MAKING MODERN LIVING POSSIBLE

Quick Guide

VLT® HVAC Basic Drive FC 101

THE REAL DRIVE

Contents

1 Quick Guide

1.1 Safety

1.1.1 Warnings

⚠WARNING

High Voltage Warning

The voltage of the adjustable frequency drive is dangerous whenever it is connected to line power. Incorrect installation of the motor or adjustable frequency drive 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

DISCHARGE TIME!

Adjustable frequency drives contain DC link capacitors that can remain charged even when the adjustable frequency drive is not powered. To avoid electrical hazards, disconnect AC line power, any permanent magnet type motors, and any remote DC link power supplies, including battery backups, UPS and DC link connections to other adjustable frequency drives. Wait for the capacitors to fully discharge before performing any service or repair work. The wait time required is listed in the *Discharge Time* table. Failure to wait for the specified period of time after power has been removed to do service or repair could result in death or serious injury.

Voltage [V]	Power range hp/[kW]	Minimum waiting time [min]
3x200	0.34–5 [0.25–3.7]	4
3x200	7.5–15 [5.5–11]	15
3x400	0.5–10 [0.37–7.5]	4
3x400	15–125 [11–90]	15
3x600	3–10 [2.2–7.5]	4
3x600	15–125 [11–90]	15

Table 1.1 Discharge Time

CAUTION

Leakage Current:

The ground leakage current from the adjustable frequency drive exceeds 3.5 mA. According to IEC 61800-5-1 a reinforced Protective Ground connection must be ensured with a min. 10 mm² Cu or an additional PG wire - with the same cable cross-section as the line power 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, MN90G.

Protective grounding of the adjustable frequency drive 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 6,600 feet [2 km], contact Danfoss regarding PELV.

1.1.2 Safety Instructions

- Make sure the adjustable frequency drive is properly grounded.
- Do not remove AC line input connections, motor connections or other power connections while the adjustable frequency drive is connected to line power.
- Protect users against supply voltage.
- Protect the motor against overloading according to national and local regulations.
- The ground leakage current exceeds 3.5 mA.
- The [Off/Reset] key is not a safety switch. It does not disconnect the adjustable frequency drive from line power.

1.2 Introduction

1.2.1 Available Literature

This Quick Guide contains the basic information necessary for installing and running the adjustable frequency drive. If more information is needed, literature can be found on the enclosed CD or downloaded from:
www.danfoss.com/BusinessAreas/DrivesSolutions/Documentations/Technical+Documentation.htm

1.2.2 Approvals

Table 1.2

IP54 enclosure adjustable frequency drive do not have UL approvals.

Table 1.3

1.2.3 IT Line Power

⚠CAUTION

IT Line Power

Installation on isolated line power source, that is, IT line power.
Max. supply voltage allowed when connected to line power: 440 V (3x380–480 V units).

On IP20 200–240 V 0.34–15 hp [0.25–11 kW] and 380–480 V IP20 0.5–30 hp [0.37–22 kW], open the RFI switch by removing the screw on the side of the adjustable frequency drive when at IT grid.

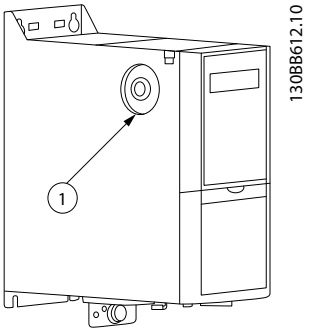


Figure 1.1 IP20 200–240 V 0.34–15 hp [0.25–11 kW], IP20 0.5–30 hp [0.37–22 kW] 380–480 V.

1	EMC screw

Table 1.4

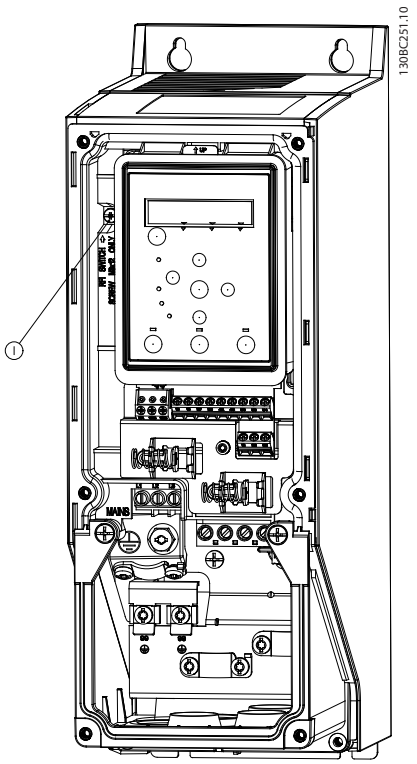


Figure 1.2 IP54 400 V 1–25 hp [0.75–18.5 kW]

1	EMC screw

Table 1.5

On all units, set to [*Off*] when operating in IT line power.

ACAUTION

If reinserted, only use M3x12 screws.

1.2.4 Avoid Unintended Start

While the adjustable frequency drive is connected to line power, the motor can be started/stopped using digital commands, bus commands, references or via the LCP.

- Disconnect the adjustable frequency drive from line power whenever personal safety considerations make it necessary to avoid unintended start of any motors.
- To avoid unintended start, always press [Off/ Reset] before changing parameters.

1.2.5 Disposal Instruction

Equipment containing electrical components may 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.

Table 1.6

1.3 Installation

1.3.1 Before Starting Repair Work

1. Disconnect FC 101 from line power (and external DC supply, if present).
2. Wait as stated in *Table 1.1* for discharge of the DC link.
3. Remove motor cable.

1.3.2 Side-by-Side Installation

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

		Power (hp [kW])			Clearance above/below mm/[inch]
Frame	IP class	3x200–240 V	3x380–480 V	3x525–600 V	
H1	IP20	0.34–2 [0.25–1.5]	0.5–2 [0.37–1.5]		100 [4]
H2	IP20	3 [2.2]	3–5 [2.2–4]		100 [4]
H3	IP20	5 [3.7]	7.5–10 [5.5–7.5]		100 [4]
H4	IP20	7.5–10 [5.5–7.5]	15–20 [11–15]		100 [4]
H5	IP20	15 [11]	25–30 [18.5–22]		100 [4]
H6	IP20	20–25 [15–18.5]	45–60 [30–45]	25–45 [18.5–30]	200/[8]
H7	IP20	30–45 [22–30]	75–100 [55–75]	50–75 [37–55]	200/[8]
H8	IP20	50–60 [37–45]	125 [90]	100–125 [75–90]	225/[8.9]
H9	IP20			3–10 [2.2–7.5]	100 [4]
H10	IP20			15–20 [11–15]	200/[8]

Table 1.7

NOTE!

With IP21/Nema Type1 option kit mounted, a distance of 2 in [50 mm] between the units is required.

1.3.3 Dimensions

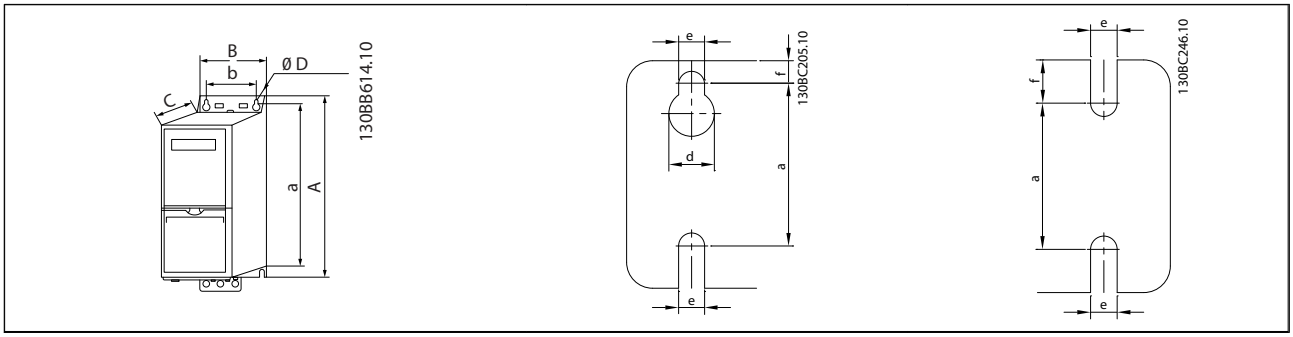


Table 1.8

Enclosure		Power (hp [kW])			Height (in [mm])			Width (in [mm])		Depth (in [mm])	Mounting hole (in [mm])			Max. Weight
Frame	IP Class	3x200–240 V	3x380–480 V	3x525–600 V	A	"A incl De-coupling Plate"	a	B	b	C	d	e	f	lb [kg]
H1	IP20	0.34–2 [0.25–1.5]	0.5–2 [0.37–1.5]		7.68 [195]	10.79 [273]	7.21 [183]	2.95 [75]	2.21 [56]	6.61 [168]	0.35 [9]	0.18 [4.5]	0.21 [5.3]	4.63 [2.1]
H2	IP20	3 [2.2]	3–5 [2.2–4.0]		8.94 [227]	11.93 [303]	8.35 [212]	3.54 [90]	2.56 [65]	7.48 [190]	0.43 [11]	0.22 [5.5]	0.29 [7.4]	7.5 [3.4]
H3	IP20	5 [3.7]	7.5–10 [5.5–7.5]		10.04 [255]	12.95 [329]	9.45 [240]	3.94 [100]	2.91 [74]	8.11 [206]	0.43 [11]	0.22 [5.5]	17.86 [8.1]	9.9 [4.5]
H4	IP20	7.5–10 [5.5–7.5]	15–20 [11–15]		11.65 [296]	14.13 [359]	10.83 [275]	5.32 [135]	4.13 [105]	9.5 [241]	0.5 [12.6]	0.28 [7]	0.33 [8.4]	17.42 [7.9]
H5	IP20	15 [11]	25–30 [18.5–22]		13.2 [334]	15.83 [402]	12.36 [314]	5.91 [150]	[97/120]	10.04 [255]	0.5 [12.6]	0.28 [7]	0.33 [8.5]	20.94 [9.5]
H6	IP20	20–25 [15–18.5]	45–60 [30–45]	25–45 [18.5–30]	20.39 [518]	23.43/25 [595/635] (60 hp [45 kW])	19.5 [495]	9.41 [239]	7.87 [200]	9.53 [242]	-	0.33 [8.5]	0.6 [15]	54 [24.5]
H7	IP20	30–45 [22–30]	75–100 [55–75]	50–75 [37–55]	21.7 [550]	24.8/27.17 [630/690] (100 hp [75 kW])	20.51 [521]	12.32 [313]	10.63 [270]	13.2 [335]	-	0.33 [8.5]	0.67 [17]	79.4 [36]
H8	IP20	50–60 [37–45]	125 [90]	100–125 [75–90]	25.98 [660]	31.5 [800]	28.84 [631]	14.76 [375]	12.99 [330]	13.2 [335]	-	0.33 [8.5]	0.67 [17]	112.44 [51]
H9	IP20			3–10 [2.2–7.5]	10.6 [269]	14.72 [374]	10.12 [257]	5.12 [130]	0.148 [110]	8.1 [205]	0.43 [11]	0.22 [5.5]	0.35 [9]	14.6 [6.6]
H10	IP20			15–20 [11–15]	15.71 [399]	16.5 [419]	14.96 [380]	6.5 [165]	5.51 [140]	9.76 [248]	0.47 [12]	0.27 [6.8]	0.3 [7.5]	26.46 [12]
I2	IP54		1–5 [0.75–4.0]		13.1 [332]	-	12.54 [318.5]	4.53 [115]	2.91 [74]	88.58 [225]	0.43 [11]	0.22 [5.5]	0.35 [9]	11.69 [5.3]
I3	IP54		7.5–10 [5.5–7.5]		14.5 [368]	-	11.94 [354]	5.32 [135]	3.5 [89]	9.33 [237]	0.47 [12]	0.26 [6.5]	0.37 [9.5]	15.87 [7.2]
I4	IP54		15–25 [11–18.5]		18.74 [476]	-	18.11 [460]	7.1 [180]	5.24 [133]	11.42 [290]	0.47 [12]	0.26 [6.5]	0.37 [9.5]	30.42 [13.8]
I5	IP54		15–25 [11–18.5]		18.9 [480]	-	17.9 [454]	9.53 [242]	8.27 [210]	10.24 [260]	0.75 [19]	0.35 [9]	0.35 [9]	50.71 [23]
I6	IP54		30–50 [22–37]		25.6 [650]	-	2.6 [624]	9.53 [242]	8.27 [210]	10.24 [260]	0.75 [19]	0.35 [9]	0.35 [9]	59.52 [27]
I7	IP54		60–75 [45–55]		26.8 [680]	-	25.51 [648]	12.13 [308]	10.71 [272]	12.21 [310]	0.75 [19]	0.35 [9]	0.39 [9.8]	99.21 [45]
I8	IP54		100–125 [75–90]		30.32 [770]	-	29.1 [739]	14.57 [370]	13.2 [334]	13.2 [335]	0.75 [19]	0.35 [9]	0.39 [9.8]	143.3 [65]

Table 1.9

The dimensions are only for the physical units, but when installing in an application it is necessary to add space for free air passage both above and below the units. The amount of space for free air passage is listed in *Table 1.10*:

Enclosure		Clearance needed for free air passage (in [mm])	
Frame	IP class	Above unit	Below unit
H1	0.79 [20]	3.94 [100]	3.94 [100]
H2	0.79 [20]	3.94 [100]	3.94 [100]
H3	0.79 [20]	3.94 [100]	3.94 [100]
H4	0.79 [20]	3.94 [100]	3.94 [100]
H5	0.79 [20]	3.94 [100]	3.94 [100]
H6	0.79 [20]	7.87 [200]	7.87 [200]
H7	0.79 [20]	7.87 [200]	7.87 [200]
H8	0.79 [20]	88.58 [225]	88.58 [225]
H9	0.79 [20]	3.94 [100]	3.94 [100]
H10	0.79 [20]	7.87 [200]	7.87 [200]
I2	2.13 [54]	3.94 [100]	3.94 [100]
I3	2.13 [54]	3.94 [100]	3.94 [100]
I4	2.13 [54]	3.94 [100]	3.94 [100]
I5	2.13 [54]	7.87 [200]	7.87 [200]
I6	2.13 [54]	7.87 [200]	7.87 [200]
I7	2.13 [54]	7.87 [200]	7.87 [200]
I8	2.13 [54]	88.58 [225]	88.58 [225]

Table 1.10 Clearance Needed for Free Air Passage (in [mm])

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, (167° F [75°C]) recommended.

