



Quick Guide

VLT[®] HVAC Basic Drive FC 101



Contents

1 Introduction	3
1.1 Purpose of the Quick Guide	3
1.2 Additional Resources	3
1.3 Document and Software Version	3
1.4 Certificates and Approvals	3
1.5 Disposal	3
2 Safety	4
2.1 Safety Symbols	4
2.2 Qualified Personnel	4
2.3 Safety	4
2.4 Motor Thermal Protection	5
3 Installation	6
3.1 Mechanical Installation	6
3.1.1 Side-by-Side Installation	6
3.1.2 Frequency Converter Dimensions	7
3.2 Electrical Installation	9
3.2.1 Electrical Installation in General	9
3.2.2 IT Mains	10
3.2.3 Connecting to Mains and Motor	11
3.2.4 Fuses and Circuit Breakers	17
3.2.5 EMC-Correct Electrical Installation	20
3.2.6 Control Terminals	21
3.2.7 Electrical Wiring	22
3.2.8 Acoustic Noise or Vibration	23
4 Programming	24
4.1 Local Control Panel (LCP)	24
4.2 Set-up Wizard	25
4.3 Parameter List	37
5 Warnings and Alarms	40
6 Specifications	42
6.1 Mains Supply	42
6.1.1 3x200–240 V AC	42
6.1.2 3x380–480 V AC	43
6.1.3 3x525–600 V AC	47
6.2 EMC Emission Test Results	48
6.3 Special Conditions	49

6.3.1 Derating for Ambient Temperature and Switching Frequency	49
6.3.2 Derating for Low Air Pressure and High Altitudes	49
6.4 General Technical Data	50
6.4.1 Protection and Features	50
6.4.2 Mains Supply (L1, L2, L3)	50
6.4.3 Motor Output (U, V, W)	50
6.4.4 Cable Lengths and Cross Sections	50
6.4.5 Digital Inputs	51
6.4.6 Analog Inputs	51
6.4.7 Analog Output	51
6.4.8 Digital Output	51
6.4.9 Control Card, RS-485 Serial Communication	52
6.4.10 Control Card, 24 V DC Output	52
6.4.11 Relay Output	52
6.4.12 Control Card, 10 V DC Output ¹⁾	52
6.4.13 Ambient Conditions	53
Index	54

1 Introduction

1.1 Purpose of the Quick Guide

The quick guide provides information for safe installation and commissioning of the frequency converter.

The quick guide is intended for use by qualified personnel. Read and follow the quick guide to use the frequency converter safely and professionally, and pay particular attention to the safety instructions and general warnings. Keep this quick guide available with the frequency converter at all times.

VLT® is a registered trademark.

1.2 Additional Resources

- VLT® HVAC Basic Drive FC 101 Programming Guide provides information on how to programme and includes complete parameter descriptions.
- VLT® HVAC Basic Drive FC 101 Design Guide provides all technical information about the frequency converter and customer design and applications. It also lists options and accessories.

The technical documentation is available in electronic form on the documentation CD that is shipped with the product, or in print at the local Danfoss sales office.

MCT 10 Set-up Software Support

Download the software from <http://www.danfoss.com/BusinessAreas/DrivesSolutions/Software+MCT10/MCT10+Downloads.htm>.

During the installation process of the software, enter access code 81463800 to activate FC 101 functionality. A licence key is not required for using FC 101 functionality.

The latest software do not always contain the latest drive updates. Contact the local sales office for the latest drive updates (*.upd files), or download the drive updates from www.danfoss.com/BusinessAreas/DrivesSolutions/fc101driveupdates.

1.3 Document and Software Version

The Quick Guide is regularly reviewed and updated. All suggestions for improvement are welcome.

Edition	Remarks	Software version
MG18A6xx	Replaces MG18A5xx	2.70

1.4 Certificates and Approvals

Certification		IP20	IP54
EC Declaration of Conformity		✓	✓
UL Listed		✓	-
C-tick		✓	✓

Table 1.1 Certificates and Approvals

The frequency converter complies with UL508C thermal memory retention requirements. For more information, refer to the section *Motor Thermal Protection* in the product specific *design guide*.

1.5 Disposal

	<p>Equipment containing electrical components must not be disposed of together with domestic waste.</p> <p>It must be separately collected with electrical and electronic waste according to local and currently valid legislation.</p>
--	---

2 Safety

2.1 Safety Symbols

The following symbols are used in this document:

⚠ WARNING

Indicates a potentially hazardous situation that could result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation that could result in minor or moderate injury. It can also be used to alert against unsafe practices.

NOTICE

Indicates important information, including situations that can result in damage to equipment or property.

2.2 Qualified Personnel

Correct and reliable transport, storage, installation, operation, and maintenance are required for the trouble-free and safe operation of the frequency converter. Only qualified personnel are allowed to install or operate this equipment.

Qualified personnel are defined as trained staff, who are authorised to install, commission, and maintain equipment, systems, and circuits in accordance with pertinent laws and regulations. Additionally, the personnel must be familiar with the instructions and safety measures described in this manual.

2.3 Safety

⚠ WARNING

HIGH VOLTAGE

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

- Installation, start-up, and maintenance must be performed by qualified personnel only.

⚠ WARNING

UNINTENDED START

When the frequency converter is connected to AC mains, DC power 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. The motor can start by means of an external switch, a serial bus command, an input reference signal from the LCP or LOP, via remote operation using MCT 10 software, or after a cleared fault condition.

To prevent unintended motor start:

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

⚠ WARNING

DISCHARGE TIME!

Frequency converters contain DC-link capacitors that can remain charged even when the frequency converter is not powered. To avoid electrical hazards, disconnect AC mains, any permanent magnet type motors, and any remote DC-link power supplies, including battery backups, UPS and DC-link connections to other frequency converters. Wait for the capacitors to fully discharge before performing any service or repair work. The amount of waiting time is listed in *Table 2.1*. Failure to wait the specified time after power has been removed before doing service or repair could result in death or serious injury.

Voltage [V]	Power range [kW(HP)]	Minimum waiting time (minutes)
3x200	0.25–3.7 (0.33-5)	4
3x200	5.5–11 (7-15)	15
3x400	0.37–7.5 (0.5–10)	4
3x400	11–90 (15–125)	15
3x600	2.2–7.5 (3–10)	4
3x600	11–90 (15–125)	15

Table 2.1 Discharge Time

⚠ WARNING**LEAKAGE CURRENT HAZARD**

Leakage currents exceed 3.5 mA. Failure to ground the frequency converter 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 frequency converter can result in serious injury, when the frequency converter is not properly closed.

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

2.4 Motor Thermal Protection

Set *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 Side-by-Side Installation

The frequency converter can be mounted side-by-side but requires the clearance above and below for cooling.

Frame	IP class	Power [kW(HP)]			Clearance above/below [mm(in)]
		3x200-240 V	3x380-480 V	3x525-600 V	
H1	IP20	0.25-1.5 (0.33-2)	0.37-1.5 (0.5-2)	–	100 (4)
H2	IP20	2.2 (3)	2.2-4 (3-5)	–	100 (4)
H3	IP20	3.7 (5)	5.5-7.5 (7.5-10)	–	100 (4)
H4	IP20	5.5-7.5 (7.5-10)	11-15 (15-20)	–	100 (4)
H5	IP20	11 (15)	18.5-22 (25-30)	–	100 (4)
H6	IP20	15-18.5 (20-25)	30-45 (40-60)	18.5-30 (25-40)	200 (7.9)
H7	IP20	22-30 (30-40)	55-75 (70-100)	37-55 (50-70)	200 (7.9)
H8	IP20	37-45 (50-60)	90 (125)	75-90 (100-125)	225 (8.9)
H9	IP20	–	–	2.2-7.5 (3-10)	100 (4)
H10	IP20	–	–	11-15 (15-20)	200 (7.9)
I2	IP54	–	0.75-4.0 (1-5)	–	100 (4)
I3	IP54	–	5.5-7.5 (7.5-10)	–	100 (4)
I4	IP54	–	11-18.5 (15-25)	–	100 (4)
I6	IP54	–	22-37 (30-50)	–	200 (7.9)
I7	IP54	–	45-55 (60-70)	–	200 (7.9)
I8	IP54	–	75-90 (100-125)	–	225 (8.9)

Table 3.1 Clearance Required for Cooling

NOTICE

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

3.1.2 Frequency Converter Dimensions

Enclosure		Power [kW(HP)]		Height [mm (in)]			Width [mm(in)]		Depth [mm(in)]	Mounting hole [mm(in)]			Max. Weight	
Size	IP Class	3x200-240 V	3x380-480 V	3x525-600 V	A	A ¹⁾	a	B	b	C	d	e	f	kg(lb)
H1	IP20	0.25-1.5 (0.33-2)	0.37-1.5 (0.5-2)	-	195 (7.7)	273 (10.7)	183 (7.2)	75 (3.0)	56 (2.2)	168 (6.6)	9 (0.35)	4.5 (0.18)	5.3 (0.21)	2.1 (4.6)
H2	IP20	2.2 (3)	2.2-4.0 (3-5)	-	227 (8.9)	303 (11.9)	212 (8.3)	90 (3.5)	65 (2.6)	190 (7.5)	11 (0.43)	5.5 (0.22)	7.4 (0.29)	3.4 (7.5)
H3	IP20	3.7 (5)	5.5-7.5 (7.5-10)	-	255 (10.0)	329 (13.0)	240 (9.4)	100 (3.9)	74 (2.9)	206 (8.1)	11 (0.43)	5.5 (0.22)	8.1 (0.32)	4.5 (9.9)
H4	IP20	5.5-7.5 (7.5-10)	11-15 (15-20)	-	296 (11.7)	359 (14.1)	275 (10.8)	135 (5.3)	105 (4.1)	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)	-	334 (13.1)	402 (15.8)	314 (12.4)	150 (5.9)	120 (4.7)	255 (10)	12.6 (0.50)	7 (0.28)	8.5 (0.33)	9.5 (20.9)
H6	IP20	15-18.5 (20-25)	30-45 (40-60)	18.5-30 (25-40)	518 (20.4)	595 (23.4)/635 (25)	495 (19.5)	239 (9.4)	200 (7.9)	242 (9.5)	-	8.5 (0.33)	15 (0.6)	24.5 (54)
H7	IP20	22-30 (30-40)	55-75 (70-100)	37-55 (50-70)	550 (21.7)	630 (24.8)/690 (27.2)	521 (20.5)	313 (12.3)	270 (10.6)	335 (13.2)	-	8.5 (0.33)	17 (0.67)	36 (79)
H8	IP20	37-45 (50-60)	90 (125)	75-90 (100-125)	660 (26)	800 (31.5)	631 (24.8)	375 (14.8)	330 (13)	335 (13.2)	-	8.5 (0.33)	17 (0.67)	51 (112)
H9	IP20	-	-	2.2-7.5 (3-10)	269 (10.6)	374 (14.7)	257 (10.1)	130 (5.1)	110 (4.3)	205 (8)	11 (0.43)	5.5 (0.22)	9 (0.35)	6.6 (14.6)
H10	IP20	-	-	11-15 (15-20)	399 (15.7)	419 (16.5)	380 (15)	165 (6.5)	140 (5.5)	248 (9.8)	12 (0.47)	6.8 (0.27)	7.5 (0.30)	12 (26.5)

1) Including decoupling plate
 The dimensions are only for the physical units. When installing in an application it is necessary to allow space above and below the units for cooling. The amount of space for free air passage is listed in Table 3.1.

Table 3.3 Dimensions, Enclosure Size H1-H10



Enclosure		Power [kW(HP)]		Height [mm (in)]		Width [mm(in)]		Depth [mm(in)]		Mounting hole [mm(in)]			Max. Weight	
Size	IP Class	3x200-240 V	3x380-480 V	3x525-600 V	A	A ¹⁾	a	B	b	C	d	e	f	kg(lb)
I2	IP54	-	0.75-4.0 (1-5)	-	332 (13.1)	-	318.5 (12.53)	115 (4.5)	74 (2.9)	225 (8.9)	11 (0.43)	5.5 (0.22)	9 (0.35)	5.3 (11.7)
I3	IP54	-	5.5-7.5 (7.5-10)	-	368 (14.5)	-	354 (13.9)	135 (5.3)	89 (3.5)	237 (9.3)	12 (0.47)	6.5 (0.26)	9.5 (0.37)	7.2 (15.9)
I4	IP54	-	11-18.5 (15-25)	-	476 (18.7)	-	460 (18.1)	180 (7)	133 (5.2)	290 (11.4)	12 (0.47)	6.5 (0.26)	9.5 (0.37)	13.8 (30.42)
I6	IP54	-	22-37 (30-50)	-	650 (25.6)	-	624 (24.6)	242 (9.5)	210 (8.3)	260 (10.2)	19 (0.75)	9 (0.35)	9 (0.35)	27 (59.5)
I7	IP54	-	45-55 (60-70)	-	680 (26.8)	-	648 (25.5)	308 (12.1)	272 (10.7)	310 (12.2)	19 (0.75)	9 (0.35)	9.8 (0.39)	45 (99.2)
I8	IP54	-	75-90 (100-125)	-	770 (30)	-	739 (29.1)	370 (14.6)	334 (13.2)	335 (13.2)	19 (0.75)	9 (0.35)	9.8 (0.39)	65 (143.3)

1) Including decoupling plate

The dimensions are only for the physical units. When installing in an application it is necessary to allow space above and below the units for cooling. The amount of space for free air passage is listed in Table 3.1.

Table 3.4 Dimensions, Enclosure Size I2-I8

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.

Power [kW(HP)]				Torque [Nm(in-lb)]					
Frame	IP class	3x200-240 V	3x380-480 V	Mains	Motor	DC connection	Control terminals	Ground	Relay
H1	IP20	0.25-1.5 (0.33-2)	0.37-1.5 (0.5-2)	0.8 (7)	0.8 (7)	0.8 (7)	0.5 (4)	0.8 (7)	0.5 (4)
H2	IP20	2.2 (3)	2.2-4.0 (3-5)	0.8 (7)	0.8 (7)	0.8 (7)	0.5 (4)	0.8 (7)	0.5 (4)
H3	IP20	3.7 (5)	5.5-7.5 (7.5-10)	0.8 (7)	0.8 (7)	0.8 (7)	0.5 (4)	0.8 (7)	0.5 (4)
H4	IP20	5.5-7.5 (7.5-10)	11-15 (15-20)	1.2 (11)	1.2 (11)	1.2 (11)	0.5 (4)	0.8 (7)	0.5 (4)
H5	IP20	11 (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	15-18.5 (20-25)	30-45 (40-60)	4.5 (40)	4.5 (40)	-	0.5 (4)	3 (27)	0.5 (4)
H7	IP20	22-30 (30-40)	55 (70)	10 (89)	10 (89)	-	0.5 (4)	3 (27)	0.5 (4)
H7	IP20	-	75 (100)	14 (124)	14 (124)	-	0.5 (4)	3 (27)	0.5 (4)
H8	IP20	37-45 (50-60)	90 (125)	24 (212) ²⁾	24 (212) ²⁾	-	0.5 (4)	3 (27)	0.5 (4)

Table 3.5 Tightening Torques for Enclosure H1-H8, 3x200-240 V & 3x380-480 V

Power [kW(HP)]				Torque [Nm(in-lb)]					
Frame	IP class	3x380-480 V	Mains	Motor	DC connection	Control terminals	Ground	Relay	
I2	IP54	0.75-4.0 (1-5)	0.8 (7)	0.8 (7)	0.8 (7)	0.5 (4)	0.8 (7)	0.5 (4)	
I3	IP54	5.5-7.5 (7.5-10)	0.8 (7)	0.8 (7)	0.8 (7)	0.5 (4)	0.8 (7)	0.5 (4)	
I4	IP54	11-18.5 (15-25)	1.4 (12)	0.8 (7)	0.8 (7)	0.5 (4)	0.8 (7)	0.5 (4)	
I6	IP54	22-37 (30-50)	4.5 (40)	4.5 (40)	-	0.5 (4)	3 (27)	0.6 (5)	
I7	IP54	45-55 (60-70)	10 (89)	10 (89)	-	0.5 (4)	3 (27)	0.6 (5)	
I8	IP54	75-90 (100-125)	14 (124)/24 (212) ¹⁾	14 (124)/24 (212) ¹⁾	-	0.5 (4)	3 (27)	0.6 (5)	

Table 3.6 Tightening Torques for Enclosure I1-I8

Power [kW]				Torque [Nm(in-lb)]					
Frame	IP class	3x525-600 V	Mains	Motor	DC connection	Control terminals	Ground	Relay	
H9	IP20	2.2-7.5 (3-10)	1.8 (16)	1.8 (16)	not recommended	0.5 (4)	3 (27)	0.6 (5)	
H10	IP20	11-15 (15-20)	1.8 (16)	1.8 (16)	not recommended	0.5 (4)	3 (27)	0.6 (5)	
H6	IP20	18.5-30 (25-40)	4.5 (40)	4.5 (40)	-	0.5 (4)	3 (27)	0.5 (4)	
H7	IP20	37-55 (50-70)	10 (89)	10 (89)	-	0.5 (4)	3 (27)	0.5 (4)	
H8	IP20	75-90 (100-125)	14 (124)/24 (212) ¹⁾	14 (124)/24 (212) ¹⁾	-	0.5 (4)	3 (27)	0.5 (4)	

Table 3.7 Tightening Torques for Enclosure H6-H10, 3x525-600 V

1) Cable dimensions $\leq 95 \text{ mm}^2$

2) Cable dimensions $> 95 \text{ mm}^2$

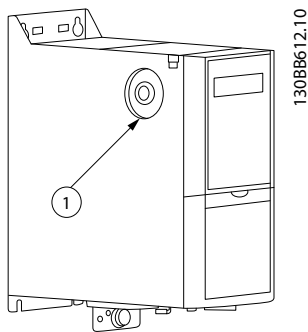
3.2.2 IT Mains

CAUTION

IT Mains

Installation on isolated mains source, that is, IT mains. Ensure the supply voltage does not exceed 440 V (3x380-480 V units) when connected to mains.

On IP20, 200-240 V, 0.25-11 kW (0.33-15 HP) and 380-480 V, IP20, 0.37-22 kW (0.5-30 HP) units, open the RFI switch by removing the screw on the side of the frequency converter when at IT grid.



