Contents

How to Read these Operating Instructions

□ **How to Read these Operating Instructions**

These Operating Instructions will help you get started, install, program, and troubleshoot your VLT® AutomationDrive FC 300.

The FC 300 comes in two shaft performance levels. FC 301 ranges from scalar (U/f) to VVC+, and FC 302 ranges from scalar (U/f) to servo performance.

These Operating Instructions cover both FC 301 and FC 302. Where information covers both series, we refer to FC 300. Otherwise, we refer specifically to either FC 301 or FC 302.

Chapter 1, **How to Read these Operating Instructions**, introduces the manual and informs you about the approvals, symbols, and abbreviations used in this literature.
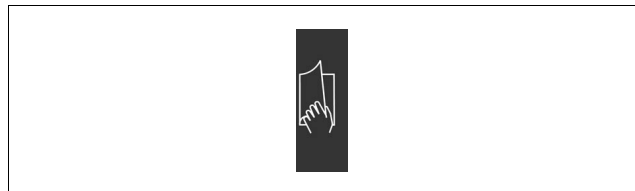
Page divider for How to Read these Operating Instructions.

Chapter 2, **Safety Instructions and General Warnings**, entails instructions on how to handle the FC 300 correctly.
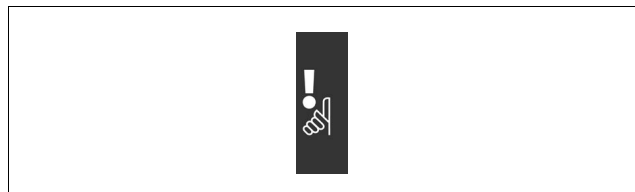
Page divider for Safety Instructions and General Warnings.

Chapter 3, **How to Install** , guides you through mechanical and technical installation.
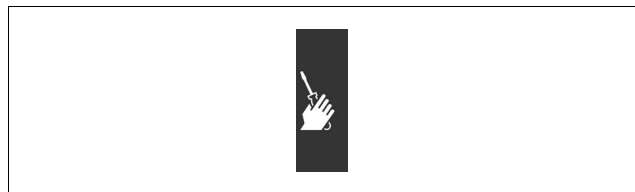
Page divider for How to Install

━ How to Read these Operating Instructions ━

Chapter 4, **How to Programme**, shows you how to operate and programme the FC 300 via the Local Control Panel.
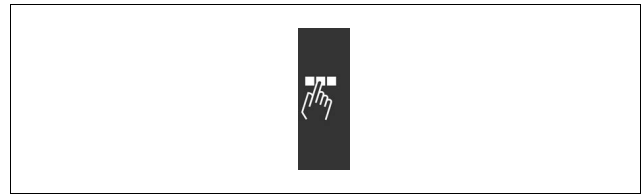
Page divider for How to Programme.

Chapter 5, **General Specifications**, entails technical data about FC 300.

Page divider for General Specifications.

Chapter 6, **Troubleshooting**, assists you in solving problems that may occur when using FC 300.
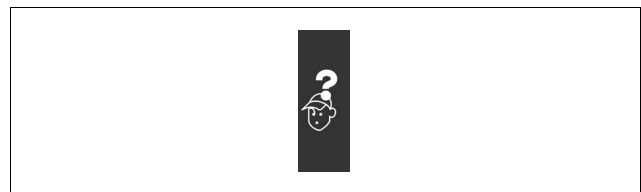
Page divider for Troubleshooting.

Available literature for FC 300

- The VLT® AutomationDrive FC 300 Operating Instructions provide the neccessary information for getting the drive up and running.
- The VLT® AutomationDrive FC 300 Design Guide entails all technical information about the drive and customer design and applications.
- The VLT® AutomationDrive FC 300 Profibus Operating Instructions provide the information required for controlling, monitoring and programming the drive via a Profibus fieldbus.
- The VLT® AutomationDrive FC 300 DeviceNet Operating Instructions provide the information required for controlling, monitoring and programming the drive via a DeviceNet fieldbus.
- The VLT® AutomationDrive FC 300 MCT 10 Operating Instructions provide information for installation and use of the software on a PC.
- The VLT® AutomationDrive FC 300 IP21 / TYPE 1 Instruction provides information for installing the IP21 / TYPE 1 option.
- The VLT® AutomationDrive FC 300 24 V DC Backup Instruction provides information for installing the 24 V DC Backup option.

Danfoss Drives technical literature is also available online at www.danfoss.com/drives.

☐ **Approvals**

— How to Read these Operating Instructions —

□ **Symbols**

Symbols used in these Operating Instructions.

NB!:
Indicates something to be noted by the reader.

Indicates a general warning.

Indicates a high-voltage warning.

∗   Indicates default setting

□ **Abbreviations**

Alternating current	AC
American wire gauge	AWG
Ampere/AMP	A
Automatic Motor Adaptation	AMA
Current limit	I_{LIM}
Degrees celcius	°C
Direct current	DC
Electronic Thermistor Relay	ETR
Frequency Converter	FC
Gram	g
Hertz	Hz
Kilohertz	kHz
Local Control Panel	LCP
Meter	m
Milliampere	mA
Millisecond	ms
Minute	min
Motion Control Tool	MCT
Nanofarad	nF
Newton Meters	Nm
Nominal motor current	$I_{M,N}$
Nominal motor frequency	$f_{M,N}$
Nominal motor power	$P_{M,N}$
Nominal motor voltage	$U_{M,N}$
Parameter	par.
Rated Inverter Output Current	I_{INV}
Revolutions Per Minute	RPM
Second	s
SLC	Smart Logic Control
Torque limit	T_{LIM}
Volts	V

Safety Instructions and General Warning
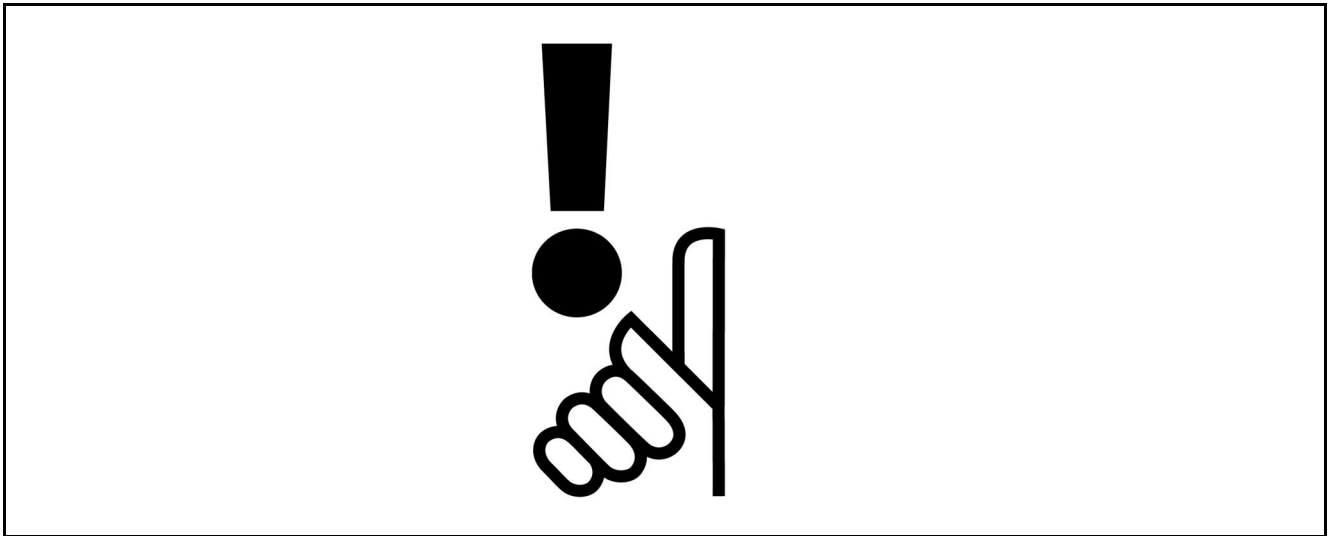
□ **High Voltage Warning**

The voltage of the FC 300 is dangerous whenever the converter is connected to mains. Incorrect fitting of the motor or VLT 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.

□ **Safety Instructions**

- Make sure the FC 300 is properly connected to earth.
- Do not remove mains plugs or motor plugs while the FC 300 is connected to mains.
- Protect users against supply voltage.
- Protect the motor against overloading according to national and local regulations.
- Motor overload protection is not included in the default settings. To add this function, set parameter 1-90 *Motor thermal protection* to value *ETR trip* or *ETR warning*. For the North American market: ETR functions provide class 20 motor overload protection, in accordance with NEC.
- The earth leakage current exceeds 3.5 mA.
- The [OFF] key is not a safety switch. It does not disconnect the FC 300 from mains.

□ **Before commencing repair work**

1. Disconnect FC 300 from mains
2. Disconnect DC bus terminals 88 and 89
3. Wait at least 4 minutes
4. Remove motor plugs

□ **Avoid Unintended Start**

While FC 300 is connected to mains, the motor can be started/stopped using digital commands, bus commands, references or via the LCP.

- Disconnect the FC 300 from mains whenever personal safety considerations make it necessary to avoid unintended start.
- To avoid unintended start, always activate the [OFF] key before changing parameters.
- Unless terminal 37 is turned off, an electronic fault, temporary overload, a fault in the mains supply, or lost motor connection may cause a stopped motor to start.

General warning

⚡ **Warning:**

130BA024.10

Touching the electrical parts may be fatal - even after the equipment has been disconnected from mains.

Also make sure that other voltage inputs have been disconnected, such as load-sharing (linkage of DC intermediate circuit), as well as the motor connection for kinetic back-up.

Using VLT AutomationDrive FC 300 (at and below 7.5 kW):

wait at least 4 minutes

⚠ **Leakage Current**

The earth leakage current from the frequency converter exceeds 3.5 mA. To ensure that the earth cable has a good mechanical connection to the earth connection (terminal 95), the cable cross section must be at least 10 mm^2 / 6 AWG or 2 rated earth wires terminated separately.

Residual current device

This product can cause a D.C. current in the protective conductor. Where a residual current device (RCD) is used for extra protection, only an RCD of Type B (time delayed) shall be used on the supply side of this product. See also RCD Application Note MN.90.GX.02.
Protective earthing of the FC 300 and the use of RCD's must always follow national and local regulations.

□ **IT Mains**

> ⚠️ **IT Mains**
>
> Do not connect 400 V units with RFI-filters to mains supplies with a voltage between phase and earth of more than 440 V. For IT mains and delta earth (grounded leg), mains voltage may exceed 440 V between phase and earth.

Par. 14-50 *RFI 1* can be used to disconnect the internal RFI capacities from the intermediate circuit.
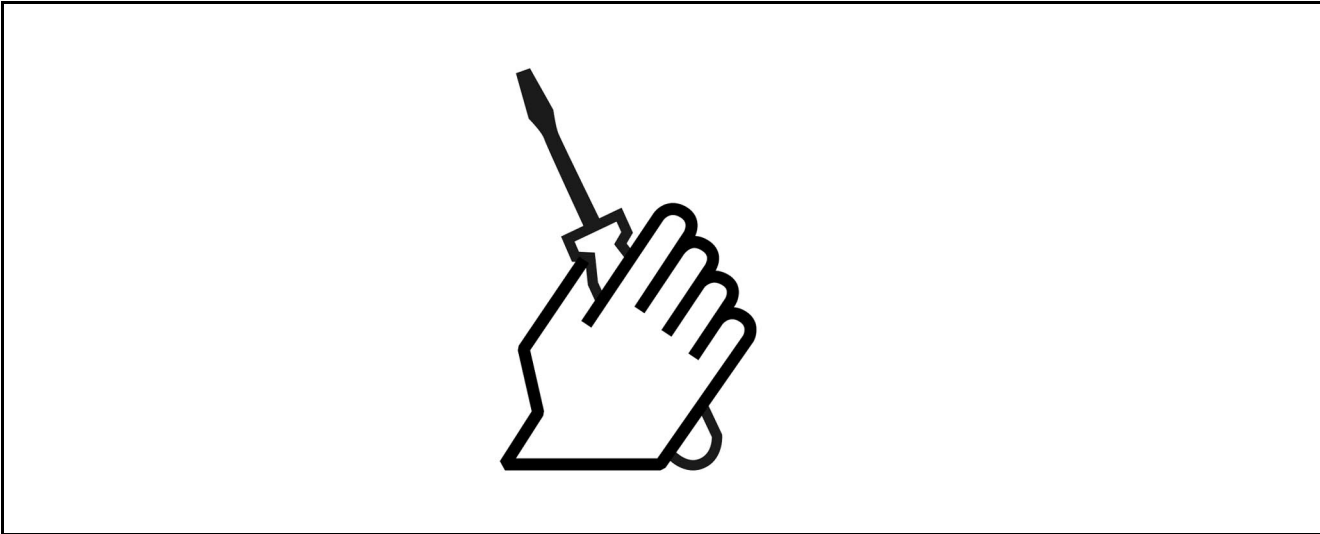
How to Install

□ About How to Install

This chapter covers mechanical and electrical installations to and from power terminals and control card terminals.

Electrical installation of *options* is described in the corresponding Instructions.

□ How to get started

You can carry out a quick and EMC-correct installation of the FC 300 by following the steps described below.

! Read the safety instructions before installing the unit.
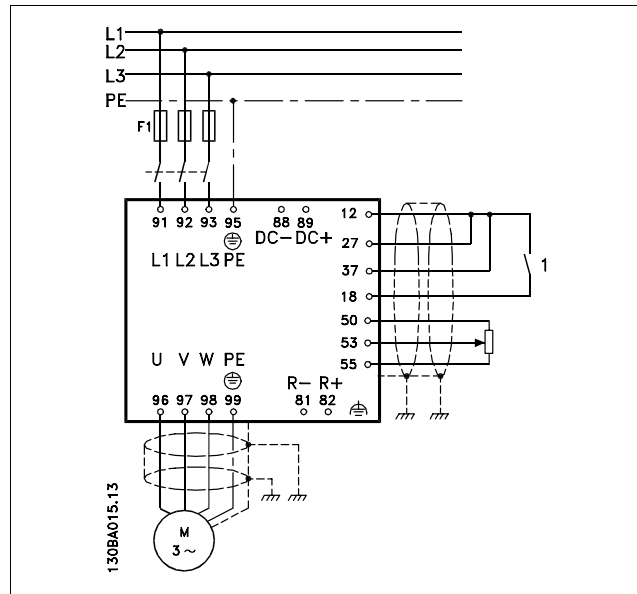
Diagram showing basic installation including mains, motor, start/stop key, and potentiometer for speed adjustment.

— How to Install —

□ **Accessory Bag**

Find the following parts included in the FC 300 Accessory Bag.

130BT309.11
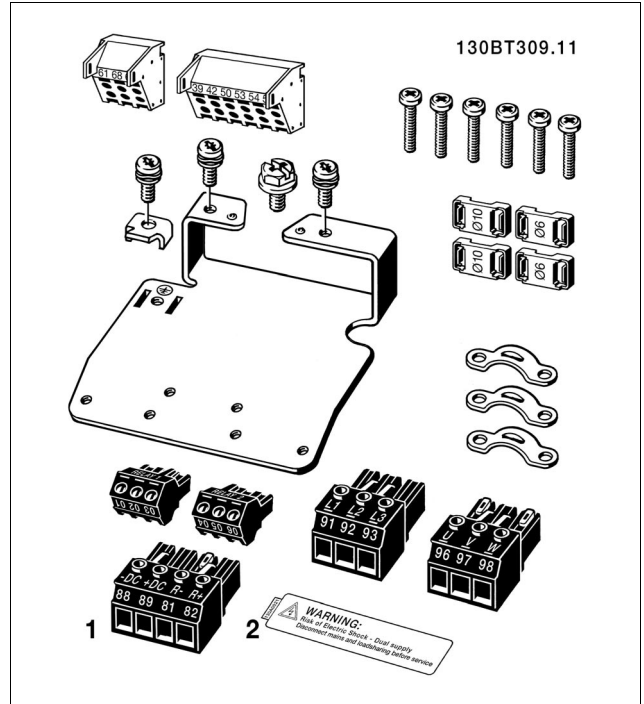
1 + 2 only available in units with brake chopper.

