

ENGINEERING  
TOMORROW

*Danfoss*

Operating guide

# VACON® NXS/NXP Air-cooled Wall-mounted and Standalone



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**VACON®**



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# 1 Introduction

## 1.1 Purpose of this Operating Guide

This operating guide provides information for safe installation and commissioning of the AC drive. It is intended for use by qualified personnel. Read and follow the instructions to use the drive safely and professionally. Pay particular attention to the safety instructions and general warnings. Always keep this operating guide available with the drive.

## 1.2 Additional Resources

Other resources are available to understand advanced AC drive functions and programming.

- The VACON® NX All-in-One Application Manual provides greater detail on working with parameters and shows many application examples.
- The VACON® NX I/O Boards User Manual gives more information on the I/O boards and their installation.
- Instructions for operation with option boards and other optional equipment.

Supplementary publications and manuals are available from Danfoss.

NOTE! Download the English and French product manuals with applicable safety, warning and caution information from <https://www.danfoss.com/en/service-and-support/>.

REMARQUE Vous pouvez télécharger les versions anglaise et française des manuels produit contenant l'ensemble des informations de sécurité, avertissements et mises en garde applicables sur le site <https://www.danfoss.com/en/service-and-support/>.

## 1.3 Disposal

### Context:

Do not dispose of equipment containing electrical components together with domestic waste. Collect it separately in accordance with local and currently valid legislation.



## 1.4 Type Approvals and Certifications

The following list is a selection of possible type approvals and certifications for Danfoss drives:



			 www.tuv.com ID 0600000000		

**⚠ NOTICE ⚠**

The specific approvals and certification for the drive are on the nameplate of the drive. For more information, contact the local Danfoss office or partner.

## 1.5 Start-up Quick Guide

### Context:

Do at minimum these procedures during the installation and commissioning.

If there are problems, speak to the local distributor.

Vacon Ltd is not responsible for the use of the AC drives against the instructions.

### Procedure

1. Check that the delivery agrees to the order, see [4.1 Checking the Delivery](#).
  2. Before starting the commissioning, read carefully the safety instructions in [2.2 Danger and Warnings](#) and [2.3 Cautions and Notices](#).
  3. Before the mechanical installation, check the minimum clearances around the AC drive ( [5.2.2 Cooling of FR4 to FR9](#) and [5.2.3 Cooling of Standalone AC drives \(FR10 to FR11\)](#) ) and check the ambient conditions in [12.8 VACON NXP Technical Data](#).
  4. Check the dimensions of the motor cable, mains cable, mains fuses and check the cable connections. Read [6.1 Cable Connections](#), [6.2 EMC-compliant Installation](#) and [6.3 Grounding](#).
  5. Obey the installation instructions, see [6.5 Installing the Cables](#).
  6. Find information on the control connections in [7.3.2 Control Terminals on OPTA1](#).
  7. If the start-up wizard is active, select the language of the control panel and the application. Accept the selections with the Enter button. If the start-up wizard is not active, obey the instructions a and b.
    - A Select the language of the control panel from the Menu M6, page 6.1. For instructions, see [8.7.3 Changing the Language](#).
    - B Select the application from the Menu M6, page 6.2. For instructions, see [8.7.4 Changing the Application](#).
  8. All parameters have factory default values. To make sure that the AC drive operates correctly, make sure that these group G2.1 parameters have the same data as the nameplate. For more information on the parameters in the list, see the VACON® All in One Application Manual.

- Nominal voltage of the motor
    - Nominal frequency of the motor
    - Nominal speed of the motor
    - Nominal current of the motor
    - Motor cos phi
  9. Obey the commissioning instructions, see [9.2 Commissioning the AC Drive](#).
- The VACON® NXS/NXP AC drive is ready for operation.

## 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 Danger and Warnings

#### ⚠ DANGER ⚠

##### **SHOCK HAZARD FROM POWER UNIT COMPONENTS**

The power unit components are live when the drive is connected to mains. A contact with this voltage can lead to death or serious injury.

- Do not touch the components of the power unit when the drive is connected to mains. Before connecting the drive to mains, make sure that the covers of the drive are closed.

#### ⚠ DANGER ⚠

##### **SHOCK HAZARD FROM TERMINALS**

The motor terminals U, V, W, the brake resistor terminals, or the DC terminals are live when the drive is connected to mains, also when the motor does not operate. A contact with this voltage can lead to death or serious injury.

- Do not touch the motor terminals U, V, W, the brake resistor terminals, or the DC terminals when the drive is connected to mains. Before connecting the drive to mains, make sure that the covers of the drive are closed.

**⚠ DANGER ⚠****SHOCK HAZARD FROM DC LINK OR EXTERNAL SOURCE**

The terminal connections and the components of the drive can be live 5 minutes after the drive is disconnected from the mains and the motor has stopped. Also the load side of the drive can generate voltage. A contact with this voltage can lead to death or serious injury.

- Before doing electrical work on the drive:
  - Disconnect the drive from the mains and make sure that the motor has stopped.
  - Lock out and tag out the power source to the drive.
  - Make sure that no external source generates unintended voltage during work.
  - Wait 5 minutes before opening the cabinet door or the cover of the AC drive.
  - Use a measuring device to make sure that there is no voltage.

**⚠ WARNING ⚠****SHOCK HAZARD FROM CONTROL TERMINALS**

The control terminals can have a dangerous voltage also when the drive is disconnected from mains. A contact with this voltage can lead to injury.

- Make sure that there is no voltage in the control terminals before touching the control terminals.

**⚠ WARNING ⚠****ACCIDENTAL MOTOR START**

When there is a power-up, a power break, or a fault reset, the motor starts immediately if the start signal is active, unless the pulse control for Start/Stop logic is selected. If the parameters, the applications or the software change, the I/O functions (including the start inputs) can change. If you activate the auto reset function, the motor starts automatically after an automatic fault reset. See the Application Guide. Failure to ensure that the motor, system, and any attached equipment are ready for start can result in personal injury or equipment damage.

- Disconnect the motor from the drive if an accidental start can be dangerous. Make sure that the equipment is safe to operate under any condition.

**⚠ WARNING ⚠****LEAKAGE CURRENT HAZARD**

Leakage currents exceed 3.5 mA. Failure to ground the drive properly can result in death or serious injury.

- Ensure the correct grounding of the equipment by a certified electrical installer.

**⚠ WARNING ⚠****SHOCK HAZARD FROM PE CONDUCTOR**

The drive can cause a DC current in the PE conductor. Failure to use a residual current-operated protective (RCD) device Type B or a residual current-operated monitoring (RCM) device can lead to the RCD not providing the intended protection and therefore can result in death or serious injury.

- Use a type B RCD or RCM device on the mains side of the drive.

## 2.3 Cautions and Notices

### ⚠ CAUTION ⚠

#### **DAMAGE TO THE AC DRIVE FROM INCORRECT MEASUREMENTS**

Doing measurements on the AC drive when it is connected to mains can damage the drive.

- Do not do measurements when the AC drive is connected to mains.

### ⚠ CAUTION ⚠

#### **DAMAGE TO THE AC DRIVE FROM INCORRECT SPARE PARTS**

Using spare parts that are not from the manufacturer can damage the drive.

- Do not use spare parts that are not from the manufacturer.

### ⚠ CAUTION ⚠

#### **DAMAGE TO THE AC DRIVE FROM INSUFFICIENT GROUNDING**

Not using a grounding conductor can damage the drive.

- Make sure that the AC drive is always with a grounding conductor that is connected to the grounding terminal that is identified with the PE symbol.

### ⚠ CAUTION ⚠

#### **CUT HAZARD FROM SHARP EDGES**

There can be sharp edges in the AC drive that can cause cuts.

- Wear protective gloves when mounting, cabling, or doing maintenance operations.

### ⚠ CAUTION ⚠

#### **BURN HAZARD FROM HOT SURFACES**

Touching surfaces, which are marked with the 'hot surface' sticker, can result in injury.

- Do not touch surfaces which are marked with the 'hot surface' sticker.

### ⚠ NOTICE ⚠

#### **DAMAGE TO THE AC DRIVE FROM STATIC VOLTAGE**

Some of the electronic components inside the AC drive are sensitive to ESD. Static voltage can damage the components.

- Remember to use ESD protection always when working with electronic components of the AC drive. Do not touch the components on the circuit boards without proper ESD protection.

**⚠ NOTICE ⚠****DAMAGE TO THE AC DRIVE FROM MOVEMENT**

Movement after installation can damage the drive.

- Do not move the AC drive during operation. Use a fixed installation to prevent damage to the drive.

**⚠ NOTICE ⚠****DAMAGE TO THE AC DRIVE FROM INCORRECT EMC LEVEL**

The EMC level requirements for the AC drive depend on the installation environment. An incorrect EMC level can damage the drive.

- Before connecting the AC drive to the mains, make sure that the EMC level of the AC drive is correct for the mains.

**⚠ NOTICE ⚠****RADIO INTERFERENCE**

In a residential environment, this product can cause radio interference.

- Take supplementary mitigation measures.

**⚠ NOTICE ⚠****MAINS CONNECTION DEVICE**

If the AC drive is used as a part of a machine, the machine manufacturer must supply a mains disconnection device (refer to EN 60204-1).

**⚠ NOTICE ⚠****MALFUNCTION OF FAULT CURRENT PROTECTIVE SWITCHES**

Because there are high capacitive currents in the AC drive, it is possible that the fault current protective switches do not operate correctly.

**⚠ NOTICE ⚠****VOLTAGE WITHSTAND TESTS**

Doing voltage withstand tests can damage the drive.

- Do not do voltage withstand tests on the AC drive. The manufacturer has already done the tests.

## 3 Product Overview

### 3.1 Intended Use

The drive is an electronic motor controller intended for:

- Regulation of motor speed in response to system feedback or to remote commands from external controllers. A power drive system consists of the AC drive, the motor, and equipment driven by the motor.
- System and motor status surveillance.

The drive can also be used for motor overload protection.

Depending on the configuration, the drive can be used in standalone applications or form part of a larger appliance or installation.

The drive is allowed for use in residential, industrial, and commercial environments in accordance with local laws and standards.

#### ⚠ NOTICE ⚠

In a residential environment, this product can cause radio interference, in which case supplementary mitigation measures can be required.

#### Foreseeable misuse

Do not use the drive in applications which are non-compliant with specified operating conditions and environments. Ensure compliance with the conditions specified in [12.8 VACON NXP Technical Data](#).

### 3.2 Manual Version

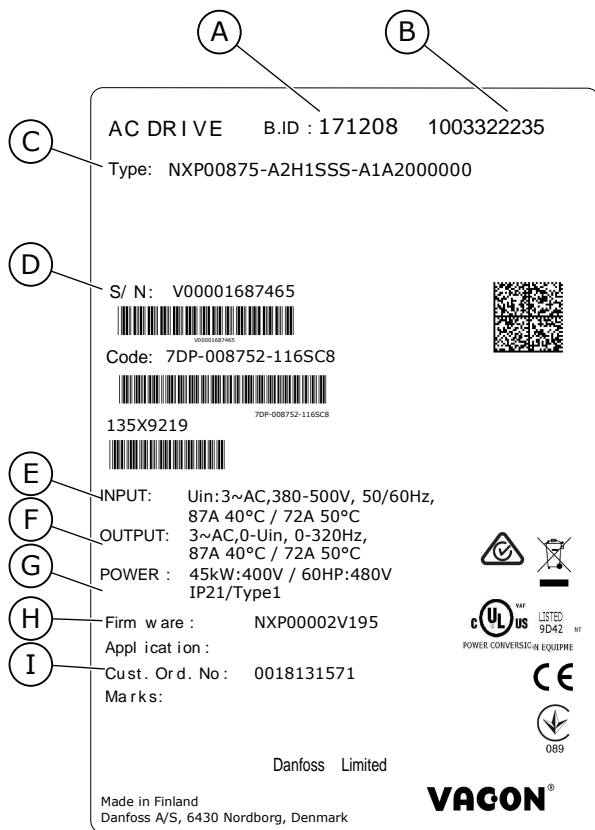
This manual is regularly reviewed and updated. All suggestions for improvement are welcome.

**Table 1: Manual and Software Version**

Edition	Remarks
DPD00910G	Package label and type code information changed in <a href="#">3.3 Package Label</a> and <a href="#">3.4 Description of the Type Code</a> . Information on removing the jumper X10-1 added in <a href="#">6.6.1 Installing the AC drive in an IT System, FR4-FR6</a> . Information on creating a service info file added in <a href="#">11.3 Creating Service Info File</a> . Structure of the manual changed.

### 3.3 Package Label

The package label gives detailed information about the delivery.



e30bf961.10

A The batch ID	B The order number of VACON®
C The type code	D The serial number
E The mains voltage	F The nominal output current
G The protection rating	H The firmware code
I The order number of the customer	

Illustration 1: Package Label of VACON® NXS/NXP AC Drives

### 3.4 Description of the Type Code

The type designation code of VACON® is made of standard codes and optional codes. Each part of the type designation code agrees to the data in the order.

**Example:**

The code can have this format, for example:

- NXP00035-A2H1SSS-A1A2C30000+DNOT



Table 2: Description of the Type Code

Code	Description
VACON	This part is same for all the products.
NXP	The product range: <ul style="list-style-type: none"> <li>• NXP = VACON® NXP</li> <li>• NXS = VACON® NXS</li> </ul>
0003	The drive rating in amperes. For example, 0003 = 3 A
5	The mains voltage: <ul style="list-style-type: none"> <li>• 2 = 208–240 V</li> <li>• 5 = 380–500 V</li> <li>• 6 = 525–600 V (IEC) 525–600 V (cULus)</li> </ul>
A	The control panel: <ul style="list-style-type: none"> <li>• A = standard (text display)</li> <li>• B = no local control panel</li> <li>• F = dummy keypad</li> <li>• G = graphic display</li> </ul>
2	The protection rating: <ul style="list-style-type: none"> <li>• 0 = IP00</li> <li>• 2 = IP21 (UL Type 1)</li> <li>• 5 = IP54 (UL Type 12)</li> <li>• T = flange-mounted (through-hole mounted)</li> </ul>
H	The EMC emission level: <ul style="list-style-type: none"> <li>• C = complies with the category C1 of standard IEC/EN 61800-3 + A1, 1st environment, and nominal voltage less than 1000 V</li> <li>• H = complies with the category C2 of standard IEC/EN 61800-3 + A1, fixed installations, and nominal voltage less than 1000 V</li> <li>• L = complies with the category C3 of standard IEC/EN 61800-3 + A1, 2nd environment, and nominal voltage less than 1000 V</li> <li>• T = complies with the standard IEC/EN 61800-3 + A1 when used in IT networks (C4).</li> <li>• N = No EMC emission protection. An external EMC filter is necessary.</li> </ul>
1	The brake chopper: <sup>(1)</sup> <ul style="list-style-type: none"> <li>• 0 = No brake chopper</li> <li>• 1 = Internal brake chopper</li> <li>• 2 = Internal brake chopper and resistor, available for:               <ul style="list-style-type: none"> <li>- 208–240 V (FR4-FR6)</li> <li>- 380–500 V (FR4-FR6)</li> </ul> </li> </ul>

Code	Description
SSS	<p>The hardware changes:</p> <ul style="list-style-type: none"> <li>• The supply, the first letter (Xxx):           <ul style="list-style-type: none"> <li>- S = 6-pulse connection (FR4 to FR11)</li> <li>- B = Additional DC-connection (FR8 to FR11)</li> <li>- J = FR10 to 11 stand-alone with main switch and DC-link terminals</li> </ul> </li> <li>• The mounting, the second letter: (xXx):           <ul style="list-style-type: none"> <li>- S = Air-cooled drive</li> </ul> </li> <li>• The boards, the third letter (xxX):           <ul style="list-style-type: none"> <li>- S = Standard boards (FR4 to FR8)</li> <li>- V = Coated boards (FR4 to FR8)</li> <li>- F = Standard boards (FR9 to FR11)</li> <li>- G = Coated boards (FR9 to FR11)</li> <li>- A = Standard boards (FR10 to FR11 standalone drives)</li> <li>- B = Coated boards (FR10 to FR11 standalone drives)</li> <li>- N = separate IP54 (UL Type 12) control box, standard boards (FR9 IP00, ≥ FR10)</li> <li>- O = separate IP54 (UL Type 12) control box, coated boards (FR9 IP00, ≥ FR10)</li> <li>- X = separate IP00 control box, standard boards (FR9 IP00)</li> <li>- Y = separate IP00 control box, coated boards (FR9 IP00)</li> </ul> </li> </ul>
A1A2C30000	<p>The option boards. 2 characters for each slot. 00 = the slot is not used</p> <p>The option board abbreviations:</p> <ul style="list-style-type: none"> <li>• A = basic I/O board</li> <li>• B = expander I/O board</li> <li>• C = fieldbus board</li> <li>• D = special board</li> <li>• E = fieldbus board</li> </ul> <p>For example, C3 = PROFIBUS DP</p>
+DNOT	<p>The optional codes. There are many options.</p> <p>The options that are related to ordering of paper manuals are:</p> <ul style="list-style-type: none"> <li>• +DNOT = No paper manuals, only Quick Guide and Safety Guide</li> <li>• +DPAP = With English paper manuals</li> <li>• +DPAP+DLDE = With German paper manuals</li> </ul>

<sup>1</sup> A brake resistor is available as an option for external installation for 208–240 V (FR7-FR11), 380–500 V (FR7-FR11), and 525–690 V (all enclosure sizes).

### 3.5 Enclosure Sizes

Example:

The codes for nominal current and nominal mains voltage are part of the type code (see [3.4 Description of the Type Code](#)) on the package label (see [3.3 Package Label](#)). Use these values to find out the enclosure size of the AC drive from the table.

In the example "NXP00035-A2H1SSS-A1A2C30000+DNOT", the code for nominal current is 0003 and the code for nominal mains voltage is 5.

Table 3: Enclosure Sizes

Nominal mains voltage	Nominal current	Enclosure size
2 (208–240 V)	0003	FR4
	0004	
	0007	
	0008	
	0011	
	0012	
	0017	FR5
	0025	
	0031	
	0048	FR6
	0061	
	0075	
	0088	FR7
	0114	
	0140	
	0170	FR8
0205		
0261	FR9	
0300		

Nominal mains voltage	Nominal current	Enclosure size
5 (380–500 V)	0003	FR4
	0004	
	0005	
	0007	
	0009	
	0012	
	0016	FR5
	0022	
	0031	
	0038	FR6
	0045	
	0061	
	0072	FR7
	0087	
	0105	
	0140	FR8
	0168	
	0205	
	0261	FR9
	0300	
	0385	FR10
0460		
0520		
0590	FR11	
0650		
0730		

Nominal mains voltage	Nominal current	Enclosure size
6 (500–690 V)	0004	FR6
	0005	
	0007	
	0010	
	0013	
	0018	
	0022	
	0027	
	0034	
	0041	
	0052	
	0062	FR8
	0080	
	0100	
	0125	FR9
	0144	
	0177	
	0205	
	0261	FR10
	0325	
	0385	
	0416	
	0460	FR11
	0502	
	0590	

### 3.6 Available Protection Ratings

Table 4: Available Protection Ratings

Mains voltage	Enclosure size	IP21 (UL Type 1)	IP54 (UL Type 12)
208–240 V	FR4-FR9	x	x
350–500 V	FR4-FR10	x	x
350–500 V	FR11	x	
525–690 V	FR4-FR10	x	x
525–690 V	FR11	x	

### 3.7 Available EMC Classes

The product standard (EMC immunity requirements) IEC/EN 61800-3 + A1 has 5 categories. The VACON® AC drives are divided into 5 EMC classes that have equivalents in the standard. All VACON® NX AC drives comply with the standard IEC/EN 61800-3 + A1.

The type code tells which category requirement the AC drive complies with (see [3.4 Description of the Type Code](#)).

The category changes when these properties in the AC drive change:

- the level of electromagnetic disturbances
- the requirements of a power system network
- the installation environment (see the standard IEC/EN 61800-3 + A1)

Table 5: Available EMC Classes

EMC class in IEC/EN 61800-3 + A1	VACON® equivalent EMC class	Description	Available for
C1	C	<p>The best EMC protection. These AC drives have the nominal voltage of less than 1000 V. They are used in the 1st environment.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p style="text-align: center;"><b>⚠ NOTICE ⚠</b></p> <p>If the protection rating of the AC drive is IP21 (UL Type 1), only the conducted emissions are in the requirements of category C1.</p> </div>	380–500 V, FR4 to FR6, IP54 (UL Type 12)
C2	H	<p>Includes AC drives in fixed installations. These AC drives have the nominal voltage of less than 1000 V. The category C2 AC drives can be used in the 1st and the 2nd environment.</p>	380–500 V, FR4 to FR9 and 208–240 V, FR4 to FR9
C3	L	<p>Includes AC drives that have the nominal voltage of less than 1000 V. These AC drives are used in the 2nd environment only.</p>	IP21 (UL Type 1) and IP54 (UL Type 12) in 380–500 V FR10 and larger, 525–690 V FR6 and larger
C4	T	<p>These AC drives comply with the standard IEC/EN 61800-3 + A1 if they are used in IT systems. In IT systems, the networks are isolated from ground, or connected to ground through high impedance to decrease the leakage current.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p style="text-align: center;"><b>⚠ NOTICE ⚠</b></p> <p>If the AC drives are used with other supplies, they do not comply with the EMC requirements.</p> </div> <p>To change the EMC class of the VACON® NX AC drive from C2 or C3 to C4, see the instructions in <a href="#">6.6 Installation in an IT System</a>.</p>	All products

EMC class in IEC/EN 61800-3 + A1	VACON® equivalent EMC class	Description	Available for
No EMC emission protection	N	<p>The AC drives of this category do not give EMC emission protection. These drives are installed in enclosures.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p style="text-align: center;"><b>⚠ NOTICE ⚠</b></p> <p>An external EMC filter is usually necessary to comply with the EMC emission requirements.</p> </div> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p style="text-align: center;"><b>⚠ NOTICE ⚠</b></p> <p><b>RADIO INTERFERENCE</b></p> <p>In a residential environment, this product can cause radio interference.</p> <ul style="list-style-type: none"> <li>- Take supplementary mitigation measures.</li> </ul> </div>	In IP00

### 3.8 Control Panel

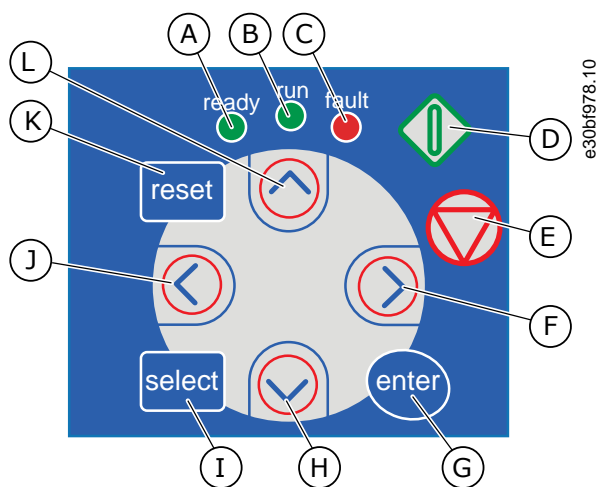
#### 3.8.1 Introduction to Control Panel

The control panel is the interface between the AC drive and the user. Use the control panel to control the speed of a motor and monitor the status of the AC drive. Use it also to set the parameters of the AC drive.

The control panel can be removed from the AC drive. The control panel is isolated from the input line potential.

#### 3.8.2 Keypad

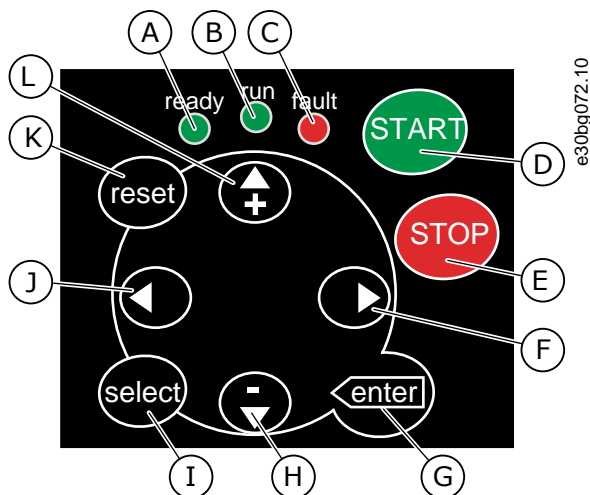
The VACON® keypad has 9 buttons with which you can control the AC drive (and motor), set parameters, and monitor values.



<p><b>A</b> The [ready] LED is on when the AC power is connected to the drive and no faults are active. At the same time, the drive status indication shows <i>READY</i>.</p>	<p><b>B</b> The [run] LED is on when the drive operates. The LED blinks when the Stop button is pushed and the drive ramps down.</p>
<p><b>C</b> The [fault] LED blinks when the AC drive is stopped because of dangerous conditions (Fault Trip). See <a href="#">8.5.1 Finding the Active Faults Menu</a>.</p>	<p><b>D</b> The Start button. When the keypad is the active control mode, this button starts the motor. See <a href="#">8.4.3 Changing the Control Mode</a>.</p>
<p><b>E</b> The Stop button. The button stops the motor (unless the stop is disabled by the parameter R3.4/R3.6). See <a href="#">8.4.2 Keypad Control Parameters M3</a>.</p>	<p><b>F</b> The Menu button Right. Use it to move forward in the menu, move the cursor right (in the parameter menu) and to go to the edit mode.</p>
<p><b>G</b> The [enter] button. Use it to accept a selection, reset the fault history (push for 2–3 s).</p>	<p><b>H</b> The Browser button Down. Use it to scroll the main menu and the pages of different submenus and to decrease a value.</p>
<p><b>I</b> The [select] button. Use it to move between 2 last displays, for example, to see how new value changes some other value.</p>	<p><b>J</b> The Menu button Left. Use it to move back in the menu, move the cursor left (in the Parameter menu).</p>
<p><b>K</b> The [reset] button. Use it to reset a fault.</p>	<p><b>L</b> The Browser button Up. Use it to scroll the main menu and the pages of different submenus and to increase a value.</p>

Illustration 2: Keypad Buttons for VACON® NXP

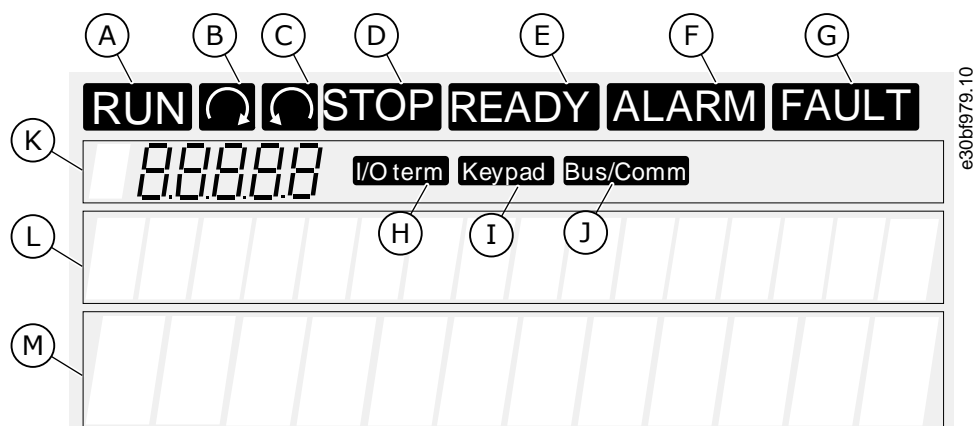




<p><b>A</b> The [ready] LED is on when the AC power is connected to the drive and no faults are active. At the same time, the drive status indication shows <i>READY</i>.</p>	<p><b>B</b> The [run] LED is on when the drive operates. The LED blinks when the Stop button is pushed and the drive ramps down.</p>
<p><b>C</b> The [fault] LED blinks when the AC drive is stopped because of dangerous conditions (Fault Trip). See <a href="#">8.5.1 Finding the Active Faults Menu</a>.</p>	<p><b>D</b> The [START] button. When the keypad is the active control mode, this button starts the motor. See <a href="#">8.4.3 Changing the Control Mode</a>.</p>
<p><b>E</b> The [STOP] button. The button stops the motor (unless the stop is disabled by the parameter R3.4/R3.6). See <a href="#">8.4.2 Keypad Control Parameters M3</a>.</p>	<p><b>F</b> The Menu button Right. Use it to move forward in the menu, move the cursor right (in the parameter menu) and to go to the edit mode.</p>
<p><b>G</b> The [enter] button. Use it to accept a selection, reset the fault history (push for 2–3 s).</p>	<p><b>H</b> The Browser button Down. Use it to scroll the main menu and the pages of different submenus and to decrease a value.</p>
<p><b>I</b> The [select] button. Use it to move between 2 last displays, for example, to see how new value changes some other value.</p>	<p><b>J</b> The Menu button Left. Use it to move back in the menu, move the cursor left (in the Parameter menu).</p>
<p><b>K</b> The [reset] button. Use it to reset a fault.</p>	<p><b>L</b> The Browser button Up. Use it to scroll the main menu and the pages of different submenus and to increase a value.</p>

Illustration 3: Keypad Buttons for VACON® NXS

### 3.8.3 Display



<b>A</b> The motor is in RUN state. The indication starts to blink when a stop command is given and blinks while the speed continues to decrease.	<b>B</b> The motor rotation direction is forward.
<b>C</b> The motor rotation direction is reverse.	<b>D</b> The drive does not operate.
<b>E</b> The AC power is on.	<b>F</b> An alarm is given.
<b>G</b> A fault is given and the AC drive is stopped.	<b>H</b> The I/O terminals is the active control mode.
<b>I</b> The control panel is the active control mode.	<b>J</b> The fieldbus is the active control mode.
<b>K</b> The location indication. The line shows the symbol and number of the menu, parameter and so on. For example, M2 = Menu 2 (Parameters) or P2.1.3 = Acceleration time.	<b>L</b> The description line. The line shows the description of the menu, value, or fault.
<b>M</b> The value line. The line shows the numerical and text values of references, parameters and so on. It also shows the number of submenus that are available in each menu.	

**Illustration 4: Display Indications**

The drive status indicators (A-G) give information about the status of the motor and the AC drive.

The control mode indications (H, I, J) show the selection of the control mode. The control mode tells from where the START/STOP commands are given and reference values are changed. To make this selection, go to the Keypad control menu (M3) (see [8.4.3 Changing the Control Mode](#)).

The three text lines (K, L, M) give information about the current location in the menu structure and the operation of the drive.

### 3.8.4 Basic Menu Structure

The data of the AC drive is in menus and submenus. The figure shows the basic menu structure of the AC drive.

This menu structure is only an example and the contents and items can vary depending on the application in use.

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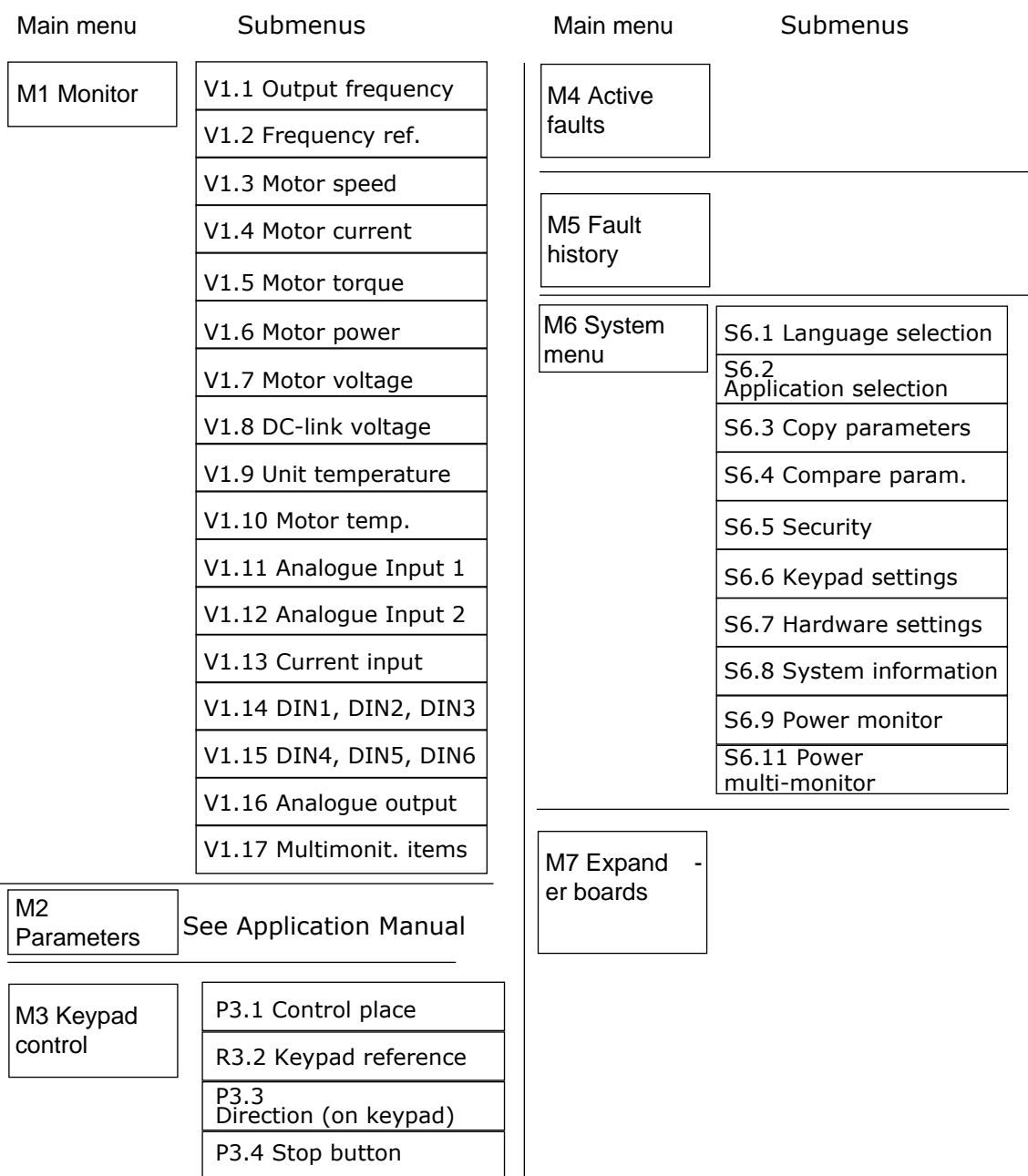


Illustration 5: Basic Menu Structure of the AC Drive

## 4 Receiving the Delivery

### 4.1 Checking the Delivery

**Context:**

Before a VACON® AC drive is sent to the customer, the manufacturer makes many tests on the drive.

**Procedure**

1. After removing the packaging, examine the drive for transport damages.

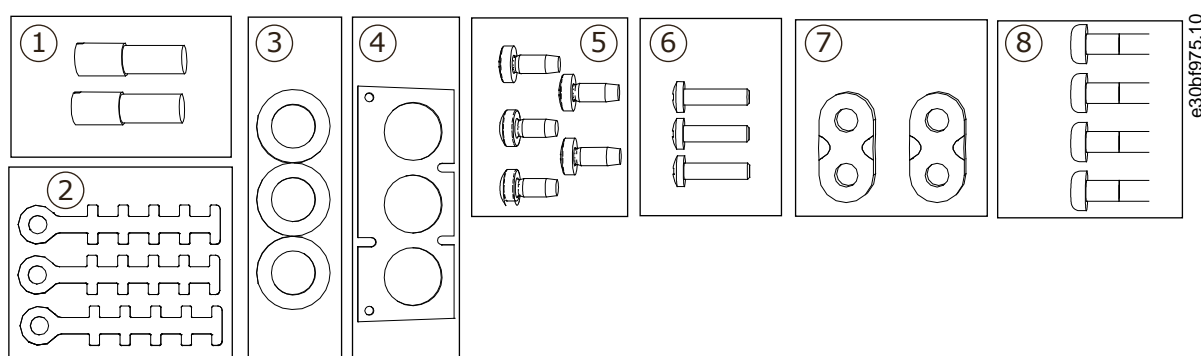
If the drive was damaged during the shipping, speak to the cargo insurance company or the carrier.

2. To make sure that the delivery is correct, compare the order data to the data on the package label, see [3.3 Package Label](#).

If the delivery does not agree with the order, speak to the vendor immediately.

3. To make sure that the contents of the delivery is correct and complete, compare the type code of the product to the type code, see [3.4 Description of the Type Code](#).
4. Check that the accessories bag contains the items shown in the figure. These accessories are part of the electrical installation. The contents of the accessories bag is different for different enclosure sizes and protection ratings.

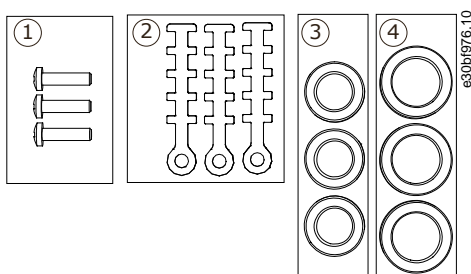
FR4-FR6



1 The grounding terminals (FR4, FR5), 2 pieces	2 The grounding clamps for control cable, 3 pieces
3 The rubber grommets (sizes vary from class to class), 3 pieces	4 The cable entry plate
5 Screws, M4x10, 5 pieces	6 Screws, M4x16, 3 pieces
7 The grounding clamps for grounding conductor (FR6), 2 pieces	8 The grounding screws M5x16 (FR6), 4 pieces

Illustration 6: Contents of the Accessories Bag for FR4-FR6

FR7-8



1 Screws, M4x16, 3 pieces	2 The grounding clamps for control cable, 3 pieces
	4 The rubber grommets GDM36 (FR7), 3 pieces

- 3 The rubber grommets GD21 (FR7 IP54/UL Type 12),  
3 pieces / (FR8), 6 pieces

Illustration 7: Contents of the Accessories Bag for FR7-FR8

## 4.2 Storing the Product

### Context:

If the product has to be stored before installing it, follow these instructions.

#### Procedure

1. If the AC drive must be stored before using it, make sure that the ambient conditions agree to the following:
  - Storage temperature:  $-40\dots+70^{\circ}\text{C}$  ( $-40\dots+158^{\circ}\text{F}$ )
  - Relative humidity: 0–95%, no condensation
2. If the AC drive must be kept in storage for a long time, connect the power to the AC drive each year. Keep the power on for a minimum of 2 hours.
3. If the storage time is more than 12 months, charge the electrolytic DC capacitors with caution. To reform the capacitors, obey the instructions in [10.2 Reforming the Capacitors](#).

We do not recommend a long storage time.

## 4.3 Lifting the Product

### Context:

Speak to the factory or the local distributor to get information on how to lift the AC drive safely.

### Prerequisites:

The weights of AC drives of different enclosure sizes are very different. It can be necessary to use a lifting device to move the drive from its package.

#### Procedure

1. Check the weight of the AC drive, see [12.1 Weights of the AC Drive](#).
2. To lift the AC drives larger than FR7 out of the package, use a jib crane.
3. After lifting the drive, check for signs of damage on the drive.

## 4.4 Using the Product Modified Label

### Context:

In the accessories bag, there is also a "product modified" label. The function of the label is to tell the service personnel about the changes that are made in the AC drive.

Drive modified:	
<input type="checkbox"/> Option board: NXOPT.....	Date:.....
in slot: A B C D E	Date:.....
<input type="checkbox"/> IP54 upgrade/Collar	Date:.....
<input type="checkbox"/> EMC level modified: H/L to T	Date:.....

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Illustration 8: The Product Modified Label

**Procedure**

1. Attach the label on the side of the AC drive to know where to find it.
2. If changes are made in the AC drive, write the change on the label.

## 5 Mounting the Unit

### 5.1 Environmental Requirements

#### 5.1.1 General Environmental Requirements

In environments with airborne liquids, particles, or corrosive gases, ensure that the protection rating of the equipment matches the installation environment. Failure to meet requirements for ambient conditions can reduce the lifetime of the AC drive. Ensure that requirements for humidity, temperature, and altitude are met.

#### Vibration and shock

The AC drive complies with requirements for units mounted on the walls and floors of production premises, and in panels bolted to walls or floors. For detailed ambient conditions specifications, see [12.8 VACON NXP Technical Data](#).

#### Installation requirements:

- Make sure that there is sufficiently free space around the AC drive for cooling, see [5.2.2 Cooling of FR4 to FR9](#) or [5.2.3 Cooling of Standalone AC drives \(FR10 to FR11\)](#).
- Some free space is also necessary for maintenance.
- Make sure that the mounting surface is sufficiently flat.

#### 5.1.2 High Altitude Installation

The density of air decreases when the altitude increases and the pressure decreases. When the air density decreases, the thermal capacity decreases (that is, less air removes less heat) and the resistance to electric field (breakdown voltage/distance) decreases.

The full thermal performance of VACON® NX AC drives is designed for installation up to 1000 m altitude. The electric insulation is designed for installations up to 2000 m altitude.

Higher installation locations are possible, when obeying the derating guidelines in this chapter.

Above 1000 m, decrease the limited maximum load current by 1% for each 100 m. For example, at 2500 m altitude, decrease the load current down to 85% of the rated output current ( $100\% - (2500 - 1000) / 100 \text{ m} \times 1\% = 85\%$ ).

When using fuses at high altitudes, the cooling effect of the fuse decreases as the density of the atmosphere decreases.

