MAKING MODERN LIVING POSSIBLE

Quick Guide

VLT® Micro Drive

VLT®
THE REAL DRIVE

1 Quick Guide

1.1 Safety

1.1.1 Warnings

⚠WARNING

HIGH VOLTAGE!

Frequency converters contain high voltage when connected to AC mains input power. Installation, start up, and maintenance should be performed by qualified personnel only. Failure to perform installation, start up, and maintenance by qualified personnel could result in death or serious injury.

High Voltage

Frequency converts are connected to hazardous mains voltages. Extreme care should be taken to protect against shock. Only trained personnel familiar with electronic equipment should install, start, or maintain this equipment.

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 4 minutes for all M1, M2 and M3 sizes. Wait at least 15 minutes for all M4 and M5 sizes.

⚠WARNING

UNINTENDED START!

When the frequency converter is connected to AC mains, the motor may start at any time. The frequency converter, motor, and any driven equipment must be in operational readiness. Failure to be in operational readiness when the frequency converter is connected to AC mains could result in death, serious injury, equipment, or property damage.

Unintended Start

When the frequency converter is connected to the AC mains, the motor may be started by means of an external switch, a serial bus command, an input reference signal, or a cleared fault condition. Use appropriate cautions to guard against an unintended start.

Leakage Current (>3.5mA)

Follow national and local codes regarding protective earthing of equipment with a leakage current > 3,5mA. Frequency converter technology implies high frequency switching at high power. This will generate a leakage current in the earth connection. A fault current in the frequency converter at the output power terminals might contain a DC component which can charge the filter capacitors and cause a transient earth current. The earth leakage current depends on various system configurations including RFI filtering, screened motor cables, and frequency converter power.

EN/IEC61800-5-1 (Power Drive System Product Standard) requires special care if the leakage current exceeds 3,5mA. Earth grounding must be reinforced in one of the following ways:

- Earth ground wire of at least 10mm^2.
- Two separate earth ground wires both complying with the dimensioning rules.

See EN 60364-5-54 § 543.7 for further information.

Using RCDs

Where residual current devices (RCDs), also known as earth leakage circuit breakers (ELCBs), are used, comply with the following:

Use RCDs of type B only which are capable of detecting AC and DC currents.

Use RCDs with an inrush delay to prevent faults due to transient earth currents.

Dimension RCDs according to the system configuration and environmental considerations.

Motor Thermal Protection

Motor overload protection is possible by setting Parameter 1-90 Motor thermal protection to the value ETR trip. For the North American market: Implemented ETR function provide class 20 motor overload protection, in accordance with NEC.

Installation at High Altitudes

For altitudes above 2km, 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

1.2 Introduction

1.2.1 Available Literature

NOTE

This quick guide contains the basic information necessary for installing and running the frequency converter.

If more information is needed, the literature below can be downloaded from:
http: //www.danfoss.com/BusinessAreas/DrivesSolutions/Documentations

Title	Literature no.
VLT Micro Drive FC 51 Operating Instructions	MG.02.AX.YY
VLT Micro Drive FC 51 Quick Guide	MG.02.BX.YY
VLT Micro Drive FC 51 Programming Guide	MG.02.CX.YY
FC 51 LCP Mounting Instruction	MI.02.AX.YY
FC 51 De-coupling Plate Mounting Instruction	MI.02.BX.YY
FC 51 Remote Mounting Kit Mounting Instruction	MI.02.CX.YY
FC 51 DIN Rail Kit Mounting Instruction	MI.02.DX.YY
FC 51 IP21 Kit Mounting Instruction	MI.02.EX.YY
FC 51 Nema1 Kit Mounting Instruction	MI.02.FX.YY

X = Revision Number, Y = Language code

1.2.2 Approvals

1.2.3 IT Mains

NOTE

IT Mains
Installation on isolated mains source, i.e. IT mains.
Max. supply voltage allowed when connected to mains: 440V.

As an option, Danfoss offers recommended line filters for improved harmonics performance.

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 Commencing Repair Work

1. Disconnect FC 51 from mains (and external DC supply, if present.)
2. Wait for 4 minutes (M1, M2 and M3) and 15 minutes (M4 and M5) for discharge of the DC-link.
3. Disconnect DC bus terminals and brake terminals (if present).
4. Remove motor cable.

1.3.2 Side-by-Side Installation

The frequency converter can be mounted side-by-side for IP 20 rating units and requires 100 mm clearance above and below for cooling. Please refer to the specifications near the end of this document for details on environmental ratings of the frequency converter.

1.3.3 Mechanical Dimensions

A template for drilling can be found on the flap of the packaging.

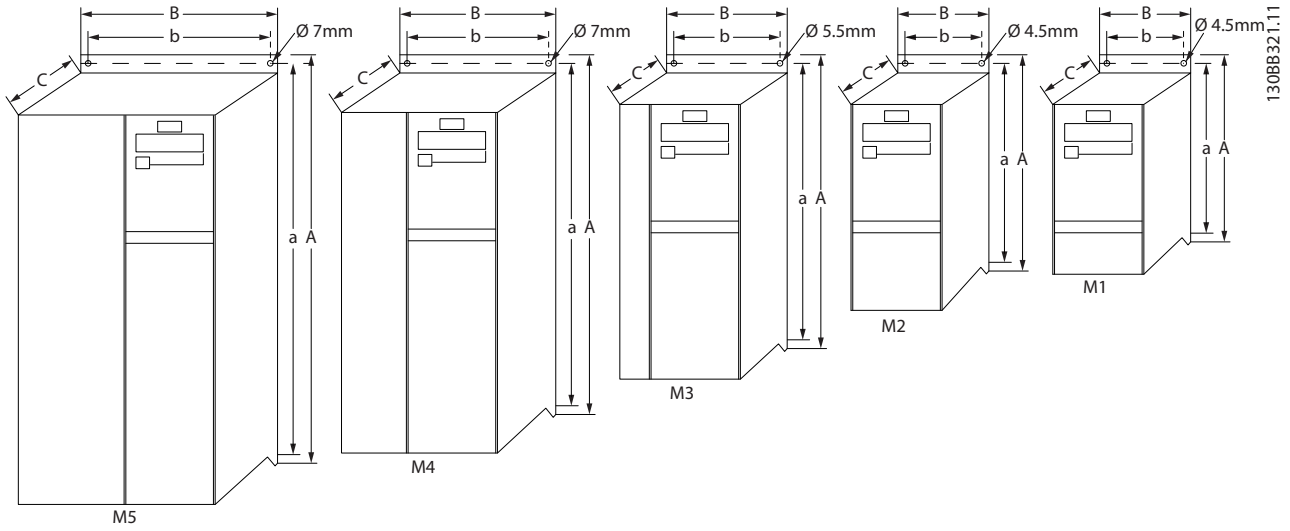

Illustration 1.1 Mechanical Dimensions.

	Power (kW)			Height (mm)			Width (mm)		Depth [1] (mm)	Max. Weight
Frame	1 X 200-240V	3 X 200 -240V	3 X 380-480V	A	A (incl. decoupling plate)	a	B	b	C	Kg
M1	0.18 - 0.75	0.25 - 0.75	0.37 - 0.75	150	205	140.4	70	55	148	1.1
M2	1.5	1.5	1.5 - 2.2	176	230	166.4	75	59	168	1.6
M3	2.2	2.2 -3.7	3.0 - 7.5	239	294	226	90	69	194	3.0
M4			11.0-15.0	292	347.5	272.4	125	97	241	6.0
M5			18.5-22.0	335	387.5	315	165	140	248	9.5
[1] For LCP with potentiometer, please add 7.6mm.										

Table 1.1 Mechanical Dimensions

1.3.4 Electrical Installation in General

NOTE

All cabling must comply with national and local regulations on cable cross-sections and ambient temperature. Copper conductors required, (60-75° C) recommended.

	Power (kW)			Torque (Nm)					
Frame	1 x 200-240V	3 x 200-240V	3 x 380-480V	Line	Motor	DC connection/Brake	Control Terminals	Earth	Relay
M1	0.18 - 0.75	0.25 - 0.75	0.37 - 0.75	1.4	0.7	Spade[1]	0.15	3	0.5
M2	1.5	1.5	1.5 - 2.2	1.4	0.7	Spade[1]	0.15	3	0.5
M3	2.2	2.2 - 3.7	3.0 - 7.5	1.4	0.7	Spade[1]	0.15	3	0.5
M4			11.0-15.0	1.3	1.3	1.3	0.15	3	0.5
M5			18.5-22.0	1.3	1.3	1.3	0.15	3	0.5
[1] Spade connectors (6.3mm Faston plugs)									

Table 1.2 Tightening of Terminals

1

1.3.5 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-circuited 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 or brake output.

