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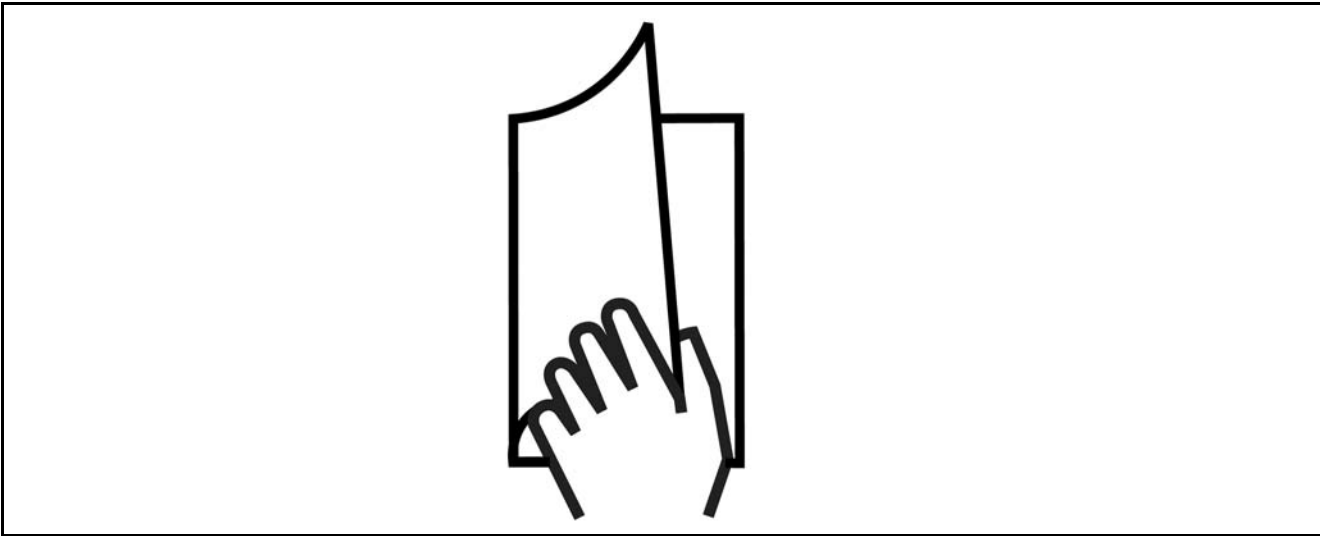
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How to Read this Instruction Manual



□ **How to Read this Instruction Manual**

This Instruction Manual 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.

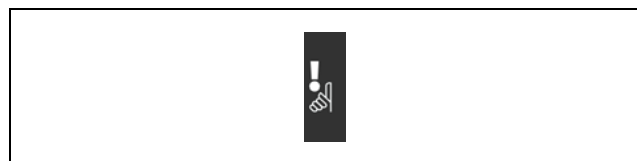
This Instruction Manual covers both FC 301 and FC 302. Where information covers both series, we refer to FC 300. Otherwise, we refer specifically to either FC 301 or FC 302.

Chapter 1, **How to Read this Instruction Manual**, introduces the manual and informs you about the approvals, symbols, and abbreviations used in this literature.



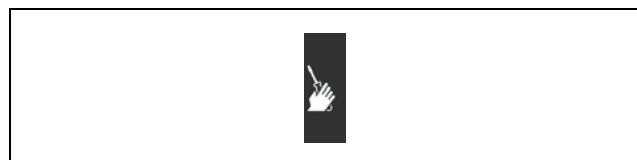
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Chapter 2, **Safety Instructions and General Warnings**, entails instructions on how to handle the FC 300 correctly.



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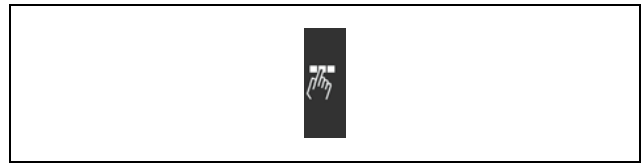
Chapter 3, **How to Install**, guides you through mechanical and technical installation.



Page divider for How to Install

— How to Read this Instruction Manual —

Chapter 4, **How to Program**, shows you how to operate and program the FC 300 via the Local Control Panel.



Page divider for How to Program.

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 Instruction Manual provides the necessary 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 (Instruction Manual) provide the information required for controlling, monitoring, and programming the drive via a Profibus fieldbus.
- The VLT® AutomationDrive FC 300 DeviceNet Operating Instructions (Instruction Manual) provide the information required for controlling, monitoring, and programming the drive via a DeviceNet fieldbus.
- The VLT® AutomationDrive FC 300 MCT 10 Operating Instructions (Instruction Manual) 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 this Instruction Manual —

□ **Symbols**

Symbols used in these Operating Instructions.



NOTE

Indicates something to be noted by the reader



Indicates a general warning.



Indicates a high voltage warning

* Indicates default setting

□ **Abbreviations**

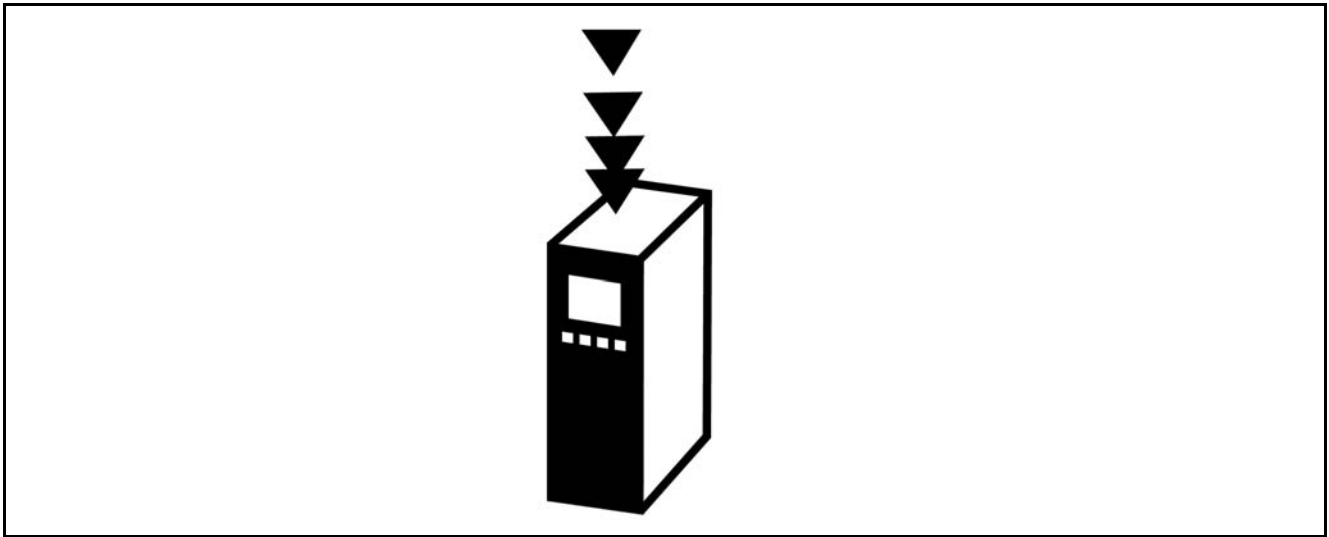
Alternating current	AC
American wire gauge	AWG
Ampere/AMP	A
Automatic Motor Adaptation	AMA
Current limit	I_{LIM}
Degrees Celsius	°C
Direct current	DC
Drive Dependent	D-TYPE
Electro Magnetic Compellability	EMC
Electronic Thermal Relay	ETR
Adjustable Frequency Drive	AFD
Gram	g
Hertz	Hz
Kilohertz	kHz
Local Control Panel	LCP
Meter	m
Milli Henry Inductance	mH
Milliampere	mA
Millisecond, Second	ms, s
Minute	min
Motion Control Tool	MCT
Motor Type Dependent	M-TYPE
Nanofarad	nF
Newton meter	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.
Protective Extra Low Voltage	PELV
Printed Circuit Board	PCB
Rated Inverter Output Current	I_{INV}
Revolutions per minute	RPM
Second	s
Torque limit	T_{LIM}
Volt	V



— How to Read this Instruction Manual —



Safety Instructions and General Warning



Equipment containing electrical components may not be disposed together with domestic waste. It must be collected separately as electrical and electronic waste according to local and currently valid legislation.



Caution

The FC 300 AutomationDrive DC link capacitors remain charged after power has been disconnected. To avoid an electrical shock hazard, disconnect the FC 300 from the power supply before carrying out maintenance. Wait at least as long as follows before servicing the adjustable frequency drive:

FC 300: 0.34 – 10 HP 4 minutes
 [0.25 – 7.5
 kW]

FC 300: 14.75 – 29.5 15 minutes
 HP [11 – 22
 kW]

Be aware that there may be high voltage on the DC link even when the LEDs are turned off.

— Safety Instructions and General Warning —

FC 300
Instruction Manual
Software version: 3.5x



This instruction manual can be used for all FC 300 Series adjustable frequency drives (AFD) with software version 3.5x.
 The software version number can be seen from parameter 15-43.



□ **High voltage warning**



The voltage of the FC 300 is dangerous whenever the converter is connected to electrical power. Incorrect fitting of the motor or adjustable frequency drive may cause damage to the equipment, serious injury or death. Consequently, it is essential to comply with the instructions in this manual as well as local and national rules and safety regulations.

□ **Safety Instructions**

- Make sure the FC 300 is properly connected to ground.
- 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 ground 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 AC line.
2. Disconnect DC bus terminals 88 and 89
3. Wait at least 15 minutes
4. Remove motor cable

□ **High start torque**

While FC 300 is connected to AC line, the motor can be started/stopped using digital commands, bus commands, references or a local stop.

- Disconnect the FC 300 from AC line 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 AC line supply, or lost motor connection may cause a stopped motor to start.

— Safety Instructions and General Warning —

□ **Safe Stop of FC 302**

The FC 302 can perform the Designated Safety Function *Uncontrolled Stopping* by removal of power. (as defined by draft IEC 61800-5-2) or *Stop Category 0* (as defined in EN 60204-1). It is designed and approved suitable for the requirements of Safety Category 3 in EN 954-1. This functionality is called Safe Stop.

In order to install and use the Safe Stop function in accordance with the requirements of Safety Category 3 in EN 954-1, the related information and instructions of the FC 300 Design Guide MG.33.BX.YY must be followed! The information and instructions of the Instruction Manual are not sufficient for a correct and safe use of the Safe Stop functionality!

General warning



Warning:

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

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 backup.

Using VLT AutomationDrive FC 300: wait at least 15 minutes.

A shorter time is allowed only if indicated on the nameplate for the specific unit.



Leakage Current

The ground leakage current from the FC 300 exceeds 3.5 mA. To ensure that the ground cable has a good mechanical connection to the ground connection (terminal 95), the cable cross-section must be at least 3.9 in² [10 mm²] or have 2 rated ground wires terminated separately.

Residual Current Device

This product can cause DC current in the protective conductor. If a residual current device (RCD) is used for extra protection, only an RCD of Type B (time delayed) may be used on the supply side of this product. See also RCD Application Note MN.90.GX.02.

Protective grounding of the FC 300 and the use of RCDs must always follow national and local regulations.



IT Line

Do not connect 400 V adjustable frequency drives with RFI filters to line power supplies with a voltage between phase and ground of more than 440 V.

