

Operating Guide

VLT® Compressor Drive CDS 803



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1 Introduction

1.1 Purpose of this Operating Guide

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

1.2 Trademarks

VLT® is a registered trademark for Danfoss A/S.

1.3 Additional Resources

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

- The programming guide provides greater detail on working with parameters and shows many application examples.
- The design guide provides detailed information about capabilities and functionality to design motor control systems.
- Supplementary publications and manuals are available from Danfoss.

See www.danfoss.com for supplementary documentation.

VLT® Motion Control Tool MCT 10 software support

Download the software from the Service and Support download page on www.danfoss.com.

During the installation process of the software, enter CD-key 34544400 to activate the CDS 803 functionality. An activation key is not required for using the CDS 803 functionality.

The latest software does not always contain the latest updates for the drive. Contact the local sales office for the latest drive updates (in the form of *.upd files), or download the drive updates from the Service and Support download page on www.danfoss.com.

1.4 Manual and Software Version







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

Table 1: Manual and Software Version

Edition	Remarks	Software version
AQ321748767627xx-xx0101	New power sizes added to product range.	6.0–10 kW (8–15 hp): Version 2.0 18–30 kW (25–40 hp): Version 1.00

1.5 Type Approvals and Certifications


The following list is a selection of possible type approvals and certifications for VLT® Compressor Drive CDS 803 drives:

Name of certification	Certification logo	IP20
EC Declaration of Conformity		✓
UL listed		✓
UL recognized (only valid for CDS 803 - S096)		✓
RCM		✓
EAC		✓
UkrSEPRO		✓

VLT® Compressor Drive CDS 803 drives having S096 in the type code (400 V AC, 18.5–30 kW (25–40 hp)) are certified to UL/EN/IEC 60730-1. The drive is also designed for systems that have to be compliant with UL/IEC/EN 60335.

For more information on UL 508C thermal memory retention requirements, refer to the section *Motor Thermal Protection* in the product-specific *design guide*.

1.6 Disposal

	<p>Do not dispose of equipment containing electrical components together with domestic waste.</p> <p>Collect it separately in accordance with local and currently valid legislation.</p>
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2 Safety

2.1 Safety Symbols

The following symbols are used in this manual:

⚠ DANGER ⚠

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING ⚠

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION ⚠

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

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

2.2 Qualified Personnel

To allow trouble-free and safe operation of the unit, only qualified personnel with proven skills are allowed to transport, store, assemble, install, program, commission, maintain, and decommission this equipment.

Persons with proven skills:

- Are qualified electrical engineers, or persons who have received training from qualified electrical engineers and are suitably experienced to operate devices, systems, plant, and machinery in accordance with pertinent laws and regulations.
- Are familiar with the basic regulations concerning health and safety/accident prevention.
- Have read and understood the safety guidelines given in all manuals provided with the unit, especially the instructions given in the Operating Guide.
- Have good knowledge of the generic and specialist standards applicable to the specific application.

2.3 Safety Precautions

⚠ WARNING ⚠

HIGH VOLTAGE

AC drives contain high voltage when connected to AC mains input, DC supply, or load sharing. Failure to perform installation, start-up, and maintenance by qualified personnel can result in death or serious injury.

- Only qualified personnel must perform installation, start-up, and maintenance.

⚠ WARNING ⚠

UNINTENDED START

When the drive is connected to AC mains, DC supply, or load sharing, the motor may start at any time. Unintended start during programming, service, or repair work can result in death, serious injury, or property damage. Start the motor with an external switch, a fieldbus command, an input reference signal from the local control panel (LCP), via remote operation using MCT 10 software, or after a cleared fault condition.

- Disconnect the drive from the mains.
- Press [Off/Reset] on the LCP before programming parameters.
- Ensure that the drive is fully wired and assembled when it is connected to AC mains, DC supply, or load sharing.

⚠ WARNING ⚠

DISCHARGE TIME

The drive contains DC-link capacitors, which can remain charged even when the drive is not powered. High voltage can be present even when the warning indicator lights are off.

Failure to wait the specified time after power has been removed before performing service or repair work could result in death or serious injury.

- Stop the motor.
- Disconnect AC mains, permanent magnet type motors, and remote DC-link supplies, including battery back-ups, UPS, and DC-link connections to other drives.
- Wait for the capacitors to discharge fully. The minimum waiting time is specified in the table *Discharge time* and is also visible on the nameplate on top of the drive.
- Before performing any service or repair work, use an appropriate voltage measuring device to make sure that the capacitors are fully discharged.

Table 2: Discharge Time

Voltage [V]	Power range [kW (hp)]	Minimum waiting time (minutes)
3x200	6.0–10 (8.0–15)	15
3x400	6.0–7.5 (8.0–10)	4
3x400	10–30 (15–40)	15

⚠ 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 ⚠**EQUIPMENT HAZARD**

Contact with rotating shafts and electrical equipment can result in death or serious injury.

- Ensure that only trained and qualified personnel perform installation, start-up, and maintenance.
- Ensure that electrical work conforms to national and local electrical codes.
- Follow the procedures in this manual.

⚠ CAUTION ⚠**INTERNAL FAILURE HAZARD**

An internal failure in the drive can result in serious injury when the drive is not properly closed.

- Ensure that all safety covers are in place and securely fastened before applying power.

2.4 Motor Thermal Protection

Context:

This procedure is only valid for VLT® Compressor Drive CDS 803 - S096 (18.2–30 kW/VZH088–VZH170))

Procedure

1. Set *parameter 1-90 Motor Thermal Protection* to [4] *ETR trip 1* to enable the motor thermal protection function.

3 Installation

3.1 Mechanical Installation

3.1.1 Cooling Capacity

Table 3: H3–H4, 400 V

Cooling capacity	400 V IP20 enclosure
4 TR/VZH028	H3
5 TR/VZH035	H3
6.5 TR/VZH044	H4

Table 4: H4–H5, 200 V

Cooling capacity	200 V IP20 enclosure
4 TR/VZH028	H4
5 TR/VZH035	H4
6.5 TR/VZH044	H5

Table 5: H5–H6, 400 V

Cooling capacity	400 V IP20 enclosure
13 TR/VZH088	H5
17 TR/VZH117	H5
26 TRVZH170	H6

3.1.2 Side-by-side Installation

The drive can be mounted side by side but requires the clearance specified in [table 6](#) above and below for cooling.

Table 6: Clearance Required for Cooling

Size	IP protection rating	Power [kW (hp)]		Clearance above/below [mm (in)]
		3x200–240 V	3x380–480 V	
H3	IP20	–	6.0–7.5 (8.0–10)	100 (4)
H4	IP20	6.0–7.5 (8.0–10)	10 (15)	100 (4)
H5	IP20	10 (15)	18.5–22 (25–30)	100 (4)
H6	IP20	–	30(40)	200 (7.9)

NOTICE

With IP21/NEMA Type1 option kit mounted, a distance of 50 mm (2 in) between the units is required.

3.1.3 Drive Dimensions

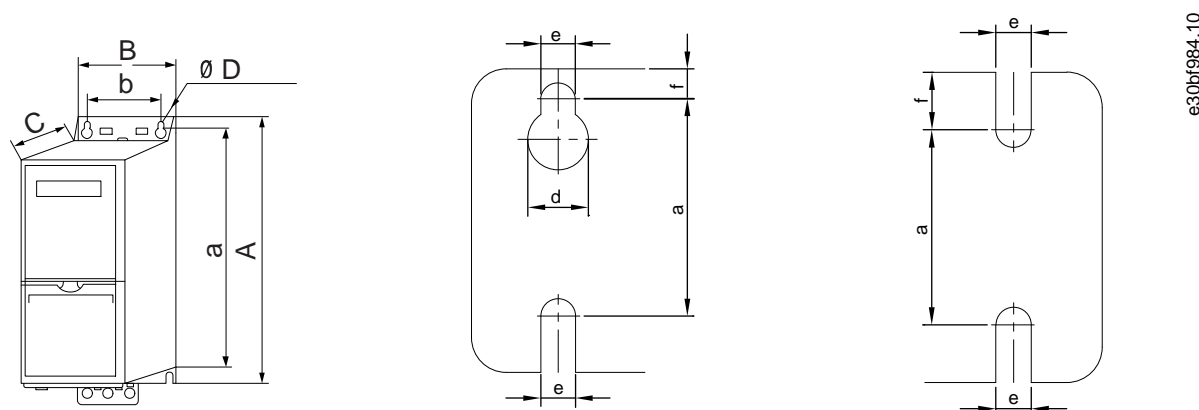


Illustration 1: Dimensions

Table 7: Dimensions, Enclosure Sizes H3–H6

Enclosure		Power [kW (hp)]		Height [mm (in)]			Width [mm (in)]	
Size	IP protection rating	3x200–240 V	3x380–480 V	A	A ⁽¹⁾	a	B	b
H3	IP20	–	6.0–7.5 (8.0–10)	255 (10.0)	329 (13.0)	240 (9.4)	100 (3.9)	74 (2.9)
H4	IP20	6.0–7.5 (8.0–10)	10 (15)	296 (11.7)	359 (14.1)	275 (10.8)	135 (5.3)	105 (4.1)
H5	IP20	10 (15)	18.5–22 (25–30)	334 (13.1)	402 (15.8)	314 (12.4)	150 (5.9)	120 (4.7)
H6	IP20	–	30 (40)	518 (20.4)	595 (23.4)/635 (25), 45 kW	495 (19.5)	239 (9.4)	200 (7.9)

¹ Including decoupling plate.

Table 8: Dimensions, Enclosure Sizes H3–H6

Enclosure		Power [kW (hp)]		Depth [mm (in)]	Mounting hole [mm (in)]			Maximum weight
Size	IP protection rating	3x200–240 V	3x380–480 V	C	d	e	f	kg (lb)
H3	IP20	–	6.0–7.5 (8.0–10)	206 (8.1)	11 (0.43)	5.5 (0.22)	8.1 (0.32)	4.5 (9.9)

Enclosure		Power [kW (hp)]		Depth [mm (in)]	Mounting hole [mm (in)]			Maximum weight
H4	IP20	6.0–7.5 (8.0–10)	11 (15)	241 (9.5)	12.6 (0.50)	7 (0.28)	8.4 (0.33)	7.9 (17.4)
H5	IP20	11 (15)	18.5–22 (25–30)	255 (10)	12.6 (0.50)	7 (0.28)	8.5 (0.33)	9.5 (20.9)
H6	IP20	–	30 (40)	242 (9.5)	–	8.5 (0.33)	15 (0.6)	24.5 (54)

3.2 Electrical Installation

3.2.1 Electrical Installation in General

All cabling must comply with national and local regulations on cable cross-sections and ambient temperature. Copper conductors are required. 75 °C (167 °F) is recommended.