Power (hp [kW])				Torque [Nm]					
Frame	IP class	3x200–240 V	3x380–480 V	Line	Motor	DC connection	Control terminals	Ground	Relay
H1	IP20	0.34–2 [0.25–1.5]	0.5–2 [0.37–1.5]	1.4	0.8	0.8	0.5	0.8	0.5
H2	IP20	3 [2.2]	3–5 [2.2–4]	1.4	0.8	0.8	0.5	0.8	0.5
H3	IP20	5 [3.7]	7.5–10 [5.5–7.5]	1.4	0.8	0.8	0.5	0.8	0.5
H4	IP20	7.5–10 [5.5–7.5]	15–20 [11–15]	1.2	1.2	1.2	0.5	0.8	0.5
H5	IP20	15 [11]	25–30 [18.5–22]	1.2	1.2	1.2	0.5	0.8	0.5
H6	IP20	20–25 [15–18]	45–60 [30–45]	4.5	4.5	-	0.5	3	0.5
H7	IP20	30–45 [22–30]	75 [55]	10	10	-	0.5	3	0.5
H7	IP20	-	100 [75]	14	14	-	0.5	3	0.5
H8	IP20	50–60 [37–45]	125 [90]	24[2]	24[2]	-	0.5	3	0.5

Table 1.11

Power (hp [kW])			Torque [Nm]					
Frame	IP class	3x380–480 V	Line	Motor	DC connection	Control terminals	Ground	Relay
I2	IP54	1–5 [0.75–4.0]	1.4	0.8	0.8	0.5	0.8	0.5
I3	IP54	7.5–10 [5.5–7.5]	1.4	0.8	0.8	0.5	0.8	0.5
I4	IP54	15–25 [11–18.5]	1.4	0.8	0.8	0.5	0.8	0.5
I5	IP54	15–25 [11–18.5]	1.8	1.8	-	0.5	3	0.6
I6	IP54	30–50 [22–37]	4.5	4.5	-	0.5	3	0.6
I7	IP54	60–75 [45–55]	10	10	-	0.5	3	0.6
I8	IP54	100–125 [75–90]	14/24[1]	14/24[1]	-	0.5	3	0.6

Table 1.12

Power (hp [kW])			Torque [Nm]					
Frame	IP class	3x525–600 V	Line	Motor	DC connection	Control terminals	Ground	Relay
H9	IP20	3–10 [2.2–7.5]	1.8	1.8	not recommended	0.5	3	0.6
H10	IP20	15–20 [11–15]	1.8	1.8	not recommended	0.5	3	0.6
H6	IP20	25–45 [18.5–30]	4.5	4.5	-	0.5	3	0.5
H7	IP20	50–75 [37–55]	10	10	-	0.5	3	0.5
H8	IP20	100–125 [75–90]	14/24[1]	14/24[1]	-	0.5	3	0.5

Table 1.13 Details of Tightening Torques

[1] *Cable dimensions ≤0.1472 [95 mm²]*

[2] *Cable dimensions >0.1472 [95 mm²]*

1.3.5 Connecting to Line Power and Motor

The adjustable frequency drive is designed to operate all standard three-phased asynchronous motors. For maximum cross-section on wires, see *1.6 General Specifications*.

- 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, see *FC 101 De-coupling Plate Mounting Instruction MI02Q*.
- Also see *EMC-compatible Installation in the VLT® HVAC Basic Design Guide, MG18C*.

1. Mount the ground wires to the ground terminal.
2. Connect the motor to terminals U, V and W.
3. Mount line power supply to terminals L1, L2 and L3 and tighten.

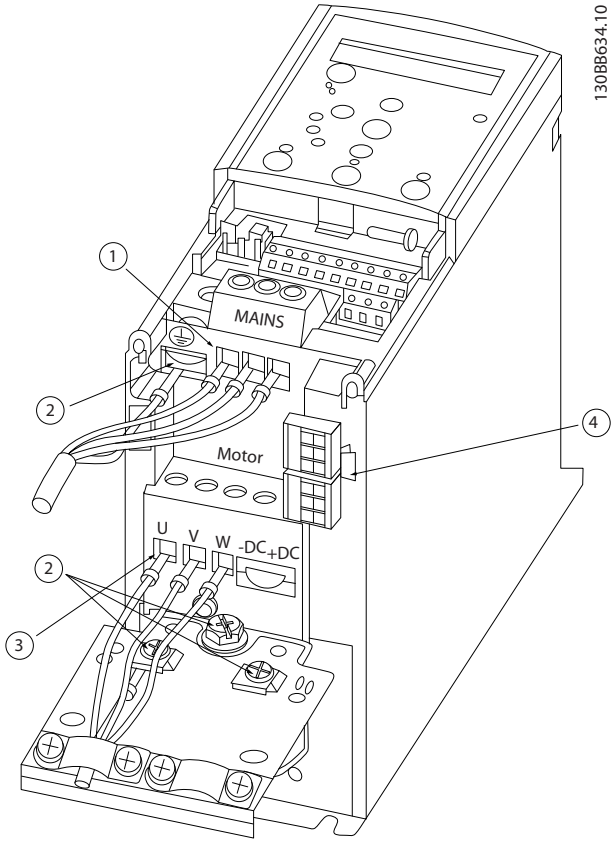


Figure 1.3 H1-H5 Frame
IP20 200–240 V 0.34–15 hp [0.25–11 kW] and IP20 380–480 V 0.5–30 hp [0.37–22 kW].

1	Line
2	Ground
3	Motor
4	Relays

Table 1.14

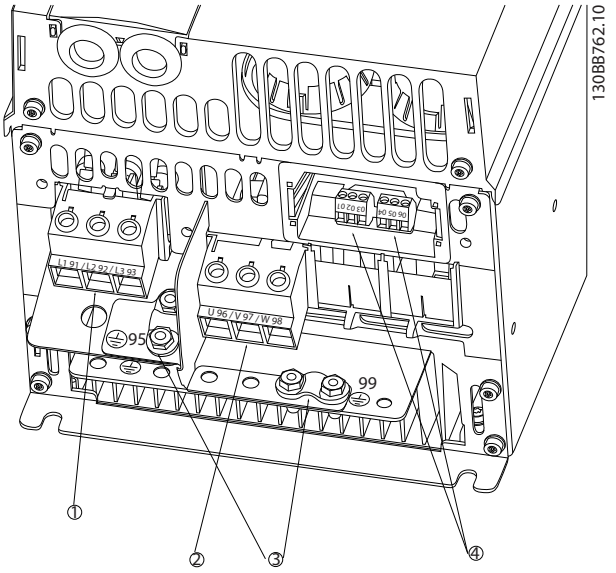


Figure 1.4 H6 Frame
IP20 380–480 V 40–60 hp [30–45 kW]
IP20 200–240 V 20–25 hp [15–18.5 kW]
IP20 525–600 V 30–40 hp [22–30 kW|

1	Line
2	Motor
3	Ground
4	Relays

Table 1.15

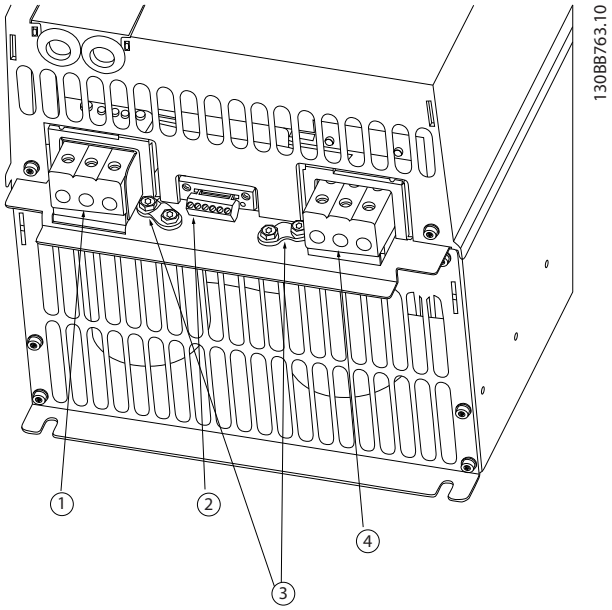


Figure 1.5 H7 Frame
IP20 380–480 V 75–100 hp [55–75 kW]
IP20 200–240 V 30–40 hp [22–30 kW]
IP20 525–600 V 60–75 hp [45–55 kW]

1	Line
2	Relays
3	Ground
4	Motor

Table 1.16

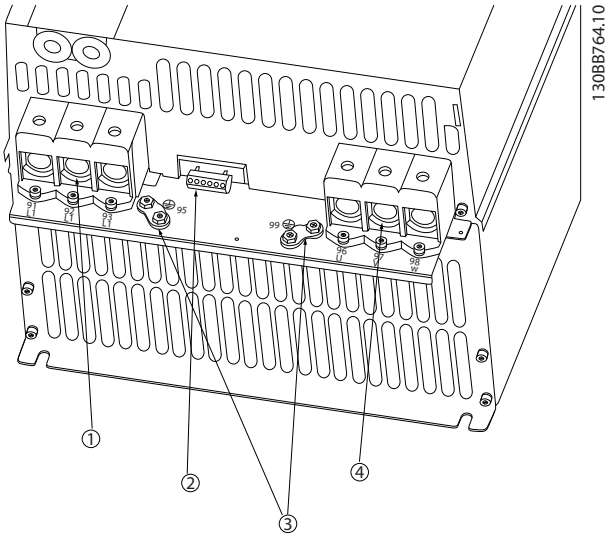


Figure 1.6 H8 Frame
IP20 380-480 V 125 hp [90 kW]
IP20 200–240 V 50–60 hp [37–45 kW]
IP20 525–600 V 100–125 hp [75–90 kW]

1	Line
2	Relays
3	Ground
4	Motor

Table 1.17

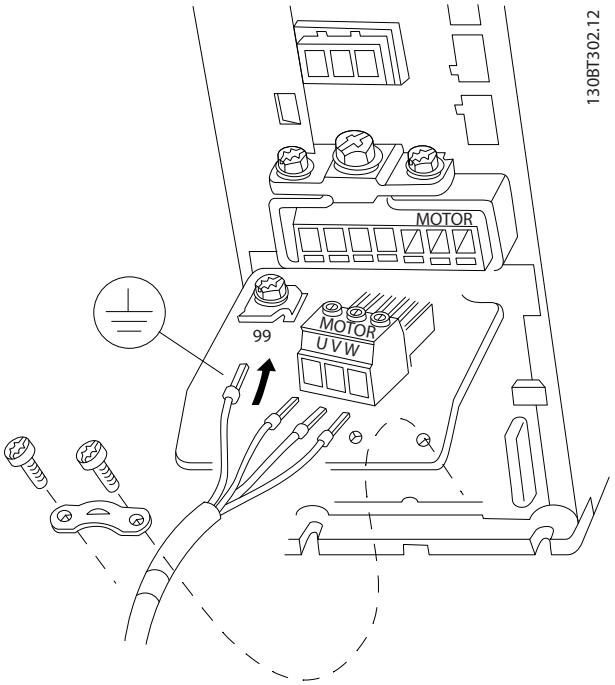


Figure 1.7 H9 Frame
IP20 600 V 3–10 hp [2.2–7.5 kW]

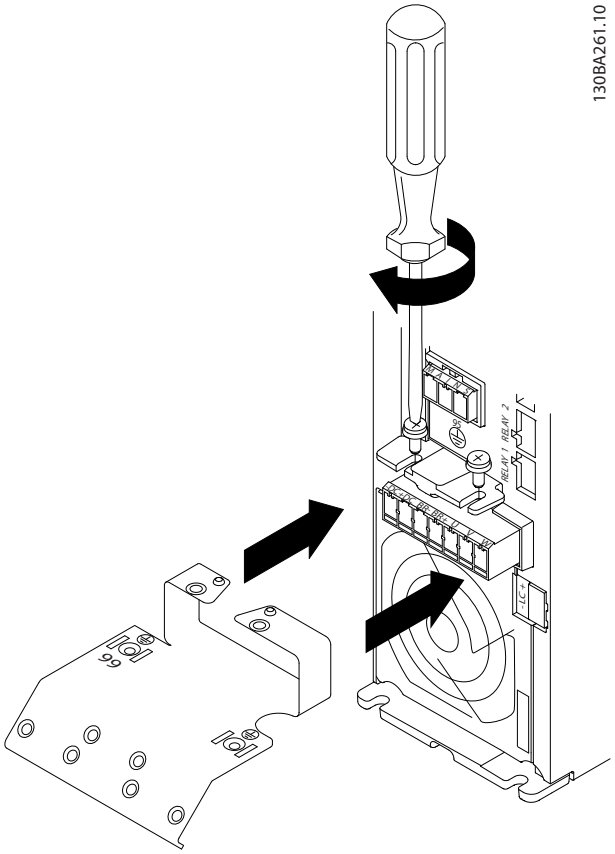


Figure 1.8

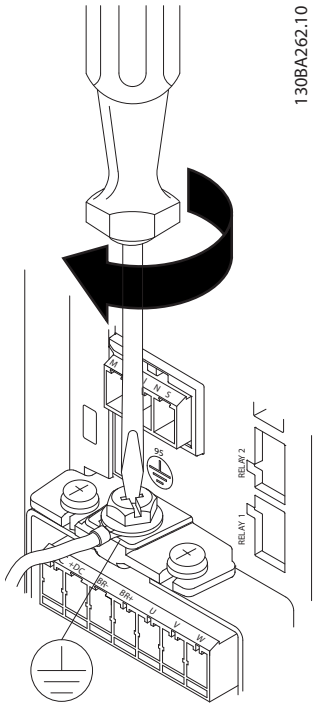


Figure 1.9

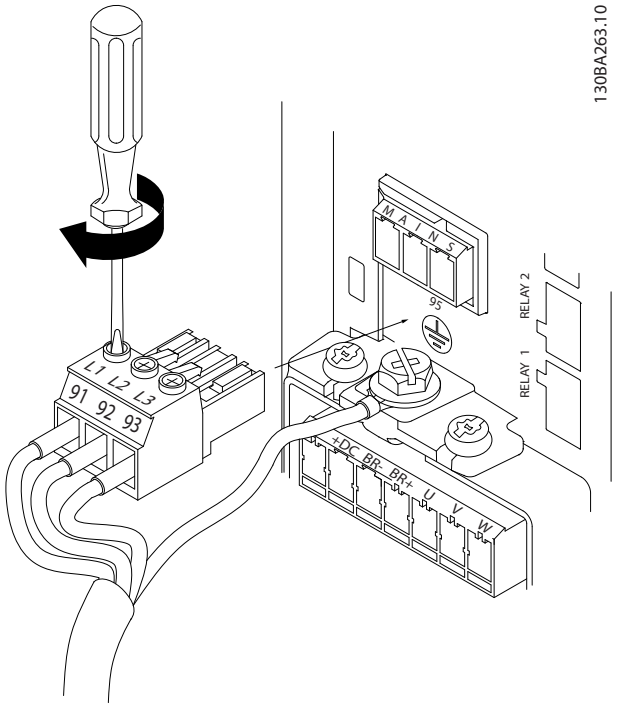


Figure 1.10

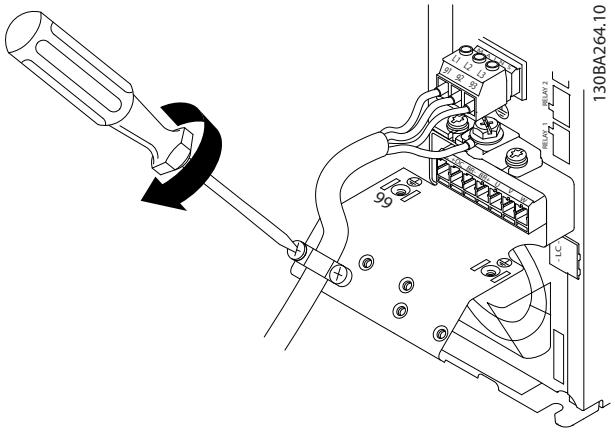


Figure 1.11

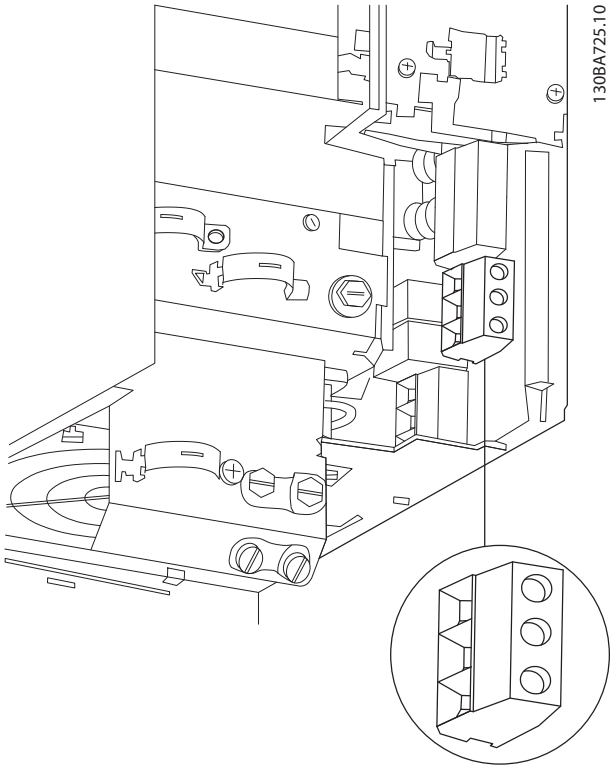


Figure 1.12 H10 Frame
IP20 600 V 15–20 hp [11–15 kW]

