ENGINEERING
TOMORROW

Operating Guide

VACON® NXS/NXP Air-cooled

Wall-mounted and Standalone

drives.danfoss.com | VACON®

Contents

1 Introduction

1.1 Purpose of this Operating Guide

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

1.2 Additional Resources

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

- The VACON® NX application guides provide greater detail on working with parameters and show 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 guides 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 Version History

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

The original language of this guide is English.

Table 1: Version History

Version	Remarks
DPD00910J	Changed information about FR10 Standalone drive structure in 6.5.7 Installing the Cables, FR10 Standalone and 12.2.4.1 Dimensions for FR10–FR11 Standalone. Added Z class definition for protection rating in 3.3 Description of the Type Code. Added tightening torque information for FR8 in 12.6 Tightening Torques of the Terminals. Other minor changes.
DPD00910K	Updated the description of the type code.

1.4 Recommended Disposal

When the product reaches the end of its service life, its primary components can be recycled.

Before the materials can be removed, the product must be disassembled. Product parts and materials can be dismantled and separated. Generally, all metals, such as steel, aluminum, copper and its alloys, and precious metals can be recycled as material. Plastics, rubber, and cardboard can be used in energy recovery. Printed circuit boards and large electrolytic capacitors with a diameter of over 2.5 cm (1 in) need further treatment according to IEC 62635 guidelines. To ease recycling, plastic parts are marked with an appropriate identification code.

Contact your local Danfoss office for further information on environmental aspects and recycling instructions for professional recyclers. End-of-life treatment must follow international and local regulations.

All products are designed and manufactured in accordance with Danfoss company guidelines on prohibited and restricted substances. A list of these substances is available at www.danfoss.com.

This symbol on the product indicates that it must not be disposed of as household waste. Do not dispose of equipment containing electrical components together with domestic waste.

It must be handed over to the applicable take-back scheme for the recycling of electrical and electronic equipment.

- Dispose of the product through channels provided for this purpose.
- Comply with all local and currently applicable laws and regulations.

1.5 Type Approvals and Certifications

The table shows examples of possible type approvals and certifications for VACON® drives. The specific approvals and certification for the drive are on the product label of the drive. For more information, contact the local Danfoss office or partner.

Table 2: Type Approvals and Certifications

CE	ErP READY		DNV·GL
cULus	EAC	089	OSHPD
BUREAU VERITAS	LR		RINA 1861
ClassNK			
ABS			

1.6 Start-up Quick Guide

Do at minimum these procedures during the installation and commissioning.

If there are problems, speak to the local distributor.

Danfoss Drives Oy 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 Safety Precautions.

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 Technical Data.
4. Check the dimensions of the motor cable, mains cable, mains fuses and check the cable connections. Read 6.1.1 Overview of Cable Connections, 6.2.1 EMC-compliant Installation, 6.2.2 Installation in a Corner-grounded Network, and 6.3 Grounding.
5. Obey the installation instructions. See 6.5.1 Overview of Installing the Cables.
6. Find information on the control connections in 7.3.2.1 Control Terminals Overview.
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, submenu 6.1. For instructions, see 8.7.3 Changing the Language.
   b. Select the application from the Menu M6, submenu 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 product label. For more information on the parameters in the list, see the *VACON® All in One Application Guide*.
   - 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 Danfoss documentation.

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 information considered important, but not hazard-related (for example, messages relating to property damage).

The guide also includes ISO symbols for general warnings, warnings related to hot surfaces and burn hazard, high voltage and electric shock, and referring to the instructions.

	ISO warning symbol for general warnings
	ISO warning symbol for hot surfaces and burn hazard
	ISO warning symbol for high voltage and electric shock
	ISO action symbol for referring to the instructions

2.2 Safety Precautions

DANGER

SHOCK HAZARD FROM POWER UNIT COMPONENTS

The components of the power unit 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, and W, and the DC terminals must be treated as live when the drive is connected to mains. Contact with voltage can lead to death or serious injury.

- Do not touch the motor terminals U, V, and W, and the DC terminals when the drive is connected to mains.
- Do not work on live equipment.
- Before doing any work on internal drive components, follow proper lock out and tag out procedure.
- Before connecting the drive to mains, make sure that all covers are installed on the drive, and the cabinet doors are closed.

DANGER

SHOCK HAZARD FROM DC LINK OR EXTERNAL SOURCE

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

- Do not touch the main circuit of the drive or the motor before the system is powered off and grounded.
- Disconnect the drive from the mains and ensure that the motor has stopped.
- Disconnect the motor.
- Lock out and tag out the power source to the drive.
- Ensure that no external source generates unintended voltage during work.
- Ground the drive for work.
- Wait for the capacitors to discharge fully before opening the door or the cover of the AC drive. Refer to the label on the drive for the correct discharge time.
- 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 DC supply. 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 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 the auto reset function is activated, 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.

- If an accidental start can be dangerous, disconnect the motor from the drive.
- 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 device (RCD) Type B or a residual current-operated monitoring device (RCM) 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.

⚠ WARNING

ELECTROMAGNETIC INTERFERENCE

AC drives and filters can produce electromagnetic interference up to 300 GHz that can affect the functionality of pacemakers and other implanted medical devices.

⚠ CAUTION

CUT HAZARD

Sharp edges in the drive can cause cuts.

- Wear protective gloves during installation, cabling, and service 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 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.

NOTICE

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.

NOTICE

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 grounded with a grounding conductor that is connected to the grounding terminal that is identified with the PE symbol.

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.

- Use ESD protection 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

This product can cause radio interference.

- Take supplementary mitigation measures.

NOTICE

MAINS DISCONNECTION 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.

VACON® NX can be used as programmable logic controller (PLC) in many applications due to extensive I/O and fieldbus options and easy programmability. Custom application development can be done with VACON® Programming tool and standard PLC programming languages defined in the IEC 61131/3.

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

RADIO INTERFERENCE

This product can cause radio interference.

- Take supplementary mitigation measures.

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 Technical Data.

3.2 Package Label

The package label gives detailed information about the delivery.

Figure 1: Package Label of VACON® NX AC Drives (Example)

A	The batch ID	**B**	The order number
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		

3.3 Description of the Type Code

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

The code can have this format, for example:

- NXP00035-A2H1SSV-A1A2E30000+DNOT

Table 3: Description of the Type Code

Code	Description
VACON	This part is the same for all the products.
NXP	The product range: • NXP = VACON® NXP • NXS = VACON® NXS
0003	The drive rating in amperes. For example, 0003 = 3 A

Table 3: Description of the Type Code - (continued)

Code	Description
5	The mains voltage: • 2 = 208–240 V • 5 = 380–500 V • 6 = 525–690 V (IEC) 525–600 V (cULus)
A	The control panel: • A = standard (text display) • B = no local control panel • F = dummy keypad • G = graphical display
2	The protection rating: • 0 = IP00 • 2 = IP21 (UL Type 1) • 5 = IP54 (UL Type 12) • T = flange-mounted (through-hole mounted), power part IP54, control part IP21 • Z = flange-mounted (through-hole mounted), power part IP54, control part IP00
H	The EMC emission level: • C = complies with the category C1 of standard IEC/EN 61800-3 + A1, 1st environment, and nominal voltage less than 1000 V • H = complies with the category C2 of standard IEC/EN 61800-3 + A1, fixed installations, and nominal voltage less than 1000 V • L = complies with the category C3 of standard IEC/EN 61800-3 + A1, 2nd environment, and nominal voltage less than 1000 V • T = complies with the standard IEC/EN 61800-3 + A1 when used in IT networks (C4) • N = no EMC emission protection. An external EMC filter is necessary
1	The brake chopper: [1] • 0 = no brake chopper • 1 = internal brake chopper • 2 = internal brake chopper and resistor, available for: ◆ 208–240 V (FR4–FR6) ◆ 380–500 V (FR4–FR6)

Table 3: Description of the Type Code - (continued)

Code	Description
SSV	The hardware changes: • The supply, the first letter (**X**xx): ◆ S = 6-pulse connection (FR4 to FR11) ◆ B = additional DC-connection (FR8 to FR11) ◆ O = standard and input switch (Standalone) ◆ J = FR10 to 11 standalone with main switch and DC-link terminals ◆ P = standard and input switch UL (Standalone) ◆ K = DC link connectors and input switch UL (standalone) • The mounting, the second letter: (x**X**x): ◆ S = air-cooled drive ◆ T = flange mounting • The boards, the third letter (xx**X**): ◆ S = standard boards (FR4 to FR8) ◆ V = coated boards (FR4 to FR8) ◆ F = standard boards (FR9 to FR11) ◆ G = coated boards (FR9 to FR11) ◆ A = fiber, Integrated control (FR10 to FR11 standalone drives) ◆ B = fiber, Integrated control, Coated boards (FR10 to FR11 standalone drives) ◆ N = separate IP54 (UL Type 12) control box, standard boards, fiber connection (FR9 IP00, ≥ FR10) ◆ O = separate IP54 (UL Type 12) control box, coated boards, fiber connection (FR9 IP00, ≥ FR10) ◆ X = separate IP00 control box, standard boards (FR9 IP00) ◆ Y = separate IP00 control box, coated boards (FR9 IP00)
A1A2E30000	The option boards. 2 characters for each slot. 00 = the slot is not used The option board abbreviations: • A = basic I/O board • B = expander I/O board • C = fieldbus board • D = special board • E = fieldbus board For example, E3 = PROFIBUS DP
+DNOT	The optional codes. See a full list of option codes in the *VACON® NXP Selection Guide*. • +DQCK = quick guide • +DPAP = paper guides • +DINS = installation guides • +DNOT = no guides included Different language versions of the guides are available, for example +DLUK means the English language.

1) 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)

3.4 Enclosure Sizes

The codes for nominal current and nominal mains voltage are part of the type code (see 3.3 Description of the Type Code) on the package label (see 3.2 Package Label). Use these values to find out the enclosure size of the AC drive from the table.

In the example "NXP**00035**-A2H1SSS-A1A2C30000+DNOT", the code for nominal current is 0003 and the code for nominal mains voltage is 5.

Table 4: 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	FR7
	0088	
	0114	
	0140	FR8
	0170	
	0205	
	0261	FR9
	0300	

Table 4: Enclosure Sizes - (continued)

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 Standalone
	0460	
	0520	
	0590	FR11 Standalone
	0650	
	0730	

Table 4: Enclosure Sizes - (continued)

Nominal mains voltage	Nominal current	Enclosure size
6 (525–690 V)	0004	FR6
	0005	
	0007	
	0010	
	0013	
	0018	
	0022	
	0027	
	0034	
	0041	FR7
	0052	
	0062	FR8
	0080	
	0100	
	0125	FR9
	0144	
	0177	
	0205	
	0261	FR10 Standalone
	0325	
	0385	
	0416	
	0460	FR11 Standalone
	0502	
	0590	

3.5 Available Protection Ratings

Table 5: 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–FR9	x	x
350–500 V	FR10 Standalone	x	x

Table 5: Available Protection Ratings - (continued)

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

3.6 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 3.3 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 6: Available EMC Classes

EMC class in IEC/EN 61800-3 + A1	Equivalent EMC class in VACON® products	Description	Available for
C1	C	The best EMC protection. These AC drives have the nominal voltage of less than 1000 V. They are used in the 1st environment. **NOTICE** If the protection rating of the AC drive is IP21 (UL Type 1), only the conducted emissions are in the requirements of category C1.	380–500 V, FR4 to FR6, IP54 (UL Type 12)
C2	H	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.	380–500 V, FR4 to FR9 and 208–240 V, FR4 to FR9
C3	L	Includes AC drives that have the nominal voltage of less than 1000 V. These AC drives are used in the 2nd environment only.	IP21 (UL Type 1) and IP54 (UL Type 12) in 380–500 V FR10 and larger, 525–690 V FR6 and larger

Table 6: Available EMC Classes - (continued)

EMC class in IEC/EN 61800-3 + A1	Equivalent EMC class in VACON® products	Description	Available for
C4	T	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 the ground, or connected to the ground through high impedance to decrease the leakage current. **NOTICE** If the AC drives are used with other supplies, they do not comply with the EMC requirements. To change the EMC class of the VACON® NX AC drive from C2 or C3 to C4, see the instructions in 6.6.1 Overview of Installation in an IT System.	All products
No EMC emission protection	N	The AC drives of this category do not give EMC emission protection. These drives are installed in enclosures. **NOTICE** • An external EMC filter is usually necessary to comply with the EMC emission requirements. **NOTICE** **RADIO INTERFERENCE** In a residential environment, this product can cause radio interference. • Take supplementary mitigation measures.	In IP00

3.7 Control Panel

3.8 Overview

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.

3.9 Keypad

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

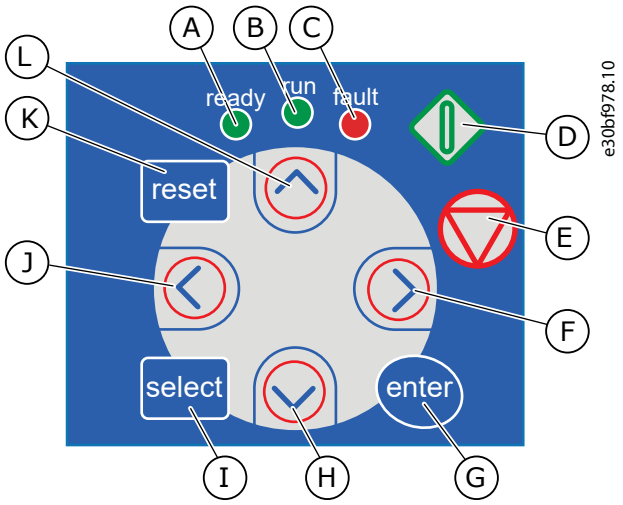


Figure 2: Keypad Buttons for VACON® NXP

A	The *ready* indicator light 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 READY.	**B**	The *run* indicator light is on when the drive operates. The LED blinks when the Stop button is pushed and the LED blinks when the Stop button is pushed and the drive ramps down.
C	The *fault* indicator light blinks when the AC drive is stopped because of dangerous conditions (Fault Trip). See 8.5.1 Finding the Active Faults Menu.	**D**	The Start button. When the keypad is in the active control mode, this button starts the motor. See 8.4.3 Changing the Control Mode.
E	The Stop button. The button stops the motor (unless the stop is disabled by the parameter R3.4/R3.6). See 8.4.2 Keypad Control Parameters M3.	**F**	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.
G	The *enter* button. Use it to accept a selection, reset the fault history (push for 2–3 s).	**H**	The Browser button Down. Use it to scroll the main menu and the pages of different submenus and to decrease a value.
I	The *select* button. Use it to move between 2 last displays, for example, to see how a new value changes some other value.	**J**	The Menu button Left. Use it to move back in the menu, move the cursor left (in the Parameter menu).
K	The *reset* button. Use it to reset a fault.	**L**	The Browser button Up. Use it to scroll the main menu and the pages of different submenus and to increase a value.

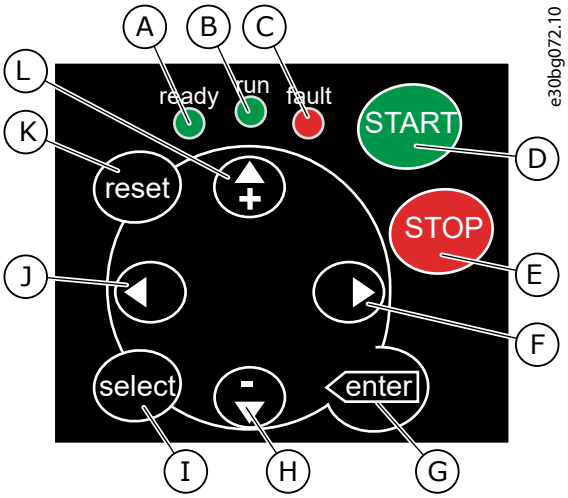


Figure 3: Keypad Buttons for VACON® NXS

A	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 READY.	**B**	The *run* LED is on when the drive operates. The LED blinks when the Stop button is pushed and the drive ramps down.
C	The *fault* LED blinks when the AC drive is stopped because of dangerous conditions (Fault Trip). See 8.5.1 Finding the Active Faults Menu.	**D**	The *START* button. When the keypad is the active control mode, this button starts the motor. See 8.4.3 Changing the Control Mode.
E	The *STOP* button. The button stops the motor (unless the stop is disabled by the parameter R3.4/R3.6). See 8.4.2 Keypad Control Parameters M3.	**F**	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.
G	The *enter* button. Use it to accept a selection, reset the fault history (push for 2–3 s).	**H**	The Browser button Down. Use it to scroll the main menu and the pages of different submenus and to decrease a value.
I	The *select* button. Use it to move between 2 last displays, for example, to see how new value changes some other value.	**J**	The Menu button Left. Use it to move back in the menu, move the cursor left (in the Parameter menu).
K	The *reset* button. Use it to reset a fault.	**L**	The Browser button Up. Use it to scroll the main menu and the pages of different submenus and to increase a value.

3.10 Display

The following figure describes the sections of the display.

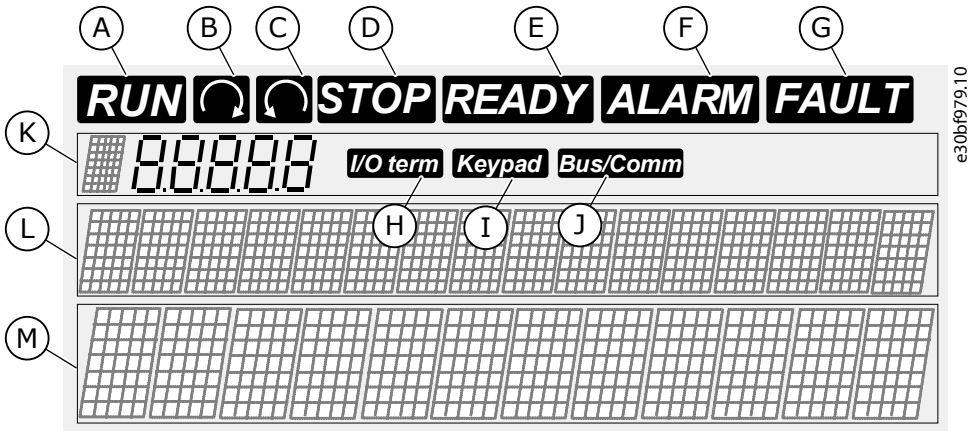


Figure 4: Display Indications

A	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**	The motor rotation direction is forward.
C	The motor rotation direction is reverse.	**D**	The drive does not operate.
E	The AC power is on.	**F**	An alarm is given.
G	A fault is given and the AC drive is stopped.	**H**	The I/O terminals is the active control mode.
I	The control panel is the active control mode.	**J**	The fieldbus is the active control mode.
K	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.	**L**	The description line. The line shows the description of the menu, value, or fault.
M	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.		

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.

3.11 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.

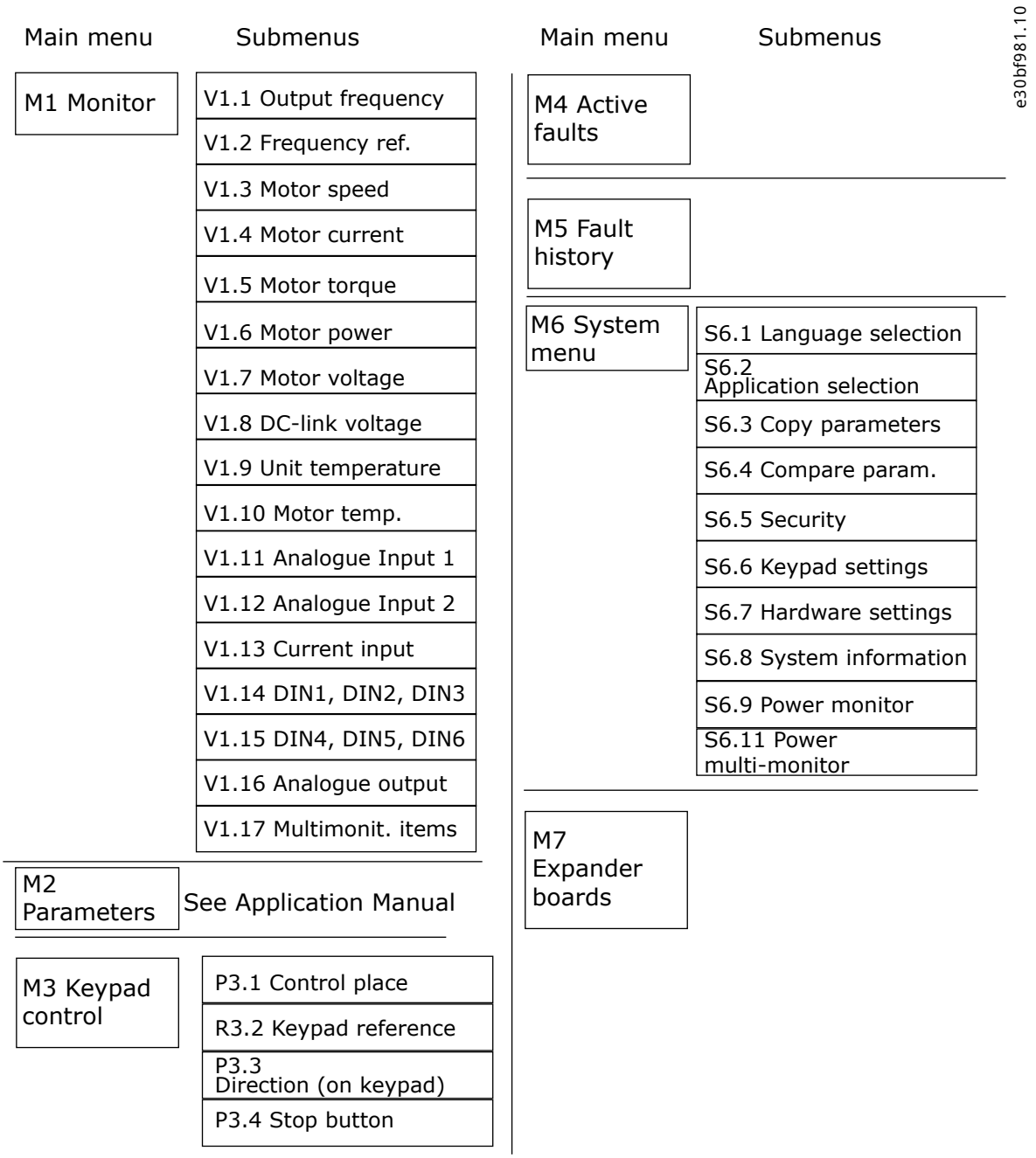


Figure 5: Basic Menu Structure of the AC Drive

4 Receiving the Delivery

4.1 Checking the Delivery

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

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 3.2 Package Label

   If the delivery does not agree with the order, contact 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 3.3 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: 4.2.1 Accessories for FR4–FR6
   - FR7–FR8: 4.2.2 Accessories for FR7–FR8
   - FR10–FR11 Standalone: 4.2.3 Accessories for FR10–FR11 Standalone
   - Flange mounting accessories kits: see details in *Flange Mounting Kit for FR4–FR6 Installation Manual* or *Flange Mounting Kit for FR7–FR9 Installation Manual*.

4.2 Accessories

4.2.1 Accessories for FR4–FR6

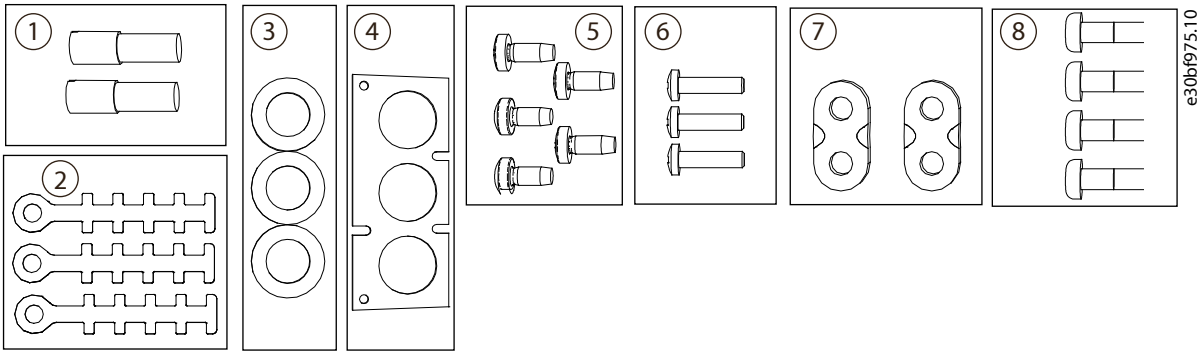


Figure 6: Contents of the Accessories Bag for FR4–FR6

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

4.2.2 Accessories for FR7–FR8

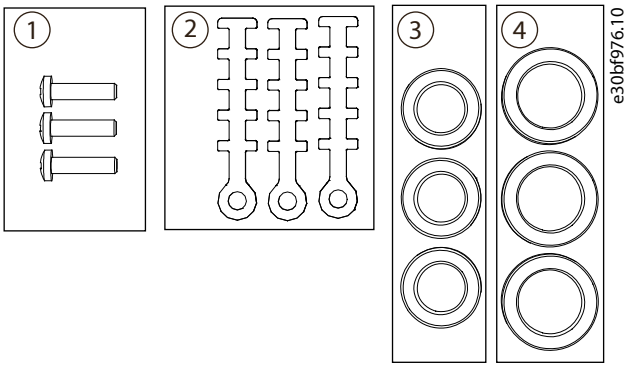


Figure 7: Contents of the Accessories Bag for FR7–FR8

1	Screws, M4x16, 3 pieces	**2**	The grounding clamps for control cable, 3 pieces
3	The rubber grommets GD21 (FR7 IP54/UL Type 12), 3 pieces / (FR8), 6 pieces	**4**	The rubber grommets GDM36 (FR7), 3 pieces

4.2.3 Accessories for FR10–FR11 Standalone

The cabinet door key is attached to the lifting rail at the top of the AC drive.

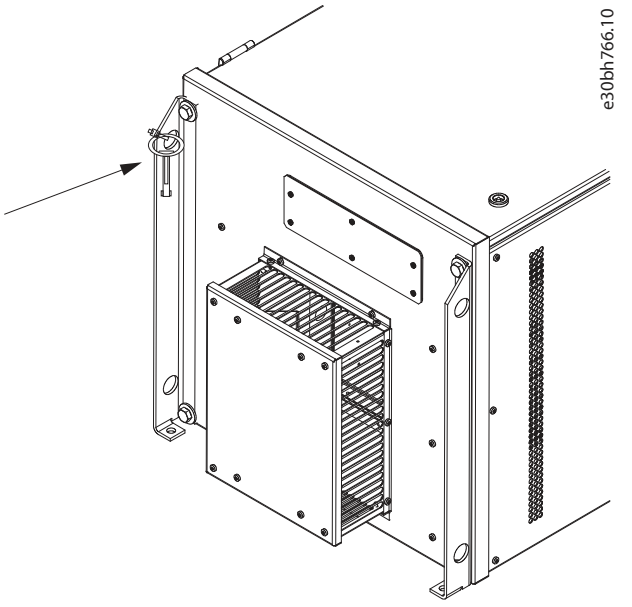


Figure 8: The Cabinet Door Key Location at Delivery

4.3 Storing the Product

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

1. If the AC drive must be stored before using it, make sure that the ambient conditions agree to the following:
   - Storage temperature: -40…+70 °C (-40...+158 °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 10.2.1 Overview of Reforming the Capacitors.

   A long storage time is not recommended.

4.4 Lifting the Product

Lifting instructions depend on the weight of the AC drive. It can be necessary to use a lifting device to move the drive from its package.

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.

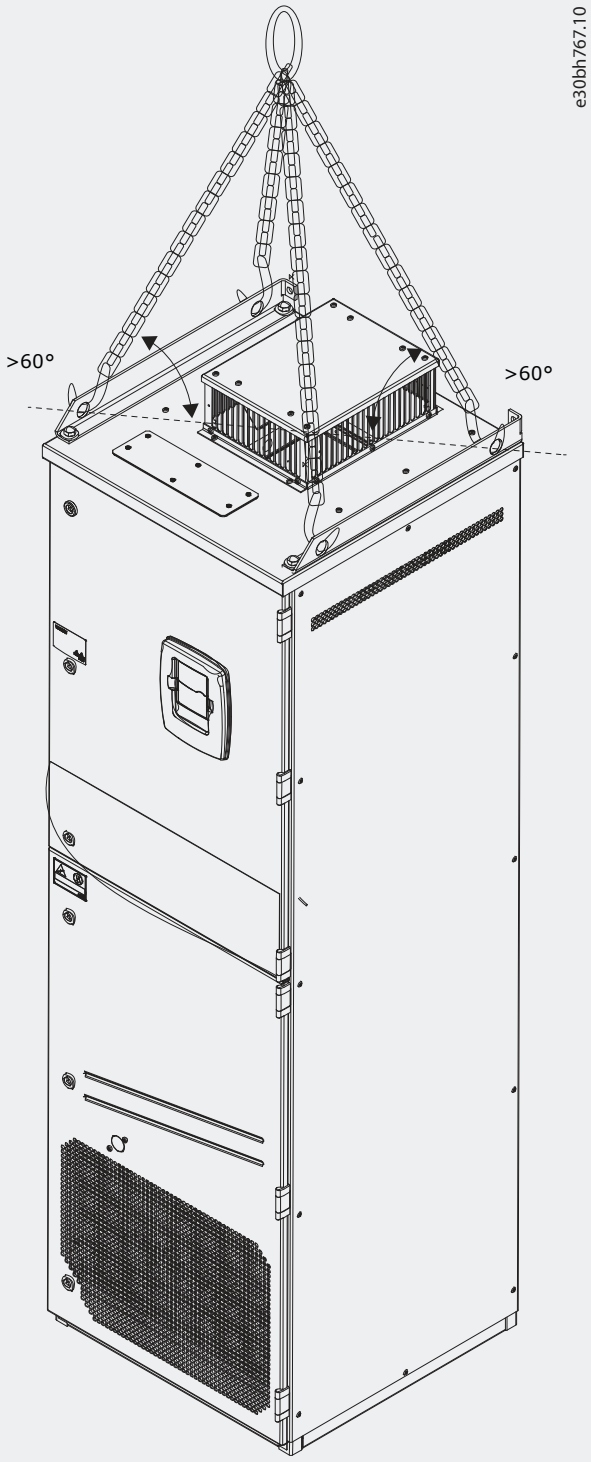


Figure 9: Lifting a Standalone Drive

3. After lifting the drive, check for signs of damage on the drive.

4.5 Using the Product Modified Label

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.

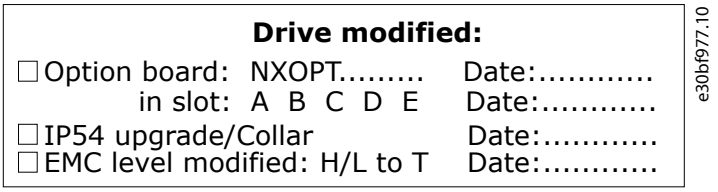


Figure 10: The Product Modified Label

1. Attach the label on the side of the AC drive, in a place where it is easy to find.
2. If changes are made to the AC drive, write the change and date 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.

The AC drive is suitable for marine installations.

For detailed ambient conditions specifications, see 12.8 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 3000 m altitude (check details for different sizes in 12.8 Technical Data).

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

For allowed maximum altitudes, see 12.8 Technical Data.

Above 1000 m, decrease the limited maximum load current by 1% for each 100 m.

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

For example, at 2500 m altitude, decrease the load current down to 85% of the rated output current (100% – (2500–1000 m) / 100 m x 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:

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

Where

I = Current rating at high altitude

I_n = Rated current of a fuse

h = Altitude in meters

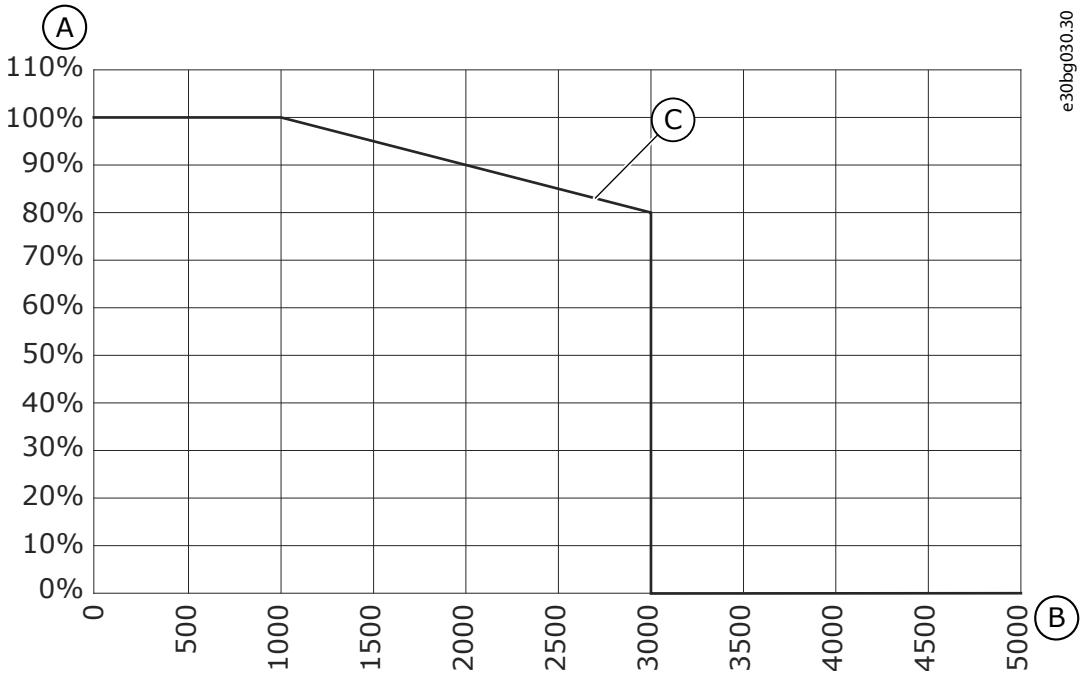


Figure 11: Loadability in High Altitudes

A	Loadability, %	**B**	Altitude, meters
C	Loadability		

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 Figure 12). Make also sure that the outlet air from the lower drive goes to a different direction than the air intake of the top drive.

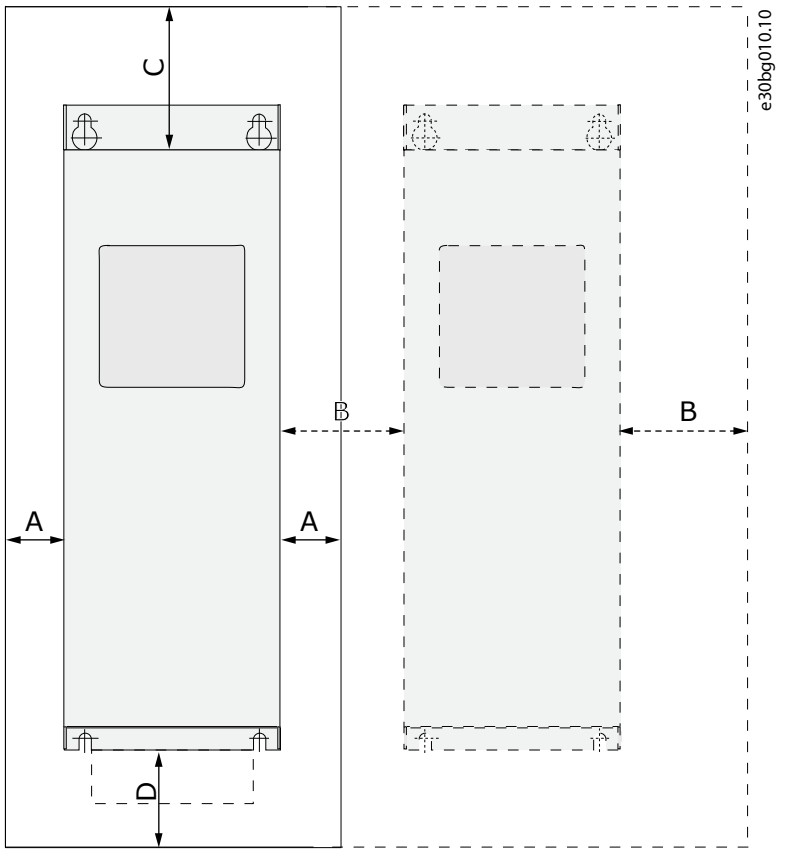


Figure 12: Installation Space

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

Table 7: Minimum Clearances around the AC Drive in mm (in inch)

Drive type	A	B	C	D
0003 2–0012 2 0003 5–0012 5	20 (0.79)	20 (0.79)	100 (3.94)	50 (1.97)
0017 2–0031 2 0016 5–0031 5	20 (0.79)	20 (0.79)	120 (4.72)	60 (2.36)
0048 2–0061 2 0038 5–0061 5 0004 6-0034 6	30 (1.18)	20 (0.79)	160 (6.30)	80 (3.15)
0075 2–0114 2 0072 5–0105 5 0041 6–0052 6	80 (3.15)	80 (3.15)	300 (11.81)	100 (3.94)

Table 7: Minimum Clearances around the AC Drive in mm (in inch) - (continued)

Drive type	A	B	C	D
0140 2–0205 2 0140 5–0205 5 0062 6–0100 6	80 (3.15) (1)	80 (3.15)	300 (11.81)	300 (11.81)
0261 2–0300 2 0261 5–0300 5 0125 6–0208 6	50 (1.97)	80 (3.15)	400 (15.75)	250 / 350 (9.84) / (13.78) (2)

1) 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).

2) The minimum clearance to change the fan.

Table 8: Required Cooling Air

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

5.2.3 Cooling of Standalone AC Drives (FR10 to FR11)

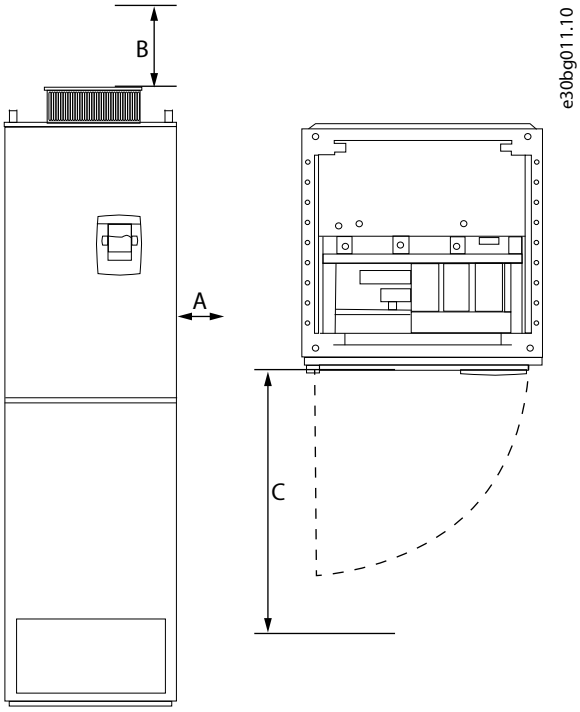


Figure 13: Minimum Clearances around the AC Drive

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

Table 9: Minimum Clearances around the AC Drive in mm (in inch)

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

Table 10: Required Cooling Air

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

For more information on the power losses in all operating conditions, see energy/mydrive/danfoss.com.

5.3 Installation Sequence

5.3.1 Installation Sequence for Wall-mounted AC Drives

Use these instructions to install the wall-mounted AC drive.

1. Select the mounting option:
   - Horizontal

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

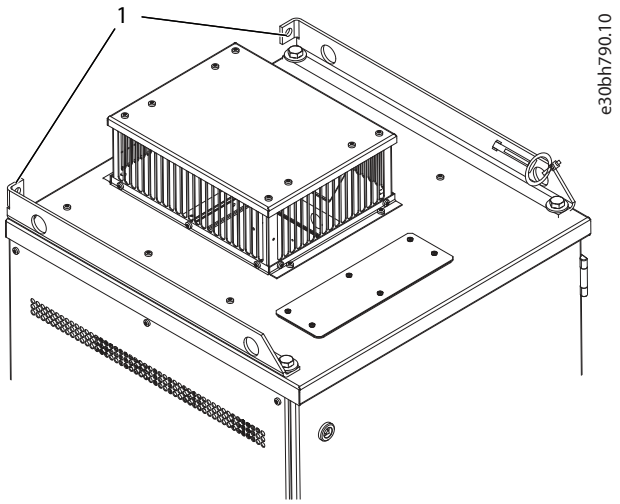
     The AC drive can also be installed into the cabinet wall with a flange mounting option (through hole mounting). With the flange mounting, the protection rating of the power unit is IP54 (UL Type 12) and the protection rating of the control unit is IP21 (UL Type 1).

     For details, see separate *Flange Mounting Kit for FR4–FR6 Installation Manual* or *Flange Mounting Kit for FR7–FR9 Installation Manual*.
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

Use these instructions to install the standalone AC drive.

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 Standalone.
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.



1	Fixing hole, Ø= 13 mm (0.51 in)

6 Electrical Installation

6.1 Cable Connections

6.1.1 Overview of Cable Connections

The mains cables are connected to terminals L1, L2, and L3 (12-pulse units 1L1, 1L2, 1L3, 2L1, 2L2, 2L3). The motor cables are connected to terminals U, V, and W. The 6- and 12-pulse 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–.