□ **Mechanical Installation**

Mechanical dimensions		Frame size B	Frame size C
		0.25-2.2 kW	3.0-3.7 kW
		(200-240 V)	(200-240 V)
		0.37-4.0 kW	5.5-7.5 kW
		(380-500 V)	(380-500 V)
			0.75-7.5 kW
			(550-600 V)
Height			
Height of back plate	A	268 mm	268 mm
Distance between mounting holes	a	257 mm	257 mm
Width			
Width of back plate	B	90 mm	130 mm
Distance between mounting holes	b	70 mm	110 mm
Depth			
From back plate to front	C	220 mm	220 mm
With option A/B		220 mm	220 mm
Without options		205 mm	205 mm
Screw holes			
	c	8.0 mm	8.0 mm
	d	ø 11 mm	ø 11 mm
	e	ø 5.5 mm	ø 5.5 mm
	f	6.5 mm	6.5 mm
Max weight		4.9 kg	6.6 kg

130BT303
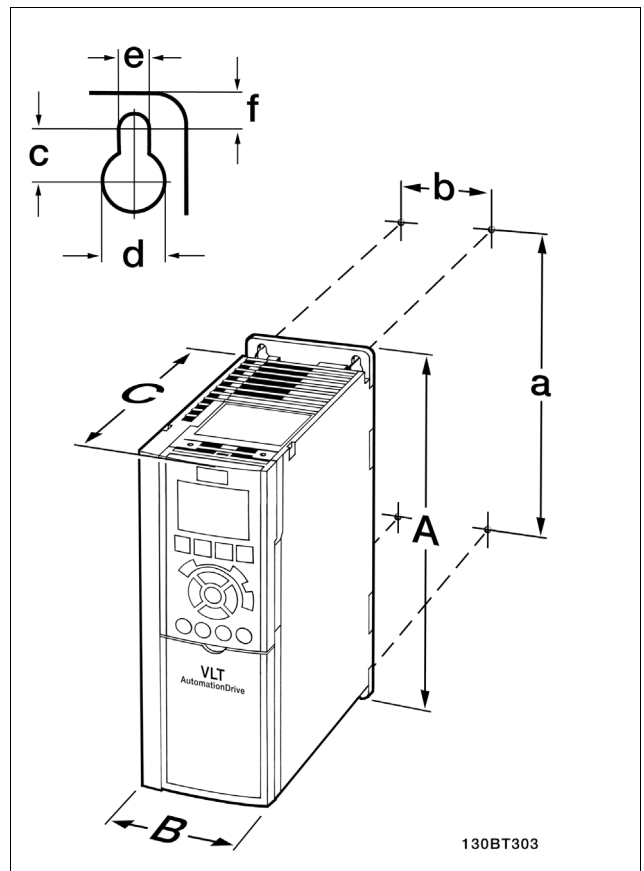
FC 300 IP20 - see accompanying table for mechanical dimensions.

— How to Install —

1. Drill holes in accordance with the measurements given.
2. You must provide screws suitable for the surface on which you want to mount the FC 300. Retighten all four screws.

For installation of IP21/TYPE 1/IP4X top and bottom - see the Option Guide enclosed with the FC 300.

FC 300 IP20 allows side-by-side installation. Because of the need for cooling, there must be a minimum of 100 mm free air passage above and below the FC 300.

Electrical Installation

Connection to Mains and Earthing

NB!:
The plug connector for power can be removed.

1. Make sure the FC 300 is properly earthed. Connect to earth connection (terminal 95). Use screw from the accessory bag.
2. Place plug connector 91, 92, 93 from the accessory bag onto the terminals labelled MAINS at the bottom of FC 300.
3. Connect mains wires to the mains plug connector.

! The earth connection cable cross section must be at least 10 mm^2 or 2 rated mains wires terminated separately.
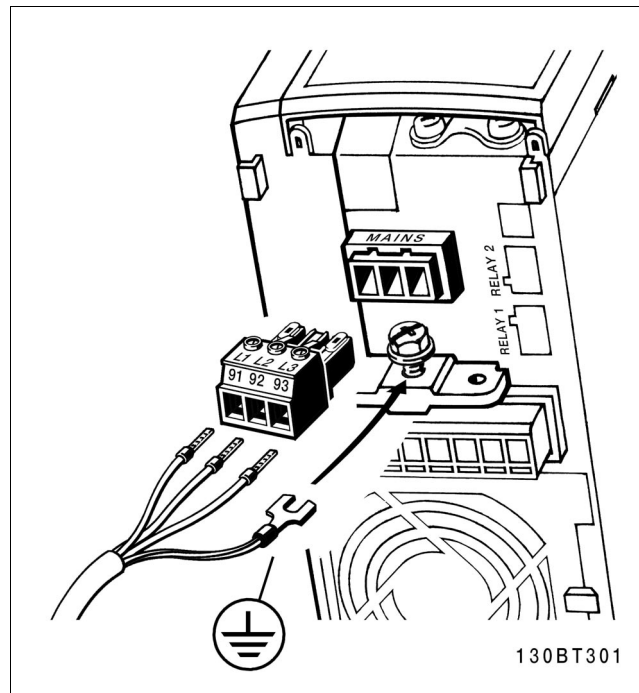
How to connect to mains and earthing.

NB!:
Check that mains voltage corresponds to the mains voltage of the FC 300 name plate.

⚠ IT Mains

Do not connect 400 V units with RFI-filters to mains supplies with a voltage between phase and earth of more than 440 V. For IT mains and delta earth (grounded leg), mains voltage may exceed 440 V between phase and earth.
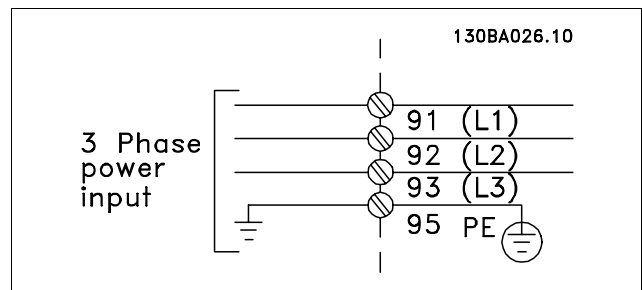

Terminals for mains and earthing.

☐ Motor Connection

NB!:
Motor cable must be screened/armoured. If an unscreened/unarmoured cable is used, some EMC requirements are not complied with. For more information, see *EMC specifications* in the *VLT AutomationDrive FC 300 Design Guide*.

1. Fasten decoupling plate to the bottom of FC 300 with screws and washers from the accessory bag.

130BT300
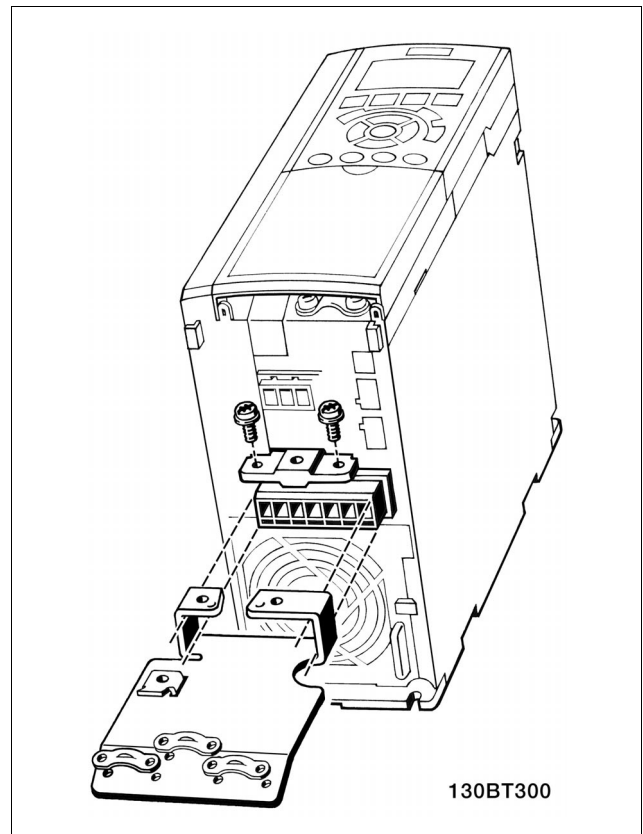
2. Attach motor cable to terminals 96 (U), 97 (V), 98 (W).
3. Connect to earth connection (terminal 99) on decoupling plate with screws from the accessory bag.
4. Insert plug connectors 96 (U), 97 (V), 98 (W) and motor cable to terminals labelled MOTOR.
5. Fasten screened cable to decoupling plate with screws and washers from the accessory bag.

130BT302
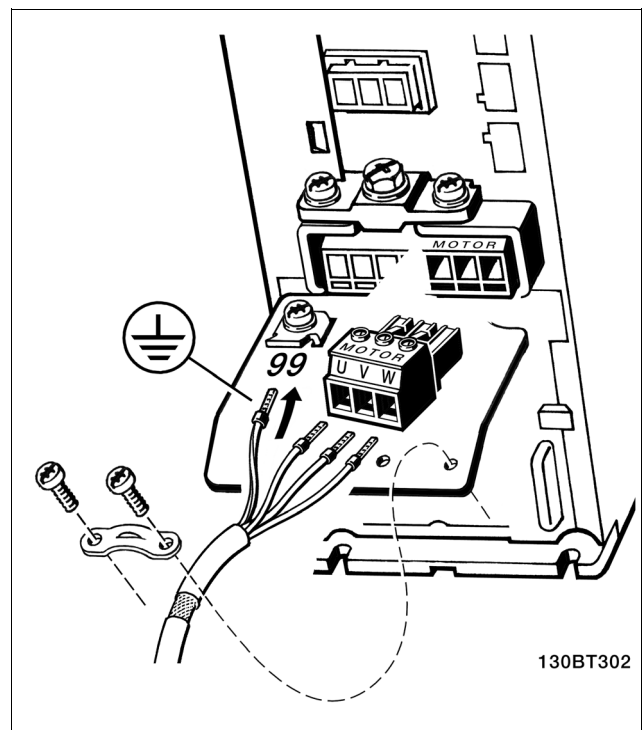
No.	96	97	98	Motor voltage 0-100%
	U	V	W	of mains voltage.
				3 wires out of motor
	U1	V1	W1	6 wires out of motor, Delta-connected
	W2	U2	V2	
	U1	V1	W1	6 wires out of motor, Star-connected
				U2, V2, W2 to be interconnected separately
No.	99			Earth connection
	PE			

All types of three-phase asynchronous standard motors can be connected to the FC 300. Normally, small motors are star-connected (230/400 V, △/Y). Large motors are normally delta-connected (400/690 V, △/Y). Refer to the motor name plate for correct connection mode and voltage.
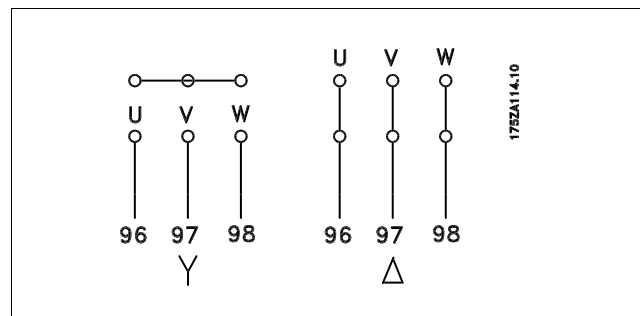
NB!:
In motors without phase insulation paper or other insulation reinforcement suitable for operation with voltage supply (such as a frequency converter), fit an LC filter on the output of the FC 300.

□ **Motor Cables**
See chapter *General Specifications* for correct dimensioning of motor cable cross-section and length. Always comply with national and local regulations on cable cross-section.

- Use a screened/armoured motor cable to comply with EMC emission specifications unless otherwise stated for the RFI filter used.
- Keep the motor cable as short as possible to reduce the noise level and leakage currents.
- Connect the motor cable screen to the decoupling plate of the FC 300 and to the metal cabinet of the motor.
- Make the screen connections with the largest possible surface area (cable clamp). This is done by using the supplied installation devices in the FC 300.
- Avoid mounting with twisted screen ends (pigtails), which will spoil high frequency screening effects.
- If it is necessary to split the screen to install a motor isolator or motor relay, the screen must be continued with the lowest possible high frequency impedance.

— How to Install —

☐ **Fuses**

Branch circuit protection:

In order to protect the installation against electrical and fire hazard, all branch circuits in an installation, switch gear, machines etc., must be shortcircuit and overcurrent protected according to the national/international regulations.

Short circuit protection:

The frequency converter must be protected against short-circuit to avoid electrical or fire hazard. Danfoss recommends using the fuses mentioned below to protect service personnel or other equipment in case of an internal failure in the drive. The frequency converter provides full short circuit protection in case of a short-circuit on the motor output.

Over current protection:

Provide overload protection to avoid fire hazard due to overheating of the cables in the installation. The frequency converter is equipped with an internal over current protection that can be used for upstream overload protection (UL-applications excluded). See par. 4-18. Moreover, fuses or circuit breakers can be used to provide the over current protection in the installation. Over current protection must always be carried out according to national regulations.

To comply with UL/cUL approvals, use pre-fuses according to the tables below.

200-240 V

VLT	Bussmann	Bussmann	Bussmann	SIBA	Littel fuse	Ferraz-Shawmut	Ferraz-Shawmut
	Type RK1	Type J	Type T	Type RK1	Type RK1	Type CC	Type RK1
K2-K75	KTN-R10	JKS-10	JJN-10	5017906-010	KLN-R10	ATM-R10	A2K-10R
1K1-2K2	KTN-R20	JKS-20	JJN-20	5017906-020	KLN-R20	ATM-R20	A2K-20R
3K0-3K7	KTN-R30	JKS-30	JJN-30	5012406-032	KLN-R30	ATM-R30	A2K-30R

380-500 V, 525-600 V

VLT	Bussmann	Bussmann	Bussmann	SIBA	Littel fuse	Ferraz-Shawmut	Ferraz-Shawmut
	Type RK1	Type J	Type T	Type RK1	Type RK1	Type CC	Type RK1
K37-1K5	KTS-R10	JKS-10	JJS-10	5017906-010	KLS-R10	ATM-R10	A6K-10R
2K2-4K0	KTS-R20	JKS-20	JJS-20	5017906-020	KLS-R20	ATM-R20	A6K-20R
5K5-7K5	KTS-R30	JKS-30	JJS-30	5012406-032	KLS-R30	ATM-R30	A6K-30R

KTS-fuses from Bussmann may substitute KTN for 240 V frequency converters.
FWH-fuses from Bussmann may substitute FWX for 240 V frequency converters.
KLSR fuses from LITTEL FUSE may substitute KLNR fuses for 240 V frequency converters.
L50S fuses from LITTEL FUSE may substitute L50S fuses for 240 V frequency converters.
A6KR fuses from FERRAZ SHAWMUT may substitute A2KR for 240 V frequency converters.
A50X fuses from FERRAZ SHAWMUT may substitute A25X for 240 V frequency converters.

Danfoss

— How to Install —

Non UL compliance

If UL/cUL is not to be complied with, we recommend using the following fuses, which will ensure compliance with EN50178:
In case of malfunction, not following the recommendation may result in unnecessary damage of the frequency converter. Fuses must be designed for protection in a circuit capable of supplying a maximum of 100,000 A$_{rms}$ (symmetrical), 500 V maximum.

VLT	Max. fuse size	Voltage	Type
K25-K75	10A[1]	200-240 V	type gG
1K1-2K2	20A[1]	200-240 V	type gG
3K0-3K7	32A[1]	200-240 V	type gG
K37-1K5	10A[1]	380-500V	type gG
2K2-4K0	20A[1]	380-500V	type gG
5K5-7K5	32A[1]	380-500V	type gG

1) Max. fuses - see national/international regulations for selecting an applicable fuse size.

□ **Access to Control Terminals**

All terminals to the control cables are located underneath the terminal cover on the front of the frequency converter. Remove the terminal cover by means of a screwdriver (see illustration).

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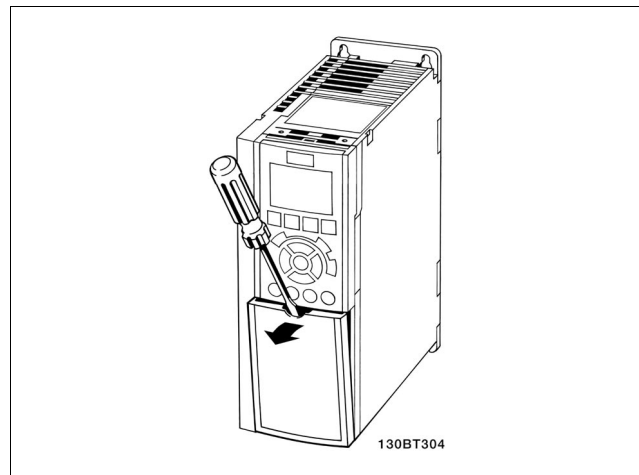
□ **Electrical Installation, Control Terminals**

1. Mount terminals from the accessory bag to the front of the FC 300.
2. Connect terminals 18, 27, and 37 to +24 V (terminal 12/13) with the control cable.

