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1. Safety

1.1.1. High Voltage Warning

The voltage of the adjustable frequency drive is dangerous whenever it is connected to AC 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.

1.1.2. Safety Instructions

- Make sure the adjustable frequency drive is properly grounded.
- Do not remove line power 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 in accordance with national and local regulations.
- The ground leakage current exceeds 3.5 mA.
- The [OFF] key is not a safety switch. It does not disconnect the adjustable frequency drive from line power.

1.1.3. Approvals

1.1.4. General Warning

Warning:
Touching the electrical parts may be fatal - even after the equipment has been disconnected from line power.
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 VLT Micro Drive, wait at least 4 minutes for all sizes.
A shorter time is allowed only if indicated on the nameplate for the specific unit.

Leakage Current
The ground leakage current from the VLT Micro Drive FC 51 exceeds 3.5 mA. According to IEC 61800-5-1, a reinforced protective ground connection must be ensured by means of a min. of 0.016 in² [10 mm²] Cu or an additional PE wire - with the same cable cross-section as the line power wiring, which must be terminated separately.

Residual Current Device
This product can cause DC current in the protective conductor. If a residual current device (RCD) is used for extra protection, only an RCD of Type B (time delayed) may be used on the supply side of this product. See also Danfoss Application Note on RCD, MN.90.GX.YY.
Protective grounding of the VLT Micro Drive and the use of RCDs must always follow national and local regulations.

1

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

Installation at high altitudes:
At altitudes higher than 6,600 feet [2 km], please contact Danfoss Drives regarding PELV.

1.1.5. IT Line

IT Line
Installation on isolated line power source, i.e., IT line power.
Max. supply voltage allowed when connected to line power: 440 V.

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

1.1.6. 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 Local Control Panel.

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

1.1.7. Disposal Instructions

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.

1.1.8. Before Commencing Repair Work

1. Disconnect the FC 51 from line power (and external DC supply, if present.)
2. Wait for 4 minutes for the DC link to discharge.
3. Disconnect the DC bus terminals and brake terminals (if present)
4. Remove motor cable.

2. Mechanical Installation

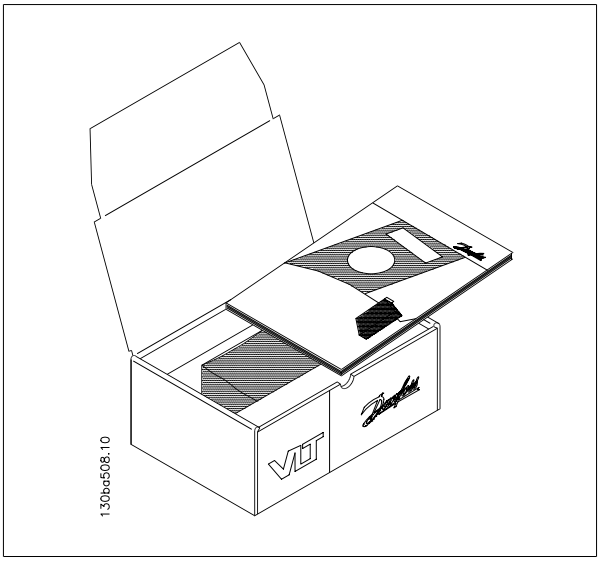
2.1. Before Starting

2.1.1. Checklist

When unpacking the adjustable frequency drive, make sure that the unit is undamaged and complete. Make sure that the packaging contains the following:

- VLT Micro Drive FC 51
- Quick Guide

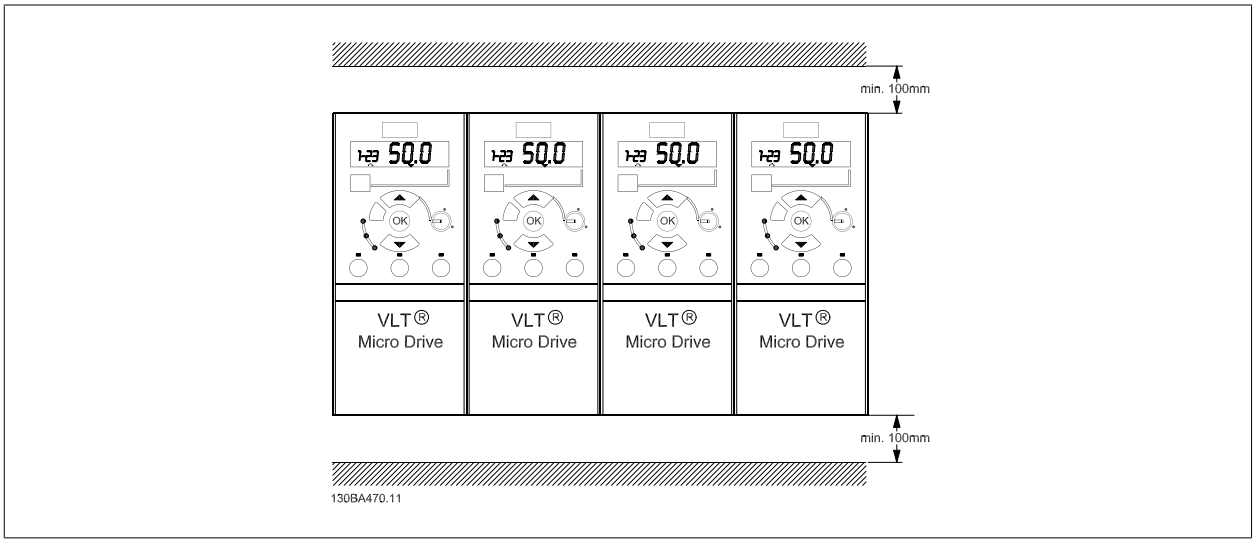
Optional: LCP and/or de-coupling plate.



2.1: Contents of box.

2.2. Side-by-Side Installation

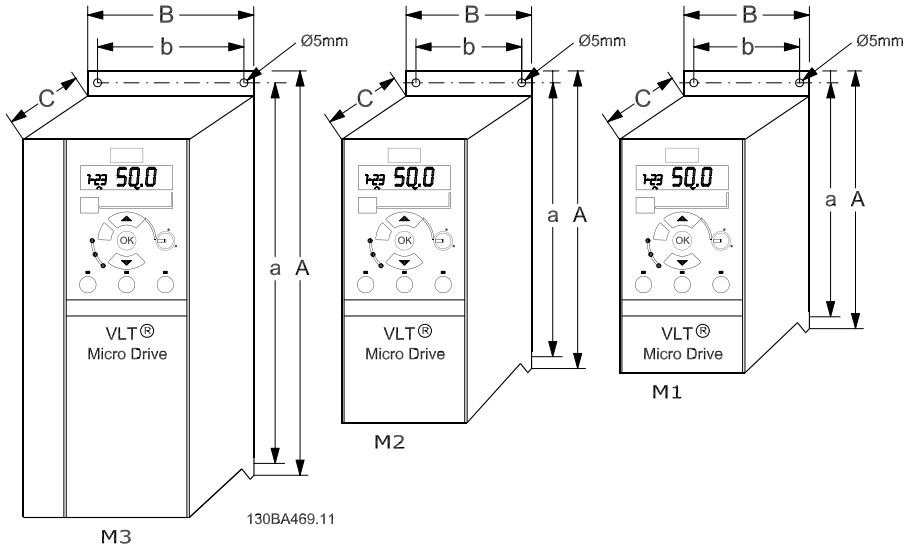
The Danfoss VLT Micro Drive can be mounted side-by-side for IP 20 rating units and requires 3.4 in. [100 mm] clearance above and below for cooling. Regarding surroundings in general, please see chapter *7. Specifications*.



2.2: Side-by-side installation.

2

2.3.1. Mechanical Dimensions



2.3: Mechanical dimensions

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

	Power (kW)			Height (mm)			Width (mm)		Depth [1] (mm)	Max. Weight
Frame	1 X 200-240 V	3 X 200 -240 V	3 X 380-480 V	A	A (incl. de-coupling 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	[2]	[2]	[2]	[2]	[2]	[2]	[2]

2.1: Mechanical Dimensions

[1] For LCP with potentiometer, please add 0.3 in [7.6 mm].

[2] These dimensions will be announced at a later point.

NOTE
DIN rail mounting kit is available for M1. Please use ordering number 132B0111.

