



Quick Guide

VLT® HVAC Basic Drive

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1 Quick Guide

1.1 Safety

1.1.1 Warnings

⚠ WARNING

High Voltage Warning

The voltage of the frequency converter is dangerous whenever it is connected to mains. Incorrect installation of the motor or frequency converter may cause damage to the equipment, serious injury or death. Consequently, it is essential to comply with the instructions in this manual as well as local and national rules and safety regulations.

⚠ WARNING

Electrical Hazard

Touching the electrical parts may be fatal - even after the equipment has been disconnected from mains. Also make sure that other voltage inputs have been disconnected (linkage of DC intermediate circuit). Be aware that there may be high voltage on the DC link even when the LEDs are turned off. Before touching any potentially live parts of the frequency converter, wait at least as stated in the table below:

Voltage (V)	Power range (kW)	Min. waiting time (min.)
3 x 200	0,25 – 3,7	4
3 x 200	5,5 – 11	15
3 x 400	0,37 – 7,5	4
3 x 400	11 – 90	15
3 x 600	2.2 – 7.5	4
3 x 600	11 – 90	15

CAUTION

Leakage Current:

The earth leakage current from the frequency converter exceeds 3.5 mA. According to IEC 61800-5-1 a reinforced Protective Earth connection must be ensured by means of a min. 10mm² Cu or an additional PE wire - with the same cable cross section as the Mains wiring - must be terminated separately.

Residual Current Device:

This product can cause a DC current in the protective conductor. Where a residual current device (RCD) is used for extra protection, only an RCD of Type B (time delayed) shall be used on the supply side of this product. See also Danfoss Application Note on RCD, MN.90.GX.YY.

Protective earthing of the frequency converter and the use of RCDs must always follow national and local regulations.

Motor Thermal Protection:

Motor overload protection is possible by setting Parameter 1-90 Motor thermal protection to the value Electronic Thermal Relay (ETR) trip.

⚠ WARNING

Installation at high altitudes

For altitudes above 2 km, please contact Danfoss regarding PELV.

1.1.2 Safety Instructions

- Make sure the frequency converter is properly connected to earth.
- Do not remove mains connections, motor connections or other power connections while the frequency converter is connected to power.
- Protect users against supply voltage.
- Protect the motor against overloading according to national and local regulations.
- The earth leakage current exceeds 3.5 mA.
- The [OFF] key is not a safety switch. It does not disconnect the frequency converter from mains.

1.2 Introduction

1.2.1 Available Literature

This quick guide contains the basic information necessary for installing and running the frequency converter. If more information is needed, literature can be found on the enclosed cd or downloaded from:

<http://www.danfoss.com/Products/Literature/Technical+Documentation.htm>

1.2.2 Approvals



1.2.3 IT Mains

CAUTION

IT Mains

Installation on isolated mains source, i.e. IT mains.
 Max. supply voltage allowed when connected to mains:
 440V (3x380-480V units).

On IP20 200-240V 0,25-11kW and 380-480V IP20 0,37-22kW, open the RFI switch by removing the screw on the side of the frequency converter when at IT grid.

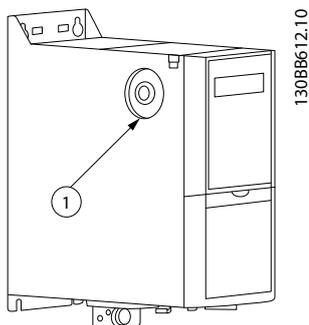


Illustration 1.1 IP20 200-240V 0,25-11kW, IP20 0,37-22kW 380-480V.
 1: EMC screw

On all units, set par. 14-50 RFI filter to OFF when operating in IT mains.

CAUTION

If reinserted, only use M3x12 screw.

1.2.4 Avoid Unintended Start

While the frequency converter is connected to mains, the motor can be started/stopped using digital commands, bus commands, references or via the LCP.

- Disconnect the frequency converter from mains whenever personal safety considerations make it necessary to avoid unintended start of any motors.
- To avoid unintended start, always activate the [OFF] key before changing parameters.

1.2.5 Disposal Instruction



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

1.3 Installation

1.3.1 Before Starting Repair Work

1. Disconnect FC 101 from mains (and external DC supply, if present.)
2. Wait as stated in the table below for discharge of the DC-link:

Voltage (V)	Power range (kW)	Min. waiting time (min.)
3 x 200	0.25 – 3.7	4
3 x 200	5.5 – 45	15
3 x 400	0.37 – 7.5	4
3 x 400	11 – 90	15
3 x 600	2.2 – 7.5	4
3 x 600	11 – 90	15

3. Remove motor cable

1.3.2 Side-by-Side Installation

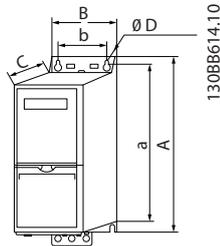
The frequency converter can be mounted side-by-side and requires the clearance above and below for cooling.

Frame	IP class	Power			Clearance above/ below (mm/inch)
		3x200-240V	3 x 380-480V	3 x 525-600V	
H1	IP20	0.25-1.5kW/0.33-2Hp	0.37-1.5kW/0.5-2Hp		100/4
H2	IP20	2.2kW/3Hp	2.2-4kW/3-5.4Hp		100/4
H3	IP20	3.7kW/5Hp	5.5-7.5 kW/7.5-10 Hp		100/4
H4	IP20	5.5-7.5kW/7.5-10Hp	11-15kW/15-20Hp		100/4
H5	IP20	11kW/15 Hp	18.5-22kW/25-30Hp		100/4
H6	IP20	15-18.5Kw/20-25Hp	30-45kW/40-60Hp	22-30kW/30-40Hp	200/7.9
H7	IP20	22-30kW/30-40Hp	55-75kW/100-120Hp	45-55kW/60-100Hp	200/7.9
H8	IP20	37-45kW/50-60Hp	90kW/125Hp	75-90kW/120-125Hp	225/8.9
H9	IP20			2.2-7.5kW/3-10Hp	100/4
H10	IP20			11-15kW/15-20Hp	200/7.9

NOTE

With IP21/Nema Type1 option kit mounted, a distance of 50mm between the units is required.

1.3.3 Mechanical Dimensions



Frame	IP class	Power (kW/HP)		Height (mm/inch)			Width (mm/inch)		Depth (mm/inch)	Hole (mm)
		3x200-240V	3 x 380-480V	A	A incl. Decoupling plate	a	B	b	C	D
H1	IP20	0.25-1.5 kW/ 0.33-2 Hp	0.37-1.5kW/ 0.5-2Hp	195/7.7	273/10.7	183/7.2	75/3	56/2.2	168/6.6	4.5
H2	IP20	2.2 kW/3 Hp	2.2-4kW/ 3-5.4Hp	227/8.4	303/11.9	212/8.3	90/3.5	65/2.6	190/7.5	5.5
H3	IP20	3.7kW/5Hp	5.5-7.5kW/ 7.5-10Hp	255/10	329/13	240/9.4	100/3.9	74/2.9	206/8.1	5.5
H4	IP20	5.5-7.5kW/ 7.5-10Hp	11-15kW/ 15-20Hp	296/11.7	359/14.1	275/10.8	135/5.3	105/4.1	241/9.5	7
H5	IP20	11kW/15Hp	18.5-22kW/ 25-30Hp	334/13.1	402/15.8	314/12.4	150/5.9	120/4.7	255/10	7
H6	IP20	15-18.5kW/ 20-25Hp	30-45kW/ 40-60Hp	518/20.4	595/23.4 635/25	495/19.5	239/31.5	200/7.9	242/9.5	8.5
H7	IP20	22-30kW/ 30-40Hp	55-75kW/ 100-120Hp	550/21.7	630/24.8 690/27.2	521/20.5	313/12.3	270/10.6	335/13.2	8.5
H8	IP20	37-45kW/ 50-60Hp	90kW/ 120Hp	660/26	800/31.5	631/24.8	375/14.8	330/13	335/13.2	8.5

Table 1.1 Mechanical Dimensions

Enclosure		Power [kW]			Height [mm]			Width [mm]		Depth [mm]	Mounting hole [mm]
Frame	IP class	3x200-240V	3x380-480V	3x525-600V	A	A incl Decoupling plate	a	B	b	C	D
H6	20	15-18.5	30-45	22-30	518	595/635	495	239	200	242	8.5
H7	20	22-30	55-75	45-55	550	630/690	521	313	270	335	8.5
H8	20	37-45	90	75-90	660	800	631	375	330	335	8.5
H9	20	-	-	2.2-7.5	268	374	257	130	110	205	5.5
H10	20	-	-	11-15	399	419	380	165	140	248	6.8
I6	54	-	22-37	-	650	-	624	242	210	260	9.0
I7	54	-	45-55	-	680	-	648	308	272	310	9.0
I8	54	-	75-90	-	770	-	739	370	334	335	9.0

1.3.4 Electrical Installation in General

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

Frame	IP class	Power (kW)		Torque (Nm)					
		3 x 200-240V	3 x 380-480	Line	Motor	DC connection	Control terminals	Earth	Relay
H1	IP20	0.25-1.5	0.37-1.5	1.4	0.8	0.8	0.5	3	0.5
H2	IP20	2.2	2.2-4	1.4	0.8	0.8	0.5	3	0.5
H3	IP20	3.7	5.5-7.5	1.4	0.8	0.8	0.5	3	0.5
H4	IP20	5.5-7.5	11-15	1.2	1.2	1.2	0.5	3	0.5
H5	IP20	11	18.5-22	1.2	1.2	1.2	0.5	3	0.5
H6	IP20	15-18	30-45	4.5	4.5	-	0.5	3	0.5
H7	IP20	22-30	55	10	10	-	0.5	3	0.5
H7	IP20	-	75	14	14	-	0.5	3	0.5
H8	IP20	37-45	90	24 ²	24 ²	-	0.5	3	0.5

Frame	IP class	Power (kW)		Torque (Nm)					
		3 x 380-480	Line	Motor	DC connection	Control terminals	Earth	Relay	
I6	IP54	22-37	4.5	4.5	-	0.5	3	0.6	
I7	IP54	45-55	10	10	-	0.5	3	0.6	
I8	IP54	75-90	14/24 ¹	14/24 ¹	-	0.5	3	0.6	

Frame	IP class	Power (kW)		Torque (Nm)					
		3 x 525-600	Line	Motor	DC connection	Control terminals	Earth	Relay	
H9	IP20	2.2-7.5	1.8	1.8	not recommended	0.5	3	0.6	
H10	IP20	11-15	1.8	1.8	not recommended	0.5	3	0.6	
H6	IP20	22-30	4.5	4.5	-	0.5	3	0.5	
H7	IP20	45-55	10	10	-	0.5	3	0.5	
H8	IP20	75-90	14/24 ¹	14/24 ¹	-	0.5	3	0.5	

Table 1.2 Details of Tightening Torques

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

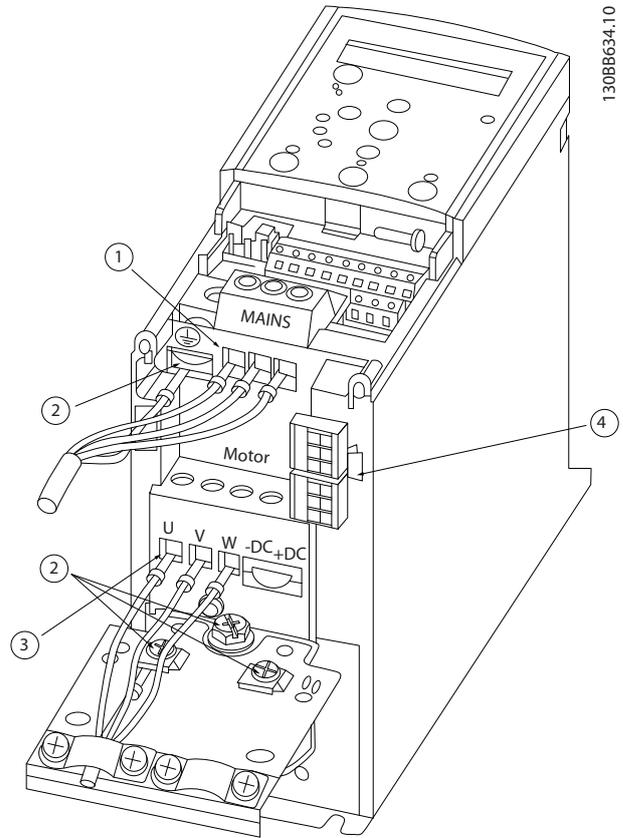
² Cable dimensions $> 95\text{mm}^2$

1.3.5 Connecting to Mains and Motor

IP20 200-240V 0.25-11kW and IP20 380-480V 0.37-22kW.

The frequency converter is designed to operate all standard three-phased asynchronous motors. For maximum cross-section on wires please see section *Mains Supply*.

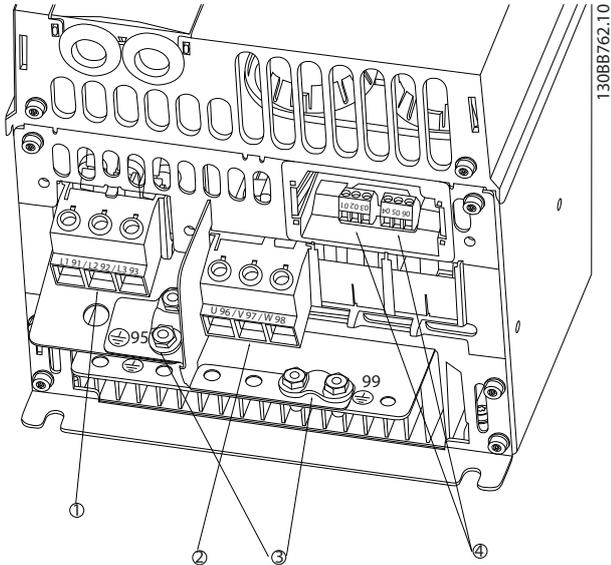
- Use a shielded/armored motor cable to comply with EMC emission specifications, and connect this cable to both the decoupling plate and the motor metal.
 - Keep motor cable as short as possible to reduce the noise level and leakage currents.
 - For further details on mounting of the decoupling plate, please see instruction MI.02.QX.YY
 - Also see *EMC-Correct Installation* in the Design Guide, MG.18.CX.YY.
1. Mount the earth wires to earth terminal.
 2. Connect motor to terminals U, V and W.
 3. Mount mains supply to terminals L1, L2 and L3 and tighten.