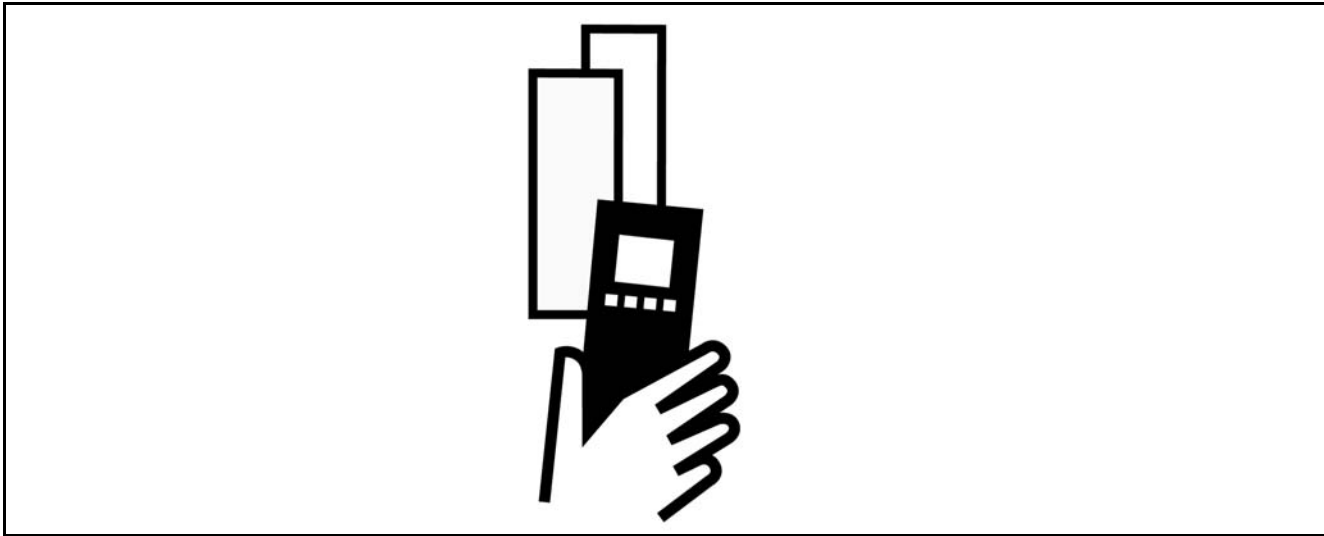
For IT line and delta ground (grounded leg), line voltage may exceed 440 V between phase and ground.

Par. 14-50 *RFI 1* can be used on the FC 302 to disconnect the internal RFI capacitors from the RFI filter to ground. If this is done, it will reduce the RFI performance to A2 level.

— Safety Instructions and General Warning —



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 "Option Guide".

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.

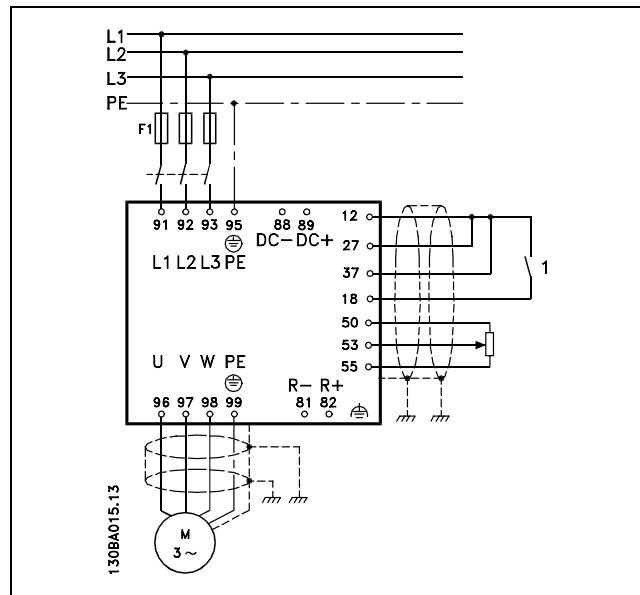


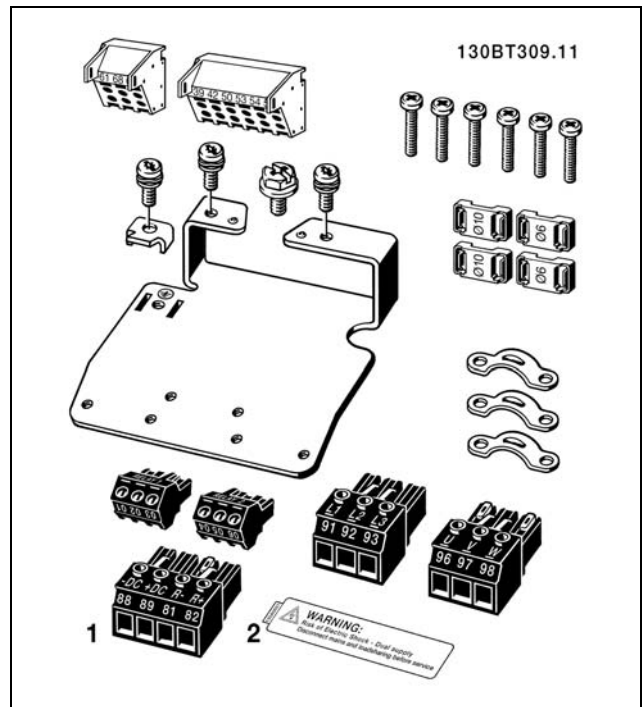
Diagram showing basic installation including, electrical connection, motor, start/stop key, and potentiometer for speed adjustment.



— How to Install —

□ **Accessory Bag ≤ 10 HP [7.5 kW]**

The following parts are included in the FC 300 Accessory Bag.

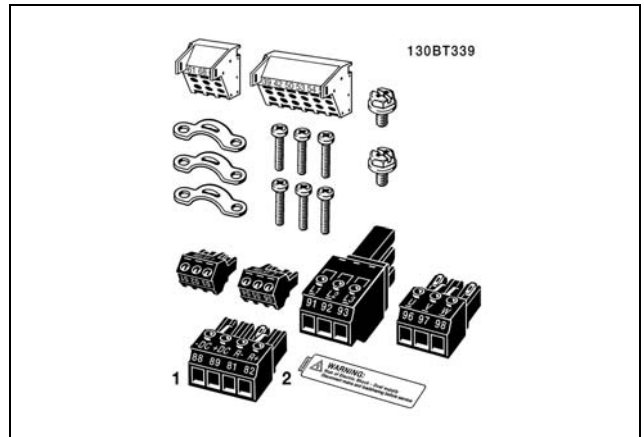


1 + 2 only available in units with brake chopper.
 There is only one relay connector for the FC 301. (≤ 10 HP [7.5 kW])
 For the DC link connection (load sharing), connector 1 can be ordered separately (order number 130B1064).



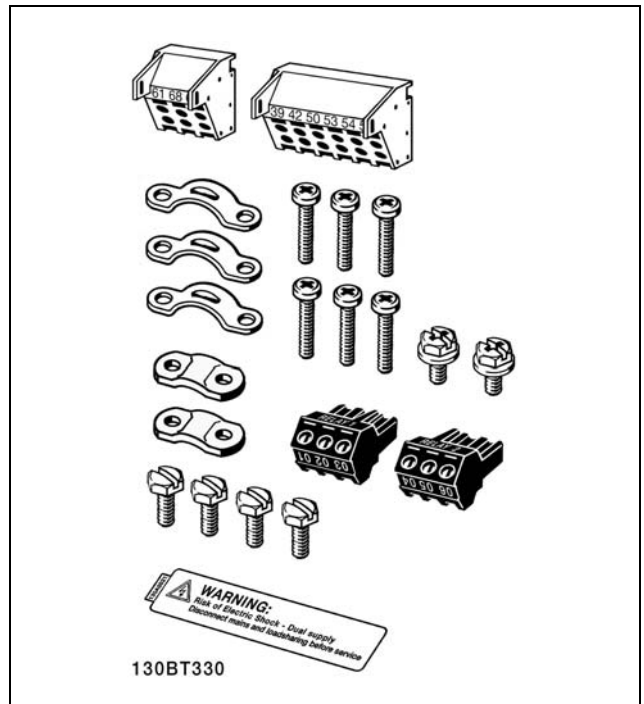
— How to Install —

Accessory Bag ≤ 10 HP [7.5 kW], IP 55



1 + 2 only available in units with brake chopper.
There is only one relay connector for the FC 301.
(≤ 10 HP [7.5 kW], IP55)

Accessory Bag 14.75-29.5 HP [11-22 kW]



There is only one relay connector for the FC 301.
(14.75-29.5 HP [11-22 kW])



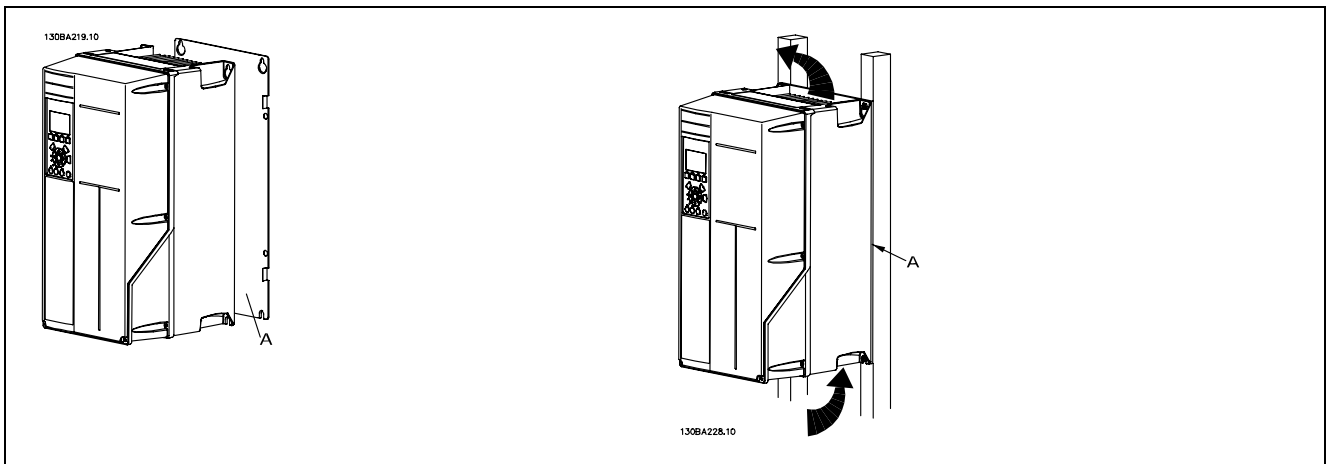
□ Mechanical Installation

□ Mechanical Mounting

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.

FC 300 IP20 allows side-by-side installation. Because of the need for cooling, there must be a minimum of 4 in (100 mm) free air passage above and below the FC 300.

The back wall must always be solid.



□ Electrical Installation



NOTE
Cables General

Always comply with national and local regulations on cable cross-sections.

Tightening-up Torque		
AFD size	Cable for:	Tightening-up torque
0.34-10 HP [0.25-7.5 kW]	Line, brake resistor, load sharing motor cable	0.5-0.6 Nm 1.8 Nm
14.75-10 HP [11-15 kW]	Line, brake resistor, load sharing motor cable	1.8 Nm
14.75-10 HP [11-15 kW]	Motor cable	1.8 Nm
	Relay	0.5-0.6 Nm
	Ground	2-3 Nm

□ Removal of Knockouts for Extra Cables

1. Remove the cable entry from the adjustable frequency drive (avoid foreign parts entering the adjustable frequency drive when removing knockouts).
2. The cable entry must be supported around the knockout you intend to remove.
3. The knockout can now be removed with a strong mandrel and a hammer.
4. Remove burrs from the hole.
5. Mount cable entry on adjustable frequency drive.



□ Connection to Line Supply and Grounding



NOTE
The plug connector for power can be removed.

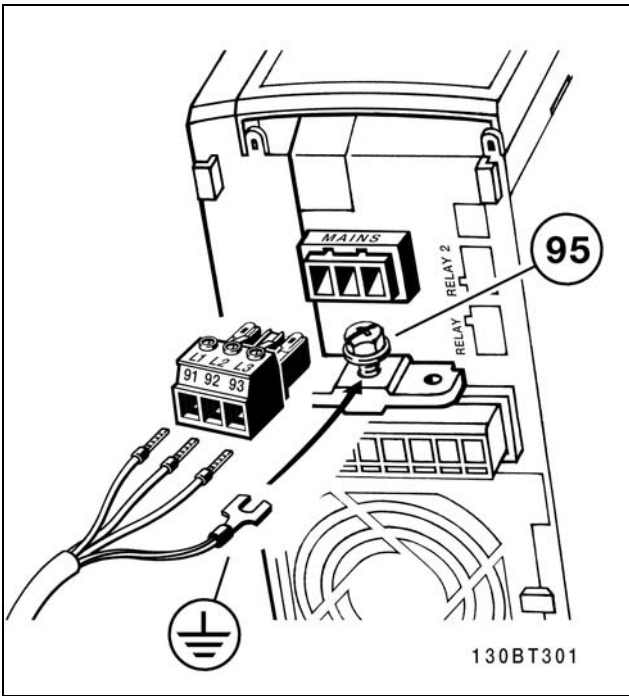
1. Make sure the FC 300 is properly grounded. Connect to ground connection (terminal 95). Use screw from the accessory bag.
2. Place plug connector 91, 92, 93 from the accessory bag onto the terminals labeled MAINS at the bottom of the FC 300.
3. Connect line wires to the line plug connector.