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 EN50178/IEC61800-5-1:
In case of malfunction, not following the fuse recommendation may result in damage to the frequency converter.

FC 51	Max. Fuses UL						Max. fuses non UL
	Bussmann	Bussmann	Bussmann	Littel fuse	Ferraz-Shawmut	Ferraz-Shawmut	
1 X 200-240V							
kW	Type RK1	Type J	Type T	Type RK1	Type CC	Type RK1	Type gG
0K18 - 0K37	KTN-R15	JKS-15	JJN-15	KLN-R15	ATM-R15	A2K-15R	16A
0K75	KTN-R25	JKS-25	JJN-25	KLN-R25	ATM-R25	A2K-25R	25A
1K5	KTN-R35	JKS-35	JJN-35	KLN-R35	-	A2K-35R	35A
2K2	KTN-R50	JKS-50	JJN-50	KLN-R50	-	A2K-50R	50A
3 x 200-240V							
0K25	KTN-R10	JKS-10	JJN-10	KLN-R10	ATM-R10	A2K-10R	10A
0K37	KTN-R15	JKS-15	JJN-15	KLN-R15	ATM-R15	A2K-15R	16A
0K75	KTN-R20	JKS-20	JJN-20	KLN-R20	ATM-R20	A2K-20R	20A
1K5	KTN-R25	JKS-25	JJN-25	KLN-R25	ATM-R25	A2K-25R	25A
2K2	KTN-R40	JKS-40	JJN-40	KLN-R40	ATM-R40	A2K-40R	40A
3K7	KTN-R40	JKS-40	JJN-40	KLN-R40	-	A2K-40R	40A
3 x 380-480V							
0K37 - 0K75	KTS-R10	JKS-10	JJS-10	KLS-R10	ATM-R10	A6K-10R	10A
1K5	KTS-R15	JKS-15	JJS-15	KLS-R15	ATM-R15	A2K-15R	16A
2K2	KTS-R20	JKS-20	JJS-20	KLS-R20	ATM-R20	A6K-20R	20A
3K0	KTS-R40	JKS-40	JJS-40	KLS-R40	ATM-R40	A6K405R	40A
4K0	KTS-R40	JKS-40	JJS-40	KLS-R40	ATM-R40	A6K-40R	40A
5K5	KTS-R40	JKS-40	JJS-40	KLS-R40	-	A6K-40R	40A
7K5	KTS-R40	JKS-40	JJS-40	KLS-R40	-	A6K-40R	40A
11K0	KTS-R60	JKS-60	JJS-60	KLS-R60	-	A6K-60R	63A
15K0	KTS-R60	JKS-60	JJS-60	KLS-R60	-	A6K-60R	63A
18K5	KTS-R60	JKS-60	JJS-60	KLS-R60	-	A6K-60R	80A
22K0	KTS-R60	JKS-60	JJS-60	KLS-R60	-	A6K-60R	80A

Table 1.3 Fuses

1.3.6 Connecting to Mains and Motor

The frequency converter is designed to operate all standard three-phased asynchronous motors.
The frequency converter is designed to accept mains/motor cables with a maximum cross-section of 4mm^2/10 AWG (M1, M2 and M3) and maximum cross-section 16mm^2/6 AWG (M4 and M5).

- 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.BX.YY.
- Also see EMC-Correct Installation in Operating Instruction MG.02.AX.YY.

Step 1: First, mount the earth wires to earth terminal.

Step 2: Connect motor to terminals U, V and W.

Step 3: Mount mains supply to terminals L1/L, L2 and L3/N (3-phase) or L1/L and L3/N (single-phase) and tighten.

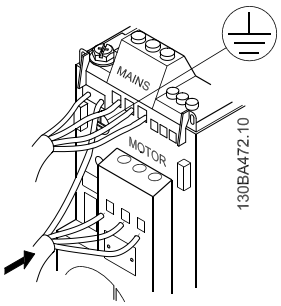

Illustration 1.2 Mounting of Earth Cable, Mains and Motor Wires

1.3.7 Control Terminals

All control cable terminals are located underneath the terminal cover in front of the frequency converter. Remove the terminal cover using a screwdriver.

NOTE

See back of terminal cover for outlines of control terminals and switches.

NOTE

Do not operate switches with power on the frequency converter.
Parameter 6-19 must be set according to Switch 4 position.

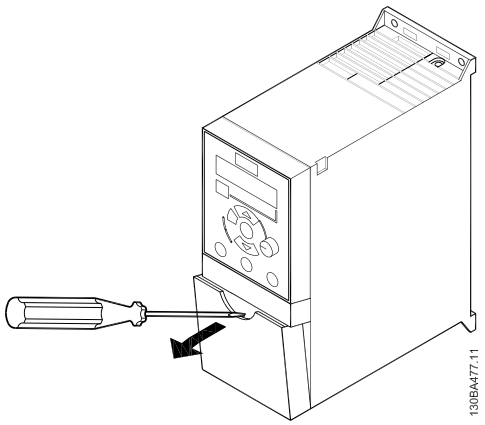

Illustration 1.3 Removing Terminal Cover

Switch 1:	*OFF = PNP terminals 29
	ON = NPN terminals 29
Switch 2:	*OFF = PNP terminal 18, 19, 27 and 33
	ON = NPN terminal 18, 19, 27 and 33
Switch 3:	No function
Switch 4:	*OFF = Terminal 53 0 - 10 V
	ON = Terminal 53 0/4 - 20 mA
* = default setting	

Table 1.4 Settings for S200 Switches 1-4

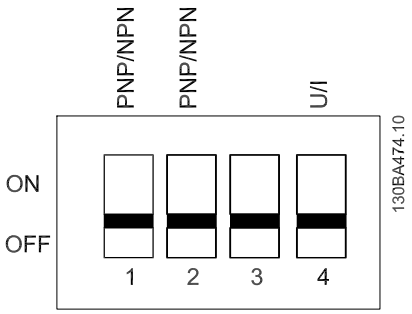

Illustration 1.4 S200 Switches 1-4

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Illustration 1.5 shows all control terminals of the frequency converter. Applying Start (term. 18) and an analog reference (term. 53 or 60) make the frequency converter run.

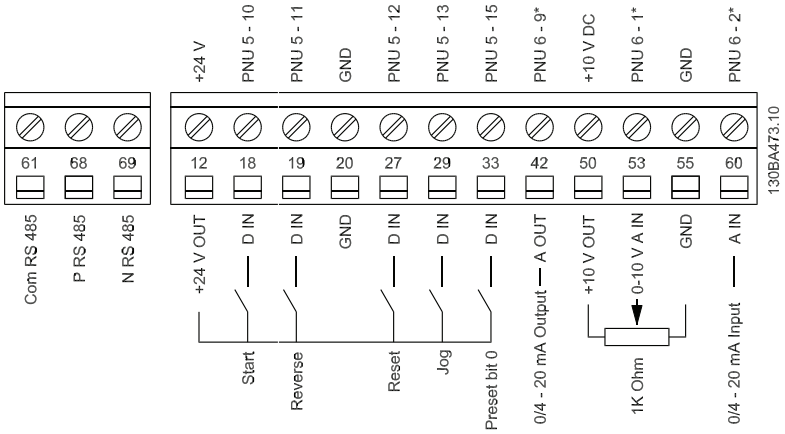

Illustration 1.5 Overview of Control Terminals in PNP-configuration and Factory Setting