   Default settings:
   18 = start
   27 = coast inverse
   37 = safe stop inverse

130BT306
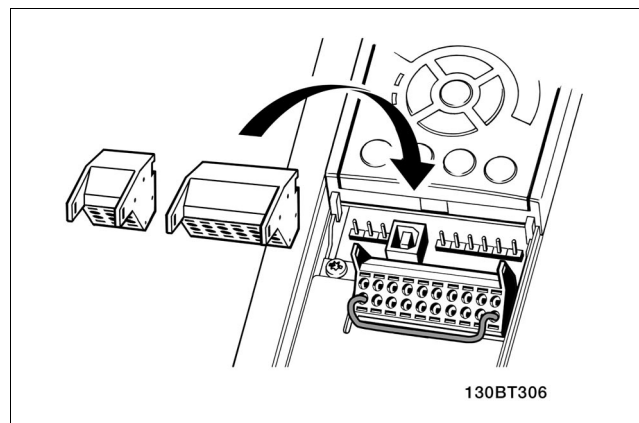
─ How to Install ─

NB!:
To mount the cable to the terminal:

1. Strip isolation of 1-10 mm
2. Insert a screw driver in the square hole.
3. Insert the cable in the adjacent circular hole.
4. Remove the screw driver. The cable is now mounted to the terminal.
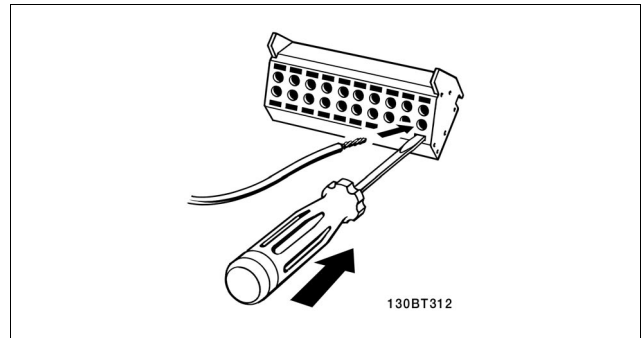
NB!:
To remove the cable from the terminal:

1. Insert a screw driver in the square hole.
2. Pull out the cable.
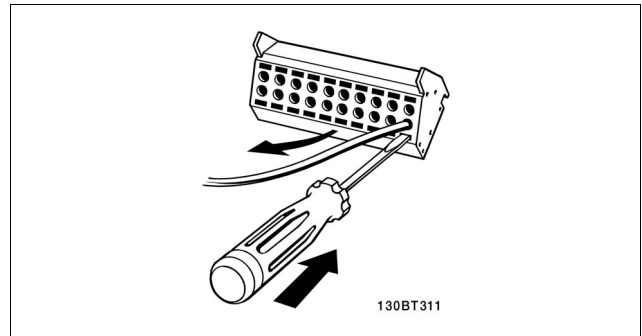
□ **Control Terminals**
Drawing reference numbers:

1. 10 pole plug digital I/O.
2. 3 pole plug RS485 Bus.
3. 6 pole analog I/O.
4. USB Connection.
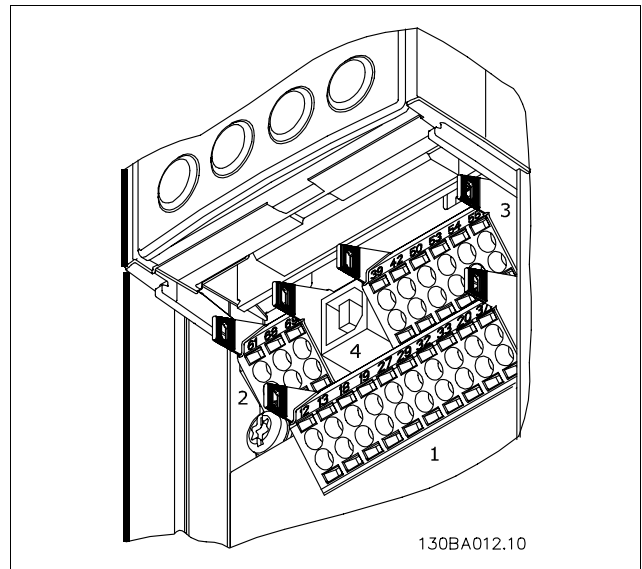
Control terminals

Danfoss

— How to Install —

□ **Electrical Installation, Control Cables**
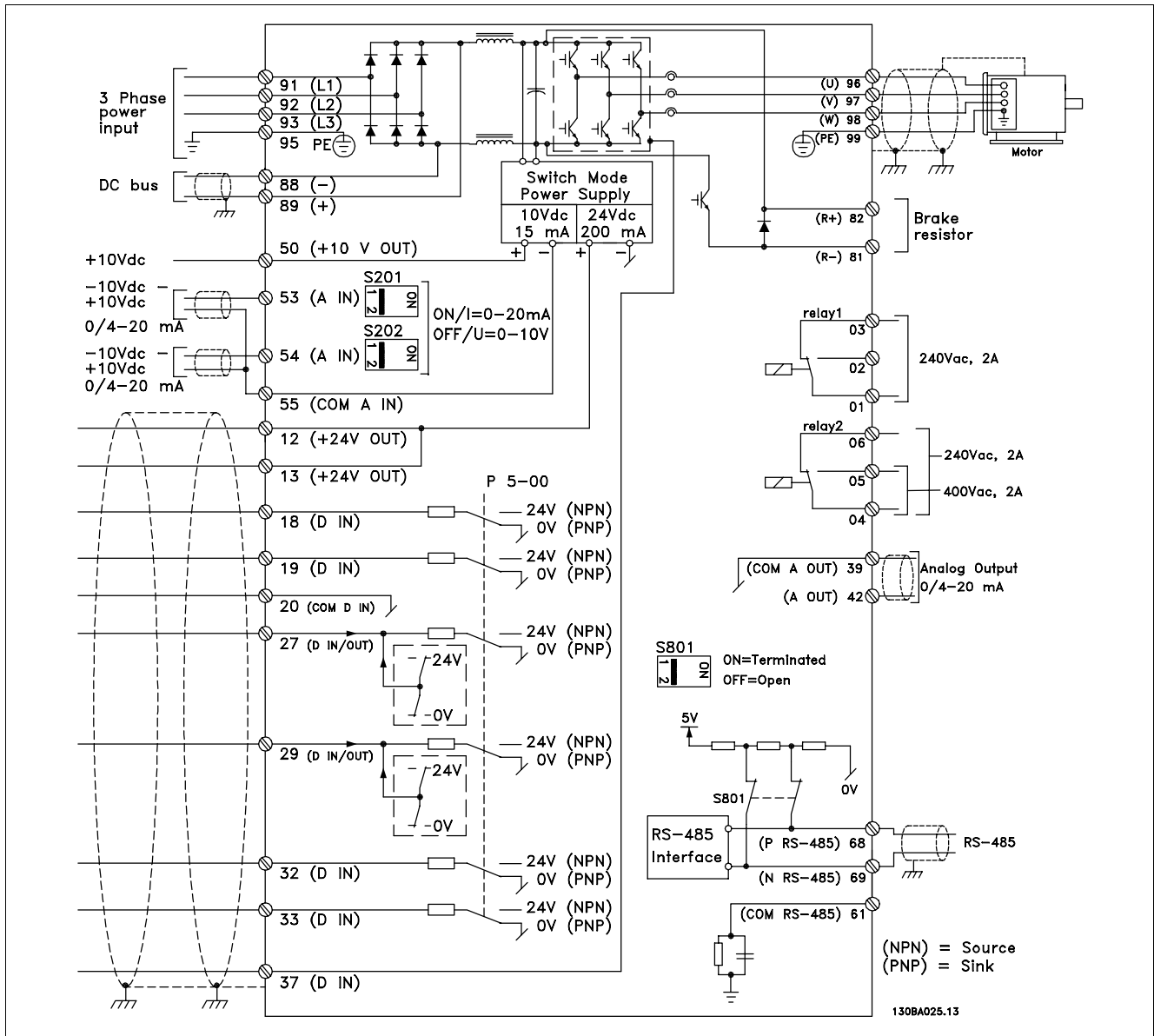
Diagram showing all electrical terminals. Terminal 37 is not included in FC 301.

Very long control cables and analogue signals may in rare cases and depending on installation result in 50/60 Hz earth loops due to noise from mains supply cables.

If this occurs, you may have to break the screen or insert a 100 nF capacitor between screen and chassis.

Common for the digital and analog in- and outputs must be connected separately to avoid common mode currents from one group (i.e. the digital inputs) to affect other groups (i.e. the analog inputs).

— How to Install —

NB!:
Control cables must be screened/armoured.

1. Use a clamp from the accessory bag to connect the screen to the decoupling plate for control cables.

See section entitled *Earthing of screened/armoured control cables* in the *VLT AutomationDrive FC 300 Design Guide* for the correct termination of control cables.

130BT305
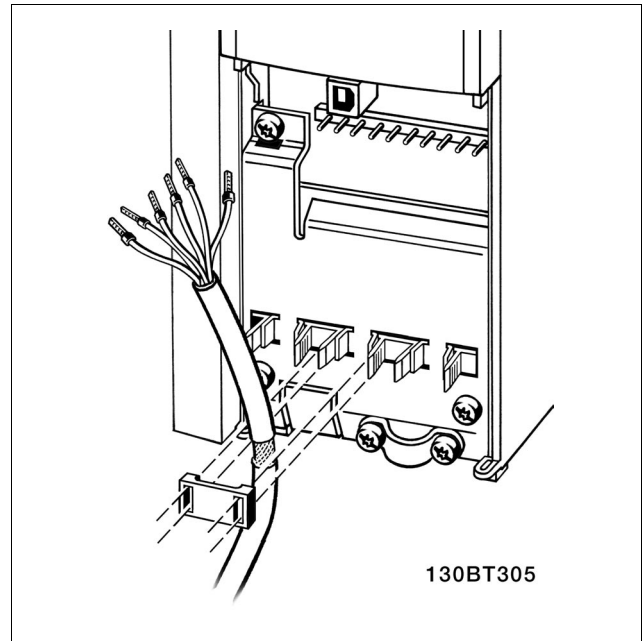
□ **Switches S201, S202, and S801**
Switches S201 (A53) and S202 (A54) are used to select a current (0-20 mA) or a voltage (-10 to 10 V) configuration of the analogue input terminals 53 and 54 respectively.

Switch S801 (BUS TER.) can be used to enable termination on the RS-485 port (terminals 68 and 69).

See drawing *Diagram showing all electrical terminals* in section *Electrical Installation.*

Default setting:

S201 (A53) = OFF (voltage input)
S202 (A54) = OFF (voltage input)
S801 (Bus termination) = OFF

130BT310
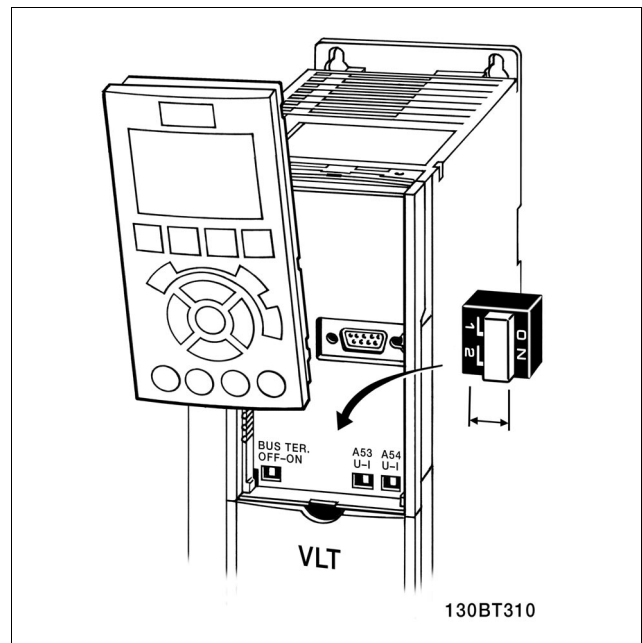
□ **Tightening Torques**
Tighten connected terminals with the following torques:

FC 300	Connections	Torque (Nm)
	Motor, mains, brake, DC Bus, Decoupling Plate screws	2-3
	Earth, 24 V DC	2-3
	Relay	0.5-0.6

☐ **Final Set-Up and Test**

To test the set-up and ensure that the frequency converter is running, follow these steps.

Step 1. Locate the motor name plate.

NB!:
The motor is either star- (Y) or delta-connected (Δ). This information is located on the motor name plate data.

BAUER D-73734 ESLINGEN

3 ∼ MOTOR NR. 1827421		2003	
BFSO-04/009LA4			
S/E005A9			
	1,5	kW	
31,5	/min.	400 Y	V
1400	/min.	50	Hz
0,60		3,6	A
1,7L			
B	IP 65	H1/1A	

130BT307
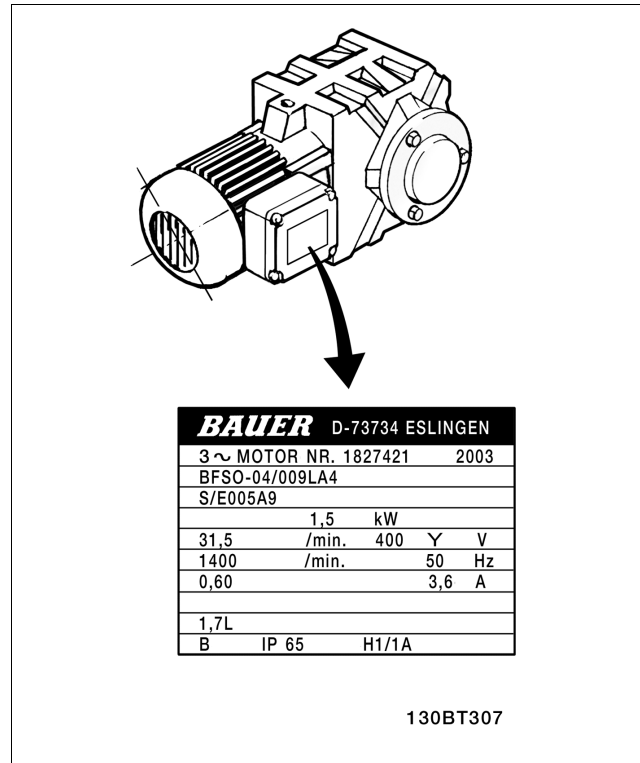
Step 2. Enter the motor name plate data in this parameter list.
To access this list first press the [QUICK MENU] key then select "Q2 Quick Setup".

1.	Motor power [kW]	parameter 1-20
2.	Motor voltage	parameter 1-22
3.	Motor frequency	parameter 1-23
4.	Motor current	parameter 1-24
5.	Motor nominal speed	parameter 1-25

Step 3. Activate the Automatic Motor Adaptation (AMA)
We recommend running an AMA to ensure optimum performance. The AMA measures the values from the motor model equivalent diagram.

1. Connect terminal 37 to terminal 12.
2. Start the frequency converter and activate the AMA parameter 1-29.
3. Choose between complete or reduced AMA. If an LC filter is mounted, run only the reduced AMA.
4. Press the [OK] key. The display shows "Press hand to start".
5. Press the [Hand on] key. A progress bar placed at the bottom of the display indicates if the AMA is in progress.

Stop the AMA during operation

1. Press the [OFF] key - the frequency converter enters into alarm mode and the display shows that the AMA was terminated by the user.

— How to Install —

Successful AMA

1. The display shows "Press [OK] to finish AMA".
2. Press the [OK] key to exit the AMA state.

Unsuccessful AMA

1. The frequency converter enters into alarm mode. A description of the alarm can be found in the *Troubleshooting* section.
2. "Report Value" in the [Alarm Log] shows the last measuring sequence carried out by the AMA, before the frequency converter entered alarm mode. This number along with the description of the alarm will assist you in troubleshooting. If you contact Danfoss Service, make sure to mention number and alarm description.

NB!:
Unsuccessful AMA is often caused by incorrectly registered motor name plate data.

Step 4. Set speed limit and ramp time

Set up the desired limits for speed and ramp time.

Minimum reference	parameter 3-02
Maximum reference	parameter 3-03

Motor speed low limit	parameter 4-11 or 4-12
Motor speed high limit	parameter 4-13 or 4-14

Ramp-up time 1 [s]	parameter 3-41
Ramp-down time 1 [s]	parameter 3-42

□ **Additional Connections**

□ **24 V Back-up Option**
Terminal numbers:

Terminal 35: - external 24 V DC supply.
Terminal 36: + external 24 V DC supply.

1. Attach 24 V DC cable to the 24 V plug connector.
2. Insert plug connector into terminals labellled 35, 36.
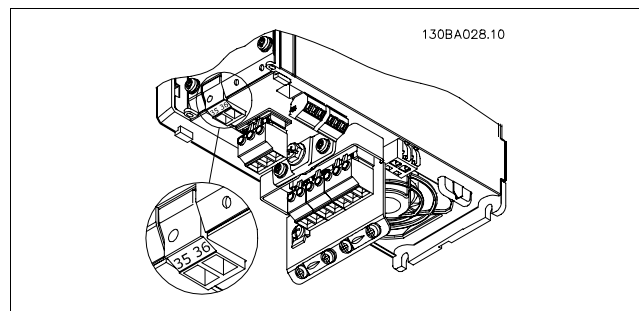
Connection to 24 V back-up supply.

— How to Install —

□ Load Sharing

With load sharing you can connect several FC 300's DC intermediate circuits if you extend the installation using extra fuses and AC coils (see illustration).
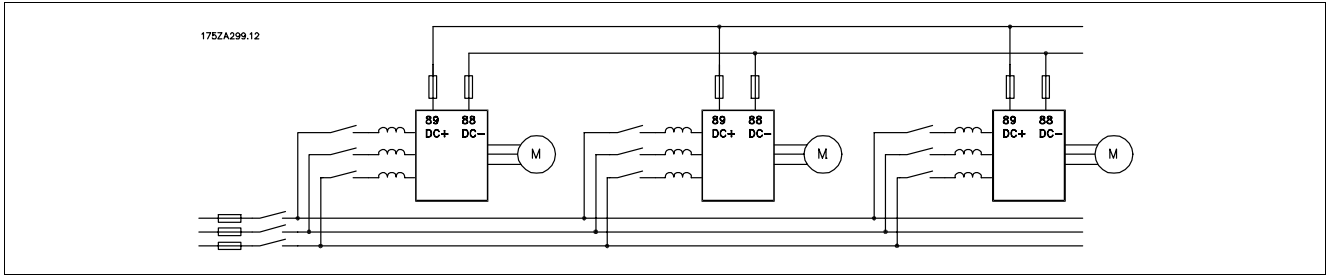
NB!:
Load sharing cables must be screened/armoured. If an unscreened/unarmoured cable is used, some EMC requirements are not complied with. For more information, see *EMC specifications* in the *VLT AutomationDrive FC 300 Design Guide*.

