. MCD 500 starters can be grouped into five classes ("frame sizes") as follows:

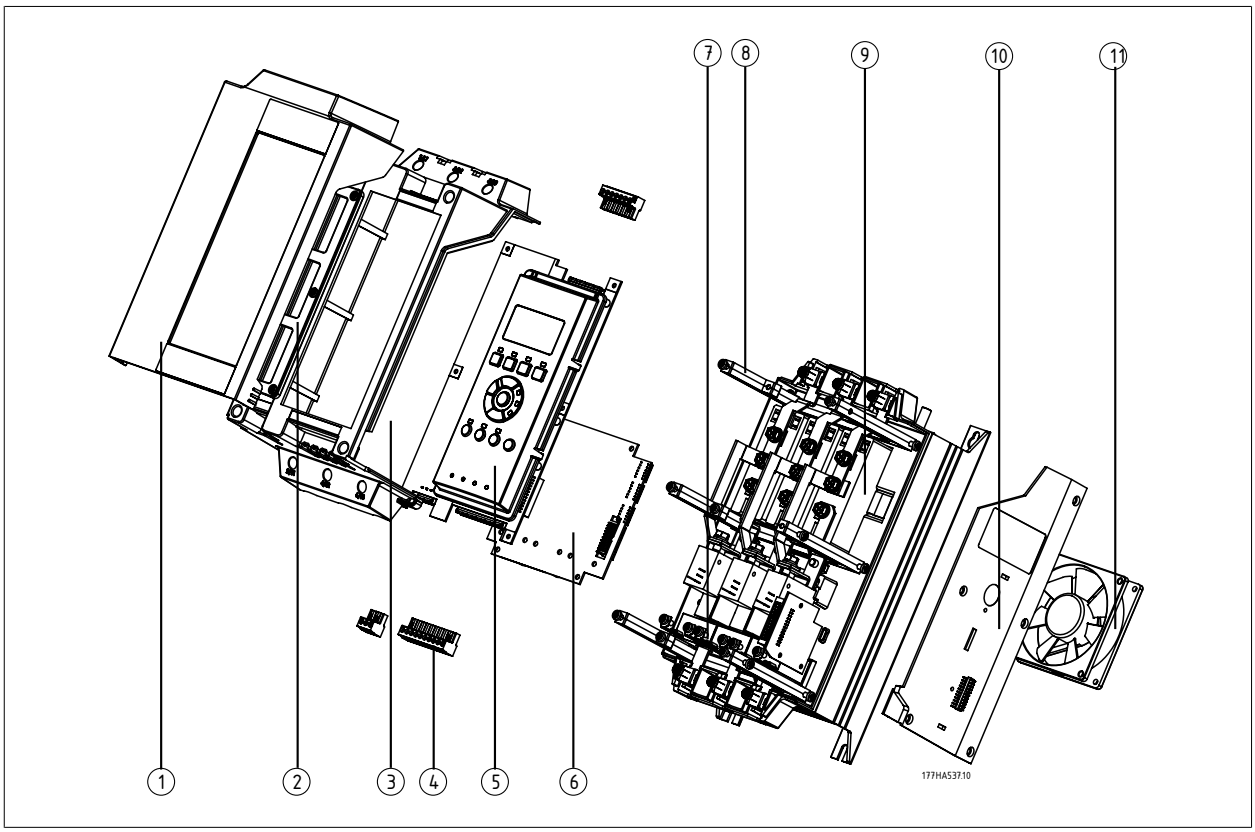
Class	MCD 500 Models
G1B	MCD5-0021B
	MCD5-0037B
	MCD5-0043B
	MCD5-0053B
	MCD5-0068B
	MCD5-0084B
	MCD5-0089B
	MCD5-0105B
G2B	MCD5-0131B
	MCD5-0141B
	MCD5-0195B
	MCD5-0215B
G3C	MCD5-0245C
G4C	MCD5-0360C
	MCD5-0380C
	MCD5-0428C
	MCD5-0595C
	MCD5-0619C
	MCD5-0790C
	MCD5-0927C
G5C	MCD5-1200C
	MCD5-1410C
	MCD5-1600C

