SIEMENS

MICROMASTER 411 & COMBIMASTER 411
REM Module

Operating Instructions **Issue 01/03**

User Documentation
6SE6400-5CT00-0BP0

SIEMENS

MICROMASTER 411 & COMBIMASTER 411

REM Module

Operating Instructions
User Documentation

Valid for

MICROMASTER 411 &
COMBIMASTER 411

Issue 01/03

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Further information is available on the Internet under:
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Other functions not described in this document may be available. However, this fact shall not constitute an obligation to supply such functions with a new control, or when servicing.

We have checked that the contents of this document correspond to the hardware and software described. There may be discrepancies nevertheless, and no guarantee can be given that they are completely identical. The information contained in this document is reviewed regularly and any necessary changes will be included in the next edition. We welcome suggestions for improvement.

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Foreword

User Documentation

WARNING

Before installing and commissioning the inverter, you must read all safety instructions and warnings carefully including all the warning labels attached to the equipment. Make sure that the warning labels are kept in a legible condition and replace missing or damaged labels.

Information is also available from:

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Internet Home Address

Customers can access technical and general information at:
http://www.siemens.de/micromaster

Contact address

Should any questions or problems arise while reading this manual, please contact the Siemens office concerned using the form provided at the back this manual.

Definitions and Warnings

Safety guidelines

This manual contains notices intended to ensure your personal safety, as well as to protect products and connected equipment against damage. Information relating to your personal safety is highlighted by a warning triangle. Warnings about property damage are displayed without a warning triangle. Depending on the degree of risk involved, safety-related information is presented in the following categories:

DANGER

For the purpose of this documentation and the product warning labels, "Danger" indicates that death, severe personal injury or substantial damage to property **will** result if proper precautions are not taken.

WARNING

For the purpose of this documentation and the product warning labels, "Warning" indicates that death, severe personal injury or substantial damage to property **can** result if proper precautions are not taken.

CAUTION

With a warning triangle, "Caution" indicates that minor personal injury can result if proper precautions are not taken.

CAUTION

Without a warning triangle, "Caution" indicates that material damage can result if proper precautions are not taken.

ATTENTION

indicates that an undesirable effect or state can occur if attention is not paid to the advice given.

NOTE

For the purpose of this documentation, "Note" indicates important information relating to the product or highlights part of the documentation for special attention.

Qualified personnel

For the purpose of this Instruction Manual and product labels, a "Qualified person" is someone who is familiar with the installation, mounting, start-up and operation of the equipment and the hazards involved.
He or she must have the following qualifications:

1. Trained and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety procedures.
2. Trained in the proper care and use of protective equipment in accordance with established safety procedures.
3. Trained in rendering first aid.

User Documentation

WARNING

Before installing and commissioning, please read these safety instructions and warnings carefully and all the warning labels attached to the equipment. Make sure that the warning labels are kept in a legible condition and replace missing or damaged labels.

Proper use

Please note the following:

WARNING

This equipment contains dangerous voltages and controls potentially dangerous rotating mechanical parts.

Non-compliance with Warnings or failure to follow the instructions contained in this manual can result in loss of life, severe personal injury or serious damage to property.

Only suitably qualified personnel should work on this equipment, and only after becoming familiar with all safety notices and maintenance procedures contained in this manual.

The successful and safe operation of this equipment is dependent upon its proper handling, storage, installation, operation and maintenance.

National safety regulations are also applicable.

Use for intended purpose only

The equipment may be used only for the application stated in the manual and only in conjunction with devices and components recommended and authorized by Siemens.

Table of Contents

1 Description

The REM Module (Resistor and Electromechanical Brake Control Module) is used to support „slow down“ of the motor and protect against regenerative feedback to the inverter from the motor as well as to control an electromechanical brake, mounted on the motor. It combines an EM brake functionality with an resistor brake functionality.

The REM Module is to be used in conjunction with the Inverters MICROMASTER 411 (6SE6411-…) or COMBIMASTER 411 (1UA1-…).

The user should make reference to the Inverter Operating Instructions (Order Number: 6SE6400-5CA00-0BP0) when connecting connecting this option module.

Figure 1-2 shows the layout of the REM Module.

Resistor Brake

The electronics of the resistor brake functionality operates completely independently from the inverter electronics, monitoring the DC link voltage. During motor braking, the motor will regenerate, causing the DC link voltage to rise.

When a set threshold is reached, the REM Module electronics will switch the resistor onto the DC link. This will cause the regenerated energy to be dissipated as heat into the resistor, thus reducing the DC link voltage and preventing an overvoltage trip.

Whilst the resistor is switched onto the DC link, the resistor temperature will rise. If the temperature continues to rise until such time as the maximum temperature (85 ºC) is reached then the operation of the resistor brake is disabled until the temperature has fallen.

EM Brake

The EM brake control provides an output to the drive coil of a DC electromechanical brake. The unit is configured using parameters P1215, P1216 and P1217, which allows for full control of brake release and brake application times. The Brake Coil voltage is configured via DIP switch settings within the unit.

The brake is applied when the supply is disconnected from the solenoid coil and is released when the solenoid coil is energized. The solenoid coil is energized by a DC voltage.

The unit is capable of providing a short duration ‘Quick release’ brake action via a full wave supply (see section 3.2.1 page 21.