Voltage levels of up to 975 V DC may occur between terminals 88 and 89.

No.	88	89	Loadsharing / DC link
	DC -	DC +	Terminals

□ Brake Connection Option

The connection cable to the brake resistor must be screened/armoured.

No.	81	82	Brake resistor
	R-	R+	terminals

1. Use cable clamps to connect the screen to the metal cabinet of the frequency converter and to the decoupling plate of the brake resistor.
2. Dimension the cross-section of the brake cable to match the brake current.

NB!:
Voltages up to 975 V DC may occur between the terminals.

NB!:
If a short circuit in the brake resistor occurs, prevent power dissipation in the brake resistor by using a mains switch or contactor to disconnect the mains for the frequency converter. Only the frequency converter can control the contactor.

Danfoss

— How to Install —

□ Relay Connection

To set relay output, see parameter group 5-4* Relays.

No.		
	01 - 02	make (normally open)
	01 - 03	break (normally closed)
	04 - 05	make (normally open)
	04 - 06	break (normally closed)

130BA029.11
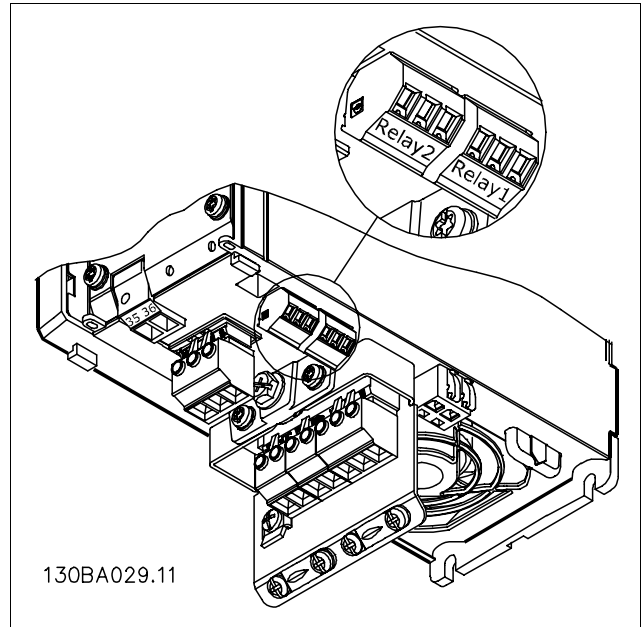
Terminals for relay connection.

□ Control of Mechanical Brake

In hoisting/lowering applications, you need to be able to control an electro-mechanical brake.

- Control the brake using any relay output or digital output (terminal 27 or 29).
- Keep the output closed (voltage-free) as long as the frequency converter is unable to 'support' the motor, for example due to the load being too heavy.
- Select *Mechanical brake control* [32] in par. 5-4* for applications with an electro-mechanical brake.
- The brake is released when the motor current exceeds the preset value in par. 2-20.
- The brake is engaged when the output frequency is less than the frequency set in par. 2-21 or 2-22, and only if the frequency converter carries out a stop command.

If the frequency converter is in alarm mode or in an overvoltage situation, the mechanical immediately brake cuts in.

— How to Install —

□ **Parallel connection of motors**

The FC 300 is able to control several parallel-connected motors. The total current consumption of the motors must not exceed the rated output current I_{INV} for the FC 300.
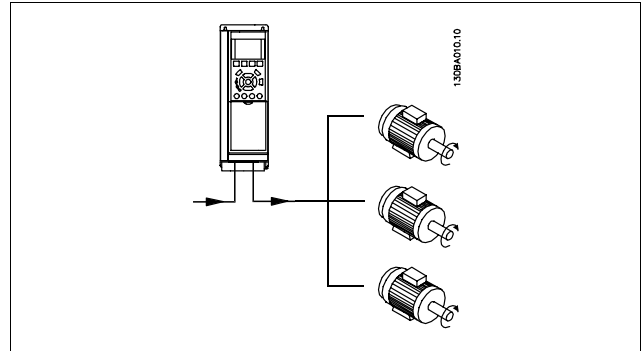
Problems may arise at start and at low RPM values if motor sizes are widely different because small motors' relatively high ohmic resistance in the stator calls for a higher voltage at start and at low RPM values.

The electronic thermal relay (ETR) of the FC 300 cannot be used as motor protection for the individual motor in systems with motors connected in parallel. Further motor protection must be provided, e.g. thermistors in each motor or individual thermal relays. (Circuit breakers are not suitable as protection).

NB!:
When motors are connected in parallel, parameter 1-29 *Automatic motor adaptation (AMA)* cannot be used.

For more information, see *VLT AutomationDrive FC 300 Design Guide.*

□ **Motor Thermal Protection**

The electronic thermal relay in FC 300 has received the UL-approval for single motor protection, when par. 1-90 *Motor Thermal Protection* is set for *ETR Trip* and par. 1-24 *Motor current, $I_{M,N}$* is set to the rated motor current (see motor name plate).

How to Programme
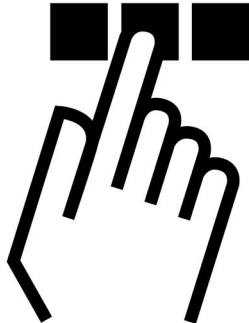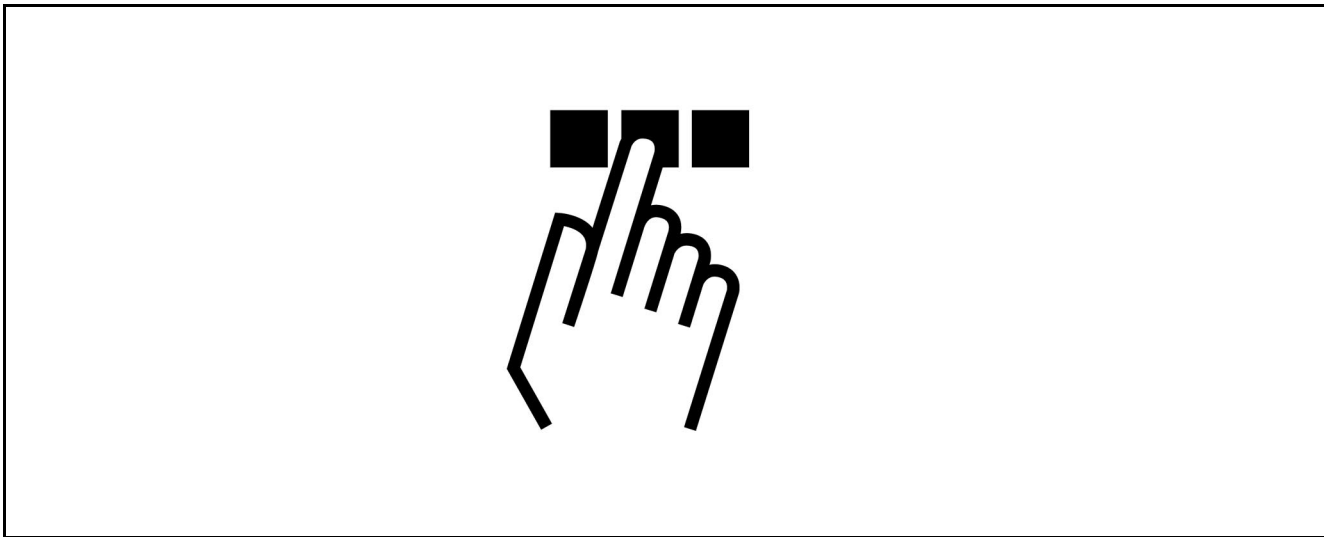
□ **How to Programme on the Local Control Panel**
In the following instructions we assume you have a graphical LCP (LCP 102):

The control panel is divided into four functional groups:
1. Graphical display with Status lines.
2. Menu keys and indicator lights - changing parameters and switching between display functions.
3. Navigation keys and indicator lights (LEDs).
4. Operation keys and indicator lights (LEDs).

All data is displayed in a graphical LCP display, which can show up to five items of operating data while displaying [Status].

Display lines:

a. **Status line:** Status messages displaying icons and graphic.
b. **Line 1-2:** Operator data lines displaying data defined or chosen by the user. By pressing the [Status] key, up to one extra line can be added.
c. **Status line:** Status messages displaying text.
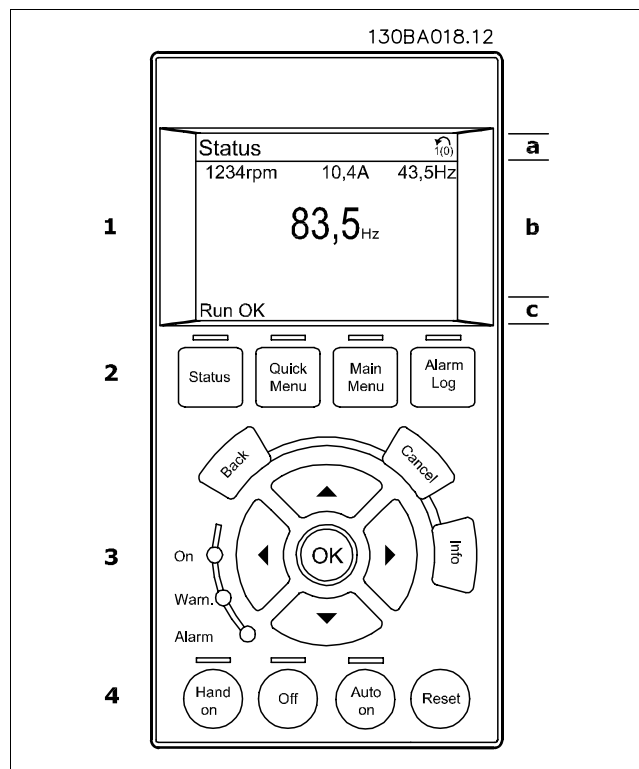
Indicator lights (LEDs):

- Green LED/On: Indicates if control section is working.
- Yellow LED/Warn.: Indicates a warning.
- Flashing Red LED/Alarm: Indicates an alarm.

— How to Programme —

Most FC 300 parameter set-ups can be changed immediately via the control panel, unless a password has been created via par. 0-60 *Main Menu Password* or via par. 0-65 *Quick Menu Password*.

LCP keys

[Status] indicates the status of the frequency converter or the motor. You can choose between 3 different read-outs by pressing the [Status] key:
5 line readouts, 4 line readouts or Smart Logic Controller.

[Quick Menu] allows quick access to different Quick Menus such as:

- My Personal Menu
- Quick Set-up
- Changes Made
- Loggings

[Main Menu] is used for programming all parameters.

[Alarm Log] displays an Alarm list of the five latest alarms (numbered A1-A5). To obtain additional details about an alarm, use the arrow keys to manoeuver to the alarm number and press [OK]. You will now receive information about the condition of your frequency converter right before entering the alarm mode.

[Back] takes you to the previous step or layer in the navigation structure.

[Cancel] annuls your last change or command as long as the display has not been changed.

[Info] supplies information about a command, parameter, or function in any display window. Exit info mode by pressing either [Info], [Back], or [Cancel].

[OK] is used for choosing a parameter marked by the cursor and for confirming the change of a parameter.

[Hand On] enables control of the frequency converter via the LCP. [Hand on] also starts the motor, and it is now possible to enter the motor speed data by means of the arrow keys. The key can be selected as Enable [1] or Disable [0] via par. *0-40 [Hand on] key on LCP.*
External stop signals activated by means of control signals or a serial bus will override a "start" command given via the LCP.

[Off] is used for stopping the connected motor. The key can be selected as Enable [1] or Disable [0] via par. *0-41 [Off] key on LCP.*

[Auto On] is used if the frequency converter is to be controlled via the control terminals and/or serial communication. When a start signal is active on the control terminals and/or the bus, the frequency converter will start. The key can be selected as Enable [1] or Disable [0] via par. *0-42 [Auto on] key on LCP.*

[Reset] is used for resetting the frequency converter after an alarm (trip). It can be selected as *Enable* [1] or *Disable* [0] via par. 0-43 *Reset Keys on LCP*.

Arrow keys are used for manoeuvering between commands and within parameters.

The parameter shortcut can be carried out by holding down the [Main Menu] key for 3 seconds. The parameter shortcut allows direct access to any parameter.

☐ **Quick Transfer of Parameter Settings**

Once the set-up of a drive is complete, we recommend that you store the data in the LCP or on a PC via MCT 10 Set-up Software Tool.

130BA027.10
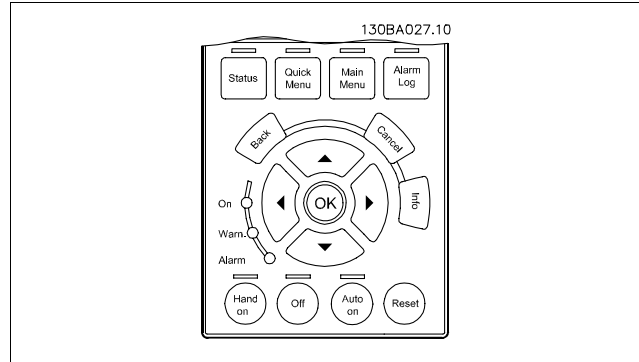
Data storage in LCP:

1. Go to par. 0-50 LCP copy
2. Press the [OK] key
3. Select "All to LCP"
4. Press the [OK] key

All parameter settings are now stored in the LCP indicated by the progress bar. When 100% is reached, press [OK].

NB!:
Stop the unit before performing this operation.

You can now connect the LCP to another frequency converter and copy the parameter settings to this frequency converter as well.

Data transfer from LCP to drive:

1. Go to par. 0-50 LCP copy
2. Press the [OK] key
3. Select "All from LCP"
4. Press the [OK] key

The parameter settings stored in the LCP are now transferred to the drive indicated by the progress bar. When 100% is reached, press [OK].

NB!:
Stop the unit before performing this operation.

☐ **Reset to Default Setting**
To restore all parameter values to their default setting go to par. 14-22 *Operating Mode* and select Initialisation. Power down the frequency converter. The frequency converter will automatically restore to default settings during the next power up.

― How to Programme ―

□ **Adjust Display Contrast**

Hold down [STATUS] and use the up or down navigation arrow to adjust the display contrast

□ **How to Connect a PC to the FC 300**

To control the frequency converter from a PC, install the MCT 10 Set-up Software.

The PC is connected via a standard (host/device) USB cable, or via the RS485 interface as shown in the section *Bus Connection* in the chapter *How to Programme*.

130BT308
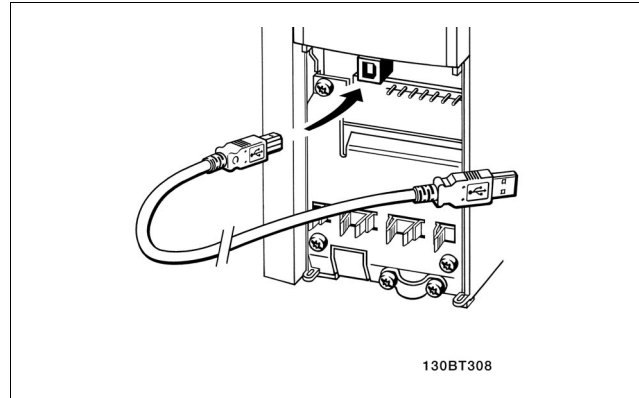
USB connection.

□ **The FC 300 Software Dialogue**
Data storage in PC via MCT 10 Set-Up Software:

1. Connect a PC to the unit via USB com port
2. Open MCT 10 Set-up Software
3. Choose "Read from drive"
4. Choose "Save as"

All parameters are now stored.

Data transfer from PC to drive via MCT 10 Set-Up Software:

1. Connect a PC to the unit via USB com port
2. Open MCT 10 Set-up software
3. Choose "Open" – stored files will be shown
4. Open the appropriate file
5. Choose "Write to drive"

All parameters are now transferred to the drive.

A separate manual for MCT 10 Set-up Software is available.

— How to Programme —

□ Connection Examples

□ Start/Stop
Terminal 18 = start/stop
Terminal 37 = coasting stop (safe)
Terminal 27 = coast inverse

    Par. 5-10 *Digital input = Start* (default)
    Par. 5-12 *Digital input = coast inverse*(default)

12	+24V
18	Par. 5-10
19	
27	Par. 5-12
37	

130BA019.12
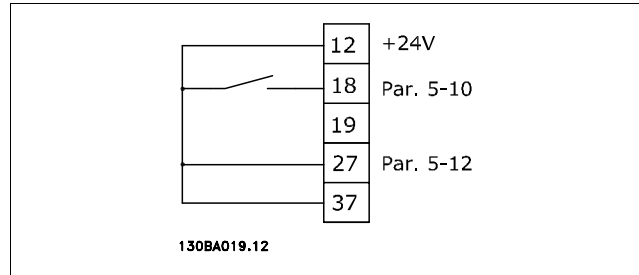
□ Pulse Start/Stop
Terminal 18 = latched start
Terminal 27= stop inverse

    Par. 5-10 *Digital input = Latched start*
    Par. 5-12 *Digital input = Stop inverse*

12	+24V
18	Par. 5-10
27	Par. 5-12
37	

130BA020.12
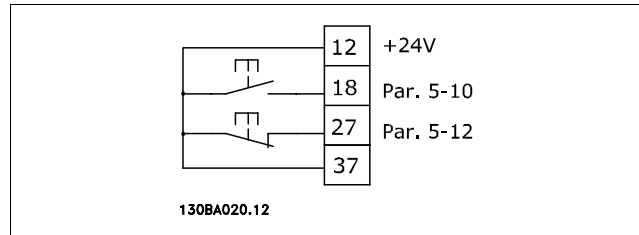
□ Speed Up/Down
Terminals 29/32 = Speed up/down.