3.1.1 MCD5-0021B - MCD5-0053B (G1B)



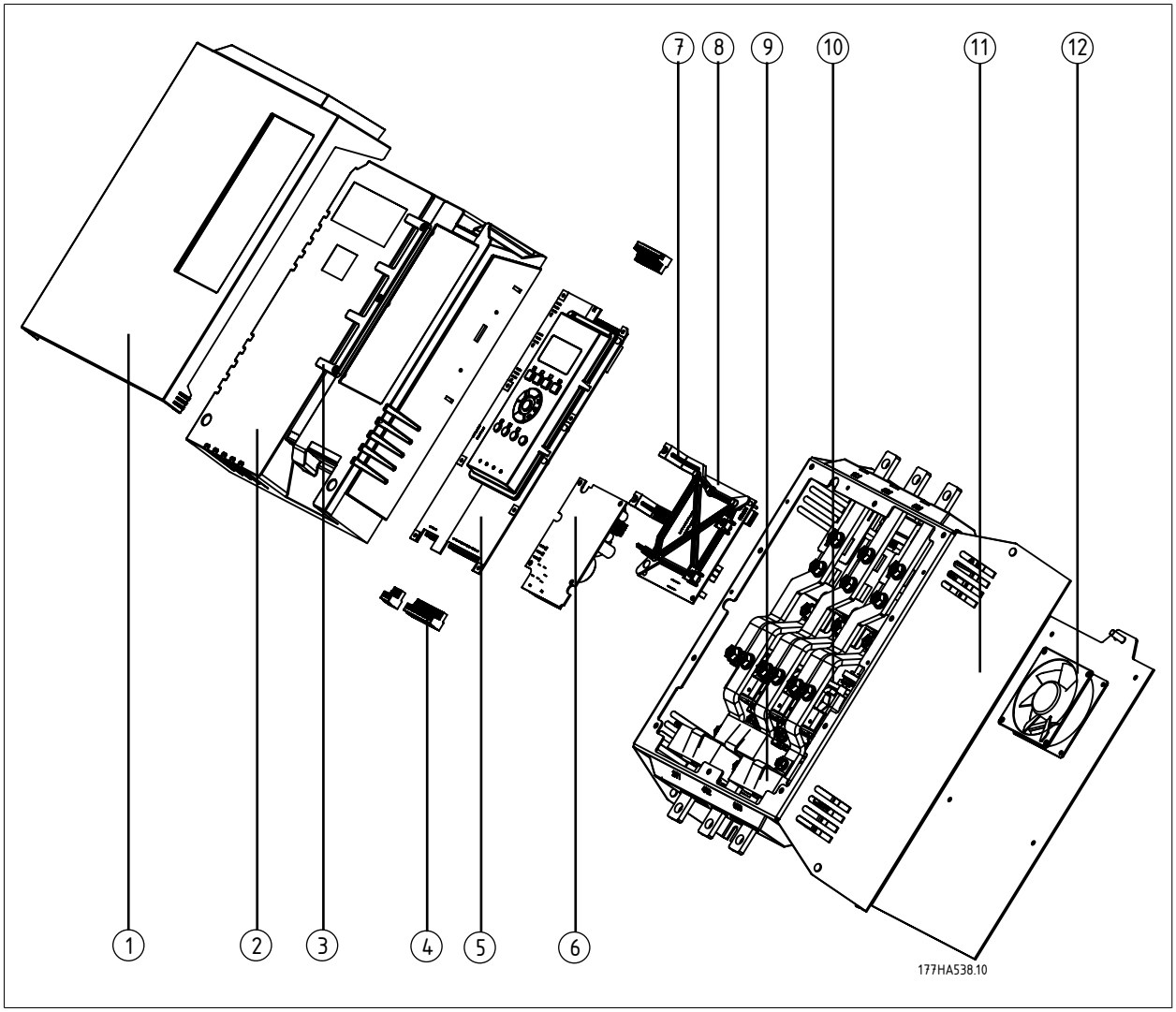
1	Cover	6	Model PCB
2	Cable guide	7	Current transformers
3	Main plastic	8	Mounting posts
4	Terminal blocks	9	SCRs
5	LCP and Main Control PCB	10	Side plastic

3.1.2 MCD5-0068B - MCD5-0105B (G1B)



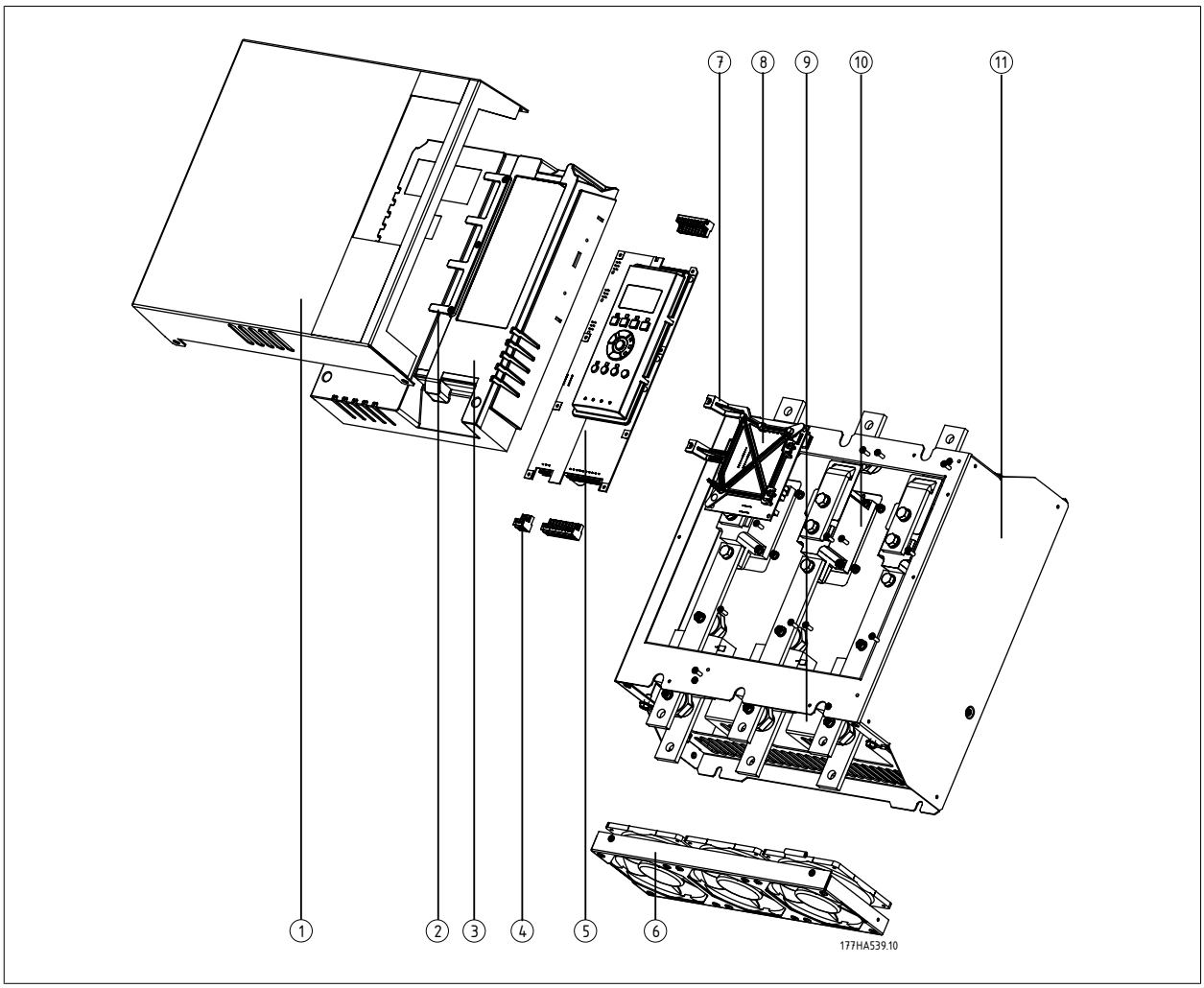
1	Cover	7	Current transformers
2	Cable guide	8	Mounting posts
3	Main plastic	9	SCRs
4	Terminal blocks	10	Side plastic
5	LCP and Main Control PCB	11	Fan
6	Model PCB		