When using fuses above 2000 meters, the continuous rating of the fuse:

$$I = I_n \cdot (1 - (h - 2000) / 100 \cdot 0.5 / 100)$$

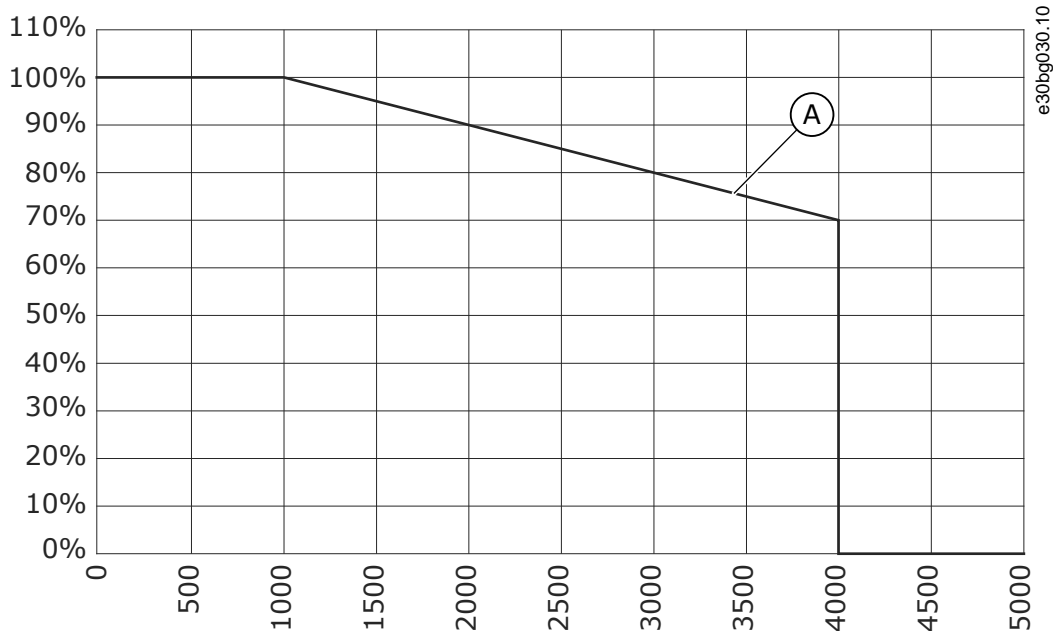
Where

I = Current rating at high altitude

$I_n$  = Rated current of a fuse

h = Altitude in meters





**A** Loadability

**Illustration 9: Loadability in High Altitudes**

For permitted maximum altitudes, see [12.8 VACON NXP Technical Data](#).

For information on option boards and I/O signals and relay outputs, see VACON® NX I/O Boards User Manual.

## 5.2 Cooling Requirements

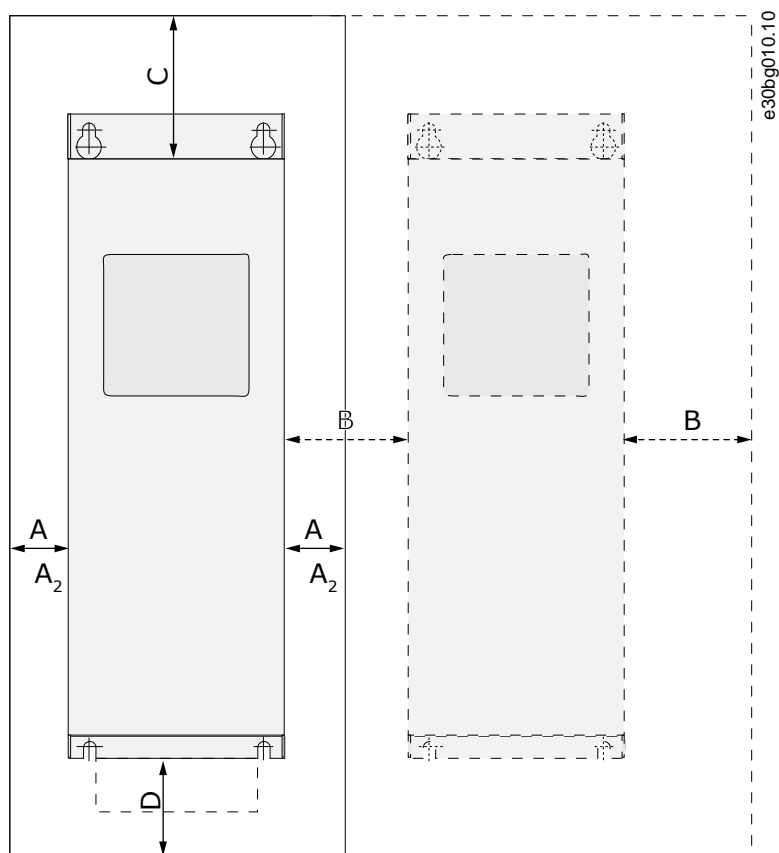
### 5.2.1 General Cooling Requirements

The AC drive produces heat in operation. The fan moves air and decreases the temperature of the drive. Make sure that there is sufficiently free space around the drive.

Make sure that the temperature of the cooling air does not go above the maximum ambient operating temperature or below the minimum ambient operating temperature of the drive.

### 5.2.2 Cooling of FR4 to FR9

If many AC drives are installed above each other, the necessary free space is C + D (see [illustration 10](#)). Make also sure that the outlet air from the lower drive goes to a different direction than the air intake of the top drive.



<b>A</b> The clearance around the drive (see also B and C)	<b>B</b> The distance from a drive to a second drive, or the distance to the cabinet wall
<b>C</b> The free space above the drive	<b>D</b> The free space below the drive

Illustration 10: Installation Space

Table 6: Minimum Clearances around the AC Drive in mm (in inch)

Drive type	A	B	C	D
0003 2-0012 2	20	20	100	50
0003 5-0012 5	(0.79)	(0.79)	(3.94)	(1.97)
0017 2-0031 2	20	20	120	60
0016 5-0031 5	(0.79)	(0.79)	(4.72)	(2.36)
0048 2-0061 2	30	20	160	80
0038 5-0061 5	(1.18)	(0.79)	(6.30)	(3.15)
0004 6-0034 6				

Drive type	A	B	C	D
0075 2-0114 2	80	80	300	100
0072 5-0105 5	(3.15)	(3.15)	(11.81)	(3.94)
0041 6-0052 6				
0140 2-0205 2	80	80	300	300
0140 5-0205 5	(3.15)	(3.15)	(11.81)	(11.81)
0062 6-0100 6	0			
0261 2-0300 2	50	80	400	250 / 350
0261 5-0300 5	(1.97)	(3.15)	(15.75)	(9.84) / (13.78)
0125 6-0208 6				0

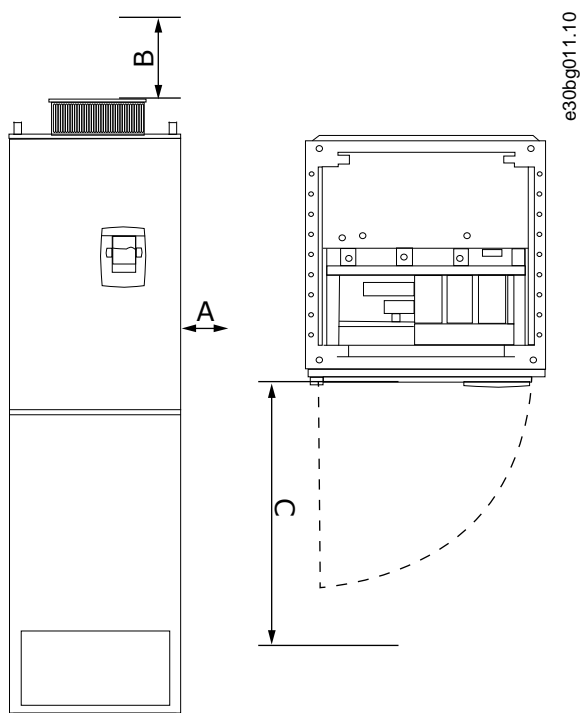
To change the fan with the motor cables connected, the necessary clearance on the 2 sides of the drive is 150 mm (5.91 inch).

The minimum clearance to change the fan.

**Table 7: Necessary Quantity of Cooling Air**

Drive type	The quantity of cooling air [m <sup>3</sup> /h]	The quantity of cooling air [CFM]
0003 2-0012 2	70	41.2
0003 5-0012 5		
0017 2-0031 2	190	112
0016 5-0031 5		
0048 2-0061 2	425	250
0038 5-0061 5		
0004 6-0034 6		
0075 2-0114 2	425	250
0072 5-0105 5		
0041 6-0052 6		
0140 2-0205 2	650	383
0140 5-0205 5		
0062 6-0100 6		
0261 2-0300 2	1000	589
0261 5-0300 5		
0125 6-0208 6		

### 5.2.3 Cooling of Standalone AC drives (FR10 to FR11)



<b>A</b> The minimum distance to the side walls or adjacent components	<b>B</b> The minimum distance from the top of the cabinet
<b>C</b> Free space in front of the cabinet	

Illustration 11: Minimum Clearances around the AC Drive

Table 8: Minimum Clearances around the AC Drive in mm (in inch)

Drive type	A	B	C
0385 5-0730 5	20	200	800
0261 6-0590 6	(0.79)	(7.87)	(31.50)

Table 9: Necessary Quantity of Cooling Air

Drive type	The quantity of cooling air [m <sup>3</sup> /h]	The quantity of cooling air [CFM]
0385 5-0520 5	2000	900
0261 6-0416 6		
0590 5-0730 5	3000	1765
0460 6-0590 6		

For more information on the power losses based on the switching frequency, see <http://drives.danfoss.com/knowledge-center/energy-efficiency-directive/#/>.

## 5.3 Installation Sequence

### 5.3.1 Installation Sequence for Wall-mounted AC Drives

#### Context:

Use these instructions to install the Wall-mounted AC Drive.

#### Procedure

1. Select the mounting option:

- Horizontal

- Vertical

If the drive is installed in a horizontal position, there is no protection against drops of water that fall vertically.

- Flange mounting

The AC drive can also be installed into the cabinet wall with a flange mounting option (throughhole mounting). With the flange mounting, the protection rating of the power unit is IP54 (UL Type 12) and the protection rating of the control unit is IP21 (UL Type 1).

2. Check the dimensions of the AC drive, see [12.2.1 List of Dimension Information](#).
3. Make sure that there is sufficiently free space around the AC drive for cooling, see [5.2.2 Cooling of FR4 to FR9](#). Some free space is also necessary for maintenance.
4. Attach the AC drive with the screws and other components in the delivery.

### 5.3.2 Installation Sequence for Standalone AC drives

#### Context:

Use these instructions to install the standalone AC drive.

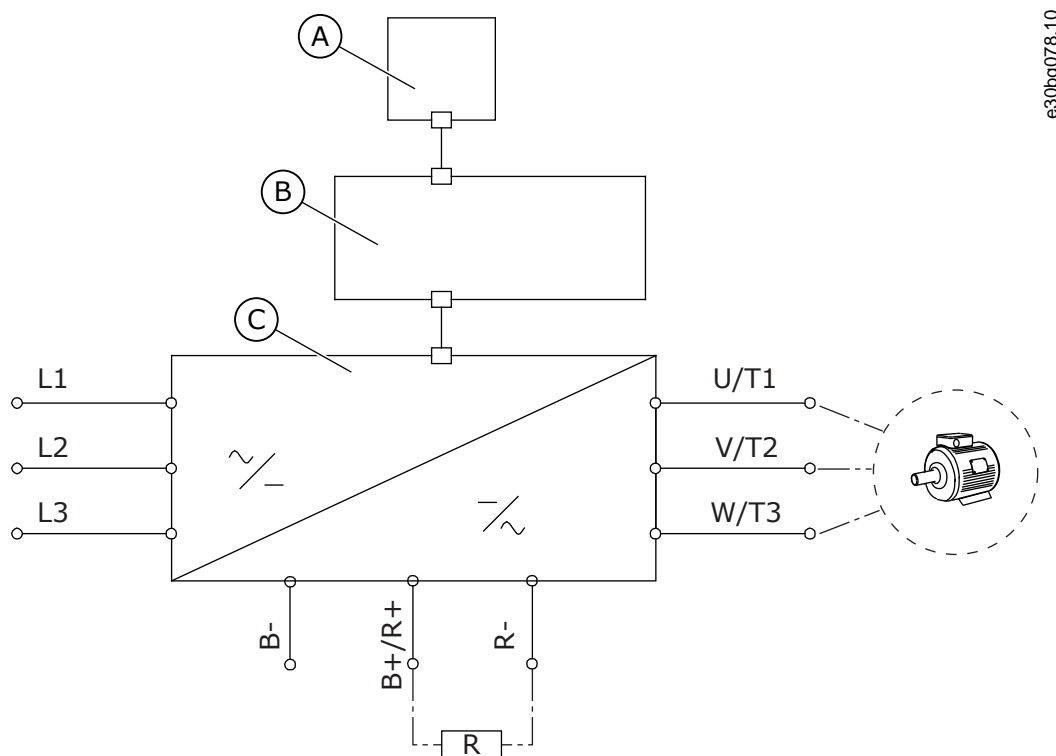
#### Procedure

1. Make sure that the mounting surface is sufficiently flat.
2. Check the dimensions of the AC drive, see [12.2.4.1 Dimensions for FR10-FR11](#).
3. Make sure that there is sufficiently free space around the AC drive for cooling, see [5.2.3 Cooling of Standalone AC drives \(FR10 to FR11\)](#). Some free space is also necessary for maintenance.
4. The enclosures have fixing holes. If needed, fix the AC Drive to the wall.

## 6 Electrical Installation

### 6.1 Cable Connections

The mains cables are connected to terminals L1, L2, and L3. The motor cables are connected to terminals U, V, and W.



A The control panel	B The control unit
C The power unit	

Illustration 12: Principal Connection Diagram

For EMC-compliant installation, see [6.2 EMC-compliant Installation](#).

#### 6.1.1 General Cable Requirements

Use cables with a minimum heat resistance of +70 °C (158 °F). In the selection of the cables and the fuses, refer to the nominal output current of the drive. Find the nominal output current on the nameplate.

We recommend selecting the cables and the fuses to agree with the output current because the input current of the AC drive is almost the same as the output current.

For information on how to make the cable installation to comply with the UL standards, see [6.1.2 UL Standards on Cabling](#).

If the motor temperature protection of the drive (see VACON® All in One Application Manual) is used as an overload protection, select the cable to agree with the protection. If 3 or more cables are used in parallel for larger AC drives, use a separate overload protection for each cable.

These instructions are valid only for processes that have 1 motor and 1 cable connection from the AC drive to the motor. In other conditions, speak to the manufacturer to get more information.

## 6.1.2 UL Standards on Cabling

To comply with the UL (Underwriters Laboratories) regulations, use a UL-approved copper wire with a minimum heat resistance of 60 °C or 75 °C (140 °F or 167 °F). To comply with the standards, use cables with +90 °C (194 °F) heat resistance for sizes 0170 2 and 0168 5 (FR8), and 0261 2, 0261 5, 0300 2 and 0300 5 (FR9).

Use Class 1 wire only.

When the drive has Class T and J fuses, it can be used on a circuit that gives a maximum of 100 000 rms symmetrical amperes, and a maximum of 600 V.

The integral solid-state short-circuit protection does not give a branch circuit protection. Obey the National Electric Code and any additional local codes to get the branch circuit protection. Only fuses give the branch circuit protection.

For the tightening torques of the terminals, see [12.6 Tightening Torques of the Terminals](#).

## 6.1.3 Cable Selection and Dimensioning

Find the typical sizes and types of cables used with the AC drive the tables in [12.3.1 List of Cable and Fuse Size Information](#). In the selection of cables, refer to local regulations, cable installation conditions and cable specification.

**The dimensions of the cables must comply with the requirements of the standard IEC60364-5-52.**

- The cables must be PVC-isolated.
- The maximum ambient temperature is +30 °C (86 °F).
- The maximum temperature of the cable surface is +70 °C (158 °F).
- Use only cables with a concentric copper shield.
- The maximum number of parallel cables is 9.

When using parallel cables, make sure to obey the requirements of the cross-sectional area and the maximum number of cables.

For important information on the requirements of the grounding conductor, see [6.3 Grounding](#).

For the correction factors for each temperature, see the standard IEC60364-5-52.

## 6.1.4 Cable Selection and Dimensioning, North America

Find the typical sizes and types of cables used with the AC drive the tables in [12.3.1 List of Cable and Fuse Size Information](#). In the selection of cables, refer to local regulations, cable installation conditions and cable specification.

**The dimensions of the cables must comply with the requirements of the National Electric Code (NEC) and the Canadian Electric Code (CEC).**

- The cables must be PVC-isolated.
- The maximum ambient temperature is +86 °F.
- The maximum temperature of the cable surface is +158 °F.
- Use only cables with a concentric copper shield.
- The maximum number of parallel cables is 9.

When using parallel cables, make sure to obey the requirements of the cross-sectional area and the maximum number of cables.

For important information on the requirements of the grounding conductor, see the NEC and CEC.

For the correction factors for each temperature, see the instructions of NEC and CEC.

### 6.1.5 Fuse Selection

We recommend the fuse type gG/gL (IEC 60269-1). To make a selection of the fuse voltage rating, refer to the mains. Do not use larger fuses than what is recommended.

Find the recommended fuses in tables in [12.3.1 List of Cable and Fuse Size Information](#).

Make sure that the operation time of the fuse is less than 0.4 s. The operation time agrees with the fuse type and the impedance of the supply circuit. For more information on faster fuses, speak to the manufacturer. The manufacturer can also recommend some aR (UL recognized, IEC 60269-4) and gS (IEC 60269-4) fuse ranges.

### 6.1.6 Principle of the Power Unit Topology

The principles for mains and motor connections of the basic 6-pulse drive in enclosure sizes FR4 to FR11 show in [illustration 13](#).



Illustration 13: Topology of Enclosure Sizes FR4 – FR11

### 6.1.7 Brake Resistor Cables

VACON® NXS/NXP AC drives have terminals for the DC supply and an optional external brake resistor. These terminals are identified with B-, B+/R+, and R-. The DC bus connection is made to terminals B- and B+ and the brake resistor connection to R+ and R-. Find the dimensions that we recommend for the brake resistor cables in the tables linked in [6.1.7 Brake Resistor Cables](#).



**⚠ CAUTION ⚠**

**SHOCK HAZARD FROM MULTI-CONDUCTOR CABLES**

With a multi-conductor cable, the conductors that are not connected can cause an accidental contact with a conducting component.

- If a multi-conductor cable is used, cut off all conductors that are not connected.

The enclosure sizes FR8 and larger have the DC connection as optional.

If it is necessary to connect an external brake resistor, see VACON® Brake Resistor Manual. See also [8.7.8.2 Setting the Internal Brake Resistor Connection](#).

## 6.2 EMC-compliant Installation

For cable selections in different EMC levels, see [table 10](#).

To comply with the EMC levels, use a grommet when installing the motor cable at the two ends. For the EMC levels C1 and C2, it is necessary to have a 360° grounding of the shield with grommets in the motor end.

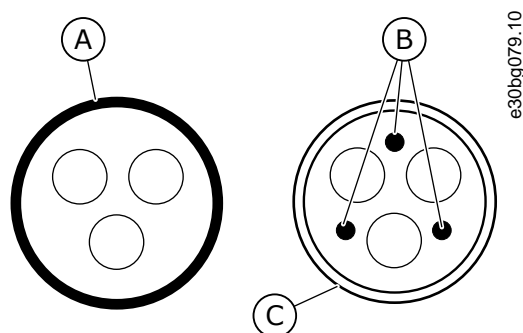
**Table 10: Recommendations for Cables**

Cable type	Category C1 and C2 <sup>(1)</sup>	Category C3 <sup>(2)</sup>	Category C4 <sup>(2)</sup>	No EMC protection <sup>(2)</sup>
Motor cable	<p>A symmetrical power cable with a compact low-impedance shield.</p> <p>A cable for the specified mains voltage.</p> <p>We recommend an NKCABLES /MCCMK, SAB/ÖZCUY-J or equivalent cable. See <a href="#">illustration 14</a>.</p>	<p>A symmetrical power cable with a concentric protection wire.</p> <p>A cable for the specified mains voltage.</p> <p>We recommend an NKCABLES/MCMK cable. See <a href="#">illustration 14</a>.</p>		
Mains cable	<p>A power cable for a fixed installation.</p> <p>A cable for the specified mains voltage.</p> <p>A shielded cable is not necessary.</p> <p>We recommend an NKCABLES/MCMK cable.</p>			
Control cable	<p>A shielded cable with a compact low-impedance shield, for example an NKCABLES/ JAMAK, or an SAB/ÖZCuY-O cable.</p>			

<sup>1</sup> 1<sup>st</sup> environment

<sup>2</sup> 2<sup>nd</sup> environment

For the definitions of EMC protection levels, see IEC/EN 61800-3 + A1.



A The PE conductor and the shield	B The PE conductors
C The shield	

Illustration 14: Cables with PE Conductors

In all the enclosure sizes, to comply with the EMC standards, use the default values of the switching frequencies.

If installing a safety switch, make sure that the EMC protection continues from the start of the cables until their ends.

The drive must obey the standard IEC 61000-3-12. To obey it, the short circuit power  $S_{SC}$  must be a minimum of  $120 R_{SCE}$  at the interface point between mains and the public mains. Make sure to connect the drive and the motor to mains with a short circuit power  $S_{SC}$  that is a minimum of  $120 R_{SCE}$ . If necessary, contact the mains operator.

### 6.2.1 Installation in a Corner-grounded Network

Corner-grounding can be used with the drive types (FR4 to FR9) with a rating of 3–300 A with a 208–240 V mains, and 261–730 A with a 380–500 V mains. In these conditions, change the EMC protection level to C4. See the instructions in [6.6 Installation in an IT System](#).

Do not use corner-grounding with the drive types (FR4 to FR8) with a rating of 3–205 A with a 380–500 V mains or with a 525–690 V mains.

Corner-grounding is permitted for the FR4-9 drives (main voltage 208–240 V) up to 3000 m and for the FR9-FR11 drives (main voltage 380–500 V) up to 2000 m.

### 6.3 Grounding

Ground the AC drive in accordance with applicable standards and directives.

**⚠ CAUTION ⚠**

**DAMAGE TO THE AC DRIVE FROM INSUFFICIENT GROUNDING**

Not using a grounding conductor can damage the drive.

- Make sure that the AC drive is always with a grounding conductor that is connected to the grounding terminal that is identified with the PE symbol.

**⚠ WARNING ⚠**

**LEAKAGE CURRENT HAZARD**

Leakage currents exceed 3.5 mA. Failure to ground the drive properly can result in death or serious injury.

- Ensure the correct grounding of the equipment by a certified electrical installer.

The standard EN 61800-5-1 tells that 1 or more of these conditions for the protective circuit must be true.

**The connection must be fixed.**

- The protective earthing conductor must have a cross-sectional area of minimum 10 mm<sup>2</sup> Cu or 16 mm<sup>2</sup> Al. OR
- There must be an automatic disconnection of the mains, if the protective earthing conductor breaks. OR
- There must be a terminal for a second protective earthing conductor in the same cross-sectional area as the first protective earthing conductor.

Cross-sectional area of the phase conductors (S) [mm <sup>2</sup> ]	The minimum cross-sectional area of the protective earthing conductor in question [mm <sup>2</sup> ]
$S \leq 16$	S
$16 < S \leq 35$	16
$35 < S$	S/2

The values of the table are valid only if the protective earthing conductor is made of the same metal as the phase conductors. If this is not so, the cross-sectional area of the protective earthing conductor must be determined in a manner that produces a conductance equivalent to that which results from the application of this table.

The cross-sectional area of each protective earthing conductor that is not a part of the mains cable or the cable enclosure, must be a minimum of:

- 2.5 mm<sup>2</sup> if there is mechanical protection, and
- 4 mm<sup>2</sup> if there is not mechanical protection. With cord-connected equipment, make sure that the protective earthing conductor in the cord is the last conductor to be interrupted, if the strain-relief mechanism breaks.

Obey the local regulations on the minimum size of the protective earthing conductor.

**⚠ NOTICE ⚠**

**MALFUNCTION OF FAULT CURRENT PROTECTIVE SWITCHES**

Because there are high capacitive currents in the AC drive, it is possible that the fault current protective switches do not operate correctly.

**⚠ NOTICE ⚠**

**VOLTAGE WITHSTAND TESTS**

Doing voltage withstand tests can damage the drive.

- Do not do voltage withstand tests on the AC drive. The manufacturer has already done the tests.

**⚠ WARNING ⚠****SHOCK HAZARD FROM PE CONDUCTOR**

The drive can cause a DC current in the PE conductor. Failure to use a residual current-operated protective (RCD) device Type B or a residual current-operated monitoring (RCM) device can lead to the RCD not providing the intended protection and therefore can result in death or serious injury.

- Use a type B RCD or RCM device on the mains side of the drive.

## 6.4 Get Access and Locate the Terminals

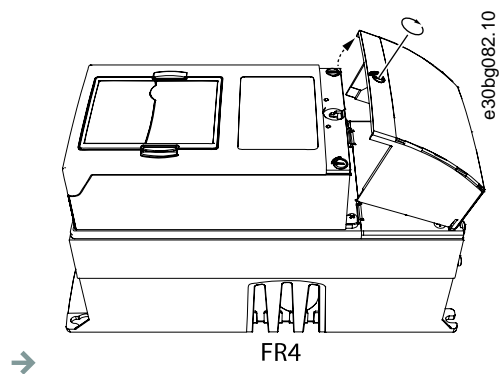
### 6.4.1 Get Access and Locate the Terminals for FR4

**Context:**

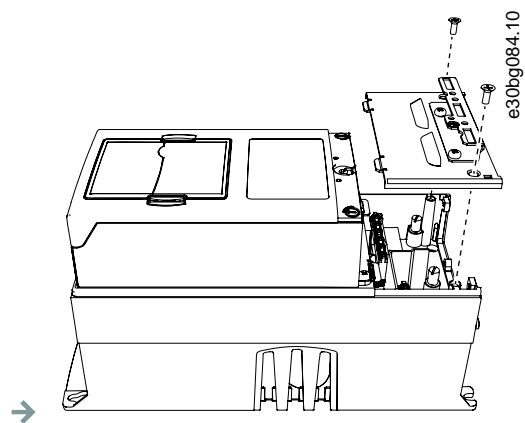
Follow these instructions to open the AC drive for installing the cables, for example.

**Procedure**

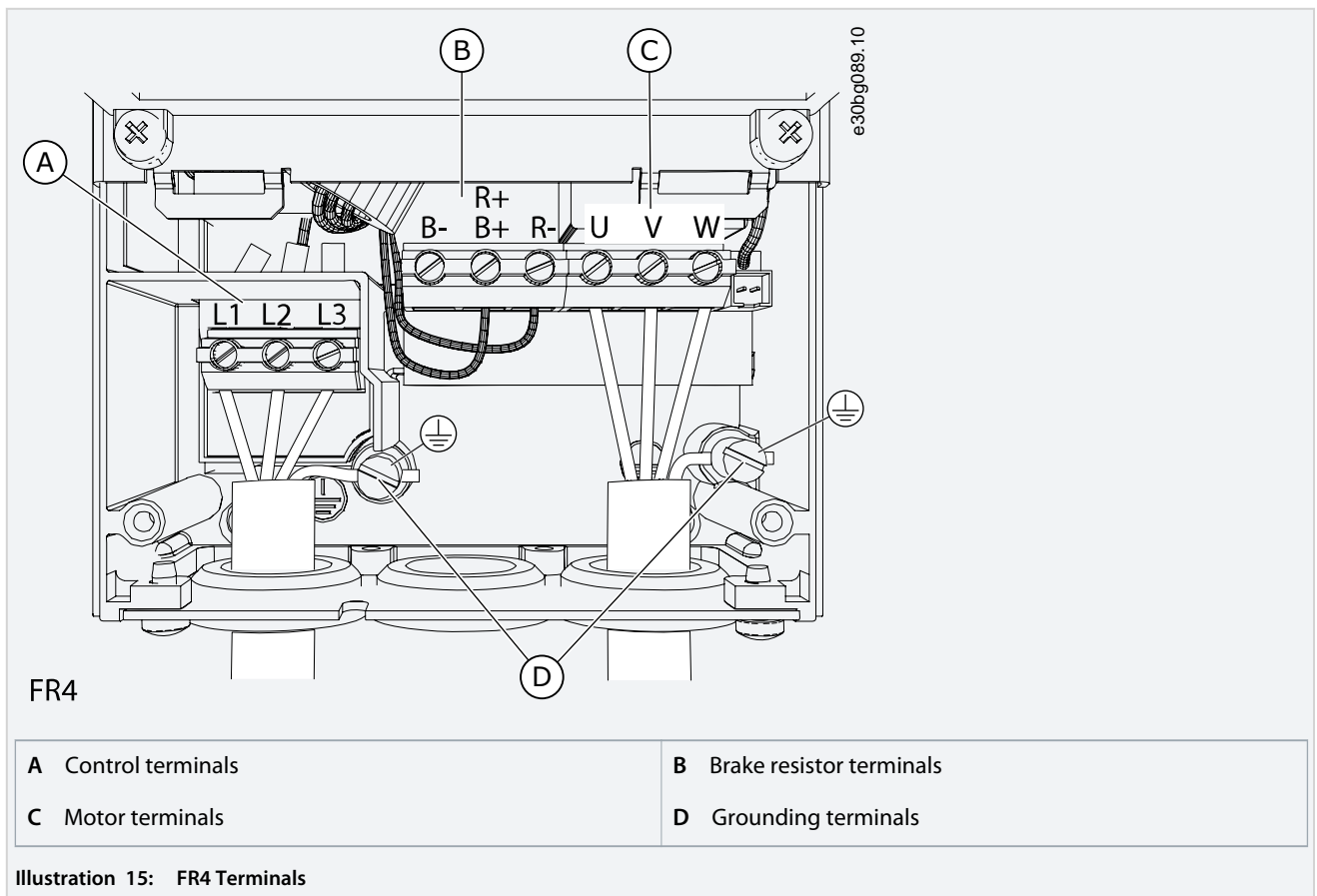
1. Open the cover of the AC drive.



2. Remove the screws of the cable cover. Remove the cable cover. Do not open the cover of the power unit.



3. Locate the terminals.



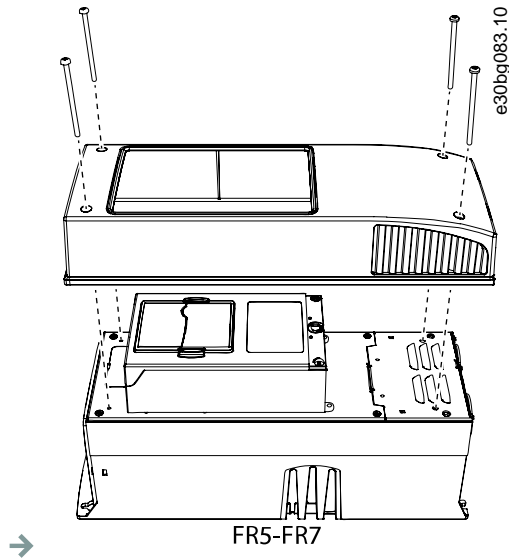
### 6.4.2 Get Access and Locate the Terminals for FR5

**Context:**

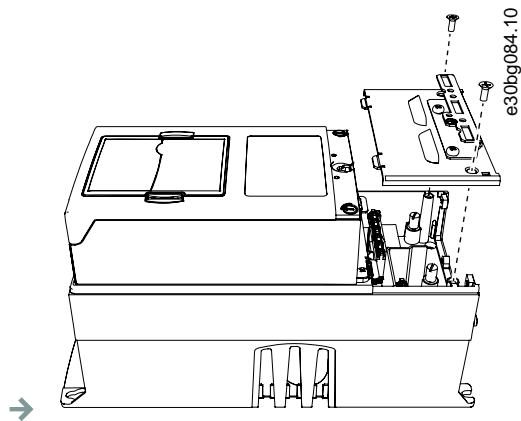
Follow these instructions to open the AC drive for installing the cables, for example.

**Procedure**

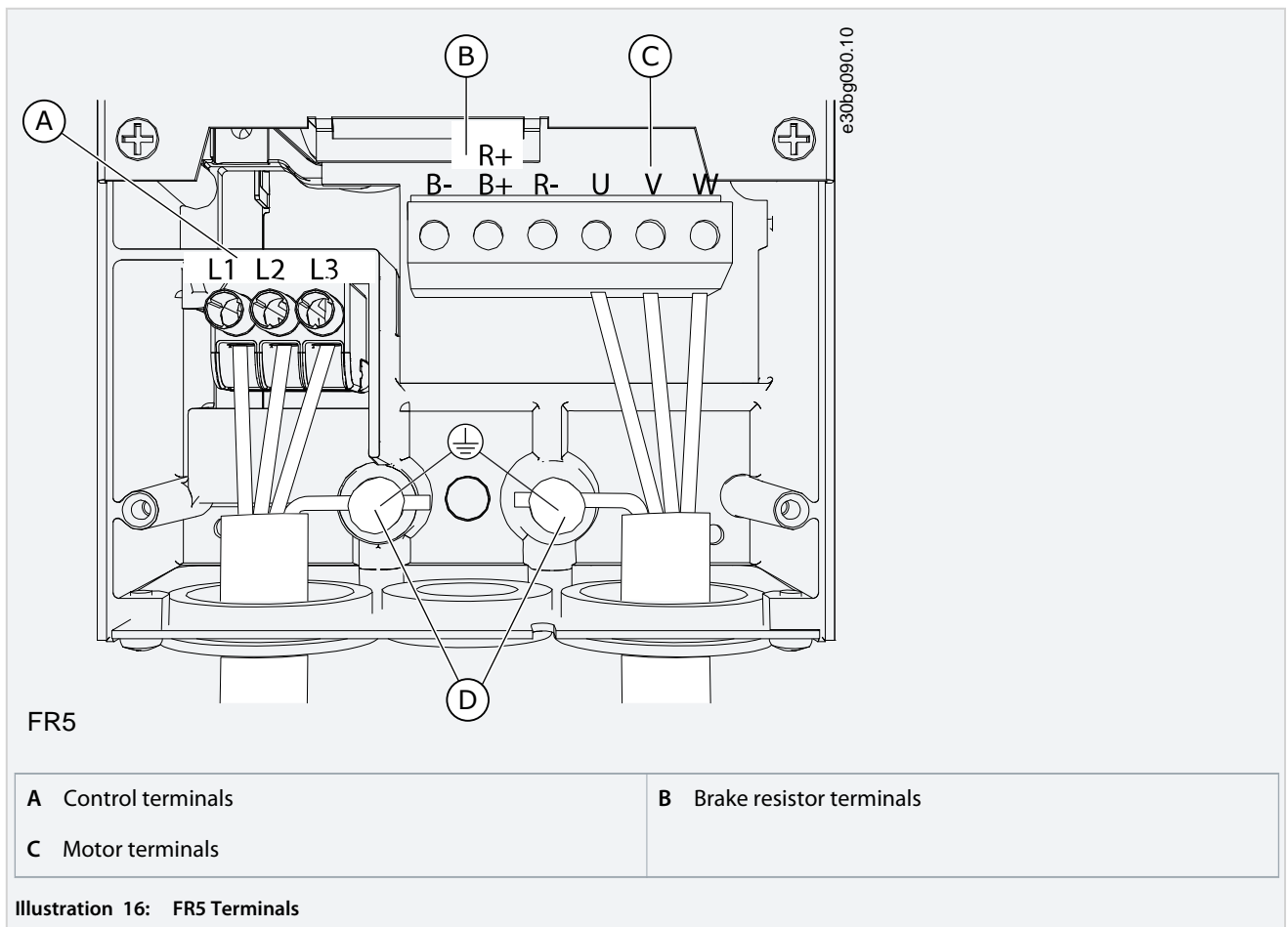
1. Open the cover of the AC drive.



2. Remove the screws of the cable cover. Remove the cable cover. Do not open the cover of the power unit.



3. Locate the terminals.



### 6.4.3 Get Access and Locate the Terminals for FR6

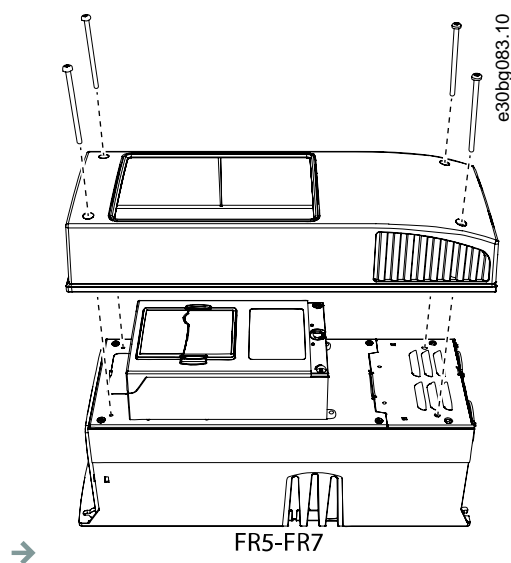
**Context:**

Follow these instructions to open the AC drive for installing the cables, for example.

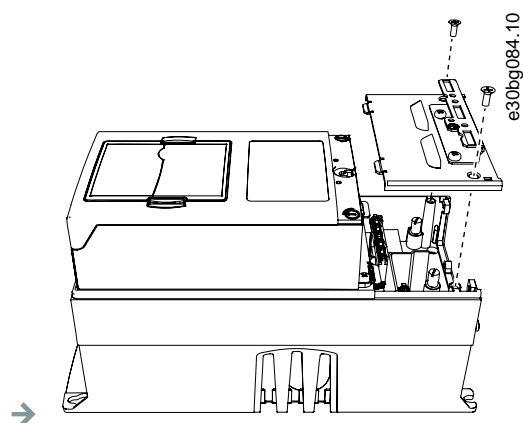


**Procedure**

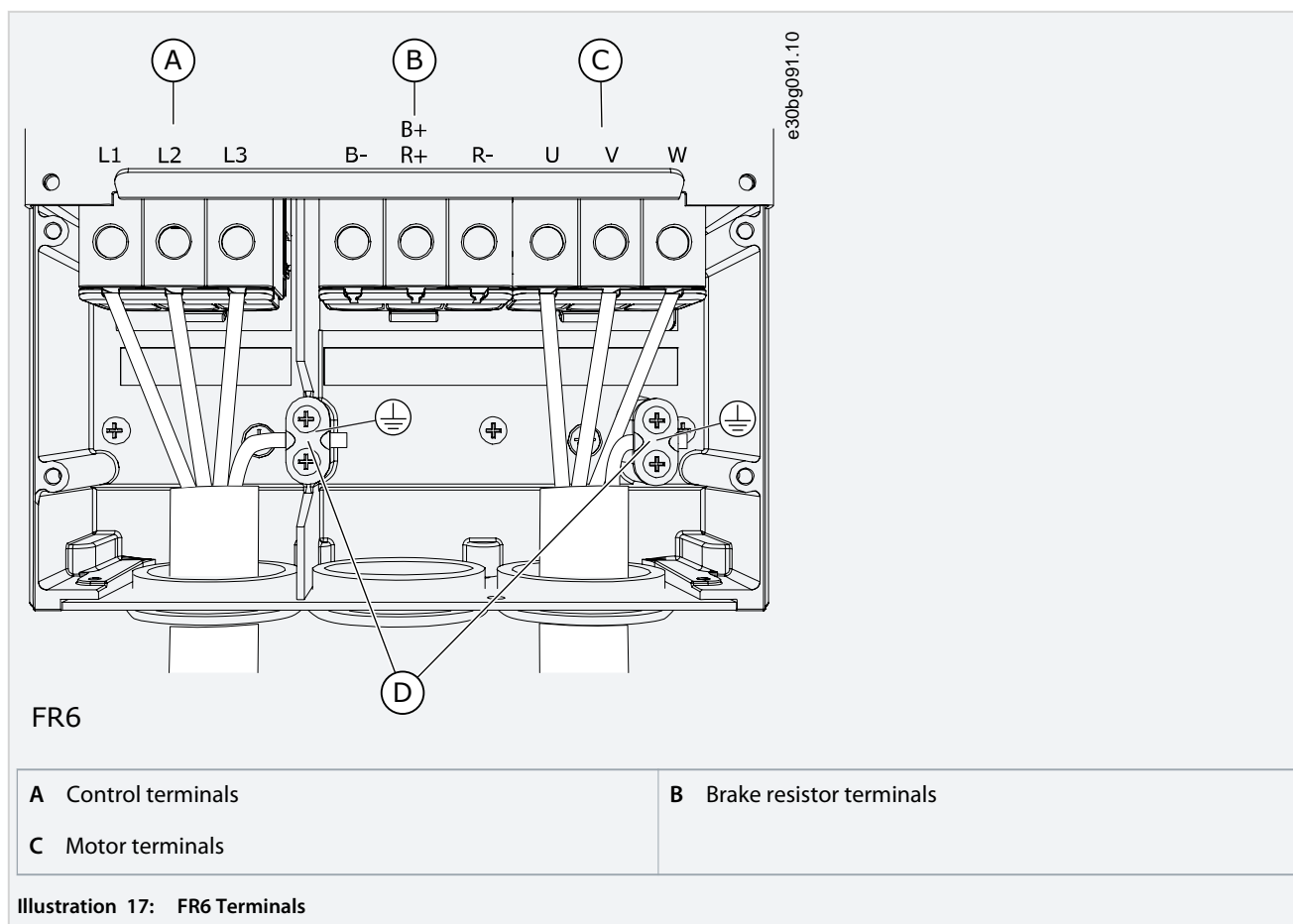
1. Open the cover of the AC drive.