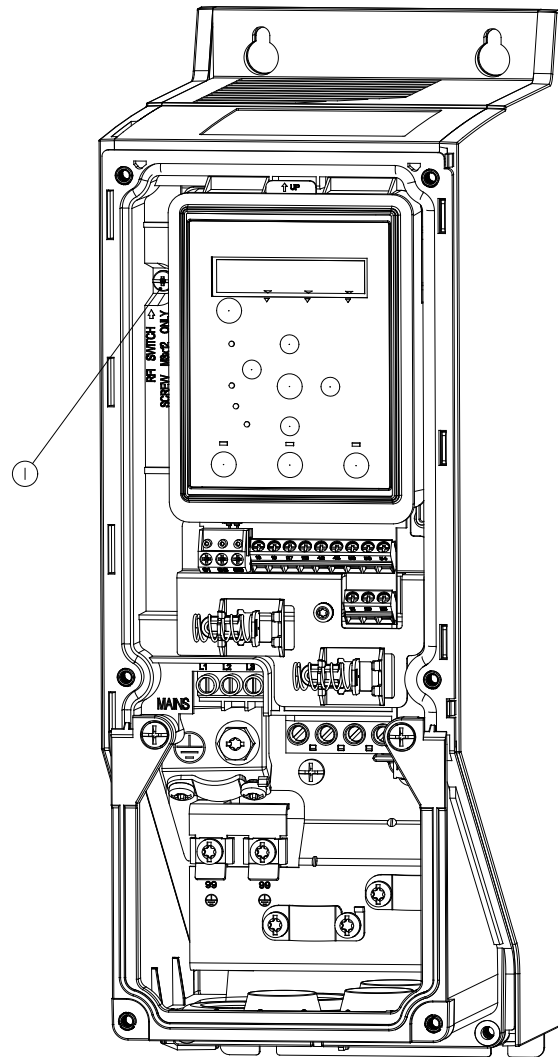
130BB612.10

1	EMC screw
---	-----------

Illustration 3.1 IP20, 200-240 V, 0.25-11 kW (0.33-15 HP), IP20, 0.37-22 kW (0.5-30 HP), 380-480 V

On 400 V, 30-90 kW (40-125 HP) and 600 V units, set 14-50 RFI Filter to [0] Off when operating in IT mains.

For IP54, 400V, 0.75-18.5 kW (1-25 HP) units, the EMC screw is inside the frequency converter, as shown in Illustration 3.2.



130BC251.10

1	EMC screw
---	-----------

Illustration 3.2 IP54, 400 V, 0.75-18.5 kW (1-25 HP)

NOTICE

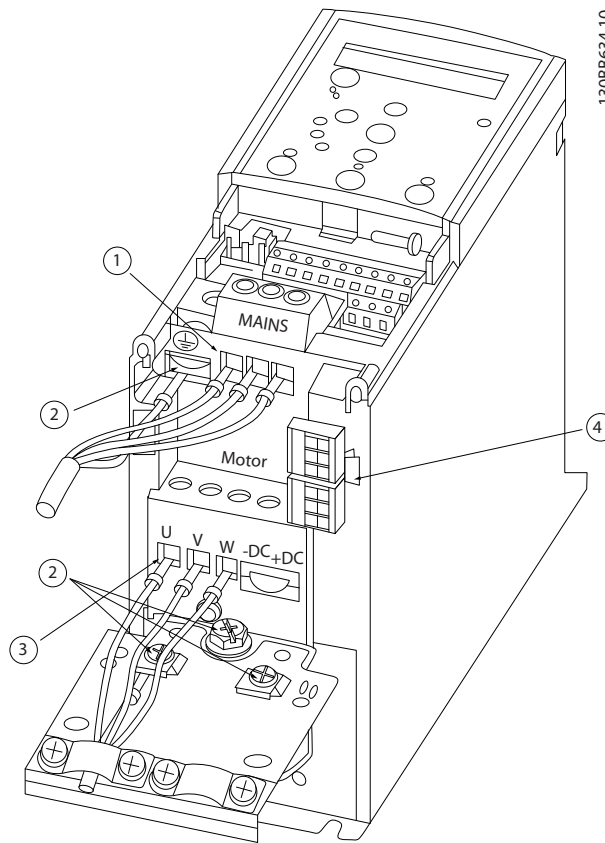
If reinserted, use only M3x12 screw.

3.2.3 Connecting to Mains and Motor

The frequency converter is designed to operate all standard 3-phase asynchronous motors. For maximum cross-section on cables, see *chapter 6.4 General Technical Data*.

- 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 *FC 101 De-coupling Plate Mounting Instruction*.
 - Also see *EMC-Correct Installation* in the *FC 101 Design Guide*.
1. Mount the ground cables to the ground terminal.
 2. Connect the motor to terminals U, V, and W, and tighten the screws according to the torques specified in *chapter 3.2.1 Electrical Installation in General*.
 3. Connect the mains supply to terminals L1, L2, and L3, and tighten the screws according to the torques specified in *chapter 3.2.1 Electrical Installation in General*.

Relays and terminals on H1-H5 enclosures



130BB634:10

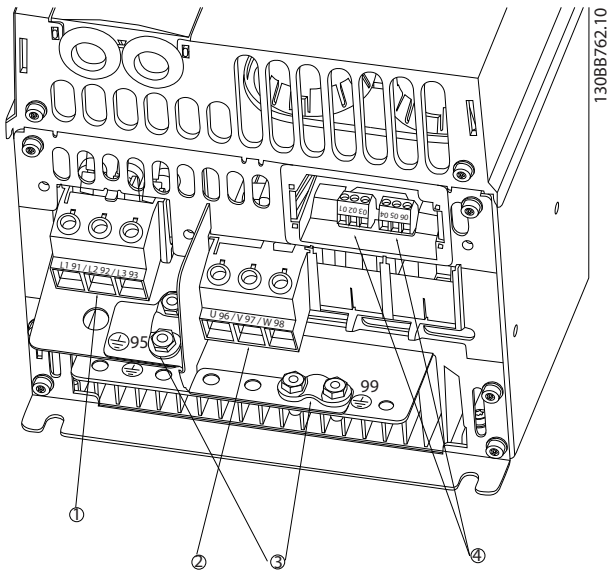
3

1	Mains
2	Ground
3	Motor
4	Relays

Illustration 3.3 H1–H5 Enclosures
 IP20, 200-240 V, 0.25–11 kW (0.33–15 HP)
 IP20, 380-480 V, 0.37–22 kW (0.5–30 HP)

3

Relays and terminals on H6 enclosure

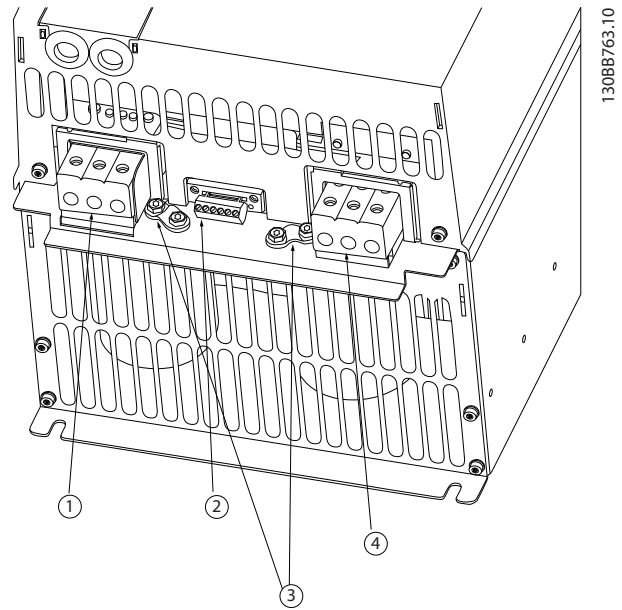


1	Mains
2	Motor
3	Ground
4	Relays

Illustration 3.4 H6 Enclosure

- IP20, 380-480 V, 30-45 kW (40-60 HP)
- IP20, 200-240 V, 15-18.5 kW (20-25 HP)
- IP20, 525-600 V, 22-30 kW (30-40 HP)

Relays and terminals on H7 enclosure

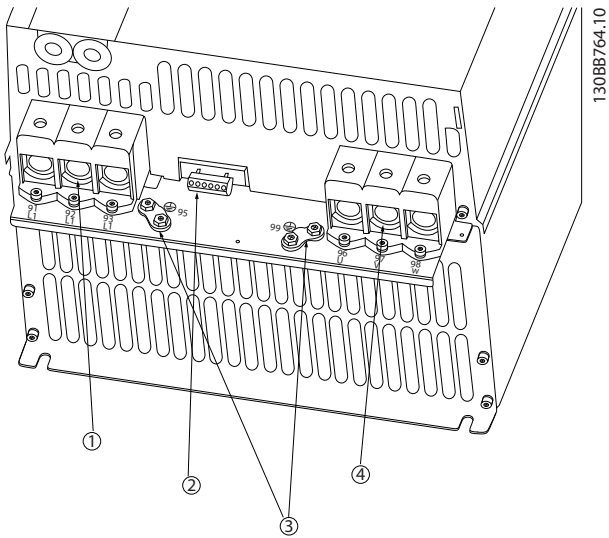


1	Mains
2	Relays
3	Ground
4	Motor

Illustration 3.5 H7 Enclosure

- IP20, 380-480 V, 55-75 kW (70-100 HP)
- IP20, 200-240 V, 22-30 kW (30-40 HP)
- IP20, 525-600 V, 45-55 kW (60-70 HP)

Relays and terminals on H8 enclosure



1	Mains
2	Relays
3	Ground
4	Motor

Illustration 3.6 H8 Enclosure

IP20, 380-480 V, 90 kW (125 HP)
 IP20, 200-240 V, 37-45 kW (50-60 HP)
 IP20, 525-600 V, 75-90 kW (100-125 HP)

Connecting to mains and motor for H9 enclosure

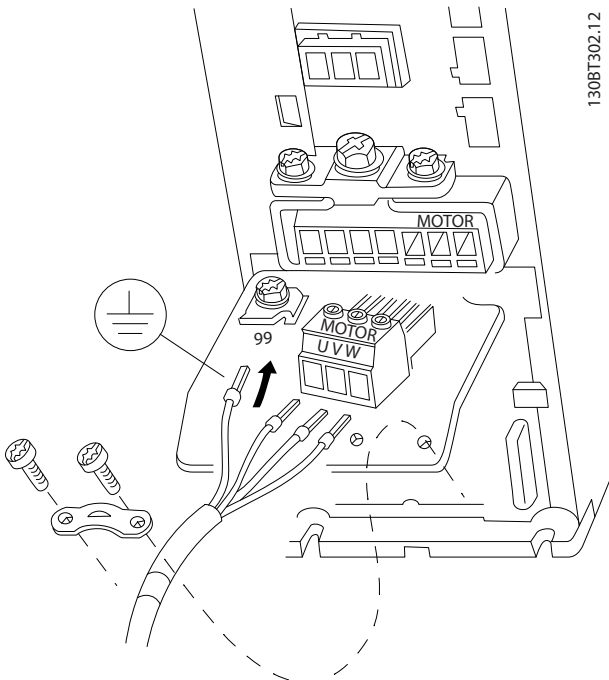


Illustration 3.7 Connecting the Frequency Converter to the Motor, H9 Enclosure

IP20, 600 V, 2.2-7.5 kW (3-10 HP)

Complete the following steps to connect the mains cables for H9 enclosure. Use the tightening torques described in chapter 3.2.1 Electrical Installation in General.

1. Slide the mounting plate into place and tighten the 2 screws, as shown in Illustration 3.8.

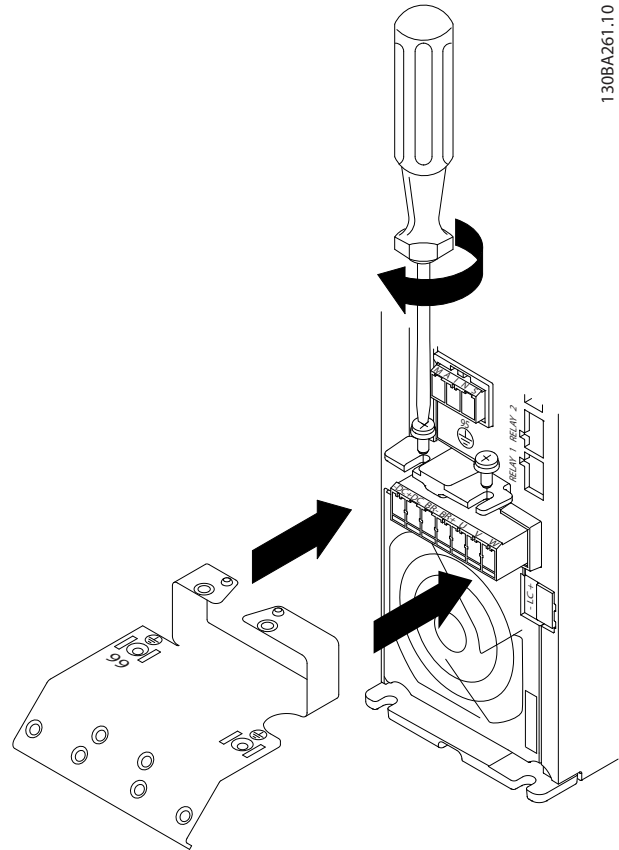


Illustration 3.8 Mounting the Mounting Plate

2. Mount the ground cable, as shown in *Illustration 3.9*.

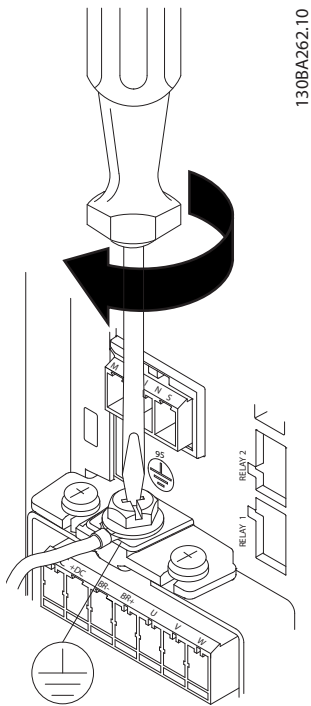


Illustration 3.9 Mounting the Ground Cable

3. Insert the mains cables to the mains plug and tighten the screws, as shown in *Illustration 3.10*.

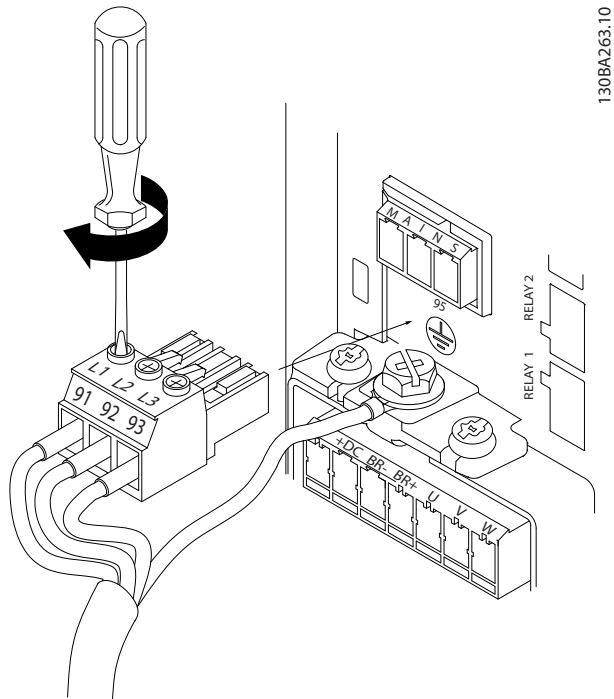


Illustration 3.10 Mounting the Mains Plug

4. Mount the support bracket across the mains cables and tighten the screws, as shown in *Illustration 3.11*.

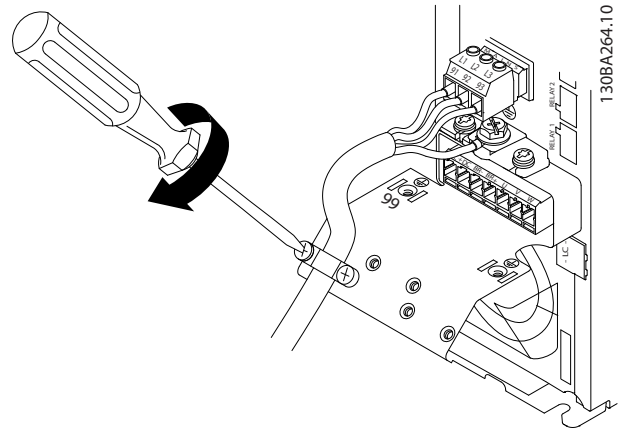


Illustration 3.11 Mounting the Support Bracket

Relays and terminals on H10 enclosure

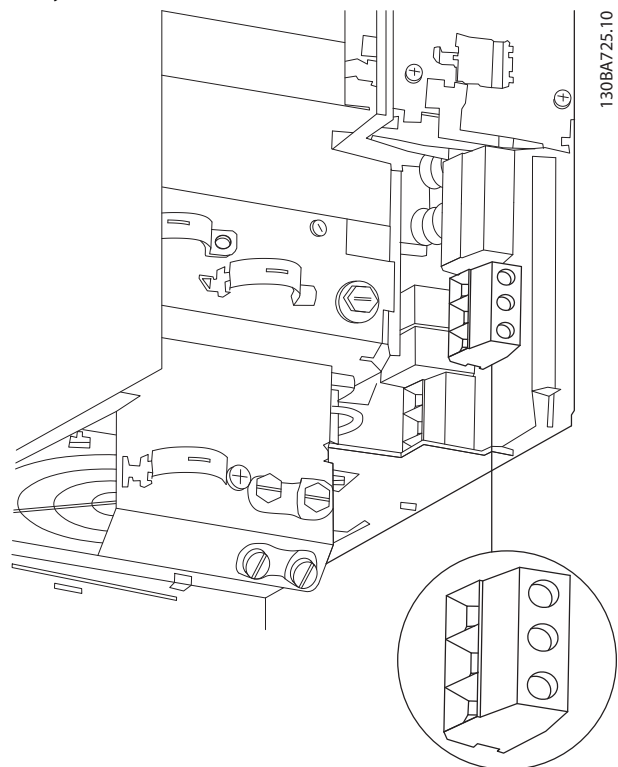
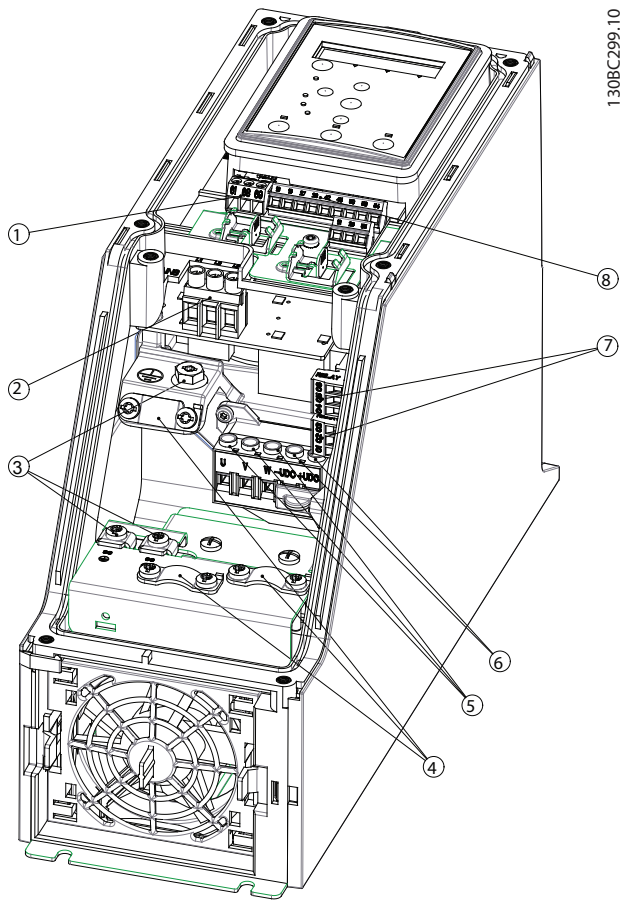