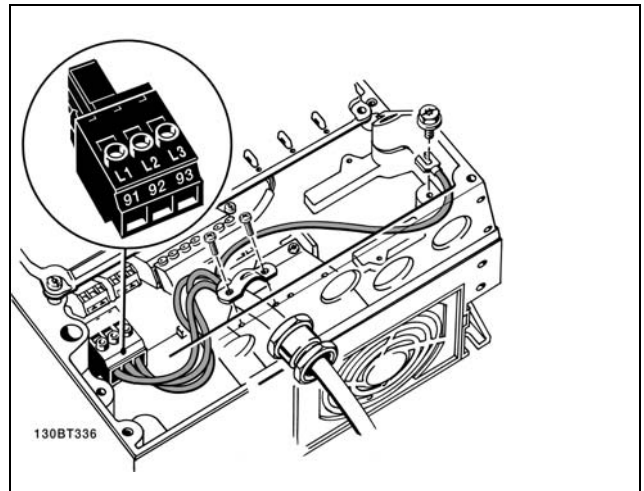
The ground connection cable cross-section must be at least 3.9 in² [10 mm²] or have 2 rated line supply wires terminated separately according to EN 50178.

The line supply connection is fitted to the line supply switch if this is included.

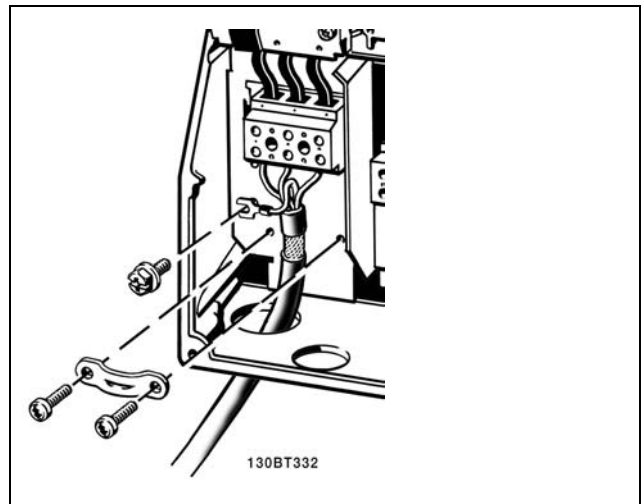
— How to Install —



How to connect to the line supply and grounding (A2 and A3 enclosure).



How to connect to the line supply and grounding (A5 enclosure).



How to connect to the line supply and grounding (B1 and B2 enclosure).



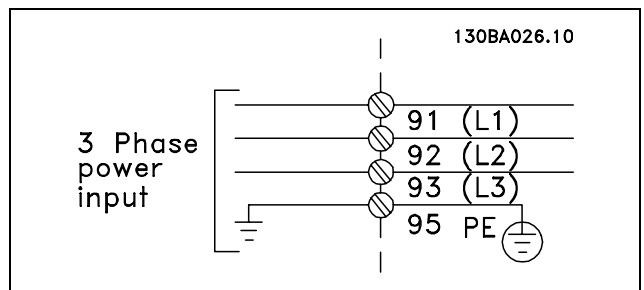
NOTE

Check that AC line voltage corresponds to the line voltage of the FC 300 nameplate.



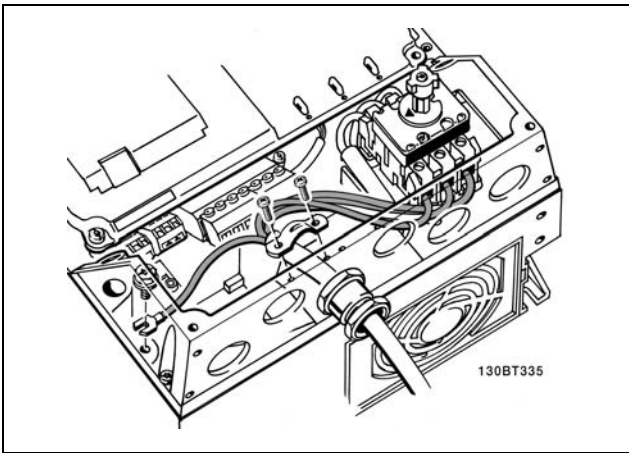
IT Line

Do not connect 400 V adjustable frequency drives with RFI filters to line supplies with a voltage between phase and ground of more than 440 V. For IT lines and delta ground (grounded leg), line voltage may exceed 440 V between phase and ground.



Terminals for line supply and grounding.

— How to Install —



How to connect to the line supply and grounding with disconnect (A5 enclosure).

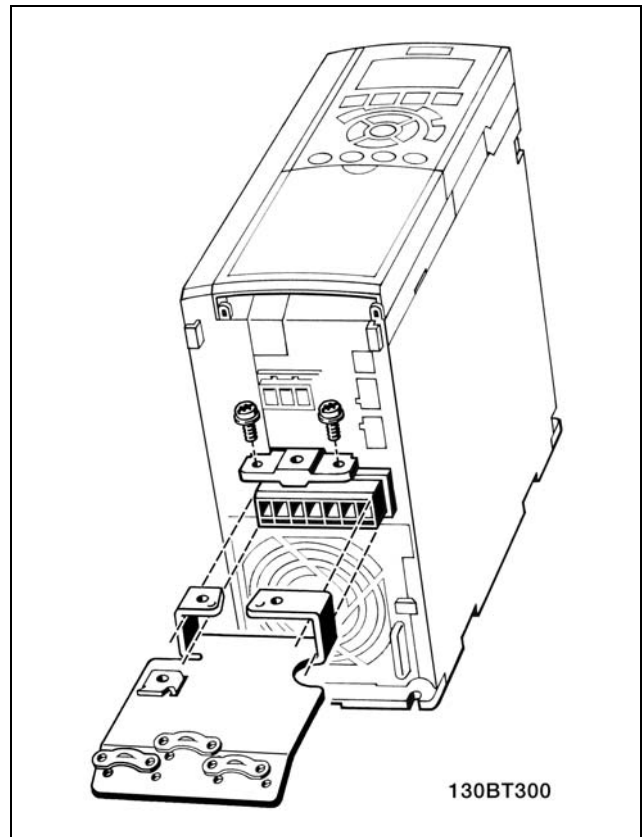


— How to Install —

□ **Motor Connection****NOTE**

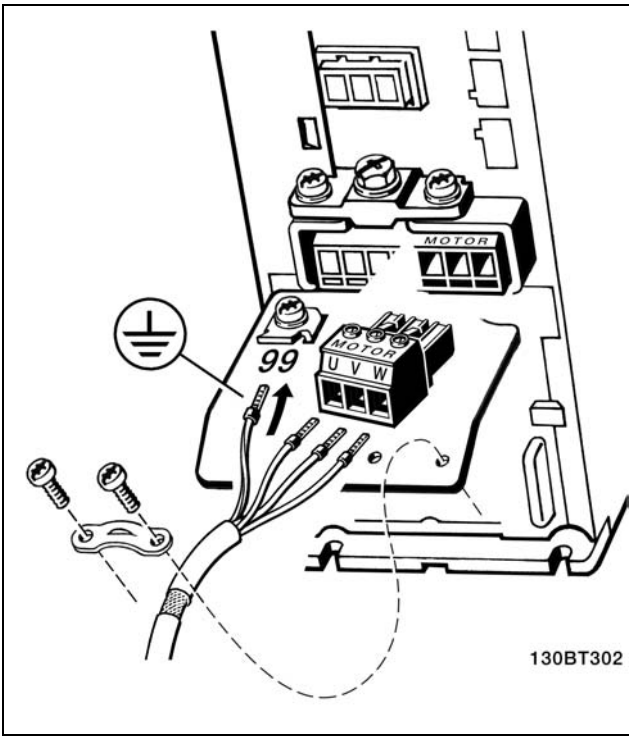
Motor cable must be shielded/armored. If an unshielded/unarmored cable is used, some EMC requirements are not complied with. For more information, see *EMC specifications* in the *VLT AutomationDrive FC 300 Design Guide*.

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

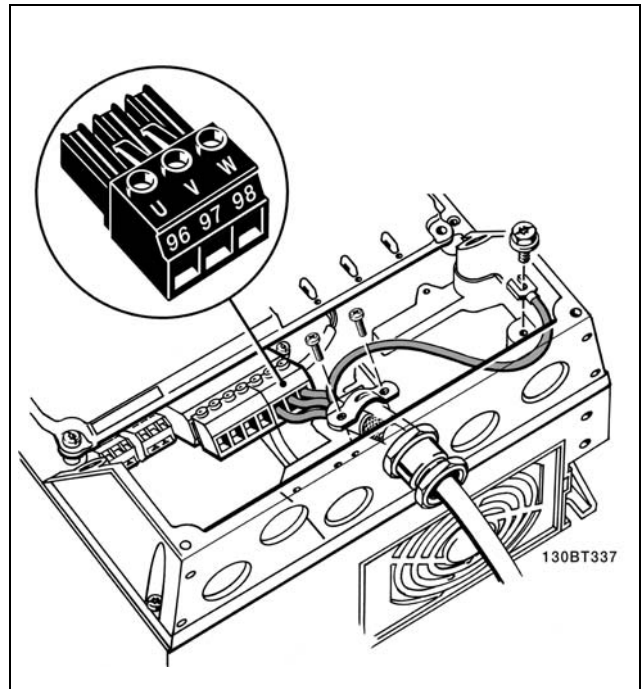


2. Attach motor cable to terminals 96 (U), 97 (V), 98 (W).
3. Connect to ground connection (terminal 99) on decoupling plate with screws from the accessory bag.
4. Insert plug connectors 96 (U), 97 (V), 98 (W) and motor cable into terminals labeled MOTOR.
5. Fasten shielded cable to decoupling plate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

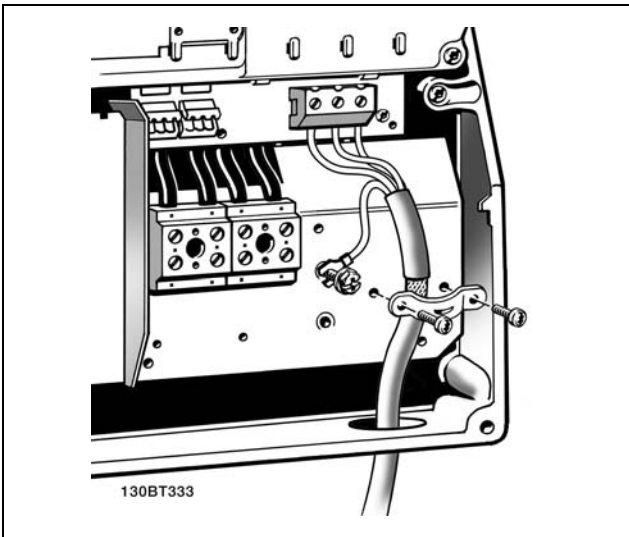
— How to Install —



Motor connection ≤ 10 HP [7.5 kW] IP 20 (A2 and A3 enclosures)



Motor connection ≤ 10 HP [7.5 kW] IP 55 / NEMA type 12



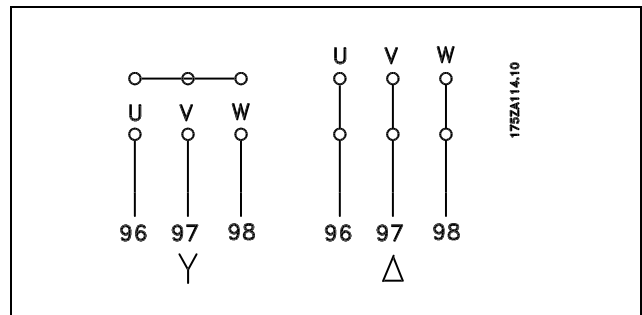
Motor connection 14.75-29.5 HP [11-22 kW] IP 21 / NEMA type 1 (B1 and B2 enclosures)



— How to Install —

No.	96	97	98	Motor voltage 0-100% of AC line voltage. 3 wires out of motor
	U	V	W	
	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			
	PE			Ground connection

All types of three-phase asynchronous standard motors can be connected to the FC 300. Normally, small motors are star-connected (230/400 V, Δ/Y). Large motors are normally delta-connected (400/690 V, Δ/Y). Refer to the motor nameplate for correct connection mode and voltage.