3.1.3 MCD5-0131B - MCD5-0215B (G2B)



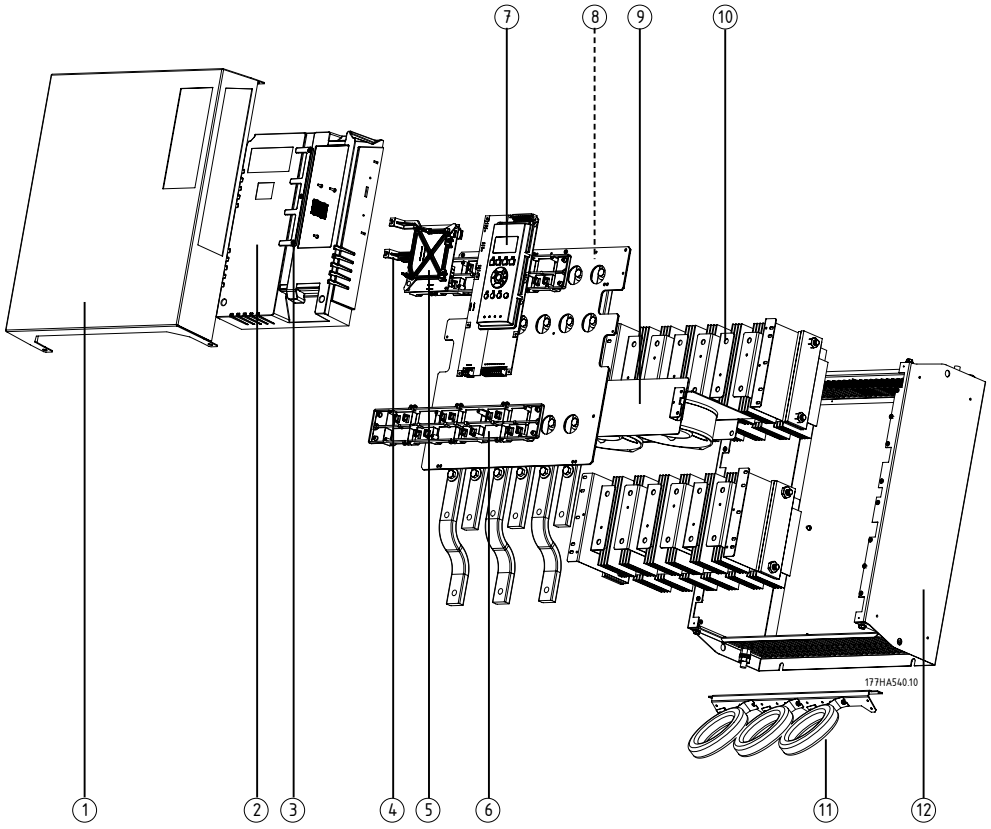
1	Cover	7	Support plastic
2	Main plastic	8	Model PCB
3	Cable guide	9	Current transformers
4	Terminal blocks	10	SCRs
5	LCP and Main Control PCB	11	Main body
6	Bypass Driver PCB	12	Fan and bracket