1	Line
2	Earth
3	Motor
4	Relays

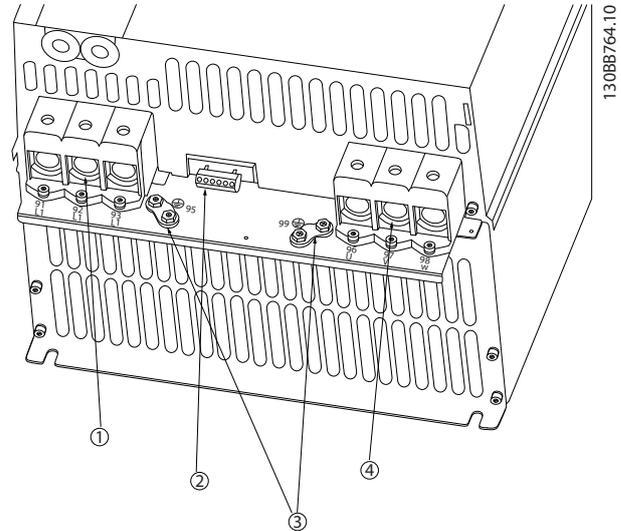
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IP20 380-480V 30-45kW



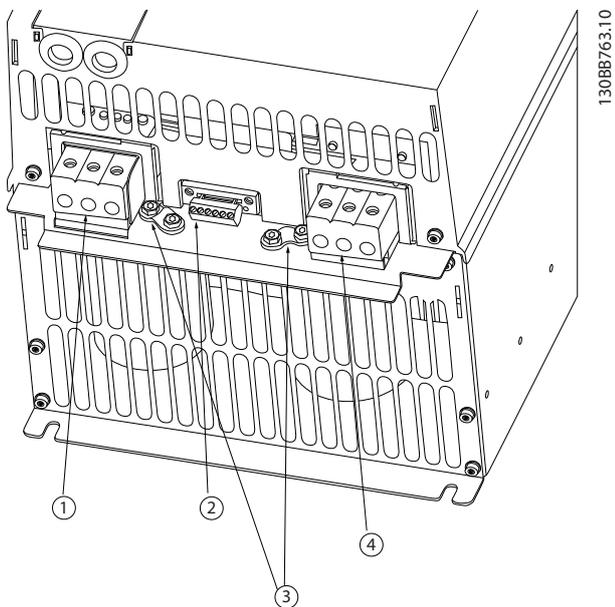
1	Line
2	Motor
3	Earth
4	Relays

IP20 380-480V 90kW



1	Line
2	Relays
3	Earth
4	Motor

IP20 380-480V 55-75kW



1	Line
2	Relays
3	Earth
4	Motor

1.3.6 Fuses

Branch circuit protection

In order 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/international regulations.

Short circuit protection

Danfoss recommends using the fuses mentioned in the following tables 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 national regulations. Fuses must be designed for protection in a circuit capable of supplying a maximum of 100,000A_{rms} (symmetrical), 480V maximum.

Non UL compliance

If UL/cUL is not to be complied with, Danfoss recommends using the fuses mentioned in the below table, which will ensure compliance with IEC 61800-5-1:

In case of malfunction, not following the fuse recommendation may result in damage to the frequency converter.

UL					Non UL
	Bussmann	Bussmann	Bussmann	Bussmann	Max. Fuse
Power kW	Type RK5	Type RK1	Type J	Type T	Type gG
3 x 200-240V					
0.25	FRS-R-10	KTN-R10	JKS-10	JJN-10	10
0.37	FRS-R-10	KTN-R10	JKS-10	JJN-10	10
0.75	FRS-R-10	KTN-R10	JKS-10	JJN-10	10
1.5	FRS-R-10	KTN-R10	JKS-10	JJN-10	10
2.2	FRS-R-15	KTN-R15	JKS-15	JJN-15	16
3.7	FRS-R-25	KTN-R25	JKS-25	JJN-25	25
5.5	FRS-R-50	KTN-R50	JKS-50	JJN-50	50
7.5	FRS-R-50	KTN-R50	JKS-50	JJN-50	50
11	FRS-R-80	KTN-R80	JKS-80	JJN-80	65
3 x 380-480V					
0.37	FRS-R-10	KTS-R10	JKS-10	JJS-10	10
0.75	FRS-R-10	KTS-R10	JKS-10	JJS-10	10
1.5	FRS-R-10	KTS-R10	JKS-10	JJS-10	10
2.2	FRS-R-15	KTS-R15	JKS-15	JJS-15	16
3	FRS-R-15	KTS-R15	JKS-15	JJS-15	16
4	FRS-R-15	KTS-R15	JKS-15	JJS-15	16
5.5	FRS-R-25	KTS-R25	JKS-25	JJS-25	25
7.5	FRS-R-25	KTS-R25	JKS-25	JJS-25	25
11	FRS-R-50	KTS-R50	JKS-50	JJS-50	50
15	FRS-R-50	KTS-R50	JKS-50	JJS-50	50
18.5	FRS-R-80	KTS-R80	JKS-80	JJS-80	65
22	FRS-R-80	KTS-R80	JKS-80	JJS-80	65
30	FRS-R-80	KTS-R80	JKS-R80	JJS-R80	80
37	FRS-R-100	KTS-R100	JKS-R100	JJS-R100	100
45	FRS-R-125	KTS-R125	JKS-R125	JJS-R125	125
55	FRS-R-150	KTS-R150	JKS-R150	JJS-R150	150
75	FRS-R-200	KTS-R200	JKS-R200	JJS-R200	200
90	FRS-R-250	KTS-R250	JKS-R250	JJS-R250	250

1.3.7 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.
- Connect the screen to earth at both ends.
- Avoid installation with twisted screen ends (pigtailed), since this ruins the screening effect at high frequencies. Use the cable clamps provided instead.
- It is important to ensure good electrical contact from the installation plate through the installation screws to the metal cabinet of the frequency converter.
- Use starwashers and galvanically conductive installation plates.
- Do not use unscreened/unarmoured motor cables in the installation cabinets.

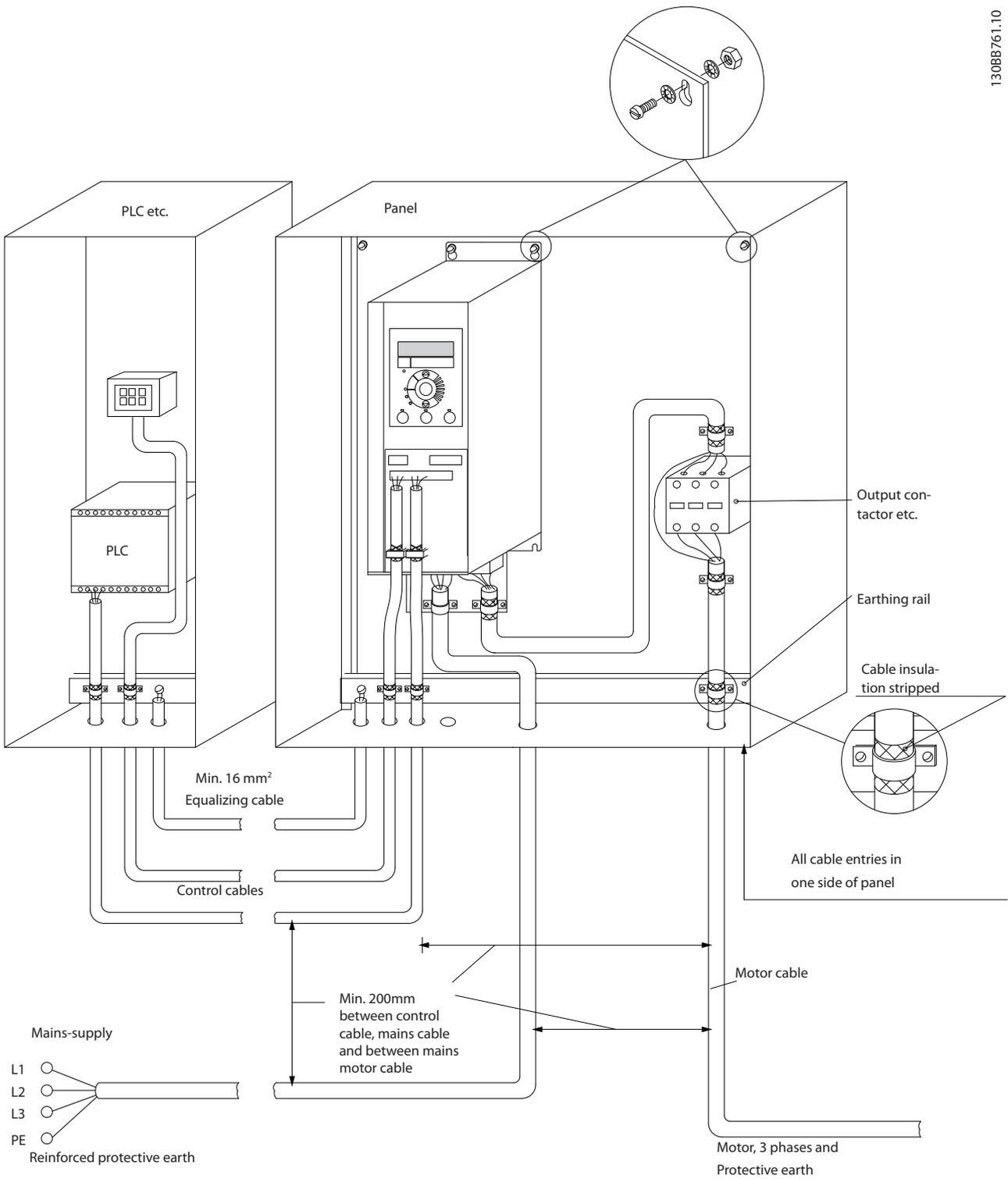


Illustration 1.2 EMC-correct Electrical Installation

For North America use metal conduits instead of shielded cables.

1.3.8 Control Terminals

IP20 200-240V 0.25-11kW and IP20 380-480V 0.37-22kW:

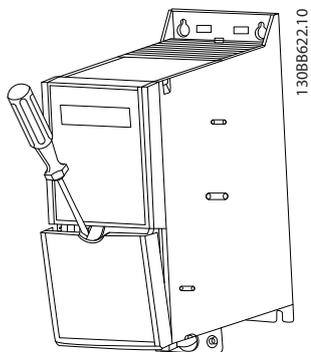
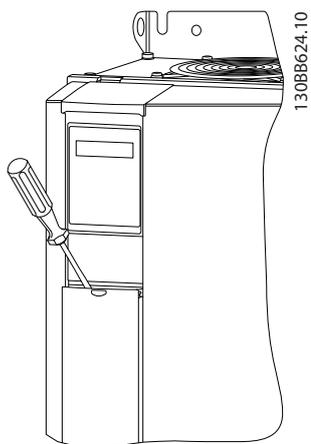


Illustration 1.3 Location of Control Terminals

1. Place a screwdriver behind the terminal cover to activate snap.
2. Tilt the screwdriver outwards to open the cover.

IP20 380-480V 30-90kW.



1. Place a screwdriver behind the terminal cover to activate snap.
2. Tilt the screwdriver outwards to open the cover.

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

Control terminals:

Illustration 1.4 shows all control terminals of the frequency converter. Applying Start (term. 18), connection between terminal 12-27 and an analog reference (term. 53 or 54 and 55) make the frequency converter run.