3. Electrical Installation

3.1. How to Connect

3.1.1. Electrical Installation in General

NOTE
All cabling must comply with national and local regulations on cable cross-sections and ambient temperature. Copper conductors required, (140°-167° F [60°-75° C]) recommended.

Details of terminal tightening torques.

	Power (kW)			Torque (Nm)					
Frame	1 x 200-240 V	3 x 200-240 V	3 x 380-480 V	Line	Motor	DC connection/Brake[1)]	Control Terminals	Ground	Relay
M1	0.18 - 0.75	0.25 - 0.75	0.37 - 0.75	1.4	0.7	-	0.15	3	0.5
M2	1.5	1.5	1.5 - 2.2	1.4	0.7	-	0.15	3	0.5
M3	2.2	2.2 - 3.7	3.0 - 7.5	1.4	0.7	-	0.15	3	0.5
[1)] Spade connectors									

3.1: Tightening of terminals.

3.1.2. Fuses

Branch circuit protection:
In order to protect the installation against electrical and fire hazards, 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 the DC link. The adjustable frequency drive 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 100,000 A_{rms} (symmetrical), 480 V maximum.

NonUL compliance:
If UL/cUL is not to be complied with, Danfoss recommends using the fuses mentioned in table 1.3, which will ensure compliance with EN50178:
In case of malfunction, not following the fuse recommendation may result in damage to the adjustable frequency drive.

FC 51	Bussmann	Bussmann	Bussmann	Littel fuse	Ferraz-Shawmut	Ferraz-Shawmut	Max. fuses non-UL
1 X 200-240 V							
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	15A
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-R45	JKS-45	JJN-45	KLN-R45	-	A2K-45R	45A
3 x 200-240 V							
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	15A
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-R30	JKS-30	JJN-30	KLN-R30	ATM-R30	A2K-30R	30A
3K7	KTN-R45	JKS-45	JJN-45	KLN-R45	-	A2K-45R	45A
3 x 380-480 V							
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	15A
2K2	KTS-R20	JKS-20	JJS-20	KLS-R20	ATM-R20	A6K-20R	20A
3K0	KTS-R25	JKS-25	JJS-25	KLS-R25	ATM-R25	A6K-25R	25A
4K0	KTS-R30	JKS-30	JJS-30	KLS-R30	ATM-R30	A6K-30R	30A
5K5	KTS-R35	JKS-35	JJS-35	KLS-R35	-	A6K-35R	35A
7K5	KTS-R45	JKS-45	JJS-45	KLS-R45	-	A6K-45R	45A

3.2: Fuses

3.1.3. EMC-correct Installation

Following these guidelines is advised where compliance with EN 61000-6-3/4, EN 55011 or EN 61800-3 *First environment* is required. If the installation is in EN 61800-3 *Second environment*, then it is acceptable to deviate from these guidelines. However, it is not recommended.

Good engineering practice to ensure EMC-correct electrical installation:

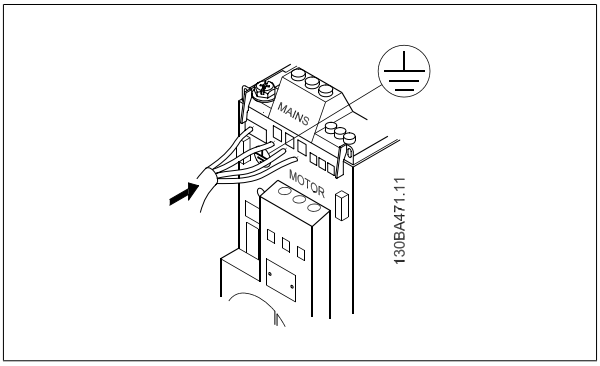
- Use only braided shielded/armored motor cables and control cables.
  The shield should provide a minimum coverage of 80%. The shield material must be metal, not limited to but typically copper, aluminum, steel or lead. There are no special requirements for the line cable.
- Installations using rigid metal conduits are not required to contain shielded cable, but the motor cable must be installed in a conduit separate from the control and line cables. Full connection of the conduit from the drive to the motor is required. The EMC performance of flexible conduits varies greatly, and information from the manufacturer must therefore be obtained.
- Connect the shield/armor/conduit to ground at both ends for motor cables and control cables.
- Avoid terminating the shield/armor with twisted ends (pigtails). This type of termination increases the high frequency impedance of the shield, which reduces its effectiveness at high frequencies. Use low impedance cable clamps or glands instead.
- Ensure good electrical contact between the de-coupling plate and the metal chassis of the adjustable frequency drive; see Instruction MI. 02.BX.YY
- Avoid using unshielded/unarmored motor or control cables inside cabinets housing the drive(s), whenever possible.

3.2. Line Connection

3.2.1. Connecting to Line Power

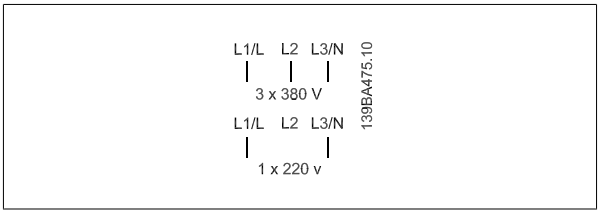
Step 1: First mount the ground cable.

Step 2: Mount wires in terminals L1/L, L2 and L3/N and tighten them.



3.1: Mounting of ground cable and line power wires.

For a 3-phase connection, connect the wires to all three terminals.
For a single-phase connection, connect the wires to terminals L1/L and L3/N.



3.2: Three-phase and single-phase wire connections.

3.3. Motor Connection

3.3.1. How to Connect the Motor

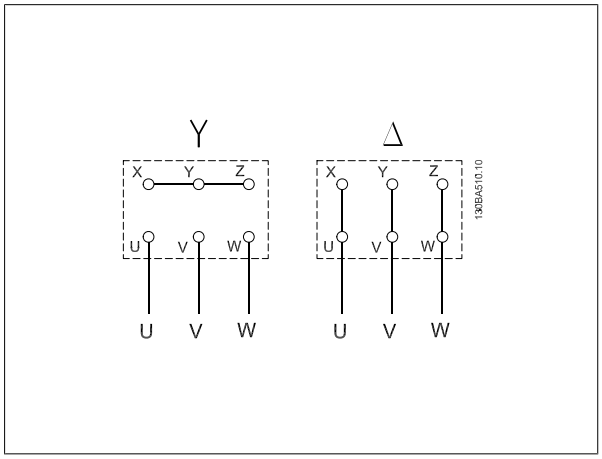
See the chapter *Specifications* for correct dimensioning of motor cable cross-section and length.

- 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.

3

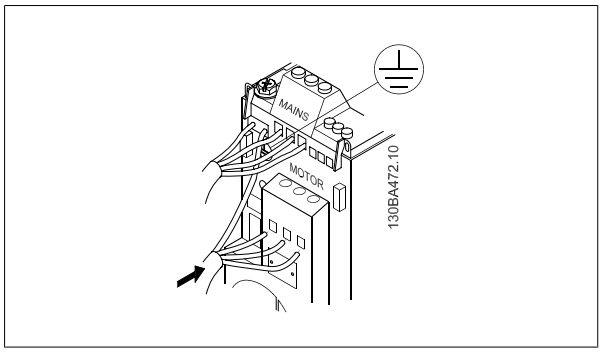
All types of three-phased asynchronous standard motors can be connected to the adjustable frequency drive. Normally, small motors are star-connected (230/400 V, Δ/Y). Large motors are delta-connected (400/690 V, Δ/Y). Refer to the motor nameplate for correct connection and voltage.



3.3: Star and delta connections.

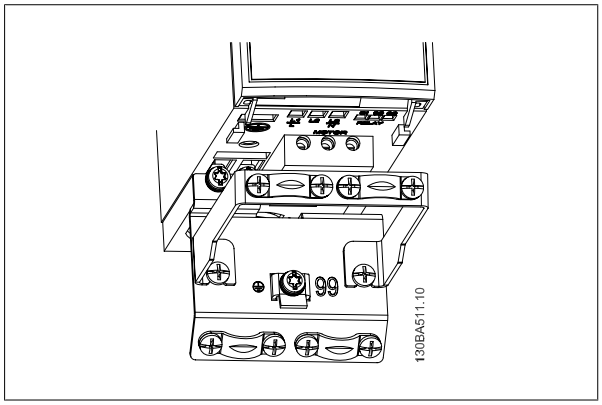
Step 1: First, mount the ground cable.

