Datasheet

FCM 300

■ Contents

When reading through this Design Guide, you will come across various symbols that require special attention.

The symbols used are the following:

This symbol indicates a general warning.

NB!:
This symbol indicates something to be noted by the reader.

This symbol indicates a high-voltage warning.

■ Integration of frequency converter and motor

The Danfoss VLT frequency converter integrated onto the asynchronous motor gives infinite speed control in one unit.

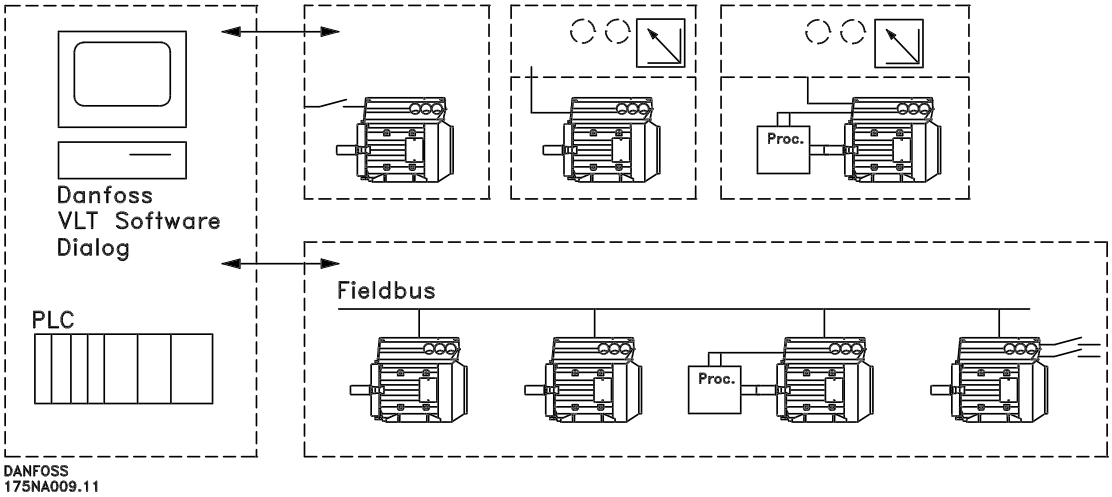
The VLT DriveMotor FCM 300 Series is a very compact alternative to the ordinary solution with VLT frequency converter and motor as separate units. The frequency converter is attached instead of the motor terminal box, and it is no higher than the standard terminal box, nor wider or longer than the motor (see chapter 6).

Installation is made extremely easy. Panel space is not a problem. There is no need for special details on wiring to meet the EMC directive, since motor cables are not necessary. The only connections are mains and control connections.

Factory-set adaption between frequency converter and motor gives precise and energy efficient control in addition to eliminating pre-setting on site.

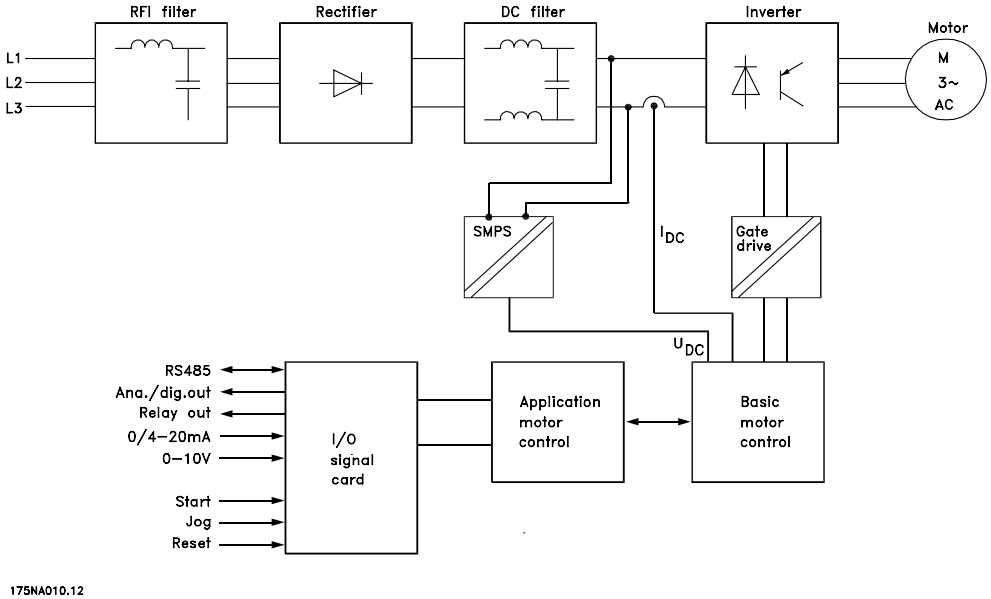
The FC motor can be used in stand alone systems with traditional control signals, such as start/stop signals, speed references and closed loop process control or in multiple drive systems with control signals distributed by a field bus.

Combination of fieldbus and traditional control signals and closed loop PID control is possible.



Control structures

■ Key diagram for FCM 300 Series



■ Product range

VLT DriveMotor FCM 300 Series, 2/4 poled motors

Type	Motor output	Mains supply
FCM 305	0.55 kW	
FCM 307	0.75 kW	
FCM 311	1.1 kW	
FCM 315	1.5 kW	
FCM 322	2.2 kW	3 phase 380-480 V
FCM 330	3.0 kW	
FCM 340	4.0 kW	
FCM 355	5.5 kW	
FCM 375	7.5 kW	

Each type in the product range is available in different versions:

Inverter versions

Drive control:

- *F00:* Without Fieldbus
- *F10:* With PROFIBUS DP 3 MBit/s
- *F12:* With PROFIBUS DP 12MBit/s

RFI filter:
Inverter with integrated RFI filter, class 1A (industrial) or class 1B (domestic).

Cooling:

- TEFV: Motor cooled by a shaft mounted fan (IC 411)

Mounting versions

- Foot mounting (B3)
- Flange mounting (B5)
- Face mounting (B14)
- Foot + flange mounting (B35)
- Foot + face mounting (B34)

See section *Dimensions*.

Inverter box position: Top, opposite motor feet.

Drainhole (+ position): None, D1, D2, D3 (see drawing in section *Ordering info for inverter box position and drain hole position.*

■ Ordering

Take a copy of the ordering form, see section *Ordering form*. Fill in and post or fax your order to the nearest branch office of the Danfoss sales organisation. On the basis of your order, the FCM 300 Series motor is given a type code.

The ordering form for the basic unit must always be completed. When the type code is written, always state the characters of the basic string (1-34). Together with the order confirmation the customer receives an 8-figure code number to be used when reordering.

Danfoss PC software for serial communication, MCT 10

All FCM 300 Series units have an RS 485 port as standard, which enables them to communicate e.g. with a PC. A programme entitled MCT 10 is available for this purpose (see section *PC Software tools*).

Ordering numbers, MCT 10

Please order your CD containing MCT 10 Set-up Software using code number 130B1000.

PC Software - VLT Software Dialog

For single or few unit installations a basic software package, VLT Software Dialog, is available. Please order using code number 175Z0967.

Accessories for the FC motor

A Local Operation Pad (LOP) for local set point and start/stop is available for the FC motor. The LOP is IP 66 enclosed. A Local Control Panel (LCP 2) which makes up a complete interface for operation, programming and monitoring of the FC motor is also available.

Ordering numbers, accessories

Local Operation Pad (LOP)	175N0128
Local Control Panel (LCP 2)	175N0131
Remote mounting kit (LCP 2)	175N0160
Plug kit (LCP 2)	175N2545
Cable for plug kit (LCP 2)	175N0162
Cable (direct mounting) (LCP 2)	175N0165
Service plug kit (LCP 2)	175N2546

■ Ordering info for Frames and Flanges

Frame sizes and the corresponding flange sizes for different mounting versions

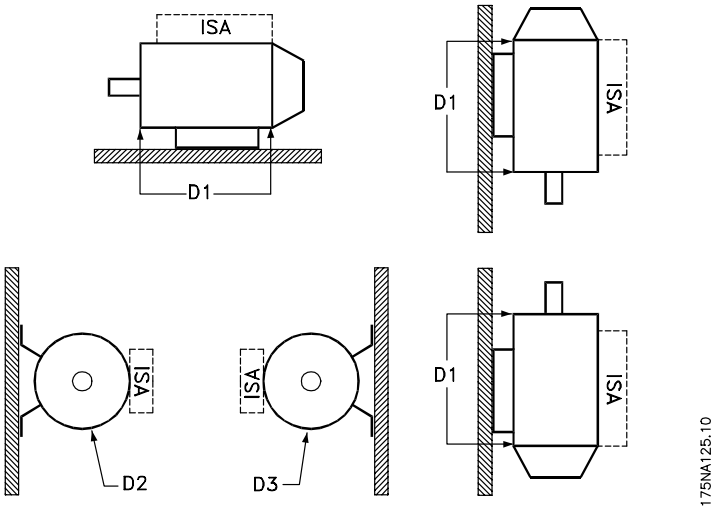
Type	Motor frame size	Mounting version	Flange size, standard (S) [mm]	Flange size, alternatives*[mm]
FCM 305	80	B5/B35	165	100/115/130/215
		B14/B34	100	85/115/130
FCM 307	80	B5/B35	165	100/115/130/215
		B14/B34	100	85/115/130
FCM 311	90	B5/B35	165	130/215
		B14/B34	115	100/130
FCM 315	90	B5/B35	165	130/215
		B14/B34	115	100/130
FCM 322	100	B5/B35	215	165/265
		B14/B34	130	115/165
FCM 330	100	B5/B35	215	165/265
		B14/B34	130	115/165
FCM 340	112	B5/B35	215	165/265
		B14/B34	130	165
FCM 355	132	B5/B35	265	215/300
		B14/B34	165	130
FCM 375	132	B5/B35	265	215/300
		B14/B34	165	130

Flange size according to IEC ref. FFxxx (Dimension M), see section *Dimensions*
S: Available as standard shaft
* No changes regarding shaft dimensions