Table 9: Tightening Torques for Enclosure Sizes H3–H6, 3x200–240 V & 3x380–480 V

Power [kW (hp)]				Torque [Nm (in-lb)]					
Enclo- sure size	IP protec- tion rat- ing	3x200–240 V	3x380–480 V	Mains	Motor	DC con- nection	Control ter- minals	Ground	Relay
H3	IP20	–	6.0–7.5 (8.0–10)	0.8 (7)	0.8 (7)	0.8 (7)	0.5 (4)	0.8 (7)	0.5 (4)
H4	IP20	6.0–7.5 (8.0–10)	10–15 (15–20)	1.2 (11)	1.2 (11)	1.2 (11)	0.5 (4)	0.8 (7)	0.5 (4)
H5	IP20	10 (15)	18.5–22 (25–30)	1.2 (11)	1.2 (11)	1.2 (11)	0.5 (4)	0.8 (7)	0.5 (4)
H6	IP20	–	30 (40)	4.5 (40)	4.5 (40)	–	0.5 (4)	3 (27)	0.5 (4)

3.2.2 IT Grid

⚠ CAUTION ⚠

IT Grid

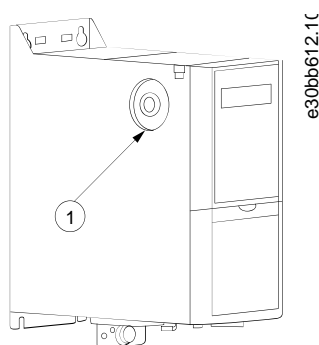
Installation on isolated mains source, that is, IT mains.

- Ensure that the supply voltage does not exceed 440 V (3x380–480 V units) when connected to mains.

NOTICE

This is only relevant for 200–240 V and 380–400 V drives in power sizes 6.0–10 kW (8.0–15 hp).

Open the RFI switch by removing the screw on the side of the drive when at IT grid.



1 EMC screw

Illustration 2: IP20, 200–240 V, 380–480 V, 6.0–10 kW (8.0–15 hp)

On 380–480 V, 18.5–30 kW (25–40 hp) units, the RFI filter cannot be switched off.

3.2.3 Mains and Motor Connection

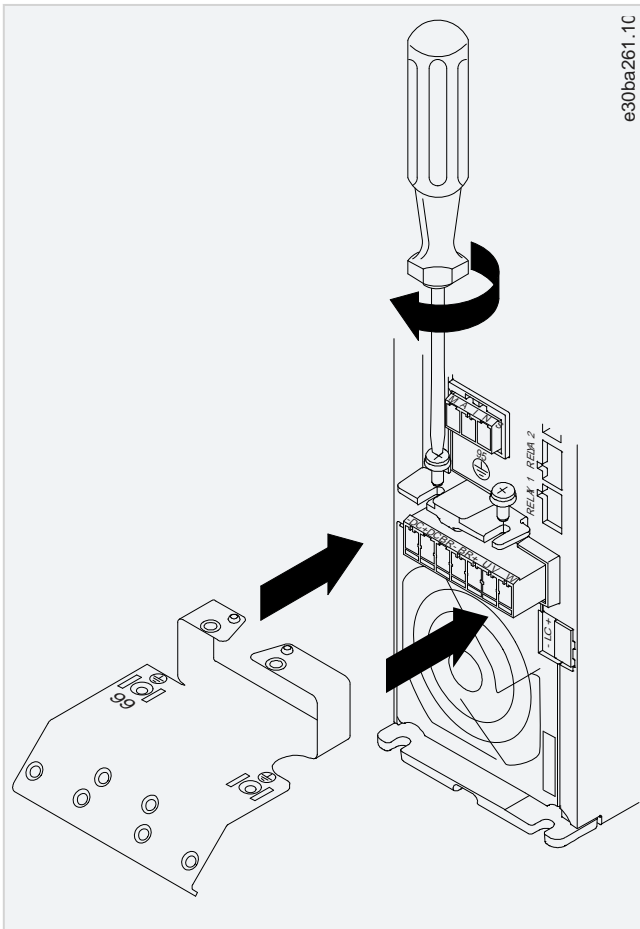
3.2.3.1 Introduction

The drive is designed to operate Danfoss VZH Compressors.

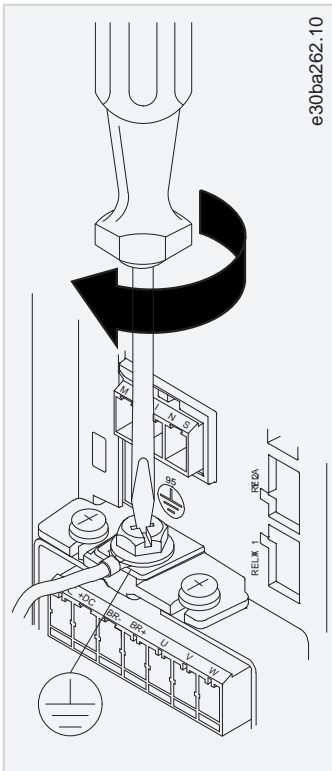
- Use a shielded/armored motor cable to comply with EMC emission specifications and connect this cable to both the decoupling plate and the motor.
- Keep the motor cable as short as possible to reduce the noise level and leakage currents.
- For further details on mounting the decoupling plate, see VLT® Compressor Drive CDS 803 Decoupling Plate Installation Instruction.
- Also see EMC-correct Installation in the [3.2.5 EMC-correct Electrical Installation](#)

3.2.3.2 Connecting to Mains and Motor

1. Mount the 2 screws in the mounting plate, slide the plate into place, and tighten fully.



2. Mount the ground cables to the ground terminal before mounting other cables.



3. Connect the compressor to terminals U, V, and W, and then tighten the screws according to the torques described in [3.2.1 Electrical Installation in General](#).

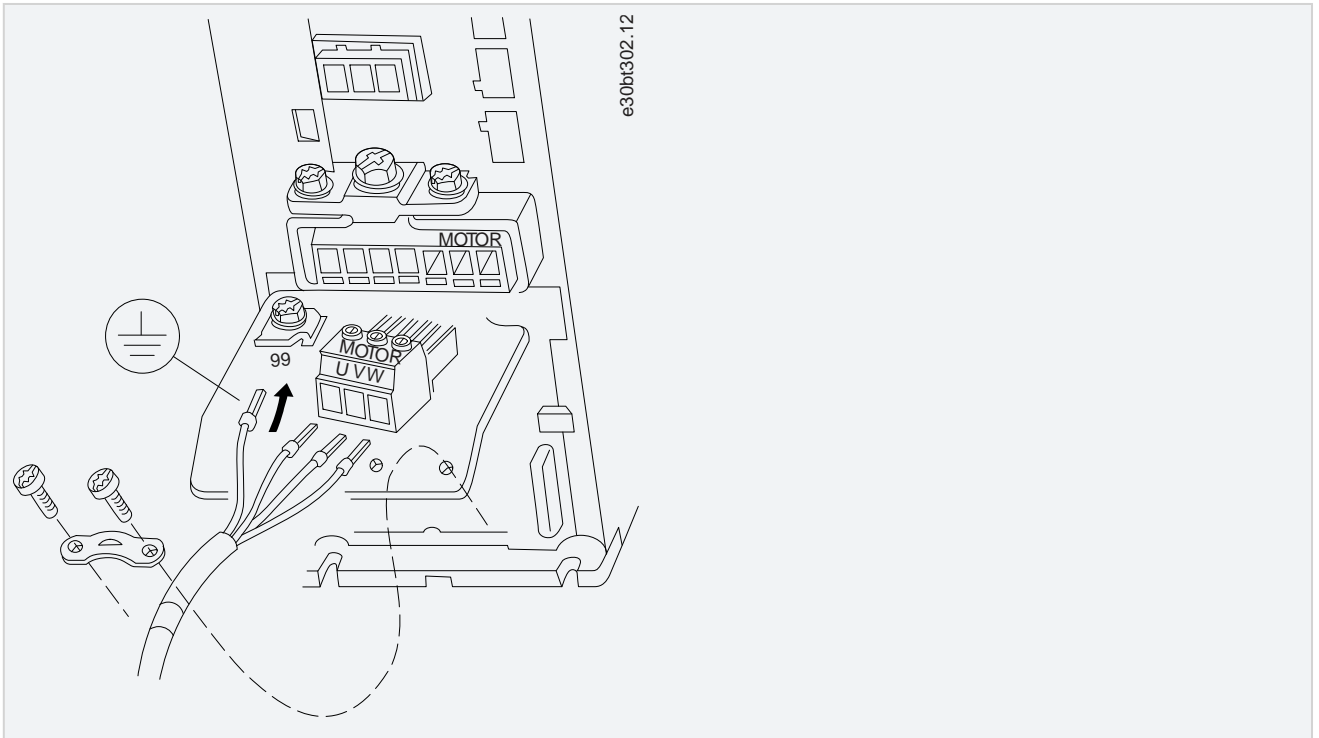
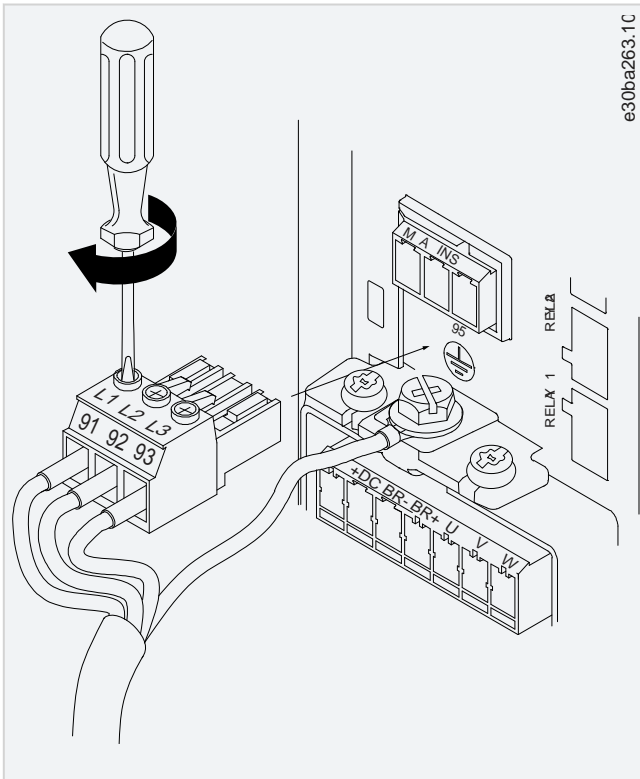