3.1.4 MCD5-0245C (G3C)



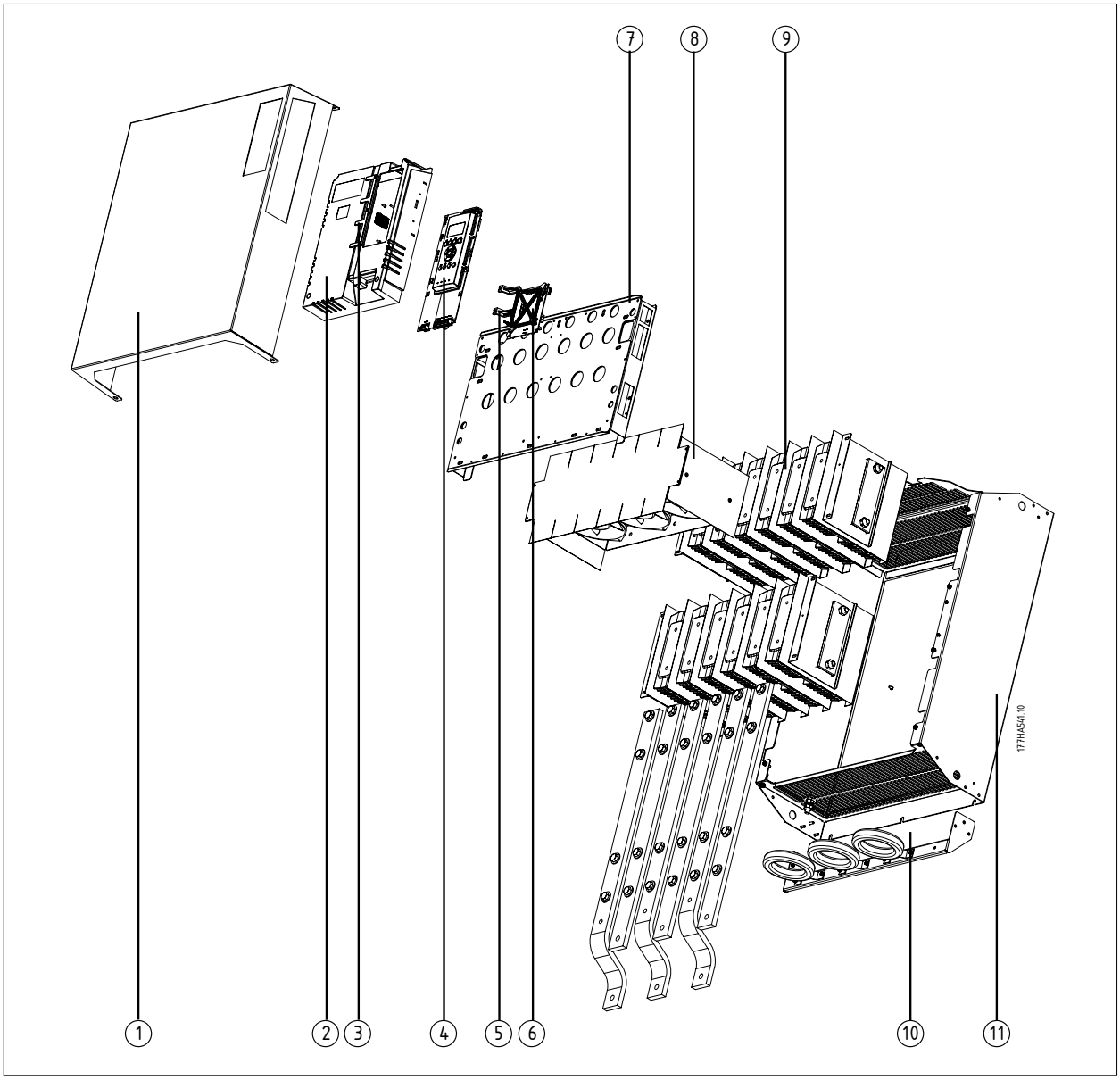
1	Cover	7	Support plastic
2	Cable guide	8	Model PCB
3	Main plastic	9	Current transformers
4	Terminal blocks	10	SCRs
5	LCP and Main Control PCB	11	Main body
6	Fan assembly		

3.1.5 MCD5-0360C - MCD5-0927C (G4C)



1	Cover	7	LCP and Main Control PCB
2	Main plastic	8	Magnetic bypass plate (models <0595>C - 0927C)
3	Cable guide	9	Fan assembly
4	Support plastic	10	Power assembly
5	Model PCB	11	Current transformer assembly
6	Module mount and spacer plastic	12	Main body

3.1.6 MCD5-1200C - MCD5-1600C (G5C)



1	Cover	7	Magnetic bypass plate
2	Main plastic	8	Fan assembly
3	Cable guide	9	Power assembly
4	LCP and Main Control PCB	10	Current transformer assembly
5	Support plastic	11	Main body
6	Model PCB		

4

4 Spare Parts

4.1.1 Spare Parts

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

4.2 Main Control PCB

Each soft starter requires **one** Main Control PCB.