Illustration 3.12 H10 Enclosure
IP20, 600 V, 11-15 kW (15-20 HP)

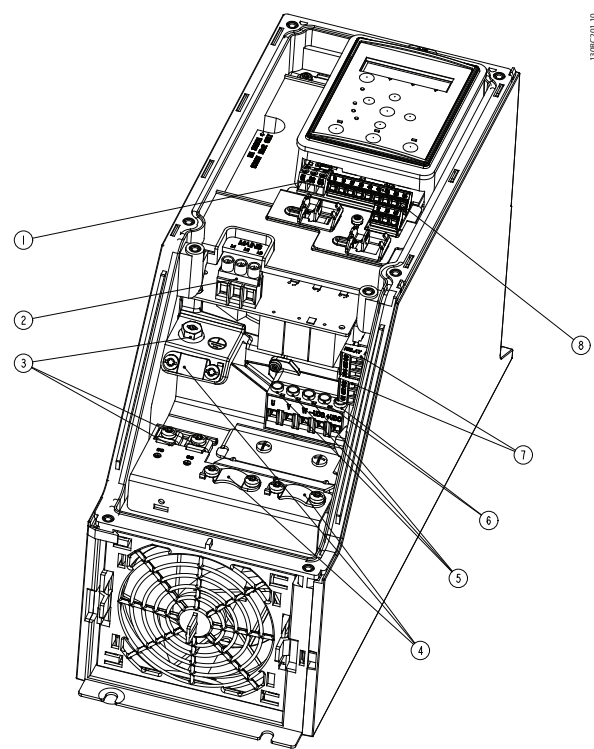
I2 enclosure



1	RS-485
2	Mains
3	Ground
4	Cable clamps
5	Motor
6	UDC
7	Relays
8	I/O

Illustration 3.13 I2 Enclosure
 IP54, 380-480 V, 0.75-4.0 kW (1-5 HP)

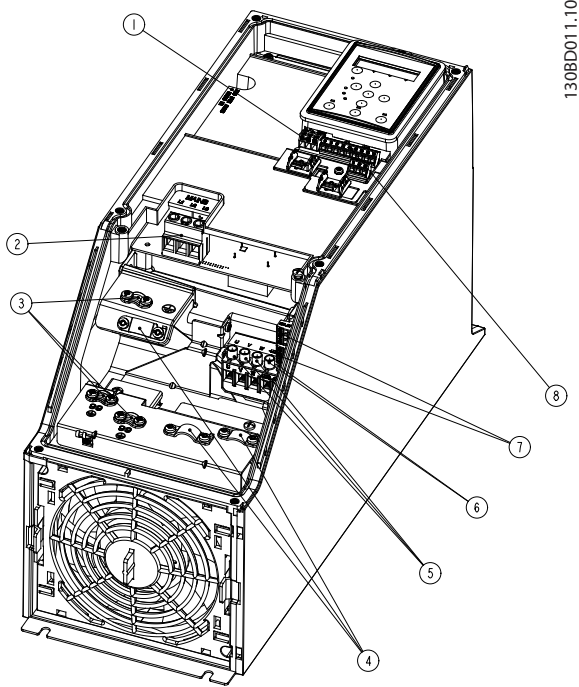
I3 enclosure



1	RS-485
2	Mains
3	Ground
4	Cable clamps
5	Motor
6	UDC
7	Relays
8	I/O

Illustration 3.14 I3 Enclosure
 IP54, 380-480 V, 5.5-7.5 kW (7.5-10 HP)

14 enclosure



1	RS-485
2	Mains
3	Ground
4	Cable clamps
5	Motor
6	UDC
7	Relays
8	I/O

Illustration 3.15 I4 Enclosure
IP54, 380-480 V, 0.75-4.0 kW (1-5 HP)

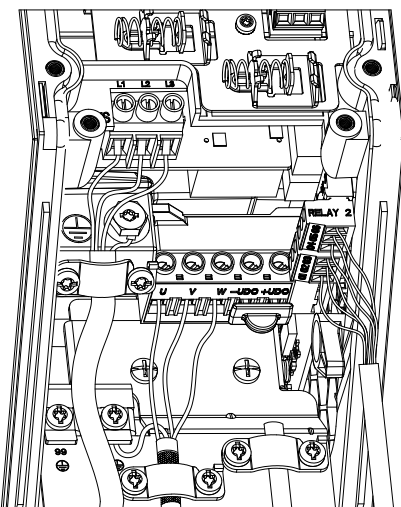


Illustration 3.16 IP54 I2-I3-I4 Enclosure

16 enclosure

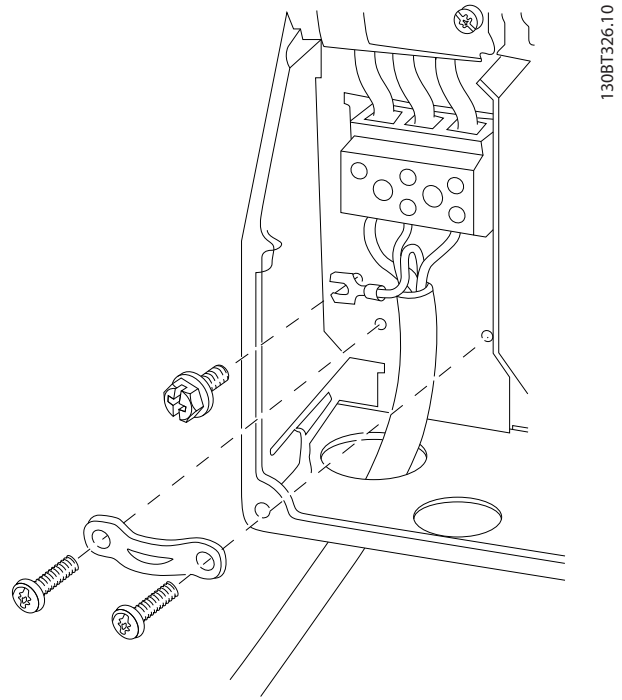


Illustration 3.17 Connecting to Mains for I6 Enclosure
IP54, 380-480 V, 22-37 kW (30-50 HP)

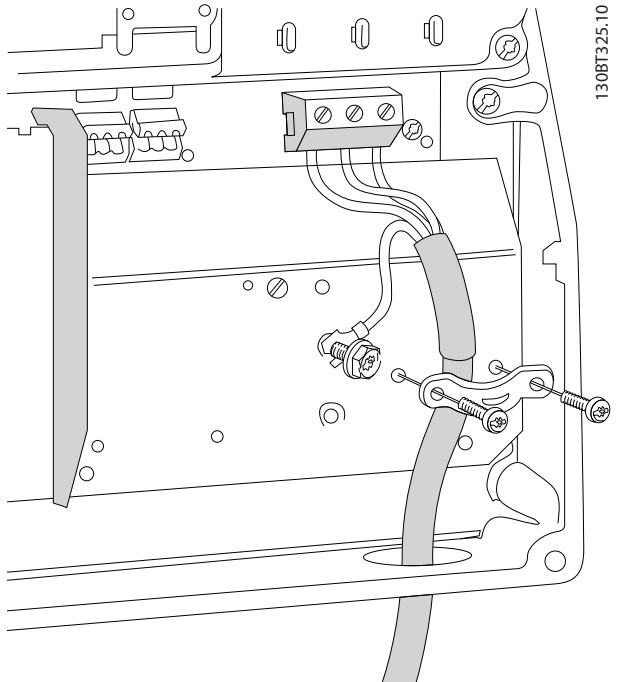
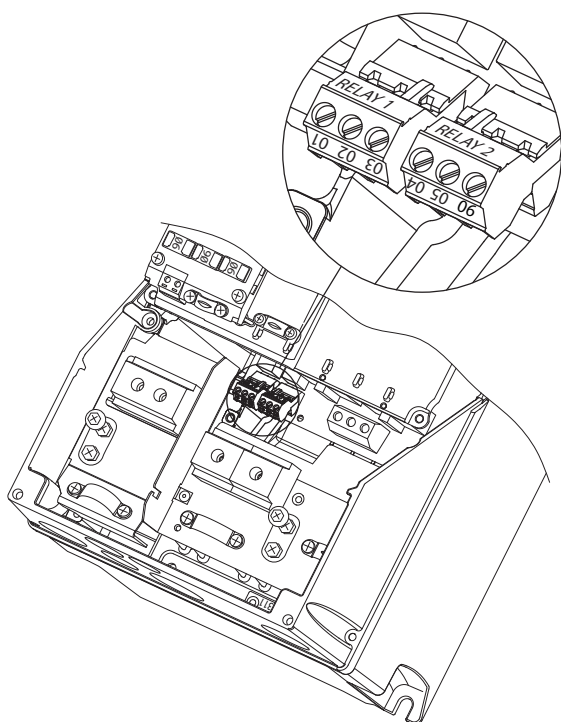


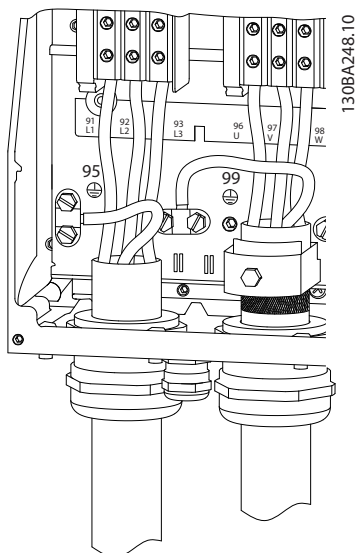
Illustration 3.18 Connecting to Motor for I6 Enclosure
IP54, 380-480 V, 22-37 kW (30-50 HP)



130BA215.10

Illustration 3.19 Relays on I6 Enclosure
IP54, 380-480 V, 22-37 kW (30-50 HP)

I7, I8 enclosures



130BA248.10

Illustration 3.20 I7, I8 Enclosure
IP54, 380-480 V, 45-55 kW (60-70 HP)
IP54, 380-480 V, 75-90 kW (100-125 HP)

3.2.4 Fuses and Circuit Breakers

Branch circuit protection

To protect the installation against electrical and fire hazard, all branch circuits in an installation, switch gear, machines etc., must be short-circuit and overcurrent protected according to national and local regulations.

Short circuit protection

Danfoss recommends using the fuses and circuit breakers listed in *Table 3.8* to protect service personnel or other equipment in case of an internal failure in the unit or short-circuit on DC-link. The frequency converter provides full short circuit protection in case of a short-circuit on the motor.

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. Circuit breakers and fuses must be designed for protection in a circuit capable of supplying a maximum of 100000 A_{rms} (symmetrical), 480 V maximum.

UL/Non UL compliance

Use the circuit breakers or fuses listed in *Table 3.8*, to ensure compliance with UL or IEC 61800-5-1. Circuit breakers must be designed for protection in a circuit capable of supplying a maximum of 10000 A_{rms} (symmetrical), 480 V maximum.

NOTICE

In the event of malfunction, failure to follow the protection recommendation may result in damage to the frequency converter.

3

	Circuit breaker		Fuse				
	UL	Non UL	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							
0.25 (0.33)			FRS-R-10	KTN-R10	JKS-10	JJN-10	10
0.37 (0.5)			FRS-R-10	KTN-R10	JKS-10	JJN-10	10
0.75 (1)			FRS-R-10	KTN-R10	JKS-10	JJN-10	10
1.5 (2)			FRS-R-10	KTN-R10	JKS-10	JJN-10	10
2.2 (3)			FRS-R-15	KTN-R15	JKS-15	JJN-15	16
3.7 (5)			FRS-R-25	KTN-R25	JKS-25	JJN-25	25
5.5 (7.5)			FRS-R-50	KTN-R50	JKS-50	JJN-50	50
7.5 (10)			FRS-R-50	KTN-R50	JKS-50	JJN-50	50
11 (15)			FRS-R-80	KTN-R80	JKS-80	JJN-80	65
15 (20)	Cutler-Hammer EGE3100FFG	Moeller NZMB1- A125	FRS-R-100	KTN-R100	JKS-100	JJN-100	125
18.5 (25)			FRS-R-100	KTN-R100	JKS-100	JJN-100	125
22 (30)	Cutler-Hammer JGE3150FFG	Moeller NZMB1- A160	FRS-R-150	KTN-R150	JKS-150	JJN-150	160
30 (40)			FRS-R-150	KTN-R150	JKS-150	JJN-150	160
37 (50)	Cutler-Hammer JGE3200FFG	Moeller NZMB1- A200	FRS-R-200	KTN-R200	JKS-200	JJN-200	200
45 (60)			FRS-R-200	KTN-R200	JKS-200	JJN-200	200
3x380–480 V IP20							
0.37 (0.5)			FRS-R-10	KTS-R10	JKS-10	JJS-10	10
0.75 (1)			FRS-R-10	KTS-R10	JKS-10	JJS-10	10
1.5 (2)			FRS-R-10	KTS-R10	JKS-10	JJS-10	10
2.2 (3)			FRS-R-15	KTS-R15	JKS-15	JJS-15	16
3 (4)			FRS-R-15	KTS-R15	JKS-15	JJS-15	16
4 (5)			FRS-R-15	KTS-R15	JKS-15	JJS-15	16
5.5 (7.5)			FRS-R-25	KTS-R25	JKS-25	JJS-25	25
7.5 (10)			FRS-R-25	KTS-R25	JKS-25	JJS-25	25
11 (15)			FRS-R-50	KTS-R50	JKS-50	JJS-50	50
15 (20)			FRS-R-50	KTS-R50	JKS-50	JJS-50	50
18.5 (25)			FRS-R-80	KTS-R80	JKS-80	JJS-80	65
22 (30)			FRS-R-80	KTS-R80	JKS-80	JJS-80	65
30 (40)	Cutler-Hammer EGE3125FFG	Moeller NZMB1- A125	FRS-R-125	KTS-R125	JKS-R125	JJS-R125	80
37 (50)			FRS-R-125	KTS-R125	JKS-R125	JJS-R125	100
45 (60)			FRS-R-125	KTS-R125	JKS-R125	JJS-R125	125
55 (70)	Cutler-Hammer JGE3200FFG	Moeller NZMB1- A200	FRS-R-200	KTS-R200	JKS-R200	JJS-R200	150
75 (100)			FRS-R-200	KTS-R200	JKS-R200	JJS-R200	200
90 (125)	Cutler-Hammer JGE3250FFG	Moeller NZMB2- A250	FRS-R-250	KTS-R250	JKS-R250	JJS-R250	250
3x525–600 V IP20							
2.2 (3)			FRS-R-20	KTS-R20	JKS-20	JJS-20	20
3 (4)			FRS-R-20	KTS-R20	JKS-20	JJS-20	20
3.7 (5)			FRS-R-20	KTS-R20	JKS-20	JJS-20	20
5.5 (7.5)			FRS-R-20	KTS-R20	JKS-20	JJS-20	20
7.5 (10)			FRS-R-20	KTS-R20	JKS-20	JJS-20	30
11 (15)			FRS-R-30	KTS-R30	JKS-30	JJS-30	35
15 (20)			FRS-R-30	KTS-R30	JKS-30	JJS-30	35
18.5 (25)	Cutler-Hammer EGE3080FFG	Cutler-Hammer EGE3080FFG	FRS-R-80	KTN-R80	JKS-80	JJS-80	80
22 (30)			FRS-R-80	KTN-R80	JKS-80	JJS-80	80
30 (40)			FRS-R-80	KTN-R80	JKS-80	JJS-80	80

	Circuit breaker		Fuse				
	UL	Non UL	UL				Non UL
			Bussmann	Bussmann	Bussmann	Bussmann	Maximum fuse
Power [kW/HP]			Type RK5	Type RK1	Type J	Type T	Type G
37 (50)	Cutler-Hammer JGE3125FFG	Cutler-Hammer JGE3125FFG	FRS-R-125	KTN-R125	JKS-125	JJS-125	125
45 (60)			FRS-R-125	KTN-R125	JKS-125	JJS-125	125
55 (70)			FRS-R-125	KTN-R125	JKS-125	JJS-125	125
75 (100)	Cutler-Hammer JGE3200FAG	Cutler-Hammer JGE3200FAG	FRS-R-200	KTN-R200	JKS-200	JJS-200	200
90 (125)			FRS-R-200	KTN-R200	JKS-200	JJS-200	200
3x380-480 V IP54							
0.75 (1)		PKZM0-16	FRS-R-10	KTS-R-10	JKS-10	JJS-10	16
1.5 (2)		PKZM0-16	FRS-R-10	KTS-R-10	JKS-10	JJS-10	16
2.2 (3)		PKZM0-16	FRS-R-15	KTS-R-15	JKS-15	JJS-15	16
3 (4)		PKZM0-16	FRS-R-15	KTS-R-15	JKS-15	JJS-15	16
4 (5)		PKZM0-16	FRS-R-15	KTS-R-15	JKS-15	JJS-15	16
5.5 (7.5)		PKZM0-25	FRS-R-25	KTS-R-25	JKS-25	JJS-25	25
7.5 (10)		PKZM0-25	FRS-R-25	KTS-R-25	JKS-25	JJS-25	25
11 (15)		PKZM4-63	FRS-R-50	KTS-R-50	JKS-50	JJS-50	63
15 (20)		PKZM4-63	FRS-R-50	KTS-R-50	JKS-50	JJS-50	63
18.5 (25)		PKZM4-63	FRS-R-80	KTS-R-80	JKS-80	JJS-80	63
22 (30)	Moeller NZMB1-A125		FRS-R-80	KTS-R-80	JKS-80	JJS-80	125
30 (40)			FRS-R-125	KTS-R-125	JKS-125	JJS-125	125
37 (50)			FRS-R-125	KTS-R-125	JKS-125	JJS-125	125
45 (60)	Moeller NZMB2-A160		FRS-R-125	KTS-R-125	JKS-125	JJS-125	160
55 (70)			FRS-R-200	KTS-R-200	JKS-200	JJS-200	160
75 (100)	Moeller NZMB2-A250		FRS-R-200	KTS-R-200	JKS-200	JJS-200	200
90 (125)			FRS-R-250	KTS-R-250	JKS-200	JJS-200	200

Table 3.8 Circuit Breakers and Fuses

3.2.5 EMC-Correct Electrical Installation

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

- Use only screened/armoured motor cables and screened/armoured control cables.
- Ground the screen at both ends.
- Avoid installation with twisted screen ends (pigtails), because this reduces the screening effect at high frequencies. Use the cable clamps provided.
- Ensure the same potential between drive and ground potential of PLC.
- Use starwashers and galvanically conductive installation plates.