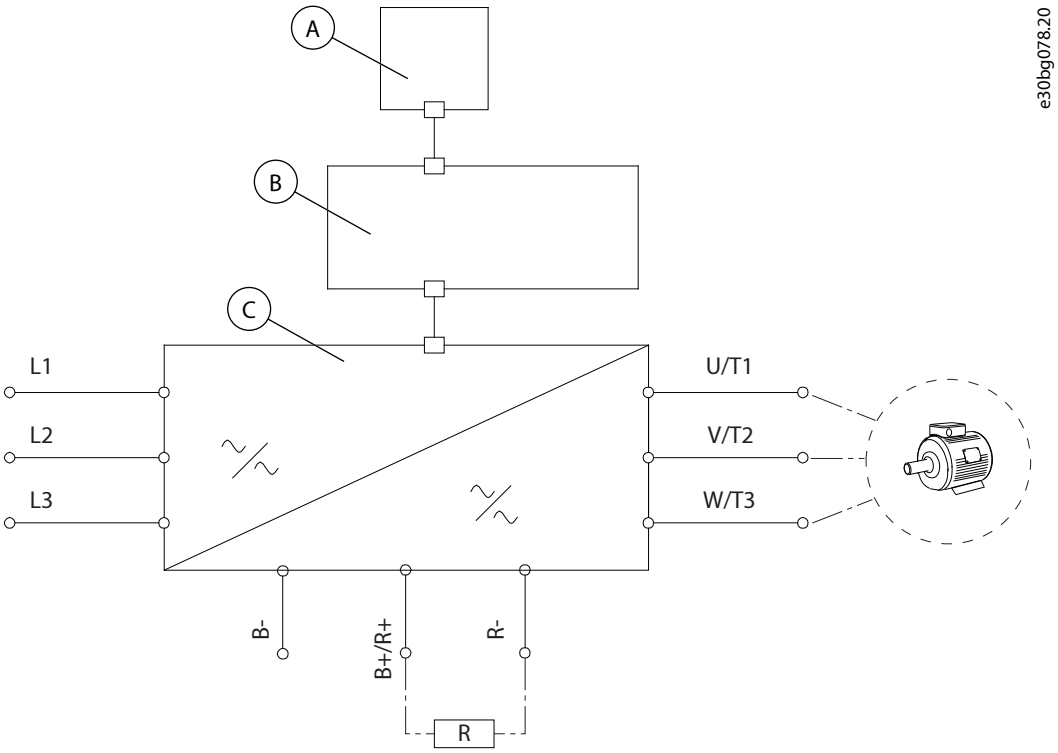


Figure 14: Principal Connection Diagram

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

For EMC-compliant installation, see 6.2.1 EMC-compliant Installation.

6.1.2 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 product label.

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 6.1.3 UL Standards on Cabling.

If the motor temperature protection of the drive (see *VACON® All in One Application Guide*) 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.

6.1.3 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.

6.1.4 Cable Selection and Dimensioning

Find the typical sizes and types of cables used with the product in 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 specifications.

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

- The maximum ambient temperature is +30 °C (86 °F).
- The maximum temperature of the cable surface is +70 °C (158 °F).
- Use only motor 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 cable cross-sections.

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.

6.1.5 Cable Selection and Dimensioning, North America

Find the typical sizes and types of cables used with the AC drive in 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 maximum ambient temperature is +86 °F.
- The maximum temperature of the cable surface is +158 °F.

- Use only motor 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.

6.1.6 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. Refer also to local regulations, cable installation conditions, and cable specification. Do not use larger fuses than what is recommended.

External fuses in the input line are required for overload and short-circuit protection of the drive.

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.

6.1.7 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 Figure 15.

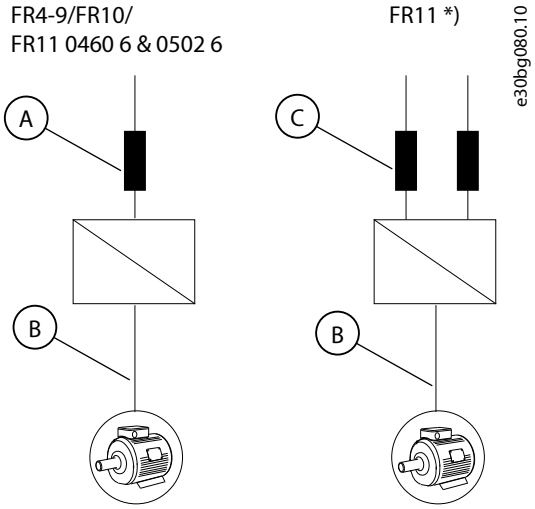


Figure 15: Topology of Enclosure Sizes FR4 – FR11

A	Single input	**B**	Single output
C	Double input	*	The FR11 types 0460 6 and 0502 6 have single input terminal.

6.1.8 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–.

Danfoss recommends shielded motor cable to be used for the brake resistor. Only 2 conductors of a normal 3-phase cable are needed. The shield of the cable must be connected at each end. 360° grounding of the shield is recommended to minimize interference.

The third, unused connector must be grounded by connecting it to the ground at one end.

See list of recommended cables in 12.3.1 List of Cable and Fuse Size Information.

⚠ 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

6.2.1 EMC-compliant Installation

For cable selections in different EMC levels, see Table 11.

For the EMC levels C1 and C2, it is necessary to have a 360° grounding of the shield on both ends of the motor cable.

Table 11: Recommendations for Cables

Cable type	Category C1 and C2[1]	Category C3[2]	Category C4[2]	No EMC protection[2]
Motor cable	• A symmetrical power cable with a compact low-impedance shield. • A cable for the specified mains voltage. • Recommended cable type: NKCABLES /MCCMK, SAB/ÖZCUY-J, or equivalent. See Figure 16.	• A symmetrical power cable with a concentric protection wire. • A cable for the specified mains voltage. • Recommended cable type: NKCABLES/MCMK cable. See Figure 16.		
Mains cable	• A power cable for a fixed installation. • A cable for the specified mains voltage. • A shielded cable is not necessary. • Recommended cable type: NKCABLES/MCMK.			
Control cable	A shielded cable with a compact low-impedance shield, for example, NKCABLES/JAMAK, or an SAB/ÖZCuY-O.			

1) 1st environment

2) 2nd environment

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

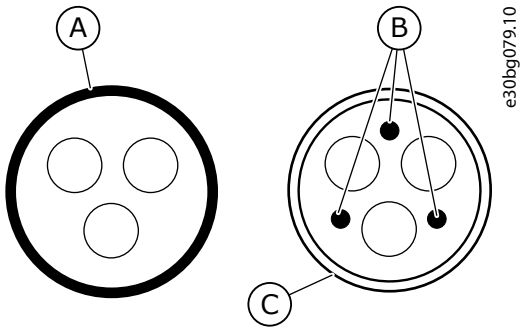


Figure 16: Cables with PE Conductors

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

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

When using 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.

6.2.2 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 6.6.1 Overview of 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 allowed for the FR4–FR9 drives (mains voltage 208–240 V) up to 3000 m and for the FR9–FR11 drives (mains voltage 380–500 V) up to 2000 m.

6.3 Grounding

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

NOTICE

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 grounded 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 protective earthing conductor must have a cross-sectional area of minimum 10 mm^2 Cu or 16 mm^2 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.

IMPORTANT: The connection must be fixed.

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

The values of the table above 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^2 if there is mechanical protection, and
- 4 mm^2 if there is no 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 device (RCD) Type B or a residual current-operated monitoring device (RCM) 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

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

1. Open the cover of the AC drive.

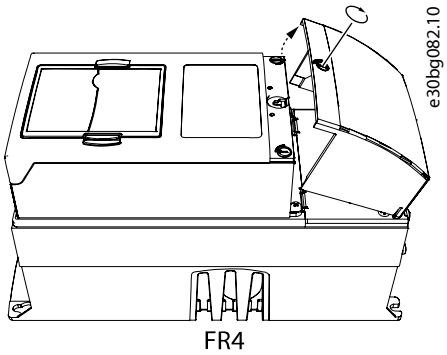


Figure 17: Opening the Cover

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

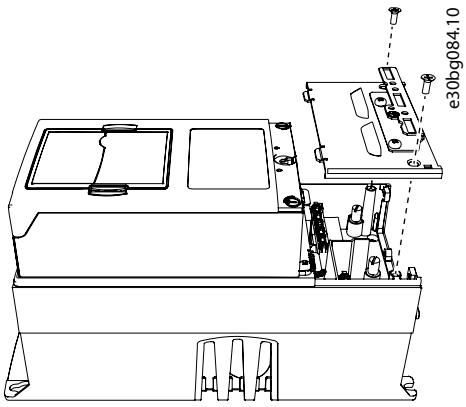


Figure 18: Opening the Cable Cover

3. Locate the terminals.

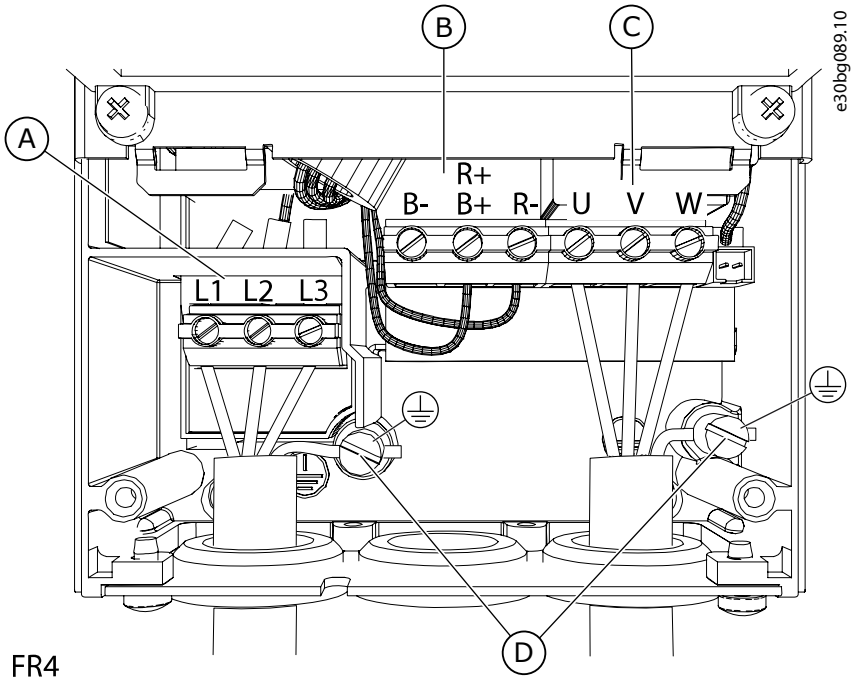


Figure 19: FR4 Terminals

A	Mains terminals	**B**	Brake resistor terminals
C	Motor terminals	**D**	Grounding terminals

6.4.2 Get Access and Locate the Terminals for FR5

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

1. Open the cover of the AC drive.

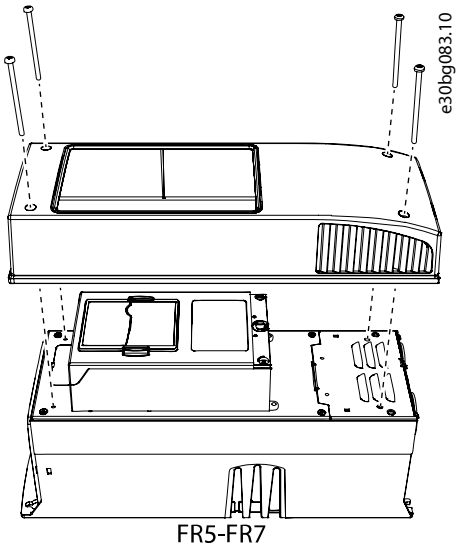


Figure 20: Opening the Cover

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

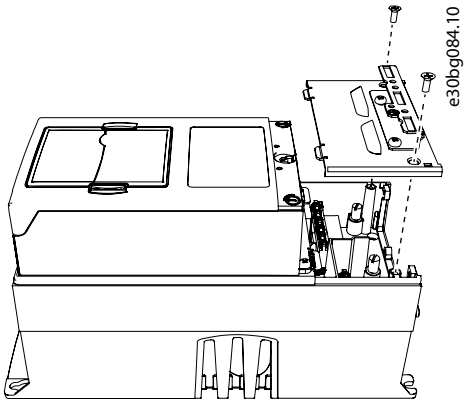
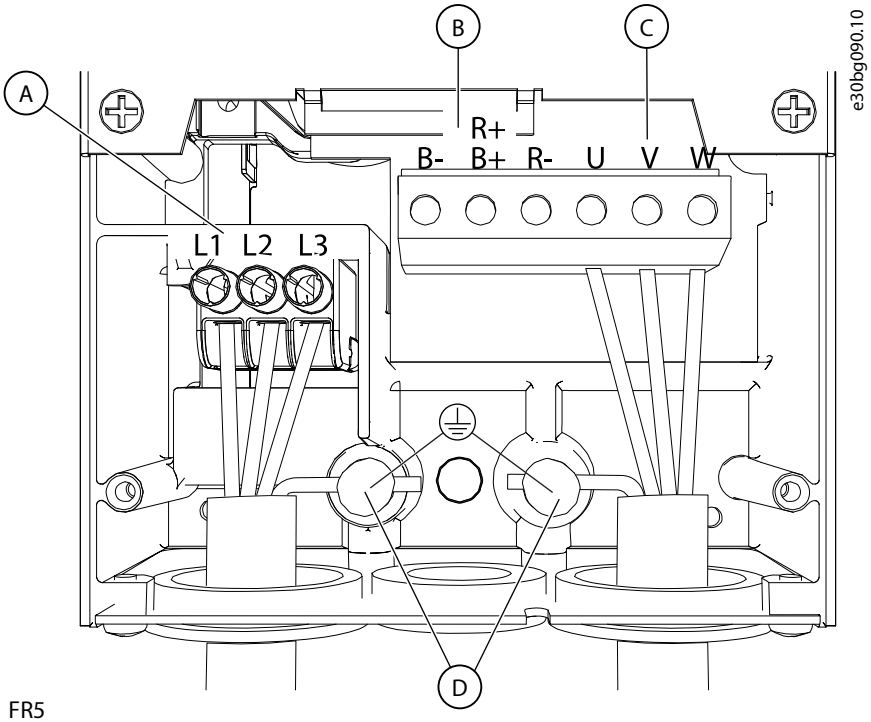


Figure 21: Opening the Cable Cover

3. Locate the terminals.



FR5

Figure 22: FR5 Terminals

A	Mains terminals	**B**	Brake resistor terminals
C	Motor terminals	**D**	Grounding terminals

6.4.3 Get Access and Locate the Terminals for FR6

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

1. Open the cover of the AC drive.

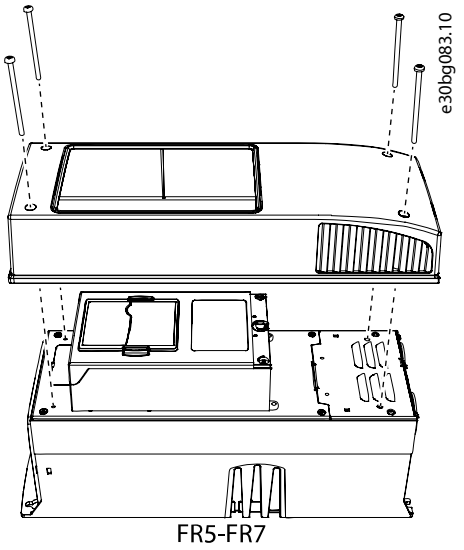


Figure 23: Opening the Cover

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

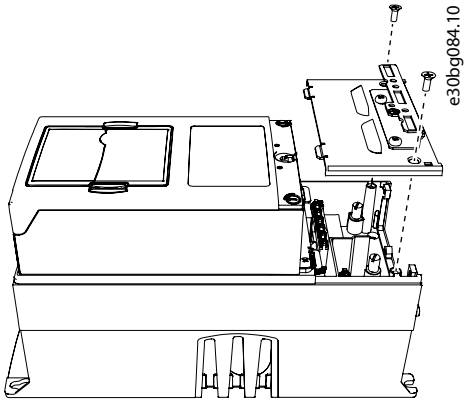


Figure 24: Opening the Cable Cover

3. Locate the terminals.

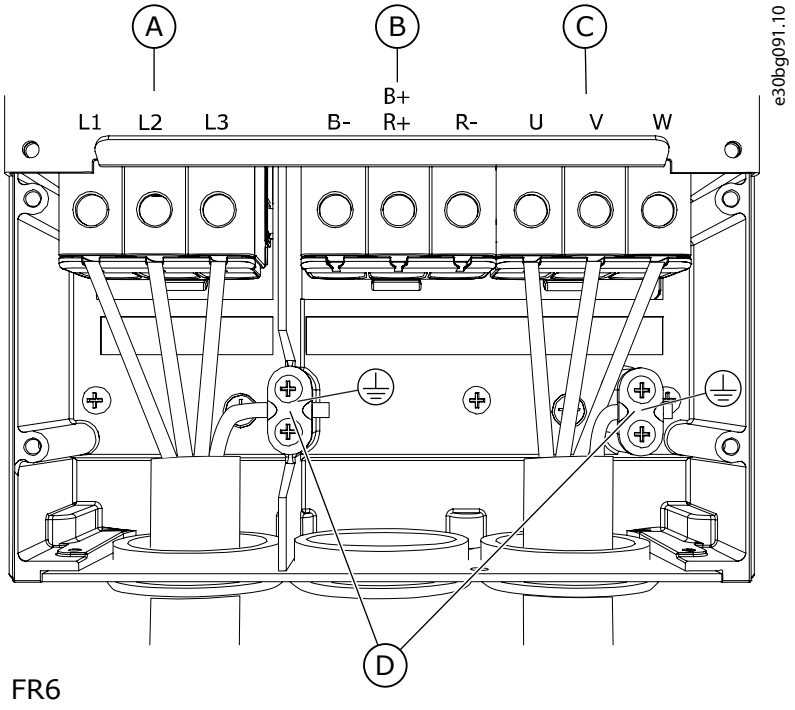


Figure 25: FR6 Terminals

A	Mains terminals	**B**	Brake resistor terminals
C	Motor terminals	**D**	Grounding terminals

6.4.4 Get Access and Locate the Terminals for FR7

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

1. Open the cover of the AC drive.

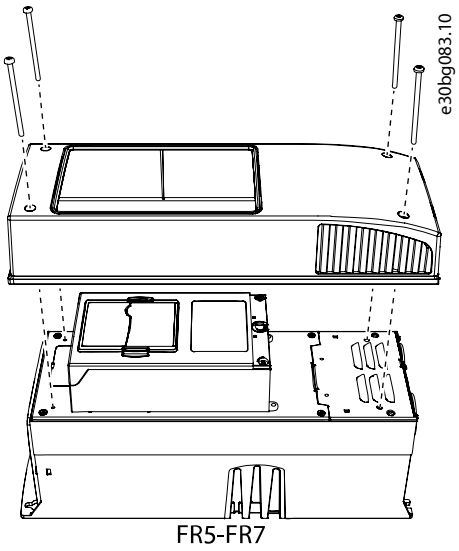


Figure 26: Opening the Cover

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

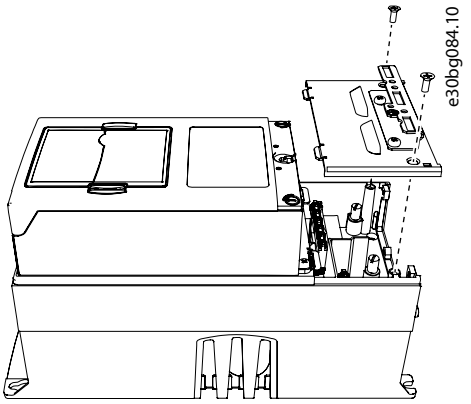


Figure 27: Opening the Cable Cover

3. Locate the terminals.

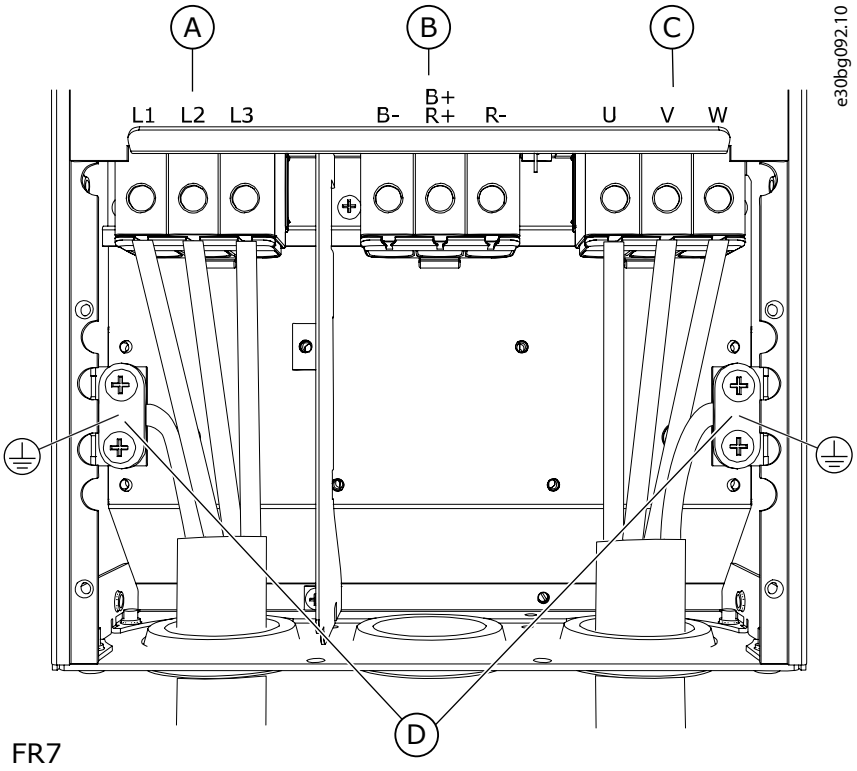


Figure 28: FR7 Terminals

A	Mains terminals	**B**	Brake resistor terminals
C	Motor terminals	**D**	Grounding terminals

6.4.5 Get Access and Locate the Terminals for FR8

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

1. Open the cover of the AC drive.

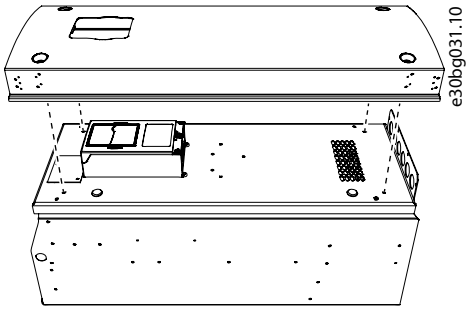


Figure 29: Opening the Cover

2. Open the power unit cover.

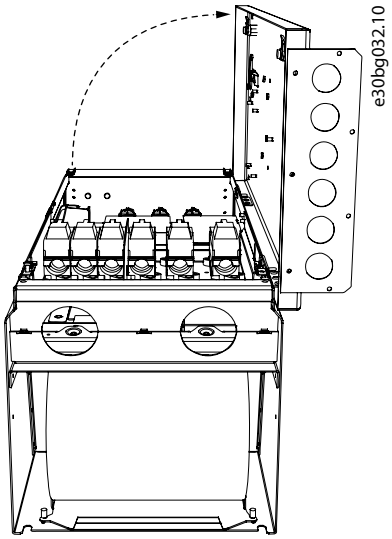


Figure 30: Opening the Power Unit Cover

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

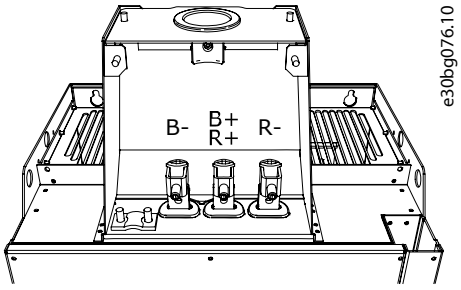


Figure 31: DC Terminals and Brake Resistor Terminals

4. Locate the terminals.

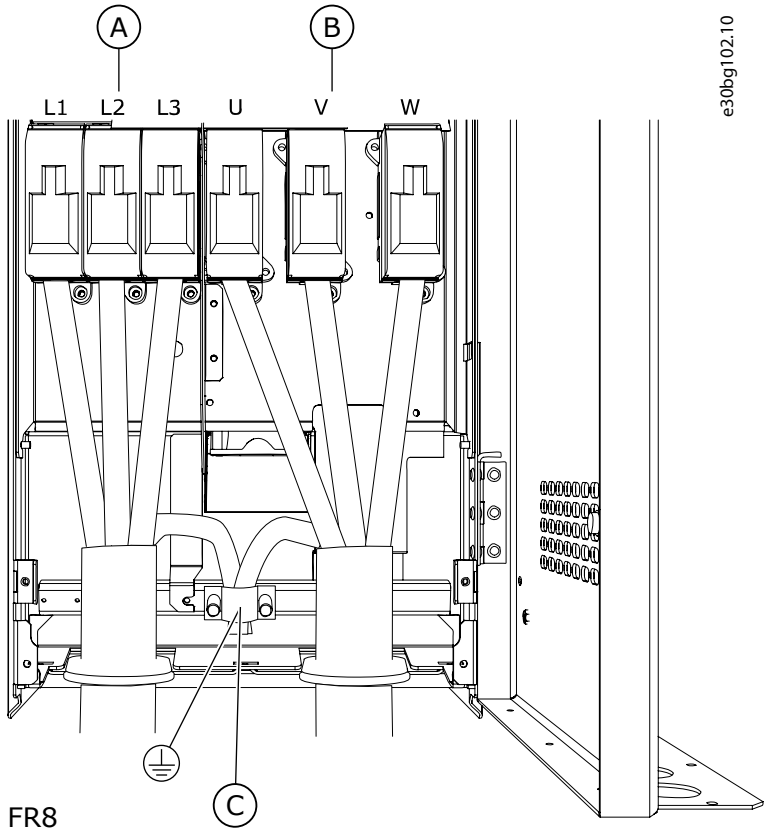


Figure 32: FR8 Terminals

A	Mains terminals	**B**	Motor terminals
C	Grounding terminals		

6.4.6 Get Access and Locate the Terminals for FR9

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

1. Remove the cable cover.

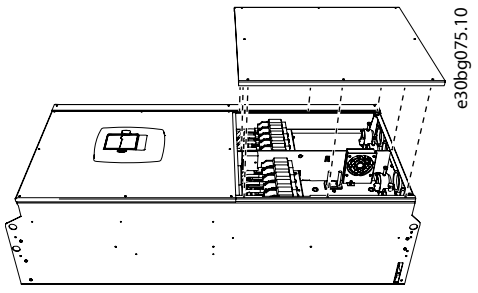
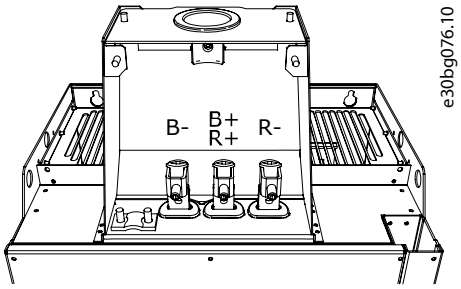
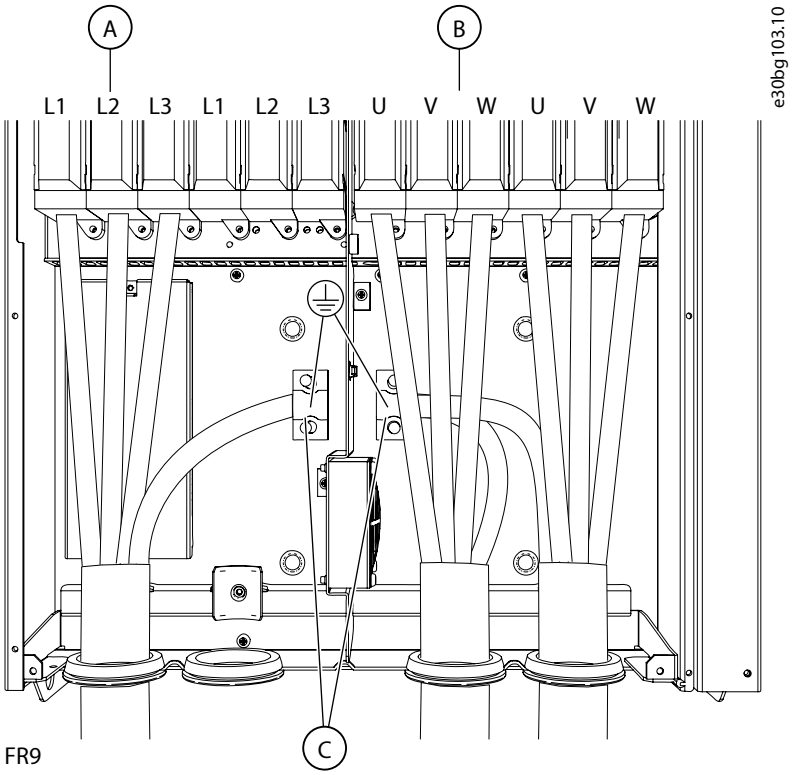


Figure 33: Opening the Cover

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



3. Locate the terminals.



FR9

Figure 34: FR9 Terminals

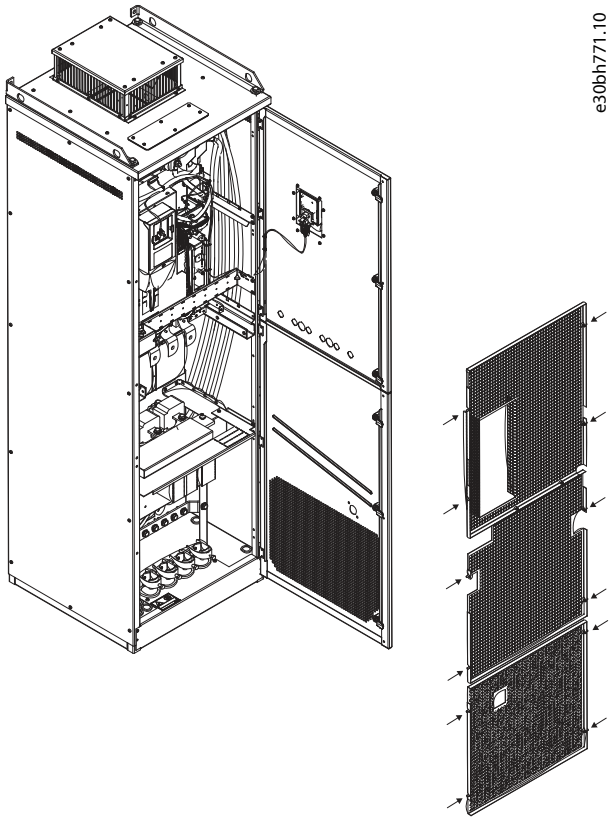
A	Mains terminals	**B**	Motor terminals
C	Grounding terminals		

6.4.7 Get Access and Locate the Terminals for FR10 Standalone

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

1. Open the cabinet door.

2. Remove the protective covers.



3. Locate the terminals.

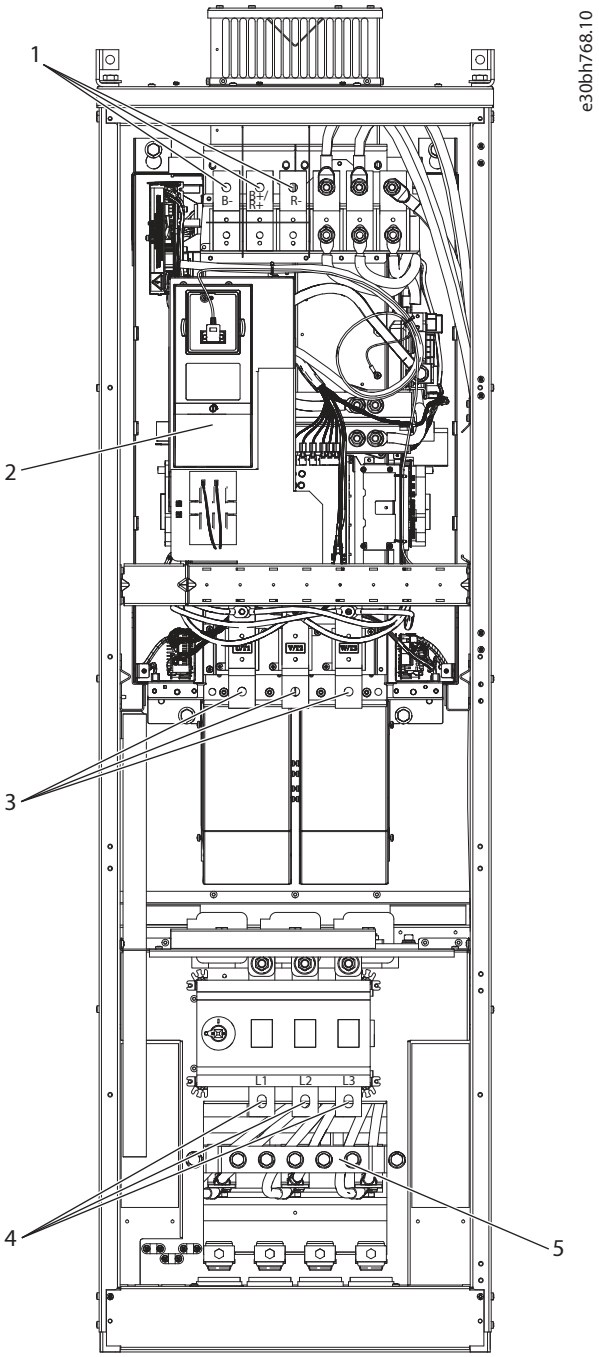


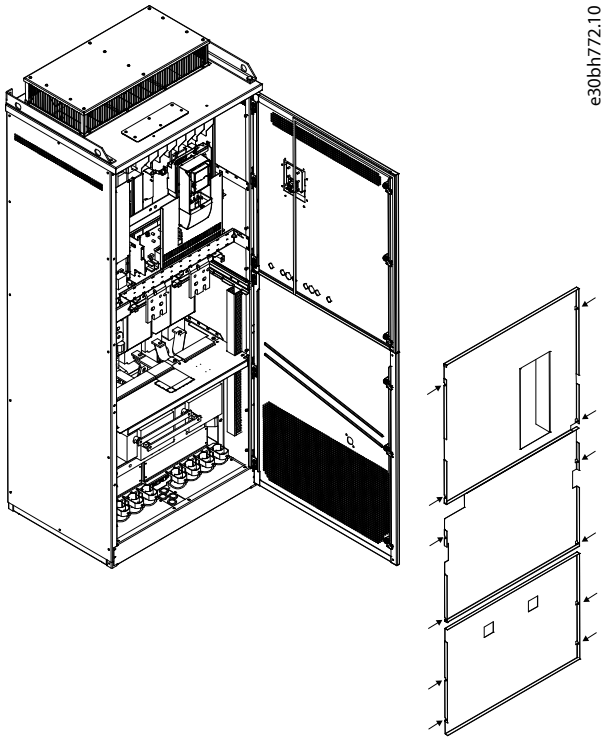
Figure 35: FR10 Standalone Terminals

1	Brake resistor and DC terminals	**2**	Control terminals
3	Motor terminals	**4**	Mains terminals
5	Grounding busbar		

6.4.8 Get Access and Locate the Terminals for FR11 Standalone

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

1. Open the cabinet door.
2. Remove the protective covers.



3. Locate the terminals.

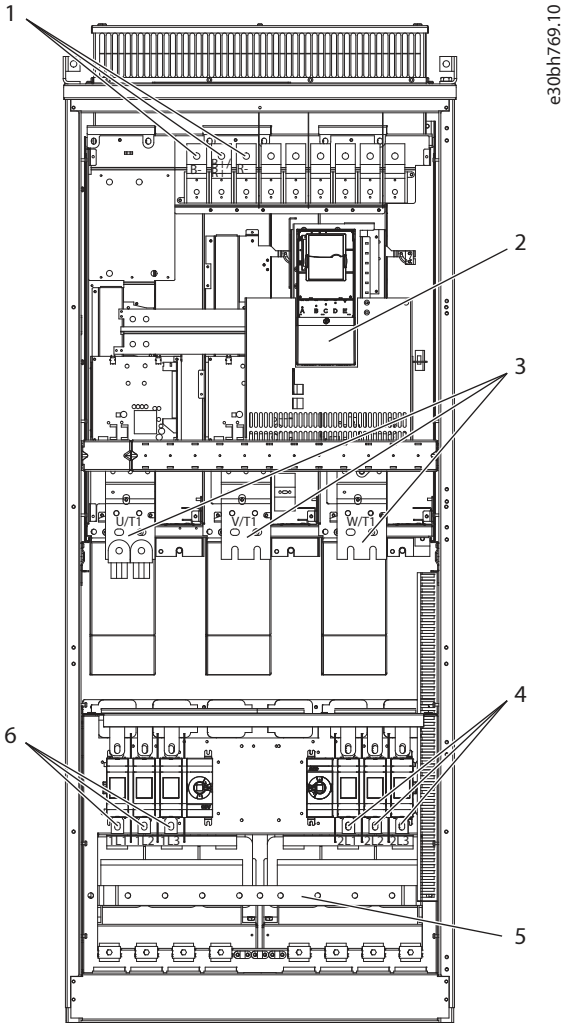


Figure 36: FR11 Standalone Terminals

1	Brake resistor and DC terminals	**2**	Control terminals
3	Motor terminals	**4**	Mains terminals 1
5	Grounding busbar	**6**	Mains terminals 2

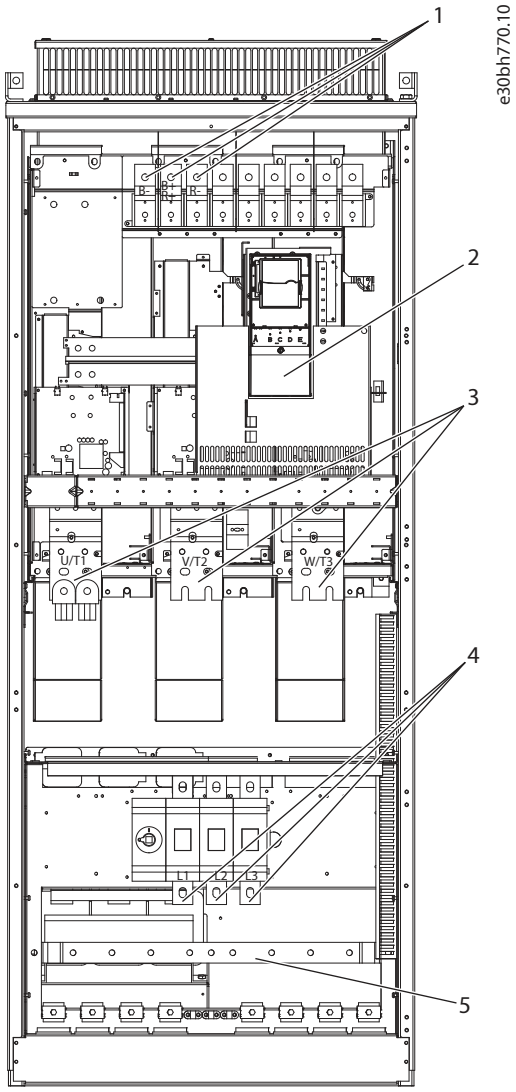


Figure 37: FR11 Standalone Terminals, 0460–0502, 690 V

1	Brake resistor and DC terminals	**2**	Control terminals
3	Motor terminals	**4**	Mains terminals
5	Grounding busbar		

6.5 Installing the Cables

6.5.1 Overview of Installing the Cables

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

1. Check the requirements related to lengths, distances, and positioning of the cables according to instructions in 6.5.2 Prerequisites for Cable Installation.
2. Follow the installation instructions of the correct enclosure size. To check the enclosure size of the AC drive, see 3.4 Enclosure Sizes.

   - 6.5.3 Installing the Cables, FR4–FR6

- 6.5.4 Installing the Cables, FR7
- 6.5.5 Installing the Cables, FR8
- 6.5.6 Installing the Cables, FR9
- 6.5.7 Installing the Cables, FR10 Standalone
- 6.5.8 Installing the Cables, FR11 Standalone

6.5.2 Prerequisites for Cable Installation

- Before starting, make sure that none of the components of the AC drive is live. Read carefully the warnings in 2.2 Safety Precautions.
- Make sure that the motor cables are sufficiently far from other cables.
- The motor cables must cross 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 12).
- 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, contact Danfoss 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 (≤1.5 kW or ≤2.01 hp), the capacitive current in the motor cable can increase the measured motor current compared to the actual motor current. Consider it when setting up the motor stall protection functions.

- If the cable insulation checks are necessary, see 9.3.1 Measuring the Insulation Resistance of the Motor Cable, 9.3.2 Measuring the Insulation Resistance of the Mains Cable, or 9.3.3 Measuring the Insulation Resistance of the Motor.

Table 12: 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	≤ 50	1.0	≤ 164.0
1.0	≤ 200	3.3	≤ 656.1

6.5.3 Installing the Cables, FR4–FR6

Prerequisite: Follow these instructions to install the cables and cable accessories.

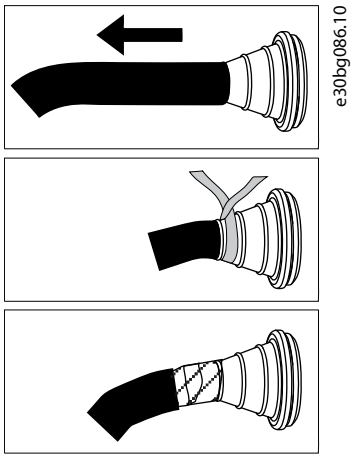
For information on how to comply with the UL regulations in cable installation, see 6.1.3 UL Standards on Cabling.

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.