2. Remove the screws of the cable cover. Remove the cable cover. Do not open the cover of the power unit.



3. Locate the terminals.



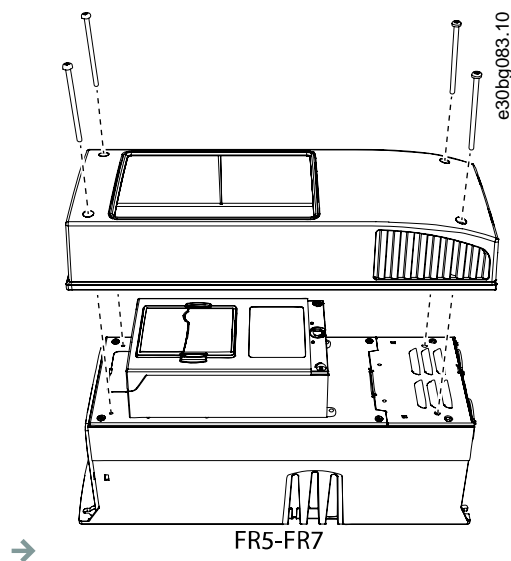
### 6.4.4 Get Access and Locate the Terminals for FR7

**Context:**

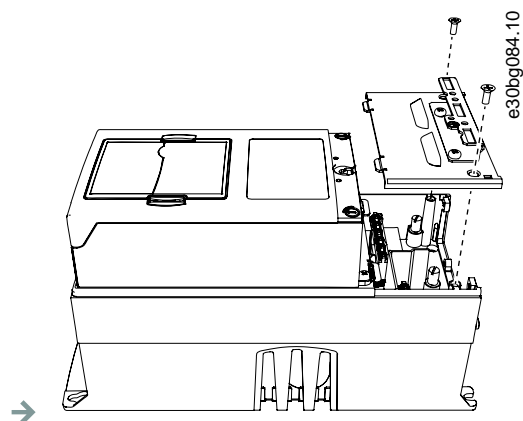
Follow these instructions to open the AC drive for installing the cables, for example.

**Procedure**

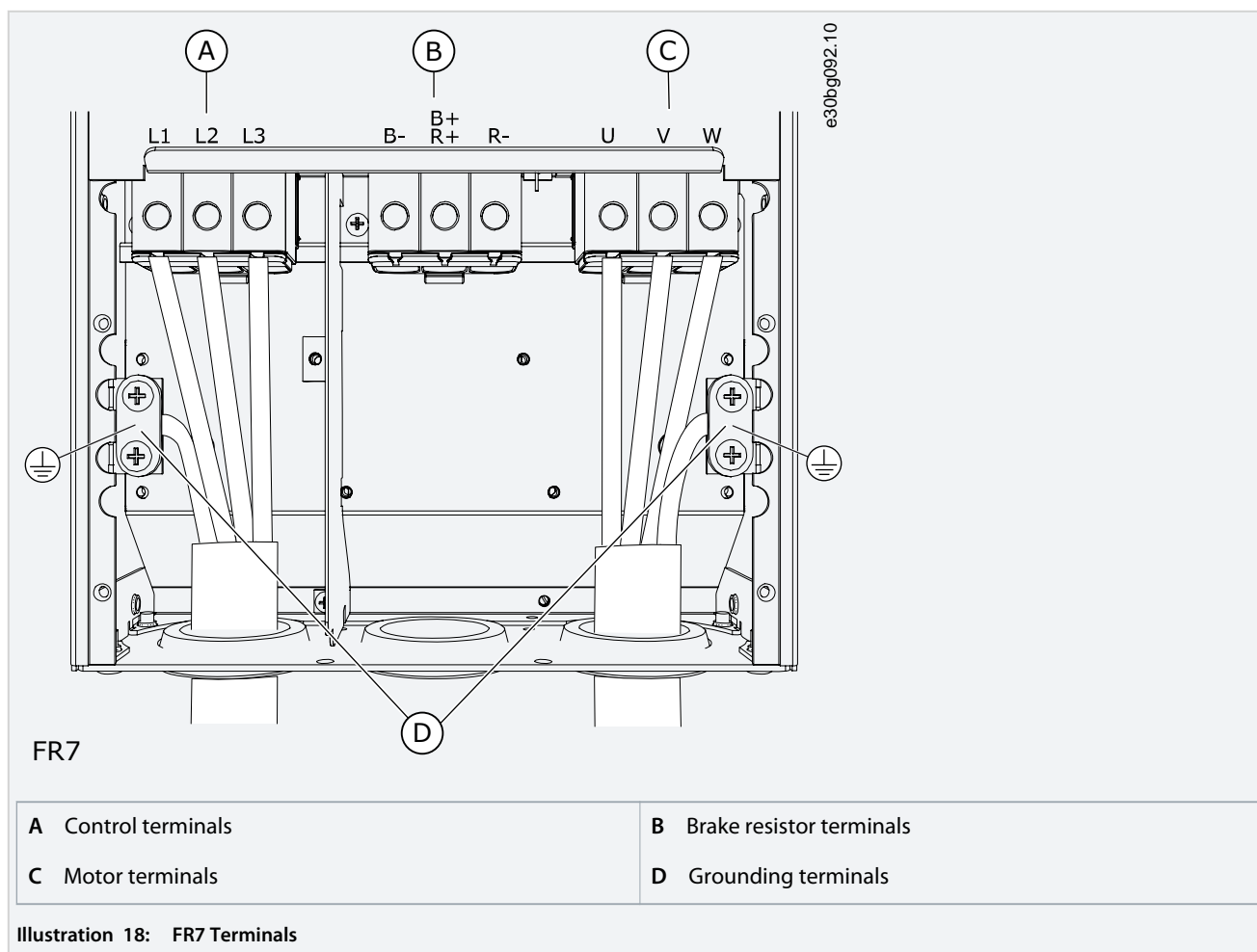
1. Open the cover of the AC drive.



2. Remove the screws of the cable cover. Remove the cable cover. Do not open the cover of the power unit.



3. Locate the terminals.



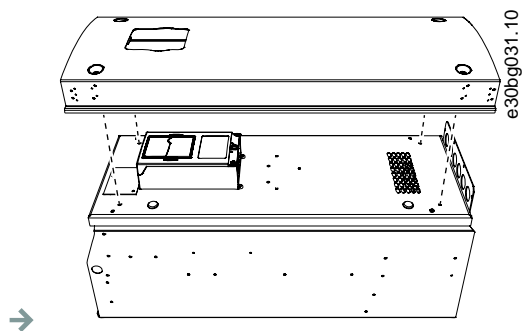
### 6.4.5 Get Access and Locate the Terminals for FR8

**Context:**

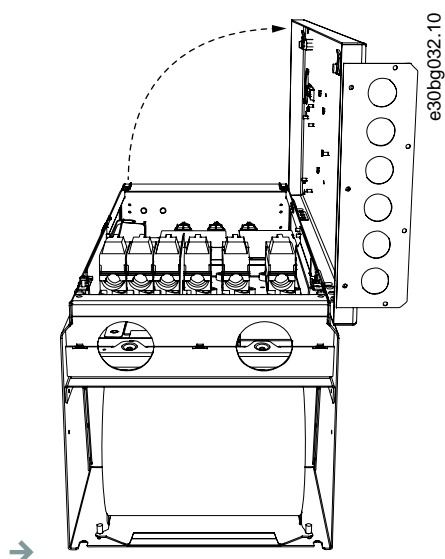
Follow these instructions to open the AC drive for installing the cables, for example.

**Procedure**

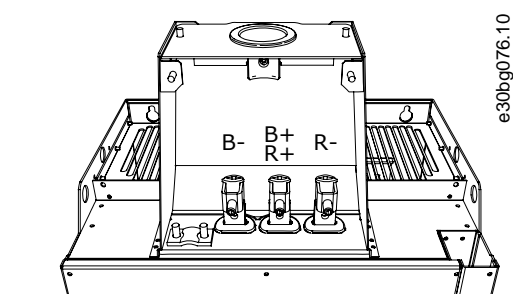
1. Open the cover of the AC drive.



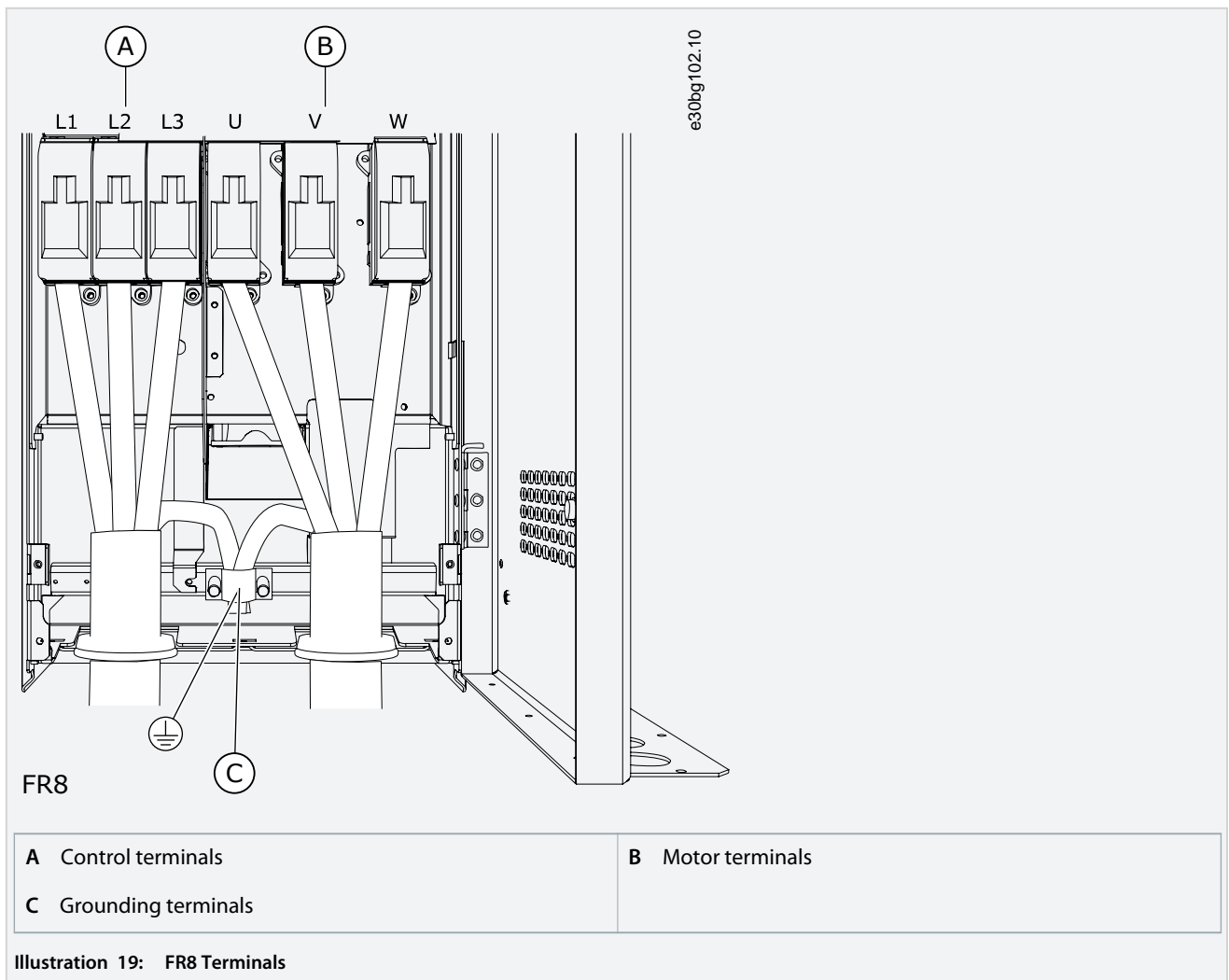
2. Open the power unit cover.



3. Find the DC terminals and Brake resistor terminals on top of the AC drive.



4. Locate the terminals.



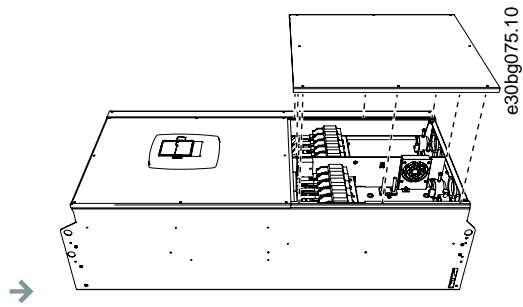
### 6.4.6 Get Access and Locate the Terminals for FR9

**Context:**

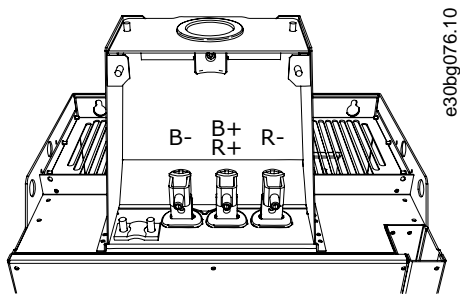
Follow these instructions to open the AC drive for installing the cables, for example.

**Procedure**

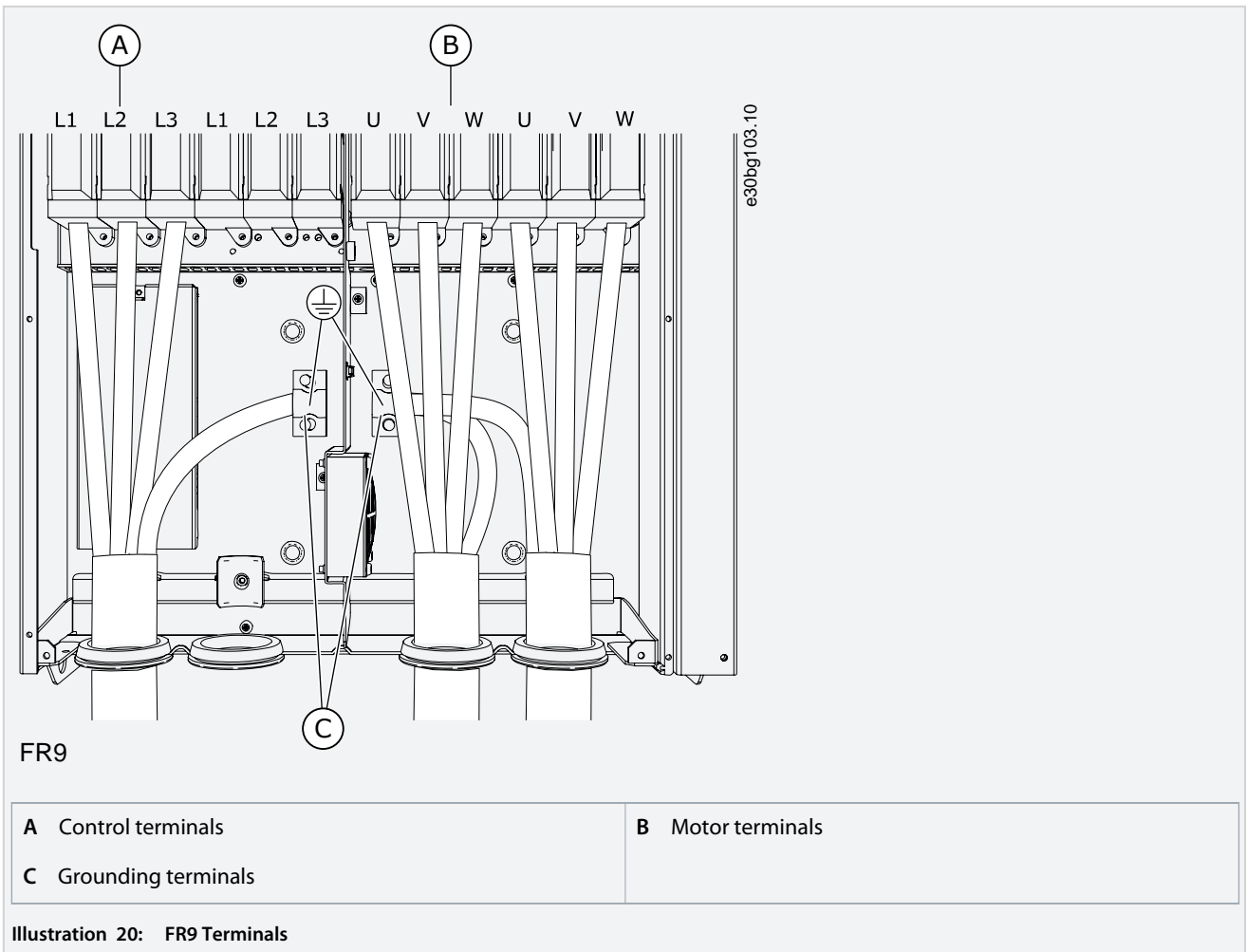
1. Remove the cable cover.



2. Find the DC terminals and Brake resistor terminals on top of the AC drive.



3. Locate the terminals.



## 6.5 Installing the Cables

### Context:

Use these instructions to find the installation instructions of the correct enclosure size.

### Procedure

1. Check the requirements related to lengths, distances, and positioning of the cables according to instructions in [6.5.1 Additional Instructions for Cable Installation](#).
2. Follow the installation instructions of the correct enclosure size. To check the enclosure size of the AC drive, see [3.5 Enclosure Sizes](#).

- [6.5.2 Installing the Cables, FR4-FR6](#)
- [6.5.3 Installing the Cables, FR7](#)
- [6.5.4 Installing the Cables, FR8](#)
- [6.5.5 Installing the Cables, FR9](#)
- [6.5.6 Installing the Cables, FR10-FR11](#)



### 6.5.1 Additional Instructions for Cable Installation

- Before starting, make sure that none of the components of the AC drive is live. Read carefully the warnings in Safety section.
- Make sure that the motor cables are sufficiently far from other cables.
- The motor cables must go across other cables at an angle of 90°.
- If it is possible, do not put the motor cables in long parallel lines with other cables.
- If the motor cables are in parallel with other cables, obey the minimum distances (see [table 11](#)).
- The distances are also valid between the motor cables and the signal cables of other systems.
- The maximum lengths of shielded motor cables are 300 m (984 ft) (AC drives with power greater than 1.5 kW or 2 hp), and 100 m (328 ft) (AC drives with power from 0.75 kW to 1.5 kW or 1–2 HP). If the used motor cables are longer than these, speak to the factory to get more information.  
Each parallel cable adds to the total length.

**⚠ NOTICE ⚠**

If long motor cables are used (maximum 100 m or 328 ft) together with small drives ( $\leq 1.5$  kW or  $\leq 2.01$  hp), the capacitive current in the motor cable can increase the measured motor current compared to the actual motor current. Think this when setting up the motor stall protection functions.

- If the cable insulation checks are necessary, see [9.3 Measuring the Cable and Motor Insulation](#).

Table 11: Minimum Distances between Cables

The distance between cables [m]	The length of the shielded cable [m]	The distance between cables [ft]	The length of the shielded cable [ft]
0.3	$\leq 50$	1.0	$\leq 164.0$
1.0	$\leq 300$	3.3	$\leq 656.1$

### 6.5.2 Installing the Cables, FR4-FR6

**Context:**

Follow these instructions to install the cables and cable accessories.

For information on how to comply with the UL regulations in cable installation, see [6.1.2 UL Standards on Cabling](#).

If it is necessary to connect an external brake resistor, see VACON® Brake Resistor Manual. See also [8.7.8.2 Setting the Internal Brake Resistor Connection](#).

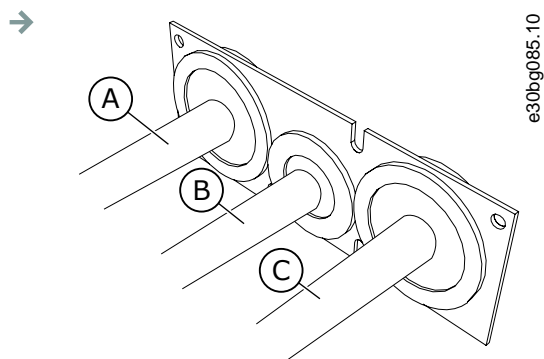
**Prerequisites:**

Make sure that the delivery contains all necessary components. For the installation, the contents of the accessories bag is needed, see [4.1 Checking the Delivery](#).

Open the covers according to instructions in [6.4.1 Get Access and Locate the Terminals for FR4](#), [6.4.2 Get Access and Locate the Terminals for FR5](#) or [6.4.3 Get Access and Locate the Terminals for FR6](#).

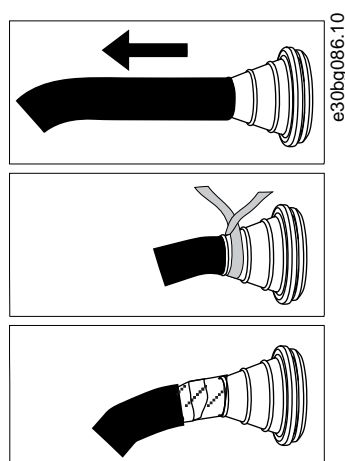
**Procedure**

1. Strip the motor cable, the mains cable, and the brake resistor cable. See [12.4 Cable Stripping Lengths](#).
2. Cut the grommets open to move the cables through them. Use the grommets delivered in the accessories bag.
  - Do not cut the grommet openings wider than what is necessary for the used cables.
  - If the grommets fold in when putting the cable, pull the cable back to make the grommets straight.
  - Use a grommet as an alternative to the grommet in types where this is necessary.
3. Put the cables - the mains cable, the motor cable, and the optional brake cable - in the openings of the cable entry plate. Use the cable entry plate delivered in the accessories bag.

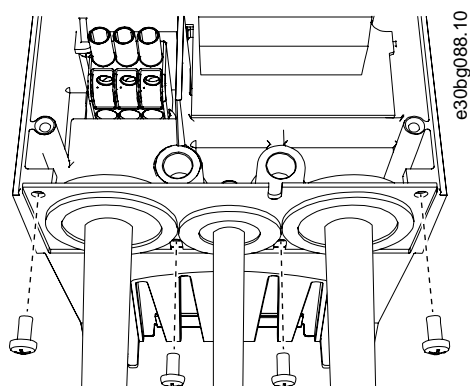


A The mains cable	B The brake cable
C The motor cable	

**Illustration 21: Cables through the Cable Entry Plate**



4. Put the cable entry plate with the cables into the groove on the frame of the drive. To attach the cable entry plate, use the M4x10 screws delivered in the accessories bag.



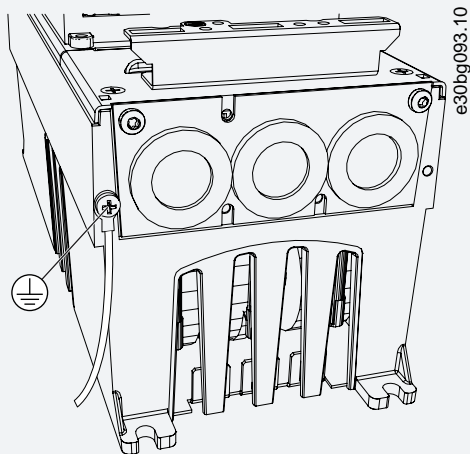
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5. Connect the cables. See the correct tightening torques in [12.6 Tightening Torques of the Terminals](#).

- Connect the phase conductors of the mains cable and of the motor cable, and the conductors of the brake resistor cable into the correct terminals.
- FR4, FR5: Attach the grounding conductor of each cable to a grounding terminal with a grounding terminal for grounding conductor. Use the grounding terminals delivered in the accessories bag.
- FR6: Attach the grounding conductor of each cable to a grounding terminal with a grounding clamp for grounding conductor. Use the grounding clamps and the screws delivered in the accessories bag.

6. Make sure to connect the grounding conductor to the motor and the terminals that are identified with the grounding symbol.

- For FR4 and FR5: Two protective conductors are necessary to comply with the requirements of the standard IEC/EN 61800-5-1. See [6.3 Grounding](#).
- If a double grounding is necessary, use the grounding terminal below the drive. Use an M5 screw and tighten it to 2.0 Nm or 17.7 lb-in.



e30bg093.10

7. Attach the cable cover [12.5 Tightening Torques for Cover Screws](#). Attach the grounding clamps for control cable with 3 pieces of M4x16 screws delivered in the accessories bag. Use these clamps to ground the control cables.

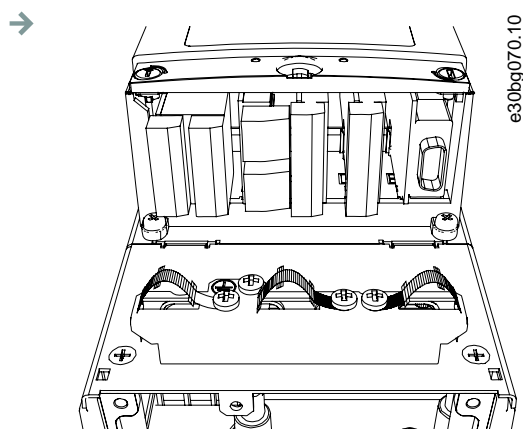


Illustration 22: FR4-FR6

8. Attach the cover of the drive. For the tightening torques of the screws, see [12.5 Tightening Torques for Cover Screws](#). Make sure that the control cables or the cables of the AC drive are not caught between the frame and the cable cover.

### 6.5.3 Installing the Cables, FR7

#### Context:

Follow these instructions to install the cables and cable accessories.'

For information on how to comply with the UL regulations in cable installation, see [6.1.2 UL Standards on Cabling](#).

If it is necessary to connect an external brake resistor, see VACON® Brake Resistor Manual. See also [8.7.8.2 Setting the Internal Brake Resistor Connection](#).

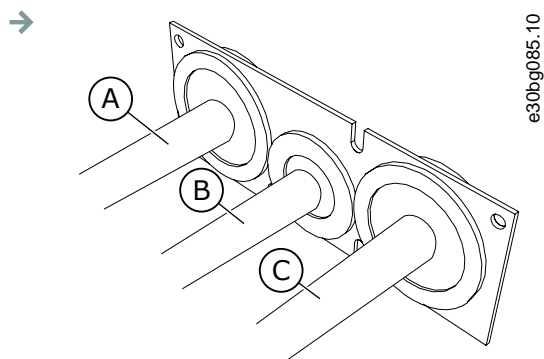
#### Prerequisites:

Make sure that the delivery contains all necessary components. For the installation, the contents of the accessories bag is needed, see [4.1 Checking the Delivery](#).

Open the covers according to instructions in [6.4.4 Get Access and Locate the Terminals for FR7](#).

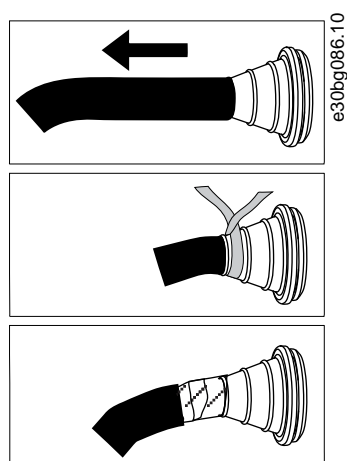
**Procedure**

1. Strip the motor cable, the mains cable, and the brake resistor cable. See [12.4 Cable Stripping Lengths](#).
2. Cut the grommets open to move the cables through them. Use the grommets delivered in the accessories bag.
  - Do not cut the grommet openings wider than what is necessary for the used cables.
  - If the grommets fold in when putting the cable, pull the cable back to make the grommets straight.
  - Use a grommet as an alternative to the grommet in types where this is necessary.
3. Put the cables - the mains cable, the motor cable, and the optional brake cable - in the openings of the cable entry plate. Use the cable entry plate delivered in the accessories bag.

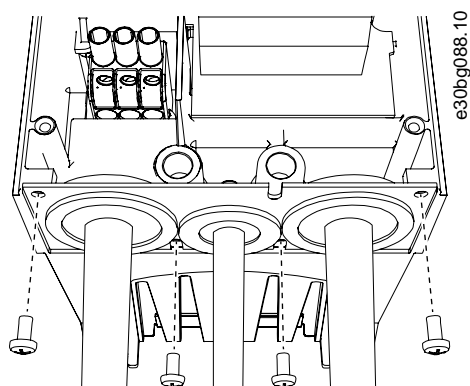


A The mains cable	B The brake cable
C The motor cable	

**Illustration 23: Cables through the Cable Entry Plate**



4. Put the cable entry plate with the cables into the groove on the frame of the drive. To attach the cable entry plate, use the M4x10 screws delivered in the accessories bag.



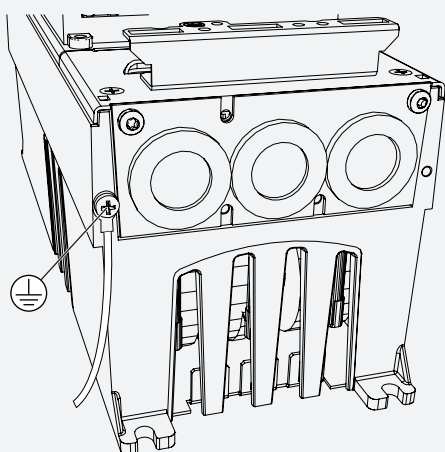
e30bg088.10

5. Connect the cables. See the correct tightening torques in [12.6 Tightening Torques of the Terminals](#).

- Connect the phase conductors of the mains cable and of the motor cable, and the conductors of the brake resistor cable into the correct terminals.

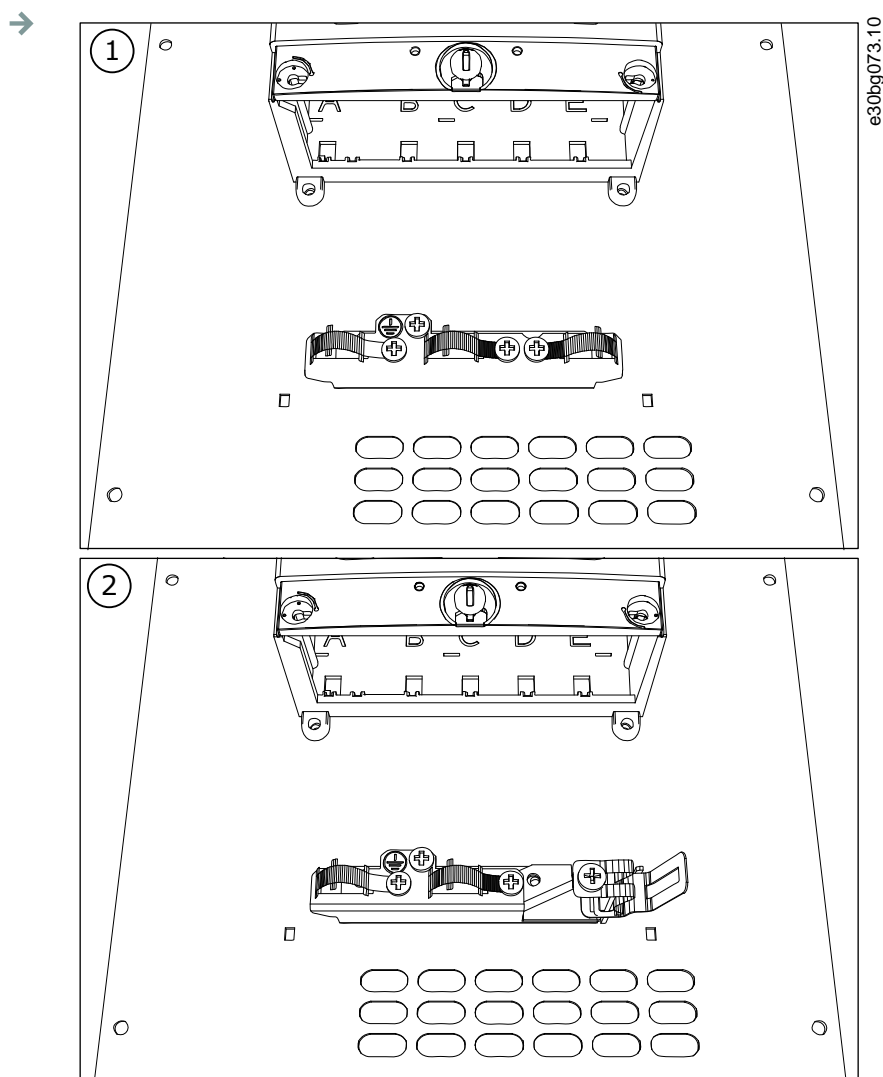
6. Make sure to connect the grounding conductor to the motor and the terminals that are identified with the grounding symbol.

- If a double grounding is necessary, use the grounding terminal below the drive. Use an M5 screw and tighten it to 2.0 Nm or 17.7 lb-in.



e30bg093.10

7. Attach the cable cover [12.5 Tightening Torques for Cover Screws](#). Attach the grounding clamps for control cable with 3 pieces of M4x16 screws delivered in the accessories bag. Use these clamps to ground the control cables.



1 Standard

2 PROFIBUS

Illustration 24: FR7

8. Attach the cover of the drive. For the tightening torques of the screws, see [12.5 Tightening Torques for Cover Screws](#). Make sure that the control cables or the cables of the AC drive are not caught between the frame and the cable cover.

### 6.5.4 Installing the Cables, FR8

**Context:**

Follow these instructions to install the cables and cable accessories.

For information on how to comply with the UL regulations in cable installations, see [6.1.2 UL Standards on Cabling](#).

If it is necessary to connect an external brake resistor, see VACON® Brake Resistor Manual. See also [8.7.8.2 Setting the Internal Brake Resistor Connection](#).

**Prerequisites:**

Make sure that the delivery contains all necessary components. For the installation, the contents of the accessories bag is needed, see [4.1 Checking the Delivery](#).

Open the covers according to instructions in [6.4.5 Get Access and Locate the Terminals for FR8](#).



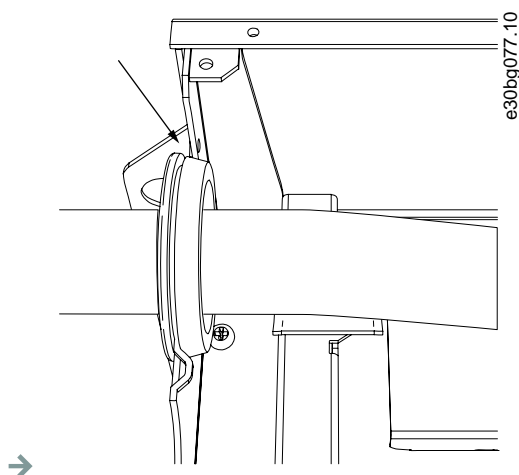
### Procedure

1. Strip the motor cable, the mains cable, and the brake resistor cable. See [12.4 Cable Stripping Lengths](#)
2. To move the cables through the grommets, cut them open. Use the grommets delivered in the accessories bag.

- Do not cut the grommet openings wider than what is necessary for the used cables.
- If the grommets fold in when putting the cable, pull the cable back to make the grommets straight.
- Use a grommet as an alternative to the grommet in types where it is necessary.

3. Attach the grommet and the cable until the frame of the drive goes into the groove of the grommet.

- With the protection rating IP54 (UL Type 12), the connection between the grommet and the cable must be tight. Pull the first bit of the cable out of the grommet until it stays straight.
- If it is not possible, make the connection tight with some insulation tape or a cable tie.



4. Connect the cables. See the correct tightening torques in [12.6 Tightening Torques of the Terminals](#).

- Connect the phase conductors of the mains cable and of the motor cable into the correct terminals. If a brake resistor cable is used, connect its conductors into the correct terminals.
- Attach the grounding conductor of each cable to a grounding terminal with a grounding clamp for grounding conductor.

5. To make a 360° connection with the grounding clamp for cable shield, expose the shield of all cables.

6. Attach the cable entry plate, and then the cable cover. For the tightening torques of the screws, see [12.5 Tightening Torques for Cover Screws](#). Make sure that the control cables or the cables of the AC drive are not caught between the frame and the cable cover.

#### Additional tightening torques:

- motor cable entry plate: 2.4 Nm
- control cable entry plate: 0.8 Nm
- DC cover: 2.4 Nm

7. Attach the grounding clamps for control cable on the grounding level with M4x16 screws. Use the clamps delivered in the accessories bag. Use the clamps to ground the control cables.

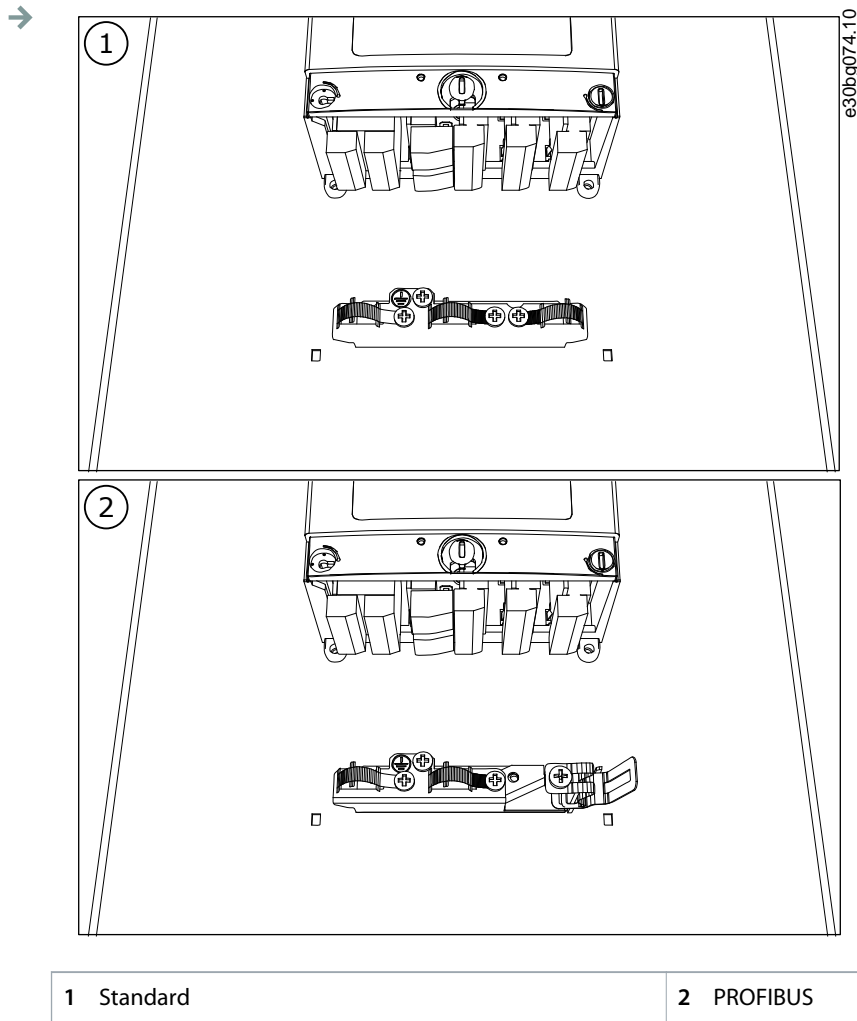


Illustration 25: FR8

8. Attach the cover of the drive. For the tightening torques of the screws, see [12.5 Tightening Torques for Cover Screws](#).

### 6.5.5 Installing the Cables, FR9

**Context:**

Follow these instructions to install the cables.

For information on how to comply with the UL regulations in cable installations, see [6.1.2 UL Standards on Cabling](#).

If it is necessary to connect an external brake resistor, see VACON® Brake Resistor Manual. See also [8.7.8.2 Setting the Internal Brake Resistor Connection](#).

**Prerequisites:**

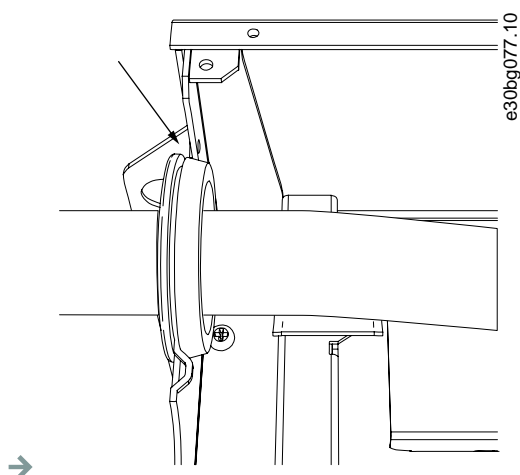
Make sure that the delivery contains all necessary components.

Open the covers according to instructions in [6.4.6 Get Access and Locate the Terminals for FR9](#).

### Procedure

1. Strip the motor cable, the mains cable, and the brake resistor cable. See [12.4 Cable Stripping Lengths](#)
2. To move the cables through grommets, cut the them open.
  - Do not cut the grommet openings wider than what is necessary for the used cables.
  - If the grommets fold in when putting the cable, pull the cable back to make the grommets straight.
  - Use a grommet as an alternative to the grommet in types where this is necessary.
3. Attach the grommet and the cable until the frame of the drive goes into the groove of the grommet.

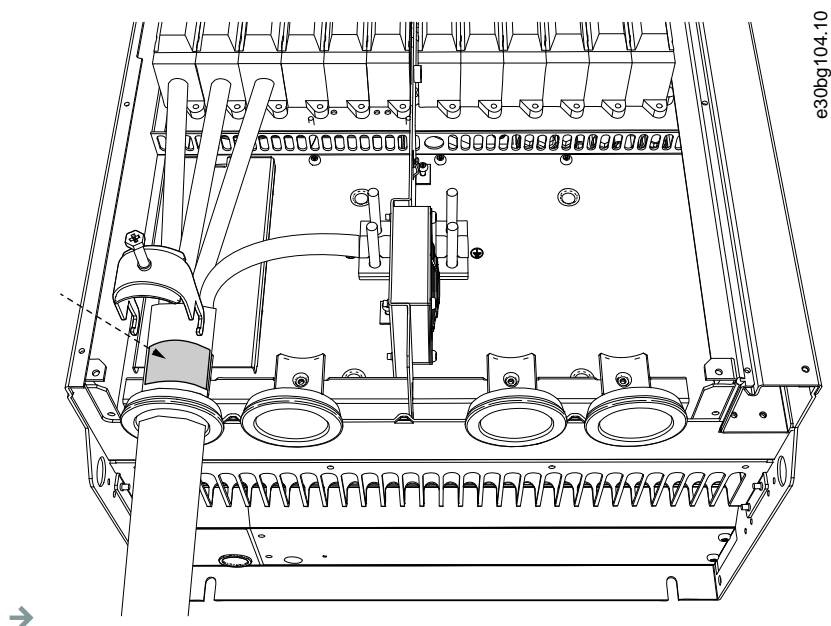
- With the protection rating IP54 (UL Type 12), the connection between the grommet and the cable must be tight. Pull the first bit of the cable out of the grommet until it stays straight.
- If this is not possible, make the connection tight with some insulation tape or a cable tie.



4. Connect the cables. See the correct tightening torques in [12.6 Tightening Torques of the Terminals](#).

- Connect the phase conductors of the mains cable and of the motor cable into the correct terminals. If a brake resistor cable is used, connect its conductors into the correct terminals.
- Attach the grounding conductor of each cable to a grounding terminal with a grounding clamp for grounding conductor.