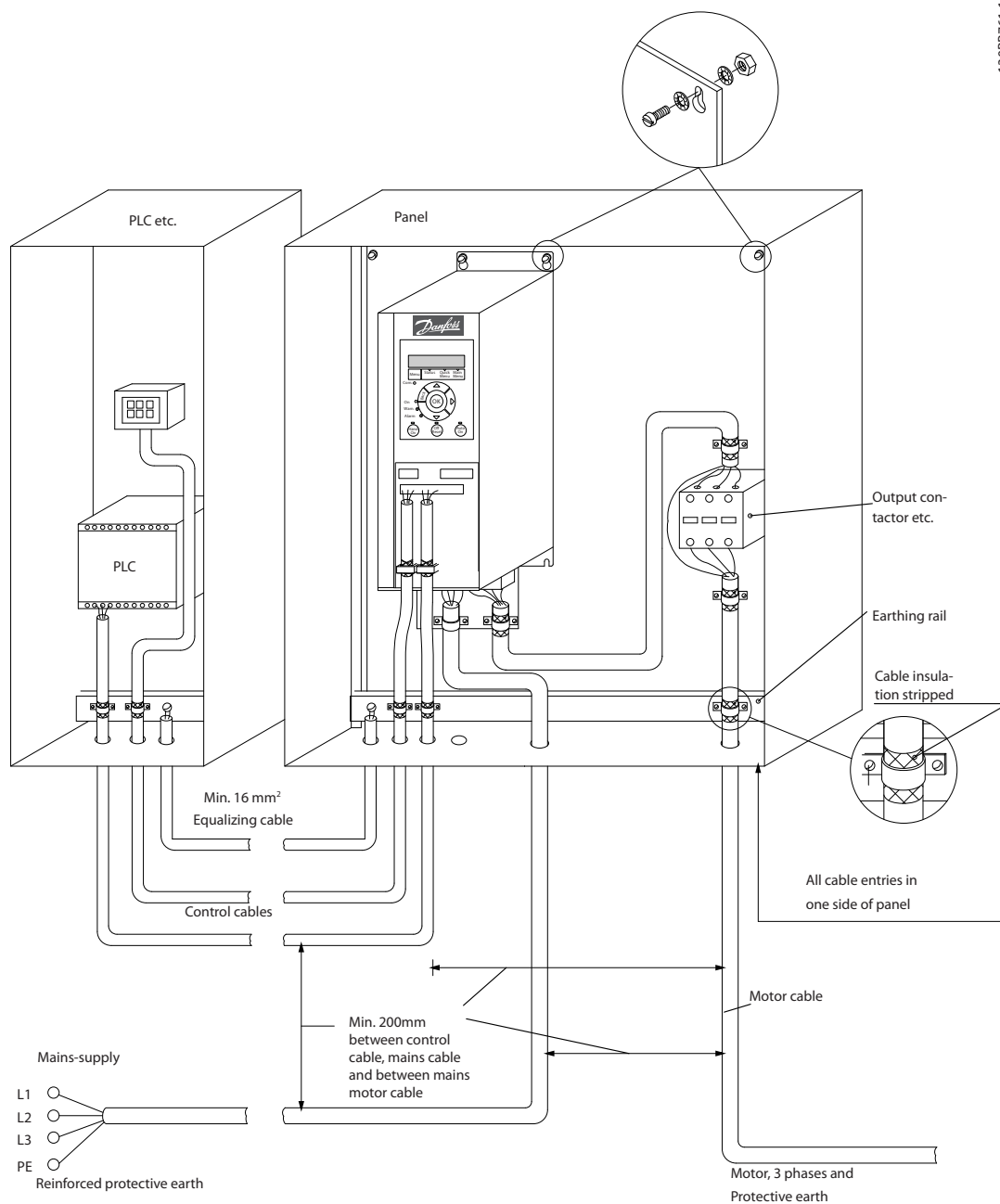


Illustration 3.21 EMC-correct Electrical Installation

3.2.6 Control Terminals

Remove the terminal cover to access the control terminals.

Use a flat-edged screwdriver to push down the lock lever of the terminal cover under the LCP, then remove the terminal cover, as shown in *Illustration 3.22*.

For IP54 units, remove the front cover before removing the terminal cover.

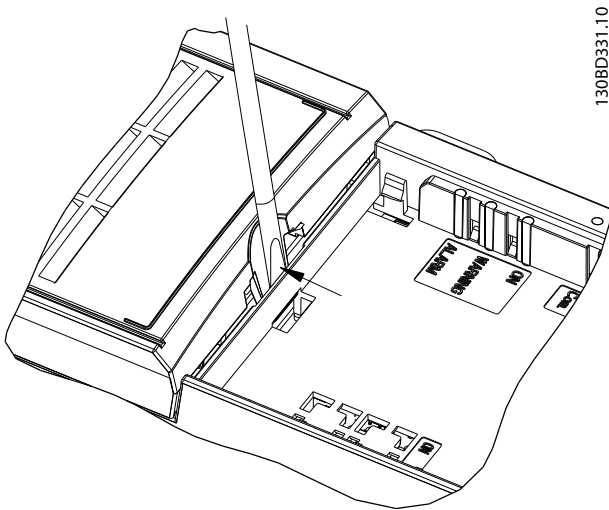


Illustration 3.22 Removing the Terminal Cover

Control terminals

Illustration 3.23 shows all the frequency converter control terminals. Applying Start (terminal 18), connection between terminal 12-27, and an analog reference (terminal 53 or 54 and 55) make the frequency converter run.

The digital input mode of terminal 18, 19, and 27 is set in *5-00 Digital Input Mode* (PNP is default value). Digital input 29 mode is set in *5-03 Digital Input 29 Mode* (PNP is default value).

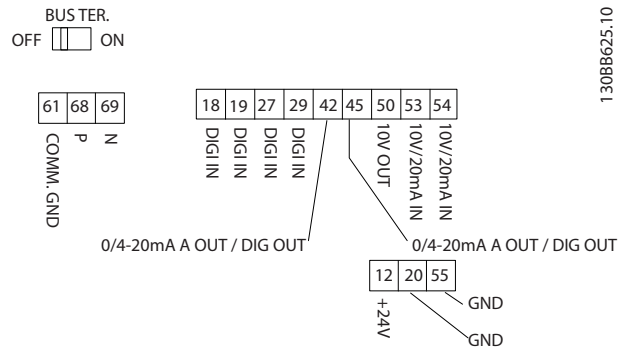


Illustration 3.23 Control Terminals

3.2.7 Electrical Wiring

3

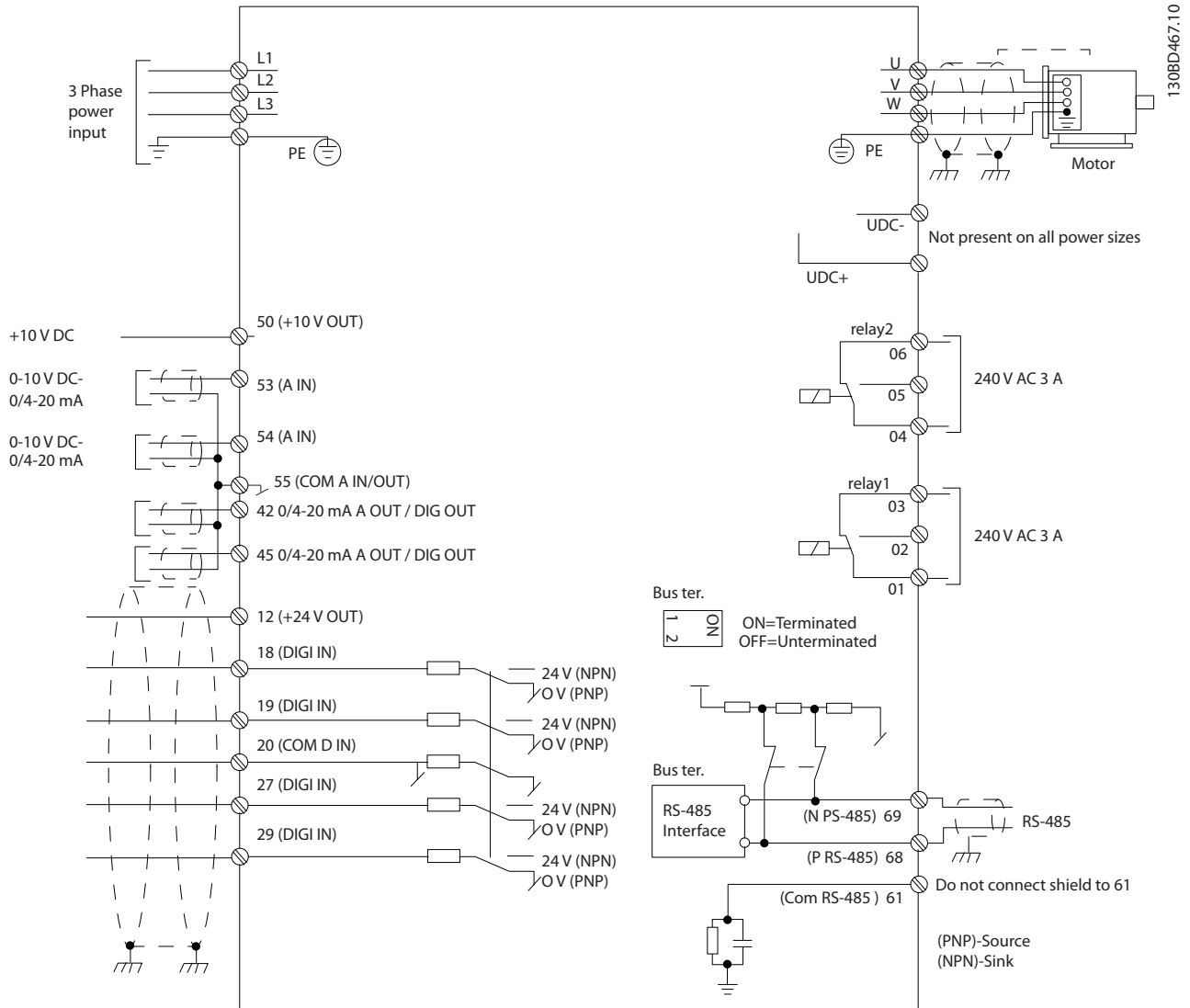


Illustration 3.24 Basic Wiring Schematic Drawing

NOTICE

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

- IP20, 380–480 V, 30–90 kW (40–125 HP)
- IP20, 200–240 V, 15–45 kW (20–60 HP)
- IP20, 525–600 V, 2.2–90 kW (3–125 HP)
- IP54, 380–480 V, 22–90 kW (30–125 HP)

3.2.8 Acoustic Noise or Vibration

If the motor or the equipment driven by the motor - e.g. a fan - is making noise or vibrations at certain frequencies, configure the following parameters or parameter groups to reduce or eliminate the noise or vibrations:

- Parameter group 4-6* *Speed Bypass*
- Set 14-03 *Overmodulation* to [0] *Off*
- Switching pattern and switching frequency parameter group 14-0* *Inverter Switching*
- 1-64 *Resonance Dampening*

4 Programming

4.1 Local Control Panel (LCP)

NOTICE

The frequency converter can also be programmed from a PC via the RS-485 COM port by installing the MCT 10 Set-up Software. Refer to *chapter 1.2.1 MCT 10 Set-up Software Support* for more details about the software.

The LCP is divided into 4 functional sections.

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

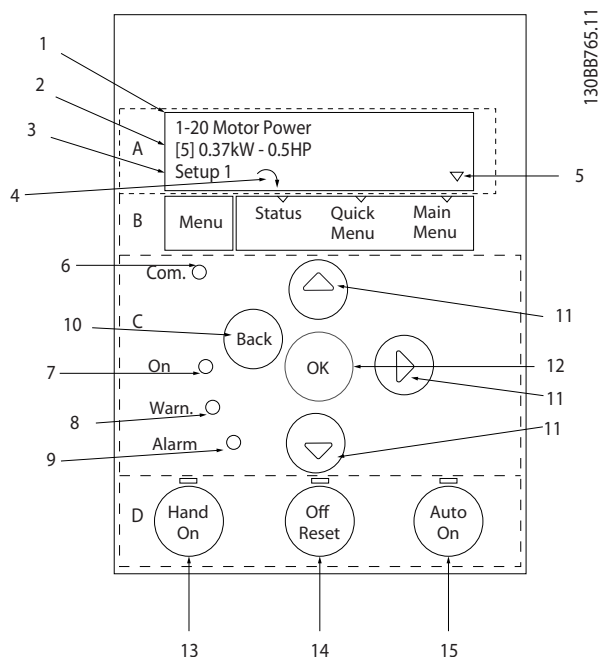


Illustration 4.1 Local Control Panel (LCP)

A. Display

The LCD-display is back-lit with 2 alphanumeric lines. All data is displayed on the LCP.

Illustration 4.1 describes the information that can be read from the display.

1	Parameter number and name.
2	Parameter value.
3	Set-up number shows the active set-up and the edit set-up. If the same set-up acts as both active and edit set-up, only that set-up number is shown (factory setting). When active and edit set-up differ, both numbers are shown in the display (set-up 12). The number flashing, indicates the edit set-up.
4	Motor direction is shown to the bottom left of the display – indicated by a small arrow pointing either clockwise or counterclockwise.
5	The triangle indicates if the LCP is in status, quick menu or main menu.

Table 4.1 Legend to Illustration 4.1

B. Menu key

Press [Menu] to select between status, quick menu or main menu.

C. Navigation keys and indicator lights (LEDs)

6	Com LED: Flashes when bus communication is communicating.
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	[▲] [▼] [▶]: For navigating among parameter groups, 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.

Table 4.2 Legend to Illustration 4.1

D. Operation keys and indicator lights (LEDs)

13	[Hand On]: Starts the motor and enables control of the frequency converter via the LCP. NOTICE [2] coast inverse is the default option for 5-12 Terminal 27 Digital Input. This means that [Hand On] does not start the motor if there is no 24 V supply to terminal 27. Connect terminal 12 to terminal 27.
14	[Off/Reset]: Stops the motor (Off). If in alarm mode, the alarm is reset.
15	[Auto On]: Frequency converter is controlled either via control terminals or serial communication.

Table 4.3 Legend to Illustration 4.1

4.2 Set-up Wizard

The built-in wizard menu guides the installer through the set-up of the frequency converter in a clear and structured manner for open-loop and closed-loop applications and quick motor settings.

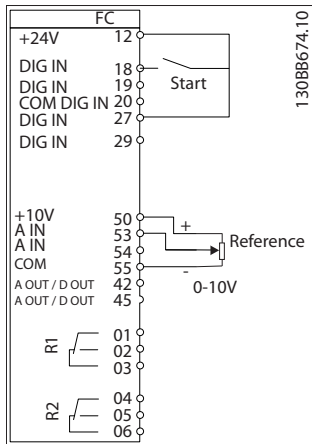


Illustration 4.2 Frequency Converter Wiring

The wizard will initially be shown after power-up until any parameter has been changed. The wizard can always be accessed again through the quick menu. Press [OK] to start the wizard. Press [Back] to return to the status screen.

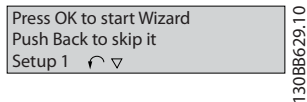
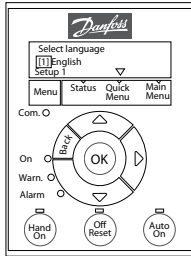
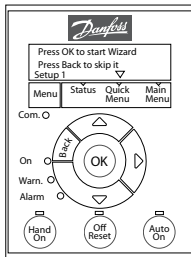


Illustration 4.3 Start-up/Quit Wizard

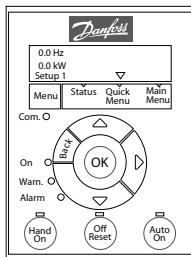
At power up the user is asked to choose the preferred language.



The next screen will be the Wizard screen.

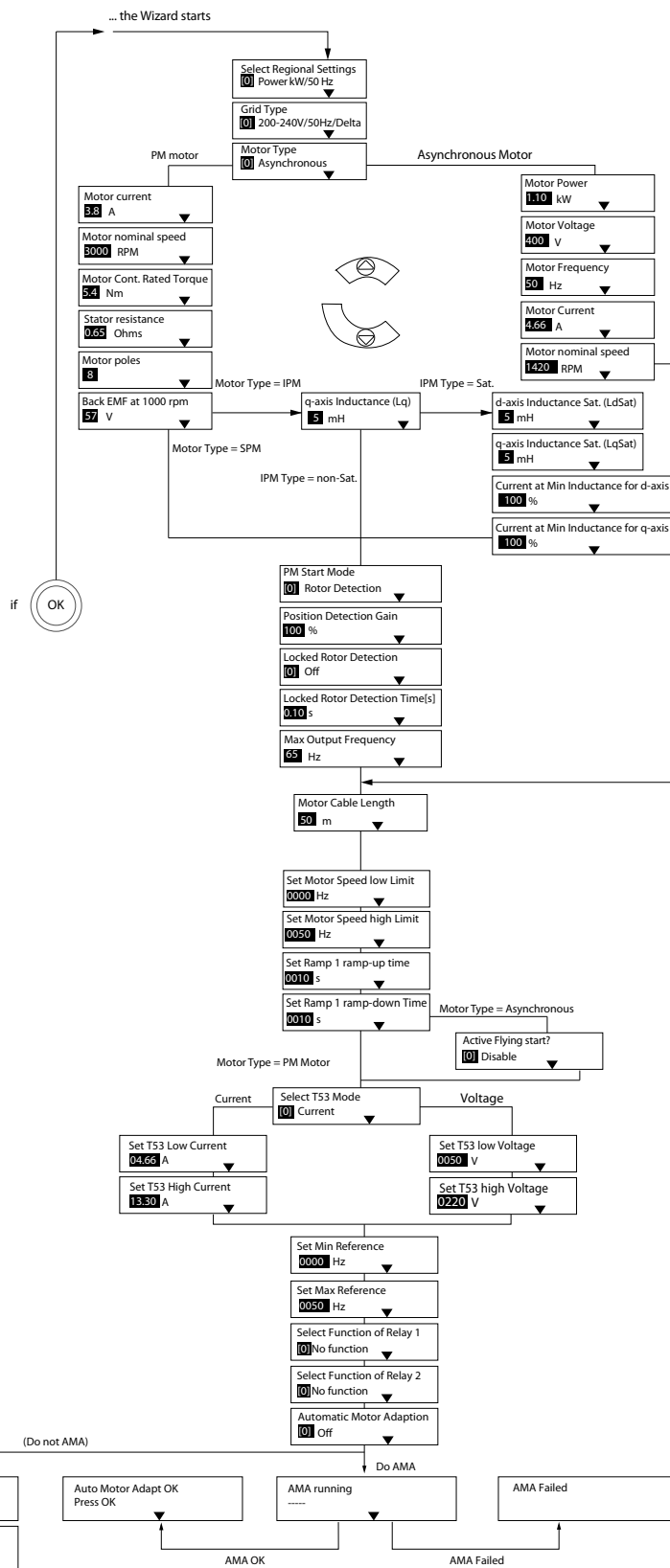


Wizard Screen



Status Screen

The Wizard can always be reentered via the Quick Menu!