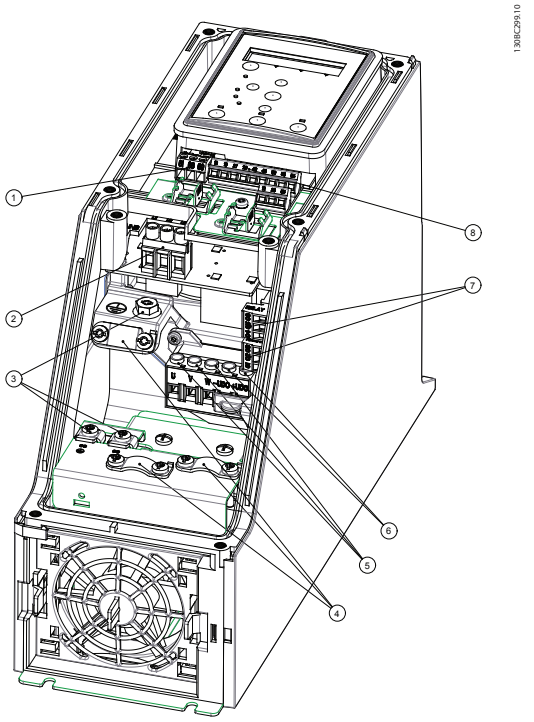


Figure 1.13 I2 Frame
IP54 380–480 V 1–5 hp [0.75–4.0 kW]

1	RS-485
2	Line in
3	Ground
4	Wire clamps
5	Motor
6	UDC
7	Relays
8	I/O

Table 1.18

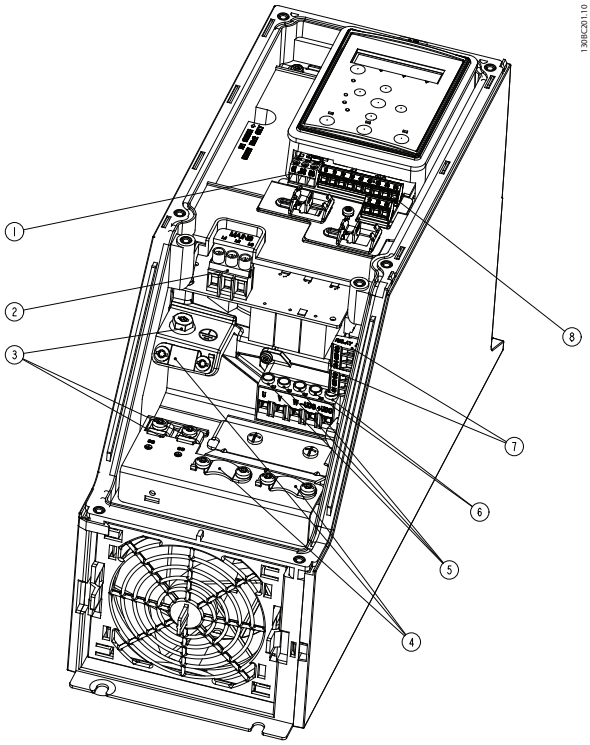


Figure 1.14 I3 Frame
IP54 380–480 V 75–100 hp [5.5–7.5 kW]

1	RS-485
2	Line in
3	Ground
4	Wire clamps
5	Motor
6	UDC
7	Relays
8	I/O

Table 1.19

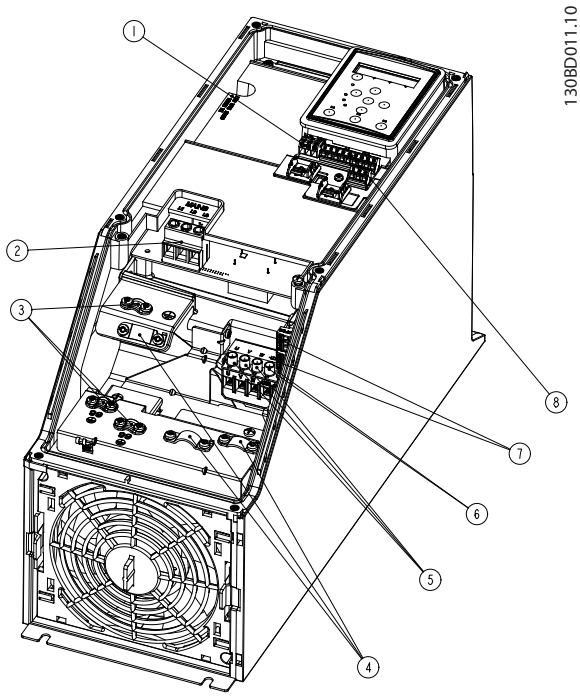
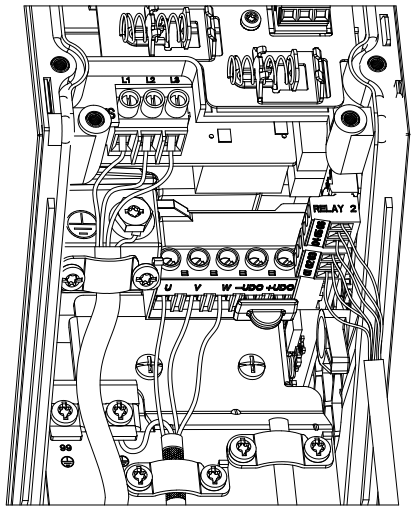


Figure 1.15 I4 Frame
IP54 380–480 V 1–5 hp [0.75–4.0 kW]

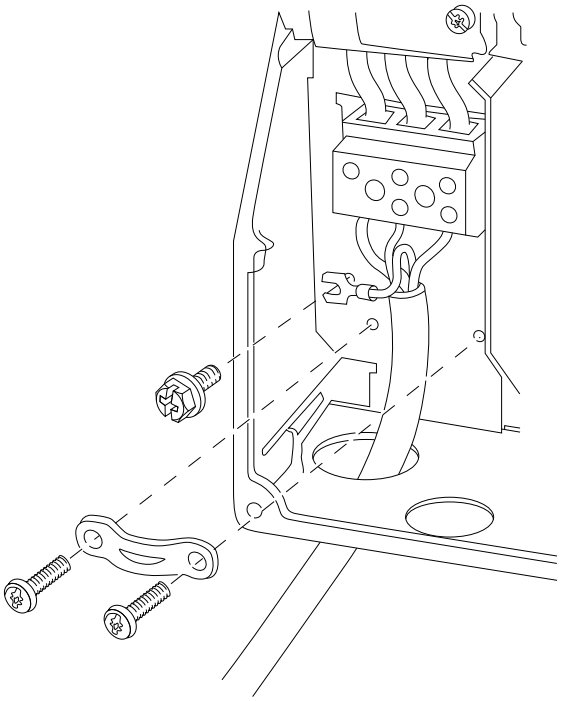
1	RS-485
2	Line in
3	Ground
4	Wire clamps
5	Motor
6	UDC
7	Relays
8	I/O

Table 1.20



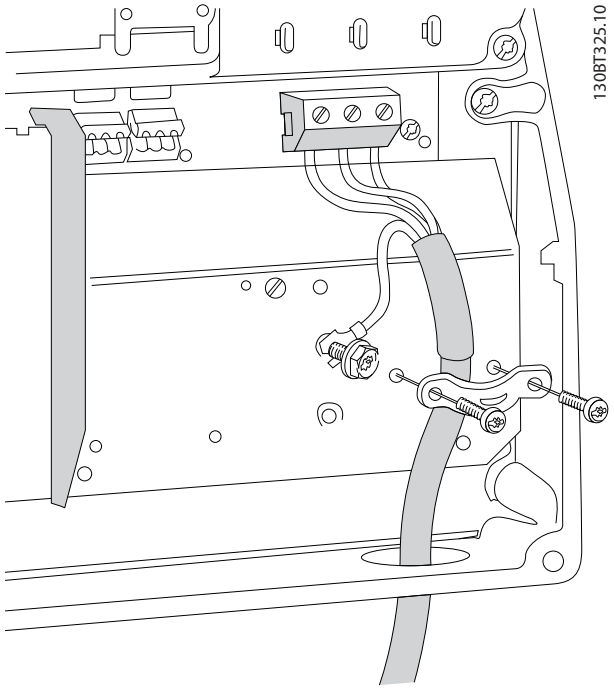
130BC203.10

Figure 1.16 IP54 I2-I3-I4 frame



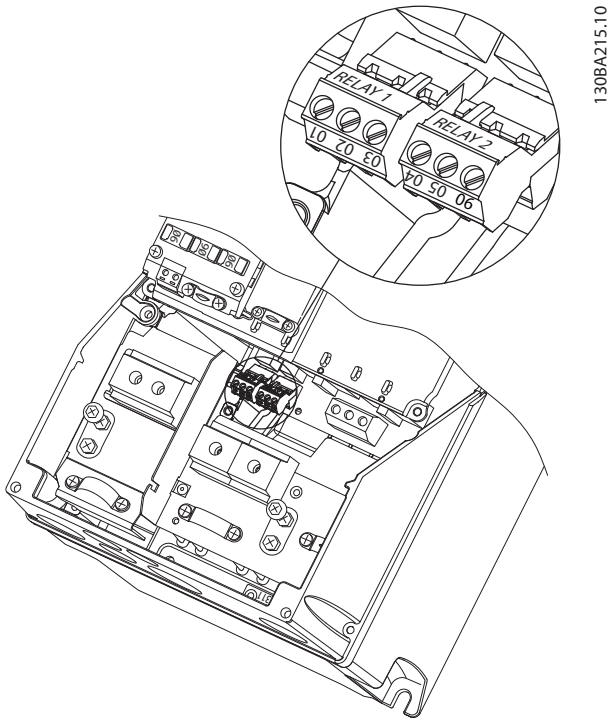
130BT326.10

Figure 1.17 I6 Frame
IP54 380-480 V 30–50 hp [22–37 kW]



130BT325.10

Figure 1.18 I6 Frame
IP54 380-480 V 30–50 hp [22–37 kW]



130BA215.10

Figure 1.19 I6 Frame
IP54 380-480 V 30–50 hp [22–37 kW]

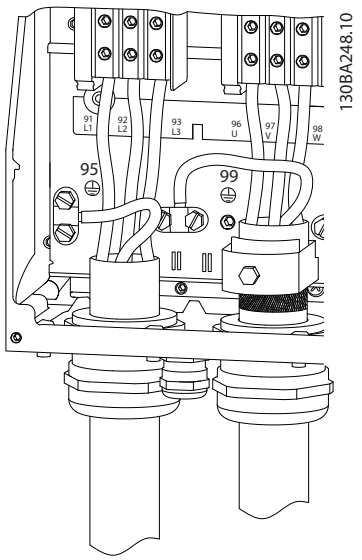


Figure 1.20 I7, I8 Frame
IP54 380–480 V 60–75 hp [45–55 kW]
IP54 380–480 V 100–125 hp [75–90 kW]

1.3.6 Fuses

Branch circuit protection
In order to protect the installation from electrical and fire hazards, all branch circuits in an installation, switch gears, machines etc., must be protected from short-circuits and overcurrents 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 adjustable frequency drive 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 100,000 A_{rms} (symmetrical), 480 V maximum.

Non-UL compliance
If UL/cUL is not to be complied with, Danfoss recommends using the fuses mentioned in *Table 1.21*, which ensures compliance with IEC 61800-5-1.
In case of malfunction, not following the fuse recommendation may result in damage to the adjustable frequency drive.