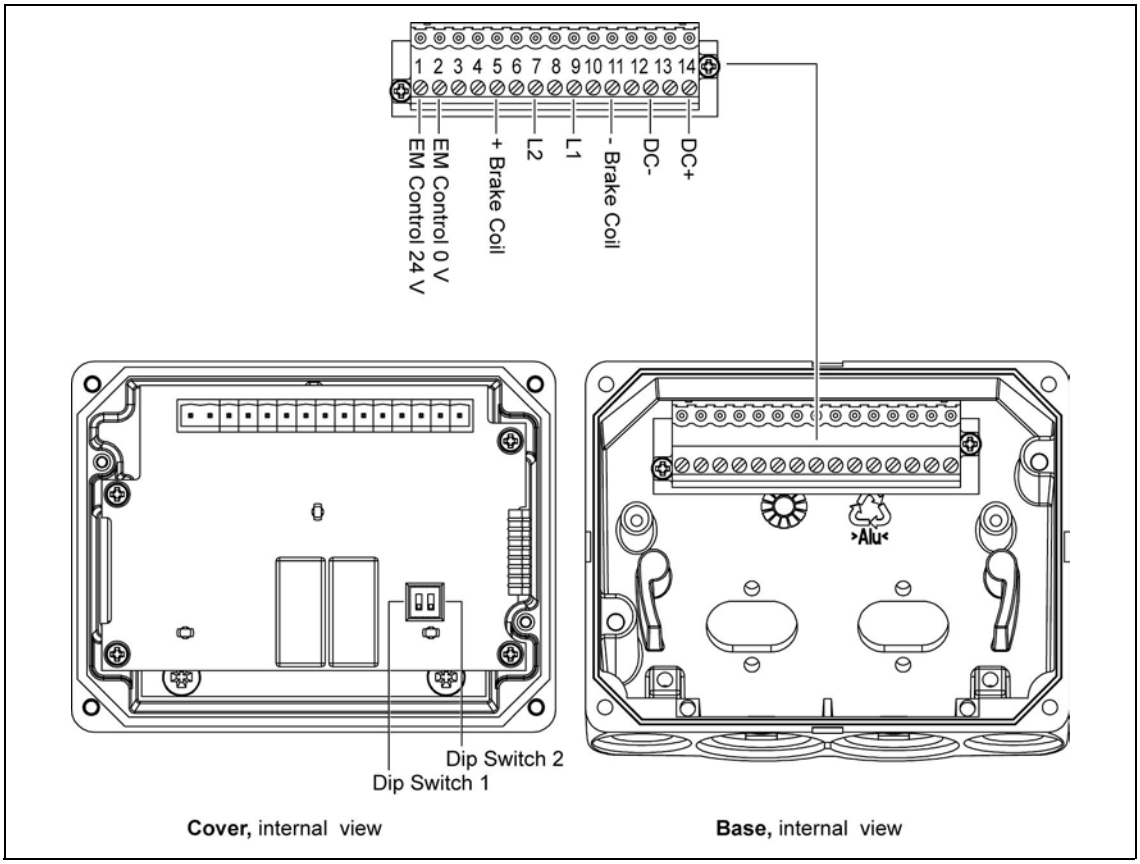

Figure 1-1 REM Module, Internal Layout

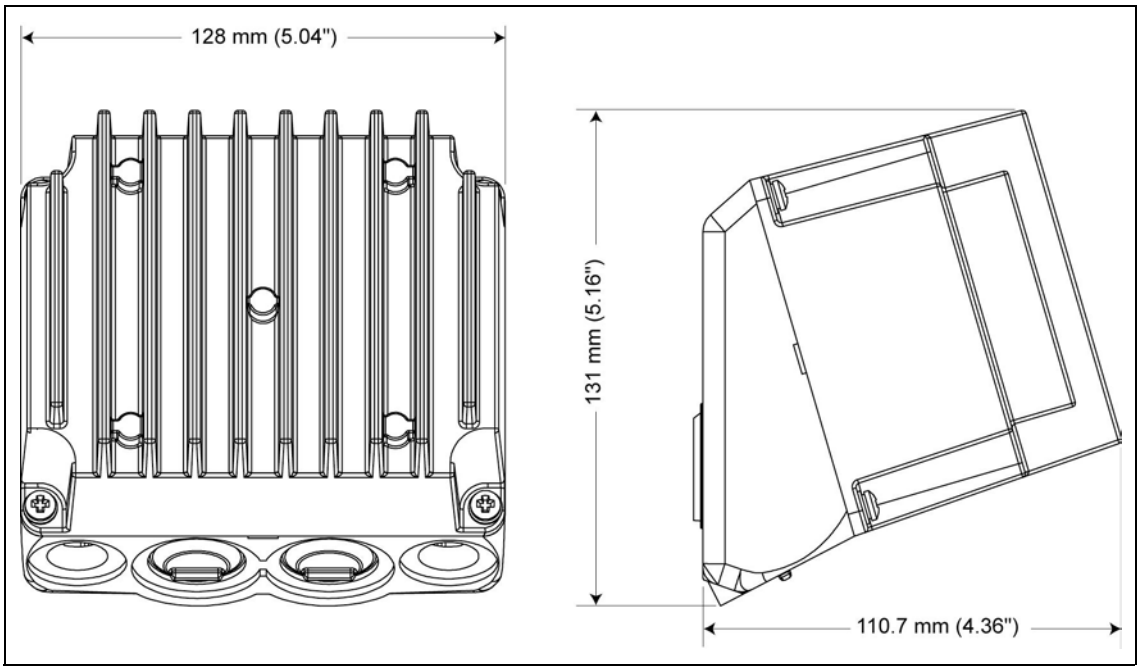

Figure 1-2 Dimensional drawing

2 Installation

WARNING

- Make sure that the MICROMASTER 411/COMBIMASTER 411 inverter is isolated from the electrical supply before you install or remove the REM Module.
- The DC Link Capacitors of the inverter carry hazardous electrical voltage. Always wait 5 minutes after switching off to allow the DC Link Capacitors to discharge before carrying out any installation work.
- The terminals of the REM Module must be connected correctly (see Figure 1-1) or permanent damage to the inverter may occur.