Step 2: Connect wires to terminals either in star or delta-connection. See the motor nameplate for further information.



3.4: Mounting of ground cable and motor wires.

For EMC-correct installation, use optional de-coupling plate; see chapter *Options for VLT Micro Drive FC 51*.

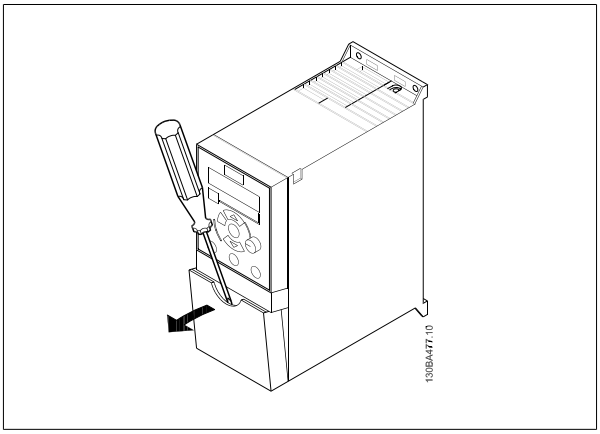


3.5: VLT Micro Drive with de-coupling plate

3.4. Control Terminals

3.4.1. Access to Control Terminals

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

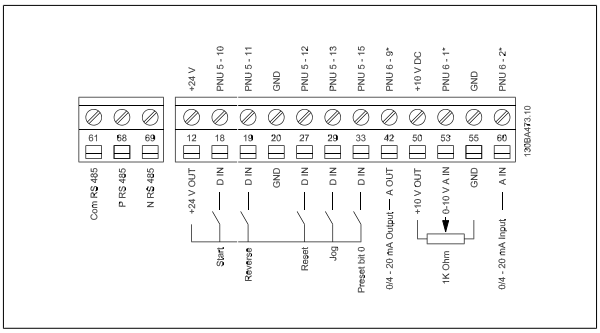


3.6: Removing the terminal cover.

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

3.4.2. Connecting to Control Terminals

This illustration shows all the control terminals on the VLT Micro Drive. Applying Start (term. 18) and an analog reference (term. 53 or 60) makes the adjustable frequency drive run.



3.7: Overview of control terminals in the PNP configuration and factory settings.

3.5. Switches

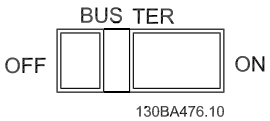
NOTE
Do not operate switches with power on the adjustable frequency drive.

3

Bus termination:

Switch *BUS TER* pos. ON terminates the RS-485 port, terminals 68, 69. See the power circuit drawing.

Default setting = Off.



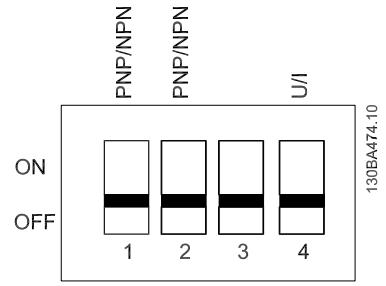
3.8: S640 Bus termination.

S200 Switches 1-4:

Switch 1:	*OFF = PNP terminal 29
	ON = NPN terminal 29
Switch 2:	*OFF = PNP terminals 18, 19, 27 and 33
	ON = NPN terminals 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

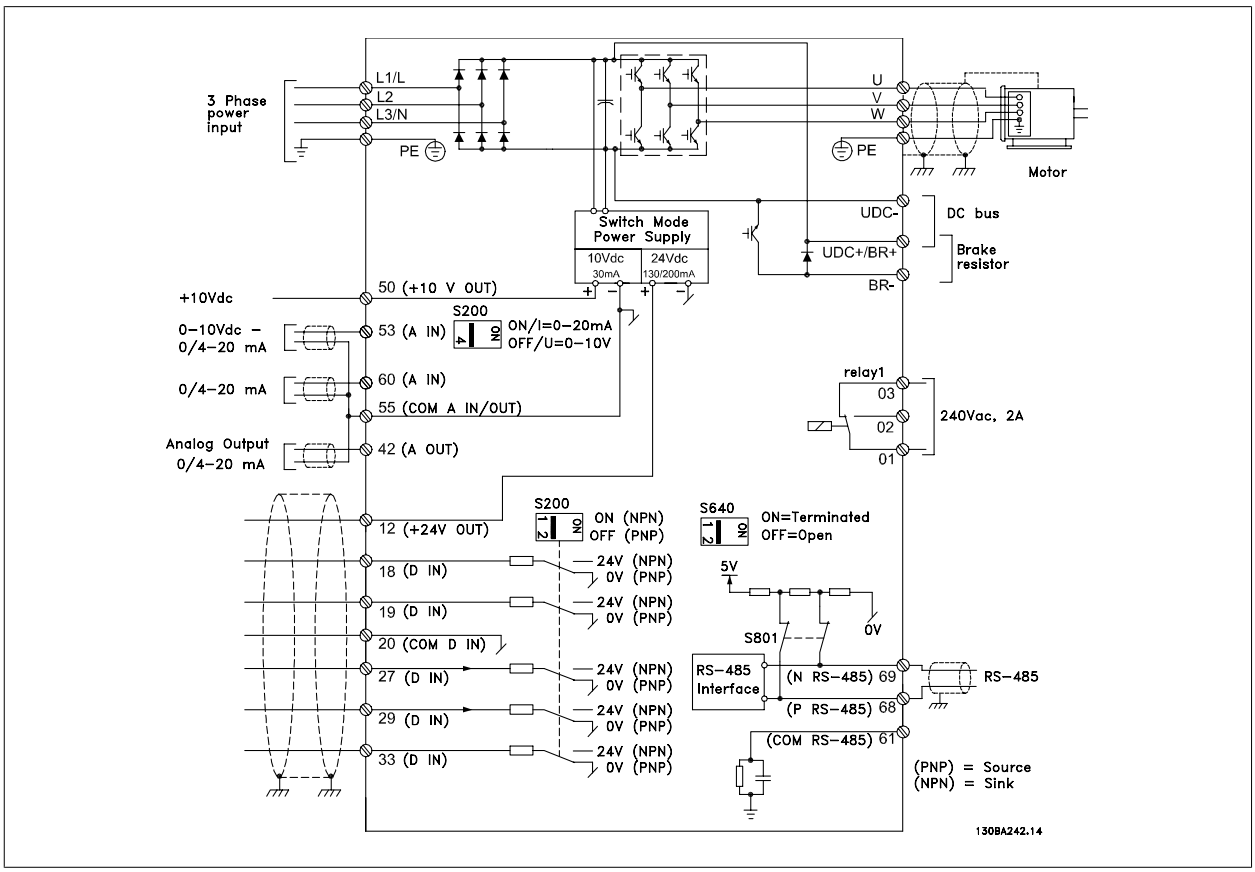
3.3: Settings for S200 Switches 1-4



3.9: S200 Switches 1-4.

NOTE
Parameter 6-19 must be set according to Switch 4 position.

3.6. Power Circuit - Overview



3.10: Diagram showing all electrical terminals.

Brake 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.

3.6.1. Load sharing/Brake

Use 0.25 in [6.3 m] 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+.

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

4. Programming

4.1. How to Program

4.1.1. Programming with MCT 10

The adjustable frequency drive can be programmed from a PC via RS-485 COM port by installing the MCT-10 Set-up software.

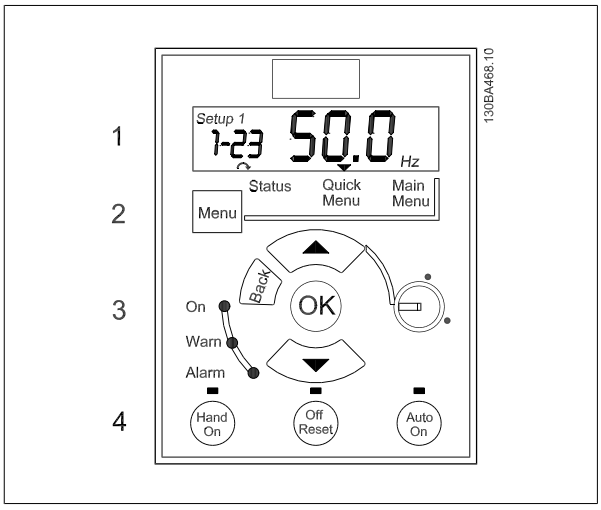
This software can either be ordered using code number 130B1000 or downloaded from the Danfoss website: www.danfoss.com, Business Area: Motion Controls.