130BC244.13

Illustration 4.4 Set-up Wizard for Open-Loop Applications

1-46 Position Detection Gain and 1-70 PM Start Mode are available in software version 2.80 and subsequent versions.

Set-up Wizard for Open-Loop Applications

Parameter	Option	Default	Usage
0-03 Regional Settings	[0] International [1] US	0	
0-06 GridType	[0] 200-240 V/50 Hz/IT-grid [1] 200-240 V/50 Hz/Delta [2] 200-240 V/50 Hz [10] 380-440 V/50 Hz/IT-grid [11] 380-440 V/50 Hz/Delta [12] 380-440 V/50 Hz [20] 440-480 V/50 Hz/IT-grid [21] 440-480 V/50 Hz/Delta [22] 440-480 V/50 Hz [30] 525-600 V/50 Hz/IT-grid [31] 525-600 V/50 Hz/Delta [32] 525-600 V/50 Hz [100] 200-240 V/60 Hz/IT-grid [101] 200-240 V/60 Hz/Delta [102] 200-240 V/60 Hz [110] 380-440 V/60 Hz/IT-grid [111] 380-440 V/60 Hz/Delta [112] 380-440 V/60 Hz [120] 440-480 V/60 Hz/IT-grid [121] 440-480 V/60 Hz/Delta [122] 440-480 V/60 Hz [130] 525-600 V/60 Hz/IT-grid [131] 525-600 V/60 Hz/Delta [132] 525-600 V/60 Hz	Size related	Select the operating-mode for restart upon reconnection of the drive to mains voltage after power down.

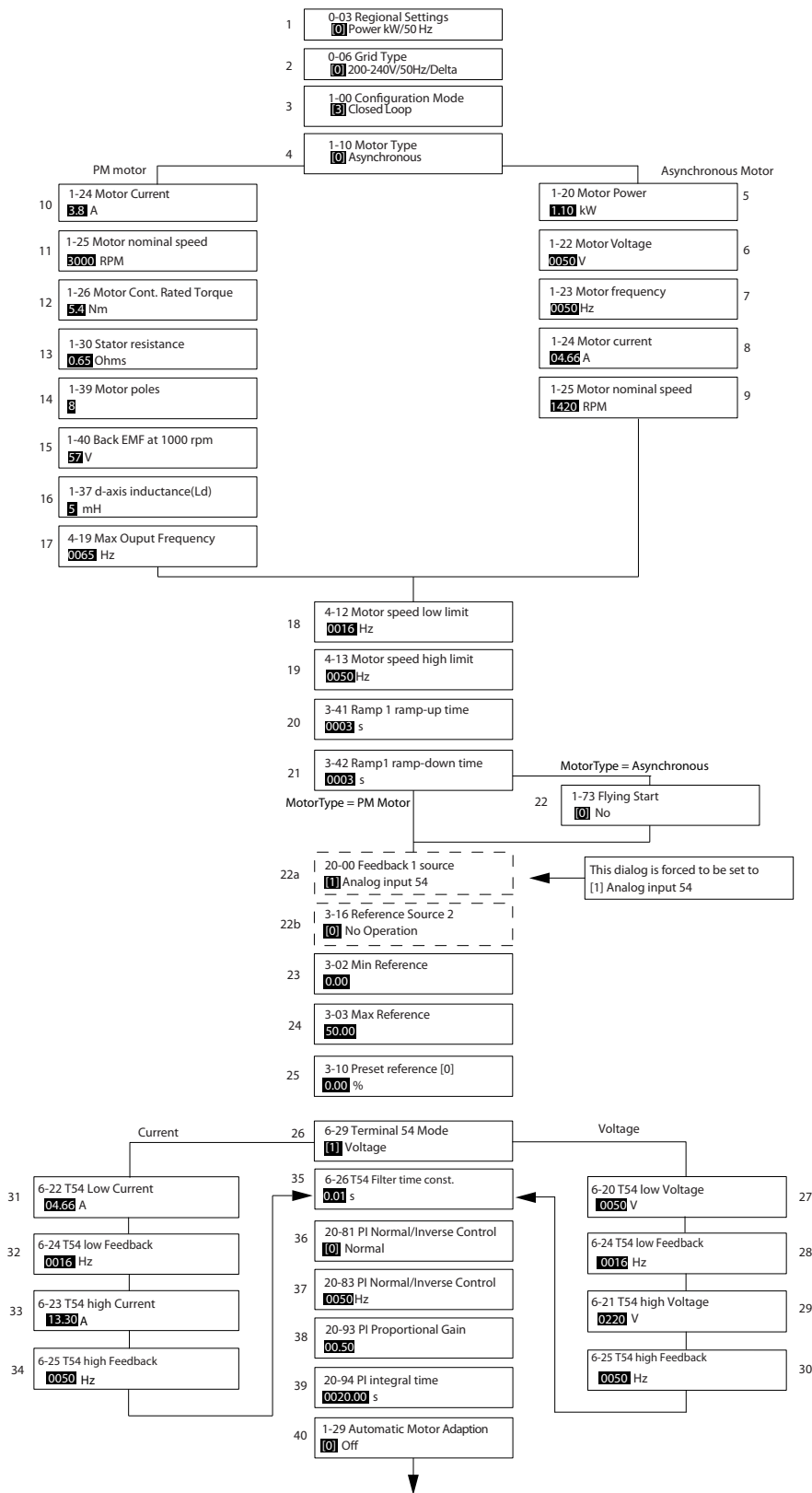
Parameter	Option	Default	Usage
1-10 Motor Construction	*[0] Asynchron [1] PM, non-salient SPM [2] PM, salient IPM, non Sat. [3] PM, salient IPM, Sat.	[0] Asynchron	Setting the parameter value might change these parameters: 1-01 Motor Control Principle 1-03 Torque Characteristics 1-14 Damping Gain 1-15 Low Speed Filter Time Const. 1-16 High Speed Filter Time Const. 1-17 Voltage filter time const. 1-20 Motor Power [kW] 1-22 Motor Voltage 1-23 Motor Frequency 1-24 Motor Current 1-25 Motor Nominal Speed 1-26 Motor Cont. Rated Torque 1-30 Stator Resistance (Rs) 1-33 Stator Leakage Reactance (X1) 1-35 Main Reactance (Xh) 1-37 d-axis Inductance (Ld) 1-38 q-axis Inductance (Lq) 1-39 Motor Poles 1-40 Back EMF at 1000 RPM 1-44 d-axis Inductance Sat. (LdSat) 1-45 q-axis Inductance Sat. (LqSat) 1-46 Position Detection Gain 1-48 Current at Min Inductance for d-axis 1-49 Current at Min Inductance for q-axis 1-66 Min. Current at Low Speed 1-70 PM Start Mode 1-72 Start Function 1-73 Flying Start 4-14 Motor Speed High Limit [Hz] 4-19 Max Output Frequency 4-58 Missing Motor Phase Function 14-65 Speed Derate Dead Time Compensation
1-20 Motor Power	0.12–110 kW/0.16–150 hp	Size related	Enter the motor power from the nameplate data.
1-22 Motor Voltage	50.0–1000.0 V	Size related	Enter the motor voltage from the nameplate data.
1-23 Motor Frequency	20.0–400.0 Hz	Size related	Enter the motor frequency from the nameplate data.
1-24 Motor Current	0.01–10000.00 A	Size related	Enter the motor current from the nameplate data.
1-25 Motor Nominal Speed	50.0–9999.0 RPM	Size related	Enter the motor nominal speed from the nameplate data.
1-26 Motor Cont. Rated Torque	0.1–1000.0	Size related	This parameter is available when 1-10 Motor Construction is set to options that enable permanent motor mode. NOTICE Changing this parameter will affect the settings of other parameters.
1-29 Automatic Motor Adaption (AMA)	See 1-29 Automatic Motor Adaption (AMA)	Off	Performing an AMA optimizes motor performance.
1-30 Stator Resistance (Rs)	0.000–99.990	Size related	Set the stator resistance value.

Parameter	Option	Default	Usage
1-37 <i>d-axis Inductance (Ld)</i>	0–1000 mH	Size related	Enter the value of the d-axis inductance. Obtain the value from the permanent magnet motor data sheet. The de-axis inductance cannot be found by performing an AMA.
1-38 <i>q-axis Inductance (Lq)</i>	0–1000 mH	Size related	Enter the value of the q-axis inductance.
1-39 <i>Motor Poles</i>	2–100	4	Enter the number of motor poles.
1-40 <i>Back EMF at 1000 RPM</i>	10–9000	Size related	Line-Line RMS back EMF voltage at 1000 RPM.
1-42 <i>Motor Cable Length</i>	0–100 m	50 m	Enter the motor cable length.
1-44 <i>d-axis Inductance Sat. (LdSat)</i>	0–1000 mH	Size related	This parameter corresponds to the inductance saturation of Ld. Ideally, this parameter has the same value as 1-37 <i>d-axis Inductance (Ld)</i> . However, if the motor supplier provides an induction curve, the induction value @ 200% of isNom should be entered here.
1-45 <i>q-axis Inductance Sat. (LqSat)</i>	0–1000 mH	Size related	This parameter corresponds to the inductance saturation of Lq. Ideally, this parameter has the same value as 1-38 <i>q-axis Inductance (Lq)</i> . However, if the motor supplier provides an induction curve, the induction value @ 200% of isNom should be entered here.
1-46 <i>Position Detection Gain</i>	20–200%	100%	Adjusts the height of the test pulse during position detection at Start.
1-48 <i>Current at Min Inductance for d-axis</i>	20–200 %	100%	Enter the inductance saturation point.
1-49 <i>Current at Min Inductance for q-axis</i>	20–200 %	100%	This parameter specifies the saturation curve of the d- and q-inductance values. From 20% to 100% of this parameter, the inductances are linearly approximated due to parameters 1-37, 1-38, 1-44, and 1-45.
1-70 <i>PM Start Mode</i>	[0] Rotor Detection [1] Parking	[0] Rotor Detection	–
1-73 <i>Flying Start</i>	[0] Disabled [1] Enabled	0	Select [1] <i>Enable</i> to enable the drive to catch a motor spinning due to mains drop-out. Select [0] <i>Disable</i> if this function is not required. When this parameter is set to [1] <i>Enable</i> , 1-71 <i>Start Delay</i> and 1-72 <i>Start Function</i> have no function. 1-73 <i>Flying Start</i> is active in VVC ⁺ mode only
3-02 <i>Minimum Reference</i>	-4999–4999	0	The minimum reference is the lowest value obtainable by summing all references.
3-03 <i>Maximum Reference</i>	-4999–4999	50	The maximum reference is the lowest obtainable by summing all references.
3-41 <i>Ramp 1 Ramp Up Time</i>	0.05–3600.0 s	Size related	Ramp up time from 0 to rated 1-23 <i>Motor Frequency</i> if Asynchron motor is selected; ramp up time from 0 to 1-25 <i>Motor Nominal Speed</i> if PM motor is selected.
3-42 <i>Ramp 1 Ramp Down Time</i>	0.05–3600.0 s	Size related	Ramp down time from rated 1-23 <i>Motor Frequency</i> to 0 if Asynchron motor is selected; ramp down time from 1-25 <i>Motor Nominal Speed</i> to 0 if PM motor is selected.
4-12 <i>Motor Speed Low Limit [Hz]</i>	0.0–400 Hz	0 Hz	Enter the minimum limit for low speed.
4-14 <i>Motor Speed High Limit [Hz]</i>	0.0–400 Hz	100 Hz	Enter the maximum limit for high speed.
4-19 <i>Max Output Frequency</i>	0–400	Size related	Enter the maximum output frequency value.
5-40 <i>Function Relay [0] Function relay</i>	See 5-40 Function Relay	Alarm	Select the function to control output relay 1.
5-40 <i>Function Relay [1] Function relay</i>	See 5-40 Function Relay	Drive running	Select the function to control output relay 2.

Parameter	Option	Default	Usage
6-10 Terminal 53 Low Voltage	0–10 V	0.07 V	Enter the voltage that corresponds to the low reference value.
6-11 Terminal 53 High Voltage	0–10 V	10 V	Enter the voltage that corresponds to the high reference value.
6-12 Terminal 53 Low Current	0–20 mA	4	Enter the current that corresponds to the low reference value.
6-13 Terminal 53 High Current	0–20 mA	20	Enter the current that corresponds to the high reference value.
6-19 Terminal 53 mode	[0] Current [1] Voltage	1	Select if terminal 53 is used for current- or voltage input.
30-22 Locked Rotor Detection	[0] Off [1] On	[0] Off	–
30-23 Locked Rotor Detection Time [s]	0.05–1 s	0.10 s	–

Table 4.4 Set-up Wizard for Open Loop Applications

Set-up Wizard for Closed-Loop Applications



1308C402.10

Illustration 4.5 Set-up Wizard for Closed-Loop Applications

1-46 Position Detection Gain and 1-70 PM Start Mode are available in software version 2.80 and subsequent versions.

Parameter	Range	Default	Usage
0-03 Regional Settings	[0] International [1] US	0	–
0-06 GridType	[0] -[[132] see start -up wizard for open loop application	Size selected	Select operating mode for restart upon reconnection of the frequency converter to mains voltage after power down.
1-00 Configuration Mode	[0] Open loop [3] Closed loop	0	–
1-10 Motor Construction	*[0] Asynchron [1] PM, non-salient SPM [2] PM, salient IPM, non Sat. [3] PM, salient IPM, Sat.	[0] Asynchron	Setting the parameter value might change these parameters: 1-01 Motor Control Principle 1-03 Torque Characteristics 1-14 Damping Gain 1-15 Low Speed Filter Time Const. 1-16 High Speed Filter Time Const. 1-17 Voltage filter time const. 1-20 Motor Power [kW] 1-22 Motor Voltage 1-23 Motor Frequency 1-24 Motor Current 1-25 Motor Nominal Speed 1-26 Motor Cont. Rated Torque 1-30 Stator Resistance (Rs) 1-33 Stator Leakage Reactance (X1) 1-35 Main Reactance (Xh) 1-37 d-axis Inductance (Ld) 1-38 q-axis Inductance (Lq) 1-39 Motor Poles 1-40 Back EMF at 1000 RPM 1-44 d-axis Inductance Sat. (LdSat) 1-45 q-axis Inductance Sat. (LqSat) 1-46 Position Detection Gain 1-48 Current at Min Inductance for d-axis 1-49 Current at Min Inductance for q-axis 1-66 Min. Current at Low Speed 1-72 Start Function 1-73 Flying Start 4-14 Motor Speed High Limit [Hz] 4-19 Max Output Frequency 4-58 Missing Motor Phase Function 14-65 Speed Derate Dead Time Compensation
1-20 Motor Power	0.09–110 kW	Size related	Enter the motor power from the nameplate data.
1-22 Motor Voltage	50–1000 V	Size related	Enter the motor voltage from the nameplate data.
1-23 Motor Frequency	20–400 Hz	Size related	Enter the motor frequency from the nameplate data.
1-24 Motor Current	0–10000 A	Size related	Enter the motor current from the nameplate data.
1-25 Motor Nominal Speed	50–9999 RPM	Size related	Enter the motor nominal speed from the nameplate data.

Parameter	Range	Default	Usage
1-26 Motor Cont. Rated Torque	0.1–1000.0	Size related	This parameter is available when 1-10 Motor Construction is set to options that enable permanent motor mode. NOTICE Changing this parameter affects the settings of other parameters.
1-29 Automatic Motor Adaption (AMA)		Off	Performing an AMA optimizes motor performance.
1-30 Stator Resistance (Rs)	0–99.990	Size related	Set the stator resistance value.
1-37 d-axis Inductance (Ld)	0–1000	Size related	Enter the value of the d-axis inductance. Obtain the value from the permanent magnet motor data sheet. The de-axis inductance cannot be found by performing an AMA.
1-38 q-axis Inductance (Lq)	0–1000 mH	Size related	Enter the value of the q-axis inductance.
1-39 Motor Poles	2–100	4	Enter the number of motor poles.
1-40 Back EMF at 1000 RPM	10–9000	Size related	Line-Line RMS back EMF voltage at 1000 RPM.
1-42 Motor Cable Length	0–100 m	50 m	Enter the motor cable length.
1-44 d-axis Inductance Sat. (LdSat)	0–1000 mH	Size related	This parameter corresponds to the inductance saturation of Ld. Ideally, this parameter has the same value as 1-37 d-axis Inductance (Ld). However, if motor supplier provides an induction curve, the induction value @ 200% of isNom should be entered here.
1-45 q-axis Inductance Sat. (LqSat)	0–1000 mH	Size related	This parameter corresponds to the inductance saturation of Lq. Ideally, this parameter has the same value as 1-38 q-axis Inductance (Lq). However, if motor supplier provides an induction curve, the induction value @ 200% of isNom should be entered here.
1-46 Position Detection Gain	20–200%	100%	Adjusts the height of the test pulse during position detection at start.
1-48 Current at Min Inductance for d-axis	20–200 %	100%	Enter the inductance saturation point.
1-49 Current at Min Inductance for q-axis	20–200 %	100%	This parameter specifies the saturation curve of the d- and q-inductance values. From 20% to 100% of this parameter, the inductances are linearly approximated due to parameters 1-37, 1-38, 1-44, and 1-45.
1-70 PM Start Mode	[0] Rotor Detection [1] Parking	[0] Rotor Detection	–
1-73 Flying Start	[0] Disabled [1] Enabled	0	Select [1] Enable to enable the frequency converter to catch a spinning motor. I.e. fan applications. When PM is selected, Flying Start is enabled.
3-02 Minimum Reference	-4999–4999	0	The minimum reference is the lowest value obtainable by summing all references.
3-03 Maximum Reference	-4999–4999	50	The maximum reference is the highest value obtainable by summing all references.
3-10 Preset Reference	-100–100%	0	Enter the set point.
3-41 Ramp 1 Ramp Up Time	0.05–3600.0 s	Size related	Ramp up time from 0 to rated 1-23 Motor Frequency if asynchron motor is selected; ramp up time from 0 to 1-25 Motor Nominal Speed if PM motor is selected.