CAUTION

- Do not knock out cable gland blanking plates unless inverter 'electronics' (Filter & I/O boards) have been removed!
- The inverter and REM Module electronics contain static sensitive devices therefore precautions must be taken against electrostatic discharge (ESD) when handling the separated inverter assembly. These include not touching the internal surfaces of the inverter and ensuring that personnel are earthed while handling the unit. The terminal housing, including Filter and I/O modules, contain no sensitive components and therefore no special handling precautions are required when separated.

List of Accessories

A list of the accessories provided with the REM Module is given below.

1. 2-off Gland Hole Blanking Covers
2. 1-off M16 Cable Gland
3. 1-off U-clamp (for earth connection)
4. 1-off Option Gland Fixing Plate
5. 2-off O-ring Sealing Gasket
6. 4-off Allen-key fixing screws (M4 CSB, M5 CSC)
7. 1-off EM Brake Control cable
8. 1-off Cable for Inverter DC Link Connection
9. 1-off Option Gland fixing Plate with Earth Lead
10. 6-off M4 x 10 Screws

2.1 Preparation of Inverter Terminal Housing

CAUTION

The REM Module **MUST** be mounted on the inverter on the same side as the Rating Label (see Figure 2-6).

To mount the REM Module on the inverter body the following procedure should be performed:

1. If the Inverter has already been fitted unscrew the four crosshead captive screws ❶ on the inverter cover (as shown Figure 2-1).
2. Remove inverter top cover.
3. Remove the I/O Board ❷ (as shown in Figure 2-2).
4. Remove the Filter Board ❸ (as shown in Figure 2-2).
5. Using a hammer and a flat-head screwdriver (as shown in Figure 2-3) strike the gland plate or “knockout”.

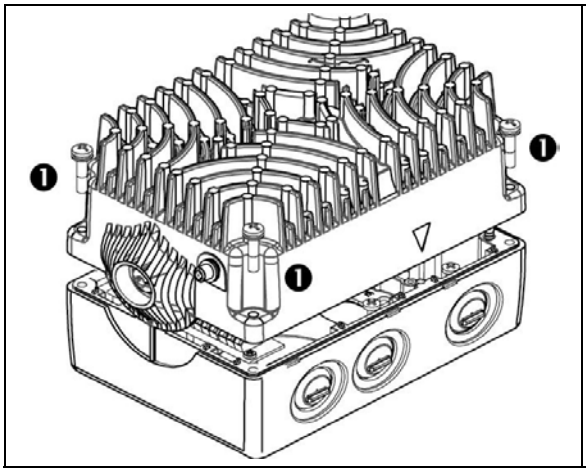

Figure 2-1 Removing Inverter cover

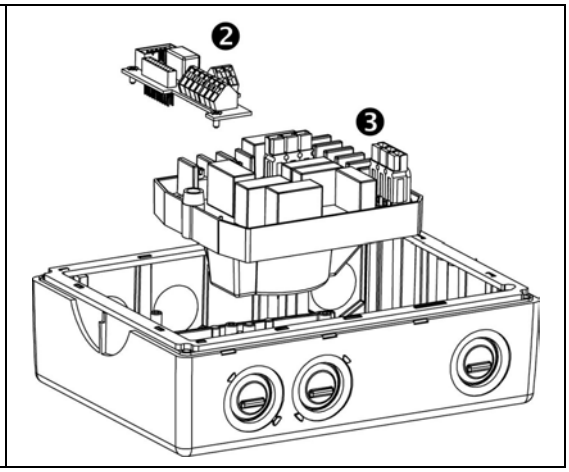

Figure 2-2 Removing the Filter and I/O Boards

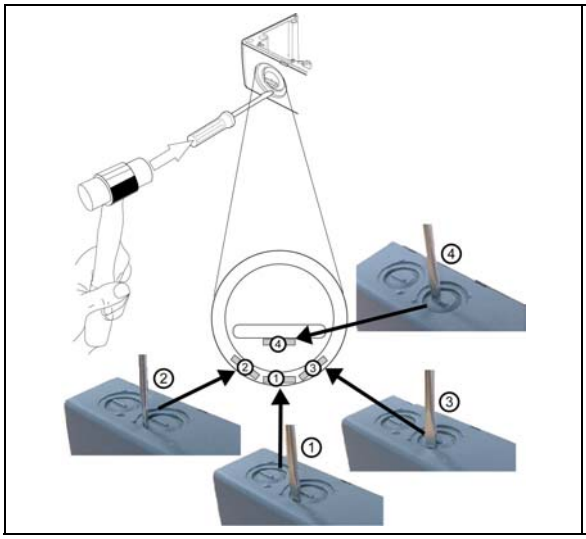

Figure 2-3 Gland Plate or “knockout“ Removal

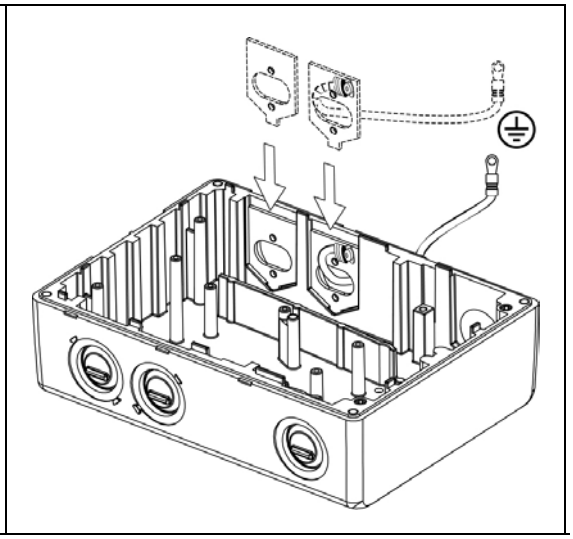

Figure 2-4 Fitting Gland Fixing Plates

6. Remove any sharp edges/burrs/swarf in the knockouts and terminal housing.
7. Ensure that the inverter is fixed to its respective mounting (wall or motor) using the Allen-key screws supplied with the option.
   If the inverter is already mounted on the motor, the mounting screws must be replaced with the Allen-key screws, supplied with the option.
8. Slide the fixing plates into the slots provided immediately behind the gland access holes (as shown in Figure 2-4).
9. Ensure that the earth lead is fed back through the fixing plate.
10. Feed the earth lead into the REM Module housing and connect it at the fixing plate.
11. Replace the Filter Module.