Please refer to manual MG.10.RX.YY.

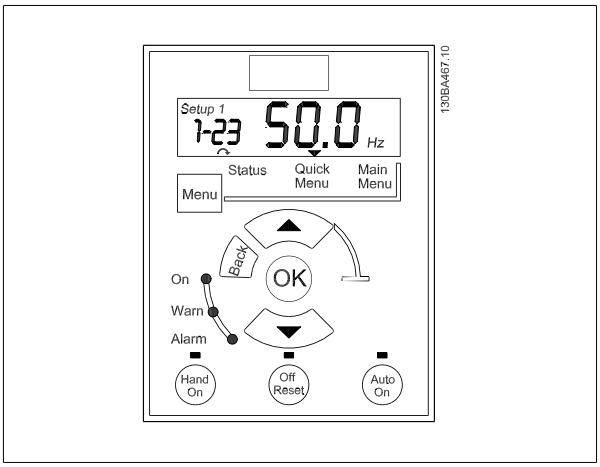
4.1.2. Programming with LCP 11 or LCP 12

The LCP is divided into four functional groups:

1. Numeric display.
2. Menu key.
3. Navigation keys.
4. Operation keys and LEDs.



4.1: LCP 12 with potentiometer.

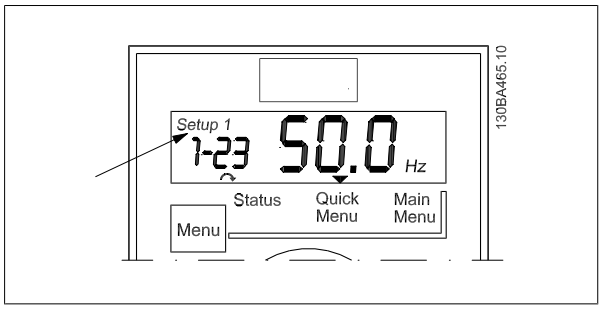


4.2: LCP 11 without potentiometer.

The display:

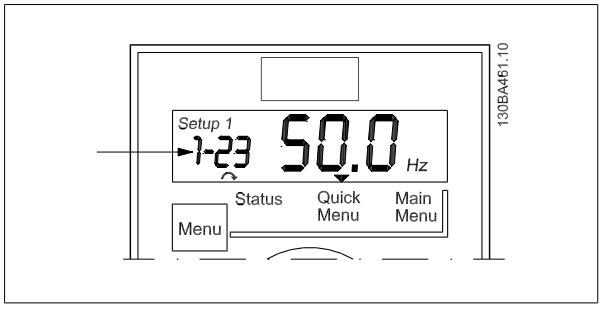
Certain information can be read from the display.

Set-up number shows the active set-up and the edit set-up. If the same set-up acts as both active and edit set-up, only the set-up number is shown (factory setting).
When active and edit set-up differ, both numbers are shown in the display (Set-up 12). The flashing number indicates the edit set-up.



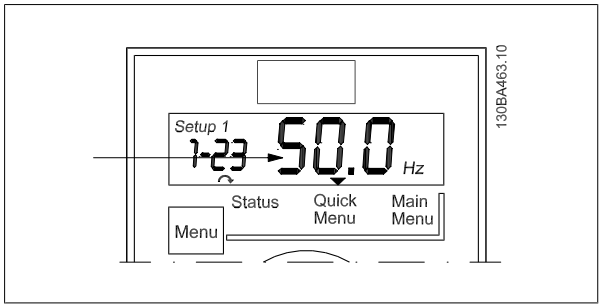
4.3: Indicating the Set-up

The small digits to the left are the selected **parameter number** .



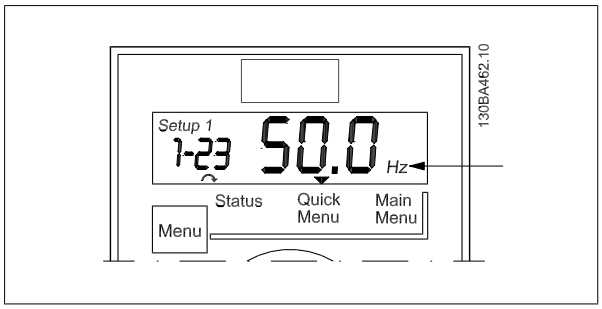
4.4: Indicating the selected par. no.

The large digits in the middle of the display show the **value** of the selected parameter.



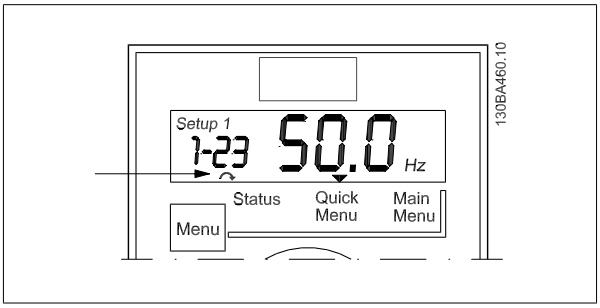
4.5: Indicating the value of the selected par.

The right side of the display shows the **unit** of the selected parameter. This can be either Hz, A, V, kW, HP, %, s or RPM.



4.6: Indicating the unit of the selected par.

Motor direction is shown to the bottom left of the display - indicated by a small arrow pointing either clockwise or counter-clockwise.



4.7: Indicating the motor direction

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

Status Menu:

The status menu is either in *Readout Mode* or *Hand on Mode*. In *Readout Mode,* the value of the currently selected readout parameter is shown in the display.

In *Hand on Mode,* the local LCP reference is displayed.

Quick Menu:

Displays quick menu parameters and their settings. Parameters in the quick menu can be accessed and edited from here. Most applications can be run by setting the parameters in the quick menus.

Main Menu:

Displays main menu parameters and their settings. All parameters can be accessed and edited here. A parameter overview is found later in this chapter. For detailed information on programming, please see *Programming Guide*, MG02CXYY.

LEDs:

- Green LED: The adjustable frequency drive is on.
- Yellow LED: Indicates a warning.
- Flashing red LED: Indicates an alarm.

Navigation Keys:

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

Operation Keys:

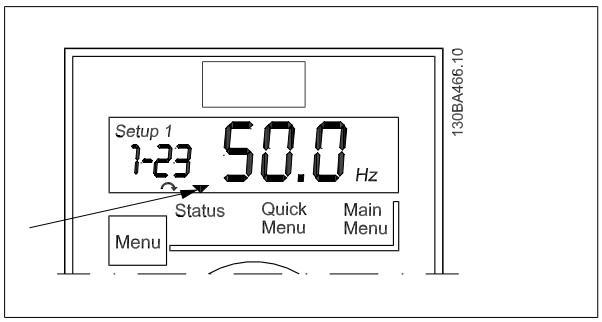
A yellow light above the operation keys indicates the active key.
[Hand on]: Starts the motor and enables control of the adjustable frequency drive via the LCP.
[Off/Reset]: The motor stops except when in alarm mode, in which case the motor will be reset.
[Auto on]: The adjustable frequency drive is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

4.2. Status Menu

After power-up, the status menu is active. Use the [MENU] key to toggle between status, the quick menu and the main menu.

Arrows [▲] and [▼] toggle between the choices in each menu.

The display indicates the status mode with a small arrow above "Status".

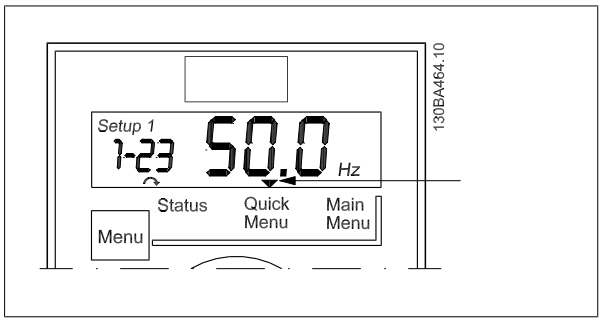


4.8: Indicating status mode

4.3. Quick Menu

The quick menu gives easy access to the most frequently used parameters.