1.3.8 Power Circuit - Overview

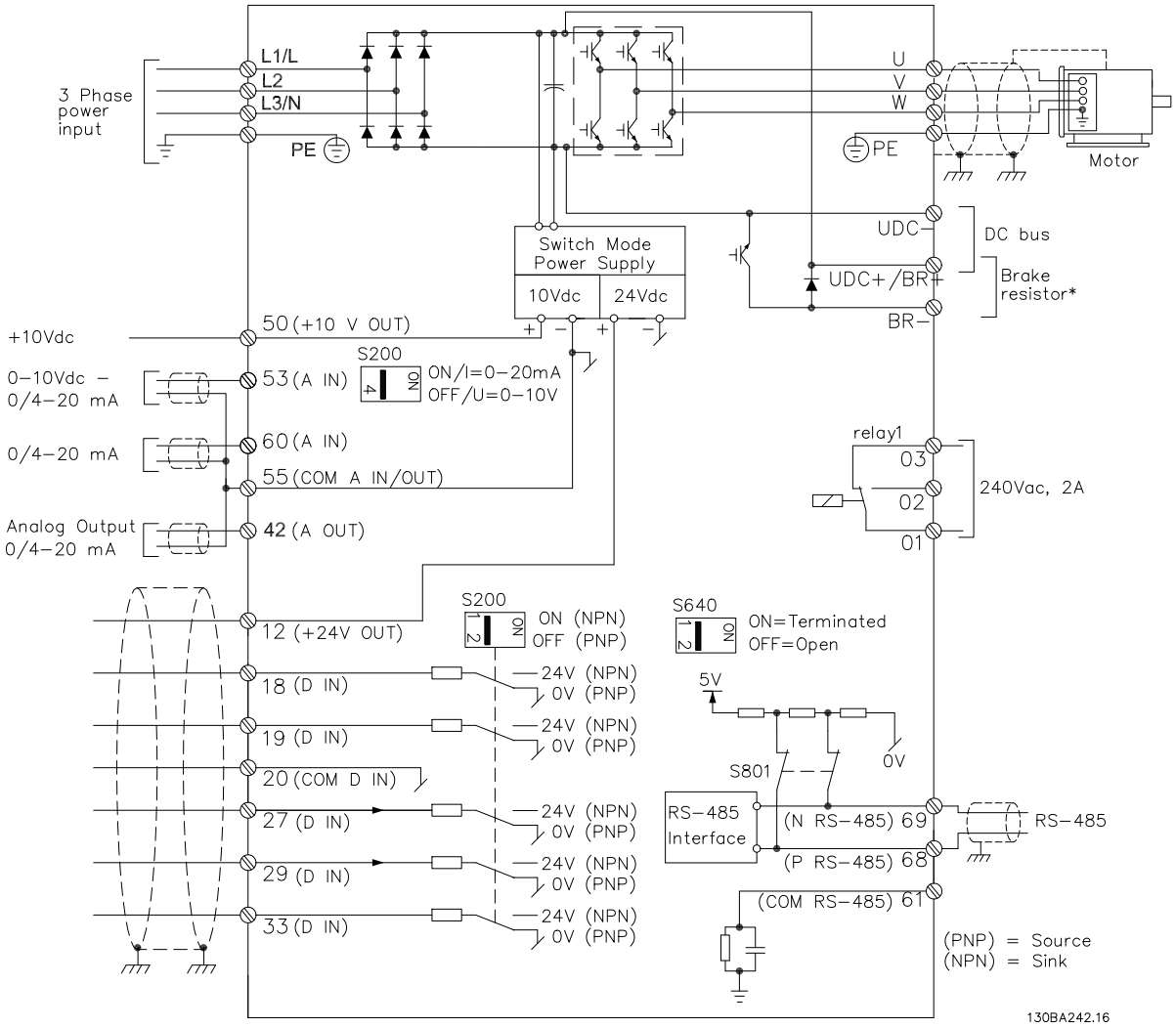

Illustration 1.6 Diagram Showing all Electrical Terminals

* Brake (BR+ and BR-) are not applicable for frame M1.

Brake resistors are available from Danfoss.
Improved power factor and EMC performance can be achieved by installing optional Danfoss line filters.
Danfoss power filters can also be used for load sharing.

NOTE

Voltage levels of up to 850V DC may occur between terminals
+UDC/+BR and -UDC. Not short circuit protected.

1.3.9 Load sharing/Brake

Use 6.3 mm insulated Faston Plugs designed for high voltage for DC (Load Sharing and brake).
Contact Danfoss or see instruction no. MI.50.Nx.02 for load sharing and instruction no. MI.90.Fx.02 for brake.

Load sharing: Connect terminals -UDC and +UDC/+BR.
Brake: Connect terminals -BR and +UDC/+BR (Not applicable for frame M1).

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1.4 Programming

1.4.1 Programming with LCP

For detailed information on programming, please see *Programming Guide*, MG.02.CX.YY.

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*

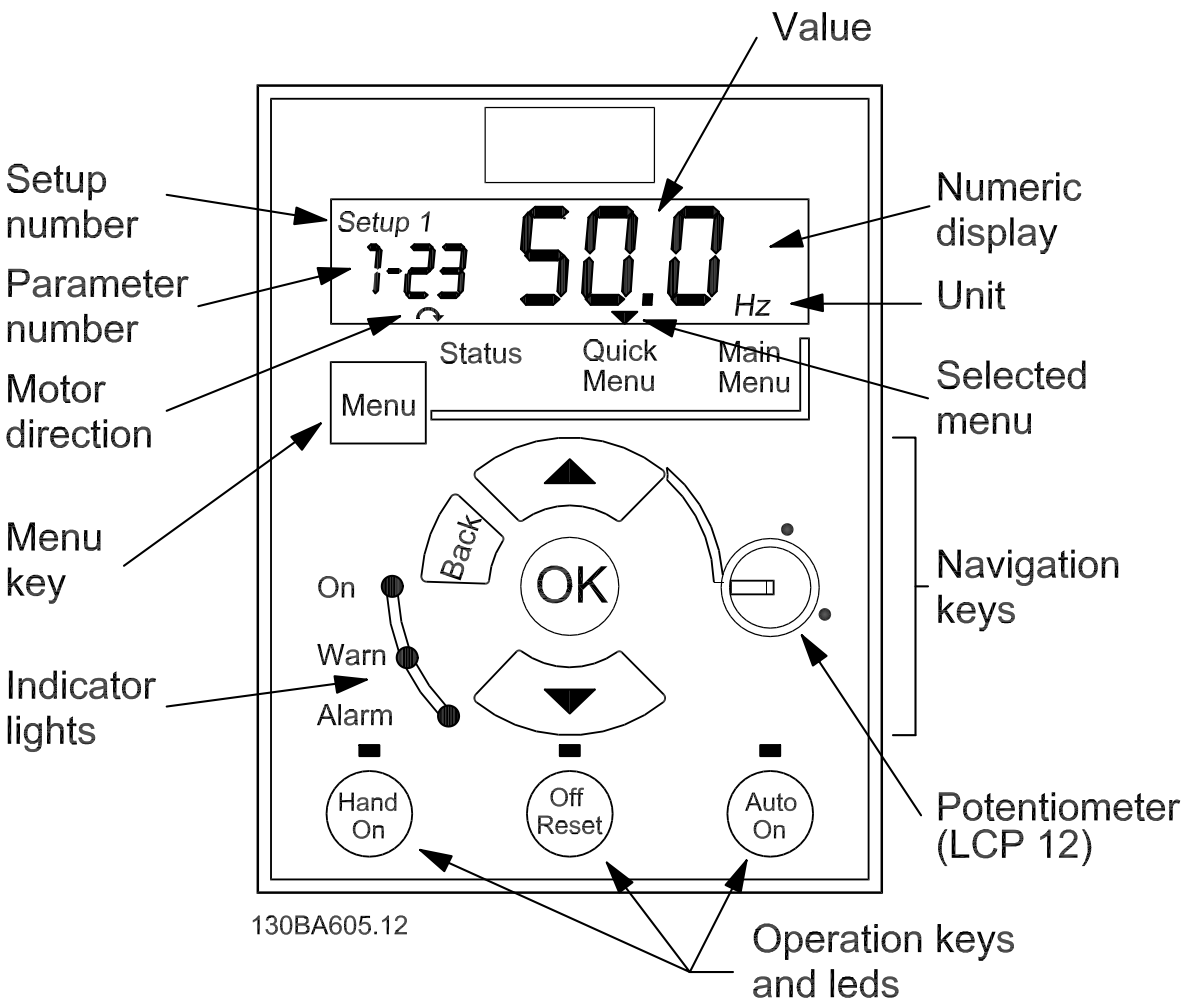


Illustration 1.7 Description of LCP Buttons and Display

Use the [MENU] key to select one of the following menus:

Status:
For readouts only.

Quick Menu:
For access to Quick Menus 1 and 2, respectively.

Main Menu:
For access to all parameters.

Navigation Keys:
[Back]: For moving to the previous step or layer in the navigation structure.
Arrows [▲] [▼]: For manoeuvring between parameter groups, parameters and within parameters.
[OK]: For selecting a parameter and for accepting changes to parameter settings.