2.2 REM Module Installation

With the fixing plates inserted it is now possible to mount the REM Module by carrying out the following procedure:

1. Unscrew the four cover retaining screws ❺ (see Figure 2-5).
2. Carefully detach the module cover ❹ from the base ❻.
3. Insert the "O" ring sealing gaskets (see Figure 2-6).
   Gaskets should be placed in position adhesive-side to the inverter.

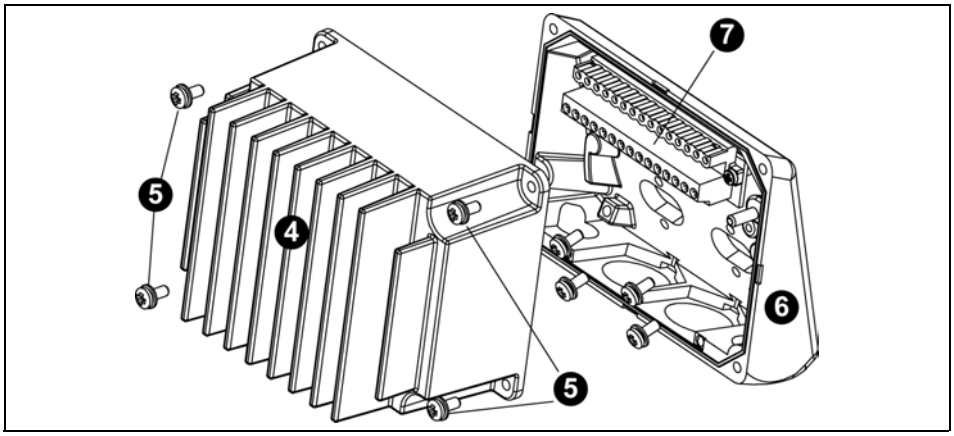

Figure 2-5 REM Module Layout

4. Align the Options case with the Fixing plates (see Figure 2-6).
5. Fasten the Options module base to the fixing plates using the retaining screws (see Figure 2-6).
6. Feed the supplied EM brake control cable between the REM Module and the corresponding control plug on the inverter I/O board (see Figure 2-7).
   Ensure that the Red wire is connected to the EM Control 24 V terminal and the Black wire is connected the EM Control 0 V terminal (see Figure 1-1).
7. Refit the I/O board.

8. Connect the DC link flying lead to the DC link connectors in the upper housing of the inverter (see Figure 2-8), ensuring that the cable is routed as indicated in Figure 2-9. It is connected within the option module to tereminals DC- and DC+ (see Figure 1-1).

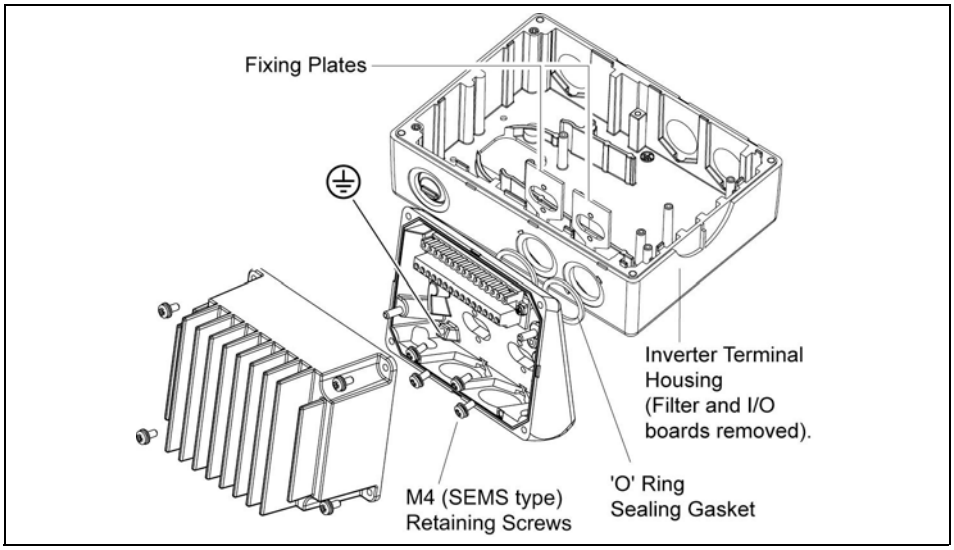

Figure 2-6 REM Module Fixing to Inverter

9. Using the U-clamp and screw, connect the earth lead (attached to the fixing plate) to the earth stud (shown as ⏚ in Figure 2-6) within the module housing.

