

# SIEMENS

## MICROMASTER 411 & COMBIMASTER 411 Electromechanical Brake Control Option

Operating Instructions

Issue 03/02









## Definitions, warnings

### 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:

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

### 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.

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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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**NOTES**

- This operating manual does not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.
- Should further information be desired or should particular problems arise which are not covered sufficiently for the Purchaser's purposes, the matter should be referred to the local Siemens Sales Office.
- The contents of this operating manual shall not become part of or modify any prior or existing agreement, commitment or relationship. The Sales Contract contains the entire obligations of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements contained herein do not create new warranties or modify the existing warranty.

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**CAUTION**

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

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**ATTENTION**

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

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**NOTE**

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

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**User documentation**

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**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.

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**Proper use**

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**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.

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# 1 Description MICROMASTER 411 & COMBIMASTER 411 EM Brake Option

## 1.1 Introduction

The Electromechanical Brake Control is housed within an Options module attached to the side of the inverter. Full IP66 environmental protection is maintained.

The Electromechanical Brake Control module 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 jumpers 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.

Figure 1-1 shows the layout of the EM Brake Module.

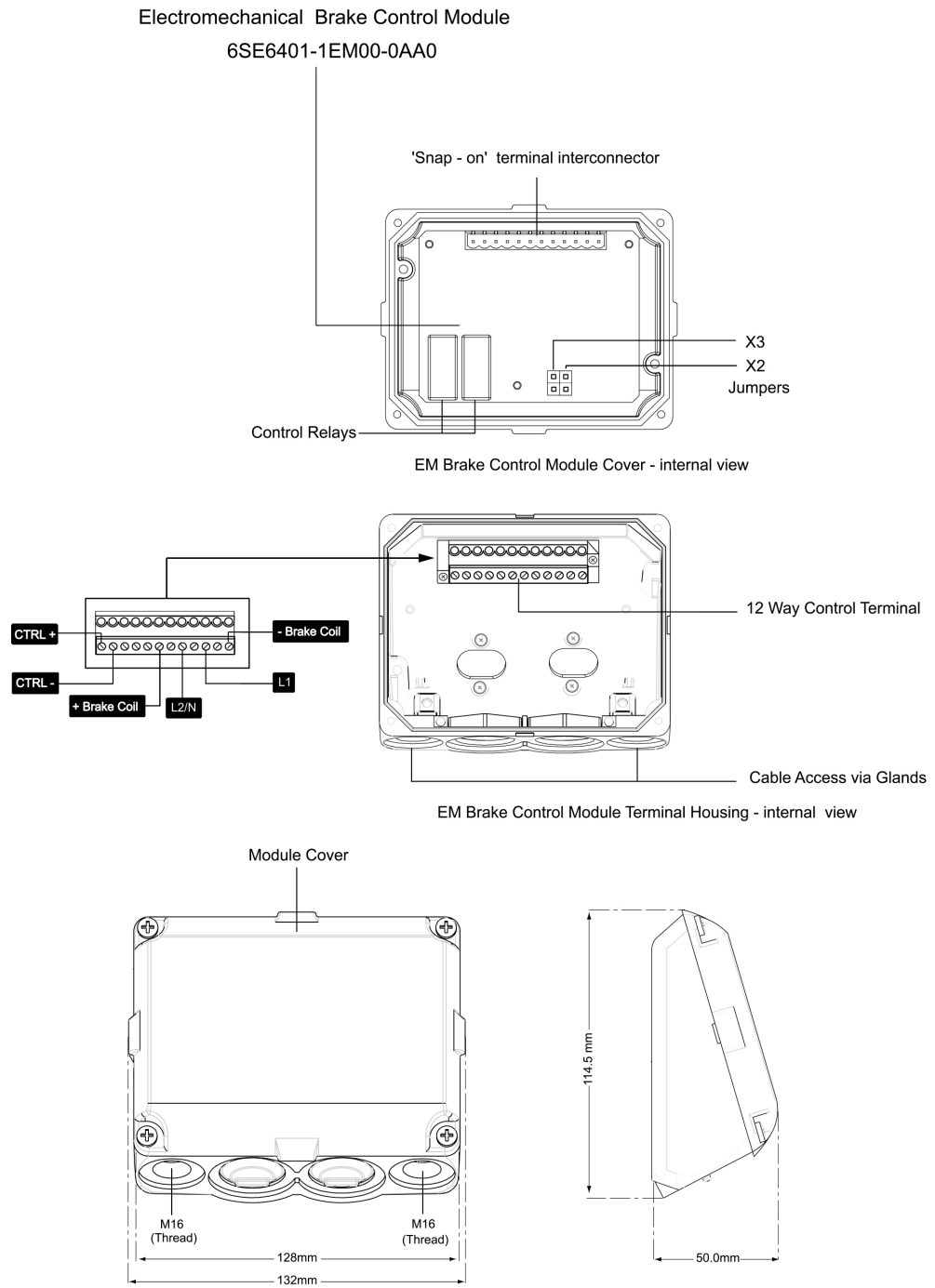


Figure 1-1 EM Brake Module Layout

## 2 Installation Instructions

### 2.1 Installing the EM Brake option module



#### Warning

- ◆ Make sure that the MICROMASTER 411/COMBIMASTER 411 inverter is isolated from the electrical supply before you install or remove the EM Brake Control module.



#### Cautions

- ◆ Do not knock out cable gland blanking plates unless inverter 'electronics' (Filter & I/O boards) have been removed!



- ◆ The inverter and EM Brake 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.

#### 2.1.1 List of Accessories

A list of the accessories provided with the EM Brake Module is given in Table 2-1 below.

Table 2-1 List of Accessories

1.	2-off Gland Hole Blanking Covers	6.	4-off M4 x 20 Screws
2.	1-off M16 Cable Gland	7.	1-off EM Brake Control cable
3.	2-off U-clamp (for earth connection)	8.	1-off Jumper
4.	1-off Option Gland Fixing Plate	9.	1-off Option Gland fixing Plate with Earth Lead
5.	2-off O-ring Sealing Gasket	10.	6-off M4 x 10 Screws

#### 2.1.2 Preparation of Inverter Terminal Housing

To mount the EM Brake 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 (1) on the inverter cover (as shown Figure 2-1).

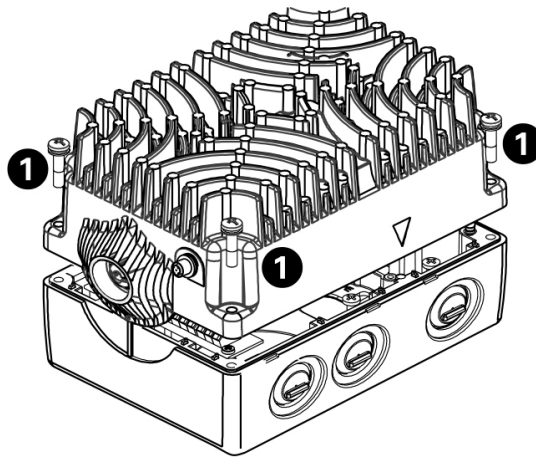


Figure 2-1 Removing Inverter cover

2. Remove inverter top cover.
3. Remove the I/O Board (2) (as shown in Figure 2-2).
4. Remove the Filter Board (1) (as shown in Figure 2-2).