■ Ordering info for inverter box position and drain hole position

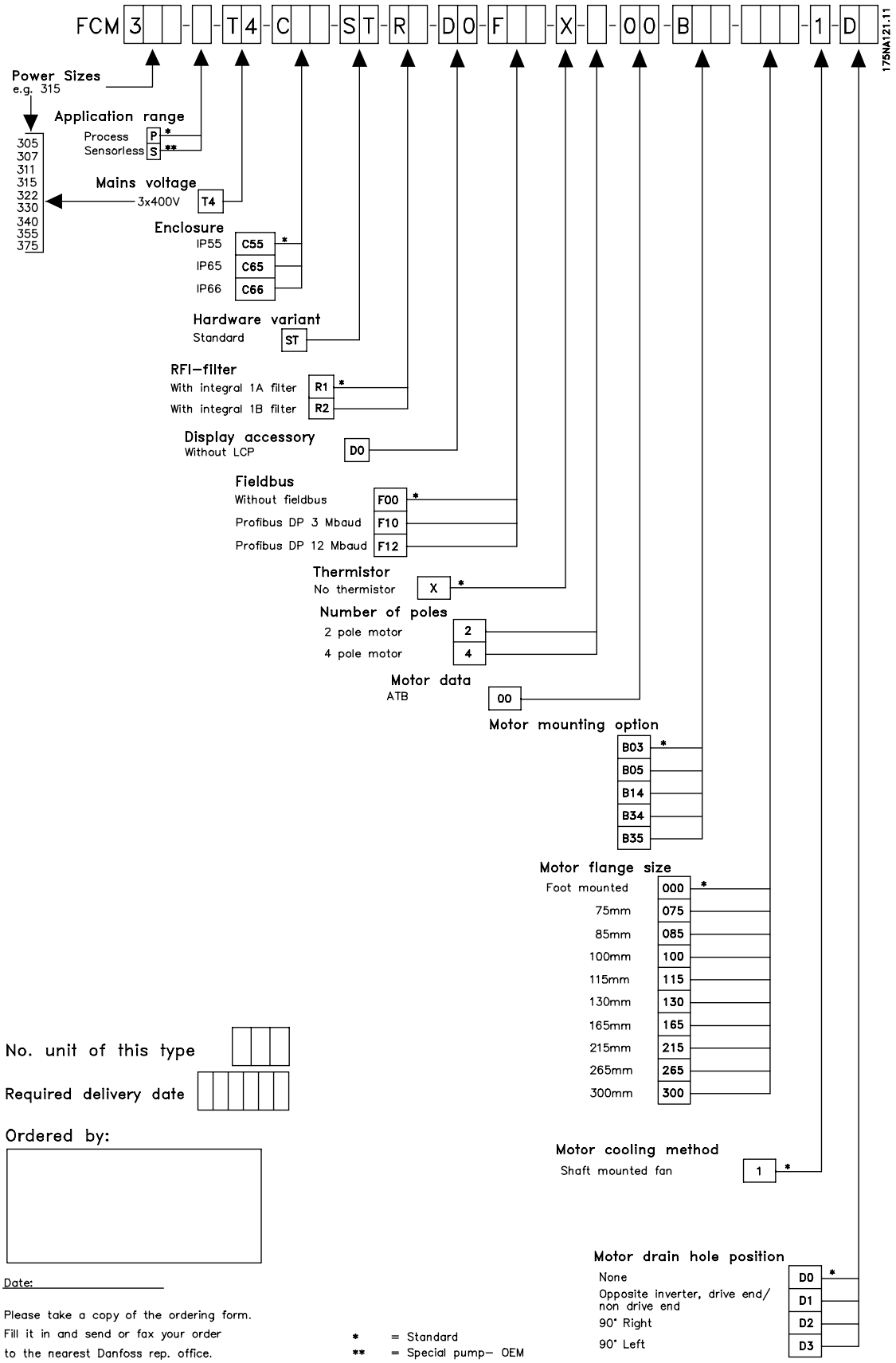
Inverter box position, always top mounted.

All drain holes are mounted with screw and washer, IP 66 if not opened.



D1: Drain holes opposite inverter side, both drive end and non drive end.
D2/D3: Drain holes 90° to inverter, both drive end and non drive end.

■ Ordering form



■ FCM 305-375 for 3 phases, 380-480 V

FCM	305	307	311	315	322	330	340	355	375
Motor output									
[HP]	0.75	1.0	1.5	2.0	3.0	4.0	5.0	7.5	10.0
[kW]	0.55	0.75	1.1	1.5	2.2	3.0	4.0	5.5	7.5
Motor torque									
2 pole [Nm][1)]	1.8	2.4	3.5	4.8	7.0	9.5	12.6	17.5	24.0
4 pole [Nm][2)]	3.5	4.8	7.0	9.6	14.0	19.1	25.4	35.0	48.0
Frame									
size [mm]	80	80	90	90	100	100	112	132	132
Weight [kg]	11	13	17	20	26	28	37	56	61
Input current [A]									
380 V									
2 p	1.5	1.8	2.3	3.4	4.5	5.0	8.0	12.0	15.0
4 p	1.4	1.7	2.5	3.3	4.7	6.4	8.0	11.0	15.5
480 V									
2 p	1.2	1.4	1.8	2.7	3.6	4.0	6.3	9.5	11.9
4 p	1.1	1.3	2.0	2.6	3.7	5.1	6.3	8.7	12.3
Efficiency at									
nom. speed									
(4 pole) %	66	71	74	80	80	81	80	84	84
Efficiency at									
nom. speed									
(2 pole) %	61	64	76	75	76	85	82	83	91
Power terminals									
[AWG]	10	10	10	10	10	10	10	6	6
[mm2]	4	4	4	4	4	4	4	10	10
Gland sizes	3xM20x1.5	3xM20x1.5	3xM20x1.5	3xM20x1.5	3xM20x1.5	3xM20x1.5	3xM20x1.5	1xM25x1.5/ 2xM20x1.5	1xM25x1.5/ 2xM20x1.5
Max. prefuse									
UL[3)] [A]	10	10	10	10	10	15	15	25	25
IEC[3)] [A]	25	25	25	25	25	25	25	25	25

1) At 400 V 3000 r/min

2) At 400 V 1500 r/min

3) Type gG prefuses must be used. If you want to maintain UL/cUL you must use prefuses of the type Bussmann KTS-R 500 V or Ferraz Shawmut, ATMR Class C (max. 30A). The fuses must be placed for protection in a circuit that is capable of supplying a maximum of 100,000 amps RMS (symmetrical), 500 V maximum.

■ General technical data

Mains supply, TT, TN and IT* (L1, L2, L3):

- Supply voltage 380-480 V units ..... 3 x 380/400/415/440/460/480 V ±10%
- Supply frequency ..... 50/60 Hz
- Max. imbalance of supply voltage ..... ±2% of rated supply voltage
- Power factor / cos ϕ ..... max. 0.9/1.0 at rated load
- No. of switching operations on supply input L1, L2, L3 ..... approx. 1 time/2 min

**) Not valid for RFI class 1B units*

Torque characteristics:

- Starting torque/overload torque ..... 160 % for 1 min
- Continuous torque ..... see above

Control card, digital/pulse inputs:

- Number of programmable digital inputs 4

- Terminal nos. ..... X101-2, -3, -4, -5
- Voltage level ..... 0-24 V DC (PNP positive logics)
- Voltage level, logic ó ..... < 5 V DC
- Voltage level, logic í ..... > 10 V DC
- Maximum voltage on input ..... 28 V DC
- Input resistance, R_i ..... approx. 2
- Scanning time ..... 20 msec

Control card, pulse input:

- No. of programmable pulse inputs 1
- Terminal nos. X101-3
- Max. frequency on terminal 3, open collector/push pull 24 V ..... 8 kHz/70 kHz
- Resolution ..... 10 bit
- Accuracy (0.1-1 kHz), terminal 3 ..... Max. error: 0.5% of full scale
- Accuracy (1-12 kHz), terminal 3 ..... Max. error: 0.1% of full scale

Control card, analogue inputs:

- No. of programmable analogue voltage inputs 1
- Terminal nos. X101-2
- Voltage level ..... 0 - 10 V DC (scalable)
- Input resistance, R_i ..... approx. 10
- No. of programmable analogue current inputs 1
- Terminal no. X101-1
- Current range ..... 0 - 20 mA (scalable)
- Input resistance, R_i ..... approx. 30
- Resolution ..... 9 bit
- Accuracy on input ..... Max. error 1% of full scale
- Scanning time ..... 20 msec.

Control card, digital/pulse and analogue outputs:

- No. of programmable digital and analogue outputs 1
- Terminal nos. X101-9
- Voltage level at digital output/load ..... 0 - 24 V DC/25 mA
- Current at analoque output ..... 0 - 20 mA
- Maximum load to frame (terminal 8) at analogue output ..... $R_{LOAD} \leq 500\ \Omega$
- Accuracy of analogue output ..... Max. error: 1.5% of full scale
- Resolution on analogue output. ..... 8 bit

Relay output:

- No. of programmable outputs 1
- Terminal nos. ..... 1-2 (make), 1-3 (brake) terminal X102
- Voltage level at contact/load (AC) ..... 250 V AC, 5A-AC load
- Voltage level at contact/load (DC) ..... 30 V DC, 5A; 40 V DC, 2A; 100 V DC, 0.5A

Control card, RS 485 serial communication:

- Terminal nos. ..... X100-1, -2

Control characteristics (frequency converter):

- Frequency range ..... 0 - 132 Hz
- Resolution on output frequency ..... 0.1 %
- System response time ..... Max. 40 msec.
- Speed acuracy (open loop, CT mode, 4 P motor driven in speed range 150-1500 rPm) ..... +/- 15 rpm

Externals:

- Enclosure ..... IP 55 (IP56, IP66)
- Vibration test ..... (IEC 68 see page 93) 1 g
- Max. relative humidity ..... 95 % (IEC 68-2-3) for storage/transport/operation
- Ambient temperature ..... Max. 40°C (24-hour average max. 35°C)

see Derating for high ambient temperature

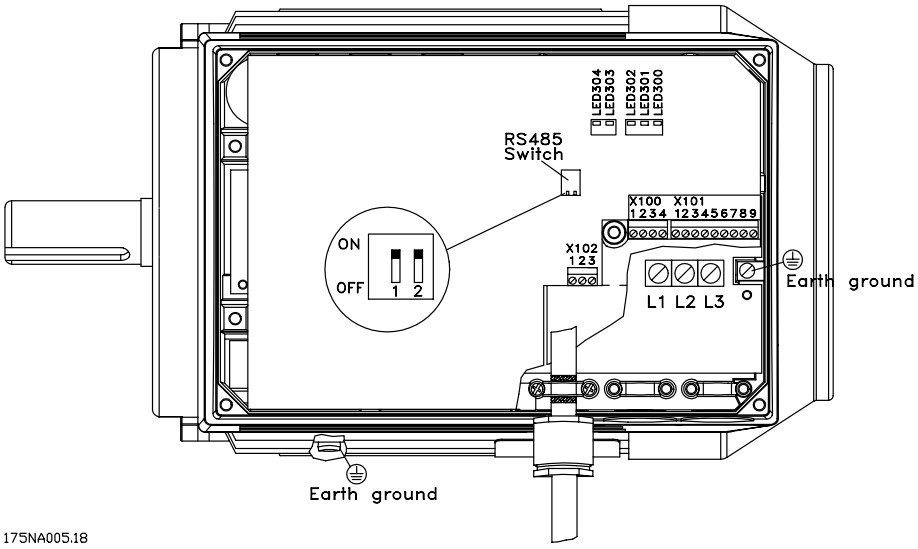
- Min. ambient temperature in full operation ..... 0°C
- Min. ambient temperature at reduced performance ..... -10°C
- Temperature during storage/transport ..... -25 - +65/70°C
- Max. altitude above sea level ..... 1000 m

see Derating for air pressure

- EMC standards applied, Emission ..... EN 61000-6-3/EN 6100-6-4, EN 61800-3, EN 55011, EN 55014
- EMC standards applied, Immunity ..... EN 61000-6-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, ENV 50204
- Safety standards applied, ... EN 60146, EN 50178, EN 60204, UL508

Protection:

- Thermal overload protection of motor and electronics.
- Monitoring of the intermediate circuit voltage ensures that the inverter cuts out if the intermediate circuit voltage gets too high or too low.
- If a mains phase is missing, the inverter will cut out when a load is placed on the motor.