	Circuit Breaker		Fuse				
	UL	Non-UL	UL				Non-UL
			Bussmann	Bussmann	Bussmann	Bussmann	Max fuse
Power (hp [kW])			Type RK5	Type RK1	Type J	Type T	Type G
3x200–240 V IP20							
0.34 [0.25]			FRS-R-10	KTN-R10	JKS-10	JIN-10	10
0.5 [0.37]			FRS-R-10	KTN-R10	JKS-10	JIN-10	10
1 [0.75]			FRS-R-10	KTN-R10	JKS-10	JIN-10	10
2 [1.5]			FRS-R-10	KTN-R10	JKS-10	JIN-10	10
3 [2.2]			FRS-R-15	KTN-R15	JKS-15	JIN-15	16
5 [3.7]			FRS-R-25	KTN-R25	JKS-25	JIN-25	25
7.5 [5.5]			FRS-R-50	KTN-R50	JKS-50	JIN-50	50
10 [7.5]			FRS-R-50	KTN-R50	JKS-50	JIN-50	50
15 [11]			FRS-R-80	KTN-R80	JKS-80	JIN-80	65

	Circuit Breaker		Fuse				
	UL	Non-UL	UL				Non-UL
			Bussmann	Bussmann	Bussmann	Bussmann	Max fuse
Power (hp [kW])			Type RK5	Type RK1	Type J	Type T	Type G
20 [15]	Cutler-Hammer EGE3100FFG	Moeller NZMB1-A125	FRS-R-100	KTN-R100			125
25 [18.5]			FRS-R-100	KTN-R100			125
30 [22]	Cutler-Hammer JGE3150FFG	Moeller NZMB1-A160	FRS-R-150	KTN-R150			160
40 [30]			FRS-R-150	KTN-R150			160
50 [37]	Cutler-Hammer JGE3200FFG	Moeller NZMB1-A200	FRS-R-200	KTN-R200			200
60 [45]			FRS-R-200	KTN-R200			200
3x380–480 V IP20							
0.5 [0.37]			FRS-R-10	KTS-R10	JKS-10	JJS-10	10
1 [0.75]			FRS-R-10	KTS-R10	JKS-10	JJS-10	10
2 [1.5]			FRS-R-10	KTS-R10	JKS-10	JJS-10	10
3 [2.2]			FRS-R-15	KTS-R15	JKS-15	JJS-15	16
4 [3]			FRS-R-15	KTS-R15	JKS-15	JJS-15	16
5 [4]			FRS-R-15	KTS-R15	JKS-15	JJS-15	16
7.5 [5.5]			FRS-R-25	KTS-R25	JKS-25	JJS-25	25
10 [7.5]			FRS-R-25	KTS-R25	JKS-25	JJS-25	25
15 [11]			FRS-R-50	KTS-R50	JKS-50	JJS-50	50
20 [15]			FRS-R-50	KTS-R50	JKS-50	JJS-50	50
25 [18.5]			FRS-R-80	KTS-R80	JKS-80	JJS-80	65
30 [22]			FRS-R-80	KTS-R80	JKS-80	JJS-80	65
40 [30]	Cutler-Hammer EGE3125FFG	Moeller NZMB1-A125	FRS-R-80	KTS-R80	JKS-R80	JJS-R80	80
50 [37]			FRS-R-100	KTS-R100	JKS-R100	JJS-R100	100
60 [45]			FRS-R-125	KTS-R125	JKS-R125	JJS-R125	125
75 [55]	Cutler-Hammer JGE3200FFG	Moeller NZMB1-A200	FRS-R-150	KTS-R150	JKS-R150	JJS-R150	150
100 [75]			FRS-R-200	KTS-R200	JKS-R200	JJS-R200	200
125 [90]	Cutler-Hammer JGE3250FFG	Moeller NZMB2-A250	FRS-R-250	KTS-R250	JKS-R250	JJS-R250	250

Table 1.21

	Circuit Breaker		Fuse				
	UL	Non-UL	UL				Non-UL
			Bussmann	Bussmann	Bussmann	Bussmann	Max fuse
Power (hp [kW])			Type RK5	Type RK1	Type J	Type T	Type G
3x525–600 V IP20							
3 [2.2]				KTS-R20			20
3				KTS-R20			20
5 [3.7]				KTS-R20			20
5.5				KTS-R20			20
10 [7.5]				KTS-R20			30
11				KTS-R30			35
20 [15]				KTS-R30			35
18.5	Cutler-Hammer EGE3080FFG	Cutler-Hammer EGE3080FFG	FRS-R-80	KTN-R80			80
30 [22]			FRS-R-80	KTN-R80			80
40 [30]			FRS-R-80	KTN-R80			80
50 [37]	Cutler-Hammer JGE3125FFG	Cutler-Hammer JGE3125FFG	FRS-R-125	KTN-R125			125
60 [45]			FRS-R-125	KTN-R125			125
75 [55]			FRS-R-125	KTN-R125			125
100 [75]	Cutler-Hammer JGE3200FAG	Cutler-Hammer JGE3200FAG	FRS-R-200	KTN-R200			200
125 [90]			FRS-R-200	KTN-R200			200
3x380–480 V IP54							
1 [0.75]							
2 [1.5]							
3 [2.2]							
4 [3]							
5 [4]							
7.5 [5.5]							
10 [7.5]							
15 [11]							
20 [15]							
25 [18.5]							
30 [22]	Moeller NZMB1-A125						125
40 [30]							125
50 [37]							125
60 [45]	Moeller NZMB2-A160						160
75 [55]							160
100 [75]	Moeller NZMB2-A250						200
125 [90]							200

Table 1.22 Fuses

1.3.7 EMC-compatible Electrical Installation

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

- Use only shielded/armored motor cables and shielded/armored control cables.
- Connect the shield to ground at both ends.
- Avoid installation with twisted shield ends (pigtails), since this ruins the shielding 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 adjustable frequency drive.
- Use star-washers and galvanically grounding plates.
- Do not use shielded/armored motor cables in the installation cabinets.

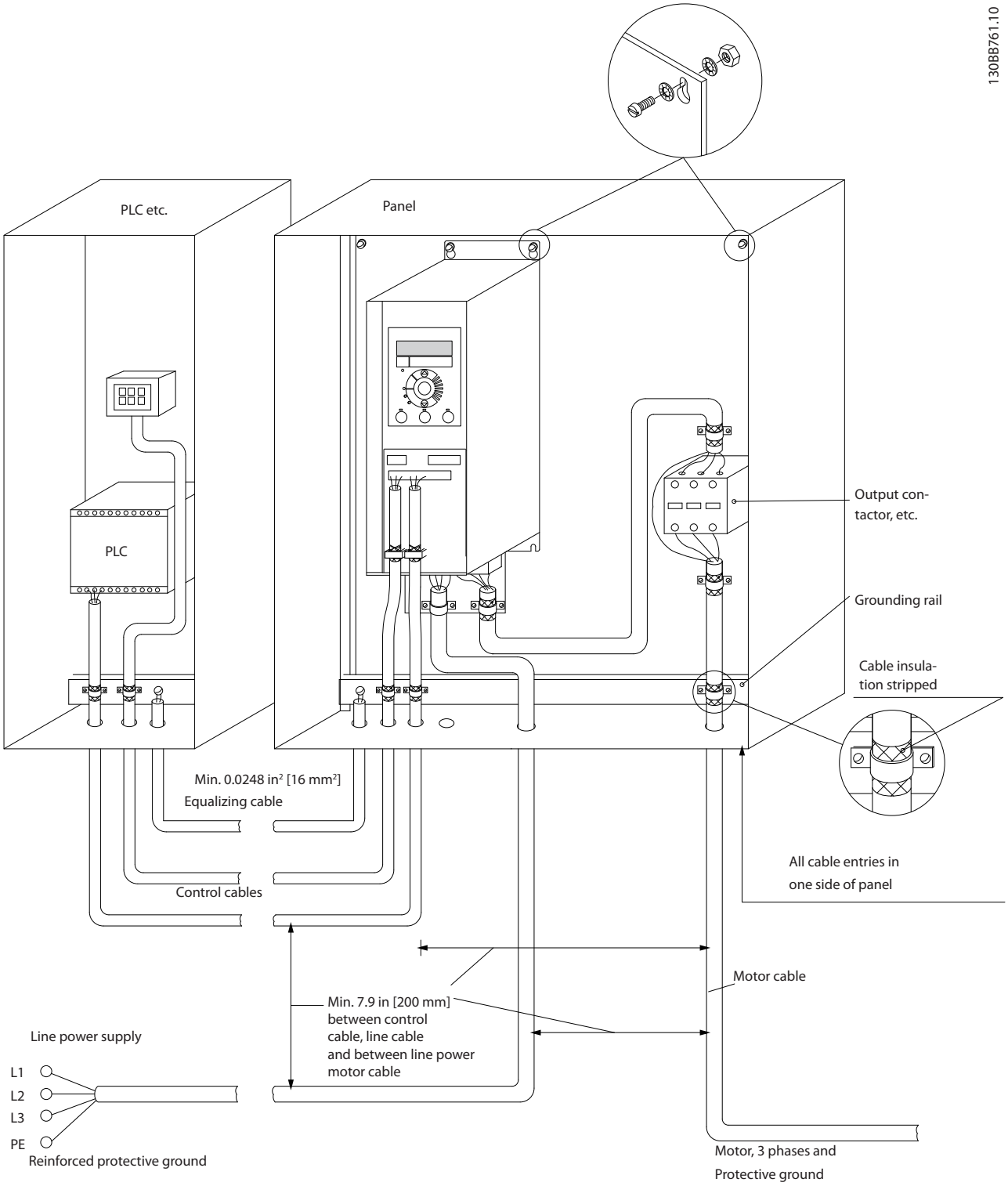


Figure 1.21 EMC-compatible Electrical Installation

NOTE!

For North America, use metal conduits instead of shielded cables.

1.3.8 Control Terminals

IP20 200–240 V 0.34–15 hp [0.25–11 kW] and IP20 380–480 V 0.5–30 hp [0.37–22 kW]:

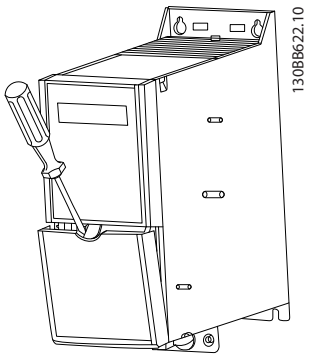


Figure 1.22 Location of Control Terminals

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

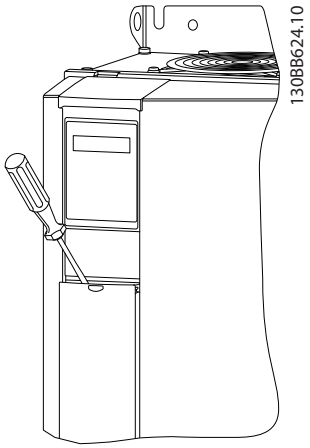


Figure 1.23 IP20 380–480 V 40–125 hp [30–90 kW]

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 Digital Input Mode* (PNP is default value) and digital input 29 mode is set in *5-03 Digital Input 29 Mode* (PNP is default value).

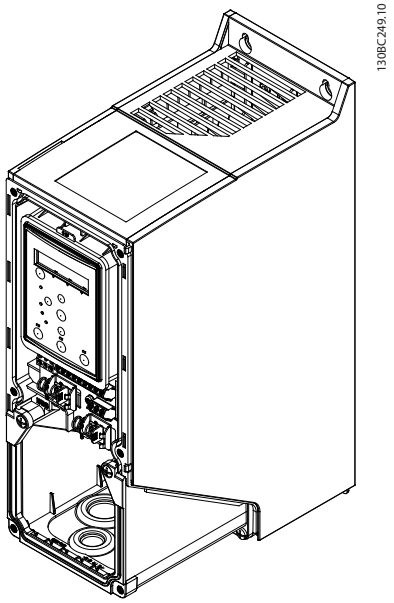


Figure 1.24 IP54 400 V 1–10 hp [0.75–7.5 kW]

1. Remove the front cover.

Control terminals

Figure 1.25 shows all control terminals of the adjustable frequency drive. Applying Start (term. 18), connection between terminal 12-27 and an analog reference (term. 53 or 54 and 55) make the adjustable frequency drive run.

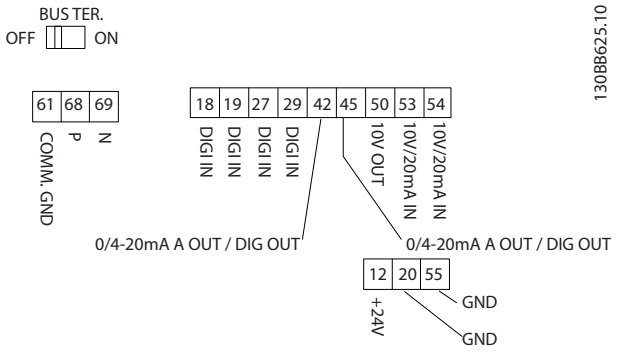


Figure 1.25 Control Terminals

1.3.9 Electrical Overview

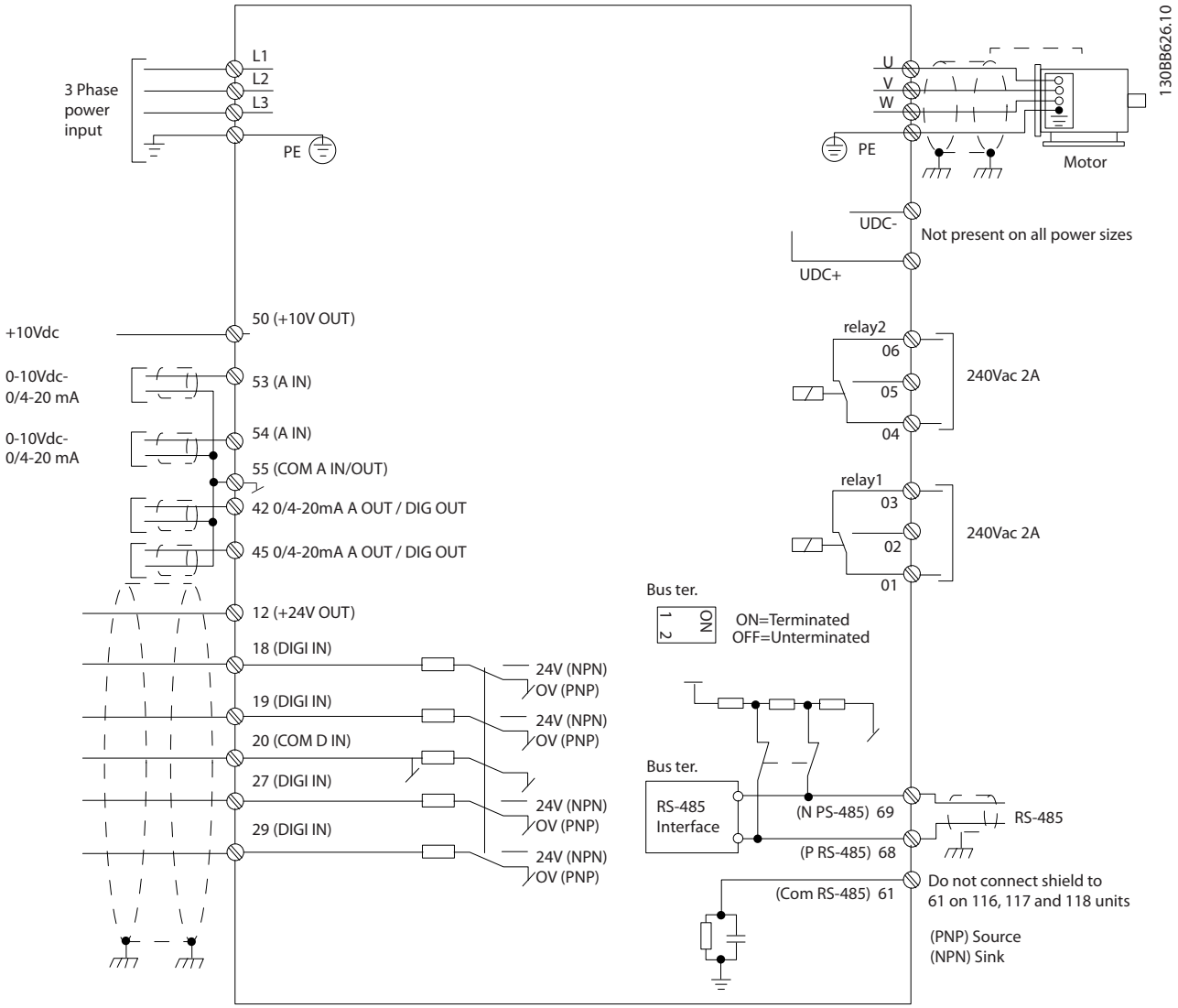


Figure 1.26

NOTE!