Parameter	Range	Default	Usage
3-42 Ramp 1 Ramp Down Time	0.05–3600.0 s	Size related	Ramp down time from rated 1-23 Motor Frequency to 0 if asynchronous motor is selected; ramp down time from 1-25 Motor Nominal Speed to 0 if PM motor is selected.
4-12 Motor Speed Low Limit [Hz]	0–400 Hz	0.0 Hz	Enter the minimum limit for low speed.
4-14 Motor Speed High Limit [Hz]	0–400 Hz	100 Hz	Enter the minimum limit for high speed.
4-19 Max Output Frequency	0–400	Size related	Enter the maximum output frequency value.
6-29 Terminal 54 mode	[0] Current [1] Voltage	1	Select if terminal 54 is used for current- or voltage input.
6-20 Terminal 54 Low Voltage	0–10 V	0.07 V	Enter the voltage that corresponds to the low reference value.
6-21 Terminal 54 High Voltage	0–10 V	10 V	Enter the voltage that corresponds to the low high reference value.
6-22 Terminal 54 Low Current	0–20 mA	4	Enter the current that corresponds to the high reference value.
6-23 Terminal 54 High Current	0–20 mA	20	Enter the current that corresponds to the high reference value.
6-24 Terminal 54 Low Ref./Feedb. Value	-4999–4999	0	Enter the feedback value that corresponds to the voltage or current set in 6-20 Terminal 54 Low Voltage/6-22 Terminal 54 Low Current.
6-25 Terminal 54 High Ref./Feedb. Value	-4999–4999	50	Enter the feedback value that corresponds to the voltage or current set in 6-21 Terminal 54 High Voltage/6-23 Terminal 54 High Current.
6-26 Terminal 54 Filter Time Constant	0–10 s	0.01	Enter the filter time constant.
20-81 PI Normal/ Inverse Control	[0] Normal [1] Inverse	0	Select [0] Normal to set the process control to increase the output speed when the process error is positive. Select [1] Inverse to reduce the output speed.
20-83 PI Start Speed [Hz]	0–200 Hz	0	Enter the motor speed to be attained as a start signal for commencement of PI control.
20-93 PI Proportional Gain	0–10	0.01	Enter the process controller proportional gain. Quick control is obtained at high amplification. However if amplification is too great, the process may become unstable.
20-94 PI Integral Time	0.1–999.0 s	999.0 s	Enter the process controller integral time. Obtain quick control through a short integral time, though if the integral time is too short, the process becomes unstable. An excessively long integral time disables the integral action.
30-22 Locked Rotor Detection	[0] Off [1] On	[0] Off	–
30-23 Locked Rotor Detection Time [s]	0.05–1 s	0.10 s	–

Table 4.5 Set-up Wizard for Closed Loop Applications
Motor set-up

The Motor Set-up wizard guides through the needed motor parameters.

Parameter	Range	Default	Usage
0-03 Regional Settings	[0] International [1] US	0	–
0-06 GridType	[0] -[132] see start -up wizard for open loop application	Size selected	Select the operating-mode for restart upon reconnection of the drive to mains voltage after power down.

Parameter	Range	Default	Usage
1-10 Motor Construction	*[0] Asynchron [1] PM, non-salient SPM [2] PM, salient IPM, non Sat. [3] PM, salient IPM, Sat.	[0] Asynchron	-
1-20 Motor Power	0.12–110 kW/0.16–150 hp	Size related	Enter the motor power from the nameplate data.
1-22 Motor Voltage	50–1000 V	Size related	Enter the motor voltage from the nameplate data.
1-23 Motor Frequency	20–400 Hz	Size related	Enter the motor frequency from the nameplate data.
1-24 Motor Current	0.01–10000.00 A	Size related	Enter the motor current from the nameplate data.
1-25 Motor Nominal Speed	50–9999 RPM	Size related	Enter the motor nominal speed from the nameplate data.
1-26 Motor Cont. Rated Torque	0.1–1000.0	Size related	This parameter is available when 1-10 Motor Construction is set to options that enable permanent motor mode. NOTICE Changing this parameter affects the settings of other parameters.
1-30 Stator Resistance (Rs)	0–99.990	Size related	Set the stator resistance value.
1-37 d-axis Inductance (Ld)	0–1000	Size related	Enter the value of the d-axis inductance. Obtain the value from the permanent magnet motor data sheet. The de-axis inductance cannot be found by performing an AMA.
1-38 q-axis Inductance (Lq)	0–1000 mH	Size related	Enter the value of the q-axis inductance.
1-39 Motor Poles	2–100	4	Enter the number of motor poles.
1-40 Back EMF at 1000 RPM	10–9000	Size related	Line-Line RMS back EMF voltage at 1000 RPM.
1-42 Motor Cable Length	0–100 m	50 m	Enter the motor cable length.
1-44 d-axis Inductance Sat. (LdSat)	0–1000 mH	Size related	This parameter corresponds to the inductance saturation of Ld. Ideally, this parameter has the same value as 1-37 d-axis Inductance (Ld). However, if the motor supplier provides an induction curve, the induction value @ 200% of isNom should be entered here.
1-45 q-axis Inductance Sat. (LqSat)	0–1000 mH	Size related	This parameter corresponds to the inductance saturation of Lq. Ideally, this parameter has the same value as 1-38 q-axis Inductance (Lq). However, if the motor supplier provides an induction curve, the induction value @ 200% of isNom should be entered here.
1-46 Position Detection Gain	20–200%	100%	Adjusts the height of the test pulse during position detection at start.

Parameter	Range	Default	Usage
1-48 Current at Min Inductance for d-axis	20–200 %	100%	Enter the inductance saturation point.
1-49 Current at Min Inductance for q-axis	20–200 %	100%	This parameter specifies the saturation curve of the d- and q-inductance values. From 20% to 100% of this parameter, the inductances are linearly approximated due to parameters 1-37, 1-38, 1-44, and 1-45.
1-70 PM Start Mode	[0] Rotor Detection [1] Parking	[0] Rotor Detection	–
1-73 Flying Start	[0] Disabled [1] Enabled	0	Select [1] Enable to enable the frequency converter to catch a spinning motor.
3-41 Ramp 1 Ramp Up Time	0.05–3600.0 s	Size related	Ramp up time from 0 to rated 1-23 Motor Frequency.
3-42 Ramp 1 Ramp Down Time	0.05–3600.0 s	Size related	Ramp down time from rated 1-23 Motor Frequency to 0.
4-12 Motor Speed Low Limit [Hz]	0–400 Hz	0.0 Hz	Enter the minimum limit for low speed.
4-14 Motor Speed High Limit [Hz]	0–400 Hz	100 Hz	Enter the maximum limit for high speed.
4-19 Max Output Frequency	0–400	Size related	Enter the maximum output frequency value.
30-22 Locked Rotor Detection	[0] Off [1] On	[0] Off	–
30-23 Locked Rotor Detection Time [s]	0.05–1 s	0.10 s	–

Table 4.6 Motor Set-up Wizard Settings
Changes Made

The *Changes Made* function lists all parameters changed from 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.

Changing parameter settings

1. Press the [Menu] key to enter the Quick Menu until indicator in display is placed above Quick Menu.
2. Press [▲] [▼] to select the wizard, closed loop set-up, motor set-up or changes made, then press [OK].
3. Press [▲] [▼] to browse through the parameters in the Quick Menu.
4. Press [OK] to select a parameter.
5. Press [▲] [▼] to change the value of a parameter setting.
6. Press [OK] to accept the change.

7. Press either [Back] twice to enter *Status*, or press [Menu] once to enter the Main Menu.

The Main Menu accesses all parameters.

1. Press the [Menu] key until indicator in 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.

4.3 Parameter List

0-0*	Operation / Display	1-44	d-axis Inductance Sat. (LdSat)	4-**	Limits / Warnings	6-2*	Analog Input 54	8-84	Slave Messages Sent
0-0*	Basic Settings	1-45	q-axis Inductance Sat. (LqSat)	4-1*	Motor Limits	6-20	Terminal 54 Low Voltage	8-85	Slave Timeout Errors
0-01	Language	1-46	Position Detection Gain	4-10	Motor Speed Direction	6-21	Terminal 54 High Voltage	8-88	Reset FC port Diagnostics
0-03	Regional Settings	1-48	Current at Min Inductance for d-axis	4-12	Motor Speed Low Limit [Hz]	6-22	Terminal 54 Low Current	8-9*	Bus Feedback
0-04	Operating State at Power-up	1-49	Current at Min Inductance for q-axis	4-14	Motor Speed High Limit [Hz]	6-23	Terminal 54 High Current	8-94	Bus Feedback 1
0-06	GridType	1-5*	Load Indep. Setting	4-18	Current Limit	6-24	Terminal 54 Low Ref./Feedb. Value	8-95	Bus Feedback 2
0-07	Auto DC Braking	1-50	Motor Magnetisation at Zero Speed	4-19	Max Output Frequency	6-25	Terminal 54 High Ref./Feedb. Value	13-** Smart Logic	
0-1*	Set-up Operations	1-52	Min Speed Normal Magnetising [Hz]	4-4*	Adj. Warnings 2	6-26	Terminal 54 Filter Time Constant	13-0* SLC Settings	
0-10	Active Set-up	1-55	U/f Characteristic - U	4-40	Warning Freq. Low	6-29	Terminal 54 mode	13-00	SL Controller Mode
0-11	Programming Set-up	1-56	U/f Characteristic - F	4-41	Warning Freq. High	6-7*	Analog/Digital Output 45	13-01	Start Event
0-12	Link Setups	1-6*	Load Depen. Setting	4-5*	Adj. Warnings	6-70	Terminal 45 Mode	13-02	Stop Event
0-3*	LCP Custom Readout	1-62	Slip Compensation	4-50	Warning Current Low	6-71	Terminal 45 Analog Output	13-03	Reset SLC
0-30	Custom Readout Unit	1-63	Slip Compensation Time Constant	4-51	Warning Current High	6-72	Terminal 45 Digital Output	13-1*	Comparators
0-31	Custom Readout Min Value	1-64	Resonance Dampening	4-54	Warning Reference Low	6-73	Terminal 45 Output Min Scale	13-10	Comparator Operand
0-32	Custom Readout Max Value	1-65	Resonance Dampening Time Constant	4-55	Warning Reference High	6-74	Terminal 45 Output Max Scale	13-11	Comparator Operator
0-37	Display Text 1	1-66	Min. Current at Low Speed	4-56	Warning Feedback Low	6-76	Terminal 45 Output Bus Control	13-12	Comparator Value
0-38	Display Text 2	1-7*	Start Adjustments	4-57	Warning Feedback High	6-9*	Analog/Digital Output 42	13-2*	Timers
0-39	Display Text 3	1-70	PM Start Mode	4-58	Missing Motor Phase Function	6-90	Terminal 42 Mode	13-20	SL Controller Timer
0-4*	LCP Keypad	1-71	Start Delay	4-6*	Speed Bypass	6-91	Terminal 42 Analog Output	13-4*	Logic Rules
0-40	[Hand on] Key on LCP	1-72	Start Function	4-61	Bypass Speed From [Hz]	6-92	Terminal 42 Digital Output	13-40	Logic Rule Boolean 1
0-42	[Auto on] Key on LCP	1-73	Flying Start	4-63	Bypass Speed To [Hz]	6-93	Terminal 42 Output Min Scale	13-41	Logic Rule Operator 1
0-44	[Off/Reset] Key on LCP	1-8*	Stop Adjustments	4-64	Semi-Auto Bypass Set-up	6-94	Terminal 42 Output Max Scale	13-42	Logic Rule Boolean 2
0-5*	Copy/Save	1-80	Function at Stop	5-**	Digital In/Out	6-96	Terminal 42 Output Bus Control	13-43	Logic Rule Operator 2
0-50	LCP Copy	1-82	Min Speed for Function at Stop [Hz]	5-0*	Digital I/O mode	8-**	Comm. and Options	13-44	Logic Rule Boolean 3
0-51	Set-up Copy	1-90	Motor Temperature	5-00	Digital Input Mode	8-0*	General Settings	13-5*	States
0-6*	Password	1-90	Motor Thermal Protection	5-03	Digital Input 29 Mode	8-01	Control Sire	13-51	SL Controller Event
0-60	Main Menu Password	1-93	Thermistor Source	5-1*	Digital Inputs	8-02	Control Source	13-52	SL Controller Action
1-0*	Load and Motor	2-**	Brakes	5-10	Terminal 18 Digital Input	8-03	Control Timeout	14-**	Special Functions
1-0*	General Settings	2-0*	DC-Brake	5-11	Terminal 19 Digital Input	8-04	Control Timeout Time	14-0*	Inverter Switching
1-00	Configuration Mode	2-00	DC Hold/Motor Preheat Current	5-12	Terminal 27 Digital Input	8-3*	FC Port Settings	14-01	Switching Frequency
1-01	Motor Control Principle	2-01	DC Brake Current	5-13	Terminal 29 Digital Input	8-30	Protocol	14-03	Overmodulation
1-03	Torque Characteristics	2-02	DC Braking Time	5-3*	Digital Outputs	8-31	Address	14-08	Damping Gain Factor
1-06	Clockwise Direction	2-04	DC Brake Cut In Speed	5-34	On Delay, Digital Output	8-32	Baud Rate	14-09	Dead Time Bias Current Level
1-08	Motor Control Bandwidth	2-06	Motor Control Current	5-35	Off Delay, Digital Output	8-33	Parity / Stop Bits	14-1*	Mains On/Off
1-1*	Motor Selection	2-07	Parking Time	5-4*	Function Relay	8-35	Minimum Response Delay	14-10	Mains Failure
1-10	Motor Construction	2-1*	Brake Energy Funct.	5-40	On Delay, Relay	8-36	Maximum Response Delay	14-11	Mains Voltage at Mains Fault
1-14	Damping Gain	2-10	Brake Function	5-41	Off Delay, Relay	8-37	Maximum Inter-char delay	14-12	Function at Mains Imbalance
1-15	Low Speed Filter Time Const	2-16	AC Brake, Max current	5-42	Off Delay, Relay	8-4*	FC MC protocol set	14-2*	Reset Functions
1-16	High Speed Filter Time Const	2-17	Over-voltage Control	5-5	Pulse Input	8-42	PCD Write Configuration	14-20	Reset Mode
1-17	Voltage filter time const	3-**	Reference / Ramps	5-50	Term. 29 Low Frequency	8-43	PCD Read Configuration	14-21	Automatic Restart Time
1-2*	Motor Data	3-0*	Reference Limits	5-51	Term. 29 High Frequency	8-45	Digital/Bus	14-22	Operation Mode
1-20	Motor Power	3-02	Minimum Reference	5-52	Term. 29 Low Ref./Feedb. Value	8-50	Coasting Select	14-27	Action At Inverter Fault
1-22	Motor Voltage	3-03	Maximum Reference	5-53	Term. 29 High Ref./Feedb. Value	8-51	Quick Stop Select	14-29	Service Code
1-23	Motor Frequency	3-1*	References	5-9*	Bus Controlled	8-52	DC Brake Select	14-4*	Energy Optimising
1-24	Motor Current	3-10	Preset Reference	5-90	Digital & Relay Bus Control	8-53	Start Select	14-40	VT Level
1-25	Motor Nominal Speed	3-11	Jog Speed [Hz]	6-**	Analog In/Out	8-54	Reversing Select	14-41	AEO Minimum Magnetisation
1-26	Motor Cont. Rated Torque	3-14	Preset Relative Reference	6-00	Analog I/O Mode	8-55	Set-up Select	14-5*	Environment
1-29	Automatic Motor Adaptation (AMA)	3-15	Reference 1 Source	6-01	Live Zero Timeout Function	8-56	Preset Reference Select	14-50	RFI Filter
1-3*	Adv. Motor Data	3-16	Reference 2 Source	6-02	Fire Mode Live Zero Timeout Function	8-7*	BACnet	14-51	DC-Link Voltage Compensation
1-30	Stator Resistance (Rs)	3-17	Reference 3 Source	6-1*	Analog Input 53	8-72	BACnet Device Instance	14-52	Fan Control
1-33	Stator Leakage Reactance (Xl)	3-4*	Ramp 1	6-10	Terminal 53 Low Voltage	8-73	M5/TP Max Masters	14-53	Fan Monitor
1-35	Main Reactance (Xh)	3-42	Ramp 1 Ramp Up Time	6-11	Terminal 53 High Voltage	8-74	M5/TP Max Info Frames	14-55	Output Filter
1-37	d-axis Inductance (Ld)	3-5*	Ramp 2	6-12	Terminal 53 Low Current	8-75	"I am" Service	14-6*	Auto Derate
1-38	q-axis Inductance (Lq)	3-51	Ramp 2 Ramp Up Time	6-13	Terminal 53 High Current	8-8*	FC Port Diagnostics	14-63	Min Switch Frequency
1-39	Motor Poles	3-52	Ramp 2 Ramp Down Time	6-14	Terminal 53 Low Ref./Feedb. Value	8-80	Bus Message Count	14-64	Dead Time Compensation Zero Current Level
1-4*	Adv. Motor Data II	3-58*	Other Ramps	6-15	Terminal 53 High Ref./Feedb. Value	8-81	Bus Error Count	14-65	Speed Derate Dead Time Compensation
1-40	Back EMF at 1000 RPM	3-80	Jog Ramp Time	6-16	Terminal 53 Filter Time Constant	8-82	Slave Messages Rcvd		
1-42	Motor Cable Length	3-81	Quick Stop Ramp Time	6-19	Terminal 53 mode	8-83	Slave Error Count		
1-43	Motor Cable Length Feet								