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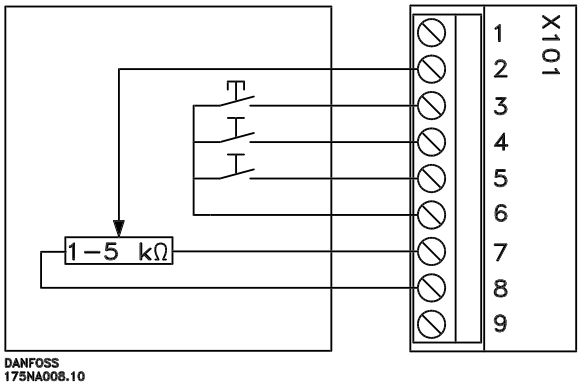
Terminal arrangement (for installation see quick setup, MG.03.AX.62)

X101: Terminal block for analogue/digital control signals

Terminal No.	Function	Example
1	Analogue input (0-20 mA)	Feedback signal
2	Analogue (0-10 V)/digital input 2	Speed reference
3	Digital input (or pulse) 3	Reset
4	Digital input (or precise stop) 4	Start
5	Digital input (other) 5	Jog (fixed speed)
6	24 V DC supply for digital inputs (max. 150 mA)	
7	10 V DC supply for potentiometer (max. 15 mA)	
8	0 V for terminals 1-7 and 9	
9	Analogue (0-20 mA)/digital output	Fault indication

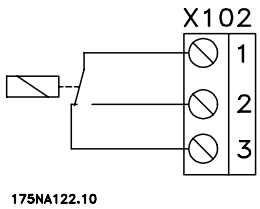
Connection diagram - factory setting



- *Reset* to be closed short time for resetting fault trips
- *Start* to be closed for changing to *run mode*
- *Jog* will run at fixed speed while closed (10 Hz)
- *Speed reference* (0-10 V) determines speed while in *run mode*

X102: Terminal block for relay output

Terminal No.	Function
1-2	Make (normally open)
1-3	Brake (normally closed)



See parameter 323 (relay output) for programming of relay output.

X100: Terminal block for data communication

Terminal No.	Function	
1	P RS 485	for connection
2	N RS 485	to bus or PC
3	5 V DC	Supply for RS
4	0 V DC	485 bus

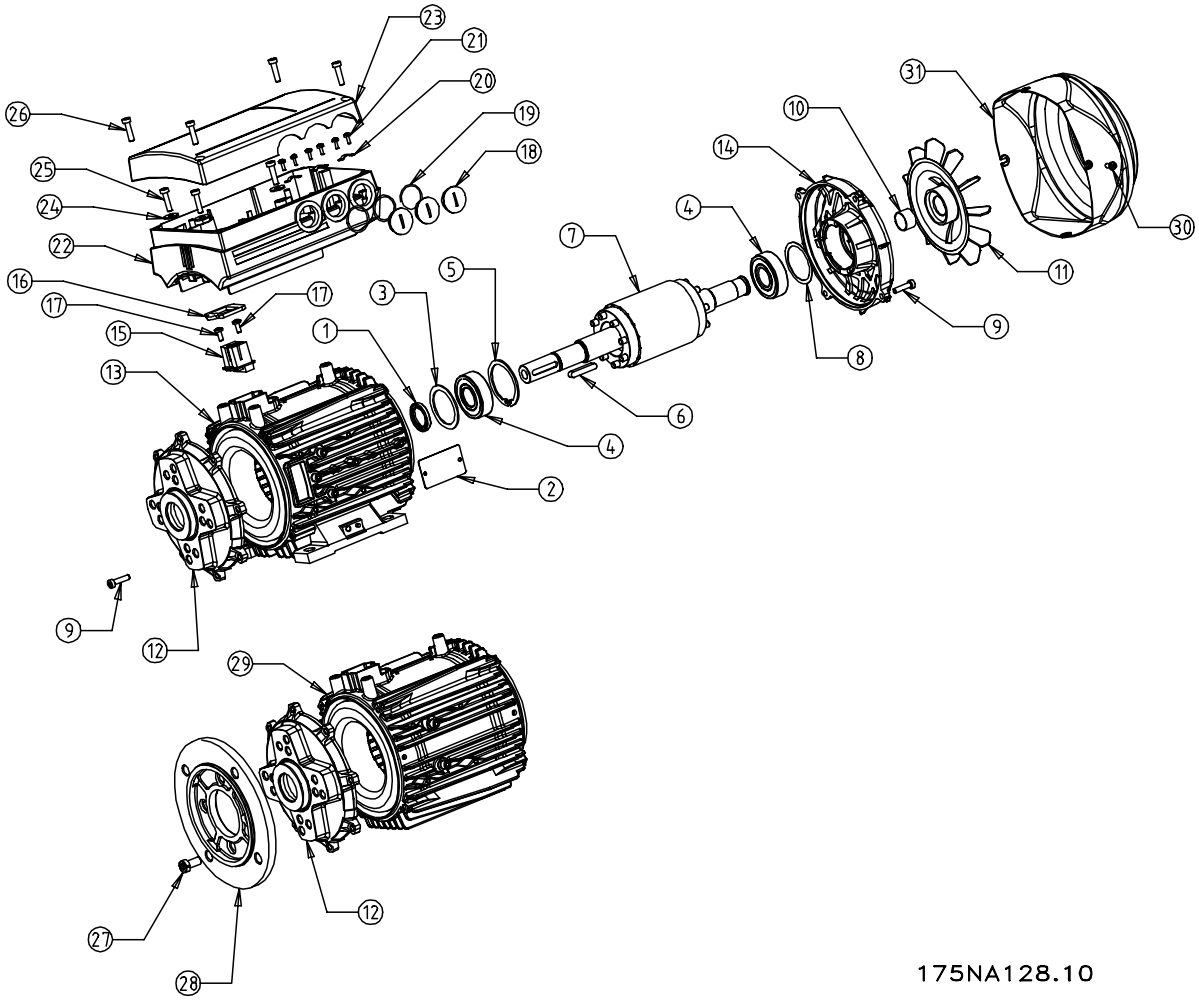
LED 300-304

LED 300 (red): Fault trip
LED 301 (yellow): Warning
LED 302 (green): Power on
LED 303-304: Communication

For PROFIBUS versions please refer to the manual MG.90.AX.YY.

■ Description of the motor

The FC motor consists of the following parts:



Item	Description
1	Gasket
2	Name plate
3	Shim ring
4	Ball bearing
5	Circlip for drive-end bearing
6	Key
7	Rotor
8	Shim ring for bearing
9	Tension screws
10	Tolerance ring for air blower
11	Air blower
12	Endshield drive end
13	Stator
14	Endshield non drive end
15	Connector block
16	Gasket
17	Screws for connector block
18	Metric blind plugs

Item	Description
19	Gaskets for cable glands
20	Cable Clamps
21	Screws for cable clamps
22	Frequency inverter
23	Lid for frequency inverter
24	Gasket
25	Torx-screws for inverter monting
26	Screws for lid
27	Mounting screws for flange ring
28	Flange ring
29	Stator
30	Mounting screws for air blower hood
31	Air blower hood

■ Handling the FC motor

Handling and lifting of VLT DriveMotors (FC motors) must only be undertaken by qualified personnel. Full product documentation and operating instructions must be available together with tools and equipment necessary for safe working practice. Eyebolts and/or lifting trunnions supplied with the FC motor are designed to support only the weight of the FC motor, not the weight of the FC motor and any auxcillary equipment attached to it. Be absolutely sure that cranes, jacks, slings and lifting beams are capable of carrying the weight of equipment to be lifted. Where an eyebolt is provided with the motor, this should be screwed down until its shoulder is firmly against the face of the stator frame to be lifted.

FCM type	approx. weight (kg.)
FCM 305	11
FCM 307	13
FCM 307	17
FCM 315	20
FCM 322	26
FCM 330	28
FCM 340	37
FCM 355	56
FCM 375	61

■ Bearings

The standard solution is fixed bearing in the drive side of the motor (shaft output side).
To avoid static indention, the storage area should be vibration free. Where exposure to some vibration is unavoidable, the shaft should be locked. Bearings may be fitted with a shaft locking device which should be kept in place during storage. Shafts should be rotated by hand, one quarter of a revolution, at weekly intervals. Bearings are despatched from the works fully charged with lithium based grease.

Lubrication

Frame size	Lubrication type	Temperatur range
80-132	Esso unirex N3	-10 to + 1400°C

Bearing life

Maximum hours bearing life (Lna) expected at 80° C bearing temp. x 10^3 hours.

FCM	3000 min^{-1}		1500 min^{-1}	
	Horiz.	Vert.	Horiz.	Vert.
305-315	22	22	30	30
322-340	26	26	30	30
355-375	26	26	30	30

Lna bearing life is the adjusted, L10 life rating, taking account of: -Reliability -Material improvement -Lubrication conditions.

Standard Bearing references and oil seals

FCM	Mounting	Poles (2/4)	Bearings		Oil seals - Bore x O/D x width in mm
			Drive end	Non-drive end	
305-307	All	All	6204 2Z-C3	6204 2RS-C3	20 x 30 x 7
311-315	All	All	6205 2Z-C3	6205 2RS-C3	25 x 35 x 7
322-330	All	All	6206 2Z-C3	6206 2RS-C3	30 x 42 x 7
340	All	All	6206 2Z-C3	6206 2RS-C3	30 x 42 x 7
355-375	All	All	6208 2Z-C3	6208 2RS-C3	40 x 52 x 7

■ Output shafts

Output shafts are produced from 35/40 Ton (460/540 MN/m^2) tensile steel. Drive end shafts are provided with a tapped hole to DIN 332 Form D and a closed profile keyway as standard.

Balance

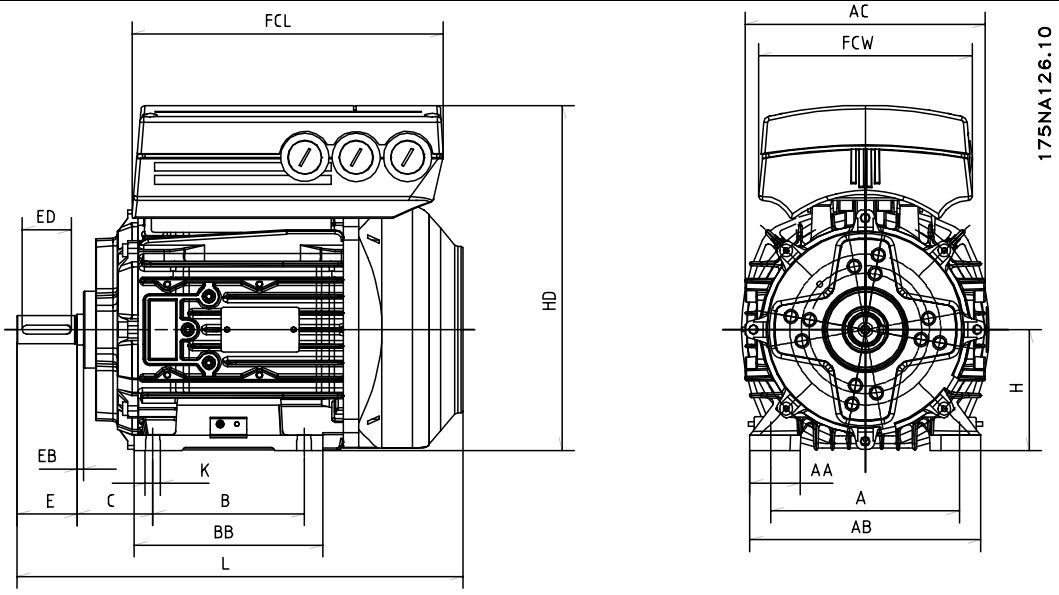
All motors are dynamically balanced, to ISO 8821with key convention to IEC 60034-14.