There is no access to UDC- and UDC+ on the following units:
IP20 380–480 V 40–125 hp [30–90 kW]
IP20 200–240 V 20–60 hp [15–45 kW]
IP20 525–600 V 3–125 hp [2.2–90 kW]
IP54 380–480 V 30–125 hp [22–90 kW]

1.4 Programming

1.4.1 Programming with the Local Control Panel (LCP)

NOTE!

The adjustable frequency drive can also be programmed from a PC via RS-485 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 *website: www.danfoss.com/BusinessAreas/DrivesSolutions/softwaredownload*

1.4.2 Local Control Panel (LCP)

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 LEDs

D. Operation keys and LEDs

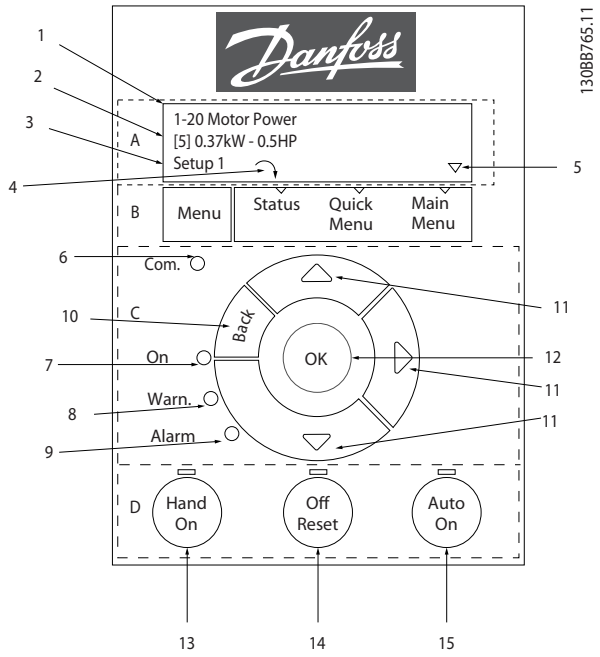


Figure 1.27

A. Alpha Numeric Display

The LCD display is backlit with two alpha-numeric lines. All data is displayed on the LCP.

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 the active and edit set-up, only that set-up number is shown (factory setting). When the active and edit set-up differ, both numbers are shown in the display (Set-up 12). The flashing number 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 counter-clockwise.
5	The triangle indicates if the LCP is in status, quick menu or main menu.

Table 1.23

B. Menu key

Use the menu key to select between status, quick menu or main menu.

C. Navigation keys and 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	[▲] [▼] [►]: For navigating 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

Table 1.24

D. Operation keys and LEDs

13	[Hand On]: Starts the motor and enables control of the adjustable frequency drive via the LCP. **NOTE!** **Terminal 27 Digital Input (*5-12 Terminal 27 Digital Input*) has coast inverse as default setting. This means that [Hand On] not starts the motor if there is no 24 V to terminal 27. 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]: The adjustable frequency drive is controlled either via control terminals or serial communication.

Table 1.25

At power-up

At the first power-up, select the preferred language. Once selected, this screen never shows again in the following power-ups, but language can still be changed in *0-01 Language*.

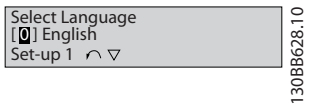


Figure 1.28

1.4.3 The Start-up Wizard for Open-loop Applications

The built-in "wizard" menu guides the installer through the set-up of the adjustable frequency drive in a clear and structured manner to set up an open-loop application. An open-loop application is here an application with a start signal, analog reference (voltage or current) and optionally also relay signals (but no feedback signal from the process applied).

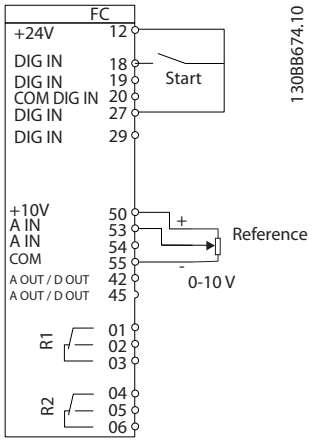


Figure 1.29

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 returns to the status screen.

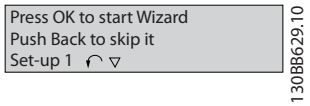
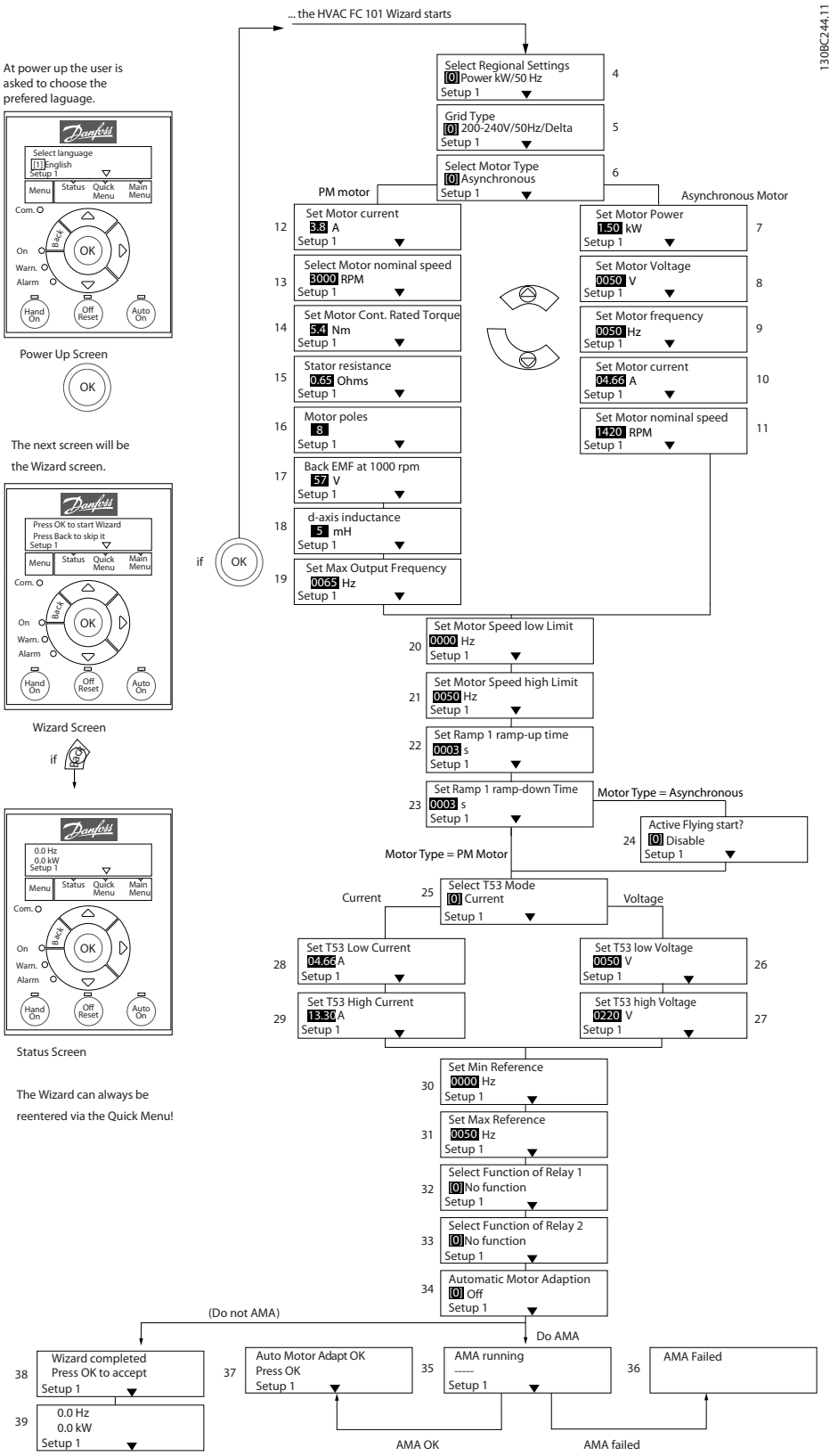


Figure 1.30


130BC244.11
... the HVAC FC 101 Wizard starts
At power up the user is asked to choose the prefered laguage.
Select language
[1] English
Setup 1
Menu
Status
Quick Menu
Main Menu
Com.
On
Warn.
Alarm
Back
OK
Hand On
Off Reset
Auto On
Power Up Screen
The next screen will be the Wizard screen.
Press OK to start Wizard
Press Back to skip it
Wizard Screen
if
0.0 Hz
0.0 kW
Status Screen
The Wizard can always be reentered via the Quick Menu!
Select Regional Settings
[0] Power kW/50 Hz
Grid Type
[0] 200-240V/50Hz/Delta
Select Motor Type
[0] Asynchronous
PM motor
Asynchronous Motor
Set Motor current
3.8 A
Set Motor Power
1.50 kW
Select Motor nominal speed
3000 RPM
Set Motor Voltage
0050 V
Set Motor Cont. Rated Torque
5.4 Nm
Set Motor frequency
0050 Hz
Stator resistance
0.65 Ohms
Set Motor current
04.66 A
Motor poles
8
Set Motor nominal speed
1420 RPM
Back EMF at 1000 rpm
57 V
d-axis inductance
5 mH
Set Max Output Frequency
0065 Hz
Set Motor Speed low Limit
0000 Hz
Set Motor Speed high Limit
0050 Hz
Set Ramp 1 ramp-up time
0003 s
Set Ramp 1 ramp-down Time
0003 s
Motor Type = Asynchronous
Active Flying start?
[0] Disable
Motor Type = PM Motor
Current
Select T53 Mode
[0] Current
Voltage
Set T53 Low Current
04.66 A
Set T53 low Voltage
0050 V
Set T53 High Current
13.30 A
Set T53 high Voltage
0220 V
Set Min Reference
0000 Hz
Set Max Reference
0050 Hz
Select Function of Relay 1
[0] No function
Select Function of Relay 2
[0] No function
Automatic Motor Adaption
[0] Off
(Do not AMA)
Do AMA
Wizard completed
Press OK to accept
0.0 Hz
0.0 kW
Auto Motor Adapt OK
Press OK
AMA running

AMA Failed
AMA OK
AMA failed

Figure 1.31

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 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 operating mode for restart upon reconnection of the drive to AC line voltage after power-down
1-10 Motor Construction	*[0] Asynchron [1] PM, non-salient SPM	[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) 1-39 Motor Poles 1-40 Back EMF at 1000 RPM 1-66 Min. Current at Low Speed 1-72 Start Function 1-73 Flying Start 4-19 Max Output Frequency 4-58 Missing Motor Phase Function
1-20 Motor Power	0.12–110 kW/0.16–150 hp	Size related	Enter motor power from nameplate data

No & Name	Range	Default	Function
1-22 Motor Voltage	50.0–1,000.0 V	Size related	Enter motor voltage from nameplate data
1-23 Motor Frequency	20.0–400.0 Hz	Size related	Enter motor frequency from nameplate data
1-24 Motor Current	0.01–10,000.00 A	Size related	Enter motor current from nameplate data
1-25 Motor Nominal Speed	100.0–9,999.0 RPM	Size related	Enter motor nominal speed from nameplate data
1-26 Motor Cont. Rated Torque	0.1–1,000.0	Size related	This parameter is available only when 1-10 Motor Construction Design is set to *[1] PM, non-salient SPM*. **NOTE!** **Changing this parameter will affect 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
1-37 d-axis Inductance (Ld)	0–1,000	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.
1-39 Motor Poles	2–100	4	Enter the number of motor poles
1-40 Back EMF at 1000 RPM	10–9,000	Size related	Line-Line RMS back EMF voltage at 1000 RPM
1-73 Flying Start			When PM is selected, Flying Start is enabled and cannot disable
1-73 Flying Start	[0] Disabled [1] Enabled	0	Select *[1] Enable* to enable the drive to catch a motor spinning due to line drop-out. Select *[0] Disable* if this function is not required. When is enabled *1-71 Start Delay* and *1-72 Start Function* have no function. is active in VVC+ mode only.
3-02 Minimum Reference	-4,999–4,999	0	The minimum reference is the lowest value obtainable by summing all references.
3-03 Maximum Reference	-4,999–4,999	50	The maximum reference is the lowest obtainable by summing all references.
3-41 Ramp 1 Ramp Up Time	0.05–3,600.0 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
3-42 Ramp 1 Ramp Down Time	0.05–3,600.0 s	Size related	Ramp-down time from rated 1-23 Motor Frequency to 0 if Asynchron 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]	0.0–400 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
4-19 Max Output Frequency	0–400	Size related	Enter the maximum output frequency value
5-40 Function Relay [0] Function relay	See 5-40 Function Relay	Alarm	Select the function to control output relay 1.

No & Name	Range	Default	Function
5-40 Function Relay [1] Function relay	See 5-40 Function Relay	Drive running	Select the function to control output relay 2.
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.