5. Expose the shield of all cables to make a 360° connection with the grounding clamp for cable shield.



6. Attach the cable entry plate, and then the cable cover. For the tightening torques of the screws, see [12.5 Tightening Torques for Cover Screws](#). Make sure that the control cables or the cables of the AC drive are not caught between the frame and the cable cover.

### 6.5.6 Installing the Cables, FR10-FR11

For more information on how to install the cables for enclosure sizes FR10 and larger, see VACON® NXP/C User Manual.

## 6.6 Installation in an IT System

If mains is impedance-grounded (IT), the AC drive must have the EMC protection level C4. If the drive has the EMC protection level C2, it is necessary to change it to C4. To do this, remove the EMC jumpers.

For equivalents of EMC levels in VACON® AC drives, see [3.4 Description of the Type Code](#).

### ⚠ WARNING ⚠

#### SHOCK HAZARD FROM THE COMPONENTS

The components of the drive are live when the drive is connected to mains.

- Do not make changes in the AC drive when it is connected to mains.

### ⚠ NOTICE ⚠

#### DAMAGE TO THE AC DRIVE FROM INCORRECT EMC LEVEL

The EMC level requirements for the AC drive depend on the installation environment. An incorrect EMC level can damage the drive.

- Before connecting the AC drive to the mains, make sure that the EMC level of the AC drive is correct for the mains.

## 6.6.1 Installing the AC drive in an IT System, FR4-FR6

### Context:

Use these instructions to change the EMC protection of the AC drive to level C4.

### Prerequisites:

Open the cover of the AC drive and remove the cable cover as instructed in [6.4.1 Get Access and Locate the Terminals for FR4](#), [6.4.2 Get Access and Locate the Terminals for FR5](#) or [6.4.3 Get Access and Locate the Terminals for FR6](#).

Procedure

1. Remove the EMC screw(s).

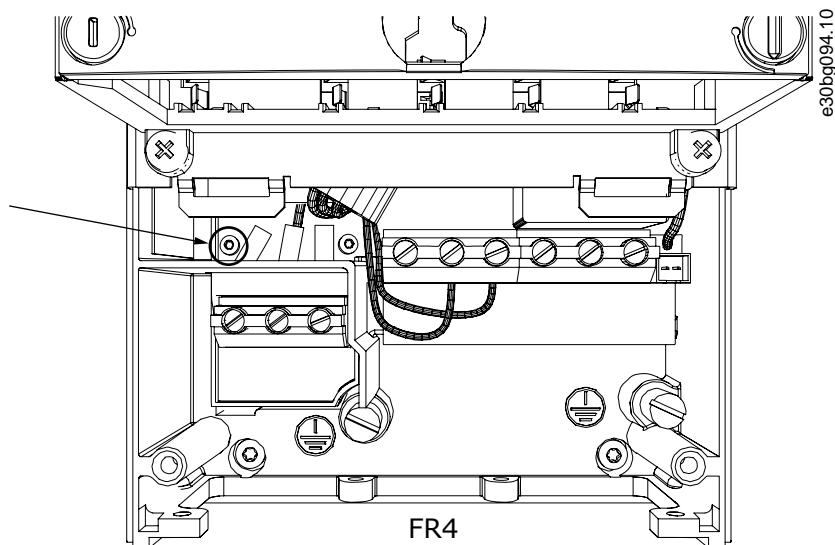


Illustration 26: FR4

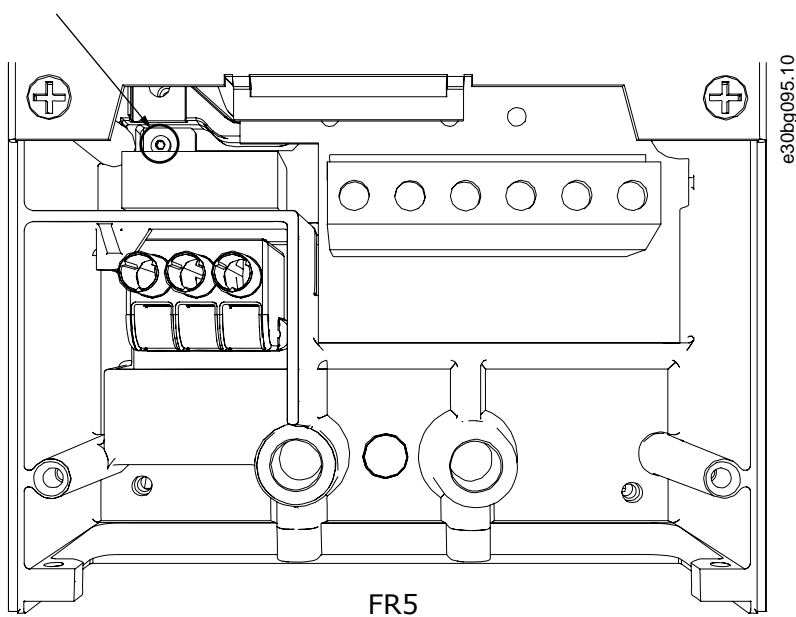


Illustration 27: FR5

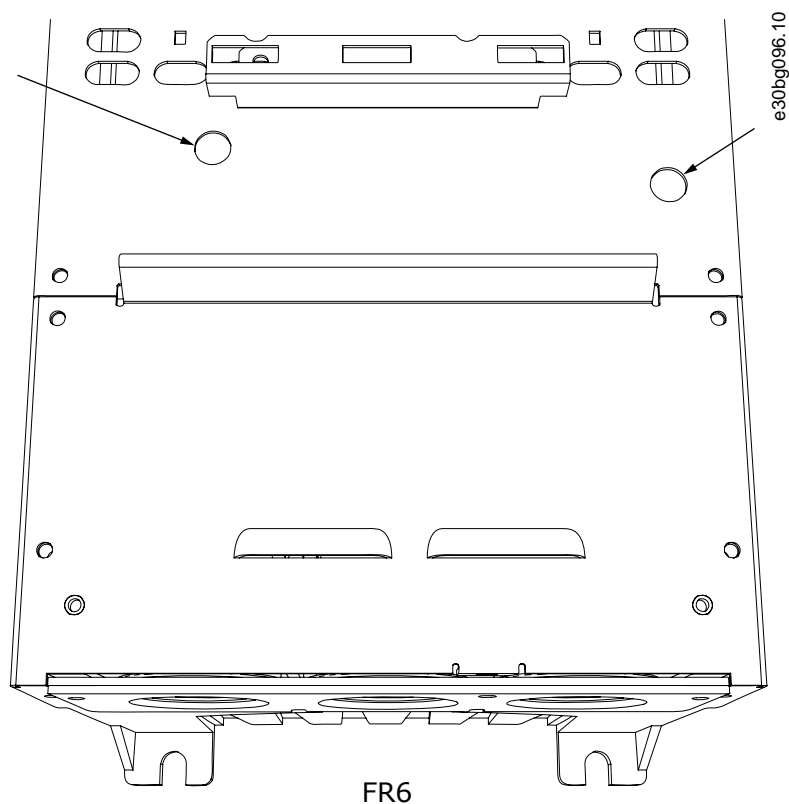
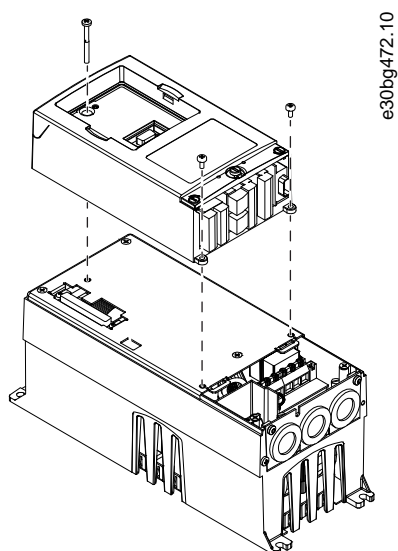


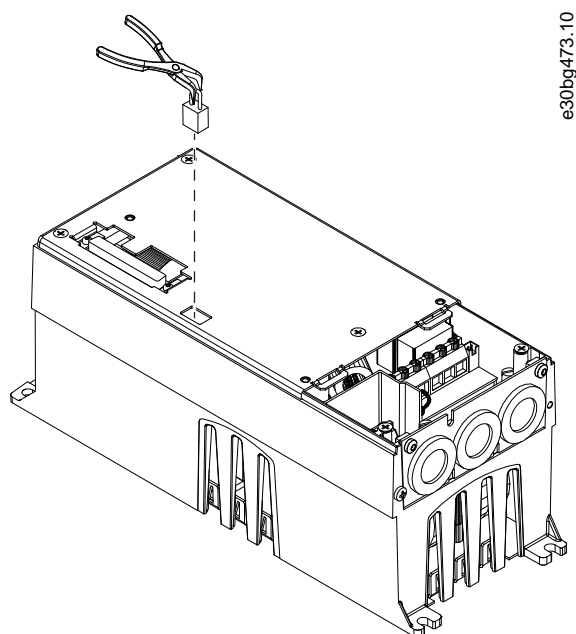
Illustration 28: FR6

2. For FR4, remove the control unit.

There is a sticker next to the terminals to remind to remove the jumper X10-1 if the AC drive requires this. If there is no sticker, move to step 4.



3. Remove the jumper X10-1.



4. Close the cover of the AC drive. For the tightening torques of the screws, see [12.5 Tightening Torques for Cover Screws](#).
5. After the change, put a check mark to "EMC Level modified" and write the date on the "product modified" label (see [4.4 Using the Product Modified Label](#)). If the label is not yet attached, attach it on the drive near the nameplate.

## 6.6.2 Installing the AC Drive in an IT System, FR7

### Context:

Use these instructions to change the EMC protection of the AC drive to level C4.

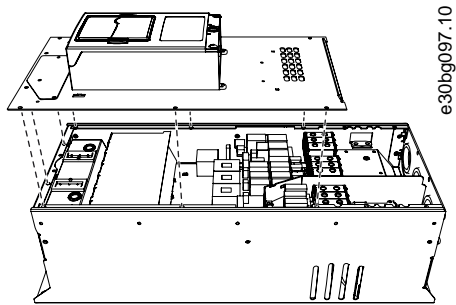
### Prerequisites:

Open the cover and the cable cover of the AC drive as instructed in [6.4.4 Get Access and Locate the Terminals for FR7](#).

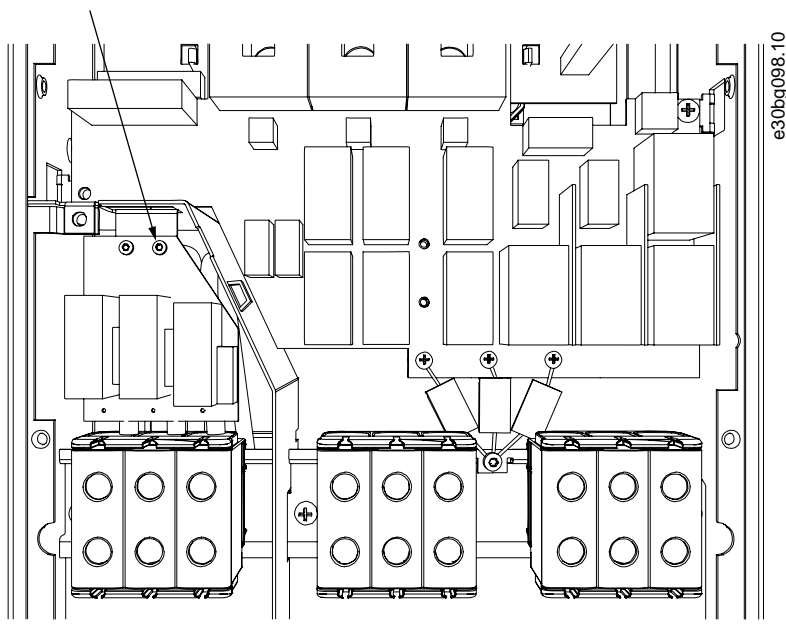


**Procedure**

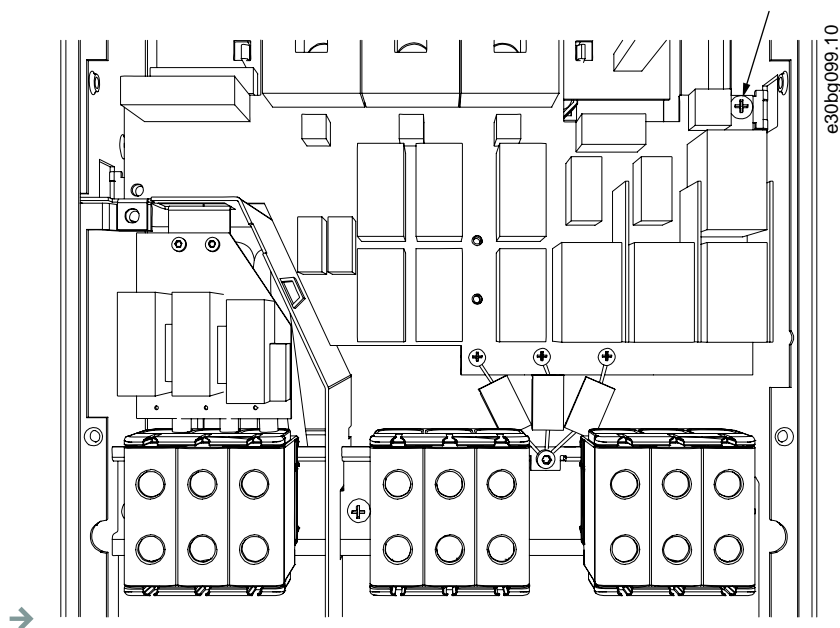
1. Open the power unit cover of the AC drive.



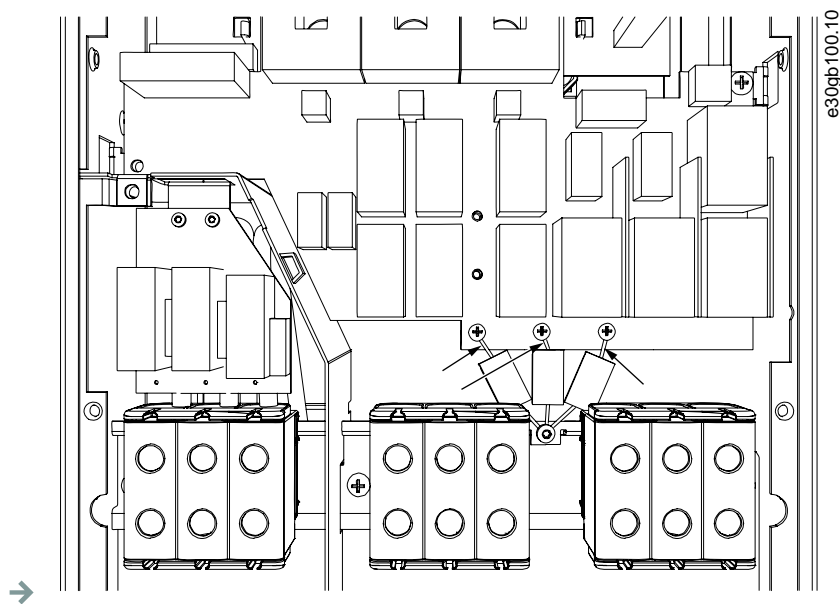
2. Remove the EMC screws.



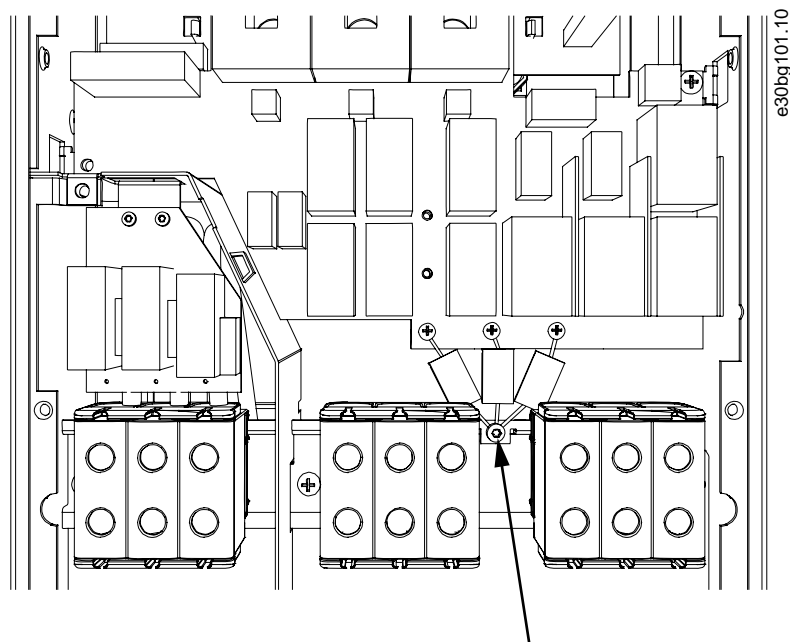
3. Remove the screw and replace with a plastic screw M4.



4. Cut the leads of the 3 capacitors.



5. Remove the screw and the capacitor assembly.



6. Close the cover of the AC drive. For the tightening torques of the screws, see [12.5 Tightening Torques for Cover Screws](#).
7. After the change, write "The EMC level was changed" and the date on the "product changed" label (see [4.4 Using the Product Modified Label](#)). If the label is not yet attached, attach it on the drive near the nameplate.



**⚠ NOTICE ⚠**

Only an authorized VACON® service person can change the EMC level of FR7 back to C2.

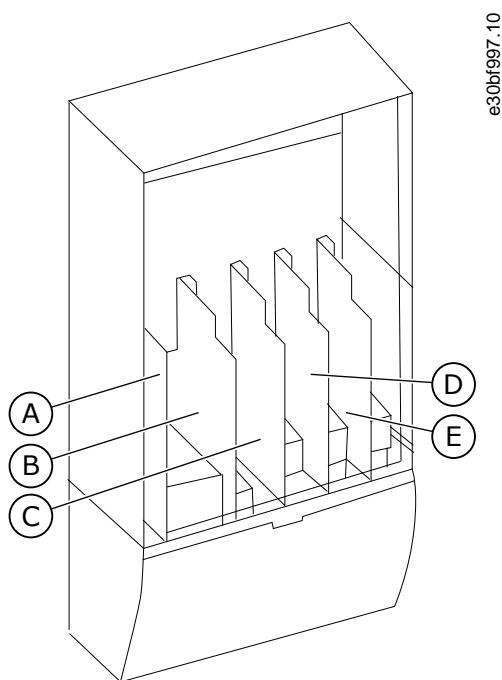
### 6.6.3 Installing the AC Drive in an IT System, FR8-FR11

Only a VACON® service person can change the EMC protection class of VACON® NXS/NXP, FR8-FR11.

## 7 Control Unit

### 7.1 Control Unit Components

The control unit of the AC drive contains the control board and additional boards (see [illustration 29](#)) connected to the 5 slot connectors (A to E) of the control board. The control board is connected to the power unit through a D-connector or fiber optic cables (FR9).



**Illustration 29: Basic and Option Slots on the Control Board**

The control unit of the delivered AC drive contains the standard control interface. If the order included special options, the AC drive is delivered according to the order. The next pages contain information on the terminals and general wiring examples. The type code shows the I/O boards that are installed at the factory. For more information on the option boards, see VACON® NX I/O Boards User manual.

The OPTA1 basic board has 20 control terminals, and the relay board has 6 or 7. The standard connections of the control unit and the descriptions of signals are shown in [7.3.2 Control Terminals on OPTA1](#).

For instructions on how to install the control unit that is not attached to the power unit, see VACON® NXP IP00 Drives Installation Manual.

### 7.2 Control Voltage (+24V/EXT +24V)

It is possible to use the drive with an external power source with these properties: +24 V DC  $\pm 10\%$ , minimum 1000 mA. Use it to externally power up the control board, and the basic and option boards. The analog outputs and inputs at OPTA1 do not work with only +24 V supplied to the control unit.

Connect the external power source to one of the 2 bidirectional terminals (#6 or #12), see the option board manual or VACON® NX I/O Boards User Manual. With this voltage, the control unit stays on and parameters can be set. The measurements of the main circuit (for example, the DC-link voltage, and the unit temperature) are not available when the drive is not connected to mains.

**⚠ NOTICE ⚠**

If the AC drive is supplied with external 24 V DC power, use a diode in terminal #6 (or #12) to prevent the current to flow in opposite direction. Put a 1 A fuse in 24 V DC line for each AC drive. The maximum current consumption of each drive is 1 A from the external supply.

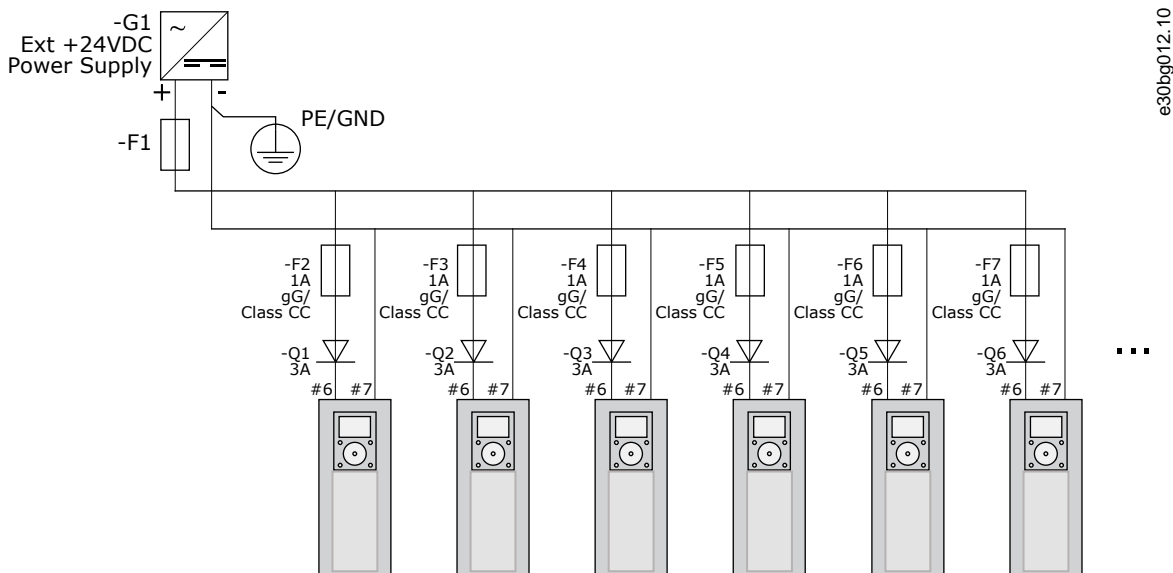


Illustration 30: Parallel Connection of 24 V Inputs with Many AC Drives

**⚠ NOTICE ⚠**

The control unit I/O ground is not isolated from the chassis ground/protective earth. In the installation, consider the potential differences between the grounding points. We recommend using galvanic isolation in the I/O and 24 V circuitry.

### 7.3 Control Unit Cabling

#### 7.3.1 Selection of the Control Cables

The control cables must be a minimum of 0.5 mm<sup>2</sup> (20 AWG) shielded multicore cables. See more on the cable types in [table 10](#). The terminal wires must be a maximum of 2.5 mm<sup>2</sup> (14 AWG) for the terminals of the relay board and 1.5 mm<sup>2</sup> (16 AWG) for other terminals.

Table 12: Tightening Torques of the Control Cables

The terminal	The terminal screw	The tightening torque in Nm (lb-in.)
Relay and thermistor terminals	M3	0.5 (4.5)
Other terminals	M2.6	0.2 (1.8)

### 7.3.2 Control Terminals on OPTA1

The figure shows the basic description of the terminals of the I/O board. For more information, see [7.3.2.2 Jumper Selections on the OPTA1 Basic Board](#). For more information on control terminals, see VACON® All in One Application manual.

Standard I/O board				
Terminal	Signal	Description		
1	+10V <sub>ref</sub>	Reference voltage	Maximum current 10 mA	
2	AI1+	Analogue input, voltage or current	Selection V/mA with jumper block X1 (*) 0...+10 V (Ri = 200 kΩ) (-10V...+10V Joystick ctrl, sel. with jumper) 0-20 mA (Ri =250 Ω)	
3	GND/AI1-	Analogue input common	Differential input if not connected to ground Allows ±20 V common mode voltage to GND	
4	AI2+	Analogue input, voltage or current	Selection V/mA with jumper block X1 (*) 0...+10 V (Ri = 200 kΩ) (-10V...+10V Joystick ctrl, sel. with jumper) 0-20 mA (Ri =250 Ω)	
5	GND/AI2-	Analogue input common	Differential input if not connected to ground Allows ±20 V common mode voltage to GND	
6	+24V	24 V aux. voltage	±15%, max. 250 mA (all boards total) 150 mA (from single board) Can also be used as external power back-up for the control unit (and fieldbus)	
7	GND	I/O ground	Ground for reference and controls	
8	DIN1	Digital input 1	Ri = min. 5 kΩ 18-30 V = 1	
9	DIN2	Digital input 2		
10	DIN3	Digital input 3		
11	CMA	Common A for DIN1–DIN3	Digital inputs can be disconnected from ground (†)	
12	+24V	Control voltage output	Same as terminal #6	
13	GND	I/O ground	Same as terminal #7	
14	DIN4	Digital input 4	Ri = min. 5 kΩ 18-30 V = 1	
15	DIN5	Digital input 5		
16	DIN6	Digital input 6		
17	CMB	Common B for DIN4-DIN6	Must be connected to GND or 24 V of I/O term. or to ext. 24 V or GND Selection with jumper block X3 (*)	
18	AO1+	Analogue signal (+output)	Output signal range: Current 0(4)-20 mA, RL max 500 Ω or Voltage 0-10 V, RL >1kΩ Selection with jumper block X6 (*)	
19	AO1-	Analogue output common		
20	DO1	Open collector output	Maximum Uin = 48 VDC Maximum current = 50 mA	

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\*) See figure in [7.3.2.2 Jumper Selections on the OPTA1 Basic Board](#)

Illustration 31: Control Terminal Signals on OPTA1

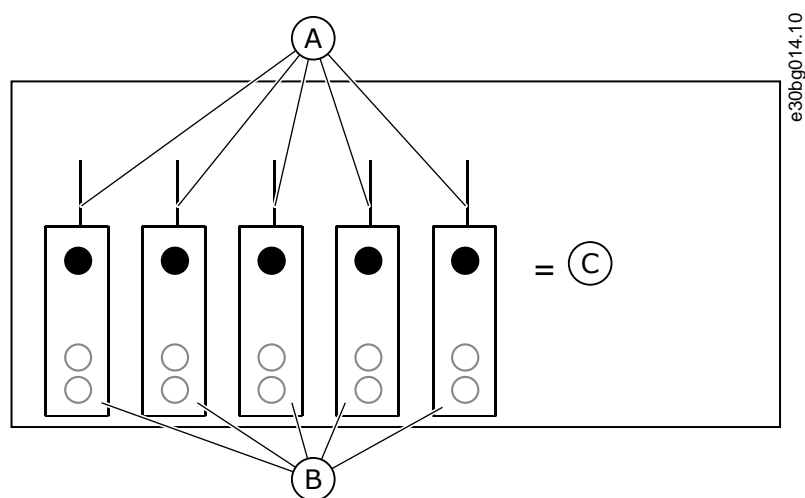
Parameter references for I/O on control panel and NCDrive are: An.IN:A.1, An.IN:A.2, DigIN:A.1, DigIN:A.2, DigIN:A.3, DigIN:A.4, DigIN:A.5, DigIN:A.6, AnOUT:A.1 and DigOUT:A.1.

To use the control voltage output +24 V/EXT+24 V:

- wire the +24 V control voltage to digital inputs through an external switch. OR
- use the control voltage to power up external equipment, such as encoders and auxiliary relays.

The specified total load on all available +24 V/EXT+24 V output terminals must not exceed 250 mA.

The maximum load on the +24 V/EXT+24 V output per board is 150 mA. If there is a +24 V/EXT+24 V output on the board, it is locally short circuit protected. If one of the +24 V/EXT+24 V outputs short circuits, the others remain powered because of the local protection.



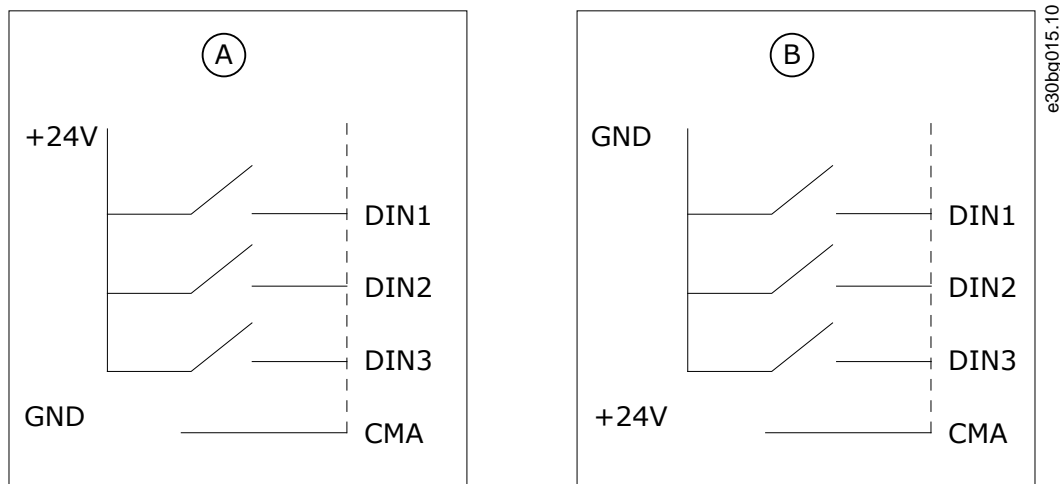
A	Maximum 150 mA	B	+24 V out
C	Maximum 250 mA		

Illustration 32: Maximum Loads on +24 V/EXT+24 V Output

### 7.3.2.1 Digital Input Signal Inversions

The active signal level is different when the common inputs CMA and CMB (terminals 11 and 17) are connected to +24 V or to ground (0 V).

The 24 V control voltage and the ground for the digital inputs and the common inputs (CMA, CMB) can be internal or external.



- A** Positive logic (+24 V is the active signal) = the input is active when the switch is closed.
- B** Negative logic (0 V is the active signal) = the input is active when the switch is closed. Set the jumper X3 to the position 'CMA/CMB isolated from ground'.

Illustration 33: Positive/Negative Logic

### 7.3.2.2 Jumper Selections on the OPTA1 Basic Board

The functions of the AC drive can be changed to make them better agree with local requirements. To do this, change some positions for the jumpers on the OPTA1 board. The positions of the jumpers set the signal type of analog and digital inputs. Changing the AI/AO signal contents requires also a change in the related board parameter in menu M7.

On the A1 basic board, there are 4 jumper blocks: X1, X2, X3, and X6. Each jumper block contains 8 pins and 2 jumpers. See the possible jumper selections in [illustration 34](#).

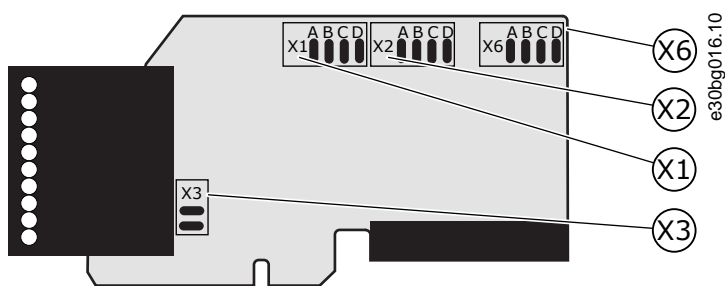
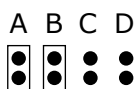


Illustration 34: Jumper Blocks on OPTA1



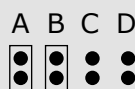
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Jumper block X1:  
AI1 mode

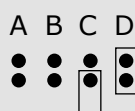


AI1 mode: 0...20mA; Current input

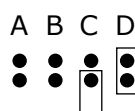
Jumper block X2:  
AI2 mode



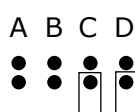
AI1 mode: 0...20mA; Current input



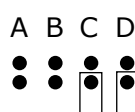
AI1 mode: Voltage input; 0...10V



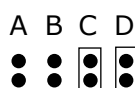
AI2 mode: Voltage input; 0...10V



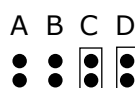
AI1 mode: Voltage input; 0...10V differential



AI2 mode: Voltage input; 0...10V differential

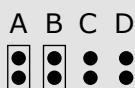


AI1 mode: Voltage input; -0...10V



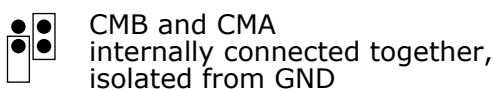
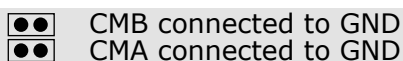
AI2 mode: Voltage input; -10...10V

Jumper block X6:  
AO1 mode



AO1 mode: 0...20mA; Current output

Jumper block X3:  
CMA and CMB grounding



= Factory default

Illustration 35: Jumper Selections for OPTA1

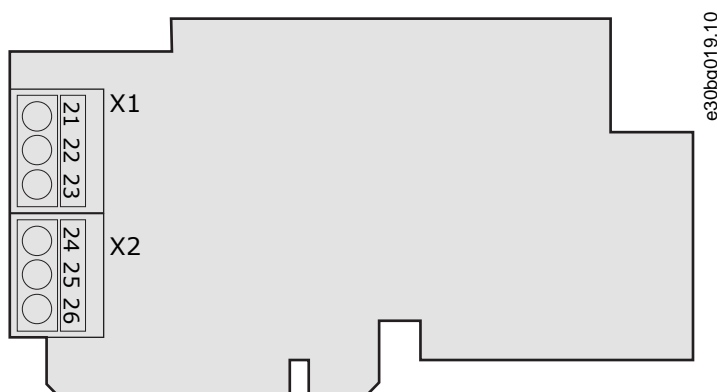
### 7.3.3 Control Terminals on OPTA2 and OPTA3

OPTA2			
21	RO1/1	Relay output 1 DigOUT:B.1 *)	Switching capacity • 24 VDC/8 A • 250 VAC/8 A • 125 VDC/0.4 A Minimum switching load • 5 V/10 mA
22	RO1/2		
23	RO1/3		
24	RO2/1	Relay output 2 DigOUT:B.2 *)	Switching capacity • 24 VDC/8 A • 250 VAC/8 A • 125 VDC/0.4 A Minimum switching load • 5 V/10 mA
25	RO2/2		
26	RO2/3		
OPTA3			
21	RO1/1	Relay output 1 DigOUT:B.1 *)	Switching capacity • 24 VDC/8 A • 250 VAC/8 A • 125 VDC/0.4 A Minimum switching load • 5 V/10 mA
22	RO1/2		
23	RO1/3		
25	RO2/1	Relay output 2 DigOUT:B.2 *)	Switching capacity • 24 VDC/8 A • 250 VAC/8 A • 125 VDC/0.4 A Minimum switching load • 5 V/10 mA
26	RO2/2		
28	TI1+		
29	TI1-		

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\*) Parameter reference on control panel and NCDrive.

Illustration 36: Control Terminal Signals on Relay Boards OPTA2 and OPTA3



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Illustration 37: OPTA2

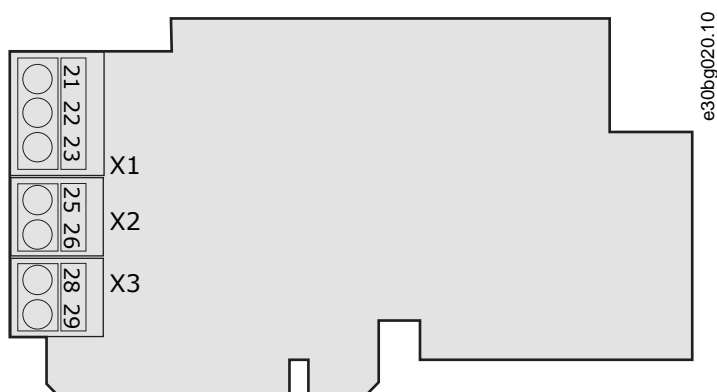


Illustration 38: OPTA3

## 7.4 Installation of Option Boards

For information on how to install the option boards, see the option board manual or VACON® NX I/O Boards User Manual.

## 7.5 Galvanic Isolation Barriers

The control connections are isolated from mains. The GND terminals are permanently connected to I/O ground. See [illustration 39](#).

The digital inputs on the I/O board are galvanically isolated from the I/O ground. The relay outputs are also double-isolated from each other at 300 VAC (EN-50178).

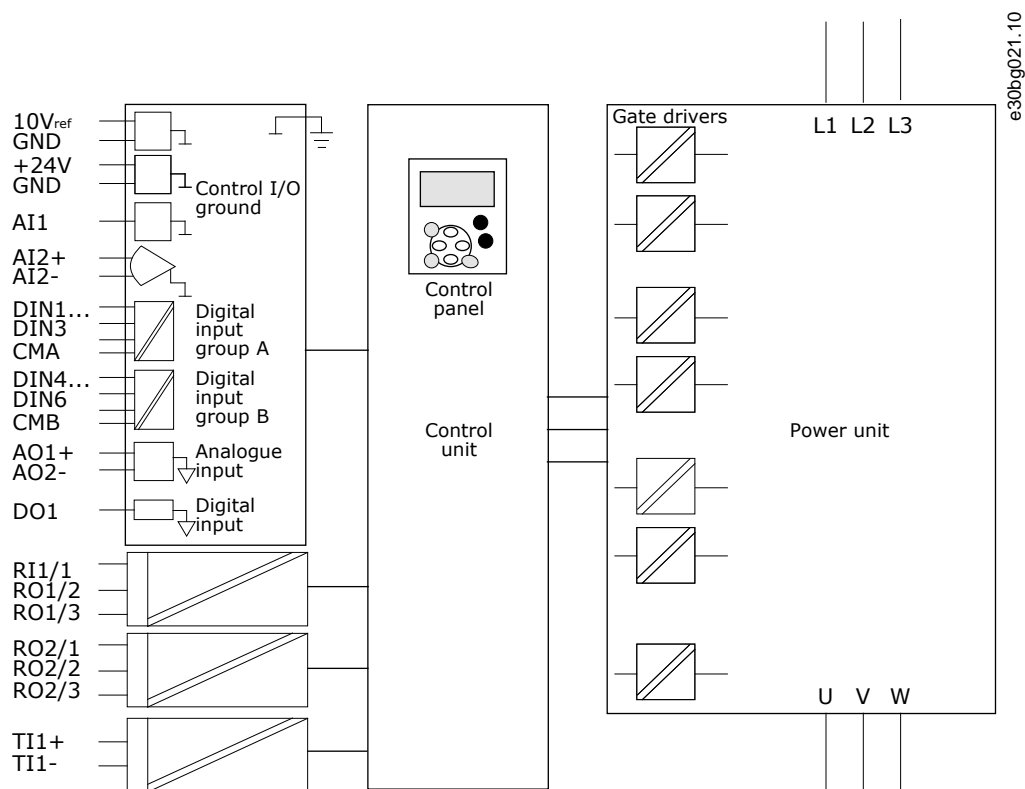


Illustration 39: Galvanic Isolation Barriers

## 8 Using the Control Panel

### 8.1 Navigating on the Control Panel

**Context:**

The data of the AC drive is in menus and submenus. Follow these instructions to navigate in the menu structure on the control panel.

**Procedure**

1. To move between the menus, use the Browser buttons Up and Down on the keypad.
2. To go into a group or an item, push the Menu button Right.

To go back to the previous level, push the Menu button Left.

- The display shows the current location in the menu, for example S6.3.2. The display also shows the name of the group or item in the current location.

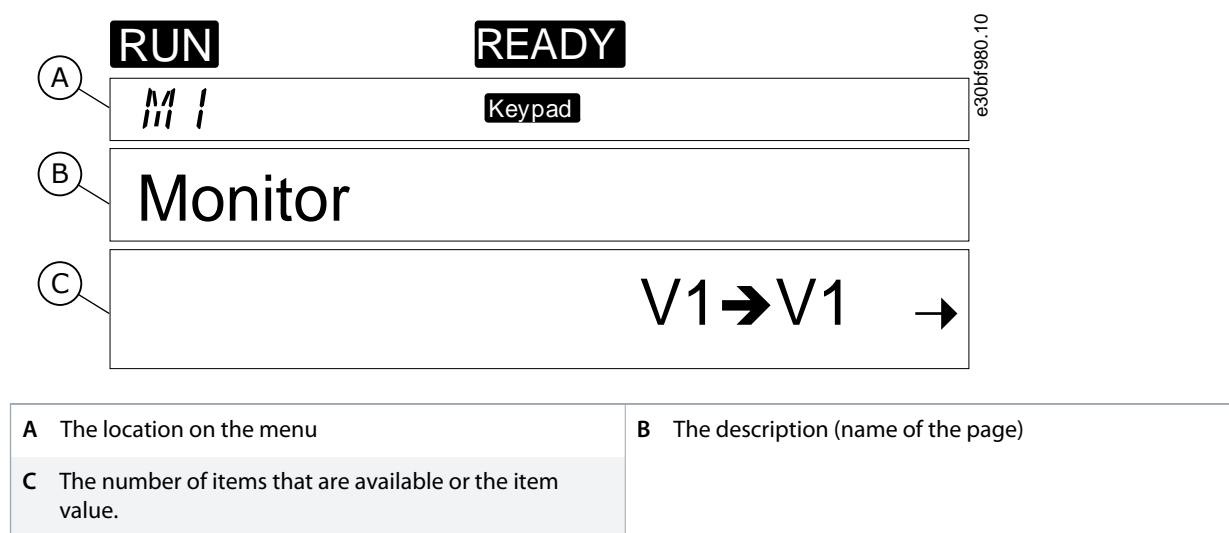


Illustration 40: Navigation Items on the Control Panel

### 8.2 Using the Monitoring Menu (M1)

**Context:**

Follow these instructions to monitor the actual values of the parameters and signals.