Table 10: Connection of Compressor to Terminals

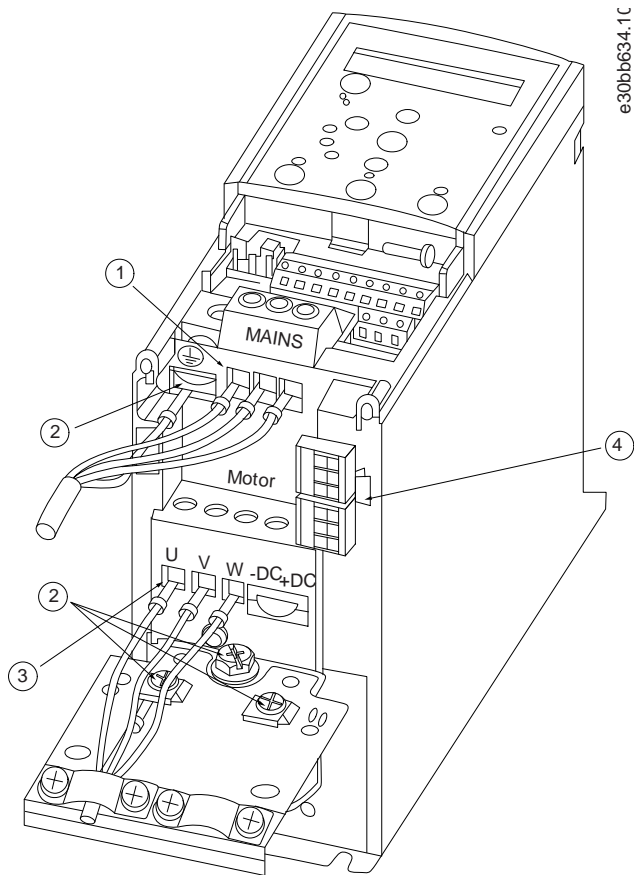
Drive terminals	Compressor
U	T1
V	T2
W	T3

4. Connect the mains supply to terminals L1, L2, and L3, and then tighten the screws according to the torques.



5. Tighten support bracket on mains wires.

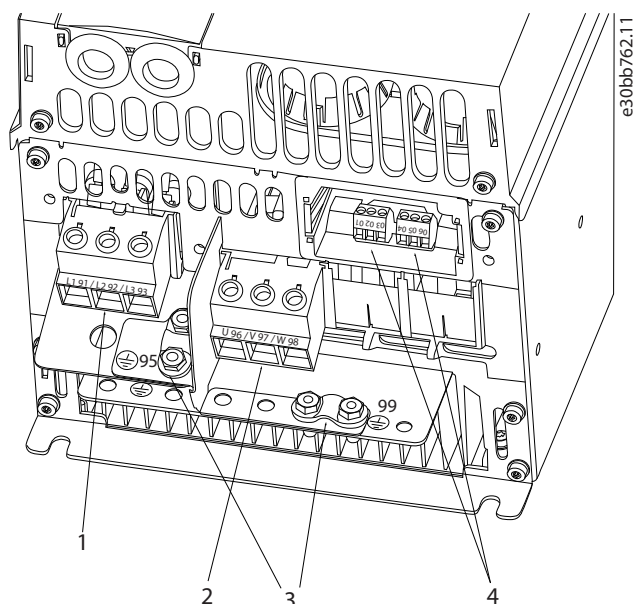
3.2.3.3 Relays and Terminals on Enclosure Sizes H3–H5



1 Mains	2 Ground
3 Compressor	4 Relays

Illustration 7: Enclosure Sizes H3–H5, IP20, 200–240 V, 6.0–10 kW (8.0–15 hp), IP20, 380–480 V, 6.0–22 kW (8.0–30 hp)

3.2.3.4 Relays and Terminals on Enclosure Size H6



1 Mains	2 Motor
3 Ground	4 Relays

Illustration 8: Enclosure Size H6, IP20, 380–480 V, 30 kW (40 hp)

3.2.4 Fuses and Circuit Breakers

3.2.4.1 Branch Circuit Protection

To prevent fire hazards, protect the branch circuits in an installation - switch gear, machines, and so on - against short circuits and overcurrent. Follow national and local regulations.

3.2.4.2 Short-circuit Protection

Danfoss recommends using the fuses and circuit breakers listed in this chapter to protect service personnel or other equipment in case of an internal failure in the unit or a short circuit on the DC link. The drive provides full short-circuit protection in case of a short circuit on the motor.

3.2.4.3 Overcurrent Protection

Provide overload protection to avoid overheating of the cables in the installation. Overcurrent protection must always be carried out according to local and national regulations. Design circuit breakers and fuses for protection in a circuit capable of supplying a maximum of 100000 A_{rms} (symmetrical), 480 V maximum.

3.2.4.4 UL/Non-UL Compliance

To ensure compliance with UL or IEC 61800-5-1, use the circuit breakers or fuses listed in this chapter. Circuit breakers must be designed for protection in a circuit capable of supplying a maximum of 10000 A_{rms} (symmetrical), 480 V maximum.

3.2.4.5 Recommendation of Fuses

NOTICE

If malfunction occurs, failure to follow the protection recommendation may result in damage to the drive.

Table 11: Fuses

	Fuse				
	UL				Non-UL
	Bussmann	Bussmann	Bussmann	Bussmann	Maximum fuse
Power [kW (hp)]	Type RK5	Type RK1	Type J	Type T	Type G
3x200–240 V IP20					
6.0 (8.0)	FRS-R-50	KTN-R50	JKS-50	JJN-50	50
7.5 (10)	FRS-R-50	KTN-R50	JKS-50	JJN-50	50
10 (15)	FRS-R-80	KTN-R80	JKS-80	JJN-80	65
3x380–480 V IP20					
6.0 (8.0)	FRS-R-25	KTS-R25	JKS-25	JJS-25	25
7.5 (10)	FRS-R-25	KTS-R25	JKS-25	JJS-25	25
10 (15)	FRS-R-50	KTS-R50	JKS-50	JJS-50	50
18.5 (25)	FRS-R-80	KTS-R80	JKS-80	JJS-80	63
22 (30)	FRS-R-80	KTS-R80	JKS-80	JJS-80	63
30 (40)	FRS-R-125	KTS-R125	JKS-R125	JJS-R125	80

3.2.5 EMC-correct Electrical Installation

General points to be observed to ensure EMC-correct electrical installation:

- Use only shielded/armored motor cables and shielded/armored control cables.
- Ground the shield at both ends.
- Avoid installation with twisted shield ends (pigtailed), because it reduces the shielding effect at high frequencies. Use the cable clamps provided.
- Ensure the same potential between the drive and the ground potential of PLC.
- Use star washers and galvanically conductive installation plates.

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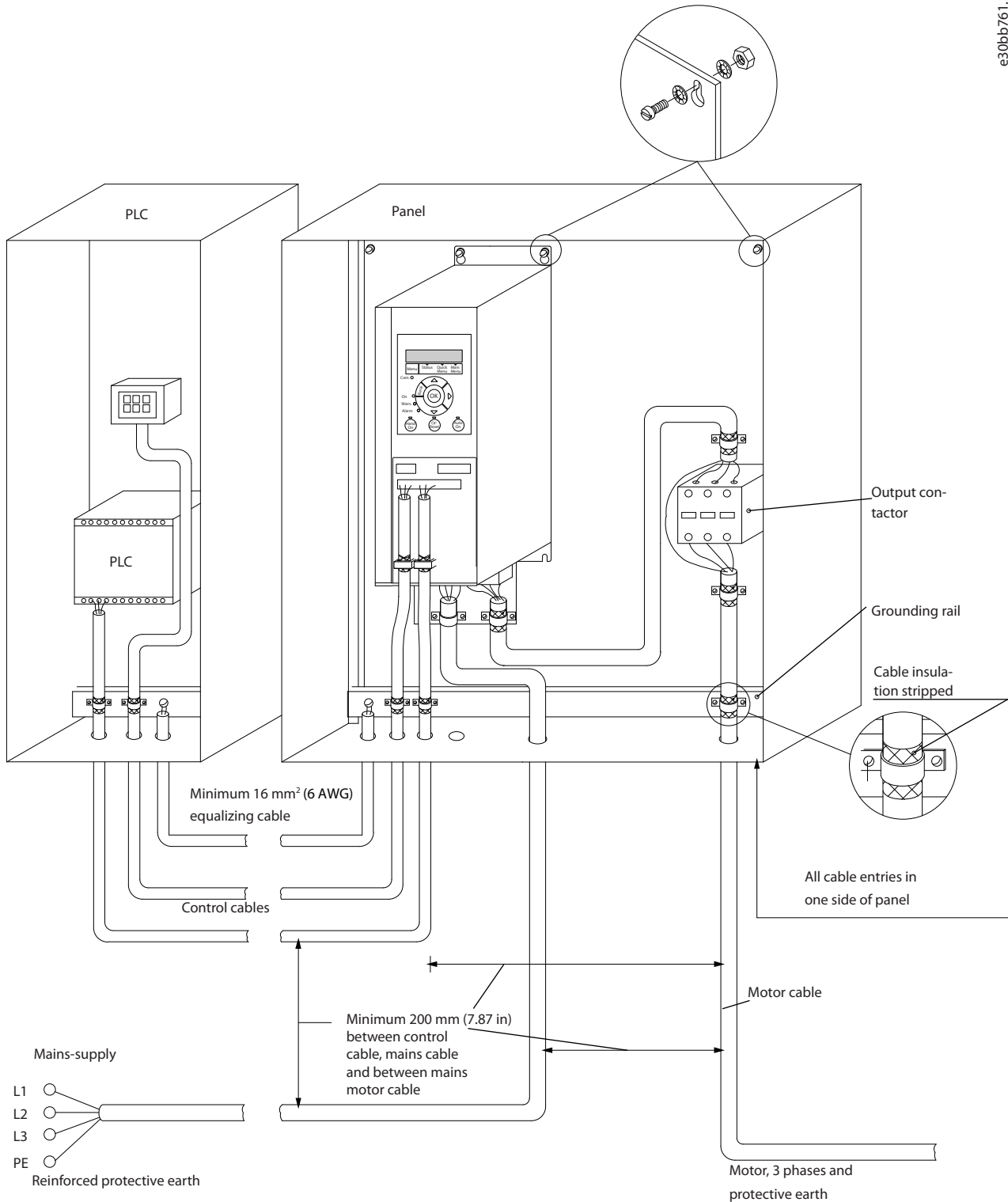


Illustration 9: EMC-correct Electrical Installation

3.2.6 Control Terminals

3.2.6.1 Accessing the Control Terminals

Procedure

1. To activate the snap, place a screwdriver behind the terminal cover.

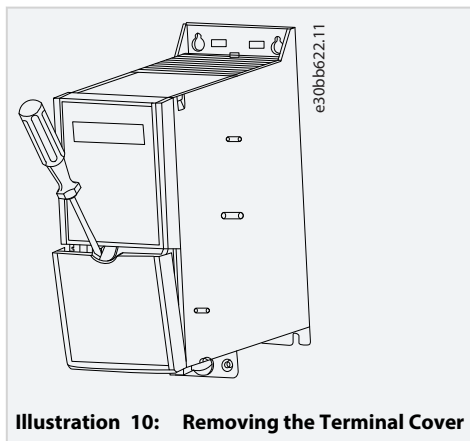


Illustration 10: Removing the Terminal Cover

2. Tilt the screwdriver outwards to open the cover.

3.2.6.2 Setting the Control Terminals to Run the Compressor

Context:

12	20	55
----	----	----

+24 V
DIGI IN
DIGI IN

20	27	29	42	45
----	----	----	----	----

GND
DIGI IN/OUT
DIGI IN/OUT
0/4-20 mA A OUT/DIG OUT
0/4-20mA A OUT/DIG OUT

50	53	54	55
----	----	----	----

10 V OUT
10 V/20 mA IN
10 V/20 mA IN
GND



61	68	69
----	----	----

COMM. GND
P
N

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Illustration 11: Overview of the Control Terminals

Procedure

1. Apply a start signal on terminal 18.
2. Connect terminals 12, 27, and terminal 53, 54, or 55.
3. Set the functions of digital inputs 18, 19, and 27 in *parameter 5-00 Digital Input Mode* (PNP is default value).
4. Set the function of digital input 29 in *parameter 5-03 Digital Input 29 Mode* (PNP is default value).