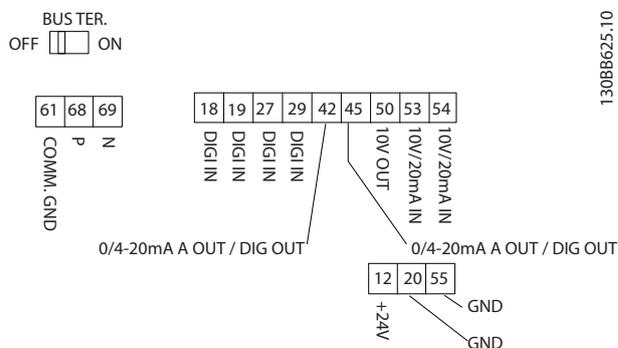
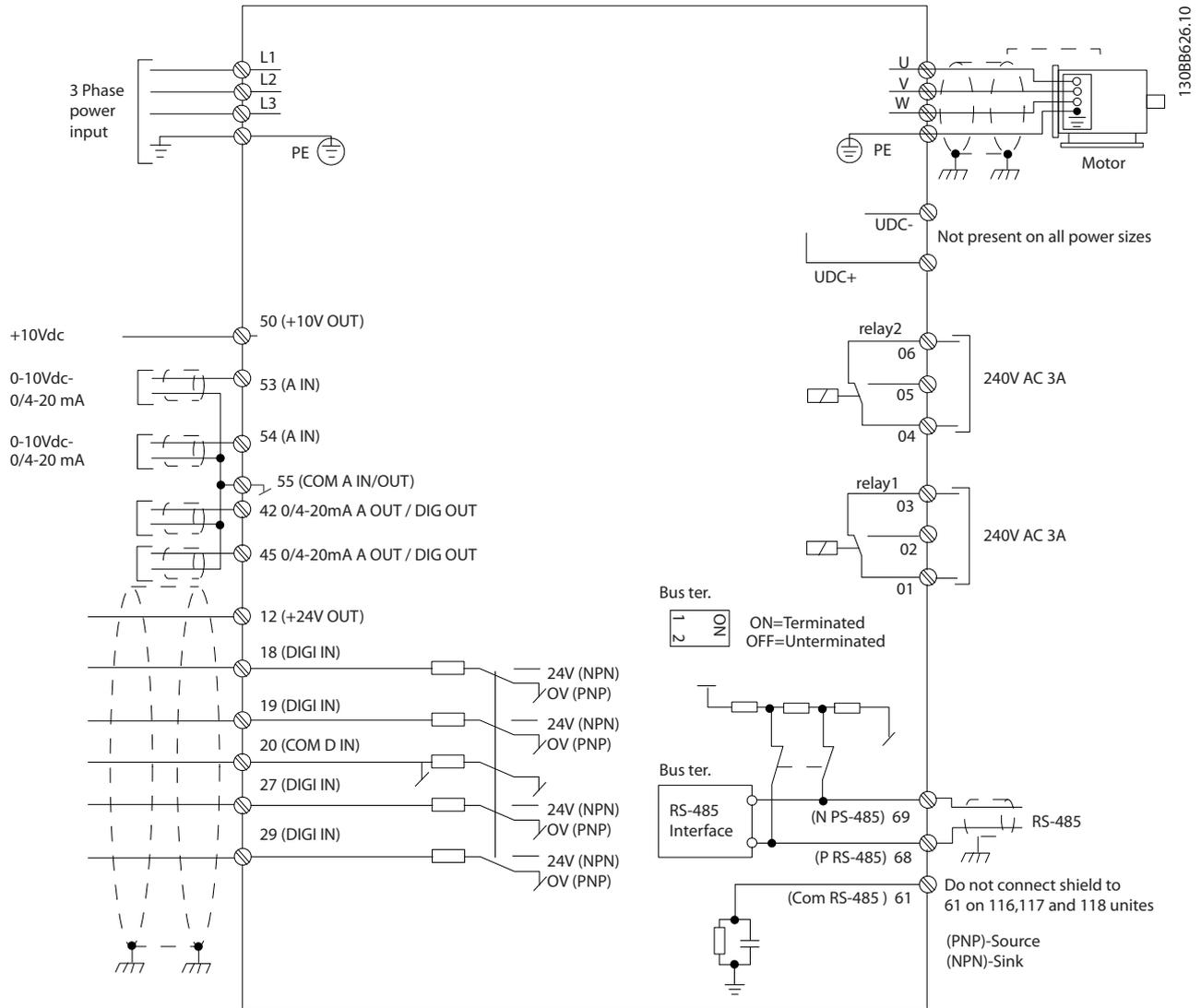


Illustration 1.4 Control Terminals

1.3.9 Electrical Overview



NOTE

Please note there is no access to UDC- and UDC+ on the following units:
IP20 380-480V 30-90kW

1.4 Programming

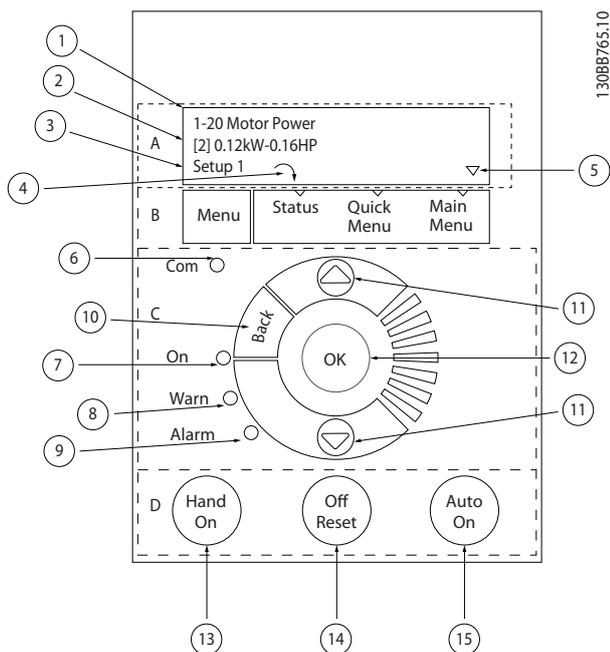
1.4.1 Programming with the Local Control Panel (LCP)

NOTE

The frequency converter can also be programmed from a PC via RS485 com-port by installing the MCT-10 Set-up Software. This software can either be ordered using code number 130B1000 or downloaded from the Danfoss Web site: www.danfoss.com/BusinessAreas/DrivesSolutions/softwaredownload

The following instructions are valid for the FC 101 LCP. The LCP is divided into four functional sections.

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



A. Alpha Numeric Display

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

A number of information 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 (Setup 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.

B. Menu Key

Use the menu key 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.
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	Arrows [▲] [▼]: For maneuvering between parameter groups, parameters and within parameters. Can also be used for setting local reference.
12	[OK]: For selecting a parameter and for accepting changes to parameter settings

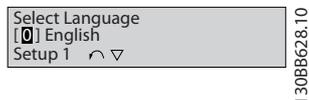
D. Operation keys and indicator lights (LEDs)

13	[Hand on]: Starts the motor and enables control of the frequency converter via the LCP. NOTE Please note that terminal 27 Digital Input (5-12 Terminal 27 Digital Input) has coast inverse as default setting. This means that [Hand On] will not start the motor if there is no 24V to terminal 27, so please connect terminal 12 to terminal 27.
14	[Off/Reset]: Stops the motor (off). If in alarm mode the alarm will be reset.
15	[Auto on]: Frequency converter is controlled either via control terminals or serial communication.

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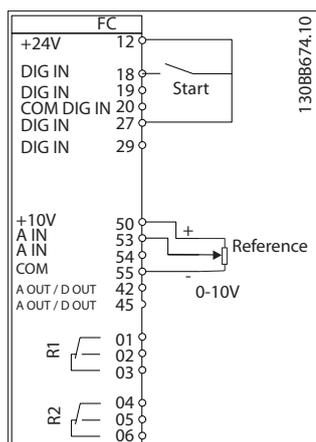
At power-up

At the first power-up the user is asked to choose preferred language. Once selected this screen will never be shown again in the following powerups, but language can still be changed in *0-01 Language*.



1.4.2 The Start-up Wizard for Open Loop Applications

The built in “wizard” menu guides the installer through the set up of the drive in a clear and structured manner in order to setup an open loop application. A open loop application is here an application with a start signal, analog reference (voltage or current) and optionally also relay signals (but no feed back signal from the process applied).

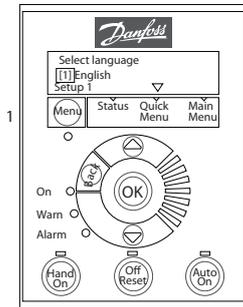


The wizard will initially be shown after power up until any parameter has been changed. The wizard can always be accessed again through the quick menu. Press [OK] to start the wizard. If [BACK] is pressed, the FC 101 will return to the status screen.



1308B993.10

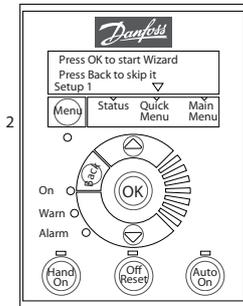
At power up the user is asked to choose the preferred language.



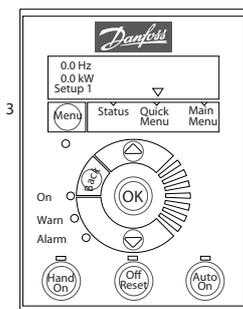
Power Up Screen



The next screen will be the Wizard screen.



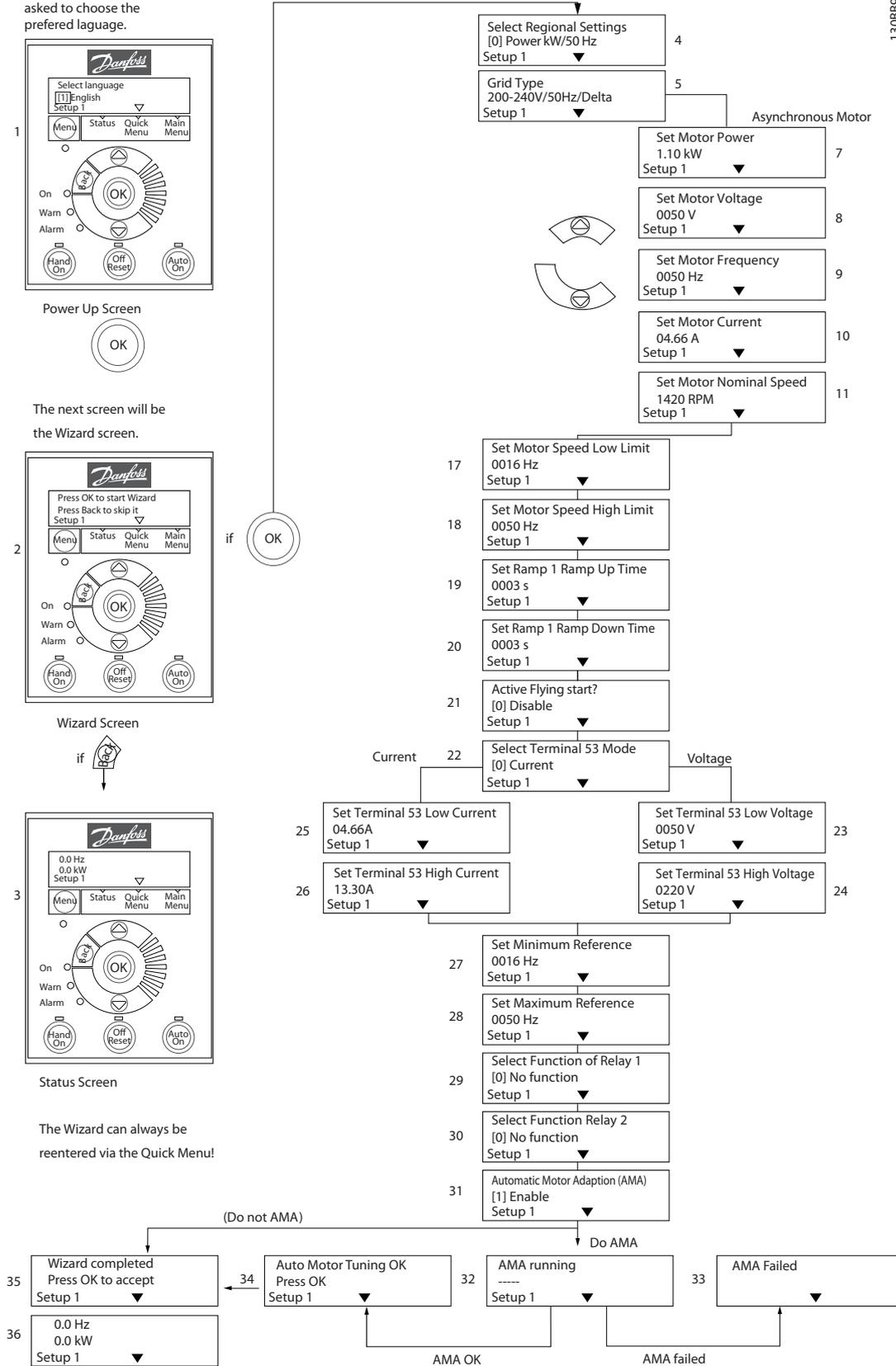
Wizard Screen



Status Screen

The Wizard can always be reentered via the Quick Menu!

- the HVAC FC 101 Wizard starts



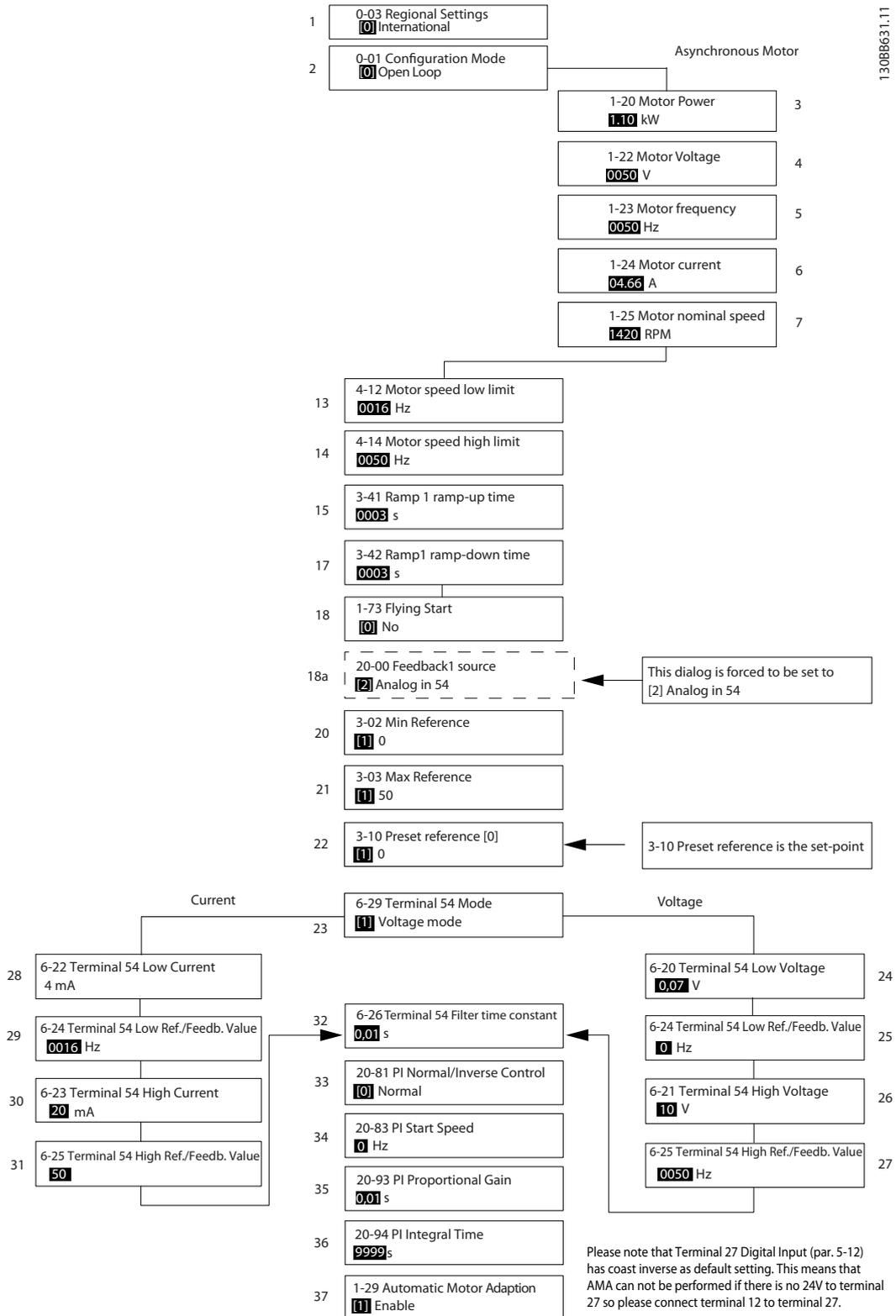
The FC 101 Start-up Wizard for Open Loop Applications