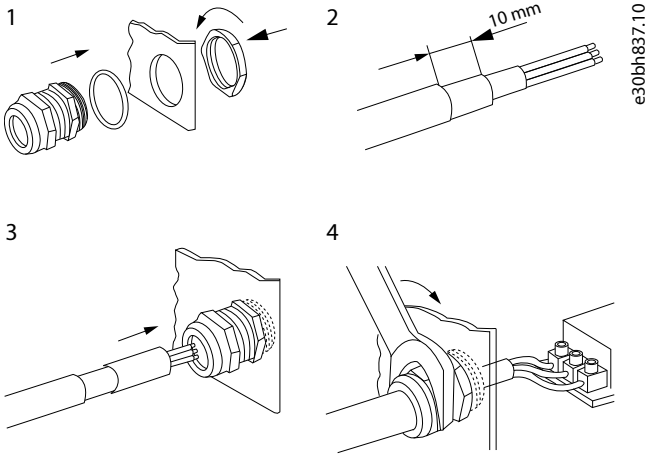
Make sure that the delivery contains all necessary components. For the installation, the contents of the accessories bag is needed, see 4.1 Checking the Delivery.

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 FR5or 6.4.3 Get Access and Locate the Terminals for FR6.

1. Strip the DC supply 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.



3. To achieve EMC class C1 and C2, use an EMC cable gland as an alternative to the grommet.



4. Put the cables - the DC supply 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.

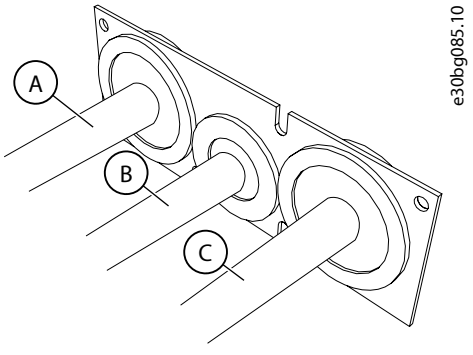
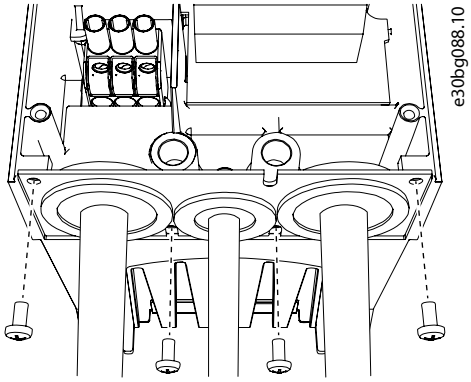


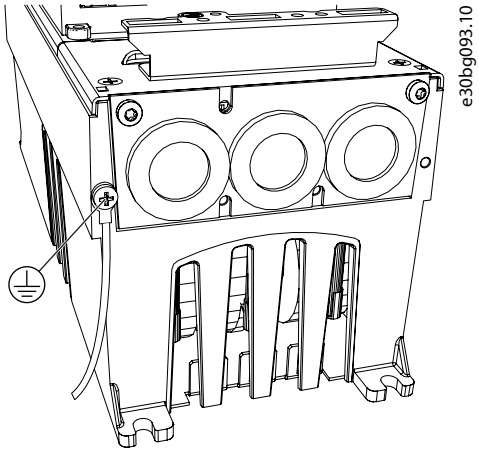
Figure 38: Cables through the Cable Entry Plate

A	The DC supply cable	**B**	The brake cable
C	The motor cable		

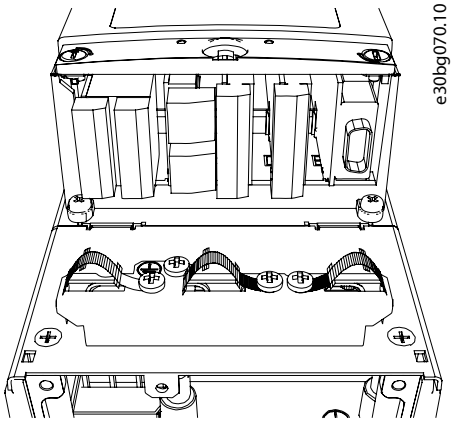
5. Put the cable entry plate with the cables into the groove on the frame of the drive. To attach the cable entry plate, use the M4x10 screws delivered in the accessories bag.



6. Connect the cables. See the correct tightening torques in 12.6 Tightening Torques of the Terminals.
   - Connect the phase conductors of the DC supply 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 with a grounding terminal. Use the grounding terminals delivered in the accessories bag.
   - FR6: Attach the grounding conductor of each cable with a grounding clamp for grounding conductor. Use the grounding clamps and the screws delivered in the accessories bag.
7. Make sure to connect the grounding conductor to the motor and the terminals that are identified with the grounding symbol.
   - For FR4, 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 in-lb.



8. Attach the cable cover. See 12.5 Tightening Torques for Cover Screws.
9. 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. Connect the control cables.



10. 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, FR7

Prerequisite: Follow these instructions to install the cables and cable accessories.

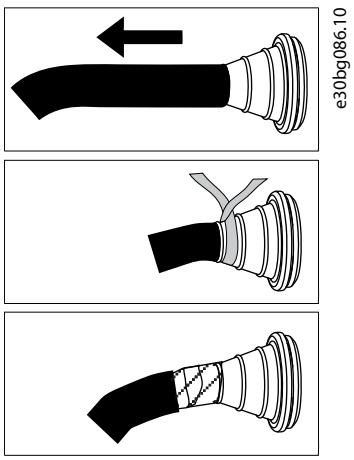
For information on how to comply with the UL regulations in cable installation, see 6.1.3 UL Standards on Cabling.

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.

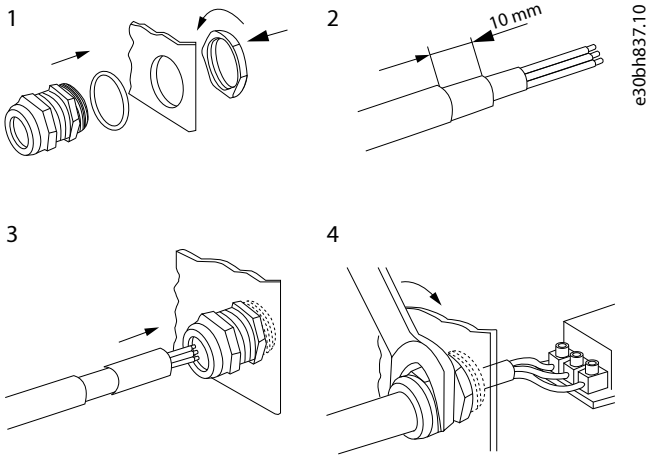
Make sure that the delivery contains all necessary components. For the installation, the contents of the accessories bag is needed, see 4.1 Checking the Delivery.

Open the covers according to instructions in 6.4.4 Get Access and Locate the Terminals for FR7.

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.



3. To achieve EMC class C1 and C2, use an EMC cable gland as an alternative to the grommet.



4. Put the cables - the DC supply 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.

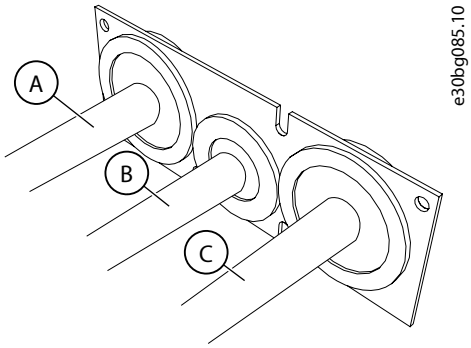
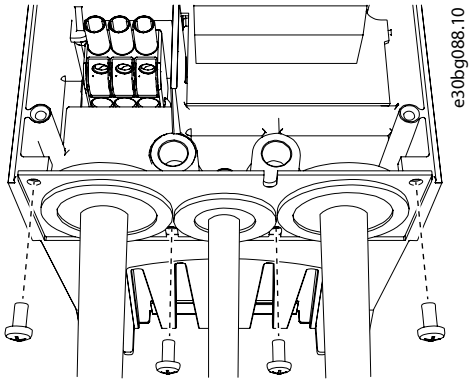


Figure 39: Cables through the Cable Entry Plate

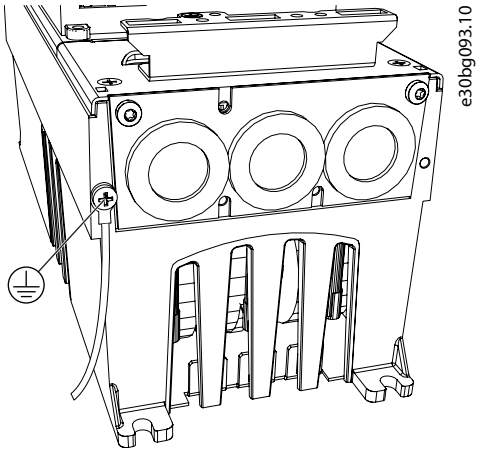
A	The DC supply cable	**B**	The brake cable
C	The motor cable		

5. 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.



6. Connect the cables. See the correct tightening torques in 12.6 Tightening Torques of the Terminals.
   - Connect the phase conductors of the DC supply cable and of the motor cable, and the conductors of the brake resistor cable into the correct terminals.
   - Attach the grounding conductor of each cable with a grounding clamp.
7. 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 in-lb.



8. Attach the cable cover. See 12.5 Tightening Torques for Cover Screws.
9. 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. Connect the control cables.

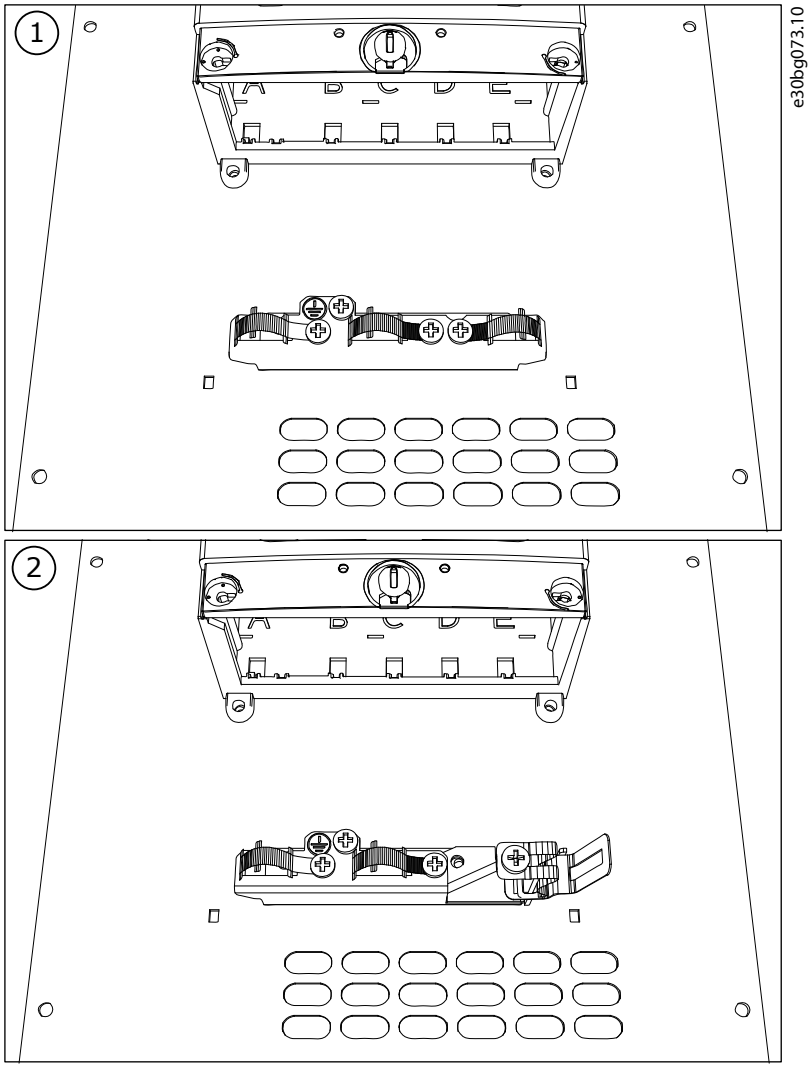


Figure 40: Attaching the Grounding Clamps for Control Cable

1	Standard	**2**	PROFIBUS

10. 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.

6.5.5 Installing the Cables, FR8

Prerequisite: Follow these instructions to install the cables and cable accessories.

For information on how to comply with the UL regulations in cable installations, see 6.1.3 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.

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.

1. Strip the motor cable, the DC supply 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.
- Cable gland can be used if preferred.

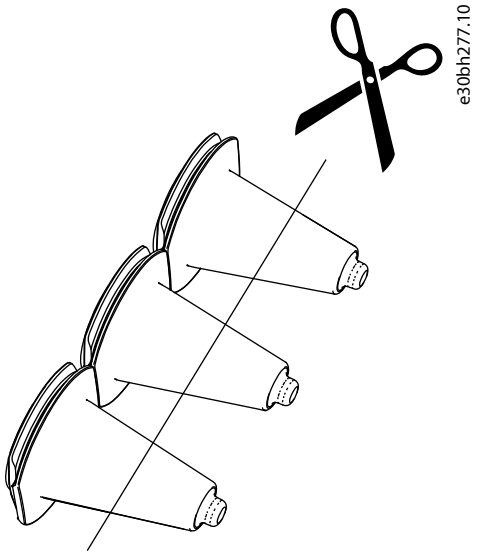


Figure 41: Cutting the Grommet in IP54

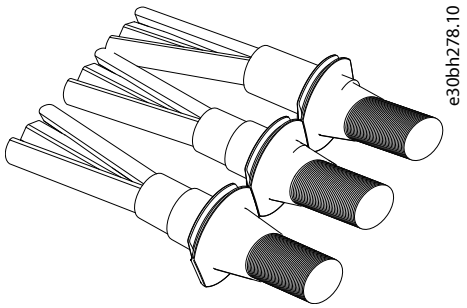


Figure 42: Putting the Cables through the Grommets

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.

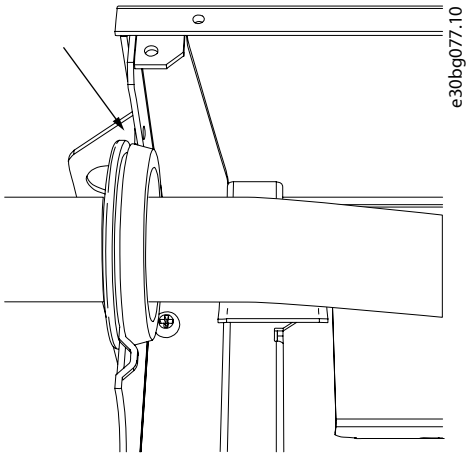


Figure 43: Rubber Grommets

4. Connect the cables. See the correct tightening torques in 12.6 Tightening Torques of the Terminals.
   - Connect the phase conductors of the DC supply 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 motor cables.

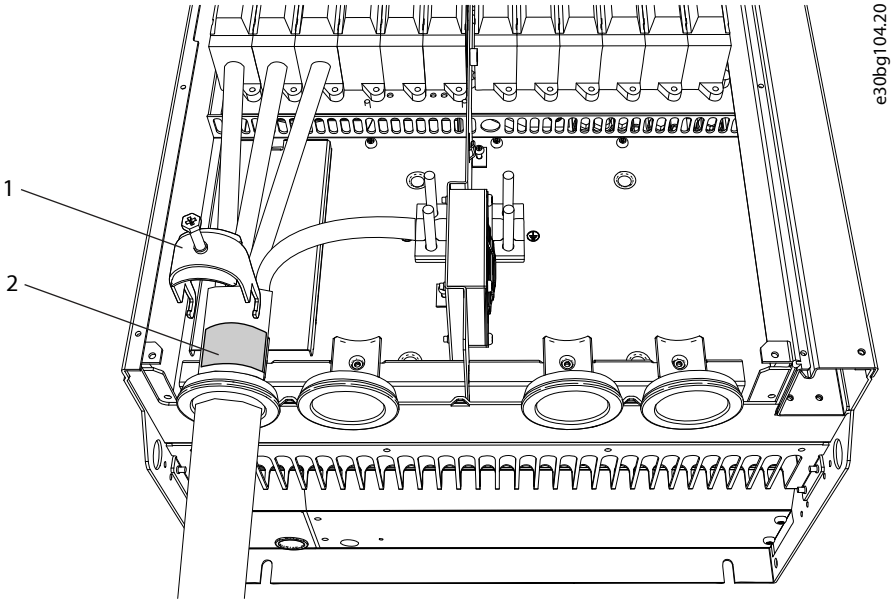


Figure 44: Exposing the Shield of the Cables

1	Grounding clamp	2	Exposed 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.

   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. Connect the control cables.

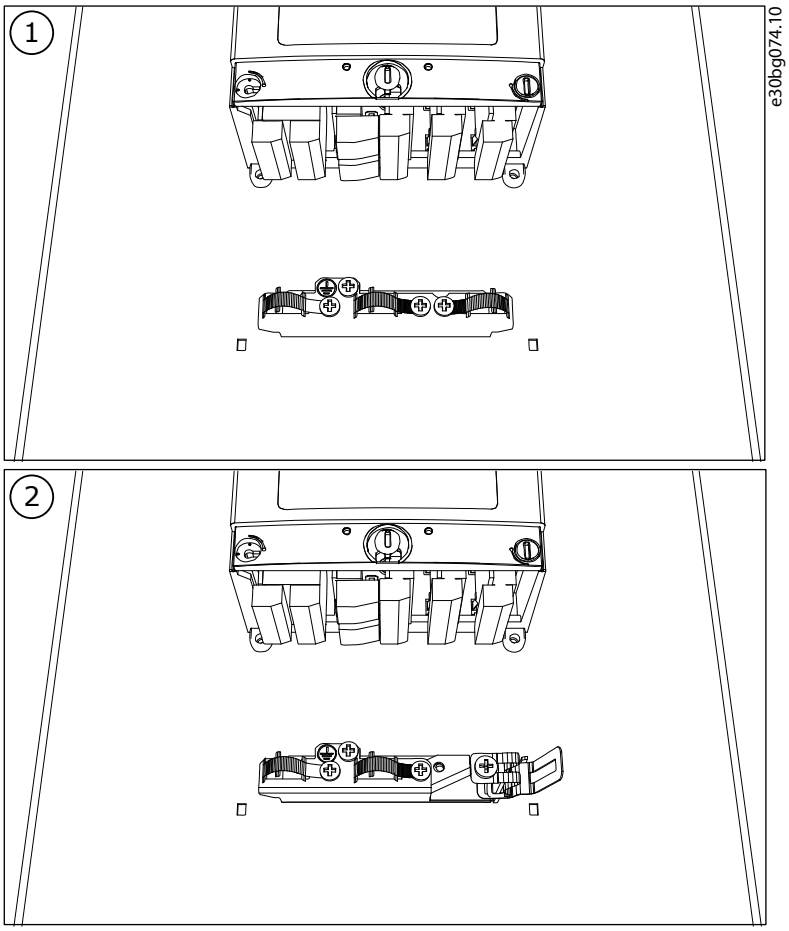


Figure 45: Attaching the Grounding Clamps for Control Cable

1	Standard	**2**	PROFIBUS

8. Attach the cover of the drive. For the tightening torques of the screws, see 12.5 Tightening Torques for Cover Screws.

6.5.6 Installing the Cables, FR9

Prerequisite: Follow these instructions to install the cables.

For information on how to comply with the UL regulations in cable installations, see 6.1.3 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.

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.

1. Strip the motor cable, the DC supply cable, and the brake resistor cable. See 12.4 Cable Stripping Lengths.
2. To move the cables through grommets, cut 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.
- Cable gland can be used if preferred.

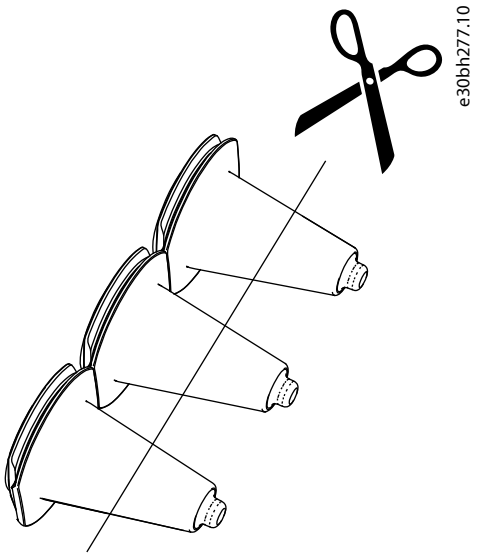


Figure 46: Cutting the Grommet in IP54

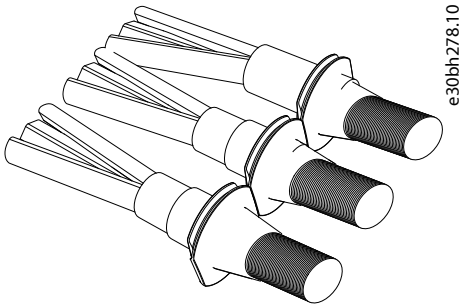


Figure 47: Putting the Cables through the Grommets

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.

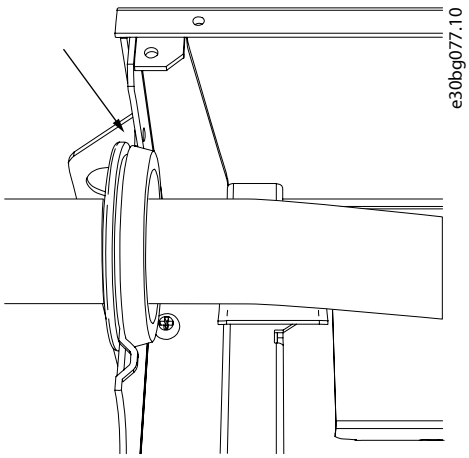


Figure 48: Rubber Grommets

4. Connect the cables. See the correct tightening torques in 12.6 Tightening Torques of the Terminals.
   - Connect the phase conductors of the DC supply 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 motor cables.

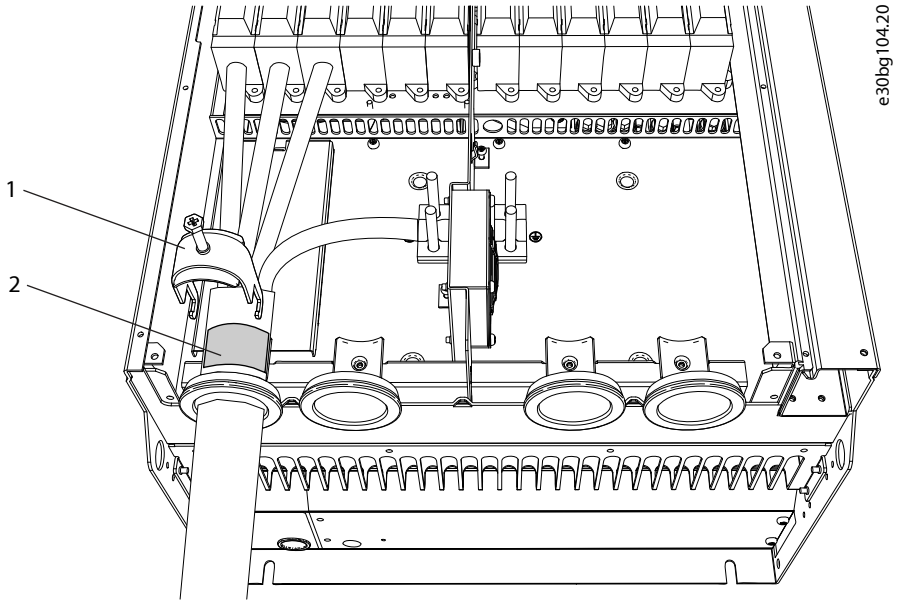


Figure 49: Exposing the Shield of the Cables

1	Grounding clamp	**2**	Exposed shield

6. 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. Connect the control cables.

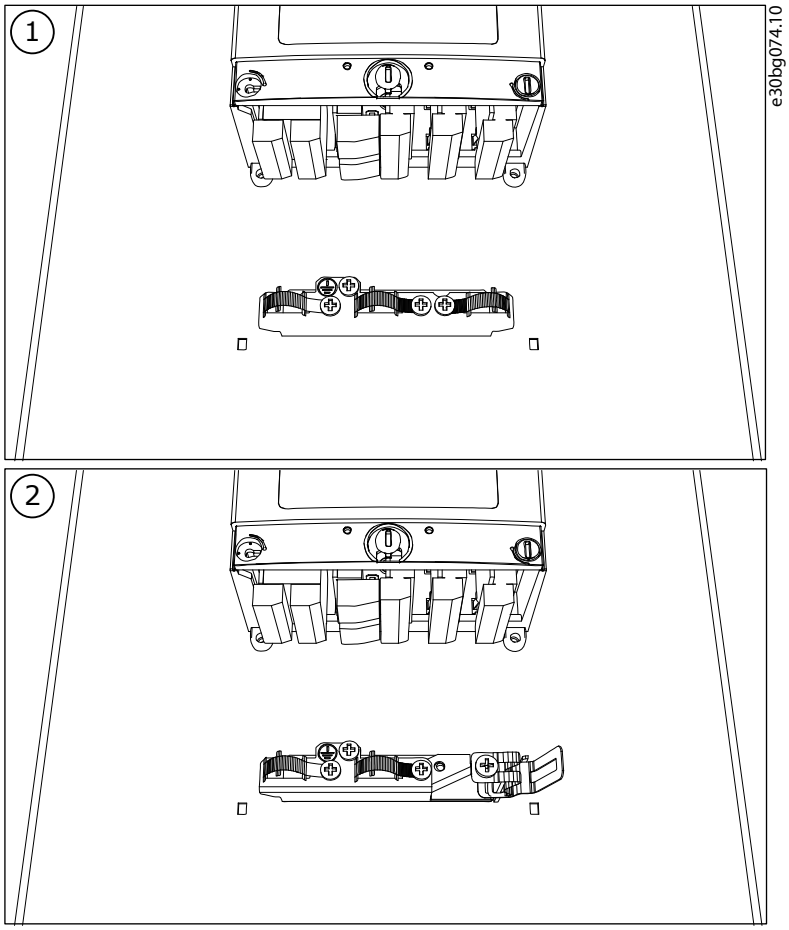


Figure 50: Attaching the Grounding Clamps for Control Cable, FR9

7. 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.

6.5.7 Installing the Cables, FR10 Standalone

Prerequisite: Follow these instructions to install the cables.

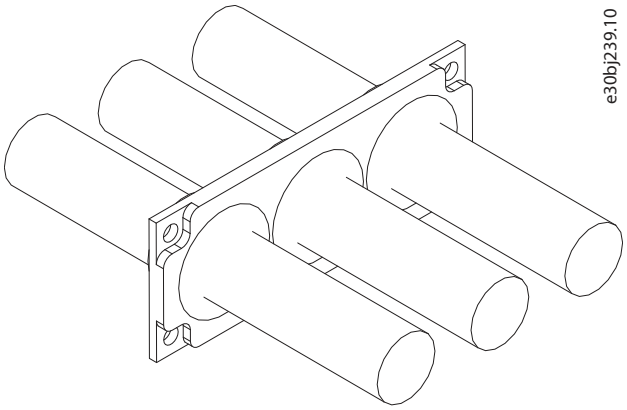
For information on how to comply with the UL regulations in cable installations, see 6.1.3 UL Standards on Cabling.

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.

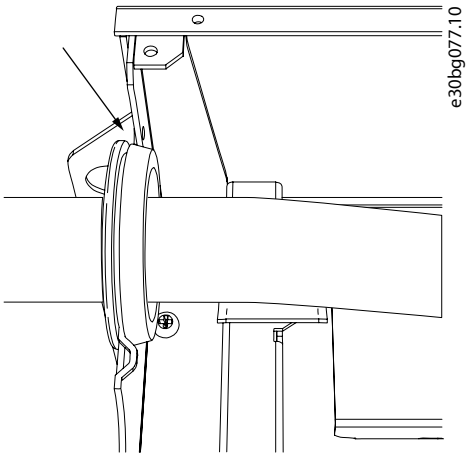
Make sure that the delivery contains all necessary components.

Open the covers according to instructions in 6.4.7 Get Access and Locate the Terminals for FR10 Standalone.

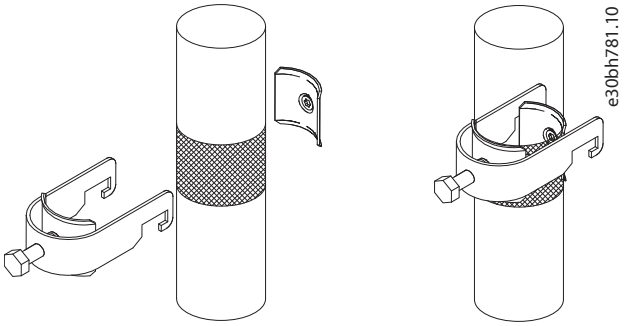
1. To move the cables through grommets, cut them open.
   - Do not cut the grommet openings wider than what is necessary for the used cables.
   - If the grommets fold in when putting the cable, pull the cable back to make the grommets straight.
   - Cable gland can be used if preferred.



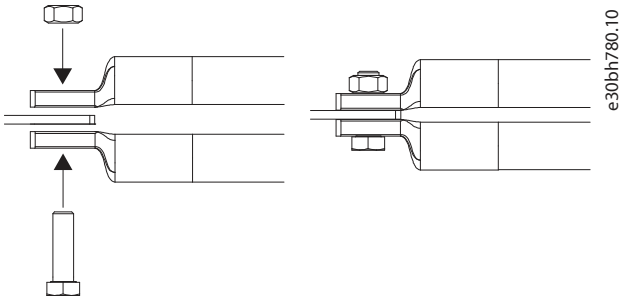
2. Attach the grommet with screws to the cable clamp.
   - With the protection rating IP54 (UL Type 12), the connection between the grommet and the cable must be tight. Pull the first bit of the cable out of the grommet until it stays straight.
   - If it is not possible, make the connection tight with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



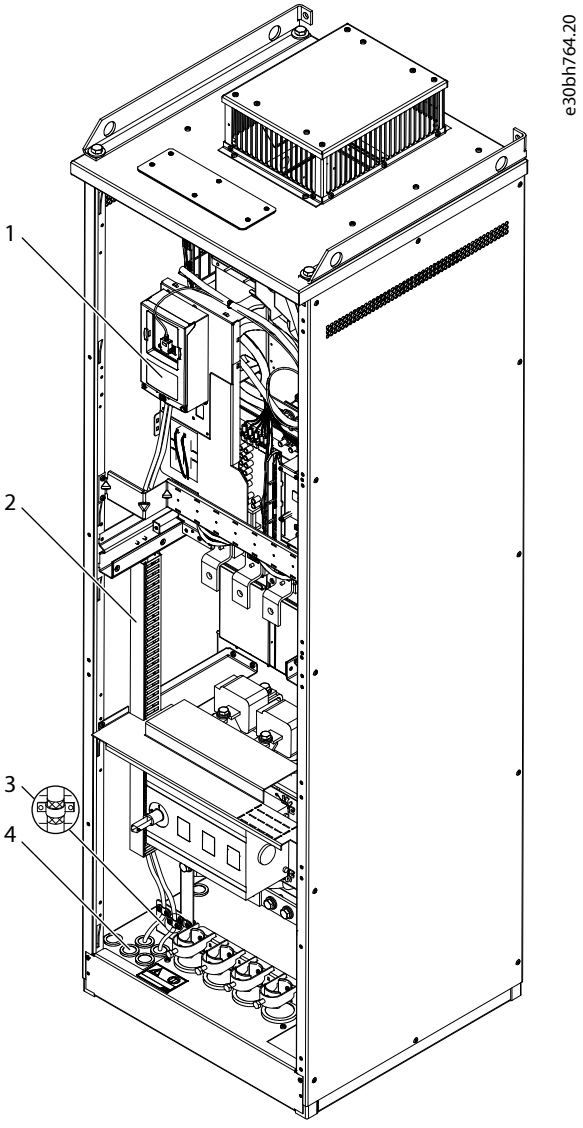
3. To make a 360° connection with the grounding clamp for cable shield, expose the shield of motor cables.



4. Connect the cables. See the correct tightening torques in 12.6 Tightening Torques of the Terminals.
   a. Connect the mains and motor cables. Use busbar to make the connection.

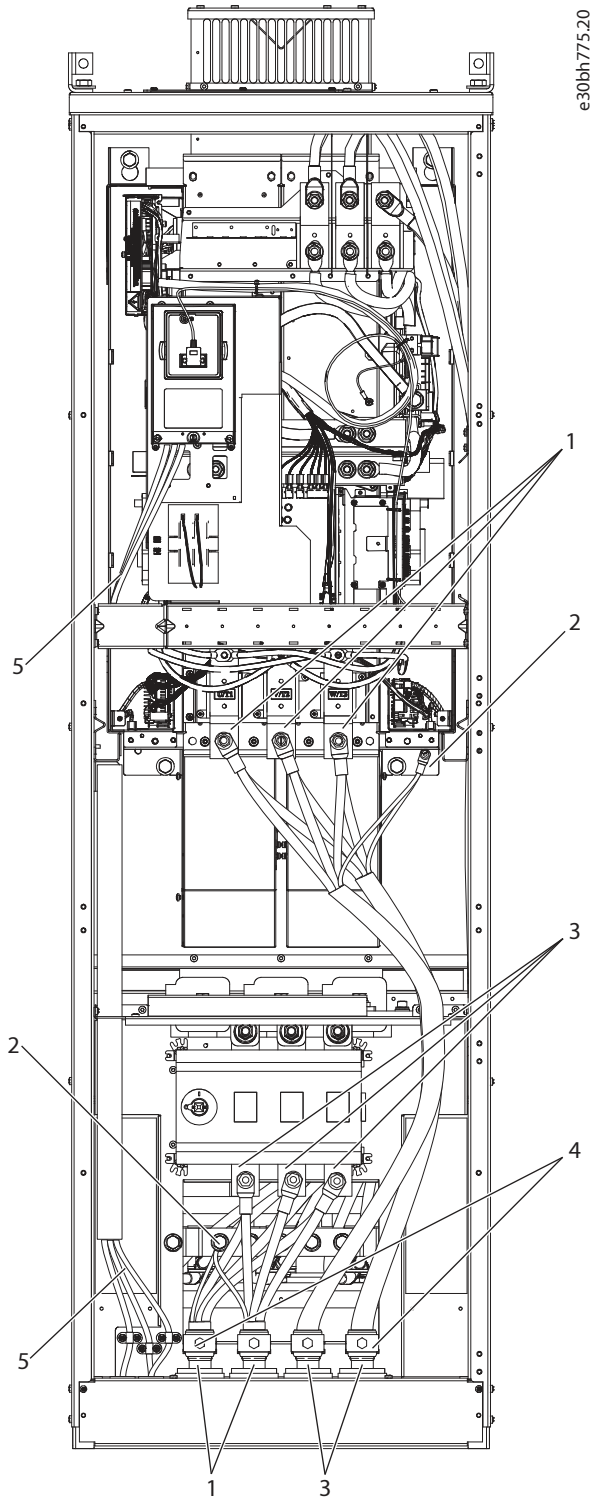


b. Connect the control cables.



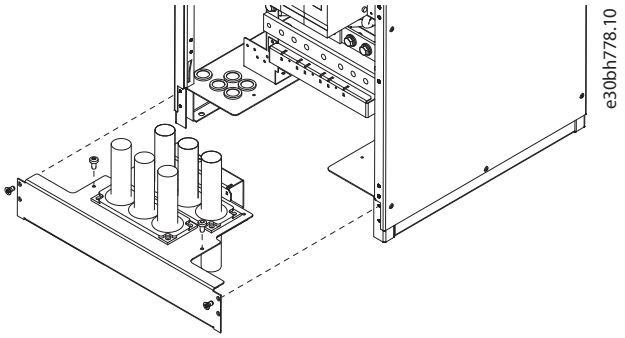
1	Control unit	**2**	Cable routing
3	Grounding	**4**	Cable entry

c. Attach the grounding conductor of each cable to a grounding terminal with a grounding clamp for grounding conductor.



1	Motor cables	**2**	PE/Grounding
3	Mains cables	**4**	360° Grounding
5	Control cables		

5. Attach the cable clamp.



6. Attach the safety covers. 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 safety covers.
7. Close the cabinet doors.

6.5.8 Installing the Cables, FR11 Standalone

Prerequisite: Follow these instructions to install the cables.

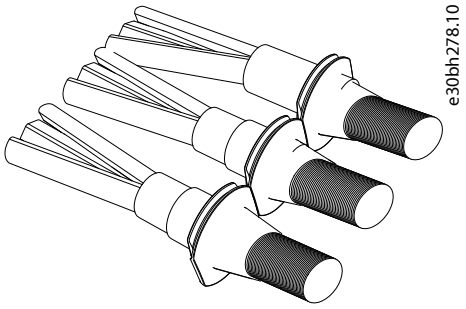
For information on how to comply with the UL regulations in cable installations, see 6.1.3 UL Standards on Cabling.

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.

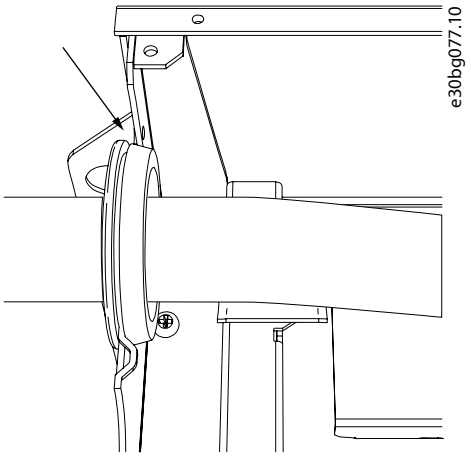
Make sure that the delivery contains all necessary components.

Open the covers according to instructions in 6.4.8 Get Access and Locate the Terminals for FR11 Standalone.

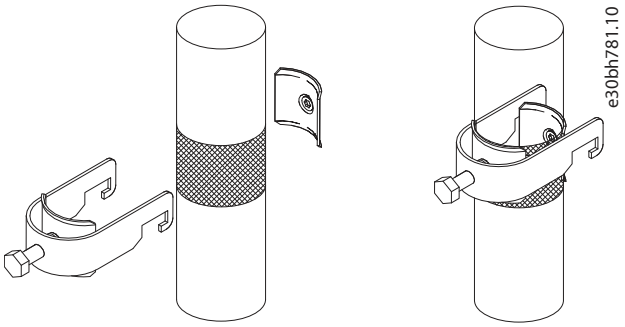
1. To move the cables through grommets, cut them open.
   - Do not cut the grommet openings wider than what is necessary for the used cables.
   - If the grommets fold in when putting the cable, pull the cable back to make the grommets straight.
   - Cable gland can be used if preferred.



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

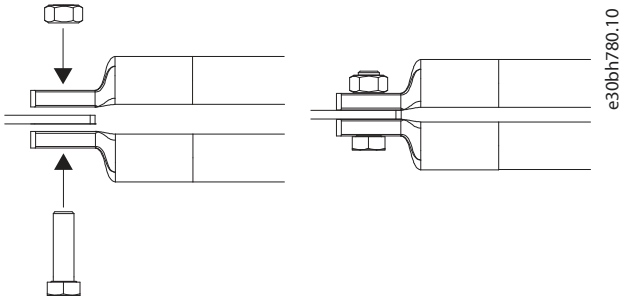


3. To make a 360° connection with the grounding clamp for cable shield, expose the shield of motor cables.

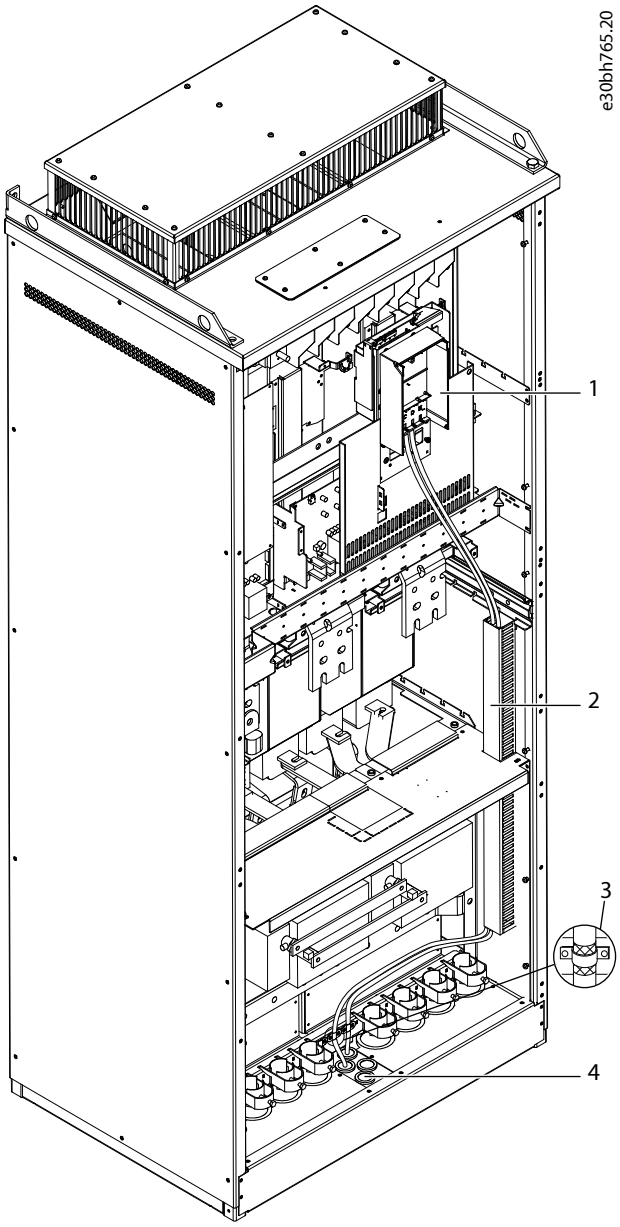


4. Connect the cables. See the correct tightening torques in 12.6 Tightening Torques of the Terminals.

   a. Connect the mains and motor cables. Use busbar to make the connection.



   b. Connect the control cables.