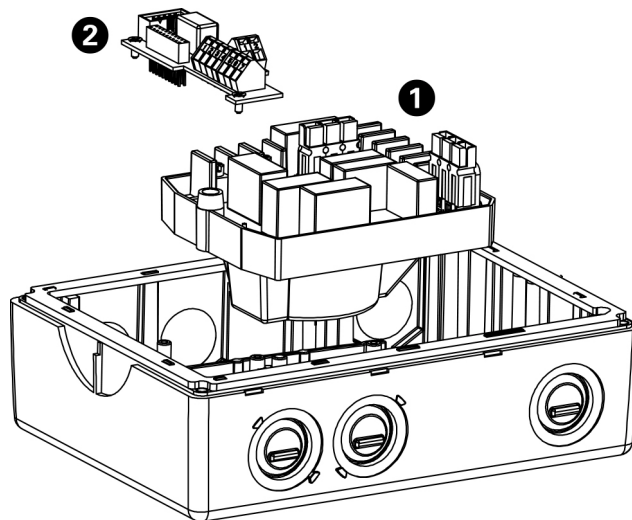


Figure 2-2 Removing the Filter and I/O Boards

5. Using a hammer and a flat-head screwdriver (as shown in Figure 2-3) strike the gland plate or “knockout”.

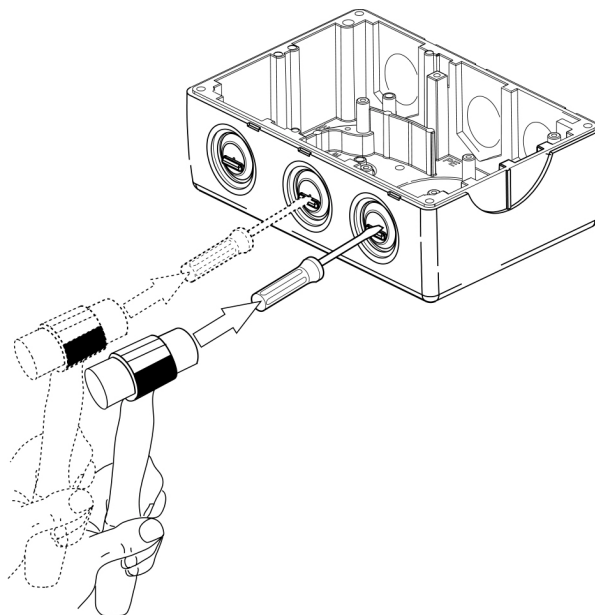


Figure 2-3 Gland Plate or "knockout" Removal

**CAUTION**

The EM Brake Module **MUST** be mounted on the inverter on the same side as the Rating Label.

6. Remove any sharp edges/burrs/swarf in the knockouts and terminal housing.
7. Slide the fixing plates into the slots provided immediately behind the gland access holes (as shown in Figure 2-4).

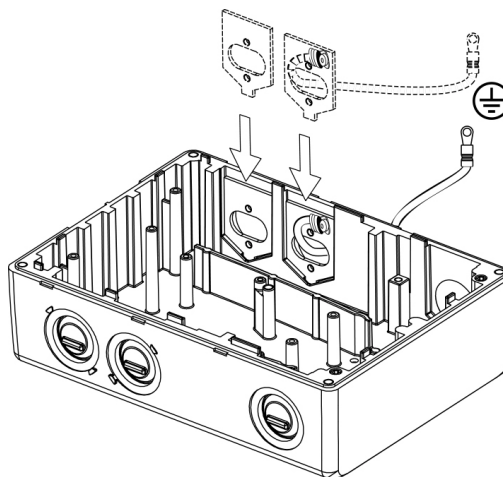


Figure 2-4 Fitting Gland Fixing Plates

8. Ensure that the earth lead is fed back through the fixing plate.
9. The earth lead is to be fed into the EM brake Module housing.
10. Replace the Filter Module.