	CV1		CV3	
	T5	T7	T5	T7
MCD5-0021B MCD5-0037B MCD5-0043B MCD5-0053B MCD5-0068B MCD5-0084B MCD5-0089B MCD5-0105B	175G5603	175G5604	175G5601	175G5602
MCD5-0131B MCD5-0141B MCD5-0195B MCD5-0215B MCD5-0241C MCD5-0360C MCD5-0380C MCD5-0428C MCD5-0595C MCD5-0619C MCD5-0790C MCD5-0927C MCD5-1200C MCD5-1410C MCD5-1600C	175G5607	175G5608	175G5605	175G5606

177HA558.10

175G5601 - 175G5604

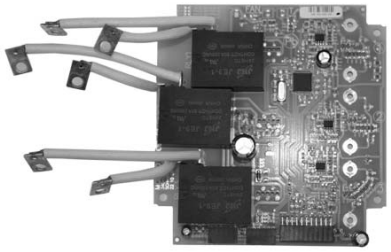
177HA559.10

175G5605 - 175G5608

4.3 Model PCB

Each soft starter requires **one** Model PCB.

MCD5-0021B	175G5609	MCD5-0245C	175G5621
MCD5-0037B	175G5910	MCD5-0360C	175G5622
MCD5-0043B	175G5611	MCD5-0380C	175G5623
MCD5-0053B	175G5612	MCD5-0428C	175G5624
MCD5-0068B	175G5613	MCD5-0595C	175G5625
MCD5-0084B	175G5614	MCD5-0619C	175G5626
MCD5-0089B	175G5615	MCD5-0790C	175G5627
MCD5-0105B	175G5616	MCD5-0927C	175G5628
MCD5-0131B	175G5617	MCD5-1200C	175G5629
MCD5-0141B	175G5618	MCD5-1410C	175G5630
MCD5-0195B	175G5619	MCD5-1600C	175G5631
MCD5-0215B	175G5620		

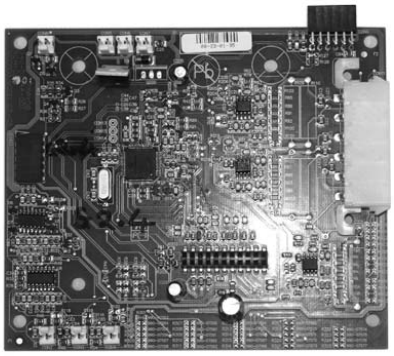


177HA560.10

175G5609 - 175G5612

177HA561.10

175G5613 - 175G5616



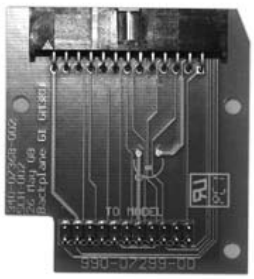
177HA562.10

175G5617 - 175G5631

4.4 Backplane PCB

Models MCD5-0021B - MCD5-0105B require **one** Backplane PCB.

MCD5-0021B MCD5-0037B MCD5-0043B MCD5-0053B MCD5-0068B MCD5-0084B MCD5-0089B MCD5-0105B	175G5632
MCD5-0131B MCD5-0141B MCD5-0195B MCD5-0215B MCD5-0245C MCD5-0360C MCD5-0380C MCD5-0428C MCD5-0595C MCD5-0619C MCD5-0790C MCD5-0927C MCD5-1200C MCD5-1410C MCD5-1600C	Not required



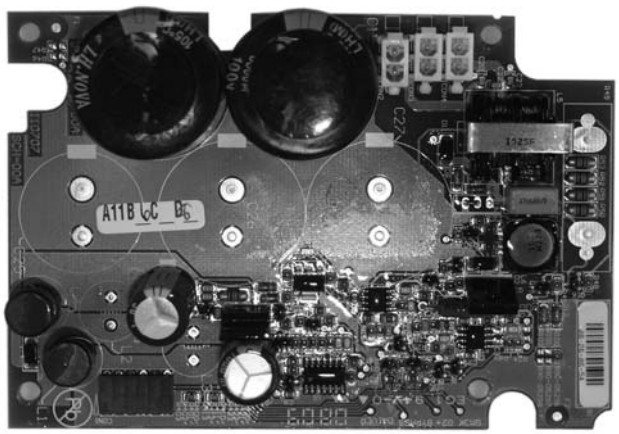
177HA563.10

175G5632

4.5 Bypass Driver PCB

Models MCD5-0131B - MCD5-0215B require **one** Bypass Driver PCB.

MCD5-0021B MCD5-0037B MCD5-0043B MCD5-0053B MCD5-0068B MCD5-0084B MCD5-0089B MCD5-0105B	Not required
MCD5-0131B MCD5-0141B MCD5-0195B MCD5-0215B	175G5633
MCD5-0245C MCD5-0360C MCD5-0380C MCD5-0428C MCD5-0595C MCD5-0619C MCD5-0790C MCD5-0927C MCD5-1200C MCD5-1410C MCD5-1600C	Not required



177HA564.10

175G5633

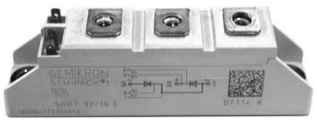
4.6 SCRs and Power Assemblies

Models MCD5-0021B - MCD5-0245C use SCRs. Each soft starter requires **three** SCRs.

MCD5-0021B	175G5119
MCD5-0037B	175G5120
MCD5-0043B	175G5121
MCD5-0053B MCD5-0068B	175G5122
MCD5-0084B	175G5123
MCD5-0089B	175G5124
MCD5-0105B MCD5-0131B	175G5634
MCD5-0141B	175G5635
MCD5-0195B	175G5126
MCD5-0215B MCD5-0245C	175G5127

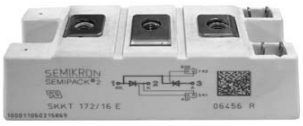
Models MCD5-0360C - MCD5-1600C use power assemblies. Each soft starter requires **two** power assemblies.