1. To enter the quick menu, press the [MENU] key until the indicator in the display is placed above *Quick Menu*, then press [OK].
2. Use [▲] [▼] to browse through the parameters in the quick menu.
3. Press [OK] to select a parameter.
4. Use [▲] [▼] to change the value of a parameter setting.
5. Press [OK] to accept the change.
6. To exit, press either [Back] twice to enter *Status*, or press [Menu] once to enter *Main Menu*.



4.9: Indicating quick menu mode

4.4. Quick Menu Parameters

4.4.1. Quick Menu Parameters - Basic Settings QM1

Below are descriptions of all parameters found in the quick menu.

* = Factory setting.

1-20 Motor Power [kW]/[HP] ($P_{m.n}$)

Option:	Function:
	Enter the motor power from the nameplate data. Two sizes down, one size up from the nominal VLT rating.
[1]	0.09 kW/0.12 HP
[2]	0.12 kW/0.16 HP
[3]	0.18kW/0.25 HP
[4]	0.25 kW/0.33 HP
[5]	0.37kW/0.50 HP
[6]	0.55 kW/0.75 HP
[7]	0.75 kW/1.00 HP
[8]	1.10 kW/1.50 HP
[9]	1.50 kW/2.00 HP
[10]	2.20 kW/3.00 HP
[11]	3.00 kW/4.00 HP
[12]	3.70 kW/5.00 HP
[13]	4.00 kW/5.40 HP
[14]	5.50 kW/7.50 HP
[15]	7.50 HP/10.0 HP
[16]	11.00 kW/15.00 Hp

NOTE
Changing this parameter affects par. 1-22 to 1-25, 1-30, 1-33 and 1-35.

1-22 Motor Voltage ($U_{m.n}$)

Range:	Function:
230/400 V [50-999 V]	Enter the motor voltage from the nameplate data.

1-23 Motor Frequency ($f_{m.n}$)

Range:	Function:
50 Hz* [20-400 Hz]	Enter the motor frequency from the nameplate data.

1-24 Motor Current ($I_{m.n}$)

Range:	Function:
Motor type	Enter the motor current from the nameplate data.
Dependent* [0.01-26.00 A]	

4

1-25 Motor Nominal Speed (n m.n)

Range:	Function:
Motor Type	Enter the motor nominal speed from the nameplate data.
Dependent* [100 - 9,999 RPM]	

1-29 Automatic Motor Tuning (AMT)

Option: **Function:**

Use AMT to optimize motor performance.

NOTE
This parameter cannot be changed while the motor is running.

1. Stop VLT – make sure the motor is at a standstill.
2. Choose [2] Enable AMT.
3. Apply start signal.
   – Via LCP: Press Hand On
   - Or in Remote On mode: Apply start signal on terminal 18.

[0] *	Off	The AMT function is disabled.
[2]	Enable AMT.	The AMT function starts running.

NOTE
For the best possible tuning of the adjustable frequency drive, it is recommended that AMT be performed on a cold motor.

3-02 Minimum Reference

Range:	Function:
0.00* [-4999 - 4999]	Enter the value for the minimum reference. The sum of all internal and external references is clamped (limited) to the minimum reference value, par. 3-02.

3-03 Maximum Reference

Range:	Function:
	The maximum reference is adjustable within the range minimum reference - 4999.
50.00* [-4999 - 4999]	Enter the value for the maximum reference. The sum of all internal and external references is clamped (limited) to the maximum reference value, par. 3-03.

3-41 Ramp1 Ramp-up Time

Range:	Function:
3.00 s* [0.05 - 3,600 s]	Enter the ramp-up time from 0 Hz to the rated motor frequency ($f_{M,N}$) set in par. 1-23. Choose a ramp-up time, ensuring that the torque limit is not exceeded; see par. 4-16.

3-42 Ramp1 Ramp-down Time

Range:	Function:
3.00* [0.05 - 3,600 s]	Enter the ramp-down time from the rated motor frequency ($f_{M,N}$) in par. 1-23 to 0 Hz. Choose a ramp-down time that does not cause overvoltage in the inverter due to the regenerative operation of the motor. Furthermore, the regenerative torque must not exceed the limit set in par. 4-17.

4.4.2. Quick Menu Parameters - PI Basic Settings QM2

The following is a brief description of the parameters for the PI Basic Settings. For a more detailed description, please see *VLT Micro Drive Programming Guide*, MG.02.CX.YY.

1-00 Configuration Mode

Range:	Function:
[]	Choose [3] Process Closed-loop

3-02 Min. Reference

Range:	Function:
[-4999 - 4999]	Sets limits for setpoint and feedback.

3-03 Max. Reference

Range:	Function:
[-4999 - 4999]	Sets limits for setpoint and feedback.

3-10 Preset Reference

Range:	Function:
[-100.00 - 100.00]	Preset [0] works as setpoint.

4-12 Motor Speed Low Limit

Range:	Function:
[0.0 - 400 Hz]	Lowest possible output frequency.

4-14 Motor Speed High Limit

Range:	Function:
[0.0 - 400.00 Hz]	Highest possible output frequency.

NOTE
Default 65 Hz should normally be reduced to 50-55 Hz.

6-22 Terminal 60 Low Current

Range:	Function:
[0.00 - 19.99 mA]	Normally set to 0 or 4 mA.

6-23 Terminal 60 High Current

Range:	Function:
[0.01 - 20.00 mA]	Normally (default) set to 20 mA.

6-24 Terminal 60 Low Feedback Value

Range:	Function:
[-4999 - 4999]	Value corresponding to P. 6-22 setting.

6-25 Terminal 60 High Feedback Value

Range:	Function:
[-4999 - 4999]	Value corresponding to P. 6-23 setting.

4

6-26 Terminal 60 Filter Time Constant

Range:	Function:
[0.01 - 10.00 s]	Noise suppressing filter.

7-20 Process CL Feedback Resource

Range:	Function:
[]	Choose [2] analog input 60.

7-30 Process PI Normal/Inverse

Range:	Function:
[]	Most PI controllers are "Normal".

7-31 Process PI Anti Windup

Range:	Function:
[]	Leave *Enabled* normally.

7-32 Process PI Start Speed

Range:	Function:
[0.0 - 200.0 Hz]	Choose expected normal running speed.

7-33 Process PI Proportional Gain

Range:	Function:
[0.00 - 10.00]	Enter the P-factor.

7-34 Process PI Integral Time

Range:	Function:
[0.10 - 9,999.00 s]	Enter the I-factor.

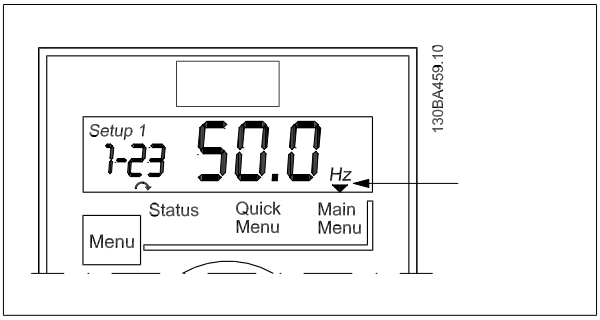
7-38 Process Feed Forward Factor

Range:	Function:
[0 - 400%]	Only applicable with changing setpoints.

4.5. Main Menu

The main menu gives access to all parameters.

1. To enter the main menu, press the [MENU] key until the indicator in display is placed above *Main Menu*.
2. Use [▲] [▼] to browse through the parameter groups.
3. Press [OK] to select a parameter group.
4. Use [▲] [▼] to browse through the parameters in the specific group.
5. Press [OK] to select the parameter.
6. Use [▲] [▼] to set/change the parameter value.
7. Press [OK] to accept the value.
8. To exit, press either [Back] twice to enter *Quick Menu*, or press [Menu] once to enter *Status*.