1	Control unit	**2**	Cable routing
3	Grounding	**4**	Cable entry

c. Attach the grounding conductor of each cable to a grounding terminal with a grounding clamp for grounding conductor.

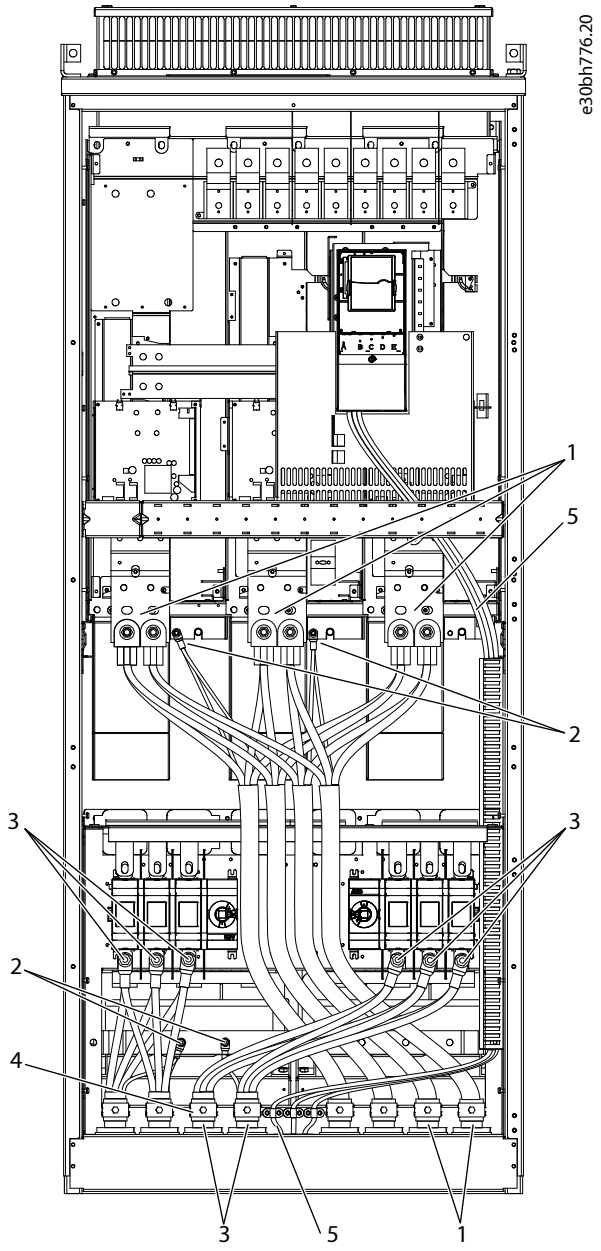


Figure 51: FR11 Standalone

1	Motor cables	**2**	PE/Grounding
3	Mains cables	**4**	360° Grounding
5	Control cables		

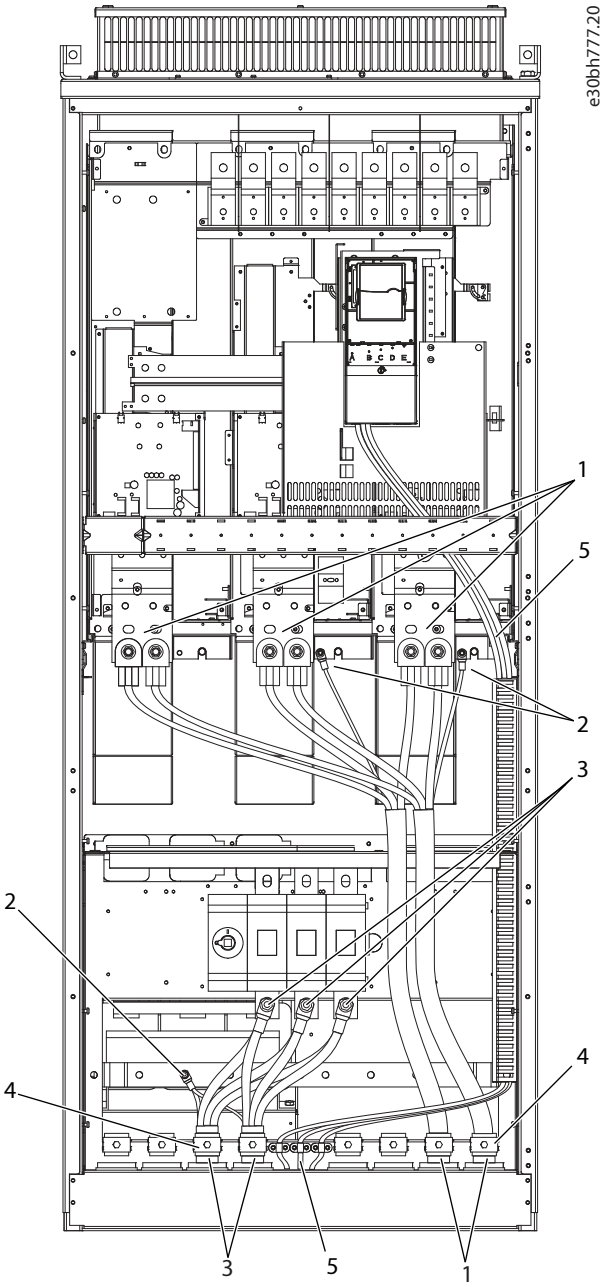
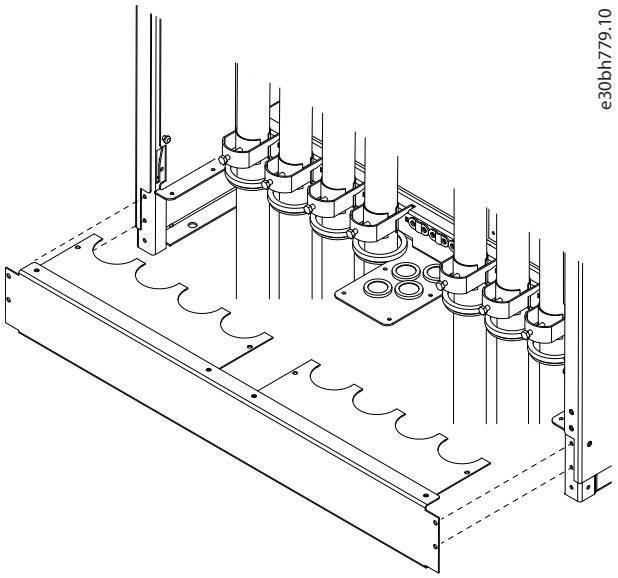


Figure 52: FR11 Standalone, 0460–0502, 690 V

1	Motor cables	**2**	PE/Grounding
3	Mains cables	**4**	360° Grounding
5	Control cables		

5. Attach the cable clamp.



6. Attach the safety covers. 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 safety covers.
7. Close the cabinet doors.

6.6 Installation in an IT System

6.6.1 Overview of 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. See instructions in:

- 6.6.2 Installing the AC drive in an IT System, FR4–FR6
- 6.6.3 Installing the AC Drive in an IT System, FR7
- 6.6.4 Installing the AC Drive in an IT System, FR8–FR11

For equivalents of EMC levels in VACON® AC drives, see 3.3 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.

6.6.2 Installing the AC drive in an IT System, FR4–FR6

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

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.

1. Remove 1 or more EMC screws.

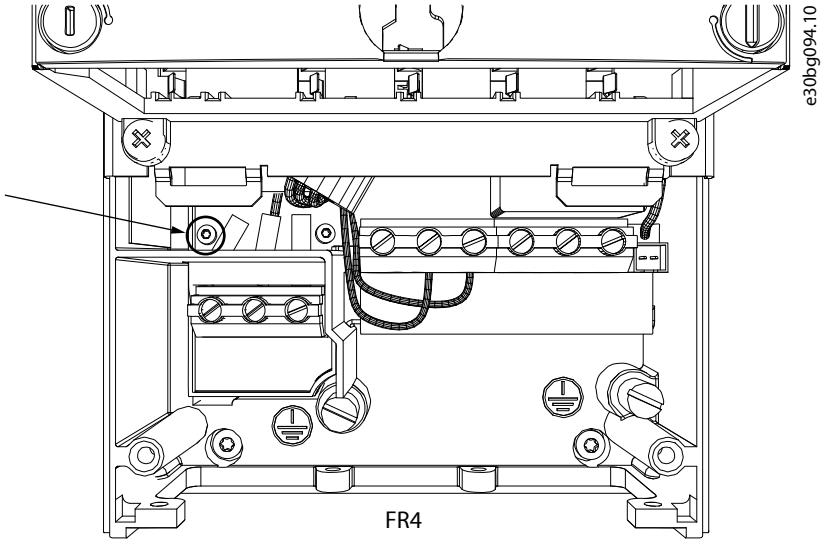


Figure 53: FR4

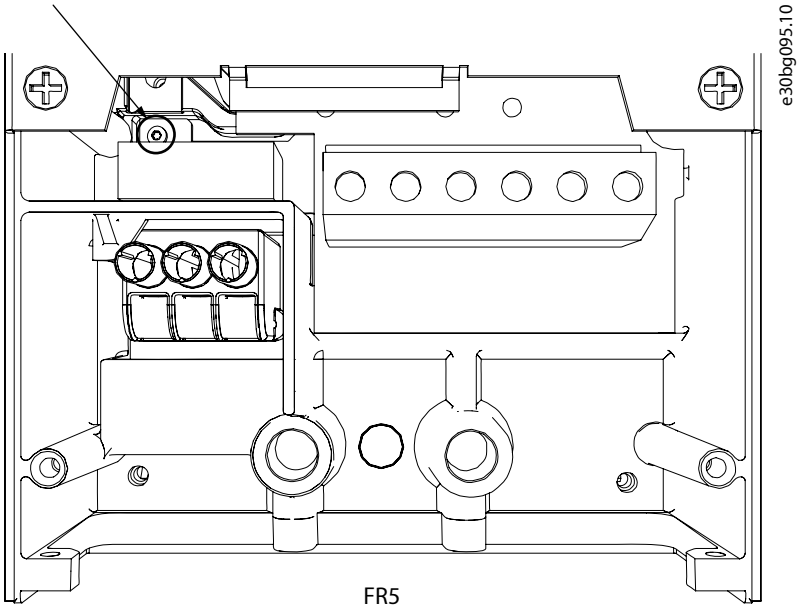


Figure 54: FR5

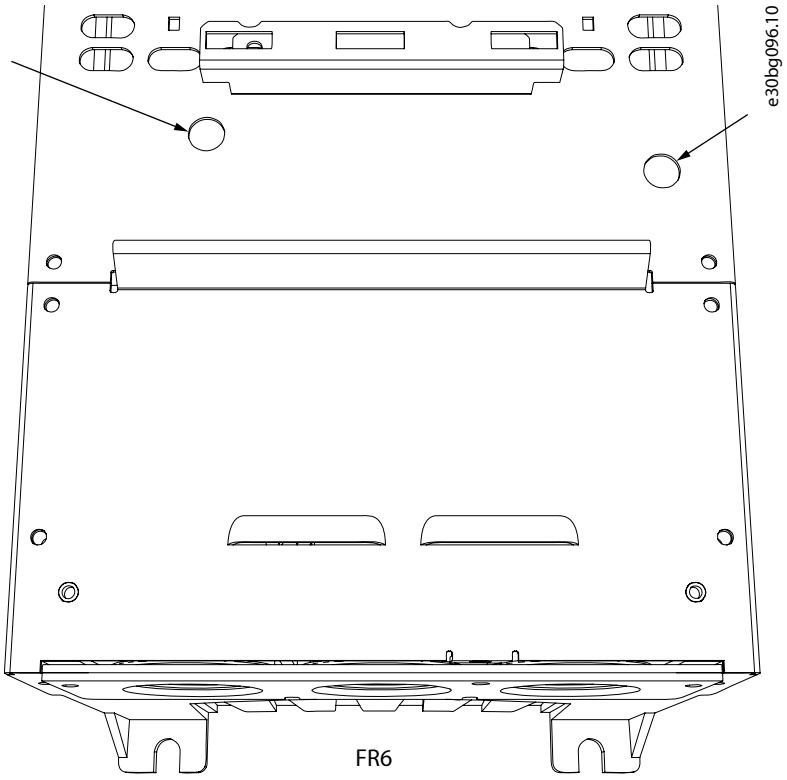
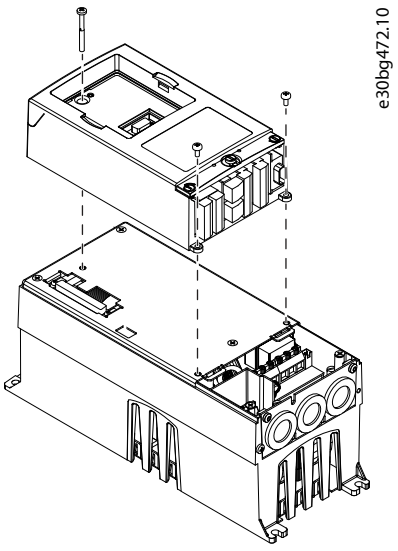


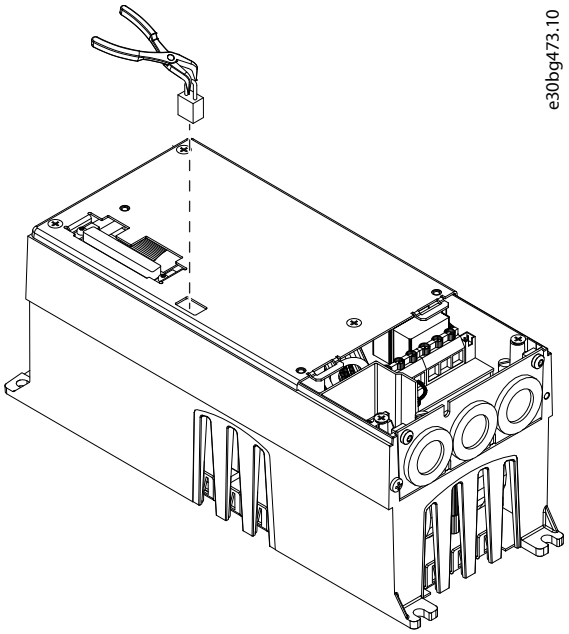
Figure 55: FR6

2. For FR4, remove the control unit.



3. Remove the jumper X10-1.

If there is a sticker next to the terminals about removing the jumper X10-1, remove the jumper. If there is no sticker, do not remove the jumper.



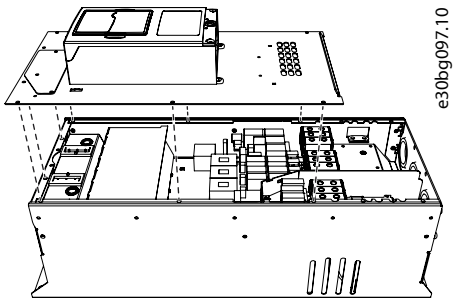
4. Close the cover of the AC drive. For the tightening torques of the screws, see 12.5 Tightening Torques for Cover Screws.
5. After the change, put a check mark to "EMC Level modified" and write the date on the "product modified" label (see 4.5 Using the Product Modified Label). If the label is not yet attached, attach it on the drive near the product label.

6.6.3 Installing the AC Drive in an IT System, FR7

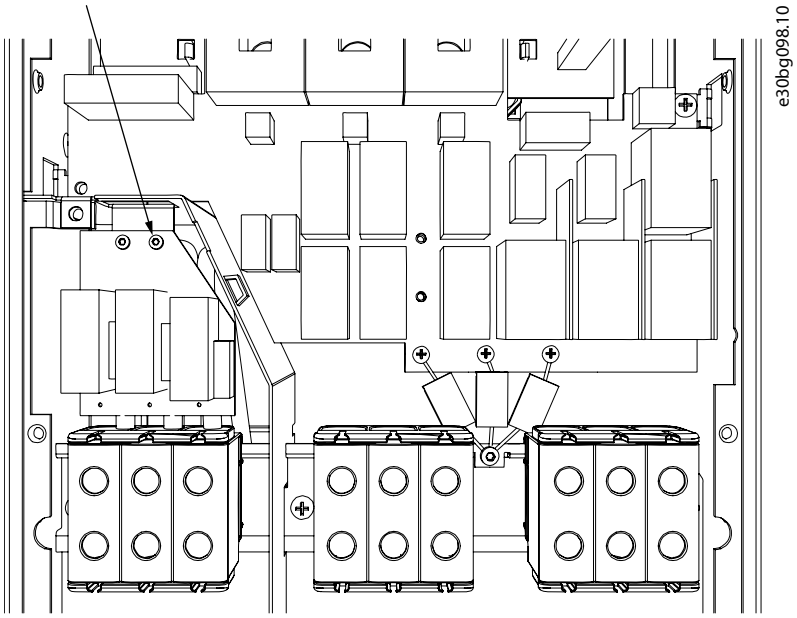
Use these instructions to change the EMC protection of the AC drive to level C4.

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.

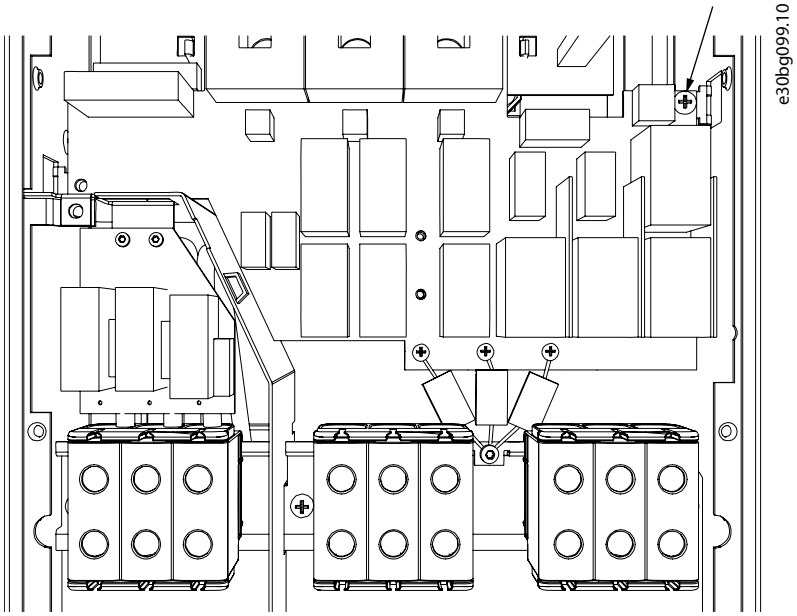
1. Open the power unit cover of the AC drive.



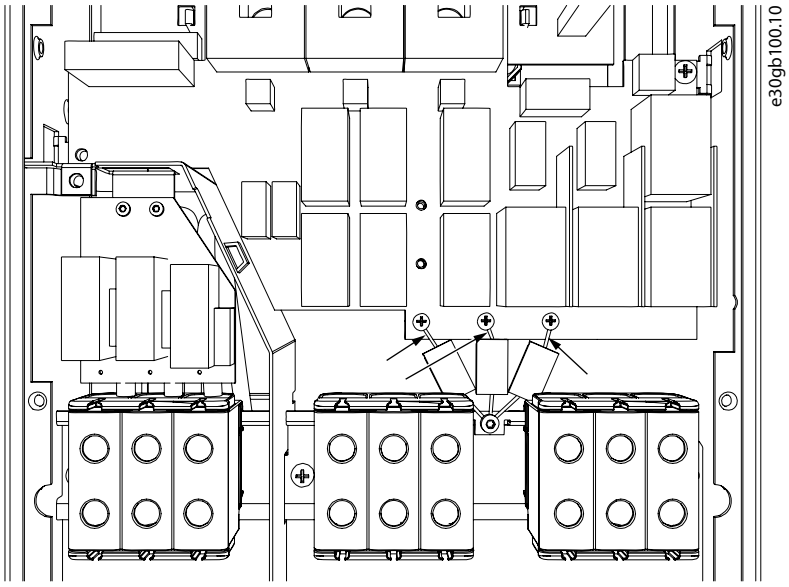
2. Remove the EMC screw.



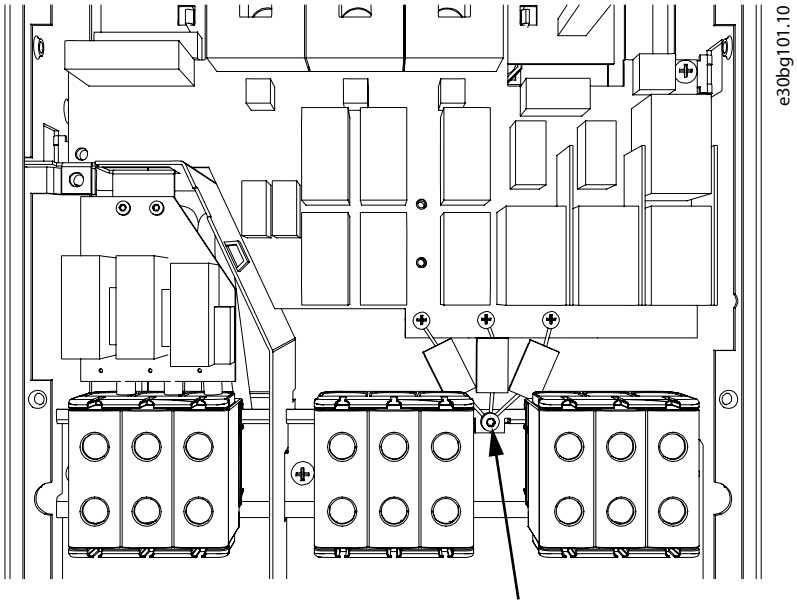
3. Remove the screw and replace with a plastic screw M4.



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 4.5 Using the Product Modified Label). If the label is not yet attached, attach it on the drive near the product label.

NOTICE

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

6.6.4 Installing the AC Drive in an IT System, FR8–FR11

Only a Danfoss service person can change the EMC protection class of FR8–FR11.

7 Control Unit

7.1 Control Unit Components

The NXP control unit gives the flexibility to create advanced features with options and programmability. See the selection guide and the application guide for a full list of features.

The control unit of the AC drive contains the control board and additional boards (see Figure 56) 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–FR11).

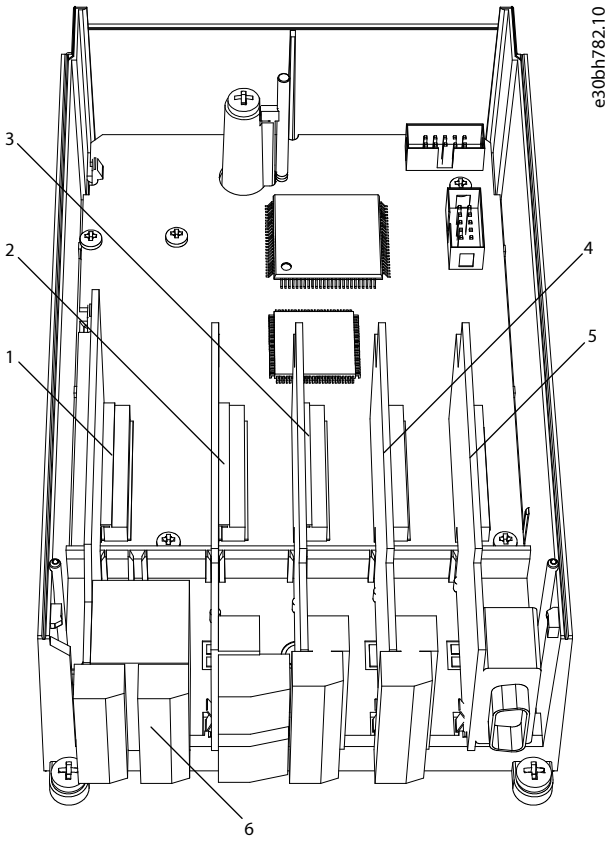


Figure 56: Basic and Option Slots on the Control Board

1	Slot A, OPTA1	**2**	Slot B, OPTA2
3	Slot C, option boards	**4**	Slot D, option boards
5	Slot E, option boards	**6**	Control terminals

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 the *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 7.3.2.1 Control Terminals Overview.

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

7.2 Control Voltage (+24 V/External +24 V)

It is possible to use the drive with an external power source with these properties: +24 V DC ±10%, minimum 1000 mA. Use the external power source to externally power up the control board, and the basic and option boards. The analog outputs and inputs of 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 guide or the *VACON® NX I/O Boards User Manual*. With this voltage, the control unit stays on and the 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 from flowing in the opposite direction.

- Put a 1 A fuse in the 24 V DC line for each AC drive. The maximum current consumption of each drive is 1 A from the external supply.

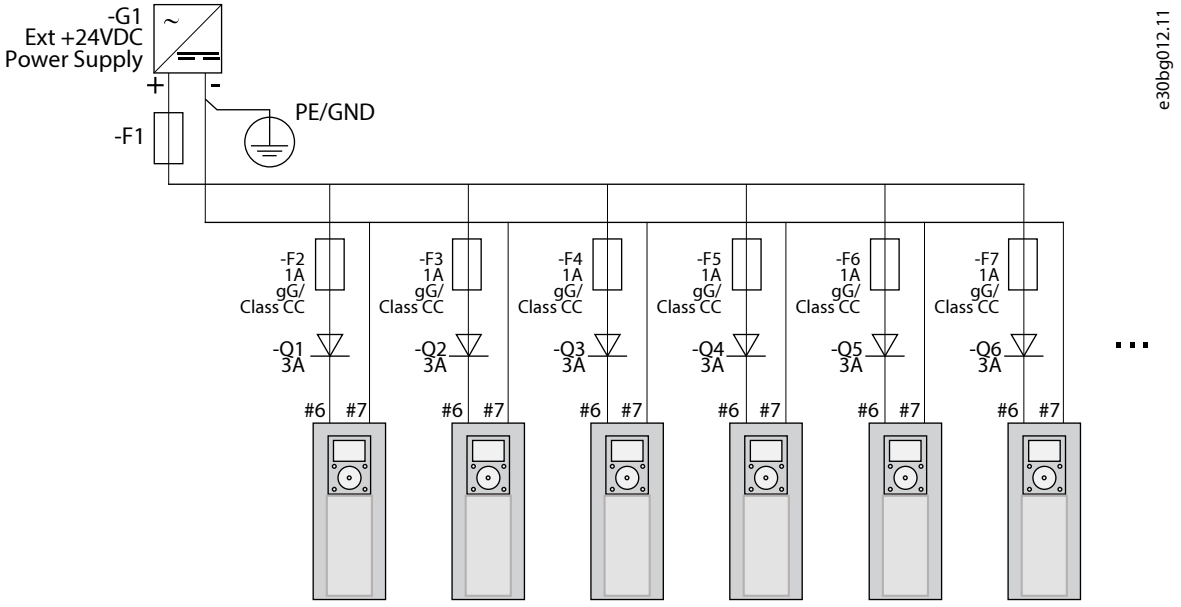


Figure 57: Parallel Connection of 24 V Inputs with Many AC Drives

NOTICE

The control unit I/O ground is not isolated from the chassis ground/protective ground. In the installation, consider the potential differences between the grounding points.

- Use 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^2 (20 AWG) shielded multicore cables. See more on the cable types in 6.2.1 EMC-compliant Installation. The terminal wires must be a maximum of 2.5 mm^2 (14 AWG) for the terminals of the relay board and 1.5 mm^2 (16 AWG) for other terminals.

Table 13: Tightening Torques of the Control Cables

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

7.3.2 Control Terminals on OPTA1

7.3.2.1 Control Terminals Overview

The Figure 58 shows the basic description of the terminals of the I/O board. For more information, see 7.3.2.3 Jumper Selections on the OPTA1 Basic Board. For more information on control terminals, see the *VACON® NX All-in-One Application Guide*.

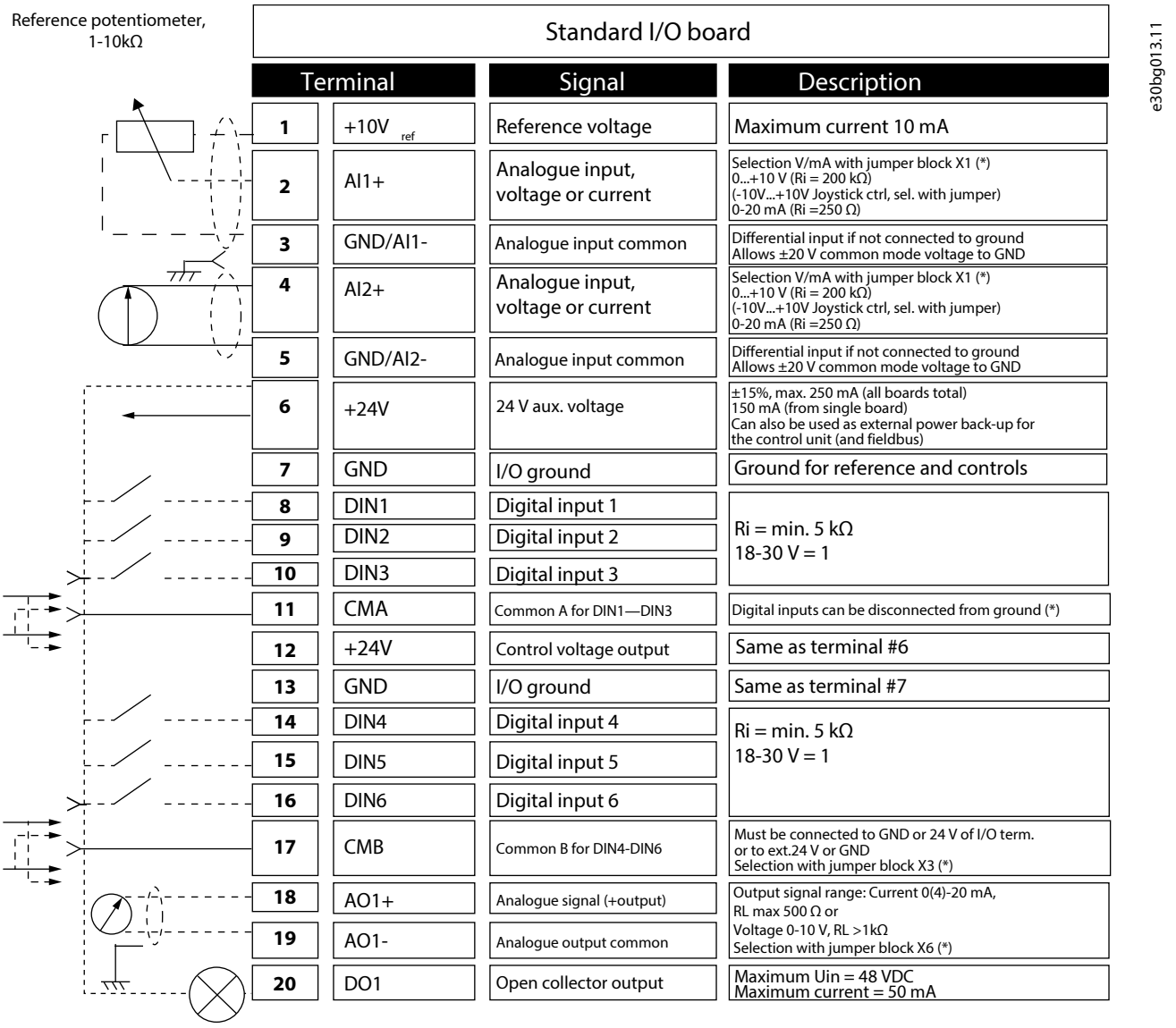


Figure 58: Control Terminal Signals on OPTA1

*) See X3 in the illustrations in 7.3.2.3 Jumper Selections on the OPTA1 Basic Board.

Parameter references for I/O on the 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 the 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.

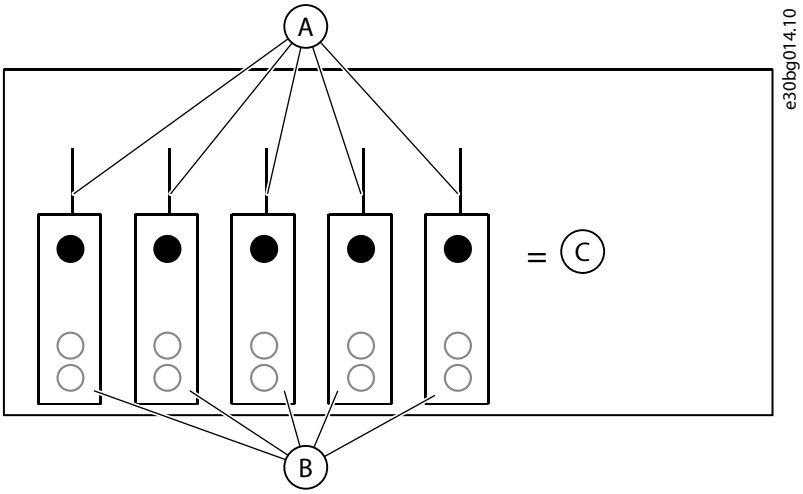


Figure 59: Maximum Loads on +24 V/EXT+24 V Output

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

7.3.2.2 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.

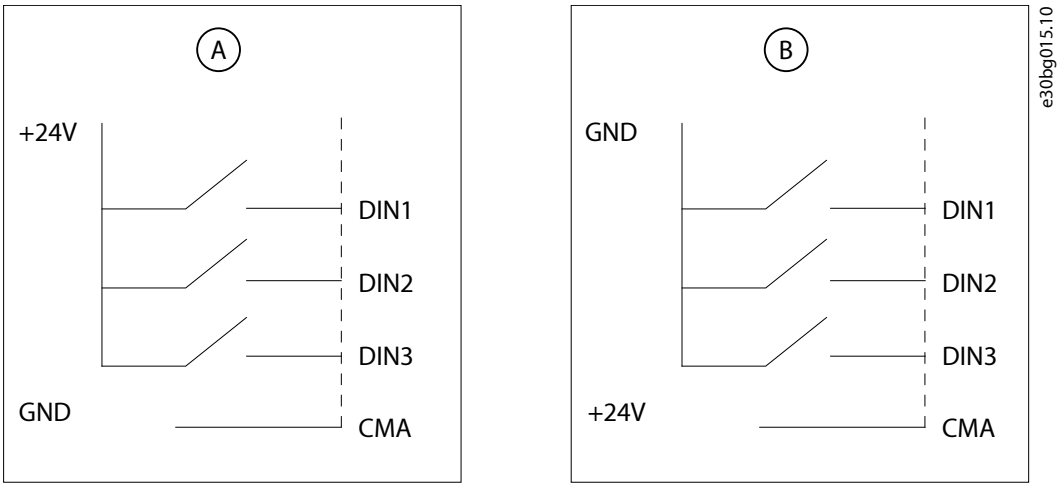


Figure 60: Positive/Negative Logic

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'.

7.3.2.3 Jumper Selections on the OPTA1 Basic Board

The functions of the AC drive can be changed to make them agree with local requirements. To do it, change the positions for the jumpers on the OPTA1 board. The positions of the jumpers set the signal type of the 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 Figure 61.

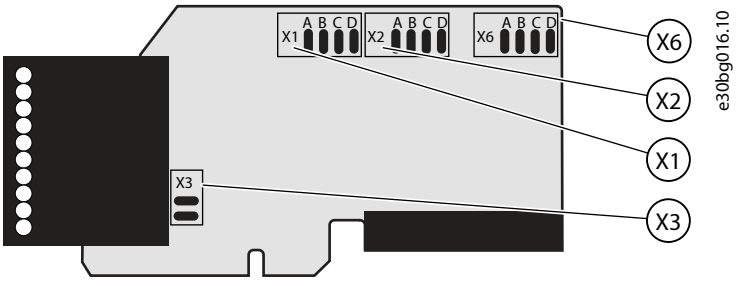


Figure 61: Jumper Blocks on OPTA1

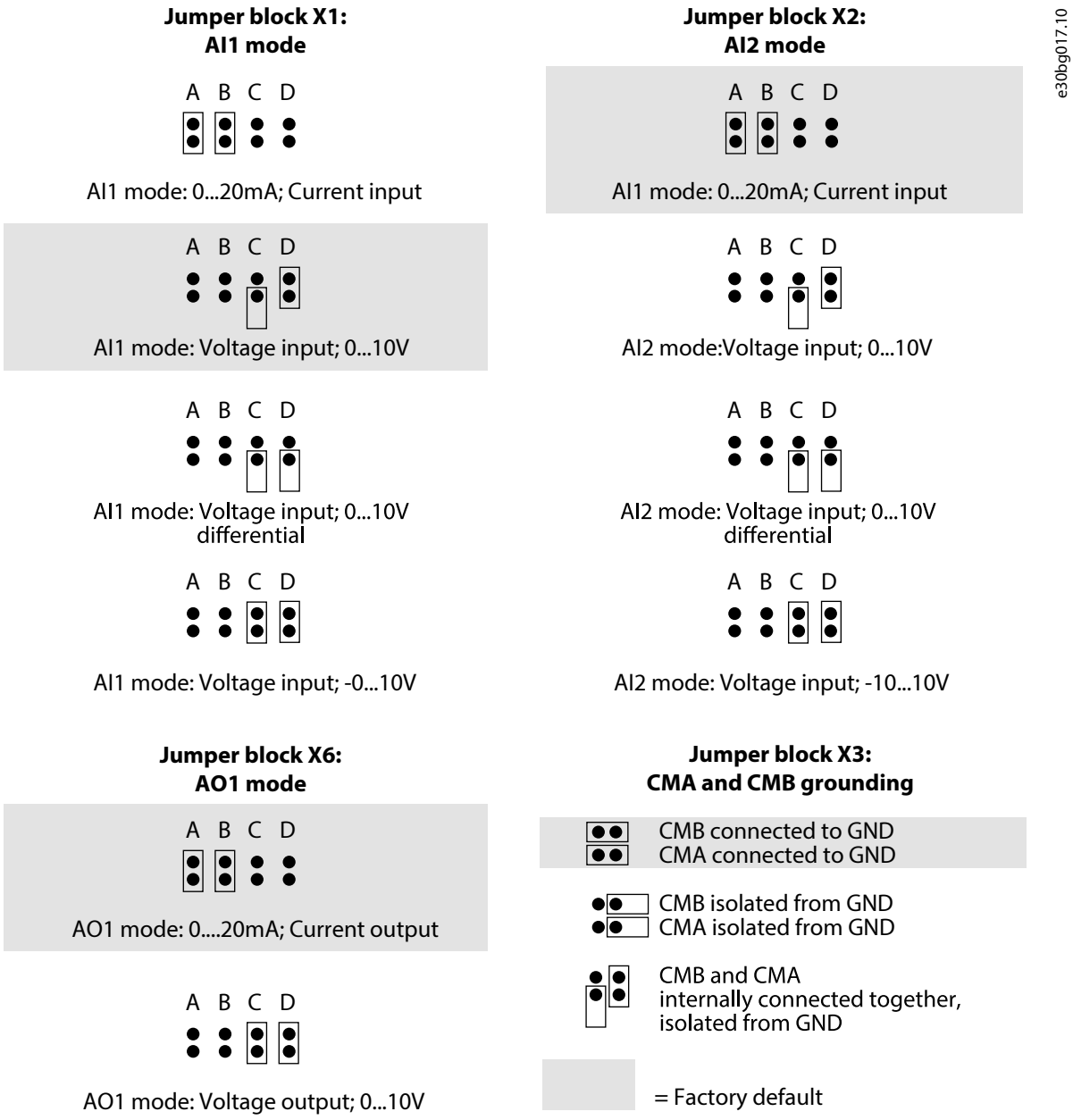


Figure 62: Jumper Selections for OPTA1

7.3.3 Control Terminals on OPTA2 and OPTA3

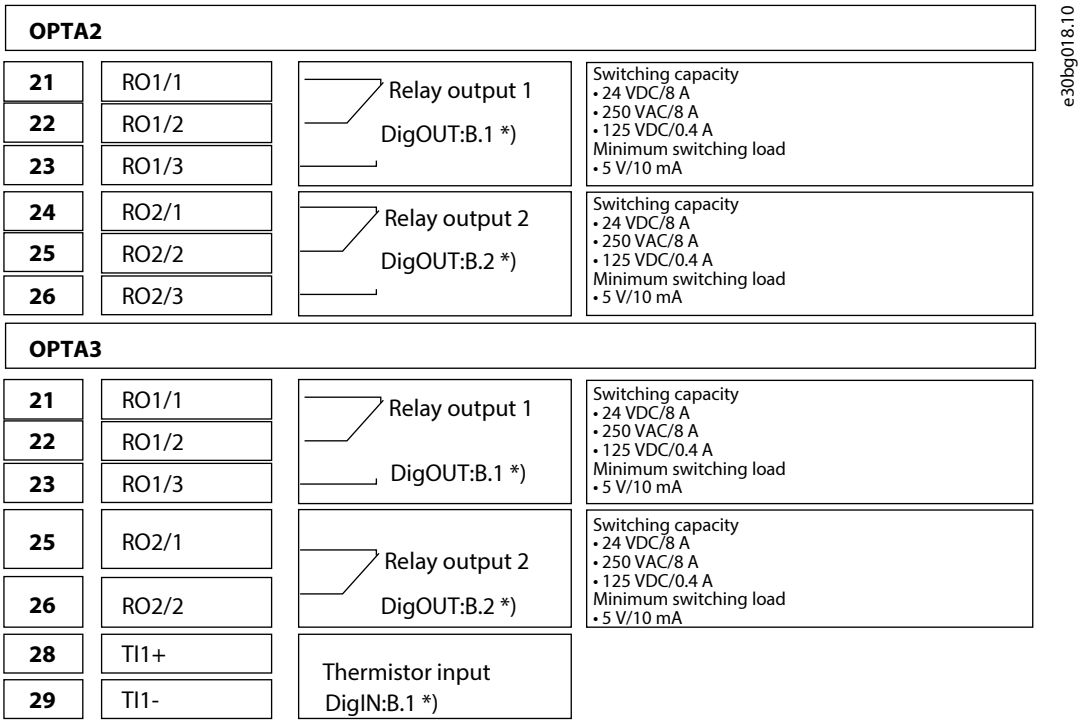


Figure 63: Control Terminal Signals on Relay Boards OPTA2 and OPTA3

*) Parameter reference on the control panel and NCDrive.