    Par. 5-10 *Digital Input = Start*(default)
    Par. 5-12 *Digital input = Freeze reference*
    Par. 5-13 *Digital input = Speed up*
    Par. 5-14 *Digital input = Speed down*

12	+24V
18	Par. 5-10
27	Par. 5-12
29	Par. 5-13
32	Par. 5-14
37	

130BA021.12
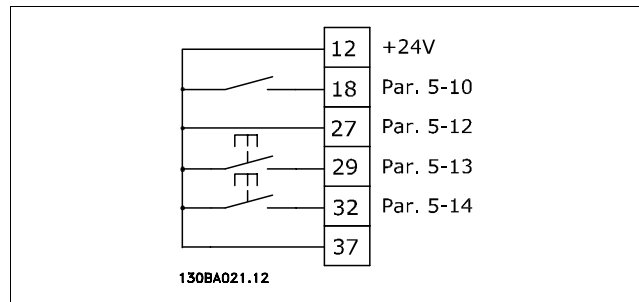
□ Potentiometer reference
Voltage reference via a potentiometer.

    Par. 3-15 *Reference resource 1 = Analog input 53* (default)
    Par. 6-10 *Terminal 53, low voltage* = 0 Volt (default)
    Par. 6-11 *Terminal 53, high voltage* = 10 Volt (default)
    Par. 6-14 *Terminal 53, low ref./feedb. value* = 0 RPM (default)
    Par. 6-15 *Terminal 53, high ref./feedb. value* = 1.500 RPM
    Switch S201 = OFF (U)

50	+10V out
53	
55	⊥

1kΩ

130BA022.13

— How to Programme —
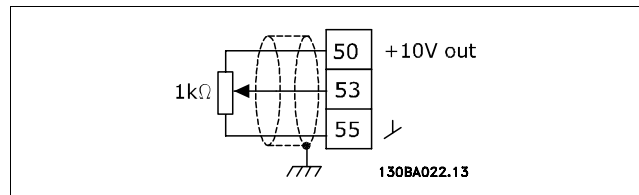
Basic Parameters

0-01 Language

Option:

✱ English (ENGLISH)	[0]
German (DEUTSCH)	[1]
French (FRANCAIS)	[2]
Danish (DANSK)	[3]
Spanish (ESPANOL)	[4]
Italian (ITALIANO)	[5]
Chinese (CHINESE)	[10]

Function:

Choose the desired LCP language.

1-20 Motor Power [kW]

Range:

0.37-7.5 kW	[Motor type dependent]

Function:

The value should equal the nameplate data on the connected motor. The default value corresponds to the nominal rated output of the unit.

NB!:
Changing the value in this parameter affects the setting of other parameters. Par. 1-20 cannot be changed while the motor is running.

1-22 Motor Voltage

Range:

200-600 V	[Motor type dependent]

Function:

The value should equal the nameplate data on the connected motor. The default value corresponds to the nominal rated output of the unit.

NB!:
Changing the value in this parameter affects the setting of other parameters. Par. 1-22 cannot be changed while the motor is running.

1-23 Motor Frequency

Option:

✱ 50 Hz (50 HZ)	[50]
60 Hz (60 HZ)	[60]
Min - Max motor frequency: 20 - 300 Hz	[60]

Function:

Select the stated value from the motor name plate. Alternatively, set the value for motor frequency to be infinitely variable. If a value different from 50 Hz or 60 Hz is selected, it is necessary to correct par. 1-50 to 1-54. For 87 Hz operation with 230/400 V motors, set the nameplate data for 230 V/50 Hz. Adapt par. 2-02 *Output Speed High Limit* and par. 2-05 *Maximum Reference* to the 87 Hz application.

NB!:
Changing the value in this parameter affects the setting of other parameters. Par. 1-23 cannot be changed while the motor is running.

NB!:
If a delta connection is used, select the rated motor frequency for the delta connection.

1-24 Motor current

Range:

Motor type dependent.	[60]

Function:

The value should equal the nameplate data on the connected motor. Data is used for calculating torque, motor protection etc.

NB!:
Changing the value in this parameter affects the setting of other parameters. Par. 1-24 cannot be changed while the motor is running.

1-25 Motor nominal speed

Range:

100. - 60000. RPM	✱ RPM

Function:

The value should equal the name plate data on the connected motor. The data is used for calculating motor compensations.

1-29 Automatic Motor Adaptation, (AMA)

Option:

✱ OFF	[0]
Enable complete AMA	[1]
Enable reduced AMA	[2]

Function:

If the AMA function is used, the frequency converter automatically sets the necessary control parameters (par. 1-30 to par. 1-35) with the motor stationary.

✱ default setting   ( ) display text   [ ] value for use in communication via serial communication port

— How to Programme —

AMA ensures optimum use of the motor. For the best possible adaptation of the frequency converter, run AMA on a cold motor.
Select *Enable complete AMA*, if the frequency converter is to carry out AMA of the stator resistance R_S, the rotor resistance R_r, the stator leakage reactance x_1, the rotor leakage reactance X_2 and the main reactance X_h.
Select *Reduced AMA* if a reduced test is to be carried out, in which only the stator resistance R_s in the system is determined.
AMA cannot be carried out while the motor is running.

Activate the AMA function by pressing [Hand on] after selecting [1] or [2]. See also section *Automatic Motor Adaptation*. After a normal sequence, the display will read, "Press [OK] to finish AMA". After pressing the [OK] key the frequency converter is now ready for operation.

NB!:
It is important to set motor par. 1-2* correctly, since these form part of the AMA algorithm. For optimum dynamic motor adaptation, an AMA must be carried out. It may take up to 10 min, depending on the power rating of the motor.

NB!:
Avoid externally generating torque during AMA.

NB!:
If one of the settings in par. 1-2* is changed, par. 1-30 to 1-39 will return to default setting.

| 3-02 Minimum Reference |

Range:

-100000.000 - par. 3-03   ✱0.000 Unit

Function:

The *Minimum reference* is the minimum value obtained by the sum of all references. *Minimum reference* is only active if *Min - Max* [0] is set in par. 3-00.
Speed control, closed loop: RPM Torque control, speed feedback: Nm

| 3-03 Maximum Reference |

Range:

Par. 3-02 - 100000.000   ✱1500.000 Unit

Function:

The *Maximum reference* is the highest value obtained by the sum of all references. The unit follows the choice of configuration in par. 1-00.
Speed control, closed loop: RPM
Torque control, speed feedback: Nm.

| 3-41 Ramp 1 Ramp-up Time |

Range:

0.01 - 3600.00 s   ✱ s

Function:

The ramp-up time is the acceleration time from 0 RPM to the rated motor speed nM,N (par. 1-23), provided that the output current does not reach the torque limit (set in par. 4-16). The value 0.00 corresponds to 0.01 s in speed mode.

130BA067.10
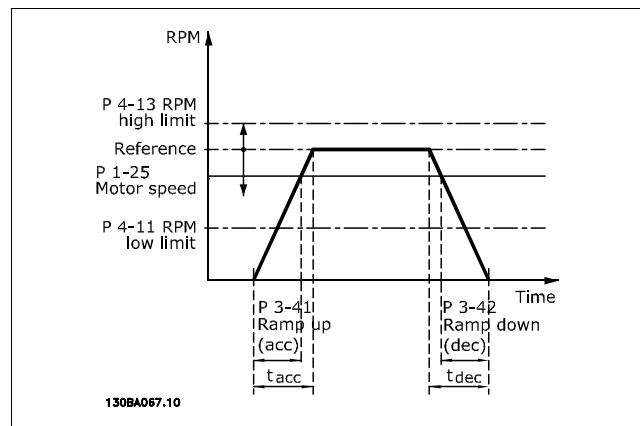
$$Par.\,3-41 = \frac{t_{acc} * n_{norm}\,[\,par.\,1-25\,]}{\triangle\,ref\,[RPM]}\,[s]$$

| 3-42 Ramp 1 ramp-down time |

Range:

0.01 - 3600.00 s   ✱ s

Function:

The ramp-down time is the deceleration time from the rated motor speed $n_{M,N}$ (par. 1-23) to 0 RPM, provided that there is no over-voltage in the inverter due to regenerative operation of the motor, or if the generated current reaches the torque limit (set in par. 4-17). The value 0.00 corresponds to 0.01 s in speed mode. See ramp-up time in par. 3-41.

$$Par.\,3-42 = \frac{t_{acc} * n_{norm}\,[\,par.\,1-25\,]}{\triangle\,ref\,[RPM]}\,[s]$$

✱ default setting   ( ) display text   [ ] value for use in communication via serial communication port

Parameter Lists

Changes during operation
"TRUE" means that the parameter can be changed while the frequency converter is in operation and "FALSE" means that the it must be stopped before a change can be made.

4-Set-up
'All set-up': the parameters can be set individually in each of the four set-ups, i.e. one single parameter can have four different data values.
'1 set-up': data value will be the same in all set-ups.

Conversion index
This number refers to a conversion figure used when writing or reading by means of a frequency converter.

Conv. index	100	67	6	5	4	3	2	1	0	-1	-2	-3	-4	-5	-6
Conv. factor	1	1/60	1000000	100000	10000	1000	100	10	1	0.1	0.01	0.001	0.0001	0.00001	0.000001

Data type	Description	Type
2	Integer 8	Int8
3	Integer 16	Int16
4	Integer 32	Int32
5	Unsigned 8	Uint8
6	Unsigned 16	Uint16
7	Unsigned 32	Uint32
9	Visible String	VisStr
33	Normalized value 2 bytes	N2
35	Bit sequence of 16 boolean variables	V2
54	Time difference w/o date	TimD

See the *FC 300 Design Guide* for further information about data types 33, 35 and 54.

✱ default setting   ( ) display text   [ ] value for use in communication via serial communication port

— How to Programme —

□ 0-** Operation/Display

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
0-0* Basic settings						
0-01	Language	[0] English	1 set-up	TRUE	-	Uint8
0-04	Operating state at Power-up (Hand)	[1] Forced stop, ref=old	All set-ups	TRUE	-	Uint8
0-1* Set-up handling						
0-10	Active set-up	[1] Setup 1	1 set-up	TRUE	-	Uint8
0-11	Edit set-up	[1] Setup 1	All set-ups	TRUE	-	Uint8
0-12	This set-up linked to	[1] Setup 1	All set-ups	FALSE	-	Uint8
0-13	Readout: Linked set-ups	0	All set-ups	FALSE	0	Uint16
0-14	Readout: Edit set-ups / channel	0	All set-ups	TRUE	0	Uint32
0-2* LCP Display						
0-20	Display line 1.1 small	[1617] Speed (RPM)	All set-ups	TRUE	-	Uint16
0-21	Display line 1.2 small	[1614] Motor current	All set-ups	TRUE	-	Uint16
0-22	Display line 1.3 small	[1610] Power (kW)	All set-ups	TRUE	-	Uint16
0-23	Display line 2 large	[1613] Frequency	All set-ups	TRUE	-	Uint16
0-24	Display line 3 large	[1602] Reference %	All set-ups	TRUE	-	Uint16
0-25	My personal menu	User depedent	1 set-up	TRUE	0	Uint16
0-4* LCP keypad						
0-40	[Hand on] key on LCP	[1] Enabled	All set-ups	TRUE	-	Uint8
0-41	[Off] key on LCP	[1] Enabled	All set-ups	TRUE	-	Uint8
0-42	[Auto on] key on LCP	[1] Enabled	All set-ups	TRUE	-	Uint8
0-43	[Reset] key on LCP	[1] Enabled	All set-ups	TRUE	-	Uint8
0-5* Copy/Save						
0-50	LCP copy	[0] No copy	All set-ups	FALSE	-	Uint8
0-51	Set-up copy	[0] No copy	All set-ups	FALSE	-	Uint8
0-6* Password						
0-60	Main menu password	100	1 set-up	TRUE	0	Uint16
0-61	Access to main menu w/o password	[0] Full access	1 set-up	TRUE	-	Uint8
0-65	Quick menu password	200	1 set-up	TRUE	0	Uint16
0-66	Access to quick menu w/o password	[0] Full access	1 set-up	TRUE	-	Uint8

✱ default setting   ( ) display text   [ ] value for use in communication via serial communication port

— How to Programme —

□ 1-** Load/Motor

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
1-0* General settings						
1-00	Configuration mode	[0] Speed open loop	All set-ups	FALSE	-	Uint8
1-01	Motor control principle	[1] VVCplus	All set-ups	FALSE	-	Uint8
1-2* Motor data						
1-20	Motor power [kW]	Drive dependent	All set-ups	FALSE	1	Uint32
1-22	Motor voltage	Drive dependent	All set-ups	FALSE	0	Uint16
1-23	Motor frequency	Drive dependent	All set-ups	FALSE	0	Uint16
1-24	Motor current	Drive dependent	All set-ups	FALSE	-2	Uint16
1-25	Motor nominal speed	Drive dependent	All set-ups	FALSE	67	Uint16
1-29	Automatic motor adaptation(AMA)	[0] Off	All set-ups	FALSE	-	Uint8
1-3* Advanced motor data						
1-30	Stator resistance (Rs)	Motor dependent	All set-ups	FALSE	-4	Uint32
1-31	Rotor resistance (Rr)	Motor dependent	All set-ups	FALSE	-4	Uint32
1-33	Stator leakage reactance (X1)	Motor dependent	All set-ups	FALSE	-4	Uint32
1-34	Rotor leakage reactance (X2)	Motor dependent	All set-ups	FALSE	-4	Uint32
1-35	Main reactance (Xh)	Motor dependent	All set-ups	FALSE	-4	Uint32
1-36	Iron loss resistance (Rfe)	Motor dependent	All set-ups	FALSE	-3	Uint32
1-39	Motor poles	Motor dependent	All set-ups	FALSE	0	Uint8
1-5* Load indep. setting						
1-50	Motor magnetizing at zero speed	100 %	All set-ups	TRUE	0	Uint16
1-51	Min speed normal magnetizing [RPM]	1 RPM	All set-ups	TRUE	67	Uint8
1-6* Load depen. setting						
1-60	Low speed load compensation	100 %	All set-ups	TRUE	0	Int16
1-61	High speed load compensation	100 %	All set-ups	TRUE	0	Int16
1-62	Slip compensation	100 %	All set-ups	TRUE	0	Int16
1-63	Slip compensation time constant	0.10 s	All set-ups	TRUE	-2	Uint16
1-64	Resonance dampening	100 %	All set-ups	TRUE	0	Uint16
1-65	Resonance dampening time constant	5 ms	All set-ups	TRUE	-3	Uint8
1-66	Min. current at low speed	100 %	All set-ups	TRUE	0	Uint8
1-67	Load type	[0] Passive load	All set-ups	TRUE	-	Uint8
1-68	Minimum inertia	Drive dependent	All set-ups	FALSE	-4	Uint32
1-69	Maximum inertia	Drive dependent	All set-ups	FALSE	-4	Uint32
1-7* Start adjustments						
1-71	Start delay	0.0 s	All set-ups	TRUE	-1	Uint8
1-72	Start function	[2] Coast/delay time	All set-ups	TRUE	-	Uint8
1-74	Start speed [RPM]	0 RPM	All set-ups	TRUE	67	Uint16
1-76	Start current	0.00 A	All set-ups	TRUE	-2	Uint16
1-8* Stop adjustments						
1-80	Function at stop	[0] Coast	All set-ups	TRUE	-	Uint8
1-81	Min speed for function at stop [RPM]	0 RPM	All set-ups	TRUE	67	Uint16
1-9* Motor temperature						
1-90	Motor thermal protection	[0] No protection	All set-ups	TRUE	-	Uint8
1-91	Motor external fan	[0] No	All set-ups	TRUE	-	Uint16
1-93	Thermistor source	[0] None	All set-ups	FALSE	-	Uint8

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How to Programme

□ **2-** Brakes**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver- sion index	Type
2-0* DC-brake						
2-00	DC hold current	50 %	All set-ups	TRUE	0	Uint8
2-01	DC brake current	50 %	All set-ups	TRUE	0	Uint16
2-02	DC braking time	10.0 s	All set-ups	TRUE	-1	Uint16
2-03	DC brake cut-in speed	0 RPM	All set-ups	TRUE	67	Uint16
2-1* Brake energy funct.						
2-10	Brake and over-voltage functions	[0] Off	All set-ups	TRUE	-	Uint8
2-11	Brake resistor (ohm)	Drive dependent	All set-ups	TRUE	0	Uint16
2-12	Brake power limit (kW)	Drive dependent	All set-ups	TRUE	0	Uint32
2-13	Brake power monitoring	[0] Off	All set-ups	TRUE	-	Uint8
2-15	Brake check	[0] Off	All set-ups	TRUE	-	Uint8
2-2* Mechanical brake						
2-20	Release brake current	0.00 A	All set-ups	TRUE	-2	Uint16
2-21	Activate brake speed [RPM]	0 RPM	All set-ups	TRUE	67	Uint16
2-23	Activate brake delay	0.0 s	All set-ups	TRUE	-1	Uint8