3.2.7 Electrical Wiring

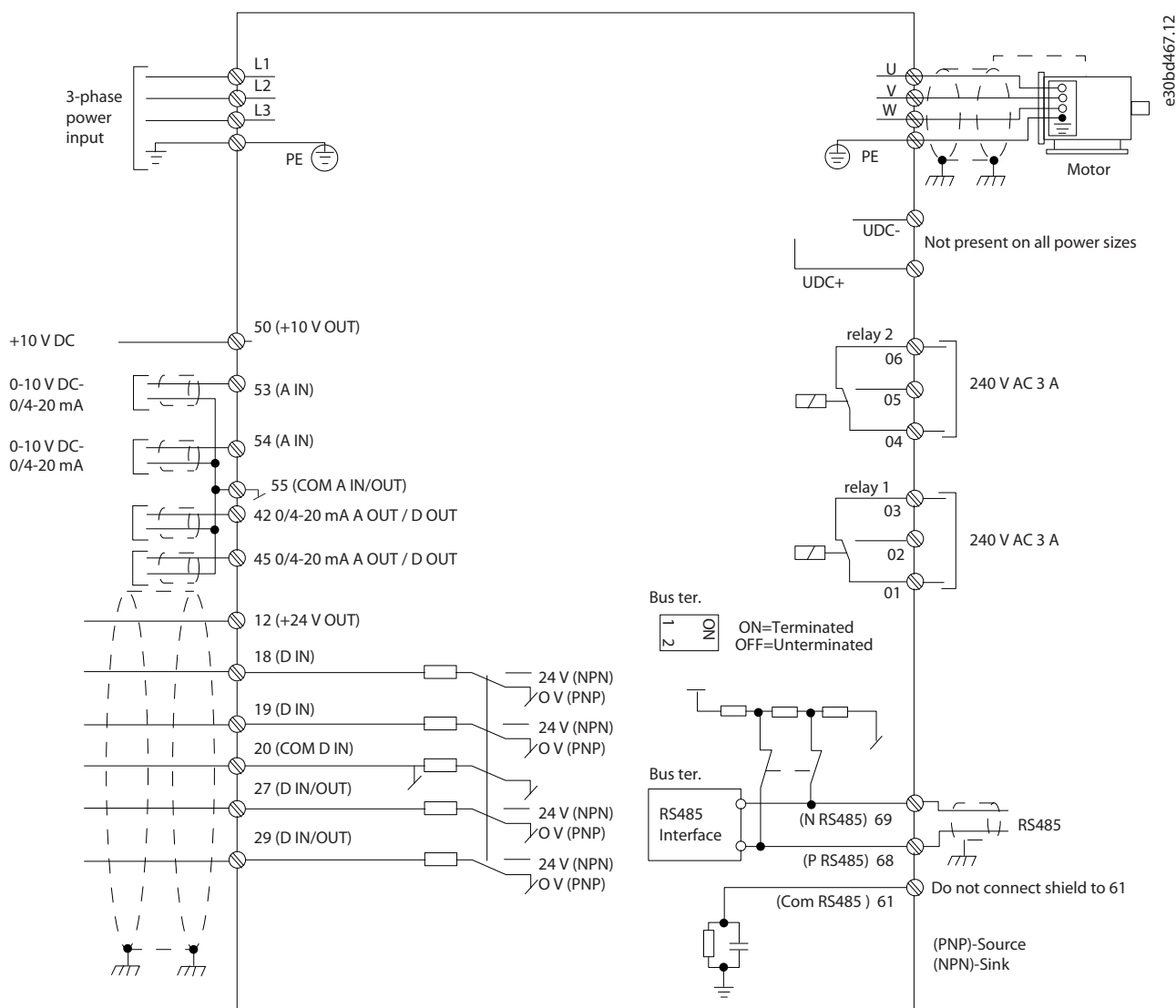


Illustration 12: Basic Wiring Schematic Drawing

NOTICE

There is no access to UDC- and UDC+ on the following units:

- IP20, 380–480 V, 30 kW (40 hp).

4 Programming

4.1 Local Control Panel (LCP)

The drive can be programmed from the LCP or from a PC via the RS485 COM port by installing the MCT 10 Setup Software.

The LCP is divided into 4 functional sections.

- A. Display
- B. Menu key
- C. Navigation keys and indicator lights
- D. Operation keys and indicator lights

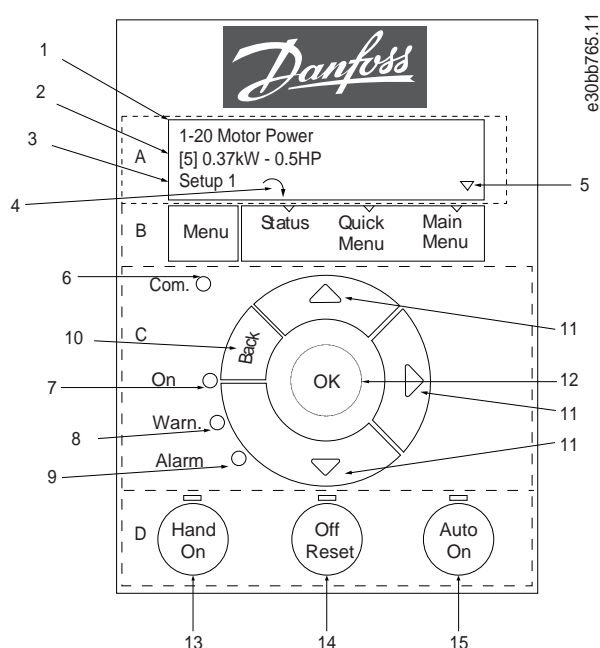


Illustration 13: Local Control Panel (LCP)

A. Display

The LCD-display is illuminated with 2 alphanumeric lines. All data is shown on the LCP. The [illustration 13](#) describes the information that can be read from the display.

Table 12: Legend to Section A

1	Parameter number and name.
2	Parameter value.
3	Setup number shows the active setup and the edit setup. If the same setup acts as both active and edit setup, only that setup number is shown (factory setting). When active and edit setup differ, both numbers are shown in the display (setup 12). The number flashing indicates the edit setup.
4	Motor direction is shown to the bottom left of the display – indicated by a small arrow pointing either clockwise or counter-clockwise.

5	The triangle indicates if the LCP is in Status, Quick Menu, or Main Menu.
---	---

B. Menu key

Press [Menu] to select among Status, Quick Menu, or Main Menu.

C. Navigation keys and indicator lights

Table 13: Legend to Section C

6	Com. LED: Flashes during bus communication.
7	Green LED/On: Control section is working correctly.
8	Yellow LED/Warn.: Indicates a warning.
9	Flashing Red LED/Alarm: Indicates an alarm.
10	[Back]: For moving to the previous step or layer in the navigation structure.
11	[Δ] [▽] [▶]: For navigating among parameter groups and parameters, and within parameters. They can also be used for setting local reference.
12	[OK]: For selecting a parameter and for accepting changes to parameter settings.

D. Operation keys and indicator lights

Table 14: Legend to Section D

13	<p>[Hand On]: Starts the motor and enables control of the drive via the LCP (disabled on 18.5–22 kW (22–30 hp)).</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">NOTICE</p> <p>[2] Coast inverse is the default option for parameter 5-12 Terminal 27 Digital Input. If there is no 24 V supply to terminal 27, [Hand On] does not start the motor. Connect terminal 12 to terminal 27.</p> </div>
14	[Off/Reset]: Stops the motor (Off). If in alarm mode, the alarm is reset.
15	[Auto On]: The drive is controlled either via control terminals or serial communication.

4.2 Start-up Quick Guide for Open-loop Applications

Table 15: Settings for Open-loop Applications

Parameter	Option	Default	Function
<i>Parameter 0-01 Language</i>	<i>[0] English</i> <i>[1] Deutsch</i> <i>[2] Francais</i> <i>[3] Dansk</i> <i>[4] Spanish</i> <i>[5] Italiano</i> <i>[28] Bras.port</i>	<i>[0] English</i>	Select the display language.
<i>Parameter 0-06 GridType</i>	<i>[0] 200–240 V/50 Hz/IT-grid</i> <i>[1] 200–240 V/50 Hz/Delta</i> <i>[2] 200–240 V/50 Hz</i> <i>[10] 380–440 V/50 Hz/IT-grid</i> <i>[11] 380–440 V/50 Hz/Delta</i> <i>[12] 380–440 V/50 Hz</i> <i>[20] 440–480 V/50 Hz/IT-grid</i> <i>[21] 440–480 V/50 Hz/Delta</i> <i>[22] 440–480 V/50 Hz</i> <i>[30] 525–600 V/50 Hz/IT-grid</i> <i>[31] 525–600 V/50 Hz/Delta</i> <i>[32] 525–600 V/50 Hz</i>	Size related	Select the operating mode for restart after reconnection of the drive to mains voltage after a power-down.