Table 1.26

Closed-loop Set-up Wizard

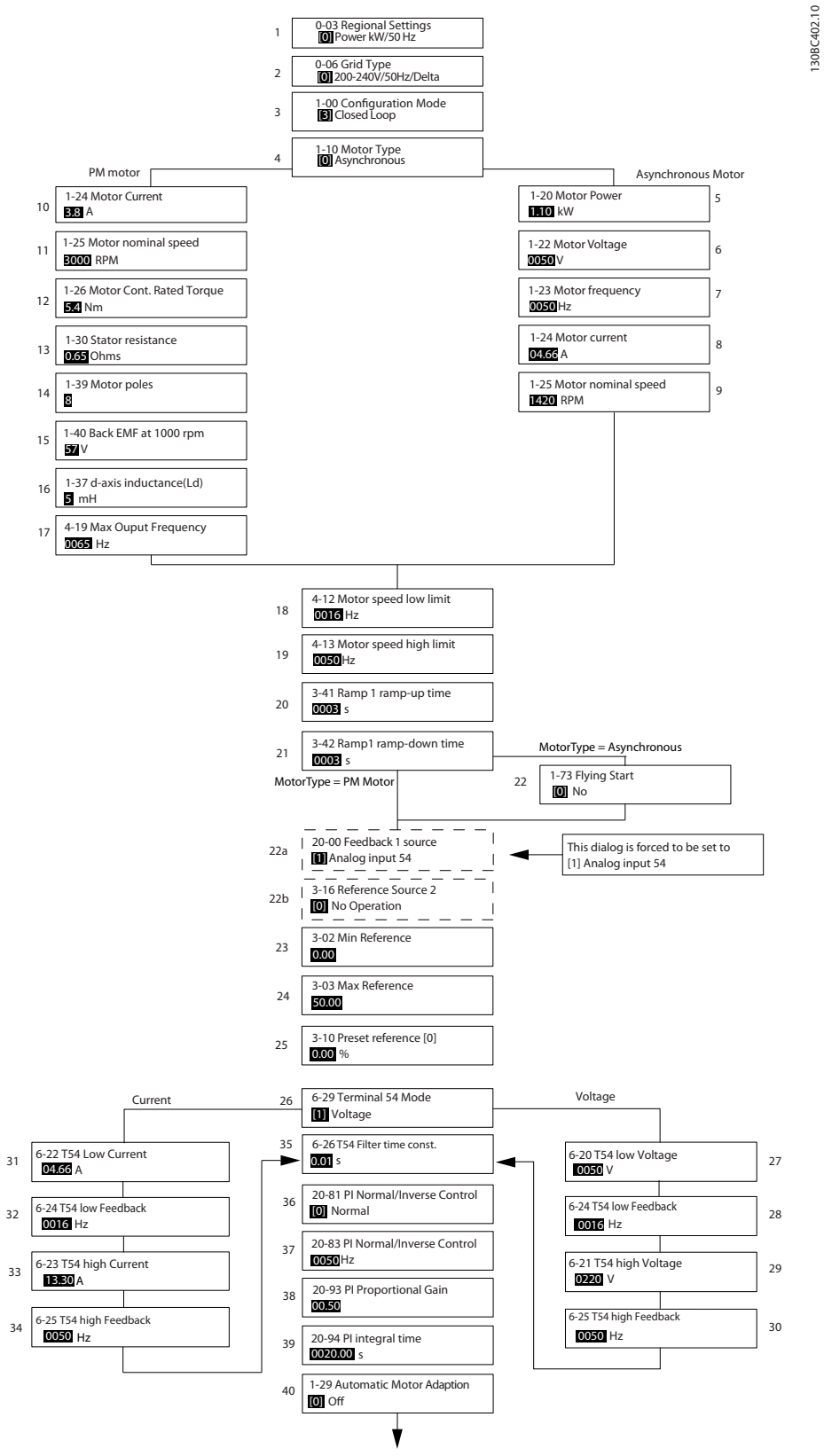

130BC402.10
1 0-03 Regional Settings [0] Power kW/50 Hz
2 0-06 Grid Type [0] 200-240V/50Hz/Delta
3 1-00 Configuration Mode [3] Closed Loop
4 1-10 Motor Type [0] Asynchronous
PM motor
Asynchronous Motor
10 1-24 Motor Current 3.8 A
11 1-25 Motor nominal speed 3000 RPM
12 1-26 Motor Cont. Rated Torque 5.4 Nm
13 1-30 Stator resistance 0.65 Ohms
14 1-39 Motor poles 8
15 1-40 Back EMF at 1000 rpm 57 V
16 1-37 d-axis inductance(Ld) 5 mH
17 4-19 Max Ouput Frequency 0065 Hz
5 1-20 Motor Power 1.10 kW
6 1-22 Motor Voltage 0050 V
7 1-23 Motor frequency 0050 Hz
8 1-24 Motor current 04.66 A
9 1-25 Motor nominal speed 1420 RPM
18 4-12 Motor speed low limit 0016 Hz
19 4-13 Motor speed high limit 0050 Hz
20 3-41 Ramp 1 ramp-up time 0003 s
21 3-42 Ramp1 ramp-down time 0003 s
MotorType = Asynchronous
22 1-73 Flying Start [0] No
MotorType = PM Motor
22a 20-00 Feedback 1 source [1] Analog input 54
This dialog is forced to be set to [1] Analog input 54
22b 3-16 Reference Source 2 [0] No Operation
23 3-02 Min Reference 0.00
24 3-03 Max Reference 50.00
25 3-10 Preset reference [0] 0.00 %
Current
26 6-29 Terminal 54 Mode [1] Voltage
Voltage
31 6-22 T54 Low Current 04.66 A
32 6-24 T54 low Feedback 0016 Hz
33 6-23 T54 high Current 13.30 A
34 6-25 T54 high Feedback 0050 Hz
35 6-26 T54 Filter time const. 0.01 s
36 20-81 PI Normal/Inverse Control [0] Normal
37 20-83 PI Normal/Inverse Control 0050 Hz
38 20-93 PI Proportional Gain 00.50
39 20-94 PI integral time 0020.00 s
40 1-29 Automatic Motor Adaption [0] Off
27 6-20 T54 low Voltage 0050 V
28 6-24 T54 low Feedback 0016 Hz
29 6-21 T54 high Voltage 0220 V
30 6-25 T54 high Feedback 0050 Hz

Figure 1.32

Closed-loop Set-up Wizard

No & Name	Range	Default	Function
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 adjustable frequency drive to AC line voltage after power-down.
1-00 Configuration Mode	[0] Open-loop [3] Closed-loop	0	Change this parameter to Closed-loop
1-10 Motor Construction	*[0] Motor construction [1] PM, non-salient SPM	[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 1-25 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) 1-39 Motor Poles 1-40 Back EMF at 1000 RPM 1-66 Min. Current at Low Speed 1-72 Start Function 1-73 Flying Start 4-19 Max Output Frequency 4-58 Missing Motor Phase Function
1-20 Motor Power	0.125–150 hp [0.09–110 kW]	Size related	Enter motor power from nameplate data
1-22 Motor Voltage	50.0–1,000.0 V	Size related	Enter motor voltage from nameplate data
1-23 Motor Frequency	20.0–400.0 Hz	Size related	Enter motor frequency from nameplate data
1-24 Motor Current	0.0–10,000.00 A	Size related	Enter motor current from nameplate data
1-25 Motor Nominal Speed	100.0–9,999.0 RPM	Size related	Enter motor nominal speed from nameplate data
1-26 Motor Cont. Rated Torque	0.1–1,000.0	Size related	This parameter is available only when 1-10 Motor Construction Design is set to *[1] PM, non-salient SPM*. **NOTE!** **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)	0.000–99.990	Size related	Set the stator resistance value
1-37 d-axis Inductance (Ld)	0–1,000	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.

No & Name	Range	Default	Function
1-39 Motor Poles	2–100	4	Enter the number of motor poles
1-40 Back EMF at 1000 RPM	10–9,000	Size related	Line-Line RMS back EMF voltage at 1000 RPM
1-73 Flying Start	[0] Disabled [1] Enabled	0	Select *[1] Enable* to enable the adjustable frequency drive to catch a spinning motor, e.g., in fan applications. When PM is selected, Flying Start is enabled.
3-02 Minimum Reference	-4,999–4,999	0	The minimum reference is the lowest value obtainable by summing all references.
3-03 Maximum Reference	-4,999–4,999	50	The maximum reference is the highest value obtainable by summing all references.
3-10 Preset Reference	-100–100%	0	Enter the setpoint.
3-41 Ramp 1 Ramp Up Time	0.05–3,600.0 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.
3-42 Ramp 1 Ramp Down Time	0.05–3,600.0 s	Size related	Ramp-down time from rated 1-23 Motor Frequency to 0 if Asynchron 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]	0.0–400 Hz	0.0 Hz	Enter the minimum limit for low speed
4-14 Motor Speed High Limit [Hz]	0–400 Hz	65 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	-4,999–4,999	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	-4,999–4,999	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

No & Name	Range	Default	Function
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.

Table 1.27

Motor Set-up

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

No & Name	Range	Default	Function
0-03 Regional Settings	[0] Interna-tional [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 drive to AC line voltage after power-down
1-10 Motor Construction	*[0] Motor construction [1] PM, non-salient SPM	[0] Asynchron	
1-20 Motor Power	0.12–110 kW/ 0.16–150 hp	Size related	Enter motor power from nameplate data
1-22 Motor Voltage	50.0–1,000.0 V	Size related	Enter motor voltage from nameplate data
1-23 Motor Frequency	20.0–400.0 Hz	Size related	Enter motor frequency from nameplate data
1-24 Motor Current	0.01–10,000.00 A	Size related	Enter motor current from nameplate data
1-25 Motor Nominal Speed	100.0–9,999.0 RPM	Size related	Enter motor nominal speed from nameplate data

No & Name	Range	Default	Function
1-26 Motor Cont. Rated Torque	0.1–1,000.0	Size related	This parameter is available only when 1-10 Motor Construction Design is set to *[1] PM, non-salient SPM.* **NOTE!** **Changing this parameter affects the settings of other parameters**
1-30 Stator Resistance (Rs)	0.000–99.990	Size related	Set the stator resistance value
1-37 d-axis Inductance (Ld)	0–1,000	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.
1-39 Motor Poles	2–100	4	Enter the number of motor poles
1-40 Back EMF at 1000 RPM	10–9,000	Size related	Line-Line RMS back EMF voltage at 1000 RPM
1-73 Flying Start	[0] Disabled [1] Enabled	0	Select Enable to enable the adjustable frequency drive to catch a spinning motor.

No & Name	Range	Default	Function
3-41 Ramp 1 Ramp Up Time	0.05–3,600.0 s	Size related	Ramp-up time from 0 to rated *1-23 Motor Frequency*
3-42 Ramp 1 Ramp Down Time	0.05–3,600.0 s	Size related	Ramp-down time from rated *1-23 Motor Frequency* to 0
4-12 Motor Speed Low Limit [Hz]	0.0–400 Hz	0.0 Hz	Enter the minimum limit for low speed
4-14 Motor Speed High Limit [Hz]	0.0–400 Hz	65	Enter the maximum limit for high speed
4-19 Max Output Frequency	0–400	Size related	Enter the maximum output frequency value

Table 1.28

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 the factory setting 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 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 “Main Menu”.

The Main Menu accesses all parameters.

1. Press [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.

1.5.1 Main menu structure

0- Operation/Display**
0-0* Basic Settings
0-01 Language
0-03 Regional Settings
0-04 Operating State at Power-up
0-06 GridType
0-07 Auto DC Braking
0-1* Set-up Operations
0-10 Active Set-up
0-11 Programming Set-up
0-12 Link Set-ups
0-3* LCP Custom Readout
0-30 Custom Readout Unit
0-31 Custom Readout Min Value
0-32 Custom Readout Max Value
0-37 Display Text 1
0-38 Display Text 2
0-39 Display Text 3
0-4* LCP Keypad
0-40 [Hand on] Key on LCP
0-42 [Auto on] Key on LCP
0-44 [Off/Reset] Key on LCP
0-5* Copy/Save
0-50 LCP Copy
0-51 Set-up Copy
0-6* Password
0-60 Main Menu Password
1- Load and Motor**
1-0* General Settings
1-00 Configuration Mode
1-01 Motor Control Principle
1-03 Torque Characteristics
1-06 Clockwise Direction
1-1* Motor Selection
1-10 Motor Construction
1-14 Damping Gain
1-15 Low Speed Filter Time Const
1-16 High Speed Filter Time Const
1-17 Voltage filter time const
1-2* Motor Data
1-20 Motor Power
1-22 Motor Voltage
1-23 Motor Frequency
1-24 Motor Current
1-25 Motor Nominal Speed
1-26 Motor Cont. Rated Torque
1-29 Automatic Motor Adaption (AMA)
1-3* Adv. Motor Data
1-30 Stator Resistance (Rs)
1-33 Stator Leakage Reactance (X1)
1-35 Main Reactance (Xh)
1-37 d-axis Inductance (Ld)
1-39 Motor Poles
1-4* Adv. Motor Data II
1-40 Back EMF at 1000 RPM
1-42 Motor Cable Length
1-43 Motor Cable Length Feet
1-5* Load Indep. Setting
1-50 Motor Magnetization at Zero Speed
1-52 Min Speed Normal Magnetizing [Hz]
1-55 U/f Characteristic - U
1-56 U/f Characteristic - F
1-6* Load Depen. Setting
1-60 Low Speed Load Compensation
1-61 High Speed Load Compensation
1-62 Slip Compensation
1-63 Slip Compensation Time Constant
1-64 Resonance Dampening
1-65 Resonance Dampening Time Constant
1-66 Min. Current at Low Speed
1-7* Start Adjustments
1-71 Start Delay
1-72 Start Function
1-73 Flying Start
1-8* Stop Adjustments
1-80 Function at Stop
1-82 Min Speed for Function at Stop [Hz]
1-9* Motor Temperature
1-90 Motor Thermal Protection
1-93 Thermistor Source
2- Brakes**
2-0* DC Brake
2-00 DC Hold/Motor Preheat Current
2-01 DC Brake Current
2-02 DC Braking Time
2-04 DC Brake Cut-in Speed
2-06 Parking Current
2-07 Parking Time
2-1* Brake Energy Funct.
2-10 Brake Function
2-16 AC Brake, Max current
2-17 Over-voltage Control
3- Reference / Ramps**
3-0* Reference Limits
3-02 Minimum Reference
3-03 Maximum Reference
3-1* References
3-10 Preset Reference
3-11 Jog Speed [Hz]
3-14 Preset Relative Reference
3-15 Reference 1 Source
3-16 Reference 2 Source
3-17 Reference 3 Source
3-4* Ramp 1
3-41 Ramp 1 Ramp-up Time
3-42 Ramp 1 Ramp-down Time
3-5* Ramp 2
3-51 Ramp 2 Ramp-up Time
3-52 Ramp 2 Ramp-down Time
3-8* Other Ramps
3-80 Jog Ramp Time
3-81 Quick Stop Ramp Time
4- Limits / Warnings**
4-1* Motor Limits
4-10 Motor Speed Direction
4-12 Motor Speed Low Limit [Hz]
4-14 Motor Speed High Limit [Hz]
4-18 Current Limit
4-19 Max Output Frequency
4-4* Adj. Warnings 2
4-40 Warning Freq. Low
4-41 Warning Freq. High
4-5* Adj. Warnings
4-50 Warning Current Low
4-51 Warning Current High
4-54 Warning Reference Low
4-55 Warning Reference High
4-56 Warning Feedback Low
4-57 Warning Feedback High
4-58 Missing Motor Phase Function
4-6* Speed Bypass
4-61 Bypass Speed From [Hz]
4-63 Bypass Speed To [Hz]
4-64 Semi-Auto Bypass Set-up
5- Digital In/Out**
5-0* Digital I/O mode
5-00 Digital Input Mode
5-03 Digital Input 29 Mode
5-1* Digital Inputs
5-10 Terminal 18 Digital Input
5-11 Terminal 19 Digital Input
5-12 Terminal 27 Digital Input
5-13 Terminal 29 Digital Input
5-3* Digital Outputs
5-34 On Delay, Digital Output
5-35 Off Delay, Digital Output
5-4* Relays
5-40 Function Relay
5-41 On Delay, Relay
5-42 Off Delay, Relay
5-5* Pulse Input
5-50 Term. 29 Low Frequency
5-51 Term. 29 High Frequency
5-52 Term. 29 Low Ref./Feedb. Value
5-53 Term. 29 High Ref./Feedb. Value
5-9* Bus Controlled
5-90 Digital & Relay Bus Control
6- Analog In/Out**
6-0* Analog I/O Mode
6-00 Live Zero Timeout Time
6-01 Live Zero Timeout Function
6-1* Analog Input 53
6-10 Terminal 53 Low Voltage
6-11 Terminal 53 High Voltage
6-12 Terminal 53 Low Current
6-13 Terminal 53 High Current
6-14 Terminal 53 Low Ref./Feedb. Value
6-15 Terminal 53 High Ref./Feedb. Value
6-16 Terminal 53 Filter Time Constant
6-19 Terminal 53 mode
6-2* Analog Input 54
6-20 Terminal 54 Low Voltage
6-21 Terminal 54 High Voltage
6-22 Terminal 54 Low Current
6-23 Terminal 54 High Current
6-24 Terminal 54 Low Ref./Feedb. Value
6-25 Terminal 54 High Ref./Feedb. Value
6-26 Terminal 54 Filter Time Constant
6-29 Terminal 54 mode
6-7* Analog/Digital Output 45
6-70 Terminal 45 Mode
6-71 Terminal 45 Analog Output
6-72 Terminal 45 Digital Output
6-73 Terminal 45 Output Min Scale
6-74 Terminal 45 Output Max Scale
6-76 Terminal 45 Output Bus Control
6-9* Analog/Digital Output 42
6-90 Terminal 42 Mode
6-91 Terminal 42 Analog Output
6-92 Terminal 42 Digital Output
6-93 Terminal 42 Output Min Scale
6-94 Terminal 42 Output Max Scale
6-96 Terminal 42 Output Bus Control
6-98 Drive Type
8- Comm. and Options**
8-0* General Settings
8-01 Control Site
8-02 Control Source
8-03 Control Timeout Time
8-04 Control Timeout Function
8-3* FC Port Settings
8-30 Protocol
8-31 Address
8-32 Baud Rate
8-33 Parity / Stop Bits
8-35 Minimum Response Delay
8-36 Maximum Response Delay
8-37 Maximum Inter-char delay
8-4* FC MC protocol set
8-43 PCD Read Configuration
8-5* Digital/Bus
8-50 Coasting Select
8-51 Quick Stop Select
8-52 DC Brake Select
8-53 Start Select
8-54 Reversing Select
8-55 Set-up Select
8-56 Preset Reference Select
8-7* BACnet
8-70 BACnet Device Instance
8-72 MS/TP Max Masters
8-73 MS/TP Max Info Frames
8-74 "I am" Service
8-75 Intialisation Password
8-8* FC Port Diagnostics
8-80 Bus Message Count
8-81 Bus Error Count
8-82 Slave Messages Rcvd
8-83 Slave Error Count
8-84 Slave Messages Sent
8-85 Slave Timeout Errors
8-88 Reset FC Port Diagnostics
8-9* Bus Feedback
8-94 Bus Feedback 1
13- Smart Logic**
13-0* SLC Settings
13-00 SL Controller Mode
13-01 Start Event
13-02 Stop Event
13-03 Reset SLC
13-1* Comparators
13-10 Comparator Operand
13-11 Comparator Operator
13-12 Comparator Value
13-2* Timers
13-20 SL Controller Timer
13-4* Logic Rules
13-40 Logic Rule Boolean 1
13-41 Logic Rule Operator 1
13-42 Logic Rule Boolean 2
13-43 Logic Rule Operator 2
13-44 Logic Rule Boolean 3
13-5* States
13-51 SL Controller Event
13-52 SL Controller Action
14- Special Functions**
14-0* Inverter Switching
14-01 Switching Frequency
14-03 Overmodulation
14-08 Damping Gain Factor
14-1* Mains On/Off
14-10 Mains Failure
14-12 Function at Mains Imbalance
14-2* Reset Functions
14-20 Reset Mode
14-21 Automatic Restart Time
14-22 Operation Mode
14-23 Typecode Setting
14-27 Action At Inverter Fault
14-28 Production Settings
14-29 Service Code
14-4* Energy Optimizing
14-40 VT Level
14-41 AEO Minimum Magnetization
14-5* Environment
14-50 RFI Filter
14-51 DC Link Voltage Compensation
14-52 Fan Control
14-53 Fan Monitor
14-55 Output Filter
14-6* Auto Derate
14-63 Min Switch Frequency
15- Drive Information**
15-0* Operating Data
15-00 Operating hours
15-01 Running Hours
15-02 kWh Counter
15-03 Power-ups
15-04 Over Temps
15-05 Over Volts