No & Name	Range	Default	Function
0-03 Regional Settings	[0] International [1] US	0	
0-06 Grid Type	0] 200-240V/50Hz/IT-grid [1] 200-240V/50Hz/Delta [2] 200-240V/50Hz [10] 380-440V/50Hz/IT-grid [11] 380-440V/50Hz/Delta [12] 380-440V/50Hz [20] 440-480V/50Hz/IT-grid [21] 440-480V/50Hz/Delta [22] 440-480V/50Hz [30] 525-600V/50Hz/IT-grid [31] 525-600V/50Hz/Delta [32] 525-600V/50Hz [100] 200-240V/60Hz/IT-grid [101] 200-240V/60Hz/Delta [102] 200-240V/60Hz [110] 380-440V/60Hz/IT-grid [111] 380-440V/60Hz/Delta [112] 380-440V/60Hz [120] 440-480V/60Hz/IT-grid [121] 440-480V/60Hz/Delta [122] 440-480V/60Hz [130] 525-600V/60Hz/IT-grid [131] 525-600V/60Hz/Delta [132] 525-600V/60Hz	Size related	Select operating mode for restart upon reconnection of the drive to mains voltage after power down
1-20 Motor Power	0.12-110kW/0.16-150hp	Size related	Enter motor power from nameplate data
1-22 Motor Voltage	50.0 - 1000.0V	Size related	Enter motor voltage from nameplate data
1-23 Motor Frequency	20.0 - 400.0Hz	Size related	Enter motor frequency from nameplate data
1-24 Motor Current	0.01 - 10000.00A	Size related	Enter motor current from nameplate data
1-25 Motor Nominal Speed	100.0 - 9999.0 RPM	Size related	Enter motor nominal speed from nameplate data
4-12 Motor Speed Low Limit [Hz]	0.0 - 400 Hz	0 Hz	Enter the minimum limit for low speed
4-14 Motor Speed High Limit [Hz]	0.0 - 400 Hz	65 Hz	Enter the maximum limit for high speed
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
1-73 Flying Start	[0] Disabled [1] Enabled	0	Select Enable to enable the frequency converter to catch a spinning motor i.e. fan applications
6-19 Terminal 53 mode	[0] Current [1] Voltage	1	Select if terminal 53 is used for current- or voltage input
6-10 Terminal 53 Low Voltage	0-10V	0.07V	Enter the voltage that corresponds to the low reference value
6-11 Terminal 53 High Voltage	0-10V	10V	Enter the voltage that corresponds to the high reference value
6-12 Terminal 53 Low Current	0-20mA	4	Enter the current that corresponds to the low reference value
6-13 Terminal 53 High Current	0-20mA	20	Enter the current that corresponds to the high reference value
3-02 Minimum Reference	-4999-4999	0	The minimum reference is the lowest value obtainable by summing all references

No & Name	Range	Default	Function
3-03 Maximum Reference	-4999-4999	50	The maximum reference is the lowest obtainable by summing all references
5-40 Function Relay [0] Function relay	See <i>5-40 Function Relay</i>	Alarm	Select the function to control output relay 1
5-40 Function Relay [1] Function relay	See <i>5-40 Function Relay</i>	Drive running	Select the function to control output relay 2
1-29 Auto Tune	See <i>1-29 Auto Tune</i>	Off	Performing an AMA optimizes motor performance

1

Closed Loop Set-up Wizard



Please note that Terminal 27 Digital Input (par. 5-12) has coast inverse as default setting. This means that AMA can not be performed if there is no 24V to terminal 27 so please connect terminal 12 to terminal 27.

Closed Loop Set-up Wizard

No & Name	Range	Default	Function
0-03 Regional Settings	[0] International [1] US	0	
1-20 Motor power	0.09-110kW	Size related	Enter motor power from nameplate data
1-22 Motor Voltage	50.0 - 1000.0V	Size related	Enter motor voltage from nameplate data
1-23 Motor Frequency	20.0 - 400.0Hz	Size related	Enter motor frequency from nameplate data
1-24 Motor Current	0.01 - 10000.00A	Size related	Enter motor current from nameplate data
1-25 Motor Nominal Speed	100.0 - 9999.0RPM	Size related	Enter motor nominal speed from nameplate data
4-12 Motor Speed Low Limit [Hz]	0.0 - Hz	0.0 Hz	Enter the minimum limit for low speed
4-14 Motor Speed High Limit [Hz]	0-Hz	65Hz	
3-41 Ramp 1 Ramp up time	0.05 - 3600.0 s	Size related	Ramp up time from 0 to rated motor frequency par. 1-23
3-42 Ramp 1 Ramp down time	0.05 - 3600.0 s	Size related	Ramp down time from rated motor frequency par. 1-23 to 0
1-73 Flying Start	[0] Disabled [1] Enabled	0	Select Enable to enable the drive to catch a spinning motor
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
6-29 Terminal 54 mode	[0] Current [1] Voltage	1	Select if terminal 54 is used for current- or voltage input
6-20 Terminal 53 Low Voltage	0-10V	0.07V	Enter the voltage that corresponds to the low reference value
6-21 Terminal 53 High Voltage	0-10V	10V	Enter the voltage that corresponds to the low high reference value
6-22 Terminal 60 Low Current	0-20mA	4	Enter the current that corresponds to the high reference value
6-23 Terminal 60 High Current	0-20mA	20	Enter the current that corresponds to the high reference value
6-24 Terminal 60 Low Ref./Feedb. Value	-4999-4999	0	Enter the feedback value that corresponds to the voltage or current set in par. 6-20/6-22
6-25 Terminal 60 High Ref./Feedb. Value	-4999-4999	50	Enter the feedback value that corresponds to the voltage or current set in par. 6-21/6-23
6-26 Terminal 60 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 <i>Normal</i> [0] to set the process control to increase the output speed when the process error is positive. Select <i>Inverse</i> [1] to reduce the output speed.
20-83 PI Start Speed	0-200Hz	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
1-29 Automatic Motor Adaption (AMA)		Off	Performing an AMA optimizes motor performance

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Motor Set-up

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

No & Name	Range	Default	Function
0-03 Regional Settings	[0] International [1] US	0	
1-20 Motor power	0.12-110kW/ 0.16-150Hp	Size related	Enter motor power from nameplate data
1-22 Motor Voltage	50.0 - 1000.0V	Size related	Enter motor voltage from nameplate data
1-23 Motor Frequency	20.0 - 400.0Hz	Size related	Enter motor frequency from nameplate data
1-24 Motor Current	0.01 - 10000.00A	Size related	Enter motor current from nameplate data
1-25 Motor Nominal Speed	100.0 - 9999.0 RPM	Size related	Enter motor nominal speed from nameplate data
4-12 Motor Speed Low Limit [Hz]	0.0 - Hz	0.0 Hz	Enter the minimum limit for low speed
4-14 Motor Speed High Limit [Hz]	0-HZ	65	
3-41 Ramp 1 Ramp up time	0.05 - 3600.0 s	Size related	Ramp up time from 0 to rated motor frequency par. 1-23
3-42 Ramp 1 Ramp down time	0.05 - 3600.0 s	Size related	Ramp down time from rated motor frequency par. 1-23 to 0
1-73 Flying Start	[0] Disabled [1] Enabled	0	Select Enable to enable the drive to catch a spinning motor

Changes Made

Changes Made lists all parameters changed since factory setting. Only the changed parameters in current edit-setup are listed in changes made.

If the parameter's value is changed back to factory setting's value from another different value, the parameter will NOT be listed in Changes Made.

1. Press [MENU] key to enter the Quick Menu until indicator in display is placed above Quick Menu.
2. Press [▲] [▼] to select either FC 101 wizard, closed loop setup, motor setup 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 "Main Menu".

The Main Menu accesses all parameters.

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

1.5 Parameter Overview

Parameter Overview			
<p>0-** Operation / Display</p> <p>0-0* Basic Settings</p> <p>0-01 Language</p> <p>*[0] English</p> <p>[1] Deutsch</p> <p>[2] Francais</p> <p>[3] Dansk</p> <p>[4] Espanol</p> <p>[5] Italiano</p> <p>[28] Portuguese</p> <p>[255] No Text</p> <p>0-03 Regional Settings</p> <p>*[0] International</p> <p>[1] US</p> <p>0-04 Operating State at Power-up</p> <p>*[0] Resume</p> <p>[1] Forced stop, ref=old</p> <p>0-06 GridType</p> <p>0] 200-240V/50Hz/IT-grid</p> <p>[1] 200-240V/50Hz/Delta</p> <p>[2] 200-240V/50Hz</p> <p>[10] 380-440V/50Hz/IT-grid</p> <p>[11] 380-440V/50Hz/Delta</p> <p>[12] 380-440V/50Hz</p> <p>[20] 440-480V/50Hz/IT-grid</p> <p>[21] 440-480V/50Hz/Delta</p> <p>[22] 440-480V/50Hz</p> <p>[30] 525-600V/50Hz/IT-grid</p> <p>[31] 525-600V/50Hz/Delta</p> <p>[32] 525-600V/50Hz</p> <p>[100] 200-240V/60Hz/IT-grid</p> <p>[101] 200-240V/60Hz/Delta</p> <p>[102] 200-240V/60Hz</p> <p>[110] 380-440V/60Hz/IT-grid</p> <p>[111] 380-440V/60Hz/Delta</p> <p>[112] 380-440V/60Hz</p> <p>[120] 440-480V/60Hz/IT-grid</p> <p>[121] 440-480V/60Hz/Delta</p> <p>[122] 440-480V/60Hz</p> <p>[130] 525-600V/60Hz/IT-grid</p> <p>[131] 525-600V/60Hz/Delta</p> <p>[132] 525-600V/60Hz</p> <p>0-07 Auto DC Braking IT</p> <p>[0] Off</p> <p>*[1] On</p> <p>0-1* Set-up Operations</p> <p>0-10 Active Set-up</p> <p>*[1] Set-up 1</p> <p>[2] Set-up 2</p> <p>[9] Multi Set-up</p> <p>0-11 Programming Set-up</p> <p>[1] Set-up 1</p>	<p>[2] Set-up 2</p> <p>*[9] Active Set-up</p> <p>0-12 Link Setups</p> <p>[0] Not linked</p> <p>*[20] Linked</p> <p>0-3* LCP Readout</p> <p>0-30 Custom Readout Unit</p> <p>[0] None</p> <p>*[1] %</p> <p>[5] PPM</p> <p>[10] 1/Min</p> <p>[11] RPM</p> <p>[12] Pulse/s</p> <p>[20] l/s</p> <p>[21] l/min</p> <p>[22] l/h</p> <p>[23] m3/s</p> <p>[24] m3/min</p> <p>[25] m3/h</p> <p>[30] kg/s</p> <p>[31] kg/min</p> <p>[32] kg/h</p> <p>[33] t/min</p> <p>[34] t/h</p> <p>[40] m/s</p> <p>[41] m/min</p> <p>[45] m</p> <p>[60] Degree Celsius</p> <p>[70] mbar</p> <p>[71] bar</p> <p>[72] Pa</p> <p>[73] kPa</p> <p>[74] m Wg</p> <p>[80] kW</p> <p>[120] GPM</p> <p>[121] gal/s</p> <p>[122] gal/min</p> <p>[123] gal/h</p> <p>[124] CFM</p> <p>[127] ft3/h</p> <p>[140] ft/s</p> <p>[141] ft/min</p> <p>[160] Degree Fahr</p> <p>[170] psi</p> <p>[171] lb/in2</p> <p>[172] in WG</p> <p>[173] ft WG</p> <p>[180] HP</p> <p>0-31 Custom Readout Min Value</p> <p>0.00 - 1,000,000.0, * 0.00</p> <p>0-32 Custom Readout Max Value</p> <p>0.00 - 1,000,000.0, * 100.00</p> <p>0-37 Display Text 1</p> <p>0-38 Display Text 2</p>	<p>0-39 Display Text 3</p> <p>0-4* LCP Keypad</p> <p>0-40 [Hand on] Key on LCP</p> <p>[0] Disabled</p> <p>*[1] Enabled</p> <p>0-44 [Off / Reset] Key on LCP</p> <p>[0] Disable All</p> <p>*[1] Enable All</p> <p>[7] Enable Reset Only</p> <p>0-42 [Auto on] Key on LCP</p> <p>[0] Disabled</p> <p>*[1] Enabled</p> <p>0-5* Copy/Save</p> <p>0-50 LCP Copy</p> <p>*[0] No copy</p> <p>[1] All to LCP</p> <p>[2] All from LCP</p> <p>[3] Size indep. from LCP</p> <p>0-51 Set-up Copy</p> <p>*[0] No copy</p> <p>[1] Copy from setup 1</p> <p>[2] Copy from setup 2</p> <p>[9] Copy from Factory setup</p> <p>0-6* Password</p> <p>0-60 Main Menu Password</p> <p>0 - 999, * 0</p> <p>1-** Load and Motor</p> <p>1-0* General Settings</p> <p>1-00 Configuration Mode</p> <p>*[0] Open loop</p> <p>[3] Closed loop</p> <p>1-01 Motor Control Principle</p> <p>[0] U/f</p> <p>*[1] VVC+</p> <p>1-03 Torque Characteristics</p> <p>*[1] Variable torque</p> <p>[3] Auto Energy Optim.</p> <p>1-06 Clockwise Direction</p> <p>*[0] Normal</p> <p>[1] Inverse</p> <p>1-20 Motor Power</p> <p>[2] 0.12kW - 0.16Hp</p> <p>[3] 0.18kW - 0.25Hp</p> <p>[4] 0.25kW - 0.33Hp</p> <p>[5] 0.37 kW - 0.50Hp</p> <p>[6] 0.55 kW - 0.75Hp</p> <p>[7] 0.75 kW - 1.00Hp</p> <p>[8] 1.10 kW - 1.50Hp</p> <p>[9] 1.50 kW - 2.00Hp</p> <p>[10] 2.20 kW - 3.00Hp</p> <p>[11] 3.00 kW - 4.00Hp</p> <p>[12] 3.70 kW - 5.00Hp</p> <p>[13] 4.00 kW - 5.40Hp</p> <p>[14] 5.50 kW - 7.50Hp</p>	<p>[15] 7.50 kW - 10.0Hp</p> <p>[16] 11.00 kW - 15.00Hp</p> <p>[17] 15.00kW - 20Hp</p> <p>[18] 18.5kW - 25Hp</p> <p>[19] 22kW - 30Hp</p> <p>[20] 30kW - 40Hp</p> <p>[21] 37kW-50Hp</p> <p>[22] 45kW-60Hp</p> <p>[23] 55kW-75Hp</p> <p>[24] 75kW-100Hp</p> <p>[25] 90kW-120Hp</p> <p>[26] 110kW-150Hp</p> <p>1-22 Motor Voltage</p> <p>50 - 1000V</p> <p>1-23 Motor Frequency</p> <p>20 - 400, *(50)Hz</p> <p>1-24 Motor Current</p> <p>0.01 - (26.00), [A]</p> <p>1-25 Motor Nominal Speed</p> <p>100 rpm - 6000 rpm,</p> <p>1-29 Automatic Motor Adaption (AMA)</p> <p>*[0] Off</p> <p>[1] Enable Complete AMA</p> <p>[2] Enable Reduced AMA</p> <p>1-3* Adv. Motor Data I</p> <p>1-30 Stator Resistance (Rs)</p> <p>0.000 ohm - 99.990 ohm</p> <p>1-33 Stator Leakage Reactance (X1)</p> <p>0.000 ohm - 999.900 ohm</p> <p>1-35 Main Reactance (Xh)</p> <p>0.00 - 999.90 ohm</p> <p>1-39 Motor Poles</p> <p>2 - 100, * 4</p> <p>1-4* Adv. Motor Data II</p> <p>1-42 Motor Cable Length</p> <p>0 - 150, * 50m</p> <p>1-43 Motor Cable Length Feet</p> <p>0 - 431, * 144</p> <p>1-5* Load Indep. Setting</p> <p>1-50 Motor Magnetisation at Zero Speed</p> <p>0 - 300, * 100%</p> <p>1-52 Min Speed Normal Magnetising [Hz]</p> <p>0.0 - 10.0, * 0.0</p> <p>1-55 U/f Characteristic - U</p> <p>0 - 999V, *0V</p> <p>1-56 U/f Characteristic - F</p> <p>0 - 400Hz, *(0)</p> <p>1-6* Load Depend. Setting</p> <p>1-62 Slip Compensation</p> <p>-400 - 399%, * 0%</p>