NOTE

In motors without phase insulation paper or other insulation reinforcement suitable for operation with voltage supply (such as adjustable frequency drive), fit an LC filter on the output of the FC 300.

□ **Motor cables**

See Technical data for correct sizing of motor cable cross-section and length. Always comply with national and local regulations on cable cross-section.

- Use a shielded/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 shield to the decoupling plate of the FC 300 and to the metal cabinet of the motor.
- Make the shield 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 (pigtailed), which will spoil high frequency screening effects.
- If it is necessary to split the shield to install a motor isolator or motor relay, the shield must be continued with the lowest possible HF 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 short-circuit and overcurrent-protected according to national/international regulations.

Short circuit protection:

The adjustable frequency drive 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 adjustable frequency drive provides full short-circuit protection in case of a short-circuit on the motor output.

Overcurrent protection:

Provide overload protection to avoid fire hazard due to overheating of the cables in the installation. The adjustable frequency drive is equipped with internal overcurrent 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 overcurrent protection in the installation. Overcurrent protection must always be provided according to national regulations.

Fuses must be designed for protection in a circuit capable of supplying a maximum of 100,000 A_{rms} (symmetrical), 500 V maximum.

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 to the adjustable frequency drive.

FC 30X	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⁾	380-500 V	type gG
2K2-4K0	20A ¹⁾	380-500 V	type gG
5K5-7K5	32A ¹⁾	380-500 V	type gG
11K	63A ¹⁾	380-500 V	type gG
15K	63A ¹⁾	380-500 V	type gG
18K	63A ¹⁾	380-500 V	type gG
22K	80A ¹⁾	380-500 V	type gG

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




— How to Install —

UL Compliance

200-240 V

FC 30X	Bussmann	Bussmann	Bussmann	SIBA	Littel fuse	Ferraz-Shawmut	Ferraz-Shawmut
kW	Type RK1	Type J	Type T	Type RK1	Type RK1	Type CC	Type RK1
2-7.5	KTN-R10	JKS-10	JJN-10	5017906-010	KLN-R10	ATM-R10	A2K-10R
1.1-2.2	KTN-R20	JKS-20	JJN-20	5017906-020	KLN-R20	ATM-R20	A2K-20R
3.0-3.7	KTN-R30	JKS-30	JJN-30	5012406-032	KLN-R30	ATM-R30	A2K-30R

380-500 V, 525-600 V



FC 30X	Bussmann	Bussmann	Bussmann	SIBA	Littel fuse	Ferraz-Shawmut	Ferraz-Shawmut
kW	Type RK1	Type J	Type T	Type RK1	Type RK1	Type CC	Type RK1
0.37-1.5	KTS-R10	JKS-10	JJS-10	5017906-010	KLS-R10	ATM-R10	A6K-10R
2.2-4.0	KTS-R20	JKS-20	JJS-20	5017906-020	KLS-R20	ATM-R20	A6K-20R
5.5-7.5	KTS-R30	JKS-30	JJS-30	5012406-032	KLS-R30	ATM-R30	A6K-30R
11.0	KTS-R40	JKS-40	JJS-40	5014006-040	KLS-R40		A6K-40R
15.0	KTS-R50	JKS-50	JJS-50	5014006-050	KLS-R50		A6K-50R
18.0	KTS-R60	JKS-60	JJS-60	5014006-063	KLS-R60		A6K-60R
22.0	KTS-R80	JKS-80	JJS-80	5014006-100	KLS-R80		A6K-80R

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

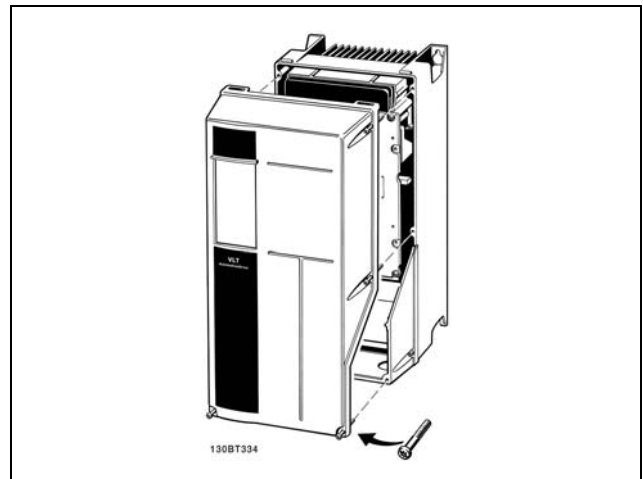
— How to Install —

□ **Access to Control Terminals**

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



A1, A2 and A3 enclosures



A5, B1 and B2 enclosures

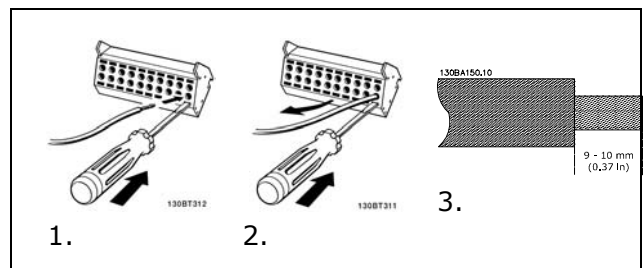
□ **Electrical Installation, Control Terminals**

To mount the cable to the terminal:

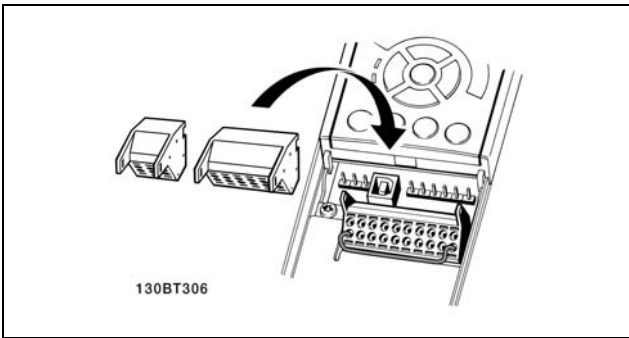
1. Strip isolation of 0.34-0.39 in [9-10 mm]
2. Insert a screwdriver in the square hole.
3. Insert the cable in the adjacent circular hole.
4. Remove the screwdriver. The cable is now mounted to the terminal.

To remove the cable from the terminal:

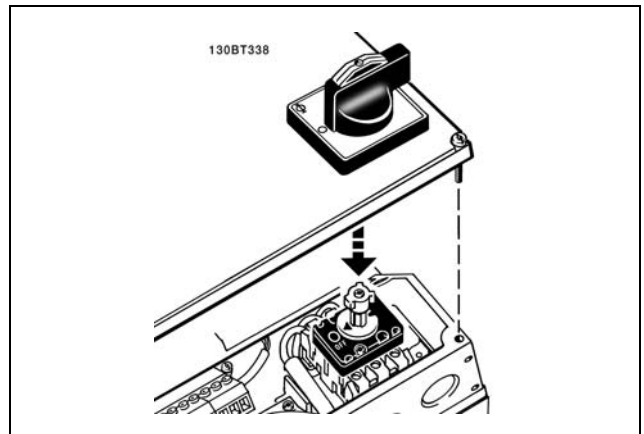
1. Insert a screwdriver in the square hole.
2. Pull out the cable.



— How to Install —



Assembling IP 55 / NEMA TYPE 12 (A5 housing) with line supply disconnector

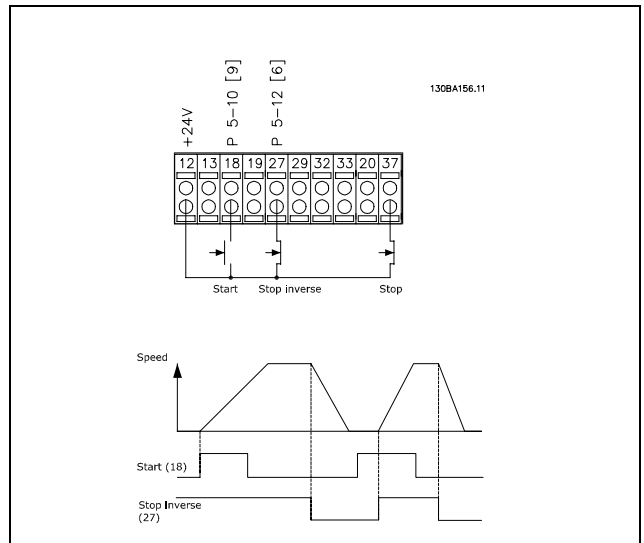


□ **Basic Wiring Example**

1. Mount terminals from the accessory bag to the front of the FC 300.
2. Connect terminals 18, 27 and 37 (FC 302 only) to +24 V (terminal 12/13)

Default settings:

- 18 = start
- 27 = coast inverse
- 37 = safe stop inverse



— How to Install —

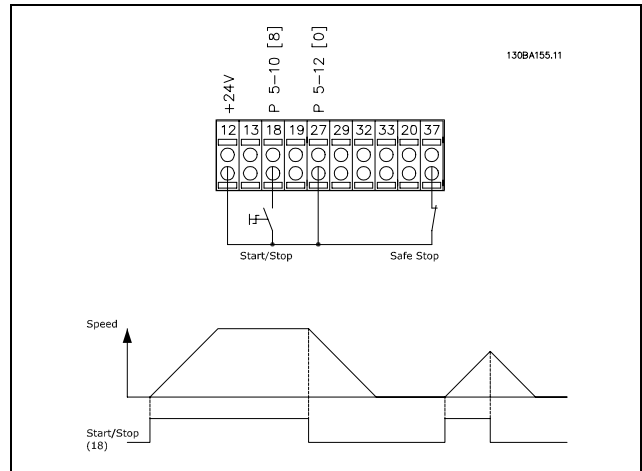
□ **Connection Examples**

□ **Start/Stop**

Terminal 18 = start/stop par. 5-10 [8] *Start*
 Terminal 27 = No operation par. 5-12 [0] *No operation* (Default *coast inverse*)
 Terminal 37 = Safe stop (FC 302 only)

Par. 5-10 *Digital Input* = *Start* (default)

Par. 5-12 *Digital Input* = *coast inverse* (default)

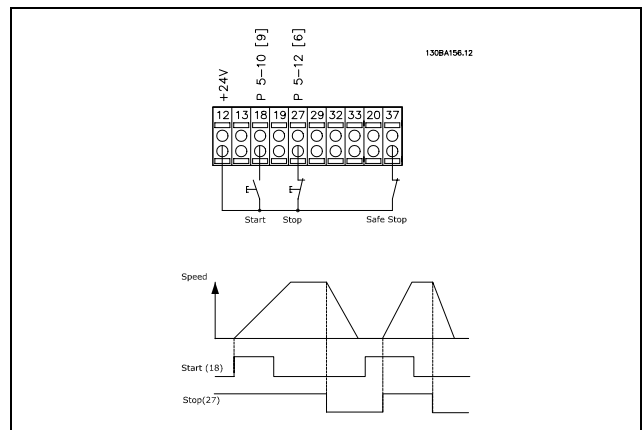


□ **Pulse start/stop**

Terminal 18 = start stop/ par. 5-10 [9] *Latched start*
 Terminal 27 = Stop par. 5-12 [6] *Stop inverse*
 Terminal 37 = Safe stop (FC 302 only)

Par. 5 *Digital input* = *Latched start*

Par. 5 *Digital input* = *Stop inverse*



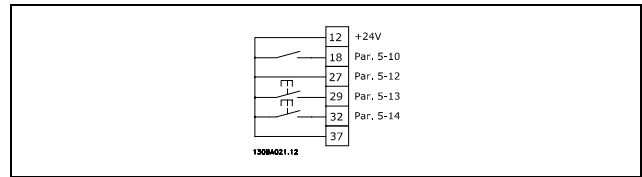
— How to Install —

□ **Speed up/slow down**

Terminals 29/32 = Speed up/slow down.