4.10: Indicating main menu mode

5

Parameter Overview

0-** Operation/Display
0-0* Basic Settings
0-03 Regional Settings
*[0] International
[1] US
0-04 Oper. State at Power-up (Hand)
[0] Resume
*[1] Forced stop, ref = old
[2] Forced stop, ref = 0
0-1* Set-up Handling
0-10 Active Set-up
*[1] Set-up 1
[2] Set-up 2
[9] Multi Set-up
0-11 Edit Set-up
*[1] Set-up 1
[2] Set-up 2
[9] Active Set-up
0-12 Link Set-ups
[0] Not Linked
*[20] Linked
0-4* LCP Keypad
0-40 [Hand on] Key on LCP
[0] Disabled
*[1] Enabled
0-41 [Off / Reset] Key on LCP
[0] Disable All
*[1] Enable All
[2] Enable Reset Only
0-42 [Auto on] Key on LCP
[0] Disabled
*[1] Enabled
0-5* Copy/Save
0-50 LCP Copy
*[0] No copy
[1] All to LCP
[2] All from LCP
[3] Size indep. from LCP
0-51 Set-up Copy
*[0] No copy
[1] Copy from set-up 1
[2] Copy from set-up 2
[9] Copy from factory set-up
0-6* Password
0-60 (Main) Menu Password
0 -999 * 0
1-** Load/Motor
1-0* General Settings
1-00 Configuration Mode
*[0] Speed open-loop
[3] Process
1-01 Motor Control Principle
[0] U/f
*[1] VVC+
1-03 Torque Characteristics
*[0] Constant torque
[2] Automatic Energy Optim.
1-05 Local Mode Configuration
[0] Speed Open-loop
*[2] As configured in param. 1-00
1-2* Motor Data
1-20 Motor Power [kW] [hp]
0.09 kW / 0.12 hp .... 11 kW / 15 hp
1-22 Motor Voltage
50-999 V * 230-400 V
1-23 Motor Frequency
20-400 Hz * 50 Hz
1-24 Motor Current
0.01-26.00 A * Motor type dep.
1-25 Motor Nominal Speed
100-9999 rpm * Motor type dep.
1-29 Automatic Motor Tuning (AMT)
*[0] Off
[2] Enable AMT
1-3* Adv. Motor Data
1-30 Stator Resistance (Rs)
[Ohm] * Dep. on motor data
1-33 Stator Leakage Reactance (X1)
[Ohm] * Dep. on motor data
1-35 Main Reactance (Xh)
[Ohm] * Dep. on motor data
1-5* Load Indep. Setting
1-50 Motor Magnetization at 0 Speed
0-300% * 100%
1-52 Min Speed Norm. Magnet. [Hz]
0.0-10.0 Hz * 0.0 Hz
1-55 U/f Characteristic - U
0-999.9 V
1-56 U/f Characteristic - F
0-400 Hz
1-6* Load Depen. Setting
1-60 Low Speed Load Compensation
0-199% * 100%
1-61 High Speed Load Compensation
0-199% * 100%
1-62 Slip Compensation
-400-399% * 100%
1-63 Slip Compensation Time Constant
0.05-5.00 s * 0.10 s
1-7* Start Adjustments
1-71 Start Delay
0.0-10.0 s * 0.0 s
1-72 Start Function
[0] DC hold/delay time
[1] DC brake/delay time
*[2] Coast/delay time
1-73 Flying Start
*[0] Disabled
[1] Enabled
1-8* Stop Adjustments
1-80 Function at Stop
*[0] Coast
[1] DC hold
1-82 Min Speed for Funct. at Stop [Hz]
0.0-20.0 Hz * 0.0 Hz
1-9* Motor Temperature
1-90 Motor Thermal Protection
*[0] No protection
[1] Thermistor warning
[2] Thermistor trip
[3] Etr warning
[4] Etr trip
1-93 Thermistor Resource
*[0] None
[1] Analog input 53
[6] Digital input 29
2-** Brakes
2-0* DC Brake
2-00 DC Hold Current
0-150% * 50%
2-01 DC Brake Current
0-150% * 50%
2-02 DC Braking Time
0.0-60.0 s * 10.0 s
2-04 DC Brake Cut-in Speed
0.0-400.0 Hz * 0.0 Hz
2-1* Brake Energy Funct.
2-10 Brake Function
*[0] Off
[1] Resistor brake
[2] AC brake
2-11 Brake Resistor (ohm)
5-5000 * 5
2-16 AC Brake, Max current
0-150% * 100%
2-17 Overvoltage Control
*[0] Disabled
[1] Enabled (not at stop)
[2] Enabled
2-2* Mechanical Brake
2-20 Release Brake Current
0.00-100.0 A * 0.00 A
2-22 Activate Brake Speed [Hz]
0.0-400.0 Hz * 0.0 Hz
3-** Reference / Ramps
3-0* Reference Limits
3-00 Reference Range
*[0] Min - Max
[1] -Max - +Max
3-02 Minimum Reference
-4999 - 4999 * 0.000
3-03 Maximum Reference
-4999 - 4999 * 50.00
3-1* References
3-10 Preset Reference
-100.0-100.0% * 0.00%
3-11 Jog Speed [Hz]
0.0-400.0 Hz * 5.0 Hz
3-12 Catch up/Slow-down Value
0.00-100.0% * 0.00%
3-14 Preset Relative Reference
-100.0-100.0% * 0.00%
3-15 Reference Resource 1
[0] No function
*[1] Analog Input 53
[2] Analog input 60
[8] Pulse input 33
[11] Local bus ref
[21] LCP Potentiometer
3-16 Reference Resource 2
[0] No function
[1] Analog Input 53
*[2] Analog input 60
[8] Pulse input 33
[11] Local bus ref
[21] LCP Potentiometer

3-17 Reference Resource 3
[0] No function
[1] Analog Input 53
[2] Analog input 60
[8] Pulse input 33
*[11] Local bus ref
[21] LCP Potentiometer
3-18 Relative Scaling Ref. Resource
*[0] No function
[1] Analog Input 53
[2] Analog input 60
[8] Pulse input 33
[11] Local bus ref
[21] LCP Potentiometer
3-4* Ramp 1
3-40 Ramp 1 Type
*[0] Linear
[2] Sine2 ramp
3-41 Ramp 1 Ramp-up Time
0.05-3600 s * 3.00 s
3-42 Ramp 1 Ramp-down Time
0.05-3600 s * 3.00 s
3-5* Ramp 2
3-50 Ramp 2 Type
*[0] Linear
[2] Sine2 ramp
3-51 Ramp 2 Ramp-up Time
0.05-3600 s * 3.00 s
3-52 Ramp 2 Ramp-down Time
0.05-3600 s * 3.00 s
3-8* Other Ramps
3-80 Jog Ramp Time
0.05-3600 s * 3.00 s
3-81 Quick Stop Ramp Time
0.05-3600 s * 3.00 s
4-** Limits / Warnings
4-1* Motor Limits
4-10 Motor Speed Direction
[0] Clockwise
[1] Counter-ClockWise
*[2] Both
4-12 Motor Speed Low Limit [Hz]
0.0-400.0 Hz * 0.0 Hz
4-14 Motor Speed High Limit [Hz]
0.1-400.0 Hz * 65.0 Hz
4-16 Torque Limit Motor Mode
0-400% * 150%
4-17 Torque Limit Generator Mode
0-400% * 100%
4-5* Adj. Warnings
4-50 Warning Current Low
0.00-26.00 A * 0.00 A
4-51 Warning Current High
0.00-26.00 A * 26.00 A
4-58 Missing Motor Phase Function
[0] Off
*[1] On
4-6* Speed Bypass
4-61 Bypass Speed From [Hz]
0.0-400.0 Hz * 0.0 Hz
4-63 Bypass Speed To [Hz]
0.0-400.0 Hz * 0.0 Hz
5-1* 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] Slow
[23] Set-up 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] Reset Counter 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
5-4* Relays
5-40 Function Relay
*[0] No operation
[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, No Warn
[29] Brake ready/No Fault
[30] Brake Fault (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
5-5* Pulse Input
5-55 Terminal 33 Low Frequency
20-4999 Hz * 20 Hz
5-56 Terminal 33 High Frequency
21-5000 Hz * 5000 Hz
5-57 Term. 33 Low Ref./Feedb. Value
-4999 - 4999 * 0.000
5-58 Term. 33 High Ref./Feedb. Value
-4999 - 4999 * 50.00
6-** Analog In/Out
6-0* Analog I/O Mode
6-00 Live Zero Timeout Time
1-99 s * 10 s
6-01 Live Zero Timeout Function
*[0] Off
[1] Freeze output
[2] Stop
[3] Jogging
[4] Max speed
[5] Stop and trip
6-1* Analog Input 1
6-10 Terminal 53 Low Voltage
0.00-9.99 V * 0.07 V
6-11 Terminal 53 High Voltage
0.01-10.00 V * 10.00 V
6-12 Terminal 53 Low Current
0.00-19.99 mA * 0.14 mA
6-13 Terminal 53 High Current
0.01-20.00 mA * 20.00 mA
6-14 Term. 53 Low Ref./Feedb. Value
-4999 - 4999 * 0.000
6-15 Term. 53 High Ref./Feedb. Value
-4999 - 4999 * 50.00
6-16 Terminal 53 Filter Time Constant
0.01-10.00 s * 0.01 s
6-19 Terminal 53 mode
*[0] Voltage mode
[1] Current mode
6-2* Analog Input 2
6-22 Terminal 60 Low Current
0.00-19.99 mA * 0.14 mA
6-23 Terminal 60 High Current
0.01-20.00 mA * 20.00 mA