Operation Keys:
A yellow light above the operation keys indicates the active key.
[Hand on]: Starts the motor and enables control of the frequency converter via the LCP.
[Off/Reset]: Stops the motor (off). If in alarm mode the alarm will be reset.
[Auto on]: The frequency converter is controlled either via control terminals or serial communication.
[Potentiometer] (LCP12): The potentiometer works in two ways depending on the mode in which the frequency converter is running.
In *Auto Mode* the potentiometer acts as an extra programmable analog input.
In *Hand on Mode* the potentiometer controls local reference.

1

1.5 Parameter Overview

Parameter Overwiev			
0-XX Operation/Display	*1-2X Motor Data*	**1-73 Flying Start**	[2] Analog input 60
0-0X Basic Settings	**1-20 Motor Power [kW] [HP]**	*[0] Disabled	[8] Pulse input 33
0-03 Regional Settings	[1] 0.09kW/0.12HP	[1] Enabled	[11] Local bus ref
*[0] International	[2] 0.12kW/0.16HP	*1-8X Stop Adjustments*	[21] LCP Potentiometer
[1] US	[3] 0.18kW/0.25HP	**1-80 Function at Stop**	**3-16 Reference Resource 2**
0-04 Oper. State at Power-up (Hand)	[4] 0.25kW/0.33HP	*[0] Coast	[0] No function
[0] Resume	[5] 0.37kW/0.50HP	[1] DC hold	[1] Analog Input 53
*[1] Forced stop, ref = old	[6] 0.55kW/0.75HP	**1-82 Min Speed for Funct. at Stop [Hz]**	*[2] Analog input 60
[2] Forced stop, ref = 0	[7] 0.75kW/1.00HP	0.0 - 20.0 Hz * 0.0 Hz	[8] Pulse input 33
0-1X Set-up Handling	[8] 1.10kW/1.50HP	*1-9XMotor Temperature*	*[11] Local bus ref
0-10 Active Set-up	[9] 1.50kW/2.00HP	**1-90 Motor Thermal Protection**	[21] LCP Potentiometer
*[1] Setup 1	[10] 2.20kW/3.00HP	*[0] No protection	**3-17 Reference Resource 3**
[2] Setup 2	[11] 3.00kW/4.00HP	[1] Termistor warning	[0] No function
[9] Multi Setup	[12] 3.70kW/5.00HP	[2] Thermistor trip	[1] Analog Input 53
0-11 Edit Set-up	[13] 4.00kW/5.40HP	[3] Etr warning	[2] Analog input 60
*[1] Setup 1	[14] 5.50kW/7.50HP	[4] Etr trip	[8] Pulse input 33
[2] Setup 2	[15] 7.50kW/10.00HP	**1-93 Thermistor Resource**	*[11] Local bus ref
[9] Active Setup	[16] 11.00kW/15.00HP	*[0] None	[21] LCP Potentiometer
0-12 Link Setups	[17] 15.00kW/20.00HP	[1] Analog input 53	**3-18 Relative Scaling Ref. Resource**
[0] Not Linked	[18] 18.50kW/25.00HP	[6] Digital input 29	*[0] No function
*[20] Linked	[19] 22.00kW/29.50HP	*2-XX Brakes*	[1] Analog Input 53
0-31 Custom Readout Min Scale	[20] 30.00kW/40.00HP	*2-0XDC-Brake*	[2] Analog input 60
0.00 – 9999.00 * 0.00	**1-22 Motor Voltage**	**2-00 DC Hold Current**	[8] Pulse input 33
0-32 Custom Readout Max Scale	50 - 999V * 230 - 400V	0 - 150% * 50%	[11] Local bus ref
0.00 – 9999.00 * 100.0	**1-23 Motor Frequency**	**2-01 DC Brake Current**	[21] LCP Potentiometer
0-4X LCP Keypad	20 - 400Hz * 50Hz	0 - 150% * 50%	*3-4X Ramp 1*
0-40 [Hand on] Key on LCP	**1-24 Motor Current**	**2-02 DC Braking Time**	**3-40 Ramp 1 Type**
[0] Disabled	0.01 - 100.00A * Motortype dep.	0.0 - 60.0s * 10.0s	*[0] Linear
*[1] Enabled	**1-25 Motor Nominal Speed**	**2-04 DC Brake Cut In Speed**	[2] Sine2 ramp
0-41 [Off / Reset] Key on LCP	100 - 9999rpm * Motortype dep.	0.0 - 400.0Hz * 0.0Hz	**3-41 Ramp 1 Ramp up Time**
[0] Disable All	**1-29 Automatic Motor Tuning (AMT)**	*2-1X Brake Energy Funct.*	0.05 - 3600s * 3.00s (10.00s[1)])
*[1] Enable All	*[0] Off	**2-10 Brake Function**	**3-42 Ramp 1 Ramp Down Time**
[2] Enable Reset Only	[2] Enable AMT	*[0] Off	0.05 - 3600s * 3.00s (10.00s [1)])
0-42 [Auto on] Key on LCP	*1-3X Adv. Motor Data*	[1] Resistor brake	*3-5X Ramp 2*
[0] Disabled	**1-30 Stator Resistance (Rs)**	[2] AC brake	**3-50 Ramp 2 Type**
*[1] Enabled	[Ohm] * Dep. on motor data	**2-11 Brake Resistor (ohm)**	*[0] Linear
0-5X Copy/Save	**1-33 Stator Leakage Reactance (X1)**	5 - 5000 * 5	[2] Sine2 ramp
0-50 LCP Copy	[Ohm] * Dep. on motor data	**2-16 AC Brake, Max current**	**3-51 Ramp 2 Ramp up Time**
*[0] No copy	**1-35 Main Reactance (Xh)**	0 - 150 % * 100%	0.05 - 3600s * 3.00s (10.00 s [1)])
[1] All to LCP	[Ohm] * Dep. on motor data	**2-17 Over-voltage Control**	**3-52 Ramp 2 Ramp down Time**
[2] All from LCP	*1-5X Load Indep. Setting*	*[0] Disabled	0.05 - 3600s * 3.00s (10.00 s[1)])
[3] Size indep. from LCP	**1-50 Motor Magnetisation at 0 Speed**	[1] Enabled (not at stop)	*3-8X Other Ramps*
0-51 Set-up Copy	0 - 300 % * 100 %	[2] Enabled	**3-80 Jog Ramp Time**
*[0] No copy	**1-52 Min Speed Norm. Magnet. [Hz]**	*2-2* Mechanical Brake*	0.05 - 3600s * 3.00s (10.00s[1)])
[1] Copy from setup 1	0.0 - 10.0Hz * 0.0Hz	**2-20 Release Brake Current**	**3-81 Quick Stop Ramp Time**
[2] Copy from setup 2	**1-55 U/f Characteristic - U**	0.00 - 100.0A * 0.00A	0.05 - 3600s * 3.00s (10.00s[1)])
[9] Copy from Factory setup	0 - 999.9V	**2-22 Activate Brake Speed [Hz]**	*4-XX Limits / Warnings*
0-6X Password	**1-56 U/f Characteristic - F**	0.0 - 400.0Hz * 0.0Hz	*4-1X Motor Limits*
0-60 (Main) Menu Password	0 - 400Hz	*3-XX Reference / Ramps*	**4-10 Motor Speed Direction**
0-999 *0	*1-6X Load Depen. Setting*	*3-0X Reference Limits*	[0] Clockwise
0-61 Access to Main/Quick Menu w/o Password	**1-60 Low Speed Load Compensation**	**3-00 Reference Range**	[1] CounterClockwise
*[0] Full access	0 - 199% * 100%	*[0] Min - Max	*[2] Both
[1] LCP:Read Only	**1-61 High Speed Load Compensation**	[1] -Max - +Max	**4-12 Motor Speed Low Limit [Hz]**
[2] LCP:No Access	0 - 199% * 100%	**3-02 Minimum Reference**	0.0 - 400.0Hz * 0.0Hz
1-XX Load/Motor	**1-62 Slip Compensation**	-4999 - 4999 * 0.000	**4-14 Motor Speed High Limit [Hz]**
1-0X General Settings	-400 - 399% * 100%	**3-03 Maximum Reference**	0.1 - 400.0 Hz * 65.0 Hz
1-00 Configuration Mode	**1-63 Slip Compensation Time Constant**	-4999 - 4999 * 50.00	**4-16 Torque Limit Motor Mode**
*[0] Speed open loop	0.05 - 5.00s * 0.10s	*3-1X References*	0 - 400 % * 150 %
[3] Process	*1-7X Start Adjustments*	**3-10 Preset Reference**	**4-17 Torque Limit Generator Mode**
1-01 Motor Control Principle	**1-71 Start Delay**	-100.0 - 100.0% * 0.00%	0 - 400% * 100%
[0] U/f	0.0 - 10.0s * 0.0s	**3-11 Jog Speed [Hz]**	*4-5X Adj. Warnings*
*[1] VVC+	**1-72 Start Function**	0.0 - 400.0Hz * 5.0Hz	**4-50 Warning Current Low**
1-03 Torque Characteristics	[0] DC hold / delay time	**3-12 Catch up/slow Down Value**	0.00 - 100.00A * 0.00A
*[0] Constant torque	[1] DC brake / delay time	0.00 - 100.0% * 0.00%	**4-51 Warning Current High**
[2] Automatic Energy Optim.	*[2] Coast / delay time	**3-14 Preset Relative Reference**	0.00 - 100.00A * 100.00A
1-05 Local Mode Configuration		-100.0 - 100.0 % * 0.00 % **3-15 Reference Resource 1**	**4-58 Missing Motor Phase Function**
[0] Speed Open Loop		[0] No function	[0] Off
*[2] As config in par. 1-00		*[1] Analog Input 53	*[1] On