The values cannot be changed in the Monitoring menu. To change the values of parameters, see [8.3.2 Selecting Values](#) or [8.3.3 Editing the Values Digit by Digit](#).

### Procedure

1. To find the Monitoring menu, scroll down in the main menu until the location indication *M1* shows on the first line of the display.



2. To go to the Monitoring menu from the main menu, push the Menu button Right.
3. To scroll through the menu, push the Browser buttons Up and Down.

## 8.2.1 Monitored Values

The monitored values have the indication V#.#. The values update each 0.3 s.

Index	Monitored value	Unit	ID	Description
V1.1	Output frequency	Hz	1	The output frequency to the motor
V1.2	Frequency reference	Hz	25	The frequency reference to motor control
V1.3	Motor speed	rpm	2	The actual speed of the motor in rpm
V1.4	Motor current	A	3	Measured motor current
V1.5	Motor torque	%	4	The calculated shaft torque
V1.6	Motor power	%	5	The calculated motor shaft power in percentage
V1.7	Motor voltage	V	6	The output voltage to the motor
V1.8	DC link voltage	V	7	The measured voltage in the DC-link of the drive
V1.9	Unit temperature	°C	8	The heat sink temperature in Celsius or Fahrenheit
V1.10	Motor temperature	%	9	The calculated motor temperature in percentage of the nominal temperature. See VACON® All in One Application Manual.
V1.11	Analog input 1	V/mA	13	AI1 <sup>(1)</sup>
V1.12	Analog input 2	V/mA	14	AI2 <sup>(1)</sup>
V1.13	DIN 1, 2, 3		15	Shows the status of the digital inputs 1-3
V1.14	DIN 4, 5, 6		16	Shows the status of the digital inputs 4-6
V1.15	DO1, RO1, RO2		17	Shows the status of the digital and relay outputs 1-3
V1.16	Analog I <sub>out</sub>	mA	26	AO1
V1.17	Multimonitoring items			Shows 3 monitored values to select from. See <a href="#">8.7.6.9 Enabling/Disabling the Change of Multimonitoring Items</a> .

<sup>1</sup> If the AC drive only has +24 V supply (for control board power-up), this value is not reliable.

See VACON® All in One Application Manual for more monitored values.

## 8.3 Using the Parameter Menu (M2)

### 8.3.1 Finding the Parameter

#### Context:

Use these instructions to find the parameter to edit.

**Procedure**

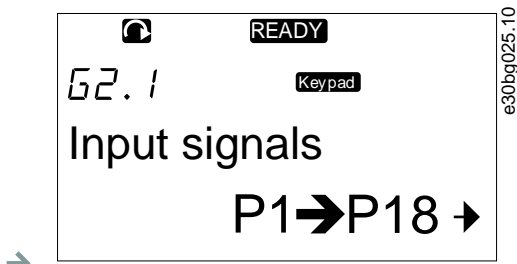
1. To find the Parameter menu, scroll down in the main menu until the location indication *M2* shows on the first line of the display.



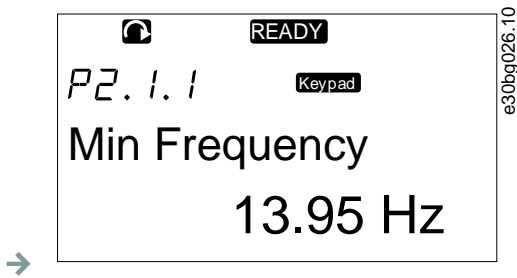
2. Push the Menu button Right to move into the Parameter Group Menu (G#).



3. To find the parameter group, use the Browser buttons Up and Down.



4. Use the Browser buttons Up and Down to find the parameter (P#) to edit. To move directly from the last parameter of a parameter group to the first parameter of that group, push the Browser button Up.



### 8.3.2 Selecting Values

**Context:**

Use these instructions to edit the text values on the control panel.

The basic application package "All in One+" includes 7 applications with different sets of parameters. For more information, see VACON® All in One Application Manual.

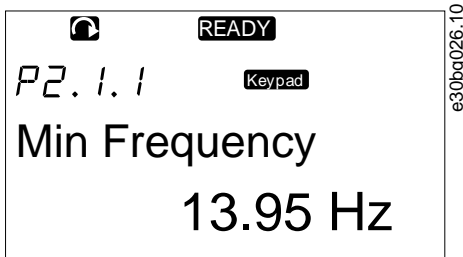


**Prerequisites:**

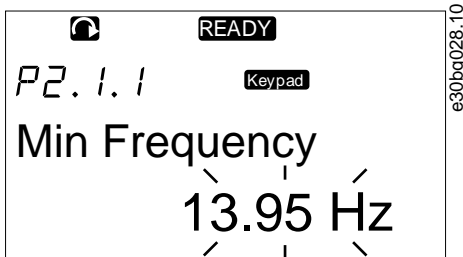
When the drive is in RUN state, many parameters are locked, and cannot be edited. Only the text *Locked* shows on the display. Stop the AC drive to edit these parameters.

**Procedure**

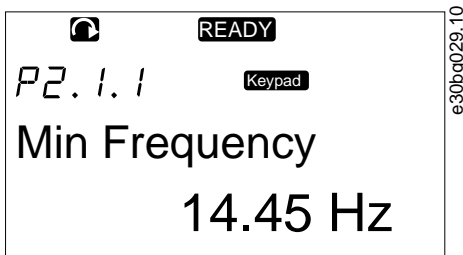
1. Use the Browser buttons Up and Down to find the parameter (P#) to edit. To move directly from the last parameter of a parameter group to the first parameter of that group, push the Browser button Up.



2. To go to the Edit mode, push the Menu button Right. The parameter value starts to blink.



3. Set the new value with the Browser buttons Up and Down.
4. To accept the change, push the [enter] button or ignore the change with menu button Left.
  - If the [enter] button is pushed, the value stops to blink and the new value shows in the value field.



5. For locking the parameter values, use the *Parameter Lock* function in menu M6, see [8.7.6.6 Locking a Parameter](#).

### 8.3.3 Editing the Values Digit by Digit

**Context:**

Use these instructions to edit the numerical values on the control panel.

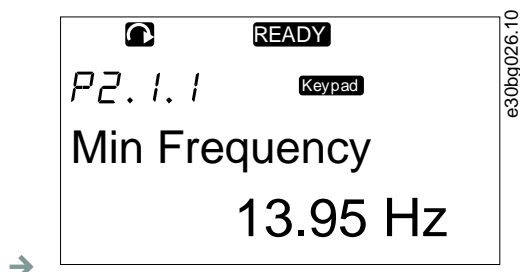
The basic application package "All in One+" includes 7 applications with different sets of parameters. For more information, see VACON® All in One Application Manual.

**Prerequisites:**

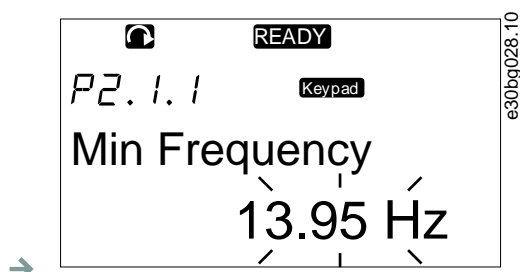
When the drive is in RUN state, many parameters are locked, and cannot be edited. Only the text *Locked* shows on the display. Stop the AC drive to edit these parameters.

#### Procedure

1. Find the parameter with the Browser and Menu buttons.



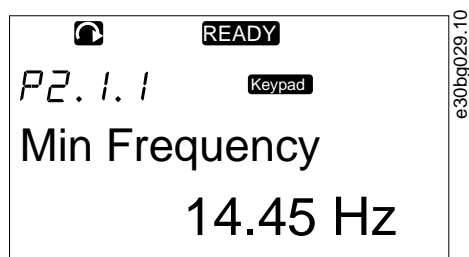
2. To go to the Edit mode, push the Menu button Right. The parameter value starts to blink.



3. Push the Menu button Right. The value can now be edited digit by digit.
4. To accept the change, push the [enter] button.

To ignore the change, push Menu button Left many times, until the view goes back to the parameter list.

- If the [enter] button is pushed, the value stops to blink and the new value shows in the value field.



5. For locking the parameter values, use the *Parameter Lock* function in menu *M6*, see [8.7.6.6 Locking a Parameter](#).

## 8.4 Using the Keypad Control Menu

### 8.4.1 Finding the Keypad Control Menu

#### Context:

In the Keypad control menu, the following functions are available: selecting the control mode, editing the frequency reference, and changing the direction of the motor.

**Procedure**

1. To find the *Keypad control* menu, scroll down in the main menu until the location indication *M3* shows on the first line of the display.



2. To go to the *Keypad control* menu from the main menu, push the Menu button Right.

### 8.4.2 Keypad Control Parameters M3

Table 13: Keypad Control Parameters, M3

Index	Parameter	Min	Max	Unit	Default	Cust	ID	Description
P3.1	Control place	1	3		1		125	The control mode 1 = I/O terminal 2 = Keypad (control panel) 3 = Fieldbus
R3.2	Keypad reference	P2.1.1	P2.1.2	Hz	0.00		123	0 = Forward 1 = Reverse
P3.3	Direction (on keypad)	0	1		0			
P3.4	Stop button	0	1		1		114	0 = Limited function of Stop button 1 = Stop button always enabled

### 8.4.3 Changing the Control Mode

**Context:**

3 control modes are available to control the AC drive. For each control place, a different symbol shows on the display:

The control mode	The symbol
I/O terminals	
Keypad (control panel)	
Fieldbus	

**Procedure**

1. In the *Keypad control* menu (M3), find the control mode (*Control Place*) with Menu buttons Up and Down.



2. To go to the edit mode, push the Menu button Right.
  - The parameter value starts to blink.
3. To scroll through the options, push the Browser buttons Up and Down.
4. To select the control mode, push the [enter] button.

## 8.4.4 Keypad Reference

The keypad reference submenu (P3.2) shows the frequency reference. In this submenu, also the frequency reference can be edited.

### 8.4.4.1 Editing the Frequency Reference

#### Context:

Use these instructions to change the frequency reference.

**Procedure**

1. In the *Keypad control* menu (M3), find the Keypad reference with Menu buttons Up and Down.
2. To go to the edit mode, push the Menu button Right. The frequency reference value starts to blink.
3. Set the new value with the Browser buttons.
  - The value changes only on the control panel.
4. To make the motor speed to agree with the value on the control panel, select the keypad as the control mode, see [8.4.3 Changing the Control Mode](#).

## 8.4.5 Changing the Rotation Direction

#### Context:

The keypad direction submenu shows the rotation direction of the motor. In this submenu, also the rotation direction can be changed.

For more information on how to control the motor with the control panel, see [3.8.2 Keypad](#) and [9.2 Commissioning the AC Drive](#).

**Procedure**

1. In the *Keypad control* menu (M3), find the Keypad direction with the Menu buttons Up and Down.
2. To go to the edit mode, push the Menu button Right.
3. Select the direction with Menu buttons Up and Down.
  - The rotation direction changes on the control panel.
4. To make the motor to agree with the set rotation direction, select the keypad as the control mode, see [8.4.3 Changing the Control Mode](#).

## 8.4.6 Disabling the Stop Motor Function

**Context:**

As a default, the motor stops when the Stop button is pushed no matter what is the control mode. Use these instructions to disable this function.

**Procedure**

1. In the *Keypad control* menu (M3), find the page 3.4. Stop button with the Browser buttons.
2. To go to the edit mode, push the Menu button Right.
3. To select Yes or No, use the Browser buttons.
4. Accept the selection with the [enter] button.
  - When the Stop motor function is not active, the Stop button stops the motor only when the keypad is the control mode.

## 8.4.7 Special Functions in Keypad Control Menu

### 8.4.7.1 Selecting the Keypad as the Control Mode

**Context:**

This is a special function only available in menu M3.

**Prerequisites:**

Make sure to be in the menu M3 and control mode is other than keypad.

**Procedure**

1. Do one of the following options:
  - Keep the Start button pushed down for 3 s when the motor is in RUN state.
  - Keep the Stop button pushed down for 3 s when the motor is stopped.

In other menu than M3, when the keypad is not the active control mode and the start button is pushed, an error message *Keypad Control NOT ACTIVE* shows. In some applications this error message is not shown.

- The keypad is selected as the control mode and the current frequency reference and direction is copied to the control panel.

## 8.4.7.2 Copying the Frequency Reference Set to the Control Panel

### Context:

These are special functions only available in menu M3.

Use these instructions to copy the frequency reference set from I/O or fieldbus to control panel.

### Prerequisites:

Make sure to be in menu M3 and that the control mode is other than keypad.

### Procedure

1. Keep the [enter] button pushed down for 3 s.

In other menu than M3, when the keypad is not the active control mode and the start button is pushed, an error message *Keypad Control NOT ACTIVE* shows.

## 8.5 Using the Active Faults Menu (M4)

### 8.5.1 Finding the Active Faults Menu

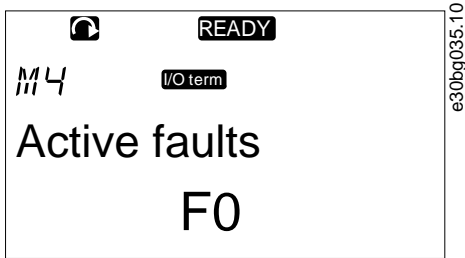
#### Context:

The Active faults menu shows a list of active faults. When there are no active faults, the menu is empty.

For more information on the fault types and how to reset faults, see [11.1 General Information on Fault Tracing](#) and [11.2 Resetting a Fault](#). For the fault codes, possible causes and information on how to correct the fault, see [12.10 Fault Codes](#).

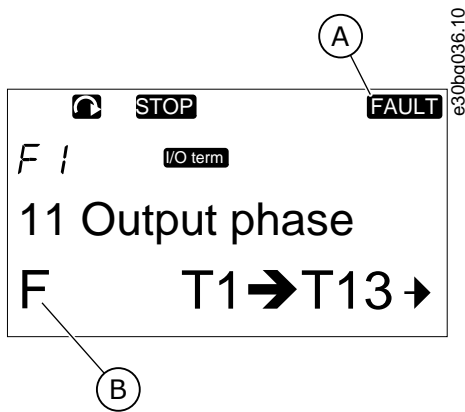
**Procedure**

1. To find the *Active faults* menu, scroll down in the main menu until the location indication *M4* shows on the first line of the display.



2. To go to the *Active faults* menu from the main menu, push the Menu button Right.

→ If there is a fault in the display, these symbols show:



A Fault symbol	B Fault type symbol
----------------	---------------------

Illustration 41: Fault Symbols

## 8.5.2 Examining the Fault Time Data Record

**Context:**

This menu shows some important data that was valid at the time of the fault. This helps to find the cause of the fault.

**Procedure**

1. Find the fault in *Active faults* menu or *Fault history* menu.
2. Push the Menu button Right.
3. Scroll the data *T.1-T.16* with the Browser buttons.

## 8.5.3 Fault Time Data Record

The fault time data record shows some important data that was valid at the time of the fault. This helps to find the cause of the fault.

If real time is set on the AC drive, the data items *T1* and *T2* show as in column Real Time Data Record.

In some special cases, some of the fields can show other data than described in the table. If the value of a field differs significantly from the expected value, this special usage can be the reason. Contact the nearest distributor to get help from the factory in understanding the data.

Code	Description	Value	Real Time Data Record
T.1	Counted operation days	d	yyyy-mm-dd
T.2	Counted operation hours	hh:mm:ss (d)	hh:mm:ss,sss
T.3	Output frequency	Hz (hh:mm:ss)	
T.4	Motor current	A	
T.5	Motor voltage	V	
T.6	Motor power	%	
T.7	Motor torque	%	
T.8	DC voltage	V	
T.9	Unit temperature	°C	
T.10	Run status		
T.11	Direction		
T.12	Warnings		
T.13	0-speed <sup>(1)</sup>		
T.14	Subcode		
T.15	Module		
T.16	Submodule		

<sup>1</sup> Tells if the drive was at zero speed (< 0.01 Hz) when the fault showed.

## 8.6 Using the Fault History Menu (M5)

### 8.6.1 Fault History Menu (M5)

There is a maximum number of 30 faults in the Fault history. The information on each fault shows in the Fault time data record, see [8.5.3 Fault Time Data Record](#).

The value line of the main page (H1->H#) shows the number of faults in the fault history. The location indication tells in which order the faults have shown. The newest fault has the indication *H5.1*, the second newest *H5.2*, and so on. If there are 30 faults in the history, the next fault that shows removes the oldest one (*H5.30*) from the history.

See the different fault codes in [12.10 Fault Codes](#).



## 8.6.2 Resetting the Fault History

**Context:**

The Fault History shows 30 latest faults at a time. Use these instructions to reset the history.

**Procedure**

1. To find the *Fault history* menu, scroll down in the main menu until the location indication *M5* shows on the first line of the display.
2. To go to the *Fault history* menu from the main menu, push the Menu button Right.
3. In the *Fault history* menu, push the [enter] button for 3 s.
  - The symbol H# changes to 0.

## 8.7 Using the System Menu (M6)

### 8.7.1 Finding the System Menu

**Context:**

The System menu includes the general settings of the AC drive. These are, for example, application selection, parameter sets and information about the hardware and software. The number of submenus and subpages shows as the symbol S# (or P#) on the value line.

**Procedure**

1. To find the System menu, scroll down in the main menu until the location indication *M6* shows on the first line of the display.
2. To go to the System menu from the main menu, push the Menu button Right.



### 8.7.2 System Menu Functions

Table 14: System Menu Functions

Code	Function	Min	Max	Unit	Default	Cust	Description
S6.1	Language selection				English		The selection is different in all the language packages

Code	Function	Min	Max	Unit	Default	Cust	Description
S6.2	Application selection				Basic applica- tion		Basic application Standard application Local/Remote control appl. Multi-Step application PID Control application Multi-Purpose Control appl. Pump and Fan Control appl.
S6.3	Copy parameters						
S6.3.1	Parameter sets						Store set 1 Load set 1 Store set 2 Load set 2 Load factory defaults
S6.3.2	Load up to keypad						All parameters
S6.3.3	Load down from keypad						All parameters All but motor parameters Application parameters
P6.3.4	Parameter back-up				Yes		Yes No
S6.4	Compare parameters						
S6.4.1	Set1				Not used		
S6.4.2	Set 2				Not used		
S6.4.3	Factory settings						
S6.4.4	Keypad set						
S6.5	Security						
S6.5.1	Password				Not used		0 = Not used
P6.5.2	Parameter lock				Change Ena- bled		Change Enabled Change Disabled
S6.5.3	Start-up wizard						No Yes

Code	Function	Min	Max	Unit	Default	Cust	Description
S6.5.4	Multimonitoring items						Change Enabled Change Disabled
S6.6	Keypad settings						
P6.6.1	Default page						
P6.6.2	Default page/ Operating menu						
P6.6.3	Timeout time	0	65535	s	30		
P6.6.4	Contrast	0	31		18		
P6.6.5	Backlight time	Always	65535	min	10		
S6.7	Hardware settings						
P6.7.1	Internal brake resistor				Connected		Not connected Connected
P6.7.2	Fan control				Continuous		Continuous Temperature First start Calc temp
P6.7.3	HMI acknowledg. timeout	200	5000	ms	200		
P6.7.4	HMI number of retries	1	10		5		
P6.7.5	Sine filter				Connected		Not connected Connected
S6.8	System information						
S6.8.1	Total counters						
C6.8.1.1	MWh counter			kWh			
C6.8.1.2	Power On day counter						
C6.8.1.3	Power On hours counter			hh:mm:ss			
S6.8.2	Trip counters						
T6.8.2.1	MWh counter			kWh			
T6.8.2.2	Clear MWh trip counter						
T6.8.2.3	Operating days trip counter						
T6.8.2.4	Operating hours trip counter			hh:mm:ss			
T6.8.2.5	Clear operating time counter						
S6.8.3	Software info						
S6.8.3.1	Software package						
S6.8.3.2	System software version						

Code	Function	Min	Max	Unit	Default	Cust	Description
S6.8.3.4	System load						
S6.8.4	Applications						
S6.8.4.#	Name of application						
D6.8.4.#. 1	Application ID						
D6.8.4.#. 2	Applications: Version						
D6.8.4.#. 3	Applications: Firmware interface						
S6.8.5	Hardware						
I6.8.5.1	Info: Power unit type code						
I6.8.5.2	Info: Unit voltage			V			
I6.8.5.3	Info: Brake chopper						
I6.8.5.4	Info: Brake resistor						
S6.8.6	Expander boards						
S6.8.7	Debug menu						For Application programming only. Speak to the factory to get instructions.

### 8.7.3 Changing the Language

**Context:**

Use these instructions to change the language of the control panel. The possible languages are different in all language packages.

**Procedure**

1. In the *System* menu (M6), find the *Language* selection page (S6.1) with the Browser buttons.
2. To go to the edit mode, push the Menu button Right.
  - The name of the language starts to blink.
3. To select the language for the control panel texts, use the Menu buttons Up and Down.
4. To accept the selection, push the [enter] button.
  - The name of the languages stops to blink and all text information on the control panel shows in the selected language.

### 8.7.4 Changing the Application

**Context:**

The application can be changed in the *Application* selection page (S6.2). When the application is changed, all parameters are reset.

For more information on the Application Package, see VACON® NX All in One Application Manual.

**Procedure**

1. In the *System* menu (*M6*), find the *Application* selection page (*S6.2, Application*) with the *Browser* buttons.
2. Push the *Menu* button *Right*.
3. To go to the edit mode, push the *Menu* button *Right*.
  - The name of the application starts to blink.
4. Scroll through the applications with the *Browser* buttons and select a different application.
5. To accept the selection, push the *[enter]* button.
  - The AC drive starts again and goes through the set-up.
6. When the display shows the question *Copy parameters?*, there are 2 options:

This question shows only if the parameter P6.3.4 Autom. Back-up is set to *Yes*.

- To upload the parameters of the new application to the control panel, select *Yes* with the *Browser* buttons.
- To keep the parameters of the application that was last used in the control panel, select *No* with the *Browser* buttons.

### 8.7.5 Copy Parameters (S6.3)

Use this function to copy parameters from one AC drive to a different AC drive or to save parameter sets in the internal memory of the AC drive.

Stop the AC drive before copying or downloading parameters.

#### 8.7.5.1 Saving Parameter Sets (Parameter Sets S6.3.1)

##### Context:

Use this function to get the factory default values back or save 1–2 customized parameter sets. A parameter set includes all parameters of the application.

**Procedure**

1. In the *Copy parameters* (*S6.3*) subpage, find the *Parameter sets* (*S6.3.1*) with the *Browser* buttons.
2. Push the *Menu* button *Right*.
3. To go to the edit mode, push the *Menu* button *Right*.
  - The text *LoadFactDef* starts to blink.
4. There are 5 options to select from. Select the function with the *Browser* buttons.
  - Select *LoadFactDef* to download again the factory default values.
  - Select *Store set 1* to save actual values of all parameters as set 1.
  - Select *Load set 1* to download the values in set 1 as the actual values.
  - Select *Store set 2* to save actual values of all parameters as set 2.
  - Select *Load set 2* to download the values in set 2 as the actual values.
5. To accept the selection, push the *[enter]* button.
6. Wait until *OK* shows on the display.

### 8.7.5.2 Uploading Parameters to Control Panel (Up To Keypad, S6.3.2)

#### Context:

Use this function to upload all parameter groups to the control panel when the AC drive is stopped.

#### Procedure

1. In the Copy parameters (S6.3) subpage, find the *Up to keypad* page (S6.3.2).
2. Push the Menu button Right.
3. To go to the edit mode, push the Menu button Right.
  - *All param.* starts to blink.
4. To accept the selection, push the [enter] button.
5. Wait until *OK* shows on the display.

### 8.7.5.3 Downloading Parameters to Drive (Down From Keypad, S6.3.3)

#### Context:

Use this function to download 1 or all parameter groups from the control panel to an AC drive when the AC drive is stopped.

#### Procedure

1. In the Copy parameters (S6.3) subpage, find the *Down from keypad* page (S6.3.3).
2. Push the Menu button Right.
3. To go to the edit mode, push the Menu button Right.
4. Use the Browser buttons to select 1 of these 3 options:

All parameters (*All param.*)

All parameters but the motor nominal value parameters (*All. no motor*)

Application parameters

5. To accept the selection, push the [enter] button.
6. Wait until *OK* shows on the display.

### 8.7.5.4 Activating or Deactivating the Automatic Parameter Back-up (P6.3.4)

#### Context:

Use these instructions to activate or deactivate the parameter back-up.

#### Prerequisites:

When the application is changed, the parameters in the parameter settings on page S6.3.1 are deleted. To copy parameters from one application to a different application, first upload them to the control panel.

**Procedure**

1. In the Copy parameters (S6.3) subpage, find the Automatic parameter back-up page (S6.3.4).
  2. To go to the edit mode, push the Menu button Right.
  3. There are 2 options:
    - To activate the Automatic parameter back-up, select Yes with the Browser buttons.
    - To deactivate the Automatic parameter back-up, select No with the Browser buttons.
- When the Automatic parameter back-up is active, the control panel makes a copy of the parameters of the application. Each time a parameter is changed, the keypad back-up is automatically updated.

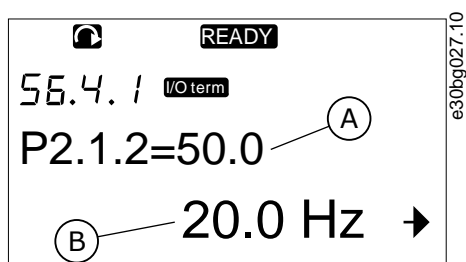
### 8.7.5.5 Comparing the Parameters

**Context:**

Use the Parameter comparison submenu (S6.4, *Param.Comparison*) to compare the actual parameter values to the values of the customized parameter sets and those uploaded to the control panel. The actual values can be compared to Set 1, Set 2, Factory Settings, and Keypad Set.

**Procedure**

1. In the Copy parameters (S6.3) subpage, find the Comparing parameters submenu with the Browser buttons.
2. Push the Menu button Right.
  - The actual parameter values are first compared to those of the customized parameter Set 1. If no differences are found, 0 shows on the bottom line. If there are differences, the display shows the number of the differences (for example, P1->P5 = 5 different values).
3. To compare the values to a different set, use the Browser buttons.
4. To go to the page with the parameter values, push the Menu button Right.
  - In the display that opens, check the values on different lines:



A Value of the selected set	B Actual value
-----------------------------	----------------

**Illustration 43: Parameter Values in Parameter Comparison**

5. To go to the edit mode, push the Menu button Right.
  - The actual value starts to blink.
6. To change the actual value, use the Browser buttons, or change the value digit by digit with the Menu button Right.

## 8.7.6 Security

### 8.7.6.1 Finding the Security Menu

#### Context:

The Security menu is password protected. Use it to handle passwords, start-up wizards, and multimonitoring items, and to lock parameters.

#### Procedure

1. To find the *Security* submenu, scroll down in the *System* menu until the location indication *S6.5* shows on the first line of the display.
2. To go to the *Security* submenu from the *System* menu, push the Menu button Right.

### 8.7.6.2 Passwords

To prevent unauthorized changes in the application selection, use the Password function (*S6.5.1*). By default, the password is not active.

#### ⚠ NOTICE ⚠

Keep the password in a safe location!

### 8.7.6.3 Setting a Password

#### Context:

Set a password to protect the application selection menu.

#### ⚠ NOTICE ⚠

Keep the password in a safe location! The password cannot be changed if a valid password is not available.



**Procedure**

1. In *Security* submenu, push the Menu button Right.
2. To go to the edit mode, push the Menu button Right.
  - The display shows 0 that blinks.
3. There are 2 options to set a password: with the Browser buttons or by digits. The password can be a number between 1 and 65535.
  - With the Browser buttons: Push the Browser buttons Up and Down to find a number.
  - By digits: Push the Menu button Right. A second 0 shows on the display.
    - Push the Browser buttons to set digit on the right.
    - Push the Menu button Left, and set the digit on the left.
    - To add a third digit, push the Menu button Left. Set up to 5 digits with Menu and Browser buttons and set the digit for each one with the Browser buttons.
4. To accept the new password, push the [enter] button.
  - The password activates after the Timeout time (P6.6.3) (see [8.7.7.4 Setting the Timeout Time](#)).

### 8.7.6.4 Entering a Password

**Context:**

In a password-protected submenu, the display shows *Password?* Use these instructions to enter the password.

**Procedure**

1. When the display shows *Password?*, give the password with the Browser buttons.

### 8.7.6.5 Deactivating the Password Function

**Context:**

Use these instructions to deactivate the password protection for application selection menu.

**Procedure**

1. Find the *Password (S6.5.1)* in the *Security* menu with the Browser buttons.
2. To go to the edit mode, push the Menu button Right.
3. Set value 0 for the password.

### 8.7.6.6 Locking a Parameter

**Context:**

Use the Parameter lock function to prevent changes to the parameters. If the parameter lock is active, the text *locked* shows on the display when trying to edit a parameter value.

**⚠ NOTICE ⚠**

This function does not prevent unauthorized changes of parameter values.

**Procedure**

1. In the *Security* menu (M6), find the Parameter lock (P6.5.2) with the Browser buttons.
2. To go to the edit mode, push the Menu button Right.
3. To change the parameter lock status, use the Browser buttons.
4. To accept the change, push the [enter] button.

### 8.7.6.7 Start-up Wizard (P6.5.3)

The start-up wizard helps in the commissioning of the AC drive. By default, the start-up wizard is active.

In the start-up wizard, this information is set:

- the language
- the application
- the values for a set of parameters that are same to all applications
- the values for a set of application-specific parameters.

The table lists the functions of the keypad buttons in the start-up wizard.

Action	Button
Accepting a value	[enter] button
Scrolling for options	Browser buttons Up and Down
Changing a value	Browser buttons Up and Down

### 8.7.6.8 Activating/Deactivating the Start-up Wizard

**Context:**

Use these instructions to activate or deactivate the Start-up Wizard function.

**Procedure**

1. In the *System* menu (M6), find the page P6.5.3.
2. To go to the edit mode, push the Menu button Right.
3. Select the action:
  - To activate the start-up wizard, select *Yes* with the Browser buttons.
  - To deactivate the start-up wizard, select *No* with the Browser buttons.
4. To accept the selection, push the [enter] button.

### 8.7.6.9 Enabling/Disabling the Change of Multimonitoring Items

**Context:**

Use Multimonitoring to monitor up to 3 actual values at the same time (see [8.2 Using the Monitoring Menu \(M1\)](#) and the chapter Monitored values in the Application Manual of your application).

Use these instructions to enable the change when changing the values that are monitored with other values.

#### Procedure

1. In the *Security* submenu, find *Multimonitoring items page (P6.5.4, Multimon. items)* with the Browser buttons.
2. To go to the edit mode, push the Menu button Right.  
→ *Change Enabled* starts to blink.
3. Use Browser buttons Up and Down to select *Change Enabled* or *Change Disabled*.
4. Accept the selection with the [enter] button.

## 8.7.7 Keypad Settings

### 8.7.7.1 Finding the Keypad Settings Menu

#### Context:

Use the Keypad settings submenu in the System menu for making changes in the control panel.

In the submenu, there are 5 pages (P#) that control the panel operation:

- *Default page (P6.6.1)*
- *Default page in the operating menu (P6.6.2)*
- *Timeout time (P6.6.3)*
- *Contrast adjustment (P6.6.4)*
- *Backlight time (P6.6.5)*

#### Procedure

1. In the *System* menu (M6), find the *Keypad settings* submenu (S6.6) with the Browser buttons.

### 8.7.7.2 Changing the Default Page

#### Context:

Use the Default page to set the location (page) to which the display automatically moves after the Timeout time or after the panel is set on.

For more information on the timeout time, see [8.7.7.4 Setting the Timeout Time](#).

If the Default Page value is 0, the function is not activated. When the Default page is not used, the control panel shows the page that was last showed on the display.

#### Procedure

1. In the *Keypad settings* submenu, find the *Default page* subpage (P6.6.1) with the Browser buttons.
2. To go to the edit mode, push the Menu button Right.
3. To change the number of the main menu, use the Browser buttons.
4. To edit the number of the submenu/page, push the Menu button Right. Change the number of the submenu/page with the Browser buttons.
5. To edit the third level page number, push the Menu button Right. Change the number of the third level page with the Browser buttons.
6. To accept the new default page value, push the [enter] button.

### 8.7.7.3 Default Page in the Operating Menu (P6.6.2)

Use this submenu to set the default page in the Operating menu. The display automatically moves to the set page after the Timeout time (see [8.7.7.4 Setting the Timeout Time](#)) or after the control panel is set on. For instructions, see [8.7.7.2 Changing the Default Page](#).

The Operating menu is only available in special applications.

### 8.7.7.4 Setting the Timeout Time

#### Context:

The Timeout time sets the time after which the control panel display goes back to the *Default page* (P6.6.1), see [8.7.7.2 Changing the Default Page](#).

If the Default page value is 0, the Timeout time setting has no effect.

#### Procedure

1. In the *Keypad settings* submenu, find the *Timeout time* subpage (P6.6.3) with the Browser buttons.
2. To go to the Edit mode, push the Menu button Right.
3. To set the timeout time, use the Browser buttons.
4. To accept the change, push the [enter] button.

### 8.7.7.5 Contrast Adjustment (P6.6.4)

If the display is not clear, adjust its contrast with the same procedure as the one for the timeout time setting, see [8.7.7.4 Setting the Timeout Time](#).

### 8.7.7.6 Backlight Time (P6.6.5)

It is possible to set the time that the backlight stays on until it goes off. Select a value between 1 and 65535 minutes or *Forever*. For instructions on how to change the value, see [8.7.7.4 Setting the Timeout Time](#).

## 8.7.8 Hardware Settings

### 8.7.8.1 Finding the Hardware Setting Menu

#### Context:

Use the Hardware settings submenu (*S6.7, HW settings*) in the *System* menu to control these functions of the hardware in the AC drive:

- Internal brake resistor connection, *InternBrakeRes*
- *Fan control*
- HMI acknowledge timeout, *HMI ACK timeout*
- *HMI retry*
- Sine filter
- Pre-charge mode.

#### Prerequisites:

Use a password to go the Hardware settings submenu, see [8.7.6.2 Passwords](#).

### Procedure

1. To find the Hardware settings submenu, scroll down in the *System* menu until the location indication *S6.7* shows on the first line of the display.
2. To go to the Hardware settings submenu from the *System* menu, push the Menu button Right.

## 8.7.8.2 Setting the Internal Brake Resistor Connection

### Context:

Use this function to tell the AC drive if the internal brake resistor is connected or not.

If the AC drive has an internal brake resistor, the default value of this parameter is *Connected*. We recommend changing this value to *Not conn.* if:

- it is necessary to install an external brake resistor to increase the braking capacity
- the internal brake resistor is disconnected for some reason.

### Prerequisites:

The brake resistor is available as optional equipment for all sizes. It can be installed internally in enclosure sizes FR4 to FR6.

### Procedure

1. In the Hardware settings submenu, find the Internal brake resistor connection (6.7.1) subpage with the Browser buttons.
2. To go to the edit mode, push the Menu button Right.
3. To change the internal brake resistor status, use the Browser buttons.
4. To accept the change, push the [enter] button.

## 8.7.8.3 Fan Control

Use this function to control the cooling fan of the AC drive. There are 4 options to select from:

- *Continuous* (default setting). The fan is always on when the power is on.
- *Temperature*. The fan starts automatically when the heat sink temperature goes to 60 °C (140 °F) or when the AC drive operates. The fan stops about a minute after one of the following:
  - the heat sink temperature falls to 55 °C (131 °F)
  - the AC drive stops
  - the fan control value is changed from *Continuous* to *Temperature*
- *First start*. When power is on, the fan is in the stop state. When the AC drive gets the first start command, the fan starts.
- *Calc temp*. The fan function agrees to the calculated IGBT temperature:
  - If the IGBT temperature is more than 40 °C (104 °F), the fan starts.
  - If the IGBT temperature is below 30 °C (86 °F), the fan stops.

As the default temperature at power-up is 25 °C (77 °F), the fan does not start immediately.

For instructions, see [8.7.8.4 Changing the Fan Control Settings](#).

### 8.7.8.4 Changing the Fan Control Settings

#### Context:

Use these instructions to change the Fan Control Settings.

#### Procedure

1. In the Hardware settings submenu, find the *Fan control* settings (6.7.2) with the Browser buttons.
2. To go to the edit mode, push the Menu button Right.
  - The parameter value starts to blink.
3. To select the fan mode, use the Browser buttons.
4. To accept the change, push the [enter] button.

### 8.7.8.5 HMI Acknowledge Timeout (P6.7.3)

Use this function to change the timeout of the HMI acknowledgement time. Use this function when there is more delay in the RS232 transmission, for example, when internet connection is used for communication over longer distances.

If the AC drive is connected to the PC with a cable, do not change the default values of parameters 6.7.3 and 6.7.4 (200 and 5).

If the AC drive is connected to the PC with an internet connection and the messages are transferred with a delay, set the values for parameter 6.7.3 to agree these delays.

For instructions, see [8.7.8.6 Changing the HMI Acknowledge Timeout](#).

#### Example:

For example, if the transfer delay between the AC drive and the PC is 600 ms, make these settings:

- Set the value of parameter 6.7.3 to 1200 ms (2 x 600, sending delay + receiving delay)
- Set the [Misc]-part of the file NCDrive.ini to agree with the settings:
  - Retries = 5
  - AckTimeOut = 1200
  - TimeOut = 6000

Do not use intervals shorter than the AckTimeOut-time in the NC-Drive monitoring.

### 8.7.8.6 Changing the HMI Acknowledge Timeout

#### Context:

Use these instructions to change the HMI Acknowledge Timeout.

#### Procedure

1. In the Hardware settings submenu, find the HMI acknowledgement time (*HMI ACK timeout*) with the Browser buttons.
2. To go to the edit mode, push the Menu button Right.
3. To change the acknowledgement time, use the Browser buttons.
4. To accept the change, push the [enter] button.

### 8.7.8.7 Changing the Number of Retries to Receive HMI Acknowledgement (P6.7.4)

#### Context:

Use this parameter to set the number of times the AC drive tries to receive acknowledgement if it does not receive it during the acknowledgement time (P6.7.3) or if the received acknowledgement is defective.

#### Procedure

1. In the Hardware settings submenu, find the Number of retries to receive HMI acknowledgement (P6.7.4) with the Browser buttons.
2. To go to the edit mode, push the Menu button Right. The value starts to blink.
3. To change the number of retries, use the Browser buttons.
4. To accept the change, push the [enter] button.

### 8.7.8.8 Sine Filter (P6.7.5)

When using an old motor or a motor that was not made to be used with an AC drive, it can be necessary to use a sine filter. A sine filter makes the sine form of the voltage better than a dU/dt filter.

If a sine filter is used in the AC drive, set this parameter to *Connected* to put it into operation.

### 8.7.8.9 Pre-charge Mode (P6.7.6)

For an F19 or a larger inverter unit, select *Ext.ChSwitch* to control an external charge switch.

## 8.7.9 System Info

### 8.7.9.1 Finding the System Info Menu

#### Context:

The *System info* submenu (S6.8) contains information on the hardware, software, and operation of the AC drive.

#### Procedure

1. To find the *System info* submenu, scroll down in the *System* menu until the location indication S6.8 shows on the first line of the display.
2. To go to the *System info* submenu from the *System* menu, push the Menu button Right.

### 8.7.9.2 Total Counters (S6.8.1)

The *Total counters* page (S6.8.1) has information on the AC drive operation times. The counters show the total number of MWh, operation days, and operation hours. The Total counters cannot be reset.

The Power On time counter (days and hours) always counts, when the AC power is on. The counter does not count when control unit runs on +24 V only.

Table 15: Total Counters

Page	Counter	Example
C6.8.1.1.	MWh counter	

Page	Counter	Example
C6.8.1.2.	Power On day counter	Value on display is 1.013. The drive has operated for 1 year and 13 days.
C6.8.1.3	Power On hour counter	Value on display is 7:05:16. The drive has operated for 7 hours 5 minutes and 16 s.

### 8.7.9.3 Trip Counters (S6.8.2)

The *Trip counters* page (S6.8.2) has information on resettable counters, that is, counters, for which the value can be set back to 0. The trip counters count only when the motor is in RUN state.

Table 16: Trip Counters

Page	Counter	Example
T6.8.2.1	MWh counter	
T6.8.2.3	Operation day counter	Value on display is 1.013. The drive has operated for 1 year and 13 days.
T6.8.2.4	Operation hour counter	Value on display is 7:05:16. The drive has operated for 7 hours 5 minutes and 16 s.

### 8.7.9.4 Resetting the Trip Counters

**Context:**

Use these instructions to reset the trip counters.

**Procedure**

1. In the *System info* submenu, find the *Trip counters* page (6.8.2) with the Browser buttons.
2. To go to the Clear MWh counter page (6.8.2.2, *Clr MWh cntr*) or to the Clear Operation time counter page (6.8.2.5, *Clr Optime cntr*), use the Menu button Right.
3. To go to the edit mode, push the Menu button Right.
4. To select Reset, push Browser buttons Up and Down.
5. To accept the selection, push the [enter] button.
6. The display shows again *Not reset*.

### 8.7.9.5 Software (S6.8.3)

The Software information page includes information on the AC drive software.

Page	Content
6.8.3.1	Software package
6.8.3.2	System software version
6.8.3.3	Firmware interface
6.8.3.4	System load



### 8.7.9.6 Applications (S6.8.4)

The *Applications* submenu (S6.8.4) contains information on all applications on the AC drive.

Page	Content
6.8.4.#	Name of application
6.8.4.#.1	Application ID
6.8.4.#.2	Version
6.8.4.#.3	Firmware interface

### 8.7.9.7 Examining the Application Page

**Context:**

Use these instructions to examine the *Applications* pages.