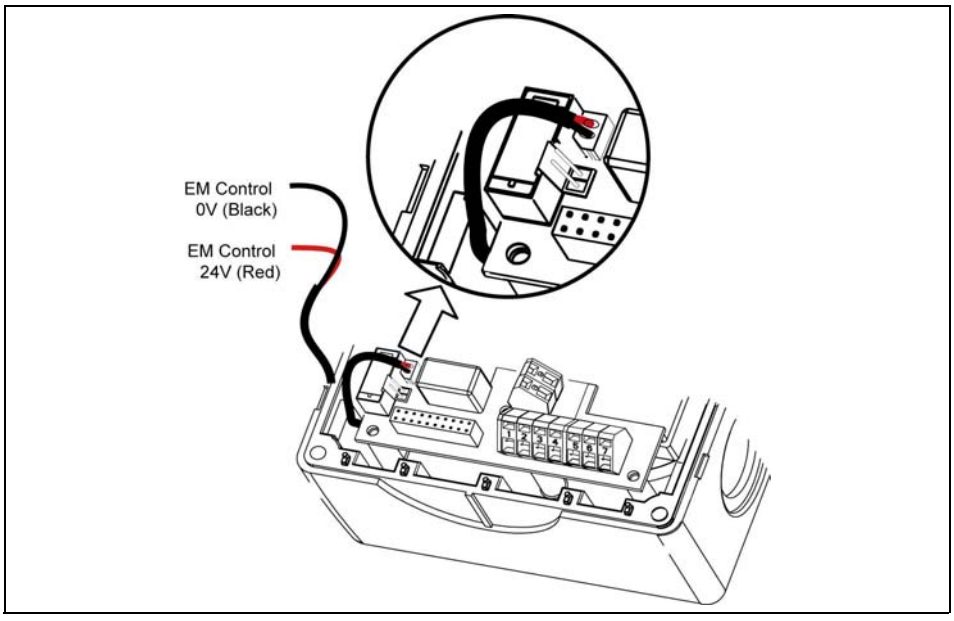

Figure 2-7 Fitting the Control Cable

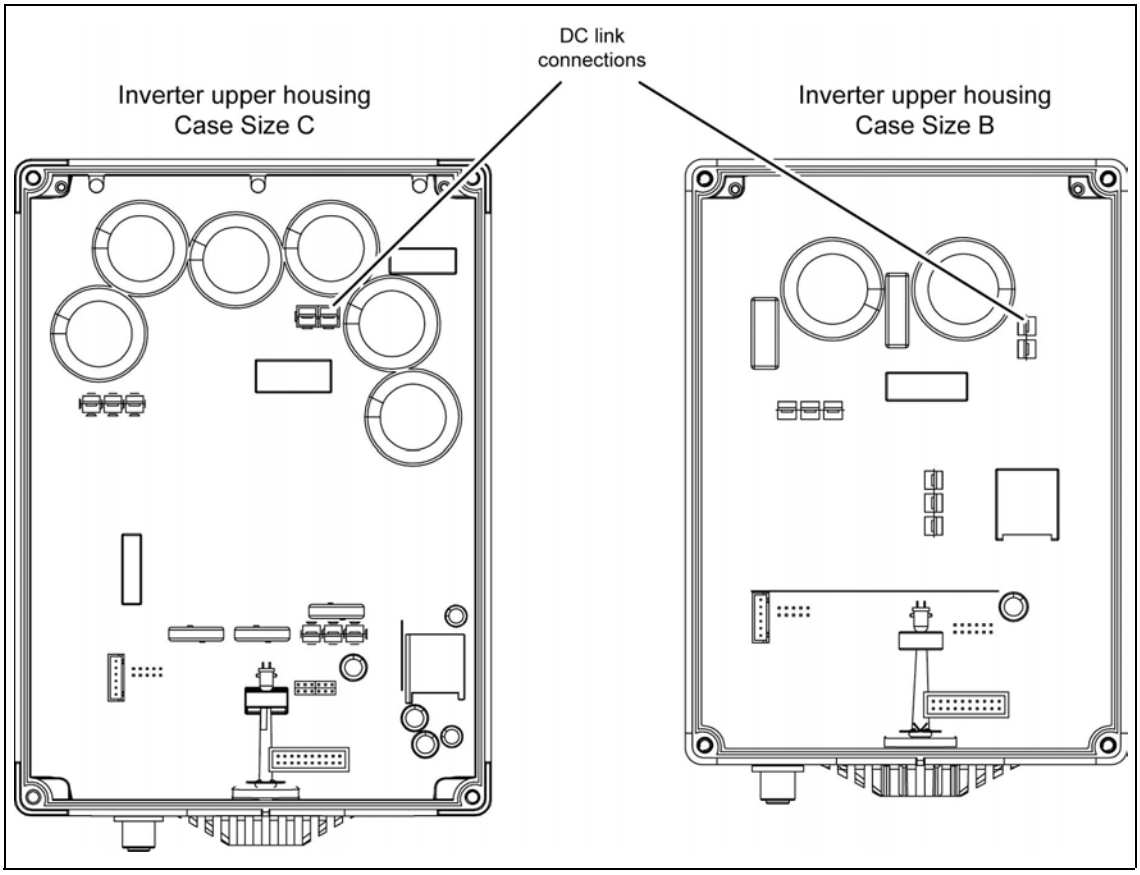

Figure 2-8 DC Link Connections

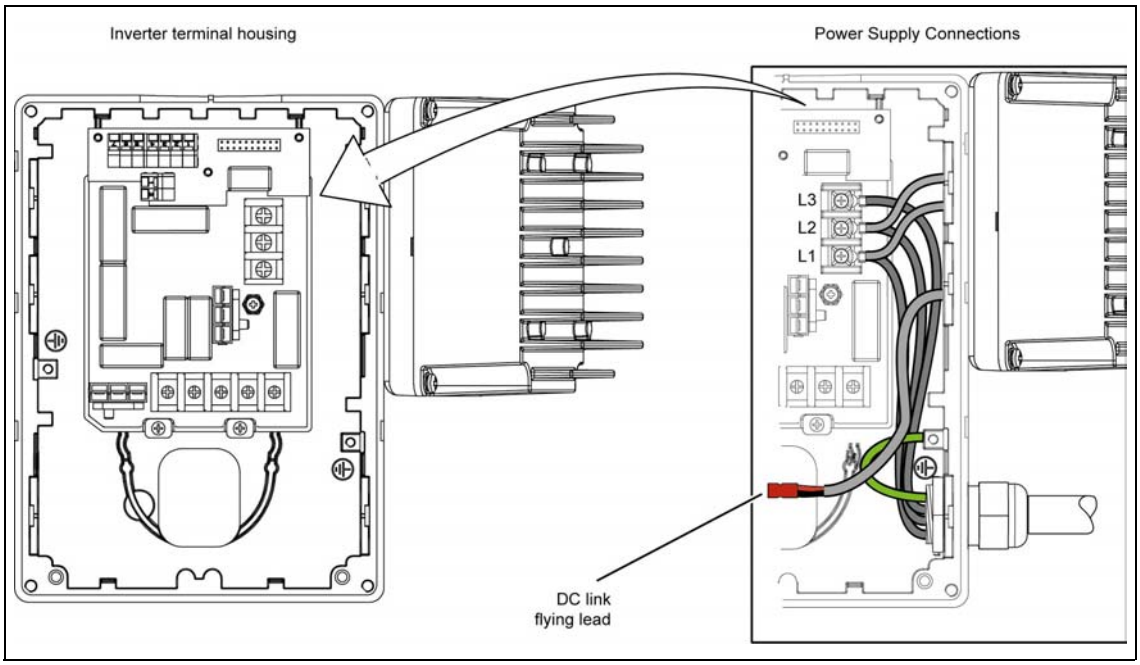

Figure 2-9 Power Supply Connection

10. Different connecting modes:
    - **Internal**
      - **Supply Voltage:**
        The power supply cable is routed from the Inverter Power Supply Terminals and Terminals L1 and L2 in the Options Module.
      - **Brake Coil cable routed within the motor:**
        The Brake Cable is routed from within the inverter and into the Option Module for connection to the +/- Brake Coil Terminals.
    - **External**
      - **Supply Voltage:**
        The power cable is routed through the Option Module's M16 cable gland to the L1 and L2 terminals of the Option Module.
      - **Brake Coil cable routed outside the motor:**
        The Brake Coil Cable is routed through the Option Module's M16 gland and connected to the +/- Brake Coil Terminals.

        The cable gland must ensure a tight fit is formed around the cable. The cable should be kept as short as possible to minimise electromagnetic radiation or pick-up.

WARNING

The user must ensure that the connection cable for the Motor Brake complies with the brake manufacturers recommendations (typically 0.5 mm^2, 2 core double insulated, with outer insulation typically 4.5 mm to 6.0 mm .

CAUTION

If the motor brake coil cable is too short it will be necessary to extend the cable length with a cable of the **same** cross section.

WARNING

- The terminals of the REM Module must be connected correctly otherwise the REM Module will not function correctly.
- The user must ensure that the DC link flying lead is disconnected when disassembling the REM Module as damage to the REM Module and inverter terminals may result.

11. Set the Dip Switches for the REM Module according Table 3-2 on page 21.
12. When the Options module has been correctly installed bring the two REM Module halves together.