[1)] M4 and M5 only

4-6X Speed Bypass
4-61 Bypass Speed From [Hz]
0.0 - 400.0Hz * 0.0Hz
4-63 Bypass Speed To [Hz]
0.0 - 400.0Hz * 0.0Hz
5-1X Digital Inputs
5-10 Terminal 18 Digital Input
[0] No function
[1] Reset
[2] Coast inverse
[3] Coast and reset inv.
[4] Quick stop inverse
[5] DC-brake inv.
[6] Stop inv
*[8] Start
[9] Latched start
[10] Reversing
[11] Start reversing
[12] Enable start forward
[13] Enable start reverse
[14] Jog
[16-18] Preset ref bit 0-2
[19] Freeze reference
[20] Freeze output
[21] Speed up
[22] Speed down
[23] Setup select bit 0
[28] Catch up
[29] Slow down
[34] Ramp bit 0
[60] Counter A (up)
[61] Counter A (down)
[62] Reset counter A
[63] Counter B (up)
[64] Counter B (down)
[65] ResetCounter B
5-11 Terminal 19 Digital Input
See par. 5-10. * [10] Reversing
5-12 Terminal 27 Digital Input
See par. 5-10. * [1] Reset
5-13 Terminal 29 Digital Input
See par. 5-10. * [14] Jog
5-15 Terminal 33 Digital Input
See par. 5-10. * [16] Preset ref bit 0
[26] Precise Stop Inverse
[27] Start, Precise Stop
[32] Pulse Input
5-4X Relays
5-40 Function Relay
*[0] No opreation
[1] Control ready
[2] Drive ready
[3] Drive ready, Remote
[4] Enable / No warning
[5] Drive 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
[21] Thermal warning
[22] Ready, No thermal warning
[23] Remote ready, No thermal warning
[24] Ready, Voltage ok
[25] Reverse
[26] Bus ok
[28] Brake,NoWarn
[29] Brake ready/NoFault
[30] BrakeFault (IGBT)
[32] Mech.brake control
[36] Control word bit 11
[51] Local ref. active
[52] Remote ref. active
[53] No alarm
[54] Start cmd active
[55] Running reverse
[56] Drive in hand mode
[57] Drive in auto mode
[60-63] Comparator 0-3
[70-73] Logic rule 0-3
[81] SL digital output B
5-5X Pulse Input
5-55 Terminal 33 Low Frequency
20 - 4999Hz * 20Hz
5-56 Terminal 33 High Frequency
21 - 5000Hz * 5000Hz
5-57 Term. 33 Low Ref./Feedb. Value
-4999 - 4999 * 0.000
5-58 Term. 33 High Ref./Feedb. Value
-4999 - 4999 * 50.000
6-XX Analog In/Out
6-0X Analog I/O Mode
6-00 Live Zero Timeout Time
1 - 99s * 10s
6-01 Live Zero TimeoutFunction
*[0] Off
[1] Freeze output
[2] Stop
[3] Jogging
[4] Max speed
[5] Stop and trip
6-1X Analog Input 1
6-10 Terminal 53 Low Voltage
0.00 - 9.99V * 0.07V
6-11 Terminal 53 High Voltage
0.01 - 10.00V * 10.00V
6-12 Terminal 53 Low Current
0.00 - 19.99mA * 0.14mA
6-13 Terminal 53 High Current
0.01 - 20.00mA * 20.00mA
6-14 Term. 53 Low Ref./Feedb. Value
-4999 - 4999 * 0.000
6-15 Term. 53 High Ref./Feedb. Value
-4999 - 4999 * 50.000
6-16 Terminal 53 Filter Time Constant
0.01 - 10.00s * 0.01s
6-19 Terminal 53 mode
*[0] Voltage mode
[1] Current mode
6-2X Analog Input 2
6-22 Terminal 60 Low Current
0.00 - 19.99mA * 0.14mA
6-23 Terminal 60 High Current
0.01 - 20.00mA * 20.00mA
6-24 Term. 60 Low Ref./Feedb. Value
-4999 - 4999 * 0.000
6-25 Term. 60 High Ref./Feedb. Value
-4999 - 4999 * 50.00
6-26 Terminal 60 Filter Time Constant
0.01 - 10.00s * 0.01s
6-8X LCP potentiometer
6-80 LCP Potmeter Enable
[0] Disabled
*[1] Enable
6-81 LCP potm. Low Reference
-4999 - 4999 * 0.000
6-82 LCP potm. High Reference
-4999 - 4999 * 50.00
6-9X Analog Output xx
6-90 Terminal 42 Mode
*[0] 0-20mA
[1] 4-20mA
[2] Digital Output
6-91 Terminal 42 Analog Output
*[0] No operation
[10] Output Frequency
[11] Reference
[12] Feedback
[13] Motor Current
[16] Power
[20] Bus Reference
6-92 Terminal 42 Digital Output
See par. 5-40
*[0] No Operation
[80] SL Digital Output A
6-93 Terminal 42 Output Min Scale
0.00 - 200.0% * 0.00%
6-94 Terminal 42 Output Max Scale
0.00 - 200.0% * 100.0%
7-XX Controllers
7-2X Process Ctrl. Feedb
7-20 Process CL Feedback 1 Resource
*[0] NoFunction
[1] Analog Input 53
[2] Analog input 60
[8] PulseInput33
[11] LocalBusRef
7-3X Process PI
Ctrl. 7-30 Process PI Normal/ Inverse Ctrl
*[0] Normal
[1] Inverse
7-31 Process PI Anti Windup
[0] Disable
*[1] Enable
7-32 Process PI Start Speed
0.0 - 200.0Hz * 0.0Hz
7-33 Process PI Proportional Gain
0.00 - 10.00 * 0.01
7-34 Process PI Integral Time
0.10 - 9999s * 9999s
7-38 Process PI Feed Forward Factor
0 - 400% * 0%
7-39 On Reference Bandwidth
0 - 200 % * 5%
8-XX Comm. and Options
8-0X General Settings
8-01 Control Site
*[0] Digital and ControlWord
[1] Digital only
[2] ControlWord only
8-02 Control Word Source
[0] None
*[1] FC RS485
8-03 Control Word Timeout Time
0.1 - 6500s * 1.0s
8-04 Control Word Timeout Function
*[0] Off
[1] Freeze Output
[2] Stop
[3] Jogging
[4] Max. Speed
[5] Stop and trip
8-06 Reset Control Word Timeout
*[0] No Function
[1] Do reset
8-3X FC Port Settings
8-30 Protocol
*[0] FC
[2] Modbus
8-31 Address
1 - 247 * 1
8-32 FC Port Baud Rate
[0] 2400 Baud
[1] 4800 Baud
*[2] 9600 Baud For choose FC Bus in 8-30
*[3] 19200 Baud For choose Modbus in 8-30
[4] 38400 Baud
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
8-35 Minimum Response Delay
0.001-0.5 * 0.010s
8-36 Max Response Delay
0.100 - 10.00s * 5.000s
8-4X FC MC protocol set
8-43 FC Port PCD Read Configuration
*[0] None Expressionlimit
[1] [1500] Operation Hours
[2] [1501] Running Hours
[3] [1502] kWh Counter
[4] [1600] Control Word
[5] [1601] Reference [Unit]
[6] [1602] Reference %
[7] [1603] Status Word
[8] [1605] Main Actual Value [%]
[9] [1609] Custom Readout
[10] [1610] Power [kW]
[11] [1611] Power [hp]
[12] [1612] Motor Voltage
[13] [1613] Frequency
[14] [1614] Motor Current
[15] [1615] Frequency [%]
[16] [1618] Motor Thermal
[17] [1630] DC Link Voltage
[18] [1634] Heatsink Temp.
[19] [1635] Inverter Thermal
[20] [1638] SL Controller State
[21] [1650] External Reference
[22] [1651] Pulse Reference
[23] [1652] Feedback [Unit]
[24] [1660] Digital Input 18,19,27,33
[25] [1661] Digtial Input 29
[26] [1662] Analog Input 53(V)
[27] [1663] Analog Input 53(mA)
[28] [1664] Analog Input 60
[29] [1665] Analog Output 42 [mA]
[30] [1668] Freq. Input 33 [Hz]
[31] [1671] Relay Output [bin]
[32] [1672] Counter A
[33] [1673] Counter B
[34] [1690] Alarm Word
[35] [1692] Warning Word
[36] [1694] Ext. Status Word