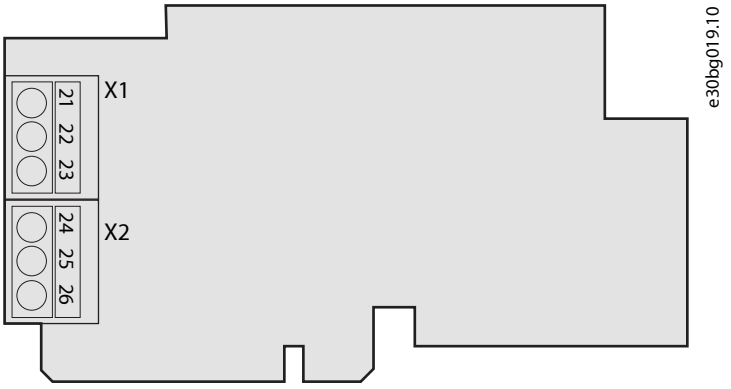


Figure 64: OPTA2

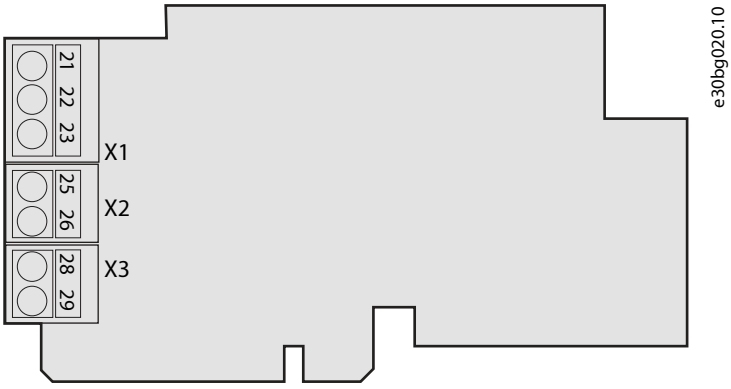


Figure 65: OPTA3

7.4 Installation of Option Boards

For information on how to install the option boards, see the option board guide or the *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 the I/O ground. See Figure 66

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

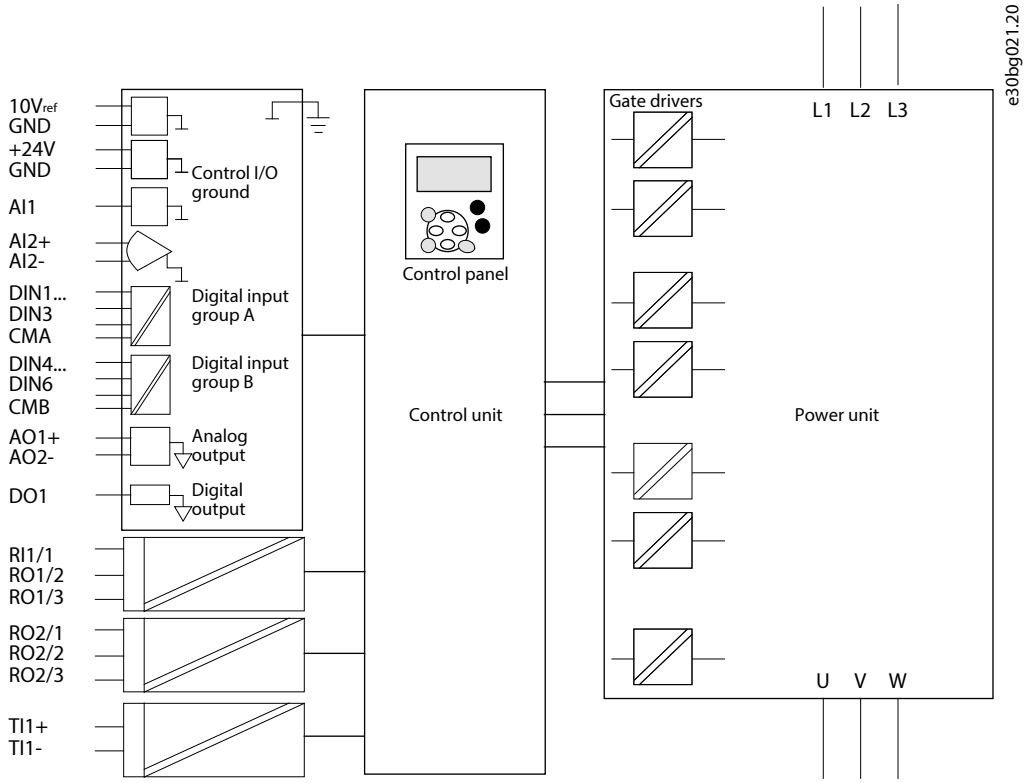


Figure 66: Galvanic Isolation Barriers

8 Using the Control Panel

8.1 Navigating on the Control Panel

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

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.

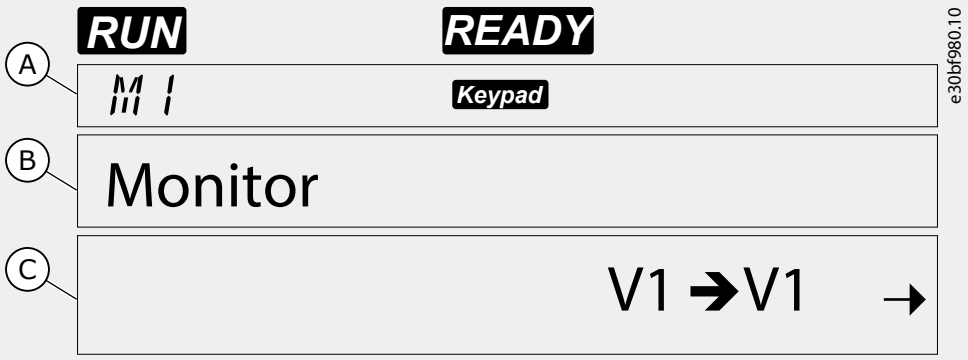


Figure 67: Navigation Items on the Control Panel

A	The location in the menu	**B**	The description (name of the menu)
C	The number of items that are available or the item value.		

8.2 Monitoring Menu

8.2.1 Using the Monitoring Menu (M1)

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.

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.

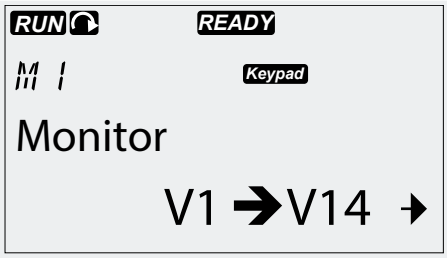


Figure 68: Monitoring Menu

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.

8.2.2 Monitoring Values

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

Table 14: Monitoring Values

Index	Monitoring 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 the 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 the *VACON® All in One Application Guide*.
V1.11	Analog input 1	V/mA	13	AI1[(1)]
V1.12	Analog input 2	V/mA	14	AI2[(1)]
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_{out}	mA	26	AO1
V1.17	Multimonitoring items	–	–	Shows 3 monitoring values to select from. See 8.7.6.9 Enabling/Disabling the Change of Multimonitoring Items.

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

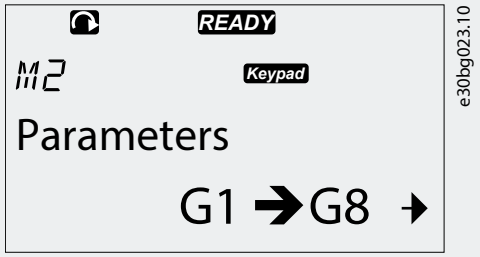
See the *VACON® All in One Application Guide* for more monitoring values.

8.3 Using the Parameter Menu (M2)

8.3.1 Finding the Parameter

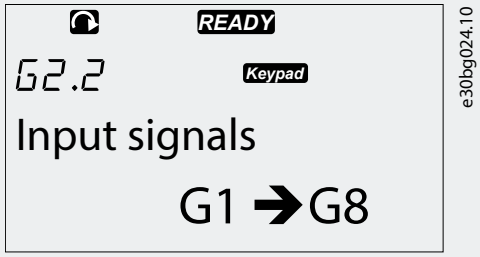
Use these instructions to find the parameter to edit.

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.



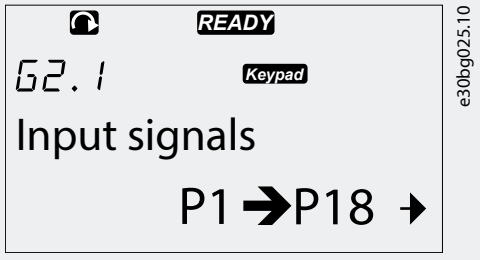
e30bg023.10

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



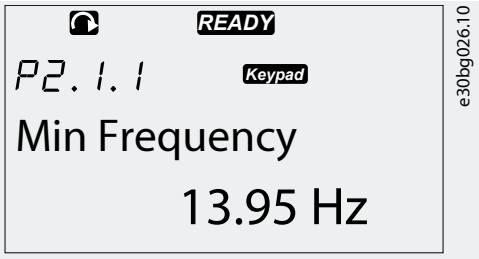
e30bg024.10

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



e30bg025.10

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 Down.



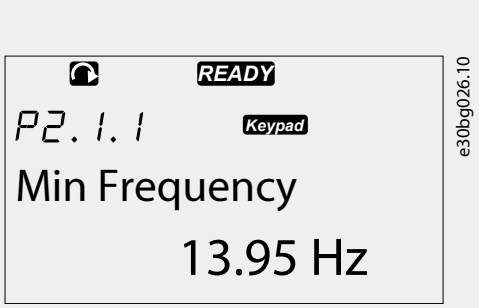
8.3.2 Selecting Values

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

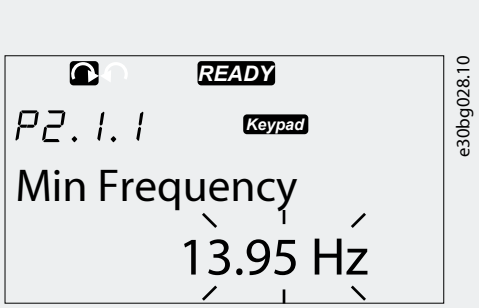
The basic application package "All in One+" includes 7 applications with different sets of parameters. For more information, see the *VACON® All in One Application Guide*.

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.

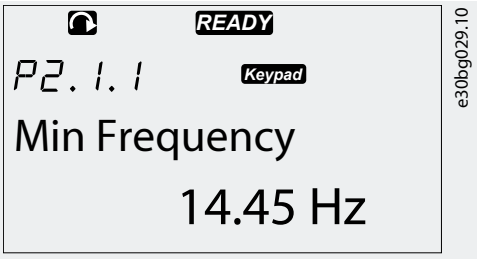
1. Use the Browser buttons Up and Down to find the parameter (P#) to edit. To move directly from the last parameter of a parameter group to the first parameter of that group, push the Browser button Down.



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.



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

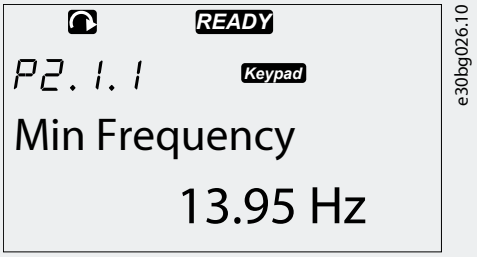
8.3.3 Editing the Values Digit by Digit

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

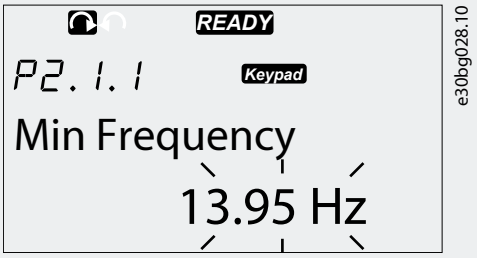
The basic application package "All in One+" includes 7 applications with different sets of parameters. For more information, see the *VACON® All in One Application Guide*.

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.

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



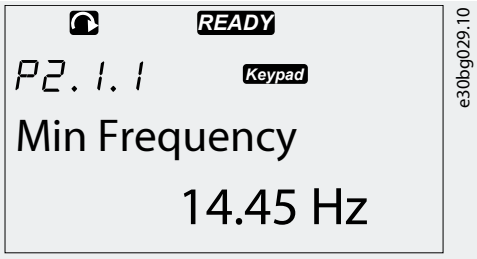
2. To go to the Edit mode, push the Menu button Right. The parameter value starts to blink.



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.

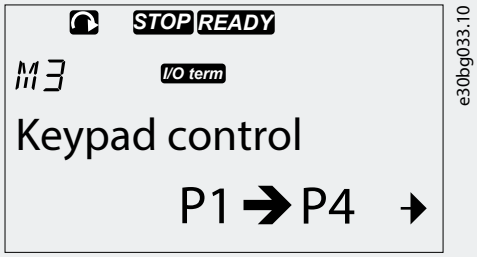
8.4 Using the Keypad Control Menu

8.4.1 Finding the Keypad Control Menu

In the Keypad control menu, the following functions are available:

- Selecting the control mode
- Editing the frequency reference
- Changing the direction of the motor

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 15: Keypad Control Parameters M3

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.1	Control place	1	3	–	1	125	The control mode 1 = I/0 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

Table 15: Keypad Control Parameters M3 - (continued)

Index	Parameter	Min	Max	Unit	Default	ID	Description
R3.3	Direction (on keypad)	0	1	–	0	–	–
R3.4	Stop button	0	1	–	1	114	0 = Limited function of Stop button 1 = Stop button always enabled

8.4.3 Changing the Control Mode

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

Table 16: The Control Modes and Symbols

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

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

8.4.4.1 The Keypad Reference Submenu

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

8.4.4.2 Editing the Frequency Reference

Use these instructions to change the frequency reference.

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 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

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 3.9 Keypad and 9.2 Commissioning the AC Drive.

1. In the *Keypad control* menu (*M3*), find the Keypad direction with the Browser buttons Up and Down.
2. To go to the edit mode, push the Menu button Right.
3. Select the direction with Browser buttons Up and Down.

   The rotation direction changes on the control panel.

4. To make the motor 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

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

1. In the *Keypad control* menu (*M3*), find the submenu 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

This is a special function only available in menu M3.

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

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

   In another 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

These are special functions only available in menu M3.

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

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

1. Keep the *enter* button pushed down for 3 s.

   In another 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.

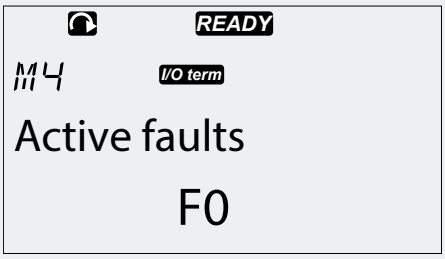
8.5 Using the Active Faults Menu (M4)

8.5.1 Finding the Active Faults Menu

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 13.1 Fault Code Information.

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 an active fault, the fault and fault type symbols are shown on the display.

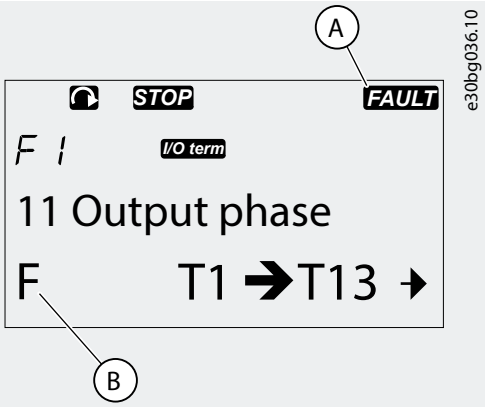


Figure 69: Fault Symbols

A	Fault symbol	**B**	Fault type symbol

8.5.2 Examining the Fault Time Data Record

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

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.

Table 17: Fault Time Data Record

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 current	V	–
T.6	Motor power	%	–
T.7	Motor torque	%	–
T.8	DC voltage	V	–
T.9	Unit temperature	°C	–
T.10	Run status	–	–

Table 17: Fault Time Data Record - (continued)

Code	Description	Value	Real Time Data Record
T.11	Direction	–	–
T.12	Warnings	–	–
T.13	0-speed(1)	–	–
T.14	Subcode	–	–
T.15	Module	–	–
T.16	Submodule	–	–

1) 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 menu (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 13.1 Fault Code Information.

8.6.2 Resetting the Fault History

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

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.

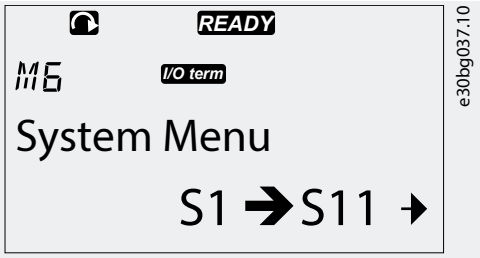
   The symbol H# changes to *0*.

8.7 Using the System Menu (M6)

8.7.1 Finding the System Menu

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.

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 18: System Menu Functions

Index	Function	Min	Max	Unit	Default	Description
S6.1	Language selection	–	–	–	English	The selection is different in all the language packages.
S6.2	Application selection	–	–	–	Basic application	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

Table 18: System Menu Functions - (continued)

Index	Function	Min	Max	Unit	Default	Description
P6.5.2	Parameter lock	–	–	–	Change Enabled	Change Enabled Change Disabled
S6.5.3	Start-up wizard	–	–	–	–	No Yes
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	–	–	–	Con-nected	Not connected Connected
P6.7.2	Fan control	–	–	–	Continu-ous	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	–	–	–	Con-nected	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	–	–

Table 18: System Menu Functions - (continued)

Index	Function	Min	Max	Unit	Default	Description
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	–	–	–	–	–
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	–	–	–	–	–
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. Contact Danfoss to get instructions.

8.7.3 Changing the Language

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

1. In the ***System*** menu (*M6*), find the *Language* selection submenu (*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 Browser 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

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

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

1. In the *System* menu (*M6*), find the *Application selection* submenu (*S6.2*) 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 setup.
6. When the display shows the question *Copy parameters?*, there are 2 options:

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

   a. To upload the parameters of the new application to the control panel, select *Yes* with the Browser buttons.

   b. 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)

8.7.5.1 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.

8.7.5.2 Saving Parameter Sets (Parameter Sets S6.3.1)

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.

1. In the Copy parameters (*S6.3*) submenu, 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.

   a. Select *LoadFactDef* to download again the factory default values.

   b. Select *Store set 1* to save the actual values of all parameters as set 1.

   c. Select *Load set 1* to download the values in set 1 as the actual values.

   d. Select *Store set 2* to save the actual values of all parameters as set 2.

   e. 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.

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

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

1. In the Copy parameters (*S6.3*) submenu, find the *Up to keypad* menu (*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.

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

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

1. In the Copy parameters (*S6.3*) submenu, find the *Down from keypad* menu (*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:
   a. All parameters (*All param.*)
   b. All parameters but the motor nominal value parameters (*All. no motor*)
   c. Application parameters
5. To accept the selection, push the *enter* button.
6. Wait until *OK* shows on the display.

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

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

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

1. In the Copy parameters (*S6.3*) submenu, find the Automatic parameter back-up menu (*S6.3.4*).
2. To go to the edit mode, push the Menu button Right.
3. There are 2 options:
   a. To activate the Automatic parameter back-up, select *Yes* with the Browser buttons.
   b. 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.

8.7.5.6 Comparing the Parameters

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.

1. In the ***Copy parameters***(*S6.3*) submenu, 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 submenu with the parameter values, push the Menu button Right.

   In the display that opens, check the values on the different lines.

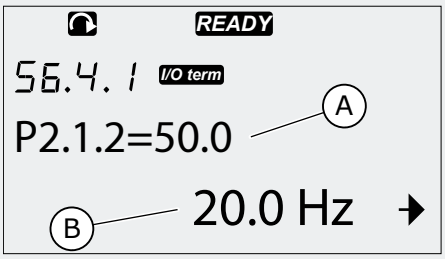


Figure 70: Parameter Values in Parameter Comparison

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

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

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

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.

IMPORTANT: Keep the password in a safe location.

8.7.6.3 Setting a Password

Set a password to protect the application selection menu.

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

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.

   i. Push the Browser buttons to set the digit on the right.

   ii. Push the Menu button Left, and set the digit on the left.

   iii. 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

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

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

8.7.6.5 Deactivating the Password Function

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

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

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.

NOTE: This function does not prevent unauthorized changes of parameter values.

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 the 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.

Table 19: Action and Button

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

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

1. In the *System* menu (*M6*), find the parameter ***P6.5.3***.
2. To go to the edit mode, push the Menu button Right.
3. Select the action:
   a. To activate the start-up wizard, select *Yes* with the Browser buttons.
   b. 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

Use Multimonitoring to monitor up to 3 actual values at the same time. See 8.2.1 Using the Monitoring Menu (M1) and the chapter *Monitoring Values* in the relevant application guide.

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

1. In the *Security* submenu, find Multimonitoring items parameter (*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

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

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

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

   - *Default page*(*P6.6.1*)
   - *Default page/Operating menu* (*P6.6.2*)
   - *Timeout time*(*P6.6.3*)
   - *Contrast adjustment* (*P6.6.4*)
   - *Backlight time* (*P6.6.5*)

8.7.7.2 Changing the Default Page

Use the *Default page* to set the location (menu) 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 menu that was last showed on the display.

1. In the *Keypad settings* submenu, find the *Default page* parameter (*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, push the Menu button Right. Change the number of the submenu with the Browser buttons.
5. To edit the third level submenu number, push the Menu button Right. Change the number of the third level submenu 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 menu 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

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.

1. In the *Keypad settings* submenu, find the *Timeout time* parameter (*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

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.

Use a password to go to the Hardware settings submenu, see 8.7.6.2 Passwords.

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

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*. Changing this value to *Not conn.* is recommended if:

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

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

1. In the Hardware settings submenu, find the Internal brake resistor connection (*P6.7.1*) parameter 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:
  - 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

Use these instructions to change the Fan Control Settings.

1. In the ***Hardware settings*** submenu, find the ***Fan control*** settings (***P6.7.2***) 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 P6.7.3 and P6.7.4 (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 ***P6.7.3*** 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 ***P6.7.3*** 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 NCDrive monitoring.

8.7.8.6 Changing the HMI Acknowledge Timeout

Use these instructions to change the HMI Acknowledge Timeout.

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)

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.

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 FI9 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

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

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*** submenu (***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 the control unit runs on +24 V only.

Table 20: Total Counters

Index	Counter	Example
C6.8.1.1.	MWh counter	
C6.8.1.2.	Power On day counter	The value on the display is 1.013. The drive has operated for 1 year and 13 days.
C6.8.1.3.	Power On hour counter	The value on the 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*** submenu (***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 21: Trip Counters

Index	Counter	Example
T6.8.2.1	MWh counter	–
T6.8.2.3	Operation day counter	The value on the display is 1.013. The drive has operated for 1 year and 13 days.
T6.8.2.4	Operation hour counter	The value on the 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

Use these instructions to reset the trip counters.

1. In the ***System info*** submenu, find the ***Trip counters*** submenu (***6.8.2***) with the Browser buttons.
2. To go to the ***Clear MWh counter*** parameter (***6.8.2.2***, ***Clr MWh cntr***) or to the ***Clear Operation time counter*** parameter (***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 submenu includes information on the AC drive software.

Table 22: Software

Index	Content
6.8.3.1	Software package
6.8.3.2	System software version

Table 22: Software - (continued)

Index	Content
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.

Table 23: Applications

Index	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 Submenu

Use these instructions to examine the ***Applications***submenus.

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

8.7.9.8 Hardware (S6.8.5)

The *Hardware* information submenu includes information on the AC drive hardware.

Table 24: Hardware

Index	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

The *Expander boards* submenus 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.

1. In the *System info*submenu, find the *Expander boards* submenu (*6.8.6*) with the Browser buttons.
2. To go to the *Expander boards* submenu, 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. Contact Danfoss 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 25: Option Board Parameters (Board OPTA1)

Index	Parameter	Min	Max	Default	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

Use these instructions to examine the connected option boards.

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

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

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 the 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 components of the power unit 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, and W, and the DC terminals must be treated as live when the drive is connected to mains. Contact with voltage can lead to death or serious injury.

- Do not touch the motor terminals U, V, and W, and the DC terminals when the drive is connected to mains.
- Do not work on live equipment.
- Before doing any work on internal drive components, follow proper lock out and tag out procedure.
- Before connecting the drive to mains, make sure that all covers are installed on the drive, and the cabinet doors are closed.

DANGER

SHOCK HAZARD FROM DC LINK OR EXTERNAL SOURCE

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

- Do not touch the main circuit of the drive or the motor before the system is powered off and grounded.
- Disconnect the drive from the mains and ensure that the motor has stopped.
- Disconnect the motor.
- Lock out and tag out the power source to the drive.
- Ensure that no external source generates unintended voltage during work.
- Ground the drive for work.
- Wait for the capacitors to discharge fully before opening the door or the cover of the AC drive. Refer to the label on the drive for the correct discharge time.
- 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 DC supply. 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/FI8 is hot.

- Do not touch the side of the AC drive FR8/FI8 when it operates.

⚠ CAUTION

FIRE HAZARD FROM HOT SURFACES

When the AC drive FR6/FI6 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/FI6 on a surface that is not fireproof.

9.2 Commissioning the AC Drive

Prerequisite: Read the safety instructions in 2.2 Safety Precautions and 9.1 Safety Checks before Starting the Commissioning and obey them.

Follow these instructions to commission the AC drive.

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:

   - 6.1.4 Cable Selection and Dimensioning and related tables
   - 6.1.1 Overview of Cable Connections
   - 6.2.1 EMC-compliant Installation
5. Make sure that the control cables are sufficiently far from the power cables. See 6.5.2 Prerequisites for Cable Installation
6. Make sure that the shields of the shielded cables are connected to a grounding terminal that is identified with the grounding symbol.
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 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

9.3.1 Measuring the Insulation Resistance of the Motor Cable

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

The AC drive is already measured at the factory.

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 MΩ at the ambient temperature of 20 °C (68 °F).

9.3.2 Measuring the Insulation Resistance of the Mains Cable

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

The AC drive is already measured at the factory.

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 MΩ at the ambient temperature of 20 °C (68 °F).

9.3.3 Measuring the Insulation Resistance of the Motor

Use these instructions to check the insulation of the motor.

The AC drive is already measured at the factory.

NOTICE

Obey the instructions of the motor manufacturer.

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 V.
4. The insulation resistance must be >1 MΩ at the ambient temperature of 20 °C (68 °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

Before starting the motor, do these checks.

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

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 the *VACON® NX All-in-One Application Guide*) to agree with the requirements of the used application. To find the necessary values for the parameters, see the motor nameplate. Set at least these parameters:
   a. Motor nominal voltage
   b. Motor nominal frequency
   c. Motor nominal speed
   d. Motor nominal current
   e. 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 9.4.2.1 Overview
   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

9.4.2.1 Overview

Do either Test A or Test B.

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

9.4.2.2 Test A: Control from the Control Terminals

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

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

9.4.2.3 Test B: Control from the Keypad

Do this RUN test when the control mode is keypad.

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 8.4.4.1 The Keypad Reference Submenu). To change the frequency reference, use the Browser buttons.
4. Check in the Monitoring menu M1 that the value of the 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

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 the drive and the motor know about the tests.

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 closed-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 9.4.2.2 Test A: Control from the Control Terminals or 9.4.2.3 Test B: Control from the Keypad.
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 closed-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 the *VACON® NX All-in-One Application Guide*, parameter ***ID631***.

10 Maintenance

10.1 Preventive Maintenance Recommendations

Generally, all technical equipment, including Danfoss AC drives, need a minimum level of preventive maintenance. To ensure trouble-free operation and long life of the drive, regular maintenance is recommended. It is also recommended as a good service practice to record a maintenance log with counter values, date, and time describing the maintenance and service actions.

Danfoss recommends the following inspections and service intervals for air-cooled drives/systems.

NOTICE

The service schedule for part replacements can vary depending on operating conditions. Under specific conditions, the combination of stressful operation and environmental conditions work together to reduce the lifetime of the components significantly. These conditions can include, for example, extreme temperature, dust, high humidity, hours of use, corrosive environment, and loading.

For operation in stressful conditions, Danfoss offers the DrivePro® Preventive Maintenance service. DrivePro® services extend the lifetime and increase the performance of the product with scheduled maintenance including customized part replacements. DrivePro® services are tailored to the specific application and operating conditions.

Table 26: Maintenance Schedule for Air-cooled Drives

Component	Inspection interval[1]	Service schedule[2]	Preventive maintenance actions
Installation			
Visual inspection	1 year	–	Check for the unusual, for example, for signs of overheating, aging, corrosion, and for dusty and damaged components.
Auxiliary equipment	1 year	According to manufacturer recommendations	Inspect equipment, switchgear, relays, disconnects, or fuses/circuit breakers. Examine the operation and condition for possible causes of operational faults or defects. The continuity check on fuses must be performed by trained service personnel.
EMC consideration	1 year	–	Inspect the wiring regarding the electromagnetic capability and the separation distance between control wiring and power cables.
Cable routing	1 year	–	Check for parallel routing of motor cables, mains wiring, and signal wiring. Avoid parallel routing. Avoid routing cables through free air without support. Check for aging and wearing of the cable insulation.
Control wiring	1 year	–	Check for tightness, damaged or crimped wires, or ribbon wires. Terminate the connections correctly with solid crimped ends. The use of shielded cables and grounded EMC plate, or a twisted pair is recommended.
Clearances	1 year	–	Check that the external clearances for proper airflow for cooling follow the requirements for the frame and product type. For clearances, refer to the local design regulations.
Sealing	1 year	–	Check that the sealing of the enclosure, the covers, and the cabinet doors are in good condition.

Table 26: Maintenance Schedule for Air-cooled Drives - (continued)

Component	Inspection interval[1]	Service schedule[2]	Preventive maintenance actions
Corrosive environments	1 year	–	Conductive dust and aggressive gases, such as sulphide, chloride, and salt mist, can damage the electrical and mechanical components. Air filters do not remove airborne corrosive chemicals. Act based on the findings.
Drive			
Programming	1 year	–	Check that the AC drive parameter settings are correct according to the motor, drive application, and I/O configuration. Only trained service personnel are allowed to perform this action.
Control panel	1 year	–	Check that the display pixels are intact. Check the event log for warnings and faults. Repetitive events are a sign of potential issues. If necessary, contact a local service center.
Drive cooling capacity	1 year	–	Check for blockages or constrictions in the air passages of the cooling channel. The heat sinks must be free of dust and condensation.
Cleaning and filters	1 year	–	Clean the interior of the enclosure annually, and more frequently if necessary. The amount of dust in the filter or inside the enclosure is an indicator for when the next cleaning or filter replacement is required.
Fans	1 year	3–10 years	Inspect the condition and operational status of all cooling fans. With the power off, the fan axis should feel tight, and spinning the fan with a finger, the rotation should be almost silent and not have abnormal rotation resistance. When in RUN mode, fan vibration, excessive or strange noise is a sign of the bearings wearing, and the fan must be replaced.
Grounding	1 year	–	The drive system requires a dedicated ground wire connecting the drive, the output filter, and the motor to the building ground. Check that the ground connections are tight and free of paint or oxidation. Daisy-chain connections are not allowed. If applicable, braided straps are recommended.
Power cables and wiring	1 year	–	Check for loose connections, aging, insulation condition, and proper torque to the drive connections. Check for proper rating of fuses and continuity check. Observe if there are any signs of operation in a demanding environment. For example, discoloration of the fuse housing can be a sign of condensation or high temperatures.
Vibration	1 year	–	Check for abnormal vibration or noise coming from the drive to ensure that the environment is stable for electronic components.
Spare parts			
Spare parts	1 year	2 years	Stock spares in their original boxes in a dry and clean environment. Avoid hot storage areas. Electrolytic capacitors require reforming as stated in the service schedule. The reforming must be performed by trained service personnel.
Exchange units and units stored for long periods before commissioning	1 year	2 years	Visually inspect for signs of damage, water, high humidity, corrosion, and dust within the visual field of view without disassembly. The exchange units with mounted electrolytic capacitors require reforming as stated in the service schedule. The reforming must be performed by trained service personnel.

1) Defined as the time after the commissioning/startup or the time from the previous inspection.

2) Defined as the time after the commissioning/startup or the time from the previous service schedule actions.

10.2 Reforming the Capacitors

10.2.1 Overview of Reforming the Capacitors

The electrolytic capacitors in the DC link rely on a chemical process to provide the insulator between the two metal plates. This process can degrade over the years when the drive has been non-operational (in storage). The result is that the working voltage of the DC link gradually falls.

Ensure that the insulation layer of the capacitor is reformed by applying a limited current using a DC supply. The current limiting ensures that the heat generated within the capacitor is kept at a sufficiently low level to avoid any damage.

DANGER

SHOCK HAZARD FROM CAPACITORS

The capacitors can be charged even when disconnected. Contact with this voltage can lead to death or serious injury.

- If the AC drive or spare capacitors are intended to be stored, discharge the capacitors before storage.
- Use a measuring device to make sure that there is no voltage.
- If in doubt, contact the local distributor.

10.2.2 Case 1: AC Drive which has been Non-operational or Stored for over 2 years

1. Connect the DC supply to L1 and L2 **or** the B+/B terminals (DC+ to B+, DC- to B-) of the DC link or directly to the capacitor terminals. In the VACON® NXP with no B+/B- terminals (FR8–FR9/FI8–FI9), connect the DC supply between 2 input phases (L1 and L2).
2. Set the current limit maximum to 800 mA.
3. Slowly increase the DC voltage to the nominal DC voltage level of the AC drive (1.35 x U_n AC).
4. Start to reform the capacitors.

   The time of reforming depends on the time of storage. See Figure 71.

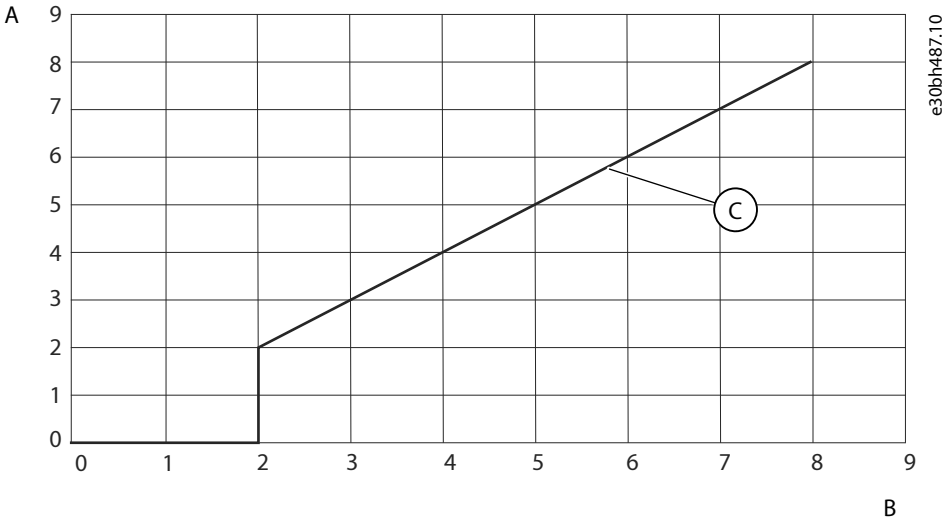


Figure 71: Storage Time and Reforming Time

A	Storage time (years)	**B**	Reforming time (hours)
C	Reforming time		

5. After the reforming operation is done, discharge the capacitors.

10.2.3 Case 2: Spare Capacitor which has been Stored for over 2 Years

1. Connect the DC supply to DC+/DC- terminals.
2. Set the current limit maximum to 800 mA.
3. Slowly increase the DC voltage to the capacitor nominal voltage level. See information from component or service documentation.
4. Start to reform the capacitors.

   The time of reforming depends on the time of storage. See Figure 71.

5. After the reforming operation is done, discharge the capacitors.

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):
  - Location indication F1.
  - Fault code, see 13.1 Fault Code Information.

    For option board related fault codes, see the option board guide.
  - Short description of the fault.
  - Fault type symbol, see Table 27.
  - *FAULT* or *ALARM* symbol.
- The red indicator light 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 27: 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 Autoreset)	The type 'AR fault' stops the drive. The fault is reset automatically and the drive tries to start the motor again. If it cannot 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 an 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

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

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:
   a. Push the *reset* button on the control panel for 2 s.
   b. 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 a Service Info File

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

Make sure the VACON® NCDrive PC tool is installed on the computer. To install it, go to www.danfoss.com/en/service-and-support/downloads/dds/mydrive-suite/.

1. Open VACON® NCDrive.
2. Go to *File* and select *Service Info...*.

   The service information file opens.
3. Save the service info file on the computer.

11.4 Error Message on Control Panel Display

The alphanumerical keypad memory has been upgraded from 32 kbit to 64 kbit in VACON® NX AC drives. This allows the applications with larger parameter sets to be copied to keypad memory. For more information on control panel display, see 3.10 Display.

If an application with larger parameter sets is uploaded into the 32 kbit control panel, it shows an error message "Failed". A new control panel version with 64 kbit must be used to avoid the error message.