Inertia

FCM	J [kgm²]	
	2 pole	4 pole
305	0.0015	0.0019
307	0.0015	0.0027
311	0.0024	0.0022
315	0.0012	0.0030
322	0.006	0.0042
330	0.0028	0.0050
340	0.0053	0.0091
355	0.0074	0.0143
375	0.0097	0.0190

■ Dimensions

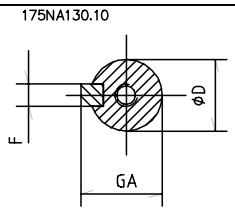
Foot mounting - B3



General

FCM	305	307	311	315	322	330	340	355	375
Frame size	80	80	90	90	100	100	112	132	132
A [mm]	125	125	140	140	160	160	190	216	216
B [mm]	100	100	125	125	140	140	140	178	178
C [mm]	50	50	56	56	63	63	70	89	89
H [mm]	80	80	90	90	100	100	112	132	132
K [mm]	9	9	9	9	12	12	12	12	12
AA [mm]	33.5	33.5	35	35	38	38	44	55	55
AB [mm]	153	153	170	170	195	195	225	256	256
BB [mm]	125	125	155	155	176	176	176	218	218
L [mm]	295	295	319	319	336	336	380	485	485
AC [mm]	159	159	176	176	196	196	220	246	246
HD [mm]	228.5	228.5	241	241	267	267	296	344	344
FCL [mm]	206	206	230	230	256	256	286	340	340
FCW [mm]	141	141	158	158	176	176	197	235	235

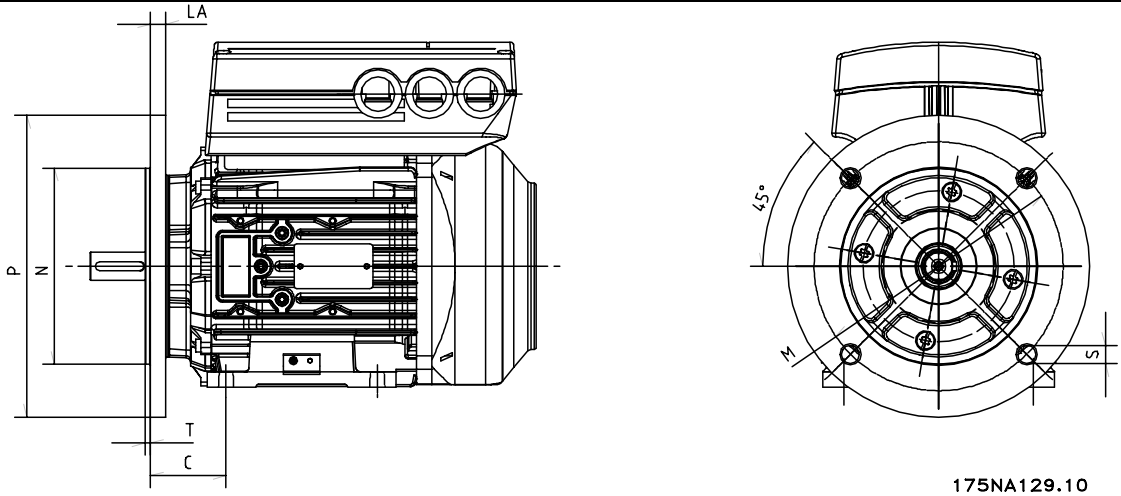
Shaft Drive End



Shaft tapped
DH x deep to
DIN 332 Form DR

FCM	305	307	311	315	322	330	340	355	375
Frame size	80	80	90	90	100	100	112	132	132
D [mm]	19	19	24	24	28	28	28	38	38
E [mm]	40	40	50	50	60	60	60	80	80
ED [mm]	32	32	40	40	50	50	50	70	70
EB [mm]	4	4	5	5	5	5	5	5	5
DH [mm]	M6x16	M6x16	M8x19	M8x19	M10x22	M10x22	M10x22	M12x28	M12x28
F [mm]	6	6	8	8	8	8	8	10	10
GA [mm]	21.5	21.5	27	27	31	31	31	41	41

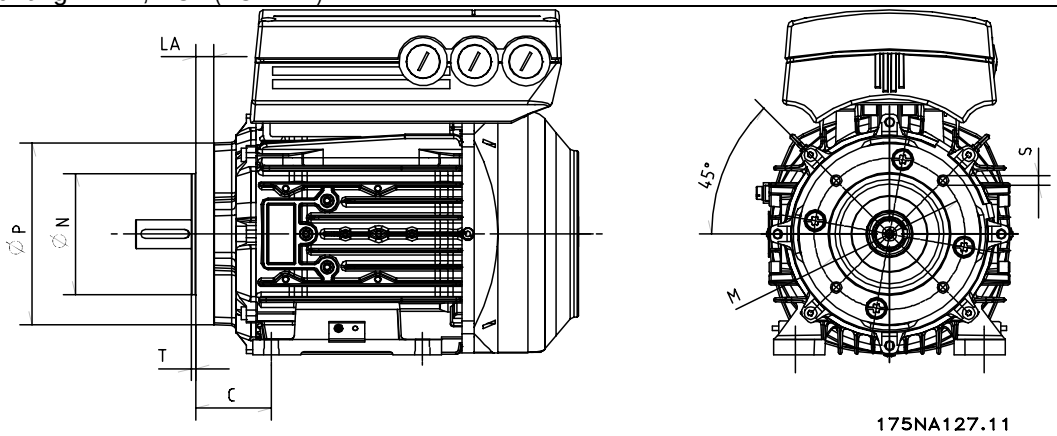
Flange mounting - B5, B35 (B3+B5)



B5

FCM	305	307	311	315	322	330	340	355	375
Frame size	80	80	90	90	100	100	112	132	132
IEC Ref.	FF165	FF165	FF165	FF165	FF215	FF215	FF215	FF265	FF265
DIN Ref.	A200	A200	A200	A200	A250	A250	A250	A300	A300
M [mm]	165	165	165	165	215	215	215	265	265
N [mm]	130	130	130	130	180	180	180	250	230
P [mm]	200	200	200	200	250	250	250	300	300
S [mm]	12	12	11.5	11.5	14	14	14	14	14
T [mm]	3.5	3.5	3.5	3.5	4	4	4	4	4
LA [mm]	10	10	10	10	11	11	11	12	12

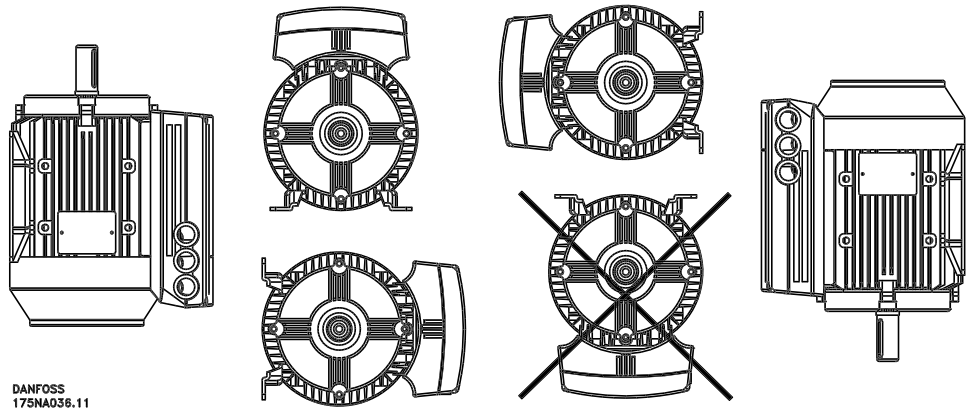
Face mounting - B14, B34 (B3+B14)



B14

FCM	305	307	311	315	322	330	340	355	375
Frame size	80	80	90	90	100	100	112	132	132
IEC Ref.	FT100	FT100	FT115	FT115	FT130	FT130	FT130	FT165	FT165
DIN Ref.	C120	C120	C140	C140	C160	C160	C160	C200	C200
M [mm]	100	100	115	115	130	130	130	165	165
N [mm]	80	80	95	95	110	110	110	130	130
P [mm]	120	120	140	140	160	160	160	200	200
S [mm]	M6	M6	M8	M8	M8	M8	M8	M10	M10
T [mm]	3	3	3	3	3.5	3.5	3.5	3.5	3.5
LA [mm]	12	12	10	10	10	10	10	12	12

■ Installation of the FC motor



FC motors must be installed with adequate access for routine maintenance. A minimum of 0.75m of working space around the motor is recommended. Adequate space around the motor, particularly at the fan inlet (50 mm), is also necessary to facilitate airflow.
Where several FC motors are installed in close proximity, care must be taken to ensure that there is no recirculation of exhausted warm air. Foundations must be solid, rigid and level.

NB!:
Electrical installation
Do not remove the top foil inside the inverter part, as this is a part of the protective arrangements.

Fitting pinions, pulleys and couplings.
These should be bored to our standard limits and fitted on the shaft with a screwing motion. Attention must be paid to correct guarding of all moving parts.

Tapping of fitments onto the FC motor shaft, with a hammer or mallet, causes bearing damage. This results in an increase in bearing noise and a significant reduction in bearing life.

NB!:
Max. length of mounting bolts penetrating the B14 flange, see section *Dimensions* in this chapter.

Installation

■ Forced ventilation (FV) units (Not yet available)

In some applications the fan built on to the motor shaft do not give sufficient cooling for operation at low speed. That problem is solved by mounting a FV unit.

Typical applications are for example conveyors, spindles and other contant torque (CT) applications where the customer wants a wide control range without reduction in torque down to low speed.

The VLT Drive Motor yields full continuous torque down to low speed with FV built on. The forced vent enclosure is IP 55. Not approved according to UL.

■ Control panel (175NO131)

The FC motor optionally features a Local Control Panel- LCP 2 which makes up a complete interface for operation and monitoring of the FC motor.
IP 65 on front.

NB!:
The LCP from the VLT 5000 Series (code number 175Z0401) cannot be used for the FC motor. However, the general LCP 2 (code number 175N0131) can be used for both the FCM 300, VLT 2800 and the VLT 5000 Series.

■ LCP installation

The LCP 2 is connected to the terminal X100, 1-4 (see separate instruction MI.03.AX.YY).