1

8-5X Digital/Bus
8-50 Coasting Select
[0] DigitalInput
[1] Bus
[2] LogicAnd
*[3] LogicOr
8-51 Quick Stop Select
See par. 8-50 * [3] LogicOr
8-52 DC Brake Select
See par. 8-50 * [3] LogicOr
8-53 Start Select
See par. 8-50 * [3] LogicOr
8-54 Reversing Select
See par. 8-50 * [3] LogicOr
8-55 Set-up Select
See par. 8-50 * [3] LogicOr
8-56 Preset Reference Select
See par. 8-50 * [3] LogicOr
8-9X Bus Jog / Feedback
8-94 Bus feedback 1
0x8000 - 0x7FFF * 0
13-XX Smart Logic
13-0X SLC Settings
13-00 SL Controller Mode
*[0] Off
[1] On
13-01 Start Event
[0] False
[1] True
[2] Running
[3] InRange
[4] OnReference
[7] OutOfCurrentRange
[8] BelowILow
[9] AboveIHigh
[16] ThermalWarning
[17] MainOutOfRange
[18] Reversing
[19] Warning
[20] Alarm_Trip
[21] Alarm_TripLock
[22-25] Comparator 0-3
[26-29] LogicRule0-3
[33] DigitalInput_18
[34] DigitalInput_19
[35] DigitalInput_27
[36] DigitalInput_29
[38] DigitalInput_33
*[39] StartCommand
[40] DriveStopped
13-02 Stop Event
See par. 13-01 * [40] DriveStopped
13-03 Reset SLC
*[0] Do not reset
[1] Reset SLC
13-1X Comparators
13-10 Comparator Operand
*[0] Disabled
[1] Reference
[2] Feedback
[3] MotorSpeed
[4] MotorCurrent
[6] MotorPower
[7] MotorVoltage
[8] DCLinkVoltage
[12] AnalogInput53
[13] AnalogInput60
[18] PulseInput33
[20] AlarmNumber
[30] CounterA
[31] CounterB
13-11 Comparator Operator
[0] Less Than
*[1] Approximately equals
[2] Greater Than
13-12 Comparator Value
-9999 - 9999 * 0.0
13-2X Timers
13-20 SL Controller Timer
0.0 - 3600 s * 0.0 s
13-4X Logic Rules
13-40 Logic Rule Boolean 1
See par. 13-01 * [0] False
[30] - [32] SL Time-out 0-2
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
13-42 Logic Rule Boolean 2
See par. 13-40 * [0] False
13-43 Logic Rule Operator 2
See par. 13-41 * [0] Disabled
13-44 Logic Rule Boolean 3
See par. 13-40 * [0] False
13-5X States
13-51 SL Controller Event
See par. 13-40 * [0] False
13-52 SL Controller Action
*[0] Disabled
[1] NoAction
[2] SelectSetup1
[3] SelectSetup2
[10-17] SelectPresetRef0-7
[18] SelectRamp1
[19] SelectRamp2
[22] Run
[23] RunReverse
[24] Stop
[25] Qstop
[26] DCstop
[27] Coast
[28] FreezeOutput
[29] StartTimer0
[30] StartTimer1
[31] StartTimer2
[32] Set Digital Output A Low
[33] Set Digital Output B Low
[38] Set Digital Output A High
[39] Set Digital Output B High
[60] ResetCounterA
[61] ResetCounterB
14-XX Special Functions
14-0X Inverter Switching
14-01 Switching Frequency
[0] 2 kHz
*[1] 4 kHz
[2] 8 kHz
[4] 16 kHz not available for M5
14-03 Overmodulation
[0] Off
*[1] On
14-1X Mains monitoring
14-12 Function at mains imbalance
*[0] Trip
[1] Warning
[2] Disabled
14-2X Trip Reset
14-20 Reset Mode
*[0] Manual reset
[1-9] AutoReset 1-9
[10] AutoReset 10
[11] AutoReset 15
[12] AutoReset 20
[13] Infinite auto reset
14-21 Automatic Restart Time
0 - 600s * 10s
14-22 Operation Mode
*[0] Normal Operation
[2] Initialisation
14-26 Action At Inverter Fault
*[0] Trip
[1] Warning
14-4X Energy Optimising
14-41 AEO Minimum Magnetisation
40 - 75 % * 66 %
15-XX Drive Information
15-0X Operating Data
15-00 Operating Days
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
*[0] Do not reset
[1] Reset counter
15-07 Reset Running Hours Counter
*[0] Do not reset
[1] Reset counter
15-3X Fault Log
15-30 Fault Log: Error Code
15-4X Drive Identification
15-40 FC Type
15-41 Power Section
15-42 Voltage
15-43 Software Version
15-46 Frequency Converter Order. No
15-48 LCP Id No
15-51 Frequency Converter Serial No
16-XX Data Readouts
16-0X General Status
16-00 Control Word
0 - 0XFFFF
16-01 Reference [Unit]
-4999 - 4999 * 0.000
16-02 Reference %
-200.0 - 200.0% * 0.0%
16-03 Status Word
0 - 0XFFFF
16-05 Main Actual Value [%]
-200.0 - 200.0% * 0.0%
16-09 Custom Readout
Dep. on par. 0-31, 0-32 and 4-14
16-1X Motor Status
16-10 Power [kW]
16-11 Power [hp]
16-12 Motor Voltage [V]
16-13 Frequency [Hz]
16-14 Motor Current [A]
16-15 Frequency [%]
16-18 Motor Thermal [%]
16-3X 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
16-5X Ref. / Feedb.
16-50 External Reference
16-51 Pulse Reference
16-52 Feedback [Unit]
16-6X Inputs / Outputs
16-60 Digital Input 18,19,27,33
0 - 1111
16-61 Digital Input 29
0 - 1
16-62 Analog Input 53 (volt)
16-63 Analog Input 53 (current)
16-64 Analog Input 60
16-65 Analog Output 42 [mA]
16-68 Pulse Input [Hz]
16-71 Relay Output [bin]
16-72 Counter A
16-73 Counter B
16-8X Fieldbus / FC Port
16-86 FC Port REF 1
0x8000 - 0x7FFF
16-9X Diagnosis Readouts
16-90 Alarm Word
0 - 0XFFFFFFFF
16-92 Warning Word
0 - 0XFFFFFFFF
16-94 Ext. Status Word
0 - 0XFFFFFFFF*18-XX Extended Motor Data*
18-8X Motor Resistors
18-80 Stator Resistance (High resolution)
0.000 - 99.990ohm * 0.000ohm
18-81 Stator Leakage Reactance(High resolution)
0.000 - 99.990ohm * 0.000ohm