Parameter	Option	Default	Function
<i>Parameter 0-06 GridType</i>	<i>[100] 200–240 V/60 Hz/IT-grid</i> <i>[101] 200–240 V/60 Hz/Delta</i> <i>[102] 200–240 V/60 Hz</i> <i>[110] 380–440 V/60 Hz/IT-grid</i> <i>[111] 380–440 V/60 Hz/Delta</i> <i>[112] 380–440 V/60 Hz</i> <i>[120] 440–480 V/60 Hz/IT-grid</i> <i>[121] 440–480 V/60 Hz/Delta</i> <i>[122] 440–480 V/60 Hz</i> <i>[130] 525–600 V/60 Hz/IT-grid</i> <i>[131] 525–600 V/60 Hz/Delta</i> <i>[132] 525–600 V/60 Hz</i>	Size related	Select the operating mode for restart after reconnection of the drive to mains voltage after a power-down.
<i>Parameter 0-60 Main Menu Password</i>	0–999	0	Define the password for access to the LCP.
<i>Parameter 1-13 Compressor Selection</i>	<i>[24] VZH028-R410A</i> <i>[25] VZH035-R410A</i> <i>[26] VZH044-R410A</i> <i>[27] VLZ028</i> <i>[28] VLZ035</i> <i>[29] VLZ044</i> <i>[30] VZH088</i> <i>[31] VZH117</i> <i>[32] VZH170</i>	Size related	Select which compressor to use.
<i>Parameter 3-03 Maximum Reference</i>	0–200 Hz	200 Hz	The maximum reference is the highest obtainable by summing all references.
<i>Parameter 3-15 Reference 1 Source</i>	<i>[0] No function</i> <i>[1] Analog in 53</i> <i>[2] Analog in 54</i> <i>[7] Pulse input 29</i> <i>[11] Local bus reference</i>	<i>[1] Analog in 53</i>	Select the input to be used for the reference signal.

Parameter	Option	Default	Function
Parameter 3-41 Ramp 1 Ramp Up Time	0.05–3600.0 s	90.00 s	Ramp-up time from 0 to <i>parameter 1-25 Motor Nominal Speed</i> .
Parameter 3-42 Ramp 1 Ramp Down Time	0.05–3600.0 s	30.00 s	Ramp-down time from nominal motor speed to 0.
Parameter 5-12 Terminal 27 Digital Input	[0] No operation [1] Reset [2] Coast inverse [3] Coast and reset inverse [4] Quick stop inverse [5] DC-brake inverse [6] Stop inverse [7] External Interlock [8] Start [9] Latched start [10] Reversing [11] Start reversing [14] Jog [16] Preset ref bit 0 [17] Preset ref bit 1 [18] Preset ref bit 2 [19] Freeze reference [20] Speed up [22] Speed down [23] Set-up select bit 0 [34] Ramp bit 0 [52] Run permissive [53] Hand start [54] Auto start [60] Counter A (up)	[6] Stop inverse	Select the input function for terminal 27.

Parameter	Option	Default	Function
<i>Parameter 5-12 Terminal 27 Digital Input</i>	<i>[61] Counter A (down)</i> <i>[62] Reset Counter A</i> <i>[63] Counter B (up)</i> <i>[64] Counter B (down)</i> <i>[65] Reset Counter B</i>		
<i>Parameter 5-40 Function Relay</i> [0] Function relay	See <i>parameter 5-40 Function Relay</i>	Alarm	Select the function to control output relay 1.
<i>Parameter 5-40 Function Relay</i> [1] Function relay	See <i>parameter 5-40 Function Relay</i>	Drive running	Select the function to control output relay 2.
<i>Parameter 6-10 Terminal 53 Low Voltage</i>	0–10 V	0.07 V	Enter the voltage that corresponds to the low reference value.
<i>Parameter 6-11 Terminal 53 High Voltage</i>	0–10 V	10 V	Enter the voltage that corresponds to the high reference value.
<i>Parameter 8-01 Control Site</i>	<i>[0] Digital and ctrl.word</i> <i>[1] Digital only</i> <i>[2] Controlword only</i>	<i>[0] Digital and ctrl.word</i>	Select if digital, bus, or a combination of both should control the drive.
<i>Parameter 8-30 Protocol</i>	<i>[0] FC</i> <i>[2] Modbus RTU</i>	<i>[0] FC</i>	Select the protocol for the integrated RS485 port.
<i>Parameter 8-32 Baud Rate</i>	<i>[0] 2400 Baud</i> <i>[1] 4800 Baud</i> <i>*[2] 9600 Baud</i> <i>[3] 19200 Baud</i> <i>[4] 38400 Baud</i> <i>[5] 57600 Baud</i> <i>[6] 76800 Baud</i> <i>[7] 115200 Baud</i>	9600	Select the baud rate for the RS485 port.

4.3 Start-up Quick Guide for Compressor Functions

Illustration 14: Compressor Functions Quick Guide

Table 16: Compressor Functions

Parameter	Option	Default	Function
Parameter 28-00 Short Cycle Protection	[0] Disabled [1] Enabled	[1] Enabled	Select if short-cycle protection is to be used.
Parameter 28-01 Interval between Starts	0–3600 s	300 s	Enter the minimum allowed time between starts.
Parameter 28-02 Minimum Run Time	10–3600 s	60 s	Enter the minimum allowed time to run before stop.
Parameter 28-10 Oil Return Management	[0] Off [1] On	[1] On	Select if oil return management is to be used.
Parameter 28-11 Low Speed Running Time	1–1440 min	120 minutes	Enter the low speed running time.
Parameter 28-12 Fixed Boost Interval	1–168 h	24 h	Oil boost is performed at fixed time intervals.
Parameter 28-13 Boost Duration	60–300 s	60 s	Enter the boost duration for the oil return.
Parameter 28-17 ORM Boost Speed [Hz]	90–200 Hz	120 Hz	Enter the speed of the compressor during oil return boost.

4.4 Start-up Quick Guide for Compressor Closed-loop Applications

1	0-01 Language [0] English	e30bd875.12
2	0-06 Grid Type Size related	
3	0-60 Main Menu Password [0]	
4	1-13 Compressor Selection Size related	
5	1-00 Configuration Mode [0] Open loop	
6	3-02 Minimum Reference 30 Hz	
7	3-03 Maximum Reference 200.000 Hz	
8	3-10 Preset Reference [0] 0.00 %	
9	3-15 Reference 1 Source [1] Analog in 53	
10	3-41 Ramp 1 Ramp Up Time 90.00 s	
11	3-42 Ramp 1 Ramp Down Time 30.00 s	
12	5-12 Terminal 27 Digital Input [2] Coast inverse	
13	5-40 Function Relay 1 [0] [9] Alarm	
14	6-19 Terminal 53 mode [1] Voltage mode	
15	6-10 Terminal 53 Low Voltage 0.07 V	
16	6-11 Terminal 53 High Voltage 10.00 V	
17	6-14 Terminal 53 Low Ref./Feedb. Size related	
18	6-15 Terminal 53 High Ref./Feedb. 200.000 Hz	
19	6-29 Terminal 54 mode [0] Current mode	
20	6-22 Terminal 54 Low Current 4.00 mA	
21	6-23 Terminal 54 High Current 20.00 mA	
22	6-24 Terminal 54 Low Ref./Feedb. 0.000	
23	6-25 Terminal 54 High Ref./Feedb. 50.000	
24	20-00 Feedback 1 Source [0] No function	
25	20-81 PI Normal/Inverse control [0] Normal	
26	8-01 Control Site [0] Digital and ctrl.word	
27	8-30 Protocol [0] FC	
28	8-32 Baud [2] 9600 Baud	

Illustration 15: Closed-loop Quick Guide

Table 17: Closed-loop Quick Guide

Parameter	Option	Default	Function
<i>Parameter 0-01 Language</i>	<i>[0] English</i> <i>[1] Deutsch</i> <i>[2] Francais</i> <i>[3] Dansk</i> <i>[4] Spanish</i> <i>[5] Italiano</i> <i>[28] Bras.port</i>	<i>[0] English</i>	Select the display language
<i>Parameter 0-06 GridType</i>	<i>[0] 200–240 V/50 Hz/IT-grid</i> <i>[1] 200–240 V/50 Hz/Delta</i> <i>[2] 200–240 V/50 Hz</i> <i>[10] 380–440 V/50 Hz/IT-grid</i> <i>[11] 380–440 V/50 Hz/Delta</i> <i>[12] 380–440 V/50 Hz</i> <i>[20] 440–480 V/50 Hz/IT-grid</i> <i>[21] 440–480 V/50 Hz/Delta</i> <i>[22] 440–480 V/50 Hz</i> <i>[30] 525–600 V/50 Hz/IT-grid</i> <i>[31] 525–600 V/50 Hz/Delta</i> <i>[32] 525–600 V/50 Hz</i>	Size related	Select the operating mode for restart after reconnection of the drive to mains voltage after power-down.

Parameter	Option	Default	Function
<i>Parameter 0-06 GridType</i>	<i>[100] 200–240 V/60 Hz/IT-grid</i> <i>[101] 200–240 V/60 Hz/Delta</i> <i>[102] 200–240 V/60 Hz</i> <i>[110] 380–440 V/60 Hz/IT-grid</i> <i>[111] 380–440 V/60 Hz/Delta</i> <i>[112] 380–440 V/60 Hz</i> <i>[120] 440–480 V/60 Hz/IT-grid</i> <i>[121] 440–480 V/60 Hz/Delta</i> <i>[122] 440–480 V/60 Hz</i> <i>[130] 525–600 V/60 Hz/IT-grid</i> <i>[131] 525–600 V/60 Hz/Delta</i> <i>[132] 525–600 V/60 Hz</i>	Size related	Select the operating mode for restart after reconnection of the drive to mains voltage after power-down.
<i>Parameter 0-60 Main Menu Password</i>	0–99	0	Define the password for access to the LCP.
<i>Parameter 1-00 Configuration Mode</i>	<i>[0] Open loop</i> <i>[3] Closed loop</i>	<i>[0] Open loop</i>	Select closed loop.
<i>Parameter 1-13 Compressor Selection</i>	<i>[24] VZH028-R410A</i> <i>[25] VZH035-R410A</i> <i>[26] VZH044-R410A</i> <i>[27] VLZ028</i> <i>[28] VLZ035</i> <i>[29] VLZ044</i>	Size related	Select the compressor used.
<i>Parameter 3-02 Minimum Reference</i>	0–200 Hz	30 Hz	The minimum reference is the lowest value obtainable by summing all references.
<i>Parameter 3-03 Maximum Reference</i>	0–200 Hz	200 Hz	The maximum reference is the highest obtainable by summing all references.
<i>Parameter 3-10 Preset Reference</i>	-100 to +100%	0%	Set up a fix setpoint in preset reference [0].

Parameter	Option	Default	Function
<i>Parameter 3-15 Reference 1 Source</i>	<i>[0] No function</i> <i>[1] Analog in 53</i> <i>[2] Analog in 54</i> <i>[7] Pulse input 29</i> <i>[11] Local bus reference</i>	<i>[1] Analog in 53</i>	Select the input to be used for the reference signal.
<i>Parameter 3-41 Ramp 1 Ramp Up Time</i>	0.05–3600.0 s	90.00 s	Ramp-up time from 0 to <i>parameter 1-25 Motor Nominal Speed</i> .
<i>Parameter 3-42 Ramp 1 Ramp Down Time</i>	0.05–3600.0 s	30.00 s	Ramp-down time from nominal motor speed to 0.
<i>Parameter 5-12 Terminal 27 Digital Input</i>	<i>[0] No operation</i> <i>[1] Reset</i> <i>[2] Coast inverse</i> <i>[3] Coast and reset inverse</i> <i>[4] Quick stop inverse</i> <i>[5] DC-brake inverse</i> <i>[6] Stop inverse</i> <i>[7] External Interlock</i> <i>[8] Start</i> <i>[9] Latched start</i> <i>[10] Reversing</i> <i>[11] Start reversing</i> <i>[14] Jog</i> <i>[16] Preset ref bit 0</i> <i>[17] Preset ref bit 1</i>	<i>[6] Stop inverse</i>	Select the input function for terminal 27.