15-06 Reset kWh Counter
15-07 Reset Running Hours Counter
15-3* Alarm Log
15-30 Alarm Log: Error Code
15-31 InternalFaultReason
15-4* Drive Identification
15-40 FC Type
15-41 Power Section
15-42 Voltage
15-43 Software Version
15-44 Ordered TypeCode
15-46 Drive Ordering No
15-47 Power Card Ordering No.
15-48 LCP ID Num.
15-49 SW ID Control Card
15-50 SW ID Power Card
15-51 Drive Serial Number
15-53 Power Card Serial Number
15-9* Parameter Info
15-92 Defined Parameters
15-97 Application Type
15-98 Drive Identification
16- Data Readouts**
16-0* General Status
16-00 Control Word
16-01 Reference [Unit]
16-02 Reference [%]
16-03 Status Word
16-05 Main Actual Value [%]
16-09 Custom Readout
16-1* Motor Status
16-10 Power [kW]
16-11 Power [hp]
16-12 Motor Voltage
16-13 Frequency
16-14 Motor current
16-15 Frequency [%]
16-18 Motor Thermal
16-3* Drive Status
16-30 DC Link Voltage
16-34 Heatsink Temp.
16-35 Inverter Thermal
16-36 Inv. Nom. Current
16-37 Inv. Max. Current
16-38 SL Controller State
16-5* Ref. & Feedb.
16-50 External Reference
16-52 Feedback[Unit]
16-6* Inputs & Outputs
16-60 Digital Input
16-61 Terminal 53 Setting
16-62 Analog Input AI53
16-63 Terminal 54 Setting
16-64 Analog Input AI54
16-65 Analog Output AO42 [mA]
16-66 Digital Output
16-67 Pulse Input #29 [Hz]
16-71 Relay Output [bin]
16-72 Counter A
16-73 Counter B
16-79 Analog Output AO45
16-8* Fieldbus & FC Port
16-86 FC Port REF 1
16-9* Diagnosis Readouts
16-90 Alarm Word
16-91 Alarm Word 2
16-92 Warning Word
16-93 Warning Word 2
16-94 Ext. Status Word
16-95 Ext. Status Word 2
18- Info & Readouts**
18-1* Fire Mode Log
18-10 FireMode Log:Event
20- Drive Closed-loop**
20-0* Feedback
20-00 Feedback 1 Source
20-01 Feedback 1 Conversion
20-8* PI Basic Settings
20-81 PI Normal/ Inverse Control
20-83 PI Start Speed [Hz]
20-84 On Reference Bandwidth
20-9* PI Controller
20-91 PI Anti Windup
20-93 PI Proportional Gain
20-94 PI Integral Time
20-97 PI Feed Forward Factor
22- Appl. Functions**
22-4* Sleep Mode
22-40 Minimum Run Time
22-41 Minimum Sleep Time
22-43 Wake-up Speed [Hz]
22-44 Wake-up Ref./FB Diff
22-45 Setpoint Boost
22-46 Maximum Boost Time
22-47 Sleep Speed [Hz]
22-6* Broken Belt Detection
22-60 Broken Belt Function
22-61 Broken Belt Torque
22-62 Broken Belt Delay
24- Appl. Functions 2**
24-0* Fire Mode
24-00 FM Function
24-05 FM Preset Reference
24-09 FM Alarm Handling
24-1* Drive Bypass
24-10 Drive Bypass Function
24-11 Drive Bypass Delay Time
38- Debug only - see PNU 1429 (service code) also**
38-0* All debug parameters
38-00 TestMonitorMode
38-01 Version And Stack
38-02 Protocol SW version
38-06 LCPEdit Set-up
38-07 EEPROMDdataVers
38-08 PowerDataVariantID
38-09 AMA Retry
38-10 DAC selection
38-12 DAC scale
38-20 MOC_TestUS16
38-21 MOC_TestS16
38-23 TestMocFunctions
38-24 DC Link Power Measurement
38-25 CheckSum
38-30 Analog Input 53 (%)
38-31 Analog Input 54 (%)
38-32 Input Reference 1
38-33 Input Reference 2
38-34 Input Reference Setting
38-35 Feedback (%)
38-36 Fault Code
38-37 Control Word
38-38 ResetCountersControl
38-39 Active Set-up For BACnet
38-40 Name Of Analog Value 1 For BACnet
38-41 Name Of Analog Value 3 For BACnet
38-42 Name Of Analog Value 5 For BACnet
38-43 Name Of Analog Value 6 For BACnet
38-44 Name Of Binary Value 1 For BACnet
38-45 Name Of Binary Value 2 For BACnet
38-46 Name Of Binary Value 3 For BACnet
38-47 Name Of Binary Value 4 For BACnet
38-48 Name Of Binary Value 5 For BACnet
38-49 Name Of Binary Value 6 For BACnet
38-50 Name Of Binary Value 21 For BACnet
38-51 Name Of Binary Value 22 For BACnet
38-52 Name Of Binary Value 33 For BACnet
38-53 Bus Feedback 1 Conversion
38-54 Run Stop Bus Control
38-58 Inverter ETR counter
38-59 Rectifier ETR counter
38-60 DB_ErrorWarnings
38-61 Extended Alarm Word
38-69 AMA_DebugS32
38-74 AOCDebug0
38-75 AOCDebug1
38-76 AO42_FixedMode
38-77 AO42_FixedValue
38-78 DI_TestCounters
38-79 Protect Func. Counter
38-80 Highest Lowest Couple
38-81 DB_SendDebugCmd
38-82 MaxTaskRunningTime
38-83 DebugInformation
38-85 DB_OptionSelector
38-86 EEPROM_Address
38-87 EEPROM_Value
38-88 Logger Time Remain
38-90 LCP FC Protocol select
38-91 Motor Power Internal
38-92 Motor Voltage Internal
38-93 Motor Frequency Internal
38-94 Lsigma
38-95 DB_SimulateAlarmWarningExStatus
38-96 Data Logger Password
38-97 Data Logging Period
38-98 Signal to Debug
38-99 Signed Debug Info
40- Debug only - Backup**
40-0* Debug parameters backup
40-00 TestMonitorMode_Backup

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 6-10 Terminal 53 Low Voltage, 6-12 Terminal 53 Low Current, 6-20 Terminal 54 Low Voltageor 6-22 Terminal 54 Low Current. See also parameter group 6-0*
4	14	Line power ph. loss	X	X	X	Missing phase on supply side or too high voltage imbalance. Check 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 the “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 *1-90 Motor Thermal Protection*
11	7	Motor th over	X	X		The thermistor or the thermistor connection is disconnected. See *1-90 Motor Thermal Protection*.
13	5	Overcurrent	X	X	X	Inverter peak current limit is exceeded.
14	2	Ground Fault		X	X	Discharge from output phases to ground.
16	12	Short-circuit		X	X	Short-circuit in the motor or on the motor terminals.
17	4	Ctrl. word TO	X	X		No communication to the adjustable frequency drive. See parameter group 8-0*
24	50	Fan Fault	X	X		The fan is not working (Only on 400 V 40–125 hp [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	Ground 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. Contact the local Danfoss supplier
50		Calibration failed		X		Contact the local Danfoss supplier.
51	15	Unom,Inom		X		The setting of motor voltage, motor current and motor power is presumably wrong. Check the settings.
52		low Inom		X		The motor current is too low. Check the settings.
53		big motor		X		The motor is too big for the to be carried out
54		small mot		X		The motor is too small for the to be carried out
55		par. range		X		The parameter values found from the motor are outside acceptable range.
56		user interrupt		X		The has been interrupted by the user

Fault number	Alarm/ Warning Bit Number	Fault text	Warning	Alarm	Trip locked	Cause of problem
57		timeout		X		Try to start the again a number of times, until the is carried out. **NOTE! 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		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 adjustable frequency drive (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 400 V 40–125 hp [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 config-uration	X	X		Internal fault. Contact the local Danfoss supplier.
80	29	Drive initialized		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*.
126		Motor Rotating		X		High back emf voltage. Stop the motor 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 spare part		X	X	The power or switch mode power supply has been exchanged. (Only on 400 V 40–125 hp [30–90 kW] units). Contact the local Danfoss supplier
251		New Typecode		X	X	The adjustable frequency drive has a new type code (only on 400 V 40–125 hp [30–90 kW] units). Contact the local Danfoss supplier.

Table 1.29

1.7 General Specifications

1.7.1 Line Power Supply 3x200–240 V AC

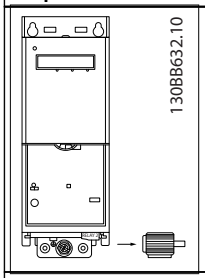
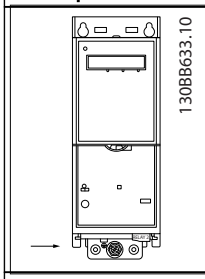
Adjustable frequency drive	PK25	PK37	PK75	P1K5	P2K2	P3K7	P5K5	P7K5	P11K	P15K	P18K	P22K	P30K	P37K	P45K
Typical shaft output [kW]	0.25	0.37	0.75	1.5	2.2	3.7	5.5	7.5	11.0	15.0	18.5	22.0	30.0	37.0	45.0
Typical shaft output [hp]	0.33	0.5	1.0	2.0	3.0	5.0	7.5	10.0	15.0	20.0	25.0	30.0	40.0	50.0	60.0
IP20 frame	H1	H1	H1	H1	H2	H3	H4	H4	H5	H6	H6	H7	H7	H8	H8
Max. cable size in terminals (line power, motor) [mm²/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															
 130BB632.10	**104° F [40°C] 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
Max. input current															
 130BB633.10															
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
Max. electrical fuses	See *1.3.6 Fuses*														
Estimated power loss hp [W], Best case/typical[1]	0.016/0.019 [12/14]	0.020/0.024 [15/18]	0.028/0.035 [21/26]	0.064/0.080 [48/60]	0.107/0.137 [80/102]	0.130/0.161 [97/120]	0.244/0.274 [182/204]	0.307/0.359 [229/268]	0.495/0.518 [369/386]	0.687 [512]	0.935 [697]	1.179 [879]	1.541 [1,149]	1.864 [1,390]	2.012 [1,500]
Weight enclosure IP20 (lb [kg])	4.41 [2.0]	4.41 [2.0]	4.41 [2.0]	4.63 [2.1]	7.5 [3.4]	9.92 [4.5]	17.42 [7.9]	17.42 [7.9]	20.94 [9.5]	54 [24.5]	54 [24.5]	79.37 [36.0]	79.37 [36.0]	112.44 [51.0]	112.44 [51.0]
Efficiency [%], Best case/ Typical[1]	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															
	122° F [50°C] 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	53.5	66.6	79.2	103.5	128.7	153.0
Intermittent (3x200–240 V) [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