1.6 Troubleshooting

No.	Description	Warning	Alarm	Trip Lock	Error	Cause of Problem
2	Live zero error	X	X			Signal on terminal 53 or 60 is less than 50% of value set in par. 6-10, 6-12 and 6-22.
4	Mains phase loss[1)]	X	X	X		Missing phase on supply side, or too high voltage imbalance. Check supply voltage.
7	DC over voltage[1)]	X	X			Intermediate circuit voltage exceeds limit.
8	DC under voltage[1)]	X	X			Intermediate circuit voltage drops below “voltage warning low” limit.
9	Inverter overloaded	X	X			More than 100% load for too long.
10	Motor ETR over temperature	X	X			Motor is too hot due to more than 100% load for too long.
11	Motor thermistor over temperature	X	X			Thermistor or thermistor connection is disconnected.
12	Torque limit	X				Torque exceeds value set in either par. 4-16 or 4-17.
13	Over Current	X	X	X		Inverter peak current limit is exceeded.
14	Earth fault		X	X		Discharge from output phases to ground.
16	Short Circuit		X	X		Short-circuit in motor or on motor terminals.
17	Control word timeout	X	X			No communication to frequency converter.
25	Brake resistor short-circuited		X	X		Brake resistor is short-circuited, thus brake function is disconnected.
27	Brake chopper short-circuited		X	X		Brake transistor is short-circuited, thus brake function is disconnected.
28	Brake check		X			Brake resistor is not connected/working
29	Power board over temp	X	X	X		Heat-sink cut-out temperature has been reached.
30	Motor phase U missing		X	X		Motor phase U is missing. Check the phase.
31	Motor phase V missing		X	X		Motor phase V is missing. Check the phase.
32	Motor phase W missing		X	X		Motor phase W is missing. Check the phase.
38	Internal fault		X	X		Contact local Danfoss supplier.
44	Earth fault		X	X		Discharge from output phases to ground.
47	Control Voltage Fault		X	X		24 V DC may be overloaded.
51	AMT check U_{nom} and I_{nom}		X			Wrong setting for motor voltage and/or motor current.
52	AMT low I_{nom}		X			Motor current is too low. Check settings.
59	Current limit	X				VLT overload.
63	Mechanical Brake Low		X			Actual motor current has not exceeded “release brake” current within “start delay” time window.
80	Drive Initialised to Default Value		X			All parameter settings are initialized to default settings.
84	The connection between drive and LCP is lost				X	No communication between LCP and frequency converter
85	Button disabled				X	See parameter group 0-4* *LCP*
86	Copy fail				X	An error occurred while copying from frequency converter to LCP or vice versa.
87	LCP data invalid				X	Occurs when copying from LCP if the LCP contains erroneous data - or if no data was uploaded to the LCP.
88	LCP data not compatible				X	Occurs when copying from LCP if data are moved between frequency converters with major differences in software versions.
89	Parameter read only				X	Occurs when trying to write to a read-only parameter.
90	Parameter database busy				X	LCP and RS485 connection are trying to update parameters simultaneously.
91	Parameter value is not valid in this mode				X	Occurs when trying to write an illegal value to a parameter.
92	Parameter value exceeds the min/max limits				X	Occurs when trying to set a value outside the range.
nw run	**N**ot **W**hile **RUN**ning				X	Parameter can only be changed when the motor is stopped.
Err.	A wrong password was entered				X	Occurs when using a wrong password for changing a password-protected parameter.

[1)] These faults may be caused by mains distortions. Installing Danfoss Line Filter may rectify this problem.

Table 1.5 Warnings and AlarmsCode list

1

1.7 Specifications

1.7.1 Mains Supply 3 x 200 - 240V AC

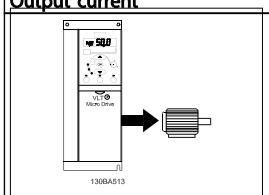
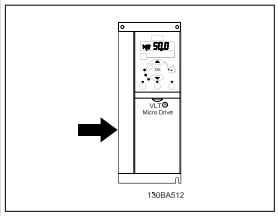
Normal overload 150% for 1 minute						
Frequency converter		PK18	PK37	PK75	P1K5	P2K2
Typical Shaft Output [kW]		0.18	0.37	0.75	1.5	2.2
Typical Shaft Output [HP]		0.25	0.5	1	2	3
IP 20		Frame M1	Frame M1	Frame M1	Frame M2	Frame M3
Output current						
	Continuous (3 x 200-240V) [A]	1.2	2.2	4.2	6.8	9.6
	Intermittent (3 x 200-240V) [A]	1.8	3.3	6.3	10.2	14.4
	Max. cable size:					
	(mains, motor) [mm² /AWG]	4/10				
Max. input current						
	Continuous (3 x 200-240V) [A]	3.3	6.1	11.6	18.7	26.4
	Intermittent (3 x 200-240V) [A]	4.5	8.3	15.6	26.4	37.0
	Max. mains fuses [A]	See Section *Fuses*				
	Environment					
	Estimated power loss [W], Best case/ Typical[1)]	12.5/ 15.5	20.0/ 25.0	36.5/ 44.0	61.0/ 67.0	81.0/ 85.1
	Weight enclosure IP20 [kg]	1.1	1.1	1.1	1.6	3.0
	Efficiency [%], Best case/Typical[1)]	95.6/ 94.5	96.5/ 95.6	96.6/ 96.0	97.0/ 96.7	96.9/ 97.1

Table 1.6 Mains Supply 3 x 200 - 240V AC

1. At rated load conditions.

1.7.2 Mains Supply 3 x 200 - 240V AC

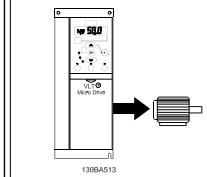
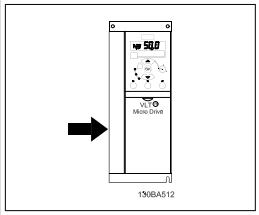
Normal overload 150% for 1 minute							
Frequency converter		PK25	PK37	PK75	P1K5	P2K2	P3K7
Typical Shaft Output [kW]		0.25	0.37	0.75	1.5	2.2	3.7
Typical Shaft Output [HP]		0.33	0.5	1	2	3	5
IP 20		Frame M1	Frame M1	Frame M1	Frame M2	Frame M3	Frame M3
Output current							
	Continuous (3 x 200-240V) [A]	1.5	2.2	4.2	6.8	9.6	15.2
	Intermittent (3 x 200-240V) [A]	2.3	3.3	6.3	10.2	14.4	22.8
	Max. cable size:						
	(mains, motor) [mm² /AWG]	4/10					
Max. input current							
	Continuous (3 x 200-240V) [A]	2.4	3.5	6.7	10.9	15.4	24.3
	Intermittent (3 x 200-240V) [A]	3.2	4.6	8.3	14.4	23.4	35.3
	Max.mains fuses [A]	See Section *Fuses*					
	Environment						
	Estimated power loss [W], Best case/ Typical[1)]	14.0/ 20.0	19.0/ 24.0	31.5/ 39.5	51.0/ 57.0	72.0/ 77.1	115.0/ 122.8
	Weight enclosure IP20 [kg]	1.1	1.1	1.1	1.6	3.0	3.0
	Efficiency [%], Best case/Typical[1)]	96.4/ 94.9	96.7/ 95.8	97.1/ 96.3	97.4/ 97.2	97.2/ 97.4	97.3/ 97.4

Table 1.7 Mains Supply 3 x 200 - 240V AC

1. At rated load conditions.

1.7.3 Mains Supply 3 x 380 - 480V AC

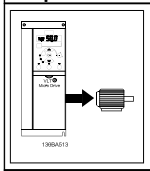
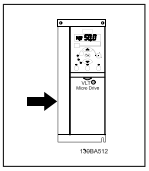
Normal overload 150% for 1 minute							
Frequency converter		PK37	PK75	P1K5	P2K2	P3K0	P4K0
Typical Shaft Output [kW]		0.37	0.75	1.5	2.2	3.0	4.0
Typical Shaft Output [HP]		0.5	1	2	3	4	5
IP 20		Frame M1	Frame M1	Frame M2	Frame M2	Frame M3	Frame M3
Output current							
	Continuous (3 x 380-440V) [A]	1.2	2.2	3.7	5.3	7.2	9.0
	Intermittent (3 x 380-440V) [A]	1.8	3.3	5.6	8.0	10.8	13.7
	Continuous (3 x 440-480V) [A]	1.1	2.1	3.4	4.8	6.3	8.2
	Intermittent (3 x 440-480V) [A]	1.7	3.2	5.1	7.2	9.5	12.3
	Max. cable size:						
	(mains, motor) [mm^2/ AWG]	4/10					
Max. input current							
	Continuous (3 x 380-440V) [A]	1.9	3.5	5.9	8.5	11.5	14.4
	Intermittent (3 x 380-440V) [A]	2.6	4.7	8.7	12.6	16.8	20.2
	Continuous (3 x 440-480V) [A]	1.7	3.0	5.1	7.3	9.9	12.4
	Intermittent (3 x 440-480V) [A]	2.3	4.0	7.5	10.8	14.4	17.5
	Max. mains fuses [A]	See Section *Fuses*					
	Environment						
	Estimated power loss [W], Best case/ Typical[1)]	18.5/ 25.5	28.5/ 43.5	41.5/ 56.5	57.5/ 81.5	75.0/ 101.6	98.5/ 133.5
	Weight enclosure IP20 [kg]	1.1	1.1	1.6	1.6	3.0	3.0
	Efficiency [%], Best case/ Typical[1)]	96.8/ 95.5	97.4/ 96.0	98.0/ 97.2	97.9/ 97.1	98.0/ 97.2	98.0/ 97.3