Parameter	Option	Default	Function
<i>Parameter 5-12 Terminal 27 Digital Input</i>	<i>[18] Preset ref bit 2</i> <i>[19] Freeze reference</i> <i>[20] Speed up</i> <i>[22] Speed down</i> <i>[23] Set-up select bit 0</i> <i>[34] Ramp bit 0</i> <i>[52] Run permissive</i> <i>[53] Hand start</i> <i>[54] Auto start</i> <i>[60] Counter A (up)</i> <i>[61] Counter A (down)</i> <i>[62] Reset Counter A</i> <i>[63] Counter B (up)</i> <i>[64] Counter B (down)</i> <i>[65] Reset Counter B</i>	<i>[6] Stop inverse</i>	Select the input function for terminal 27.
<i>Parameter 5-40 Function Relay [0] Functional relay</i>	See <i>parameter 5-40 Function Relay</i>	Alarm	Select the function to control output relay 1.
<i>Parameter 5-40 Function Relay [1] Functional relay</i>	See <i>parameter 5-40 Function Relay</i>	Drive running	Select the function to control output relay 2.
<i>Parameter 6-10 Terminal 53 Low Voltage</i>	0–10 V	0.07 V	Enter the voltage that corresponds to the low reference value.
<i>Parameter 6-11 Terminal 53 High Voltage</i>	0–10 V	10 V	Enter the voltage to the high reference value.
<i>Parameter 6-14 Terminal 53 Low Ref./ Feedb. Value</i>	-4999 to +4999	Size related	Enter the reference value that corresponds to the voltage set in <i>parameter 6-10 Terminal 53 Low Voltage</i> .
<i>Parameter 6-15 Terminal 53 High Ref./ Feedb. Value</i>	-4999 to +4999	200	Enter the reference value that corresponds to the voltage set in <i>parameter 6-11 Terminal 53 High Voltage</i> .
<i>Parameter 6-22 Terminal 54 Low Current</i>	0.00–20.00 mA	4.00 mA	Enter the current that corresponds to the low reference value.
<i>Parameter 6-23 Terminal 54 High Current</i>	0–10 V	10 V	Enter the current that corresponds to the high reference value.
<i>Parameter 6-24 Terminal 54 Low Ref./ Feedb. Value</i>	-0.00 to +20.00 mA	20.00 mA	Enter the reference value that corresponds to the current set in <i>parameter 6-20 Terminal 54 Low Voltage</i> .

Parameter	Option	Default	Function
<i>Parameter 6-25 Terminal 54 High Ref./Feedb. Value</i>	-4999 to +4999	Size related	Enter the reference value that corresponds to the current set in <i>parameter 6-21 Terminal 54 High Voltage</i> .
<i>Parameter 8-01 Control Site</i>	[0] Digital and ctrl.word [1] Digital only [2] Controlword only	[0] Digital and ctrl.word	Select if digital, bus, or a combination of both should control the drive.
<i>Parameter 8-30 Protocol</i>	[0] FC [2] Modbus RTU	[0] FC	Select the protocol for the integrated RS485 port.
<i>Parameter 8-32 Baud Rate</i>	[0] 2400 Baud [1] 4800 Baud [2] 9600 Baud [3] 19200 Baud [4] 38400 Baud [5] 57600 Baud [6] 76800 Baud [7] 115200 Baud	[2] 9600 Baud	Select the baud rate for the RS485 port.
<i>Parameter 20-00 Feedback 1 Source</i>	[0] No function [1] Analog Input 53 [2] Analog Input 54 [3] Pulse input 29 [100] Bus Feedback 1 [101] Bus Feedback 2	[0] No function	Select which input to use as the source of the feedback signal.
<i>Parameter 20-01 Feedback 1 Conversion</i>	[0] Linear [1] Square root	[0] Linear	Select how to calculate the feedback.

4.5 Changes Made

Changes Made lists all parameters changed from the default settings.

- The list shows only parameters which have been changed in the current edit setup.
- Parameters, which have been reset to default values, are not listed.
- The message *Empty* indicates that no parameters have been changed.

4.6 Changing Parameter Settings

Procedure

1. To enter the Quick Menu, press the [Menu] key until the indicator in the display is placed above Quick Menu.
2. Press [▲] [▼] to select the quick guide, closed-loop setup, compressor setup, or changes made.
3. Press [OK].
4. Press [▲] [▼] to browse through the parameters in the Quick Menu.
5. Press [OK] to select a parameter.
6. Press [▲] [▼] to change the value of a parameter setting.
7. Press [OK] to accept the change.
8. Press either [Back] twice to enter Status, or press [Menu] once to enter the Main Menu.

4.7 Accessing All Parameter via the Main Menu

Procedure

1. Press [Menu] until the indicator in the display is placed above *Main Menu*.
2. Press [▲] [▼] to browse through the parameter groups.
3. Press [OK] to select a parameter group.
4. Press [▲] [▼] to browse through the parameters in the specific group.
5. Press [OK] to select the parameter.
6. Press [▲] [▼] to set/change the parameter value.

14-64	Dead Time Compensation Level	16-30	DC Link Voltage	28-12	Fixed Boost Interval
14-65	Speed Derate	16-34	Heatsink Temp.	28-13	Boost Duration
	Time Compensation	16-35	Inverter Thermal	28-15	ORM Min Speed Limit [Hz]
		16-36	Inv. Nom. Current	28-17	ORM Boost Speed [Hz]
14-9*	Fault Settings	16-37	Inv. Max. Current	28-3*	
14-90	Fault Level	16-38	SL Controller State	28-30	Crankcase Heating Control
15-**	Drive Information	16-5*	Ref. & Feedb.	28-31	Heating DC current
15-0*	Operating Data	16-50	External Reference	28-32	Crankcase Heating Delay
15-00	Operating hours	16-52	Feedback[Unit]	28-4*	Anti-reverse Protection at Stop
15-01	Running Hours	16-54	Feedback 1 [Unit]	28-40	Reverse Protection Control
15-03	Power Up's	16-55	Feedback 2 [Unit]	28-6*	Compressor Readouts
15-04	Over Temp's	16-6*	Inputs & Outputs	28-60	RPS
15-05	Over Volt's	16-60	Digital Input	30-**	Special Features
15-06	Reset kWh Counter	16-61	Terminal 53 Setting	30-2*	Adv. Start Adjust
15-07	Reset Running Hours Counter	16-62	Analog input 53	30-20	High Starting Torque Time
15-08	Number of Starts	16-63	Terminal 54 Setting	30-21	High Starting Torque Current [%]
15-09	Number of Auto Resets	16-64	Analog input 54	30-22	Locked Rotor Protection
15-3*	Alarm Log	16-65	Analog output 42 [mA]	30-23	Locked Rotor Detection Time [s]
15-30	Alarm Log: Error Code	16-66	Digital Output		
15-31	InternalFaultReason	16-67	Pulse input 29 [Hz]		
15-4*	Drive Identification	16-71	Relay output		
15-40	FC Type	16-72	Counter A		
15-41	Power Section	16-73	Counter B		
15-42	Voltage	16-79	Analog output 45 [mA]		
15-43	Software Version	16-8*	Fieldbus & FC Port		
15-44	Ordered TypeCode	16-86	FC Port REF 1		
15-45	Actual Typecode String	16-9*	Diagnosis Readouts		
15-46	Drive Ordering No	16-90	Alarm Word		
15-48	LCP Id No	16-91	Alarm Word 2		
15-49	SW ID Control Card	16-92	Warning Word		
15-50	SW ID Power Card	16-93	Warning Word 2		
15-51	Drive Serial Number	16-94	Ext. Status Word		
15-53	Power Card Serial Number	16-95	Ext. Status Word 2		
15-57	File Version	16-97	Alarm Word 3		
15-59	Filename	20-**	Drive Closed Loop		
15-9*	Parameter Info	20-0*	Feedback		
15-92	Defined Parameters	20-00	Feedback 1 Source		
15-97	Application Type	20-01	Feedback 1 Conversion		
15-98	Drive Identification	20-03	Feedback 2 Source		
16-**	Data Readouts	20-04	Feedback 2 Conversion		
16-0*	General Status	20-2*	Feedback/Setpoint		
16-00	Control Word	20-20	Feedback Function		
16-01	Reference [Unit]	20-8*	PI Basic Settings		
16-02	Reference [%]	20-81	PI Normal/ Inverse Control		
16-03	Status Word	20-83	PI Start Speed [Hz]		
16-05	Main Actual Value [%]	20-84	On Reference Bandwidth		
16-09	Custom Readout	20-9*	PI Controller		
16-1*	Motor Status	20-91	PI Anti Windup		
16-10	Power [kW]	20-93	PI Proportional Gain		
16-11	Power [hp]	20-94	PI Integral Time		
16-12	Motor Voltage	20-97	PI Feed Forward Factor		
16-13	Frequency	28-**	Compressor Functions		
16-14	Motor current	28-0*	Short Cycle Protection		
16-15	Frequency [%]	28-00	Short Cycle Protection		
16-16	Torque [Nm]	28-01	Interval between Starts		
16-17	Speed [RPM]	28-02	Minimum Run Time		
16-18	Motor Thermal	28-1*	Oil Return Management		
16-22	Torque [%]	28-10	Oil Return Management		
16-3*	Drive Status	28-11	Low Speed Running Time		

5 Troubleshooting

5.1 Acoustic Noise or Vibration

If the compressor is making noise or vibrations at certain frequencies, set the speed bypass parameters in *parameter 4-6* Speed Bypass*.