Parameter Overview			
<p>1-63 Slip Compensation Time Constant 0.05 - 5.00s, * 0.10</p> <p>1-64 Resonance Dampening 0 - 500%, * 100</p> <p>1-65 Resonance Dampening Time Constant 0.001 - 0.050s, * 0.005</p> <p>1-7* Start Adjustments</p> <p>1-71 Start Delay 0.0 - 10.0s, * 0.0</p> <p>1-72 Start Function [0] DC Hold/delay time *[2] Coast/delay time</p> <p>1-73 Flying Start *[0] Disabled [1] Enabled</p> <p>1-8* Stop Adjustments</p> <p>1-80 Function at Stop *[0] Coast [1] DC hold/MotorPreheat</p> <p>1-82 Min Speed for Function at Stop [Hz] 0.0 - 20.0Hz, * 0.0</p> <p>1-9* Motor Temperature</p> <p>1-90 Motor Thermal Protection *[0] No protection [1] Thermistor warning [2] Thermistor trip [3] ETR warning 1 [4] ETR trip 1</p> <p>1-93 Thermistor Resource *[0] None [1] Analog input 53 [6] Digital input 29</p> <p>2-** Brakes</p> <p>2-0* DC-Brake</p> <p>2-00 DC Hold/Motor Preheat Current 0 - 160%, * 50</p> <p>2-01 DC Brake Current 0 - 150%, * 50</p> <p>2-02 DC Braking Time 0.0 - 60.0s, * 10.0</p> <p>2-04 DC Brake Cut In Speed 0.0 - 400.0Hz, * 0.0</p> <p>2-1* Brake Energy Funct.</p> <p>2-17 Over-voltage Control [0] Disabled *[2] Enabled</p> <p>3-** Reference / Ramps</p> <p>3-0* Reference Limits</p> <p>3-02 Minimum Reference (-4999.000) - 4999.000, * 0.000</p> <p>3-03 Maximum Reference (-4999.000) - 4999.000, * 50.000</p>	<p>3-1* References</p> <p>3-10 Preset Reference -100.00 - 100.00%, * 0.00</p> <p>3-11 Jog Speed [Hz] 0.0 - 400.0Hz, * 5.0</p> <p>3-14 Preset Relative Reference -100.00 - 100.00, * 0.00</p> <p>3-15 Reference Resource 1 [0] No function *[1] Analog in 53 [2] Analog in 54 [11] Local bus reference</p> <p>3-16 Reference 2 Resource [0] No function [1] Analog in 53 *[2] Analog in 54 [11] Local bus reference</p> <p>3-17 Reference 3 Resource [0] No function [1] Analog in 53 [2] Analog in 54 *[11] Local bus reference</p> <p>3-4* Ramp 1</p> <p>3-41 Ramp 1 Ramp up Time 0.05 - 3600.00s, *Size related</p> <p>3-42 Ramp 1 Ramp Down Time 0.05 - 3600.00s, *Size related</p> <p>3-5* Ramp 2</p> <p>3-51 Ramp 2 Ramp up Time 0.05 - 3600.00s, *Size related</p> <p>3-52 Ramp 2 Ramp down Time 0.05 - 3600.00s, *Size related</p> <p>3-8* Other Ramps</p> <p>3-80 Jog Ramp Time 0.05 - 3600.00s, *Size related</p> <p>3-81 Quick Stop Ramp Time 0.05 - 3600.00s, *Size related</p> <p>4-** Limits / Warnings</p> <p>4-1* Motor Limits</p> <p>4-10 Motor Speed Direction [0] Clockwise *[2] Both directions</p> <p>4-12 Motor Speed Low Limit [Hz] 0.0 - 400Hz, * 0.0Hz</p> <p>4-14 Motor Speed High Limit [Hz] 0.1 - 400Hz, * 65.0Hz</p> <p>4-18 Current Limit 0 - 300%, * 110</p> <p>4-19 Max Output Frequency 0.0 - 400.0Hz, * 65.0</p> <p>4-4* Adj. Warnings 2</p> <p>4-40 Warning Freq. Low 0.0-400.0Hz, *400.0</p> <p>4-41 Warning Freq. High 0.0-400.0Hz, *400.0</p> <p>4-5* Adj. Warnings</p> <p>4-50 Warning Current Low</p>	<p>0.00 - 194.00A, * 0.00</p> <p>4-51 Warning Current High 0.00 - 194.00A, * 194.00</p> <p>4 -54 Warning Reference Low -4999.000 - 4999.000, *-4999.000</p> <p>4 -55 Warning Reference High -4999.000 - 4999.000, *4999.000</p> <p>4 -56 Warning Feedback Low -4999.000 - 4999.000, *-4999.000</p> <p>4 -57 Warning Feedback High -4999.000 - 4999.000, *4999.000</p> <p>4-58 Missing Motor Phase Function [0] Off *[1] On</p> <p>4-6* Speed Bypass</p> <p>4-61 Bypass Speed From [Hz] 0.0 - 400.0, * 0.0</p> <p>4-63 Bypass Speed To [Hz] 0.0 - 400.0, * 0.0</p> <p>4-64 Semi-Auto Bypass Set-up *[0] Off [1] Enable</p> <p>5-** Digital In/Out</p> <p>5-0* Digital I/O mode 5-00 Digital Input Mode *[0] PNP [1] NPN</p> <p>5-03 Digital Input 29 Mode *[0] PNP [1] NPN</p> <p>5-1* Digital Inputs</p> <p>5-10 Terminal 18 Digital Input [0] No operation [1] Reset [2] Coast inverse [3] Coast and reset inverse [4] Quick stop inverse [5] DC-brake inverse [6] Stop inverse [7] External Interlock *[8] Start [9] Latched start [10] Reversing [11] Start reversing [14] Jog [16] Preset ref bit 0 [17] Preset ref bit 1 [18] Preset ref bit 2 [19] Freeze reference [20] Freeze output [21] Speed up [22] Speed down [23] Set-up select bit 0 [34] Ramp bit 0 [37] Fire mode [52] Run permissive [53] Hand Start</p>	<p>[54] Auto start</p> <p>[60] Counter A (up)</p> <p>[61] Counter A (down)</p> <p>[62] Reset Counter A</p> <p>[63] Counter B (up)</p> <p>[64] Counter B (down)</p> <p>[65] Reset Counter B</p> <p>5-11 Terminal 19 Digital Input See par. 5-10, *[0] No operation</p> <p>5-12 Terminal 27 Digital Input See par. 5-10, *[2] Coast inverse</p> <p>5-13 Terminal 29 Digital Input See par. 5-10, *[14 Jog]</p> <p>5-3* Digital Outputs</p> <p>5 -34 On Delay, Digital Output 0.00 - 600.00 s, *0.01 s</p> <p>5 -35 Off Delay, Digital Output 0.00 - 600.00 s, *0.01 s</p> <p>5-4* Relays</p> <p>5-40 Function Relay *[0] No operation [1] Control ready [2] Drive ready [3] Drive ready/remote control [4] Enable / no warning [5] VLT running [6] Running / no warning [7] Run in range/no warning [8] Run on ref/no warning [9] Alarm [10] Alarm or warning [12] Out of current range [13] Below current, low [14] Above current, high [16] Below frequency, low [17] Above frequency, high [19] Below feedback, low [20] Above feedback, high [21] Thermal warning [22] Ready, no thermal warning [23] Remote, ready, no thermal warning [24] Ready, Voltage OK [25] Reverse [26] Bus OK [35] External Interlock [36] Control word bit 11 [37] Control word bit 12 [45] Bus Control [60] Comparator 0 [61] Comparator 1 [62] Comparator 2 [63] Comparator 3 [64] Comparator 4 [65] Comparator 5 [70] Logic rule 0 [71] Logic rule 1 [72] Logic rule 2</p>