### 2.1.3 EM Brake Option Module Installation

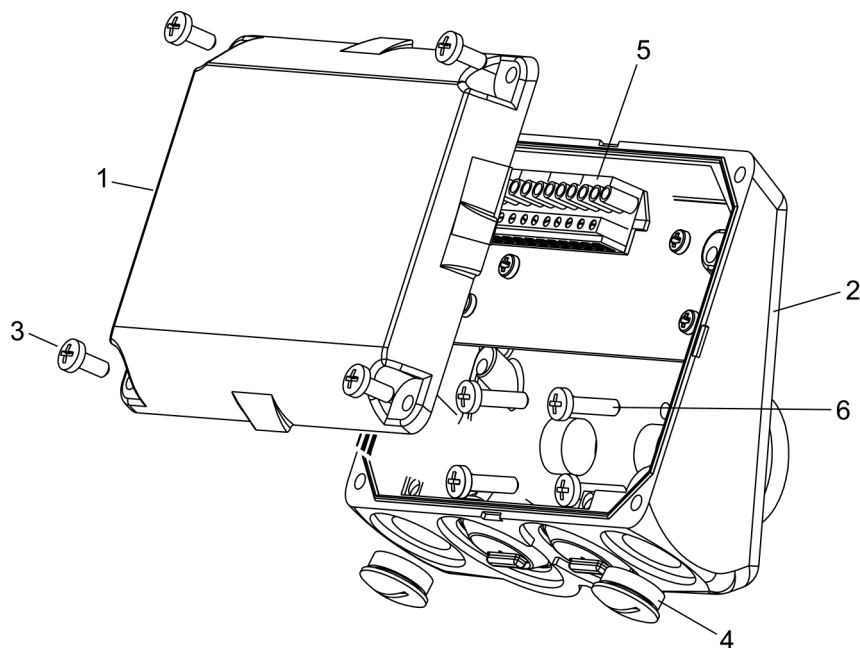


Figure 2-5 EM Brake Module Layout

With the fixing plates inserted it is now possible to mount the EM Brake module by carrying out the following procedure:

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



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#### CAUTION

The EM Brake Module **MUST** be mounted on the inverter on the same side as the Rating Label.

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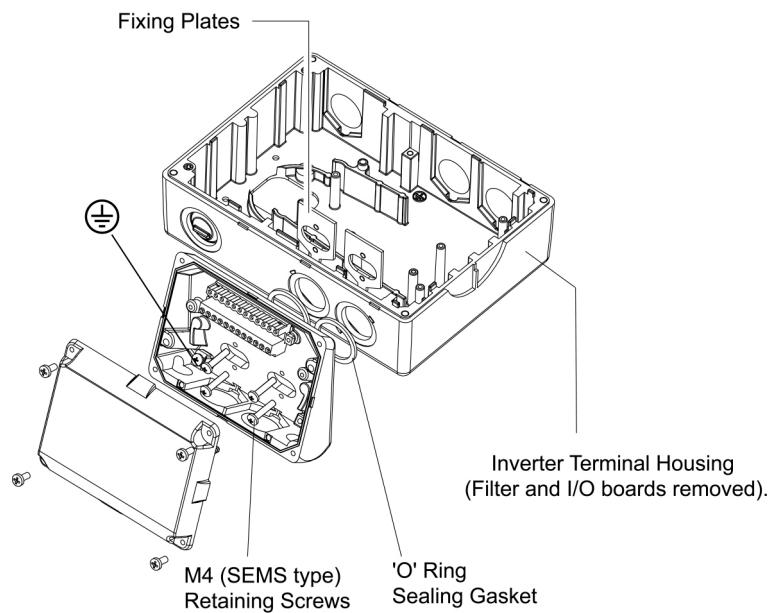


Figure 2-6 EM Brake Module Fixing to Inverter

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 control cable between the EM Brake 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 Ctrl+ terminal and the Black wire is connected the Ctrl- terminal (see Figure 1-1 on page 10).

7. Refit the I/O board.

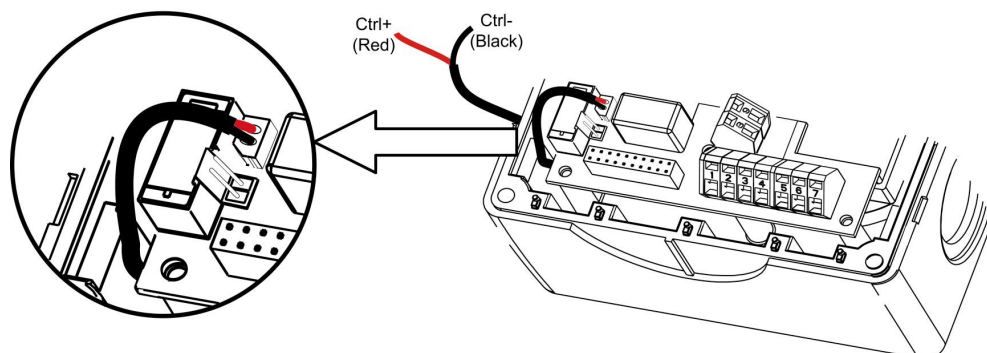


Figure 2-7 Fitting the Control Cable

8. 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.
9. Feed the EM Brake supply cable and EM Brake Coil connection into the unit. See Table 2-3 Power Supply Cable Requirements.