5.2 List of Warnings and Alarms

Table 18: Warnings and Alarms

Fault number	Alarm/warning bit number	Fault text	Warning	Alarm	Trip lock	Cause of problem
2	16	Live zero error	X	X	–	Signal on terminal 53 or 54 is less than 50% of the value set in <i>parameter 6-10 Terminal 53 Low Voltage</i> , <i>parameter 6-12 Terminal 53 Low Current</i> , <i>parameter 6-20 Terminal 54 Low Voltage</i> , or <i>parameter 6-22 Terminal 54 Low Current</i> . See also <i>parameter group 6-0* Analog I/O Mode</i> .
3		No motor	–	X	–	The motor is not connected properly to the drive.
4	14	Mains ph. loss	X	X	X	Missing phase on the supply side or too high voltage imbalance. Check the supply voltage. See <i>parameter 14-12 Function at Mains Imbalance</i> .
7	11	DC over volt	X	X	–	DC-link voltage exceeds the limit.
8	10	DC under volt	X	X	–	DC-link voltage drops below voltage warning low-limit.
9	9	Inverter over-load	X	X	–	More than 100% load for a long time.
10	8	Motor ETR over	X	X	–	For 6.0–10 kW (8.0–15 hp) drives: The motor is too hot due to more than 100% load for a long time. See <i>parameter 1-90 Motor Thermal Protection</i> . For 18.5–30 kW (22–40 hp) drives: <i>Parameter 1-90 Motor Thermal Protection</i> is disabled. <i>Alarm 10</i> is used for compressor overload.
11	7	Motor th over	X	X	–	Thermistor or thermistor connection is disconnected. See <i>parameter 1-90 Motor Thermal Protection</i> .
13	5	Over Current	X	X	X	Inverter peak current limit is exceeded.
14	2	Earth Fault	–	X	X	Discharge from output phases to ground.
16	12	Short Circuit	–	X	X	Short circuit in motor or on motor terminals.
17	4	Ctrl. word TO	X	X	–	No communication to drive. See <i>parameter group 8-0* General Settings</i> .
24	50	Fan Fault	X	X	–	The heat sink cooling fan is not working (only on 400 V, 30 kW (40 hp) units).
30	19	U phase loss	–	X	X	Motor phase U is missing. Check the phase.
31	20	V phase loss	–	X	X	Motor phase V is missing. Check the phase.
32	21	W phase loss	–	X	X	Motor phase W is missing. Check the phase.
38	17	Internal fault	–	X	X	Contact the local Danfoss supplier.

Fault number	Alarm/warning bit number	Fault text	Warning	Alarm	Trip lock	Cause of problem
44	28	Earth Fault	–	X	X	Discharge from output phases to ground, using the value of <i>parameter 15-31 Alarm Log Value</i> if possible.
46	33	Control Voltage Fault	–	X	X	Control voltage is low. Contact the local Danfoss supplier.
47	23	24 V supply low	X	X	X	24 V DC supply may be overloaded.
50	–	AMA calibration failed	–	X	–	Contact the local Danfoss supplier.
51	15	AMA U_{nom} , I_{nom}	–	X	–	The setting of motor voltage, motor current, and motor power is wrong. Check the settings.
52	–	AMA low I_{nom}	–	X	–	The motor current is too low. Check the settings.
53	–	AMA big motor	–	X	–	The motor is too big to perform AMA.
54	–	AMA small mot	–	X	–	The motor is too small to perform AMA.
55	–	AMA par. range	–	X	–	The parameter values found from the motor are outside the acceptable range.
56	–	AMA user interrupt	–	X	–	The AMA has been interrupted.
57	–	AMA timeout	–	X	–	<p>Try to start the AMA again some times, until the AMA is carried out.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="text-align: center; margin: 0;">NOTICE</p> <p style="margin: 0;">Repeated runs may heat the motor to a level where the resistance R_s and R_r are increased. Usually, however, this is not critical.</p> </div>
58	–	AMA internal	X	X	–	Contact the local Danfoss supplier.
59	25	Current limit	X	–	–	The current is higher than the value in <i>parameter 4-18 Current Limit</i> .
60	44	External Interlock	–	X	–	External interlock has been activated. To resume normal operation, apply 24 V DC to the terminal programmed for external interlock and reset the drive (via serial communication, digital I/O, or by pressing [Reset] on the LCP).
66	26	Heat sink Temperature Low	X	–	–	This warning is based on the temperature sensor in the IGBT module (on 400 V, 30 kW (40 hp) and 600 V units).
69	1	Pwr. Card Temp	X	X	X	The temperature sensor on the power card exceeds the upper or lower limits.
70	36	Illegal FC configuration	–	X	X	The control card and power card are not matched.
79	–	Illegal power section configuration	X	X	–	Internal fault. Contact the local Danfoss supplier.

Fault number	Alarm/warning bit number	Fault text	Warning	Alarm	Trip lock	Cause of problem
80	29	Drive initialised	–	X	–	All parameter settings are initialized to default settings.
87	47	Auto DC Braking	X	–	–	The drive is auto DC braking.
95	40	Broken Belt	X	X	–	Torque is below the torque level set for no load, indicating a broken belt. See <i>parameter group 22-6* Broken Belt Detection</i> .
99		Locked rotor	–	X	–	The rotor is locked or the load is too high.
126	–	Motor Rotating	–	X	–	High back EMF voltage. Stop the rotor of the PM motor.
200	–	Fire Mode	X	–	–	Fire mode has been activated.
202	–	Fire Mode Limits Exceeded	X	–	–	Fire mode has suppressed 1 or more warranty voiding alarms.
250	–	New spare part	–	X	X	The power or switch mode power supply has been exchanged. Contact the local Danfoss supplier.
251	–	New Typecode	–	X	X	The drive has a new type code. Contact the local Danfoss supplier.

6 Specifications

6.1 Mains Supply 3x200–240 V AC

Table 19: 3x200–240 V AC

Drive	4 TR/VZH028	5 TR/VZH035	6.5 TR/VZH044
Typical shaft output [kW]	6.0	7.5	10
IP20 enclosure protection rating	H4	H4	H5
Maximum cable size in terminals (mains, compressor) [mm ² /AWG]	16/6	16/6	16/6
Output current			
Continuous (3x200–240 V) [A]	20.7	25.9	33.7
Intermittent (3x200–240 V) [A]	–	–	37.1
Maximum input current			
Continuous (3x200–240 V) [A]	23	28.3	37
Intermittent (3x200–240 V) [A]	–	–	41.5
Maximum mains fuses, see 3.2.4.5 Recommendation of Fuses			
Estimated power loss [W], best case/typical ⁽¹⁾	182/204	229/268	369/386
Weight enclosure protection IP20 [kg/(lb)]	7.9 (17.4)	7.9 (17.4)	9.5 (21)
Efficiency [%], best case/typical ⁽¹⁾	97.3/97	98.5/97.1	97.2/97.1

¹ At rated load conditions.

6.2 Mains Supply 3x380–480 V AC

Table 20: 3x380–480 V AC

Drive	4 TR/VZH028	5 TR/VZH035	6.5 TR/VZH044	13 TR/VZH088	17 TR/VZH117	26 TR/VZH170
Typical shaft output [kW]	6.0	7.5	10	18.5	22.0	30.0
Typical shaft output [hp]	8.0	10	15	25	30	40
Protection rating IP20	H3	H3	H4	H5	H5	H6
Maximum cable size in terminals (mains, motor) [mm ² (AWG)]	4/10	4/10	16/6	16 (6)	16 (6)	35 (2)
Output current - 40 °C (104 °F) ambient temperature						
Continuous (3x380–440 V)[A]	11.6	14.3	16.4	37	44	61
Intermittent (3x380–440 V) [A]	–	–	18	40.7	46.8	67.1
Continuous (3x441–480 V) [A]	9.8	12.3	15.5	34	40	52

Drive	4 TR/VZH028	5 TR/VZH035	6.5 TR/ VZH044	13 TR/ VZH088	17 TR/ VZH117	26 TR/ VZH170
Intermittent (3x441–480 V) [A]	–	–	17	37.4	44	57.2
Output current - 50 °C (122 °F) ambient temperature						
Continuous (3x380–440 V) [A]				34.1	38	48.8
Intermittent (3x380–440 V) [A]				37.5	41.8	53.7
Continuous (3x441–480 V) [A]				31.3	35	41.6
Intermittent (3x441–480 V) [A]				34.4	38.5	45.8
Maximum input current						
Continuous (3x380–440 V) [A]	12.7	15.1	18	35.2	42.6	57
Intermittent (3x380–440 V) [A]	–	–	19.8	38.7	45.7	62.7
Continuous (3x441–480 V) [A]	10.8	12.6	17	29.3	34.6	49.2
Intermittent (3x441–480 V) [A]	–	–	18.7	32.2	38.1	54.1
Maximum mains fuses see 3.2.4.5 Recommendation of Fuses .						
Estimated power loss [W], best case/typical ⁽¹⁾	104/131	159/198	248/274	412/456	475/523	733
Weight enclosure protection rating IP20 [kg (lb)]	4.3 (9.5)	4.3 (9.5)	7.9 (17.4)	9.5 (20.9)	9.5 (20.9)	24.5 (54)
Efficiency [%], best case/typical ⁽²⁾	98.4/98	98.2/97.8	98.1/97.9	98.1/97.9	98.1/97.9	97.8

¹ Applies for dimensioning of drive cooling. If the switching frequency is higher than the default setting, the power losses may increase. LCP and typical control card power consumptions are included. For power loss data according to EN 50598-2, refer to the section on energy efficiency at www.danfoss.com.

² Efficiency measured at nominal current. For energy efficiency class, see [6.5.14 Ambient Conditions](#). For part load losses, see the section on energy efficiency at www.danfoss.com.

6.3 EMC Emission Test Results

The following test results have been obtained using a system with a drive, a shielded control cable, a control box with potentiometer, and a shielded motor cable.

Table 21: EMC Emission Test Results

RFI filter type	Conduct emission. Maximum shielded cable length [m (ft)]						Radiated emission					
	Class A Group 2		Class A Group 1		Class B		Class A Group 2		Class A Group 1		Class B	
EN 55011	Industrial environment		Industrial environment		Housing, trades, and light industries		Industrial environment		Industrial environment		Housing, trades, and light industries	
EN/IEC 61800-3	Category C3 Second environment Industrial		Category C2 First environment Home and office		Category C1 First environment Home and office		Category C3 Second environment Industrial		Category C2 First environment Home and office		Category C1 First environment Home and office	
	Without external filter	With external filter	Without external filter	With external filter	Without external filter	With external filter	Without external filter	With external filter	Without external filter	With external filter	Without external filter	With external filter
H4 RFI filter (EN 55011 A1, EN/IEC61800-3 C2)												
6.0– 10 kW (8.0– 15 hp) 3x200– 240 V IP20	–	–	25 (82)	50 (164)	–	20 (66)	–	–	Yes	Yes	–	No
H2 RFI filter (EN 55011 A2, EN/IEC 61800-3 C3)												
18–30 kW (25– 40 hp) 3x380– 480 V IP20	5 (16.4)	–	–	–	–	–	Yes	–	No	–	No	–

6.4 Special Conditions

6.4.1 Derating for Ambient Temperature and Switching Frequency

Ensure that the ambient temperature measured over 24 hours is at least 5 °C (41 °F) lower than the maximum ambient temperature that is specified for the drive. If the drive is operated at a high ambient temperature, decrease the constant output current. For derating curve, see the VLT® Compressor Drive CDS 803 Design Guide.

6.4.2 Derating for Low Air Pressure and High Altitudes

The cooling capability of air is decreased at low air pressure. For altitudes above 2000 m (6562 ft), contact Danfoss regarding PELV. Below 1000 m (3281 ft) altitude, derating is not necessary. For altitudes above 1000 m (3281 ft), decrease the ambient temperature or the maximum output current. Decrease the output by 1% per 100 m (328 ft) altitude above 1000 m (3281 ft) or reduce the maximum ambient temperature by 1 °C (33.8 °F) per 200 m (656 ft).