12 Specifications

12.1 Weights of the AC Drive

Table 28: Weights of the AC Drive

Enclosure size	Weight, 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 Standalone	340	750
FR11 Standalone(1)	470	1036
FR11 Standalone(1), 0460–0502, 690 V	400	882

1) Only available in IP21

12.2 Dimensions

12.2.1 List of Dimension Information

This topic gives a list of dimension information for different types of VACON® 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 Standalone

12.2.2 **Wall-mounted**

12.2.2.1 **Dimensions for FR4–FR6**

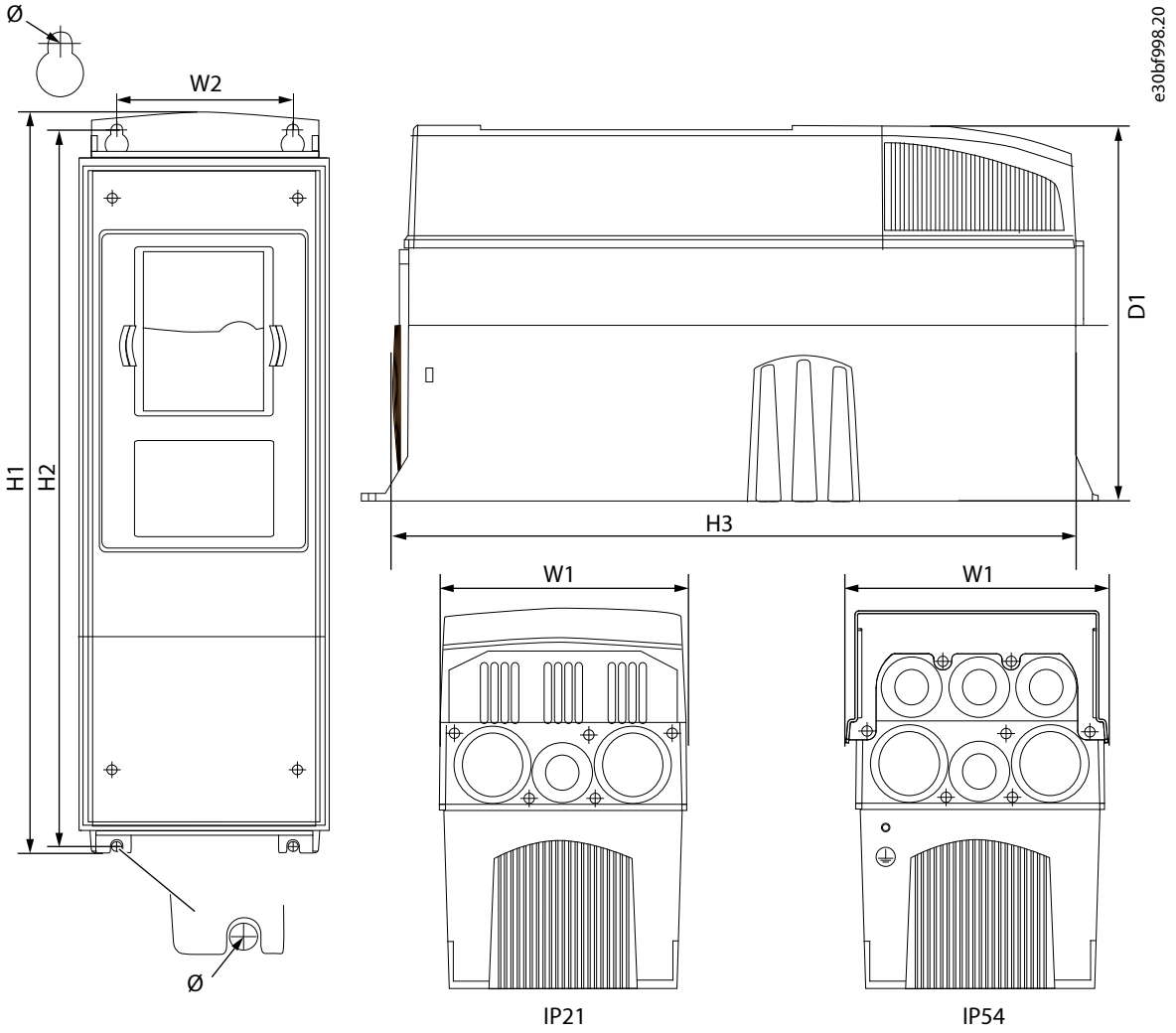


Figure 72: Dimensions of the VACON® NXS/NXP AC Drive, FR4–FR6

Table 29: Dimensions in mm (in inch) of the VACON® NXS/NXP AC Drive, FR4–FR6

Drive type	W1	W2	H1	H2	H3	D1	Ø
• 0003 2–0012 2 • 0003 5–0012 5	128 (5.04)	100 (3.94)	327 (12.87)	313 (12.32)	292 (11.5)	190 (7.48)	7 (0.27)
• 0017 2–0031 2 • 0016 5–0031 5	144 (5.67)	100 (3.94)	419 (16.5)	406 (15.98)	391 (15.39)	214 (8.43)	7 (0.27)
• 0048 2–0061 2 • 0038 5–0061 5 • 0004 6–0034 6	195 (7.68)	148 (5.83)	558 (21.97)	541 (21.3)	519 (20.43)	237 (9.33)	9 (0.35)

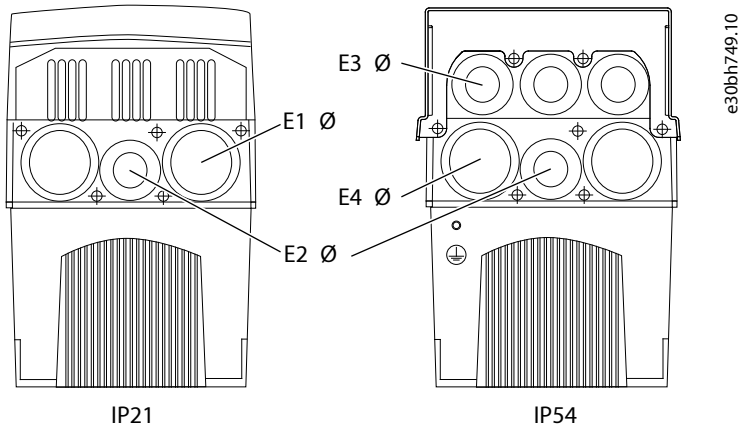


Figure 73: Dimensions of the Mounting Holes for VACON® NXS/NXP AC Drive, FR4–FR6

Table 30: Dimensions of the Mounting Holes in mm (inch) for VACON® NXS/NXP AC Drive, FR4–FR6

Drive type	E1Ø, grommet inside diameter	E1Ø, gland plate hole	E2Ø, grommet inside diameter[1]	E2Ø, gland plate hole	E3Ø, grommet inside diameter[1]	E3Ø, gland plate hole	E4Ø, grommet inside diameter[1]	E4Ø, gland plate hole
• 0003 2–0012 2 • 0003 5–0012 5	13.5 (0.53)	20.3 (0.80)	13.5 (0.53)	20.3 (0.80)	• +QGLM: 13.5 (0.53) • +QGLC: 21 (0.83)	• +QGLM: 20.3 (0.80) • +QGLC: 28 (1.1)	• +QGLM: 16 (0.63) • +QGLC: 21 (0.83)	• +QGLM: 25.3 (3 x 1.0) • +QGLC: 28 (1.1)
• 0017 2–0025 2 • 0016 5–0022 5	16 (0.63)	3 x 25.3 (3 x 1.0)	16 (0.63)	3 x 25.3 (3 x 1.0)	16 (0.63)	6 x 25.3 (6 x 1.0)	16 (0.63)	6 x 25.3 (6 x 1.0)

Table 30: Dimensions of the Mounting Holes in mm (inch) for VACON® NXS/NXP AC Drive, FR4–FR6 - (continued)

Drive type	E1Ø, grommet inside diameter	E1Ø, gland plate hole	E2Ø, grommet inside diameter(1)	E2Ø, gland plate hole	E3Ø, grommet inside diameter(1)	E3Ø, gland plate hole	E4Ø, grommet inside diameter(1)	E4Ø, gland plate hole
• 0031 2 • 0031 5	21 (0.83)	33 (1.30)	16 (0.63)	25.3 (1.0)	21 (0.83)	25.3 (1.0)	16 (0.63)	33 (1.30)
• 0048 2–0061 2 • 0038 5–0061 5 • 0004 6–0034 6	21 (0.83)	3 x 33 (3 x 1.30)	21 (0.83)	3 x 33 (3 x 1.30)	16 (0.63)	• +QGLM: 3 x 25.3 (3 x 1.0) • +QGLC: 3 x 28.3 (3 x 1.11)	• +QGLM: 21 (0.83) • +QGLC: 29 (1.14)	• +QGLM: 3 x 33 (3 x 1.30) • +QGLC: 3 x 37 (3 x 1.46)

1) Same as maximum cable thickness

12.2.2.2 Dimensions for FR7

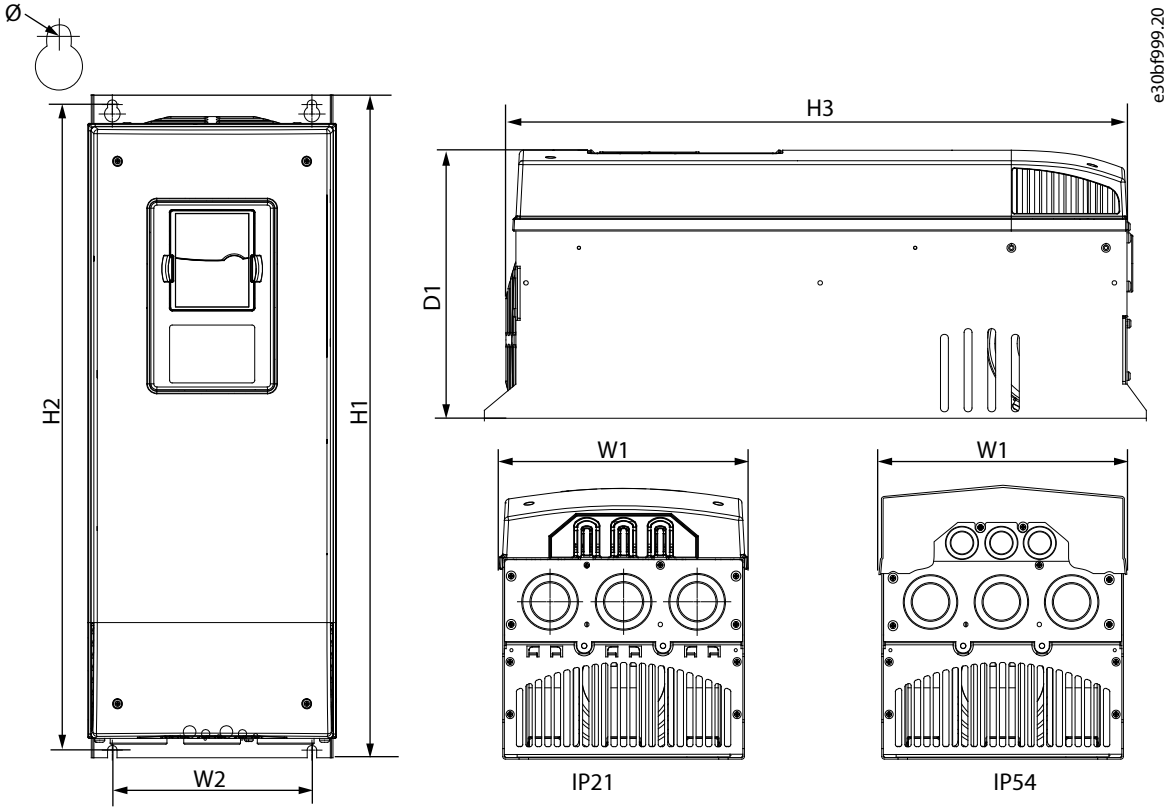


Figure 74: Dimensions of the VACON® NXS/NXP AC Drive, FR7

Table 31: Dimensions in mm (in inch) of the VACON® NXS/NXP AC Drive, FR7

Drive type	W1	W2	H1	H2	H3	D1	Ø
• 0075 2–0114 2 • 0072 5–0105 5 • 0041 6–0052 6	237 (9.33)	190 (7.48)	630 (24.80)	614 (24.17)	591 (23.27)	257 (10.12)	9 (0.35)

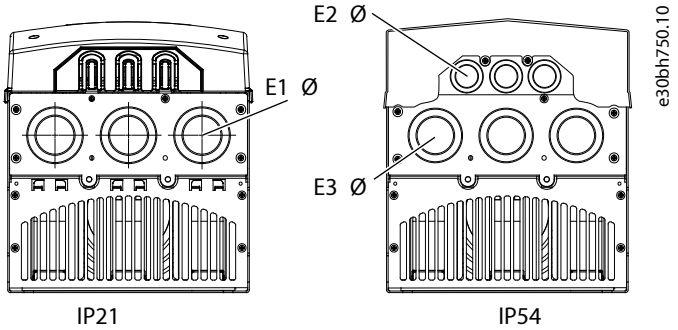


Figure 75: Dimensions of the Mounting Holes for VACON® NXS/NXP AC Drive, FR7

Table 32: Dimensions of the Mounting Holes in mm (inch) for VACON® NXS/NXP AC Drive, FR7

Drive type	E1Ø, grommet inside diameter[1]	E1Ø, gland plate hole	E2Ø, grommet inside diameter[1]	E2Ø, gland plate hole	E3Ø, grommet inside diameter[1]	E3Ø, gland plate hole
• 0075 2–0114 2 • 0072 5–0105 5 • 0041 6–0052 6	36 (1.42)	3 x 50.3 (3 x 1.98)	21 (0.83)	3 x 28.3 (3 x 1.11)	36 (1.42)	3 x 50.3 (3 x 1.98)

1) Same as maximum cable thickness

12.2.2.3 Dimensions for FR8

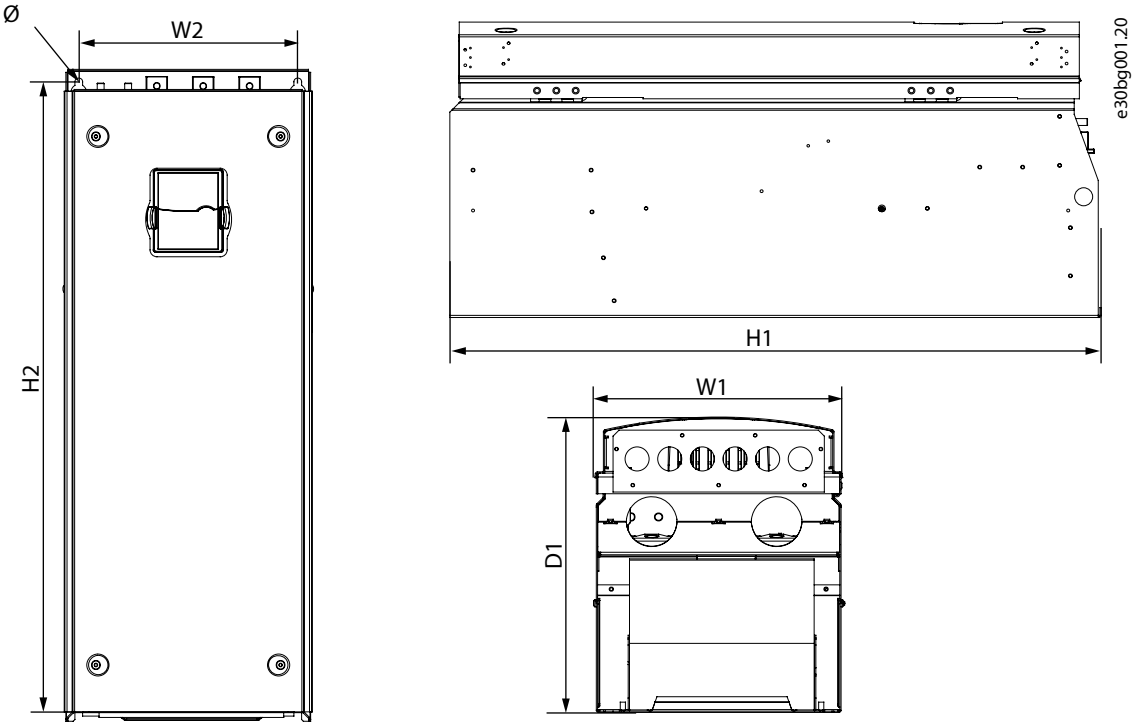


Figure 76: Dimensions of the VACON® NXS/NXP AC Drive, FR8, IP21/IP54

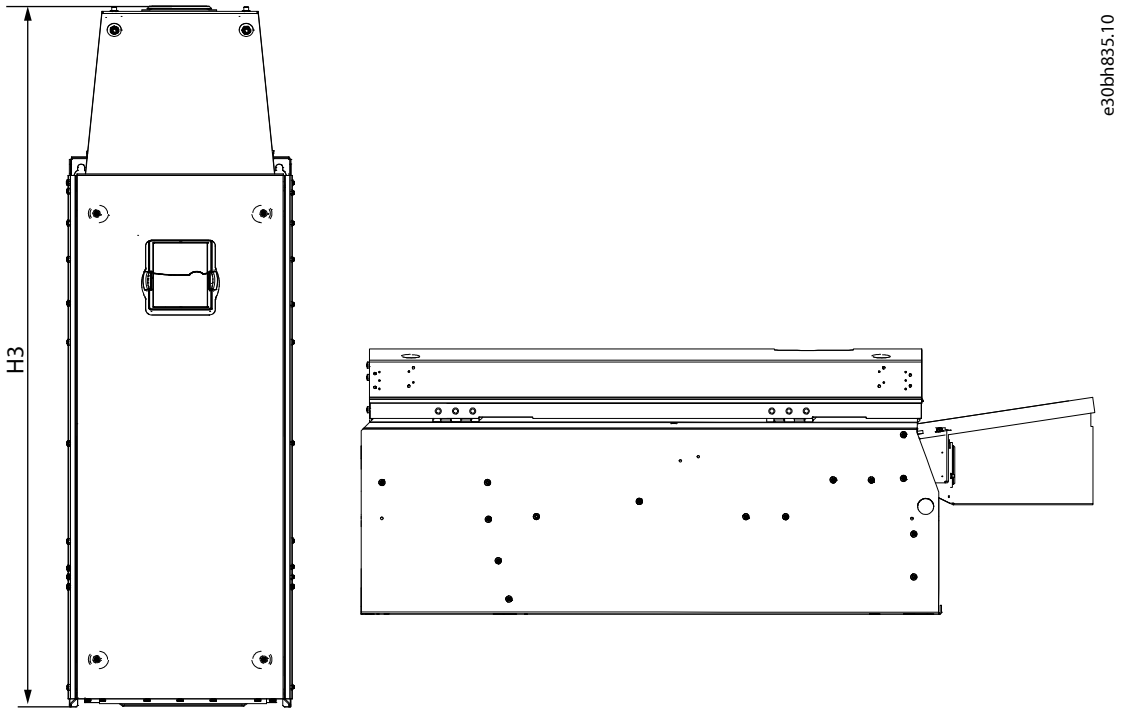


Figure 77: Dimensions of the VACON® NXS/NXP AC Drive, FR8 with DC Connection Extension Box

Table 33: Dimensions in mm (in inch) of the VACON® NXS/NXP AC Drive, FR8

Drive type	W1	W2	H1	H2	H3	D1	Ø
• 0140 2–0205 2 • 0140 5–0205 5 • 0062 6–0100 6	291 (11.47)	255 (10.04)	758 (29.88)	732 (28.81)	1008 (39.69)	344 (13.54)	9 (0.35)

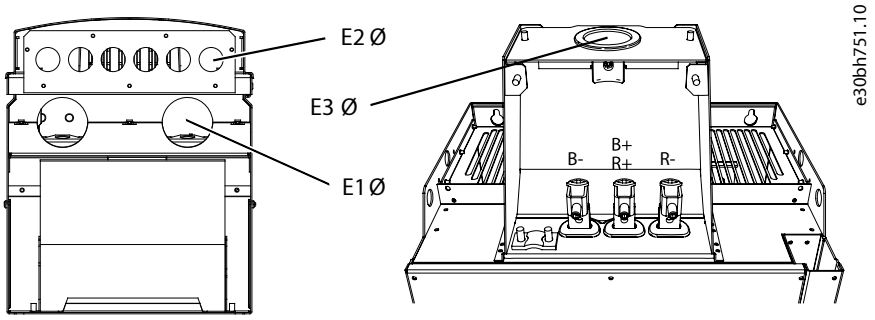


Figure 78: Dimensions of the Mounting Holes for VACON® NXS/NXP AC Drive, FR8

Table 34: Dimensions of the Mounting Holes in mm (inch) for VACON® NXS/NXP AC Drive, FR8

Drive type	E1Ø, grommet inside diameter[1]	E1Ø, gland plate hole	E2Ø, grommet inside diameter[1]	E2Ø, gland plate hole	E3Ø, grommet inside diameter[1]	E3Ø, gland plate hole
• 0140 2–0205 2 • 0140 5–0205 5 • 0062 6–0100 6	• IP21: 2 x GD48, 48 (1.89) • IP54: 2 x MC07115, 56 (2.20)	2 x 59 (2 x 2.32)	–	6 x 28 (6 x 1.10)	60 (2.36)	75 (2.95)

1) Same as maximum cable thickness. NOTE! Cable clamps have 40 mm internal diameter. The clamps are used for 360 degree grounding of the shield. Exposing the cable shield decreases outer diameter of the cable so the recommended 3x185+95 mm² MCCMK motor cables fit in the clamp.

12.2.2.4 Dimensions for FR9

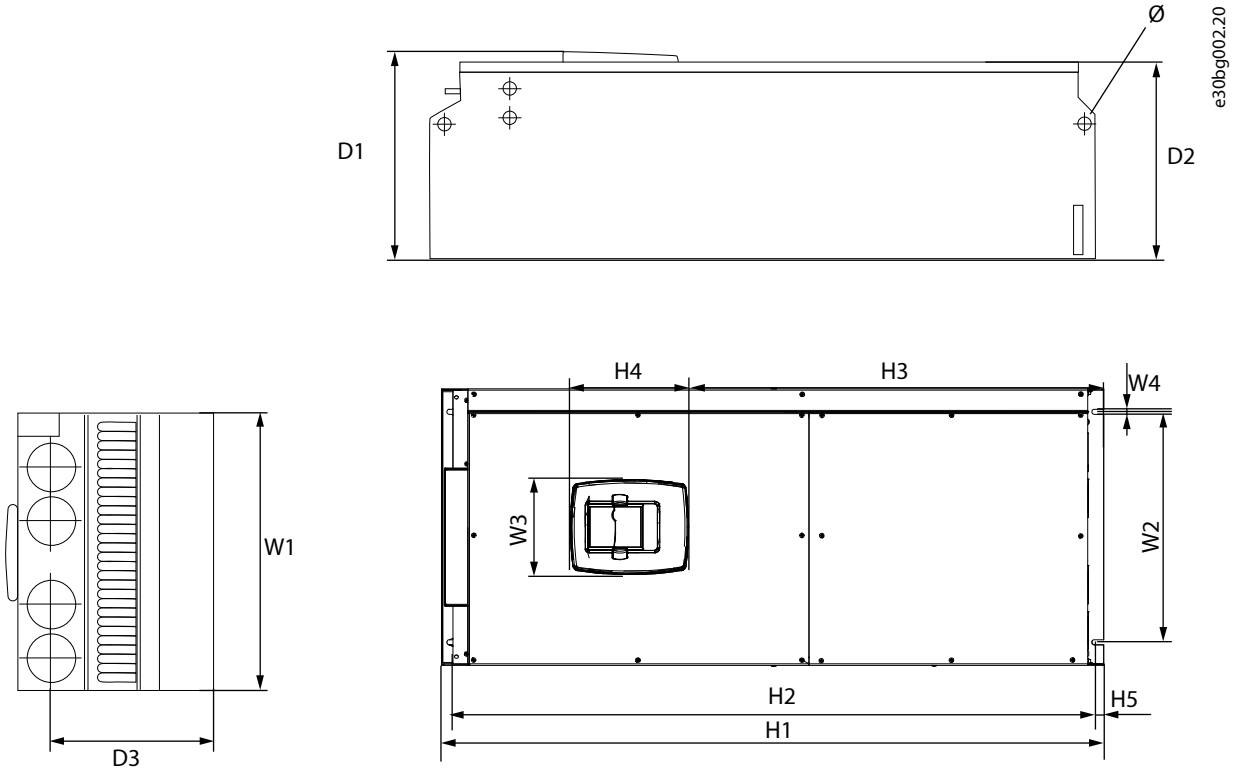


Figure 79: Dimensions of the VACON® NXS/NXP AC Drive, FR9, IP21/IP54

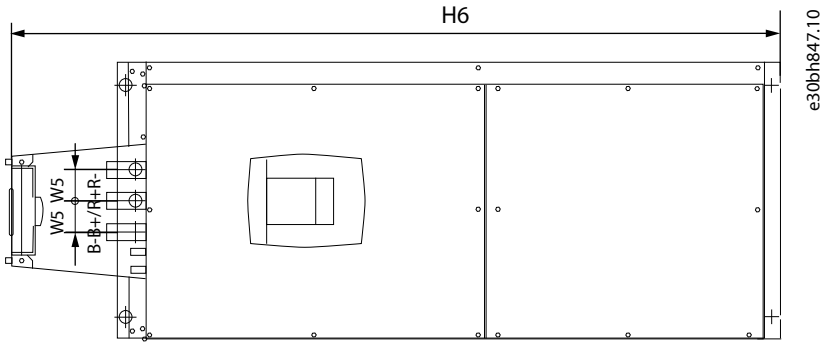


Figure 80: Dimensions of the VACON® NXS/NXP AC Drive, FR9 with DC Extension Connection Box

Table 35: 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 • 0261 5–0300 5 • 0125 6–0208 6	480 (18.9)	400 (15.75)	165 (15.74)	9 (0.35)	54 (2.13)	362 (14.25)	340 (13.39)	285 (11.22)

Table 36: Dimensions in mm (in inch) of the VACON® NXS/NXP AC Drive, FR9, part 2

Drive type	H1	H2	H3	H4	H5	H6	Ø
• 0261 2–0300 2 • 0261 5–0300 5 • 0125 6–0208 6	1150 (45.28) (1)	1120 (44.09)	721 (28.39)	205 (8.07)	16 (0.63)	1338 (52.68)	21 (0.83)

1) 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).

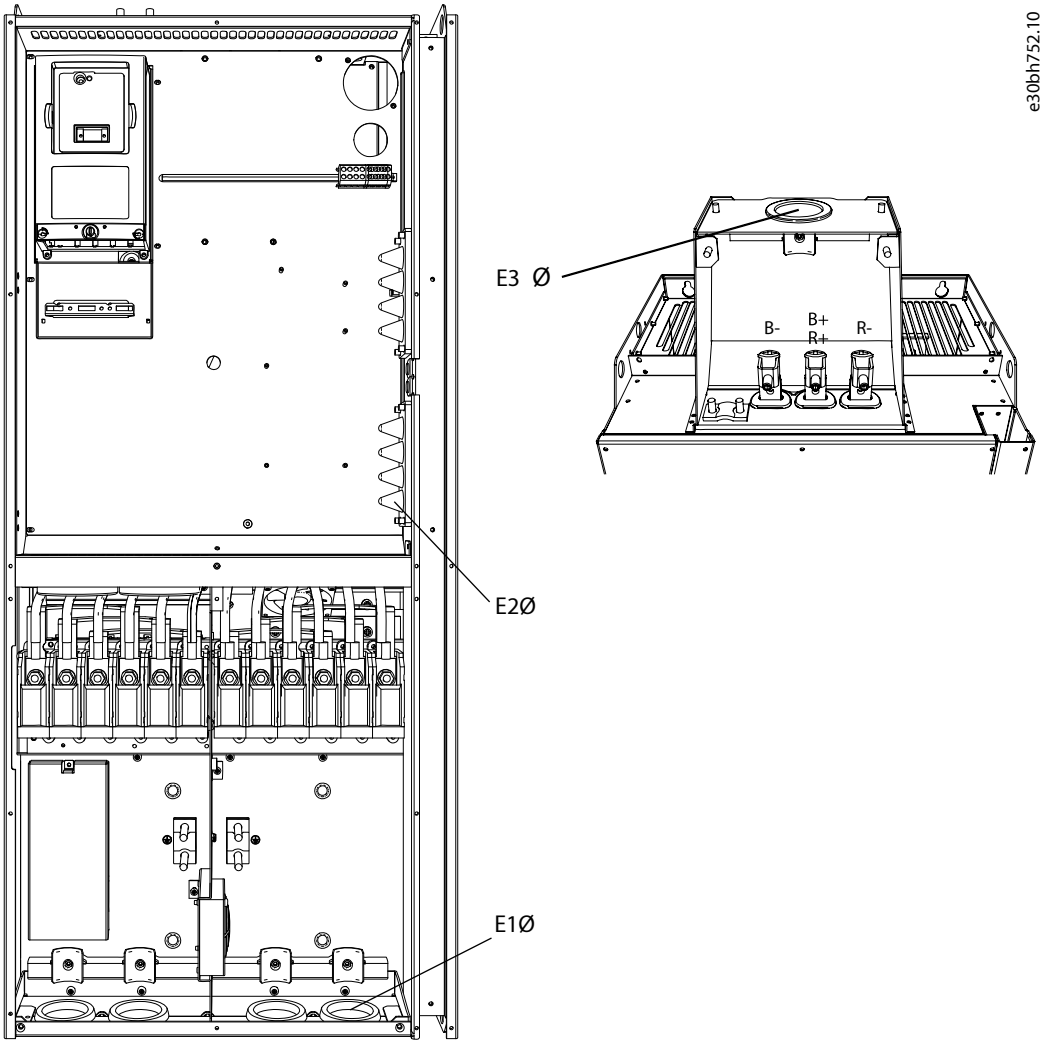


Figure 81: Dimensions of the Mounting Holes for VACON® NXS/NXP AC Drive, FR9

Table 37: Dimensions of the Mounting Holes in mm (inch) for VACON® NXS/NXP AC Drive, FR9

Drive type	E1Ø, grommet inside diameter(1)	E1Ø, gland plate hole	E2Ø, grommet inside diameter(1)	E2Ø, gland plate hole	E2Ø, grommet inside diameter(1)	E3Ø, gland plate hole
• 0261 2–0300 2 • 0261 5–0300 5 • 0125 6–0208 6	• IP21: 4 x GD48, 48 (1.89) • IP54: ◆ 2 x GD48, 48 (1.89) ◆ 2 x MC07115 , 56 (2.20)	4 x 59 (4 x 2.32)	25 (0.98)	25 (0.98)	60 (2.36)	75 (2.95)

1) Same as maximum cable thickness. NOTE! Cable clamps have 40 mm internal diameter. The clamps are used for 360 degree grounding of the shield. Exposing the cable shield decreases outer diameter of the cable so the recommended 3x185+95 mm² MCCMK motor cables fit in the clamp.

12.2.3 Flange mounting

12.2.3.1 Dimensions for Flange Mounting, FR4–FR6

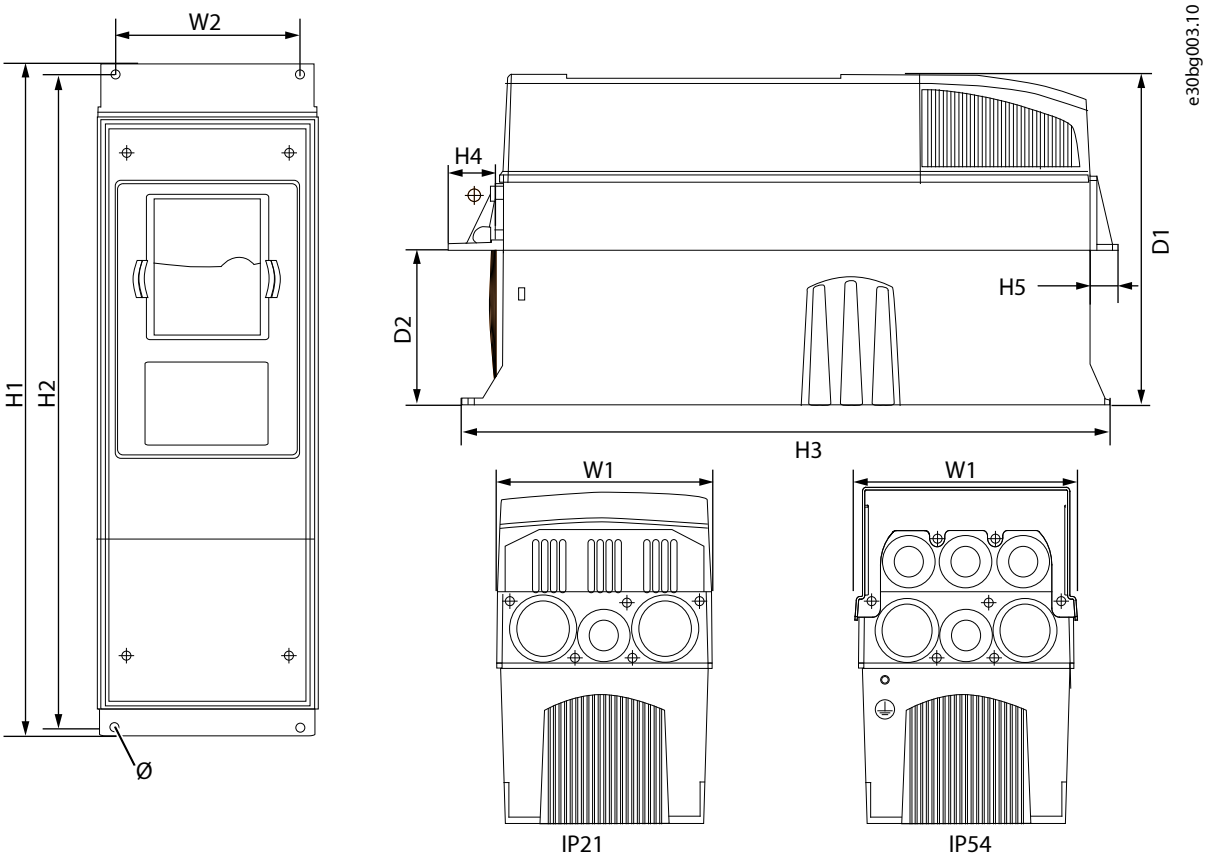


Figure 82: Dimensions of the VACON® NXS/NXP AC Drive with Flange, FR4–FR6

Table 38: 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 0003 5–0012 5	128 (5.03)	113 (4.45)	337 (13.27)	325 (12.8)	327 (12.9)	30 (1.18)	22 (0.87)	190 (7.48)	77 (3.03)	7 (0.27)
0017 2–0031 2 0016 5–0031 5	144 (5.67)	120 (4.72)	434 (17.09)	420 (16.54)	419 (16.5)	36 (1.42)	18 (0.71)	214 (8.43)	100 (3.94)	7 (0.27)
0048 2–0061 2 0038 5–0061 5 0004 6–0034 6	195 (7.68)	170 (6.69)	560 (22.05)	549 (21.61)	558 (22)	30 (1.18)	20 (0.79)	237 (9.33)	106 (4.17)	6.5 (0.26)

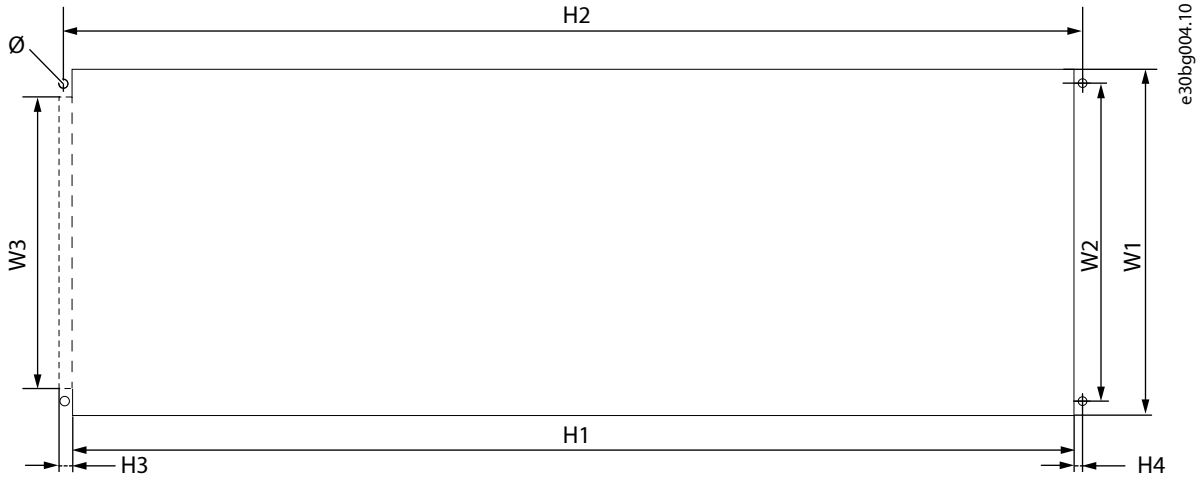


Figure 83: The Dimensions of the Opening and Drive Outline with Flange, FR4–FR6

Table 39: The Dimensions in mm (in inch) of the Opening and Drive Outline with Flange, FR4–FR6

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

12.2.3.2 Dimensions for Flange Mounting, FR7–FR8

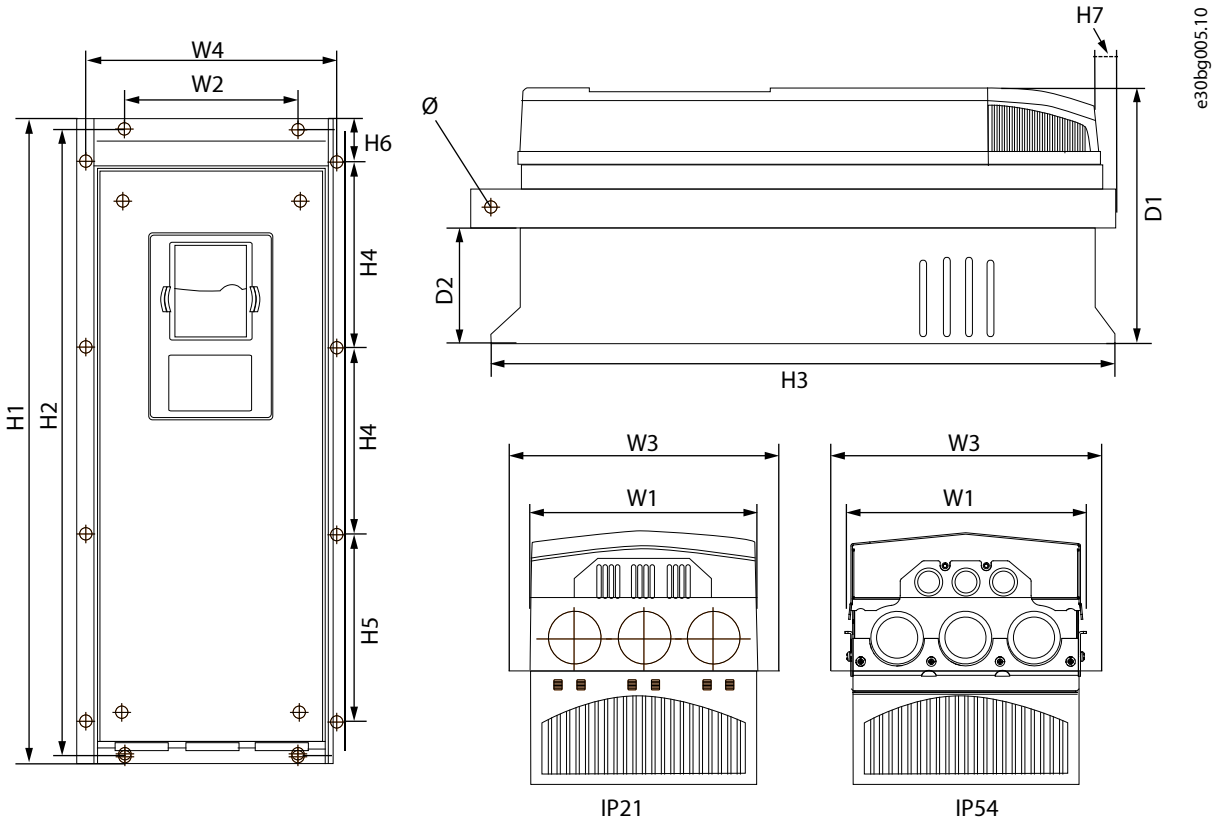


Figure 84: Dimensions of the VACON® NXS/NXP AC Drive with Flange, FR7–FR8

Table 40: Dimensions in mm (in inch) of the VACON® NXS/NXP AC Drive with Flange, FR7–FR8, Part 1

Drive type	W1	W2	W3	W4	D1	D2	Ø
0075 2–0114 2 0072 5–0105 5 0041 6–0052 6	237 (9.33)	175 (6.89)	270 (10.63)	253 (9.96)	257 (10.12)	109 (4.29)	6.5 (0.26)
0140 2–0205 2 0140 5–0205 5 0062 6–0100 6	289 (11.38)	–	355 (13.98)	330 (12.99)	344 (13.54)	110 (4.33)	9 (0.35)

Table 41: Dimensions in mm (in inch) of the VACON® NXS/NXP AC Drive with Flange, FR7–FR8, Part 2

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

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

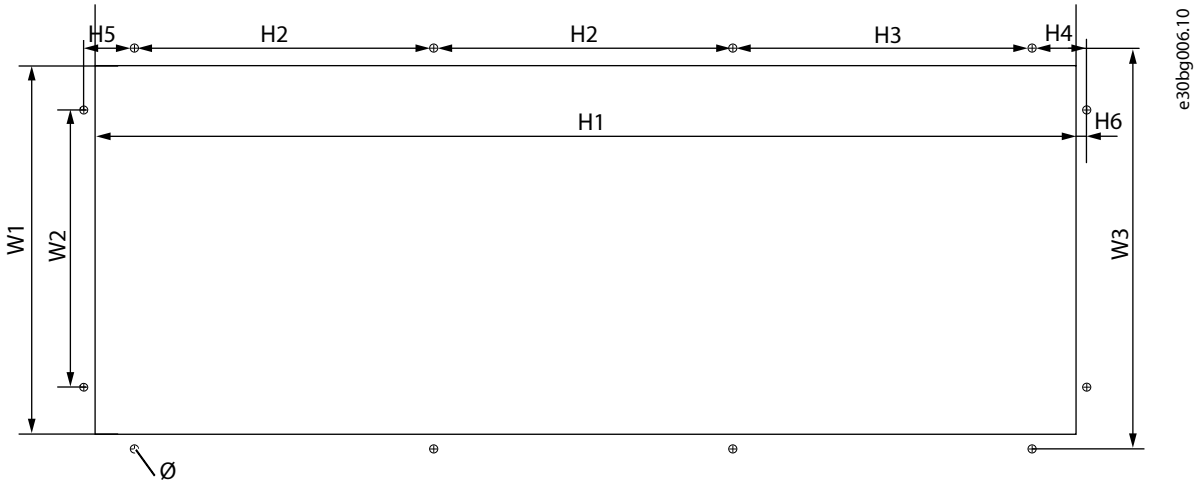


Figure 85: Dimensions of the Opening and Drive Outline with Flange, FR7

Table 42: 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 0072 5–0105 5 0041 6–0052 6	233 (9.17)	175 (6.89)	253 (9.96)	619 (24.4)	188.5 (7.42)	188.5 (7.42)	34.5 (1.36)	32 (1.26)	7 (0.28)	7 (0.28)

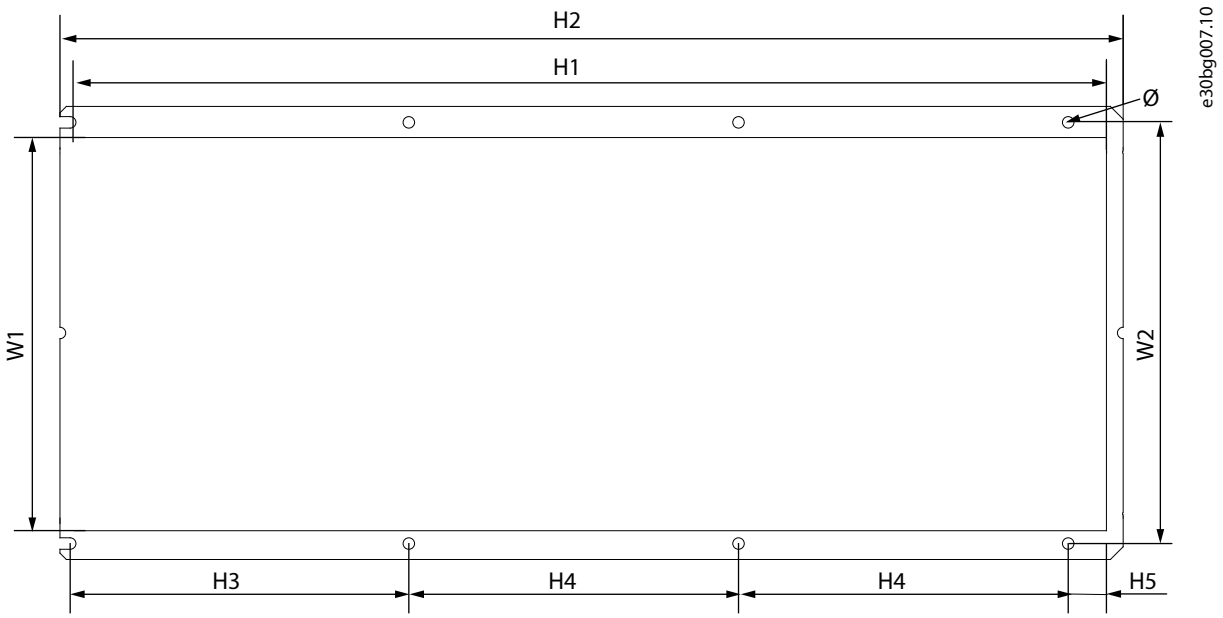


Figure 86: Dimensions of the Opening and Drive Outline with Flange, FR8

Table 43: 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 2–02052 0140 5–02055 0062 6–01006	301 (11.85)	330 (12.99)	810 (31.89)	832 (32.76)	265 (10.43)	258 (10.16)	33 (1.30)	9 (0.35)