13. Align the corresponding sub-assemblies so that the opposing sections of the in-line pcb connector mate (see Figure 2-5 on page 13).
14. Apply a gentle pressure until the cover (1) is firmly closed (see Figure 2-5 on page 13).
15. Secure the cover via retaining screws ❺ at each corner (see Figure 2-5 on page 13).

Table 2-1 Torque Values

Thread Size	Retention Screw	Torque Value	
		Nm	lbf.in
M3	Filter and I/O board screw.	0.8	7.0
M4	CSB Inverter cover screw. Option module cover Option module earth lead	1.2	10.6
M4	Option module base	2.0	17.7
M4	CSB Inverter terminal housing fixing screws (Allen screws)	2.5	22.1
M5	CSC Inverter cover screws.	2.4	21.3
M5	CSC Inverter terminal housing fixing screws (Allen screws)	2.5	22.1

Table 2-2 Power Supply Cable Requirements

Terminals	Unit	Min.	Max.
Tightening Torque	Nm	-	0.6
	lbf.in	-	5.3
Cable Cross Section	mm^2	0.2	2.5
	AWG		14
Cable Strip Length	mm	7	
	In	0.3	

3 Engineering Information

3.1 Resistor Brake Function

Table 3-1 Resistor Brake Function

Feature	Specification
Maximum Braking Duty at 40 ºC ambient temperature ➢ Max. operation time 5 min, (see Figure 3-1und Figure 3-2) ➢ Continuous operation (Figure 3-3)	➢ 3 kW for 1 s at a recovery time of 30 s ➢ 3 kW for 1 s at a recovery time of 100 s for shorter braking times the recovery time can be reduced according Figure 3-3
Resistance	200 Ω ± 10 %
Operating Threshold Voltage	780 Vdc
Max. Continuous Braking (see Figure 3-3)	30 W at 40 ºC ambient temperature 50 W at 20 ºC ambient temperature

WARNING

In the event of failure, it is possible for the brake module and its heatsink to become excessively hot and for the brake resistor to fail.

Overheating and failure of the resistor can be prevented using an external temperature switch to monitor the temperature of the REM Brake Module and if necessary isolate the mains power supply.

CAUTION

- The REM Brake will not be available whilst the EM Brake is de-energized, i.e. when the mechanical brake is applied.
- The REM Brake has no alarm outputs.