MCD5-0360C	175G5636
MCD5-0380C	175G5637
MCD5-0428C	175G5638
MCD5-0595C	175G5639
MCD5-0619C	175G5640
MCD5-0790C	175G5641
MCD5-0927C	175G5642
MCD5-1200C	175G5643
MCD5-1410C	175G5644
MCD5-1600C	175G5645



177ha547.10

175G5119 - 175G5122



177HA548.10

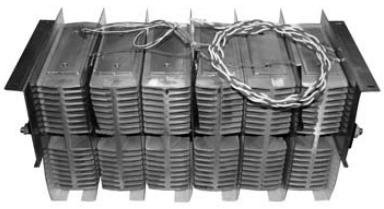
175G5123, 175G5124, 175G5134

177HA549.10

175G5135, 175G5126, 175G5127

177HA550.10

175G5636 - 175G5642



177HA551.10

175G5643 - 175G5645

4.7 Fans

Certain models include a fan. The number of fans required differs between units and is shown in the table below.

	Part number	Quantity
MCD5-0021B MCD5-0037B MCD5-0043B MCD5-0053B	Not required	
MCD5-0068B MCD5-0084B MCD5-0089B MCD5-0105B MCD5-0131B	175G5646	1
MCD5-0141B	Not required	
MCD5-0195B MCD5-0215B	175G5646	1
MCD5-0245C MCD5-0360C MCD5-0380C MCD5-0428C MCD5-0595C	175G5647	3
MCD5-0619C MCD5-0790C MCD5-0927C	175G5648	2
MCD5-1200C MCD5-1410C MCD5-1600C	175G5648	3

177HA552.10

175G5646, 175G5647

177HA553.10

175G5648

4.8 Current Transformers

Each soft starter requires **three** current transformers.

MCD5-0021B MCD5-0037B MCD5-0043B MCD5-0053B MCD5-0068B MCD5-0084B MCD5-0089B MCD5-0105B	175G5649
MCD5-0131B MCD5-0141B MCD5-0195B MCD5-0215B	175G5650
MCD5-0245C	175G5650
MCD5-0360C	175G5652
MCD5-0380C MCD5-0428C	175G5653
MCD5-0595C MCD5-0619C	175G5654
MCD5-0790C	175G5655
MCD5-0927C	175G5656
MCD5-1200C	175G5657
MCD5-1410C	175G5658
MCD5-1600C	175G5659

177HA554.10

175G5649 - 175G5650

177HA555.10

175G5652 - 175G5659

4.9 Bypass Contactors

Models MCD5-0021B - MCD5-0215B are internally bypassed. The bypass contactor for models MCD5-0021B - MCD5-0053B is included in the Model PCB. The bypass contactors for models MCD5-0068B - MCD5-0215B are shown below. Each soft starter requires **three** bypass contactors.

MCD5-0021B MCD5-0037B MCD5-0043B MCD5-0053B	Not required
MCD5-0068B MCD5-0084B MCD5-0089B MCD5-0105B	175G5660
MCD5-0131B MCD5-0141B MCD5-0195B MCD5-0215B	175G5661
MCD5-0245C MCD5-0360C MCD5-0380C MCD5-0428C MCD5-0595C MCD5-0619C MCD5-0790C MCD5-0927C MCD5-1200C MCD5-1410C MCD5-1600C	Not required

177HA556.10

175G5660

177HA557.10

175G5661

4.10 Plastics

The following body plastic components are available for MCD-500.

	Cover	Main plastic	Cable guide	Mounting posts
MCD5-0021B MCD5-0037B MCD5-0043B MCD5-0053B MCD5-0068B MCD5-0084B MCD5-0089B MCD5-0105B	175G5667	175G5671	175G5669	175G5670 (set of 3)
MCD5-0131B MCD5-0141B MCD5-0195B MCD5-0215B	175G5668	175G5672		Not required
MCD5-0245C MCD5-0360C MCD5-0380C MCD5-0428C MCD5-0595C MCD5-0619C MCD5-0790C MCD5-0927C MCD5-1200C MCD5-1410C MCD5-1600C	Not required			

177HA566.10

175G5667, 175G5668

177HA571.10

175G5671, 175G5672

177HA568.10

175G5669

177HA569.10

175G5670

4.10.1 Complete plastics

The complete plastics kit contains the following items:

- 175G5673: 175G5667, 175G5671, 175G5669, 175G5670, side plastic, plastic base
- 175G5674: 175G5668, 175G5672, 175G5669, support plastic
- 175G5675: 175G5672, 175G5669, support plastic

	Complete plastics
MCD5-0021B MCD5-0037B MCD5-0043B MCD5-0053B MCD5-0068B MCD5-0084B MCD5-0089B MCD5-0105B	175G5673
MCD5-0131B MCD5-0141B MCD5-0195B MCD5-0215B	175G5674
MCD5-0245C MCD5-0360C MCD5-0380C MCD5-0428C MCD5-0595C MCD5-0619C MCD5-0790C MCD5-0927C MCD5-1200C MCD5-1410C MCD5-1600C	175G5675

4.11 Bus Bars

Each soft starter requires a total of six bus bars (three input and three output). Each kit contains three bus bars (unless otherwise stated) and fixing accessories if applicable.