- Par. 5 Digital input = Pulse start -10
- Par. 5 Digital input = Freeze reference -12
- Par. 5 Digital input = Speed up -13
- Par. 5-14 Digital input = Slow down

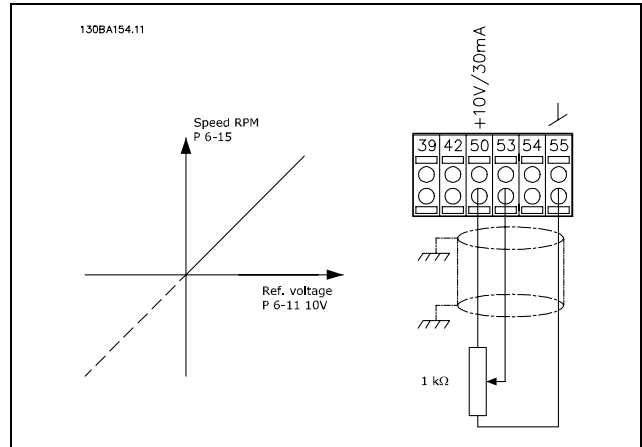
Note: Terminal 29 only in FC 302.



□ **Potentiometer Reference**

Voltage reference via a potentiometer.

- Par. 3-15 Reference Resource 1 [1] = Analog Input 53
- Par. 6-10 Terminal 53, Low Voltage = 0 Volt
- Par. 6-11 Terminal 53, High Voltage = 10 Volt
- Par. 6-14 Terminal 53, Low Ref./Feedb. Value Value = 0 RPM
- Par. 6-15 Terminal 53, High Ref./Feedb. Value Value = 1,500 RPM
- Switch S201 = OFF (U)



— How to Install —

□ Electrical Installation, Control Cables

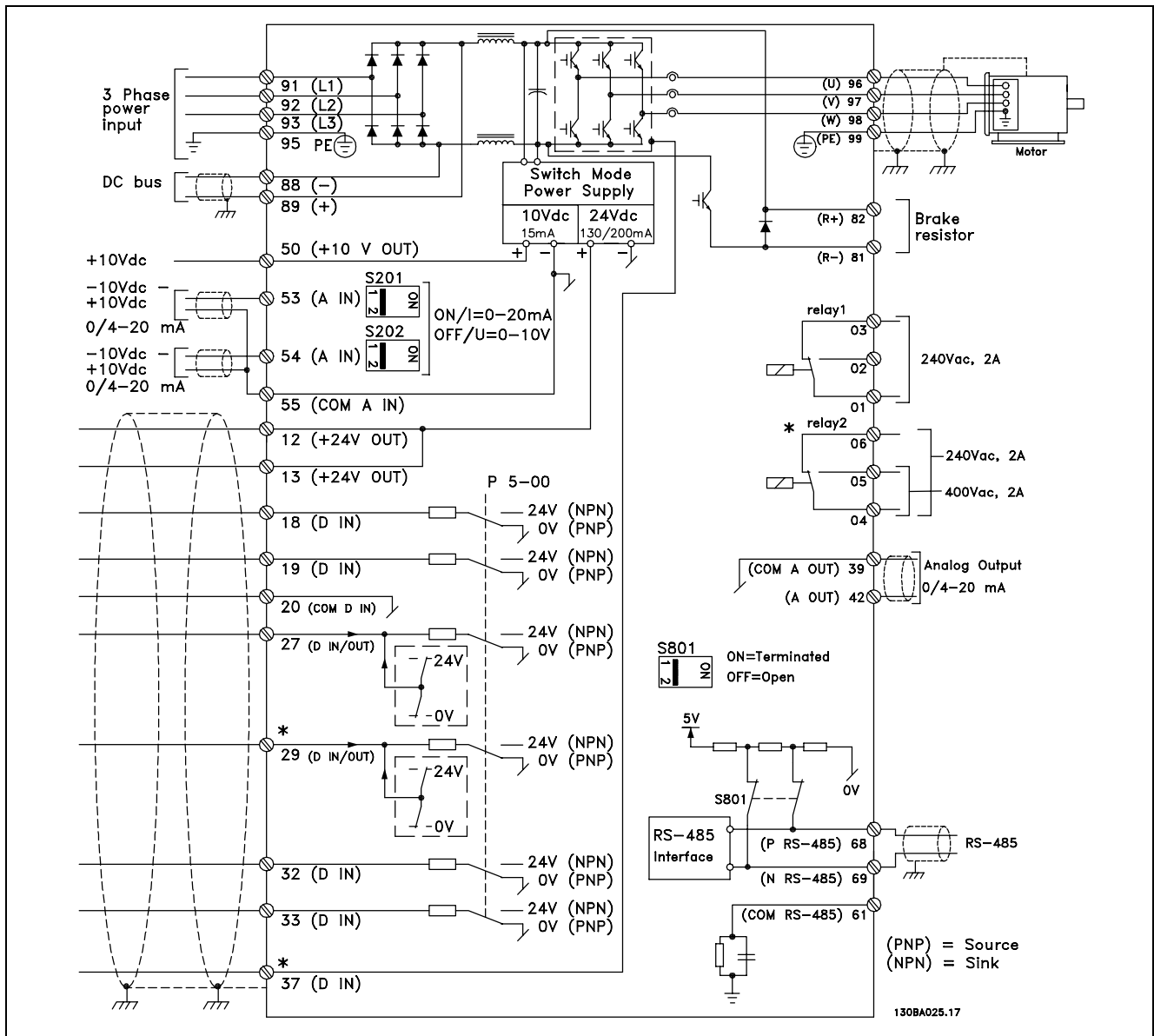


Diagram showing all electrical terminals.

Terminal 37 is not included in FC 301.

Terminal 37 is the input to be used for Safe Stop. For instructions on Safe Stop installation please refer to the section *Safe Stop Installation*.

* Terminal 29 and 37, relay 2 are not included in FC 301.

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

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

The digital and analog inputs and outputs must be connected separately to the FC 300 common inputs (terminal 20, 55, 39) to avoid ground currents from both groups affecting other groups. For example, switching on the digital input may disturb the analog input signal.

— How to Install —

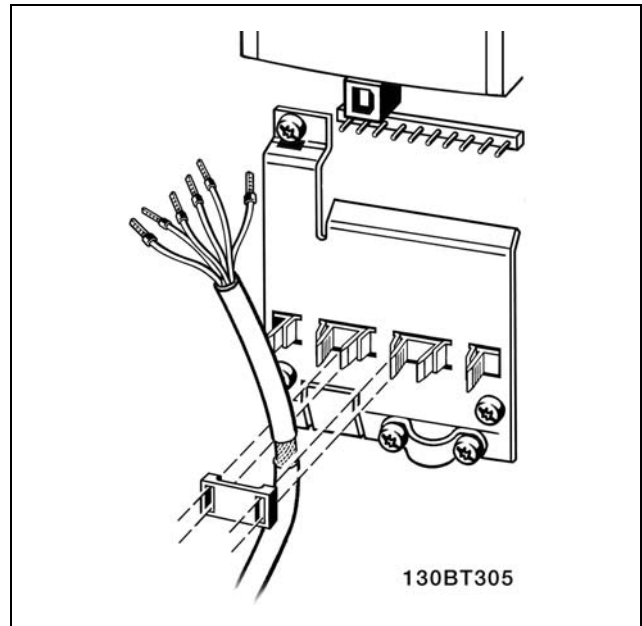


NOTE

Control cables must be shielded/armored.

1. Use a clamp from the accessory bag to connect the shield to the FC 300 grounding plate for control cables.

See section entitled *Grounding of Shielded/Armored Control Cables* for the correct termination of control cables.



□ **Switches S201, S202, and S801**

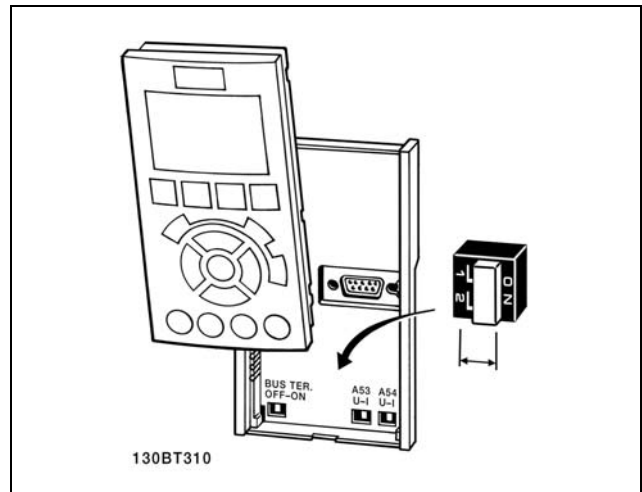
Switches S201 (A53) and S202 (A54) are used to select a current (0-20 mA) or a voltage (-10 to 10 V) configuration of the analog input terminals 53 and 54 respectively.

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



□ **Tightening torques**

Tighten power, electrical, brake, and ground terminals with the following torques:

FC 300	Connections	Torque (Nm)
	Motor, electrical supply, brake, DC Bus	0.5-0.6
	Ground, 24 DC	2-3
	Relay, DC filter feedback	0.5-0.6

— How to Install —

□ **Final Set-Up and Test**

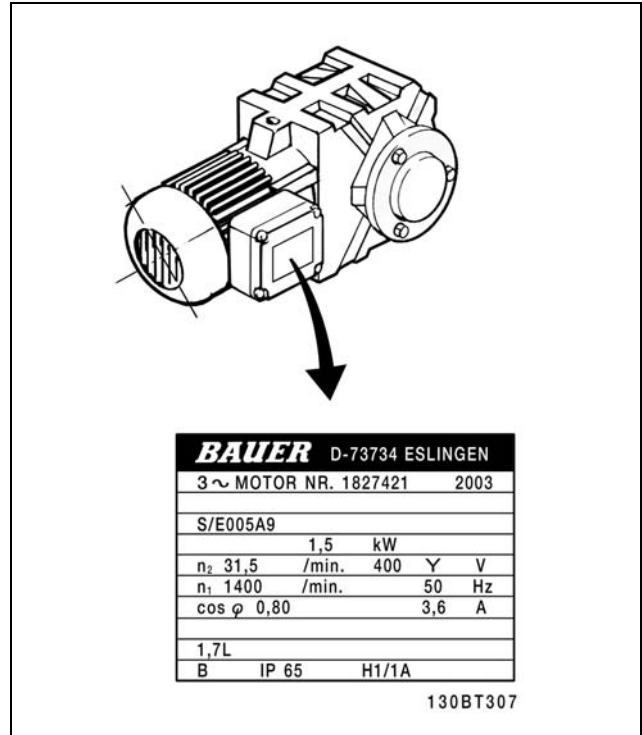
To test the set-up and ensure that the adjustable frequency drive is running, follow these steps.

Step 1. Locate the motor nameplate.



NOTE

The motor is either star- (Y) or delta-connected (Δ). This information is located on the motor nameplate data.



Step 2. Enter the motor nameplate data in this parameter list.

To access this list first press the [QUICK MENU] key, then select "Q2 Quick Setup".

1.	Motor Power [kW] or Motor Power [HP]	par. 1-20 par. 1-21
2.	Motor Voltage	par. 1-22
3.	Motor Frequency	par. 1-23
4.	Motor Current	par. 1-24
5.	Motor Nominal Speed	par. 1-25

Step 3. Activate the Automatic Motor Adaptation (AMA)

Performing an AMA will ensure optimum performance. The AMA measures the values from the motor model equivalent diagram.