□ **2-** Brakes**

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How to Programme

□ 3-** Reference / Ramps

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
3-0* Reference limits						
3-00	Reference range	[0] Min - Max	All set-ups	TRUE	-	Uint8
3-03	Maximum reference	1500.000 Unit	All set-ups	TRUE	-3	Int32
3-1* References						
3-10	Preset reference	0.00 %	All set-ups	TRUE	-2	Int16
3-12	Catch up/slow down value	0.00 %	All set-ups	TRUE	-2	Int16
3-13	Reference site	[0] Linked to Hand / Auto	All set-ups	FALSE	-	Uint8
3-14	Preset relative reference	0.00 %	All set-ups	TRUE	-2	Int32
3-15	Reference resource 1	[1] Analog input 53	All set-ups	FALSE	-	Uint8
3-16	Reference resource 2	[2] Analog input 54	All set-ups	FALSE	-	Uint8
3-17	Reference resource 3	[11] Local bus reference	All set-ups	FALSE	-	Uint8
3-18	Relative scaling reference resource	[0] No function	All set-ups	FALSE	-	Uint8
3-19	Jog speed	200 RPM	All set-ups	TRUE	67	Uint16
3-4* Ramp 1						
3-40	Ramp 1 type	[0] Linear	All set-ups	TRUE	-	Uint8
3-41	Ramp 1 ramp up time	Drive dependent	All set-ups	TRUE	-2	Uint32
3-42	Ramp 1 ramp down time	Drive dependent	All set-ups	TRUE	-2	Uint32
3-5* Ramp 2						
3-50	Ramp 2 type	[0] Linear	All set-ups	TRUE	-	Uint8
3-51	Ramp 2 ramp up time	Drive dependent	All set-ups	TRUE	-2	Uint32
3-52	Ramp 2 ramp down time	Drive dependent	All set-ups	TRUE	-2	Uint32
3-6* Ramp 3						
3-60	Ramp 3 type	[0] Linear	All set-ups	TRUE	-	Uint8
3-61	Ramp 3 ramp up time	Drive dependent	All set-ups	TRUE	-2	Uint32
3-62	Ramp 3 ramp down time	Drive dependent	All set-ups	TRUE	-2	Uint32
3-7* Ramp 4						
3-70	Ramp 4 type	[0] Linear	All set-ups	TRUE	-	Uint8
3-71	Ramp 4 ramp up time	Drive dependent	All set-ups	TRUE	-2	Uint32
3-72	Ramp 4 ramp down time	Drive dependent	All set-ups	TRUE	-2	Uint32
3-8* Other ramps						
3-80	Jog ramp time	Drive dependent	All set-ups	TRUE	-2	Uint32
3-81	Quick stop ramp time	Drive dependent	1 set-up	TRUE	-2	Uint32
3-9* Digital Pot.Meter						
3-90	Step Size	0.01 %	All set-ups	FALSE	-2	Uint16
3-91	Ramp Time	1.00 s	All set-ups	FALSE	-2	Uint32
3-92	Power Restore	[0] Off	All set-ups	FALSE	-	Uint8
3-93	Limit	100 %	All set-ups	FALSE	0	Uint16

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□ **4-** ** Limits / Warnings**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
4-1*	**Motor limits**					
4-10	Motor speed direction	[2] Both directions	All set-ups	FALSE	-	Uint8
4-11	Motor speed low limit [RPM]	0 RPM	All set-ups	TRUE	67	Uint16
4-13	Motor speed high limit [RPM]	3600 RPM	All set-ups	TRUE	67	Uint16
4-16	Torque limit motor mode	160.0 %	All set-ups	TRUE	-1	Uint16
4-17	Torque limit generator mode	160.0 %	All set-ups	TRUE	-1	Uint16
4-18	Current limit	160.0 %	All set-ups	TRUE	-1	Uint16
4-19	Max output frequency	132.0 Hz	All set-ups	FALSE	-1	Uint16
4-5*	**Adj. warnings**					
4-50	Warning current low	0.00 A	All set-ups	TRUE	-2	Uint16
4-51	Warning current high	Par. 16-37	All set-ups	TRUE	-2	Uint16
4-52	Warning speed low	0 RPM	All set-ups	TRUE	67	Uint16
4-53	Warning speed high	Par. 4-13	All set-ups	TRUE	67	Uint16
4-58	Missing motor phase function	[0] Off	All set-ups	FALSE	-	Uint8
4-6*	**Speed bypass**					
4-60	Bypass speed from [RPM]	0 RPM	All set-ups	TRUE	67	Uint16
4-62	Bypass speed to [RPM]	0 RPM	All set-ups	TRUE	67	Uint16

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— How to Programme —

□ 5-** Digital In/Out

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
5-0* Digital IO mode						
5-00	Digital I/O mode	[0] PNP	All set-ups	FALSE	-	Uint8
5-01	Terminal 27 mode	[0] Input	All set-ups	FALSE	-	Uint8
5-02	Terminal 29 mode	[0] Input	All set-ups	FALSE	-	Uint8
5-1* Digital inputs						
5-10	Terminal 18 digital input	[8] Start	All set-ups	TRUE	-	Uint8
5-11	Terminal 19 digital input	[10] Reversing	All set-ups	TRUE	-	Uint8
5-12	Terminal 27 digital input	[2] Coast inverse	All set-ups	TRUE	-	Uint8
5-13	Terminal 29 digital input	[14] Jog	All set-ups	TRUE	-	Uint8
5-14	Terminal 32 digital input	[0] No operation	All set-ups	TRUE	-	Uint8
5-15	Terminal 33 digital input	[0] No operation	All set-ups	TRUE	-	Uint8
5-3* Digital outputs						
5-30	Terminal 27 digital output	[0] No operation	All set-ups	TRUE	-	Uint8
5-31	Terminal 29 digital output	[0] No operation	All set-ups	TRUE	-	Uint8
5-4* Relays						
5-40	Function relay	[0] No operation	All set-ups	TRUE	-	Uint8
5-41	On delay, relay	0.01 s	All set-ups	TRUE	-2	Uint16
5-42	Off delay, relay	0.01 s	All set-ups	TRUE	-2	Uint16
5-5* Pulse input						
5-50	Term. 29 low frequency	100 Hz	All set-ups	TRUE	0	Uint32
5-51	Term. 29 high frequency	100 Hz	All set-ups	TRUE	0	Uint32
5-52	Term. 29 low ref./feedb. value	0.000 Unit	All set-ups	TRUE	-3	Int32
5-53	Term. 29 high ref./feedb. value	1500.000 Unit	All set-ups	TRUE	-3	Int32
5-54	Pulse filter time constant #29	100 ms	All set-ups	FALSE	-3	Uint16
5-55	Term. 33 low frequency	100 Hz	All set-ups	TRUE	0	Uint32
5-56	Term. 33 high frequency	100 Hz	All set-ups	TRUE	0	Uint32
5-57	Term. 33 low ref./feedb. value	0.000 Unit	All set-ups	TRUE	-3	Int32
5-58	Term. 33 high ref./feedb. value	1500.000 Unit	All set-ups	TRUE	-3	Int32
5-59	Pulse filter time constant #33	100 ms	All set-ups	FALSE	-3	Uint16
5-6* Pulse output						
5-60	Terminal 27 pulse output variable	[0] No operation	All set-ups	FALSE	-	Uint8
5-62	Pulse output maximum frequency #27	5000 Hz	All set-ups	FALSE	0	Uint32
5-63	Terminal 29 pulse output variable	[0] No operation	All set-ups	FALSE	-	Uint8
5-65	Pulse output maximum frequency #29	5000 Hz	All set-ups	FALSE	0	Uint32
5-7* 24V encoder input						
5-70	Term 32/33 encoder resolution	1024	All set-ups	FALSE	0	Uint16
5-71	Term 32/33 encoder direction	[0] Clockwise	All set-ups	FALSE	-	Uint8

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— How to Programme —

□ 6-** Analog In/Out

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver- sion index	Type
6-0* Analog IO mode						
6-00	Live zero Timeout Time	10 s	All set-ups	TRUE	0	Uint8
6-01	Live zero Timeout Function	[0] Off	All set-ups	TRUE	-	Uint8
6-1* Analog input 1						
6-10	Terminal 53 low voltage	0.07 V	All set-ups	TRUE	-2	Int16
6-11	Terminal 53 high voltage	10.00 V	All set-ups	TRUE	-2	Int16
6-12	Terminal 53 low current	0.14 mA	All set-ups	TRUE	-5	Int16
6-13	Terminal 53 high current	20.00 mA	All set-ups	TRUE	-5	Int16
6-14	Terminal 53 low ref./feedb. value	0.000 Unit	All set-ups	TRUE	-3	Int32
6-15	Terminal 53 high ref./feedb. value	1500.000 Unit	All set-ups	TRUE	-3	Int32
6-16	Terminal 53 filter time constant	0.001 s	All set-ups	FALSE	-3	Uint16
6-2* Analog input 2						
6-20	Terminal 54 low voltage	0.07 V	All set-ups	TRUE	-2	Int16
6-21	Terminal 54 high voltage	10.00 V	All set-ups	TRUE	-2	Int16
6-22	Terminal 54 low current	0.14 mA	All set-ups	TRUE	-5	Int16
6-23	Terminal 54 high current	20.00 mA	All set-ups	TRUE	-5	Int16
6-24	Terminal 54 low ref./feedb. value	0.000 Unit	All set-ups	TRUE	-3	Int32
6-25	Terminal 54 high ref./feedb. value	1500.000 Unit	All set-ups	TRUE	-3	Int32
6-26	Terminal 54 filter time constant	0.001 s	All set-ups	FALSE	-3	Uint16
6-5* Analog output 1						
6-50	Terminal 42 output	[0] No operation	All set-ups	TRUE	-	Uint8
6-51	Terminal 42 output min scale	0.00 %	All set-ups	TRUE	-2	Int16
6-52	Terminal 42 output max scale	100.00 %	All set-ups	TRUE	-2	Int16

□ 7-** Controllers

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver- sion index	Type
7-0* Speed PID ctrl.						
7-02	Speed PID proportional gain	0.015	All set-ups	TRUE	-3	Uint16
7-03	Speed PID Integral Time	Drive dependent	All set-ups	TRUE	-4	Uint32
7-04	Speed PID differentiation time	Drive dependent	All set-ups	TRUE	-4	Uint16
7-05	Speed PID diff. gain Limit	5.0	All set-ups	TRUE	-1	Uint16
7-06	Speed PID lowpass filter time	10.0 ms	All set-ups	TRUE	-4	Uint16

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― How to Programme ―

□ 8-** Comm. and options

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
8-0* General settings						
8-01	Control site	[0] Digital and ctrl.word	All set-ups	TRUE	-	Uint8
8-02	Controlword source	[0] FC RS485	All set-ups	TRUE	-	Uint8
8-03	Controlword Timeout Time	1.0 s	1 set-up	TRUE	-1	Uint32
8-04	Controlword Timeout Function	[0] Off	1 set-up	FALSE	-	Uint8
8-05	End-of-timeout function	[1] Resume set-up	1 set-up	TRUE	-	Uint8
8-06	Reset Controlword Timeout	[0] Do not reset	All set-ups	TRUE	-	Uint8
8-07	Diagnosis trigger	[0] Disable	1 set-up	FALSE	-	Uint8
8-1* Ctrl. word settings						
8-10	Control word profile	[0] FC profile	All set-ups	TRUE	-	Uint8
8-3* FC Port settings						
8-30	Protocol	[0] FC	1 set-up	FALSE	-	Uint8
8-31	Address	1	1 set-up	FALSE	0	Uint8
8-32	FC port baudrate	[2] 9600 Baud	1 set-up	FALSE	-	Uint8
8-35	Minimum response delay	10 ms	All set-ups	FALSE	-3	Uint16
8-36	Max response delay	5000 ms	1 set-up	FALSE	-3	Uint16
8-37	Max inter-char delay	25 ms	1 set-up	FALSE	-3	Uint16
8-5* Digital/Bus						
8-50	Coasting select	[3] Logic OR	All set-ups	TRUE	-	Uint8
8-51	Quick stop select	[3] Logic OR	All set-ups	TRUE	-	Uint8
8-52	DC Brake select	[3] Logic OR	All set-ups	TRUE	-	Uint8
8-53	Start select	[3] Logic OR	All set-ups	TRUE	-	Uint8
8-54	Reversing select	[3] Logic OR	All set-ups	TRUE	-	Uint8
8-55	Set-up select	[3] Logic OR	All set-ups	TRUE	-	Uint8
8-56	Preset reference select	[3] Logic OR	All set-ups	TRUE	-	Uint8
8-9* Bus jog						
8-90	Bus Jog 1 Speed	100 RPM	All set-ups	TRUE	67	Uint16
8-91	Bus Jog 2 Speed	200 RPM	All set-ups	TRUE	67	Uint16

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— How to Programme —

□ 9-** Profibus

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
9-00	Setpoint	0	All set-ups	TRUE	0	Uint16
9-07	Actual Value	0	All set-ups	FALSE	0	Uint16
9-15	PCD write configuration	0	1 set-up	TRUE	-	Uint16
9-16	PCD read configuration	0	1 set-up	TRUE	-	Uint16
9-18	Node address	126	1 set-up	TRUE	0	Uint8
9-22	Telegram selection	[1] Standard telegram 1	1 set-up	TRUE	-	Uint8
9-23	Parameters for signals	0	All set-ups	TRUE	-	Uint16
9-27	Parameter edit	[1] Enabled	1 set-up	FALSE	-	Uint16
9-28	Process control	[1] Enable cyclic master	1 set-up	FALSE	-	Uint8
9-53	Profibus Warning Word	0	All set-ups	TRUE	0	V2
9-63	Actual baud rate	[255] No baudrate found	All set-ups	TRUE	-	Uint8
9-64	Device Identification	0	All set-ups	TRUE	0	Uint16
9-65	Profile number	0	All set-ups	TRUE	0	Uint8
9-67	Control word 1	0	All set-ups	TRUE	0	V2
9-68	Status word 1	0	All set-ups	TRUE	0	V2
9-71	Save Data Values	[0] Off	All set-ups	TRUE	-	Uint8
9-72	Drive Reset	[0] No action	1 set-up	FALSE	-	Uint8
9-80	Defined parameters (1)	0	All set-ups	FALSE	0	Uint16
9-81	Defined parameters (2)	0	All set-ups	FALSE	0	Uint16
9-82	Defined parameters (3)	0	All set-ups	FALSE	0	Uint16
9-83	Defined parameters (4)	0	All set-ups	FALSE	0	Uint16
9-90	Changed parameters (1)	0	All set-ups	FALSE	0	Uint16
9-91	Changed parameters (2)	0	All set-ups	FALSE	0	Uint16
9-92	Changed parameters (3)	0	All set-ups	FALSE	0	Uint16
9-93	Changed parameters (4)	0	All set-ups	FALSE	0	Uint16

□ 10-** CAN fieldbus

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
10-0* Common settings						
10-00	CAN protocol	[1] Device Net	All set-ups	FALSE	-	Uint8
10-01	Baudrate select	[20] 125 Kbps	All set-ups	FALSE	-	Uint8
10-02	MAC ID	63	All set-ups	FALSE	0	Uint8
10-05	Readout Transmit Error Counter	0	All set-ups	TRUE	0	Uint8
10-06	Readout Receive Error Counter	0	All set-ups	TRUE	0	Uint8
10-07	Readout Bus Off Counter	0	All set-ups	TRUE	0	Uint16
10-1* DeviceNet						
10-10	Process data type selection	App. dependent	1 set-up	TRUE	-	Uint8
10-11	Process Data Config Write	0	All set-ups	FALSE	0	Uint8
10-12	Process Data Config Read	0	All set-ups	FALSE	0	Uint8
10-13	Warning Parameter	63	All set-ups	FALSE	0	Uint8
10-14	Net Reference	[0] Off	All set-ups	TRUE	-	Uint8
10-15	Net Control	[0] Off	All set-ups	TRUE	-	Uint8
10-2* COS filters						
10-20	COS Filter 1	65535	All set-ups	FALSE	0	Uint16
10-21	COS Filter 2	65535	All set-ups	FALSE	0	Uint16
10-22	COS Filter 3	65535	All set-ups	FALSE	0	Uint16
10-23	COS Filter 4	65535	All set-ups	FALSE	0	Uint16
10-3* Parameter access						
10-30	Parameter Data Types	[0] Errata 1	All set-ups	TRUE	-	Uint8
10-31	Array index	0	All set-ups	TRUE	0	Uint16
10-39	Devicenet F parameters	0	All set-ups	TRUE	0	Uint32