Depending on the required configuration the routing of cables may be through the body of the inverter or external. Use the Blanking Plug or Cable Glands as required. See Figure 1-1 on page 10 for connection details.

10. Set the Jumpers for the EM Brake as explained in Table 3-1 on page 18.
11. When the Options module has been correctly installed bring the two EM Brake Module halves together.
12. Align the corresponding sub-assemblies so that the opposing sections of the in-line pcb connector (5) mate (see Figure 2-5).
13. Apply a gentle pressure until the lid (1) is firmly closed.
14. Secure the lid via retaining screws (3) at each corner.

Table 2-2 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. CSB & C Module Fixing. Cover Retaining Screw.	1.2	10.6
M5	CSC Inverter Cover screws.	2.4	21.3

Table 2-3 Power Supply Cable Requirements

Terminals	Unit of Measurement	Min.	Max.
Tightening Torque	Nm	-	0.6
	lbf in	-	5.3
Cable Cross Section	mm <sup>2</sup>	0.2	2.5
	AWG	24	14
Cable Strip Length	mm	7	
	In	0.3	





### 3 Engineering Information

Table 3-1 Jumper Settings

Jumper		Solenoid Supply Mode	DC Brake Voltage
X2	X3		
-	Fitted	Half-Wave Rectification	0.45 x $V_{ac}$ (rms)
-	-	Full-Wave Rectification	0.90 x $V_{ac}$ (rms)
Fitted	-	Full-Wave Rectification for 0.3 seconds followed by half wave rectification.	0.90 x $V_{ac}$ (rms)
			0.45 x $V_{ac}$ (rms)

Refer to Table 3-2 for details on the Relationship between Supply and Coil Voltage

#### 3.1 Parameters for the EM Brake Control Option

Below is a brief explanation of the parameters that are used to control the functionality of 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.

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##### **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 3-1. Parameter P1215 must be enabled for the correct operation of the EM Brake option.