Parameter Overview			
[73] Logic rule 3	[0] Current mode	[26] Bus OK	[4] Enable / no warning
[74] Logic rule 4	*[1] Voltage mode	[35] External Interlock	[5] Drive running
[75] Logic rule 5	6-2* Analog Input 54	[45] Bus Control	[6] Running / no warning
[80] SL digital output A	6-20 Terminal 54 Low Voltage	[60] Comparator 0	[7] Run in range/no warning
[81] SL digital output B	0.00 - 10.00V, * 0.07	[61] Comparator 1	[8] Run on ref/no warning
[82] SL digital output C	6-21 Terminal 54 High Voltage	[62] Comparator 2	[9] Alarm
[83] SL digital output D	0.00 - 10.00V, * 10.00	[63] Comparator 3	[10] Alarm or warning
[160] No alarm	6-22 Terminal 54 Low Current	[64] Comparator 4	[12] Out of current range
[161] Running reverse	0.00 - 20.00, * 4.00mA	[65] Comparator 5	[13] Below current, low
[165] Local ref. active	6-23 Terminal 54 High Current	[70] Logic rule 0	[14] Above current, high
[166] Remote ref. active	0.00 - 20.00, * 20.00mA	[71] Logic rule 1	[21] Thermal warning
[167] Start command activ	6-24 Terminal 54 Low Ref./Feedb. Value	[72] Logic rule 2	[22] Ready, no thermal warning
[168] Drive in hand mode	-4999.000 - 4999.000, * 0.000	[73] Logic rule 3	[23] Remote, ready, no thermal warning
[169] Drive in auto mode	6-25 Terminal 54 High Ref./Feedb. Value	[74] Logic rule 4	[24] Ready, Voltage OK
[193] Sleep Mode	-4999.000 - 4999.000, * 50.000	[75] Logic rule 5	[25] Reverse
[194] Broken Belt Function	6-26 Terminal 54 Filter Time Constant	[80] SL digital output A	[26] Bus OK
[196] Fire Mode	0.01 - 10.00, * 0.01	[81] SL digital output B	[35] External Interlock
[198] Drive Bypass	6-29 Terminal 54 mode [0] Current mode	[82] SL digital output C	[45] Bus Control
5-41 On Delay, Relay	[0] Current mode	[83] SL digital output D	[60] Comparator 0
0.00 - 600.00 s, *0.01 s	*[1] Voltage mode	[160] No alarm	[61] Comparator 1
5-42 Off Delay, Relay	6-7* Analog Output 45	[161] Running reverse	[62] Comparator 2
0.00 - 600.00 s, *0.01 s	6-70 Terminal 45 Mode	[165] Local ref. active	[63] Comparator 3
5-5* Pulse Input	*[0] 0-20 mA	[166] Remote ref. active	[64] Comparator 4
5-9* Bus Controlled	[1] 4-20 mA	[167] Start command activ	[65] Comparator 5
5-90 Digital and Relay Bus Control	[2] Digital Output	[168] Drive in hand mode	[70] Logic rule 0
0 - 0xFFFFFFFF, * 0	6-71 Terminal 45 Analog Output	[169] Drive in auto mode	[71] Logic rule 1
6-** Analog In/Out	*[0] No operation	[194] Broken Belt Function	[72] Logic rule 2
6-0* Analog I/O Mode	[100] Output frequency	[196] Fire Mode	[73] Logic rule 3
6-00 Live Zero Timeout Time	[101] Reference	[198] Bypass Mode	[74] Logic rule 4
1 - 99s, * 106-01 Live Zero Timeout Function	[102] Feedback	6-73 Terminal 45 Output Min Scale	[75] Logic rule 5
*[0] Off	[103] Motor current	0.00 - 200.00%, * 0.00	[80] SL digital output A
[[106] Power	6-74 Terminal 45 Output Max Scale	[81] SL digital output B
1] Freeze output	[139] Bus Control	0.00 - 200.00%, * 100.00	[82] SL digital output C
[2] Stop	6-72 Terminal 45 Digital Output	6-76 Terminal 45 Output Bus Control	[83] SL digital output D
[3] Jogging	*[0] No operation	0.00 - 100.00%, * 0.00	[160] No alarm
[4] Max. speed	[1] Control ready	6-9* Analog Output 42	[161] Running reverse
[5] Stop and trip	[2] Drive ready	6-90 Terminal 42 Mode	[165] Local ref. active
6-1* Analog Input 53	[3] Drive ready/remote control	*[0] 0-20 mA	[166] Remote ref. active
6-10 Terminal 53 Low Voltage	[4] Standby / no warning	[1] 4-20 mA	[167] Start command activ
0.00 - 10.00V, * 0.07	[5] Drive running	[2] Digital Output	[168] Drive in hand mode
6-11 Terminal 53 High Voltage	[6] Running / no warning	6-91 Terminal 42 Analog Output	[169] Drive in auto mode
0.00 - 10.00V, * 10.00	[7] Run in range/no warning	*[0] No operation	[193] Sleep Mode
6-12 Terminal 53 Low Current	[8] Run on ref/no warning	[100] Output frequency	[194] Broken Belt Function
0.00 - 20.00, * 4.00mA	[9] Alarm	[101] Reference	[196] Fire Mode
6-13 Terminal 53 High Current	[10] Alarm or warning	[102] Feedback	[198] Drive Bypass
0.00 - 20.00, * 20.00mA	[12] Out of current range	[103] Motor current	6-93 Terminal 42 Output Min Scale
6-14 Terminal 53 Low Ref./Feedb. Value	[13] Below current, low	[105] TorquereltoRated	0.00 - 200.00%, * 0.00
-4999.000 - 4999.000, * 0.000	[14] Above current, high	[106] Power	6-94 Terminal 42 Output Max Scale
6-15 Terminal 53 High Ref./Feedb. Value	[21] Thermal warning	[139] Bus Control	0.00 - 200.00%, * 100.00
-4999.000 - 4999.000, * 50.000	[22] Ready, no thermal warning	6-92 Terminal 42 Digital Output	6-96 Terminal 42 Output Bus Control
6-16 Terminal 53 Filter Time Constant	[23] Remote, ready, no thermal warning	*[0] No operation	0.00 - 100.00%, * 0.00
0.01 - 10.00s, * 0.01	[24] Ready, Voltage OK	[1] Control ready	8-** Comm. and Options
6-19 Terminal 53 mode	[25] Reverse	[2] Drive ready	8-0* Comm. General Settings
		[3] Drive ready/remote control	8-01 Control Site

Parameter Overview			
<p>*[0] Digital and ctrl.word [1] Digital only [2] Controlword only</p> <p>8-02 Control Source [0] None *[1] FC Port</p> <p>8-03 Control Timeout Time 0.1 - 6500.0s, * 1.0</p> <p>8-04 Control Timeout Function *[0] Off [1] Freeze output [2] Stop [3] Jogging [4] Max. speed [5] Stop and trip [20] N2 Override Release</p> <p>8-06 Reset Control Word Timeout *[0] No function [1] Do reset</p> <p>8-3* FC Port Settings</p> <p>8-30 Protocol *[0] FC [2] Modbus RTU [3] Metasys N2 [4] FLN [5] BACNet</p> <p>8-31 Address 1 - 247, * 1</p> <p>8-32 FC Port Baud Rate [0] 2400 Baud [1] 4800 Baud *[2] 9600 Baud [3] 19200 Baud [4] 38400 Baud [5] 57600 Baud [6] 76800 Baud [7] 115200 Baud</p> <p>8-33 FC Port Parity *[0] Even Parity, 1 Stop Bit [1] Odd Parity, 1 Stop Bit [2] No Parity, 1 Stop Bit [3] No Parity, 2 Stop Bits</p> <p>8-35 Minimum Response Delay 0.001 - 0.500s, * 0.010</p> <p>8-36 Max Response Delay 0.100 - 10.000s, *5.000</p> <p>8-37 Max Inter-char delay 0.025 - 0.025s, * 0.025</p> <p>8-5* Digital/Bus</p> <p>8-50 Coasting Select [0] Digital input [1] Bus [2] Logic AND *[3] Logic OR</p> <p>8-51 Quick Stop Select [0] Digital input [1] Bus [2] Logic AND *[3] Logic OR</p>	<p>8-52 DC Brake Select [0] Digital input [1] Bus [2] Logic AND *[3] Logic OR</p> <p>8-53 Start Select [0] Digital input [1] Bus [2] Logic AND *[3] Logic OR</p> <p>8-54 Reversing Select [0] Digital input [1] Bus [2] Logic AND *[3] Logic OR</p> <p>8-55 Set-up Select [0] Digital input [1] Bus [2] Logic AND *[3] Logic OR</p> <p>8-56 Preset Reference Select [0] Digital input [1] Bus [2] Logic AND *[3] Logic OR</p> <p>8-7* Bacnet</p> <p>8-70 BACnet Device Instance 0 - 0x400000UL * 1</p> <p>8-72 MS/TP Maxmaster 0 - 127, * 127</p> <p>8-73 MS/TP Max Info Frames 1 - 65534, * 1</p> <p>8-74 "I am" Service *[0] Send at power-up [1] Continuously</p> <p>8-75 Intialisation Password</p> <p>8-8* FC Port Diagnostics</p> <p>8-80 Bus Message Count 0 - 65536, * 0</p> <p>8-81 Bus Error Count 0 - 65536, * 0</p> <p>8-82 Slave Message Rcvd 0 - 65536, * 0</p> <p>8-83 Slave Error Count 0 - 65536, * 0</p> <p>8-84 Slave Message Sent 0 - 65536, * 0</p> <p>8-85 Slave Timeout Errors 0 - 65536, * 0</p> <p>8-88 Reset FC port Diagnostics *[0] Do not reset [1] Reset counter</p> <p>8-9* Bus Feedback</p> <p>8-94 Bus feedback 1 -32768 - 32767, * 0</p> <p>13-** Smart Logic</p> <p>13-0* SLC Settings</p>	<p>13-00 SL Controller Mode *[0] Off [1] On</p> <p>13-01 Start Event [0] False [1] True [2] Running [3] In range [4] On reference [7] Out of current range [8] Below I_{low} [9] Above I_{high} [16] Thermal warning [17] Mains out of range [18] Reversing [19] Warning [20] Alarm (trip) [21] Alarm (trip lock) [22] Comparator 0 [23] Comparator 1 [24] Comparator 2 [25] Comparator 3 [26] Logic rule 0 [27] Logic rule 1 [28] Logic rule 2 [29] Logic rule 3 [33] Digital input 18 [34] Digital input 19 [35] Digital input 27 [36] Digital input 29 *[39] Start command [40] Drive stopped [41] Reset trip [42] Auto reset trip [43] Key Ok [44] Key Reset [47] Key Up [48] Key Down [50] Comparator 4 [51] Comparator 5 [60] Logic rule 4 [83] Broken belt</p> <p>13-02 Stop Event See par. 13-02, *[40] Drive stopped</p> <p>13-03 Reset SLC *[0] Do not reset [1] Reset SLC</p> <p>13-1* Comparators</p> <p>13-10 Comparator Operand *[0] Disabled [1] Reference [2] Feedback [3] Motor speed [4] Motor current [6] Motor power [7] Motor voltage [8] DC-link voltage [12] Analog in 53</p>	<p>[13] Analog in 54 [20] Alarm number [30] Counter A [31] Counter B</p> <p>13-11 Comparator Operator [0] Less Than *[1] Approx. Equal [2] GreaterThan</p> <p>13-12 Comparator Value -9999.0 - 9999.0, * 0.0</p> <p>13-2* Timers</p> <p>13-20 SL Controller Timer 0.00 - 3600.00, * 0.00</p> <p>13-4* Logic Rules</p> <p>13-40 Logic Rule Boolean 1 See par. 13-01, *[0] False</p> <p>13-41 Logic Rule Operator 1 *[0] Disabled [1] AND [2] OR [3] AND NOT [4] OR NOT [5] NOT AND [6] NOT OR [7] NOT AND NOT [8] NOT OR NOT</p> <p>13-42 Logic Rule Boolean 2 See par. 13-01, *[0] False</p> <p>13-43 Logic Rule Operator 2 See par. 13-41, *[0] Disabled</p> <p>13-44 Logic Rule Boolean 3 See par. 13-01, *[0] False</p> <p>13-5* States</p> <p>13-51 SL Controller Event See par. 13-01, *[0] False</p> <p>13-52 SL Controller Action *[0] Disabled [1] No action [2] Select set-up 1 [3] Select set-up 2 [10] Select preset ref 0 [11] Select preset ref 1 [12] Select preset ref 2 [13] Select preset ref 3 [14] Select preset ref 4 [15] Select preset ref 5 [16] Select preset ref 6 [17] Select preset ref 7 [18] Select ramp 1 [19] Select ramp 2 [22] Run [23] Run reverse [24] Stop [25] Qstop [26] DC Brake [27] Coast [28] Freeze output [29] Start timer 0</p>

Parameter Overview			
[30] Start timer 1	[11] Automatic reset x 15	15-05 Over Volt's	16-38 SL Controller State
[31] Start timer 2	[12] Automatic reset x 20	0 - 65535, * 0	0 - 255, * 0
[32] Set digital out A low	[13] Infinite auto reset	15-06 Reset kWh Counter	16-5* Ref. and Feedb.
[33] Set digital out B low	14-21 Automatic Restart Time	*[0] Do not reset	16-50 External Reference
[34] Set digital out C low	0 - 600s, * 10	[1] Reset counter	-200.0 - 200.0%, * 0.0
[35] Set digital out D low	14-22 Operation Mode	15-07 Reset Running Hours Counter	16-52 Feedback
[38] Set digital out A high	*[0] Normal operation	*[0] Do not reset	-4999.000 - 4999.000, * 0.000
[39] Set digital out B high	[2] Initialisation	[1] Reset counter	16-6* Inputs and Outputs
[40] Set digital out C high	14-27 Action At Inverter Fault	15-3* Fault Log	16-60 Digital input
[41] Set digital out D high	[0] Off	15-30 Fault Log:	0 - 65535, * 0
[60] Reset Counter A	*[1] On	Error Code 0 - 255, * 0	16-61 Terminal 53 Setting
[61] Reset Counter B	14-28 Production Settings	15-4* Drive Identification	*[0] Current mode
[70] Start timer 3	*[0] No action	15-40 FC Type	[1] Voltage mode
[71] Start timer 4	[1] Service reset	15-41 Power Section	16-62 Analog Input 53
[72] Start timer 5	[3] Software Reset	15-42 Voltage	0.00 - 10.00, * 1.00
[73] Start timer 6	14-29 Service Code	15-43 Software Version	16-63 Terminal 54 Setting
[74] Start timer 7	0 - 0x7FFFFFFF, * 0	15-44 OrderedTypeCode	*[0] Current mode
[100] Reset Alarm	14-3* Current Limit Ctrl.	15-46 Frequency Converter	[1] Voltage mode
14-** Special Functions	14-4* Energy Optimising	Ordering No	16-64 Analog Input 54
14-0* Inverter Switching	14-40 VT Level	15-47 Power Card Ordering No	0.00 - 20.00, * 1.00
14-01 Switching Frequency	40 - 90%, * 90%	15-48 LCP Id No	16-65 Analog Output 42 [mA]
[0] Ran3	14-41 AEO Minimum Magnetisation	15-49 Software ID Control Card	0.00 - 20.00, * 0.00
[1] Ran5	40 - 75%, * 66	15-50 Software ID Power Card	16-61 Digital Output
[2] 2.0 kHz	14-5* Environment	15-51 Frequency Converter Serial Number	16-72 Counter A
[3] 3.0 kHz	14-50 RFI Filter	15-53 Power Card Serial Number	-32768 - 32767, * 0
[4] 4.0 kHz	[0] Off	16-** Data Readouts	16-73 Counter B
[5] 5.0 kHz	*[1] On	16-0* General Status	-32768 - 32767, * 0
[6] 6.0 kHz	14-51 DC-link Voltage Compensation	16-00 Control Word	16-79 Analog output 45
[7] 8.0 kHz	[0] Off	0 - 65535, * 0	20 - 20mA, * 0
[8] 10.0 kHz	*[1] On	16-01 Reference [Unit]	16-8* Fieldbus / FC Port
[9] 12.0kHz	14-52 Fan Control	-4999.000 - 4999.000, * 0.000	16-86 FC Port REF 1
[10] 16.0kHz	*[0] Auto	16-02 Reference	-32768 - 32767, * 0
14-03 Overmodulation	[4] Auto Low temp env	% -200.0 - 200.0, * 0.0	16-9* Diagnosis Readouts
[0] Off	14-53 Fan Monitor	16-03 Status Word	16-90 Alarm Word
*[1] On	[0] Disabled	0 - 65535, * 0	0 - 0xFFFFFFFF, * 0
14-08 Damping Gain Factor	*[1] Warning	16-05 Main Actual Value [%]	16-91 Alarm Word 2
0 - 100-%, * 96	[2] Trip	-200.00 - 200.00, * 0.00	0 - 0xFFFFFFFF, * 0
14-1* Mains on/off	14-55 Output Filter	16-09 Custom Readout	16-92 Warning Word
14-12 Function at Mains Imbalance	*[0] No Filter	0.00 - 9999.00, * 0.00	0 - 0xFFFFFFFF, * 0
[0] Trip	[1] Sine-Wave Filter	16-1 Motor Status	16-93 Warning Word 2
[1] Warning	[3] Sine-Wave Filter with Feedback	16-10 Power [kW]	0 - 0xFFFFFFFF, * 0
[2] Disabled	14-63 Min Switch Frequency	0.000-4.294, 967.500, *0.000	16-94 Ext. Status Word
[3] Derate	1 - 16kHz, * 1	16-11 Power [hp]	0 - 0xFFFFFFFF, * 0
14-2* Reset Functions	15-** Drive Information	0.000 - 2.294, 967.500 *0.000	16-95 Ext. Status Word 2
14-20 Reset Mode	15-0* Operating Data	16-3* Drive Status	0 - 0xFFFFFFFF, * 0
*[0] Manual reset	15-00 Operating Hours	16-30 DC Link Voltage	18-**Extended Motor Data
[1] Automatic reset x 1	0 - 2147483647, * 0	0 - 65535, * 0	18-1* Firemode Log
[2] Automatic reset x 2	15-01 Running Hours	16-34 Heatsink Temp.	18-10 Firemode log: Event
[3] Automatic reset x 3	0 - 2147483647, * 0	0 - 255, * 0	0-255, *0
[4] Automatic reset x 4	15-02 kWh Counter	16-35 Inverter Thermal	20-** FC Closed Loop
[5] Automatic reset x 5	0 - 65535, * 0	0 - 255%, * 0	20-0* Feedback
[6] Automatic reset x 6	15-03 Power Up's	16-36 Inv. Nom. Current	20-00 Feedback 1 Source
[7] Automatic reset x 7	0 - 2147483647, * 0	0.00 - 655.35, * 0.00	*[0] No function
[8] Automatic reset x 8	15-04 Over Temp's	16-37 Inv. Max. Current	[1] Analog in 53
[9] Automatic reset x 9	0 - 65535, * 0	0.00 - 655.35	[2] Analog in 54
[10] Automatic reset x 10			[100] Bus Feedback 1