	Input	Output
MCD5-0021B MCD5-0037B MCD5-0043B MCD5-0053B	175G5677	175G5678
MCD5-0068B	175G5679	175G5680
MCD5-0084B MCD5-0089B MCD5-0105B	175G5681	174G5682
MCD5-0131B	175G5696	175G5683
MCD5-0141B MCD5-0195B MCD5-0215B	175G5684	175G5685
MCD5-0245C	175G5686 (set of 6)	175G5687
MCD5-0360C MCD5-0380C MCD5-0428C MCD5-0595C	175G5688	175G5689
MCD5-0619C MCD5-0790C MCD5-0927C	175G5690	175G5691
MCD5-1200C	175G5692	175G5693
MCD5-1410C MCD5-1600C	175G5694	175G5695

177HA573.10

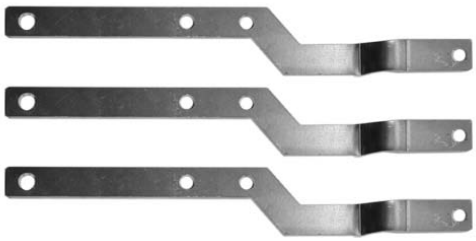
175G5677

177HA574.10

175G5679, 175G5681

177HA575.10

175G5678, 175G5680, 175G5682



177HA576.10

175G5696, 175G5684

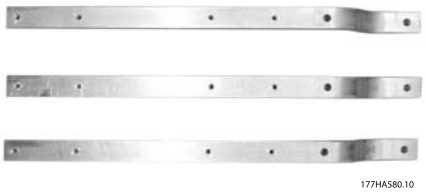
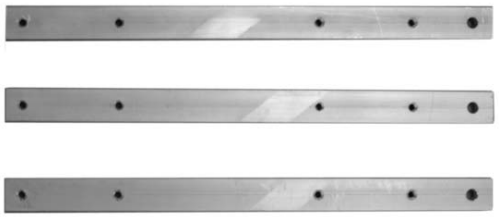
177HA577.10

175G5683, 175G5685

4

177HA578.10

177HA579.10

175G5686	175G5687
 177HA580.10	 177HA581.10
175G5688, 175G5690, 175G5692, 175G5694	175G5689, 175G5691, 175G5693, 175G5695

4.12 Other Spare Parts

The following spare parts are also available.

	Cage Clamps	Connector Plugs
MCD5-0021B MCD5-0037B MCD5-0043B MCD5-0053B MCD5-0068B MCD5-0084B MCD5-0089B MCD5-0105B	175G5666 (set of 3)	175G5676 (set of 3)
MCD5-0131B MCD5-0141B MCD5-0195B MCD5-0215B MCD5-0245C MCD5-0360C MCD5-0380C MCD5-0428C MCD5-0595C MCD5-0619C MCD5-0790C MCD5-0927C MCD5-1200C MCD5-1410C MCD5-1600C	Not required	

177HA565.10

175G5666

177HA572.10

175G5676

5

5 Avoiding Damage

5.1 SCRs

5.1.1 Typical Causes of SCR Damage

SCR damage is generally 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 starter
- power factor correction connected to the output of the soft starter
- over-corrected bulk power factor correction on a lightly loaded system causing severe ringing voltages

Overtemperature:

- blocked heatsinks or restricted ventilation
- inadequate ventilation
- excessive ambient temperatures
- bypass relay fails to close during running (internally bypassed starters only)

5.1.2 Protecting SCRs

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

5.1.3 Semiconductor Fuses

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

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

5.1.4 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 is blocking the full line voltage. Using a main contactor to remove voltage from the SCR input when the starter is off eliminates the risk of SCR damage due to overvoltage.

5.2 Output Relays

MCD 500 soft starters have four programmable output relays. These relays are often used to control the main contactor.