12.2.3.3 Dimensions for Flange Mounting, FR9

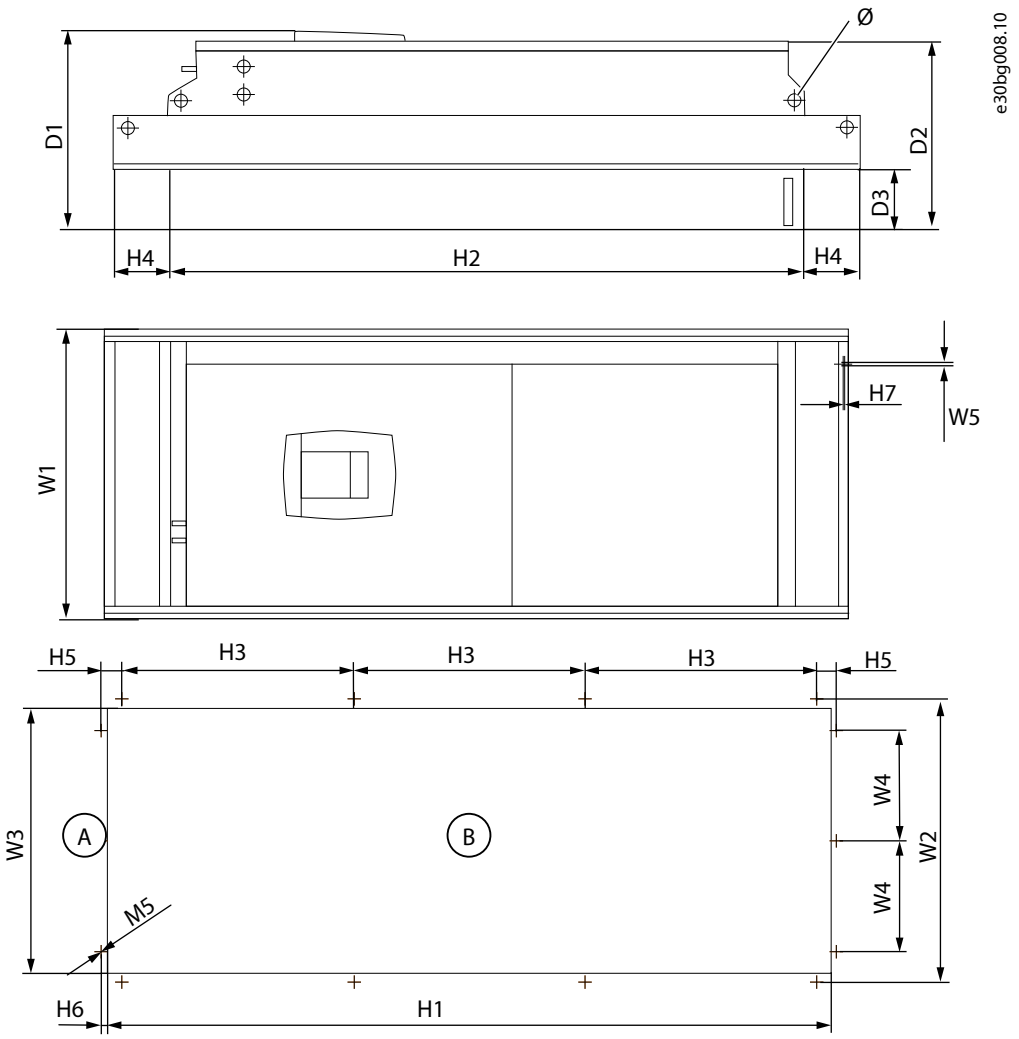


Figure 87: Dimensions of the VACON® NXS/NXP AC Drive, FR9

A	Top	**B**	Opening

Table 44: 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 0261 5– 0300 5 0125 6– 0208 6	530 (20.87)	510 (20.08)	485 (19.09)	200 (7.87)	5.5 (0.22)	362 (14.25)	340 (13.39)	109 (4.29)	21 (0.83)

Table 45: 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 0261 5–0300 5 0125 6–0208 6	1312 (51.65)	1150 (45.28)	420 (16.54)	100 (3.94)	35 (1.38)	9 (0.35)	2 (0.08)

12.2.4 Standalone

12.2.4.1 Dimensions for FR10–FR11 Standalone

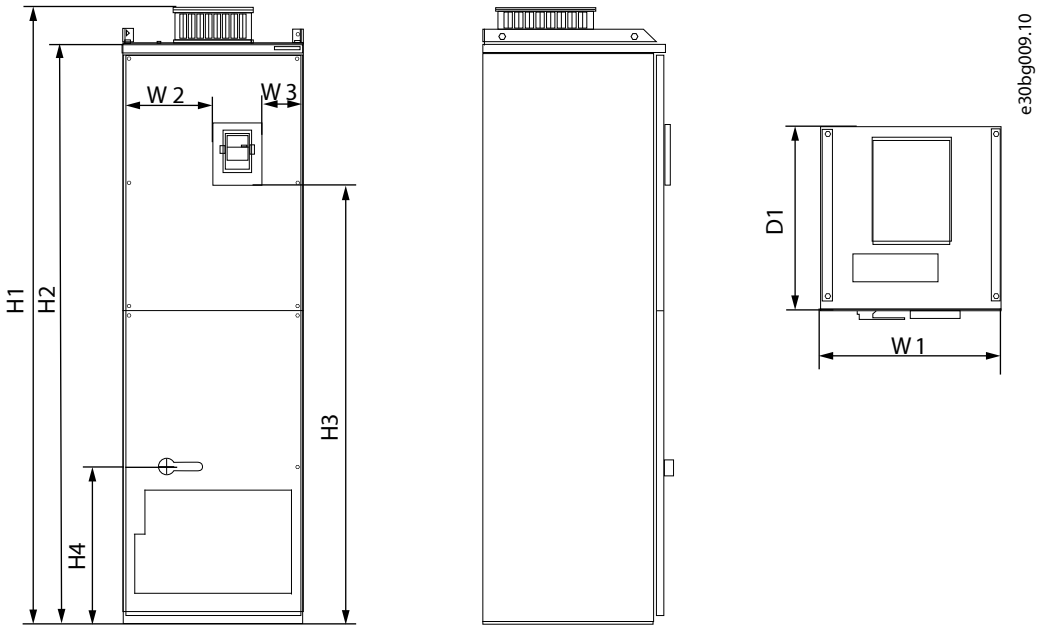


Figure 88: Dimensions of the VACON® NXS/NXP AC Drive, FR10 and FR11 Standalone

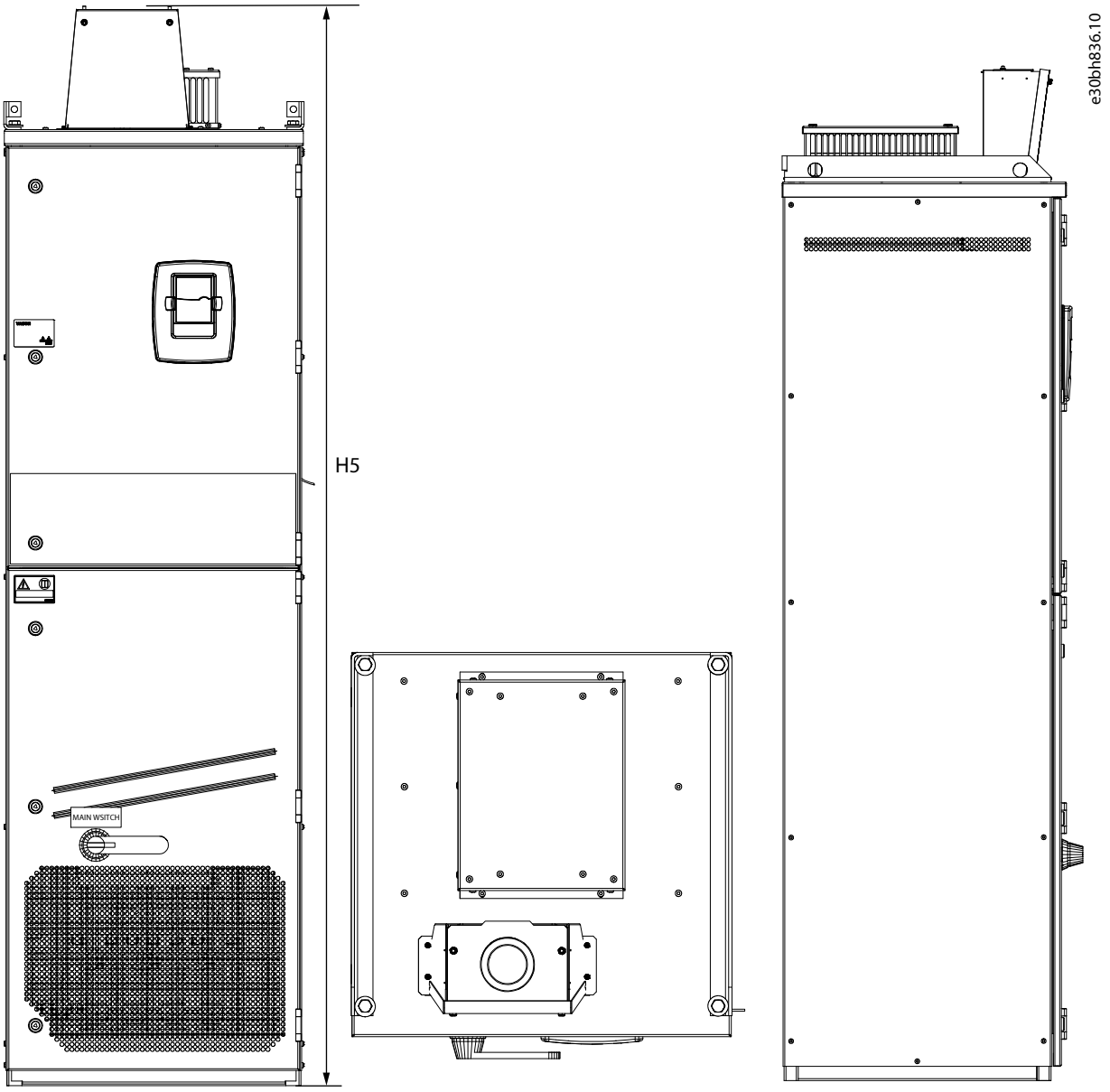


Figure 89: Dimensions of the VACON® NXS/NXP AC Drive, FR10 and FR11 Standalone with DC Connection Extension Box

Table 46: Dimensions in mm (in inch) of the VACON® NXS/NXP AC Drive, FR10 and FR11 Standalone

Drive type	W1	W2	W3	H1	H2	H3	H4	H5	D1
• 0385 5–0520 5 • 0261 6–0416 6	595 (23.43)	291 (11.46)	131 (5.16)	2018 (79.45)	1900 (74.8)	1435 (56.5)	512 (20.16)	2139 (84.21)	602 (23.70)
• 0590 5–0730 5 • 0460 6–0590 6	794 (31.26)	390 (15.35)	230 (9.06)	2018 (79.45)	1900 (74.80)	1435 (56.5)	512 (20.16)	2139 (84.21)	602 (23.70)

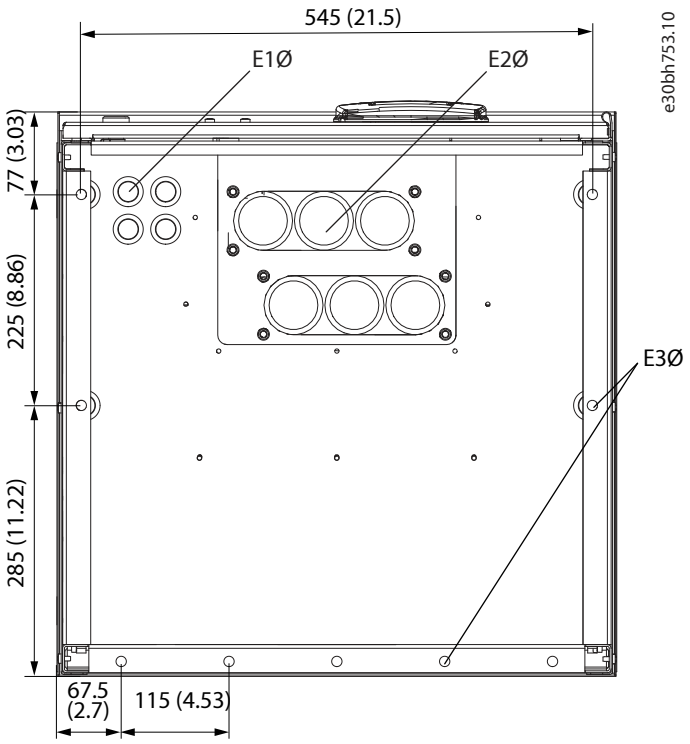


Figure 90: Dimensions of the Mounting Holes for VACON® NXS/NXP AC Drive, FR10 Standalone

Table 47: Dimensions of the Mounting Holes in mm (inch) for VACON® NXS/NXP AC Drive, FR10 Standalone

Drive type	E1Ø, grommet inside diameter(1)	E1Ø, gland plate hole	E2Ø, grommet inside diameter(1)	E2Ø, gland plate hole	E3Ø, mounting holes for fixing to floor
• 0385 5–0520 5 • 0261 6–0416 6	4 x 21 (4 x 0.83)	4 x 28 (4 x 1.10)	4 x 48 (4 x 1.89)	4 x 60 (4 x 2.36)	9 x 11 (9 x 0.43)

1) Same as maximum cable thickness. NOTE! Cable clamps have 40 mm internal diameter. The clamps are used for 360 degree grounding of the shield. Exposing the cable shield decreases outer diameter of the cable so the recommended 3x185+95 mm^2 MCCMK motor cables fit in the clamp.

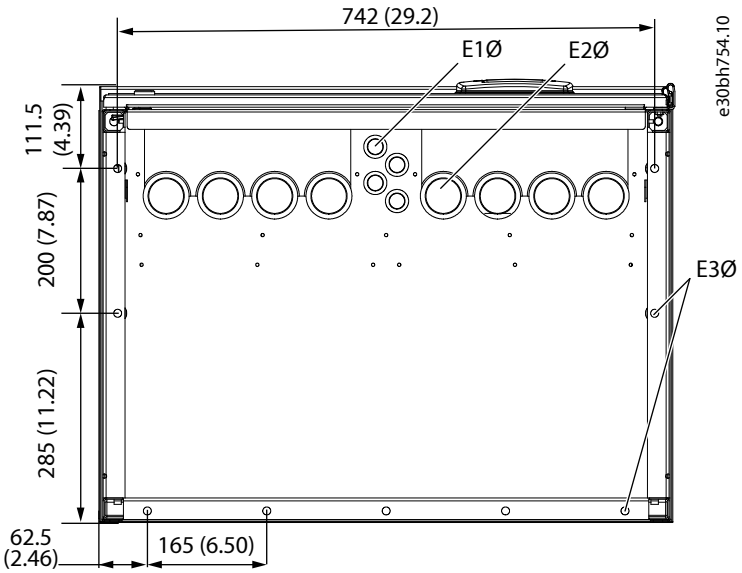


Figure 91: Dimensions of the Mounting Holes for VACON® NXS/NXP AC Drive, FR11 Standalone

Table 48: Dimensions of the Mounting Holes in mm (inch) for VACON® NXS/NXP AC Drive, FR11 Standalone

Drive type	E1Ø, grommet inside diameter[1]	E1Ø, gland plate hole	E2Ø, grommet inside diameter[1]	E2Ø, gland plate hole	E3Ø, mounting holes for fixing to floor
• 0590 5–0730 5 • 0460 6–0590 6	4 x 21 (4 x 0.83)	4 x 28 (4 x 1.10)	8 x 48 (8 x 1.89)	8 x 60 (8 x 2.36)	9 x 11 (9 x 0.43)

1) Same as maximum cable thickness. NOTE! Cable clamps have 40 mm internal diameter. The clamps are used for 360 degree grounding of the shield. Exposing the cable shield decreases outer diameter of the cable so the recommended 3x185+95 mm² MCCMK motor cables fit in the clamp.

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.

Use external gG/gL or T/J fuses for overload and short-circuit protection.

- 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 Standalone
- 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 49: Cable and Fuse Sizes for VACON® NXS/NXP

Enclosure size	Drive type	I_L [A]	Fuse (gG/gL) [A]	Mains and motor cable Cu [mm²][1]	Mains terminal [mm²]	Grounding terminal [mm²]
FR4	0003 2–0008 2 0003 5–0009 5	3–8 3–9	10	3*1.5+1.5	1–4	1–4
	0011 2–0012 2 0012 5	11–12 12	16	3*2.5+2.5	1–4	1–4

Table 49: Cable and Fuse Sizes for VACON® NXS/NXP - (continued)

Enclosure size	Drive type	I_L [A]	Fuse (gG/ gL) [A]	Mains and motor cable Cu [mm^2](1)	Mains terminal [mm^2]	Grounding terminal [mm^2]
FR5	0017 2 0016 5	17 16	20	3*4+4	1–10	1–10
	0025 2 0022 5	25 22	25	3*6+6	1–10	1–10
	0031 2 0031 5	31 31	35	3*10+10	1–10	1–10
FR6	0048 2 0038 5–0045 5	48 38–45	50	3*10+10	2.5–50 Cu 6–50 Al	2.5–35
	0061 2 0061 5	61	63	3*16+16	2.5–50 Cu 6–50 Al	2.5–35
FR7	0075 2 0072 5	75 72	80	3*25+16	2.5–50 Cu 6–50 Al	6–70
	0088 2 0087 5	88 87	100	3*35+16	2.5–50 Cu 6–50 Al	6–70
	0114 2 0105 5	114 105	125	3*50+25	2.5–50 Cu 6–50 Al	6–70
FR8	0140 2 0140 5	140	160	3*70+35	25–95 Cu/Al	6–95
	0170 2 0168 5	168	200	3*95+50	95–185 Cu/Al	6–95
	0205 2 0205 5	205	250	3*150+70	95–185 Cu/Al	6–95
FR9	0261 2 0261 5	261	315	3*185+95 or 2*(3*120+70)	95–185 Cu/Al	6–95
	0300 2 0300 5	300	315	2*(3*120+70)	95–185 Cu/Al	6–95

1) 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 50: Cable and Fuse Sizes for VACON® NXS/NXP, North America

Enclosure size	Drive type	Fuse Class Fast Acting (T/J) [A]	Mains and motor cable Cu [AWG][(1)(2)]	Mains terminal [AWG]	Grounding terminal [AWG]
FR4	0003 2–0008 2 0003 5–0007 5	10	3*16 AWG + 16 AWG	18 AWG - 4 AWG	18 AWG - 4 AWG
	0009 5	15	3*16 AWG + 16 AWG	18 AWG - 4 AWG	18 AWG - 4 AWG
	0011 2–0012 2 0012 5	15	3*14 AWG + 14 AWG	18 AWG - 4 AWG	18 AWG - 4 AWG
FR5	0017 2 0016 5	20	3*12 AWG + 12 AWG	18 AWG - 8 AWG	18 AWG - 8 AWG
	0025 2 0022 5	30	3*10 AWG + 10 AWG	18 AWG - 8 AWG	18 AWG - 8 AWG
	0031 2 0031 5	40	3*8 AWG + 8 AWG	18 AWG - 8 AWG	18 AWG - 8 AWG
FR6	0038 5	50	3*8 AWG + 8 AWG	14 AWG - 1 AWG Cu 10 AWG - 1 AWG Al	14 AWG - 2 AWG
	0048 2 0045 5	60	3*8 AWG + 8 AWG	14 AWG - 1 AWG Cu 10 AWG - 1 AWG Al	14 AWG - 2 AWG
	0061 2 0061 5	90	3*6 AWG + 6 AWG	14 AWG - 1 AWG Cu 10 AWG - 1 AWG Al	14 AWG - 2 AWG
FR7	0075 2 0072 5	90	3*4 AWG + 6 AWG	14 AWG - 1 AWG Cu 10 AWG - 1 AWG Al	10 AWG - 2/0 AWG
	0088 2 0087 5	110	3*2 AWG + 6 AWG	14 AWG - 1 AWG Cu 10 AWG - 1 AWG Al	10 AWG - 2/0 AWG
	0114 2 0105 5	150	3*2 AWG + 4 AWG	14 AWG - 1 AWG Cu 10 AWG - 1 AWG Al	10 AWG - 2/0 AWG
FR8	0140 2 0140 5	175	3*2/0 AWG + 2 AWG	4 AWG - 3/0 AWG Cu/Al	10 AWG - 3/0 AWG
	0170 2 0168 5	250	3*3/0 AWG + 1/0 AWG	3/0 AWG - 350 kcmil Cu/Al	10 AWG - 3/0 AWG
	0205 2 0205 5	250	3*300 kcmil + 2/0 AWG	3/0 AWG - 350 kcmil Cu/Al	10 AWG - 3/0 AWG

Table 50: Cable and Fuse Sizes for VACON® NXS/NXP, North America - (continued)

Enclosure size	Drive type	Fuse Class Fast Acting (T/J) [A]	Mains and motor cable Cu [AWG](1)(2)	Mains terminal [AWG]	Grounding terminal [AWG]
FR9	0261 2 0261 5	350	3*350 kcmil + 3/0 AWG 2*(3*250 kcmil + 2/0 AWG)	3/0 AWG - 350 kcmil Cu/Al	10 AWG - 3/0 AWG
	0300 2 0300 5	400	2*(3*250 kcmil + 2/0 AWG)	3/0 AWG - 350 kcmil Cu/Al	10 AWG - 3/0 AWG

1) Uses a correction factor 0.7

2) 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 51: Cable and Fuse Sizes for VACON® NXS/NXP

Enclosure size	Drive type	I_L [A]	Fuse (gG/gL) [A]	Mains and motor cable Cu [mm^2] (1)	Mains terminal [mm^2]	Grounding terminal [mm^2]
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 0170 6	125–144 170	160 200	3*95+50	95–185 Cu/Al	6–95
	0208 6	208	250	3*150+70		

1) 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 52: 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 and motor cable Cu [AWG](1)(2)	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	10 AWG - 1 AWG
	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

1) Uses a correction factor 0.7.

2) 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 Standalone

NOTE! In FR10 and FR11 Standalone drives, the drive cabinet includes ultra-fast aR fuses for short-circuit protection. Use external gG or T/J fuses for overload protection in the FR10 and FR11 Standalone drives.

Table 53: Cable and Fuse Sizes for VACON® NXS/NXP

Enclosure size	Drive type	I_L [A]	Fuse (gG/gL) [A]	Mains and motor cable (1) [mm^2]	Number of supply cables	Number of motor cables
FR10 Standalone	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)	Even/Odd	Even/Odd
	0520 5	520	630 (3 pcs)	Cu: 2*(3*185+95)	Even/Odd	Even/Odd
FR11 Standalone	0590 5	590	315 (6 pcs)	Cu: 2*(3*95+50) 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*120+70) Al: 4*(3*185Al +57Cu)	Even	Even/Odd

1) Uses a correction factor 0.7

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

NOTE! In FR10 and FR11 Standalone drives, the drive cabinet includes ultra-fast aR fuses for short-circuit protection. Use external gG or T/J fuses for overload protection in the FR10 and FR11 Standalone drives.

Table 54: Cable and Fuse Sizes for VACON® NXS/NXP, North America

Enclosure size	Drive type	Fuse Class Fast Acting (T/J) [A]	Mains and motor cable Cu [AWG](1)(2)	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)	Even/Odd	Even/Odd
	0520 5	700 (3 pcs)	Cu: 2*(3*350 kcmil + 3/0 AWG)	Even/Odd	Even/Odd

Table 54: Cable and Fuse Sizes for VACON® NXS/NXP, North America - (continued)

Enclosure size	Drive type	Fuse Class Fast Acting (T/J) [A]	Mains and motor cable Cu [AWG](1)(2)	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

1) Uses a correction factor 0.7.

2) 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

NOTE! In FR10 and FR11 Standalone drives, the drive cabinet includes ultra-fast aR fuses for short-circuit protection. Use external gG or T/J fuses for overload protection in the FR10 and FR11 Standalone drives.

Table 55: Cable and Fuse Sizes for VACON® NXS/NXP

Enclosure size	Drive type	I_L [A]	Fuse (gG/gL) [A]	Mains and motor cable [mm^2]	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

Table 55: Cable and Fuse Sizes for VACON® NXS/NXP - (continued)

Enclosure size	Drive type	I_L [A]	Fuse (gG/gL) [A]	Mains and motor cable [mm^2]	Number of supply cables	Number of motor cables
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: 4x(3x95+29)	Even/Odd	Even/Odd
	0590 6	590	315 (6 pcs)	Cu: 2*(3*240+120) Al: 4*(3*120Al +41Cu)	Even	Even/Odd

1) 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

NOTE! In FR10 and FR11 Standalone drives, the drive cabinet includes ultra-fast aR fuses for short-circuit protection. Use external gG or T/J fuses for overload protection in the FR10 and FR11 Standalone drives.

Table 56: 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 and motor cable Cu(1) [AWG](2)	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

Table 56: Cable and Fuse Sizes for VACON® NXS/NXP, North America, UL Rating 525–600 V - (continued)

Enclosure size	Drive type	Fuse Class Fast Acting (T/J) [A]	Mains and motor cable Cu[1] [AWG][2]	Number of supply cables	Number of motor cables
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: 4x(3x3/0AWG)	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

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

2) Uses a correction factor 0.7

12.4 Cable Stripping Lengths

See the illustration for the parts of cables to be stripped and check the corresponding stripping length in the table.

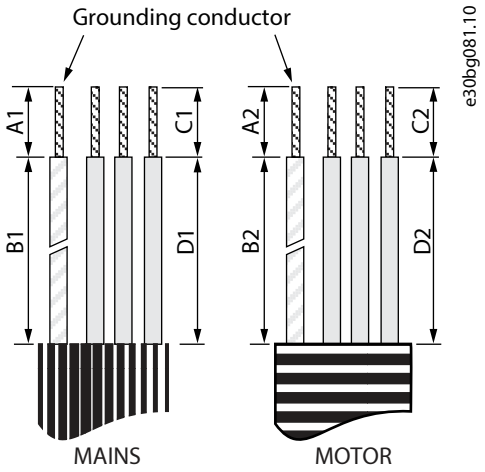


Figure 92: Cable Stripping

Table 57: 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

Table 57: Cable Stripping Lengths [mm] - (continued)

Enclosure size	A1	B1	C1	D1	A2	B2	C2	D2
FR8, 0140	23	240	23	240	23	240	23	240
FR8, 0168–0205	28	240	28	240	28	240	28	240
FR9	28	295	28	295	28	295	28	295

Table 58: 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, 0140	0.91	9.45	0.91	9.45	0.91	9.45	0.91	9.45
FR8, 0168–0205	1.10	9.45	1.10	9.45	1.10	9.45	1.10	9.45
FR9	1.10	11.61	1.10	11.61	1.10	11.61	1.10	11.61

12.5 Tightening Torques for Cover Screws

Table 59: Tightening Torques for Cover Screws, FR4–FR9

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[(1)]	0.8
FR9	0.8	0.8

1) The cover of the power unit.

Table 60: Tightening Torques for Cover Screws, FR10–FR11

Enclosure size and class	Safety cover screws (Nm)
FR10 Standalone	4.2
FR11 Standalone	4.2

12.6 Tightening Torques of the Terminals

Table 61: Tightening Torques of the Mains and Motor Terminals

Enclosure size	Drive type	Tightening torque (Nm)	Tightening torque (in-lb)
FR4	0004 2–0012 2 0003 5–0012 5	0.5–0.6	4.5–5.3
FR5	0017 2–0031 2 0016 5–0031 5	1.2–1.5	10.6–13.3
FR6	0048 2–0061 2 0038 5–0061 5 0004 6–0034 6	10	88.5
FR7	0075 2–0114 2 0072 5–0105 5 0041 6–0052 6	10	88.5
FR8	0140 2 0140 5 0062 6–0100 6	20	177
FR8	0168 2–0205 2 0168 5–0205 5	40	354
FR9	0261 2–0300 2 0261 5–0300 5 0125 6–0208 6	40	354
FR10 Standalone	0385 5–0520 5 0261 6–0416 6	40	354
FR11 Standalone	0590 5–0730 5 0460 6–0590 6	40	354

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 RMS current is not more than I_L during the duty cycle.

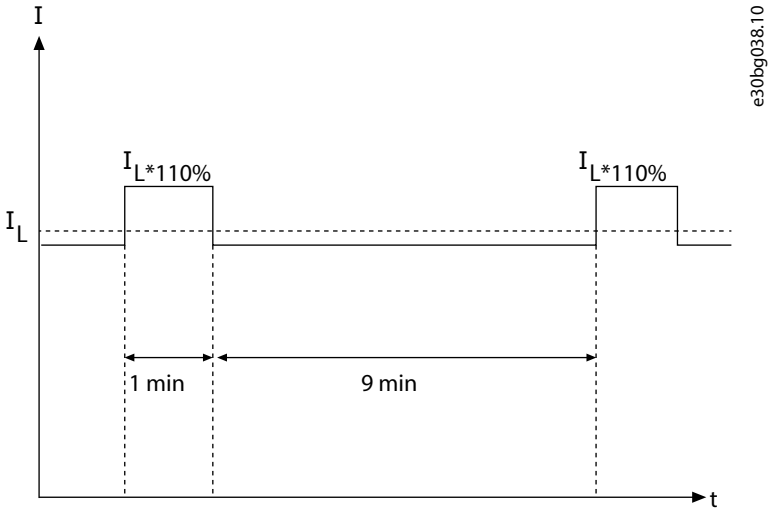


Figure 93: Low Overload

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 RMS current is not more than I_H during the duty cycle.

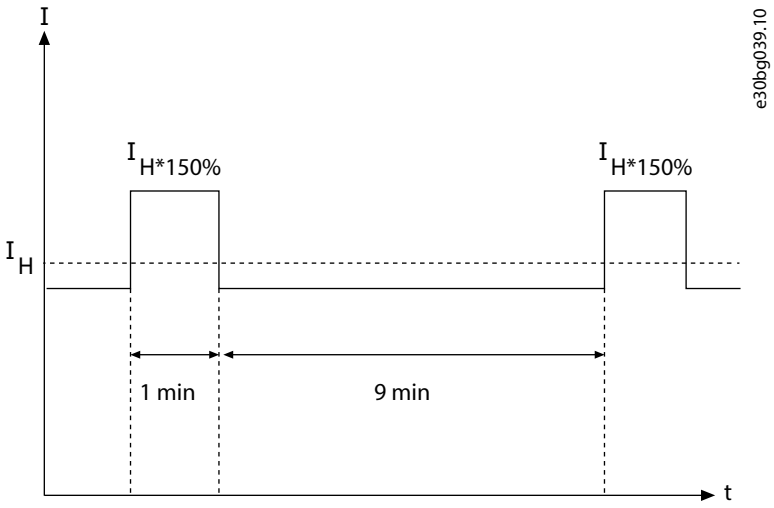


Figure 94: High Overload

For more information, refer to the standard IEC61800-2.

12.7.2 Power Ratings for Mains Voltage 208–240 V

Table 62: Power Ratings in Mains 208–240 V, 50 Hz, 3~

Enclosure size	Drive type	Input current I_{in} (1)	Low loadability: I_L [A](2)	Low loadability: 10% overload I [A]	High loadability: I_H [A](2)	High loadability: 50% overload I [A]	Loadability: Max I_S 2 s	Motor shaft power(3): 10% overload 40 °C [kW]	Motor shaft power(3): 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
	0012	12.5	12.5	13.8	11.0	16.5	22.0	3.0	2.2
FR5	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
	0031	31	31	34.1	25.0	37.5	50.0	7.5	5.5
FR6	0048	48	48	52.8	31.0	46.5	62.0	11.0	7.5
	0061	61	61.0	67.1	48.0	72.0	96.0	15.0	11.0
FR7	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
	0114	114	114.0	125.0	88.0	132.0	176.0	30.0	22.0
FR8	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
	0205	205	205.0	226.0	170.0	255.0	340.0	55.0	45.0
FR9	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

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

2) See 12.7.1 Overload Capability

3) 230 V

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

Table 63: 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] (2)	Low loadability: 10% overload I [A]	High loadability: I_H[A] (2)	High loadability: 50% overload I [A]	Loadability : Max I_S 2 s	Motor shaft power (3): 10% overload 104 °F [hp]	Motor shaft power (3): 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
	0012	12.5	12.5	13.8	11.0	16.5	22.0	4	3
FR5	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
	0031	31	31	34.1	25.0	37.5	50.0	10	7.5
FR6	0048	48	48	52.8	31.0	46.5	62.0	15	10
	0061	61	61.0	67.1	48.0	72.0	96.0	20	15
FR7	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
	0114	114	114.0	125.0	88.0	132.0	176.0	40	30
FR8	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
	0205	205	205.0	226.0	170.0	255.0	340.0	75	60
FR9	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

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

2) See 12.7.1 Overload Capability

3) 240 V

12.7.4 Power Ratings for Mains Voltage 380–500 V

Table 64: Power Ratings in Mains 380–500 V, 50 Hz, 3~

Enclosure size	Drive type	Input current I_{in} (1)	Low loadability: I_L [A](2)	Low loadability: 10% overload I [A]	High loadability: I_H[A](2)	High loadability: 50% overload I [A]	Loadability : Max I_S 2 s	Motor shaft power(3): 10% overload 40 °C [kW]	Motor shaft power(3): 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(3)	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(3)	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

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

2) See 12.7.1 Overload Capability

3) 400 V

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

Table 65: Power Ratings in Mains 380–500 V, 60 Hz, 3~

Enclosure size	Drive type	Input current I_{in} (1)	Low loadability: I_L [A] (2)	Low loadability: 10% overload I [A]	High loadability: I_H[A] (2)	High loadability: 50% overload I [A]	Loadability : Max I_S 2 s	Motor shaft power (3): 10% overload 104 °F [hp]	Motor shaft power (3): 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
	0012	12	12	13.2	9	13.5	18	10	7.5
FR5	0016	16	16	17.6	12	18	24	13	10
	0022	23	23	25.3	16	24	32	20	13
	0031	31	31	34	23	35	44	25	20
FR6	0038	38	38	42	31	47	62	30	25
	0045	46	46	49.5	38	57	76	40	30
	0061	61	61	67	46	69	92	50	40
FR7	0072	72	72	79	61	92	122	60	50
	0087	87	87	96	72	108	144	75	60
	0105	105	105	116	87	131	174	90	75
FR8	0140	140	140	154	105	158	210	125	90
	0168	170	170	187	140	210	280	150	125
	0205	205	205	226	170	255	340	175	150
FR9	0261	261	261	287.1	205	308	410	200	175
	0300	300	300	330	245	368	490	250	200
FR10 (3)	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 (3)	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

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

2) See 12.7.1 Overload Capability

3) 480 V

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

Table 66: Power Ratings in Mains 525–600 V, 50 Hz, 3~

Enclosure size	Drive type	Input current I_{in} (1)	Low loadability: I_L [A] (2)	Low loadability: 10% overload I [A]	High loadability: I_H[A] (2)	High loadability: 50% overload I [A]	Loadability : Max I_S 2 s	Motor shaft power (3): 10% overload 40 °C [kW]	Motor shaft power (3): 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	30.0
	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 (3)	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 (3)	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

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

2) See 12.7.1 Overload Capability

3) 690 V

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

Table 67: Power Ratings in Mains 525–600 V, 60 Hz, 3~

Enclosure size	Drive type	Input current I_{in} (1)	Low loadability: I_L [A] (2)	Low loadability: 10% overload I [A]	High loadability: I_H[A] (2)	High loadability: 50% overload I [A]	Loadability : Max I_S 2 s	Motor shaft power (3): 10% overload 104 °F [hp]	Motor shaft power (3): 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 (3)	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 (3)	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

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

2) See 12.7.1 Overload Capability

3) 575 V

12.8 Technical Data

Table 68: 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	Maximum ±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-Uin
	Constant output current	I_L: Ambient temperature maximum +40 °C (104 °F) overload 1.1 x I_L (1 min/10 min) I_H: Ambient temperature maximum +50 °C (122 °F) overload 1.5 x I_H (1 min/10 min) For 50–55 °C (122–131 °F) ambient temperatures, use a derating factor 2.5% / 1 °C.
	Starting current	I_S for 2 s each 20 s. After 2 s, the current controller reduces the current to 150% I_H.
	Output frequency	0–320 Hz (standard VACON® NXP and NXS); 7200 Hz (special NXP with special software)
	Frequency resolution	0.01 Hz (VACON® NXS); Application-dependent (VACON® NXP)

Table 68: Technical Data - (continued)

Technical item or function		Technical data
Control qualities	Control method	Frequency control U/f, Open Loop Sensorless Vector Control, Closed Loop Vector Control (VACON® 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
	Frequency reference Analog input Panel reference	Resolution 0.1% (VACON® NXP: 12-bit), accuracy ±1% Resolution 0.01 Hz
	Field weakening point	8–320 Hz
	Acceleration time	0.1–3000 s
	Deceleration time	0.1–3000 s
	Brake power	DC brake: 30% * T_N (without the brake option)

Table 68: Technical Data - (continued)

Technical item or function		Technical data
Ambient conditions	Ambient operating temperature	**FR4-FR9 I_L current:** -10 °C (-14 °F) (no frost)...+40 °C (104 °F) I_H current: -10 °C (-14 °F) (no frost)...+50 °C (122 °F) **FR10-FR11 Standalone (IP21/UL Type 1)** I_H/I_L: -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)) **FR10 Standalone (IP54/UL Type 12)** I_H/I_L: -10 °C (-14 °F) (no frost)…+40 °C (104 °F) (except 380–500 V, 0520, and 525–690 V, 0416: -10 °C (-14 °F) (no frost)… +35 °C (95 °F)) For higher ambient temperatures, see Motor connection – Continuous output current in this table.
	Storage temperature	-40 °C (-104 °F)...+70 °C (158 °F)
	Relative humidity	0–95% RH, non-condensing, non-corrosive, no dripping water
	Altitude	100% load capacity (no derating) up to 1000 m (3281 ft) 1% derating for each 100 m (328 ft) above 1000 m (3281 ft) Maximum altitudes: • FR4–FR8: ◆ 208–240 V: 3000 m (9843 ft) (TN, TT, IT systems, and corner-grounded networks*) ◆ 380–500 V: 3000 m (9843 ft) (TN, TT, and IT systems) ◆ 525–690 V: 2000 m (6562 ft) (TN, TT, and IT systems) • FR9–FR11: ◆ 208–240 V: 3000 m (9843 ft) (TN, TT, IT systems, and corner-grounded networks*) ◆ 380–500 V: 3000 m (9843 ft) (TN, TT, and IT systems) ◆ 380–500 V: 2000 m (6562 ft) (corner-grounded network **) ◆ 525–690 V: 2000 m (6562 ft) (TN, TT, and IT systems) * Corner-grounded network is allowed for FR4–FR9 (Main voltage 208–240 V) up to 3000 m (see 6.2.2 Installation in a Corner-grounded Network) ** Corner-grounded network is allowed for FR9–FR11 (Main voltage 380–500 V) up to 2000 m (see 6.2.2 Installation in a Corner-grounded Network)

Table 68: Technical Data - (continued)

Technical item or function		Technical data
Ambient conditions	**Air quality:** • chemical vapors • mechanical particles	Designed according to • IEC 60721-3-3 Edition 2.2, AC drive in operation, class 3C3 • IEC 60721-3-3 Edition 2.2, AC drive in operation, class 3S2
	Vibration IEC/EN 60068-2-6 IEC/EN 61800-5-1	5–150 Hz Displacement amplitude 1 mm (peak) at 5–15.8 Hz (FR4–FR9) Maximum acceleration amplitude 1 G at 15.8–150 Hz (FR4–FR9) Displacement amplitude 0.25 mm (peak) at 5–31 Hz (FR10–FR11) Maximum acceleration amplitude 0.25 G at 31–150 Hz (FR10–FR11)
	Shock IEC/EN 60068-2-27	UPS Drop Test (for applicable UPS weights) Storage and shipping: Maximum 15 G, 11 ms (in package)
	Protection rating	IP21 (UL Type 1) standard in the entire kW/HP range (FR4–FR9 and FR10–FR11 Standalone) IP54 (UL Type 12) option in FR4- FR9 and FR10 Standalone. 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 In < 75 A High frequency: Complies with IEC/EN 61800-3 + A1, 1st and 2nd environment
	Emissions	Depend on EMC level. See Table 3.
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

Table 68: Technical Data - (continued)

Technical item or function		Technical data
Functional safety	Hardware based 'Safe Torque Off' safety function to prevent the drive from generating torque on the motor shaft. STO safety function has been designed for use in accordance with the following standards	• EN 61800-5-2 Safe Torque Off (STO) SIL 3 • EN ISO 13849-1 PL "e" Category 3 • EN 62061 SILCL3 • IEC 61508 SIL 3 • The function also corresponds to an uncontrolled stop in accordance with stop category 0, EN 60204-1. • EN 954-1, Category 3
	SS1 safety function is realized in compliance with type C of the drives safety standard EN61800-5-2 (Type C: "The PDS(SR) initiates the motor deceleration and initiates the STO function after an application-specific time delay"). SS1 safety function has been designed for use in accordance with the following standards:	• EN 61800-5-2 Safe Stop 1 (SS1) SIL 3 • EN ISO 13849-1 PL "e" Category 3 • EN 62061 SILCL3 • IEC 61508 SIL 3 • The function also corresponds to a controlled stop in accordance with stop category 1, EN60204-1.
	ATEX thermistor input	94/9/EC, CE 0537 Ex 11 (2) GD
Approvals	–	CE, cULus, RCM, KC, EAC, UA. (See the product label of the drive for more approvals.) Marine approvals: LR, BV, DNVGL, ABS, RMRS, CCS, KR, NK.
Efficiency	–	See energy.mydrive.danfoss.com
Control connections (apply to boards OPTA1, OPTA2, and OPTA3)	Analog input voltage	0…+10 V, Ri = 200 kΩ, (-10 V…+10 V joystick control) Resolution 0.1% (VACON® NXP: 12-bit, VACON® 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 V DC
	Auxiliary voltage	+24 V, ±10%, max volt. ripple < 100 mV rms; maximum 250 mA Dimensioning: Maximum 1000 mA/control box (power backup)
	Output reference voltage	+10 V, +3%, maximum load 10 mA
	Analog output	0(4)–20 mA; R_L maximum 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 V DC/8 A, 250 V AC/8 A, 125 V DC/0.4 A Min.switching load: 5 V/10 mA

Table 68: Technical Data - (continued)

Technical item or function		Technical data
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. (1) 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
Drive enclosure materials		Paint color codes for the enclosure: • Dark grey = NCS 7010-R90B (Pantone 7546C) • Blue = NCS S3020-B

1) 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 Chopper Ratings

12.9.1 Brake Chopper Ratings

For brake chopper rating tables, see:

- 12.9.2 Brake Chopper Ratings for Mains Voltage 208–240 V
- 12.9.3 Brake Chopper Ratings for Mains Voltage 380–500 V
- 12.9.4 Brake Chopper Ratings for Mains Voltage 525–690 V
- 12.9.4 Brake Chopper Ratings for Mains Voltage 525–690 V

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

12.9.2 Brake Chopper Ratings for Mains Voltage 208–240 V

Table 69: Brake Chopper 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] (1)
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

1) When using recommended resistor types. Peak power capability of the brake chopper can be calculated with DC-link voltage (Udc) and brake resistor resistance Rb by Udc^2/Rb.