Table 1.30

1) At rated load conditions

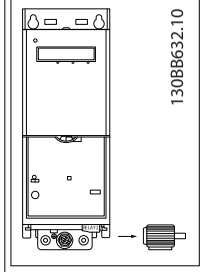
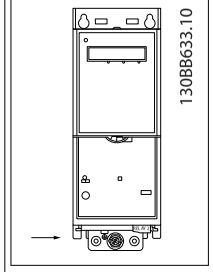
Adjustable frequency drive	PK37	PK75	P1K5	P2K2	P3K0	P4K0	P5K5	P7K5	P11K	P15K	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K
Typical shaft output [kW]	0.37	0.75	1.5	2.2	3.0	4.0	5.5	7.5	11.0	15.0	18.5	22.0	30.0	37.0	45.0	55.0	75.0	90.0
Typical shaft output [hp]	0.5	1.0	2.0	3.0	4.0	5.0	7.5	10.0	15.0	20.0	25.0	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 (line power, motor) [mm²/AWG]	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	120/250MCM
Output current																		
 130BB632.10	**104° F [40°C] 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	37.0	42.5	61.0	73.0	90.0	106.0	147.0	177.0
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	40.7	46.8	67.1	80.3	99.0	116.0	161.0	194.0
Continuous (3x440–480 V) [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 (3x440–480 V) [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																		
 130BB633.10	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	35.2	41.5	57.0	70.0	84.0	103.0	140.0	166.0
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	38.7	45.7	62.7	77.0	92.4	113.0	154.0	182.0
Continuous (3x440–480 V) [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 (3x440–480 V) [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. electrical fuses	See *1.3.6 Fuses*																	

Table 1.31

Adjustable frequency drive		PK37	PK75	P1K5	P2K2	P3K0	P4K0	P5K5	P7K5	P11K	P15K	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K
Estimated power loss hp [W], Best case/ typical[1)]		0.017/0 .020 [13/15]	0.021/ 0.028 [16/21]	0.062/ 0.076 [46/57]	0.062/ 0.078 [46/58]	0.089/0 .111 [66/83]	0.127/0 .158 [95/11 8]	0.139/ 0.176 [104/1 31]	0.213/ 0.266 [159/1 98]	0.333/ 0.367 [248/2 74]	0.473/ 0.508 [353/3 79]	0.552/ 0.612 [412/4 56]	0.637/ 0.701 [475/5 23]	0.983 [733]	1.236 [922]	1.431 [1,067]	1.519 [1,133]	2.324 [1,733]	2.871 [2,141]
Weight enclosure IP20 (lb [kg])		4.41 [2.0]	4.41 [2.0]	4.63 [2.1]	7.28 [3.3]	7.28 [3.3]	7.5 [3.4]	9.48 [4.3]	9.92 [4.5]	17.42 [7.9]	17.42 [7.9]	20.94 [9.5]	20.94 [9.5]	54 [24.5]	54 [24.5]	54 [24.5]	79.37 [36.0]	79.37 [36.0]	112.44 [51.0]
Efficiency [%], Best case/Typical 1		97.8/97 .3	98.0/9 7.6	97.7/9 7.2	98.3/9 7.9	98.2/97 .8	98.0/97 .6	98.4/9 8.0	98.2/9 7.8	98.1/9 7.9	98.0/9 7.8	98.1/9 7.9	98.1/9 7.9	97.8	97.7	98	98.2	97.8	97.9
Output current																			
	122° F [50°C] 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	34.1	38.0	48.8	58.4	72.0	74.2	102.9	123.9
	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	37.5	41.8	53.7	64.2	79.2	81.6	113.2	136.3
	Continuous (3x440–480 V) [A]	1.0	1.8	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 (3x440–480 V) [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

Table 1.32

1.7.3 Line Power Supply 3x380–480 V AC

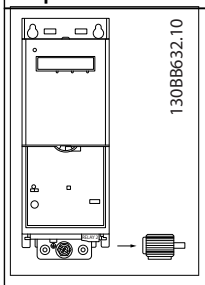
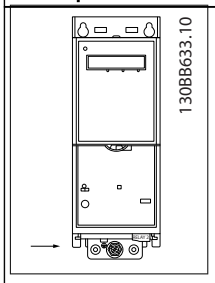
Adjustable frequency drive		PK75	P1K5	P2K2	P3K0	P4K0	P5K5	P7K5	P11K	P15K	P18K	P11K	P15K	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K
Typical shaft output [kW]		0.75	1.5	2.2	3.0	4.0	5.5	7.5	11	15	18.5	11	15	18.5	22.0	30.0	37.0	45.0	55.0	75.0	90.0
Typical shaft output [hp]		1.0	2.0	3.0	4.0	5.0	7.5	10.0	15	20	25	15.0	20	25.0	30.0	40.0	50.0	60.0	70.0	100.0	125.0
IP54 frame		I2	I2	I2	I2	I2	I3	I3	I4	I4	I4	I5	I5	I5	I6	I6	I6	I7	I7	I8	I8
Max. cable size in terminals (line power, motor) [mm²/AWG]		4/10	4/10	4/10	4/10	4/10	4/10	4/10	16/6	16/6	16/6	10/7	10/7	10/7	35/2	35/2	35/2	50/1	50/1	95/ (3/0)	120/ (4/0)
Output current																					
	104° F [40°C] 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	24	32	37.5	44.0	61.0	73.0	90.0	106.0	147.0	177.0
	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	26.2	35.2	41.3	48.4	67.1	80.3	99.0	116.6	161.7	194.7
	Continuous (3x440–80 V) [A]	2.1	3.4	4.8	6.3	8.2	11.0	14.0	21.0	27.0	34.0	21	27	34	40.0	52.0	65.0	80.0	105.0	130.0	160.0
	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	23.1	29.7	37.4	44.0	57.2	71.5	88.0	115.5	143.0	176.0
Max. 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	22	29	34	41.8	57.0	70.3	84.2	102.9	140.3	165.6
	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	24.2	31.9	37.3	46.0	62.7	77.4	92.6	113.1	154.3	182.2
	Continuous (3x440–80 V) [A]	1.8	2.9	3.9	5.3	6.8	9.4	12.6	18.4	24.7	29.3	19	25	31	36.0	49.2	60.6	72.5	88.6	120.9	142.7
	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	20.9	27.5	34.1	39.6	54.1	66.7	79.8	97.5	132.9	157.0
Max. electrical fuses		See *1.3.6 Fuses*																			

Table 1.33

Adjustable frequency drive	PK75	P1K5	PK2K2	PK3KO	PK4KO	PK5K5	PK7K5	P11K	P15K	P18K	PK11K	PK15K	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K
Estimated power loss hp [W], Best case/typical[1)]	0.028/0.035 [21/16]	0.062/0.076 [46/57]	0.062/0.078 [46/58]	0.088/0.111 [66/83]	0.127/0.158 95/118	0.139/0.176 [104/131]	0.213/0.266 [159/198]	0.333/0.367 [248/274]	0.473/0.508 [353/379]	0.553/0.612 412/456	0.325 [242]	0.443 [330]	0.531 [396]	0.665 [496]	0.984 [734]	1.334 [995]	1.126 [840]	1.474 [1,099]	2.038 [1,520]	2.388 [1,781]
Weight enclosure IP54 (lbs [kg])	11.69 [5.3]	11.69 [5.3]	11.69 [5.3]	11.69 [5.3]	11.69 [5.3]	15.87 [7.2]	15.87 [7.2]	30.42 [13.8]	30.42 [13.8]	30.42 [13.8]	50.71 [23]	50.71 [23]	50.71 [23]	59.52 [27]	59.52 [27]	59.52 [27]	99.21 [45]	99.21 [45]	143.3 [65]	143.3 [65]
Efficiency [%], Best case/Typical 1	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	98.0	98.0	98.0	98.0	97.8	97.6	98.3	98.2	98.1	98.3
Output current																				
	122° F [50°C] 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	19.2	25.6	30	35.2	48.8	58.4	63.0	74.2	102.9	123.9
	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	21.2	28.2	33	38.7	53.9	64.2	69.3	81.6	113.2	136.3
	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	16.8	21.6	27.2	32.0	41.6	52.0	56.0	73.5	91.0	112.0
	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	18.5	23.8	30	35.2	45.8	57.2	61.6	80.9	100.1	123.2

Table 1.34

1.7.4 Line Power Supply 3x525–600 V AC

Adjustable frequency drive	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
Max. cable size in terminals (line power, motor) [mm²/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															
 130BB632.10	**104° F [40°C] 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
Max. input current															
 130BB633.10	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
Max. electrical fuses	See *1.3.6 Fuses*														
Estimated power loss hp [W], Best case/typical[1)]	0.087 [65]	0.121 [90]	0.148 [110]	0.177 [132]	0.241 [180]	0.290 [216]	0.394 [294]	0.516 [385]	0.614 [458]	0.727 [542]	0.801 [597]	0.975 [727]	1.464 [1,092]	1.851 [1,380]	2.223 [1.658]
Weight enclosure IP54 lbs [kg]	14.6 [6.6]	14.6 [6.6]	14.6 [6.6]	14.6 [6.6]	14.6 [6.6]	25.35 [11.5]	25.35 [11.5]	54 [24.5]	54 [24.5]	54 [24.5]	79.37 [36.0]	79.37 [36.0]	79.37 [36.0]	112.44 [51.0]	112.44 [51.0]
Efficiency [%], Best case/Typical 1	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															
	122° F [50°C] 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	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
1-42	(3x551–600 V) [A]															
	Intermittent (3x551–600 V)	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

1.7.5 EMC Test Results

The following test results have been obtained using a system with an adjustable frequency drive, a shielded control cable, a control box with potentiometer, as well as a motor shielded cable.

RFI Filter Type	Conduct emission. Maximum shielded cable length [m]						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)										
0.34–15 hp [0.25–11 kW] 3x200–240 V IP20			25	50		20	Yes	Yes		No
0.5–30 hp [0.37–22 kW] 3x380–480 V IP20			25	50		20	Yes	Yes		No
H2 RFI filter (Class A2)										
2–60 hp [1.5–45 kW] 3x200–240 V IP20	25						No		No	
40–125 hp [30–90 kW] 3x380–480 V IP20	25						No		No	
1–25 [0.75–18.5 kW] 3x380–480 V IP54	25						Yes			
30–125 hp [22–90 kW] 3x380–480 V IP54	25						No		No	
H3 RFI filter (Class A1/B)										
2–60 hp [1.5–45 kW] 3x200–240 V IP20			50		20		Yes		No	
40–125 hp [30–90 kW] 3x380–480 V IP20			50		20		Yes		No	
1–25 [0.75–18.5 kW] 3x380–480 V IP54			25		10		Yes			
30–125 hp [22–90 kW] 3x380–480 V IP54			50		10		Yes		No	

Table 1.36

Protection and features

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

Line power supply (L1, L2, L3)	
Supply voltage	200–240 V ±10%
Supply voltage	380–480 V ±10%
Supply voltage	525–600 V ±10%
Supply frequency	50/60 Hz
Max. temporary imbalance between line phases	3.0% of rated supply voltage
True Power Factor (λ)	≥ 0.9 nominal at rated load
Displacement Power Factor (cosφ) near unity	(>0.98)
Switching on the input supply L1, L2, L3 (power-ups) enclosure frame H1-H5, I2, I3, I4	Max. 2 times/min.
Switching on the input supply L1, L2, L3 (power-ups) enclosure frame H6-H8, I6-I8	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, 240/480 V maximum.	

Motor output (U, V, W)	
Output voltage	0–100% of supply voltage
Output frequency	0–200 Hz (VVC^{plus}), 0–400 Hz (u/f)
Switching on output	Unlimited
Ramp times	0.05–3,600 s

Cable lengths and cross-sections	
Max. motor cable length, shielded/armored (EMC-compliant installation)	See *1.7.5 EMC Test Results*
Max. motor cable length, unshielded/unarmored	165 ft [50m]
Max. cross-section to motor, line power*	
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
*See *1.7.2 Line Power Supply 3x380–480 V AC* for more information	

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	Approx. 4 k
Digital input 29 as thermistor input	Fault: >2.9 kΩ 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	0–10 V
Input resistance, R_i	approx. 10 kΩ
Max. voltage	20 V
Current level	0/4 to 20 mA (scalable)
Input resistance, R_i	<500 Ω
Max. current	29 mA

Analog output	
Number of programmable analog outputs	2
Terminal number	42, 45[1)]
Current range at analog output	0/4–20 mA
Max. load to common at analog output	500 Ω
Max. voltage at analog output	17 V
Accuracy on analog output	Max. error: 0.4% of full scale
Resolution on analog output	10 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	17 V
Max. output current at digital output	20 mA
Max. load at digital output	1 kΩ

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, 24 V DC output	
Terminal number	12
Max. load enclosure frame H1-H8, I2-I8	80 mA

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)	250 V AC, 3 A
Max. terminal load (AC-15)[1)] on 01-02/04-05 (NO) (Inductive load @ cosφ 0.4)	250 V AC, 0.2 A
Max. terminal load (DC-1)[1)] on 01-02/04-05 (NO) (Resistive load)	30 V DC, 2 A
Max. terminal load (DC-13)[1)] on 01-02/04-05 (NO) (Inductive load)	24 V DC, 0.1 A
Max. terminal load (AC-1)[1)] on 01-03/04-06 (NC) (Resistive load)	250 V AC, 3 A
Max. terminal load (AC-15)[1)] on 01-03/04-06 (NC) (Inductive load @ cosφ 0.4)	250 V AC, 0.2 A
Max. terminal load (DC-1)[1)] on 01-03/04-06	30 V DC, 2 A
(NC) (Resistive load)	Min. 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.

Control card, 10 V DC output	
Terminal number	50
Output voltage	10.5 V ±0.5 V
Max. load	25 mA

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	1.0 g
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 104°/122° F [40°/50°C] in the tables line power supply

Derating for high ambient temperature, see *1.7.6 Surroundings*

Minimum ambient temperature during full-scale operation	32° F [0°C]
Minimum ambient temperature at reduced performance, enclosure frame H1-H5	-4° F [-20°C]
Minimum ambient temperature at reduced performance, enclosure frame H6-H10	14° F [-10°C]
Temperature during storage/transport	122° to 149°/158° F [-30 to +65/70°C]
Maximum altitude above sea level without derating	3,300 ft [1,000 m]
Maximum altitude above sea level with derating	10,000 ft [3,000 m]
Derating for high altitude, see *1.7.6 Surroundings*	
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
EMC standards, Immunity	EN 61800-3, EN 61000-3-12, EN 61000-6-1/2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6

1.8 Special Conditions

1.8.1 Derating for Ambient Temperature and Switching Frequency

The ambient temperature measured over 24 hours should be at least 41° F [5°C] lower than the max. ambient temperature. If the adjustable frequency drive is operated at a high ambient temperature, the continuous output current should be decreased. For derating curve, see *VLT® HVAC Basic Design Guide MG18C*.

1.8.2 Derating for Low Air Pressure

The cooling capability of air is decreased at low air pressure. For altitudes above 6,500 ft [2,000 m], contact Danfoss regarding PELV. Below 3,300 ft [1,000 m] altitude, no de-rating is necessary, but above 3281 ft [1000 m], the ambient temperature or the maximum output current should be decreased. Decrease the output by 1% per 330 ft [100 m] altitude above 3,3001 ft [1,000 m] or reduce the max. ambient temperature by 1° per 660 ft [200 m].

1.9 Options for VLT® HVAC Basic Drive FC 101

For options, see the *VLT® HVAC Basic Design Guide MG18C*.

1.10 MCT 10 Support

MCT 10 information is available at: *www.danfoss.com/BusinessAreas/DrivesSolutions/fc101driveupdates*

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