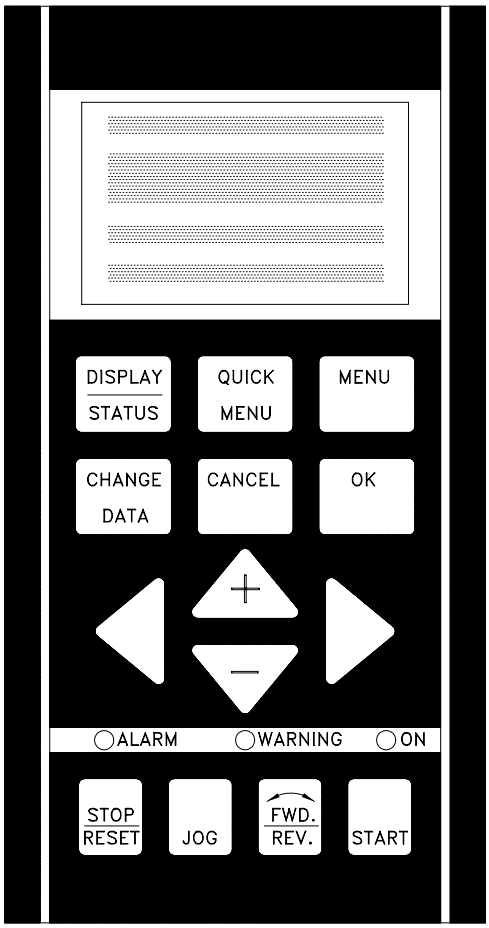
1. Service Plug Kit (175N2546) (see section *Service plug kit*) and cabel 175N0162
2. Plug kit (175N2545) (see section *Plug kit*) and cabel 175N0162
3. Remote mounting kit (175N0160) (see section *Remote mounting kit*)

■ LCP functions

The functions of the control panel can be divided into three groups:

- display
- keys for changing program parameters
- keys for local operation

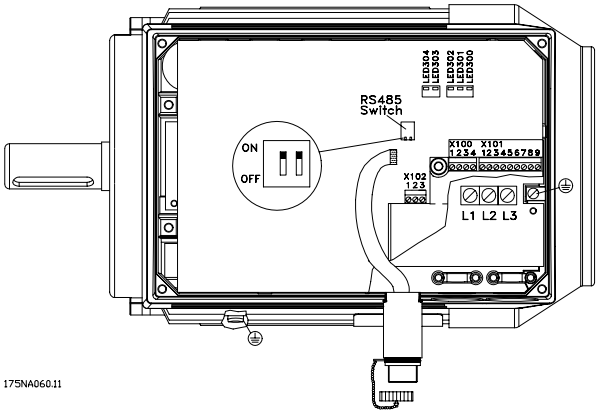
All data are indicated by means of a 4-line alphanumeric display, which in normal operation is able show 4 measurements and 3 operating conditions continuously. During programming, all the information required for quick, effective parameter Setup of the FC motor will be displayed. As a supplement to the display, there are three LEDs for voltage, warning and alarm. All program parameters of the FC motor can be changed immediately from the control panel, unless this function has been blocked via parameter 018.



DANFOSS
175ZA004.10

■ Service plug kit (175N2546)

Purpose:
To run LCP2 and PROFIBUS at the same time. The service plug can be used with FCM 300 of serial number 03Gxxx and software version as from 2.03. Used together with cable for plug kit 175N0162.

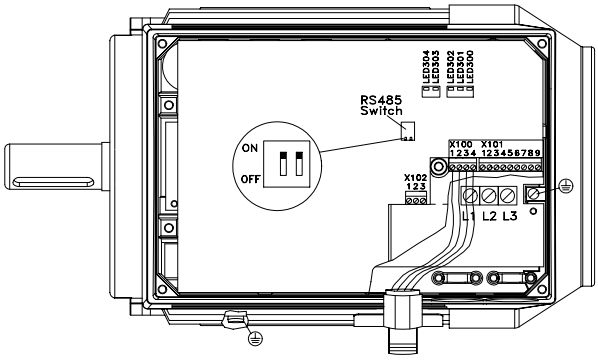


175NA060.11

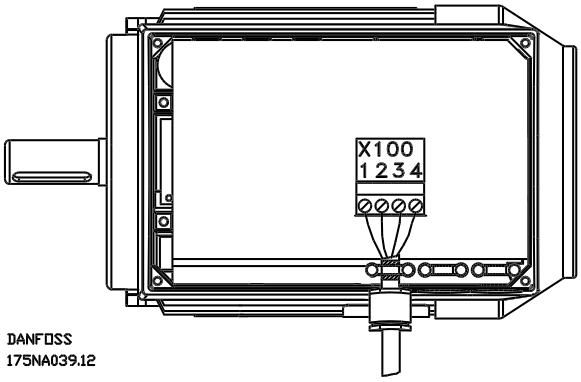
■ Plug kit (175N2545)

Purpose

To make a plugable connection between LCP 2 and FCM 300.
Used together with cable for plug kit 175N0162.



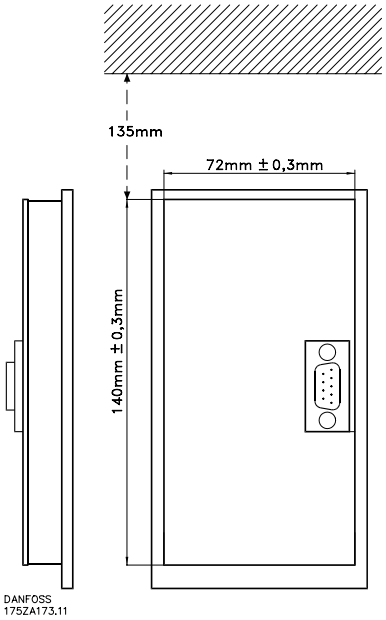
■ Remote mounting kit (175N0160)

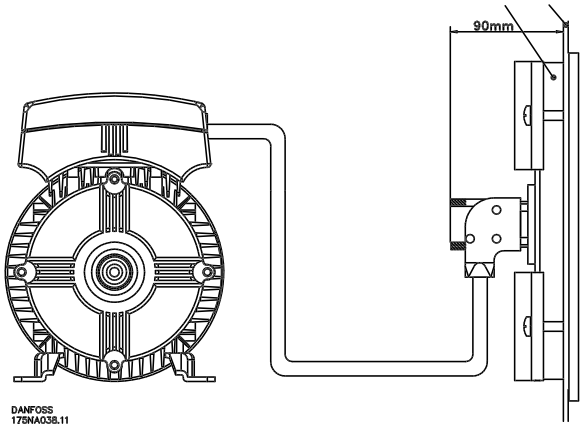


Connections

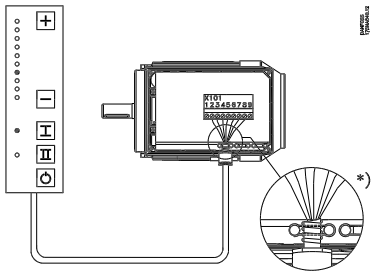
Colour of wire/	Terminal X100/	D-sub pin
yellow	1	8
green	2	9
red	3	2
blue	4	3

■ **Remote mounting kit cont.**





■ Local Operation Pad (LOP) (175N0128) IP65



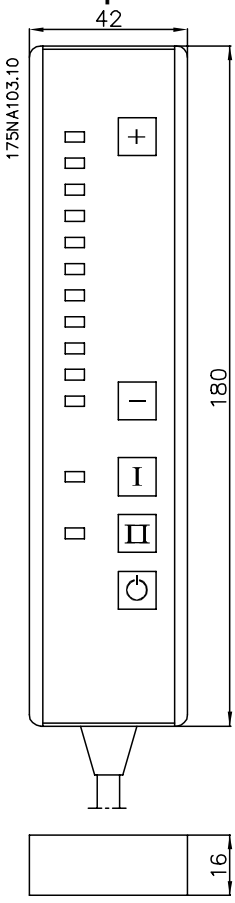
Use the +/- keys to set reference

Wiring

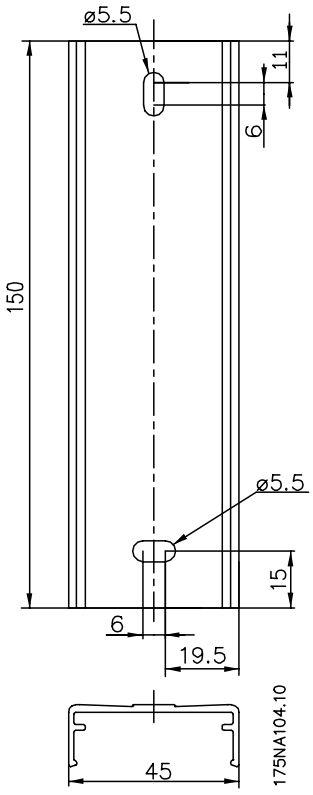
Colour of wire	Terminal	Function
White	2	Reference
Brown	3	Reset
Purple * or Grey	4	See table under button
Green	5	See table under button
Red	6	+24V
Yellow	7	+10V
Blue	8	Ground

* Can be orange in some cables

Local Operation Panel (LOP) 175N0128 IP 65



Fixture for LOP 175N1114



Installation

Functions/settings	Key I (Start)	Key II (Start)	⏻ Key (Stop)
Default - Dual speed operation (connect purple wire): No changes to factory setting.	Run on set reference (+/-)	Run on 10 Hz** jog speed	Stop (and reset* - if trip)
Function 2 - Dual mode operation (connect purple wire) Select desired modes of operation in Setups 1 and 2 (use para. 4-6) Parameter 335 = 18 (select Setup)	Run with Setup 1	Run with Setup 2	Stop (and reset* - if trip)
Function 3 - Dual direction operation (connect grey wire) Parameter 335 = 10 (start reversing) Parameter 200 = 1 (both directions)	Run forward	Run reverse	Stop (and reset* - if trip)

*If no reset is required, do not connect the brown wire
**or set parameter 213

At power up the unit will always be in stop mode. Set reference will be stored during power down. If permanent start mode is desired, connect terminal 6 to terminal 4 and do not connect purple/grey wire to terminal 4. This means the stop function on LOP is disabled.

NB!:
After fitting, cut off or isolate excess wire.

■ Galvanic isolation (PELV)

PELV offers protection by way of extra low voltage. Protection against electric shock is considered to be ensured when all connected devices are of the PELV type and the installation is made as described in local/national regulations on PELV supplies.

In FCM 300 Series all control terminals are supplied from or in connection with extra low voltage (PELV).

Galvanic (ensured) isolation is obtained by fulfilling requirements concerning higher isolation and by providing the relevant creapage/clearance distances. These requirements are described in the EN 50178 standard.

The components that make up the electrical isolation, as described below, also comply with the requirements concerning higher isolation and the relevant test as described in EN 50178.

The galvanic isolation can be shown in three locations (see drawing below), namely:

1. Power supply (SMPS) incl. signal isolation of U_{DC}, indicating the intermediate current voltage.
2. Gate drive that runs the IGBTs (optocouplers).
3. Current transducers (opto-couplers).

■ Earth leakage current

Earth leakage current is primarily caused by the capacitance between motor phases and the motor frame. The RFI filter contributes additional leakage current, as the filter circuit is connected to earth through capacitors.

The size of the leakage current to the ground depends on the following factors, in order of priority:

1. Switching frequency
2. Motor grounded on site or not

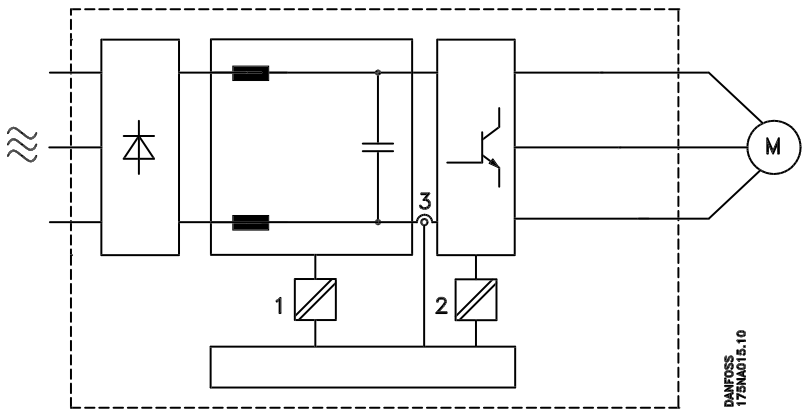
The leakage current is of importance to safety during handling/operation of the frequency converter if (by mistake) the frequency converter has not been earthed.