1. Connect terminal 37 to terminal 12 (FC 302).
2. Connect terminal 27 to terminal 12 or set par. 5-12 to 'No function' (par. 5-12 [0]).
3. Activate the AMA par. 1-29.
4. Choose between complete or reduced AMA. If an LC filter is mounted, run only the reduced AMA, or remove the LC filter during the AMA procedure.
5. Press the [OK] key. The display shows "Press [Hand on] to start".
6. Press the [Hand on] key. A progress bar indicates if the AMA is in progress.

— How to Install —

Stop the AMA during operation.

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

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 adjustable frequency drive 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 adjustable frequency drive 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.



NOTE

Unsuccessful AMA is often caused by incorrectly registered motor nameplate data or a difference between the motor power size and the FC 300 power size that is too large.

Step 4. Set speed limit and ramp time

Set up the desired limits for speed and ramp time.

Minimum Reference	par. 3-02
Maximum Reference	par. 3-03

Motor Speed Low Limit	par. 4-11 or 4-12
Motor Speed High Limit	par. 4-13 or 4-14

Ramp-up Time 1 [s]	par. 3-41
Ramp-down Time 1 [s]	par. 3-42

□ Additional Connections

□ Control of Mechanical Brake

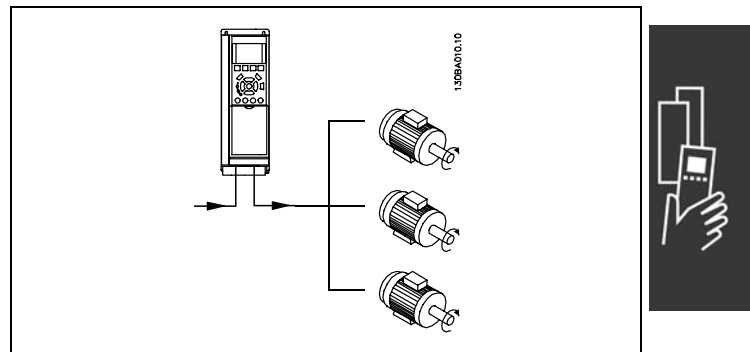
Control an electromechanical brake in hoisting/lowering applications.

- Control the brake using any relay output or digital output (terminal 27 or 29).
- Keep the output closed (voltage-free) as long as the adjustable frequency drive 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 electromechanical 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 adjustable frequency drive carries out a stop command.

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

□ 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).



NOTE

When motors are connected in parallel, parameter 1-02 *Automatic motor adaptation (AMA)* cannot be used and Parameter 1-01 *Torque characteristics* must be set to *Special motor characteristics*.

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

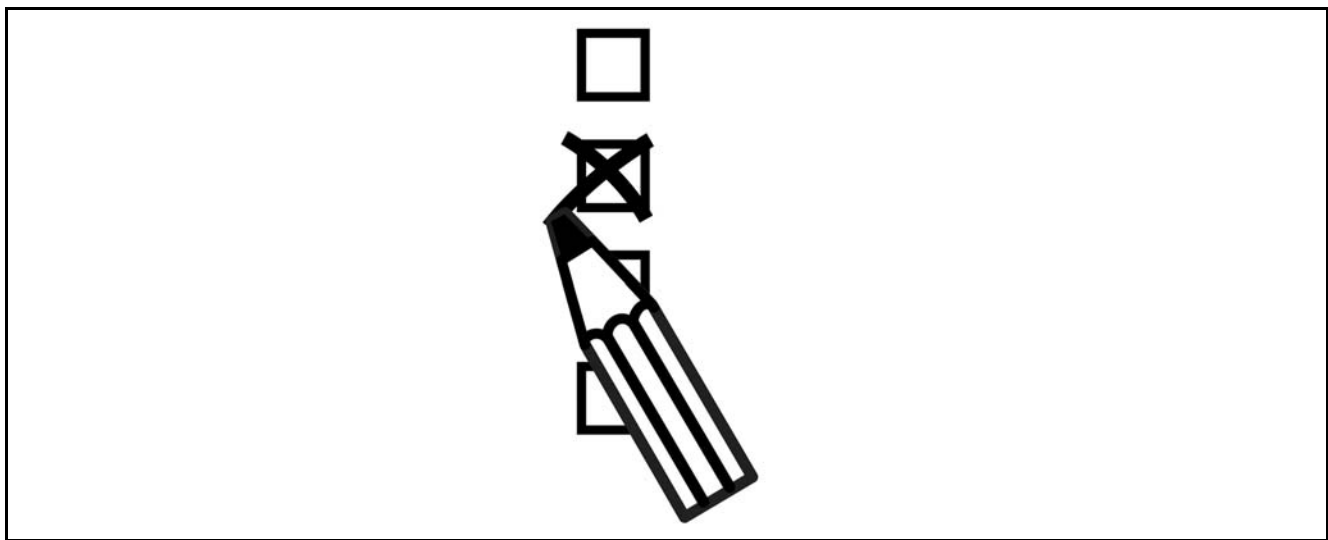
□ Motor Thermal Protection

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 Install —



How to Program



— How to Program —

□ **Quick Setup**

0-01 Language

Option:

*English UK (ENGLISH)	[0]
German (DEUTSCH)	[1]
French (FRANCAIS)	[2]
Danish (DANSK)	[3]
Spanish (ESPAÑOL)	[4]
Italian (ITALIANO)	[5]
Chinese (CHINESE)	[10]
Finnish (FINNISH)	[20]
English US (ENGLISH US)	[22]
Greek (GREEK)	[27]
Portuguese (PORTUGUESE)	[28]
Slovenian (SLOVENIAN)	[36]
Korean (KOREAN)	[39]
Japanese (JAPANESE)	[40]
Turkish (TURKISH)	[41]
Traditional Chinese	[42]
Bulgarian	[43]
Serbian	[44]
Romanian (ROMANIAN)	[45]
Hungarian (HUNGARIAN)	[46]
Czech	[47]
Polish (POLISH)	[48]
Russian	[49]
Thai	[50]
Bahasa Indonesian (BAHASA INDONESIAN)	[51]

Function:

Defines the language to be used in display.

The adjustable frequency drive can be delivered with 4 various language packages. English and German are included in all packages. English cannot be erased or manipulated.

Language package 1 consists of: English, German, French, Danish, Spanish, Italian and Finnish.

Language package 2 consists of: English, German, Chinese, Korean, Japanese, Thai and Bahasa Indonesian.

Language package 3 consists of: English, German, Slovenian, Bulgarian, Serbian, Romanian, Hungarian, Czech and Russian.

Language package 4 consists of: English, German, Spanish, English US, Greek, Brazilian Portuguese, Turkish and Polish.

1-20 Motor Power [kW]

Range:

0.5-10 HP [0.37-7.5 kW] [M-TYPE]

Function:

Enter the nominal motor power in kW according to the motor nameplate data. The default value corresponds to the nominal rated output of the unit. This parameter cannot be adjusted while the motor is running.

1-22 Motor Voltage

Range:

200-600 V [M-TYPE]

Function:

Enter the nominal motor voltage according to the motor nameplate data. The default value corresponds to the nominal rated output of the unit. This parameter cannot be adjusted 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	

Function:

Select the motor frequency value from the motor nameplate data. 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 adapt the load independent settings in par. 1-50 to 1-53. For 87 Hz operation with 230/400 V motors, set the nameplate data for 230 V/50 Hz. Adapt par. 4-13 *Motor Speed High Limit [RPM]* and par. 3-03 *Maximum Reference* to the 87 Hz application. This parameter cannot be adjusted while the motor is running.



NOTE

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

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

— How to Program —



NOTE

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

1-24 Motor Current

Range:

Motor type dependent.

Function:

Enter the nominal motor current value from the motor nameplate data. The data are used for calculating torque, motor protection, etc. This parameter cannot be adjusted while the motor is running.

1-25 Motor Nominal Speed

Range:

100 - 60000 RPM * RPM

Function:

Enter the nominal motor speed value from the motor nameplate data. The data are used for calculating motor compensations. This parameter cannot be adjusted while the motor is running.

1-29 Automatic Motor Adaptation (AMA)

Option:

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

Function:

The AMA function optimises dynamic motor performance by automatically optimising the advanced motor parameters (par. 1-30 to par. 1-35) while the motor is stationary.

Select the type of AMA. *Enable complete AMA* [1] performs 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 this option if an LC filter is used between the drive and the motor.

FC 301: The Complete AMA does not include X_h measurement for FC 301. Instead, the X_h value is determined from the motor database. Par. 1-35 *Main Reactance (X^h)* may be adjusted to obtain optimal start performance.

Select *Reduced AMA* [2] performs a reduced AMA of the stator resistance R_s in the system only.

Activate the AMA function by pressing [Hand on]

after selecting [1] or [2]. See also the 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 ready for operation.
Note:

- For the best adaptation of the frequency converter, run AMA on a cold motor.
- AMA cannot be performed while the motor is running.
- AMA cannot be performed on permanent magnet motors.



NOTE

It is important to set motor par. 1-2* Motor Data correctly, since these form part of the AMA algorithm. An AMA must be performed to achieve optimum dynamic motor performance. It may take up to 10 min, depending on the power rating of the motor.



NOTE

Avoid generating external torque during AMA.



NOTE

If one of the settings in par. 1-2* Motor Data is changed, par. 1-30 to 1-39, the advanced motor parameters, will return to default setting. This parameter cannot be adjusted while the motor is running.



3-02 Minimum Reference

Option:

-100000.000 - MaxReference (par. 3-03) *0.000

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

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

— How to Program —

Function:

Enter the maximum reference. The maximum reference is the highest value obtainable by summing all references. The maximum reference unit matches

- The choice of configuration in par. 1-00

Configuration Mode: for *Speed closed-loop* [1], RPM; for *Torque* [2], Nm.

- The unit selected in par. 3-01 *Reference/Feedback Unit*.

3-41 Ramp 1 Ramp-up Time**Range:**

0.01 - 3600.00 s * s

Function:

Enter the ramp-up time, i.e., the acceleration time from 0 RPM to the rated motor speed $n_{M,N}$ (par. 1-25). Choose a ramp-up time such that the output current does not exceed the current limit in par. 4-18 during ramping. The value 0.00 corresponds to 0.01 sec. in speed mode. See ramp-down time in par. 3-42.

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

3-42 Ramp 1 Ramp-down Time**Range:**

0.01 - 3600.00 s * s

Function:

Enter the ramp-down time, i.e., the deceleration time from the rated motor speed $n_{M,N}$ (par. 1-25) to 0 RPM. Choose a ramp-down time such that no over-voltage arises in the inverter due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in par. 4-18. The value 0.00 corresponds to 0.01 s in speed mode. See ramp-up time in par. 3-41.

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

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

— How to Program —

Parameter lists

Changes during operation

"TRUE" means that the parameter can be changed while the adjustable frequency drive 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 variable frequency drive.