Resistor braking duty

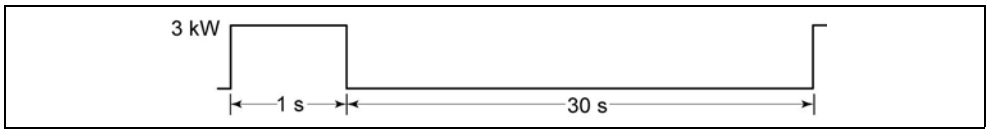

Figure 3-1 Maximum Resistor Braking Duty

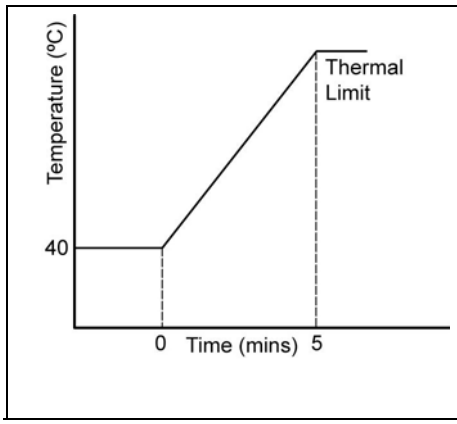

Figure 3-2 Resistor Brake Thermal Duty

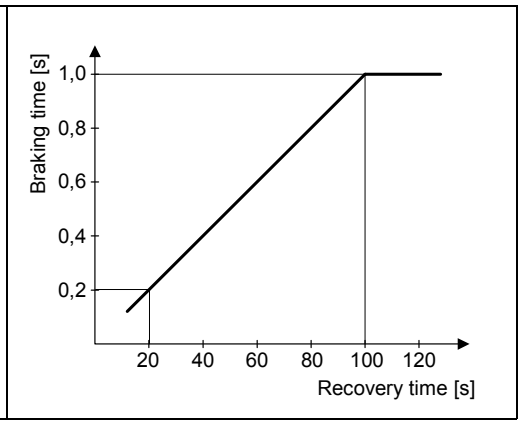

Figure 3-3 Braking times for continuous operation at 40 °C ambient temperature at 3 kW

3.2 Electromechanical Brake Function

3.2.1 Relationship between Supply and Coil Voltage

Given below is information concerning the relationship between supply and coil voltage.

NOTE

The coil voltages given in Table 3-2 are standard voltage values. N/A indicates that the brake coil of this voltage is not standard and not available.

Table 3-2 Relationship between Supply and Coil Voltages

Power Supply	**Full-Wave** (Input voltage x 0.9)	**Half-Wave** (Input voltage x 0.45)	**Accelerated Release** (Input voltage x 0.9 for 0.3 s, than Input voltage x 0.45)
	DIP switch 1 = OFF DIP switch 2 = OFF	DIP switch 1 = ON DIP switch 2 = OFF	DIP switch 1 = OFF DIP switch 2 = ON
220 V a.c.	205 V d.c.	105 V d.c.	205 V d.c./105 V d.c.
230 V a.c.	205 V d.c.	105 V d.c.	205 V d.c./105 V d.c.
240 V a.c.	215 V d.c.	105 V d.c.	205 V d.c./105 V d.c.
380 V a.c.	N/A	180 V d.c.	350 V d.c/180 V d.c.
400 V a.c.	N/A	180 V d.c.	350 V d.c/180 V d.c.
415 V a.c.	N/A	180 V d.c.	350 V d.c/180 V d.c.
460 V a.c.	N/A	205 V d.c.	420 V d.c/205 V d.c.
480 V a.c.	N/A	205 V d.c.	420 V d.c/205 V d.c.

The factory default settings are; Half-wave, that is, SW1 = ON and SW2 = OFF.

CAUTION

It is essential that the user checks that the DIP switch settings are appropriate for the brake coil voltage rating, otherwise the brake coil may be damaged.

NOTE

The Standard Siemens Electromechanical Brake Option G26 (205 V d.c.) can be used with this brake option when an external 230 V a.c. power supply is provided (full-wave rectified).

3.2.2 Parameters for the EM Brake Control Option

P1080 – Minimum Frequency

This parameter sets the minimum frequency (Hz) at which the motor will run irrespective of frequency setpoint.

NOTES

- The value set in P1080 is valid for both clockwise and anti-clockwise rotation.
- Under certain conditions (e.g. ramping, current limiting) the motor can run below the minimum frequency.

P1215 – Holding Brake Profile Enable

This parameter enables or disables the holding brake function

Parameter functionality allows for the inverter to follow the braking profile as shown in Figure 3-4 and Figure 3-5. Parameter P1215 must be enabled for the correct operation of the EM Brake option.

The brake is released by energizing the coil at Point 1.

The brake is applied by de-energizing its coil at Point 2.