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How to Programme

13-** Smart logic control

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver- sion index	Type
13-1* Comparators						
13-10	Comparator Operand	[0] DISABLED	1 set-up	FALSE	-	Uint8
13-11	Comparator Operator	[1] ≈	1 set-up	FALSE	-	Uint8
13-12	Comparator Value	0.000	1 set-up	FALSE	-3	Int32
13-2* Timers						
13-20	SL control timer	0.000 s	1 set-up	FALSE	-3	TimD
13-4* Logic rules						
13-40	Logic Rule Boolean 1	[0] False	1 set-up	FALSE	-	Uint8
13-41	Logic Rule Operator 1	[0] DISABLED	1 set-up	FALSE	-	Uint8
13-42	Logic Rule Boolean 2	[0] False	1 set-up	FALSE	-	Uint8
13-43	Logic Rule Operator 2	[0] DISABLED	1 set-up	FALSE	-	Uint8
13-44	Logic Rule Boolean 3	[0] False	1 set-up	FALSE	-	Uint8
13-5* Smart logic ctrl.						
13-50	SL control mode	[0] Off	1 set-up	FALSE	-	Uint8
13-51	SL control event	[0] False	1 set-up	FALSE	-	Uint8
13-52	SL control action	[0] DISABLED	1 set-up	FALSE	-	Uint8

14-** Special functions

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver- sion index	Type
14-0* Inverter switching						
14-00	Switching Pattern	[1] SFAVM	All set-ups	FALSE	-	Uint8
14-01	Switching Frequency	[5] 5.0 kHz	All set-ups	FALSE	-	Uint8
14-03	Overmodulation	[0] Off	All set-ups	FALSE	-	Uint8
14-04	PWM random	[0] Off	All set-ups	FALSE	-	Uint8
14-1* Mains on/off						
14-10	Mains Failure	[0] No function	All set-ups	FALSE	-	Uint8
14-11	Mains Voltage at Mains Fault	342 V	All set-ups	TRUE	0	Uint16
14-12	Function at Mains Imbalance	[0] Trip	All set-ups	TRUE	-	Uint8
14-2* Trip reset						
14-20	Reset mode	[0] Manual reset	All set-ups	TRUE	-	Uint8
14-21	Automatic restart time	10 s	All set-ups	TRUE	0	Uint16
14-22	Operation mode	[0] Normal operation	All set-ups	TRUE	-	Uint8
14-25	Trip delay at torque limit	60 s = Off	All set-ups	FALSE	0	Uint8
14-29	Service code	0	All set-ups	FALSE	0	Int32
14-3* Current limit ctrl.						
14-30	Current lim cont, Proportional Gain	100 %	All set-ups	FALSE	0	Uint16
14-31	Current lim contr, Integration Time	0.020 s	All set-ups	FALSE	-3	Uint16
14-5* Environment						
14-50	RFI 1	[1] On	1 set-up	FALSE	-	Uint8

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— How to Programme —

□ 15-** Drive information

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
15-0*	**Operating Data**					
15-00	Operating hours	0 h	All set-ups	FALSE	74	Uint32
15-01	Running hours	0 h	All set-ups	FALSE	74	Uint32
15-02	kWh counter	0 kWh	All set-ups	FALSE	75	Uint32
15-03	Power up's	0	All set-ups	FALSE	0	Uint32
15-04	Over temp's	0	All set-ups	FALSE	0	Uint16
15-05	Over volt's	0	All set-ups	FALSE	0	Uint16
15-06	Reset kWh counter	[0] Do not reset	All set-ups	FALSE	-	Uint8
15-07	Reset running hours counter	[0] Do not reset	All set-ups	FALSE	-	Uint8
15-2*	**Historic Log**					
15-20	Historic log: Event	0	All set-ups	FALSE	0	Uint8
15-21	Historic log: Value	0	All set-ups	FALSE	0	Uint32
15-22	Historic log: Time	0 ms	All set-ups	FALSE	-3	Uint32
15-3*	**Fault Log**					
15-30	Fault log: Error code	0	All set-ups	FALSE	0	Uint8
15-31	Fault log: Value	0	All set-ups	FALSE	0	Int16
15-32	Fault log: Time	0 s	All set-ups	FALSE	0	Uint32
15-4*	**Drive identification**					
15-40	FC type	0	All set-ups	FALSE	0	VisStr[6]
15-41	Power section	0	All set-ups	FALSE	0	VisStr[20]
15-42	Voltage	0	All set-ups	FALSE	0	VisStr[20]
15-43	Software version	0	All set-ups	FALSE	0	VisStr[5]
15-44	Ordered typecode string	0	All set-ups	FALSE	0	VisStr[40]
15-45	Actual typecode string	0	All set-ups	FALSE	0	VisStr[40]
15-46	Drive ordering no	0	All set-ups	FALSE	0	VisStr[8]
15-47	Power card ordering no	0	All set-ups	FALSE	0	VisStr[8]
15-48	LCP Id no	0	All set-ups	FALSE	0	VisStr[20]
15-49	SW id control card	0	All set-ups	FALSE	0	VisStr[20]
15-50	SW id power card	0	All set-ups	FALSE	0	VisStr[20]
15-51	Drive serial number	0	All set-ups	FALSE	0	VisStr[10]
15-53	Power card serial number	0	All set-ups	FALSE	0	VisStr[19]
15-6*	**Option ident**					
15-60	Option in slot A	0	All set-ups	FALSE	0	VisStr[30]
15-61	Slot A option SWversion	0	All set-ups	FALSE	0	VisStr[20]
15-62	Slot A ordering no	0	All set-ups	FALSE	0	VisStr[8]
15-63	Slot A option serial number	0	All set-ups	FALSE	0	VisStr[10]
15-65	Option in slot B	0	All set-ups	FALSE	0	VisStr[30]
15-66	Slot B option SWversion	0	All set-ups	FALSE	0	VisStr[20]
15-67	Slot B ordering no	0	All set-ups	FALSE	0	VisStr[8]
15-68	Slot B option serial number	0	All set-ups	FALSE	0	VisStr[10]
15-70	Option in slot C	0	All set-ups	FALSE	0	VisStr[30]
15-71	Slot C option SWversion	0	All set-ups	FALSE	0	VisStr[20]
15-72	Slot C ordering no	0	All set-ups	FALSE	0	VisStr[8]
15-73	Slot C option serial number	0	All set-ups	FALSE	0	VisStr[10]
15-75	Option in slot D	0	All set-ups	FALSE	0	VisStr[30]
15-9*	**Parameter info**					
15-92	Defined parameters	0	All set-ups	FALSE	0	Uint16
15-93	Modified parameters	0	All set-ups	FALSE	0	Uint16
15-99	Parameter metadata	0	All set-ups	FALSE	0	Uint16

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□ 16-** Data readouts

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
16-0*	**General status**					
16-00	Control Word	0	All set-ups	FALSE	0	V2
16-01	Reference [Unit]	0.000 Unit	All set-ups	FALSE	-3	Int32
16-02	Reference %	0.0 %	All set-ups	FALSE	-1	Int16
16-03	Status word	0	All set-ups	FALSE	0	V2
16-05	Main actual value [%]	0	All set-ups	FALSE	0	N2
16-1*	**Motor status**					
16-10	Power [kW]	0.0 kW	All set-ups	FALSE	2	Uint32
16-11	Power [hp]	0.00 hp	All set-ups	FALSE	-2	Uint32
16-12	Motor voltage	0.0 V	All set-ups	FALSE	-1	Uint16
16-13	Frequency	0.0 Hz	All set-ups	FALSE	-1	Uint16
16-14	Motor current	0.00 A	All set-ups	FALSE	-2	Uint32
16-16	Torque	0.0 Nm	All set-ups	FALSE	-1	Int16
16-17	Speed [RPM]	0 RPM	All set-ups	FALSE	67	Int32
16-18	Motor thermal	0 %	All set-ups	FALSE	0	Uint8
16-3*	**Drive status**					
16-30	DC link Voltage	0 V	All set-ups	FALSE	0	Uint16
16-32	Brake energy /s	0.000 kW	All set-ups	FALSE	0	Uint32
16-33	Brake energy /2 min	0.000 kW	All set-ups	FALSE	0	Uint32
16-34	Heatsink temp.	0 °C	All set-ups	FALSE	100	Uint8
16-35	Inverter thermal	0 %	All set-ups	FALSE	0	Uint8
16-36	InomVLT	Drive dependent	All set-ups	FALSE	-2	Uint16
16-37	ImaxVLT	Drive dependent	All set-ups	FALSE	-2	Uint16
16-38	SL controller state	0	All set-ups	FALSE	0	Uint8
16-39	Controlcard temp.	0 °C	All set-ups	FALSE	100	Uint8
16-5*	**Ref. & feedb.**					
16-50	External reference	0.0	All set-ups	FALSE	-1	Int16
16-51	Pulse reference	0.0	All set-ups	FALSE	-1	Uint32
16-6*	**Inputs & outputs**					
16-60	Digital input	0	All set-ups	FALSE	0	Uint16
16-61	Terminal 53 switch setting	[0] Current	All set-ups	FALSE	-	Uint8
16-62	Analog input 53	0.000	All set-ups	FALSE	-3	Int32
16-63	Terminal 54 switch setting	[0] Current	All set-ups	FALSE	-	Uint8
16-64	Analog input 54	0.000	All set-ups	FALSE	-3	Int32
16-65	Analog output 42 [mA]	0.000	All set-ups	FALSE	-3	Int16
16-66	Digital output [bin]	0	All set-ups	FALSE	0	Int16
16-67	Freq. input #29 [Hz]	0	All set-ups	FALSE	0	Int32
16-68	Freq. input #33 [Hz]	0	All set-ups	FALSE	0	Int32
16-69	Pulse output #27 [Hz]	0	All set-ups	FALSE	0	Int32
16-70	Pulse output #29 [Hz]	0	All set-ups	FALSE	0	Int32
16-8*	**Fieldbus & FC port**					
16-80	Fieldbus CTW 1	0	All set-ups	FALSE	0	V2
16-82	Fieldbus REF 1	0	All set-ups	FALSE	0	N2
16-84	Comm. option STW	0	All set-ups	FALSE	0	V2
16-85	FC port CTW 1	0	All set-ups	FALSE	0	V2
16-86	FC port REF 1	0	All set-ups	FALSE	0	N2
16-9*	**Diagnosis Readout**					
16-90	Alarm word	0	All set-ups	FALSE	0	Uint32
16-92	Warning word	0	All set-ups	FALSE	0	Uint32
16-94	Extended status word	0	All set-ups	FALSE	0	Uint32

✱ default setting   ( ) display text   [ ] value for use in communication via serial communication port

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General Specifications

Mains supply (L1, L2, L3):

Supply voltage .... 200-240 V ±10%
Supply voltage .... FC 301: 380-480 V / FC 302: 380-500 V ±10%
Supply voltage .... FC 302: 525-600 V ±10%
Supply frequency .... 50/60 Hz
Max. imbalance between mains phases .... ± 3.0 % of rated supply voltage
True Power Factor (λ) .... 0.92 nominal at rated load
Displacement Power Factor (cos φ) near unity .... (> 0.98)
Switching on input supply L1, L2, L3 (power-ups) .... maximum 2 times/min.
Environment according to EN60664-1 .... overvoltage category 111/pollution degree 2
The unit is suitable for use on a circuit capable of delivering not 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 .... FC 301: 0.2 - 1000 Hz / FC 302: 0 - 1000 Hz
Switching on output .... Unlimited
Ramp times .... 0.02 - 3600 sec.

Torque characteristics:

Starting torque (Constant torque) .... maximum 160% for 1 min.*
Starting torque .... maximum 180% up to 0.5 sec.*
Overload current (Constant torque) .... maximum 160% for 1 min.*
Percentage relates to FC 300's nominal current.

Digital inputs:

Programmable digital inputs .... FC 301: 4 (5) / FC 302: 4 (6)
Terminal number .... 18, 19, 27 [1), 29 [1), 32, 33, 37[2)
Logic .... PNP or NPN[3)
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[3) .... > 19 V DC
Voltage level, logic '1' NPN[3) .... < 14 V DC
Maximum voltage on input .... 28 V DC

— General Specifications —

Input resistance, R_i .... approx. 4 kΩ
All digital inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.
1) Terminals 27 and 29 can also be programmed as output.
2) Terminal 37 is only available in FC 302. It can only be used as "safe stop" input. Terminal 37 is suitable
for category 3 installations according to EN 954-1 (safe stop according to category 0 EN 60204-1).
3) Exception: Terminal 37 is fixed PNP logic.

Analogue inputs:

Number of analogue inputs 2
Terminal number 53, 54
Modes .... Voltage or current
Mode select .... Switch S201 and switch S202
Voltage mode .... Switch S201/switch S202 = OFF (U)
Voltage level .... FC 301: 0 to + 10 / FC 302: -10 to +10 V (scaleable)
Input resistance, R_i .... approx. 10 kΩ
Max. voltage .... ± 20 V
Current mode .... Switch S201/switch S202 = ON (I)
Current level .... 0/4 to 20 mA (scaleable)
Input resistance, R_i .... approx. 200 Ω
Max. current .... 30 mA
Resolution for analogue inputs .... 10 bit (+ sign)
Accuracy of analogue inputs .... Max. error 0.5% of full scale
Bandwidth .... FC 301: 20 Hz / FC 302: 100 Hz
The analogue inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage
terminals.
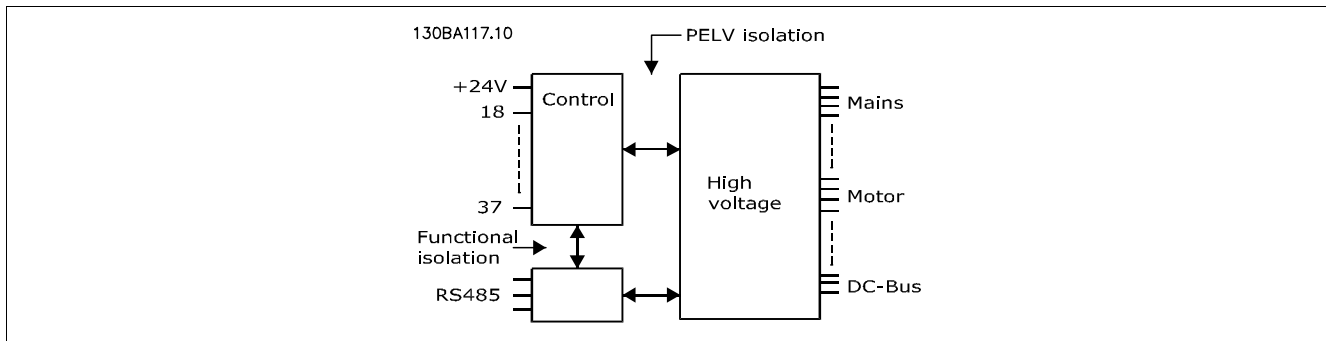
Pulse/encoder inputs:

Programmable pulse/encoder inputs 2/1
Terminal number pulse/encoder .... 29, 33[1] / 18, 32, 33[2]
Max. frequency at terminal 18, 29, 32, 33 .... 110 kHz (Push-pull driven)
Max. frequency at terminal 18, 29, 32, 33 .... 5 kHz (open collector)
Min. frequency at terminal 18, 29, 32, 33 .... 4 Hz
Voltage level .... see section on Digital input
Maximum voltage on input .... 28 V DC
Input resistance, R_i .... approx. 4 kΩ
Pulse input accuracy (0.1 - 1 kHz) .... Max. error: 0.1% of full scale
Encoder input accuracy (1 - 110 kHz) .... Max. error: 0.05 % of full scale
The pulse and encoder inputs (terminals 18, 29, 32, 33) are galvanically isolated from the supply voltage
(PELV) and other high-voltage terminals.
1) Pulse inputs are 29 and 33
2) Encoder inputs: 18 = Z, 32 = A, and 33 = B

▬ General Specifications ▬

Digital output:

Programmable digital/pulse outputs	2
Terminal number	27, 29 [1]
Voltage level at digital/frequency output	0 - 24 V
Max. output current (sink or source)	40 mA
Max. load at frequency output	1 kΩ
Max. capacitive load at frequency output	10 nF
Minimum output frequency at frequency output	0 Hz
Maximum output frequency at frequency output	32 kHz
Accuracy of frequency output .... Max. error: 0.1 % of full scale
Resolution of frequency outputs	12 bit

1) Terminal 27 and 29 can also be programmed as input.

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

Analogue output:

Number of programmable analogue outputs	1
Terminal number	42
Current range at analogue output	0/4 - 20 mA
Max. load to common at analogue output	500 Ω
Accuracy on analogue output .... Max. error: 0.5 % of full scale
Resolution on analogue output	12 bit

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

Control card, 24 V DC output:

Terminal number	12, 13
Max. load .... FC 301: 130 mA / FC 302: 200 mA

The 24 V DC supply is galvanically isolated from the supply voltage (PELV), but has the same potential as the analogue and digital inputs and outputs.

Control card, 10 V DC output:

Terminal number	50
Output voltage	10.5 V ±0.5 V
Max. load	15 mA

The 10 V DC supply 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 supplier voltage (PELV).

— General Specifications —

Control card, USB serial communication:

USB standard	2.0 (low speed)
USB plug	USB type B "device" plug

Connection to PC is carried out via a standard host/device USB cable.
The USB connection is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Relay outputs

Programmable relay outputs	FC 301: 1 / FC 302: 2
Terminal number, power card	1-3 (break), 1-2 (make), 4-6 (break), 4-5 (make)
Max. terminal load (AC) on 1-3 (break), 1-2 (make), 4-6 (break) power card	240 V AC, 2 A
Max. terminal load (AC) on 4-5 (make) power card	400 V AC, 2 A
Min. terminal load on 1-3 (break), 1-2 (make), 4-6 (break), 4-5 (make) power card	24 V DC 10 mA, 24 V AC 100 mA
Environment according to EN 60664-1	overvoltage category III/pollution degree 2

The relay contacts are galvanically isolated from the rest of the circuit by reinforced isolation (SELV).