Parameter Overview			
20-01 Feedback 1 Conversion *[0] Linear [1] Square root 20-8* PI Basic Setting 20-81 Process PI Normal/ Inverse Control *[0] Normal [1] Inverse 20-83 Process PI Start Speed[Hz] 0.0 - 200.0, * 0.0 20-84 On Reference Bandwidth 0 - 200%, * 5 20-9* PI Controller 20-91 PI Anti Windup [0] Off *[1] On 20-93 PI Proportional Gain 0.00 - 10.00, * 0.01	20-94 PI Integral Time 0.10 - 9999.00s, * 9999.00 20-97 Process PI Feed Forward Factor 0 - 400%, * 0 22-** Appl. functions 22-4* Sleep mode 22-40 Minimum Run Time 0 - 600s, * 10 22-41 Minimum Sleep Time 0 - 600s, * 10 22-43 Wake-Up Speed [Hz] 0.0 - 400.0, * 100.0 22-44 Wake-Up Ref./FB difference 0 - 100%, * 10 22-45 Setpoint Boost -100 - 100%, * 0	22-46 Maximum Boost Time 0 - 600s, * 60 22-47 Sleep Speed [Hz] 0.0 - 400.0, * 0.0 22-6* Broken Belt Detection 22-60 Broken Belt Detection *[0] Off [1] Warning [2] Trip 22-61 Broken Belt Torque 5 - 100%, * 10 22-62 Broken Belt Delay 0 - 600s, * 10 24-** Appl. functions 2 24-0* Fire mode 24-00 Fire Mode Function	*[0] Disabled [1] Enabled Run Forward [2] Enabled Run Reverse [3] Enable-Coast [4] Enabled - Run Fwd/Rev 24-05 Fire Mode Preset Reference -100 - 100%, * 0 24-09 Fire Mode Alarm Handling *[1] Trip, Critical Alarms [2] Trip, All Alarms/Test 24-1* Drive Bypass 24-10 Drive Bypass Function *[0] Disabled [2] Enabled (Fire Mode only) 24-11 Bypass Delay Timer 0 - 600s, * 0

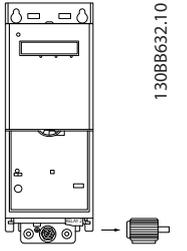
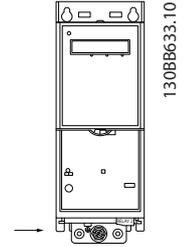
1.6 Warnings and Alarms

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 value set in par. 6-10, 6-12, 6-20 or 6-22. See also parameter group 6-0X
4	14	Mains ph. loss	X	X	X	Missing phase on supply side or too high voltage imbalance. Check supply voltage. See parameter 14-12
7	11	DC over volt	X	X		Intermediate circuit voltage exceeds 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 too long.
10	8	Motor ETR over	X	X		Motor is too hot due to more than 100% load for too long. See parameter 1-90
11	7	Motor th over	X	X		Thermistor or thermistor connection is disconnected. See parameter 1-90.
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 8-0X
24	50	Fan Fault	X	X		The fan is not working (Only on 400V 30-90 kW units).
30	19	U phase loss		X	X	Motor phase U is missing. Check the phase. See parameter 4-58.
31	20	V phase loss		X	X	Motor phase V is missing. Check the phase. See parameter 4-58.
32	21	W phase loss		X	X	Motor phase W is missing. Check the phase. See parameter 4-58.
38	17	Internal fault		X	X	Contact your local Danfoss supplier.
44	28	Earth Fault		X	X	Discharge from output phases to ground.
47	23	Control Voltage Fault	X	X	X	24 V DC may be overloaded.
48	25	VDD1 Supply Low		X	X	Control voltage low. Please contact your local Danfoss supplier

Fault number	Alarm/Warning Bit Number	Fault text	Warning	Alarm	Trip locked	Cause of problem
50		AMA Calibration failed		X		Contact your local Danfoss supplier.
51	15	AMA Unom,Inom		X		The setting of motor voltage, motor current and motor power is presumably 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 for the AMA to be carried out
54		AMA small mot		X		The motor is too small for the AMA to be carried out
55		AMA par. range		X		The parameter values found from the motor are outside acceptable range
56		AMA user interrupt		X		The AMA has been interrupted by the user
57		AMA timeout		X		Try to start the AMA again a number of times, until the AMA is carried out. Please note that 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 your local Danfoss supplier.
59	25	Current limit	X			The current is higher than the value in par. 4-18 Current Limit
60	44	External Interlock		X		External interlock has been activated. To resume normal operation, apply 24V 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 (Only on 400V 30-90 kW units).
69	1	Pwr. Card Temp	X	X	X	The temperature sensor on the power card is either too hot or too cold.
79		Illegal power section configuration	X	X		Internal fault. Contact your local Danfoss supplier.
80	29	Drive initialised		X		All parameter settings are initialized to default settings.
87	47	Auto DC Braking	X			The drive is auto DC braking
95	40	Broken Belt	X	X		Torque is below the torque level set for no load, indicating a broken belt. See parameter group 22-6.
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. (Only on 400V 30-90 kW units). Contact your local Danfoss supplier
251		New Typecode		X	X	The frequency converter has a new type code (Only on 400V 30-90 kW units). Contact your local Danfoss supplier.

1.7 General Specifications

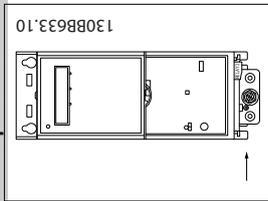
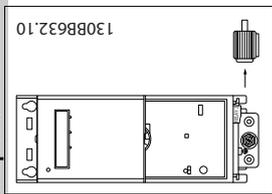
1.7.1 Mains Supply 3 x 200-240V AC

Frequency converter	PK2 5	PK3 7	PK7 5	P1K 5	P2K2	P3K 7	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	
Max. 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 ambient temperature																
 130BB632.10	Continuous (3x200-240V) [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 (3x200-240V)[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
Max. input current																
 130BB633.10	Continuous (3x200-240V) [A]	1.1	1.6	2.8	5.6	8.8/7 .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 (3x200-240V)[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
Max. mains fuses	See 1.3.6 Fuses															
Estimated power loss [W], Best case/typical ¹⁾	12/1 4	15/1 8	21/2 6	48/6 0	80/1 02	97/1 20	182/ 204	229/ 268	369/ 386	512	658	804	1015	1459	1350	
Weight enclosure IP20 [kg]	2.	2.0	2.0	2.1	3.4	4.5	7.9	7.9	9.5	24.5	24.5	36.0	36.0	51.0	51.0	
Efficiency [%], Best case/Typical	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	96.9	96.8	97.0	96.5	97.3	
Output current																
50°C ambient temperature																
	Continuous (3x200-240V) [A]	1.5	1.9	3.5	6.8	9.6	13.0	19.8	23.0	33.0	53.5	66.6	79.2	103.5	128.7	153.0
	Intermittent (3x200-240V) [A]	1.7	2.1	3.9	7.5	10.6	14.3	21.8	25.3	36.3	58.9	73.3	87.1	113.9	141.6	168.3

1) At rated load conditions

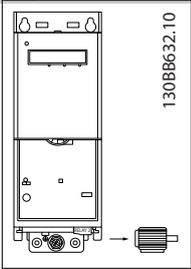
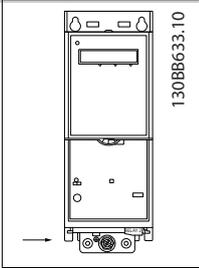
1.7.2 Mains Supply 3 x 380-480VAC

Frequency converter	PK37	PK75	P1K5	P2K2	P3K0	P4K0	P5K5	P7K5	P11K	P15K	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K	
Typical shaft output (kW)	0.37	0.75	1.5	2.2	3.0	4.0	5.5	7.5	11.0	15.0	18.0	22.0	30.0	37.0	45.0	55.0	75.0	90.0	
Typical shaft output (hp)	0.5	1.0	2.0	3.0	4.0	5.0	7.5	10.0	15.0	20.0	25.0	30.0	40.0	50.0	60.0	70.0	100.0	125.0	
IP20 frame	H1	H1	H1	H2	H2	H2	H3	H3	H4	H4	H5	H5	H6	H6	H6	H7	H7	H8	
Max. cable size in terminals (mains, motor)	4/10	4/10	4/10	4/10	4/10	4/10	4/10	4/10	16/6	16/6	16/6	16/6	35/2	35/2	35/2	50/1	95/0	120/25	
[mm ² /AWG]																		0MCM	
Output current	40°C ambient temperature																		
Continuous (3x380-440V)[A]	1.2	2.2	3.7	5.3	7.2	9.1	12.0	15.5	23.0	31.0	37.0	42.5	61.0	73.0	90.0	106.0	147.0	177.0	
Intermittent (3x380-440V)[A]	1.3	2.4	4.1	5.8	7.9	9.9	13.2	17.1	25.3	34.0	40.7	46.8	67.1	80.3	99.0	116.0	161.0	194.0	
Continuous (3x440-480V)[A]	1.1	2.1	3.4	4.8	6.3	8.2	11.0	14.0	21.0	27.0	34.0	40.0	52.0	65.0	80.0	105.0	130.0	160.0	
Intermittent (3x440-480V)[A]	1.2	2.3	3.7	5.3	6.9	9.0	12.1	15.4	23.1	29.7	37.4	44.0	57.2	71.5	88.0	115.0	143.0	176.0	
Max. input current																			
Continuous (3x380-440V)[A]	1.2	2.1	3.5	4.7	6.3	8.3	11.2	15.1	22.1	29.2	35.2	41.5	57.0	70.0	84.0	103.0	140.0	166.0	
Intermittent (3x380-440V)[A]	1.3	2.3	3.9	5.2	6.9	9.1	12.3	16.6	24.3	32.9	38.7	45.7	62.7	77.0	92.4	113.0	154.0	182.0	
Continuous (3x440-480V)[A]	1.0	1.8	2.9	3.9	5.3	6.8	9.4	12.6	18.4	24.7	29.3	34.6	49.2	60.6	72.5	88.6	120.9	142.7	
Intermittent (3x440-480V)[A]	1.1	2.0	3.2	4.3	5.8	7.5	10.3	13.9	20.2	27.2	32.2	38.1	54.1	66.7	79.8	97.5	132.9	157.0	
Max. mains fuses	See 5.1.4 Fuses																		