**Procedure**

1. In the *System info* submenu, find the *Applications* page with the Browser buttons.
2. To go to the *Applications* page, push the Menu button Right.
3. To select the application, use the Browser buttons. There are as many pages as there are applications on the AC drive.
4. To go to the Information pages, use the Menu button Right.
5. To see the different pages, use the Browser buttons.

### 8.7.9.8 Hardware (S6.8.5)

The Hardware information page includes information on the AC drive hardware.

Page	Content
6.8.5.1	Power unit type code
6.8.5.2	Nominal voltage of the unit
6.8.5.3	Brake chopper
6.8.5.4	Brake resistor
6.8.5.5	Serial number

### 8.7.9.9 Checking the Status of an Option Board

**Context:**

The *Expander boards* pages give information about the basic and option boards connected to the control board. See [7.1 Control Unit Components](#) for more information on the boards.

For more information on the parameters of the option boards, see [8.8.1 Expander Board Menu](#).

**Procedure**

1. In the *System info* submenu, find the *Expander boards* page (6.8.6) with the Browser buttons.
2. To go to the *Expander boards* page, push the Menu button Right.
3. To select the board, use the Browser buttons.
  - If no board is connected to the slot, the display shows *no board*.

If a board is connected to a slot but there is no connection, the display shows *no conn..*

4. To see the status of the board, push the Menu button Right.
5. To see the program version of the board, push the Browser button Up or Down.

### 8.7.9.10 Debug Menu (S6.8.7)

The Debug menu is for advanced users and application designers. Speak to the factory to get instructions, if it is necessary.

## 8.8 Using the Expander Board Menu

### 8.8.1 Expander Board Menu

The *Expander board* menu, that is, the menu for option board information, allows to:

- see which option boards are connected to the control board
- find and edit the option board parameters.

**Table 17: Option Board Parameters (Board OPTA1)**

Page	Parameter	Min	Max	Default	Cust	Selections
P7.1.1.1	AI1 mode	1	5	3		1 = 0–20 mA 2 = 4–20 mA 3 = 0–10 V 4 = 2–10 V 5 = –10...+10 V
P7.1.1.2	AI2 mode	1	5	1		See P7.1.1.1
P7.1.1.3	AO1 mode	1	4	1		1 = 0–20 mA 2 = 4–20 mA 3 = 0–10 V 4 = 2–10 V

### 8.8.2 Examining the Connected Option Boards

**Context:**

Use these instructions to examine the connected option boards.

**Procedure**

1. To find the *Expander board* menu, scroll down in the main menu until the location indication *M7* shows on the first line of the display.
2. To go to the *Expander board* menu from the main menu, push the Menu button Right.
3. To examine the list of connected option boards, use the Browser buttons Up and Down.
4. To see the information on the option board, push the Menu button Right.

### 8.8.3 Finding the Option Board Parameters

**Context:**

Use these instructions to check the values of the option board parameters.

**Procedure**

1. Find the option board with the Browser and Menu buttons in the *Expander Board Menu*.
2. To see the information on the option board, push the Menu button Right. For instructions on how to examine the connected option boards, see [8.8.2 Examining the Connected Option Boards](#).
3. To scroll to the Parameters use the Browser buttons Up and Down.
4. To examine the parameter list, push the Menu button Right.
5. To scroll through the parameters, use the Browser buttons Up and Down.
6. To go to the edit mode, push the Menu button Right. For instructions on how to edit the parameter values, see [8.3.2 Selecting Values](#) and [8.3.3 Editing the Values Digit by Digit](#).

## 8.9 Further Control Panel Functions

The VACON® NX control panel has more application-related functions. See VACON NX Application Package for more information.

## 9 Commissioning

### 9.1 Safety Checks before Starting the Commissioning

Before starting the commissioning, read these warnings.

#### ⚠ DANGER ⚠

##### SHOCK HAZARD FROM POWER UNIT COMPONENTS

The power unit components are live when the drive is connected to mains. A contact with this voltage can lead to death or serious injury.

- Do not touch the components of the power unit when the drive is connected to mains. Before connecting the drive to mains, make sure that the covers of the drive are closed.

#### ⚠ DANGER ⚠

##### SHOCK HAZARD FROM TERMINALS

The motor terminals U, V, W, the brake resistor terminals, or the DC terminals are live when the drive is connected to mains, also when the motor does not operate. A contact with this voltage can lead to death or serious injury.

- Do not touch the motor terminals U, V, W, the brake resistor terminals, or the DC terminals when the drive is connected to mains. Before connecting the drive to mains, make sure that the covers of the drive are closed.

#### ⚠ DANGER ⚠

##### SHOCK HAZARD FROM DC LINK OR EXTERNAL SOURCE

The terminal connections and the components of the drive can be live 5 minutes after the drive is disconnected from the mains and the motor has stopped. Also the load side of the drive can generate voltage. A contact with this voltage can lead to death or serious injury.

- Before doing electrical work on the drive:
  - Disconnect the drive from the mains and make sure that the motor has stopped.
  - Lock out and tag out the power source to the drive.
  - Make sure that no external source generates unintended voltage during work.
  - Wait 5 minutes before opening the cabinet door or the cover of the AC drive.
  - Use a measuring device to make sure that there is no voltage.

#### ⚠ WARNING ⚠

##### SHOCK HAZARD FROM CONTROL TERMINALS

The control terminals can have a dangerous voltage also when the drive is disconnected from mains. A contact with this voltage can lead to injury.

- Make sure that there is no voltage in the control terminals before touching the control terminals.

**⚠ CAUTION ⚠****BURNING HAZARD FROM HOT SURFACES**

The surface of the side of the AC drive FR8 is hot.

- Do not touch the side of the AC drive FR8 with hands when it operates.

**⚠ CAUTION ⚠****FIRE HAZARD FROM HOT SURFACES**

When the AC drive FR6 operates, the rear surface of the drive is hot, and can cause fire on the surface it is installed on.

- Do not install the AC drive FR6 on a surface that is not fireproof.

## 9.2 Commissioning the AC Drive

**Context:**

Follow these instructions to commission the AC drive.

**Prerequisites:**

Read the safety instructions in [2.2 Danger and Warnings](#) and [9.1 Safety Checks before Starting the Commissioning](#) and obey them.

### Procedure

1. Make sure that the motor is installed correctly.
2. Make sure that the motor is not connected to mains.
3. Make sure that the AC drive and the motor are grounded.
4. Make sure to select the mains cable, the brake cable, and the motor cable correctly.

For information on cable selections, see:

- [6.1.3 Cable Selection and Dimensioning](#) and related tables
- [6.1 Cable Connections](#)
- [6.2 EMC-compliant Installation](#)

5. Make sure that the control cables are as far as possible from the power cables. See [6.5.1 Additional Instructions for Cable Installation](#)
6. Make sure that the shields of the shielded cables are connected to a grounding terminal that is identified with
7. Do a check of the tightening torques of all the terminals.
8. Make sure that no power correction capacitors are connected to the motor cable.
9. Make sure that the cables do not touch the electrical components of the drive.
10. Make sure that the common input +24 V is connected to an external power source and the ground of the digital input is connected to ground of the control terminal.
11. Do a check of the quality and quantity of the cooling air.

For further information on cooling requirements, see:

- [5.2.1 General Cooling Requirements](#)
- [5.2.2 Cooling of FR4 to FR9](#)
- [5.2.3 Cooling of Standalone AC drives \(FR10 to FR11\)](#)
- [12.8 VACON NXP Technical Data](#)

12. Make sure that there is no condensation on the surfaces of the AC drive.
13. Make sure that there are no unwanted objects in the installation space.
14. Before connecting the drive to mains, do a check of the installation and the condition of all the fuses (see [12.3.1 List of Cable and Fuse Size Information](#)) and other protective devices.

## 9.3 Measuring the Cable and Motor Insulation

Do these checks if necessary.

- The insulation checks of the motor cable, see [9.3.1 Insulation Checks of the Motor Cable](#)
- The insulation checks of the mains cable, see [9.3.2 Insulation Checks of the Mains Cable](#)
- The insulation checks of the motor, see [9.3.3 Insulation Checks of the Motor](#)

### 9.3.1 Insulation Checks of the Motor Cable

#### Context:

Use these instructions to check the insulation of the motor cable.

**Procedure**

1. Disconnect the motor cable from the terminals U, V, and W and from the motor.
2. Measure the insulation resistance of the motor cable between phase conductors 1 and 2, between phase conductors 1 and 3, and between phase conductors 2 and 3.
3. Measure the insulation resistance between each phase conductor and the grounding conductor.
4. The insulation resistance must be  $>1\text{ M}\Omega$  at the ambient temperature of  $20\text{ }^{\circ}\text{C}$  ( $68\text{ }^{\circ}\text{F}$ ).

### 9.3.2 Insulation Checks of the Mains Cable

**Context:**

Use these instructions to check the insulation of the mains cable.

**Procedure**

1. Disconnect the mains cable from the terminals L1, L2, and L3 and from mains.
2. Measure the insulation resistance of the mains cable between phase conductors 1 and 2, between phase conductors 1 and 3, and between phase conductors 2 and 3.
3. Measure the insulation resistance between each phase conductor and the grounding conductor.
4. The insulation resistance must be  $>1\text{ M}\Omega$  at the ambient temperature of  $20\text{ }^{\circ}\text{C}$  ( $68\text{ }^{\circ}\text{F}$ ).

### 9.3.3 Insulation Checks of the Motor

**Context:**

Use these instructions to check the insulation of the motor.

**⚠ NOTICE ⚠**

Obey the instructions of the motor manufacturer.

**Procedure**

1. Disconnect the motor cable from the motor.
2. Open the bridging connections in the motor connection box.
3. Measure the insulation resistance of each motor winding. The voltage must be the same or higher than the motor nominal voltage, but at least  $1000\text{ V}$ .
4. The insulation resistance must be  $>1\text{ M}\Omega$  at the ambient temperature of  $20\text{ }^{\circ}\text{C}$  ( $68\text{ }^{\circ}\text{F}$ ).
5. Connect the motor cables to the motor.
6. Do the final insulation check on the drive side. Put all phases together and measure to the ground.
7. Connect the motor cables to the drive.

## 9.4 Checks after Commissioning

### 9.4.1 Testing the AC Drive after Commissioning

#### Context:

Before starting the motor, do these checks.

#### Prerequisites:

- Before the tests, make sure that it is safe to do each test.
- Make sure that the other workers near know about the tests.

#### Procedure

1. Make sure that all the START and STOP switches that are connected to the control terminals are in the STOP position.
2. Make sure that the motor can be started safely.
3. Set the parameters of group 1 (see VACON® All in One Application Manual) to agree with the requirements of the used application. To find the necessary values for the parameters, see the motor nameplate.

Set these parameters at a minimum:

- Motor nominal voltage
  - Motor nominal frequency
  - Motor nominal speed
  - Motor nominal current
  - Motor cos phi
4. Set the maximum frequency reference (that is, the maximum speed of the motor) to agree with the motor and the device that is connected to the motor.
  5. Do the following tests in this order:
    - A RUN test without the load, see [9.4.2 RUN Test without Load](#)
    - B Start-up test, see [9.4.3 Start-up Test](#)
    - C Identification run, see [9.4.4 Identification Run](#)

### 9.4.2 RUN Test without Load

Do either Test A or Test B.

- Test A: Controls from the control terminals
- Test B: Control from the control panel

#### 9.4.2.1 Test A: Controls from the control terminals

#### Context:

Do this RUN test when the control mode is I/O terminals.



**Procedure**

1. Turn the Start/Stop switch to ON position.
2. Change the frequency reference (potentiometer).
3. Do a check in the Monitoring menu *M1* that the value of output frequency changes the equivalent quantity to the frequency reference.
4. Turn the Start/Stop switch to OFF position.

### 9.4.2.2 Test B: Control from the keypad

**Context:**

Do this RUN test when the control mode is keypad.

**Procedure**

1. Change the control from the control terminals to the keypad. For the instructions, see [8.4.3 Changing the Control Mode](#).
2. Push the Start button on the control panel.
3. Go to the Keypad control menu (*M3*) and *Keypad Reference* submenu (see [8.4.4 Keypad Reference](#)). To change the frequency reference, use the Browser buttons.
4. Do a check in the Monitoring menu *M1* that the value of output frequency changes the equivalent quantity to the frequency reference.
5. Push the Stop button on the control panel.

### 9.4.3 Start-up Test

**Context:**

Do the start-up tests without the load, if possible. If this is not possible, make sure that it is safe to do each test before doing it. Make sure that the other workers near know about the tests.

**Procedure**

1. Make sure that all Start/Stop switches are in Stop positions.
2. Turn the mains switch ON.
3. Check the rotation direction of the motor.
4. If close loop control is used, make sure that the encoder frequency and direction are the same as the motor direction and frequency.
5. Do again the Run test A or B, see [9.4.2 RUN Test without Load](#).
6. If the motor was not connected in the start-up test, connect the motor to the process.
7. Make the identification run without the motor running. If close loop control is used, make the identification run with the motor running. See [9.4.4 Identification Run](#).

### 9.4.4 Identification Run

The Identification Run helps to tune the motor and the drive-related parameters. It is a tool to be used in commissioning to find the best possible parameter values for most drives. The automatic motor identification calculates or measures the necessary motor parameters for the best possible motor and speed control. For more information on the Identification Run, see VACON® All in One Application Manual, parameter ID631.

## 10 Maintenance

### 10.1 Maintenance Schedule

In normal conditions, VACON® NX AC drives are maintenance-free. To make sure that the drive operates correctly and has a long life, we recommend doing regular maintenance. Refer to the table for maintenance intervals.

Table 18: Maintenance Intervals and Tasks

Maintenance interval	Maintenance task
12 months (if the AC drive is kept in store)	Reform the capacitors (see <a href="#">10.2 Reforming the Capacitors</a> )  If the AC drive was in store for much longer than 12 months and the capacitors were not charged, speak to the factory to get instructions before connecting the power.
6–24 months (The interval is different in different environments.)	<ul style="list-style-type: none"> <li>Do a check of the tightening torques of the terminals.</li> <li>Clean the heat sink.</li> <li>Do a check of the mains terminal, motor terminal, and the control terminals.</li> <li>Clean the cooling channel.</li> <li>Make sure that the cooling fan operates correctly.</li> <li>Make sure that there is no corrosion on the terminals, the busbars or other surfaces.</li> <li>In case of cabinet installation, do a check of the door filters.</li> </ul>
5–7 years	Change the cooling fans: <ul style="list-style-type: none"> <li>the main fan</li> <li>the internal IP54 (UL Type 12) fan</li> <li>the cabinet cooling fan/filter</li> </ul>
5–10 years	Change the DC bus capacitors, if the DC voltage ripple is high.

### 10.2 Reforming the Capacitors

#### Context:

After a long storage time, it is necessary to reform the capacitors to prevent damage to the capacitors. To make sure that the possible high leakage current through the capacitors stays in minimum, use a DC supply with an adjustable current limit.

If the AC drive was in store for much longer than 12 months and the capacitors were not charged, speak to the factory to get instructions before connecting the power.

#### Procedure

- Set the current limit to 300–800 mA to agree with the size of the drive.
- Connect the DC supply to the B+/B terminals (DC+ to B+, DC- to B-) of the DC-link or directly to the capacitor terminals. In the NX AC drives with no B+/B- terminals (FR8/FR9), connect the DC supply between 2 input phases (L1 and L2).
- In drives FR8 to FR11: To make sure that the capacitors are fully charged, remove the fuses of the cooling fan. If necessary, speak to the factory to get more instructions.
- Set the DC voltage to the nominal DC voltage level of the AC drive ( $1.35 \cdot U_n$  AC) and give the AC drive power for 1 hour, at minimum.

## 11 Fault Tracing

### 11.1 General Information on Fault Tracing

When the control diagnostics of the AC drive find an unusual condition in the operation of the drive, the drive shows this information:

- This information shows on the display (see [8.5.1 Finding the Active Faults Menu](#)):
  - the location indication F1
  - the fault code, see [12.10 Fault Codes](#)
  - a short description of the fault
  - the fault type symbol, see [table 19](#)
  - the *FAULT* or *ALARM* symbol
- The red LED on the control panel starts to blink (only when a fault shows).

If many faults show at the same time, examine the list of active faults with the Browser buttons.

In the VACON® NX AC drives, there are 4 different types of faults.

Table 19: Fault Types

Fault type symbol	Description
A (Alarm)	The type A fault (Alarm) tells about unusual operation on the drive. It does not stop the drive. The 'A fault' stays in the display for about 30 s.
F (Fault)	The type 'F fault' stops the drive. To start the drive again, find a solution to the problem.
AR (Fault Autore-set)	The type 'AR fault' stops the drive. The fault is reset automatically and the drive tries to start the motor again. If it cannot the start the motor again, a fault trip (see FT, Fault Trip) shows.
FT (Fault Trip)	If the drive cannot start the motor after an AR fault, an FT fault shows. The type 'FT fault' stops the AC drive.

The fault stays active until it is reset, see [11.2 Resetting a Fault](#). The memory of active faults can keep the maximum of 10 faults in the order in which they were shown.

Reset the fault with the [reset] button on the control panel, or through the control terminal, fieldbus, or the PC tool. The faults stay in the Fault history.

Before asking help from the distributor or the factory because of unusual operation, prepare some data. Write down all the texts on the display, the fault code, the source information, the Active Faults list, and the Fault History.

### 11.2 Resetting a Fault

#### Context:

The fault stays active until it is reset. Reset the fault using these instructions.

**Procedure**

1. Remove the external Start signal before resetting the fault to prevent that the drive starts again without a note.
2. There are 2 options to reset a fault:
  - Push the [reset] button on the control panel for 2 s.
  - Use a reset signal from the I/O terminal or fieldbus.

→ The display goes back to the same state it was before the fault.

### 11.3 Creating Service Info File

**Context:**

Use these instructions to create a service info file in VACON® NCDrive PC tool to help to troubleshoot in a fault situation.

**Prerequisites:**

Make sure the VACON® NCDrive PC tool is installed on the computer. To install it, go to our website <http://drives.danfoss.com/downloads/portal/>.

**Procedure**

1. Open the VACON® NCDrive.
2. Go to *File* and select *Service Info...*
  - The service information file opens.
3. Save the service info file on the computer.

## 12 Specifications

### 12.1 Weights of the AC Drive

Enclosure size	, IP21/IP54 [kg]	Weight, UL Type 1/Type 12 [lb.]
FR4	5.0	11.0
FR5	8.1	17.9
FR6	18.5	40.8
FR7	35.0	77.2
FR8	58.0	128
FR9	146	322
FR10	340	750
FR11 <sup>(1)</sup>	470	1036

<sup>1</sup> For FR11, the product types 0460 and 0502: 400 kg (882 lb.)

### 12.2 Dimensions

#### 12.2.1 List of Dimension Information

This topic gives a list of dimension information for different types of NXS/NXP AC Drives.

For Wall-mounted AC drives, see:

- [12.2.2.1 Dimensions for FR4-FR6](#)
- [12.2.2.2 Dimensions for FR7](#)
- [12.2.2.3 Dimensions for FR8](#)
- [12.2.2.4 Dimensions for FR9](#)

For Flange-mounted AC drives, see:

- [12.2.3.1 Dimensions for Flange Mounting, FR4-FR6](#)
- [12.2.3.2 Dimensions for Flange Mounting, FR7-FR8](#)
- [12.2.3.3 Dimensions for Flange Mounting, FR9](#)

For Standalone AC drives, see:

- [12.2.4.1 Dimensions for FR10-FR11](#)

## 12.2.2 Wall-mounted

## 12.2.2.1 Dimensions for FR4-FR6

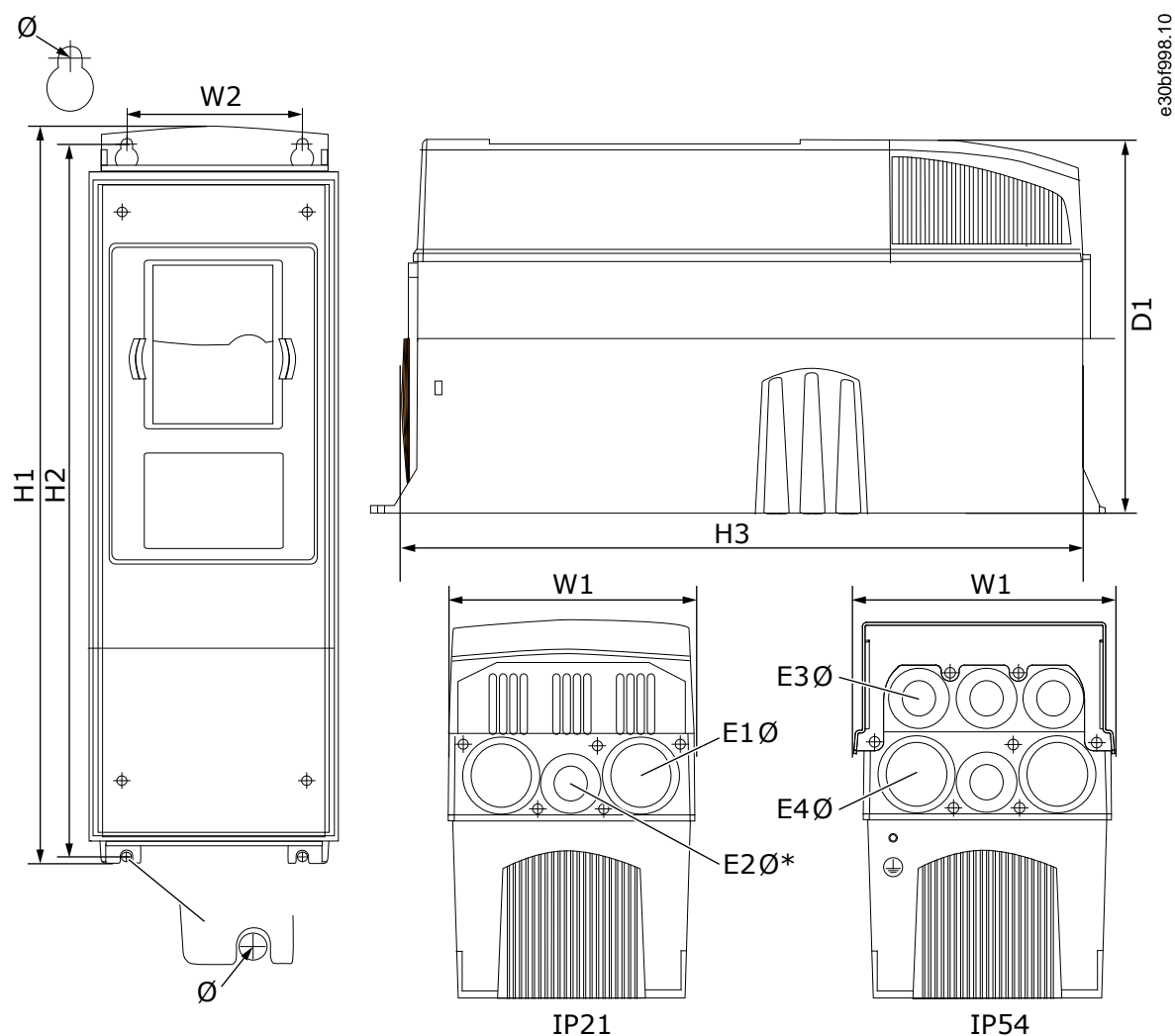


Illustration 44: Dimensions of the VACON® NXS/NXP AC Drive, FR4-FR6

Table 20: Dimensions in mm (in inch) of the VACON® NXS/NXP AC Drive, FR4-FR6

Drive type	W1	W2	H1	H2	H3	D1	Ø	E1Ø	E2Ø <sup>(1)</sup>	E3Ø	E4Ø <sup>(2)</sup>
0004 2-0012 2	128	100	327	313	292	190	7	3 x 28.3	-	6 x 28.3	-
0003 5-0012 5	(5.04)	(3.94)	(12.87)	(12.32)	(11.5)	(7.48)	(0.27)	(3 x 1.11)	(-)	(6 x 1.11)	(-)
0017 2-0031 2	144	100	419	406	391	214	7	2 x 37	28.3	2 x 37	4 x 28.3
0016 5-0031 5	(5.67)	(3.94)	(16.5)	(15.98)	(15.39)	(8.43)	(0.27)	(2 x 1.46)	(1.11)	(2 x 1.46)	(4 x 1.11)

Drive type	W1	W2	H1	H2	H3	D1	Ø	E1Ø	E2Ø <sup>(1)</sup>	E3Ø	E4Ø <sup>(2)</sup>
0048 2-0061 2	195	148	558	541	519	237	9	3 x 37	-	3 x 37	3 x 28.3
0038 5-0061 5	(7.68)	(5.83)	(21.97)	(21.3)	(20.43)	(9.33)	(0.35)	(3 x 1.46)	(-)	(3 x 1.46)	(3 x 1.11)
0004 6-0034 6											

<sup>1</sup> FR5 only

<sup>2</sup> FR5 and FR6 only

### 12.2.2.2 Dimensions for FR7

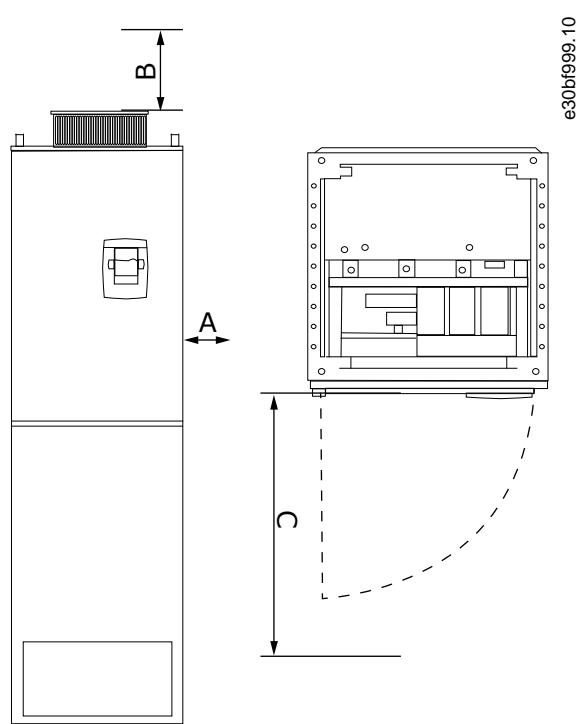


Illustration 45: Dimensions of the VACON® NXS/NXP AC Drive, FR7

Table 21: Dimensions in mm (in inch) of the VACON® NXS/NXP AC Drive, FR7

Drive type	W1	W2	H1	H2	H3	D1	Ø	E1Ø	E2Ø	E3Ø
0075 2-0114 2	237	190	630	614	591	257	9	3 x 50.3	3 x 50.3	3 x 28.3
0072 5-0105 5	(9.33)	(7.48)	(24.80)	(24.17)	(23.27)	(10.12)	(0.35)	(3 x 1.98)	(3 x 1.98)	(3 x 1.11)
0041 6-0052 6										

### 12.2.2.3 Dimensions for FR8

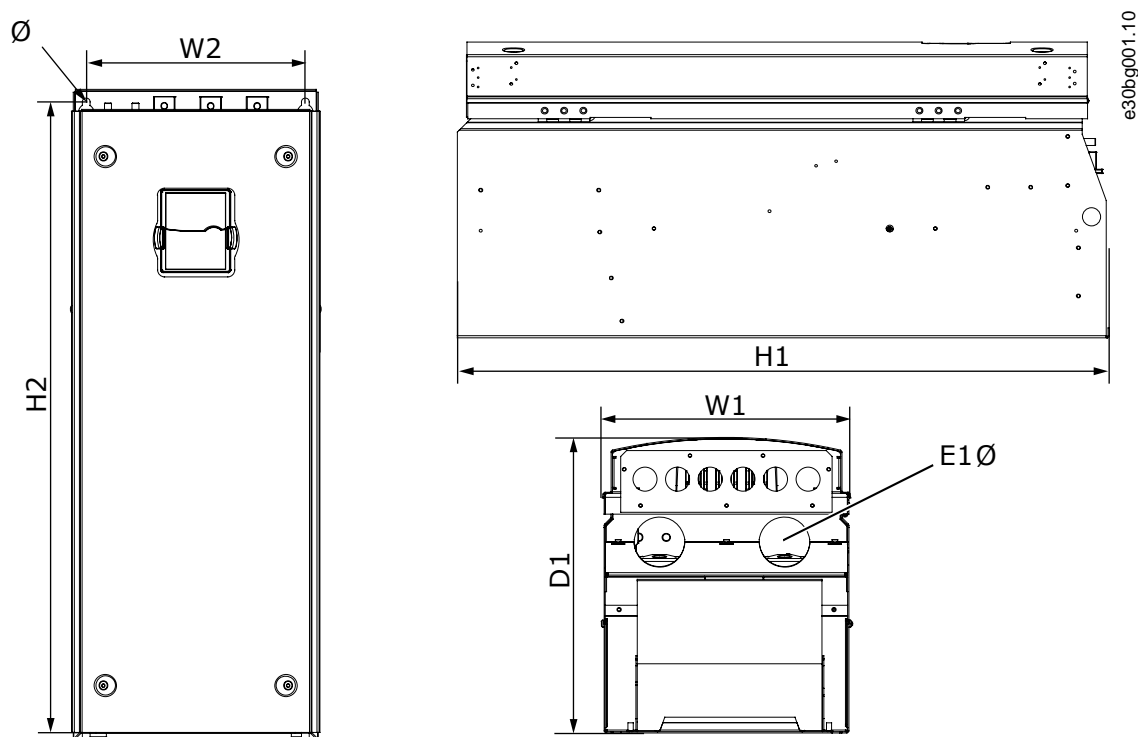


Illustration 46: Dimensions of the VACON® NXS/NXP AC Drive, FR8

Table 22: Dimensions in mm (in inch) of the VACON® NXS/NXP AC Drive, FR8

Drive type	W1	W2	H1	H2	D1	Ø	E1Ø
0140 2-0205 2	291	255	758	732	344	9	2 x 59
0140 5-0205 5	(11.47)	(10.04)	(29.88)	(28.81)	(13.54)	(0.35)	(2 x 2.32)
0062 6-0100 6							



12.2.2.4 Dimensions for FR9

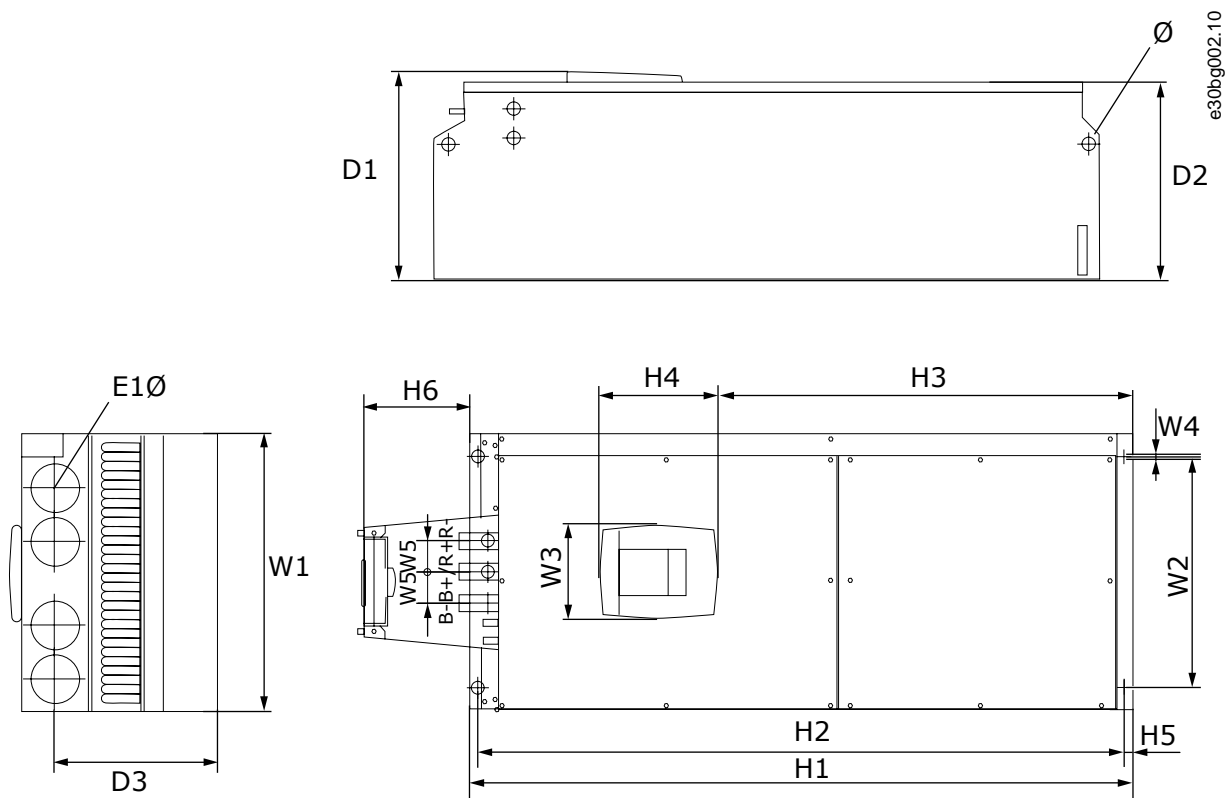


Illustration 47: Dimensions of the VACON® NXS/NXP AC Drive, FR9

Table 23: Dimensions in mm (in inch) of the VACON® NXS/NXP AC Drive, FR9, part 1

Drive type	W1	W2	W3	W4	W5	D1	D2	D3
0261 2-0300 2	480	400	165	9	54	362	340	285
0261 5-0300 5	(18.9)	(15.75)	(15.74)	(0.35)	(2.13)	(14.25)	(13.39)	(11.22)
0125 6-0208 6								

Table 24: Dimensions in mm (in inch) of the VACON® NXS/NXP AC Drive, FR9, part 2

Drive type	H1	H2	H3	H4	H5	H6	Ø	E1Ø
0261 2-0300 2	1150	1120	721	205	16	188	21	59
0261 5-0300 5	(45.28)	(44.09)	(28.39)	(8.07)	(0.63)	(7.40)	(0.83)	(2.32)
0125 6-0208 6	(1)							

<sup>1</sup> Brake resistor terminal box (H6) not included. For FR8 and FR9 when brake chopper or an additional DC connection is selected in type code, the total height of the AC drive is increased by 203 mm (7.99 inch).

### 12.2.3 Flange mounting

#### 12.2.3.1 Dimensions for Flange Mounting, FR4-FR6

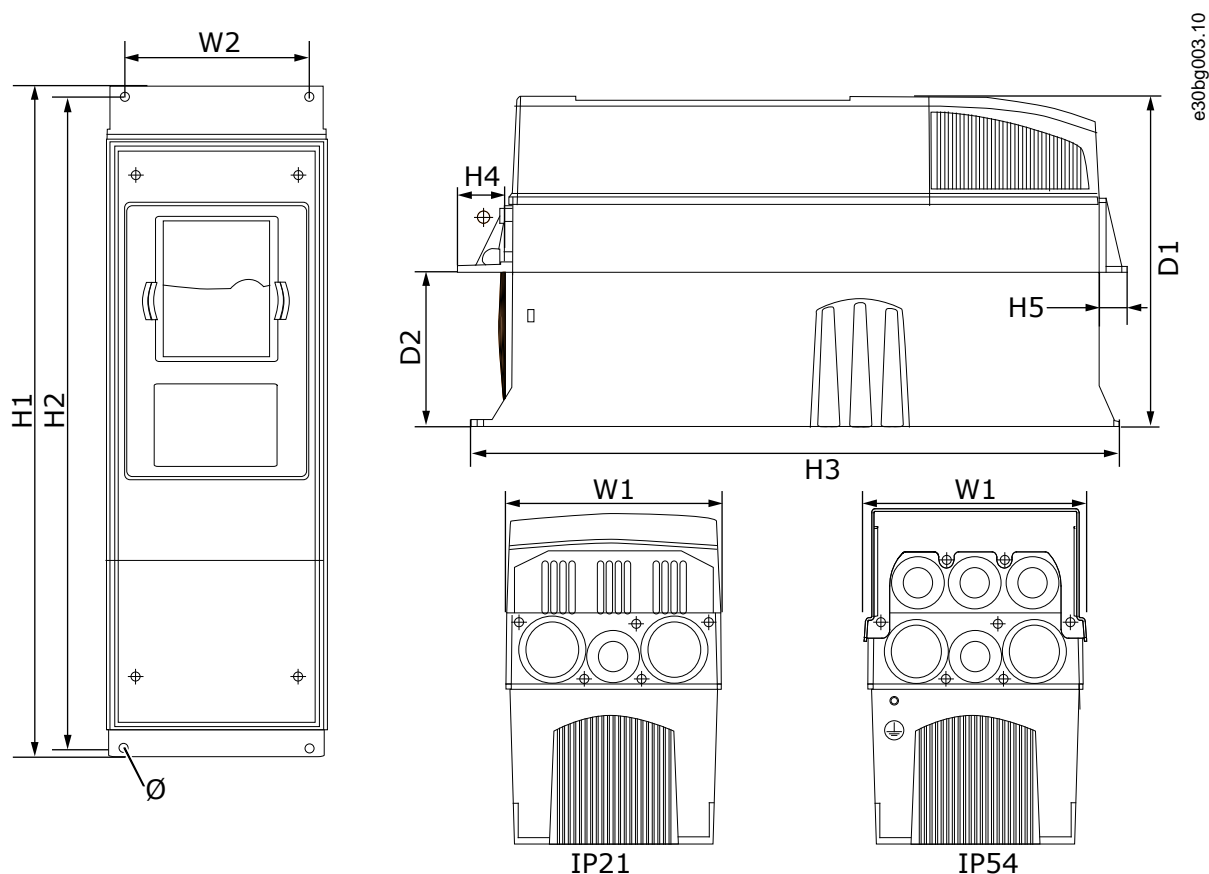


Illustration 48: Dimensions of the VACON® NXS/NXP AC Drive with Flange, FR4-FR6

Table 25: Dimensions in mm (in inch) of the VACON® NXS/NXP AC Drive with Flange, FR4-FR6

Drive type	W1	W2	H1	H2	H3	H4	H5	D1	D2	Ø
0004 2-0012 2	128	113	337	325	327	30	22	190	77	7
0003 5-0012 5	(5.03)	(4.45)	(13.27)	(12.8)	(12.9)	(1.18)	(0.87)	(7.48)	(3.03)	(0.27)
0017 2-0031 2	144	120	434	420	419	36	18	214	100	7
0016 5-0031 5	(5.67)	(4.72)	(17.09)	(16.54)	(16.5)	(1.42)	(0.71)	(8.43)	(3.94)	(0.27)
0048 2-0061 2	195	170	560	549	558	30	20	237	106	6.5
0038 5-0061 5	(7.68)	(6.69)	(22.05)	(21.61)	(22)	(1.18)	(0.79)	(9.33)	(4.17)	(0.26)
0004 6-0034 6										

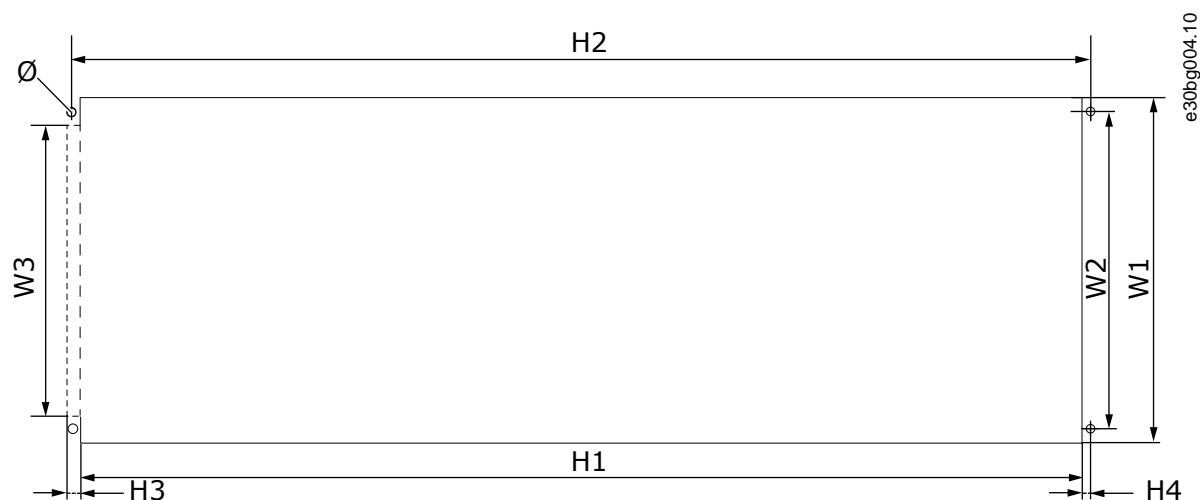


Illustration 49: The Dimensions of the Opening and Drive Outline with Flange, FR4 to FR6

Table 26: The Dimensions in mm (in inch) of the Opening and Drive Outline with Flange, FR4 to FR6

Drive type	W1	W2	W3	H1	H2	H3	H4	Ø
0004 2-0012 2	123	113	-	315	325	-	5	6.5
0003 5-0012 5	(4.84)	(4.45)	(-)	(12.40)	(12.8)	(-)	(0.20)	(0.26)
0017 2-0031 2	135	120	-	410	420	-	5	6.5
0016 5-0031 5	(5.31)	(4.72)	(-)	(16.14)	(16.54)	(-)	(0.20)	(0.26)
0048 2-0061 2	185	170	157	539	549	7	5	6.5
0038 5-0061 5	(7.28)	(6.69)	(6.18)	(21.22)	(21.61)	(0.27)	(0.20)	(0.26)
0004 6-0034 6								

12.2.3.2 Dimensions for Flange Mounting, FR7-FR8

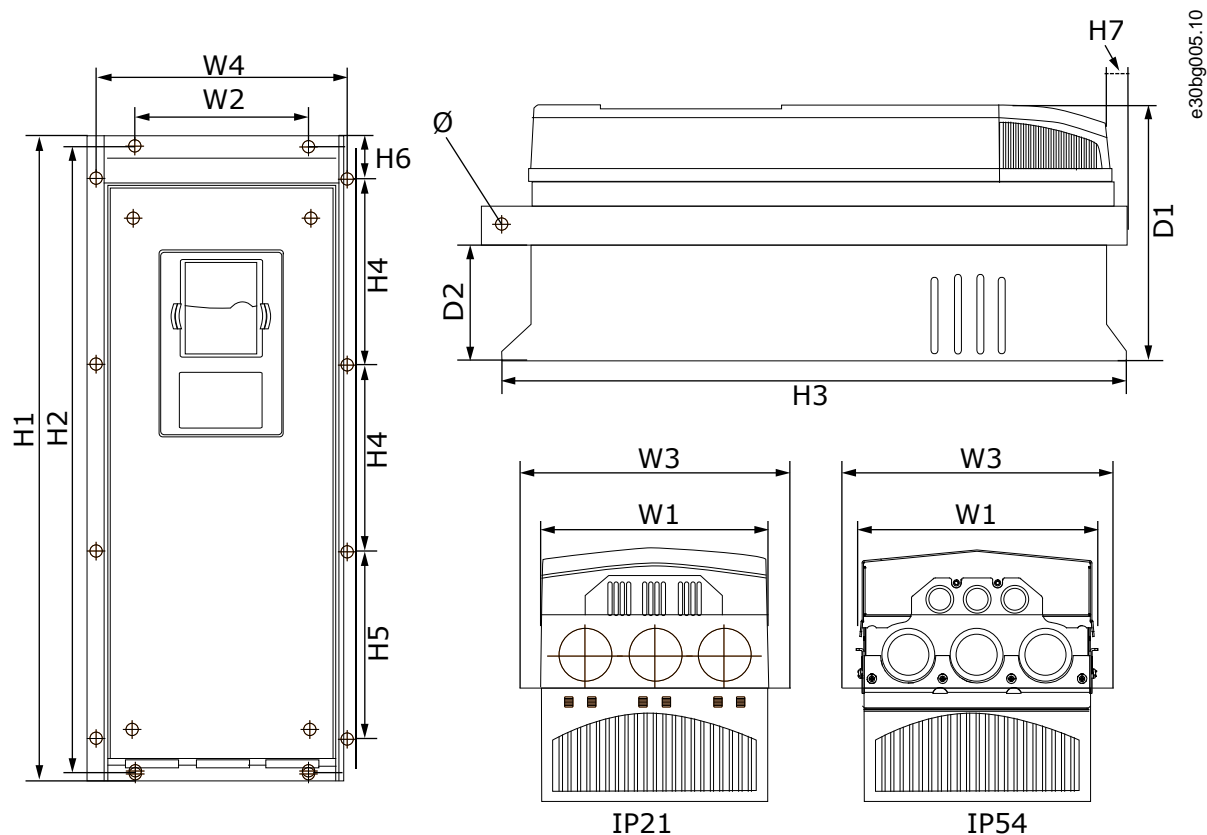


Illustration 50: Dimensions of the VACON® NXS/NXP AC Drive with Flange, FR7 and FR8

Table 27: Dimensions in mm (in inch) of the VACON® NXS/NXP AC Drive with Flange, FR7 and FR8, part 1

Drive type	W1	W2	W3	W4	D1	D2	Ø
0075 2-0114 2	237	175	270	253	257	117	6.5
0072 5-0105 5	(9.33)	(6.89)	(10.63)	(9.96)	(10.12)	(4.61)	(0.26)
0041 6-0052 6							
0140 2-0205 2	289	-	355	330	344	110	9
0140 5-0205 5	(11.38)	(-)	(13.98)	(12.99)	(13.54)	(4.33)	(0.35)
0062 6-0100 6							

Table 28: Dimensions in mm (in inch) of the VACON® NXS/NXP AC Drive with Flange, FR7 and FR8, part 2

Drive type	H1	H2	H3	H4	H5	H6	H7
0075 2-0114 2	652	632	630	188.5	188.5	23	20
0072 5-0105 5	(25.67)	(24.88)	(24.80)	(7.42)	(7.42)	(0.91)	(0.79)
0041 6-0052 6							
0140 2-0205 2	832	-	759	258	265	43	57
0140 5-0205 5	(32.76)	(-)	(29.88)	(10.16)	(10.43)	(1.69)	(2.24)
0062 6-0100 6	<sup>(1)</sup>						

<sup>1</sup> The brake resistor terminal box (202.5 mm (7.97 in)) and conduit box (68 mm (2.68 in)) are not included.