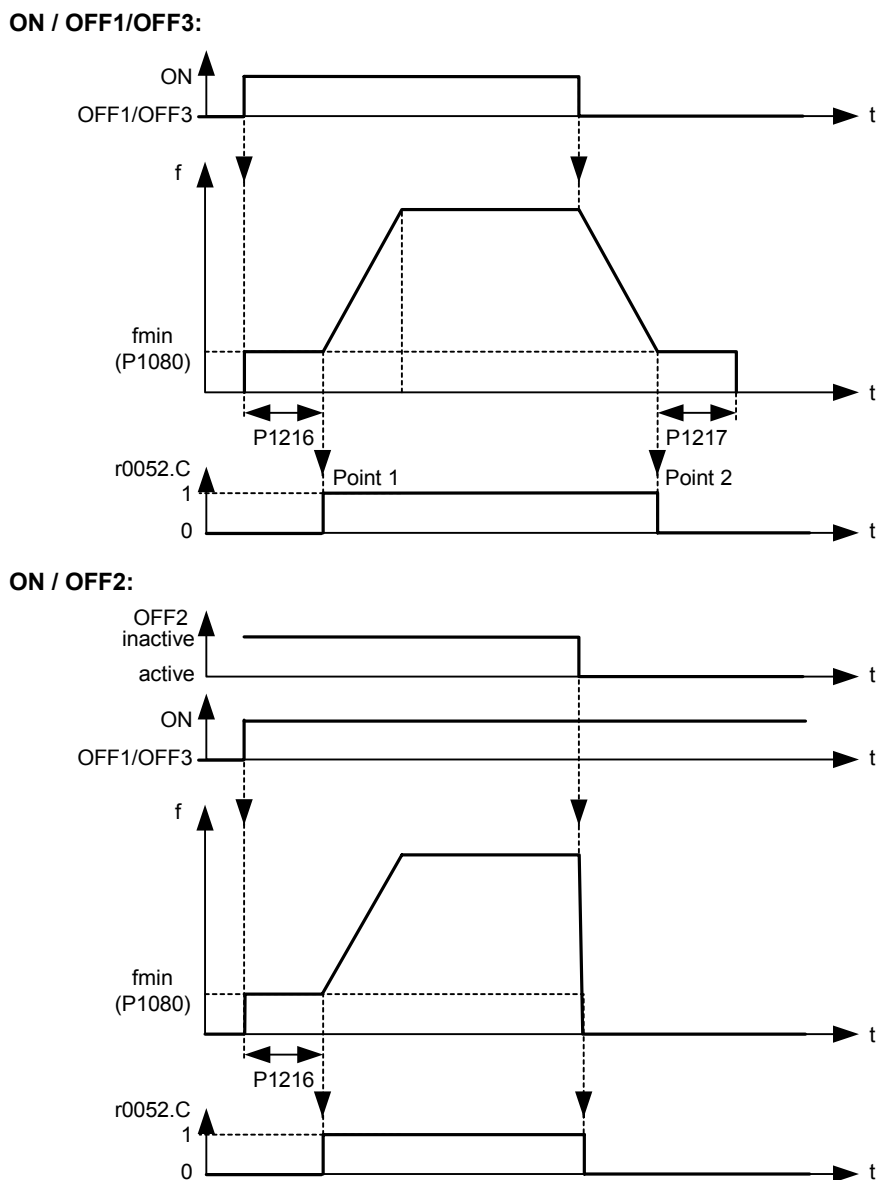


Figure 3-1 P1215 Braking Profile

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

**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 3-1). 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 3-1).

---

#### 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 of the motor.
- You can calculate the rated slip frequency by using the following formula:

$$\frac{n_{syn} - n_{rated}}{n_{syn}} \times f_{rated}$$

Where:  $n_{syn}$  = Synchronous motor rotation speed. This can be calculated using the following formula:

$$n_{syn} = \frac{\text{Rated Frequency} \times 60}{\text{Number of pole pairs}}$$

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

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

---

## 3.2 Relationship between Supply and Coil Voltage

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

Table 3-2 Relationship between Supply and Coil Voltage

Mains Supply	Coil Voltage Half Wave/Accelerated Release	Coil Voltage Full Wave
220 V a.c.	105 V d.c.	205 V d.c.
230 V a.c.	105 V d.c.	205 V d.c.
240 V a.c.	105 V d.c.	215 V d.c.
380 V a.c.	180 V d.c.	N/A
400 V a.c.	180 V d.c.	N/A
415 V a.c.	180 V d.c.	N/A
460 V a.c.	205 V d.c.	N/A
480 V a.c.	215 V d.c.	N/A

### Full Wave Coil Voltage

This mode is selected by leaving Jumper positions X2 and X3 open. The AC mains is applied to a full wave bridge rectifier. Bridge output is given by the following formula:

$$V \text{ d.c.} = V \text{ a.c.} \times \sqrt{2} \times \frac{2}{\pi} = 0.9 V \text{ a.c.}$$

### Half Wave Coil Voltage

This mode is selected by inserting a Jumper into position X3. Jumper X2 remains open. AC mains is applied to a half wave bridge rectifier. Bridge output for the dc coil is given by the following formula:

$$V \text{ d.c.} = V \text{ a.c.} \times \sqrt{2} \times \frac{2}{\pi} \times \frac{1}{2} = 0.45 V \text{ a.c.}$$

### Accelerated Brake Release

This mode is selected by inserting a Jumper into position X2. Jumper X3 remains open. The AC mains is applied to a full wave bridge rectifier. Bridge output will be as follows:

$$V \text{ d.c.} = 0.9 V \text{ a.c. for first 0.3 seconds}$$

$$0.45 V \text{ a.c. thereafter.}$$

In the Accelerated Release mode the Brake coil current increases more quickly to a level at which the solenoid pulls the armature away from the brake friction lining.

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Siemens AG  
Automation and Drives Group (A&D)  
Standard Drives (SD) Division  
Postfach 3269, D-91050 Erlangen  
Federal Republic of Germany

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