Cable lengths and cross sections:

Max. motor cable length, screened/armoured	FC 301: 50 m / FC 302: 150 m
Max. motor cable length, unscreened/unarmoured	FC 301: 75 m / FC 302: 300 m
Max. cross section to motor, mains, load sharing and brake (see section Electrical Data in the FC 300 Design Guide MG.33.BX.YY for more information), (0.25 kW - 7.5 kW)	4 mm^2 / 10 AWG
Maximum cross section to control wires, rigid wire	1.5 mm^2/16 AWG (2 x 0.75 mm^2)
Maximum cross section to control cables, flexible cable	1 mm^2/18 AWG
Maximum cross section to control cables, cable with enclosed core	0.5 mm^2/20 AWG
Minimum cross section to control wires	0.25 mm^2

Cable lengths and RFI performance			
FC 30x	Filter	Supply voltage	RFI compliance at max. motor cable lengths
FC 301 FC 302	With A2 filter	200 - 240 V / 380 - 500 V / 400 - 500 V	<5 m. EN 55011 Group A2
FC 301	With A1/B	200 - 240 V / 400 - 500 V	<40 m. EN 55011 Group A1 <10 m. EN 55011 Group B
FC 302	With A1/B	200 - 240 V / 380 - 500 V	<150 m. EN 55011 Group A1 <40 m. EN 55011 Group B
FC 302	No RFI filter	550 - 600 V	Not compliant with EN 55011

In certain instances, shorten the motor cable to comply with EN 55011 A1 and EN 55011 B.
Copper (60/75°C) conductors recommended.

Aluminium conductors
Aluminium conductors are not recommended. Terminals can accept aluminium conductors but the conductor surface has to be clean and the oxidation must be removed and sealed by neutral acid free Vaseline grease before the conductor is connected.
Furthermore, the terminal screw must be retightened after two days due to the softness of the aluminium. It is crucial to keep the connection a gas tight joint, otherwise the aluminium surface will oxidize again.

Control card performance:

Scan interval	FC 301: 10 mS / FC 302: 1 ms

— General Specifications —

Control characteristics:

Resolution of output frequency at 0 - 1000 Hz .... FC 301: +/- 0.013 Hz / FC 302: +/- 0.003 Hz
Repeat accuracy of *Precise start/stop* (terminals 18, 19) .... FC 301: ≤ ± 1ms / FC 302: ≤ ± 0.1 msec
System response time (terminals 18, 19, 27, 29, 32, 33) .... FC 301: ≤ 20 ms / FC 302: ≤ 2 ms
Speed control range (open loop) .... 1:100 of synchronous speed
Speed control range (closed loop) .... 1:1000 of synchronous speed
Speed accuracy (open loop) .... 30 - 4000 rpm: Maximum error of ±8 rpm
Speed accuracy (closed loop) .... 0 - 6000 rpm: Maximum error of ±0.15 rpm
All control characteristics are based on a 4-pole asynchronous motor

Surroundings:

Enclosure .... IP 20
Enclosure kit available .... IP21/TYPE 1/IP 4X top
Vibration test .... 1.0 g
Max. relative humidity .... 5% - 95%(IEC 721-3-3; Class 3K3 (non-condensing) during operation
Aggressive environment (IEC 721-3-3), uncoated .... class 3C2
Aggressive environment (IEC 721-3-3), coated .... class 3C3
Ambient temperature .... Max. 50 °C (24-hour average maximum 45 °C)
Derating for high ambient temperature, see special conditions in the Design Guide
Minimum ambient temperature during full-scale operation .... 0 °C
Minimum ambient temperature at reduced performance .... - 10 °C
Temperature during storage/transport .... -25 - +65/70 °C
Maximum altitude above sea level .... 1000 m
Derating for high altitude, see special conditions in the Design Guide
EMC standards, Emission .... EN 61800-3, EN 61000-6-3/4, EN 55011, (EN 50081-1/2)
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, (EN 50082-1/2)
See section on special conditions in the Design Guide

Protection and Features:

- Electronic thermal motor protection against overload.
- Temperature monitoring of the heatsink ensures that the trips if the temperature reaches 95 °C ± 5°C. An overload temperature cannot be reset until the temperature of the heatsink is below 70 °C ± 5°C.
- The frequency converter is protected against short-circuits on motor terminals U, V, W.
- If a mains phase is missing, the frequency converter trips or issues a warning.
- Monitoring of the intermediate circuit voltage ensures that the frequency converter trips if the intermediate circuit voltage is too low or too high.
- The frequency converter is protected against earth faults on motor terminals U, V, W.

General Specifications

Troubleshooting

□ **Warnings/Alarm Messages**

A warning or an alarm icon appears in the display as well as a text string describing the problem. A warning is shown on the display until the fault has been corrected, while an alarm will continue to flash on the LED until you activate the [RESET] key. The table (next page) shows the various warnings and alarms, and whether the fault locks the FC 300. After an *Alarm/Trip locked*, cut off the mains supply and correct the fault. Reconnect mains supply. The FC 300 is now unlocked. The *Alarm/Trip* can be reset manually in three ways:

1. Via the operating key [RESET].
2. Via a digital input.
3. Via serial communication.

You can also choose an automatic reset in parameter 14-20 *Reset mode*. When an X appears in both warning and alarm, it means that either a warning comes before an alarm or that you can define whether a warning or an alarm appears for a given fault. For example, this is possible in parameter 1-90 *Motor thermal protection*. After an alarm/trip, the motor will remain coasted, and alarm and warning will flash on the FC 300. If the fault disappears, only the alarm will flash.

Troubleshooting

No.	Description	Warning	Alarm/Trip	Alarm/Trip locked
1	10 Volts low	X		
2	Live zero error	(X)	(X)	
3	No motor	X		
4	Mains phase loss	X	X	X
5	DC link voltage high	X		
6	DC link voltage low	X		
7	DC over voltage	X	X	
8	DC under voltage	X	X	
9	Inverter overloaded	X	X	
10	Motor ETR over temperature	X	X	
11	Motor thermistor over temperature	X	X	
12	Torque limit	X	X	
13	Over Current	X	X	X
14	Earth fault	X	X	X
16	Short Circuit		X	X
17	Control word timeout	(X)	(X)	
25	Brake resistor short-circuited	X		
26	Brake resistor power limit	X	X	X
27	Brake chopper fault	X		
28	Brake check	X	X	
29	Drive over temperature	X	X	X
30	Motor phase U missing		X	X
31	Motor phase V missing		X	X
32	Motor phase W missing		X	X
33	Inrush fault		X	X
34	Fieldbus communication fault	X	X	
35	Out of frequency range	X		
38	Internal fault		X	X
47	24 V supply low	X	X	X
48	1.8V supply low		X	X
49	Speed limit	X		
50	AMA calibration failed		X	
51	AMA check Unom and Inom		X	
52	AMA low Inom		X	
53	AMA motor too big		X	
54	AMA motor too small		X	
55	AMA parameter out of range		X	
56	AMA interrupted by user		X	
57	AMA timeout		X	
58	AMA internal fault		X	
59	Current limit	X		
61	Encoder loss	(X)	(X)	
62	Output Frequency at Maximum Limit	X		
63	Mechanical Brake Low		X	
64	Voltage Limit	X		
65	Control Card Overtemperature	X	X	X
66	Heatsink Temperature Low	X		
67	Option Configuration has Changed		X	
68	Safe Stop Activated		X	
80	Drive Initialised to Default Value		X	
(X)	Dependent on parameter			

LED indication	
Warning	yellow
Alarm	flashing red
Trip locked	yellow and red

— Troubleshooting —

WARNING 1
10 Volts low:
The 10 V voltage from terminal 50 on the control card is below 10 V.
Remove some of the load from terminal 50, as the 10 V supply is overloaded. Max. 15 mA or minimum 590 Ω.

WARNING/ALARM 2
Live zero error:
The signal on terminal 53 or 54 is less than 50% of the value set in par. 6-10, 6-12, 6-20, or 6-22 respectively.

WARNING/ALARM 3
No motor:
No motor has been connected to the output of the frequency converter.

WARNING/ALARM 4
Mains phase loss:
A phase is missing on the supply side, or the mains voltage imbalance is too high.
This message also appears in case of a fault in the input rectifier on the frequency converter.
Check the supply voltage and supply currents to the frequency converter.

WARNING 5
DC link voltage high:
The intermediate circuit voltage (DC) is higher than the overvoltage limit of the control system. The frequency converter is still active.

WARNING 6:
DC link voltage low
The intermediate circuit voltage (DC) is below the undervoltage limit of the control system. The frequency converter is still active.

WARNING/ALARM 7
DC over voltage:
If the intermediate circuit voltage exceeds the limit, the frequency converter trips after a time.
Possible corrections:

    Connect a brake resistor
    Extend the ramp time
    Activate functions in par. 2-10
    Increase par. 14-26

Connect a brake resistor. Extend the ramp time

Alarm/warning limits:			
FC 300 Series	3 x 200 - 240 V [VDC]	3 x 380 - 500 V [VDC]	3 x 525 - 600 V [VDC]
Undervoltage	185	373	532
Voltage warning low	205	410	585
Voltage warning high (w/o brake - w/brake)	390/405	810/840	943/965
Overvoltage	410	855	975

The voltages stated are the intermediate circuit voltage of the FC 300 with a tolerance of ± 5 %. The corresponding mains voltage is the intermediate circuit voltage (DC-link) divided by 1.35

WARNING/ALARM 8
DC under voltage:
If the intermediate circuit voltage (DC) drops below the "voltage warning low" limit (see table above), the frequency converter checks if 24 V backup supply is connected.
If no 24 V backup supply is connected, the frequency converter trips after a given time depending on the unit.
To check whether the supply voltage matches the frequency converter, see *General Specifications*.

WARNING/ALARM 9
Inverter overloaded:
The frequency converter is about to cut out because of an overload (too high current for too long). The counter for electronic, thermal inverter protection gives a warning at 98% and trips at 100%, while giving an alarm. You <u>cannot</u> reset the frequency converter until the counter is below 90%.
The fault is that the frequency converter is overloaded by more than 100% for too long.

WARNING/ALARM 10
Motor ETR over temperature:
According to the electronic thermal protection (ETR), the motor is too hot. You can choose if you want the frequency converter to give a warning or an alarm when the counter reaches 100% in par. 1-90. The fault is that the motor is overloaded by more than 100% for too long. Check that the motor par. 1-24 is set correctly.

WARNING/ALARM 11
Motor thermistor over temp:
The thermistor or the thermistor connection is disconnected. You can choose if you want the frequency converter to give a warning or an alarm

— Troubleshooting —

when the counter reaches 100% in par. 1-90. Check that the thermistor is connected correctly between terminal 53 or 54 (analogue voltage input) and terminal 50 (+ 10 Volts supply), or between terminal 18 or 19 (digital input PNP only) and terminal 50. If a KTY sensor is used, check for correct connection between terminal 54 and 55.

WARNING/ALARM 12
Torque limit:
The torque is higher than the value in par. 4-16 (in motor operation) or the torque is higher than the value in par. 4-17 (in regenerative operation).

WARNING/ALARM 13
Over Current:
The inverter peak current limit (approx. 200% of the rated current) is exceeded. The warning will last approx. 8-12 sec., then the frequency converter trips and issues an alarm. Turn off the frequency converter and check if the motor shaft can be turned and if the motor size matches the frequency converter.
If extended mechanical brake control is selected, trip can be reset externally.

ALARM: 14
Earth fault:
There is a discharge from the output phases to earth, either in the cable between the frequency converter and the motor or in the motor itself.
Turn off the frequency converter and remove the earth fault.

ALARM: 16
Short-circuit:
There is short-circuiting in the motor or on the motor terminals.
Turn off the frequency converter and remove the short-circuit.

WARNING/ALARM 17
Control word timeout:
There is no communication to the frequency converter.
The warning will only be active when par. 8-04 is NOT set to *OFF*.
If par. 8-04 is set to *Stop* and *Trip*, a warning appears and the frequency converter ramps down until it trips, while giving an alarm.
par. 8-03 *Control word Timeout Time* could possibly be increased.

WARNING 25
Brake resistor short-circuited:
The brake resistor is monitored during operation. If it short-circuits, the brake function is disconnected

and the warning appears. The frequency converter still works, but without the brake function. Turn off the frequency converter and replace the brake resistor (see par. 2-15 *Brake Check*.

ALARM/WARNING 26
Brake resistor power limit:
The power transmitted to the brake resistor is calculated as a percentage, as a mean value over the last 120 s, on the basis of the resistance value of the brake resistor (par. 2-11) and the intermediate circuit voltage. The warning is active when the dissipated braking power is higher than 90%. If *Trip* [2] has been selected in par. 2-13, the frequency converter cuts out and issues this alarm, when the dissipated braking power is higher than 100%.

WARNING 27
Brake chopper fault:
The brake transistor is monitored during operation and if it short-circuits, the brake function disconnects and the warning comes up. The frequency converter is still able to run, but since the brake transistor has short-circuited, substantial power is transmitted to the brake resistor, even if it is inactive.
Turn off the frequency converter and remove the brake resistor.

> ! Warning: There is a risk of substantial power being transmitted to the brake resistor if the brake transistor is short-circuited.

ALARM/WARNING 28
Brake check failed:
Brake resistor fault: the brake resistor is not connected/working.

ALARM 29
Drive over temperature:
If the enclosure is IP 20 or IP 21/TYPE 1, the cut-out temperature of the heat-sink is 95 ^{o}C $\pm$5 ^{o}C. The temperature fault cannot be reset, until the temperature of the heatsink is below 70 ^{o}C $\pm$5 ^{o}C. The fault could be:

- Ambient temperature too high
- Too long motor cable

ALARM 30
Motor phase U missing:
Motor phase U between the frequency converter and the the motor is missing.
Turn off the frequency converter and check motor phase U.

── Troubleshooting ──

ALARM 31
Motor phase V missing:
Motor phase V between the frequency converter and the motor is missing.
Turn off the frequency converter and check motor phase V.

ALARM 32
Motor phase W missing:
Motor phase W between the frequency converter and the motor is missing.
Turn off the frequency converter and check motor phase W.

ALARM: 33
Inrush fault:
Too many powerups have occured within a short time period. See the chapter *General Specifications* for the allowed number of powerups within one minute.

WARNING/ALARM 34
Fieldbus communication fault:
The fieldbus on the communication option card is not working.

WARNING 35
Out of frequency range:
This warning is active if the output frequency has reached its *Warning speed low* (par. 4-52) or *Warning speed high* (par. 4-53). If the frequency converter is in *Process control, closed loop* (par. 1-00), the warning is active in the display. If the frequency converter is not in this mode bit 008000 Out of *frequency range* in extended status word is active but there is no warning in the display.

WARNING 38
Internal fault:
Contact your Danfoss supplier.

WARNING 47
24 V supply low:
The external 24 V DC backup power supply may be overloaded, otherwise Contact your Danfoss supplier.

WARNING 48
1.8 V supply low:
Contact your Danfoss supplier.

WARNING 49
Speed limit:
Contact your Danfoss supplier.

ALARM 50
AMA calibration failed:
Contact your Danfoss supplier.

ALARM 51
AMA check Unom and Inom:
The setting of motor voltage, motor current, and motor power is presumably wrong. Check the settings.

ALARM 52
AMA low Inom:
The motor current is too low. Check the settings.

ALARM 53
AMA motor too big:
The motor is too big for the AMA to be carried out.

ALARM 54
AMA motor too small:
The motor is too big for the AMA to be carried out.

ALARM 55
AMA par. out of range:
The par. values found from the motor are outside acceptable range.

ALARM 56
AMA interrupted by user:
The AMA has been interrupted by the user.

ALARM 57
AMA timeout:
Try to start the AMA again a number of times, until the AMA is carried out. Please note that repeated runs may heat the motor to a level where the resistance Rs and Rr are increased. In most cases, however, this is not critical.

ALARM 58
AMA internal fault:
Contact your Danfoss supplier.

WARNING 59
Current limit:
Contact your Danfoss supplier.

WARNING 61
Encoder loss:
Contact your Danfoss supplier.

WARNING 62
Output Frequency at Maximum Limit:
The output frequency is higher than the value set in par. 4-19

ALARM 63
Mechanical Brake Low:
The actual motor current has not exceeded the "release brake" current within the "Start delay" time window.

WARNING 64

Voltage Limit:

The load and speed combination demands a motor voltage higher than the actual DC link voltage.

WARNING/ALARM/TRIP 65

Control Card Over Temperature:

Control card over temperature: The cut-out temperature of the control card is 80° C.

WARNING 66

Heatsink Temperature Low:

The heat sink temperature is measured as 0° C. This could indicate that the temperature sensor is defect and thus the fan speed is increased to the maximum in case the power part or control card is very hot.

ALARM 67

Option Configuration has Changed:

One or more options has either been added or removed since the last power-down.

ALARM 68

Safe Stop Activated:

Safe Stop has been activated. To resume normal operation, apply 24 V DC to terminal 37, then send a reset signal (via Bus, Digital I/O, or by pressing [RESET]).

ALARM 80

Drive Initialised to Default Value:

Parameter settings are initialised to default setting after a manual (three-finger) reset.

Index

— Index —