14-9* Fault Settings	16-6* Inputs & Outputs	24-0* Fire Mode
14-90 Fault Level	16-60 Digital Input	24-00 FM Function
15** Drive Information	16-61 Terminal 53 Setting	24-01 Fire Mode Configuration
15-0* Operating Data	16-62 Analog Input AI53	24-05 FM Preset Reference
15-00 Operating Hours	16-63 Terminal 54 Setting	24-06 Fire Mode Reference Source
15-01 Running Hours	16-64 Analog Input AI54	24-07 Fire Mode Feedback Source
15-02 kWh Counter	16-65 Analog Output AO42 [mA]	24-09 FM Alarm Handling
15-03 Power Up's	16-66 Digital Output	24-1* Drive Bypass
15-04 Over Temp's	16-67 Pulse Input #29 [Hz]	24-10 Drive Bypass Function
15-05 Over Volt's	16-71 Relay Output [bin]	24-11 Drive Bypass Delay Time
15-06 Reset kWh Counter	16-72 Counter A	30** Special Features
15-07 Reset Running Hours Counter	16-73 Counter B	30-2* Adv. Start Adjust
15-3* Alarm Log	16-79 Analog Output AO45	30-22 Locked Rotor Detection
15-30 Alarm Log: Error Code	16-8* Fieldbus & FC Port	30-23 Locked Rotor Detection Time [s]
15-31 InternalFaultReason	16-86 FC Port REF 1	
15-4* Drive Identification	16-9* Diagnosis Readouts	
15-40 FC Type	16-90 Alarm Word	
15-41 Power Section	16-91 Alarm Word 2	
15-42 Voltage	16-92 Warning Word	
15-43 Software Version	16-93 Warning Word 2	
15-44 Ordered TypeCode	16-94 Ext. Status Word	
15-45 Actual Typecode String	16-95 Ext. Status Word 2	
15-46 Drive Ordering No	18** Info. & Readouts	
15-48 LCP Id No	18-1* Fire Mode Log	
15-49 SW ID Control Card	18-10 FireMode LogEvent	
15-50 SW ID Power Card	20** Drive Closed Loop	
15-51 Drive Serial Number	20-0* Feedback	
15-53 Power Card Serial Number	20-00 Feedback 1 Source	
15-59 CSIV Filename	20-01 Feedback 1 Conversion	
16** Data Readouts	20-03 (20-03) Feedback 2 Source	
16-0* General Status	20-04 Feedback 2 Conversion	
16-00 Control Word	20-2* Feedback/Setpoint	
16-01 Reference [Unit]	20-20 Feedback Function	
16-02 Reference [%]	20-48 Sleep Delay Time	
16-03 Status Word	20-49 Wake-Up Delay Time	
16-05 Main Actual Value [%]	20-8* PI Basic Settings	
16-09 Custom Readout	20-81 PI Normal/ Inverse Control	
16-1* Motor Status	20-83 PI Start Speed [Hz]	
16-10 Power [kW]	20-84 On Reference Bandwidth	
16-11 Power [hp]	20-9* PI Controller	
16-12 Motor Voltage	20-91 PI Anti Windup	
16-13 Frequency	20-93 PI Proportional Gain	
16-14 Motor current	20-94 PI Integral Time	
16-15 Frequency [%]	20-97 PI Feed Forward Factor	
16-16 Torque [Nm]	22** Appl. Functions	
16-18 Motor Thermal	22-02 Sleepmode CL Control Mode	
16-22 Torque [%]	22-4* Sleep Mode	
16-3* Drive Status	22-40 Minimum Run Time	
16-30 DC Link Voltage	22-41 Minimum Sleep Time	
16-34 Heatsink Temp.	22-43 Wake-Up Speed [Hz]	
16-35 Inverter Thermal	22-44 Wake-Up Ref/FB Diff	
16-36 Inv. Nom. Current	22-45 Setpoint Boost	
16-37 Inv. Max. Current	22-46 Maximum Boost Time	
16-38 SL Controller State	22-47 Sleep Speed [Hz]	
16-5* Ref. & Feeds	22-6* Broken Belt Detection	
16-50 External Reference	22-60 Broken Belt Function	
16-52 Feedback[Unit]	22-61 Broken Belt Torque	
16-54 Feedback 1 [Unit]	22-62 Broken Belt Delay	
16-55 Feedback 2 [Unit]	24** Appl. Functions 2	

5 Warnings and Alarms

5

Fault number	Alarm/warning bit number	Fault text	Warning	Alarm	Trip locked	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 6-10 Terminal 53 Low Voltage, 6-12 Terminal 53 Low Current, 6-20 Terminal 54 Low Voltage, or 6-22 Terminal 54 Low Current. See also parameter group 6-0* Analog I/O Mode.
4	14	Mains ph. loss	X	X	X	Missing phase on the supply side or too high voltage imbalance. Check the supply voltage. See 14-12 Function at Mains Imbalance.
7	11	DC over volt	X	X	-	Intermediate circuit voltage exceeds the limit.
8	10	DC under volt	X	X	-	Intermediate circuit voltage drops below voltage warning low limit.
9	9	Inverter overload	X	X	-	More than 100% load for a long time.
10	8	Motor ETR over	X	X	-	Motor is too hot due to more than 100% load for a long time. See 1-90 Motor Thermal Protection.
11	7	Motor th over	X	X	-	Thermistor or thermistor connection is disconnected. See 1-90 Motor Thermal Protection.
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 frequency converter. See parameter group 8-0* General Settings.
24	50	Fan Fault	X	X	-	The heat-sink cooling fan is not working (only on 400 V, 30-90 kW units).
30	19	U phase loss	-	X	X	Motor phase U is missing. Check the phase. See 4-58 Missing Motor Phase Function.
31	20	V phase loss	-	X	X	Motor phase V is missing. Check the phase. See 4-58 Missing Motor Phase Function.
32	21	W phase loss	-	X	X	Motor phase W is missing. Check the phase. See 4-58 Missing Motor Phase Function.
38	17	Internal fault	-	X	X	Contact the local Danfoss supplier.
44	28	Earth Fault	-	X	X	Discharge from output phases to ground, using the value of 15-31 Alarm Log Value 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 Unom,Inom	-	X	-	The setting of motor voltage, motor current, and motor power is wrong. Check the settings.
52	-	AMA low Inom	-	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 by the user.

Fault number	Alarm/warning bit number	Fault text	Warning	Alarm	Trip locked	Cause of problem
57	-	AMA timeout	-	X	-	Try to start the AMA again a number of times, until the AMA is carried out. NOTICE Repeated runs may heat the motor to a level where the resistance Rs and Rr are increased. In most cases, however, this is not critical.
58	-	AMA internal	X	X	-	Contact the local Danfoss supplier.
59	25	Current limit	X	-	-	The current is higher than the value in 4-18 Current Limit.
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 frequency converter (via serial communication, digital I/O, or by pressing reset button on keypad).
66	26	Heat sink Temperature Low	X	-	-	This warning is based on the temperature sensor in the IGBT module (on 400 V, 30-90 kW (40-125 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.
80	29	Drive initialised	-	X	-	All parameter settings are initialised 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 parameter group 22-6* Broken Belt Detection.
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 one or more warranty voiding alarms.
250	-	New sparepart	-	X	X	The power or switch mode power supply has been exchanged (on 400 V, 30-90 kW (40-125 HP) and 600 V units). Contact the local Danfoss supplier.
251	-	New Typecode	-	X	X	The frequency converter has a new type code (on 400 V, 30-90 kW (40-125 HP) and 600 V units). Contact the local Danfoss supplier.

Table 5.1 Warnings and Alarms

6 Specifications

6.1 Mains Supply

6.1.1 3x200–240 V AC

Frequency converter	PK25	PK37	PK75	P1K5	P2K2	P3K7	P5K5	P7K5	P11K	P15K	P18K	P22K	P30K	P37K	P45K
Typical shaft output [kW]	0.25	0.37	0.75	1.5	2.2	3.7	5.5	7.5	11.0	15.0	18.5	22.0	30.0	37.0	45.0
Typical shaft output [HP]	0.33	0.5	1.0	2.0	3.0	5.0	7.5	10.0	15.0	20.0	25.0	30.0	40.0	50.0	60.0
IP20 frame	H1	H1	H1	H1	H2	H3	H4	H4	H5	H6	H6	H7	H7	H8	H8
Maximum cable size in terminals (mains, motor) [mm ² (AWG)]	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	16 (6)	16 (6)	16 (6)	35 (2)	35 (2)	50 (1)	50 (1)	95 (0)	120 (4/0)
Output current															
40 °C (104 °F) ambient temperature															
Continuous (3x200–240 V) [A]	1.5	2.2	4.2	6.8	9.6	15.2	22.0	28.0	42.0	59.4	74.8	88.0	115.0	143.0	170.0
Intermittent (3x200–240 V) [A]	1.7	2.4	4.6	7.5	10.6	16.7	24.2	30.8	46.2	65.3	82.3	96.8	126.5	157.3	187.0
Maximum input current															
Continuous 3x200–240 V [A]	1.1	1.6	2.8	5.6	8.6/7.2	14.1/12.0	21.0/18.0	28.3/24.0	41.0/38.2	52.7	65.0	76.0	103.7	127.9	153.0
Intermittent (3x200–240 V) [A]	1.2	1.8	3.1	6.2	9.5/7.9	15.5/13.2	23.1/19.8	31.1/26.4	45.1/42.0	58.0	71.5	83.7	114.1	140.7	168.3
Maximum mains fuses	See chapter 3.2.4 Fuses and Circuit Breakers														
Estimated power loss [W], Best case/typical ¹⁾	12/14	15/18	21/26	48/60	80/102	97/120	182/204	229/268	369/386	512	697	879	1149	1390	1500
Weight enclosure IP20 [kg (lb)]	2.0 (4.4)	2.0 (4.4)	2.0 (4.4)	2.1 (4.6)	3.4 (7.5)	4.5 (9.9)	7.9 (17.4)	7.9 (17.4)	9.5 (20.9)	24.5 (54)	24.5 (54)	36.0 (79.4)	36.0 (79.4)	51.0 (112.4)	51.0 (112.4)
Efficiency [%], best case/typical ²⁾	97.0/96.5	97.3/96.8	98.0/97.6	97.6/97.0	97.1/96.3	97.9/97.4	97.3/97.0	98.5/97.1	97.2/97.1	97.0	97.1	96.8	97.1	97.1	97.3
Output current															
50 °C (122 °F) ambient temperature															
Continuous (3x200–240 V) [A]	1.5	1.9	3.5	6.8	9.6	13.0	19.8	23.0	33.0	41.6	52.4	61.6	80.5	100.1	119
Intermittent (3x200–240 V) [A]	1.7	2.1	3.9	7.5	10.6	14.3	21.8	25.3	36.3	45.8	57.6	67.8	88.6	110.1	130.9

Table 6.1 3x200–240 V AC, 0.25–45 kW (0.33–60 HP)

1) Applies for dimensioning of frequency converter 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 www.danfoss.com/vtenergyefficiency.

2) Efficiency measured at nominal current. For energy efficiency class, see chapter 6.4.13 Ambient Conditions. For part load losses, see www.danfoss.com/vtenergyefficiency.

6.1.2 3x380–480 V AC

Frequency converter	PK37	PK75	P1K5	P2K2	P3K0	P4K0	P5K5	P7K5	P11K	P15K
Typical shaft output [kW]	0.37	0.75	1.5	2.2	3.0	4.0	5.5	7.5	11.0	15.0
Typical shaft output [HP]	0.5	1.0	2.0	3.0	4.0	5.0	7.5	10.0	15.0	20.0
IP20 frame	H1	H1	H1	H2	H2	H2	H3	H3	H4	H4
Maximum cable size in terminals (mains, motor) [mm ² (AWG)]	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	16 (6)	16 (6)
Output current - 40 °C (104 °F) ambient temperature										
Continuous (3x380–440 V) [A]	1.2	2.2	3.7	5.3	7.2	9.0	12.0	15.5	23.0	31.0
Intermittent (3x380–440 V) [A]	1.3	2.4	4.1	5.8	7.9	9.9	13.2	17.1	25.3	34.0
Continuous (3x441–480 V) [A]	1.1	2.1	3.4	4.8	6.3	8.2	11.0	14.0	21.0	27.0
Intermittent (3x441–480 V) [A]	1.2	2.3	3.7	5.3	6.9	9.0	12.1	15.4	23.1	29.7
Maximum input current										
Continuous (3x380–440 V) [A]	1.2	2.1	3.5	4.7	6.3	8.3	11.2	15.1	22.1	29.9
Intermittent (3x380–440 V) [A]	1.3	2.3	3.9	5.2	6.9	9.1	12.3	16.6	24.3	32.9
Continuous (3x441–480 V) [A]	1.0	1.8	2.9	3.9	5.3	6.8	9.4	12.6	18.4	24.7
Intermittent (3x441–480 V) [A]	1.1	2.0	3.2	4.3	5.8	7.5	10.3	13.9	20.2	27.2
Maximum mains fuses	See chapter 3.2.4 Fuses and Circuit Breakers									
Estimated power loss [W], best case/typical ¹⁾	13/15	16/21	46/57	46/58	66/83	95/118	104/131	159/198	248/274	353/379
Weight enclosure IP20 [kg (lb)]	2.0 (4.4)	2.0 (4.4)	2.1 (4.6)	3.3 (7.3)	3.3 (7.3)	3.4 (7.5)	4.3 (9.5)	4.5 (9.9)	7.9 (17.4)	7.9 (17.4)
Efficiency [%], best case/typical ²⁾	97.8/97.3	98.0/97.6	97.7/97.2	98.3/97.9	98.2/97.8	98.0/97.6	98.4/98.0	98.2/97.8	98.1/97.9	98.0/97.8
Output current - 50 °C (122 °F) ambient temperature										
Continuous (3x380–440 V) [A]	1.04	1.93	3.7	4.85	6.3	8.4	10.9	14.0	20.9	28.0
Intermittent (3x380–440 V) [A]	1.1	2.1	4.07	5.4	6.9	9.2	12.0	15.4	23.0	30.8
Continuous (3x441–480 V) [A]	1.0	1.8	3.4	4.4	5.5	7.5	10.0	12.6	19.1	24.0
Intermittent (3x441–480 V) [A]	1.1	2.0	3.7	4.8	6.1	8.3	11.0	13.9	21.0	26.4

Table 6.2 3x380–480 V AC, 0.37–15 kW (0.5–20 HP), Enclosure Type H1–H4

1) Applies for dimensioning of frequency converter 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 www.danfoss.com/vlteneryefficiency.

2) Efficiency measured at nominal current. For energy efficiency class, see chapter 6.4.13 Ambient Conditions. For part load losses, see www.danfoss.com/vlteneryefficiency.

Frequency converter	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K
Typical shaft output [kW]	18.5	22.0	30.0	37.0	45.0	55.0	75.0	90.0
Typical shaft output [HP]	25.0	30.0	40.0	50.0	60.0	70.0	100.0	125.0
IP20 frame	H5	H5	H6	H6	H6	H7	H7	H8
Maximum cable size in terminals (mains, motor) [mm ² (AWG)]	16 (6)	16 (6)	35 (2)	35 (2)	35 (2)	50 (1)	95 (0)	120 (250MCM)
Output current - 40 °C (104 °F) ambient temperature								
Continuous (3x380–440 V)[A]	37.0	42.5	61.0	73.0	90.0	106.0	147.0	177.0
Intermittent (3x380–440 V) [A]	40.7	46.8	67.1	80.3	99.0	116.0	161.0	194.0
Continuous (3x440–480 V) [A]	34.0	40.0	52.0	65.0	80.0	105.0	130.0	160.0
Intermittent (3x440–480 V) [A]	37.4	44.0	57.2	71.5	88.0	115.0	143.0	176.0
Maximum input current								
Continuous (3x380–440 V) [A]	35.2	41.5	57.0	70.0	84.0	103.0	140.0	166.0
Intermittent (3x380–440 V) [A]	38.7	45.7	62.7	77.0	92.4	113.0	154.0	182.0
Continuous (3x440–480 V) [A]	29.3	34.6	49.2	60.6	72.5	88.6	120.9	142.7
Intermittent (3x440–480 V) [A]	32.2	38.1	54.1	66.7	79.8	97.5	132.9	157.0
Maximum mains fuses								
Estimated power loss [W], best case/typical ¹⁾	412/456	475/523	733	922	1067	1133	1733	2141
Weight enclosure IP20 [kg (lb)]	9.5 (20.9)	9.5 (20.9)	24.5 (54)	24.5 (54)	24.5 (54)	36.0 (79.4)	36.0 (79.4)	51.0 (112.4)
Efficiency [%], best case/typical ²⁾	98.1/97.9	98.1/97.9	97.8	97.7	98	98.2	97.8	97.9
Output current - 50 °C (122 °F) ambient temperature								
Continuous (3x380–440 V) [A]	34.1	38.0	48.8	58.4	72.0	74.2	102.9	123.9
Intermittent (3x380–440 V) [A]	37.5	41.8	53.7	64.2	79.2	81.6	113.2	136.3
Continuous (3x440–480 V) [A]	31.3	35.0	41.6	52.0	64.0	73.5	91.0	112.0
Intermittent (3x440–480 V) [A]	34.4	38.5	45.8	57.2	70.4	80.9	100.1	123.2

Table 6.3 3x380–480 V AC, 18.5–90 kW (25–125 HP), Enclosure Type H5–H8

1) Applies for dimensioning of frequency converter 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 www.danfoss.com/vtenergyefficiency.

2) Efficiency measured at nominal current. For energy efficiency class, see chapter 6.4.13 Ambient Conditions. For part load losses, see www.danfoss.com/vtenergyefficiency.