NB!:
FCM 305-375 all have leakage currents > 3.5 mA, approx 4 to 20 mA. Varies with switching frequencies within the given interval.

This means reinforced earthing mus be established (see Quick Guide MG.03.A1.02), if EN50178 is to be complied with.
Never use ELCB (Earth Leakage Circuit Breaker) relays also called RCD(Residual Current Device) that are not suitable for DC fault currents (type A).

If a RCD is used it must be:
- Suitable for protecting equipment with a DC current content in the fault current (3-phase rectifier)
- Suitable for power-up with short charging current to earth
- Suitable for a high leakage current.

This means it is possible to operate the FCM 300 on RCD type B:
Residual Current Devices (RCD) type B has a tolerance on trip level. It is therefore recommended to use a RCD where the max leakage current for the FCM (see above, 20 mA) is less than 1/3 of the trip level for the RCD. This means the trip level for the RCD will have to be 60 mA or higher, i.e. a RCD type B with a trip level 100 mA can be used for protection.



Galvanic isolation

■ Extreme running conditions

Motor-generated overvoltage

The voltage in the intermediate circuit is increased when the motor acts as a generator. This occurs in two cases:

1. The load drives the motor (at constant output frequency from the frequency converter), i.e. the load generates energy.
2. During deceleration ("ramp-down") if the moment of inertia is high, the load is low and the ramp-down time is too short for the energy to be dissipated as a loss in the VLT frequency converter, the motor and the installation.

The control unit attempts to correct the ramp if possible.

The inverter turns off to protect the transistors and the intermediate circuit capacitors when a certain voltage level is reached.

Mains drop-out

During a mains drop-out, FCM 300 Series continues until the intermediate circuit voltage drops below the minimum stop level, which is typically 15% below FCM 300 Series's lowest rated supply voltage.

The time before the inverter stops depends on the mains voltage before the drop-out and on the motor load.

Static overload

When FCM 300 Series is overloaded (the current limit in parameter 221 has been reached), the controls will reduce the output frequency in an attempt to reduce the load.

If the overload is excessive, a current may occur that makes the FC motor cut out after approx. 1.5 sec.

■ Acoustic noise

Below are the typical values measured at a distance of 1 m from the unit at full load:

	2 pole	4 pole
FCM 305		54 dB(A)
FCM 311		58 dB(A)
FCM 315		59 dB(A)
FCM 322		58 dB(A)
FCM 330		61 dB(A)
FCM 340	62 dB(A)	63 dB(A)
FCM 355	64 dB(A)	60 dB(A)
FCM 375		61 dB(A)

■ Balance

The FCM 300 is balanced to class R according to ISO8821 (reduced balance). For critical applications especially at high speed (>4000 RPM) special balance (class S) might be required.

■ Thermal Protection and Derating

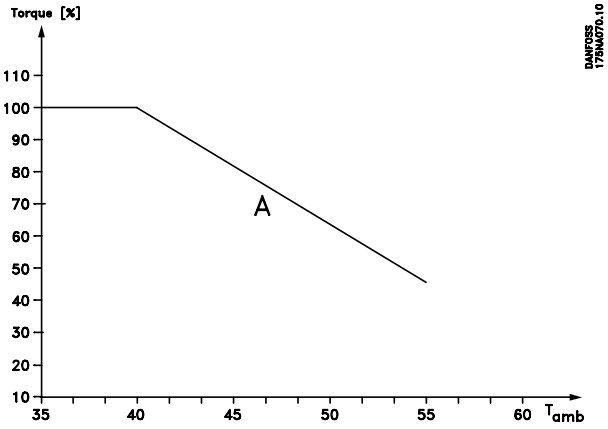
The FCM 300 Series motor is thermally protected in case limits are exceeded. At high temperatures the switching frequency will be gradually reduced down to 2 kHz and eventually the motor will trip.

NB!:
Combination of high switching frequency and missing fan cooling might damage the unit.

■ Derating for ambient temperature

The ambient temperature ($T_{AMB,MAX}$) is the maximum temperature allowed. The average ($T_{AMB,AVG}$) measured over 24 hours must be at least 5ºC lower.

If FCM 300 Series is operated at temperatures above 40 ºC, a derating of the continuous output current is necessary.

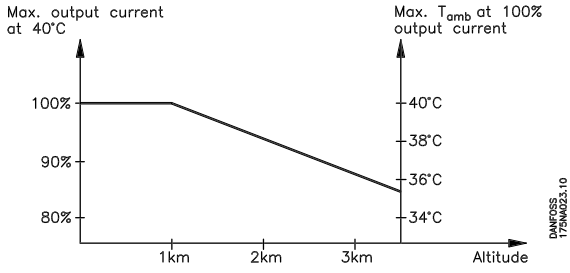


■ Derating for air pressure

Below 1000 m altitude no derating is necessary.

Above 1000 m the ambient temperature (T_{AMB}) or max. output current ($I_{VLT,MAX}$) must be derated in accordance with the following diagram:

1. Derating of output current versus altitude at T_{AMB} = max. 40°C
2. Derating of max. T_{AMB} versus altitude at 100% output current.

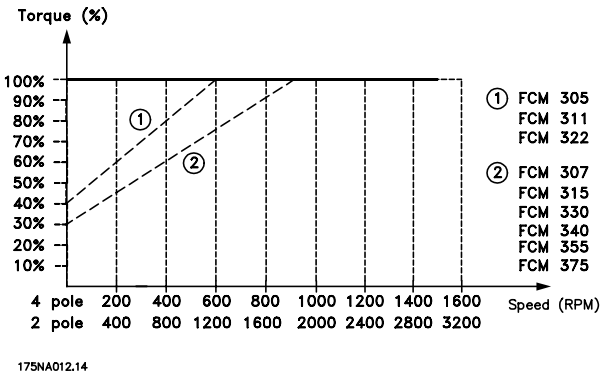


■ Derating for running at low speed

When a centrifugal pump or a fan is controlled by a FC motor, it is not necessary to reduce the output at low speed because the load characterstic of the centrifugal pumps/fans, automatically ensures the necessary reduction.

FC motors running constant load torque applications continuously at low speed must be derated (see diagram) or an independent fan must be used (cooling option 2, not yet available).

Nominal torque (100%) can be yielded up to 15 min and at a duty cycle up to 25% at low speed.



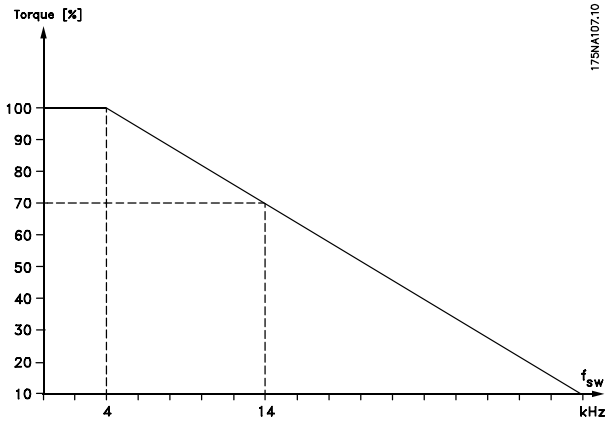
■ Derating for high switching frequency

The FCM 300 Series motor can use two different PWM schemes, SFAVM and 60° AVM. Factory setting is SFAVM. The PWM scheme can be changed in parameter 446. Below 25 Hz motor speed the FCM 300 Series motor automatically change to SFAVM.

Factory setting of the switching frequency is 4000 Hz. It can be changed between 2 and 14 kHz in parameter 411.

A higher switching frequency leads to a quieter running unit but higher losses in the electronics of the FC motor and makes an appropriate derating necessary.

See below Torque carateteristic



■ Vibration and shock

FCM 300 Series has been tested according to a procedure based on the following standards:

IEC 60068-2-6:	Vibration (sinusoidal) - 1970
IEC 60068-2-34:	Random vibration broad-band - general requirements
IEC 60068-2-35:	Random vibration broad-band - high reproducibility
IEC 60068-2-36:	Random vibration broad-band - medium reproducibility

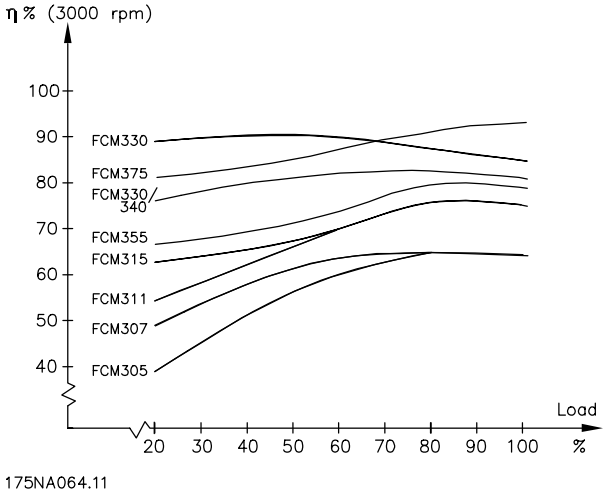
FCM 300 Series complies with requirements that correspond to conditions in the standards mentioned above.

■ Air humidity

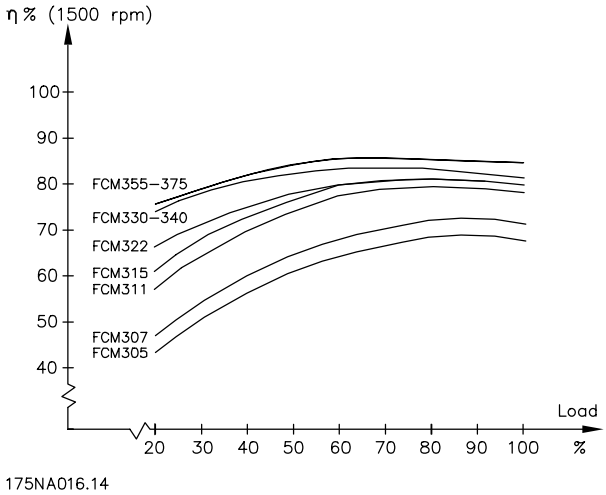
FCM 300 Series has been designed to meet the IEC 60068-2-3 standard, EN 50178 item 9.4.2.2/DIN 40040, class E, at 40°C.

Cyclic damp heat according to IEC 60068-2-30, 40°C.