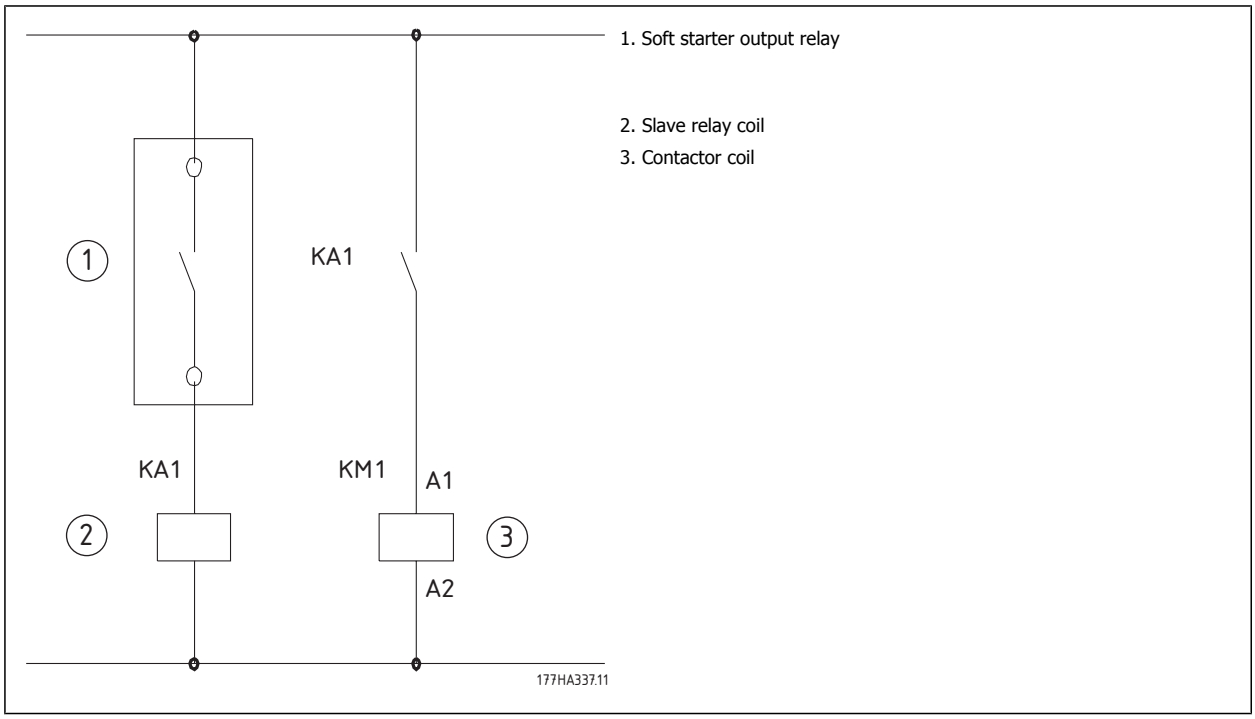
The electronic contactor coils used in many contactors have a high initial inrush current, which can damage the soft starter's internal relays if the contactor coil is switched directly.

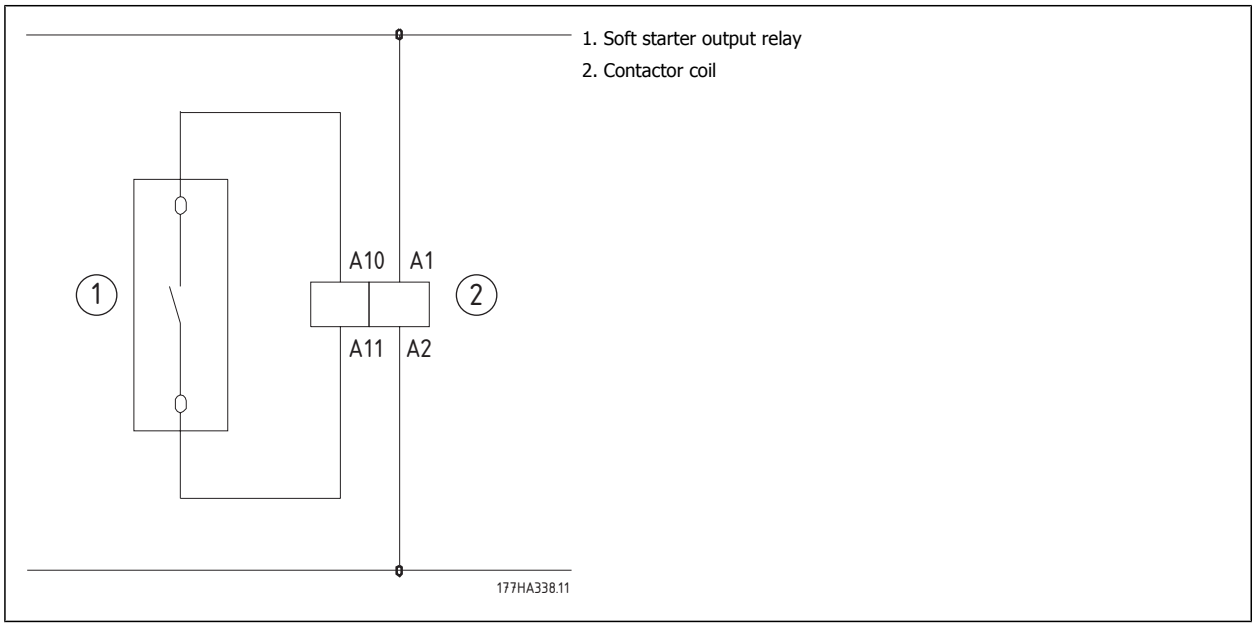
5.2.1 Using the Soft Starter to Switch a Contactor

Before using the soft starter's output relay to switch an electronic contactor coil, consult the contactor manufacturer. Some contactor manufacturers (eg Klockner-Moeller) state that you cannot use PCB mount relays for direct switching of their electronic contactor coils.

If this is the case, there are two solutions:

1. Use the soft starter's output relay to control a slave relay. This slave relay can then be used to directly switch the electronic contactor coil circuit.





5.3 Control Input

MCD 500 soft starters can be operated by external two wire or three wire control signals. External switches are configured and wired into control input terminals 01, 02.

- External switches operating the control inputs must be rated for the control voltage being used and a continuous current of 100 mA.
- Incorrect configuration and wiring of the external contacts/switches to the control input terminals may cause damage.
- If long cable runs are used, wiring must be twisted pair or shielded cable and must be separated from AC power cables by at least 300 mm.