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
0.01-10.00 s * 0.010 s
6-8* LCP potmeter
6-81 LCP potm. Low Reference
-4999 - 4999 * 0.000
6-82 LCP potm. High Reference
-4999 - 4999 * 50.00
6-9* Analog Output xx
6-90 Terminal 42 Mode
*[0] 0-20 mA
[1] 4-20 mA
[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 Control
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-** Controllers
7-2* Process Ctrl. Feedb
7-20 Process CL Feedback 1 Resource
*[0] NoFunction
[1] Analog Input 53
[2] Analog input 60
[8] PulseInput33
[11] LocalBusRef
7-3* 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
0.0-200.0 Hz * 0.0 Hz
7-33 Process PI Proportional Gain
0.00-10.00 * 0.01
7-34 Process PI Integral Time
0.10-9999 s * 9999 s
7-38 Process PI Feed Forward Factor
0-400% * 0%
7-39 On Reference Bandwidth
0-200% * 5%
8-** Comm. and Options
8-0* General Settings
8-01 Control Site
*[0] Digital and Control Word
[1] Digital only
[2] Control Word only
8-02 Control Word Source
[0] None
*[1] FC RS-485
8-03 Control Word Timeout Time
0.1-6500 s * 1.0 s
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
8-3* 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
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 * 0.010 s
8-36 Max Response Delay
0.100-10.00 s * 5.000 s
8-5* Digital/Bus
8-50 Coasting Select
[0] Digital Input
[1] Bus
[2] Logic And
*[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
8-9* Bus Jog/Feedback
8-94 Bus feedback 1
0x8000 - 0x7FFF * 0
13-** Smart Logic
13-0* 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
13-1* 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
13-2* Timers
13-20 SL Controller Timer
0.0-3600 s
13-4* 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
13-43 Logic Rule Operator 2
See par. 13-41 * [0] Disabled
13-44 Logic Rule Boolean 3
See par. 13-40
13-5* States
13-51 SL Controller Event
See par. 13-40
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
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6. Troubleshooting

No.	Description	Warning	Alarm	Trip Lock	Cause of Problem
2	Live zero error	X	X		Signal on terminal 53 or 60 is less than 50% of the value set in par. 6-10, 6-12 and 6-22.
4	Line phase loss[1)]	X	X	X	Missing phase on the supply side, or a voltage imbalance that is too high. Check supply voltage.
7	DC overvoltage[1)]	X	X		Intermediate circuit voltage exceeds the limit.
8	DC undervoltage[1)]	X	X		Intermediate circuit voltage drops below the "voltage warning low" limit.
9	Inverter overloaded	X	X		More than 100% load for too long.
10	Motor ETR overtemperature	X	X		Motor is too hot due to more than 100% load for too long.
11	Motor thermistor overtemperature	X	X		The thermistor or the thermistor connection is disconnected.
12	Torque limit		X		Torque exceeds the value set in either par. 4-16 or 4-17.
13	Overcurrent	X	X	X	Inverter peak current limit is exceeded.
14	Ground fault		X	X	Discharge from output phases to ground.
16	Short Circuit		X	X	Short-circuit in the motor or on the motor terminals.
17	Control word timeout	X	X		No communication to the adjustable frequency drive.
25	Brake resistor short-circuited		X	X	Brake resistor is short-circuited, thus the brake function is disconnected.
27	Brake chopper short-circuited		X	X	Brake transistor is short-circuited, thus the brake function is disconnected.
28	Brake check		X		Brake resistor is not connected/working.
29	Power board overtemp.	X	X	X	Heatsink 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 your local Danfoss supplier.
47	Control Voltage Fault	X	X	X	24 V DC may be overloaded.
51	AMT check U_{nom} and I_{nom}		X		Wrong setting for motor voltage, motor current and motor voltage.
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 the "release brake" current in the "start delay" time window.
80	Drive Initialized to Default Value		X		All parameter settings are initialized to default settings.

[1)] These faults may be caused by line power distortions. Installing a Danfoss line filter may rectify this problem.

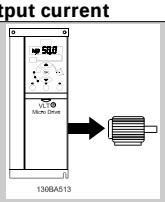
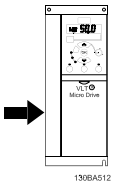
6.1: Code list

7

7. Specifications

7.1. Line Supply

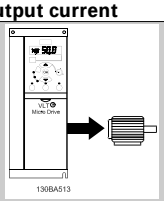
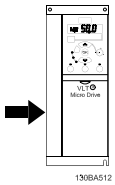
7.1.1. Line Supply 1 x 200-240 V AC

Normal overload 150 % for 1 minute						
		Frame M1	Frame M1	Frame M1	Frame M2	Frame M3
Adjustable frequency drive		P0K18	P0K37	P0K75	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
Output current						
	Continuous (3 x 200-240 V) [A]	1.2	2.2	4.2	6.8	TBD
	Intermittent (3 x 200-240 V) [A]	1.8	3.3	6.3	10.2	TBD
	Max. cable size:					
	(line power, motor) [mm² /AWG]			4/10		
Max. input current						
	Continuous (1 x 200-240 V) [A]	3.3	6.1	11.6	18.7	TBD
	Intermittent (1 x 200-240 V) [A]	4.5	8.3	15.6	26.4	TBD
	Max. pre-fuses [A]	See section *Fuses*.				
	Environment					
	Estimated power loss at rated load [W], Best case/Typical[1)]	12.5/ 15.5	20.0/ 25.0	36.5/ 44.0	61.0/ 67.0	TBD
	Weight enclosure IP 20 [kg]	1.1	1.1	1.1	1.6	TBD
	Efficiency Best case/Typical[1)]	95.6/ 94.5	96.5/ 95.6	96.6/ 96.0	97.0/ 96.7	TBD

7.1: Line supply 1 x 200-240 V AC

7.1.2. Line Supply 3 x 200-240 V AC

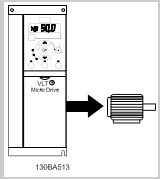
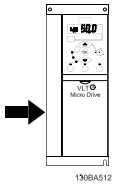
Normal overload 150 % for 1 minute

		Frame M1	Frame M1	Frame M1	Frame M2	Frame M3	Frame M3
Adjustable frequency drive		P0K25	P0K37	P0K75	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
Output current							
	Continuous (3 x 200-240 V) [A]	1.5	2.2	4.2	6.8	TBD	TBD
	Intermittent (3 x 200-240 V) [A]	2.3	3.3	6.3	10.2	TBD	TBD
	Max. cable size:						
	(line power, motor) [mm² /AWG]			4/10			
Max. input current							
	Continuous (3 x 200-240 V) [A]	2.4	3.5	6.7	10.9	TBD	TBD
	Intermittent (3 x 200-240 V) [A]	3.2	4.6	8.3	14.4	TBD	TBD
	Max. pre-fuses [A]			See section *Fuses.*			
	Environment						
	Estimated power loss at rated load [W], Best case/Typical[1)]	14.0/ 20.0	19.0/ 24.0	31.5/ 39.5	51.0/ 57.0	TBD	TBD
	Weight enclosure IP 20 [kg]	1.1	1.1	1.1	1.6	TBD	TBD
	Efficiency Best case/Typical[1)]	96.4/ 94.9	96.7/ 95.8	97.1/ 96.3	97.4/ 97.2	TBD	TBD