■ Efficiency



2 pole



4 pole

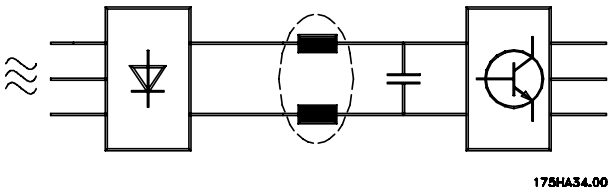
■ Mains supply interference/harmonics

A FC motor takes up a non-sinusoidal current from mains, which increases the input current I_{RMS}. A nonsinusoidal current can be transformed by means of a Fourier analysis and split up into sine wave currents with different frequencies, i.e. different harmonic currents I_N with 50 Hz as the basic frequency:

Harmonic currents	I_1	I_5	I_7	I_{11}
Hz	50 Hz	250 Hz	350 Hz	550 Hz
In/I1 [%]	100%	44%	29%	8%

The harmonics do not affect the power consumption directly, but increase the heat losses in the installation (transformer, cables). Consequently, in plants with a rather high percentage of rectifier load, it is important to maintain harmonic currents at a low level to avoid overload of the transformer and high temperature in the cables.

Some of the harmonic currents might disturb communication equipment connected to the same transformer or cause resonance in connection with power-factor correction batteries.



To ensure low, harmonic currents, FCM 300 has intermediate circuit coils as standard..
THD (current) ≤ 54%
The voltage distortion on the mains supply depends on the size of the harmonic currents multiplied by the mains impedance for the frequency in question. The total voltage distortion THD is calculated on the basis of the individual voltage harmonics using the following formula:

$$THD = \frac{U_1}{\sqrt{U_2^2 + ... + U_n^2}} \ (\%)$$

■ Power factor

The power factor is the relation between I_1 and I_{RMS} .

The power factor for 3-phase control

$$= \frac{\sqrt{3 \times U \times I_1 \times \cos_{\varphi 1}}}{\sqrt{3 \times U \times I_{RMS}}}$$

$$\text{Power factor} = \frac{I_1 \times \cos_{\varphi i}}{I_{RMS}} = \frac{I_1}{I_{RMS}} 0.9 \text{ since } \cos \varphi = 1$$

The power factor indicates the extent to which the FC motor imposes a load on the mains supply.

The lower the power factor, the higher the I_{RMS} for the same kW performance.

In addition, a high power factor indicates that the different harmonic currents are low.

$$I_{RMS} = \sqrt{I_1^2 + I_5^2 + I_7^2 + ... + I_n^2}$$

■ What is CE labelling?

The purpose of CE labellingis to avoid technical obstacles to trade within EFTA and the EU. The EU has introduced the CE label as a simple way of showing whether a product complies with the relevant EU directives. The CE label says nothing about the specifications or quality of the product. Frequency converters are regulated by three EU directives:

■ The machinery directive(98/37/EEC)

All machines with critical moving parts are covered by the machinery directive, which came into force on 1 January 1995. Since a frequency converter is largely electrical, and the motor always will be placed in connection with other machines, it does not fall under the machinery directive. However, if a FC motor is supplied for use in a machine, we provide information on safety aspects relating to the FC motor. We do this by means of a manufacturer's declaration.

■ The low-voltage directive (73/23/EEC)

Frequency converters must be CE labelled in accordance with the low-voltage directive. The directive applies to all electrical equipment and appliances used in the voltage range of 50-1000 V AC and 75-1500 V DC.

■ The EMC directive(89/336/EEC)

EMC is short for electromagnetic compatibility. The presence of electromagnetic compatibility means that the mutual interference between different components/ appliances is so small that the functioning of the appliances is not affected. The EMC directive came into force on 1 January 1996. The directive distinguishes between components, appliances, systems and installations.

■ What is covered?

The EU "Guidelines on the Application of Council Directive 89/336/EEC" outline three typical situations of using a FC motor. For each of these situations, explanations are offered as to whether the situation in question is covered by the EMC directive and must be CE labelled.

1. The FC motor is sold directly to the endconsumer. The FC motor is for example sold to a DIY market. The end-consumer is a layman. He installs the FC motor himself for use with a hobby machine, a kitchen appliance, etc. For such applications, the FC motor must be CE labelled in accordance with the EMC directive.
2. The FC motor is sold for installation in a plant. The plant is built up by professionals of the trade. It could be a production plant or a heating/ ventilation plant designed and installed by professionals of the trade. Neither the FC motor nor the finished plant has to be CE labelled under the EMC directive. However, the unit must comply with the basic EMC requirements of the directive. The installer can ensure this by using components, appliances and systems that are CE labelled under the EMC directive.

3. The FC motor is sold as part of a complete system. The system is being marketed as complete. It could be e.g. an air-conditioning system. The complete system must be CE labelled in accordance with the EMC directive. The manufacturer who supplies the system can ensure CE labelling under the EMC directive either by using CE labelled components or by testing the EMC of the system. If he chooses to use only CE labelled components, he does not have to test the entire system.

■ Danfoss FCM 300 Series motor and CE labelling

CE labelling is a positive feature when used for its original purpose, i.e. to facilitate trade within the EU and EFTA.

However, CE labelling may cover many different specifications. This means that it has to be checked what a given CE label specifically covers.

The specifications covered can in fact be widely different. That is why a CE label can give the installer a false feeling of security when using a FC motor as a component in a system or an appliance.

We CE label our VLT® DriveMotors in accordance with the low-voltage directive. This means that as long as the FC motor is installed correctly, we guarantee that it complies with the low-voltage directive. We issue a declaration of conformity that confirms our CE labelling in accordance with the low-voltage directive.

The CE label also applies to the EMC directive, on condition that the instructions given in the Operating Instructions for EMC-correct installation and filtering have been followed. On this basis, a declaration of conformity in accordance with the EMC directive is issued.

The Quick Guide gives detailed instructions for installation to ensure that your installation is EMCcorrect. Furthermore, we specify which norms that are complied with by our different products.

We offer the filters that can be seen from the specifications and gladly provide other types of assistance that can help you obtain the best EMC result.

■ Compliance with EMC directive 89/336/EEC

In the great majority of cases, the VLT DriveMotor is used by professionals of the trade as a complex component forming part of a larger appliance, system or installation. It must be noted that the responsibility for the final EMC properties of the appliance, system or installation rests with the installer. As an aid to the installer, Danfoss has prepared EMC installation guidelines for the Power Drive System. The standards and test levels stated for Power Drive Systems are complied with, provided the right EMC-correct instructions for installation have been followed, see electrical installation.

■ EMC standards

NB!:

- All EMC specifications are stated with factory settings.
- Maximum 4 kHz switching frequency.
- Screened data/control cables must be used for surge protection.
- The FC motor must be connected to earth in order to comply.
- Maximum/minimum line impedance Z_{max} = 0.24 + j0.15 ohm; Z_{min} = 0 + j0 ohm. (EN 61800-3 commutation notches)

Generic standards

The generic standards are stated in the EMC directive (89/336/EEC).

The FC motor complies with:
EN 61000-6-3 [1], EN 61000-6-1.
Residential, commercial and light industrial environment.

EN 61000-6-2, EN 61000-6-4.
Industrial environment.

[1]Emission levels stated by EN 61000-6-3 are only fulfilled by FC motors with class B-1 optional filter.

Furthermore the FC motor complies with:
DIN VDE 0160/1990 [2]

[2]'Protection against overvoltage 7.3.1. class1'

Product standards

The product standards are stated in EN 61800-3 (IEC 61800-3).

The FC motor complies with:
EN 61800-3, unrestricted distribution[3].
EN 61800-3, restricted distribution.

[3] Emission levels stated by EN 61800-3 unrestricted distribution are only fulfilled by FC motors with class B-1 filter.

Basic standards, emissions

- *EN 55011:* Limits and methods of measuring radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment.
- *EN 55022:* Limits and methods of measuring radio disturbance characteristics of information technology equipment.

- *EN 61000-3-2:* Limits for harmonic current emissions (equipment input current ≥ 16 A)
- *EN 61000-3-4:* Limits for harmonic current emissions (equipment input current ≤ 16 A)

Basic standards, immunity

- *EN 61000-2-4 (IEC 61000-2-4):* Compatibility levels
  Simulation of voltage and frequency fluctuations, harmonics and commutation notches on the power line.
- *EN 61000-4-2 (IEC 61000-4-2):* Electrostatic discharge (ESD)
  Simulation of electrostatic discharge.
- *EN 61000-4-4 (IEC 61000-4-4):* Fast transients, burst 5/ 50 nS
  Simulation of transients caused by switching of contactors, relays or similar devices.
- *EN 61000-4-5 (IEC 61000-4-5):*
  Surges 1.2/ 50 µS.
  Simulation of transients caused by e.g. lightning that strikes near an installation.
- *EN 61000-4-3: (IEC 61000-4-3):*
  Radio-frequency electromagnetic field.
  Amplitude modulated.
  Simulation of interference caused by radio transmission equipment.
- *EN 61000-4-6: (IEC 61000-4-6):*
  RF common mode.
  Simulation of the effect from radio-transmitting equipment connected to connection cables.
- *ENV 50204:*
  Radio-frequency electromagnetic field.
  Pulse modulated.
  Simulation of interference caused by GSM mobile phones.

General aspects of EMC emissions

For high frequency shielding, screened cables used for Profibus, standard bus, control cables and signal interface must in general be connected to the enclosure at both ends.

General aspects of EMC immunity

If there are problems with low frequency interference (ground loops), screened cable used for Profibus, standard bus, control cables and signal interface can be left open at one end.

■ Aggressive environments

In common with all electronic equipment, a VLT frequency converter contains a large number of mechanical and electronic components, all of which are vulnerable to environmental effects to some extent.

The VLT frequency converter should not therefore be installed in environments with airborne liquids, particles or gases capable of affecting and damaging the electronic components. Failure to take the necessary protective measures increases the risk of stoppages, thus reducing the life of the VLT frequency converter.

Liquids can be carried through the air and condense in the VLT frequency converter. In addition to this, liquids may cause corrosion of components and metal parts. Steam, oil and salt water may cause corrosion of components and metal parts.
In such environments, equipment with enclosure rating ≥ IP 54 is recommended.

In environments with high temperatures and humidity, corrosive gases such as sulphur, nitrogen and chlorine compounds will cause chemical processes on the VLT frequency converter components. Such chemical reactions will rapidly affect and damage the electronic components.

NB!:
Mounting VLT frequency converters in aggressive environments will increase the risk of stoppages and furthermore considerably reduce the life of the converter.

Before the installation of the VLT frequency converter, the ambient air should be checked for liquids, particles and gases. This may be done by observing existing installations in this environment. Typical indicators of harmful airborne liquids are water or oil on metal parts, or corrosion of metal parts.

Excessive dust particle levels are often found on installation cabinets and existing electrical installations. One indicator of aggressive airborne gases is blackening of copper rails and cable ends on existing installations.

■ List of parameters

Functions to programme, to control, and to monitor via bus (PROFIBUS) or by PC.