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 Program —

- 1-xx Load and motor parameters, including all load- and motor-related parameters
- 2-xx Brake parameters
 - DC brake
 - Dynamic brake (resistor brake)
 - Mechanical brake
 - Over-voltage control
- 3-xx References and ramping parameters includes DigiPot function
- 4-xx Limits and warnings; setting of limits and warning parameters
- 5-xx Digital inputs and outputs, including relay controls
- 6-xx Analog inputs and outputs
- 7-xx Controls; setting parameters for speed and process control
- 8-xx Communication and option parameters for setting of FC RS-485 and FC USB port parameters.
- 9-xx Profibus parameters
- 10-xx DeviceNet and CAN Fieldbus parameters
- 13-xx Smart Logic Control parameters
- 14-xx Special function parameters
- 15-xx Drive information parameters
- 16-xx Readout parameters
- 17-xx Encoder option parameters



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

— How to Program —

□ **0-** Operation/Display**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion 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 dependent	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
0-64	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 Program —

□ **1-** Load/Motor**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion 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 [HP]	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

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

— How to Program —

□ **2-** Brakes**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion 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



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□ **3-** Reference / Ramps**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion 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	25 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	Conversion 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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□ **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] Reverse	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	[24] Set-up select bit 1	All set-ups	TRUE	-	Uint8
5-15	Terminal 33 digital input	[23] Set-up select bit 0	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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□ **6-** Analog In/Out**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion 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	Conversion 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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□ **8-** Comm. and options**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
8-0* General settings						
8-00	Enabled options	[1] All	All set-ups	FALSE	-	Uint8
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	2 set-ups	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	Reverse 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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□ 9-** Profibus

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



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□ **10-** CAN fieldbus**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion 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

□ **13-** Smart logic control**

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

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□ **14-** Special functions**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion 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* Electrical power On/Off						
14-10	Electrical failure	[0] No function	All set-ups	FALSE	-	Uint8
14-11	Electrical Voltage at Electrical Fault	342 V	All set-ups	TRUE	0	Uint16
14-12	Function at Electrical 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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□ **15-** Drive information**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion 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 of 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	Conversion 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	0.0 HP	All set-ups	FALSE	0	Uint32
16-33	Brake energy /2 min	0.0 HP	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
16-52	Feedback [Unit]	0.000	All set-ups	FALSE	-3	Int32
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

— How to Program —

□ **17-** Motor Feedb.Option**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
17-1* Inc. Enc. Interface						
		[1] RS422 (5V TTL/linedrv.)				
17-10	Signal Type	TTL/linedrv.)	All set-ups	FALSE	-	Uint8
17-11	Resolution (PPR)	1024 N/A	All set-ups	FALSE	0	Uint16
17-2* Abs. Enc. Interface						
17-20	Protocol Selection	[0] None	All set-ups	FALSE	-	Uint8
17-21	Resolution (Positions/Rev)	[32768] 32768	All set-ups	FALSE	-	Uint16
17-34	HIPERFACE Baudrate	[4] 9600	All set-ups	FALSE	-	Uint8
17-6* Monitoring and App.						
17-60	Encoder Positive Direction	[0] Clockwise	All set-ups	FALSE	-	Uint8



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

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 temporary between mains phases	3.0 % of rated supply voltage
True Power Factor (λ)	0.90 nominal at rated load
Displacement Power Factor ($\cos \phi$) near unity	(> 0.98)
Switching on input supply L1, L2, L3	2 times/min.
Environment according to EN60664-1	overvoltage category III/pollution degree 2
<i>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.</i>	

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	0.01 - 3600 sec.

Torque characteristics:

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

Digital inputs:

Programmable digital inputs	FC 301: 4 (5) / FC 302: 4 (6)
Terminal number	18, 19, 27 ¹⁾ , 29 ⁴⁾ , 32, 33,
Logic	PNP or NPN
Voltage level	0 - 24 V DC
Voltage level, logic'0' PNP	< 5 V DC
Voltage level, logic'1' PNP	> 10 V DC



— General Specifications —

Voltage level, logic '0' NPN ²⁾	> 19 V DC
Voltage level, logic '1' NPN ²⁾	< 14 V DC
Maximum voltage on input	28 V DC
Input resistance, R _i	approx. 4 kΩ

Safe stop Terminal 37⁴⁾:
Terminal 37 is fixed PNP logic

Voltage level	0 - 24 V DC
Voltage level, logic'0' PNP	< 4 V DC
Voltage level, logic'1' PNP	>20 V DC
Nominal input current at 24 V	50 mA rms
Nominal input current at 20 V	60 mA rms
Input capacitance	400 nF

All digital inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

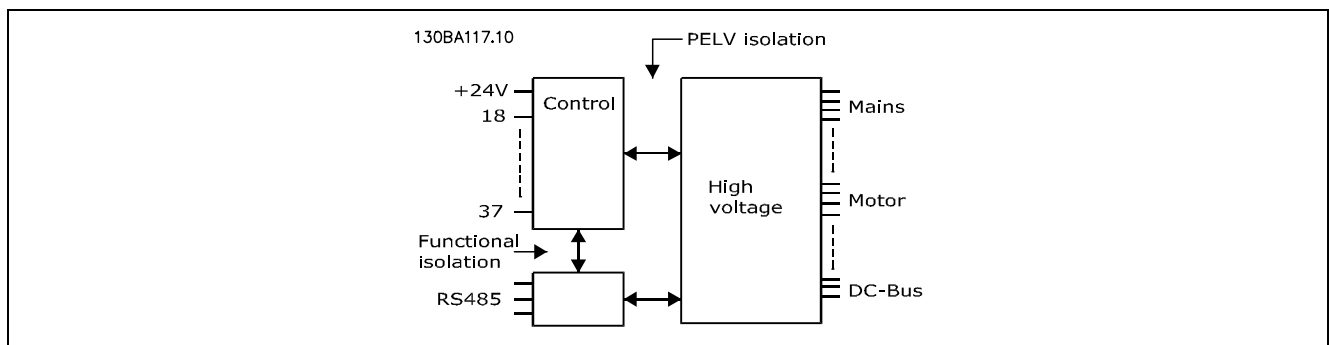
- 1) Terminals 27 and 29 can also be programmed as output.
- 2) Except safe stop input Terminal 37.
- 3) Terminal 37 is only available in the FC 302. It can only be used as safe stop input. Terminal 37 is suitable for category 3 installations according to EN 954-1 (safe stop according to category 0 EN 60204-1) as required by the EU Machinery Directive 98/37/EC. Terminal 37 and the Safe Stop function are designed in conformance with EN 60204-1, EN 50178, EN 61800-2, EN 61800-3, and EN 954-1. For correct and safe use of the Safe Stop function, follow the related information and instructions in the Design Guide.
- 4) FC 302 only.

Analog inputs:

Number of analog 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 (scalable)
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 (scalable)
Input resistance, R _i	approx. 200 Ω
Max. current	30 mA
Resolution for analog inputs	10 bit (+ sign)
Accuracy of analog inputs	Max. error 0.5% of full scale
Bandwidth	FC 301: 20 Hz / FC 302: 100 Hz

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

HZ
V
A
IP
°C
Ω



— General Specifications —

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: 32 = A, and 33 = B

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 output frequency	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.

Analog output:

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

The analog 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 analog 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.



— General Specifications —

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).

Control card, USB serial communication:

USB standard 1.1 (Full 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.
 The USB connection is not galvanically isolated from protection ground. Only use an isolated laptop as a PC connection to the USB connector on the FC 300 drive.*

Relay outputs:

Programmable relay outputs FC 301: 1 / FC 302: 2
 Relay 01 Terminal number 1-3 (break), 1-2 (make)
 Max. terminal load (AC-1)¹⁾ on 1-3 (NC), 1-2 (NO) (Resistive load) 240 V AC, 2 A
 Max. terminal load (AC-15)¹⁾ (Inductive load @ cosφ 0.4) 240 V AC, 0.2 A
 Max. terminal load (DC-1)¹⁾ on 1-2 (NO), 1-3 (NC) (Resistive load) 60 V DC, 1A
 Max. terminal load (DC-13)¹⁾ (Inductive load) 24 V DC, 0.1A
 Relay 02 (FC 302 only) Terminal number 4-6 (break), 4-5 (make)
 Max. terminal load (AC-1)¹⁾ on 4-5 (NO) (Resistive load) 400 V AC, 2 A
 Max. terminal load (AC-15)¹⁾ on 4-5 (NO) (Inductive load @ cosφ 0.4) 240 V AC, 0.2 A
 Max. terminal load (DC-1)¹⁾ on 4-5 (NO) (Resistive load) 80 V DC, 2 A
 Max. terminal load (DC-13)¹⁾ on 4-5 (NO) (Inductive load) 24 V DC, 0.1A
 Max. terminal load (AC-1)¹⁾ on 4-6 (NC) (Resistive load) 240 V AC, 2 A
 Max. terminal load (AC-15)¹⁾ on 4-6 (NC) (Inductive load @ cosφ 0.4) 240 V AC, 0.2A
 Max. terminal load (DC-1)¹⁾ on 4-6 (NC) (Resistive load) 50 V DC, 2 A
 Max. terminal load (DC-13)¹⁾ on 4-6 (NC) (Inductive load) 24 V DC, 0.1 A
 Min. terminal load on 1-3 (NC), 1-2 (NO), 4-6 (NC), 4-5 (NO) 24 V DC 10 mA, 24 V AC 20 mA
 Environment according to EN 60664-1 overvoltage category III/pollution degree 2
 1) IEC 60947 part 4 and 5
The relay contacts are galvanically isolated from the rest of the circuit by reinforced isolation (PELV).

Cable lengths and cross -sections:

Max. motor cable length, shielded/armored FC 301: 150 ft (50 m) / FC 302: 500 ft (150 m)
 Max. motor cable length, non-shielded/unarmored FC 301: 250 ft (75 m) / FC 302: 1000 ft (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), (0.34 HP - 10 HP / 0.25 kW - 7.5 kW) 0.006 in.² (4 mm²) / 10 AWG
 Maximum cross-section to control wires, rigid wire 0.002 in.² (1.5 mm²)/16 AWG (2 x 0.001 in.² (2 x 0.75 mm²))
 Maximum cross-section to control cables, flexible cable 0.0015 in.² (1 mm²)/18 AWG
 Maximum cross-section to control cables, cable with enclosed core 0.0008 in.² (0.5 mm²)/20 AWG
 Minimum cross-section to control wires 0.0004 in.² (0.25 mm²)

Control card performance:

Scan interval FC 301: 5 ms / FC 302: 1 ms



— General Specifications —

Control characteristics:

Resolution of output frequency at 0 - 1000 Hz	0.013 Hz
Repeat accuracy of <i>Precise start/stop</i> (terminals 18, 19)	FC 301: $\leq \pm 1$ ms / FC 302: $\leq \pm 0.1$ msec
System response time (terminals 18, 19, 27, 29, 32, 33)	FC 301: ≤ 10 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: Max. error of ± 8 rpm
Speed accuracy (closed loop)	0 - 6000 rpm: Max. error of ± 0.15 rpm

All control characteristics are based on a 4-pole asynchronous motor

Surroundings:

Enclosure ≤ 10 HP [7.5 kW]	IP 20, IP 55
Enclosure ≥ 14.75 HP [11 kW]	IP 21, IP 55
Enclosure kit available ≤ 10 HP [7.5 kW]	IP21/TYPE 1/IP 4X top
Vibration test	0.03 oz [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. 122°F [50°C] (24-hour average maximum 113°F [45°C])
<i>Derating for high ambient temperature, see special conditions in the Design Guide</i>	
Minimum ambient temperature during full-scale operation	32°F [0°C]
Minimum ambient temperature at reduced performance	14°F [-10°C]
Temperature during storage/transport	-13° - +149/158°F [-25° - +65/70°C]
Maximum altitude above sea level	3281 ft. [1000 m]
<i>Derating for high altitude, see special conditions in the Design Guide.</i>	
EMC standards, Emission	EN 61800-3, EN 61000-6-3/4, EN 55011
EMC standards, Immunity	EN 61800-3, EN 61000-6-1/2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6

See section on special conditions in the Design Guide

Protection and Features:

-
- Electronic thermal motor protection against overload.
 - Temperature monitoring of the heatsink ensures that the adjustable frequency drive trips if the temperature reaches 203°F \pm 9°F [95 °C \pm 5°C]. An overload temperature cannot be reset until the temperature of the heatsink is below 158°C \pm 9°C [70°C \pm 5°C] (Guideline - these temperatures may vary for different power sizes, enclosures, etc.).
 - The adjustable frequency drive is protected against short circuits on motor terminals U, V, W.
 - If a line phase is missing, the adjustable frequency drive trips or issues a warning (depending on the load).
 - Monitoring of the intermediate circuit voltage ensures that the adjustable frequency drive trips if the intermediate circuit voltage is too low or too high.
 - The adjustable frequency drive is protected against ground faults on motor terminals U, V, W.



— General Specifications —

HZ
V
A
IP
°C
Ω

Warnings and Alarms



□ Warnings/Alarm Messages

A warning or an alarm is signaled by the relevant LED on the front of the adjustable frequency drive and indicated by a code on the display.