Table 1.8 Mains Supply 3 x 380 - 480V AC

1. At rated load conditions.

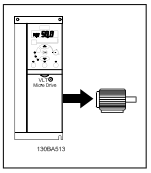
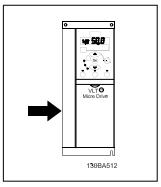
Normal overload 150% for 1 minute							
Frequency converter		P5K5	P7K5	P11K	P15K	P18K	P22K
Typical Shaft Output [kW]		5.5	7.5	11	15	18.5	22
Typical Shaft Output [HP]		7.5	10	15	20	25	30
IP 20		Frame M3	Frame M3	Frame M4	Frame M4	Frame M5	Frame M5
Output current							
	Continuous (3 x 380-440V) [A]	12.0	15.5	23.0	31.0	37.0	43.0
	Intermittent (3 x 380-440V) [A]	18.0	23.5	34.5	46.5	55.5	64.5
	Continuous (3 x 440-480V) [A]	11.0	14.0	21.0	27.0	34.0	40.0
	Intermittent (3 x 440-480V) [A]	16.5	21.3	31.5	40.5	51.0	60.0
	Max. cable size:						
	(mains, motor) [mm^2/ AWG]	4/10		16/6			
Max. input current							
	Continuous (3 x 380-440V) [A]	19.2	24.8	33.0	42.0	34.7	41.2
	Intermittent (3 x 380-440V) [A]	27.4	36.3	47.5	60.0	49.0	57.6
	Continuous (3 x 440-480V) [A]	16.6	21.4	29.0	36.0	31.5	37.5
	Intermittent (3 x 440-480V) [A]	23.6	30.1	41.0	52.0	44.0	53.0
	Max. mains fuses [A]	See Section *Fuses*					
	Environment						
	Estimated power loss [W], Best case/ Typical[1)]	131.0/ 166.8	175.0/ 217.5	290.0/ 342.0	387.0/ 454.0	395.0/ 428.0	467.0/ 520.0
	Weight enclosure IP20 [kg]	3.0	3.0				
	Efficiency [%], Best case/ Typical[1)]	98.0/ 97.5	98.0/ 97.5	97.8/ 97.4	97.7/ 97.4	98.1/ 98.0	98.1/ 97.9

Table 1.9 Mains Supply 3 x 380 - 480V AC

1. At rated load conditions.

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1.8 General Technical Data

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/L, L2, L3/N):	
Supply voltage	200-240V ±10%
Supply voltage	380-480V ±10%
Supply frequency	50/60Hz
Max. imbalance temporary between mains phases	3.0% of rated supply voltage
True Power Factor (λ)	≥ 0.4 nominal at rated load
Displacement Power Factor (cosφ) near unity	(> 0.98)
Switching on input supply L1/L, L2, L3/N (power-ups)	maximum 2 times/min.
Environment according to EN60664-1	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 - 3600sec.
Cable lengths and cross sections:	
Max. motor cable length, screened/armoured (EMC correct installation)	15m
Max. motor cable length, unscreened/unarmoured	50m
Max. cross section to motor, mains*	
Connection to load sharing/brake (M1, M2, M3)	6.3mm insulated Faston Plugs
Max. cross section to load sharing/brake (M4, M5)	16mm^2/6AWG
Maximum cross section to control terminals, rigid wire	1.5mm^2/16 AWG (2 x 0.75mm^2)
Maximum cross section to control terminals, flexible cable	1mm^2/18 AWG
Maximum cross section to control terminals, cable with enclosed core	0.5mm^2/20AWG
Minimum cross section to control terminals	0.25mm^2

** See tables for mains supply for more information!*

Digital Inputs (Pulse/Enocder Inputs):	
Programmable digital inputs (Pulse/encoder)	5 (1)
Terminal number	18, 19, 27, 29, 33,
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. 4k
Max. pulse frequency at terminal 33	5000Hz
Min. pulse frequency at terminal 33	20Hz

Analog Inputs:	
Number of analog inputs	2
Terminal number	53, 60
Voltage mode (Terminal 53)	Switch S200=OFF(U)
Current mode (Terminal 53 and 60)	Switch S200=ON(I)
Voltage level	0 -10V
Input resistance, R_i	approx. 10 kΩ
Max. voltage	20V
Current level	0/4 to 20 mA (scaleable)
Input resistance, R_i	approx. 200Ω
Max. current	30mA

Analog output:	
Number of programmable analog outputs	1
Terminal number	42
Current range at analog output	0/4 - 20mA
Max. load to common at analog output	500Ω
Max. voltage at analog output	17V
Accuracy on analog output	Max. error: 0.8 % of full scale
Resolution on analog output	8bit

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 (M1 and M2)	160mA
Max. load (M3)	30mA
Max. load (M4 and M5)	200mA
Relay output:	
Programmable relay output	1
Relay 01 Terminal number	01-03 (break), 01-02(make)
Max. terminal load (AC-1)[1)] on 01-02 (NO) (Resistive load)	250V AC, 2 A
Max. terminal load (AC-15)[1)] on 01-02 (NO) (Inductive load @ cosφ 0.4)	250V AC, 0.2 A
Max. terminal load (DC-1)[1)] on 01-02 (NO) (Resistive load)	30V DC, 2 A
Max. terminal load (DC-13)[1)] on 01-02 (NO) (Inductive load)	24V DC, 0.1A
Max. terminal load (AC-1)[1)] on 01-03 (NC) (Resistive load)	250V AC, 2 A
Max. terminal load (AC-15)[1)] on 01-03 (NC) (Inductive load @ cosφ 0.4)	250V AC, 0.2A
Max. terminal load (DC-1)[1)] on 01-03 (NC) (Resistive load)	30V DC, 2 A
Min. terminal load on 01-03 (NC), 01-02 (NO)	24V DC 10 mA, 24V AC 20 mA
Environment according to EN 60664-1	overvoltage category III/pollution degree 2

1) IEC 60947 part 4 and 5

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

NOTE

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

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Surroundings:	
Enclosure	IP 20
Enclosure kit available	IP 21, 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	class 3C3
Test method according to IEC 60068-2-43 H2S (10 days)	
Ambient temperature	Max. 40 °C
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	- 10 °C
Temperature during storage/transport	-25 - +65/70 °C
Maximum altitude above sea level without derating	1000 m
Maximum altitude above sea level with derating	3000 m
Derating for high altitude, see 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
EMC standards, Immunity	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 61000-4-6
See section on special conditions	

1.9 Special Conditions

1.9.1 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.

The frequency converter has been designed for operation at max 50°C ambient temperature with one motor size smaller than nominal. Continuous operation at full load at 50 °C ambient temperature will reduce the lifetime of the frequency converter.

1.9.2 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 de-rating 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

1.9.3 Derating for Running at Low Speeds

When a motor is connected to at frequency converter, it is necessary to check that the cooling of the motor is adequate.
A problem may occur at low speeds in constant torque applications. Running continuously at low speeds – below half the nominal motor speed – may require additional air cooling. Alternatively, choose a larger motor (one size up).

1.10 Options for VLT® Micro Drive FC 51

Ordering No	Description
132B0100	VLT Control Panel LCP 11 w/o potentiometer
132B0101	VLT Control Panel LCP 12 with potentiometer
132B0102	Remote Mounting Kit for LCP incl. 3 m cable IP55 with LCP 11, IP21 with LCP 12
132B0103	Nema Type 1 kit for M1 frame
132B0104	Type 1 kit for M2 frame
132B0105	Type 1 kit for M3 frame
132B0106	De-coupling plate kit for M1 and M2 frames
132B0107	De-coupling plate kit for M3 frame
132B0108	IP21 for M1 frame
132B0109	IP21 for M2 frame
132B0110	IP21 for M3 frame
132B0111	DIN rail mounting kit for M1 and M2 frames
132B0120	Type 1 kit for M4 frame
132B0121	Type 1 kit for M5 frame
132B0122	De-coupling plate kit for M4 and M5 frames
132b0126	M1 frame spare parts kits
132b0127	M2 frame spare parts kits
132b0128	M3 frame spare parts kits
132b0129	M4 frame spare parts kits
132b0130	M5 frame spare parts kits

Danfoss Line Filters and brake resistors are available upon request.

www.danfoss.com/drives

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