Parameter No.	Function	Range/number of settings/value	Factory setting	Data type	Conv. index
001	Language	6	English	5	0
002	Local/remote control	2	Remote control	5	0
003	Local reference		000.000	4	-3
004	Active Setup	4	Setup 1	5	0
005	Programming Setup	4	Active setup	5	0
006	Copying of Setups	4	No copying	5	0
007	LCP copy	4	No copying	5	0
008	Display scaling of motor frequency		100	6	-2
009	Display line 2	24	Frequency [Hz]	5	0
010	Display line 1.1		Reference [%]	5	0
011	Display line 1.2		Motor current [A]	5	0
012	Display line 1.3		Power [kW]	5	0
013	Local control/configuration	5	LCP digital control/par. 100	5	0
014	Local stop	2	Possible	5	0
015	Local jog	2	Not possible	5	0
016	Local reversing	2	Not possible	5	0
017	Local reset of trip	2	Possible	5	0
018	Lock for data change	2	Not locked	5	0
019	Operating state at power up, local c.	3	Forced stop, use saved ref.	5	0
100	Configuration	2	Speed, open loop mode	5	0
101	Torque characteristics	4	Constant torque	5	0
102	Motor power	XX.XX kW - dep. on unit		6	1
103	Motor voltage	XX.XX V - dep. on unit		6	0
104	Motor frequency	XX.X Hz - dep. on unit		6	-1
105	Motor current	XX.XX A - dep. on unit		7	-2
106	Rated motor speed	XX rpm - dep. on unit		6	0
117	Resonance damping	off - 100%	off %	6	0
126	DC braking time	0.0 (off) - 60.0 sec.	10.0 sec.	6	-1
127	DC brake cut-in frequency	0.0 Hz - f_{MAX}	0.0 Hz	6	-1
128	Motor thermal protection	2	Disable	5	0
132	DC braking voltage	0 - 100 %	0 %	5	0
133	Start voltage	0.00 - 100.00 V	Motor dependent	6	-2
134	Start compensation	0.0 - 300.0 %	100.0 %	6	-1
135	U/f ratio	0.00 - 20.00 V/Hz	Motor dependent	6	-2
136	Slip compensation	-500.0 - +500.0 %	100.0 %	3	-1
137	DC holding voltage	0 - 100 %	0 %	5	0
138	Brake cut out frequency	0.5 - 132 Hz	3.0 Hz	6	-1
139	Brake cut in frequency	0.5 - 132 Hz	3.0 Hz	6	-1

Conversion index:

This number refers to a conversion figure to be used when writing or reading via serial communication with a frequency converter.

See *Databytes* in *Serial Bus.*

Data type:

Data type shows the type and length of the telegram.

Data type	Description
3	Integer 16
4	Integer 32
5	Unsigned 8
6	Unsigned 16
7	Unsigned 32
9	Text string

Functions to programme, to control, and to monitor via bus (PROFIBUS) or by PC.

Parameter No.	Function	Range/number of settings/value	Factory setting	Data type	Conv. index
200	Rotation direction	3	Only clockwise 0 - 132 Hz	5	0
201	Min. output frequency (f_{MIN})	0.0 Hz - f_{MAX}	0.0 Hz	6	-1
202	Max. output frequency (f_{MAX})	f_{MIN} - f_{RANGE}	f_{RANGE} (132 Hz)	6	-1
203	Reference/feedback range	Min. - max./-max.- +max.	Min. - Max.	5	0
204	Minimum reference	-100,000.000 - Ref_{MAX}	0.000	4	-3
205	Maximum reference	Ref_{MIN} - 100,000.000	50.000	4	-3
207	Ramp-up time 1	0.05 - 3600.00 sec.	3.00 sec.	7	-2
208	Ramp-down time 1	0.05 - 3600.00 sec.	3.00 sec.	7	-2
209	Ramp-up time 2	0.15 - 3600.00 sec.	3.00 sec	7	-2
210	Ramp-down time 2	0.15 - 3600.00 sec.	3.00 sec	7	-2
211	Jog ramp time	0.05 - 3600.00 sec.	3.00 sec.	7	-2
212	Quick stop ramp-down time	0.05 - 3600.00 sec.	3.00 sec.	7	-2
213	Jog frequency	0 Hz - f_{MAX}	10.0 Hz	6	-1
214	Reference function	2	Sum	5	0
215	Preset reference 1	-100.00 % - +100.00 %	0.00 %	3	-2
216	Preset reference 2	-100.00 % - +100.00 %	0.00 %	3	-2
219	Catch up/slow down value	0.00 - 100.00 %	0.00 %	6	-2
221	Current limit for motor mode	Min.- max. limit in % of I_{rated}	Max. limit	6	-1
229	Frequency bypass, bandwidth	0 (off) - 100 %	0 %	6	0
230	Frequency bypass 1	0.0 - 132 Hz	0.0 Hz	6	-1
231	Frequency bypass 2	0.0 - 132 Hz	0.0 Hz	6	-1
241	Reference preset 1	-100.00 % - +100.00 %	0.00 %	3	-2
242	Reference preset 2	-100.00 % - +100.00 %	0.00 %	3	-2
243	Reference preset 3	-100.00 % - +100.00 %	0.00 %	3	-2
244	Reference preset 4	-100.00 % - +100.00 %	0.00 %	3	-2
245	Reference preset 5	-100.00 % - +100.00 %	0.00 %	3	-2
246	Reference preset 6	-100.00 % - +100.00 %	0.00 %	3	-2
247	Reference preset 7	-100.00 % - +100.00 %	0.00 %	3	-2

Functions to programme, to control, and to monitor via bus (PROFIBUS) or by PC.

Parameter No.	Function	Range/number of settings/value	Factory setting	Data type	Conv. index
317	Time out	1 -99 sec.	10 sec.	5	0
318	Function after time out	Off/Stop and trip	Off	5	0
323	X102 relay function	13	No operation	5	0
327	Pulse reference/feedback, max. freq.	100 - 70000 Hz	5000 Hz	7	0
331	Terminal 1, analog input current	3	No operation	6	0
332	Terminal 2, digital input	25	Reference	6	0
333	Terminal 3, digital input	25	Reset	6	0
334	Terminal 4, digital input	24	Start	6	0
335	Terminal 5, digital input	23	Jog	6	0
336	Terminal 1, min. scaling	0.0 - 20.0 mA	0.0 mA	6	-4
337	Terminal 1, max. scaling	0.0 - 20.0 mA	20.0 mA	6	-4
338	Terminal 2, min. scaling	0.0 - 10.0 V	0.0 V	6	-1
339	Terminal 2, max. scaling	0.0 - 10.0 V	10.0 V	6	-1
340	Output functions	21	No operation	6	0

Functions to programme, to control, and to monitor via bus (PROFIBUS) or by PC.

Parameter No.	Function	Range/number of settings/value	Factory setting	Data type	Conv. index
400	Brake function	Off/AC braking	Off	5	0
403	Sleep mode timer	0-300 sec.	Off	6	0
404	Sleep frequency	f_{MIN} - par 407	0 Hz	6	-1
405	Reset function	11	Manual reset	5	0
406	Boost setpoint	1-200 %	100 %	6	0
407	Wake up frequency	Par 404 - f_{MAX}	50 Hz	6	-1
411	Switching frequency	1.5 - 14.0 kHz	Unit dependent	6	0
412	Variable switching frequency	3	Temp. dep. sw. freq.	5	0
413	Overmodulation function	Off/On	On	5	0
414	Minimum feedback	-100000 - FB_{HIGH}	0	4	-3
415	Maximum feedback	FB_{LOW} - 100,000	1500	4	-3
416	Reference/feedback unit	42	%	5	0
437	Process PID normal/inverse ctrl.	Normal/inverse	Normal	5	0
438	Process PID anti windup	Disable/Enable	Enable	5	0
439	Process PID start frequency	f_{MIN} - f_{MAX}	f_{MIN}	6	-1
440	Process PID proportional gain	0.00 (off) - 10.00	0.01	6	-2
441	Process PID integral time	0.01 - 9999 sec. (off)	9999 sec.	7	-2
442	Process PID differentation time	0.00 (off) - 10.00 sec.	0.00 sec.	6	-2
443	Process PID different. gain limit	5 -50	5	6	-1
444	Process PID lowpass filter time	0.1 - 10.00 sec.	0.1 sec.	6	-2
445	Flying start	4	Disable	5	0
446	Switching pattern	2	SFAVM	5	0
461	Feedback conversion	Linear or square root	Linear	5	0

Conversion index:

This number refers to a conversion figure to be used when writing or reading via serial communication with a frequency converter.

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Functions to programme, to control, and to monitor via bus (PROFIBUS) or by PC.

Parameter No.	Function	Range/number of settings/value	Factory setting	Data type	Conv. index
500	Bus address	1 - 126	1	5	0
501	Baudrate	300 - 9600 Baud/6	9600 Baud	5	0
502	Coasting	4	Logic or	5	0
503	Quick-stop	4	Logic or	5	0
504	DC-brake	4	Logic or	5	0
505	Start	4	Logic or	5	0
506	Reversing	4	Logic or	5	0
507	Selection of setup	4	Logic or	5	0
508	Selection of speed	4	Logic or	5	0
509	Bus jog 1	0.0 - f_{MAX}	10.0 Hz	6	-1
510	Bus jog 2	0.0 - f_{MAX}	10.0 Hz	6	-1
512	Telegram profile	Profidrive/FC Drive	FC Drive	5	0
513	Bus time interval		1 sec.	5	0
514	Bus time interval function	6	Off	5	0
515	Data read-out: Reference	XXX.X		3	-1
516	Data read-out: Refer. unit	Hz/rpm		4	-3
517	Data read-out: Feedback			4	-3
518	Data read-out: Frequency	Hz		3	-1
519	Data read-out: Frequency x scale	Hz		7	-2
520	Data read-out: Current	A x 100		7	-2
521	Data read-out: Torque	%		3	-1
522	Data read-out: Power	kW		7	1
523	Data read-out: Power	hp		7	-2
524	Data read-out: Motor voltage	V		6	-1
525	Data read-out: DC link voltage	V		6	0
527	Data read-out: FC therm.	0 - 100 %		5	0
528	Data read-out: Digital input			5	0
533	Data read-out: External reference	-200.0 - +200.0 %		6	-1
534	Data read-out: Status word, binary			6	0
537	Data read-out: FC temperature	°C		5	0
538	Data read-out: Alarm word, binary			7	0
539	Data read-out: Control word, binary			6	0
540	Data read-out: Warning word, 1			7	0
541	Data read-out: Warning word, 2			7	0
542	Data read-out: Terminal 1, analog input	mA X 10		5	-4
543	Data read-out: Terminal 2, analog input	V X 10		5	-1

Functions to programme, to control, and to monitor via bus (PROFIBUS) or by PC.

Parameter No.	Function	Range/number of settings/value	Factory setting	Data type	Conv. index
600	Operating data: Operating hours	0 - 130,000.0 hours		5	0
601	Operating data: Hours run	0 - 130,000.0 hours		7	73
603	Operating data: Number of power-up's	0 - 9999		7	73
604	Operating data: Number of overtemp.	0 - 9999		6	0
605	Operating data: Number of overvoltages	0 - 9999		6	0
615	Fault log, read-out: Error code	Index XX - XXX		6	0
616	Fault log, read-out: Time	Index XX - XXX		5	0
617	Fault log, read-out: Value	Index XX - XXX		7	-1
619	Reset of hours-run counter	No reset/reset	No reset	3	0
620	Operation mode	3	Normal function	5	0
621	Nameplate: FC motor type	Depends on unit		5	0
624	Nameplate: Software version no.	Depends on unit		9	0
625	LCP version	Depends on unit		9	0
626	Nameplate: Database identification no.	Depends on unit		9	0
628	Nameplate: Application option type			9	-2
630	Nameplate: Communication option type			9	0
632	BMC software identification			9	0
633	Motor database identification			9	0
634	Unit identification for communication			9	0
635	Software part No.			9	0

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See *Databytes* in *Serial Bus.*

Data type:
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