6.5 General Technical Data

6.5.1 Protection and Features

- Electronic motor thermal protection against overload.
- Temperature monitoring of the heat sink ensures that the drive trips if there is overtemperature.
- The drive is protected against short circuits between compressor terminals U, V, W.
- When a compressor phase is missing, the drive trips and issues an alarm.
- When a mains phase is missing, the drive trips or issues a warning (depending on the load).
- Monitoring of the DC-link voltage ensures that the drive trips when the DC-link voltage is too low or too high.
- The drive is protected against ground faults on compressor terminals U, V, W.

6.5.2 Mains Supply (L1, L2, L3)

Supply voltage	200–240 V ±10%
Supply voltage	380–480 V ±10%
Supply frequency	50/60 Hz
Maximum imbalance temporary between mains phases	3.0% of rated supply voltage
True power factor (λ)	≥0.9 nominal at rated load
Displacement power factor ($\cos\phi$) near unity	(>0.98)
Switching on the input supply L1, L2, L3 (power-ups)	Maximum 2 times/minute
Environment according to EN 60664-1	Overvoltage category III/pollution degree 2
The unit is suitable for use on a circuit capable of delivering not more than 100000 A _{rms} symmetrical Amperes, 240/480 V maximum.	

6.5.3 Compressor Output (U, V, W)

Output voltage	0–100% of supply voltage
Output frequency	0–200 Hz (VVC ⁺), 0–400 Hz (u/f)
Switching on output	Unlimited
Ramp times	0.05–3600 s

6.5.4 Cable Lengths and Cross-sections

Maximum compressor cable length, shielded/armored (EMC-correct installation)	See 6.3 EMC Emission Test Results .
Maximum compressor cable length, unshielded/unarmoured	50 m (164 ft)
Maximum cross-section to compressor, mains	See 6.2 Mains Supply 3x380–480 V AC for more information
Cross-section DC terminals for filter feedback on enclosure size H3	4 mm ² /11 AWG
Cross-section DC terminals for filter feedback on enclosure sizes H4–H6	16 mm ² /6 AWG
Maximum cross-section to control terminals, rigid wire	2.5 mm ² /14 AWG
Maximum cross-section to control terminals, flexible wire	2.5 mm ² /14 AWG

Minimum cross-section to control terminals 0.05 mm²/30 AWG

6.5.5 Digital Inputs

Programmable digital inputs	4
Terminal number	18, 19, 27, 29
Logic	PNP or NPN
Voltage level	0–24 V DC
Voltage level, logic 0 PNP	<5 V DC
Voltage level, logic 1 PNP	>10 V DC
Voltage level, logic 0 NPN	>19 V DC
Voltage level, logic 1 NPN	<14 V DC
Maximum voltage on input	28 V DC
Input resistance, R _i	Approximately 4 kΩ
Digital input 29 as thermistor input	Fault: >2.9 kΩ and no fault: <800 Ω
Digital input 29 as pulse input	Maximum frequency 32 kHz push-pull-driven & 5 kHz (O.C.)

6.5.6 Analog Inputs

Number of analog inputs	2
Terminal number	53, 54
Terminal 53 mode	<i>Parameter 6-61 Terminal 53 Setting: 1=voltage, 0=current</i>
Terminal 54 mode	<i>Parameter 6-63 Terminal 54 Setting: 1=voltage, 0=current</i>
Voltage level	0–10 V
Input resistance, R _i	Approximately 10 kΩ
Maximum voltage	20 V
Current level	0/4–20 mA (scalable)
Input resistance, R _i	<500 Ω
Maximum current	29 mA
Resolution on analog input	10 bit

6.5.7 Analog Outputs

Number of programmable analog outputs	2
Terminal number	42, 45 ⁽¹⁾
Current range at analog output	0/4–20 mA
The load resistor to common at analog out	500 Ω
Maximum voltage at analog output	17 V
Accuracy on analog output	Maximum error: 0.4% of full scale
Resolution on analog output	10 bit

¹ Terminals 42 and 45 can also be programmed as digital outputs.

6.5.8 Digital Outputs

Number of digital outputs	4
Terminals 27 and 29	
Terminal number	27, 29 ⁽¹⁾
Voltage level at digital output	0–24 V
Maximum output current (sink and source)	40 mA
Terminals 42 and 45	
Terminal number	42, 45 ⁽²⁾
Voltage level at digital output	17 V
Maximum output current at digital output	20 mA
The load resistor at digital output	1 kΩ

¹ Terminals 27 and 29 can also be programmed as input.

² Terminals 42 and 45 can also be programmed as analog output.

The digital outputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

6.5.9 Control Card, RS485 Serial Communication

Terminal number	68 (P, TX+, RX+), 69 (N, TX-, RX-)
Terminal number	61 common for terminals 68 and 69

6.5.10 Control Card, 24 V DC Output

Terminal number	12
Maximum load	80 mA

6.5.11 Relay Outputs, Enclosure Sizes H3–H5

Programmable relay output	2
Relay 01 and 02, enclosure sizes H3–H5	01–03 (NC), 01–02 (NO), 04–06 (NC), 04–05 (NO)
Maximum terminal load (AC-1) ⁽¹⁾ on 01–02/04–05 (NO) (Resistive load)	250 V AC, 3 A
Maximum terminal load (AC-15) ⁽¹⁾ on 01–02/04–05 (NO) (Inductive load @ cosφ 0.4)	250 V AC, 0.2 A
Maximum terminal load (DC-1) ⁽¹⁾ on 01–02/04–05 (NO) (Resistive load)	30 V DC, 2 A
Maximum terminal load (DC-13) ⁽¹⁾ on 01–02/04–05 (NO) (Inductive load)	24 V DC, 0.1 A
Maximum terminal load (AC-1) ⁽¹⁾ on 01–03/04–06 (NC) (Resistive load)	250 V AC, 3 A
Maximum terminal load (AC-15) ⁽¹⁾ on 01–03/04–06 (NC) (Inductive load @ cosφ 0.4)	250 V AC, 0.2 A
Maximum terminal load (DC-1) ⁽¹⁾ on 01–03/04–06 (NC) (Resistive load)	30 V DC, 2 A
Minimum terminal load on 01–03 (NC), 01–02 (NO)	24 V DC 10 mA, 24 V AC 20 mA
Environment according to EN 60664-1	Overvoltage category III/pollution degree 2

¹ IEC 60947 parts 4 and 5. Endurance of the relay varies with different load type, switching current, ambient temperature, driving configuration, working profile, and so forth. Mount a snubber circuit when connecting inductive loads to the relays.

6.5.12 Relay Outputs, Enclosure Size H6

Programmable relay output		2
Relay 01 and 02	01–03 (NC), 01–02 (NO), 04–06 (NC), 04–05 (NO)	
Maximum terminal load (AC-1) ⁽¹⁾ on 04–05 (NO) (resistive load) ^{(2) (3)}		400 V AC, 2 A
Maximum terminal load (AC-15) ⁽¹⁾ on 04–05 (NO) (Inductive load @ cosφ 0.4)		240 V AC, 0.2 A
Maximum terminal load (DC-1) ⁽¹⁾ on 04–05 (NO) (Resistive load)		80 V DC, 2 A
Maximum terminal load (DC-13) ⁽¹⁾ on 04–05 (NO) (Inductive load)		24 V DC, 0.1 A
Maximum terminal load (AC-1) ⁽¹⁾ on 04–06 (NC) (Resistive load)		240 V AC, 4 A
Maximum terminal load (AC-15) ⁽¹⁾ on 04–06 (NC) (Inductive load @ cosφ 0.4)		240 V AC, 0.2 A
Maximum terminal load (DC-1) ⁽¹⁾ on 04–06 (NC) (Resistive load)		50 V DC, 2 A
Maximum terminal load (DC-13) ⁽¹⁾ on 04–06 (NC) (Inductive load)		24 V DC, 0.1 A
Minimum terminal load on 01–03 (NC), 01–02 (NO), 04–06 (NC), 04–05 (NO)		24 V DC 10 mA, 24 V AC 20 mA
Environment according to EN 60664-1		Overvoltage category III/pollution degree 2

² Overvoltage Category II.

³ UL applications 300 V AC 2 AC.

6.5.13 Control Card, 10 V DC Output

Terminal number		50
Output voltage		10.5 V ±0.5 V
Maximum load		25 mA

6.5.14 Ambient Conditions

Enclosure protection rating		IP20
Enclosure kit available		IP21, TYPE 1
Vibration test		1.0 g
Maximum relative humidity	5–95% (IEC 60721-3-3; Class 3K3 (non-condensing) during operation)	
Aggressive environment (IEC 60721-3-3), coated (standard), enclosure sizes H3–H5		Class 3C3
Aggressive environment (IEC 60721-3-3), non-coated enclosure size H6		Class 3C2
Test method according to IEC 60068-2-43 H2S (10 days)		
Ambient temperature, enclosure sizes H3–H5 ⁽¹⁾		50 °C (122 °F)
Ambient temperature, enclosure size H6		45 °C (113 °F)
Minimum ambient temperature during full-scale operation		0 °C (32 °F)
Minimum ambient temperature at reduced performance, enclosure sizes H3–H5		-20 °C (-4 °F)
Minimum ambient temperature at reduced performance, enclosure size H6		-10 °C (14 °F)
Temperature during storage/transport		-30 to +65/70 °C (-22 to +149/158°F)
Maximum altitude above sea level without derating		1000 m (3281 ft)
Maximum altitude above sea level with derating		3000 m (9843 ft)

Derating for high altitude, see [6.4.2 Derating for Low Air Pressure and High Altitudes](#).

Safety standards	EN/IEC 61800-5-1, UL 508C, EN/IEC/UL 60730-1
EMC standards, Emission	EN 61800-3, EN 61000-6-3/4, EN 55011, IEC 61800-3
EMC standards, Immunity	EN 61800-3, EN 61000-3-12, EN 61000-6-1/2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6
Energy efficiency class ⁽²⁾	IE2

¹ Refer to [6.4 Special Conditions](#) for:

- Derating for high ambient temperature.
- Derating for high altitude.

² Determined according to EN 50598-2 at:

- Rated load.
- 90% rated frequency.
- Switching frequency factory setting.
- Switching pattern factory setting.

NOTICE

The VLT® Compressor Drive CDS803 with S096 in the type code (400 V, 18–30 kW (25–40 hp) is certified to UL/EN/IEC 60730-1. The drive is also designed for systems compliant to UL/IEC/EN 60335.

6.6 Options for VLT® Compressor Drive CDS 803

To see the options available for VLT® Compressor Drive CDS 803, see the VLT® Compressor Drive CDS 803 Design Guide.

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