A warning remains active until its cause is no longer present. Under certain circumstances, operation of the motor may still be continued. Warning messages may be critical, but are not necessarily so.

In the event of an alarm, the adjustable frequency drive will have tripped. Alarms must be reset to restart operation once their cause has been rectified. This may be done in three ways:

1. By using the [RESET] control button on the LCP control panel.
2. Via a digital input with the "Reset" function.
3. Via serial communication/optional serial communication bus.



NOTE

After a manual reset using the [RESET] button on the LCP, the [AUTO ON] button must be pressed to restart the motor.

If an alarm cannot be reset, the reason may be that its cause has not been rectified, or the alarm is trip-locked (see also table on following page).

Alarms that are trip-locked offer additional protection, meaning that the line supply must be switched off before the alarm can be reset. After being switched back on, the FC 300 is no longer blocked and may be reset as described above once the cause has been rectified.

Alarms that are not trip-locked can also be reset using the automatic reset function in parameters 14-20 (Warning: automatic wake-up is possible!)

If a warning and alarm is marked against a code in the table on the following page, this means that either a warning occurs before an alarm, or else that you can specify whether it is a warning or an alarm that is to be displayed for a given fault.



— Warnings and Alarms —

This is possible, for instance, in parameters 1-90 *Motor Thermal Protection*. After an alarm/trip, the motor will remain coasted, and alarm and warning will flash on the FC 300. Once the problem has been rectified, only the alarm continues flashing.



— Warnings and Alarms —

Alarm/Warning code list					
No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
1	10 Volts low	X			
2	Live zero error	(X)	(X)		6-01
3	No motor	(X)			1-80
4	Line phase loss	(X)	(X)	(X)	14-12
5	DC link voltage high	X			
6	DC link voltage low	X			
7	DC overvoltage	X	X		
8	DC undervoltage	X	X		
9	Inverter overloaded	X	X		
10	Motor ETR overtemperature	(X)	(X)		1-90
11	Motor thermistor overtemperature	(X)	(X)		1-90
12	Torque limit	X	X		
13	Overcurrent	X	X	X	
14	Ground fault	X	X	X	
15	Hardware mis-match		X	X	
16	Short Circuit		X	X	
17	Control word timeout	(X)	(X)		8-04
25	Brake resistor short-circuited	X			
26	Brake resistor power limit	(X)	(X)		2-13
27	Brake chopper short-circuited	X	X		
28	Brake check	(X)	(X)		2-15
29	Power board overtemp	X	X	X	
30	Motor phase U missing	(X)	(X)	(X)	4-58
31	Motor phase V missing	(X)	(X)	(X)	4-58
32	Motor phase W missing	(X)	(X)	(X)	4-58
33	Soft-charge fault		X	X	
34	Serial communication bus fault	X	X		
38	Internal fault		X	X	
47	24 V supply low	X	X	X	
48	1.8 V supply low		X	X	
49	Speed limit	X			
50	AMA calibration failed		X		
51	AMA check U_{nom} and I_{nom}		X		
52	AMA low I_{nom}		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	X		
59	Current limit	X			
61	Tracking Error	(X)	(X)		4-30
62	Output Frequency at Maximum Limit	X			
63	Mechanical Brake Low		(X)		2-20
64	Voltage Limit	X			
65	Control Board Overtemperature	X	X	X	
66	Heatsink Temperature Low	X			
67	Option Configuration has Changed		X		
68	Safe Stop Activated		X		
80	Drive Initialized to Default Value		X		
90	Encoder Loss	(X)	(X)		17-61

(X) Dependent on parameter

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



— Warnings and Alarms —

Description of Alarm Word, Warning Word, and extended Status Word					
Alarm Word	Extended Status Word				
Bit	Hex	Dec	AlarmWord	WarningWord	ExtendedStatusWord
0	00000001	1	Brake Check	Brake Check	Ramping
1	00000002	2	Pwr. Card Temp	Pwr. Card Temp	AMA Running
2	00000004	4	Ground Fault	Ground Fault	Start CW/CCW
3	00000008	8	Ctrl.Card Temp	Ctrl.Card Temp	Slow-down
4	00000010	16	Ctrl. Word TO	Ctrl. Word TO	Catch-up
5	00000020	32	Overcurrent	Overcurrent	Feedback High
6	00000040	64	Torque Limit	Torque Limit	Feedback Low
7	00000080	128	Thrmstr overld	Thrmstr overld	Output Current High
8	00000100	256	Motor ETR Over	Motor ETR Over	Output Current Low
9	00000200	512	Inverter Overld.	Inverter Overld.	Output Freq High
10	00000400	1024	DC undervolt	DC undervolt	Output Freq Low
11	00000800	2048	DC overvolt	DC overvolt	Brake Check OK
12	00001000	4096	Short Circuit	DC Voltage Low	Braking Max
13	00002000	8192	Soft-charge fault	DC Voltage High	Braking
14	00004000	16384	Line ph. Loss	Line ph. Loss	Out of Speed Range
15	00008000	32768	AMA Not OK	No Motor	OVC Active
16	00010000	65536	Live Zero Error	Live Zero Error	
17	00020000	131072	Internal Fault	10 V Low	
18	00040000	262144	Brake Overload	Brake Overload	
19	00080000	524288	U phase loss	Brake Resistor	
20	00100000	1048576	V-phase Loss	Brake IGBT	
21	00200000	2097152	W-phase Loss	Speed Limit	
22	00400000	4194304	Ser. com. bus fault	Ser. com. bus fault	
23	00800000	8388608	24 V Supply Low	24 V Supply Low	
24	01000000	16777216	Line Failure	Line Failure	
25	02000000	33554432	1.8 V Supply Low	Current Limit	
26	04000000	67108864	Brake Resistor	Low Temp	
27	08000000	134217728	Brake IGBT	Voltage Limit	
28	10000000	268435456	Option Change	Unused	
29	20000000	536870912	Drive Initialized	Unused	
30	40000000	1073741824	Safe Stop	Unused	
31	80000000	2147483648	Mech. brake low	Extended Status Word	

The alarm words, warning words and extended status words can be read out via serial bus or optional serial communication bus for diagnosis. See also par. 16-90, 16-92, and 16-94.

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 adjustable frequency drive.

WARNING/ALARM 4

Line phase loss:

A phase is missing on the supply side, or the line voltage imbalance is too high.
This message also appears in case of a fault in the input rectifier on the adjustable frequency drive.
Check the supply voltage and supply currents to the adjustable frequency drive.



— Warnings and Alarms —

WARNING 5

DC link voltage high:

The intermediate circuit voltage (DC) is higher than the overvoltage limit of the control system. The adjustable frequency drive is still active.

WARNING 6

DC link voltage low

The intermediate circuit voltage (DC) is below the undervoltage limit of the control system. The adjustable frequency drive is still active.

WARNING/ALARM 7

DC overvoltage:

If the intermediate circuit voltage exceeds the limit, the adjustable frequency drive 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 -	3 x 380 -	3 x 525 -
	240 V	500 V	600 V
	[VDC]	[VDC]	[VDC]
Undervoltage	185	373	532
Voltage	205	410	585
warning low			
Voltage	390/405	810/840	943/965
warning high			
(w/o brake -			
w/brake)			
Overvoltage	410	855	975

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

WARNING/ALARM 8

DC undervoltage:

If the intermediate circuit voltage (DC) drops below the "voltage warning low" limit (see table above), the adjustable frequency drive checks if 24 V backup supply is connected.

If no 24 V backup supply is connected, the adjustable frequency drive trips after a given time depending on the unit.

To check whether the supply voltage matches the adjustable frequency drive, see the *General Specifications*.

WARNING/ALARM 9

Inverter overloaded:

The adjustable frequency drive 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 cannot reset the adjustable frequency drive until the counter is below 90%.

The fault is that the adjustable frequency drive is overloaded by more than 100% for too long.

WARNING/ALARM 10

Motor ETR overtemperature:

According to the electronic thermal protection (ETR), the motor is too hot. You can choose whether the adjustable frequency drive should 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 overtemp:

The thermistor or the thermistor connection is disconnected. You can choose whether the adjustable frequency drive should give a warning or an alarm when the counter reaches 100% in par. 1-90. Make sure the thermistor is connected correctly between terminal 53 or 54 (analog voltage input) and terminal 50 (+ 10 V supply), or between terminal 18 or 19 (digital input PNP only) and terminal 50. If a KTY sensor is used, make sure the connection between terminal 54 and 55 is correct.

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).



— Warnings and Alarms —

WARNING/ALARM 13**Overcurrent:**

The inverter peak current limit (approx. 200% of the rated current) is exceeded. The warning will last approx. 8-12 sec., then the adjustable frequency drive trips and issues an alarm. Turn off the adjustable frequency drive and check if the motor shaft can be turned and if the motor size matches the adjustable frequency drive.

If extended mechanical brake control is selected, the trip can be reset externally.

ALARM 14**Ground fault:**

There is a discharge from the output phases to ground, either in the cable between the adjustable frequency drive and the motor or in the motor itself. Turn off the adjustable frequency drive and remove the ground fault.

ALARM 15**Incomplete hardware:**

A fitted option is not handled by the present control board (hardware or software).

ALARM 16**Short-circuit:**

There is short-circuiting in the motor or on the motor terminals.

Turn off the adjustable frequency drive and remove the short-circuit.

WARNING/ALARM 17**Control word timeout:**

There is no communication to the adjustable frequency drive.

The warning will only be activated when par. 8-04 is NOT set to OFF.

If par. 8-04 is set to *Stop* and *Trip*, a warning appears and the adjustable frequency drive 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 adjustable frequency drive still works, but without the brake function.

Turn off the adjustable frequency drive 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 energy is higher than 90%. If *Trip* [2] has been selected in par. 2-13, the adjustable frequency drive cuts out and issues this alarm, when the dissipated braking energy 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 adjustable frequency drive 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 adjustable frequency drive 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 heatsink is $203\text{ °F} \pm 9\text{ °}$ [$95\text{ °C} \pm 5\text{ °C}$]. The temperature fault cannot be reset until the temperature of the heatsink is below $158\text{ °F} \pm 9\text{ °F}$ [$70\text{ °C} \pm 5\text{ °C}$].

The fault could be:

- Ambient temperature too high
- Too long motor cable

ALARM 30**Motor phase U missing:**

Motor phase U between the adjustable frequency drive and the motor is missing.

Turn off the adjustable frequency drive and check motor phase U.



— Warnings and Alarms —

ALARM 31**Motor phase V missing:**

Motor phase V between the adjustable frequency drive and the motor is missing.

Turn off the adjustable frequency drive and check motor phase V.

ALARM 32**Motor phase W missing:**

Motor phase W between the adjustable frequency drive and the motor is missing.

Turn off the adjustable frequency drive and check motor phase W.

ALARM 33**Soft-charge fault:**

Too many power-ups have occurred within a short time period. See the chapter *General Specifications* for the allowed number of power-ups within one minute.

WARNING/ALARM 34**Ser. com. bus fault:**

The serial communication bus 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 adjustable frequency drive is in *Process control, closed-loop* (par. 1-00), the warning is active in the display. If the adjustable frequency drive 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.

ALARM 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:**

The speed is not within the specified range in par. 4-11 and par. 4-13.

ALARM 50**AMA calibration failed:**

Contact your Danfoss supplier.

ALARM 51**AMA check Unom and Inom:**

The settings for motor voltage, motor current, and motor power are 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 small for the AMA to be carried out.

ALARM 55**AMA par. out of range:**

The par. values found for the motor are outside the 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 resistances R_s and R_r 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.



— Warnings and Alarms —

WARNING 61**Encoder loss:**

Contact your Danfoss supplier.

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

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 Overtemperature:**

Control card overtemperature: The cut-out temperature of the control card is 176°F [80°C].

WARNING 66**Heatsink Temperature Low:**

The heatsink temperature is measured as 32°F [0°C]. This could indicate that the temperature sensor is defective 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 have 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]). For correct and safe use of the Safe Stop function, follow the related information and instructions in the Design Guide

ALARM 70**Illegal Frequency Configuration:**

Actual combination of control board and power board is illegal.

ALARM 80

Drive Initialized to Default Value:



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