Possible **P1215** settings: 0 = Disabled
1 = Enabled

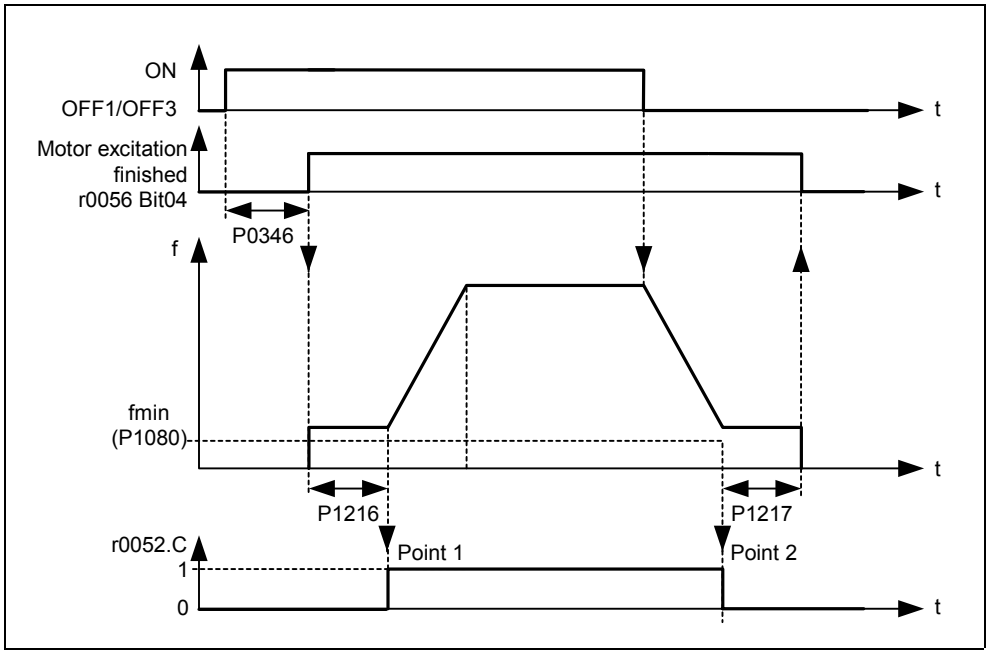

Figure 3-4 P1215 Braking Profile, ON / OFF1 / OFF3

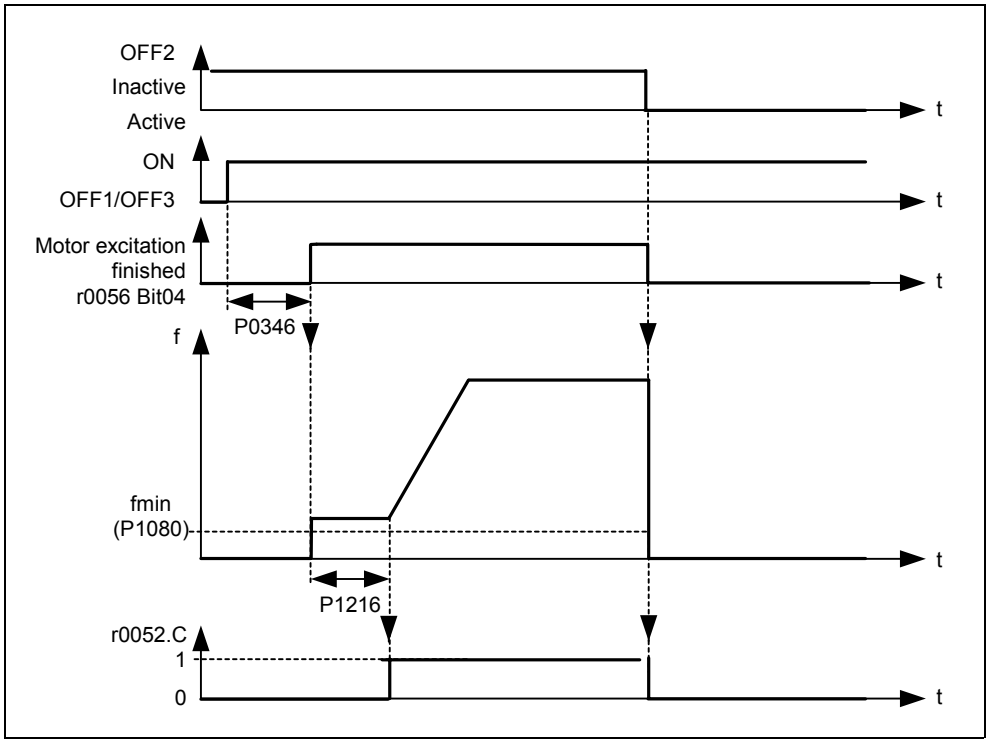

Figure 3-5 P1215 Braking Profile, ON / OFF2

P1216 – Holding Brake Release Delay

This parameter defines the period during which the inverter runs at the minimum frequency P1080 before ramping up at point 1 (see Figure 3-4). The inverter starts at the minimum frequency P1080 on this profile, i.e. it does not use a ramp.

P1217 – Holding Time after Ramp Down

Defines the time at which the inverter runs at the minimum frequency after ramping down at point 2 (see Figure 3-4 on page 22).

NOTES

- The inverter starts at f_{min} on this profile, i.e. it does not use a ramp.
- If this is being used to hold the motor at a certain frequency against a mechanical brake (i.e. you are using a relay to control a mechanical brake), it is important that f_{min} < 5 Hz; otherwise, the current drawn may be too high and the relay may not open as inverter is in current limit.
- A typical value of f_{min} for this type of application is the slip frequency (f_{slip}) of the motor.
- You can calculate the rated slip frequency by:
- $f_{slip} = \frac{n_{syn} - n_{rated}}{n_{syn}} * f_{rated}$, where $n_{syn} = \frac{\text{Rated Frequency} * 60}{\text{Number of pole pairs}}$

  n_{syn} = Synchronous motor rotation speed.

  n_{rated} = Rated motor rotation speed (see rating label).

  f_{rated} = Nominal motor frequency (see rating label).

4 Technical Data

Table 4-1 Technical Data

Supply voltage	200 V a.c. to 480 V a.c. ± 10%
Output Current Rating	0.5 A d.c.
Brake Coil Rating (EM brake)	100 W (typical)
Size (height x width x depth)	131 mm x 128 mm x 110.7 mm
Degree of protection	IP66
Mechanical strength	Acc. to DIN IEC 68-2-6 (with correctly installed board)
In stationary state	
- Deflection	0.15 mm in 10 Hz to 58 Hz frequency range
- Acceleration	19.6 m/s^2 in > 58 Hz to 500 Hz frequency range
During transportation	
- Deflection	3.5 mm in 5 Hz to 9 Hz frequency range
- Acceleration	9.8 m/s^2 in > 9 Hz to 500 Hz frequency range
Environment class	Class 3K3 to DIN IEC 721-3-3 (in operation)
Cooling method	Natural air cooling
Permissible ambient or coolant temperature	
- In operation	–10 °C to +40 °C (14 °F to 104 °F)
- In storage	–25 °C to +70 °C (–13 °F to 158 °F)
- In transit	–25 °C to +70 °C (–13 °F to 158 °F)
Permissible humidity rating	Transit, Storage and Operation: 99% RH – non-condensing

Suggestions and/or Corrections

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Order Number:
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Date of Issue: 01/03

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