12.9.3 Brake Chopper Ratings for Mains Voltage 380–500 V

Table 70: Brake Chopper Ratings for VACON® NXS/NXP AC Drives, Mains Voltage 380–500 V, 50/60 Hz, 3~

Enclosure size	Drive type	The minimum brake resistance [Ω]	Brake power @845 V DC [kW] (1)
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

Table 70: Brake Chopper Ratings for VACON® NXS/NXP AC Drives, Mains Voltage 380–500 V, 50/60 Hz, 3~ - (continued)

Enclosure size	Drive type	The minimum brake resistance [Ω]	Brake power @845 V DC [kW] (1)
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

1) When using recommended resistor types. Peak power capability of the brake chopper can be calculated with DC-link voltage (Udc) and brake resistor resistance Rb by Udc^2/Rb; $P=U^2/R$.

12.9.4 Brake Chopper Ratings for Mains Voltage 525–690 V

Table 71: Brake Chopper Ratings for VACON® NXS/NXP AC Drives, Mains Voltage 525–690 V, 50/60 Hz, 3~

Enclosure size	Drive type	The minimum brake resistance [Ω]	Brake power @1166 V DC [kW] (1)
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

1) When using recommended resistor types. Peak power capability of the brake chopper can be calculated with DC-link voltage (Udc) and brake resistor resistance Rb by Udc^2/Rb.

12.9.5 Internal Brake Resistors, FR4–FR6 (380–500 V)

The enclosure sizes FR4, FR5, and FR6 (380–500 V) can be equipped with an internal brake resistor as a factory option. The brake resistors are designed for a 2 s full torque braking from nominal motor speed to zero or a 1 s full power braking every minute.

Table 72: Internal Brake Resistors, FR4–FR6

Enclosure size	Resistance [Ω]	Energy 2 s full torque braking [kJ]	Average power 1 pulse/min [W]
FR4 (380–500 V)	120	4	45
FR5 (380–500 V)	55	8.9	100
FR6 (380–500 V)	30	16	175

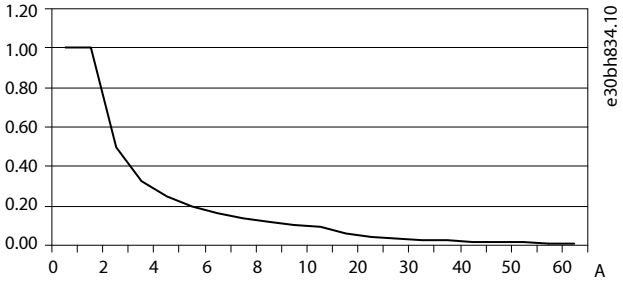


Figure 95: Relative Power Handling Capability of Internal Resistors

A	Time (s)

13 Faults and Alarms

13.1 Fault Code Information

This chapter lists all the faults and alarms in the product.

Fault 1 - Overcurrent, Subcode S1 - Hardware Trip

Cause

There is too high a current in the motor cable. Its cause can be 1 of the following:

- A sudden heavy load increase
- A short circuit in the motor cables
- The motor is not the correct type

Troubleshooting

- Check the load.
- Check the motor.
- Check the cables and connections.
- Make an identification run.

Fault 1 - Overcurrent, Subcode S2 - Current cutter supervision (VACON® NXS)

There is too high a current in the motor cable. Its cause can be 1 of the following:

- a sudden heavy load increase
- a short circuit in the motor cables
- the motor is not the correct type

Troubleshooting

- Check the load.
- Check the motor.
- Check the cables and connections.
- Make an identification run.

Fault 1 - Overcurrent, Subcode S3 - Current Limit Controller Supervision

Cause

There is too high a current in the motor cable. Its cause can be 1 of the following:

- A sudden heavy load increase
- A short circuit in the motor cables
- The motor is not the correct type

Troubleshooting

- Check the load.
- Check the motor.
- Check the cables and connections.
- Make an identification run.

Fault 1 - Overcurrent, Subcode S4 - Software-based Overcurrent Fault

Cause

There is too high a current in the motor cable. Its cause can be 1 of the following:

- A sudden heavy load increase
- A short circuit in the motor cables
- The motor is not the correct type

Troubleshooting

- Check the load.
- Check the motor.
- Check the cables and connections.
- Make an identification run.

Fault 2 - Overvoltage, Subcode S1 - Hardware Trip

Cause

The DC-link voltage is higher than the limits.

- Too short a deceleration time
- High overvoltage spikes in the supply
- Start/Stop sequence too fast

Troubleshooting

- Set the deceleration time longer.
- Use the brake chopper or the brake resistor. They are available as options.
- Activate the overvoltage controller.
- Check the input voltage.

Fault 2 - Overvoltage, Subcode S2 - Overvoltage Control Supervision

Cause

The DC-link voltage is higher than the limits.

- Too short a deceleration time
- High overvoltage spikes in the supply

- Motor load is generative
- Start/Stop sequence too fast

Troubleshooting

- Set the deceleration time longer.
- Use the brake chopper or the brake resistor. They are available as options.
- Activate the overvoltage controller.
- Check the input voltage.

Fault 3 - Earth Fault

Cause

The measurement of current tells that the sum of the motor phase current is not zero.

- Insulation malfunction in the cables or in the motor.

It is possible to set different responses in the application for this fault. See parameter group Protections.

Troubleshooting

- Check the motor cables and the motor.

Fault 5 - Charging Switch

Cause

The charging switch is open, when the START command is given.

- Operation malfunction
- Defective component

Troubleshooting

- Reset the fault and start the drive again.
- If the fault shows again, ask instructions from the local distributor.

Fault 6 - Emergency Stop

Cause

Stop signal has been given from the option board.

Troubleshooting

- Check the emergency stop circuit.

Fault 7 - Saturation Trip

This fault cannot be reset from the control panel.

Cause

- Defective component

- Brake resistor short circuit or overload

Troubleshooting

- Switch off the power.
- DO NOT RESTART THE DRIVE OR CONNECT THE POWER!
- Ask instructions from the factory. If this fault shows at the same time with Fault 1, check the motor cable and the motor.

Fault 8 - System Fault, Subcode S1 - ASIC Phase Feedback

Cause

- Operation malfunction
- Defective component

Troubleshooting

- Reset the fault and start the drive again.
- If the fault shows again, ask instructions from the local distributor.

Fault 8 - System fault, Subcode S4 - ASIC trip

Cause

- Operation malfunction
- Defective component

Troubleshooting

- Reset the fault and start the drive again.
- If the fault shows again, ask instructions from the local distributor.

Fault 8 - System fault, Subcode S5 - Disturbance in VaconBus

Cause

- Operation malfunction
- Defective component

Troubleshooting

- Reset the fault and start the drive again.
- If the fault shows again, ask instructions from the local distributor.

Fault 8 - System fault, Subcode S6 - Feedback of charging switch

Cause

- Operation malfunction
- Defective component

Troubleshooting

- Reset the fault and start the drive again.
- If the fault shows again, ask instructions from the local distributor.

Fault 8 - System fault, Subcode S7 - Charging switch

Cause

- Operation malfunction
- Defective component

Troubleshooting

- Reset the fault and start the drive again.
- If the fault shows again, ask instructions from the local distributor.

Fault 8 - System fault, Subcode S8 - No power to driver card

Cause

- Operation malfunction
- Defective component

Troubleshooting

- Reset the fault and start the drive again.
- If the fault shows again, ask instructions from the local distributor.

Fault 8 - System fault, Subcode S9 - Power unit communication (TX)

Cause

- Operation malfunction
- Defective component

Troubleshooting

- Reset the fault and start the drive again.
- If the fault shows again, ask instructions from the local distributor.

Fault 8 - System fault, Subcode S10 - Power unit communication (Trip)

Cause

- Operation malfunction
- Defective component

Troubleshooting

- Reset the fault and start the drive again.
- If the fault shows again, ask instructions from the local distributor.

Fault 8 - System fault, Subcode S11 - Power unit comm. (Measurement)

Cause

- Operation malfunction
- Defective component

Troubleshooting

- Reset the fault and start the drive again.
- If the fault shows again, ask instructions from the local distributor.

Fault 8 - System fault, Subcode S12 - System bus fault (slot D or E)

Cause

Error in system bus option board (OPTD1 or OPTD2) in slot D or E.

- Operation malfunction
- Defective component

Troubleshooting

- Reset the fault and start the drive again.
- If the fault shows again, ask instructions from the local distributor.
- Check the cables and connections.

Fault 8 - System fault, Subcode S30 - OPTAF: STO channels are different from each other

Cause

The Safe Disable inputs are in different states. It is not allowed according to EN954-1, category 3. This fault occurs when the Safe Disable inputs are in different states for more than 5 s.

Troubleshooting

- Check the S1 switch.
- Check the cabling to the OPTAF board.
- If the fault shows again, ask instructions from the local distributor.

Fault 8 - System fault, Subcode S31 - OPTAF: Thermistor short circuit detected

Cause

Thermistor short circuit detected.

Troubleshooting

- Correct the cable connections.
- Check the jumper for the thermistor short circuit supervision, if the thermistor function is not used and the thermistor input is short-circuited.

Fault 8 - System fault, Subcode S32 - OPTAF board has been removed

Cause

OPTAF board has been removed. It is not allowed to remove the OPTAF board once the software has recognized it.

Troubleshooting

- The system requires a manual acknowledgement using *System* menu parameter P6.5.5 OPTAF Remove. Ask help from the local distributor.

Fault 8 - System fault, Subcode S33 - OPTAF: EEPROM error

Cause

OPTAF board EEPROM error (checksum, not answering and so on).

Troubleshooting

- Change the OPTAF board.

Fault 8 - System fault, Subcode S34 - OPTAF: Voltage problem

Cause

OPTAF supply voltage hardware problem detected.

Troubleshooting

- Change the OPTAF board.

Fault 8 - System fault, Subcode S35 - OPTAF: Overvoltage

Cause

OPTAF supply voltage hardware problem detected.

Troubleshooting

- Change the OPTAF board.

Fault 8 - System fault, Subcode S36 - OPTAF: Undervoltage

Cause

OPTAF supply voltage hardware problem detected.

Troubleshooting

- Change the OPTAF board.

Fault 8 - System fault, Subcode S37 - OPTAF: Test pulse is not detected in both STO channels

Cause

Single hardware problem detected in Safe Disable inputs.

Troubleshooting

- Change the OPTAF board.
- Change the control board.

Fault 8 - System fault, Subcode S38 - OPTAF: Test pulse is not detected in STO channel 1

Cause

Single hardware problem detected in Safe Disable inputs.

Troubleshooting

- Change the OPTAF board.
- Change the control board.

Fault 8 - System fault, Subcode S39 - OPTAF: Test pulse is not detected in STO channel 2

Cause

Single hardware problem detected in Safe Disable inputs.

Troubleshooting

- Change the OPTAF board.
- Change the control board.

Fault 8 - System fault, Subcode S40 - OPTAF: ASIC trip ETR is not set, even if STO channel 1 is active

Cause

Single hardware problem detected in Safe Disable inputs.

Troubleshooting

- Change the OPTAF board.
- Change the control board.

Fault 8 - System fault, Subcode S41 - OPTAF: STO channels are not active when the thermistor trip is active

Cause

Single hardware problem detected in the thermistor input.

Troubleshooting

- Change the OPTAF board.

Fault 8 - System fault, Subcode S42 - OPTAF: Test pulse low is not detected on thermistor

Cause

Single hardware problem detected in the thermistor input.

Troubleshooting

- Change the OPTAF board.

Fault 8 - System fault, Subcode S43 - OPTAF: Test pulse high is not detected on thermistor

Cause

Single hardware problem detected in the thermistor input.

Troubleshooting

- Change the OPTAF board.

Fault 8 - System fault, Subcode S44 - OPTAF: STO channel 1 is not active, even if the analog input supervision indicates

Cause

Single hardware problem detected in Safe Disable inputs or in the thermistor input.

Troubleshooting

- Change the OPTAF board.
- Change the control board.

Fault 8 - System fault, Subcode S45 - OPTAF: STO channel 2 is not active, even if the analog input supervision indicates

Cause

Single hardware problem detected in Safe Disable inputs or in the thermistor input.

Troubleshooting

- Change the OPTAF board.
- Change the control board.

Fault 8 - System fault, Subcode S46 - OPTAF: Thermistor or analog input is not set, even if STO is active

Cause

Single hardware problem detected in Safe Disable inputs or in the thermistor input.

Troubleshooting

- Change the OPTAF board.
- Change the control board.

Fault 8 - System fault, Subcode S47 - OPTAF: Board mounted in old NXP control board with no safety hardware

Cause

OPTAF board mounted in old VACON® NXP control board, which is not equipped with the Safe Disable function.

Troubleshooting

- Change the control board to VB00561 revision H or newer.

Fault 8 - System fault, Subcode S48 - OPTAF: Mismatch between Therm Trip (HW) parameter and jumper setting

Cause

The parameter Expander boards/ SlotB/ Therm Trip(HW) is set to OFF even though the jumper X12 is not cut.

Troubleshooting

- Correct the parameter P7.2.1.1 Therm Trip (HW) to match the X12 jumper setting.

Fault 8 - System fault, Subcode S49 - OPTAF: Board mounted in VACON NXS control board

Cause

OPTAF is only compatible with VACON® NXP.

Troubleshooting

- Remove the OPTAF board.

Fault 8 - System fault, Subcode S50 - OPTAF: Filter discharge resistor fault

Cause

Problem with the control board.

Troubleshooting

- Ask instructions from the local distributor.

Fault 8 - System fault, Subcode S70 - False fault activated

Cause

Fault in application.

Troubleshooting

- Ask instructions from the local distributor.

Fault 9 - Undervoltage, Subcode S1 - DC-link too low during run

Cause

The DC-link voltage is lower than the limits.

- Too low a supply voltage
- AC drive internal fault
- A defective input fuse
- The external charge switch is not closed.

It is possible to set different responses in the application for this fault. See parameter group Protections.

Troubleshooting

- If there is a temporary supply voltage break, reset the fault and start the drive again.
- Check the supply voltage. If the supply voltage is sufficient, there is an internal fault.
- Ask instructions from the local distributor.

Fault 9 - Undervoltage, Subcode S2 - No data from power unit

Cause

The DC-link voltage is lower than the limits.

- Too low a supply voltage
- AC drive internal fault
- A defective input fuse
- The external charge switch is not closed.

It is possible to set different responses in the application for this fault. See parameter group Protections.

Troubleshooting

- If there is a temporary supply voltage break, reset the fault and start the drive again.
- Check the supply voltage. If the supply voltage is sufficient, there is an internal fault.
- Ask instructions from the local distributor.

Fault 9 - Undervoltage, Subcode S3 - Undervoltage control supervision

Cause

The DC-link voltage is lower than the limits.

- Too low a supply voltage
- AC drive internal fault
- A defective input fuse
- The external charge switch is not closed.

It is possible to set different responses in the application for this fault. See parameter group Protections.

Troubleshooting

- If there is a temporary supply voltage break, reset the fault and start the drive again.
- Check the supply voltage. If the supply voltage is sufficient, there is an internal fault.
- Ask instructions from the local distributor.

Fault 10 - Input line supervision, Subcode S1 - Phase supervision diode supply

Cause

The input line phase is missing.

It is possible to set different responses in the application for this fault. See parameter group Protections.

Troubleshooting

- Do a check of the supply voltage, the fuses, and supply cable.

Fault 11 - Output phase supervision, Subcode S1 - Common output phase supervision

Cause

The measurement of current tells that there is no current in 1 motor phase.

It is possible to set different responses in the application for this fault. See parameter group Protections.

Troubleshooting

- Check the motor cable and the motor.

Fault 11 - Output phase supervision, Subcode S2 - Additional closed loop control output phase fault

Cause

The measurement of current tells that there is no current in 1 motor phase.

It is possible to set different responses in the application for this fault. See parameter group Protections.

Troubleshooting

- Check the motor cable and the motor.

Fault 11 - Output phase supervision, Subcode S3 - Additional open loop control output phase fault during start DC brake

Cause

The measurement of current tells that there is no current in 1 motor phase.

It is possible to set different responses in the application for this fault. See parameter group Protections.

Troubleshooting

- Check the motor cable and the motor.

Fault 11 - Output phase supervision, Subcode S4 - Additional closed loop output phase fault during PM StartAngleID run

Cause

The measurement of current tells that there is no current in 1 motor phase.

It is possible to set different responses in the application for this fault. See parameter group Protections.

Troubleshooting

- Check the motor cable and the motor.

Fault 12 - Brake chopper supervision

Cause

- There is no brake resistor.
- The brake resistor is broken.
- A defective brake chopper.

Troubleshooting

- Check 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.

Fault 13 - AC drive undertemperature

Cause

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).

Troubleshooting

- Add an external heater near the AC drive.

Fault 14 - AC drive overtemperature, Subcode S1 - Overtemperature warning in unit, board, or phases

Cause

Overheating detected in AC drive.

Heat sink temperature is over 90 °C (194 °F). Overtemperature alarm is issued when the heat sink temperature goes over 85 °C (185 °F).

In 525–690 V, FR6: Heat sink temperature is over 77 °C (170.6 °F). Overtemperature alarm is issued when the heat sink temperature goes over 72 °C (161.6 °F).

Troubleshooting

- Check the actual amount and flow of cooling air.
- Examine the heat sink for dust.
- Check the ambient temperature.
- Make sure that the switching frequency is not too high in relation to the ambient temperature and the motor load.

- For FR10-FR11 Standalone: check door filters, and clean or replace if needed.

Fault 14 - AC drive overtemperature, Subcode S2 - Overtemperature in power board

Cause

Overheating detected in AC drive.

Heat sink temperature is over 90 °C (194 °F). Overtemperature alarm is issued when the heat sink temperature goes over 85 °C (185 °F).

In 525–690 V, FR6: Heat sink temperature is over 77 °C (170.6 °F). Overtemperature alarm is issued when the heat sink temperature goes over 72 °C (161.6 °F).

Troubleshooting

- Check the actual amount and flow of cooling air.
- Examine the heat sink for dust.
- Check the ambient temperature.
- Make sure that the switching frequency is not too high in relation to the ambient temperature and the motor load.
- For FR10-FR11 Standalone: check door filters, and clean or replace if needed.

Fault 14 - AC drive overtemperature, Subcode S4 - Overtemperature on ASIC board or driver boards

Cause

Overheating detected in AC drive.

Heat sink temperature is over 90 °C (194 °F). Overtemperature alarm is issued when the heat sink temperature goes over 85 °C (185 °F).

In 525–690 V, FR6: Heat sink temperature is over 77 °C (170.6 °F). Overtemperature alarm is issued when the heat sink temperature goes over 72 °C (161.6 °F).

Troubleshooting

- Check the actual amount and flow of cooling air.
- Examine the heat sink for dust.
- Check the ambient temperature.
- Make sure that the switching frequency is not too high in relation to the ambient temperature and the motor load.
- For FR10-FR11 Standalone: check door filters, and clean or replace if needed.

Fault 15 - Motor stalled

Cause

The motor stalled.

It is possible to set different responses in the application for this fault. See parameter group Protections.

Troubleshooting

- Check the motor and the load.
- Insufficient motor power, check motor stall protection parameterization.

Fault 16 - Motor overtemperature

Cause

There is too heavy a load on the motor.

It is possible to set different responses in the application for this fault. See parameter group Protections.

Troubleshooting

- Decrease the motor load.
- If there is no motor overload, check the temperature model parameters.

Fault 17 - Motor underload

Cause

Motor underload protection has tripped.

It is possible to set different responses in the application for this fault. See parameter group Protections.

Troubleshooting

- Check the load.
- Check underload protection parameterization.

Fault 18 - Unbalance, Subcode S1 - Current unbalance

Cause

Unbalance between power modules in paralleled power units.

This fault is type A fault (Alarm).

Troubleshooting

- If the fault occurs again, ask instructions from the local distributor.

Fault 18 - Unbalance, Subcode S2 - DC voltage unbalance

Cause

Unbalance between power modules in paralleled power units.

This fault is type A fault (Alarm).

Troubleshooting

- If the fault occurs again, ask instructions from the local distributor.

Fault 19 - Current overload

Cause

Motor current overload warning.

Troubleshooting

- Ask instructions from the local distributor.

Fault 22 - Parameter fault, Subcode S1 - Firmware interface power down variable checksum error

Cause

Parameter save fault.

- Operation malfunction
- defective component

Troubleshooting

- If the fault occurs again, ask instructions from the local distributor.

Fault 22 - Parameter fault, Subcode S2 - Firmware interface variable check sum error

Cause

Parameter save fault.

- Operation malfunction
- defective component

Troubleshooting

- If the fault occurs again, ask instructions from the local distributor.

Fault 22 - Parameter fault, Subcode S3 - System power down variable check sum error

Cause

Parameter save fault.

- Operation malfunction
- defective component

Troubleshooting

- If the fault occurs again, ask instructions from the local distributor.

Fault 22 - Parameter fault, Subcode S4 - System parameter checksum error

Cause

Parameter save fault.

- Operation malfunction
- defective component

Troubleshooting

- If the fault occurs again, ask instructions from the local distributor.

Fault 22 - Parameter fault, Subcode S5 - Application-defined power-down, variable checksum error

Cause

Parameter save fault.

- Operation malfunction
- defective component

Troubleshooting

- If the fault occurs again, ask instructions from the local distributor.

Fault 22 - Parameter fault, Subcode S6 - Application-defined power-down, variable checksum

Cause

Parameter save fault.

- Operation malfunction
- defective component

Troubleshooting

- If the fault occurs again, ask instructions from the local distributor.

Fault 22 - Parameter fault, Subcode S10 - System parameter checksum error

Cause

Parameter save fault.

- Operation malfunction
- defective component

Troubleshooting

- If the fault occurs again, ask instructions from the local distributor.

Fault 22 - Parameter fault, Subcode S13 - Checksum error in application-specific parameter set

Cause

Parameter save fault.

Troubleshooting

- Recommission the application.
- Check parameters.

Fault 24 - Counter fault

Cause

Values that showed on the counters are incorrect.

Troubleshooting

- Have a critical attitude towards values shown on counters.

Fault 25 - Microprocessor watchdog fault, Subcode S1 - CPU watchdog timer

Cause

- operation malfunction
- defective component

Troubleshooting

- Reset the fault and start the drive again.
- If the fault shows again, ask instructions from the local distributor.

Fault 25 - Microprocessor watchdog fault, Subcode S2 - ASIC reset

Cause

- operation malfunction
- defective component

Troubleshooting

- Reset the fault and start the drive again.
- If the fault shows again, ask instructions from the local distributor.

Fault 26 - Start-up prevented, Subcode S1 - Prevention of accidental start-up

Cause

Start-up of the drive has been prevented. Run request is ON when new application is downloaded to the drive.

Troubleshooting

- Cancel prevention of start-up if it can be done safely.
- Remove Run request.

Fault 26 - Start-up prevented, Subcode S2 - RUN request is kept active after drive returns to READY state from safe state

Cause

Start-up of the drive has been prevented. START command is ON when returning to READY state after Safe Disable has been active..

Troubleshooting

- Cancel prevention of start-up if it can be done safely.
- Remove Run request.

Fault 26 - Start-up prevented, Subcode S30 - RUN request given too quickly

Cause

Start-up of the drive has been prevented. START command is ON after system software or application was downloaded, or after application was changed.

Troubleshooting

- Cancel prevention of start-up if it can be done safely.
- Remove Run request.

Fault 29 - Thermistor fault, Subcode S1 - Thermistor input activated on OPTAF board

Cause

The thermistor input of option board has detected increase of the motor temperature.

It is possible to set different responses in the application for this fault. See parameter group Protections.

Troubleshooting

- Check the motor cooling and loading.
- Check the thermistor connection.
- (If thermistor input of the option board is not in use it has to be short-circuited).

Fault 29 - Thermistor fault, Subcode S2 - Special application

Cause

The thermistor input of option board has detected increase of the motor temperature.

It is possible to set different responses in the application for this fault. See parameter group Protections.

Troubleshooting

- Check the motor cooling and loading.
- Check the thermistor connection.
- (If thermistor input of the option board is not in use it has to be short-circuited).

Fault 30 - Safe disable

Cause

The input on OPTAF board has opened.

STO inputs SD1 and SD2 are activated through the OPTAF option board.

Troubleshooting

- Cancel Safe Disable if it can be done safely.

Fault 31 - IGBT temperature (hardware)

Cause

IGBT Inverter Bridge overtemperature protection has detected too high a short-term overload current.

Troubleshooting

- Check the load.
- Check the motor frame size.
- Make an identification run.

Fault 32 - Fan cooling

Cause

Cooling fan of the AC drive does not start, when ON command is given.

Troubleshooting

- Ask instructions from the local distributor.

Fault 34 - CAN bus communication

Cause

Sent message not acknowledged.

Troubleshooting

- Make sure that there is another device on the bus with the same configuration.

Fault 35 - Application

Cause

Problem in application software.

Troubleshooting

- Ask instructions from the local distributor.
- For an application programmer: check the application program.

Fault 36 - Control unit

Cause

The software needs newer version of the control unit.

Troubleshooting

- Change the control unit.

Fault 37 - Device changed (same type), Subcode S1 - Control board

Cause

A new option board has replaced the old one in the same slot. The parameters are available in the drive.

Troubleshooting

- Reset the fault. The device is ready for use. The drive starts to use the old parameter settings.

Fault 38 - Device added (same type), Subcode S1 - Control board

Cause

The option board was added. The same option board has been used in the same slot before. The parameters are available in the drive.

Troubleshooting

- Reset the fault. The device is ready for use. The drive starts to use the old parameter settings.

Fault 39 - Device removed

Cause

An option board was removed from the slot.

Troubleshooting

- The device is not available. Reset the fault.

Fault 40 - Device unknown, Subcode S1 - Unknown device

Cause

An unknown or mismatching device was connected (the power unit or option board).

Troubleshooting

- Ask instructions from the local distributor.

Fault 40 - Device unknown, Subcode S2 - StarCoupler: power sub units are not identical

Cause

An unknown or mismatching device was connected (the power unit or option board).

Troubleshooting

- Ask instructions from the local distributor.

Fault 40 - Device unknown, Subcode S3 - StarCoupler is not compatible with the control board

Cause

An unknown or mismatching device was connected (the power unit or option board).

Troubleshooting

- Ask instructions from the local distributor.

Fault 40 - Device unknown, Subcode S4 - Wrong PropertiesType in control board EEPROM

Cause

An unknown or mismatching device was connected (the power unit or option board).

Troubleshooting

- Ask instructions from the local distributor.

Fault 40 - Device unknown, Subcode S5 - Wrong VACON® NXP control board EEPROM size detected

Cause

An unknown or mismatching device was connected (the power unit or option board).

Troubleshooting

- Ask instructions from the local distributor.

Fault 40 - Device unknown, Subcode S6 - Old power unit (Asic) and new software mismatch

Cause

An unknown or mismatching device was connected (the power unit or option board).

Troubleshooting

- Ask instructions from the local distributor.

Fault 40 - Device unknown, Subcode S7 - Old ASIC detected

Cause

An unknown or mismatching device was connected (the power unit or option board).

Troubleshooting

- Ask instructions from the local distributor.

Fault 41 - IGBT temperature, Subcode S1 - Calculated IGBT temperature too high

Cause

IGBT Inverter Bridge overtemperature protection has detected too high a short-term overload current.

Troubleshooting

- Check the load.
- Check the motor frame size.
- Make an identification run.

Fault 41 - IGBT temperature, Subcode S3 - Calculated IGBT temperature too high (longterm protection)

Cause

IGBT Inverter Bridge overtemperature protection has detected too high a short-term overload current.

Troubleshooting

- Check the load.
- Check the motor frame size.
- Make an identification run.

Fault 41 - IGBT temperature, Subcode S4 - Peak current too high

Cause

IGBT Inverter Bridge overtemperature protection has detected too high a short-term overload current.

Troubleshooting

- Check the load.
- Check the motor frame size.
- Make an identification run.

Fault 41 - IGBT temperature, Subcode S5 - BCU: Filtered current too high for some time

Cause

IGBT Inverter Bridge overtemperature protection has detected too high a short-term overload current.

Troubleshooting

- Check the load.
- Check the motor frame size.
- Make an identification run.

Fault 41 - IGBT temperature, Subcode S6 - BCU: Current momentarily too high

Cause

IGBT Inverter Bridge overtemperature protection has detected too high a short-term overload current.

Troubleshooting

- Check the load.
- Check the motor frame size.
- Make an identification run.
- Check brake resistor resistance.

Fault 42 - Brake resistor overtemperature, Subcode S1 - Internal brake chopper overtemperature

Cause

Brake resistor overtemperature protection has detected too heavy braking.

Troubleshooting

- Reset unit.
- Set the deceleration time longer.
- Dimensioning of the brake chopper is not correct.
- Use external brake resistor.

Fault 42 - Brake resistor overtemperature, Subcode S2 - Brake resistance too high (BCU)

Cause

Brake resistor overtemperature protection has detected too heavy braking.

Troubleshooting

- Reset unit.
- Set the deceleration time longer.
- Dimensioning of the brake chopper is not correct.
- Use external brake resistor.

Fault 42 - Brake resistor overtemperature, Subcode S3 - Brake resistance too low (BCU)

Cause

Brake resistor overtemperature protection has detected too heavy braking.

Troubleshooting

- Reset unit.
- Set the deceleration time longer.
- Dimensioning of the brake chopper is not correct.
- Use external brake resistor.

Fault 42 - Brake resistor overtemperature, Subcode S4 - Brake resistance not detected (BCU)

Cause

Brake resistor overtemperature protection has detected too heavy braking.

Troubleshooting

- Reset unit.
- Set the deceleration time longer.
- Dimensioning of the brake chopper is not correct.
- Use external brake resistor.

Fault 42 - Brake resistor overtemperature, Subcode S5 - Brake resistance leakage (earth fault) (BCU)

Cause

Brake resistor overtemperature protection has detected too heavy braking.

Troubleshooting

- Reset unit.
- Set the deceleration time longer.
- Dimensioning of the brake chopper is not correct.
- Use external brake resistor.

Fault 43 - Encoder fault, Subcode S1 - Encoder 1 channel A is missing

Cause

Problem detected in encoder signals.

Encoder channel A is missing.

Troubleshooting

1. Check the encoder connections.
2. Check the option board.
3. Measure the encoder pulses.
   a. If the pulses are correct, the option board is faulty.
   b. If the pulses are not correct, the encoder/cabling is faulty.

Fault 43 - Encoder fault, Subcode S2 - Encoder 1 channel B is missing

Cause

Problem detected in encoder signals.

Encoder channel B is missing.

Troubleshooting

1. Check the encoder connections.
2. Check the option board.
3. Measure the encoder pulses.
   a. If the pulses are correct, the option board is faulty.
   b. If the pulses are not correct, the encoder/cabling is faulty.

Fault 43 - Encoder fault, Subcode S3 - Both encoder 1 channels are missing

Cause

Problem detected in encoder signals.

Encoder channels A and B are missing.

Troubleshooting

1. Check the encoder connections.
2. Check the option board.
3. Measure the encoder pulses.
   a. If the pulses are correct, the option board is faulty.
   b. If the pulses are not correct, the encoder/cabling is faulty.

Fault 43 - Encoder fault, Subcode S4 - Encoder reversed

Cause

Problem detected in encoder signals.

The encoder is reversed. The output frequency has been set to the positive value, but the encoder signal is negative.

Troubleshooting

1. Change the frequency value polarity so that the encoder signal is positive. With some encoders, interchanging the encoder channels can be used to change the indicated rotation direction.

Fault 43 - Encoder fault, Subcode S5 - Encoder board missing

Cause

The encoder board is missing.

Troubleshooting

1. Check the encoder board.
2. Check the terminals.
3. Check the board connections.

Fault 43 - Encoder fault, Subcode S6 - Serial communication fault

Cause

Problem detected in encoder signals.

Serial communication fault. The encoder cable is not connected or there are interferences in the cable.

Troubleshooting

1. Check cabling between encoder and OPTBE, especially Data and Clock signals.
2. Check that actual encoder type matches with OPTBE “Operating mode” parameter.

Fault 43 - Encoder fault, Subcode S7 - Ch A / Ch B Mismatch

Cause

Problem detected in encoder signals.

Encoder channels A and B are mismatched.

Troubleshooting

1. Check the cable connections and terminals.

Fault 43 - Encoder fault, Subcode S8 - Resolver/Motor pole pair mismatch

Cause

Problem detected in parameterization of option board.

There is a mismatch of the resolver/ motor pole pair number. Resolver pole pair number (if >1) is not matching the motor pole pair number.

Troubleshooting

1. Check that OPTBC parameter “Resolver Poles” and possible Gear Ratio parameters in application match motor pole count.

Fault 43 - Encoder fault, Subcode S9 - Missed Start Angle

Cause

Encoder zero positioning identification run has not been made.

The encoder start angle is missing.

Troubleshooting

1. Make encoder identification run.

Fault 43 - Encoder fault, Subcode S10 - Sin/Cos encoder feedback is missing

Cause

Problem detected in encoder signals.

For the closed loop control, encoder modes "EnDat only" or "SSI only" (absolute channel only) are not allowed.

Troubleshooting

1. Check the wiring, jumper settings, and encoder mode.
2. Change OPTBE “Operating mode” parameter is either "EnDat+SinCos", "SSI+SinCos" or "SinCos only", or avoid using closed loop control.

Fault 43 - Encoder fault, Subcode S11 - Encoder angle is drifting

Cause

Error angle between the angle read from the absolute channel and the angle calculated from the incremental channels.

Troubleshooting

1. Check the encoder cable, cable shield, and grounding of the cable shield.
2. Check the mechanical mounting of the encoder and make sure that the encoder is not slipping.
3. Check the encoder parameters (for example, encoder ppr).

Fault 43 - Encoder fault, Subcode S12 - Dual speed supervision fault

Cause

Encoder speed supervision. The difference between the encoder speed and estimated speed is too large. Dual speed supervision:

Estimated speed and encoder speed difference is too high (0.05 x fn or minimum motor nominal slip frequency). See variable EstimatedShaftFrequency.

Troubleshooting

1. Check the encoder speed signal ShaftFrequency vs. EstimatedShaftFrequency.
2. If the ShaftFrequency is incorrect, check the encoder, cable, and encoder parameters.
3. If the EstimatedShaftFrequency is incorrect, check the motor parameters.

Fault 43 - Encoder fault, Subcode S13 - Encoder angle supervision fault

Cause

The estimated shaft position error (estimated angle - encoder angle) is more than 90° electrical.

See variable EstimatedAngleError.

Troubleshooting

1. Repeat the encoder ID run (absolute encoders).
2. Check the mechanical mounting of the encoder and make sure that the encoder is not slipping.
3. Check the encoder ppr number.
4. Check the encoder cable.

Fault 43 - Encoder fault, Subcode S14 - Encoder estimated missing pulse fault, switch from the CL ctrl to the OL sensorl

Cause

Problem detected in encoder signals.

Software has detected too many missing pulses in the encoder. Closed loop control is switched to sensorless open loop control.

Troubleshooting

1. Check the encoder.
2. Check the encoder cable, cable shield, and grounding of the cable shield.
3. Check the mechanical mounting of the encoder.
4. Check the encoder parameters.

Fault 45 - Device added (different type), Subcode S1 - Control board

Cause

Option board of different type added.

Troubleshooting

1. Reset.
2. Set the power unit parameters again.

Fault 49 - Division by zero in application

Cause

Division by zero has occurred in application program.

Troubleshooting

1. If the fault shows again while the AC drive is in run state, ask instructions from the local distributor.
2. For an application programmer: check the application program.

Fault 50 - Analogue input I_{in} < 4 mA (sel. signal range 4 to 20 mA)

Cause

Current at the analog input is < 4 mA.

- Control cable is broken or loose
- signal source has failed.

It is possible to set different responses in the application for this fault. See parameter group Protections.

Troubleshooting

1. Check the current loop circuitry.

Fault 51 - External fault 1

Cause

Digital input fault.

Digital input has been programmed as external fault 1 input and this input is active.

Troubleshooting

1. Check the programming.
2. Check the device which the error message indicates.
3. Check the cabling for the respective device.

Fault 52 - Keypad communication fault

Cause

The connection between the control panel (or VACON® NCDrive) and the drive is defective.

Troubleshooting

1. Check the control panel connection and the control panel cable.

Fault 53 - Fieldbus fault

Cause

The data connection between the fieldbus master and the fieldbus board is defective.

Troubleshooting

1. Check the installation and fieldbus master.
2. If the installation is correct, ask instructions from the local distributor.

Fault 54 - Slot fault

Cause

Defective option board or slot.

Troubleshooting

1. Check the board and slot.
2. Ask instructions from the local distributor.

Fault 56 - Measured Temperature

Cause

Shows temperature measurement fault for option board OPTBH or OPTB8.

- Temperature exceeded set limit.
- Sensor disconnected.
- Short circuit.

Troubleshooting

1. Find the cause of temperature rise.

Fault 57 - Identification

Cause

Identification run has failed.

This fault is type A fault (Alarm).

Troubleshooting

1. Run command was removed before completion of identification run.
2. The motor is not connected to the AC drive.
3. There is load on motor shaft.

Fault 58 - Brake

Cause

Actual status of the brake is different from the control signal.

It is possible to set different responses in the application for this fault. See parameter group Protections.

Troubleshooting

1. Check the mechanical brake state and connections.

Fault 59 - Follower communication

Cause

SystemBus or CAN communication is broken between Master and Follower.

Troubleshooting

1. Check the option board parameters.
2. Check the optical fiber cable or CAN cable.

Fault 60 - Cooling

Cause

External cooling has failed.

Normally this fault comes from the heat exchanger unit.

Troubleshooting

1. Check the reason for the failure on the external system.

Fault 61 - Speed error

Cause

Motor speed is unequal to reference.

Troubleshooting

1. Check the encoder connection.
2. PMS motor has exceeded the pull-out torque.

Fault 62 - Run disable

Cause

Run enable signal is low.

Troubleshooting

1. Check the reason for the Run enable signal.

Fault 63 - Quick stop

Cause

Command for quick stop received from digital input or fieldbus.

This fault is type A fault (Alarm).

Troubleshooting

1. Reset the fault.

Fault 64 - Input switch open

Cause

Drive input switch is open.

This fault is type A fault (Alarm)

Troubleshooting

1. Check the main power switch of the drive.

Fault 65 - Measured Temperature

Cause

Shows temperature measurement fault for option board OPTBH or OPTB8.

- Temperature exceeded set limit.
- Sensor disconnected.
- Short circuit.

Troubleshooting

1. Find the cause of temperature rise or sensor malfunction.

Fault 70 - Active filter fault

Cause

Fault triggered by digital input (see param. P2.2.7.33).

It is possible to set different responses in the application for this fault. See parameter group Protections.

Troubleshooting

1. Remove fault situation on active filter.

Fault 74 - Follower fault

Cause

When using normal Master Follower function this fault code is given if one or more follower drives trips to fault.

Troubleshooting

1. Correct the fault cause on follower and reset fault.

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