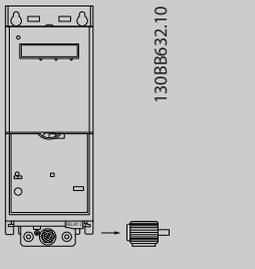
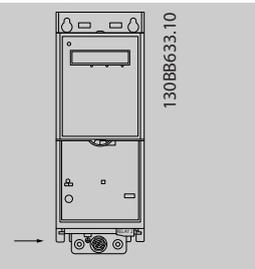
Frequency converter	PK37	PK75	P1K5	P2K2	P3K0	P4K0	P5K5	P7K5	P11K	P15K	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K	
Estimated power loss [W], Best case/typical ¹⁾	13/15	21/16	46/57	46/58	66/83	95/118	104/13	159/19	248/27	353/37	412/45	475/52	780	893	1160	1130	1460	1780	
Weight enclosure IP20kg)	4.4/2.0	4.4/2.0	4.6/2.1	7.3/3.3	7.3/3.3	7.5/3.4	9.5/4.3	9.9/4.5	17.4/7.	17.4/7.	20.9/9.	20.9/9.	54.0/24	54.0/24	54.0/24	79.4/36	79.4/36	112.4/5	
Efficiency [%], Best case/Typical 1	97.8/97.	98.0/97.	97.7/97	98.3/97	98.2/97.	98.0/97.	98.4/98	98.2/97	98.1/97	98.0/97	98.1/97	98.1/97	97.8	97.9	97.1	98.3	98.3	98.3	
Output current	3	6	.2	.9	8	6	.0	.8	.9	.8	.9	.9	.5	.5	.5	.0	.0	1.0	
50°C ambient temperature																			
Continuous (3x380-440V) [A]	1.0	1.9	3.7	4.9	6.3	8.4	10.9	14.0	20.9	28.0	34.1	38.0	48.8	58.4	72.0	74.2	102.9	123.9	
Intermittent (3x380-440V) [A]	1.1	2.1	4.07	5.4	6.9	9.2	12.0	15.4	23.0	30.8	37.5	41.8	53.7	64.2	79.2	81.6	113.2	136.3	
Continuous (3x440-480V) [A]	1.0	1.89	3.4	4.4	5.5	7.5	10.0	12.6	19.1	24.0	31.3	35.0	41.6	52.0	64.0	73.5	91.0	112.0	
Intermittent (3x440-480V) [A]	1.1	2.0	3.7	4.8	6.1	8.3	11.0	13.9	21.0	26.4	34.4	38.5	45.8	57.2	70.4	80.9	100.1	123.2	

1.7.3 Mains Supply 3 x 380-480VAC

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	
Max. 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 ambient temperature							
	Continuous (3x380-440V)[A]	44.0	61.0	73.0	90.0	106.0	147.0	177.0
	Intermittent (3x380-440V)[A]	48.4	67.1	80.3	99.0	116.6	161.7	194.7
	Continuous (3x440-480V)[A]	40.0	52.0	65.0	80.0	105.0	130.0	160.0
	Intermittent (3x440-480V)[A]	44.0	57.2	71.5	88.0	115.5	143.0	176.0
Max. input current								
	Continuous (3x380-440V)[A]	41.8	57.0	70.3	84.2	102.9	140.3	165.6
	Intermittent (3x380-440V)[A]	46.0	62.7	77.4	92.6	113.1	154.3	182.2
	Continuous (3x440-480V)[A]	36.0	49.2	60.6	72.5	88.6	120.9	142.7
	Intermittent (3x440-480V)[A]	39.6	54.1	66.7	79.8	97.5	132.9	157.0
	Max. mains fuses							

Frequency converter	P22K	P30K	P37K	P45K	P55K	P75K	P90K	
Estimated power loss [W], Best case/typical ¹⁾	496	734	705	927	1075	1425	1469	
Weight enclosure IP54[kg]	27	27	27	45	45	65	65	
Efficiency [%], Best case/Typical 1	98.0	97.8	98.3	98.3	98.3	98.3	98.5	
Output current								
	50°C ambient temperature							
	Continuous (3x380-440V) [A]	35.2	48.8	58.4	63.0	74.2	102.9	123.9
	Intermittent (3x380-440V) [A]	38.7	53.9	64.2	69.3	81.6	113.2	136.3
	Continuous (3x440-480V) [A]	32.0	41.6	52.0	56.0	73.5	91.0	112.0
	Intermittent (3x440-480V) [A]	35.2	45.8	57.2	61.6	80.9	100.1	123.2

1.7.4 Mains Supply 3 x 525-600VAC

Frequency converter	P2K2	P3K0	P5K5	P7K5	P11K	P15K	P22K	P30K	P45K	P55K	P75K	P90K	
Typical shaft output (kW)	2.2	3.0	5.5	7.5	11.0	15.0	22.0	30.0	45.0	55.0	75.0	90.0	
Typical shaft output (hp)	3.0	4.0	7.5	10.0	15.0	20.0	30.0	40.0	60.0	70.0	100.0	125.0	
IP frame	Ip20	Ip20	Ip20	Ip20	Ip20	Ip20	Ip20	Ip20	Ip20	Ip20	Ip20	Ip20	
Max. cable size in terminals (mains, motor) [mm ² /AWG]	4/10	4/10	4/10	4/10	10/8	10/8	35/2	35/2	50/1	50/1	95/0	120/(4/0)	
Output current													
 130BB632.10	40°C ambient temperature												
	Continuous (3x525-550V)[A]	4.1	5.2	9.5	11.5	19.0	23.0	36.0	43.0	65.0	87.0	105.0	137.0
	Intermittent (3x525-550V)[A]	4.5	5.7	10.5	12.7	20.9	25.3	39.6	47.3	71.5	95.7	115.5	150.7
	Continuous (3x551-600V)[A]	3.9	4.9	9.0	11.0	18.0	22.0	34.0	41.0	62.0	83.0	100.0	131.0
	Intermittent (3x551-600V)[A]	4.3	5.4	9.9	12.1	19.8	24.2	37.4	45.1	68.2	91.3	110.0	144.1
Max. input current													
 130BB633.10	Continuous (3x525-550V)[A]	3.7	5.1	8.7	11.9	16.5	22.5	33.1	45.1	66.5	81.3	109.0	130.9
	Intermittent (3x525-550V)[A]	4.1	5.6	9.6	13.1	18.2	24.8	36.4	49.6	73.1	89.4	119.9	143.9
	Continuous (3x551-600V)[A]	3.5	4.8	8.3	11.4	15.7	21.4	31.5	42.9	63.3	77.4	103.8	124.5
	Intermittent (3x551-600V)[A]	3.9	5.3	9.2	12.5	17.3	23.6	34.6	47.2	69.6	85.1	114.2	137.0
	Max. mains fuses												
Estimated power loss [W], Best case/typical ¹⁾	8.4	112.0	178.0	239.0	360.0	503.0	607.0	820.0	972.0	1182.0	1281.0	1437.0	
Weight enclosure IP54kg)	6.6	6.6	6.6	6.6	11.5	11.5	24.5	24.5	36.0	36.0	51.0	51.0	
Efficiency [%], Best case/Typical 1	97.0	97.0	97.0	97.0	97.0	97.0	97.5	97.5	98.0	98.0	98.4	98.5	
Output current													
	50°C ambient temperature												
	Continuous (3x525-550V)[A]	2.9	3.6	6.7	8.1	13.3	16.1	25.2	30.1	45.5	60.9	73.5	95.9
	Intermittent (3x525-550V)[A]	3.2	4.0	7.4	8.9	14.6	17.7	27.7	33.1	50.0	67.0	80.9	105.5
	Continuous (3x551-600V)[A]	2.7	3.4	6.3	7.7	12.6	15.4	23.8	28.7	43.3	58.1	70.0	91.7
	Intermittent (3x551-600V)[A]	3.0	3.7	6.9	8.5	13.9	16.9	26.2	31.6	47.7	63.9	77.0	100.9

1.7.5 EMC 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, as well as a motor screened cable.

RFI Filter Type	Conduct emission. Maximum shielded cable length						Radiated emission			
	Industrial environment				Housing, trades and light industries		Industrial environment		Housing, trades and light industries	
	EN 55011 Class A2		EN 55011 Class A1		EN 55011 Class B		EN 55011 Class A1		EN 55011 Class B	
	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 (Class A1)										
0.25-11kW 3x200-240V IP20			25m	50m		20m	Yes	Yes		-
0.37-22kW 3x380-480V IP20			25m	50m		20m	Yes	Yes		-
H2 RFI filter (Class A2)										
1.5-45kW 3x200-240V IP20	25m						no		-	
30-90kW 3x380-480V IP20	25m						no		-	
22-90kW 3x380-480V IP54	25m						no		-	
H3 RFI filter (Class A1/B)										
1.5-45kW 3x200-240V IP20			50m		20m		yes		-	
30-90kW 3x380-480V IP20			50m		20m		yes		-	
22-90kW 3x380-480V IP54			50m		10m		yes		-	

Protection and features

- Electronic thermal motor protection against overload.
- Temperature monitoring of the heatsink ensures that the frequency converter trips in case of overtemperature.
- The frequency converter is protected against short-circuits between motor terminals U, V, W.
- If a motor phase is missing, the frequency converter trips and issues an alarm.
- If 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 if the intermediate circuit voltage is too low or too high.
- The frequency converter is protected against earth faults on motor terminals U, V, W.

Mains supply (L1, L2, L3)

Supply voltage	200-240V ±10%
Supply voltage	380-480V ±10%
Supply voltage	525-600V ±10%
Supply frequency	50/60Hz
Max. imbalance temporary between mains phases	3.0% of rated supply voltage
True Power Factor (λ)	≥ 0.9 nominal at rated load
Displacement Power Factor ($\cos\phi$) near unity	(> 0.98)
Switching on the input supply L1, L2, L3 (power-ups) enclosure frame H1-H5	Max. 2 times/min.
Switching on the input supply L1, L2, L3 (power-ups) enclosure frame H6-H8	Max. 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 100.000 RMS symmetrical Amperes, 240/480V maximum.	

Motor output (U, V, W)

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

Cable lengths and cross sections

Max. motor cable length, screened/armoured (EMC correct installation)	See chapter EMC test results
Max. motor cable length, unscreened/unarmoured	50m
Max. cross section to motor, mains*	
Cross section DC terminals for filter feedback on enclosure frame H1-H3	4mm ² /11AWG
Cross section DC terminals for filter feedback on enclosure frame H4-H5	16mm ² /6AWG
Maximum cross section to control terminals, rigid wire	2.5mm ² /14AWG
Maximum cross section to control terminals, flexible cable	2.5mm ² /14AWG
Minimum cross section to control terminals	0.05mm ² /30AWG

*See tables for mains supply for more information

Digital inputs:

Programmable digital inputs	4
Terminal number	18, 19, 27, 29
Logic	PNP or NPN
Voltage level	0-24V DC
Voltage level, logic '0' PNP	< 5V DC
Voltage level, logic '1' PNP	> 10V DC
Voltage level, logic '0' NPN	> 19V DC
Voltage level, logic '1' NPN	< 14V DC
Maximum voltage on input	28V DC
Input resistance, R_i	Approx. 4 k
Digital input 29 as thermistor input	Fault: > 2.9k Ω and no fault: < 800 Ω

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 - 10V
Input resistance, R_i	approx. 10k Ω
Max. voltage	20V
Current level	0/4 to 20mA (scalable)
Input resistance, R_i	<500 Ω
Max. current	29mA

Analog output

Number of programmable analog outputs	2
Terminal number	42, 45 ¹⁾
Current range at analog output	0/4 - 20mA
Max. load to common at analog output	500 Ω
Max. voltage at analog output	17V
Accuracy on analog output	Max. error: 0.4% of full scale
Resolution on analog output	12 bit

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

Digital output

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

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

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

Control card, 24V DC output:

Terminal number	12
Max. load enclosure frame H1-H8	80mA

Relay output

Programmable relay output	2
Relay 01 and 02	01-03 (NC), 01-02 (NO), 04-06 (NC), 04-05 (NO)
Max. terminal load (AC-1) ¹⁾ on 01-02/04-05 (NO) (Resistive load)	250V AC, 3A
Max. terminal load (AC-15) ¹⁾ on 01-02/04-05 (NO) (Inductive load @ $\cos\phi$ 0.4)	250V AC, 0.2A
Max. terminal load (DC-1) ¹⁾ on 01-02/04-05 (NO) (Resistive load)	30V DC, 2A
Max. terminal load (DC-13) ¹⁾ on 01-02/04-05 (NO) (Inductive load)	24V DC, 0.1A
Max. terminal load (AC-1) ¹⁾ on 01-03/04-06 (NC) (Resistive load)	250V AC, 3A
Max. terminal load (AC-15) ¹⁾ on 01-03/04-06 (NC) (Inductive load @ $\cos\phi$ 0.4)	250V AC, 0.2A
Max. terminal load (DC-1) ¹⁾ on 01-03/04-06 (NC) (Resistive load)	30V DC, 2A
	Min. terminal load on 01-03 (NC), 01-02 (NO) 24V DC 10mA, 24V AC 20mA
Environment according to EN 60664-1	Overvoltage category III/pollution degree 2

1) IEC 60947 parts 4 and 5.

Control card, 10V DC output

Terminal number	50
Output voltage	10.5V \pm 0.5V
Max. load	25mA

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

Surroundings

Enclosure	IP20
Enclosure kit available	IP21, TYPE 1
Vibration test	1.0g
Max. 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
Test method according to IEC 60068-2-43 H2S (10 days)	
Ambient temperature	See max. output current at 40/50°C in the tables mains supply

Derating for high ambient temperature, see section on special conditions

Minimum ambient temperature during full-scale operation	0°C
Minimum ambient temperature at reduced performance, enclosure frame H1-H5	-20°C
Minimum ambient temperature at reduced performance, enclosure frame H6-H10	-10°C
Temperature during storage/transport	-30 - +65/70°C
Maximum altitude above sea level without derating	1000m
Maximum altitude above sea level with derating	3000m
Derating for high altitude, see section on special conditions	
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 61000-6-1/2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN
EMC standards, Immunity	61000-4-6

1.8 Special Conditions

1.8.1 Derating for Ambient Temperature

The ambient temperature measured over 24 hours should be at least 5°C lower than the max. ambient temperature. If the frequency converter is operated at high ambient temperature, the continuous output current should be decreased.

1.8.2 Derating for Low Air Pressure

The cooling capability of air is decreased at low air pressure. For altitudes above 2000m, please contact Danfoss regarding PELV. Below 1000m altitude no derating is necessary, but above 1000m the ambient temperature or the maximum output current should be decreased. Decrease the output by 1% per 100m altitude above 1000m or reduce the max. ambient temperature by 1 degree per 200m.

1.9 Options for VLT HVAC Basic Drive FC

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For options please see the Design Guide.



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