Frequency converter	PK75	P1K5	P2K2	P3K0	P4K0	P5K5	P7K5	P11K	P15K	P18K
Typical shaft output [kW]	0.75	1.5	2.2	3.0	4.0	5.5	7.5	11	15	18.5
Typical shaft output [HP]	1.0	2.0	3.0	4.0	5.0	7.5	10.0	15	20	25
IP54 frame	I2	I2	I2	I2	I2	I3	I3	I4	I4	I4
Maximum cable size in terminals (mains, motor) [mm ² (AWG)]	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	16 (6)	16 (6)	16 (6)
Output current										
40 °C (104 °F) ambient temperature										
Continuous (3x380–440 V) [A]	2.2	3.7	5.3	7.2	9.0	12.0	15.5	23.0	31.0	37.0
Intermittent (3x380–440 V) [A]	2.4	4.1	5.8	7.9	9.9	13.2	17.1	25.3	34.0	40.7
Continuous (3x440–480 V) [A]	2.1	3.4	4.8	6.3	8.2	11.0	14.0	21.0	27.0	34.0
Intermittent (3x440–480 V) [A]	2.3	3.7	5.3	6.9	9.0	12.1	15.4	23.1	29.7	37.4
Maximum input current										
Continuous (3x380–440 V) [A]	2.1	3.5	4.7	6.3	8.3	11.2	15.1	22.1	29.9	35.2
Intermittent (3x380–440 V) [A]	2.3	3.9	5.2	6.9	9.1	12.3	16.6	24.3	32.9	38.7
Continuous (3x440–480 V) [A]	1.8	2.9	3.9	5.3	6.8	9.4	12.6	18.4	24.7	29.3
Intermittent (3 x 440–480 V) [A]	2.0	3.2	4.3	5.8	7.5	10.3	13.9	20.2	27.2	32.2
Maximum mains fuses	See chapter 3.2.4 Fuses and Circuit Breakers									
Estimated power loss [W], best case/typical ¹⁾	21/ 16	46/ 57	46/ 58	66/ 83	95/ 118	104/ 131	159/ 198	248/ 274	353/ 379	412/ 456
Weight enclosure IP54 [kg (lb)]	5.3 (11.7)	5.3 (11.7)	5.3 (11.7)	5.3 (11.7)	5.3 (11.7)	7.2 (15.9)	7.2 (15.9)	13.8 (30.4)	13.8 (30.4)	13.8 (30.4)
Efficiency [%], best case/typical ²⁾	98.0/ 97.6	97.7/ 97.2	98.3/ 97.9	98.2/ 97.8	98.0/ 97.6	98.4/ 98.0	98.2/ 97.8	98.1/ 97.9	98.0/ 97.8	98.1/ 97.9
Output current - 50 °C (122 °F) ambient temperature										
Continuous (3x380–440 V) [A]	1.93	3.7	4.85	6.3	7.5	10.9	14.0	20.9	28.0	33.0
Intermittent (3x380–440 V) [A]	2.1	4.07	5.4	6.9	9.2	12.0	15.4	23.0	30.8	36.3
Continuous (3x440–480 V) [A]	1.8	3.4	4.4	5.5	6.8	10.0	12.6	19.1	24.0	30.0
Intermittent (3x440–480 V) [A]	2.0	3.7	4.8	6.1	8.3	11.0	13.9	21.0	26.4	33.0

Table 6.4 3x380–480 V AC, 0.75–18.5 kW (1-25 HP), Enclosure Type I2–I4

1) Applies for dimensioning of frequency converter 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 www.danfoss.com/vltenergyefficiency.

2) Efficiency measured at nominal current. For energy efficiency class, see chapter 6.4.13 Ambient Conditions. For part load losses, see www.danfoss.com/vltenergyefficiency.

Frequency converter	P22K	P30K	P37K	P45K	P55K	P75K	P90K
Typical shaft output [kW]	22.0	30.0	37.0	45.0	55.0	75.0	90.0
Typical shaft output [HP]	30.0	40.0	50.0	60.0	70.0	100.0	125.0
IP54 frame	16	16	16	17	17	18	18
Maximum cable size in terminals (mains, motor) [mm ² (AWG)]	35 (2)	35 (2)	35 (2)	50 (1)	50 (1)	95 (3/0)	120 (4/0)
Output current							
40 °C (104 ° F) ambient temperature							
Continuous (3x380–440 V) [A]	44.0	61.0	73.0	90.0	106.0	147.0	177.0
Intermittent (3x380–440 V) [A]	48.4	67.1	80.3	99.0	116.6	161.7	194.7
Continuous (3x440–480 V) [A]	40.0	52.0	65.0	80.0	105.0	130.0	160.0
Intermittent (3x440–480 V) [A]	44.0	57.2	71.5	88.0	115.5	143.0	176.0
Maximum input current							
Continuous (3x380–440 V) [A]	41.8	57.0	70.3	84.2	102.9	140.3	165.6
Intermittent (3x380–440 V) [A]	46.0	62.7	77.4	92.6	113.1	154.3	182.2
Continuous (3x440–480 V) [A]	36.0	49.2	60.6	72.5	88.6	120.9	142.7
Intermittent (3 x 440–480 V) [A]	39.6	54.1	66.7	79.8	97.5	132.9	157.0
Maximum mains fuses							
Estimated power loss [W], best case/typical ¹⁾	496	734	995	840	1099	1520	1781
Weight enclosure IP54 [kg (lb)]	27 (59.5)	27 (59.5)	27 (59.5)	45 (99.2)	45 (99.2)	65 (143.3)	65 (143.3)
Efficiency [%], best case/typical ²⁾	98.0	97.8	97.6	98.3	98.2	98.1	98.3
Output current - 50 °C (122 °F) ambient temperature							
Continuous (3x380–440 V) [A]	35.2	48.8	58.4	63.0	74.2	102.9	123.9
Intermittent (3x380–440 V) [A]	38.7	53.9	64.2	69.3	81.6	113.2	136.3
Continuous (3x440–480 V) [A]	32.0	41.6	52.0	56.0	73.5	91.0	112.0
Intermittent (3x440–480 V) [A]	35.2	45.8	57.2	61.6	80.9	100.1	123.2

Table 6.5 3x380–480 V AC, 22–90 kW (30–125 HP), Enclosure Type I6–I8

1) Applies for dimensioning of frequency converter 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 www.danfoss.com/vtenergyefficiency.

2) Efficiency measured at nominal current. For energy efficiency class, see chapter 6.4.13 Ambient Conditions. For part load losses, see www.danfoss.com/vtenergyefficiency.

6.1.3 3x525–600 V AC

Frequency converter	P2K2	P3K0	P3K7	P5K5	P7K5	P11K	P15K	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K
Typical shaft output [kW]	2.2	3.0	3.7	5.5	7.5	11.0	15.0	18.5	22.0	30.0	37	45.0	55.0	75.0	90.0
Typical shaft output [HP]	3.0	4.0	5.0	7.5	10.0	15.0	20.0	25.0	30.0	40.0	50.0	60.0	70.0	100.0	125.0
IP20 frame	H9	H9	H9	H9	H9	H10	H10	H6	H6	H6	H7	H7	H7	H8	H8
Maximum cable size in terminals (mains, motor) [mm ² (AWG)]	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	10 (8)	10 (8)	35 (2)	35 (2)	35 (2)	50 (1)	50 (1)	50 (1)	95 (0)	120 (4/0)
Output current - 40 °C (104 °F) ambient temperature															
Continuous (3x525–550 V) [A]	4.1	5.2	6.4	9.5	11.5	19.0	23.0	28.0	36.0	43.0	54.0	65.0	87.0	105.0	137.0
Intermittent (3x525–550 V) [A]	4.5	5.7	7.0	10.5	12.7	20.9	25.3	30.8	39.6	47.3	59.4	71.5	95.7	115.5	150.7
Continuous (3x551–600 V) [A]	3.9	4.9	6.1	9.0	11.0	18.0	22.0	27.0	34.0	41.0	52.0	62.0	83.0	100.0	131.0
Intermittent (3x551–600 V) [A]	4.3	5.4	6.7	9.9	12.1	19.8	24.2	29.7	37.4	45.1	57.2	68.2	91.3	110.0	144.1
Maximum input current															
Continuous (3x525–550 V) [A]	3.7	5.1	5.0	8.7	11.9	16.5	22.5	27.0	33.1	45.1	54.7	66.5	81.3	109.0	130.9
Intermittent (3x525–550 V) [A]	4.1	5.6	6.5	9.6	13.1	18.2	24.8	29.7	36.4	49.6	60.1	73.1	89.4	119.9	143.9
Continuous (3x551–600 V) [A]	3.5	4.8	5.6	8.3	11.4	15.7	21.4	25.7	31.5	42.9	52.0	63.3	77.4	103.8	124.5
Intermittent (3x551–600 V) [A]	3.9	5.3	6.2	9.2	12.5	17.3	23.6	28.3	34.6	47.2	57.2	69.6	85.1	114.2	137.0
Maximum mains fuses	See chapter 3.2.4 Fuses and Circuit Breakers														
Estimated power loss [W], best case/typical ¹⁾	65	90	110	132	180	216	294	385	458	542	597	727	1092	1380	1658
Weight enclosure IP54 [kg (lb)]	6.6 (14.6)	6.6 (14.6)	6.6 (14.6)	6.6 (14.6)	6.6 (14.6)	11.5 (25.3)	11.5 (25.3)	24.5 (54)	24.5 (54)	24.5 (54)	36.0 (79.3)	36.0 (79.3)	36.0 (79.3)	51.0 (112.4)	51.0 (112.4)
Efficiency [%], best case/typical ²⁾	97.9	97	97.9	98.1	98.1	98.4	98.4	98.4	98.4	98.5	98.5	98.7	98.5	98.5	98.5
Output current - 50 °C (122 °F) ambient temperature															
Continuous (3x525–550 V) [A]	2.9	3.6	4.5	6.7	8.1	13.3	16.1	19.6	25.2	30.1	37.8	45.5	60.9	73.5	95.9
Intermittent (3x525–550 V) [A]	3.2	4.0	4.9	7.4	8.9	14.6	17.7	21.6	27.7	33.1	41.6	50.0	67.0	80.9	105.5
Continuous (3x551–600 V) [A]	2.7	3.4	4.3	6.3	7.7	12.6	15.4	18.9	23.8	28.7	36.4	43.3	58.1	70.0	91.7
Intermittent (3x551–600 V) [A]	3.0	3.7	4.7	6.9	8.5	13.9	16.9	20.8	26.2	31.6	40.0	47.7	63.9	77.0	100.9

Table 6.6 3x525–600 V AC, 2.2–90 kW (3-125 HP), Enclosure Type H6–H10

1) Applies for dimensioning of frequency converter 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 www.danfoss.com/vtenergyefficiency.

2) Efficiency measured at nominal current. For energy efficiency class, see chapter 6.4.13 Ambient Conditions. For part load losses, see www.danfoss.com/vtenergyefficiency.

6.2 EMC Emission Test Results

The following test results have been obtained using a system with a frequency converter, a screened control cable, a control box with potentiometer, and a screened motor cable.

RFI filter type	Conduct emission. Maximum shielded cable length [m]						Radiated emission			
	Industrial environment				Class B		Class A Group 1		Class B	
	Class A Group 2 Industrial environment		Class A Group 1 Industrial environment		Class B Housing, trades and light industries		Class A Group 1 Industrial environment		Class B Housing, trades and light industries	
EN 55011	Category C3 Second environment Industrial		Category C2 First environment Home and office		Category C1 First environment Home and office		Category C2 First environment Home and office		Category C1 First environment Home and office	
EN/IEC 61800-3	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 (EN55011 A1, EN/IEC61800-3 C2)										
0.25–11 kW 3x200–240 V IP20	–	–	25	50	–	20	Yes	Yes	–	No
0.37–22 kW 3x380–480 V IP20	–	–	25	50	–	20	Yes	Yes	–	No
H2 RFI filter (EN 55011 A2, EN/IEC 61800-3 C3)										
15–45 kW 3x200–240 V IP20	25	–	–	–	–	–	No	–	No	–
30–90 kW 3x380–480 V IP20	25	–	–	–	–	–	No	–	No	–
0.75–18.5 kW 3x380–480 V IP54	25	–	–	–	–	–	Yes	–	–	–
22–90 kW 3x380–480 V IP54	25	–	–	–	–	–	No	–	No	–
H3 RFI filter (EN55011 A1/B, EN/IEC 61800-3 C2/C1)										
15–45 kW 3x200–240 V IP20	–	–	50	–	20	–	Yes	–	No	–
30–90 kW 3x380–480 V IP20	–	–	50	–	20	–	Yes	–	No	–
0.75–18.5 kW 3x380–480 V IP54	–	–	25	–	10	–	Yes	–	–	–
22–90 kW 3x380–480 V IP54	–	–	25	–	10	–	Yes	–	No	–

Table 6.7 EMC Emission Test Results

6.3 Special Conditions

6.3.1 Derating for Ambient Temperature and Switching Frequency

The ambient temperature measured over 24 hours should be at least 5 °C lower than the maximum ambient temperature that is specified for the frequency converter. If the frequency converter is operated at a high ambient temperature, the continuous output current should be decreased. For derating curve, see *VLT® HVAC Basic Drive Design Guide*.

6.3.2 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, no derating is necessary. Above 1000 m (3281 ft) the ambient temperature or the maximum output current should be decreased. 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 per 200 m (656 ft).

6.4 General Technical Data

6.4.1 Protection and Features

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

6

6.4.2 Mains Supply (L1, L2, L3)

Supply voltage	200–240 V \pm 10%
Supply voltage	380–480 V \pm 10%
Supply voltage	525–600 V \pm 10%
Supply frequency	50/60 Hz
Maximum imbalance temporary between mains phases	3.0% of rated supply voltage
True power factor (λ)	\geq 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) enclosure frame H1–H5, I2, I3, I4	Maximum 2 times/min.
Switching on the input supply L1, L2, L3 (power-ups) enclosure frame H6–H8, I6–I8	Maximum 1 time/min.
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 RMS symmetrical Amperes, 240/480 V maximum.	

6.4.3 Motor 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

6.4.4 Cable Lengths and Cross Sections

Maximum motor cable length, screened/armoured (EMC correct installation)	See <i>chapter 6.2.1 EMC Emission Test Results</i>
Maximum motor cable length, unscreened/unarmoured	50 m
Maximum cross section to motor, mains ¹⁾	
Cross section DC terminals for filter feedback on enclosure frame H1–H3, I2, I3, I4	4 mm ² /11 AWG
Cross section DC terminals for filter feedback on enclosure frame H4–H5	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 cable	2.5 mm ² /14 AWG
Minimum cross section to control terminals	0.05 mm ² /30 AWG

1) See *chapter 6.1.2 3x380–480 V AC* for more information

6.4.5 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 k Ω
Digital input 29 as thermistor input	Fault: >2.9 k Ω and no fault: <800 Ω
Digital input 29 as Pulse input	Maximum frequency 32 kHz push-pull-driven & 5 kHz (O.C.)

6.4.6 Analog Inputs

Number of analog inputs	2
Terminal number	53, 54
Terminal 53 mode	Parameter 6-19: 1=voltage, 0=current
Terminal 54 mode	Parameter 6-29: 1=voltage, 0=current
Voltage level	0–10 V
Input resistance, R_i	approximately 10 k Ω
Maximum voltage	20 V
Current level	0/4 to 20 mA (scalable)
Input resistance, R_i	<500 Ω
Maximum current	29 mA
Resolution on analog input	10 bit

6.4.7 Analog Output

Number of programmable analog outputs	2
Terminal number	42, 45 ¹⁾
Current range at analog output	0/4–20 mA
Maximum load to common at analog output	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) Terminal 42 and 45 can also be programmed as digital outputs.

6.4.8 Digital Output

Number of digital outputs	2
Terminal number	42, 45 ¹⁾
Voltage level at digital output	17 V
Maximum output current at digital output	20 mA
Maximum load at digital output	1 k Ω

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

6.4.9 Control Card, RS-485 Serial Communication

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

6.4.10 Control Card, 24 V DC Output

Terminal number	12
Maximum load	80 mA

6.4.11 Relay Output

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 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
	30 V DC, 2 A
Maximum terminal load (DC-1) ¹⁾ on 01-03/04-06 (NC) (Resistive load)	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.

6.4.12 Control Card, 10 V DC Output¹⁾

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

1) All inputs, outputs, circuits, DC supplies and relay contacts are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

6.4.13 Ambient Conditions

Enclosure	IP20, IP54
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) frame H1–H5	Class 3C3
Aggressive environment (IEC 60721-3-3), non-coated frame H6–H10	Class 3C2
Aggressive environment (IEC 60721-3-3), coated (optional) frame H6–H10	Class 3C3
Aggressive environment (IEC 60721-3-3), non-coated frame I2–I8	Class 3C2
Test method according to IEC 60068-2-43 H2S (10 days)	
Ambient temperature ¹⁾	See maximum output current at 40/50 °C in <i>chapter 6.1.2 3x380–480 V AC</i>
Minimum ambient temperature during full-scale operation	0 °C
Minimum ambient temperature at reduced performance	-20 °C
Minimum ambient temperature at reduced performance	-10 °C
Temperature during storage/transport	-30 to +65/70 °C
Maximum altitude above sea level without derating	1000 m
Maximum altitude above sea level with derating	3000 m
Derating for high altitude, see <i>chapter 6.3.2 Derating for Low Air Pressure and High Altitudes</i>	
Safety standards	EN/IEC 61800-5-1, UL 508C
EMC standards, Emission	EN 61800-3, EN 61000-6-3/4, EN 55011, IEC 61800-3 EN 61800-3, EN 61000-3-12, EN 61000-6-1/2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4,
EMC standards, Immunity	EN 61000-4-5, EN 61000-4-6
Energy efficiency class	IE2

1) Refer to special conditions in the design guide for:

- Derating for high ambient temperature
- Derating for high altitude

2) Determined according to EN50598-2 at:

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

Index

A

Ambient condition..... 53

Analog input..... 51

Analog output..... 51

C

Cable length..... 50

Circuit breaker..... 17

Connecting to motor..... 11

Control card, 10 V DC output..... 52

Control card, 24 V DC output..... 52

Cross section..... 50

D

Digital input..... 51

Digital output..... 51

Display..... 24

E

Electrical installation..... 9

Electrical overview..... 22

Electronic waste..... 3

Energy efficiency..... 42, 43, 44, 45, 46, 47

Energy efficiency class..... 53

F

Fuse..... 17

H

High voltage..... 4

I

Indicator light..... 24

Installation..... 20

L

L1, L2, L3..... 50

LCP..... 24

Leakage current..... 5

Literature..... 3

Load sharing..... 4

M

Mains supply (L1, L2, L3)..... 50

Mains supply 3x200–240 V AC..... 42

Mains supply 3x380–480 V AC..... 43

Mains supply 3x525–600 V AC..... 47

Menu key..... 24

Motor output (U, V, W)..... 50

Motor protection..... 50

N

Navigation key..... 24

O

Operation key..... 24

Overcurrent protection..... 17

P

Protection..... 17, 50

Q

Qualified personnel..... 4

R

RS-485 serial communication, control card..... 52

S

Safety..... 5

Side-by-side installation..... 6

T

Thermal protection..... 3

U

UL compliance..... 17

Unintended start..... 4

W

Warning and alarm list..... 40



www.danfoss.com/drives

.....
Danfoss can accept no responsibility for possible errors in catalogues, brochures and other printed material. Danfoss reserves the right to alter its products without notice. This also applies to products already on order provided that such alterations can be made without subsequential changes being necessary in specifications already agreed. All trademarks in this material are property of the respective companies. Danfoss and the Danfoss logotype are trademarks of Danfoss A/S. All rights reserved.
.....

Danfoss A/S
Ulsnaes 1
DK-6300 Graasten
www.danfoss.com/drives