7.2: Line supply 3 x 200-240 VAC

1. Power loss at rated load conditions.

7.1.3. Line Supply 3 x 380-480 V AC

Normal overload 150% for 1 minute									
Adjustable frequency drive		P0K37	P0K75	P1K5	P2K2	P3K0	P4K0	P5K5	P7K5
Typical Shaft Output [kW]		0.37	0.75	1.5	2.2	3.0	4.0	5.5	7.5
Typical Shaft Output [HP]		0.5	1	2	3	4	5	7.5	10
IP 20		Frame M1	Frame M1	Frame M2	Frame M2	Frame M3	Frame M3	Frame M3	Frame M3
Output current									
	Continuous (3 x 380-440 V) [A]	1.2	2.2	3.7	5.3	TBD	TBD	TBD	TBD
	Intermittent (3 x 380-440 V) [A]	1.8	3.3	5.6	8.0	TBD	TBD	TBD	TBD
	Continuous (3 x 440-480 V) [A]	1.1	2.1	3.4	4.8	TBD	TBD	TBD	TBD
	Intermittent (3 x 440-480 V) [A]	1.7	3.2	5.1	7.2	TBD	TBD	TBD	TBD
	Max. cable size:								
	(line power, motor) [mm²/ AWG]				4/10				
Max. input current									
	Continuous (3 x 380-440 V) [A]	1.9	3.5	5.9	8.5	TBD	TBD	TBD	TBD
	Intermittent (3 x 380-440 V) [A]	2.6	4.7	8.7	12.6	TBD	TBD	TBD	TBD
	Continuous (3 x 440-480 V) [A]	1.7	3.0	5.1	7.3	TBD	TBD	TBD	TBD
	Intermittent (3 x 440-480 V) [A]	2.3	4.0	7.5	10.8	TBD	TBD	TBD	TBD
	Max. pre-fuses [A]				See section *Fuses.*				
	Environment								
	Estimated power loss at rated load [W] Best case/Typical[1)]	18.5/25.5	28.5/43.5	41.5/56.5	57.5/81.5	TBD	TBD	TBD	TBD
	Weight enclosure IP 20 [kg]	1.1	1.1	1.6	1.6	TBD	TBD	TBD	TBD
	Efficiency Best case/Typical[1)]	96.8/95.5	97.4/96.0	98.0/97.2	97.9/97.1	TBD	TBD	TBD	TBD

1. Power loss at rated load conditions.

7.3: Line supply 3 x 380-480 VAC

7.2. Other Specifications

Protection and Features:

- Electronic thermal 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 on motor terminals U, V, W.
- If a motor phase is missing, the frequency 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 supply (L1/L, L2, L3/N):	
Supply voltage	200-240 V ±10%
Supply voltage	380-480 V ±10%
Supply frequency	50/60 Hz
Max. imbalance temporary between line 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 twice/min.
Environment according to EN60664-1	overvoltage category III/pollution degree 2

The unit is suitable for use on a circuit capable of delivering no more than 100,000 RMS symmetrical Amperes, 240/500/600 V maximum.

Motor output (U, V, W):	
Output voltage	0-100% of supply voltage
Output frequency	0-200 Hz (VVC+), 0-400 Hz (u/f)
Switching on output	Unlimited
Ramp times	0.05 - 3,600 sec.

Cable lengths and cross-sections:	
Max. motor cable length, shielded/armored (EMC-correct installation)	49 ft [15 m]
Max. motor cable length, unshielded/unarmored	164 ft [50 m]
Max. cross-section to motor, line power, load sharing and brake *	
Maximum cross-section to control terminals, rigid wire	0.0023 in.^{2} [1.5 mm^2]/16 AWG (2 x 0.0012 in.^{2} [2 x 0.75 mm^2])
Maximum cross-section to control terminals, flexible cable	0.0016 in.^{2} [1 mm^2]/18 AWG
Maximum cross-section to control terminals, cable with enclosed core	0.00078 in.^{2} [0.5 mm^2]/20 AWG
Minimum cross-section to control terminals	0.00039 in.^{2} [0.25 mm^2]

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

Digital inputs (pulse/encoder inputs):	
Programmable digital inputs (pulse/encoder)	5 (1)
Terminal number	18, 19, 27, 29, 33,
Logic	PNP or NPN
Voltage level	0-24 V DC
Voltage level, logic'0' PNP	< 5 V DC
Voltage level, logic'1' PNP	> 10 V DC
Voltage level, logic '0' NPN	> 19 V DC
Voltage level, logic '1' NPN	< 14 V DC

Maximum voltage on input	28 V DC
Input resistance, R_i	approximately 4 kΩ
Max. pulse frequency at terminal 33	5000 Hz
Min. pulse frequency at terminal 33	20 Hz

Analog inputs:	
Number of analog inputs	2
Terminal number	53, 60
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	approx. 200 Ω
Max. current	30 mA

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

The analog output is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

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

The RS-485 serial communication circuit is functionally separated from other central circuits and galvanically isolated from the supply voltage (PELV).

Control card, 24 V DC output:	
Terminal number	12
Max. load	200 mA

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)	250 V AC, 2 A
Max. terminal load (AC-15)[1)] on 01-02 (NO) (inductive load @ cosφ 0.4)	250 V AC, 0.2 A
Max. terminal load (DC-1)[1)] on 01-02 (NO) (resistive load)	30 V DC, 2 A
Max. terminal load (DC-13)[1)] on 01-02 (NO) (inductive load)	24 V DC, 0.1A
Max. terminal load (AC-1)[1)] on 01-03 (NC) (resistive load)	250 V AC, 2 A
Max. terminal load (AC-15)[1)] on 01-03 (NC) (inductive load @ cosφ 0.4)	250 V AC, 0.2 A
Max. terminal load (DC-1)[1)] on 01-03 (NC) (resistive load)	30 V DC, 2 A
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 part 4 and 5

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

The 10 V DC supply is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Surroundings:	
Enclosure	IP 20
Enclosure kit available.	IP 21
Enclosure kit available.	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. 104° F [40° C]

Derating for high ambient temperature, see section on special conditions

Minimum ambient temperature during full-scale operation	32° F [0° C]
Minimum ambient temperature at reduced performance	14° F [-10° C]
Temperature during storage/transport	-13°-+149°/158° F [-25°-+65°/70° C]
Maximum altitude above sea level without derating	3280 ft [1000 m]
Maximum altitude above sea level with derating	9842 ft [3000 m]

Derating for high altitude, see section on special conditions.

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.

7.3. Special Conditions

7.3.1. The Purpose of Derating

Derating must be taken into account when using the adjustable frequency drive at low air pressure (heights), at low speeds or at high ambient temperature. The required action is described in this section.

7.3.2. Derating for Ambient Temperature

The ambient temperature measured over 24 hours should be at least 9° 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.

The VLT Micro Drive FC 51 has been designed for operation at a max. of 122° F [50° C] ambient temperature with one motor size smaller than nominal. Continuous operation at full load at 122° F [50° C] ambient temperature will reduce the lifetime of the adjustable frequency drive.

7.3.3. Derating for Low Air Pressure

The cooling capability of air is decreased at low air pressure.

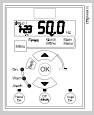
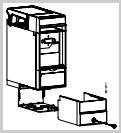
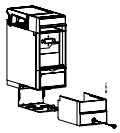
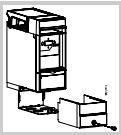
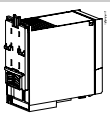
For altitudes above 6,600 feet [2000 m], please contact Danfoss Drives regarding PELV.

Below altitudes of 3,280 ft [1,000 m], no derating is necessary, but at 3,280 ft [1,000 m] and higher, the ambient temperature or maximum output current should be decreased.
Decrease the output by 1% per 328 ft [100 m] higher than an altitude of 3,289 ft [1000 m], or reduce the max. ambient temperature by 1 degree per 656 ft [200 m].

7.3.4. Derating for Running at Low Speeds

When a motor is connected to an adjustable frequency drive, it is necessary to make sure 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).

7.4. 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. 10 ft [3 m] cable IP 54 with LCP 11, IP 21 with LCP 12	
132B0103	Nema Type 1 kit for M1 frame	
132B0104	Nema Type 1 kit for M2 frame	
132B0105	Nema 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	IP 21 for M1 frame	
132B0109	IP 21 for M2 frame	
132B0110	IP 21 for M3 frame	
132B0111	DIN rail mounting kit for M1	

Danfoss line filters and brake resistors are available upon request.

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