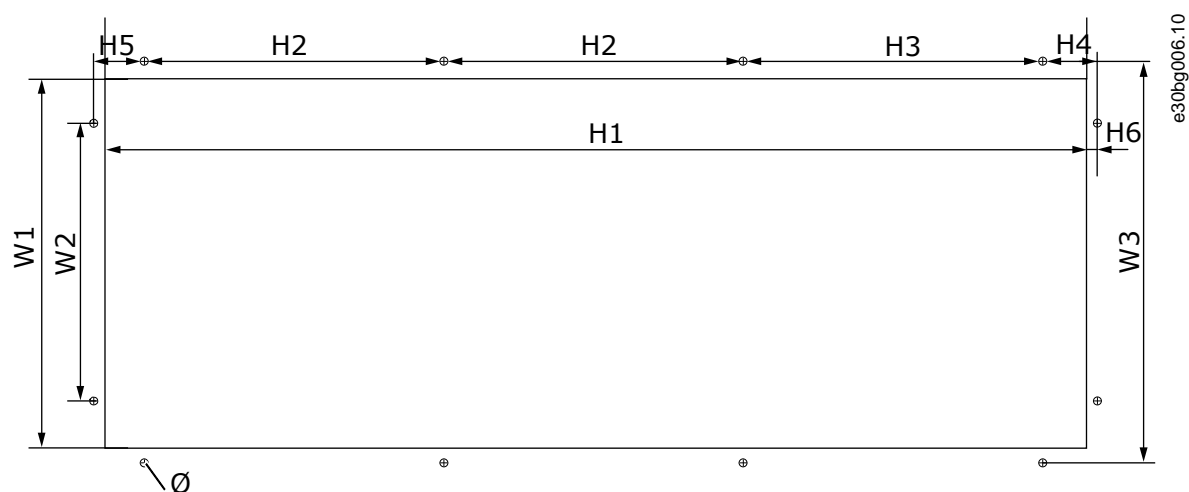


Illustration 51: Dimensions of the Opening and Drive Outline with Flange, FR7

Table 29: Dimensions in mm (in inch) of the Opening and Drive Outline with Flange, FR7

Drive type	W1	W2	W3	H1	H2	H3	H4	H5	H6	Ø
0075 2-0114 2	233	175	253	619	188.5	188.5	34.5	32	7	7
0072 5-0105 5	(9.17)	(6.89)	(9.96)	(24.4)	(7.42)	(7.42)	(1.36)	(1.26)	(0.28)	(0.28)
0041 6-0052 6										

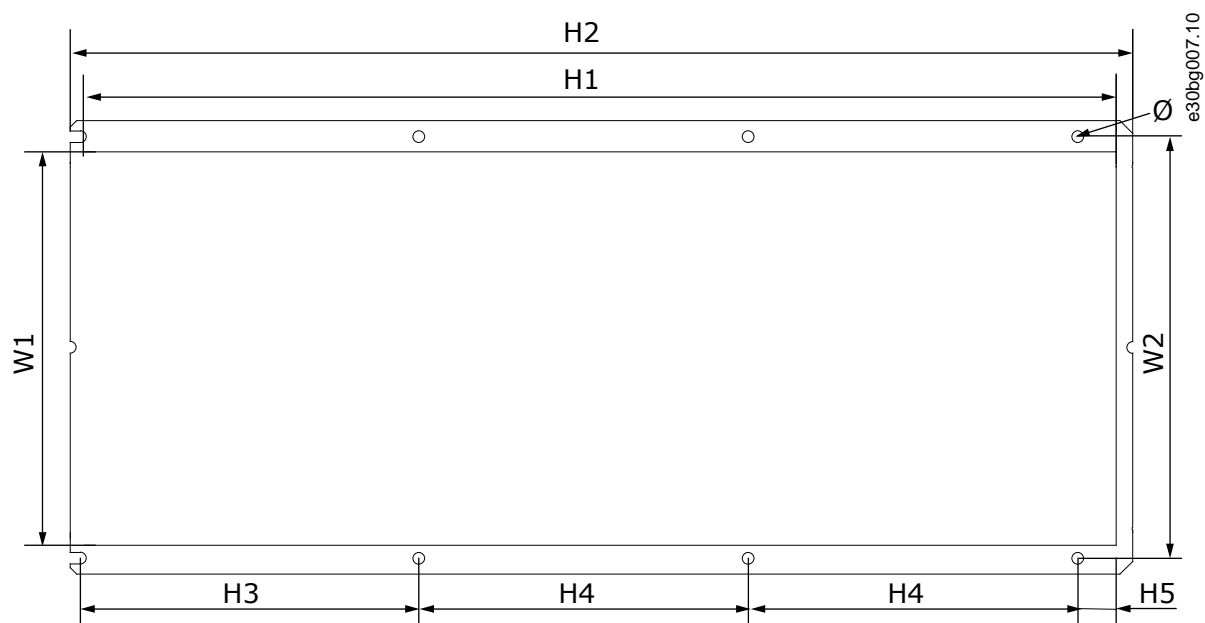
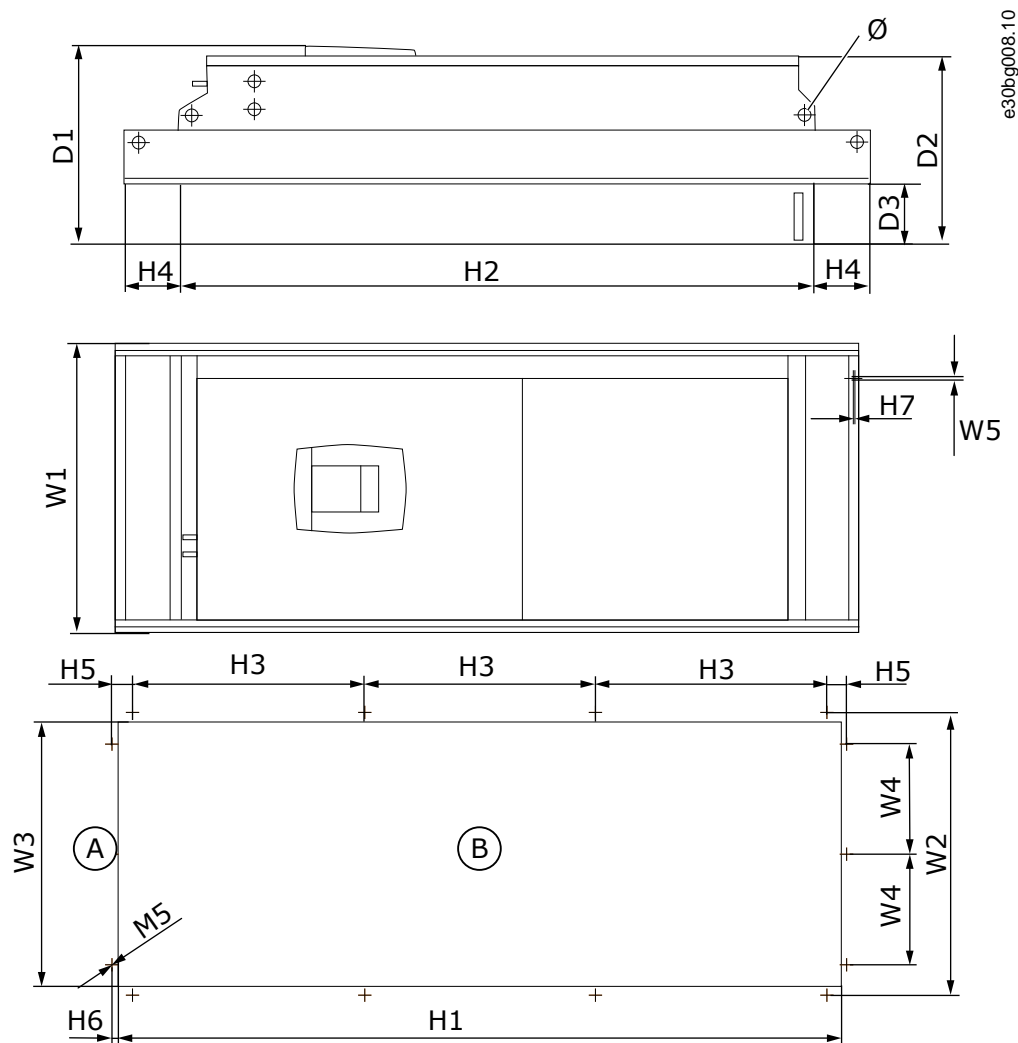


Illustration 52: Dimensions of the Opening and Drive Outline with Flange, FR8

Table 30: Dimensions in mm (in inch) of the Opening and Drive Outline with Flange, FR8

Drive type	W1	W2	H1	H2	H3	H4	H5	Ø
0140 2-0205 2	301	330	810	832	265	258	33	9
0140 5-0205 5	(11.85)	(12.99)	(31.89)	(32.76)	(10.43)	(10.16)	(1.30)	(0.35)
0062 6-0100 6								

12.2.3.3 Dimensions for Flange Mounting, FR9



A Top	B Opening
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Illustration 53: Dimensions of the VACON® NXS/NXP AC Drive, FR9

Table 31: Dimensions in mm (in inch) of the VACON® NXS/NXP AC Drive, FR9, part 1

Drive type	W1	W2	W3	W4	W5	D1	D2	D3	Ø
0261 2-0300 2	530	510	485	200	5.5	362	340	109	21
0261 5-0300 5	(20.87)	(20.08)	(19.09)	(7.87)	(0.22)	(14.25)	(13.39)	(4.29)	(0.83)
0125 6-0208 6									

Table 32: Dimensions in mm (in inch) of the VACON® NXS/NXP AC Drive, FR9, part 2

Drive type	H1	H2	H3	H4	H5	H6	H7
0261 2-0300 2	1312	1150	420	100	35	9	2
0261 5-0300 5	(51.65)	(45.28)	(16.54)	(3.94)	(1.38)	(0.35)	(0.08)
0125 6-0208 6							

## 12.2.4 Standalone

### 12.2.4.1 Dimensions for FR10-FR11

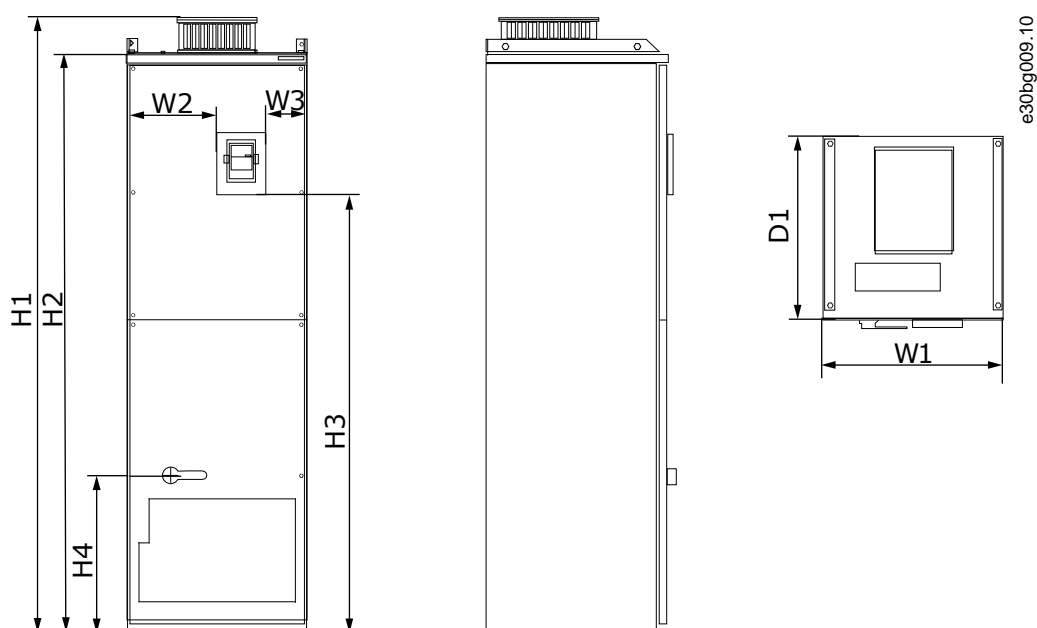


Illustration 54: Dimensions of the VACON® NXS/NXP AC Drive, FR10 and FR11

Table 33: Dimensions in mm (in inch) of the VACON® NXS/NXP AC Drive, FR10 and FR11

Drive type	W1	W2	W3	H1	H2	H3	H4	D1
0385 5-0520 5	595	291	131	2018	1900	1435	512	602
0261 6-0416 6	(23.43)	(11.46)	(5.16)	(79.45)	(74.8)	(56.5)	(20.16)	(23.70)
0590 5-0730 5	794	390	230	2018	1900	1435	512	602
0460 6-0590 6	(31.26)	(15.35)	(9.06)	(79.45)	(74.80)	(56.5)	(20.16)	(23.70)



## 12.3 Cable and Fuse Sizes

### 12.3.1 List of Cable and Fuse Size Information

This topic lists the links to find the cable and fuse size tables for VACON™ NXS and NXP Air Cooled AC Drive.

- [12.3.2 Cable and Fuse Sizes for 208–240 V and 380–500 V, FR4 to FR9](#)
- [12.3.4 Cable and Fuse Sizes for 525–690 V, FR6 to FR9](#)
- [12.3.6 Cable and Fuse Sizes for 380–500 V, FR10 to FR11](#)
- [12.3.8 Cable and Fuse Sizes for 525–690 V, FR10 to FR11](#)

For AC Drives in North America, see:

- [12.3.3 Cable and Fuse Sizes for 208–240 V and 380–500 V, FR4 to FR9, North America](#)
- [12.3.5 Cable and Fuse Sizes for 525–690 V \(UL Rating 600 V\), FR6 to FR9, North America](#)
- [12.3.7 Cable and Fuse Sizes for 380–500 V, FR10 to FR11, North America](#)
- [12.3.9 Cable and Fuse Sizes for 525–690 V \(UL Rating 600 V\), FR10 to FR11, North America](#)

### 12.3.2 Cable and Fuse Sizes for 208–240 V and 380–500 V, FR4 to FR9

Table 34: Cable and Fuse Sizes for VACON® NXS/NXP

Enclosure size	Drive type	I <sub>L</sub> [A]	Fuse (gG/gL) [A]	Mains, motor and brake resistor cable Cu <sup>(1)</sup> [mm <sup>2</sup> ]	Mains terminal [mm <sup>2</sup> ]	Grounding terminal [mm <sup>2</sup> ]
FR4	0003 2—0008 2	3–8	10	3*1.5+1.5	1–4	1–4
	0003 5—0009 5	3–9				
	0011 2—0012 2	11–12	16	3*2.5+2.5	1–4	1–4
	0012 5	12				
FR5	0017 2	17	20	3*4+4	1–10	1–10
	0016 5	16				
	0025 2	25	25	3*6+6	1–10	1–10
	0022 5	22				
	0031 2	31	35	3*10+10	1–10	1–10
	0031 5	31				
FR6	0048 2	48	50	3*10+10	2.5–50 Cu	2.5–35
	0038 5—0045 5	38–45			6–50 Al	
	0061 2	61	63	3*16+16	2.5–50 Cu	2.5–35
	0061 5				6–50 Al	

Enclosure size	Drive type	I <sub>L</sub> [A]	Fuse (gG/gL) [A]	Mains, motor and brake resistor cable Cu <sup>(1)</sup> [mm <sup>2</sup> ]	Mains terminal [mm <sup>2</sup> ]	Grounding terminal [mm <sup>2</sup> ]
FR7	0075 2	75	80	3*25+16	2.5–50 Cu	6–70
	0072 5	72			6–50 Al	
	0088 2	88	100	3*35+16	2.5–50 Cu	6–70
	0087 5	87			6–50 Al	
	0114 2	114	125	3*50+25	2.5–50 Cu	6–70
	0105 5	105			6–50 Al	
FR8	0140 2	140	160	3*70+35	25–95 Cu/Al	6–95
	0140 5					
	0170 2	168	200	3*95+50	95–185 Cu/Al	6–95
	0168 5					
	0205 2	205	250	3*150+70	95–185 Cu/Al	6–95
	0205 5					
FR9	0261 2	261	315	3*185+95 or 2*(3*120+70)	95–185 Cu/Al	6–95
	0261 5					
	0300 2	300	315	2*(3*120+70)	95–185 Cu/Al	6–95
	0300 5					

<sup>1</sup> Uses a correction factor 0.7

### 12.3.3 Cable and Fuse Sizes for 208–240 V and 380–500 V, FR4 to FR9, North America

Table 35: Cable and Fuse Sizes for VACON® NXS/NXP, North America

Enclosure size	Drive type	Fuse Class Fast Acting (T/J) [A]	Mains, Motor, and brake resistor cable Cu [AWG] <sup>(1) (2)</sup>	Mains terminal [AWG]	Grounding terminal [AWG]
FR4	0003 2—0008 2	10	3*16 AWG + 16 AWG	18 AWG - 4 AWG	18 AWG - 4 AWG
	0003 5—0007 5				
	0009 5	15	3*16 AWG + 16 AWG	18 AWG - 4 AWG	18 AWG - 4 AWG
	0011 2—0012 2	15	3*14 AWG + 14 AWG	18 AWG - 4 AWG	18 AWG - 4 AWG
	0012 5				

Enclosure size	Drive type	Fuse Class Fast Acting (T/J) [A]	Mains, Motor, and brake resistor cable Cu [AWG] <sup>(1) (2)</sup>	Mains terminal [AWG]	Grounding terminal [AWG]
FR5	0017 2	20	3*12 AWG + 12 AWG	18 AWG - 8 AWG	18 AWG - 8 AWG
	0016 5				
	0025 2	30	3*10 AWG + 10 AWG	18 AWG - 8 AWG	18 AWG - 8 AWG
	0022 5				
0031 2	40	3*8 AWG + 8 AWG	18 AWG - 8 AWG	18 AWG - 8 AWG	
0031 5					
FR6	0038 5	50	3*8 AWG + 8 AWG	14 AWG - 1 AWG Cu	14 AWG - 2 AWG
				10 AWG - 1 AWG Al	
	0048 2	60	3*8 AWG + 8 AWG	14 AWG - 1 AWG Cu	14 AWG - 2 AWG
	0045 5			10 AWG - 1 AWG Al	
	0061 2	90	3*6 AWG + 6 AWG	14 AWG - 1 AWG Cu	14 AWG - 2 AWG
	0061 5			10 AWG - 1 AWG Al	
FR7	0075 2	90	3*4 AWG + 6 AWG	14 AWG - 1 AWG Cu	10 AWG - 2/0 AWG
	0072 5			10 AWG - 1 AWG Al	
	0088 2	110	3*2 AWG + 6 AWG	14 AWG - 1 AWG Cu	10 AWG - 2/0 AWG
	0087 5			10 AWG - 1 AWG Al	
	0114 2	150	3*2 AWG + 4 AWG	14 AWG - 1 AWG Cu	10 AWG - 2/0 AWG
0105 5	10 AWG - 1 AWG Al				
FR8	0140 2	175	3*2/0 AWG + 2 AWG	4 AWG - 3/0 AWG Cu/Al	10 AWG - 3/0 AWG
	0140 5				
	0170 2	250	3*3/0 AWG + 1/0 AWG	3/0 AWG - 350 kcmil Cu/Al	10 AWG - 3/0 AWG
	0168 5				
	0205 2	250	3*300 kcmil + 2/0 AWG	3/0 AWG - 350 kcmil Cu/Al	10 AWG - 3/0 AWG
0205 5					
FR9	0261 2	350	3*350 kcmil + 3/0 AWG	3/0 AWG - 350 kcmil Cu/Al	10 AWG - 3/0 AWG
	0261 5		2*(3*250 kcmil + 2/0 AWG)		
	0300 2	400	2*(3*250 kcmil + 2/0 AWG)	3/0 AWG - 350 kcmil Cu/Al	10 AWG - 3/0 AWG
	0300 5				

<sup>1</sup> Uses a correction factor 0.7

<sup>2</sup> Use cables with a +90 °C (194 °F) heat resistance to comply with the UL standards.

### 12.3.4 Cable and Fuse Sizes for 525–690 V, FR6 to FR9

**Table 36: Cable and Fuse Sizes for VACON® NXS/NXP**

Enclosure size	Drive type	$I_L$ [A]	Fuse (gG/gL) [A]	Mains, motor, and brake resistor cable Cu <sup>(1)</sup> [mm <sup>2</sup> ]	Mains terminal [mm <sup>2</sup> ]	Grounding terminal [mm <sup>2</sup> ]
FR6	0004 6—0007 6	3–7	10	3*2.5+2.5	2.5–50 Cu 6–50 Al	2.5–35
	0010 6—0013 6	10–13	16	3*2.5+2.5	2.5–50 Cu 6–50 Al	2.5–35
	0018 6	18	20	3*4+4	2.5–50 Cu 6–50 Al	2.5–35
	0022 6	22	25	3*6+6	2.5–50 Cu 6–50 Al	2.5–35
	0027 6—0034 6	27–34	35	3*10+10	2.5–50 Cu 6–50 Al	2.5–35
FR7	0041 6	41	50	3*10+10	2.5–50 Cu 6–50 Al	6–50
	0052 6	52	63	3*16+16	2.5–50 Cu 6–50 Al	6–50
FR8	0062 6—0080 6	62–80	80	3*25+16	25–95 Cu/Al	6–95
	0100 6	100	100	3*35+16		
FR9	0125 6—0144 6	125–144	160	3*95+50	95–185 Cu/Al	6–95
	0170 6	170	200			
	0208 6	208	250	3*150+70		

<sup>1</sup> Uses a correction factor 0.7

### 12.3.5 Cable and Fuse Sizes for 525–690 V (UL Rating 600 V), FR6 to FR9, North America

Table 37: Cable and Fuse Sizes for VACON® NXS/NXP, North America, UL Rating 525–600 V

Enclosure size	Drive type	Fuse Class Fast Acting (T/J) [A]	Mains, Motor, and brake resistor cable Cu [AWG] <sup>(1) (2)</sup>	Mains terminal [AWG]	Grounding terminal [AWG]
FR6	0004 6—0007 6	10	3*14 AWG + 14 AWG	14 AWG - 1 AWG Cu 10 AWG - 1 AWG Al	14 AWG - 2 AWG
	0010 6	15	3*14 AWG + 14 AWG	14 AWG - 1 AWG Cu 10 AWG - 1 AWG Al	14 AWG - 2 AWG
	0013 6	20	3*14 AWG + 14 AWG	14 AWG - 1 AWG Cu 10 AWG - 1 AWG Al	14 AWG - 2 AWG
	0018 6	25	3*12 AWG + 12 AWG	14 AWG - 1 AWG Cu 10 AWG - 1 AWG Al	14 AWG - 2 AWG
	0022 6	30	3*10 AWG + 10 AWG	14 AWG - 1 AWG Cu 10 AWG - 1 AWG Al	14 AWG - 2 AWG
	0027 6	40	3*8 AWG + 8 AWG	14 AWG - 1 AWG Cu 10 AWG - 1 AWG Al	14 AWG - 2 AWG
	0034 6	50	3*8 AWG + 8 AWG	14 AWG - 1 AWG Cu 10 AWG - 1 AWG Al	14 AWG - 2 AWG
	FR7	0041 6	50	3*8 AWG + 8 AWG	14 AWG - 1 AWG Cu 10 AWG - 1 AWG Al
0052 6		70	3*6 AWG + 6 AWG	14 AWG - 1 AWG Cu 10 AWG - 1 AWG Al	10 AWG - 1 AWG
FR8	0062 6	80	3*4 AWG + 6 AWG	4 AWG - 3/0 AWG Cu/Al	10 AWG - 3/0 AWG
	0080 6	100	3*4 AWG + 6 AWG	4 AWG - 3/0 AWG Cu/Al	10 AWG - 3/0 AWG
	0100 6	125	3*2 AWG + 6 AWG	4 AWG - 3/0 AWG Cu/Al	10 AWG - 3/0 AWG
FR9	0125 6—0144 6	200	3*3/0 AWG + 1/0 AWG	3/0 AWG - 350 kcmil Cu/Al	10 AWG - 3/0 AWG
	0170 6	250	3*3/0 AWG + 1/0 AWG	3/0 AWG - 350 kcmil Cu/Al	10 AWG - 3/0 AWG
	0208 6	300	3*300 kcmil + 2/0 AWG	3/0 AWG - 350 kcmil Cu/Al	10 AWG - 3/0 AWG

<sup>1</sup> Uses a correction factor 0.7.

<sup>2</sup> Use cables with a +90 °C (194 °F) heat resistance to comply with the UL standards.

### 12.3.6 Cable and Fuse Sizes for 380–500 V, FR10 to FR11

Table 38: Cable and Fuse Sizes for VACON® NXS/NXP

Enclosure size	Drive type	I <sub>L</sub> [A]	Fuse (gG/gL) [A]	Mains, motor, and brake resistor cable <sup>(1)</sup> [mm <sup>2</sup> ]	Number of supply cables	Number of motor cables
FR10	0385 5	385	400 (3 pcs)	Cu: 2*(3*120+70) Al: 2*(3*185Al+57Cu)	Even/Odd	Even/Odd
	0460 5	460	500 (3 pcs)	Cu: 2*(3*150+70) Al: 2*(3*240Al+72Cu)	Even/Odd	Even/Odd
	0520 5	520	630 (3 pcs)	Cu: 2*(3*185+95) Al: 2*(3*300Al+88Cu)	Even/Odd	Even/Odd
FR11	0590 5	590	315 (6 pcs)	Cu: 2*(3*240+120) Al: 4*(3*120Al+41Cu)	Even	Even/Odd
	0650 5	650	400 (6 pcs)	Cu: 4*(3*95+50) Al: 4*(3*150Al+41Cu)	Even	Even/Odd
	0730 5	730	400 (6 pcs)	Cu: 4*(3*150+70) Al: 4*(3*185Al+57Cu)	Even	Even/Odd

<sup>1</sup> Uses a correction factor 0.7

### 12.3.7 Cable and Fuse Sizes for 380–500 V, FR10 to FR11, North America

Table 39: Cable and Fuse Sizes for VACON® NXS/NXP, North America

Enclosure size	Drive type	Fuse Class Fast Acting (T/J) [A]	Mains, Motor, and brake resistor cable Cu [AWG] <sup>(1)</sup> <sup>(2)</sup>	Number of supply cables	Number of motor cables
FR10	0385 5	500 (3 pcs)	Cu: 2*(3*250 kcmil + 2/0 AWG) Al: 2*(3*350 kcmil Al + 1/0 AWG Cu)	Even/Odd	Even/Odd
	0460 5	600 (3 pcs)	Cu: 2*(3*300 kcmil + 2/0 AWG) Al: 2*(3*500 kcmil Al + 2/0 Cu AWG)	Even/Odd	Even/Odd
	0520 5	700 (3 pcs)	Cu: 2*(3*350 kcmil + 3/0 AWG) Al: 2*(3*600 kcmil Al + 3/0 AWG Cu)	Even/Odd	Even/Odd

Enclosure size	Drive type	Fuse Class Fast Acting (T/J) [A]	Mains, Motor, and brake resistor cable Cu [AWG] <sup>(1)</sup> <sup>(2)</sup>	Number of supply cables	Number of motor cables
FR11	0590 5	400 (6 pcs)	Cu: 2*(3*500 kcmil + 250 kcmil) Al: 4*(3*250 kcmil Al + 1 AWG Cu)	Even	Even/Odd
	0650 5	400 (6 pcs)	Cu: 4*(3*3/0 AWG + 1/0 AWG) Al: 4*(3*300 kcmil Al + 1 AWG Cu)	Even	Even/Odd
	0730 5	500 (6 pcs)	Cu: 4*(3*300 kcmil + 2/0 AWG) Al: 4*(3*350 kcmil Al + 1/0 AWG Cu)	Even	Even/Odd

<sup>1</sup> Uses a correction factor 0.7.

<sup>2</sup> Use cables with a +90 °C (194 °F) heat resistance to comply with the UL standards.

### 12.3.8 Cable and Fuse Sizes for 525–690 V, FR10 to FR11

Table 40: Cable and Fuse Sizes for VACON® NXS/NXP

Enclosure size	Drive type	I <sub>L</sub> [A]	Fuse (gG/gL) [A]	Mains, motor, and brake resistor cable <sup>(1)</sup> [mm <sup>2</sup> ]	Number of supply cables	Number of motor cables
FR10	0261 6	261	315 (3 pcs)	Cu: 3*185+95 Al: 2*(3*95Al+29Cu)	Even/Odd	Even/Odd
	0325 6	325	400 (3 pcs)	Cu: 2x(3*95 + 50) Al: 2*(3*150Al+41Cu)	Even/Odd	Even/Odd
	0385 6	385	400 (3 pcs)	Cu: 2*(3*120+70) Al: 2*(3*185Al+57Cu)	Even/Odd	Even/Odd
	0416 6	416	500 (3 pcs)	Cu: 2*(3*150+70) Al: 2*(3*185Al+57Cu)	Even/Odd	Even/Odd
FR11	0460 6	460	500 (3 pcs)	Cu: 2*(3*150+70) Al: 2*(3*240Al+72Cu)	Even/Odd	Even/Odd
	0502 6	502	630 (3 pcs)	Cu: 2*(3*185+95) Al: 2*(3*300Al+88 Cu)	Even/Odd	Even/Odd
	0590 6	590	315 (6 pcs)	Cu: 2*(3*240+120) Al: 4*(3*120Al+41Cu)	Even	Even/Odd

<sup>1</sup> Uses a correction factor 0.7

### 12.3.9 Cable and Fuse Sizes for 525–690 V (UL Rating 600 V), FR10 to FR11, North America

Table 41: Cable and Fuse Sizes for VACON® NXS/NXP, North America, UL Rating 525–600 V

Enclosure size	Drive type	Fuse Class Fast Acting (T/J) [A]	Mains, Motor, and brake resistor cable Cu <sup>(1)</sup> [AWG] ( <sup>2</sup> )	Number of supply cables	Number of motor cables
FR10	0261 6	350 (3 pcs)	Cu: 3*350 kcmil + 3/0 AWG Al: 2*(3*3/0 AWG Al + 2 AWG Cu)	Even/Odd	Even/Odd
	0325 6	400 (3 pcs)	Cu: 2*(3*3/0 AWG + 1/0 AWG) Al: 2*(3*300 kcmil Al + 1 AWG Cu)	Even/Odd	Even/Odd
	0385 6	500 (3 pcs)	Cu: 2*(3*250 kcmil + 2/0 AWG) Al: 2*(3*350 kcmil Al + 1/0 AWG Cu)	Even/Odd	Even/Odd
	0416 6	500 (3 pcs)	Cu: 2*(3*300 kcmil + 2/0 AWG) Al: 2*(3*350 kcmil Al + 1/0 AWG Cu)	Even/Odd	Even/Odd
FR11	0460 6	600 (3 pcs)	Cu: 2*(3*300 kcmil + 2/0 AWG) Al: 2*(3*500 kcmil Al + 2/0 AWG Cu)	Even/Odd	Even/Odd
	0502 6	700 (3 pcs)	Cu: 2*(3*350 kcmil + 3/0 AWG) Al: 2*(3*600 kcmil Al + 3/0 AWG Cu)	Even/Odd	Even/Odd
	0590 6	400 (6 pcs)	Cu: 2*(3*500 kcmil + kcmil250) Al: 4*(3*250 kcmil Al + 1 AWG Cu)	Even	Even/Odd

<sup>1</sup> Use cables with a +90 °C (194 °F) heat resistance to comply with the UL standards.

<sup>2</sup> Uses a correction factor 0.7

### 12.4 Cable Stripping Lengths

See [illustration 55](#) for parts of cables to be stripped and check the corresponding stripping length in the table.



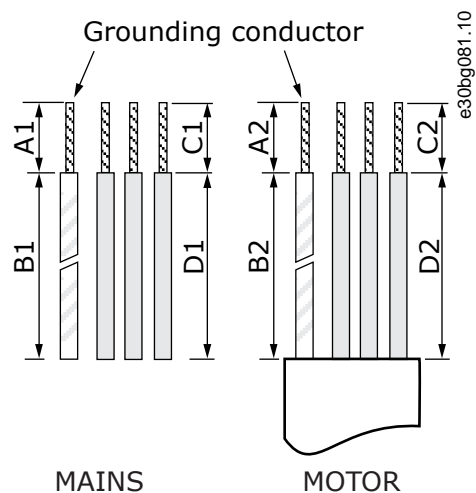


Illustration 55: Cable Stripping

Table 42: Cable Stripping Lengths [mm]

Enclosure size	A1	B1	C1	D1	A2	B2	C2	D2
FR4	15	35	10	20	7	50	7	35
FR5	20	40	10	30	20	60	10	40
FR6	20	90	15	60	20	90	15	60
FR7	25	120	25	120	25	120	25	120
FR8	23	240	23	240	23	240	23	240
0140	28	240	28	240	28	240	28	240
0168—0205								
FR9	28	295	28	295	28	295	28	295

Table 43: Cable Stripping Lengths [in]

Enclosure size	A1	B1	C1	D1	A2	B2	C2	D2
FR4	0.59	1.38	0.39	0.79	0.28	1.97	0.28	1.38
FR5	0.79	1.57	0.39	1.18	0.79	2.36	0.79	1.57
FR6	0.79	3.54	0.59	2.36	0.79	3.54	0.59	2.36
FR7	0.98	4.72	0.98	4.72	0.98	4.72	0.98	4.72
FR8	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
0140	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
0168—0205								
FR9	1.10	11.61	1.10	11.61	1.10	11.61	1.10	11.61

## 12.5 Tightening Torques for Cover Screws

Enclosure size and class	Cable cover screws (Nm)	Screws on the cover of the AC drive (Nm)
FR4 IP54	2.2	0.7
FR5 IP21/ IP54	2.2	0.7
FR6 IP21/ IP54	2.2	0.7
FR7 IP21/ IP54	2.4	0.8
FR8 IP54	0.8 Nm <sup>(1)</sup>	0.8
FR9	0.8	0.8

<sup>1</sup> The cover of the power unit.

## 12.6 Tightening Torques of the Terminals

Table 44: Tightening Torques of the Mains and Motor Terminals

Enclosure size	Drive type	Tightening torque (Nm)	Tightening torque (lb-in.)
FR4	0004 2-0012 2	0.5–0.6	4.5–5.3
	0003 5-0012 5		
FR5	0017 2-0031 2	1.2–1.5	10.6–13.3
	0016 5-0031 5		
FR6	0048 2-0061 2	10	88.5
	0038 5-0061 5		
	0004 6-0034 6		
FR7	0075 2-0114 2	10	88.5
	0072 5-0105 5		
	0041 6-0052 6		
FR8	0168 2-0205 2	40	354
	0168 5-0205 5		
FR9	0261 2-0300 2	40	354
	0261 5-0300 5		
	0125 6-0208 6		

## 12.7 Power ratings

### 12.7.1 Overload Capability

The **low overload** means that if 110% of the continuous current ( $I_L$ ) is required for 1 minute every 10 minutes, the remaining 9 minutes must be approximately 98% of  $I_L$  or less. This is to make sure that the output current is not more than  $I_L$  during the duty cycle.

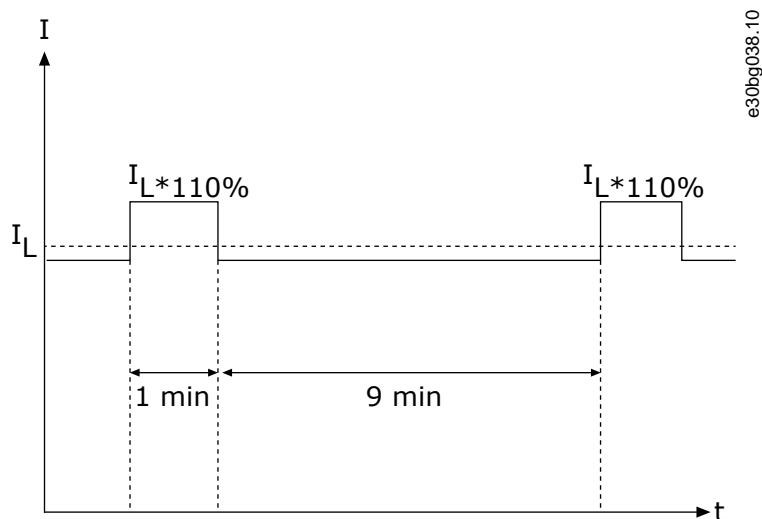


Illustration 56: Low Overload

The **high overload** means that if 150% of the continuous current ( $I_H$ ) is required for 1 minute every 10 minutes, the remaining 9 minutes must be approximately 92% of  $I_H$  or less. This is to make sure that the output current is not more than  $I_H$  during the duty cycle.

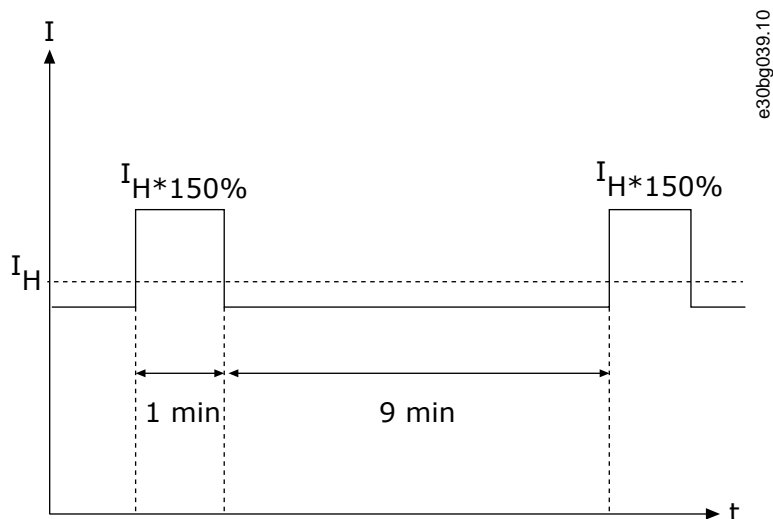


Illustration 57: High Overload

For more information, refer to the standard IEC61800-2 (IEC:1998).

## 12.7.2 Power Ratings for Mains Voltage 208–240 V

Table 45: Power Ratings in Mains 208–240 V, 50 Hz, 3~

Enclosure size	Drive type	Input current $I_{in}^{(1)}$	Low loadability: $I_L$ [A] <sup>(2)</sup>	Low loadability: 10% overload I [A]	High loadability: $I_H$ [A] <sup>(2)</sup>	High loadability: 50% overload I [A]	Loadability: Max $I_5$ 2 s	Motor shaft power <sup>(3)</sup> : 10% overload 40°C [kW]	Motor shaft power <sup>(3)</sup> : 50% overload 50°C [kW]
FR4	0003	3.7	3.7	4.1	2.4	3.6	4.8	0.55	0.37
	0004	4.8	4.8	5.3	3.7	5.6	7.4	0.75	0.55
	0007	6.6	6.6	7.3	4.8	7.2	9.6	1.1	0.75
	0008	7.8	7.8	8.6	6.6	9.9	13.2	1.5	1.1
	0011	11	11.0	12.1	7.8	11.7	15.6	2.2	1.5
FR5	0012	12.5	12.5	13.8	11.0	16.5	22.0	3.0	2.2
	0017	17.5	17.5	19.3	12.5	18.8	25.0	4.0	3.0
	0025	25	25	27.5	17.5	26.3	35.0	5.5	4.0
FR6	0031	31	31	34.1	25.0	37.5	50.0	7.5	5.5
	0048	48	48	52.8	31.0	46.5	62.0	11.0	7.5
FR7	0061	61	61.0	67.1	48.0	72.0	96.0	15.0	11.0
	0075	75	75.0	83.0	61.0	92.0	122.0	22.0	15.0
	0088	88	88.0	97.0	75.0	113.0	150.0	22.0	22.0
FR8	0114	114	114.0	125.0	88.0	132.0	176.0	30.0	22.0
	0140	140	140.0	154.0	105.0	158.0	210.0	37.0	30.0
	0170	170	170.0	187.0	140.0	210.0	280.0	45.0	37.0
FR9	0205	205	205.0	226.0	170.0	255.0	340.0	55.0	45.0
	0261	261	261.0	287.0	205.0	308.0	410.0	75.0	55.0
	0300	300	300.0	330.0	245.0	368.0	490.0	90.0	75.0

<sup>1</sup> The currents in given ambient temperatures are achieved only when the switching frequency is the same or smaller than the factory default.

<sup>2</sup> See [12.7.1 Overload Capability](#)
<sup>3</sup> 230 V

## 12.7.3 Power Ratings for Mains Voltage 208–240 V, North America

Table 46: Power Ratings in Mains 208–240 V, 60 Hz, 3~, North America

Enclosure size	Drive type	Input current $I_{in}^{(1)}$	Low loadability: $I_L$ [A] <sup>(2)</sup>	Low loadability: 10% overload I [A]	High loadability: $I_H$ [A] <sup>(2)</sup>	High loadability: 50% overload I [A]	Loadability: Max $I_S$ 2 s	Motor shaft power <sup>(3)</sup> : 10% overload 104°F [hp]	Motor shaft power <sup>(3)</sup> : 50% overload 122°F [hp]
FR4	0003	3.7	3.7	4.1	2.4	3.6	4.8	0.75	0.5
	0004	4.8	4.8	5.3	3.7	5.6	7.4	1	0.75
	0007	6.6	6.6	7.3	4.8	7.2	9.6	1.5	1
	0008	7.8	7.8	8.6	6.6	9.9	13.2	2	1.5
	0011	11	11.0	12.1	7.8	11.7	15.6	3	2
FR5	0012	12.5	12.5	13.8	11.0	16.5	22.0	4	3
	0017	17.5	17.5	19.3	12.5	18.8	25.0	5	4
	0025	25	25	27.5	17.5	26.3	35.0	7.5	5
FR6	0031	31	31	34.1	25.0	37.5	50.0	10	7.5
	0048	48	48	52.8	31.0	46.5	62.0	15	10
FR7	0061	61	61.0	67.1	48.0	72.0	96.0	20	15
	0075	75	75.0	83.0	61.0	92.0	122.0	25	20
	0088	88	88.0	97.0	75.0	113.0	150.0	30	25
FR8	0114	114	114.0	125.0	88.0	132.0	176.0	40	30
	0140	140	140.0	154.0	105.0	158.0	210.0	50	40
	0170	170	170.0	187.0	140.0	210.0	280.0	60	50
FR9	0205	205	205.0	226.0	170.0	255.0	340.0	75	60
	0261	261	261.0	287.0	205.0	308.0	410.0	100	75
	0300	300	300.0	330.0	245.0	368.0	490.0	125	100

<sup>1</sup> The currents in given ambient temperatures are achieved only when the switching frequency is the same or smaller than the factory default.

<sup>2</sup> See [12.7.1 Overload Capability](#)
<sup>3</sup> 240 V

## 12.7.4 Power Ratings for Mains Voltage 380–500 V

Table 47: Power Ratings in Mains 380–500 V, 50 Hz, 3~

Enclosure size	Drive type	Input current $I_{in}^{(1)}$	Low load-ability: $I_L$ [A] <sup>(2)</sup>	Low load-ability: 10% overload I [A]	High loadability: $I_H$ [A] <sup>(2)</sup>	High loadability: 50% overload I [A]	Loadability: Max $I_S$ 2 s	Motor shaft power <sup>(3)</sup> : 10% overload 40°C [kW]	Motor shaft power <sup>(3)</sup> : 50% overload 50°C [kW]
FR4	0003	3.3	3.3	3.6	2.2	3.3	4.4	1.1	0.75
	0004	4.3	4.3	4.7	3.3	5	6.6	1.5	1.1
	0005	5.6	5.6	6.2	4.3	6.5	8.6	2.2	1.5
	0007	7.6	7.6	8.4	5.6	8.4	11.2	3	2.2
	0009	9	9	9.9	7.6	11.4	15.2	4	3
	0012	12	12	13.2	9	13.5	18	5.5	4
FR5	0016	16	16	17.6	12	18	24	7.5	5.5
	0022	23	23	25.3	16	24	32	11	7.5
	0031	31	31	34	23	35	44	15	11
FR6	0038	38	38	42	31	47	62	18.5	15
	0045	46	46	49.5	38	57	76	22	18.5
	0061	61	61	67	46	69	92	30	22
FR7	0072	72	72	79	61	92	122	37	30
	0087	87	87	96	72	108	144	45	37
	0105	105	105	116	87	131	174	55	45
FR8	0140	140	140	154	105	158	210	75	55
	0168	170	170	187	140	210	280	90	75
	0205	205	205	226	170	255	340	110	90
FR9	0261	261	261	287.1	205	308	410	132	110
	0300	300	300	330	245	368	490	160	132
FR10 <sup>(3)</sup>	0385	385	385	424	300	450	600	200	160
	0460	460	460	506	385	578	770	250	200
	0520	520	520	576	460	690	920	250	250
FR11 <sup>(3)</sup>	0590	590	590	649	520	780	1040	315	250
	0650	650	650	715	590	885	1180	355	315
	0730	730	730	803	650	975	1300	400	355

<sup>1</sup> The currents in given ambient temperatures are achieved only when the switching frequency is the same or smaller than the factory default.

<sup>2</sup> See [12.7.1 Overload Capability](#)
<sup>3</sup> 400 V

### 12.7.5 Power Ratings for Mains Voltage 380–500 V, North America

Table 48: Power Ratings in Mains 380–500 V, 60 Hz, 3~

Enclosure size	Drive type	Input current $I_{in}^{(1)}$	Low load-ability: $I_L^{(2)}$	Low load-ability: 10% overload $I$ [A]	High loadability: $I_H$ [A] <sup>(2)</sup>	High loadability: 50% overload $I$ [A]	Loadability: Max $I_s$ 2 s	Motor shaft power <sup>(3)</sup> : 10% overload 104°F [hp]	Motor shaft power <sup>(3)</sup> : 50% overload 122°F [hp]
FR4	0003	3.3	3.3	3.6	2.2	3.3	4.4	2	1.5
	0004	4.3	4.3	4.7	3.3	5	6.6	3	2
	0005	5.6	5.6	6.2	4.3	6.5	8.6	4	3
	0007	7.6	7.6	8.4	5.6	8.4	11.2	5	4
	0009	9	9	9.9	7.6	11.4	15.2	7.5	5
FR5	0012	12	12	13.2	9	13.5	18	10	7.5
	0016	16	16	17.6	12	18	24	13	10
	0022	23	23	25.3	16	24	32	20	13
FR6	0031	31	31	34	23	35	44	25	20
	0038	38	38	42	31	47	62	30	25
	0045	46	46	49.5	38	57	76	40	30
FR7	0061	61	61	67	46	69	92	50	40
	0072	72	72	79	61	92	122	60	50
	0087	87	87	96	72	108	144	75	60
FR8	0105	105	105	116	87	131	174	90	75
	0140	140	140	154	105	158	210	125	90
	0168	170	170	187	140	210	280	150	125
FR9	0205	205	205	226	170	255	340	175	150
	0261	261	261	287.1	205	308	410	200	175
	0300	300	300	330	245	368	490	250	200
FR10 <sup>(3)</sup>	0385	385	385	424	300	450	600	350	250
	0460	460	460	506	385	578	770	400	350
	0520	520	520	576	460	690	920	450	400
FR11 <sup>(3)</sup>	0590	590	590	649	520	780	1040	500	450
	0650	650	650	715	590	885	1180	600	500
	0730	730	730	803	650	975	1300	650	600

<sup>1</sup> The currents in given ambient temperatures are achieved only when the switching frequency is the same or smaller than the factory default.

<sup>2</sup> See [12.7.1 Overload Capability](#)

<sup>3</sup> 480 V

### 12.7.6 Power Ratings for Mains Voltage 525–690 V (UL Rating 600 V)

Table 49: Power Ratings in Mains 525–600 V, 50 Hz, 3~

Enclosure size	Drive type	Input current $I_{in}^{(1)}$	Low loadability: $I_L$ [A] <sup>(2)</sup>	Low loadability: 10% overload I [A]	High loadability: $I_H$ [A] <sup>(2)</sup>	High loadability: 50% overload I [A]	Loadability: Max $I_s$ 2 s	Motor shaft power <sup>(3)</sup> : 10% overload 40°C [kW]	Motor shaft power <sup>(3)</sup> : 50% overload 50°C [kW]
FR6	0004	4.5	4.5	5.0	3.2	4.8	6.4	3.0	2.2
	0005	5.5	5.5	6.1	4.5	6.8	9.0	4.0	3.0
	0007	7.5	7.5	8.3	5.5	8.3	11.0	5.5	4.0
	0010	10.0	10.0	11.0	7.5	11.3	15.0	7.5	5.5
	0013	13.5	13.5	14.9	10.0	15.0	20.0	11.0	7.5
	0018	18.0	18	19.8	13.5	20.3	27.0	15.0	11.0
	0022	22.0	22.0	24.2	18.0	27.0	36.0	18.5	15.0
	0027	27.0	27.0	29.7	22.0	33.0	44.0	22.0	18.5
	0034	34.0	34.0	37.0	27.0	41.0	54.0	30.0	22.0
	FR7	0041	41.0	41.0	45.0	34.0	51.0	68.0	37.5
0052		52.0	52.0	57.0	41.0	62.0	82.0	45.0	37.5
FR8	0062	62.0	62.0	68.0	52.0	78.0	104.0	55.0	45.0
	0080	80.0	80.0	88.0	62.0	93.0	124.0	75.0	55.0
	0100	100.0	100.0	110.0	80.0	120.0	160.0	90.0	75.0
FR9	0125	125.0	125.0	138.0	100.0	150.0	200.0	110.0	90.0
	0144	144.0	144.0	158.0	125.0	188.0	250.0	132.0	110.0
	0170	170.0	170.0	187.0	144.0	216.0	288.0	160.0	132.0
	0208	208.0	208.0	229.0	170.0	255.0	340.0	200.0	160.0
FR10 <sup>(3)</sup>	0261	261.0	261.0	287.0	208.0	312.0	416.0	250.0	200.0
	0325	325.0	325.0	358.0	261.0	392.0	522.0	315.0	250.0
	0385	385.0	385.0	424.0	325.0	488.0	650.0	355.0	315.0
	0416	416.0	416.0	358.0	325.0	488.0	650.0	400.0	315.0
FR11 <sup>(3)</sup>	0460	460.0	460.0	506.0	385.0	578.0	770.0	450.0	355.0
	0502	502.0	502.0	552.0	460.0	690.0	920.0	500.0	450.0
	0590	590.0	590.0	649.0	502.0	753.0	1004.0	560.0	500.0

<sup>1</sup> The currents in given ambient temperatures are achieved only when the switching frequency is the same or smaller than the factory default.

<sup>2</sup> See [12.7.1 Overload Capability](#)

<sup>3</sup> 690 V



### 12.7.7 Power Ratings for Mains Voltage 525–690 V (UL Rating 600 V), North America

Table 50: Power Ratings in Mains 525–600 V, 60 Hz, 3~

Enclosure size	Drive type	Input current $I_{in}^{(1)}$	Low loadability: $I_L$ [A] <sup>(2)</sup>	Low loadability: 10% overload I [A]	High loadability: $I_H$ [A] <sup>(2)</sup>	High loadability: 50% overload I [A]	Loadability: Max $I_s$ 2 s	Motor shaft power <sup>(3)</sup> : 10% overload 104°F [hp]	Motor shaft power <sup>(3)</sup> : 50% overload 122°F [hp]
FR6	0004	4.5	4.5	5.0	3.2	4.8	6.4	3	2
	0005	5.5	5.5	6.1	4.5	6.8	9.0	4	3
	0007	7.5	7.5	8.3	5.5	8.3	11.0	5	4
	0010	10.0	10.0	11.0	7.5	11.3	15.0	7.5	5
	0013	13.5	13.5	14.9	10.0	15.0	20.0	10	7.5
	0018	18.0	18	19.8	13.5	20.3	27.0	15	10
	0022	22.0	22.0	24.2	18.0	27.0	36.0	20	15
	0027	27.0	27.0	29.7	22.0	33.0	44.0	25	20
	0034	34.0	34.0	37.0	27.0	41.0	54.0	30	25
FR7	0041	41.0	41.0	45.0	34.0	51.0	68.0	40	30
	0052	52.0	52.0	57.0	41.0	62.0	82.0	50	40
FR8	0062	62.0	62.0	68.0	52.0	78.0	104.0	60	50
	0080	80.0	80.0	88.0	62.0	93.0	124.0	75	60
	0100	100.0	100.0	110.0	80.0	120.0	160.0	100	75
FR9	0125	125.0	125.0	138.0	100.0	150.0	200.0	125	100
	0144	144.0	144.0	158.0	125.0	188.0	250.0	150	125
	0170	170.0	170.0	187.0	144.0	216.0	288.0	150	150
	0208	208.0	208.0	229.0	170.0	255.0	340.0	200	150
FR10 <sup>(3)</sup>	0261	261.0	261.0	287.0	208.0	312.0	416.0	250	200
	0325	325.0	325.0	358.0	261.0	392.0	522.0	350	250
	0385	385.0	385.0	424.0	325.0	488.0	650.0	400	350
	0416	416.0	416.0	358.0	325.0	488.0	650.0	450	350
FR11 <sup>(3)</sup>	0460	460.0	460.0	506.0	385.0	578.0	770.0	500	450
	0502	502.0	502.0	552.0	460.0	690.0	920.0	550	500
	0590	590.0	590.0	649.0	502.0	753.0	1004.0	600	550

<sup>1</sup> The currents in given ambient temperatures are achieved only when the switching frequency is the same or smaller than the factory default.

<sup>2</sup> See [12.7.1 Overload Capability](#)

<sup>3</sup> 575 V

## 12.8 VACON NXP Technical Data

Table 51: Technical Data

Technical item or function		Technical data
Connection of mains	Input voltage $U_{in}$	208–240 V, 380–500 V, 525–690 V, UL rating up to 600 V, -10%...+10%
	Input frequency	45–66 Hz
	Connection to mains	Once per minute or less
	Starting delay	2 s (FR4 to FR8), 5 s (FR9)
	Network imbalance	Max. $\pm 3\%$ of the nominal voltage
	Mains	Mains types: TN, TT, and IT short-circuit current: the maximum short-circuit current must be $< 100$ kA.
Motor connection	Output voltage	0- $U_{in}$
	Constant output current	$I_L$ : Ambient temperature max. $+40$ °C ( $104$ °F) overload $1.1 \times I_L$ (1 min/10 min) $I_H$ : Ambient temperature max. $+50$ °C ( $122$ °F) overload $1.5 \times I_H$ (1 min/10 min) For $50$ – $55$ °C ambient temperatures use derating factor $I_H * 2.5\% / ^\circ\text{C}$
	Starting current	$I_S$ for 2 s each 20 s. After 2 s the current controller makes it go down to $150\% I_H$ .
	Output frequency	0–320 Hz (standard NXP and NXS); 7200 Hz (special NXP with special software)
	Frequency resolution	0.01 Hz (NXS); Application-dependent (NXP)

Technical item or function		Technical data
Control qualities	Control method	Frequency control U/f, Open Loop Sensorless Vector Control, Closed Loop Vector Control (NXP only)
	Switching frequency (see parameter P2.6.9)	208–240 V and 380–500 V, up to 0061: 1–16 kHz Default: 6 kHz 208–240 V, 0075 and larger: 1–10 kHz Default: 3.6 kHz 380–500 V, 0072 and larger: 1–6 kHz Default: 3.6 kHz 525–690 V: 1–6 kHz Default: 1.5 kHz
	<b>Frequency reference</b>	Resolution 0.1% (NXP: 12-bit), accuracy ±1%
	Analog input	Resolution 0.01 Hz
	Panel reference	
	Field weakening point	8–320 Hz
	Acceleration time	0.1–3000 s
	Deceleration time	0.1–3000 s
Braking torque	DC brake: 30% * TN (without the brake option)	

Technical item or function		Technical data
Ambient conditions	Ambient operating temperature	<p><b>FR4-FR9 I<sub>L</sub> current:</b></p> <p>-10 °C (-14 °F) (no frost)...+40 °C (104 °F)</p> <p>I<sub>H</sub> current: -10 °C (-14 °F) (no frost)...+50 °C (122 °F)</p> <p><b>FR10-FR11 (IP21/UL Type 1)</b></p> <p>I<sub>H</sub>/I<sub>L</sub> : -10 °C (-14 °F) (no frost)...+40 °C (104 °F) (except 525–690 V, 0461 and 0590: -10 °C (-14 °F) (no frost)... +35 °C (95 °F))</p> <p><b>FR10 (IP54/UL Type 12)</b></p> <p>I<sub>H</sub>/I<sub>L</sub> : -10 °C (-14 °F) (no frost)...+40 °C (104 °F) (except 380–500 V, 0520 V and 525–690 V, 0416: -10 °C (-14 °F) (no frost)...+35 °C (95 °F))</p> <p>For higher ambient temperatures see Motor connection – Continuous output current in this table.</p>
	Storage temperature	-40 °C (-104 °F)...+70 °C (158 °F)
	Relative humidity	0–95% RH, non-condensing, non-corrosive, no dripping water
	<p><b>Air quality:</b></p> <ul style="list-style-type: none"> <li>• chemical vapors</li> <li>• mechanical particles</li> </ul>	<p>Designed according to</p> <ul style="list-style-type: none"> <li>• IEC 60721-3-3, AC drive in operation, class 3C2</li> <li>• IEC 60721-3-3, AC drive in operation, class 3S2</li> </ul>
	Altitude	<p>100% load capacity (no derating) up to 1000 m (3281 ft) 1% derating for each 100 m (328 ft) above 1000 m (3281 ft)</p> <p>Maximum altitudes:</p> <ul style="list-style-type: none"> <li>• FR4-8 208–240 V: 3000 m (9843 ft) (TN, TT, and IT systems)</li> <li>• FR9-11 208–240 V: 4000 m (13123 ft) (TN, TT, and IT systems)</li> <li>• 208–240 V: 3000 m (9843 ft) (corner-grounded network*)</li> <li>• FR4-8 380–500 V: 3000 m (9843 ft) (TN, TT, and IT systems)</li> <li>• FR9-11 380–500 V: 4000 m (13123 ft) (TN, TT, and IT systems)</li> <li>• 380–500 V: 2000 m (6562 ft) (corner-grounded network **)</li> <li>• 525–690 V: 2000 m (6562 ft) (TN, TT and IT systems, no corner-grounding)</li> </ul> <p>* Corner-grounded network is permitted for FR4-FR9 (Main voltage 208–240 V) up to 3000 m (see <a href="#">6.2.1 Installation in a Corner-grounded Network</a>)</p> <p>** Corner-grounded network is permitted for FR9 – FR11 (Main voltage 380–500 V) up to 2000 m (see <a href="#">6.2.1 Installation in a Corner-grounded Network</a>)</p>
	<p><b>Vibration</b></p> <p>IEC/EN 60068-2-6</p> <p>IEC/EN 61800-5-1</p>	<p>5–150 Hz</p> <p>Displacement amplitude 1 mm (peak) at 5-15.8 Hz (FR4-FR9)</p> <p>Maximum acceleration amplitude 1 G at 15.8–150 Hz (FR4-FR9)</p> <p>Displacement amplitude 0.25 mm (peak) at 5–31 Hz (FR10–FR11)</p> <p>Maximum acceleration amplitude 0.25 G at 31–150 Hz (FR10–FR11)</p>

Technical item or function		Technical data
Ambient conditions	<b>Shock</b> IEC/EN 60068-2-27	UPS Drop Test (for applicable UPS weights) Storage and shipping: max. 15 G, 11 ms (in package)
	Protection rating	IP21 (UL Type 1) standard in entire kW/HP range  IP54 (UL Type 12) option in FR4 to FR10. For IP54 (UL Type 12), a keypad is necessary.
	Pollution degree	PD2
EMC (at default settings)	Immunity	Low frequency:  Complies with IEC 61000-3-12, when $R_{SCE} > 120$ and $I_n < 75$ A  High frequency:  Complies with IEC/EN 61800-3 + A1, 1st and 2 <sup>nd</sup> environment
	Emissions	Depend on EMC level. See <a href="#">table 2</a> .
Noise level	Average noise level (cooling fan) in dB(A)	The sound pressure depends on the cooling fan speed, which is controlled in accordance with the drive temperature.  FR4: 44  FR5: 49  FR6-FR7: 57  FR8: 58  FR9-FR11: 76
Safety standards		IEC/EN 61800-5-1, UL 508C, CSA C22.2 No.274
Approvals		CE, cULus, RCM, KC, EAC, UA. (See the nameplate of the drive for more approvals.) Marine approvals: LR, BV, DNVGL, ABS, RMRS, CCS, KR.
Efficiency		See <a href="http://drives.danfoss.com/knowledge-center/energy-efficiency-directive/#/">http://drives.danfoss.com/knowledge-center/energy-efficiency-directive/#/</a>

Technical item or function		Technical data
Control connections (apply to boards OP-TA1, OPTA2, and OP-TA3)	Analog input voltage	0...+10 V, Ri = 200 kΩ, (-10 V...+10 V joystick control)  Resolution 0.1% (NXP: 12-bit, NXS: 10-bit), accuracy ±1%
	Analog input current	0(4)-20 mA, Ri = 250 Ω differential
	Digital inputs (6)	Positive or negative logic; 18–30 VDC
	Auxiliary voltage	+24 V, ±10%, max volt. ripple < 100 mVrms; max. 250 mA  Dimensioning: max. 1000 mA/control box (power back-up)
	Output reference voltage	+10 V, +3%, max. load 10 mA
	Analog output	0(4)-20 mA; RL max. 500 Ω; Resolution 10 bit; Accuracy ±2%
	Digital outputs	Open collector output, 50 mA/48 V
	Relay outputs	2 programmable change-over relay outputs  Switching capacity (resistive): 24 VDC/8 A, 250 VAC/8 A, 125 VDC/0.4 A  Min.switching load: 5 V/10 mA
Protections	Overvoltage trip limit	The 240 volt drives: 437 V DC  The 500 volt drives: 911 V DC  The 690 volt drives: 1200 V DC
	Undervoltage trip limit	Mains voltage 240 V: 183 V DC  Mains voltage 500 V: 333 V DC  Mains voltage 690 V: 461 V DC
	Ground fault protection	If there is a ground fault in the motor or motor cable, only the AC drive is protected.
	Mains supervision	Trips if some of the input phases are missing
	Motor phase supervision	Trips if some of the output phases are missing
	Overcurrent protection	Yes
	Unit overtemperature protection	Yes
	Motor overload protection	Yes. <sup>(1)</sup>  The motor overload protection activates at 110% of the full load current.
	Motor stall protection	Yes
	Motor underload protection	Yes
Short-circuit protection of +24 V and +10 V reference voltages	Yes	

<sup>1</sup> For the motor thermal memory and the memory retention function to obey the UL 508C requirements, use the system software version NXS00001V175, NXS00002V177 or NXP00002V186 or a newer version. If an older system software is used, install a motor overtemperature protection to comply with the UL regulations.

## 12.9 Brake Resistor Ratings

### 12.9.1 Brake Resistor Ratings

For brake resistor rating tables, see:

- [12.9.2 Brake Resistor Ratings for Mains Voltage 208–240 V](#)
- [12.9.3 Brake Resistor Ratings for Mains Voltage 380–500 V](#)
- [12.9.4 Brake Resistor Ratings for Mains Voltage 525–690 V](#)

For more information, see VACON® NX Brake Resistors User Manual.

### 12.9.2 Brake Resistor Ratings for Mains Voltage 208–240 V

Table 52: Brake Resistor Ratings for VACON® NXS/NXSP AC drives, Mains Voltage 208–240 V, 50/60 Hz, 3~

Enclosure size	Drive type	The minimum brake resistance [Ω]	Brake power @405 V DC [kW] <i>(1)</i>
FR4	0003	30	0.55
	0004	30	0.75
	0007	30	1.1
	0008	30	1.5
	0011	30	2.2
	0012	30	3.0
FR5	0017	30	4.0
	0025	30	5.5
	0031	20	7.5
FR6	0048	10	11.0
	0061	10	15.0
FR7	0075	3.3	22.0
	0088	3.3	22.0
	0114	3.3	30.0
FR8	0140	1.4	37.0
	0170	1.4	45.0
	0205	1.4	55.0
FR9	0261	1.4	75.0
	0300	1.4	90.0

<sup>1</sup> When using recommended resistor types.

## 12.9.3 Brake Resistor Ratings for Mains Voltage 380–500 V

Table 53: Brake Resistor Ratings for VACON® NXS/NXP AC drives, Mains Voltage 380–500 V, 50/60 Hz, 3~

Enclosure size	Drive type	The minimum brake resistance [ $\Omega$ ]	Brake power @845 V DC [kW] <i>(1)</i>
FR4	0003	63	1.5
	0004	63	2.2
	0005	63	3.0
	0007	63	4.0
	0009	63	5.5
	0012	63	7.5
FR5	0016	63	11.0
	0022	63	11.3
	0031	42	17.0
FR6	0038	19	22.0
	0045	19	30.0
	0061	14	37.0
FR7	0072	6.5	45.0
	0087	6.5	55.0
	0105	6.5	75.0
FR8	0140	3.3	90.0
	0168	3.3	110.0
	0205	3.3	132.0
FR9	0261	2.5	160.0
	0300	2.5	200.0
FR10	0385	1.4	250.0
	0460	1.4	315.0
	0520	1.4	355.0
FR11	0590	0.9	400.0
	0650	0.9	450.0
	0730	0.9	500.0

<sup>1</sup> When using recommended resistor types.



## 12.9.4 Brake Resistor Ratings for Mains Voltage 525–690 V

Table 54: Brake Resistor Ratings for VACON® NXS/NXP AC Drives, Mains Voltage 525–690 V, 50/60 Hz, 3~

Enclosure size	Drive type	The minimum brake resistance [ $\Omega$ ]	Brake power @1166 V DC [kW] <i>(1)</i>
FR6	0004	100	3.0
	0005	100	4.0
	0007	100	5.5
	0010	100	7.5
	0013	100	11.0
	0018	30	15.0
	0022	30	18.5
	0027	30	22.0
	0034	30	30.0
FR7	0041	18	37.5
	0052	18	45.0
FR8	0062	9	55.0
	0080	9	75.0
	0100	9	90.0
FR9	0125	6.7	110.0
	0144	6.7	132.0
	0170	6.7	160.0
	0208	6.7	194.2
FR10	0261	2.5	250.0
	0325	2.5	315.0
	0385	2.5	355.0
	0416	2.5	400.0
FR11	0460	1.7	450.0
	0502	1.7	500.0
	0590	1.7	560.0

<sup>1</sup> When using recommended resistor types.

## 12.10 Fault Codes

Table 55: Fault Codes

Fault code	Fault	Subcode in T.14	Possible cause	How to correct the fault
1	Overcurrent	S1 = Hardware trip	<p>There is too high a current (<math>&gt;4 \cdot I_H</math>) in the motor cable. Its cause can be 1 of the following:</p> <ul style="list-style-type: none"> <li>a sudden heavy load increase</li> <li>a short circuit in the motor cables</li> <li>the motor is not the correct type</li> </ul>	Do a check of the loading.
		S2 = Reserved		Do a check of the motor.
		S3 = Current controller supervision		Do a check of the cables and connections.
		S4 = User configured overcurrent limit exceeded		Make an identification run.
2	Overvoltage	S1 = Hardware trip	<p>The DC-link voltage is higher than the limits.</p> <ul style="list-style-type: none"> <li>too short a deceleration time</li> <li>high overvoltage spikes in the supply</li> <li>Start/Stop sequence too fast</li> </ul>	Set the deceleration time longer.
		S2 = Overvoltage control supervision		<p>Use the brake chopper or the brake resistor. They are available as options.</p> <p>Activate the overvoltage controller.</p> <p>Do a check of the input voltage.</p>
3 <sup>(1)</sup>	Earth fault		<p>The measurement of current tells that the sum of the motor phase current is not zero.</p> <ul style="list-style-type: none"> <li>an insulation malfunction in the cables or the motor</li> </ul>	Do a check of the motor cables and the motor.
5	Charging switch		<p>The charging switch is open, when the START command is given.</p> <ul style="list-style-type: none"> <li>operation malfunction</li> <li>defective component</li> </ul>	<p>Reset the fault and start the drive again.</p> <p>If the fault shows again, ask instructions from the local distributor.</p>
6	Emergency stop		Stop signal has been given from the option board.	Do a check of the emergency stop circuit.
7	Saturation trip		<ul style="list-style-type: none"> <li>defective component</li> <li>brake resistor short circuit or overload</li> </ul>	<p>This fault cannot be reset from the control panel.</p> <p>Switch off the power.</p> <p><b>DO NOT RESTART THE DRIVE or CONNECT THE POWER!</b></p> <p>Ask instructions from the factory. If this fault shows at the same time with Fault 1, do a check of the motor cable and the motor.</p>

Fault code	Fault	Subcode in T.14	Possible cause	How to correct the fault
8	System fault	S1 = Reserved	<ul style="list-style-type: none"> <li>operation malfunction</li> <li>defective component</li> </ul>	<p>Reset the fault and start the drive again.</p> <p>If the fault shows again, ask instructions from the local distributor.</p>
		S2 = Reserved		
		S3 = Reserved		
		S4 = Reserved		
		S5 = Reserved		
		S6 = Reserved		
		S7 = Charging switch		
		S8 = No power to driver card		
		S9 = Power unit communication (TX)		
		S10 = Power unit communication (Trip)		
		S11 = Power unit comm. (Measurement)		
9 <sup>(1)</sup>	Undervoltage	S1 = DC-link too low during run	<p>The DC-link voltage is lower than the limits.</p> <ul style="list-style-type: none"> <li>too low a supply voltage</li> <li>AC drive internal fault</li> <li>a defective input fuse</li> <li>the external charge switch is not closed</li> </ul>	<p>If there is a temporary supply voltage break, reset the fault and start the drive again.</p> <p>Do a check of the supply voltage. If the supply voltage is sufficient, there is an internal fault.</p> <p>Ask instructions from the local distributor.</p>
		S2 = No data from power unit		
		S3 = Undervoltage control supervision		
10 <sup>(1)</sup>	Input line supervision		The input line phase is missing.	Do a check of the supply voltage, the fuses, and supply cable.

Fault code	Fault	Subcode in T.14	Possible cause	How to correct the fault
11 <sup>(1)</sup>	Output phase supervision		The measurement of current tells that there is no current in 1 motor phase.	Do a check of the motor cable and the motor.
12	Brake chopper supervision		There is no brake resistor. The brake resistor is broken. A defective brake chopper.	Do a check of the brake resistor and the cabling.  If they are in good condition, there is a fault in the resistor or the brake chopper. Ask instructions from the local distributor.
13	Frequency converter under-temperature		Too low a temperature in the heat sink of the power unit or in the power board. The heat sink temperature is below -10 °C (14 °F).	
14	Frequency converter overtemperature		heat sink temperature is over 90 °C (194 °F) (or 77 °C (170.6 °F), NX_6, FR6). Overtemperature alarm is issued when the heat sink temperature goes over 85 °C (185 °F) (72 °C (161.6 °F)).	Do a check of the actual amount and flow of cooling air.  Examine the heat sink for dust.  Do a check of the ambient temperature.  Make sure that the switching frequency is not too high in relation to the ambient temperature and the motor load.
15 <sup>(1)</sup>	Motor stalled		The motor stalled.	Do a check of the motor and the load.
16 <sup>(1)</sup>	Motor over-temperature		There is too heavy a load on the motor.	Decrease the motor load. If there is no motor overload, do a check of the temperature model parameters.
17 <sup>(1)</sup>	Motor under-load		Motor underload protection has tripped.	Do a check of the load.
18 <sup>(2)</sup>	Unbalance	S1 = Current unbalance	Unbalance between power modules in paralleled power units.	If the fault occurs again, ask instructions from the local distributor.
		S2 = DC voltage unbalance		
22	EEPROM checksum fault		Parameter save fault. <ul style="list-style-type: none"><li>• operation malfunction</li><li>• defective component</li></ul>	If the fault occurs again, ask instructions from the local distributor.
24 <sup>(2)</sup>	Counter fault		Values that showed on the counters are incorrect	
25	Microprocessor watchdog fault		<ul style="list-style-type: none"><li>• operation malfunction</li><li>• defective component</li></ul>	Reset the fault and start the drive again.  If the fault shows again, ask instructions from the local distributor.

Fault code	Fault	Subcode in T.14	Possible cause	How to correct the fault
26	Start-up prevented		Start-up of the drive has been prevented. Run request in ON when new application is downloaded to the drive.	Cancel prevention of start-up if it can be done safely.  Remove Run request
29 <sup>(1)</sup>	Thermistor fault		The thermistor input of option board has detected increase of the motor temperature.	Do a check of the motor cooling and loading.  Do a check of the thermistor connection.  (If thermistor input of the option board is not in use it has to be short-circuited).
30	Safe disable		The input on OPTAF board has opened.	Cancel Safe Disable if it can be done safely.
31	IGBT temperature (hardware)		IGBT Inverter Bridge overtemperature protection has detected too high a short-term overload current.	Do a check of the loading.  Do a check of the motor frame size.  Make an identification run.
32	Fan cooling		Cooling fan of the AC drive does not start, when ON command is given.	Ask instructions from the local distributor.
34	CAN bus communication		Sent message not acknowledged.	Make sure that there is another device on the bus with the same configuration.
35	Application		Problem in application software.	Ask instructions from the local distributor.  For an application programmer: do a check of the application program.
36	Control unit		NXS Control Unit cannot control NXP Power Unit and the opposite way.	Change the control unit.
37 <sup>(2)</sup>	Device changed (same type)		The option board was replaced by a new one that was used before in the same slot. The parameters are available in the drive.	Reset the fault. The device is ready for use. The drive starts to use the old parameter settings.
38 <sup>(2)</sup>	Device added (same type)		The option board was added. The same option board has been used in the same slot before. The parameters are available in the drive.	Reset the fault. The device is ready for use. The drive starts to use the old parameter settings.
39 <sup>(2)</sup>	Device removed		An option board was removed from the slot.	The device is not available. Reset the fault.
40	Device unknown	S1 = Unknown device	An unknown device was connected (the power unit/ option board)	Ask instructions from the local distributor.
		S2 = Power1 not same type as Power2		

Fault code	Fault	Subcode in T.14	Possible cause	How to correct the fault
41	IGBT temperature		IGBT Inverter Bridge overtemperature protection has detected too high a short-term overload current.	Do a check of the loading. Do a check of the motor frame size. Make an identification run.
42	Brake resistor overtemperature		Brake resistor overtemperature protection has detected too heavy braking.	Set the deceleration time longer. Use external brake resistor.
43	Encoder fault	1 = Encoder 1 channel A is missing	Problem detected in encoder signals.	Do a check of the encoder connections. Do a check of the encoder board. Do a check of the encoder frequency in the open loop.
		2 = Encoder 1 channel B is missing		
		3 = Both encoder 1 channels are missing		
		4 = Encoder reversed		
		5 = Encoder board missing		
44 <sup>(2)</sup>	Device changed (different type)		Option board or power unit changed. New device of different type or different power rating.	Reset. Set the option board parameters again if option board was changed. If power unit was changed, set AC drive parameters again.
45 <sup>(2)</sup>	Device added (different type)		Option board of different type added.	Reset. Set the power unit parameters again.
49	Division by zero in application		Division by zero has occurred in application program.	If the fault shows again while the AC drive is in run state, ask instructions from the local distributor. For an application programmer: do a check of the application program.
50 <sup>(1)</sup>	Analogue input $I_{in} < 4\text{mA}$ (sel. signal range 4 to 20 mA)		Current at the analog input is $< 4\text{mA}$ control cable is broken or loose signal source has failed.	Do a check of the current loop circuitry.
51	External fault		Digital input fault.	Remove fault situation on external device.

Fault code	Fault	Subcode in T.14	Possible cause	How to correct the fault
52	Keypad communication fault		The connection between the control panel (or NCDrive) and the drive is defective.	Do a check of the control panel connection and the control panel cable.
53	Fieldbus fault		The data connection between the fieldbus master and the fieldbus board is defective.	Do a check of the installation and fieldbus master.  If the installation is correct, ask instructions from the local distributor.
54	Slot fault		Defective option board or slot	Do a check of the board and slot.  Ask instructions from the local distributor.
56	Over Temp.		Temperature exceeded set limit.  Sensor disconnected.  Short circuit.	Find the cause of temperature rise.
57 <sup>(2)</sup>	Identification		Identification run has failed.	Run command was removed before completion of identification run.  The motor is not connected to the AC drive.  There is load on motor shaft.
58 <sup>(1)</sup>	Brake		Actual status of the brake is different from the control signal.	Do a check of the mechanical brake state and connections.
59	Follower communication		SystemBus or CAN communication is broken between Master and Follower.	Do a check of the option board parameters.  Do a check of the optical fiber cable or CAN cable.
60	Cooling		Cooling liquid circulation on liquid-cooled drive has failed.	Do a check of the reason for the failure on the external system.
61	Speed error		Motor speed is unequal to reference.	Do a check of the encoder connection.  PMS motor has exceeded the pull-out torque.
62	Run disable		Run enable signal is low.	Do a check of the reason for the Run enable signal.
63 <sup>(2)</sup>	Emergency stop		Command for emergency stop received from digital input or fieldbus.	New run command is accepted after reset.
64 <sup>(2)</sup>	Input switch open		Drive input switch is open.	Do a check of the main power switch of the drive.
65	Over Temp.		Temperature exceeded set limit.  Sensor disconnected.  Short circuit.	Find the cause of temperature rise.
70 <sup>(1)</sup>	Active filter fault		Fault triggered by dig. input (see param. P2.2.7.33).	Remove fault situation on active filter

Fault code	Fault	Subcode in T.14	Possible cause	How to correct the fault
74	Follower fault		When using normal Master Follower function this fault code is given if one or more follower drives trip to fault.	

<sup>1</sup> It is possible to set different responses in the application for these faults. See parameter group Protections.

<sup>2</sup> A faults (alarms) only.



12.11 EU Declaration of Conformity



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**EU DECLARATION OF CONFORMITY**

**Danfoss A/S**

**Vacon Ltd**

declares under our sole responsibility that the

Product(s) Vacon NXL AC drive

Type(s) Vacon NXL 0001 5.... to 0061 5....  
Vacon NXL 0002 2.... to 0006 2....

Covered by this declaration is in conformity with the following directive(s), standard(s) or other normative document(s), provided that the product is used in accordance with our instructions.

Safety: EN 61800-5-1:2007  
EN 60204-1:2006+A1:2009 (as relevant)

EMC: EN 61800-3:2004+A1:2012

RoHS: EN 50581:2012

and conforms to the relevant safety provisions of Low Voltage Directive 2014/35/EU, EMC Directive 2014/30/EU and RoHS Directive 2011/65/EU.

The year the CE marking was affixed: 2002

Date: 27/10 2017	Issued by Signature: Name: Michael Quitzau Title: Head of Standard & Decentral Drives	Date: 27/10 2017	Approved by Signature: Name: Timo Kasi Title: VP, Design Center Finland and Italy
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Danfoss only vouches for the correctness of the English version of this declaration. In the event of the declaration being translated into any other language, the translator concerned shall be liable for the correctness of the translation.

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Illustration 58: EU Declaration of Conformity

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